FINAL

MISSION BAY SUBSEQUENT ENVIRONMENTAL IMPACT REPORT

CITY AND COUNTY OF SAN FRANCISCO PLANNING DEPARTMENT • SAN FRANCISCO REDEVELOPMENT AGENCY

PLANNING DEPARTMENT FILE NO. 96.771E

SAN FRANCISCO REDEVELOPMENT AGENCY CASE NO. ER 919-97

STATE CLEARINGHOUSE NO. 97092068

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VOLUME II: SETTING AND IMPACT ANALYSIS (CONTINUED FROM VOLUME I)

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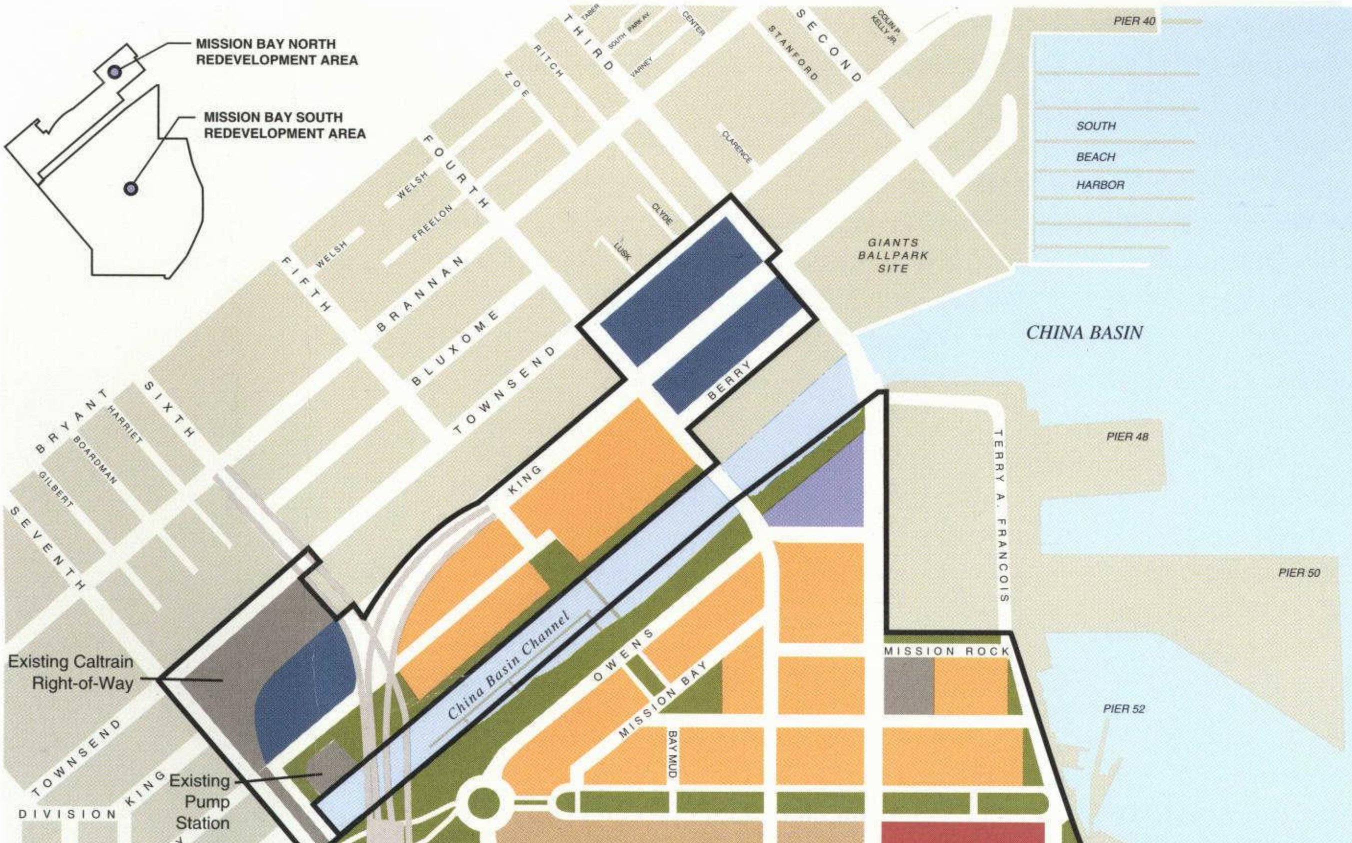
ASSOCIATES



SOURCE: San Francisco Redevelopment Agency

- COMMERCIAL INDUSTRIAL
- COMMERCIAL INDUSTRIAL / RETAIL
- MISSION BAY NORTH RETAIL
- MISSION BAY RESIDENTIAL
- MISSION BAY OPEN SPACE (allows recreation-serving retail building east of Terry A. Francois Blvd.)
- HOTEL
- UCSF (includes City school site)
- ADDITIONAL BAYFRONT OPEN SPACE (PORT PROPERTY)
- MISSION BAY PUBLIC FACILITIES
- PROPOSED BOUNDARIES OF MISSION BAY REDEVELOPMENT AREAS

COMBINATION OF PROJECT FEATURES AND VARIANTS AS ADOPTED

SEE INSIDE BACK COVER FOR THE LAND USE PROGRAM ANALYZED AS THE PROJECT IN THE DRAFT EIR

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VOLUME II
SETTING AND IMPACT ANALYSIS
(CONTINUED FROM VOLUME I)

● Indicates material that is new or has been revised since publication of the Draft SEIR.

This report has been prepared on post-consumer recycled paper.

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J. CONTAMINATED SOILS AND GROUNDWATER

SETTING

This section describes the available information about chemicals in soil and groundwater in the Project Area. It provides some basic definitions of terms, and background on physical conditions. Historic and current land uses are briefly summarized in this section, based on information in the 1990 FEIR. These land uses relate to the constituents detected in soil and groundwater. Since preparation of the 1990 FEIR, numerous investigations and various remedial activities have taken place in the Project Area. This section updates the information in the 1990 FEIR, and summarizes the results of comprehensive soil and groundwater investigations performed since then, including an evaluation of any potential for immediate hazards from chemicals detected in the Project Area. In addition, a description of regulatory requirements that provide for the management of soil or groundwater contamination in the Project Area is provided.

A number of acronyms are used throughout this section for both agency names and some chemical types. They are spelled out upon first use; a list with the full names or chemicals is provided at the end of the section, immediately before the endnotes, on p. V.J.100.

DEFINITIONS OF TERMS USED IN THIS SECTION

As used in this SEIR, the term "hazardous materials" refers to both hazardous substances and hazardous wastes. Hazardous materials are defined in California Health and Safety Code Section 25501:

> A hazardous material is any material that, because of its quantity, concentration, or physical, or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. "Hazardous materials" include, but are not limited to, hazardous substances, hazardous waste, and any material which a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment.

Hazardous wastes are defined in Section 25117:

> Hazardous wastes are wastes that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may either cause, or significantly contribute to an increase in mortality or an increase in serious illness, or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

The Regional Water Quality Control Board (RWQCB) has been designated as the "Administering Agency" for purposes of site investigation and remediation of the Project Area (please see the "Regulatory Framework" discussion presented at the end of Setting)./1/ Therefore, the following definitions of hazardous materials and hazardous wastes as established in Section 25260 are also applicable:

> Hazardous material means a substance or waste, that, because of its physical, chemical, or other characteristics, may pose a risk of endangering human health or safety or of degrading the environment. Hazardous material includes, but is not limited to, all of the following: (1) a hazardous substance, as defined in Section 25281 or 25316; (2) a hazardous waste, as defined in Section 25117; (3) a waste, as defined in Section 470 or as defined in Section 13050 of the Water Code.

Definitions of many technical terms used in this section are provided in a glossary at the end of the section, after the list of acronyms.

Hazard Versus Risk

Workers and general public health are potentially at risk whenever hazardous materials have been used or where there could be an exposure to such materials as the result of the presence of unidentified fill materials or historic uses of a site, such as at locations in the Project Area. Ecological communities, such as avian and terrestrial habitats and the aquatic environment, may also be at risk, depending on the type of populations and locations relative to potential exposure sources. Inherent in the setting and analyses presented in this section are the concepts of the "hazard" of these materials and the "risk" they pose to human health and the ecological environment. Terms pertaining to hazardous materials, toxicity, and hazardous wastes are briefly discussed below as they relate to soil and groundwater contamination issues associated with historic filling and industrial uses in the Project Area. For further information pertaining to hazardous materials use, storage, transport, and disposal as a result of occupancy of the proposed project, see Section V.I, Health and Safety.

Exposure to some chemical substances may harm internal organs or systems in the human body, ranging from temporary effects to permanent disability, or death. Aquatic, terrestrial, or avian species may also be similarly adversely affected. Hazardous materials that result in adverse effects are generally considered "toxic." Other chemical materials, however, may be corrosive, or react with other substances to form other hazardous materials, but they are not considered toxic because organs or systems are not affected. Because toxic materials can result in adverse health effects, they are considered hazardous materials, but not all hazardous materials are necessarily "toxic." For purposes of the information and analyses presented in this section, the terms hazardous substances or hazardous materials are used interchangeably and include materials that are considered toxic.

A hazard is any situation that has the potential to cause damage to human health and the environment. The risk to human health and the ecological environment is determined by the probability of exposure to hazardous material and severity of harm such exposure would pose. That is to say, the likelihood and means of exposure, in addition to the inherent toxicity of a material, are used to determine the degree of risk to human health or the ecosystem. For example, a high probability of exposure to a low toxicity chemical would not necessarily pose an unacceptable human health or ecological risk, whereas a low probability of exposure to a very high toxicity chemical might. Various regulatory agencies, such as the U.S. Environmental Protection Agency (U.S. EPA), State Water Resources Control Board (SWRCB) and the Regional Boards, the California Department of Toxic Substances Control (DTSC), and state and federal Occupational Safety and Health Administrations (OSHA) are responsible for developing and/or enforcing risk-based standards to protect the public and the environment. The "Regulatory Framework" discussion later in this section presents more detailed discussion.

SITE BACKGROUND

Hydrogeologic Conditions

The types of soil or rock material underlying sites where contaminants have been detected, the depth to groundwater, proximity to surface water relative to the contamination, and variations in groundwater or surface water levels are important factors governing the fate of contaminants in the environment. In the Project Area, Bay Mud, clay deposits with interbedded sand, and weathered Franciscan Formation bedrock underlie fill material. The thickness of the fill and underlying unconsolidated materials varies throughout the Project Area. The depth to bedrock varies from just below the ground surface in the southern part of the Project Area near Mariposa Street to approximately 200 feet below ground surface near China Basin Channel./2/

Groundwater south of the Channel generally ranges from 2 to 10 feet below ground surface and flows towards China Basin Channel or San Francisco Bay./3/ North of the Channel groundwater elevations range from 3 to 13 feet below ground surface./4/ Some fluctuation in groundwater levels due to tidal action has been identified in the Project Area. Groundwater levels are more highly influenced by tides as the distance to China Basin Channel or San Francisco Bay decreases, particularly within 50 feet of the water./5/

The results of a tidal influence study were used to calculate the potential reduction (attenuation) in chemical concentrations that could be predicted to occur in groundwater adjacent to China Basin Channel and San Francisco Bay as it moves toward tidally influenced areas in Mission Bay South. A one-dimensional model was used to predict the concentrations of chemicals in groundwater at the point of flow into saltwater bodies. The model assumes no dilution within the saltwater body. The model incorporated the periodic rise and fall of tides in San Francisco Bay, their cumulative effect on groundwater flow, and associated chemical transport within the local groundwater regime. The model does not account for lateral dispersion, dilution, sorption, or degradation that would naturally occur in a three-dimensional system. Therefore, the results of the modeling were considered conservative because they overestimated the concentrations of chemicals in groundwater./6/ The model used to calculate the attenuation factor is equally applicable to Mission Bay North because the hydraulic driving forces for the attenuation are common to both areas. The primary reason tidal-related attenuation occurs is that groundwater flows through a porous material (the fill materials) toward and into a tidally influenced surface water body (either China Basin Channel or the Bay). This process is active in both Mission Bay North and Mission Bay South; hence, the attenuation factor is equally applicable in both areas./7/

The results of the tidal influence model show an average 10-fold reduction (attenuations) in chemical concentrations as groundwater flows within the last 50 feet toward China Basin Channel and the San Francisco Bay. The 10-fold reduction represents a low-end estimate of the actual reduction. Consequently, actual reduction effects may be greater./8/ The tidal influence model is discussed in more detail in Appendix I under "Tidal Influence Study" under "Analysis of Potential Adverse Ecological Effects associated with Current Conditions in the Project Area." Note that groundwaer flowing to the Bay and Channel is a natural phenomenon; it is not considered to be a "point source"discharge to the Bay because the water does not enter the Bay at a single location like a sewer or stormwater discharge pipe.

In the late 1970s, two large subgrade box sewers were installed, one each north and south of China Basin Channel, to expand the City's combined storm and sanitary sewer system. The box sewers are constructed of poured-in-place reinforced concrete approximately 12 inches thick and supported by piles. The large box sewers are approximately parallel to China Basin Channel, as shown in Figure M.6 in Section V.M, Community Services and Utilities. On the north side of the Channel, the box sewer runs beneath portions of Sixth, Berry, Fourth, and King Streets and is more than 200 feet from the Channel. The 17½-foot-square concrete sewer extends to approximately 25 feet below the ground surface (bgs). On the south side of the Channel, the 13-foot-square box sewer runs beneath Channel Street and is approximately 18 feet bgs. The box sewer on the south side of the Channel is approximately 100 feet from the Channel. These box sewers appear to impede or slow the general flow of groundwater toward the Channel by reducing the amount of groundwater that enters the area between the box sewers and the Channel edge; they do not stop the flow, rather, groundwater flows around the sewers to the Channel. They do not appear to have a major influence in reducing chemical concentrations in groundwater in tidally influenced areas that principally occur within 50 feet of the shoreline./9/

The U.S. Geological Survey (USGS), in cooperation with the San Francisco Water Department, inventoried aquifers and water supply wells in San Francisco and reported no use of groundwater for water supply within the Mission Bay Project Area. There are no water production wells or aquifers used for water supply within the Project Area. The USGS also reported that sediments in areas on and near the Mission Bay Project Area have relatively limited water-producing capacity. Shallow groundwater in the Project Area contains high levels of total dissolved solids (TDS), which is a measure of salinity. The high TDS levels make it unsuitable for drinking water or industrial purposes./10/

See Section V.K, Hydrology and Water Quality, for more information regarding hydrological characteristics, and the Initial Study (Appendix A) for more information on geological characteristics.

Ecological Conditions

The Project Area is highly urbanized, except along China Basin Channel. It supports mainly urban landscaping and weedy vegetation with no terrestrial habitats containing rare, threatened, or endangered species. Therefore terrestrial vegetation and wildlife would not be affected by chemicals in soil or groundwater (see "Biology" in the Initial Study [Appendix A]). This section focuses on the effects of chemicals in soil and groundwater on near-shore aquatic habitats under existing conditions.

The Project Area does not include the Channel, except for a small amount of water surface at Channel edges. At the Bay entrance to the Channel, immediately east of the Project Area, there is a marine plant community indicative of native Bay conditions on the rocks and pilings that could be affected by chemicals in soil or groundwater. The Channel sides support salt marsh vegetation, including a narrow fringe of native pickleweed approximately 2 to 5 feet wide. Pickleweed is a dominant plant species of the northern coastal salt marsh community. This type of wetland is considered sensitive because it has generally high wildlife value; the amount of this type of wetland has declined substantially in the Bay region.

The bottom-dwelling (benthic) invertebrate community is comprised mainly of pollution-tolerant mollusks (such as mussels) and marine worms in the upper (western) part of the Channel, indicative of degraded ecological conditions. The degraded condition is likely to be primarily the result of former industrial and sewage discharges from sites in and near the Project Area. The Regional Water

Quality Control Board has included the Channel in its list of candidates for designation as a regional toxic hot spot that may need remediation, based on a limited screening level analysis, in a proposed regional toxic hot spots plan./11/ The proposed plan is preliminary and is subject to revision as new information becomes available. "Candidate" toxic hot spots are not considered "known" toxic hot spots without further study and a formal public review and approval by the RWQCB.

Pacific herring spawn near the mouth of the Channel during December through March. Trawl surveys in the Channel taken in 1979 and 1997 showed fish species common to the Bay. No threatened or endangered fish species are known to inhabit the Channel. No threatened or endangered bird species are known to nest in the Channel area, although it provides some foraging and resting habitat for a wide variety of waterfowl. The brown pelican is a listed species that has been found foraging in and near the Channel. The Channel provides resting and limited foraging habitat for the California sea lion and the harbor seal; neither is listed on state or federal Endangered Species Act lists, but both are protected by the Federal Marine Mammal Protection Act. More detail on the Channel habitat is provided in Section V.L, China Basin Channel Vegetation and Wildlife: Setting.

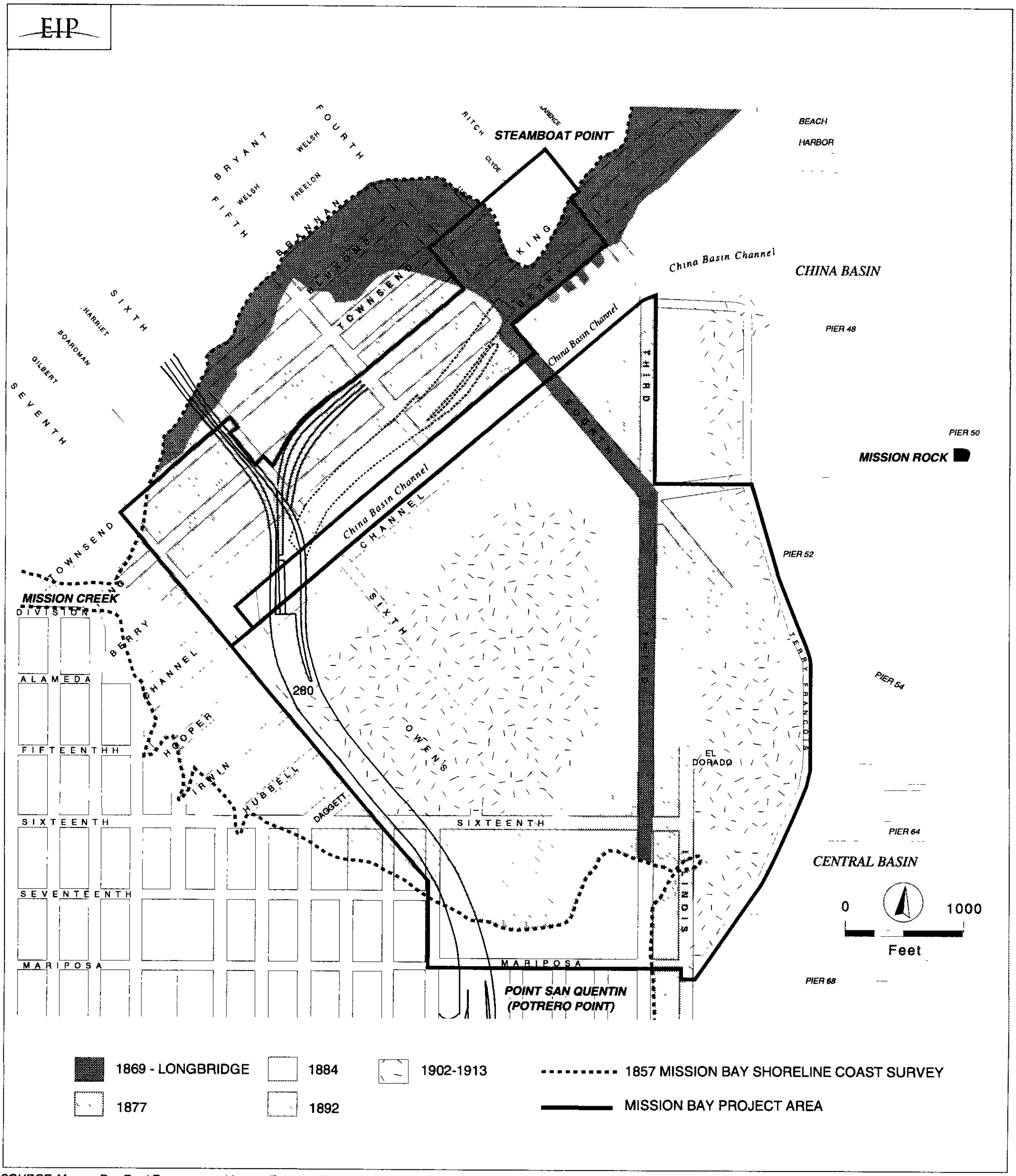
Historic and Current Land Uses

Historic Land Uses

As discussed in the 1990 FEIR, most of the Project Area was originally a bay covered by shallow waters. In 1859, filling began north of the Channel, continuing for approximately 50 years. In the late 1860s, railyards were constructed and operated for several decades. A wide variety of commercial businesses and industries have also been located in the Project Area throughout its history. Materials that were used to fill Mission Bay and numerous industrial uses have the potential to affect soil and groundwater conditions. These historic land uses are discussed in greater detail in this section.

Landfills and Industrial Uses

The Project Area was filled beginning in 1859 and continued for approximately 50 years./12/ The 1990 FEIR described the sequence of fill, which consisted primarily of earthquake rubble, municipal garbage, and rock and soil from other locations in San Francisco. The progression of fill in the Project Area is shown in Figure V.J.1 and is summarized below. The results of the additional investigations completed since 1990 are consistent with the site history discussion presented in the 1990 FEIR.



SOURCE: Mission Bay Final Environmental Impact Report, 1990

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FIGURE V.J.1 PROGRESSION OF FILL

Filling of the area north of the Channel occurred between approximately 1859 and 1884. From about 1878 to 1895, the area south of Berry Street between Fifth and Seventh Streets was used as a municipal dump by the City of San Francisco. Once filled, various industrial activities were conducted. These included glass manufacturing; lumber yards; a cooperage (barrel making); a building material storage depot; an artificial stone company; asbestos storage; concrete mixer and sand and gravel bunkers; a box factory; and a vinegar works./13/

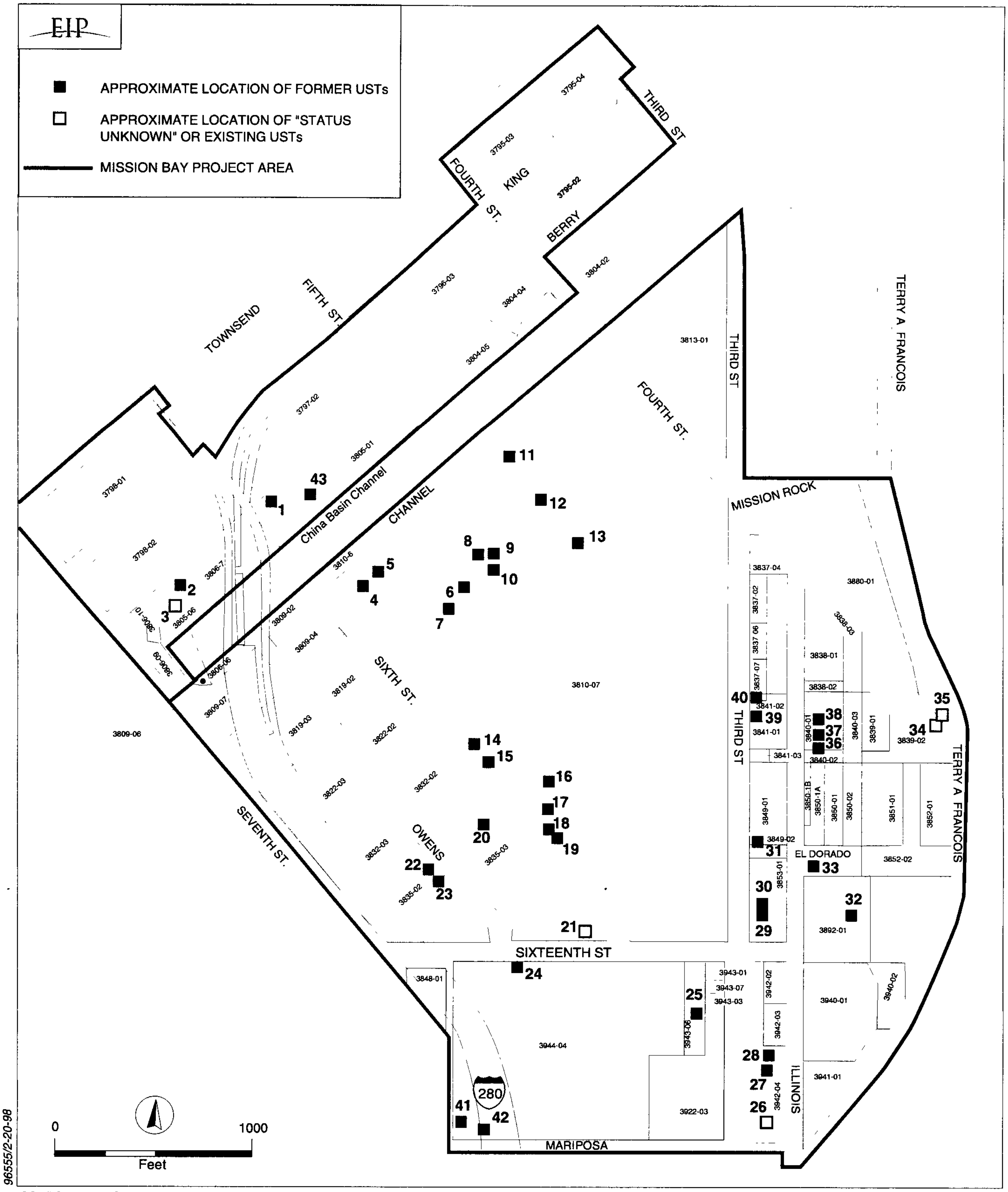
Filling of the area south of the Channel took place between approximately 1869 and 1913. Fill materials used from 1869 to 1892 included dirt and rock from the Second Street cut, and serpentine rock blasted from Irish Hill./14/ By 1892, Mission Bay was completely enclosed, shutting off the direct tidal flushing of San Francisco Bay. Filling of Mission Bay was completed following the earthquake and fire of 1906, when rail lines were used to transport building rubble and debris from downtown San Francisco to Mission Bay. The debris was used to fill the center of Mission Bay as well as to extend the eastern shoreline into San Francisco Bay. Once filled, industrial activities similar to those that occurred north of the Channel took place south of the Channel. In addition, rail yards and a roundhouse for locomotive repair occupied most of the central portion of the Project Area south of the Channel.

Appendix Table I.2 presents a summary of historical site usage for each of the Assessor's Blocks located in the Mission Bay Project Area. Assessor's Block locations for the Project Area are shown in Appendix Figure I.1.

Underground storage tanks (USTs) were used extensively throughout the Project Area, and Port property east of Illinois Street was an area of numerous petroleum-related activities such as fuel transfer and storage. Locations where these activities occurred in the past have been previously identified as potential sources of soil or groundwater contamination in the Project Area. The current status of investigation and cleanup efforts at these sites are described in greater detail below.

Underground Storage Tanks

At one time, there were thought to be about 100 known or suspected USTs in and near the Project Area, approximately 50 in the Project Area, and 50 nearby./15/ As a result of investigations carried out during the past 10 years, 43 USTs have been identified in the Project Area; the remaining 7 were determined not to exist or to be duplicate listings. Most of the Project Area USTs were located south of the Channel. The USTs typically contained fuel products such as oil, gasoline, or diesel, although some may have contained liquid chemical materials or wastes used in the various industrial operations that were present. Figure V.J.2 illustrates the approximate locations of the 43 identified USTs in the Project Area./16/



SOURCE ENVIRON International Corp

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FIGURE V.J.2 LOCATION OF FORMER AND EXISTING UNDERGROUND STORAGE TANKS WITHIN THE PROJECT AREA

Landowners and tenants in the Project Area have been actively implementing programs since the early 1980s to remove USTs no longer in service or where removal has been determined to be necessary to mitigate identified or potential soil or groundwater contamination./17/ Appendix Table I.3 contains a summary of the status of USTs that are known or believed to have existed in the Project Area.

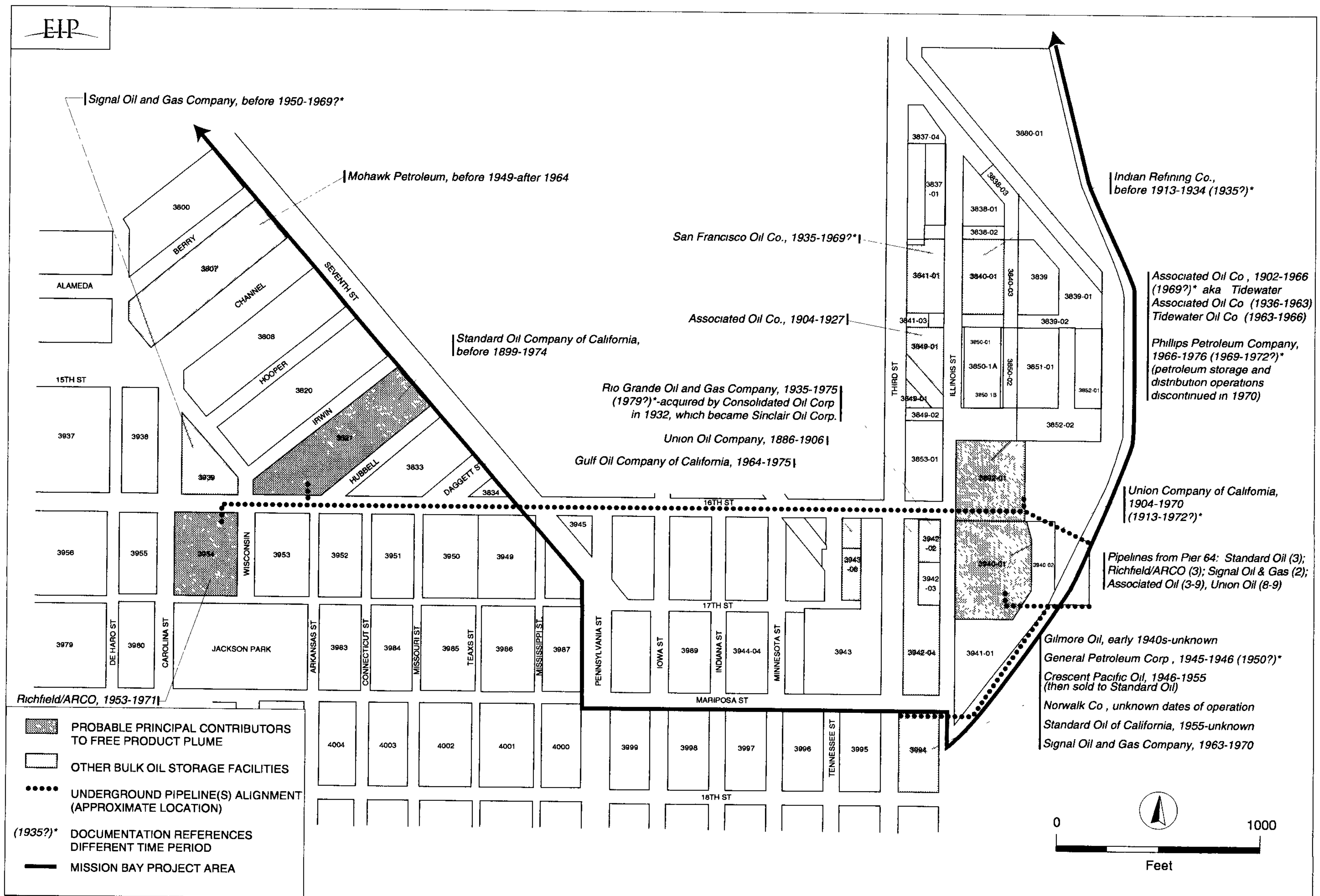
Of the 43 identified USTs, 38 have been removed and 2 have been closed in place. Three are still present in the Project Area: one active tank at Seventh and Berry Streets, and two inactive tanks near Fourth Street and Terry A. François Boulevard (locations 3, 34, and 35 on Figure V.J.2). The current status of the remaining two inactive USTs is unknown, according to information compiled by ENVIRON in 1997. Reports documenting the results of the petroleum hydrocarbon sampling at former UST locations addressed the extent of soil and/or groundwater contamination (if any was identified) and recommendations for further action, where necessary./18/ These reports are listed in Appendix Table I.1. Where contamination was identified, most results showed petroleum hydrocarbon in the form of diesel fuel and motor oil.

Bulk Petroleum Handling Facilities

Various oil companies operated on several parcels in the area south of the Channel, primarily on the Port property east of Illinois Street. Figure V.J.3 illustrates the past bulk oil storage facilities. On-site storage activities ceased during or soon after 1970. Operation of pipelines that carried oil in the area apparently ceased in the 1960's, with petroleum products apparently left in place within the lines. Oil companies that reportedly operated bulk storage facilities or operated the petroleum pipelines included ARCO, Chevron, Phillips, Texaco, and UNOCAL.

In July 1990, an investigation of the Esprit de Corp (Esprit) property located northwest of Mariposa and Third Streets was performed to assess the extent of potential petroleum hydrocarbon contamination from petroleum bulk storage and handling activities that took place at that location from 1904 to 1970. Petroleum hydrocarbons were detected in most of the soil and groundwater samples from the property. Approximately one foot of petroleum free product was found on groundwater at the northwest corner of the Esprit property, and trace amounts of free product were also detected at other sampling locations./19/ ("Free" product, defined in glossary, is petroleum not confined in a tank or pipeline, and can be found floating on groundwater.) Free product contamination at the Esprit site is currently under RWQCB oversight as part of a cleanup plan that addresses several parcels in that area, as described in more detail below.

In early 1991, two small spills from the pipelines occurred, releasing a total of approximately 50-60 gallons of oil (possibly weathered bunker fuel) into San Francisco Bay. Following the releases, with



SOURCE: ENVIRON International Corp

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FIGURE V.J.3 HISTORIC BULK OIL STORAGE FACILITIES IN AND NEAR THE PROJECT AREA

the approval of the U.S. Coast Guard, the Port of San Francisco sealed the ends of all the pipelines with concrete and pumped approximately 500 gallons of oil from pipes. After a third leak in 1991, the Port excavated the pipelines back from the shoreline approximately 20 feet, removed the remaining product from the pipelines, which was approximately 10,000 gallons, cut off and permanently capped all of the pipelines and constructed a containment vault around the capped pipelines. The U.S. Coast Guard approved the port actions. ARCO, Texaco, and UNOCAL all made financial contributions toward the remediation and fines associated with the pipeline leaks, spills, and emergency response./20/ As with the Esprit site, the area is under current RWQCB oversight.

An investigation was also conducted on port property at the former Atchison, Topeka and Santa Fe (ATSF) Railway Company China Basin Railyard, which encompasses much of the area east of Illinois Street in the south of Channel area. During the 1996 investigation, petroleum hydrocarbons were detected in soil and groundwater at the former railyard. Detections of petroleum hydrocarbons were mainly attributed to the upgradient former bulk storage facilities located immediately southwest and west. The subsurface pipelines along 16th Street to Pier 64 were identified as a potential source of petroleum hydrocarbons that could have been released to soil or groundwater./21/

Based on the findings of comprehensive investigations performed by ENVIRON during 1996-97 (presented later in this section) and the results of the Port, Esprit, and ATSF investigations summarized above, the Regional Water Quality Control Board, San Francisco Bay Region (RWQCB) requested that ARCO, Chevron, Phillips, UNOCAL, and Texaco prepare a work plan to address the contamination. The RWQCB considers the free product plume and pipelines as one "site" under RWQCB oversight. In response to the request from the RWQCB, ARCO, Chevron, Phillips, UNOCAL and Texaco submitted a Joint Assessment Work Plan to the RWQCB staff for review in November 1997. The initial proposed work is intended to verify the extent of the free product area and to determine if the hydrocarbon contamination could affect San Francisco Bay. According to the work plan, testing to adequately characterize the extent of contamination and completion of main remediation activities was expected to occur within approximately six months following completion of characterization studies./22/ The proposed work plan must be approved by RWQCB staff. In January 1998, RWQCB staff requested modification of the work plan to more fully address the abandoned pipelines. The consultant for the oil companies prepared a response to the RWQCB request in February 1998./23/ Site cleanup for the free product will take place irrespective of actions on the Mission Bay Redevelopment Plans and build-out of the Project Area.

There is a variety of institutional and technical responses that could be used to manage the free product area. Remediation techniques vary in the amount of treatment, containment, and removal of the free product, and would result in varying degrees of risk reduction. There are at least nine options among the range of remedial actions that could be implemented, independently or in combination. Implementation of any one of these options will take place independent of future actions contemplated within the Mission Bay Project Area.

These options are listed here. An analysis of each is presented in ENVIRON's *Technical Memorandum #2, Development and Screening of Remedial Alternatives for Free Product Area in Region of Former Oil Storage Facilities*, April 1998. 1) A "no further action" option would continue the natural attenuation of the subsurface free product, with deed restrictions placed on the use of the property in the free product area. No further action would not immediately reduce the current distribution of free product, nor would it reduce the potential for free product or its constituents to migrate. 2) "Natural attenuation with monitoring" would be the same as the first option, but would record the progress of reduction in free product and its constituents. 3) "Investigation and closure" of the 14 oil pipelines in the vicinity of the free product plume would involve detailed investigations of the locations of the pipelines, removal of residual free product in groundwater and soil to the extent feasible, and either sealing the pipelines or excavation and removal of pipelines. 4) "Soil vapor extraction" would partially remediate the free product area. It reduces the amounts of the more volatile fractions of petroleum hydrocarbons. This method would result in limited reduction in risk to human health and the ecological environment because most of the free product is heavier crude oil that is not volatile. 5) "*In situ* bioremediation" involves enhancing existing natural biodegradation by adding more nutrients and/or adding microorganisms. This option may or may not be feasible, depending on whether the particular hydrocarbons found at this site are susceptible to this approach. It could potentially take tens of years to complete, but, if applicable, would be faster than natural processes. 6) "Containment barriers" could be used to prevent offsite migration of free product and its constituents. This option would not reduce risks for the properties under which the free product lies. Groundwater monitoring would be required to monitor the effectiveness of this approach. 7) "Capping" the free product area with clay, asphalt, concrete or synthetic membranes, or other similar materials, would prevent direct access to the free product by any construction or maintenance workers who might otherwise carry out excavation in the area. Capping could reduce leaching of hydrocarbons to groundwater but would not control potential migration of free product and the constituents of the free product to the aquatic environment. Capping could reduce or eliminate vapors from volatile compounds that could be released to the atmosphere depending on the composition of the cap. 8) "Extraction" of free product would physically remove groundwater and treat it to remove or reduce the constituents of free product. Chemicals in soil would remain. 9) "Excavation" would remove soils contaminated with free products and the constituents of free product for treatment or off-site disposal. This option could require excavation and transport or treatment of over 300,000 cubic yards of soil.

Excavation of soils or exposure of groundwater associated with any of the remediation options could result in potential short-term exposure of populations to the chemicals in the soil or groundwater; these exposures would need to be controlled. Long-term effects of any of the remediation options would vary, depending on the extent of removal or treatment of the free product and, therefore, the amount of risk reduction accomplished by the remediation effort. These options, or combinations of them, will be considered by the RWQCB; cleanup will be carried out pursuant to RWQCB requirements regardless of actions taken on the proposed project. Measures to protect human health and the environment during cleanup activities and that would be appropriate for the selected cleanup option(s) would also be identified prior to cleanup.

Current Land Uses In and Adjacent to Project Area

The Project Area is an industrial area primarily occupied by block-long warehouses, concrete and gravel processing facilities, and truck terminals, with large tracts of undeveloped land that previously contained rail lines and a rail yard. Rail tracks have been removed in some areas. There are two truck terminals and about 50 warehouses, buildings, other structures, and recreational uses including a golf driving range and in-line skating facility. Buildings range from small materials sheds to large warehouses. Building uses include distribution and storage facilities for food products, clothing, rental furniture and personal effects; light manufacturing; and some office use. Uses of undeveloped areas include maintenance yards, parking areas for container trucks and commercial buses, and storage areas for construction materials. Additional information on existing land uses within the Project Area is presented in "Existing Land Uses in the Project Area," in Section V.B, Land Use, and in Figure V.B.2.

The Caltrain terminal, China Basin Landing buildings, China Basin Channel, and Mission Creek houseboat community in the Central Bayfront Nearby Area are outside of and adjacent to the Project Area. The Caltrain rail rights-of-way run along the western border of the Project Area. As discussed in greater detail in "Existing Land Uses in Nearby Areas," in Section V.B, Land Use, other nearby land uses include the site of the San Francisco Giants Ballpark, the South End Historic District, the South Park and South Beach mixed-use neighborhoods, and residential, commercial, and industrial land uses associated with the Lower Potrero, North Potrero/Potrero Hill, and Showplace Square.

Potential Contaminants of Concern

As discussed in the 1990 FEIR, the potential for contamination by, and residual hazards from historic industries in the Project Area varies by the type of industry and the period in which it operated. The Project Area was occupied by a large variety of industries that could have used hazardous chemicals.

The bulk petroleum storage facilities typically handled products such as kerosene, gasoline, lubricating oil, crude oil, and bunker fuel oil. In addition, hazardous materials such as asbestos for fire-proofing and lead-based paints were commonly used in buildings.

Types of Contaminants

Based on these past uses and fill activities, potential types of chemicals associated with past land uses were identified in the 1990 FEIR as potential contaminants of concern that would require investigation because of their potential to adversely affect soil, groundwater, or surface water.

Soil and Groundwater

Based on historic uses, soil and groundwater could be contaminated with chemicals such as pesticides, petroleum hydrocarbons, asbestos, various metals, or various organic compounds. A detailed list of chemicals that could be found in soil and groundwater was prepared for the 1990 FEIR, based on block-by-block analysis of historic land uses. General categories of chemicals and examples are summarized in Table V.J.1./24/

Landfill Gas

In addition to the constituents shown in Table V.J.1, garbage dumps, such as the one that existed in the Project Area at the turn of the century, often contain organic matter that decomposes into landfill gas. This dump was in use before the adoption of most or all modern landfill environmental controls, including regulations requiring devices to control gas generation. Methane, the primary component of landfill gas, is a combustible gas that can explode when ignited in the presence of air when concentrations range from approximately 5% to 14% total landfill gas concentration. Over time, however, methane production from the buried refuse decreases, thus reducing the associated hazard. Because the landfilled materials are nearly 100 years old, methane concentrations would be expected to be very low.

Hazardous Building Materials

The project would include demolition of all existing buildings in the Project Area, with the possible exception of the old Fire Station No. 30 building. Building materials sometimes contain hazardous materials that could be released during demolition. The most common building hazards, which are described below, are asbestos, lead, polychlorinated biphenyls (PCBs), and mercury from old lighting fixtures. In addition, dusts containing metals (e.g., at the former Castle Metals warehouse) can also

TABLE V.J.1
POTENTIAL CONTAMINANTS OF CONCERN BASED ON HISTORICAL SITE USES

Category	Examples of Chemicals or Products
acid and alkaline solutions	nitric acid and sulfuric acid
polycylic aromatic hydrocarbons (PAHs)	benzo(a) pyrene, naphthalene
volatile organic compounds (VOCs)	benzene, solvents, and glues
pesticides	DDT, chlordane
polychlorinated biphenyls (PCBs)	transformers, light ballast
total petroleum hydrocarbons (TPH)	gasoline, diesel, motor oil
wood treatment compounds	creosote, copper salts, pentachlorophenol
metals and metal salts	mercury, cadmium oxide
asbestos	insulation, fire-proofing material

Source: 1990 FEIR; 1997 Mission Bay North and 1998 Mission Bay South reports.

be present. These potential hazardous materials in buildings are described further below. The results of testing for these materials that could be present in soils in the Project Area are discussed in "Results of the 1997 Soil and Groundwater Investigation," below, and in Appendix I under "Summary of Soil and Groundwater Sampling Results."

Asbestos

Asbestos can be found in a variety of building materials and components. Loose insulation, ceiling panels, and brittle plaster are potential sources of friable (easily crumbled or pulverized) asbestos. Friable asbestos fibers from these materials are a health threat when they become airborne. Nonfriable asbestos is generally bound to other materials such that it does not become airborne under normal conditions. This kind of asbestos is usually found in building materials such as linoleum, flooring adhesives, and insulation. In some cases the asbestos is sealed within or mixed with another material and thus unable to present an exposure hazard. However, any activity that involves cutting, grinding, or drilling during building renovation or demolition could release asbestos fibers unless proper precautions are taken. Because of potential adverse health effects such as lung cancer and asbestosis, asbestos is regulated both as a hazardous air pollutant and as a potential worker safety hazard. Cal/OSHA regulations prohibit emissions of asbestos from asbestos-related demolition or construction activities and specify precautions and safe work practices that must be followed to minimize the potential for release of asbestos fibers (see "Regulatory Framework," below, for more information on Cal/OSHA regulations).

Friable and nonfriable asbestos were found in a 1992 survey of two buildings in the 1300 block of Sixth Street in Mission Bay South; the friable asbestos was detected primarily in linoleum flooring and drywall./25/ Additional sampling was recommended for these sites by the investigator prior to renovation or demolition; demolition would take place according to applicable laws and regulations. A site-wide survey has not been completed to determine the type and amount of asbestos that may be present in other Project Area buildings expected to be demolished. The survey is not warranted at this time because this SEIR has been prepared under the conservative assumption that asbestos is present in the building materials in most or all Project Area buildings due to their age.

Polychlorinated Biphenyls (PCBs) and Mercury

PCBs are organic chemicals, usually in the form of an oil, that were formerly used in electrical equipment, including transformers and capacitors, primarily as electrical insulators, in fluorescent light ballasts, and in hydraulic equipment in old elevator systems. Nearly all ballasts manufactured prior to 1979 contain PCBs. In California, PCB-containing materials must be managed and disposed of as hazardous waste. Heavy metals, such as mercury, are sometimes a component of older fluorescent light tubes and high-intensity discharge lamps. As with PCBs, mercury-containing materials must be managed and disposed of as hazardous waste.

A site-wide survey to determine the presence, if any, of PCB- or mercury-containing items or materials that may be present in buildings to be demolished has not been completed. As with asbestos, a site-wide survey of buildings is not warranted at this time, and it is assumed for purposes of this SEIR analysis that old transformers, capacitors, hydraulic lifts or other fixtures containing PCB oils are present in the building materials due to the age of the buildings.

Lead and Other Metals

Lead is a naturally occurring metallic element. Among its numerous uses and sources, lead is used in paint to increase its durability and can be found in water pipes, solder in plumbing systems, and in soils around buildings or structures coated with lead-based paint. Lead can also be found in dust inside buildings that had gasoline-powered equipment or included automobile repair activities; the lead in these buildings is from leaded gasoline that was in use until the 1980's. Lead, chromium, mercury and nickel were found in dust samples taken from the warehouse at 1900 Third Street (the Castle Metals site), associated with metal fabrication activities./26/ Other structures and buildings in the Project Area have not been tested for lead-based paints. Due to the age of the buildings, it is likely that lead-based paint is present in the building materials.

Because of its toxic properties, lead is regulated as a hazardous material. Inspection, testing, and removing (abatement) lead-containing building materials must be performed by state-certified contractors who are required to comply with applicable health and safety and hazardous materials regulations. Chapter 36 of the San Francisco Building Code requires contaminant barriers around sites where exterior lead paint is being disturbed.

Associated Human Health Effects

The chemicals and products listed in Table V.J.1 are considered contaminants of concern because, under certain conditions, adverse effects on human health and the environment can result from exposure to these compounds.

The types of health risks associated with exposure to such chemicals were summarized in the 1990 FEIR and described in greater detail in the Hazards Mitigation Program./27/ As noted in those documents, toxic or other harmful properties can vary greatly from one material to the next and from individual to individual. Whether the substance results in any damage also varies greatly and depends on such factors as the amount (dose), characteristics of the individual (e.g., age, gender, height/weight, general health), length of time the individual was exposed to the substance, and how the material enters the body. Potential health effects from exposure to the chemicals or products listed in Table V.J.1 may be short-term (acute) or long-term (chronic). Acute effects, which may result from a single exposure to a hazardous material, can include damage to organs or systems in the body, and possibly death, depending on the amount or type of material. Chronic effects, which may result from long-term exposure to a hazardous material, can also include organ or systemic damage; however, chronic effects of particular concern include birth defects, genetic damage, and cancer.

HISTORY OF SITE INVESTIGATIONS

Summary of 1990 FEIR Analysis

A detailed description of historic uses in the Project Area and potential soil and groundwater contamination issues associated with each parcel were presented in Section VI.N and Appendix L of the Mission Bay 1990 FEIR./28/ At the time the EIR was prepared, the analysis was qualitative in nature and assumed, based on similar historic uses in other locations in San Francisco, that soil and groundwater would contain concentrations of contaminants that would require remediation. In the absence of site-specific data to quantify the extent of contamination and potential risks to the public and the environment, a conservative, worst-case approach to the analysis was determined to be appropriate. Therefore, to address potential hazards that could be encountered during construction and occupancy of the project proposed under the 1990 FEIR, a Hazards Mitigation Program was developed as part of the FEIR to establish actions that could be implemented to reduce potential adverse effects to less-than-significant levels./29/ These actions included development of plans intended to identify the extent of soil and groundwater contamination that may have occurred within the Project Area, to evaluate possible health effects due to exposure to contaminants that might be present, and to generally identify the types of remedial actions that could be used to manage identified contamination so that it would not present an unacceptable health or ecological risk.

Investigations After 1990

The combination of individual and site-wide investigations performed subsequent to the 1990 FEIR has provided information to sufficiently identify potential soil and groundwater contamination hazards, including those areas that would be developed by Catellus, UCSF, or other entities, for the purposes of this SEIR analysis. Based on the results of these investigations, no new constituents of concern or unanticipated types or locations of soil or groundwater contamination were identified as a result of investigations performed subsequent to the 1990 FEIR. Studies conducted in 1997 (see Appendix Table I.1) more clearly delineated the location and extent of petroleum hydrocarbon contamination thought to exist in the area of former bulk petroleum handling facilities in the southeast part of the Project Area.

Two types of investigations have been carried out for individual sites in the Project Area since the 1990 FEIR was certified: specific studies of individual locations in the Project Area and a more comprehensive investigation of the entire Project Area as a whole. Reports and relevant public agency correspondence that describe the results of the individual investigations are listed in Appendix Table I.1.

The most comprehensive of the Project Area investigations completed since 1990 are the *Results of Investigation Mission Bay North of Channel, San Francisco, California* ("1997 Mission Bay North report") and *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California* ("1998 Mission Bay South report") prepared for Catellus by ENVIRON Corporation (ENVIRON)./30/,/31/ These studies relied on a combination of an understanding of the fill history and subsequent historic and industrial uses in the Project Area and the results of previous site-specific investigations noted in Appendix Table I.1 to develop and implement site-specific testing and analysis plans that would identify significant source areas that could adversely affect human health or the ecological environment within the Project Area./32/ The scope of the 1997 ENVIRON investigations is presented in the following discussion based on the 1997 and 1998 reports and a number of technial memoranda prepared by ENVIRON in 1998, followed by a summary of analytical results and a discussion of the human health and ecological risks under existing (pre-development) conditions. Additional detail regarding the sampling program, analytical results, and methods ENVIRON used to evaluate the data is included in Appendix I under "Field Investigation and Sample Analysis Procedures."

SCOPE OF 1997 SOIL AND GROUNDWATER INVESTIGATIONS

The scope of the sampling programs for the Mission Bay areas north and south of the Channel were designed to be sufficiently comprehensive to characterize soils and groundwater conditions in the Project Area so that potential adverse effects to human health and the ecological environment and the appropriate risk management measures could be identified. The testing program was intended to identify significant contaminant source areas./33/

Work plans to guide the 1997 Mission Bay soil and groundwater investigations were prepared for the Mission Bay North and Mission Bay South areas./34/,/35/ (The areas north and south of the Channel are proposed to be two redevelopment areas—Mission Bay North and Mission Bay South—and are designated this way in discussing the proposed project in the Impacts sections.) As stated above, in developing the work plans for each area to be investigated, ENVIRON considered the results and conclusions of previous investigations (primarily associated with underground storage tank removals and soil remediation) as well as other site-specific assessments. From this information, the types of investigative methods that would effectively allow the collection data necessary to identify significant source areas and to evaluate potential health and ecological risks were determined. The RWQCB staff approved the work plan for Mission Bay North in November 1996. The Mission Bay South work plan was approved by the RWQCB staff in March 1997./36/

RESULTS OF THE 1997 SOIL AND GROUNDWATER INVESTIGATIONS

The following discussion is divided into two parts: the first summarizes the analytical results of the Mission Bay North and Mission Bay South investigations as presented in the two reports on the Project Area; the second part identifies potential human health and ecological risks associated with the concentrations of contaminants detected and an evaluation of the risk under existing (pre-development) conditions and establishes a baseline against which to compare the effects of the proposed project.

Analytical results for soil and groundwater sampling performed in the Project Area are presented in more detail in Appendix I under "Summary of Soil and Groundwater Results."

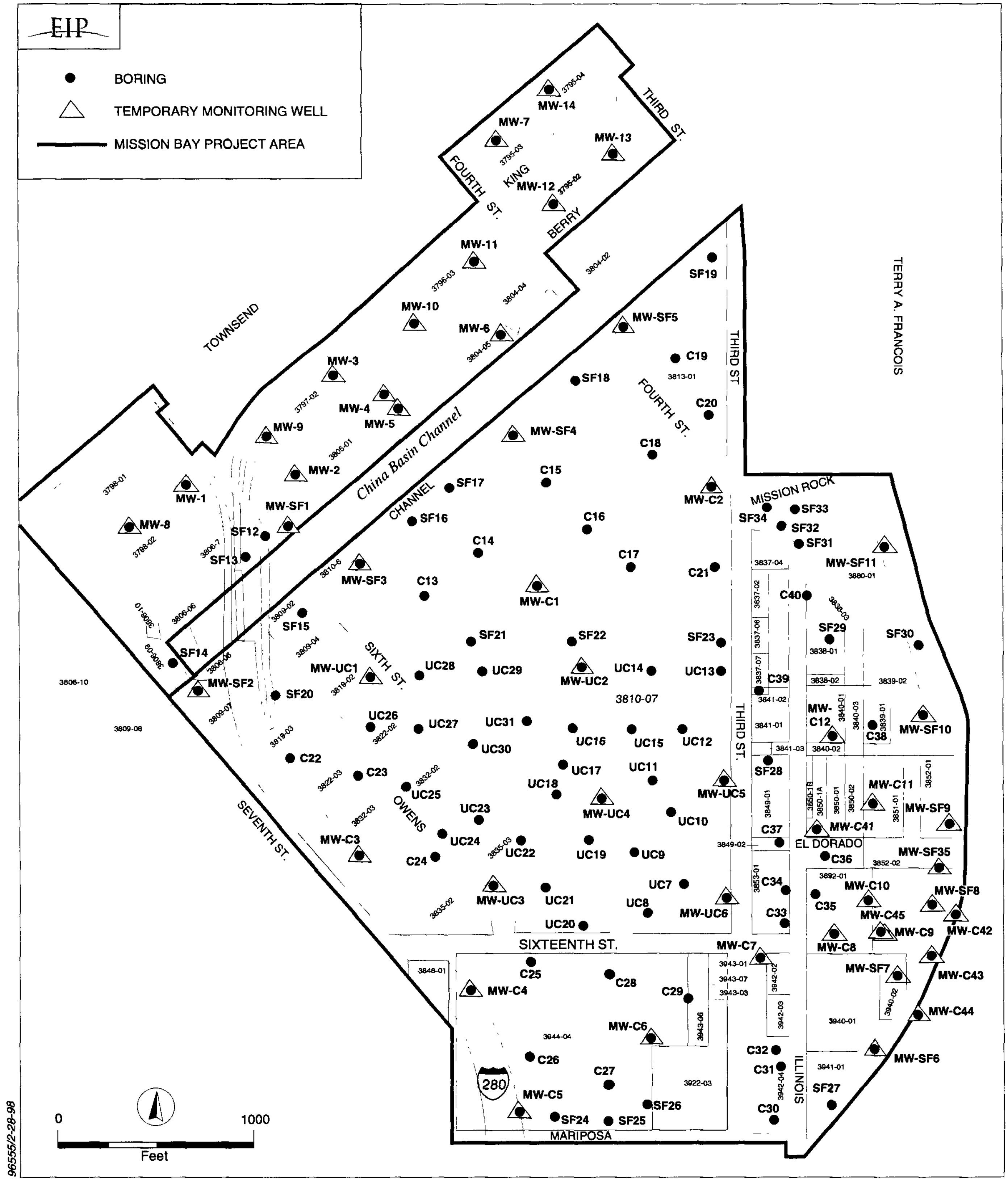
Sampling Program and Analytical Results

Mission Bay North

The Mission Bay North soil and groundwater investigation was conducted from December 5, 1996, monitoring to February 17, 1997. Soil and groundwater samples were collected from 14 borings and wells as shown in Figure V.J.4. Two soil samples from each boring, ranging in depth from 2.5 to 5.0 feet below the ground surface, were collected and analyzed. Soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs, a type of SVOC), pesticides and polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) as gasoline, diesel and motor oil fractions, metals, asbestos, fluoride, cyanide, sulfide, pH (measure of acidity or alkalinity), methane, and ignitability. The shallower of the two soil samples from each location was not tested for VOCs, as these compounds do not tend to persist in surface soils. The list of analytes includes those specified in Article 20 of the San Francisco Public Works Code, the Hazardous Waste in Soil Ordinance (described in "Regulatory Framework," below). Groundwater was tested for VOCs, SVOCs, metals, TPH, and pH. Testing requirements in Article 20 of the Public Works Code do not apply to groundwater. In addition, groundwater level data were collected to determine flow direction, the effects of tides on groundwater levels, and the extent to which the box culverts restrict groundwater flow toward China Basin Channel (for more information on this topic, see "Tidal Influence Studies" in Appendix I)./37/

The results of the Mission Bay North study are presented in the *Results of Investigation Mission Bay North of Channel, San Francisco, California*, prepared for Catellus by ENVIRON Corporation in April 1997./38/ Results of the Mission Bay North study were submitted to the RWQCB in April 1997.

The information presented in this section, supplemented with additional data in Appendix I in "Summary of Soil and Groundwater Sampling Results," is intended to summarize the key contaminants and locations of concern within Mission Bay North to support the impact analysis that follows.



SOURCE ENVIRON International Corp

MISSION BAY SUBSEQUENT EIR

FIGURE V.J.4 LOCATIONS OF BORINGS AND TEMPORARY MONITORING WELLS

Mission Bay North Soil Results

Results of soil sampling in Mission Bay North are summarized in Appendix Tables I.4 through I.10. Each table lists the chemical detected, the range of concentrations, and the number of detections of each chemical compared to the number of total samples. In addition, Figures V.J.5 through V.J.8 show the locations of borings where various chemicals were detected and the concentrations of those chemicals. Overall the detections of chemicals in soil samples showed a variable spatial distribution with no contamination patterns indicative of a specific, identifiable source area in Mission Bay North./39/

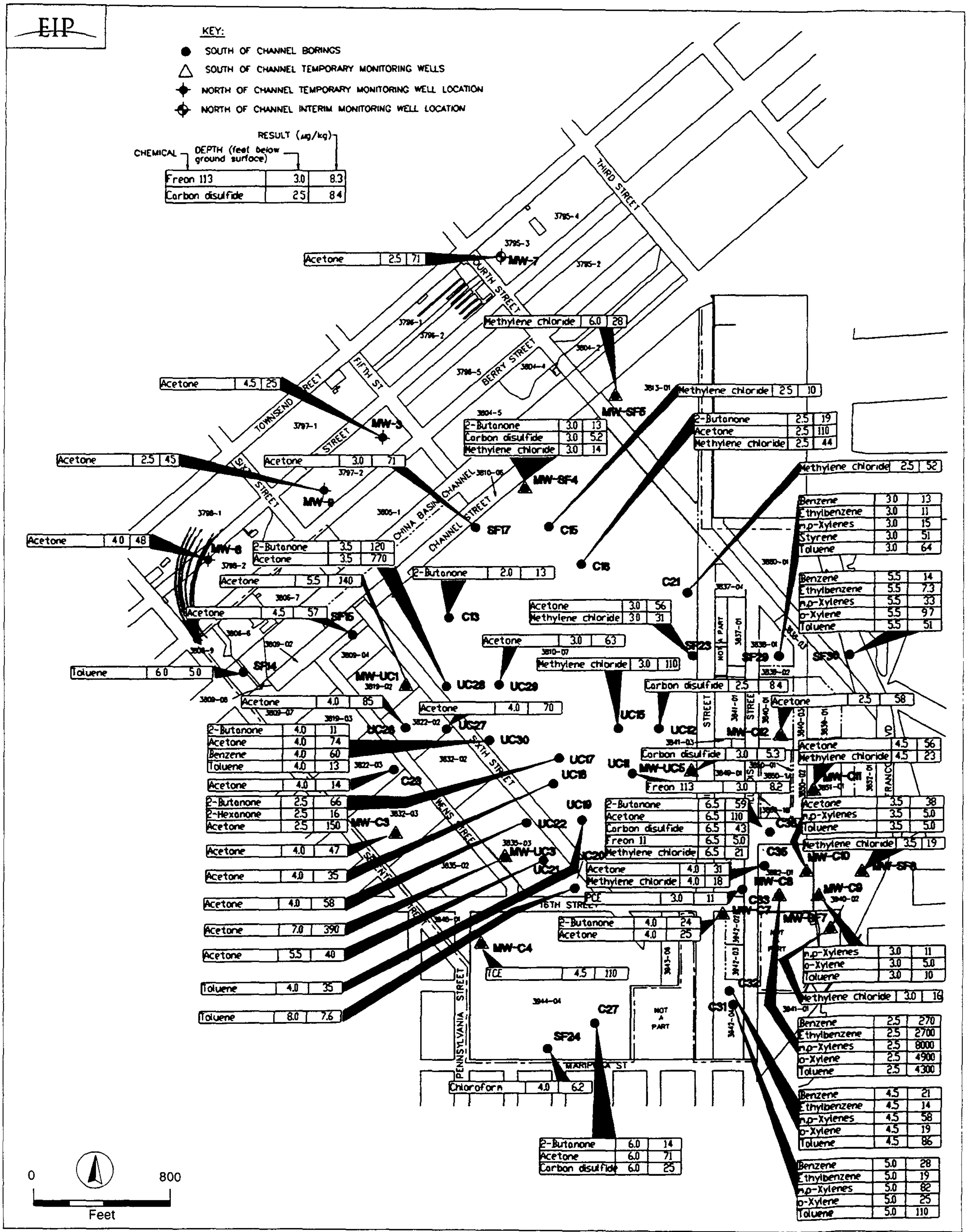
Acetone was the only VOC detected in soil in Mission Bay North; it was detected in 4 out of 14 soil samples collected. Acetone is a chemical used in analytical laboratory processes. It is possible that some of the acetone detections may be from the laboratory analyses, rather than actual detections in soil./40/ VOCs were not detected in soil borings adjacent to the China Basin Channel.

SVOCs were detected in five borings in Mission Bay North. With the exception of two compounds, the SVOCs detected were carcinogenic and noncarcinogenic PAHs. The number of samples in which the PAHs were detected as compared to the number of total detections expressed as a percent ("frequency of detection") was relatively low (less than 20%). Neither the detection frequency nor the distribution pattern of SVOCs in soils indicated a specific, identifiable source of SVOCs./41/ PAHs are typically associated with heavy-end fuels and the combustion of organic material (such as coal and gas) and are pervasive at industrial sites. They are generally found tightly bound to soils./42/

In soil samples tested for TPH-gasoline, -diesel, and -motor oil fractions, TPH-gasoline was not detected in any soil sample analyzed. TPH-diesel and TPH-motor oil were detected in every soil boring in Mission Bay North. Many of the detections of TPH-diesel and TPH-motor oil are likely attributable to the presence of natural oils that were not filtered out during the laboratory analytical process./43/

One PCB (Arochlor 1254) was detected in one soil boring sample. No PCBs were detected in a deeper sample from that boring or at any of the other boring locations. Components of the pesticide DDT (4',4-DDD and 4',4-DDT) were detected in one sample taken from two soil sample locations in Mission Bay North./44/

All metals that were included in the list of analytes tested were detected in all soil samples in throughout Mission Bay North. Arsenic, barium, chromium, cobalt, copper, lead, nickel, vanadium,



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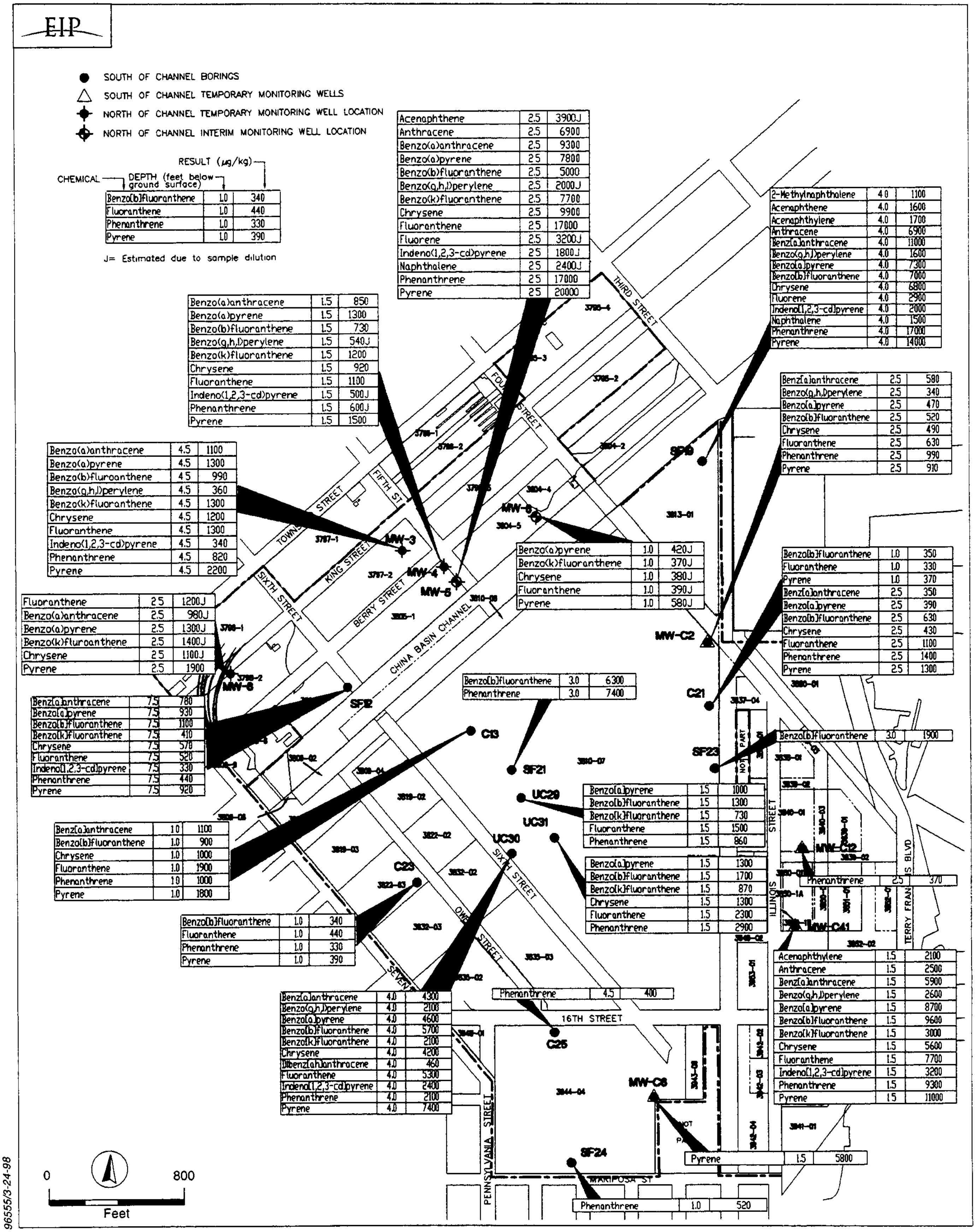
SOURCE ENVIRON International Corp

MISSION BAY SUBSEQUENT EIR

FIGURE V.J.5 DETECTIONS OF VOLATILE ORGANIC COMPOUNDS IN SOIL



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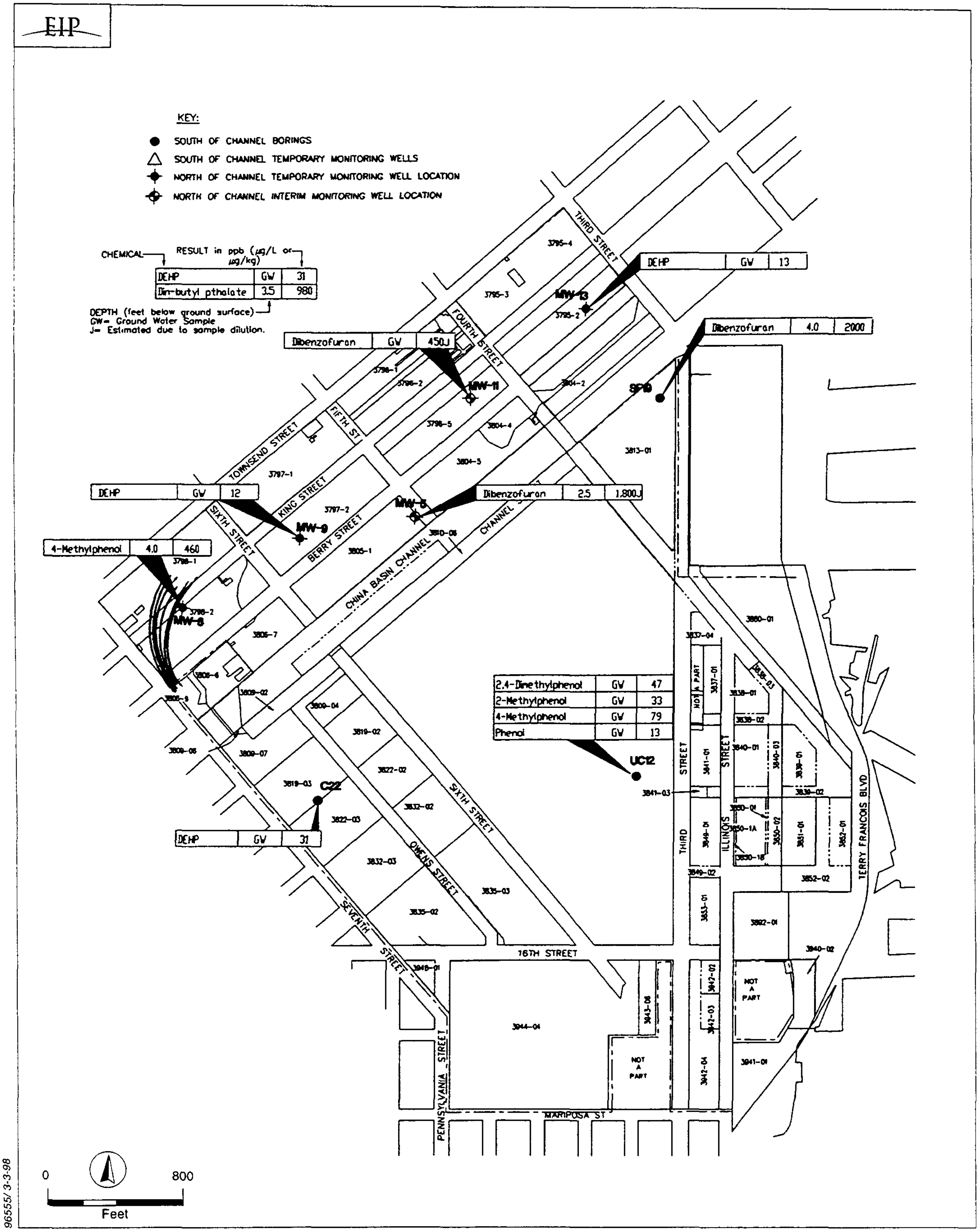
SOURCE ENVIRON International Corp

MISSION BAY SUBSEQUENT EIR

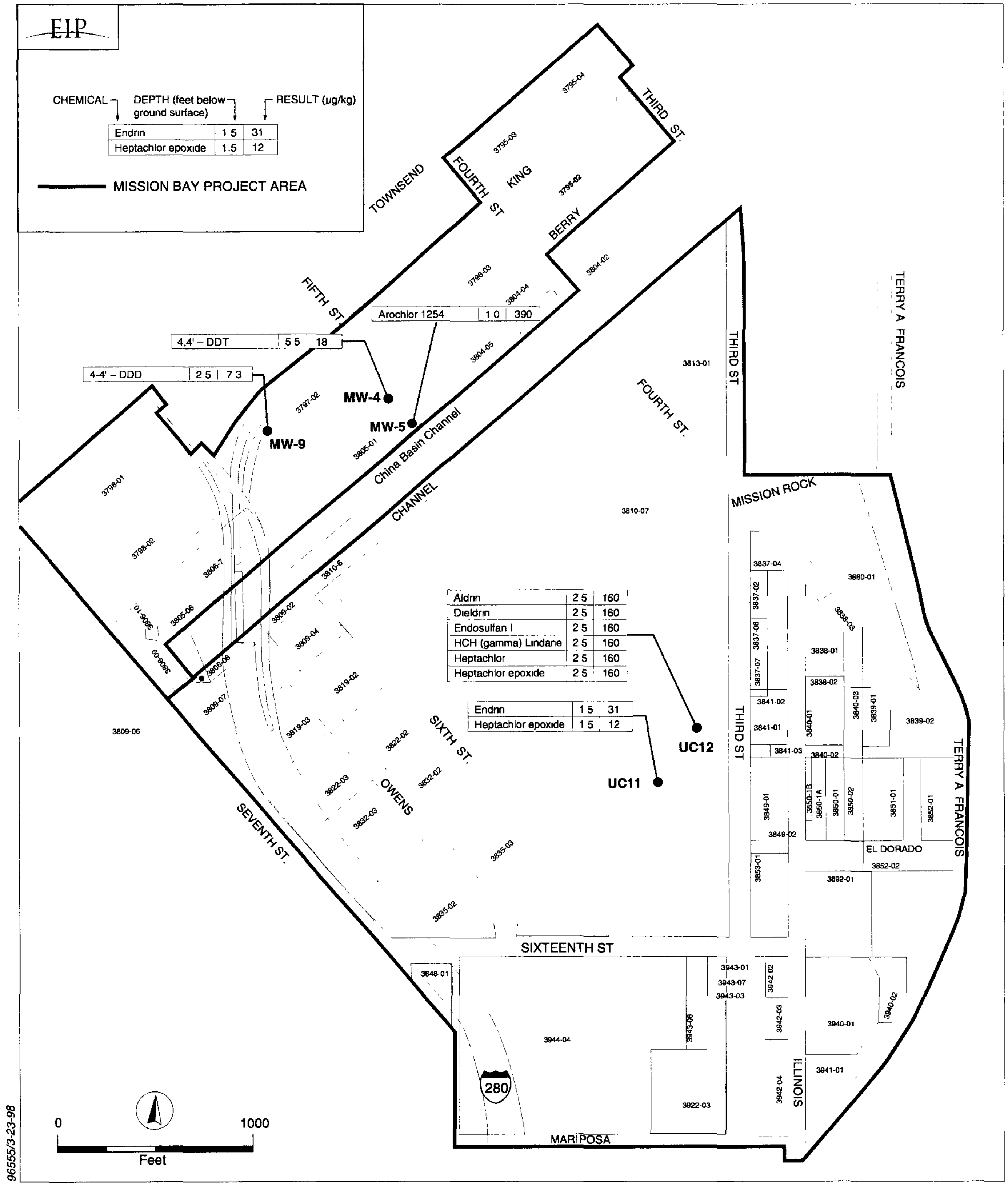
FIGURE V.J.6 DETECTIONS OF PAHs IN SOIL



SOURCE: ENVIRON International Corp

MISSION BAY SUBSEQUENT EIR

FIGURE V.J.7 DETECTIONS OF OTHER SEMIVOLATILE ORGANIC COMPOUNDS IN SOIL AND GROUNDWATER



SOURCE. ENVIRON International Corp.

MISSION BAY SUBSEQUENT EIR

FIGURE V.J.8 DETECTIONS OF PESTICIDES AND PCBs IN SOIL

and zinc were detected most frequently. The absence of geographic pattern to the detections suggests there is no specific identifiable source area, but that the concentrations are more likely representative of background conditions for Mission Bay fill materials./45/

Sulfide and cyanide, analyzed as part of the Article 20 list of chemicals to be tested, were not detected in any soil samples collected during the investigation. Chrysotile asbestos was detected in one sample. The asbestos was believed to be related to pieces of roofing material contained in the sample rather than to the soil. Soil samples were also tested for flammability (ignitability) and methane. The results indicated that the material would not be classified as ignitable, and reported concentrations of methane were well below the explosive range for methane./46/

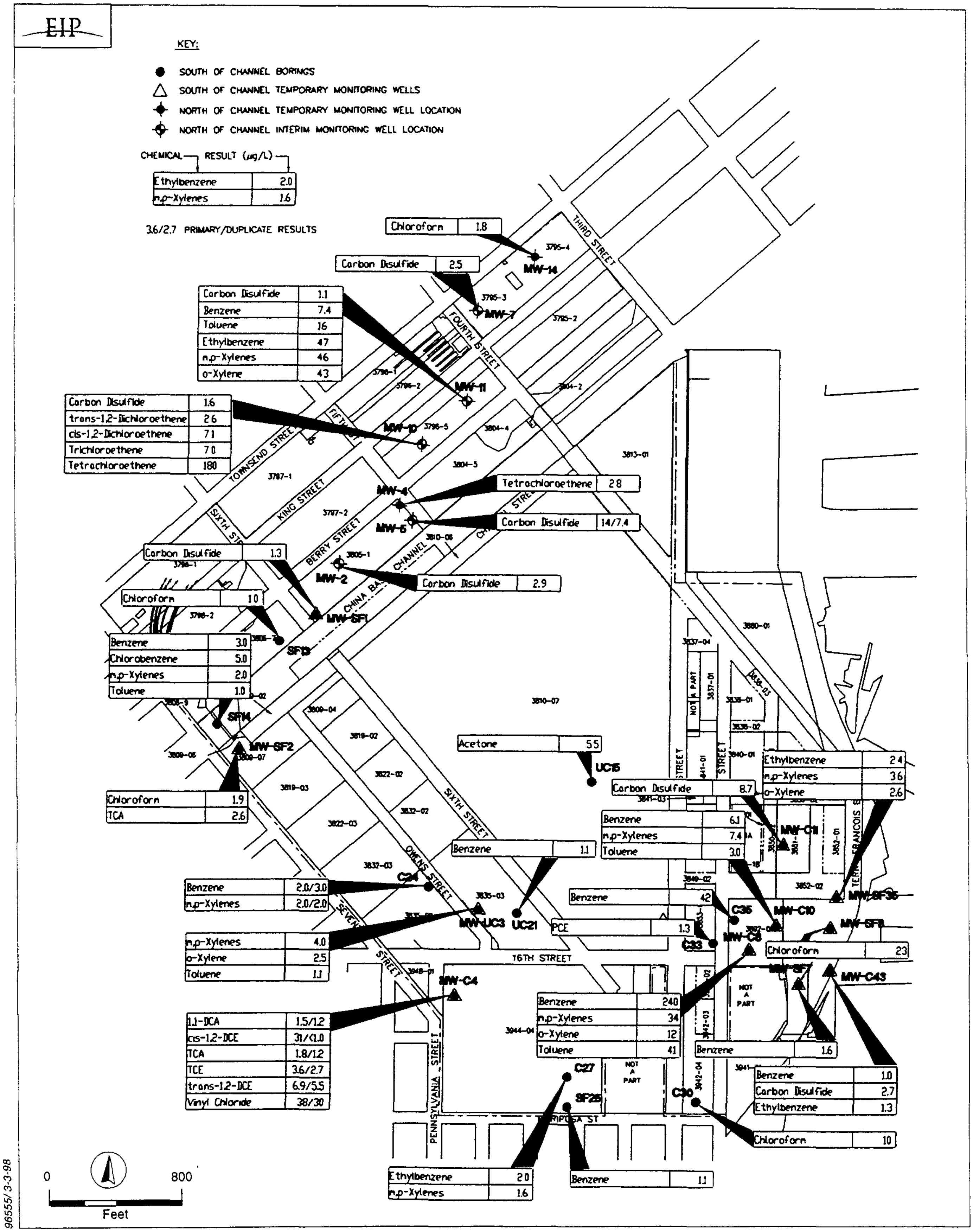
Mission Bay North Groundwater Results

Results of groundwater sampling performed in Mission Bay North are summarized in Appendix Tables I.11 through I.15. Each table lists the chemical detected, the range of concentrations, and the number of detections of each chemical compared to the number of total samples. In addition, Figures V.J.6, and V.J.9 through V.J.13 show the location of monitoring wells where some chemicals were detected and the concentrations of those chemicals.

VOC concentrations in groundwater were not widespread. There appeared to be no pattern in levels of contamination, and the VOC concentrations did not correlate well with chemical concentrations in soil. This suggests that there is no specific identifiable source area for VOC contamination in Mission Bay North. The one location where BTEXs were detected in groundwater is likely attributable to the former UST on the Caltrain property located upgradient of Mission Bay North. VOCs near the Channel were found in low concentrations or were not detected./47/

SVOCs in the groundwater in Mission Bay North are not widespread, and the locations and concentrations of SVOCs suggest there is no identifiable source area in Mission Bay North. SVOCs were not detected in samples collected from wells located next to China Basin Channel. The one location where PAHs (one kind of SVOC) were detected in groundwater is likely attributable to the former UST on the Caltrain property located upgradient of Mission Bay North./48/

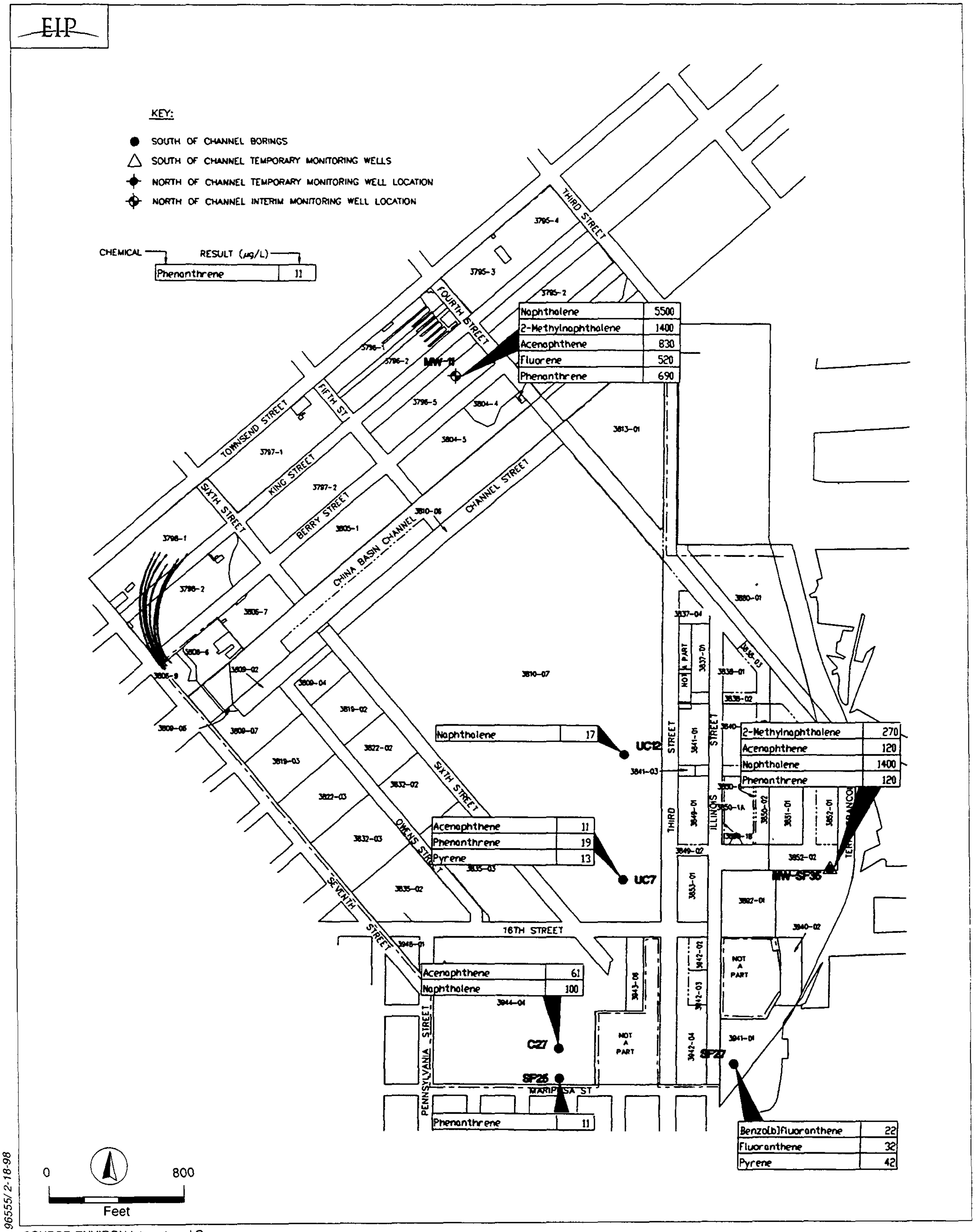
TPH-gasoline was detected in one well downgradient of a former UST on the Caltrain property near Fourth and King Streets. TPH-diesel was detected in groundwater at all monitoring well locations, with the highest concentration near the location of the former UST. TPH-motor oil was detected at low concentrations in 7 of the 14 monitoring wells. TPH concentrations in wells near the Channel were generally lower than in other locations./49/



SOURCE ENVIRON International Corp

MISSION BAY SUBSEQUENT EIR

FIGURE V.J.9 DETECTIONS OF VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER



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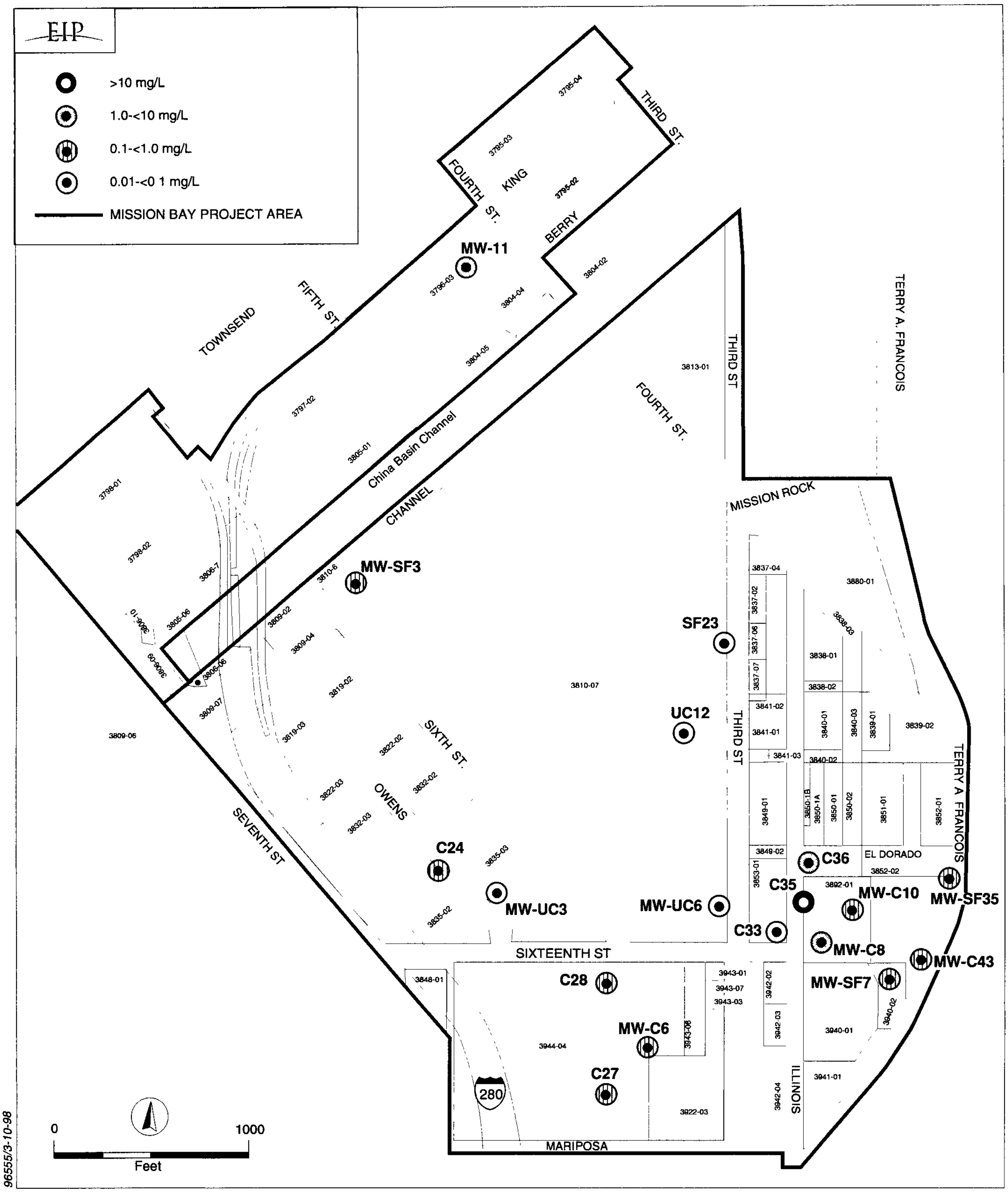
SOURCE ENVIRON International Corp

MISSION BAY SUBSEQUENT EIR

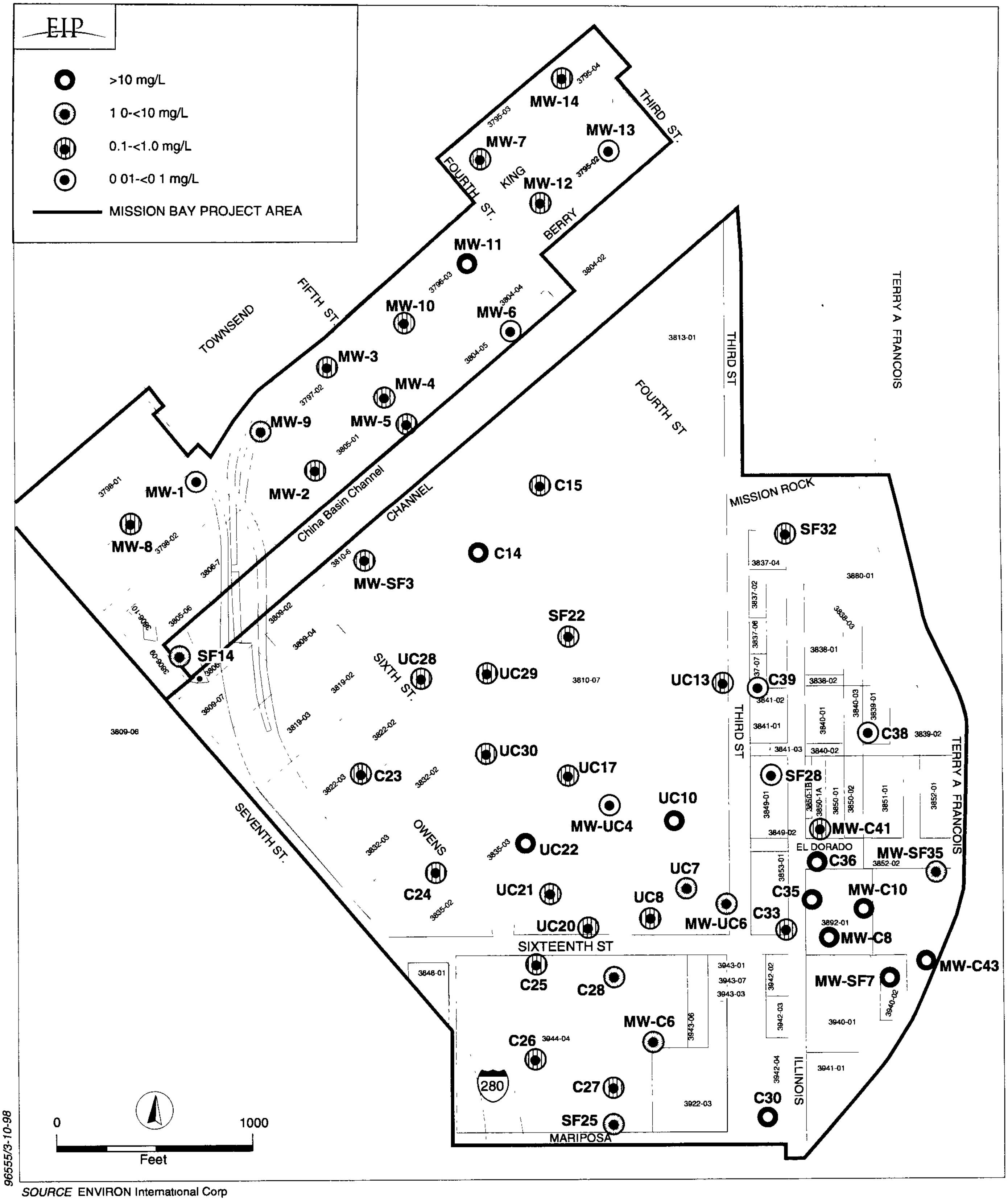
FIGURE V.J.10 DETECTIONS OF PAHS IN GROUND WATER



SOURCE. ENVIRON International Corp

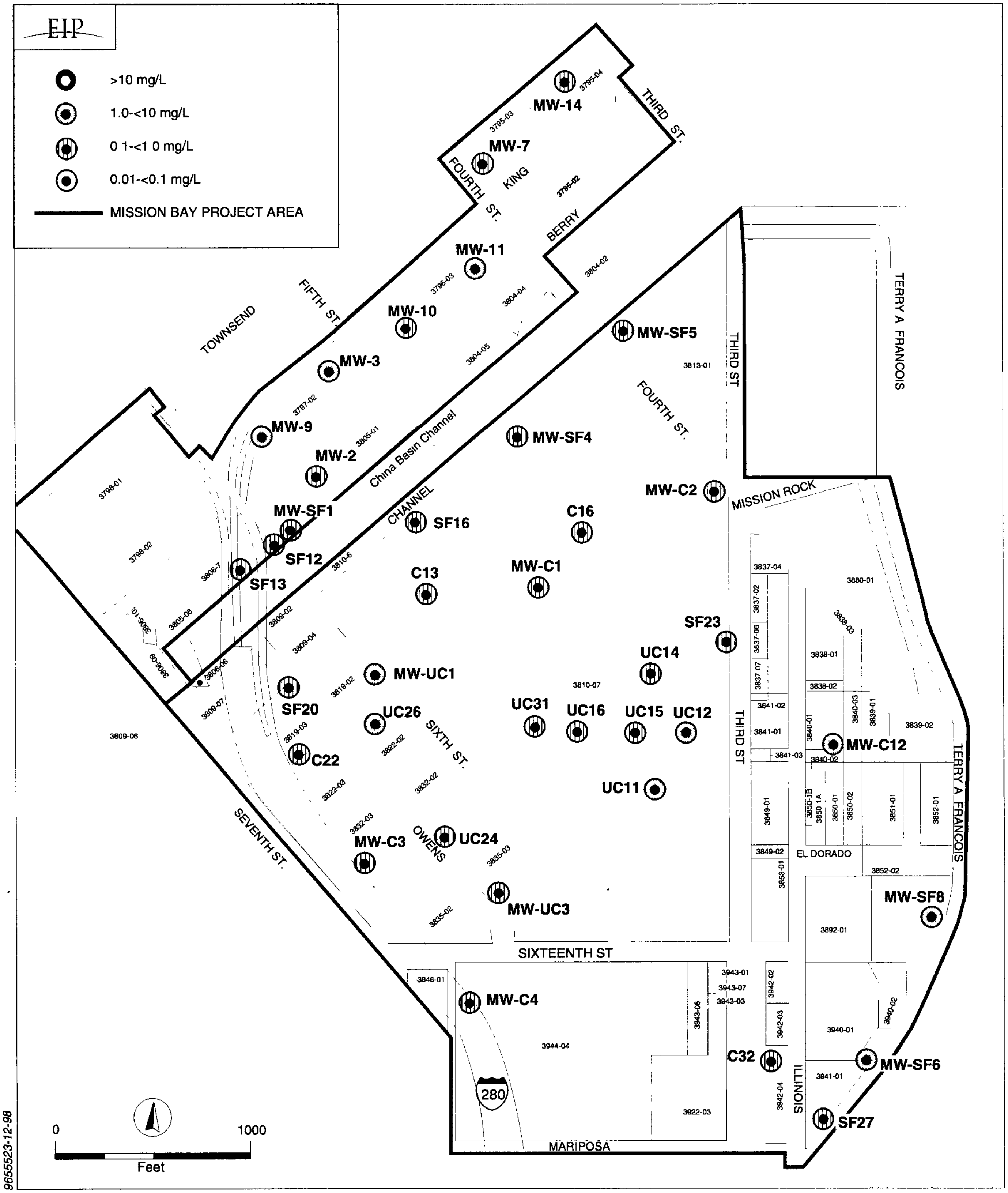
MISSION BAY SUBSEQUENT EIR

FIGURE V.J.11 RANGE OF DETECTIONS OF TPH GASOLINE IN GROUNDWATER



MISSION BAY SUBSEQUENT EIR

FIGURE V.J.12 RANGE OF DETECTIONS OF TPH DIESEL IN GROUNDWATER



SOURCE. ENVIRON International Corp.

MISSION BAY SUBSEQUENT EIR

FIGURE V.J.13 RANGE OF DETECTIONS OF TPH MOTOR OIL IN GROUNDWATER

Twelve metals (antimony, arsenic, barium, chromium, cobalt, lead, mercury, molybdenum, nickel, thallium, vanadium, and zinc) were detected in groundwater in Mission Bay North. The data indicate that there is no specific pattern of metals in groundwater that would indicate a specific, identifiable source area in Mission Bay North./50/

Status of RWQCB Review

Results of the Mission Bay North study were submitted to the RWQCB staff in April 1997. In June 1997, the RWQCB staff responded with a letter indicating concurrence with the conclusions presented in the report, citing the low concentrations and lack of specific sources of contaminants in Mission Bay North as the basis for concurrence./51/ The RWQCB staff suggested that localized, elevated concentrations of TPH-diesel and SVOCs in two monitoring wells in the vicinity of a former UST be managed to mitigate potential health and safety hazards at that location. As a condition for no further investigation or remediation, the RWQCB staff assumed that a Risk Management Plan (RMP) or health and safety plan would be developed and implemented to manage environmental conditions in Mission Bay North, including construction and maintenance worker activities at that location. RWQCB staff also noted that should groundwater extraction at the site occur due to future development, an analysis of the effect of that extraction on the localized TPH-diesel contamination may be required.

Mission Bay South

The Mission Bay South investigation was conducted from April 21 to June 24, 1997, including the Atcheson, Topeka and Santa Fe Railroad area. The study area included all Mission Bay South parcels owned by Catellus or by City agencies except the Channel Pump Station site. Parcels owned or operated by Esprit and Castle Metals were investigated independently; the results of those investigations were considered in the overall evaluation of the Project Area.

The results of the Mission Bay South study are presented in the *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California* ("1998 Mission Bay South report") prepared for Catellus by ENVIRON in April through September 1997. The report was submitted to the RWQCB staff in February 1998/52/ and is currently being reviewed by RWQCB staff.

Soil and groundwater samples were collected from a total of 111 borings and temporary monitoring wells as shown in Figure V.J.4. Two soil samples from each boring, ranging in depth from 0.5 to 8 feet below the ground surface, were collected and analyzed. All soil samples were analyzed for VOCs; SVOCs including PAHs; pesticides and PCBs; TPH gasoline, diesel, and motor oil fractions;

metals; and asbestos. Groundwater from each soil boring that was converted into a temporary monitoring well approximately 15 feet deep or collected from a Hydropunch™ boring was tested for VOCs, SVOCs, metals, TPH, and pH. The metals sampling program included antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. In addition, groundwater level data were collected to determine flow direction, the effects of tides on groundwater levels, the extent to which the box culverts could restrict groundwater flow toward China Basin Channel, and for use in modeling the potential reduction in chemical concentrations that could occur in groundwater as it moves toward tidally-influenced areas in Mission Bay South./53/

The information presented in this section, supplemented with additional data in Appendix I under "Summary of Soil and Groundwater Sampling Results," summarizes the results of soil and groundwater testing within Mission Bay South as presented in the 1998 Mission Bay South report./54/ Results of other site-specific studies on the Esprit and Castle Metals sites are summarized briefly at the end of this section.

Mission Bay South Soil Results

Results of soil sampling in Mission Bay South are summarized in Appendix Tables I.4 through I.10. Each table lists the chemical detected, the range of concentrations, and the number of detections of each chemical compared to the number of total samples. In addition, Figures V.J.5 through V.J.8 show the locations of soil borings where various chemicals were detected and the concentrations of these chemicals.

VOCs were detected in nearly one-half of the soil borings in Mission Bay South (see Figure V.J.5). Most of the soils containing VOCs are generally located close to former USTs or to the former bulk petroleum storage, pipelines, and transfer facilities previously located in the southeast portion of the Mission Bay South area (UST locations are shown in Figure V.J.2, petroleum facilities in Figure V.J.3)./55/ As shown in Appendix Table I.4, among the VOCs detected most frequently were acetone, 2-butanone, carbon disulfide, methylene chloride, benzene, toluene, ethylbenzene, and xylenes (the last four are collectively referred to as "BTEX" compounds). As with acetone, methylene chloride is another chemical used in analytical laboratory processes. It is possible that some of the acetone and methylene chloride detections may be from the laboratory analyses, rather than actual detections in soil./56/

SVOCs were detected in 16 borings in Mission Bay South. All but one of the SVOCs detected were PAHs. Based on the low frequency of detections, it appears that there is no pattern associated with the PAH detections, which indicates there is no specific, identifiable source of PAHs detected in soil in Mission Bay South./57/

Diesel and motor oil fractions of TPH were detected in varying concentrations in about one-fourth and one-half of the samples analyzed, respectively. Relatively few (less than 10%) of the soil samples contained detectable levels of TPH-gasoline./58/

Organochlorine pesticides were detected in two soil borings on the UCSF site. Pesticides were not detected in any other soil sample collected from Mission Bay South. PCBs were not detected in any soil sample in Mission Bay South./59/

All 17 metals that were included in the list of analytes tested (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc) were detected in varying concentrations in soil throughout Mission Bay South. Evaluation of the data indicates that there is no specific pattern of metals in soil. The widespread detection of metals indicates that the concentrations are likely associated with the composition of the fill, rather than a specific, identifiable source area in Mission Bay South./60/

Asbestos was detected in approximately one-third of the borings in Mission Bay South. The detections are believed to be attributable to the construction debris and fill placed in Mission Bay South and are randomly distributed throughout the Project Area./61/ Serpentinite, one of several rock types surrounding and underlying the Project Area, is a constituent in some of the material used to fill Mission Bay. Consequently, the presence of chrysotile asbestos in soil from naturally occurring chrysotile fibers in serpentinite fill material is not unexpected.

Mission Bay South Groundwater Results

Results of groundwater sampling performed in Mission Bay South are summarized in Appendix Tables I.11 through I.15. Each table lists the chemical detected, the range of concentrations, and the number of detections of each chemical compared to the number of total samples. In addition, Figures V.J.6, and V.J.9 through V.J.13 show the locations of monitoring wells where chemicals were detected and the concentrations of the chemical. A summary of this information is provided below.

Volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PAHs, metals, and total petroleum hydrocarbons (TPH) in gasoline, diesel, and motor oil fractions were detected in Mission Bay South groundwater samples. In addition, petroleum free product was found floating on top of the groundwater in the an area east of Illinois and Third Streets. This is discussed in more detail, below.

Detections of VOCs occur throughout Mission Bay South, but tend to be concentrated near the former bulk petroleum storage, pipelines, and transfer facilities previously located near the area east of Illinois Street on the port property. Aside from the VOCs associated with petroleum contamination, most of the other VOCs were detected in one monitoring well and comprise a small percentage of all VOCs detected.

SVOCs were detected in groundwater samples. The pattern of detections, concentrations of SVOCs, and low frequency of detections indicate that there are no specific, identifiable sources of contamination in the Project Area that could be attributed to the presence of these chemicals in Mission Bay South groundwater./62/

Total petroleum hydrocarbons (TPH) in the diesel, gasoline, and motor oil fractions were detected at varying concentrations. The TPH gasoline detections were located on or near Assessor's Block 3892, lot 1, near former petroleum bulk storage, pipelines and transfer facilities (see Figure V.J.3 for locations of bulk storage facilities, and Appendix Figure I.1 for a map showing Assessor's Blocks and lots). Detections of TPH-diesel and TPH-motor oil in groundwater were scattered through the investigation area. Most of the higher concentrations were detected in the former petroleum bulk storage, pipelines, and transfer facilities./63/

All metals except beryllium and thallium were detected in one or more of the groundwater samples in Mission Bay South. Arsenic, barium, chromium, copper, lead, and nickel were detected most frequently and at low concentrations./64/ A statistical analysis of upgradient versus downgradient concentrations of metals indicated that arsenic, barium, chromium, copper, lead, mercury, and nickel are not substantially higher downgradient than upgradient. This suggests that there is no significant contribution of these metals from a specific, identifiable source area within Mission Bay South and no net gain of these dissolved metals as groundwater migrates under the Project Area. Thus, the source of metals detections in groundwater appears to be related to the fill materials placed in Mission Bay South rather than releases from specific, identifiable sources such as industrial waste disposal or releases./65/

Petroleum Free Product

In general, no single contaminant source areas were identified in Mission Bay South, with the exception of an area of petroleum free product in the southeast portion of Mission Bay South. The chemicals detected in that area appear to be primarily related to former petroleum bulk storage, pipelines, and transfer facilities formerly located on port property on or near Assessor's Block 3892, lot 1, and the Esprit site on Assessor's Block 3940 (see Appendix Figure I.1 for a map showing

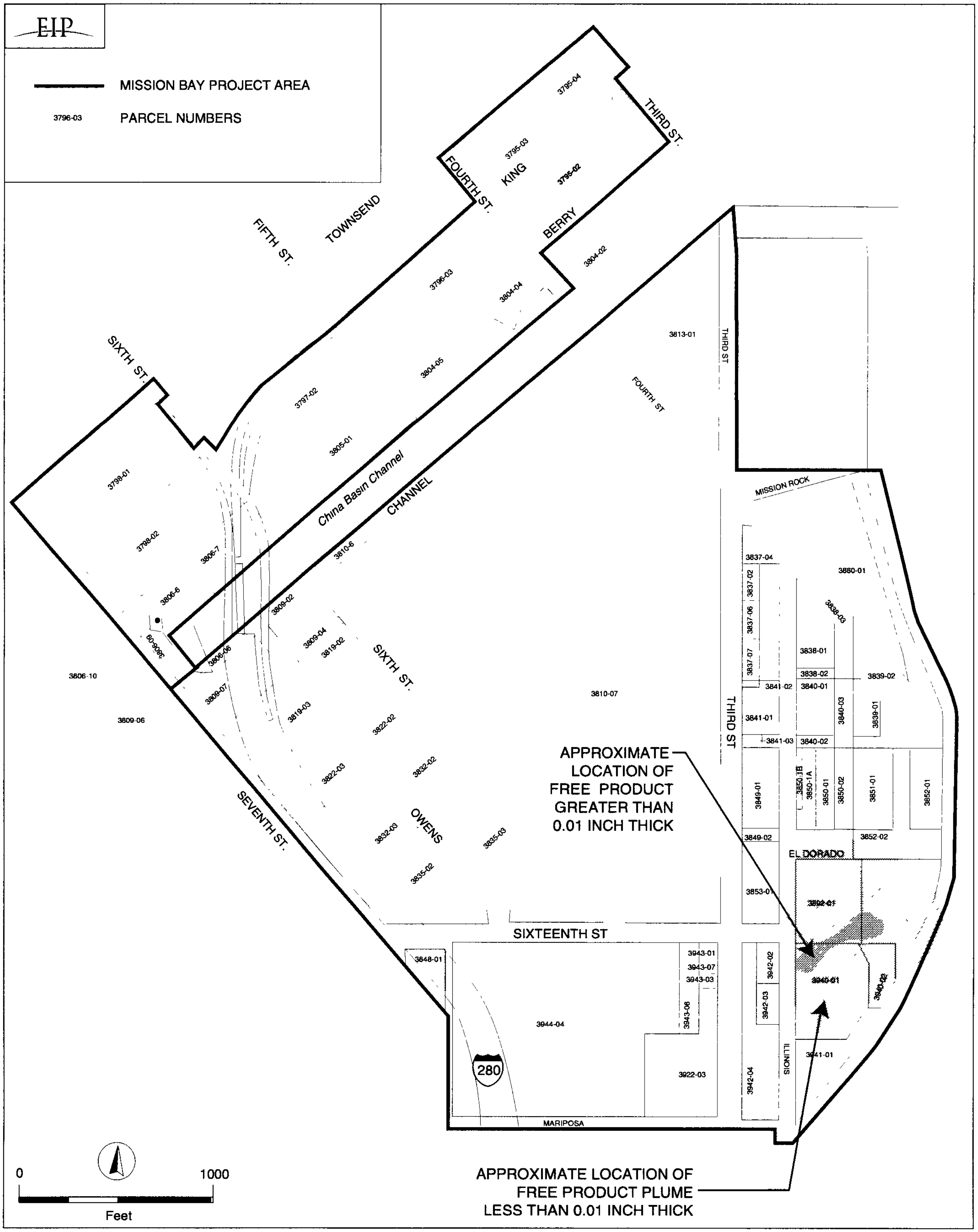
Assessor's Blocks and lots). Chemicals found in other areas of Mission Bay South are likely attributable to the various fill materials used to fill in the former shallow bay. Some could be the result of former industrial activities in Mission Bay South.

As discussed above, under "Bulk Petroleum Handling Facilities," based on observations made during drilling and sampling activities, a petroleum free product area was identified in the southeast portion of Mission Bay South. The approximate horizontal extent of free product with a measurable thickness greater than 0.01 inch is shown in Figure V.J.14. A free product thickness of 1.6 feet was measured by ENVIRON in monitoring well MW-C9, about 300 feet east of Illinois Street approximately in line with the extension of 16th Street (near the pipelines shown in 16th Street in Figure V.J.3)./66/

Chemical analysis indicates that the free product is most likely weathered crude oil that had undergone moderate biodegradation. Some volatile (lighter end) hydrocarbons were also present in the free product. The chemical characteristics of the weathered crude oil are believed to be consistent with a release that may have occurred over 10 years ago. The presence of free product is likely related to the former petroleum bulk storage, pipelines and transfer facilities previously located on Assessor's Block 3892, lot 1, and on the Esprit site near the 16th and Illinois Streets intersection (Assessor's Block 3940), as well as the underground petroleum pipelines used by these facilities that run beneath 16th Street to Pier 64./67/ These facilities, which handled products such as diesel, kerosene, gasoline, lubricating oil, crude oil, and bunker fuel oil, were active from the early 1900's to the 1960's and early 1970's./68/

Status of RWQCB Review

The final report describing the results of the 1997 investigation for Mission Bay South was submitted to the RWQCB staff in February 1998 and is currently under review. Based on preliminary information provided to RWQCB staff in June 1997, the RWQCB staff indicated in August 1997 that they would not refer any portion of Mission Bay South to the U.S. EPA as a Superfund site or to the California Environmental Protection Agency to be managed under the Hazardous Substances Account Act./69/ As discussed in greater detail in Contaminated Soils and Groundwater: Impacts, an RMP for the Project Area, or RMPs for each development site or phase, is proposed that would specify actions to be implemented during and after project completion to ensure that construction workers, future occupants, workers, and visitors would not be adversely affected by chemical contaminants that have been detected in Project Area soil or groundwater. The RMP would include a determination of whether contaminant concentrations in soil or groundwater would pose an adverse risk to people exposed to the contaminants. If an adverse risk is possible, the RMP would identify measures that would be implemented to reduce such risk. The RMP would be submitted to the Regional Board



SOURCE. ENVIRON International Corp

MISSION BAY SUBSEQUENT EIR

FIGURE V.J.14 APPROXIMATE LOCATION OF PETROLEUM FREE PRODUCT PLUME IN AND NEAR THE PROJECT AREA

staff, as Administering Agency, for review and approval. Preparation and subsequent RWQCB staff approval of the RMPs would occur independent of the California Environmental Quality Act (CEQA) process under the administrative jurisdiction of the RWQCB.

Other Investigations in Mission Bay South

Soil and groundwater were tested by ENSR Consulting and Engineering (ENSR) on the property at 499 Illinois Street in 1990 for Esprit de Corp. The results of that study showed that petroleum hydrocarbons were in soil and in groundwater on the property and that petroleum free product was found on groundwater in the western, southern, and eastern portions of the property./70/ This information was incorporated and accounted for in the ENVIRON studies described above for Mission Bay South.

Property located northwest of the intersection of Third and Mariposa Streets (1900 Third Street) was evaluated in 1993, 1994, and 1996 by LAW Engineering and Environmental Services, Inc. (LAW) to identify the potential for contamination or other hazardous materials-related issues that could affect future development of the site./71/,/72/ The site and surrounding area had previously been used for industrial purposes, including fuel oil storage, since the early 1900's. The site is currently occupied by a warehouse and attached offices and an asphalt parking lot. Castle Metals occupied a portion of the warehouse until about 1996 and carried out some metal cutting and shaping on the site.

Site reconnaissance, geophysical testing, and regulatory file review activities performed during the assessments indicated that USTs had been removed from the site. Soil samples were also collected from eight borings and analyzed for VOCs, SVOCs, TPH, and metals. Metals, oil, and grease were detected in soils at about 4 to 5 feet below ground surface in a few locations and were attributed to fill materials or historical railyard activities to the north. No specific potential off-site sources of contamination that could affect the site were identified. Based on the results of the three assessments, LAW did not recommend additional investigation or remediation, except in association with Article 20 site development requirements./73/

Conditions Related to Potential Sources of Contamination Outside the Project Area

In order to determine whether off-site sources are impacting the Project Area, soil and groundwater samples were collected and analyzed for a wide range of chemical constituents from locations across the Project Area. Results of the 1997 Mission Bay North and Mission Bay South investigations indicate that, except for metals and chemicals detected in the vicinity of the Caltrain property, none of the chemicals detected along the upgradient sides of the Project Area illustrated patterns of detection that suggest that their origin was from off-site areas. Metals in soil and groundwater occur naturally both on-site and off-site. Some metals in the Project Area may have migrated from off-site but if so, the data do not suggest a specific source area.

TPHs and SVOCs appear to have been released to the subsurface in the vicinity of the former UST on Caltrain property north of the Project Area. These releases appear to have migrated into the Project Area in Mission Bay North. As discussed in "Status of RWQCB Review" in "Sampling Program and Analytical Results" for Mission Bay North, above, no further investigation or remediation has been requested by RWQCB staff, but the contaminants must be effectively managed during Project Area development so they do not present a hazard. In other locations, where elevated concentrations of petroleum hydrocarbons were detected in samples collected from within the Project Area but near the upgradient Project Area boundaries, they were associated with historic site uses that occurred within the Project Area. Other chemicals detected in soil and groundwater samples collected from within the Project Area along its upgradient boundaries were not substantially elevated, indicating a lack of migration of chemicals from off-site areas into the Mission Bay Project Area./74/

Summary of Existing Human Health and Ecological Risks from Contaminants Detected in Soil and Groundwater in the Project Area

This section identifies current potential human health and ecological risks associated with the concentrations of contaminants detected in soil and groundwater in the Project Area and summarizes the significance of the risk under existing (pre-development) conditions. This discussion also establishes the baseline against which to compare the effects of the proposed project.

Existing Human Health Risks

Based on current uses within and adjacent to the Project Area, individuals that could be exposed to potential health risks due to the presence of chemicals detected in soil or groundwater include existing commercial and industrial tenants and their employees, visitors, and nearby residents. Additionally, transient populations occasionally occupy portions of the Project Area.

Extended periods (several months or years) of direct contact with exposed soil could result in an increased potential for various adverse human health effects if the exposed soils contain sufficiently elevated levels of chemicals, such as metals, PAHs, or TPHs. The primary routes of exposure would be via inhalation of dust containing the contaminants or inhalation of volatile constituents in the vicinity of the free product area that could migrate into indoor or ambient air. Ingestion or dermal (skin or eye) contact with soils containing contaminants could also occur. Direct contact with groundwater is not considered a pathway through which current populations could be exposed to chemicals in the groundwater because shallow groundwater is not used for domestic or industrial purposes and no excavations to groundwater depth exist or are planned in the short-term future. It is possible that some individuals involved in the free product remediation efforts in the southeastern portion of the Project Area could come into contact with the free product or groundwater contaminated with petroleum hydrocarbons as part of the selected remedial action. This would not represent a significant source of exposure to current populations because site controls and cleanup methods would be implemented that would restrict access to and prevent contact with contaminated soil, groundwater, or the free product itself./75/

The Risk Management Plans (RMPs) would evaluate further the potential for the current conditions on undeveloped parcels to pose a risk to populations in the interim period between now and when the site development is expected to be complete, and identify measures that could be required or recommended to address these potential impacts. Since the RMP is not expected to be prepared, submitted, and approved by the RWQCB staff prior to mid-1998, ENVIRON evaluated the need for the implementation of immediate risk management measures to protect human health.

The agencies responsible for overseeing site remediation have not developed specific risk assessment guidelines to identify sites that require an immediate response. To determine the need for immediate control measures in the absence of specific regulatory criteria, ENVIRON developed a tiered approach, which is presented in *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*. The process consisted of identifying chemicals of potential immediate concern (COPIC), identifying the levels of COPIC to which individuals could potentially be exposed, and then evaluating whether the potential for the levels of COPIC to which individuals may actually be exposed would represent a potential human health threat sufficient to warrant the implementation of immediate risk management measures. The evaluation of the potential immediate human health impacts was based on the potential for the short-term exposure to the COPIC present in the Project Area to cause cancer, noncancer, or acute health effects in the potentially exposed populations. The tiered approach consisted of two steps, identification of chemicals of concern and analysis of COPIC.

ENVIRON compared the maximum concentration of chemicals detected in the soil anywhere in the Project Area to the risk-based preliminary remediation goals (PRGs) developed by U.S. EPA Region IX for the protection of industrial land uses (Region IX Industrial PRGs). (Additional information on PRGs is presented in "Analysis of Potential Adverse Human Health Effects Associated with Current Conditions in the Project Area," in Appendix I.) The maximum concentrations of arsenic, beryllium, lead, and various carcinogenic PAHs exceeded the Region IX Industrial PRGs and were, therefore, identified as COPICs. The upper numerical limit of a calculated statistical average of the concentration of each COPIC in the exposed soils was compared with Region IX Industrial PRGs to determine if any PRGs were exceeded. An exceedance would indicate that there would be a potential for that COPIC to cause adverse health effects./76/ Specific assumptions and the methodology that were used in the evaluation of COPICs are also presented in "Analysis of Potential Adverse Human Health Effects Associated with Current Conditions in the Project Area" in Appendix I.

Based on that evaluation, none of the chemicals detected in the exposed surface soils in either Mission Bay North or Mission Bay South were detected at levels that would indicate that any immediate risk management measures are necessary or would be otherwise required prior to approval of the RMP in mid- to late 1998. Each of the COPIC are below Region IX Industrial PRGs adjusted to account for a limited six-month exposure period (for potential carcinogenic compounds) and are also below the Region IX Industrial PRGs developed to protect against noncarcinogenic effects. Further, the maximum concentrations of COPIC detected in the exposed soils are below the acute threshold criteria, suggesting that even high-level, short-term exposure to child populations would not pose any acute health risks./77/

The presence of the free product in the southeastern portion of the Project Area has not been identified as an immediate human health hazard. As discussed previously, additional investigation is underway, and remediation of the free product area may be necessary to minimize it as a potential source of contamination that could adversely affect near-shore aquatic environments. Remediation of the free product, for which risk management measures would also be implemented, will take place irrespective of whether Mission Bay redevelopment projects occur and regardless of future actions associated with implementation of risk management measures.

Existing Ecological Risks

As described in Section V.L, Vegetation and Wildlife: Setting, the Project Area is primarily industrial and does not provide habitat for any rare or endangered terrestrial species. Therefore, the following discussion of existing conditions pertains only to marine aquatic organisms in the near-shore environment.

The potential for chemicals detected in groundwater to pose a risk to the near-shore aquatic organisms present in either China Basin Channel or San Francisco Bay under existing conditions was also evaluated as part of the 1997 investigations. Results of the assessment for Mission Bay North were presented in *Technical Memorandum #3, North of Channel Screening-Level Ecological Risk*

Evaluation, Mission Bay Project Area, prepared by ENVIRON in 1998. Results of the evaluation for Mission Bay South were presented in the 1998 Mission Bay South report.

Chemicals in soil in the Project Area could impact aquatic species if chemicals are released to water bodies through surface water runoff. As indicated in Section V.K, Hydrology and Water Quality: Impacts, under "Volume and Quality of Direct Stormwater Discharge to Bay," no direct measurements of runoff quality from the Project Area are available. Reasonable estimates of pollutant concentrations are discussed in "Construction Activity Pollutants," in Section V.K, Hydrology and Water Quality: Impacts. This section discusses potential ecological effects of chemicals in groundwater in the Project Area.

A screening-level process similar to that used to assess human health effects was used to determine the effect, if any, that chemicals in groundwater of potential ecological concern (COPECs) could have on the ecological environment in Mission Bay North and Mission Bay South. The process included identifying the COPECs, determining potential pathways for those chemicals to migrate to groundwater or surface water, identifying appropriate criteria for comparison, and evaluating whether the COPECs could be released at concentrations sufficient to pose a potential risk to the aquatic organisms at the present time./78/ The methodology used in selecting the COPEC and in evaluating the significance of each COPEC, including aquatic criteria used, is described in Appendix I in "Analysis of Potential Adverse Ecological Effects Associated with Current Conditions in the Project Area." The results of the analysis for Mission Bay North and Mission Bay South are presented below.

Using the process described in Appendix I, VOCs, metals, all three fractions of TPH (diesel, gasoline, and motor oil), BTEX compounds, and naphthalene were identified as COPECs in Mission Bay North and Mission Bay South./79/ The importance of each of these compounds relative to potential risk to the near-shore aquatic environment of China Basin Channel and San Francisco Bay is discussed below.

Volatile Organic Compounds

The maximum detected concentrations of VOCs detected anywhere in Mission Bay North or Mission Bay South do not exceed the U.S. EPA acute and chronic ambient water quality criteria. Although water quality criteria have not been established by the U.S. EPA for some of the VOCs detected, the low concentrations of the VOCs, combined with the low frequency of detections, location of detected VOCs relative to surface water, and tidal flushing action, indicate that VOCs in groundwater are not adversely affecting the near-shore aquatic environment./80/

Metals

As previously noted, metals were detected in groundwater throughout the Project Area. Several metals were detected at a frequency greater than 50% of the samples. The consistent detection of metals in groundwater, with no apparent pattern in the distribution of detections, is considered representative of background conditions. According to ENVIRON's analysis, the data also suggest that the metals in groundwater are related to fill materials placed around the turn of the century rather than specific point-source releases from past commercial or industrial activities (such as USTs or the petroleum free product area).

In the 1997 Mission Bay North investigation, two metals (mercury and nickel) were detected in groundwater at average concentrations above chronic water quality criteria for the marine aquatic environment. The average concentrations of mercury and nickel exceed the chronic water quality criteria (without taking the calculated attenuation into account) by factors of 5.6 and 3.1, respectively. None of the chemicals are present at average concentrations that exceed the acute water quality criteria. In the 1997 Mission Bay South investigation, four metals (copper, lead, mercury, and nickel) were detected in groundwater at average levels above the chronic water quality criteria. The average concentrations of copper, lead, mercury, and nickel detected in the 500-foot zone adjacent to the China Basin Channel exceed the chronic water quality criteria (without taking the calculated attenuation into account) by factors of 2.9, 9.2, 5.4, and 1.8, respectively. None of the chemicals are present at average concentrations that exceed the acute water quality criteria. Similarly, the average contentrations of copper, lead, mercury, and nickel detected in the 500-foot zone adjacent to the Bay exceed the chronic water quality criteria (without taking the calculated attenuation into account) by factors of 1.2, 1.3, 4.8, and 2.1, respectively. None of the chemicals are present at average concentrations that exceed the acute water quality criteria.

As discussed under "Toxic Substances," and under "Impairment of Central San Francisco Bay," in Section V.K, Hydrology and Water Quality: Setting, San Francisco Bay is considered "impaired" for copper and mercury, indicating that Bay water quality exceeds acceptable limits. In the past, groundwater from the Project Area may have contributed to the overall concentrations of copper and mercury in the Bay, although any contribution would be too small to be individually measured at the regional monitoring stations located in the center of the Bay.

The continued presence of those metals in groundwater is not considered to be adversely affecting aquatic organisms near the shore in China Basin Channel or San Francisco Bay for several reasons. First, the tidal influence study predicts that tidal flushing action in groundwater within the last 50 feet toward China Basin Channel and San Francisco Bay reduces the average concentrations of metals in the groundwater adjacent to the Channel and the Bay approximately 10-fold. Consequently, the average concentration of all metals in groundwater prior to entering China Basin Channel or San Francisco Bay are lower than the chronic aquatic criteria. Second, the concentrations of metals in groundwater that enter and persist in the marine environment may be lower than the concentrations predicted by the tidal influence model (see "Hydrogeologic Conditions," above for more discussion of the tidal influence model). Many metals will form complexes with naturally occurring organic material and, thus, will be less biologically available to the aquatic organisms than the dissolved concentrations in groundwater. In addition, the box sewer likely acts as a partial barrier to groundwater flow toward the Channel. As discussed previously, metals detected in groundwater appear to be the result of metals present in fill materials placed around the turn of the century rather than specific, identifiable source releases from past commercial or industrial activities./81/

Petroleum Hydrocarbons

Petroleum hydrocarbons characterized in the TPH-gasoline, TPH-diesel, and TPH-motor oil ranges as well as BTEX compounds and naphthalene were identified as COPECs in groundwater./82/ Unlike the metals, detections of TPH are associated with specific uses, such as USTs or bulk petroleum handling facilities. Because the releases of these chemicals appear to be localized, the concentrations in monitoring wells directly adjacent to China Basin Channel and San Francisco Bay were compared to available water quality standards and toxicity guidelines derived from peer-reviewed scientific literature, as described in more detail in Appendix I in "Evaluation of Potential Ecological Risks." A comparison of groundwater TPH concentrations to aquatic toxicity values, combined with tidal flushing action and the box sewer that restricts flow towards the Channel, indicates that, with the possible exception of the free product area, the near-shore aquatic community is not at risk from TPH compounds./83/

TPHs, particularly in the TPH-diesel range, were detected in greater concentrations to the east along the San Francisco Bay fringe than along the Channel edge. The TPH-diesel concentrations along the Bay exceed toxicity values; those locations are in the free product area that is already under investigation and is expected to be remediated independent of the Mission Bay redevelopment project./84/

BTEX compounds were detected infrequently in groundwater in the San Francisco Bay waterfront area in Mission Bay South. All detections of BTEX compounds were less than the estimated lowest chronic concentration for marine organisms, and PAHs (e.g., naphthalene) were not detected in any of the groundwater samples from the China Basin Channel area. The levels of TPH in the monitoring wells adjacent to China Basin Channel are all well below toxicity criteria developed in recent studies described in Appendix I in "Evaluation of Potential Ecological Risks." Therefore, neither TPH nor the petroleum constituents BTEX and naphthalene present a risk to aquatic organisms in the China Basin Channel area under existing conditions. Because the concentrations did not exceed water quality criteria, those compounds are not considered to represent a significant risk to the aquatic community./85/

The single detection of naphthalene in the San Francisco Bay waterfront area exceeded the estimated lowest chronic aquatic criterion by a factor of 3. The estimated chronic criterion is considered conservative, and the detected naphthalene concentration in groundwater prior to entering the Bay would be reduced 10-fold or greater due to tidal influences, which would further minimize the potential for adverse aquatic effects./86/

Summary

In summary, based on the analytical results and the screening process described above, no contaminants detected in Mission Bay North or Mission Bay South groundwater are adversely impacting the aquatic community in the near-shore habitats of China Basin Channel and San Francisco Bay, with the potential exception of the petroleum free product plume in the southeastern portion of the Project Area. As previously described, that area is under additional study./87/ The groundwater samples collected to date do not indicate that significant concentrations of COPEC in the soil are being dissolved and leaching into the groundwater.

REGULATORY FRAMEWORK

The management of hazardous materials is regulated independently of the CEQA process at federal, state, and local levels through programs administered by the U.S. EPA, agencies within the California Environmental Protection Agency(Cal/EPA) such as the Department of Toxic Substances Control (DTSC) and the RWQCB, U.S. Department of Transportation (DOT), California Highway Patrol, federal and state Occupational Safety and Health agencies (OSHA), and the City and County of San Francisco Departments of Public Health and Public Works. In 1981, the California Legislature enacted "State Superfund" legislation to establish a regulatory process to address the release of hazardous substances that may be harmful to public health and the environment. This process requires responsible parties to cleanup contamination and enables persons or parties injured by these hazardous materials releases to be compensated for their injuries./88/ The Mission Bay property is not a Superfund site; however, many of the regulatory guidelines, standards, and methods established as part of the Superfund process to evaluate potential risks and identify the need for remedial action at

Superfund sites are relevant and were used to support the conclusions regarding existing and potential future risks to human health and the environment in the Project Area.

Key Terms

Some of the key terms used in the management of hazardous materials and the context within which they apply to sites where contaminants have been identified in soil or groundwater are presented below.

The definitions of hazardous material and hazardous waste found in "Definitions of Terms," at the beginning of this Setting section, are derived from the California Health and Safety Code and are consistent with those found in the federal Clean Water Act, Resource Conservation and Recovery Act, and Clean Air Act. Crude oil and petroleum products are specifically excluded by law from these definitions, although from a practical standpoint, contamination caused by these products may be treated as a hazardous substance./89/

A "hazardous materials release site" refers to any area, location, or facility where a hazardous material has been released or threatens to be released to the environment./90/

"Remedial action" or "remediation" refers to actions required by state or local laws, ordinances, or regulations necessary to prevent, minimize, or mitigate damage that may result from the release or threatened release of a hazardous material./91/ These actions include the cleanup of the site, monitoring, testing and analysis of site conditions, site operation and maintenance, and placing conditions or restrictions on the land use of the site upon completion of remedial actions.

Oversight of Hazardous Materials Release Sites

Regional Water Quality Control Board as Administering Agency

The oversight of hazardous materials release sites often involves several different agencies that may have overlapping authority and jurisdiction. The DTSC and RWQCB are the two primary state agencies responsible for issues pertaining to hazardous materials release sites. Therefore, the California Legislature enacted AB 2061 in 1993 to create a process for designating a single administering agency that takes preemptive authority over cleanup of a site./92/

Under AB 2061, a single agency is designated to supervise all aspects of the investigation and remedial action ("Administering Agency"). That agency is granted jurisdiction over all activities necessary to respond to hazardous materials releases, investigation and remedial action. The Administering Agency must consult with other agencies ("Appropriate Agencies" or "Support Agencies") when issuing permits or other authorizations not normally within its jurisdiction.

The investigation and remediation of hazardous material releases in the Mission Bay Project Area will be overseen by the RWQCB. On July 15, 1997, the California Environmental Protection Agency (Cal/EPA) designated the RWQCB as the Administering Agency for the site investigation and remediation of the Project Area (Resolution No. 97-10, Cal/EPA July 14, 1997). The designation was made after application and public hearing under the requirements of Assembly Bill 2061 (Health and Safety Code, Division 20, Chapter 6.65, Section 25260 *et seq.*). The Support Agencies are: Cal/EPA, DTSC, Air Resources Board, Office of Environmental Health Hazard Assessment, Department of Fish and Game, and State Water Resources Control Board.

When the RWQCB decides to take action as Administering Agency, it may convene an advisory committee meeting of the involved Support Agencies as well as local agencies. The public may be invited to attend particular meetings as appropriate. Because of its role as the Administering Agency, the RWQCB and its staff will have the lead regulatory role in deciding whether and how the ecological and health risks at the Mission Bay Project Area would be managed under RMPs. The RWQCB staff would specifically approve each RMP and would be responsible for ensuring compliance with each RMP.

Once site assessment activities and/or remedial actions have concluded, the RWQCB staff may issue a "certificate of completion" detailing the extent of contamination and the attainment of standards and objectives if remediation was necessary./93/

Regulatory Process for Determining Need for Remediation

The current regulatory view of site redevelopment where chemical constituents are present in the soil or groundwater is that the decisions regarding cleanup and future site use should be based on actual and reasonably projected risks presented by individual sites. This site-specific, risk-based decision making process is often referred to as "Risk Based Corrective Action," or RBCA. Prior to the development of the concept of RBCA, the goal at sites undergoing corrective action was to restore the sites either to pristine conditions or to achieve conservative generic concentration levels set in advance by the regulatory oversight agency. The levels established by the regulatory agency were the same at every site, regardless of possible indirect environmental effects (e.g., hazardous waste disposal site capacities or availabilities) or the potential future use of the property. The RBCA approach is marked by a focus on planned land uses, a recognition that all sites do not present the same risk, the understanding that the actual risks posed by a site are a function of the populations that could be present and the activities they could be engaged in, and an acknowledgment that many risks can be reduced and/or eliminated through the implementation of a risk management plan.

The risk estimates that are identified through the RBCA process take into consideration such factors as the concentration and further migration of contaminants, potential hazards to remediation workers and nearby populations, and potential exposures to the public, based on future land use. The risk-based decision-making relies on the preparation of risk-based evaluations to quantify potential exposures and resultant adverse health effects. For instance, in an area of contamination where a building is to be constructed, once the building is in place it would provide a barrier to prevent direct access to the contamination. However, volatile chemicals that may be present in the soil or groundwater underneath the building may volatilize and migrate through the soil column into indoor air. Thus, although building occupants would not have direct contact with the soils under the buildings, they could be exposed to volatile constituents that have migrated into indoor air.

Depending on the types of chemicals present and potential pathways through which individuals might be exposed to the chemicals, contaminants in soil or groundwater can often be left in place or cleaned up to a degree that does not pose a threat to human health or the environment. For sites contaminated by petroleum products from underground storage tanks, the RWQCB has drafted investigation and corrective action guidelines./94/

Many risks identified through the RBCA process can be safely managed through the implementation of risk management plans. These plans describe how risks to the public and environment can be reduced to levels that are considered insignificant./95/ In addition, they describe mechanisms to ensure successful implementation, enforcement and monitoring necessary to continuously manage these risks. RMPs are used to outline the processes and procedures that would be followed by owners of sites to reduce any risks identified in the RBCA process.

Hazardous Wastes in Soil

● Hazardous wastes in soil are regulated at federal, state, and local levels. At the state level, the Cal/EPA Department of Toxic Substances Control administers hazardous waste laws and regulations pursuant to Division 20, Chapter 6.5 of the California Health and Safety Code and Title 22 of the California Code of Regulations, respectively. The Cal/EPA Department of Toxic Substances Control regulations list state-designated hazardous chemicals. Certain specific wastes because of their concentrations (e.g., a site on the National Priorities List) or inclusion on federal lists of wastes (such as RCRA Section 3001 hazardous wastes list or the toxic pollutants list established pursuant to Section 307 of the Federal Clean Water Act), are also regulated as federal hazardous wastes by U.S. EPA. The Regional Water Quality Control Board is concerned with contaminated soils that may impact groundwater.

In San Francisco, Article 20, Section 1000 *et seq.*, of the San Francisco Public Works Code, entitled "Analyzing the Soil for Hazardous Waste," commonly known as the Maher Ordinance, requires building permit applicants proposing to disturb 50 cubic yards of soil or more on sites located bayward of the San Francisco 1851 high tide line to conduct environmental assessments of that soil for possible hazardous waste. Soil samples must be collected at the depths and locations of site excavations, including basements, utility trenches, elevator pits, and foundations. Where hazardous wastes are found in excess of state or federal standards, the permit applicant is required to submit a site mitigation plan prepared by a qualified expert to the Director of Public Health and the Director of Public Works, and must implement the site mitigation plan and certify completion prior to issuance of any building permit. Where hazardous wastes are found for which no standards are established, the permit applicant must request a determination from the Director of Public Health as to whether a site mitigation plan is needed. The Project Area is within the geographic area covered by this ordinance, and all development that would disturb 50 cubic yards of soil or more must comply with Article 20.

Air Quality Controls

The Bay Area Air Quality Management District (BAAQMD) is primarily responsible for planning, implementing, and enforcing federal and state ambient air quality standards in the San Francisco Bay Area. BAAQMD regulates both criteria air pollutants and toxic air contaminants (see "Regulatory Framework" in Section V.F, Air Quality: Setting). Particulate matter from construction activities is regulated by BAAQMD. In addition, volatiles and any toxic air contaminants generated by excavation or remediation of contaminated soil in the Project Area would be regulated by the BAAQMD.

Construction-Generated Dust

BAAQMD requires the implementation of various dust control measures in order to keep the small-diameter particulates, or $PM_{10,}$ levels to a minimum. BAAQMD's Regulation 6-305 prohibits visible particles from falling on real property other than that of the person responsible for the emission. The BAAQMD's approach to CEQA analyses of construction impacts is to emphasize implementation of effective and comprehensive control measures rather than detailed quantification of emissions./96/

Toxic Air Contaminants

As described in "Summary of Existing Human Health and Ecological Risks from Contaminants Detected in Soil and Groundwater in the Project Area," above, remediation of contaminated soil or groundwater is not currently anticipated in the Project Area, except in the free product area. It may, however, be necessary to remediate contaminated soil and/or groundwater in the Project Area if unexpected chemicals or sources of hazardous materials are found during the development of the Project Area or Article 20 testing. If a device or process employed for on-site treatment of a hazardous substance in soil has the potential to emit toxic air contaminants (TACs), a permit from the Bay Area Air Quality Management District may be required./97/ As part of the permit process, a risk screening evaluation may be required to determine the potential risks attributable to emissions from a particular process or device./98/ For instance, soil vapor extraction is routinely employed to remove volatile chemicals from soil. A similar method can be used to treat contaminated groundwater. Volatile substances (e.g., benzene) are usually transferred to carbon adsorption devices that are then managed as hazardous waste. Use of these and similar remediation techniques would require a BAAQMD permit.

Underground Storage Tanks

Chapter 6.7 of the California Health and Safety Code addresses the removal and cleanup of hazardous substance contamination resulting from leaking underground storage tanks. Title 23 of the California Code of Regulations provides the implementing procedures for this law. The law and regulations require that operational tanks have valid permits, inactive or unused tanks be properly abandoned, and that contaminated soils and/ or groundwater caused by leaking tanks be abated.

While statewide oversight of the UST program is assigned to the various Regional Water Quality Control Boards, most regulatory and permit functions are handled by county health departments, which in San Francisco is the Department of Public Health, Environmental Health Services Division. UST removal is the responsibility of the Hazardous Materials Unified Program Agency. Under contract with the RWQCB, the Local Oversight Program oversees the cleanup of any contamination associated with USTs that may have leaked. The contract with the RWQCB provides that the RWQCB may oversee any tank site in lieu of the Local Oversight Program. The RWQCB has chosen to oversee all tank cleanup in Mission Bay; therefore the Local Oversight Program has not been associated with UST work in the Project Area.

Contaminated Groundwater

It may be necessary to pump groundwater or "dewater" areas to facilitate construction. Discharges to the sewerage system related to these activities are regulated by the San Francisco Department of Public Works through Article 4.1, the Industrial Waste Ordinance, of the Public Works Code. Groundwater from dewatering and/or cleanup activities must meet specific treatment standards before being discharged to the City sewage system under permits issued by the Department of Public Works (see "Water" in the Initial Study [Appendix A]). Permittees/dischargers must also monitor the groundwater discharged to the sewer system and report regularly to the Department of Public Works.

If groundwater were to be pumped directly into the Bay, the discharger would be required to obtain a National Pollutant Discharge Elimination System (NPDES) permit from the RWQCB, as described in "Stormwater Pollution Prevention Plan," in Section V.K, Hydrology and Water Quality: Impacts. Any groundwater proposed for discharge from the Project Area into the Bay must meet strict water quality standards established by NPDES permits, and may have to be treated before discharge into the Bay to avoid degradation of the Bay's water quality. Furthermore, dischargers are required to meet stringent monitoring standards established by NPDES permits to assure compliance under this permitting system.

Hazardous Waste Handling Requirements

As a result of demolition activities or remedial actions determined to be necessary as a result of Article 20 testing or that would otherwise be required, hazardous waste may be generated from the Project Area and would need to be transported to a facility permitted to accept such waste. Management of specific hazardous wastes is addressed at the federal, state and local levels. The federal Resource Conservation and Recovery Act/99/ (RCRA) is administered by the U.S. EPA, and the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) administers the state's Hazardous Waste Control Law./100/ Under state law, DTSC has adopted extensive regulations governing the generation, transportation, treatment and disposal of hazardous wastes, also referred to as "cradle to grave." State requirements differ little from federal laws; both RCRA and the Hazardous Waste Control Law impose regulatory systems for handling hazardous wastes in a manner that protects human health and the environment, including use of hazardous waste "manifests" used to track hazardous wastes from the point of generation to the disposal site. Hazardous waste manifests describe the waste and regulatory information about it.

As discussed in more detail in "General Soil Movement and Transport During Construction," below, DTSC has determined that soils excavated during construction in the Mission Bay Project Area can be moved around and reused in the Project Area without triggering hazardous waste management requirements, provided the soils are managed in accordance with RMP measures. However, DTSC's determination does not apply to building demolition debris or waste soils or other waste materials from any necessary remediation activities. In the event these wastes contain levels of constituents that would result in their classification as hazardous waste, the hazardous waste regulations described above would apply to those materials.

Hazardous Materials Transportation

Hazardous materials that could possibly be excavated from construction and/or remediation activities in the Project Area may require offsite transportation for disposal and/or treatment. Transportation and disposal of soil that is classified as hazardous waste (described in the "Hazard Versus Risk" subsection, above) would be subject to applicable federal and state regulations. The U.S. Department of Transportation regulates hazardous materials transportation, including contaminated soil, between states. The California Highway Patrol and the California Department of Transportation (Caltrans) are the state agencies with primary responsibility for enforcing federal and state regulations related to transportation within California. These agencies respond to hazardous materials (contaminated soil) transportation emergencies. Together, these agencies determine container types to be used and license hazardous waste haulers for hazardous waste transportation on public roads.

Worker Safety

Occupational safety standards exist in federal and state laws to minimize worker safety risks from both physical and chemical hazards in the workplace. California Department of Occupational Safety and Health Administration (Cal/OSHA) and the federal Occupational Safety and Health Administration are the agencies with primary responsibility for assuring worker safety in the workplace. Cal/OSHA has primary responsibility for developing and enforcing standards for safe workplaces and work practices in California. A Site Health and Safety Plan (HASP) must be prepared prior to commencing any work at a contaminated site or involving disturbance of building materials containing hazardous substances, to protect workers and the public from exposure to potential hazards. As described in "Regulatory Framework," in V.I, Health and Safety: Setting, there are several workplace safety requirements. There are several Cal/OSHA regulations specified in Title 8 of the California Code of Regulations (CCR). Title 8 comprises the "General Industry Safety Orders," which contain numerous workplace-safety requirements that would be implemented in conjunction with the RMP to protect construction workers from residual contaminants that may be present in soil or groundwater. For example, under 8 CCR 5194 (Hazard Communication Standard), workers must be informed about hazardous substances that may be encountered in the workplace. Compliance with Injury Illness Prevention Program requirements (8 CCR 3203) would ensure that workers are properly trained to recognize workplace hazards and to take appropriate steps to reduce potential risks due to such hazards. This would be particularly important if previously unidentified contamination or buried hazards are encountered. If additional investigation or remediation is determined to be necessary, then compliance with Cal/OSHA standards for hazardous waste operations (Title 8 CCR, Section 5192) would be required for those individuals involved in the investigation or cleanup work. Please refer to "Health and Safety Laws and Regulations" in Section

V.I, Health and Safety: Setting, and Appendix H, Health and Safety, for more detail on worker safety and health plan requirements and regulations.

Building Demolition and Renovation

Most of the existing structures and buildings in the Project Area are proposed for demolition. As such, hazardous wastes may be generated in the form of asbestos from friable building materials, lead paint on building surfaces, and lighting fixtures. In addition, previously unknown contamination, possibly the result of improper disposal or housekeeping activities, may be discovered as structures are demolished.

Asbestos

Inhalation of airborne fibers is the primary mode of asbestos entry into the body, making friable (easily crumbled) materials the greatest health threat. For this reason, asbestos is regulated both as a hazardous air pollutant under the Federal Clean Air Act regulations and as a potential worker safety hazard under the authority of Cal/OSHA./101/ These regulations prohibit emissions of asbestos from asbestos-related manufacturing, demolition, or construction activities; require medical examinations and monitoring of employees engaged in activities that could disturb asbestos; specify precautions and safe work practices that must be followed to minimize the potential for release of asbestos fibers; and require notice to federal and local government agencies prior to beginning renovation or demolition that could disturb asbestos. The agencies with primary responsibility for asbestos safety are the BAAQMD, Cal/OSHA and OSHA, and U.S. EPA./102/ Some state regulations addressing asbestos-containing materials are more stringent than federal regulations. For example, California requires licensing of contractors who conduct asbestos abatement activities.

Lead

Federal, state, and local laws and regulations govern handling of building materials that contain lead-based paint. OSHA's Lead Construction Standards/103/ establish a maximum safe exposure level for the following types of construction work where lead exposure may occur: demolition or salvage of structures where lead or materials containing lead are present; removal or encapsulation of materials containing lead; and, new construction, alteration, repair or renovation of structures or materials containing lead. Typically, building materials with lead-based paint attached are not considered hazardous waste (Chapter II, Division 4.5, Title 22, CCR) unless the paint is chemically or physically removed from the building debris.

Chapter 36 of the San Francisco Building Code establishes requirements for removal of lead-based paint on the exteriors of buildings. It is implemented by the Department of Building Inspection. The ordinance contains performance standards, including a requirement to establish containment barriers that are at least as effective at protecting human health and the environment as those in the most recent *Guidelines for Evaluation and Control of Lead-Based Paint Hazards* promulgated by the U.S. Department of Housing and Urban Development.

Lighting Wastes and PCBs

Spent fluorescent light tubes and high intensity discharge (HID) lamps contain heavy metals which, if disposed of in landfills, can leach into the soil and groundwater. Fluorescent light ballasts may also contain PCBs (see below). These lighting tubes typically contain concentrations of mercury which may exceed federal and state regulatory thresholds and as such must be managed as hazardous waste. Lighting wastes may be classified as a Resource Conservation and Recovery Act (RCRA) hazardous waste if they contain concentrations of mercury or lead which exceed the toxicity characteristic (TC) as measured by the Toxicity Characteristic Leaching Potential (TCLP) pursuant to Title 22, California Code of Regulations./104/ The California Department of Toxic Substances Control has classified PCBs as a hazardous waste when the concentrations exceed specified limits in liquid or nonliquid substances./105/ At concentrations greater than the state levels, PCBs may be regulated as a federal RCRA waste./106/

PCBs may also be found in lighting wastes. Fluorescent light ballasts that contain PCBs, regardless of size or quantity, are regulated as hazardous waste and must be transported and disposed of as hazardous waste. Ballasts manufactured after January 1, 1978, do not contain PCBs and are required to have a label clearly stating that PCBs are not present in the unit.

Reporting Releases to Environmental Agencies

At any time prior to, during, and following development, certain releases of hazardous substances at the Mission Bay Project Area must be reported to federal, state, and local environmental agencies, depending on the quantity and the type of substance released. Parties operating at the Mission Bay Project Area would be responsible for knowledge of and carrying out their release reporting responsibilities. The release reporting requirements include the following:

- Any non-emergency, unauthorized release of a reportable quantity of a hazardous substance must be reported within 30 days in writing to DTSC by the owner of the property and the person responsible for the release, unless the release occurred prior to January 1, 1994, or was otherwise already reported to DTSC, the State Office of Emergency Services, or was required to be reported under federal law (Health and Safety Code 25359.4). The statute also requires that any owner of nonresidential real property who knows or has reasonable cause to believe that any release of a hazardous substance has come to be located on or beneath that real property must give notice to the buyer, lessee or renter of the property, prior to the sale, lease, or rental of the property (Health and Safety Code Section 25359.7).

- Any person that causes or permits the release or discharge of established amounts of hazardous substances or oil into a water of the State of California, such as China Basin Channel or San Francisco Bay, must report this release to the State Office of Emergency Services in compliance with Sections 13271 and 13272 of the California Water Code.

- In addition, to the extent that any activity entails certain types of hazardous materials management activities, if any release occurs that could threaten human health or the ecological environment outside of the facility handling the materials, the owner or operator of the facility, or the generator of the hazardous materials, must immediately report the required information to the State Office of Emergency Services, and submit the required information in writing within 30 days to DTSC. 22 Cal Code Reg. Section 66265.56.

The owners, operators, generators and persons responsible for any release would be required to ascertain whether these or other release reporting laws apply and to submit a report to an environmental agency.

IMPACTS

This section addresses the potential impacts to construction workers, the public, and the ecological environment from exposure to potentially hazardous chemicals that have been identified in the Mission Bay Project Area soils and groundwater. The presence of these compounds is related to both the history of filling of Mission Bay as well as former industrial and rail activities. As stated in the Setting, above, no *immediate* adverse health effects to current human populations have been identified in the Project Area. At the time of publication of this SEIR, no *adverse* ecological effects to aquatic communities from chemicals present in groundwater have been identified in the near-shore areas of China Basin Channel or San Francisco Bay that require management, with the possible exception of the petroleum free product area. The free product area is under continuing investigation to determine appropriate solutions to protect the aquatic environment. Reasonable estimates of pollutants contained in urban stormwater runoff are discussed in "Volume and Quality of Direct Stormwater Discharge to Bay," in Section V.K, Hydrology and Water Quality: Impacts. The existing conditions, as described, provide the baseline against which to compare the effects of the proposed project.

Due to the presence of contaminants in soil and groundwater, the potential exists for construction workers, future occupants, or visitors to be exposed to these chemicals during and after development of the Project Area. Therefore, the following impact analyses focus on the potential human health and ecological effects associated with chemicals identified in soil and groundwater that could be encountered during construction and gradual, new occupancy (project development), and at full build-out (post-development) of the proposed project.

The analysis also evaluates potential health effects due to materials such as asbestos, lead, or PCBs that could be present in buildings that would be demolished or renovated. The potential for previously unidentified contamination to be encountered and possible adverse effects, if any, are qualitatively analyzed as well.

The analysis presented in this section is based on conditions as they exist in 1997-1998. To the extent that changes could occur and can be reasonably evaluated, the analysis also considers potential effects due to changed circumstances (e.g., if the project is not completely built out or if the RWQCB or other agency requires new or additional remediation other than that assumed for this SEIR).

As described in the Setting, the RWQCB staff has determined that additional investigation is necessary and potential remediation may be required in the free product area located in the southeast portion of Mission Bay South. The requirements for additional characterization and potential remediation are based on the potential for the free product area to adversely impact the nearby aquatic environment. An evaluation of the risks under future development plans has indicated that the existing conditions in the free product area would not adversely impact human health, even if one were to build directly over the free product area./107/ The compounds that are present in the free product area are generally weathered, and the constituents that remain are relatively nonvolatile and of low toxicity. Potential human health impacts associated with remediation of the free product area would be controlled through the development and implementation of health and safety measures that would be required as a component of the remediation plan for the free product area. Accordingly, although remediation of the free product area would not be necessary to protect human health, the potential impacts on nearby human populations from the implementation of the remediation activities could be effectively controlled and would thus not limit the ability to develop in the free product area (see "Additional Remediation Requirements," below). However, since the specific remediation measures for the free product area are not yet known, development in that area would occur in a manner that would not preclude the RWQCB from selecting and implementing the appropriate solution for the free product area.

The free product area is an existing condition. Remediation is expected to occur irrespective of whether or not the Mission Bay project is implemented. The remediation of the free product area is not expected to affect nor be affected by project development, assuming coordination of development and free product remediation occurs. Therefore, analysis of the free product investigation and cleanup, as it is currently envisioned by the affected oil companies and the RWQCB, is not necessary in this SEIR.

The following impact analyses assume compliance with applicable site development regulations including, but not limited to, the requirements of Article 20, OSHA standards, and Cal/EPA laws and regulations. In addition, RMPs would be implemented to minimize potential adverse effects to human health or the ecological community from exposure to contaminated soils or groundwater during and after development. Implementation of the RMPs during and after site development is assumed as part of project implementation. A summary of the scope of the RMPs is presented below in "Approach to Analysis of Potential Effects During Project Development" and "Approach to Analysis of Potential Effects After Build-Out (Post-Development)." In addition, a discussion illustrating how the RMPs would reduce potential human health and ecosystem hazards during and after construction is presented within each of the specific impact topics. The measures that would be included in the RMPs are described in mitigation measures in Section VI.J, Mitigation Measures: Contaminated Soils and Groundwater.

Managing environmental conditions in the Mission Bay Project Area using RMPs would effectively control potential risks to human health and the environment through all phases of the development. Other approaches that might attempt to manage site environmental conditions through measures such as removal of large amounts of soils and groundwater or the construction of subsurface barriers would not result in more effective control of potential risks to human health and the environment over that already provided by RMPs. Instead, these alternative control measures would be less practical to implement, would come with greater cost, and would cause substantial disturbance to the local community during their installation. Additionally, some alternative approaches may increase the risks to human health and environment during their implementation by creating potentially significant exposures beyond those that currently exist within the Mission Bay Project Area./108/

The Impacts section for Contaminated Soils and Groundwater is organized differently from other sections of the SEIR; for other sections, the analyses of potential impacts of phased development and of interim uses are presented separately, near the end of the impact discussion because, for the most part, the potential impacts at full build-out would be greatest and are presented first. In the Impacts section, existing uses remaining in the Project Area and new interim uses in the Project Area during development present issues similar to those of phased development. The issues would be whether there would be potentially significant impacts to people occupying sites in the Project Area 1) while some sites with chemicals in soil and groundwater remained vacant and exposed, and 2) while development that would disturb soils was occurring at adjacent or nearby sites in the Project Area. These impacts would be more important than impacts following build-out, because exposure to chemicals in soil and groundwater would be more likely to occur during, rather than after, development. Thus, the analysis of potential human health and ecological effects that could occur during construction applies to existing remaining and to interim uses, and to permanent uses occupied in early or middle phases of development, and is presented before the analysis of the project at build-out.

STANDARDS OF SIGNIFICANCE

The City has not adopted any formal standards of significance for environmental analysis of contaminated soils or groundwater. Generally, an impact would be considered significant if the presence of chemicals in soil or groundwater or in existing building materials, or disturbance of these chemicals during construction, were to create a substantial potential public health hazard or a substantial hazard to important animal or plant populations in the Project Area.

APPROACH TO ANALYSIS OF POTENTIAL EFFECTS DURING PROJECT DEVELOPMENT

Because development is proposed to occur in phases over a period of 17 or more years, development and occupancy of some portions of Mission Bay would occur at the same time as demolition and construction would occur in other portions of the Project Area in which contaminated soils or groundwater have been identified. Because there are no residents in the Project Area and much of the property is vacant or used for truck parking, relatively few individuals would be exposed to the potential contaminated material during the initial construction phases. During later phases of construction, existing uses may remain, some interim uses may be occupied, and some of the proposed commercial, industrial, and residential uses would be completed and occupied.

Consequently, an increasingly greater number of people would be affected by chemicals in soil or groundwater on vacant sites and by construction activities involving the disturbance of contaminated soil or groundwater during later phases of development. This would be a particular issue in the residential portions of the Project Area, where construction in contaminated soils could occur near occupied residential units.

Thus, the analyses of impacts during construction is divided into a discussion of effects from vacant sites in the Project Area and effects from construction activities in the Project Area. Both could expose the same site occupants to chemicals in the soil. For both sources of exposure, ranges of measures would be presented in an area-wide RMP or in RMPs prepared for a development site or phase.

The potential effects that could occur during phased development of the proposed project are qualitatively evaluated based on information presented in the 1997 Mission Bay North report and the 1998 Mission Bay South report and on a technical memorandum entitled *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area* prepared by ENVIRON in April 1998.

Information presented in these reports and considered in the analysis includes, but is not limited to, historic and proposed land uses, sampling results, anticipated construction activities, and conceptual development phasing. The analysis contemplates potential health effects on construction personnel, workers, or visitors in the Project Area who may be exposed to contaminants during excavation, grading, dewatering, building demolition, or other site preparation activities, as well as potential effects on the ecological community.

RMPs that would be developed for each site or group of sites are proposed to be used to identify specific potential health effects during project development and to establish means to reduce these effects. The mitigation measures described in the RMP to reduce health risks are presented in Measures J.1d through J.1k in Section VI.J, Mitigation Measures: Contaminated Soils and Groundwater. The following section describes the process that would be used in the RMP to analyze further whether conditions during the interim period between now and when development is complete would pose a risk to potentially exposed populations due to the presence of contaminants in soil and groundwater in the Project Area.

Risk Management Plan for Project Area Development

The RMP for development of the Project Area would identify specific measures to reduce potential risks to human and ecological populations during construction of the proposed project for each site or group of sites to be developed. The RMP will be submitted to the RWQCB for review by staff. The RMP must be approved by the RWQCB staff prior to site preparation for the first site that would be developed in the Project Area. As noted in the Setting, above, preparation of the RMPs and subsequent RWQCB staff approval would occur independent of the CEQA process under the administrative jurisdiction of the RWQCB.

If a single RMP is prepared for all of the Catellus property in the Project Area, all risk management measures would be presented in the RMP and submitted to the RWQCB staff for approval. If additional or alternative risk management measures are identified by RWQCB staff, then the RMP would be revised and resubmitted to the RWQCB for its approval. RMPs prepared for areas larger than a single site would include ranges of measures; for a particular site, specific measures appropriate to the types of chemicals and activities proposed for the site would be selected from the range of measures. If multiple RMPs were prepared for development of Catellus property, appropriate ranges of risk management measures would be presented to RWQCB staff for review and approval for each development area. RMPs would also be prepared for sites under other ownership in the Project Area.

- The RWQCB has stated that it follows U.S. EPA guidelines for risk management. The DTSC has also adopted the U.S. EPA's policy of using a risk range of 1 x 10^{-4} to 1 x 10^{-6}; on a site-specific basis DTSC has made risk management decisions, with community input, to use 1 x 10^{-5}. Consistent with U.S. EPA guidelines, RWQCB staff has advised ENVIRON that, for the Mission Bay Project, it will evaluate the potential risks to human health considering a 1 x 10^{-5} cumulative carcinogenic risk level and a noncarcinogenic Hazard Index of 1./109/ U.S. EPA and DTSC guidelines divide potential human health risks associated with exposure to chemicals into cancer risks and noncancer hazard indices. The calculated cancer risk characterizes health risks as a result of exposure to carcinogenic substances by using estimated or measured concentrations and risk/potency factors. The calculated cancer risk is an approximation of the probability of an individual developing cancer over the course of a lifetime as a result of exposure to a particular cumulative dose of a potential carcinogen.

Unlike cancer risk estimates, the measure used to describe the potential for noncarcinogenic toxic effects to occur is expressed in terms of a Hazard Index (HI), which is calculated as the ratio of the predicted acute or chronic exposure (dose) of a noncarcinogenic substance to that chemical's toxicity threshold (often referred to as the reference dose). The HI assumes that there is a level of exposure below which it is unlikely, even for sensitive populations, to experience adverse health effects. Because there are inherent uncertainties and assumptions used in the modeling, the final calculated risk value should, therefore, be viewed as a very conservatively estimated probability of occurrence.

Enforcement and Regulatory Oversight of Risk Management Plan During Project Development

The interim measures specified in the RMP must be adhered to in order to ensure that the conditions in the Project Area remain protective of human health and the environment during site development. Each owner of any portion of the Project Area with responsibility for development would be apprised of the RMP and its contents, and would be required to comply with them (or cause others to comply with them) through a number of mechanisms. Four mechanisms would provide a structure for risk management measures applicable to the Project Area to be in place and effective during construction. These mechanisms, which would also apply to long-term management after project completion, include:

- As applicable, contractual obligations would be used to notify all owners of the RMP and its requirements;

- Use restrictions in the RMP would be recorded and enforced against owners and occupants as an environmental restriction and covenant under Civil Code Section 1471;
- The RWQCB would maintain residual enforcement authority against all owners and occupants with control over affected portions of the Project Area; and
- Portions of the RMP would be enforced through Article 20 during the process of obtaining building permits from the City.

The first two mechanisms are features of the project. The second two mechanisms are regulatory in nature and would be enforceable by the RWQCB and the City, respectively.

IMPACTS DURING PROJECT DEVELOPMENT

As discussed in the Setting, various organic substances, metals, and petroleum products and related chemicals have been detected in soil and groundwater throughout the Project Area. The following analysis evaluates the potential effects on human health and the ecological environment that could occur during construction due to the presence of residual contaminants in soil or groundwater.

Overview of Site Development Exposure Scenarios and Potential Effects

As described in the 1990 FEIR, without mitigation, construction activities could pose some potential risk to receptors in the Project Area from contaminants that have been detected in soil or groundwater./110/ All individuals, whether in existing remaining activities, interim new uses, or early permanent residential or nonresidential uses or visitors, would be subject to two conditions during development: 1) vacant parcels with exposed soil that may contain chemicals, and 2) construction sites with disturbed soil and exposed groundwater that may contain chemicals. These conditions would be managed somewhat differently. Therefore, they are discussed separately in the sections that follow. In addition, people in commercial and industrial areas immediately adjacent to the Project Area, as well as individuals in residential and other mixed-use areas not immediately adjacent to the Project Area (e.g., Potrero Hill) theoretically could also be exposed to risks identified for the project. The degree of risk would vary in relation to the distance from the site being disturbed, wind speeds and directions, the activity being performed, among other factors. In the impact discussions that follow, individuals present outside the Project Area are also considered in the analysis.

Most development sites in the Project Area are not expected to include basements, and would not disturb or excavate large amounts of soil. However, the Redevelopment Plans for Mission Bay North and Mission Bay South do not prohibit excavation for basements, and Catellus has indicated that it wishes to reserve the opportunity to construct basements for parking on some sites in the Project Area. Installation of utilities and site preparation for buildings with or without basements would also involve soil disturbance that could encounter groundwater. Unless properly managed, these activities also have the potential both to release chemicals found in soil and groundwater to the air, groundwater, or surface water, and to expose construction workers, residents and employees in the Project Area and visitors to the Project Area to hazardous materials. Exposure of construction workers, residents, or employees in existing or new buildings in the Project Area during the course of development to some of these chemicals could cause adverse health effects if exposures occurred for a sufficient length of time to cause these effects.

Unless properly managed, human exposure to contaminants in the soil or groundwater could occur through inhalation of vapors from petroleum products or related compounds such as benzene that may have accumulated in the soils, from inhalation of soil particles or dust containing elevated concentrations of metals, PAHs, or asbestos, or from direct contact with contaminants (e.g., petroleum free product, or exposed or stockpiled soils). Since long-term health effects, including cancer, generally occur with exposures continuing over many years, it is more likely that adverse health effects from construction activities would be acute in nature. Adverse acute health effects, for example, could range from respiratory irritation to kidney disease.

Construction activities also could pose some potential ecological risks. Construction dust, dewatering activities, and surface water runoff from construction sites could potentially impact terrestrial and avian wildlife and aquatic organisms through contact with contaminants in soil or groundwater.

As discussed below, mitigation, in the form of the RMP, would be implemented to reduce exposure of people and terrestrial, avian, and aquatic organisms to potential construction-related effects (see also Measures J.1d through J.1k in Section VI.J, Contaminated Soils and Groundwater).

Exposure from Vacant, Undeveloped Sites

Uncovered soils, if not properly managed at vacant, undeveloped sites, could expose people to contaminants present in the soils during development of the project. Individuals who could be affected would include Project Area residents, workers, or visitors at developed parcels adjacent to the vacant, undeveloped sites, or trespassers at the vacant, undeveloped location. As discussed in "Overview of Site Development Exposure Scenarios and Potential Effects," above, exposure to contaminants could result in adverse human health effects. To reduce the risk of adverse health effects, appropriate risk reduction measures identified in the RMP or RMPs would be implemented, as noted in "Risk Management Plan for Project Area Development," above. The following discussion describes the process by which health risks to the public from vacant, undeveloped parcels would be identified and presents a range of actions that could be used to reduce identified risks, if any, to less-than-significant levels.

The RMP would first identify all areas where exposed soils currently exist. The identification of the current areas that are uncovered, and the assumption that they could remain uncovered for the entire time of Project Area development, is considered conservative because the amount of exposed soils would decrease as development progresses. Consequently, such an assumption would conservatively estimate the exposures that individuals could incur from these soil areas.

The RMP would then identify specific constituents that have been detected in the exposed soils that could potentially pose a risk to people during site development. Interim Target Levels (ITLs) for chemicals in soil would then be developed for those populations that could be exposed to chemicals present in the exposed surface soils over time until development is complete. The ITLs would provide a means for evaluating whether the concentration of chemicals detected in the soils on the vacant, undeveloped parcel could present an adverse health risk and where interim risk management measures are appropriate. The approach used to develop the ITLs would be consistent with standard risk assessment approaches and would be presented to the RWQCB staff for consideration as an appropriate method for identifying areas where interim risk management measures could be warranted./111/ For purposes of this discussion, the interim period is defined as the period of time between initial project approval and complete build-out. Based on the results of the soil and groundwater investigations conducted in the Project Area described in the Setting section, above, and the evaluations of human health risk that have been conducted to estimate the risks to future occupants in the Project Area, the constituents present in the exposed soils for which interim target levels would be developed include metals, PAHs and TPH constituents. ITLs would not be developed for the pesticides or other SVOCs due to the infrequent detection of these chemicals, in addition to the low concentrations at which they were detected. Further, ITLs would not be developed for the volatile constituents for two reasons. One, VOCs do not persist in surface soils. Therefore, direct contact with the surface soils is not likely to result in any incremental exposure to volatile constituents. Two, the pathway through which exposure to the VOCs present in deeper soils and groundwater could occur is through the inhalation of vapors that might have migrated up through the soil column into either the ambient or indoor air. An evaluation of this potential pathway was conducted, as discussed under "Post-Development Impacts," to determine whether the VOCs present in the deeper soils and groundwater would pose a risk to the future occupants of, and visitors to, the Project Area. That evaluation did not assume a soil cap or other post-development measures that would reduce exposure to VOCs./112/ Thus, the analysis of VOCs is applicable to both the post-development and interim period scenarios. The evaluation concluded that the VOCs do not pose a health risk for the planned long-term occupancy including populations such as park visitors, or shoppers who may visit the Project Area. Therefore, the presence of VOCs in the subsurface soils and groundwater would also not pose a risk over the shorter-term interim period./113/

The RMP would also identify the populations most likely to be exposed to the soils during development of the project. As currently envisioned, the exposed populations are likely to include the following:

- Adult and child visitors/trespassers
- Nearby residents (both adults and children)
- Workers (on-site and adjacent to the Project Area)

Once the populations who could come in contact with the exposed soils have been identified, the RMP would then describe the pathways through which the populations could be exposed to the constituents present in exposed soils prior to project completion. The specific exposure assumptions would be based on existing U.S. EPA- and DTSC-recommended exposure assumptions. If the agency guidance does not contain specific exposure assumptions for the populations, site-specific exposure assumptions would be developed based on the expected patterns of exposure and assumptions that have been used and approved at other similar sites, particularly sites in the Bay Area. All exposure assumptions would be developed in consultation with the RWQCB, prior to the completion of the RMP.

Using the specific exposure information that would be developed as described in the preceding paragraphs, combined with toxicity values developed by the U.S. EPA and Cal/EPA, ITLs would then be developed for each of the individual constituents that are identified as chemicals of potential concern. Consistent with the human health evaluation standard set by the RWQCB for the Project Area, calculation of the ITLs would assume a cancer risk criterion of 1×10^{-5} and a Hazard Index of 1. The methodology that would be used in the development of the ITLs would follow the standard regulatory risk assessment guidelines promulgated by the DTSC and the U.S. EPA./114/ This basic approach has also been approved by the RWQCB for use in evaluating the impact of various USTs in Mission Bay South./115/ Any ITLs developed for the Project Area would be presented to RWQCB staff for consideration and approval.

Once developed, the chemical-specific ITLs would then be compared to the concentrations detected in the exposed soils. Areas where the concentration in the exposed soil exceed the ITLs would be identified. This comparison would provide the basis for identifying specific sites that could require interim risk management measures. To reduce the potential for uncontrolled exposures to impact the health of individuals in the Project Area, and to reduce the potential for existing or future tenants to engage in activities that could impact their health or the health of those in the vicinity during site development, the RMP would present a range of interim risk management measures for areas where concentrations of chemicals in soils exceed ITLs. These measures are listed in Measure J.1c in Section VI.J, Contaminated Soils and Groundwater. The range of measures that could be used to reduce risk include, among other actions, the following:

- Limit direct access to uncovered soil on undeveloped portions of the Project Area, where site evaluations show elevated risks.
- Hydroseed or apply other vegetative cover to large uncovered areas.
- Include safety notices in leases for tenants of occupied portions of the Project Area notifying them of risks involved in disturbing existing ground covers (hard-scape or plantings).
- Conduct periodic inspections of open areas to reduce the illegal occupancy by transient populations, and to reduce the potential for illegal dumping by unauthorized occupants or off-site populations within the Project Area.
- Conduct periodic monitoring to verify that the risk management measures that are implemented remain effective in controlling exposure during development of the Project Area.

The actual control measure(s) that would be implemented would be developed to account for the specific characteristics of each site, contaminant concentrations, potential exposure pathways, and populations that could be at risk. Implementation of these measures, if necessary, would be adequate to control exposure from vacant, undeveloped sites. Therefore, chemicals in soil and groundwater are not proposed to be removed prior to construction activities.

Exposure from Construction Activities

There are three general types of construction activity that would involve the potential exposure of construction workers and the public to hazardous materials due to soil disturbance. These activities include: 1) excavation, grading and trenching where workers and the public would potentially be exposed to dust containing contaminants or to soil gases; 2) installation of building foundation piles for structural support where workers would potentially be exposed to soil; and 3) identification and removal of USTs where workers and the public would potentially be exposed to contaminated material including the tank, vapors, or soil.

Construction-related impacts could also result from moving soil, both on and off site; installing piles for building foundations; installing utilities; and dewatering during excavation. Surface runoff from construction sites during rainy weather could affect the City's sewer system or the nearby Channel and Bay. Also, subsurface hazards that have not been identified by the various studies of soil and groundwater carried out for the Project Area could be encountered during construction. This description is necessarily generalized in nature; potential hazards would depend on the nature of building or site preparation activities and the type and amount of chemical constituents at each location, as discussed in greater detail in each of the impact analyses that follow.

Construction-Generated Dust Effects

Construction of the proposed project would involve site preparation activities such as excavation, trenching, or grading that would result in soil disturbance. Various organic substances, metals, and petroleum products and related chemicals have been detected in soil throughout the Project Area. Exposure of construction workers, or of residents or employees in existing or new buildings in the Project Area, to some of these chemicals could cause adverse health effects. The concentrations of chemicals are greater in some locations in Mission Bay North and Mission Bay South than in others. For example, high concentrations of some metals and PAHs were found in Mission Bay South soils. In addition, petroleum hydrocarbons were found floating on groundwater ("free product") in the southeast corner of Mission Bay South. The potential exists during construction for exposure to dust contaminated with toxic materials.

Construction workers, persons currently working in the Project Area, or visitors could be exposed to potential hazards associated with the chemicals detected in Project Area soils when those soils are disturbed during development. The concurrent development of some portions of the Project Area and simultaneous occupancy of other portions of the Project Area could result in potential exposure of new residents and/or employees in the area to contaminants that could be released during construction.

Potential Effects on Human Health

A screening risk assessment was prepared to assess the potential human health risks associated with construction-generated dust if dust control measures were not implemented./116/ The screening-level evaluation assessed the types of impacts that could be encountered as a result of chemicals in soil adhering to dust particles in a reasonable worst-case uncontrolled dust emission scenario. That evaluation, which is presented in *Approach to a Plan for Risk Management* prepared by ENVIRON in April 1998, concluded that risks to nearby populations (i.e., populations directly adjacent to construction areas where dust levels would be highest), even if continuously exposed to dust generated for 20 years, would be below the target levels specified by the RWQCB for the Project Area./117/ The risk evaluation was conducted following standard regulatory risk assessment guidelines developed by the DTSC/118/ and U.S. EPA/119/,/120/, and is summarized in Appendix I under "Methodology to Evaluate Human Health Risk Due to Exposure to Uncontrolled Construction-Generated Dust." To estimate the theoretical risk of an adverse health effect due to construction dust that could contain contaminants, risk values were quantified using mathematical modeling.

The screening-level cancer risk estimates developed for potential exposure to dusts generated during excavation activities, if control measures were not implemented, indicate the total cancer risks calculated for nearby worker and residential populations are 9 in 1 million (9×10^{-6}) and 4 in 1 million (4×10^{-6}), respectively./121/ These values are below the cancer risk criterion of 10 in 1 million (10×10^{-6}) approved by the RWQCB for the Mission Bay Project Area./122/ These values are also below the project significance threshold level of 1×10^{-5} (which is the same as 10×10^{-6}) defined by BAAQMD for CEQA analysis purposes, as described in more detail under "Standards of Significance" in Section V.F, Air Quality./123/

The total estimated noncancer Hazard Indices for the nearby worker and resident populations are 0.11 and 0.08, respectively/124/, which are both less than the HI criterion of 1, approved by the RWQCB for the Project Area/125/, and recommended by the U.S. EPA as the level below which adverse noncancer health effects are not expected to occur./126/ A Hazard Index of 1 is also the threshold level for projects defined by the BAAQMD for CEQA purposes; concentrations which would result in a HI of greater than 1 are considered to represent a significant air quality impact./127/

Human Health Impacts of Lead Exposure from Construction Dust

Because DTSC has established a specific guidance for evaluating potential adverse health effects resulting from exposure to lead in the environment that differs from the screening health risk assessment methodology described above, an analysis of the potential health risks associated with exposure to lead in construction-generated dust was also prepared by ENVIRON./128/ Consistent with U.S. EPA risk assessment guidance, ENVIRON calculated a specific lead concentration that would represent, with a high degree of certainty, the reasonable maximum exposure of lead that would be expected to occur over the exposure period. That value was determined to be 926 milligrams per kilogram (mg/kg) of lead for all soils in Mission Bay South./129//130/

ENVIRON assessed two scenarios using DTSC estimated blood-level concentrations guidance: 1) the blood-lead levels that could result from exposure to naturally-occurring background levels of lead that individuals could be exposed to in the air, food and drinking water (default background levels defined by DTSC /131/); and 2) the blood-lead levels that could result from exposure to the lead that could become airborne during the construction activities in the Project Area. The difference between these two scenarios is the incremental increase in blood-lead levels due to the contribution of the construction activities.

Based on DTSC information, the blood concentration of concern in children and adults is 10 micrograms (μg) of lead (Pb) per deciliter (dl) of whole blood (Pb/dl)./132/ The stated goal of DTSC is to ensure that 99% of the population has blood-lead levels less than 10 μg Pb/dl blood. Using DTSC-recommended default exposure parameters, the 99th percentile blood-lead level associated with natural background sources in air, food and drinking water is 7.7 and 4.6 μg Pb/dl blood, for children and adults respectively. Using the reasonable maximum exposure value for Mission Bay South of 926 mg/kg of lead, the 99th percentile blood-lead level in children and adults from exposures to dust generated during construction-related activities is estimated to be 8.7 and 5.4 μg Pb/dl blood, respectively. In other words, under both scenarios, 99% of the residents, exposed as described in ENVIRON's evaluation, are predicted to have blood-level levels below 8.7 μg Pb/dl blood, which is below the 10 μg/dl level of concern. Therefore, exposure to lead that could be present in dusts, assuming the conservatively high levels of dust generated during construction activities described earlier, would not result in any significant incremental increase in blood-lead levels over those resulting from background exposures. The incremental blood-lead levels contributed by emissions from the dusts generated during construction are 1.0 and 0.8 μg Pb/dl blood, for the children and adults, respectively. These concentrations represent a worst-case exposure under uncontrolled construction dust conditions./133/ Exposure to lead in construction-generated dust would, therefore, be a less-than-significant impact, even if dust control measures are not implemented.

Construction Dust Controls

To reduce exposure to construction workers and new occupants of the Project Area, the RWQCB-approved RMP for each site would contain the health and safety training and health protection objectives for workers who may directly contact the contaminated soil or dust during construction. In the event that prescribed exposure levels are exceeded, personal protective equipment would be required in accordance with Cal/OSHA regulations. If hazardous levels of constituents are encountered, a HASP would also be prepared for each development site in accordance with state standards for workers engaged in activities in which hazardous waste is present.

ENVIRON's *Technical Memorandum #1, Approach to a Plan for Risk Management*, also presents control measures to reduce potential exposure to dusts generated during construction activities. The BAAQMD suggests implementation of various dust control measures in order to keep the PM_{10} (small-diameter particulate matter) levels, irrespective of the chemicals that could be adsorbed to the

PM_{10}, to a minimum. All dust control measures would be detailed in the RMP, which would be reviewed for approval by the RWQCB staff, and would be adequate to reduce dust-related impacts to less-than-significant levels. The BAAQMD's approach to CEQA analyses of construction impacts is to emphasize implementation of effective and comprehensive control measures rather than detailed quantification of emissions.

BAAQMD has identified a set of feasible PM_{10} control measures for construction activities. These control measures are listed as Mitigation Measure F.2 in Section VI.F, Mitigation Measures: Air Quality, and are assumed to be part of the project to reduce the PM_{10} air quality impact to a less-than-significant level.

Implementation of these measures would control dust generated from demolition and excavation activities, truck traffic, wind traversing the soil stockpiles, and loading of transportation vehicles.

Effective control of the dust would prevent nuisance dust and dust containing inorganics, PAHs, and other constituents from migrating off-site and impacting nearby populations. Implementation of the dust control methods would also reduce impacts to the on-site construction workers. Furthermore, implementation of the dust control measures would control any potential impacts associated with emissions of respirable asbestos that could be present in soils disturbed during construction. According to BAAQMD guidelines, compliance with the BAAQMD recommended dust control measures would reduce temporary impacts associated with dusts to insignificant levels./134/ Controlling exposure to dusts would simultaneously control exposures to the chemicals adsorbed to the dust particles.

The RMP developed for each site or group of sites would also contain a program for off-site dust monitoring. The monitoring program would be used to demonstrate that the health and safety of individuals not engaged in construction activities (e.g., visitors, workers, and future residents) would not be adversely affected by chemicals (e.g., metals) that could be contained in dust generated by soil-disturbing activities. The monitoring program would consist of real-time monitoring for PM_{10} concentrations. As discussed in Appendix I under "Dust Level Generated During Construction Activities," as long as off-site dust concentration are 250 $\mu g/m^3$, or lower (where off-site refers to areas directly outside of the construction zone), the risks to nearby populations exposed continuously for a 20-year period to chemicals adsorbed to particulates generated from construction of the Project Area would be within the range of levels considered acceptable by the U.S. EPA and would be below the level defined by BAAQMD to represent a significant threshold. If dust levels exceeded these levels, additional dust control measures could be implemented. Monitoring equipment locations would be established based in part on expected localized wind conditions.

Implementation of the RWQCB-approved RMP measures described above, in combination with BAAQMD-suggested controls and OSHA requirements, would be adequate to ensure that there would be no significant risk to people due to project-generated construction dust.

Potential Dust-Related Effects on Aquatic and Terrestrial Environment

The potential impacts of construction-related dusts on the ecological environment could include potential exposure to terrestrial and avian wildlife, as well as potential exposure to aquatic organisms through deposition of particulates onto the surface water bodies if dust control measures were not implemented. Although the pathways through which the terrestrial, avian, and aquatic species could be exposed to dusts are potentially complete pathways, the exposures are not expected to provide a significant dose to any of the ecological receptors. Accordingly, the generation of dusts that could occur during the construction and development of the Project Area would not represent a significant impact on the ecological environment. The rationale for this conclusion is provided below.

Terrestrial and avian species could potentially be exposed to windblown dust through inhalation, and ingestion during preening and prey consumption. As discussed in the 1990 FEIR, the primary reason that such exposures do not represent a significant impact on terrestrial species is that the current and future conditions within the Project Area do not provide habitat capable of supporting an important terrestrial wildlife community. Further, although various avian species use the area around China Basin Channel for loafing and foraging, the mobility of the bird species results in their use of a relatively large home range and foraging range. Because the types of resources are limited along China Basin Channel and San Francisco Bay, the avian species are expected to make use of foraging habitats, such as mudflats, over a large home range area, and would not be present in one foraging area for an extended period of time. Due to their mobility, and their use of a relatively large home range and foraging range, it is unlikely that avian species could be exposed to significant exposures of dusts, and the chemicals adsorbed to the dusts, during the construction of the Project Area./135/ Therefore, potential dust-related effects on terrestrial or nesting avian species would be less than significant.

Under uncontrolled conditions, impacts on the aquatic environment from windblown dust depositing onto the water bodies could occur through direct exposure to filter feeding molluscs, and other aquatic species. Additionally, excessive deposition of dust onto the water bodies could potentially increase the turbidity in these water bodies, which in turn could decrease the light penetration into the water bodies and the available oxygen. However, even if dust control measures were not implemented, it is anticipated that dusts potentially generated during construction would be dispersed by the wind over a relatively large area, with no one area receiving sufficient dust to generate a significant exposure to species./136/ Thus, potential impacts on the aquatic environment from uncontrolled dusts blowing from the construction zone and depositing onto surface water would be less than significant, even if dust control measures were not implemented. With implementation of BAAQMD dust control measures, impacts would be further reduced to levels considered insignificant.

Potential Health and Safety Effects on Construction Workers

The workers engaged in the construction activities in the Project Area could be exposed to chemicals detected in the soil or ground water if direct contact with either soils or ground water were to occur. Exposures could occur through direct contact (dermal absorption and incidental ingestion) and through the inhalation of particulates and vapors. Further, the construction worker could be exposed to the potential physical and chemical hazards associated with identifying unknown structures, sumps, or USTs, as discussed in more detail in the "Previously Unidentified Subsurface Hazards Encountered During Construction" impact presented later in this section. To protect construction workers from potential adverse health impacts associated with exposure to any of the compounds present in the Project Area, workers engaged in subsurface activities where direct contact with subsurface soils or groundwater could occur, would conduct the work in accordance with specific health and safety training and worker protection objectives. The types of protective measures that could be implemented to protect the health and safety of those workers involved in the construction at the Project Area are described below and would be delineated in the RMP.

Worker exposure to contaminated soils or vapors that could be inhaled would be subject to monitoring and personal safety equipment requirements established in Cal/OSHA regulations that specifically address airborne contaminants. Potential effects related to dusts or vapors that could be inhaled, and applicable safety regulations, are discussed in the "Construction-Generated Dust Effects" section, above. Site controls pertaining to asbestos and lead exposure during construction activities are also included in Cal/OSHA regulations (in Title 8). While the primary intent of the Title 8 requirements is to protect workers, compliance with some of these regulations would also reduce potential hazards to non-construction workers and Project Area occupants, because required site monitoring, reporting, and other controls would be in place.

Compliance with regulations described in "Regulatory Framework," would ensure that workers that could directly contact soil or the ground water containing hazardous levels of constituents would perform all activities in accordance with a hazardous operations site-specific Health and Safety Plan (HASP). Consistent with the Cal/OSHA standards, a HASP would not be required for workers such as heavy equipment operators, carpenters, painters, or other construction workers who would not be performing investigation or remediation activities where direct contact with materials containing hazardous levels of constituents could occur. However, elements of the HASP would protect those workers who may be adjacent to cleanup activities because it would establish engineering controls, monitoring, and security measures to prevent unauthorized entry to cleanup sites and to reduce hazards outside the investigation/cleanup area. A site-specific HASP would be developed, as necessary, by an environmental contractor prior to the commencement of any investigation or cleanup activities. The RMP would specify developer notification procedures to ensure appropriate coordination and timing of site investigation/cleanup activities and routine construction.

Implementation of required safety laws and regulations, described above in conjunction with the RWQCB-approved RMP, would be adequate to ensure that risks to construction workers would not be significant.

General Soil Movement and Transport During Construction

Various construction activities in the Mission Bay Project Area, such as grading, trenching, compacting and excavating, would result in soil being excavated, handled and moved. Most excavated soil is expected to be used elsewhere in the Project Area. When soil is required to be disposed of outside the Project Area, trucks would be routed down major arterial streets to the nearest freeway access ramps—via Third, Brannan, and Fifth Streets to the Bay Bridge/I-80 ramp at the intersection of Fifth and Bryant Street, or via the King Street or Mariposa Street ramps to I-280. Construction activities in the Project Area would expose soils that are now covered, potentially require movement of soils within the Project Area, and could import new soil to some parts of the Project Area. These types of activities could cause localized erosion and would likely spill soil on streets in the Project Area, unless effectively managed. These soils may contain chemicals that could be washed into the Channel or Bay, possibly affecting the aquatic environment in the Channel and the Bay. Potential effects related to dusts containing contaminants that could be released during soil movement are discussed in "Construction-Generated Dust Effects."

The general protocols for managing soil movement and transport during the development of the Project Area are summarized below. These protocols would be included in the RMP in addition to the specific dust-control measures described in the next subsection. As described previously, the RMP would be reviewed by the RWQCB staff for approval prior to the initiation of construction.

As stated in the Setting, building permit applicants proposing to disturb 50 cubic yards or more of soil at sites located bayward of the San Francisco 1851 high tide line are required by Article 20 of the San Francisco Public Works Code to conduct environmental assessments of that soil for hazardous constituents and, if detected, to prepare a site-specific mitigation plan. All of the Project Area is located bayward of the 1851 high tide line, and thus is subject to Article 20. Compliance with the Article 20 requirements is another mechanism, in addition to the RMPs, that could control potential risks to human health and the ecological environment associated with handling of the soils in the Project Area. The site-specific mitigation required by Article 20 could be satisfied by the RMP prepared for the site, plus any additional measures as necessary to address chemical levels found in the soil.

Surface materials and materials for landscaped areas would consist of approved imported fill or excavated material. The minimum depth of approved fill that could be required for different landscaped areas, as well as the specific threshold levels of chemicals that would be appropriate, would be determined in the RMP and would be reviewed for approval by the RWQCB staff.

The DTSC has determined that soils in the Mission Bay Project Area can be moved around, managed, and reused on-site without triggering hazardous waste management requirements./137/,/138/ The RWQCB and DTSC concurred that reuse of soils in the Mission Bay Project Area would be acceptable if conducted in accordance with RWQCB-approved RMPs that specify soil management procedures. If excavated soil remains within the Project Area, it could be placed under buildings or other covered areas such as parking lots or paved walkways to prevent human exposure. If excavated soil is to be used on-site in any manner that could result in direct human exposure, the RMP would call for characterization of the soil excavated to confirm that it meets the appropriate standards (including City requirements) and would be approved by the RWQCB as appropriate for the intended use.

Transportation of soil from one area to another would be carefully controlled to reduce the potential for human or ecological exposure to the soil. Dust control measures could include placing covers on the trucks to reduce the potential for spreading material from one area to another. Further, whenever workers could be exposed to hazardous levels of chemicals, a site-specific HASP would be prepared by the contractor prior to construction and would contain a section regarding decontamination of both personnel and equipment. These actions would prevent soil from migrating off-site.

The potential for trespassers or visitors to gain access to construction sites and come into direct contact with contaminated soils would be minimal because access to construction sites would be controlled through the implementation of the HASP for applicable sites. While the HASP is primarily intended to protect construction workers from potential hazards, it would also specify measures to prevent unauthorized entry into the construction site and provide appropriate monitoring/enforcement procedures to ensure the effectiveness of site security. Measures that would be implemented as part of the RMP are presented in Measures J.1d, J.1e, and J.1f in Section VI.J, Mitigation Measures: Contaminated Soils and Groundwater.

Compliance with the procedures described above and other specific risk management measures that would be included in the RMP would be adequate to ensure that soil movement within the Project Area would not present a significant risk to human health and the ecological environment, and would also reduce the potential for inadvertent exposure of adults and children to contaminated soils to less-than-significant levels. In addition, additional testing would be conducted on any soil disposed of outside the Project Area. Any soil disposed outside the Project Area is subject to all applicable federal and state regulations, which would minimize potential environmental effects of disposing the soil at those locations. Therefore, impacts would be less than significant.

Effect on Groundwater of Foundation Pile Installation

Foundation support piles would be driven from the surface to various depths within the Project Area to provide structural support for various building and structure features. (The discussion that follows is related to pile driving on land; pile driving in the Channel is discussed in "Turbidity From Construction Activities," in V.L, China Basin Channel, Vegetation and Wildlife.) Unless properly managed and depending on the depth and location of the support piles, shallow groundwater could be encountered as a result of this activity. Piles installed in locations where contaminants have been identified could, under certain soil conditions, create a vertical conduit for chemicals occurring in shallow groundwater to move along the pile to deeper groundwater zones, causing degradation of the deeper groundwater.

The Project Area is principally underlain by fill materials that overlie a thick sequence of Bay Mud. Additional clay units and bedrock underlie the Bay Mud. When piles are installed in the Project Area, they would generally extend far into the Bay Mud and, in certain locations, could extend to the clays and bedrock that underlie the Bay Mud. During pile installation, a borehole would first be drilled through the artificial fill materials. The borehole would be drilled so that the pile can be started without being damaged or vertically misaligned from debris and rubble that is commonly encountered in the fill materials, which would prevent artificial fill materials or other materials in the upper intervals from pushing through to Bay Mud or lower depths. It is presumed that predrilling the bore hole is the only appropriate technique for drilling in unengineered fill material. All excess fill or native soil materials generated during pile driving would be managed consistent with the procedures in the RMP. The pile would move downward through the predrilled borehole to a pre-determined depth into the Bay Mud layer. From that depth, it would be driven through the Bay Mud sequence into underlaying soils or bedrock below.

Because Bay Mud is soft, cohesive, and has a low permeability/139/, the materials encountered during pile installation would adhere to the sides of piles during and after placement. This action would form a seal that would prevent the formation of conduits for shallow groundwater to migrate downward into deeper water-bearing zones. Therefore, natural conditions would prevent the creation of a vertical conduit for chemicals moving from shallow intervals to deeper ones, even in the free product area. While no water production wells or aquifers used for water supply have been identified in the Project Area, the natural sealing action would ensure that if water supplies were developed in the future, construction of foundation support piles would not affect these groundwater uses. Therefore, no significant groundwater quality impacts would occur from piledriving.

Utility Trench Excavation

Utility trenches would be constructed within the Project Area for the installation of underground utilities along alignments in the streets and on individual parcels. The trench depths could vary from approximately 2 to 10 feet below ground surface. Typical underground utility construction would include the placement of permeable backfill immediately surrounding the utility pipes along the entire horizontal alignment. For most typical utility installations, a six-inch layer of sand would be placed at the bottom of the trench, and the utility pipe would rest on top of the first sand layer. Additional sand would then be placed around the sides of the pipe at least six inches to one foot above the pipe. Pipe bedding material is more permeable than the surrounding fill, creating a potential conduit for horizontal migration of fluids. These conditions could create a horizontal conduit for chemical contaminants contained in soil vapors or shallow groundwater to migrate along the permeable soils that would be placed as trench backfill.

To reduce these risks, the remainder of the open trench could be backfilled with sand or other suitable engineered fill (such as a sand, gravel and clay mixture). Where horizontal migration of fluids is undesirable, as in areas like the free product area, material that is less permeable than the surrounding soil would be placed through a variety of methods at intervals along the trench to disrupt the flow within the trench backfill. One method during initial trench backfilling could be the construction of a short section backfilled with a concrete or cement and bentonite mixture. Another method could be the creation of a clay plug by compacting clay around the pipe for an approximately 5-foot section of trench. A third method could be the installation of barrier collars around the pipes by forming and pouring concrete in place. These engineering techniques or other similar methods identified in the RMP would be effective in preventing horizontal conduits. This would minimize the potential for horizontal migration of contaminants in the Project Area, which would reduce effects to less-than-significant levels.

Construction Dewatering

Extensive subsurface excavation is not anticipated as part of the proposed project; however, there may be some sites where some dewatering may be necessary. Because contamination has been detected in a number of monitoring wells at various locations throughout the Project Area, below-grade soil excavation or trenching activities that require dewatering to maintain adequate construction conditions could potentially encounter contaminated groundwater, if contaminants are present. It is possible that pumping water from excavation pits or dewatering wells at construction sites could release contaminated groundwater or draw a contaminant plume towards or into the excavation. Groundwater extracted in these areas could contain toxic chemicals that could expose construction workers, wastewater treatment system workers (if the water is discharged to the sewer), or the public to hazardous situations or contaminated groundwater, if direct or indirect contact were to occur. In addition, dewatering activities could influence localized groundwater gradient(s) and contribute to the spread of contaminated groundwater in the Project Area, particularly in and near the areas with petroleum free product on the groundwater in Mission Bay South.

Methods to control water removed from excavations and trenches would be specified in the RMP. Such measures would include, but would not be limited to, site-specific analysis and identification of contaminants and appropriate construction and wastewater discharge methods. For example, prior to dewatering, the amount of water that would need to be removed would be estimated using quantitative hydrogeologic calculations to identify appropriate dewatering methods. Selecting and implementing appropriate dewatering methods would prevent uncontrolled releases of contaminated groundwater and prevent uncontrolled alterations in the flow rate or direction of groundwater that could exacerbate existing conditions, including conditions in the free product area.

If appropriate for deeper excavations, the excavations would first be encircled with sheetpiles or a similar process would be used, to limit the volume of water that could enter an excavation or trench. Dewatering wells could be installed inside the area surrounded by sheetpiles to lower the groundwater level. Properly installed sheetpiles that are interlocked and driven through dense clay materials would effectively limit groundwater flow through the piles installed in the Project Area. Consequently, any contaminants in groundwater would not flow toward the excavation or trench. This would minimize the potential for groundwater containing residual contaminants to degrade groundwater in other locations which did not contain contaminants. Where shallower excavation or trenching would occur within the artificial fill layer, sump pumps could be used for localized dewatering. Under this condition, there would be no widespread effect on groundwater flow patterns or distribution of contaminants in adjacent groundwater at those locations; therefore impacts would be less than significant.

It is anticipated that most groundwater removed during dewatering activities would be discharged into the City's combined sewer system. As described in "Contaminated Groundwater" in "Regulatory Framework," above, discharge of dewatered groundwater into the City's combined sewer system would require a discharge permit from the City. Compliance with the discharge permit, which would be specified in the RMP, would ensure that contaminant levels would be reduced to the extent required by the City./140/ If direct discharge to surface water is determined to be the appropriate method for disposal of groundwater removed during dewatering, permits issued by the RWQCB under the National Pollution Discharge Elimination System would be required (see "Other Construction-Related Pollutants," in Section V.K, Hydrology and Water Quality: Impacts). In either case, the types and amounts of contaminants that could be released to surface water either indirectly through the combined sewer system or as a result of direct discharge would be minimized to the extent required by law. Based on the need for discharge permits, potential effects on the aquatic environment would be reduced to acceptable levels.

Measures identified in the RMP would restrict unauthorized access to construction sites where contaminated soils are present. This would effectively reduce the potential for direct human contact with contaminated groundwater. Therefore, impacts would be less than significant.

Surface Runoff from Construction Sites

Construction activities, such as the compaction and installation of fill, grading, and other geotechnical work, have the potential to remove the vegetative cover from the site, spill soils onto roads, or otherwise create the potential for erosion or movement of soils from the project site and potentially into surface waters during rain storms, absent implementation of management measures. Soils could include chemicals such as metals or petroleum hydrocarbons, contributing to pollution in the Channel or Bay. Implementation of measures to control stormwater runoff during construction would also control discharge of potential chemicals adhered to soil in the runoff. These measures are described under "Construction Activity Pollutants" in Section V.K, Hydrology and Water Quality: Impacts, and include implementation of a Stormwater Management Program and best management practices for construction sites. See also Mitigation Measure K.5 in Section VI.K, Mitigation Measures: Hydrology and Water Quality.

Previously Unidentified Subsurface Hazards Encountered During Construction

Underground Storage Tanks, Buried Debris, or Unidentified Contamination

As noted in the Setting subsection, there have been a number of investigations and actions to identify and remove old USTs from the Project Area where the tanks were no longer needed, and to manage identified contamination from UST leakage. Although these efforts have been extensive, the potential still exists for unidentified old or abandoned USTs to be present at sites to be developed in the Project Area; in particular, physical investigation or comprehensive soil testing to determine the presence of USTs or the extent, if any, of soil contamination under buildings has been infeasible on sites occupied by existing buildings or structures. Similarly, some debris in the old dump areas could contain hazardous constituents that, because of their quantity or form, could present a hazard, and would be difficult to identify from surface investigations. Other hazardous substances could be present that were not indicated in previous studies that have been carried out to date. The results of soil and groundwater investigations in Mission Bay North and Mission Bay South suggest that the likelihood of encountering many unidentified hazards is not great, however, because specific, identifiable source areas, with the exception of the petroleum free product area, have not been identified. Therefore, if such debris is present, it is likely to be localized and limited in extent. If, however, an unidentified UST containing hazardous materials or vapors or buried hazardous debris were uncovered or disturbed during excavation, construction workers, visitors, or occupants could experience adverse health effects associated with an inadvertent release of hazardous substances from the USTs or from the debris itself, as noted in the 1990 FEIR./141/

Inadvertent discovery of an unidentified UST could pose a possible explosion hazard or result in the release of stored materials (such as fuels or solvents). Hazardous fumes, mists, or vapors could be emitted, or releases could contaminate soil or shallow groundwater. If an unidentified UST were discovered during construction activities, it would have to be closed in place or removed. Removal activities could pose both health and safety risks, such as the exposure of workers, tank handling personnel, and the public to tank contents or vapors. Similarly, the discovery of buried debris that could be hazardous could also present an increased risk of adverse health or environmental effects, similar to those described for USTs.

The theoretical health risks associated with unidentified subsurface hazards would potentially affect the same populations as would be exposed to other health risks associated with the project, such as construction-generated dust, if uncontrolled. The risk associated with unidentified subsurface hazards cannot be quantified, as the nature and extent of exposure are unknown. However, the identification and release of unknown volatiles, if uncontrolled, could result in an additional incremental exposure to nearby populations.

The likelihood that significant adverse effects from unidentified USTs would occur would be minimal because risk management measures outlined in the RMP would be implemented. Such measures would include, but would not be limited to, compliance with Article 20, RWQCB and San Francisco Department of Public Health UST removal and site cleanup requirements, implementation of contingency monitoring procedures and RWQCB notification (as necessary), and implementation of a site-specific HASP prepared in accordance with Cal/OSHA regulations. Implementation of Measures J.1i and J.1j, presented in Section VI.J, Contaminated Soils and Groundwater, as well as legal and regulatory requirements, would be adequate to ensure that potential adverse effects on human health and the ecological environment from unidentified subsurface hazards would not be significant.

In the event additional investigation or remediation is necessary as result of the discovery of potentially hazardous buried debris, USTs, or other previously unidentified conditions, potential risks associated with such activities would be mitigated as discussed in the "Additional Investigation or Hazards Remediation" section, below.

Landfill Gas

As discussed in the Setting, methane, the primary component of landfill gas, is a combustible gas that can explode under certain conditions. Methane gas migrates through the soil column and can accumulate in enclosed structures, where it can present an explosion hazard.

Soil samples from all borings collected in Mission Bay North were classified as non-ignitable; therefore, the potential for hazardous concentrations of methane to be present in sufficient quantities to accumulate in enclosed structures and present an explosion hazard would be negligible and is not considered significant. The methane content of soils in Mission Bay South is believed to be extremely small since the soils were placed as fill nearly 100 years ago./142/ Further, the area where dump fill materials were placed in locations south of Berry Street, between Sixth and Seventh Streets, between 1878 and 1895 has been undeveloped for many years, allowing any methane generated to escape to the atmosphere so that buildup would not occur. Methane and ignitability would be analyzed in soil samples from Mission Bay North and Mission Bay South as a part of Article 20 compliance prior to construction. Implementation of Article 20 testing requirements would confirm that risks to people or the environment due to the possible presence of methane gas would not be significant. In the unlikely event that methane is present at levels of concern, standard building construction techniques, such as installation of an aggregate sub-base material for venting, could be used to ensure safe construction and building occupation.

Building Demolition

Implementation of the proposed project could involve construction activities that would require demolition of existing structures, some of which contain or may contain friable asbestos material, lead-based paint, PCB- or mercury-containing materials. There is no indication, based on soils testing results, that existing buildings or facilities that could contain these materials have resulted in any releases resulting in soil contamination in the Project Area. However, as discussed in the Setting under Hazardous Building Materials, buildings that would be affected by project development have not been comprehensively tested for the presence of such materials.

Inadvertent releases of friable asbestos, lead, or PCBs contained in materials or items removed during demolition activities could expose construction workers, occupants, or visitors to these hazardous materials, which could result in various adverse health effects if exposures were of sufficient quantity. To reduce potential human exposures to acceptable levels and to protect the environment, several regulations and guidelines pertaining to abatement of and protection from exposure to asbestos and lead, as discussed in the Setting under "Regulatory Framework" will be complied with, as appropriate (e.g., Cal/OSHA has regulations on worker exposure to both chemicals). Although a similar abatement program has not been adopted by the state for PCB or mercury testing and cleanup/143/, items containing PCBs, mercury, or other hazardous substances that are intended for disposal must be managed as hazardous waste and must be handled in accordance with OSHA worker protection requirements.

Implementation of applicable regulations and standards would ensure that potential health and environmental hazards associated with asbestos, lead, or PCBs in buildings and structures to be demolished would be minimized to the extent required by law. Therefore, impacts would be less than significant.

APPROACH TO ANALYSIS OF POTENTIAL EFFECTS AFTER BUILD-OUT (POST-DEVELOPMENT)

The discussion of potential human health and ecological effects at buildout is based on conclusions presented in the 1997 Mission Bay North and 1998 Mission Bay South reports, *North of Channel Screening-Level Ecological Risk Evaluation, Mission Bay Project Area*, and *Approach to a Plan for Risk Management, Mission Bay Project Area*, prepared by ENVIRON International Corporation. The analysis assumes implementation of post-development measures identified in the RMP for post-development conditions, which is described below.

A quantitative human health and ecological risk assessment was prepared by ENVIRON to evaluate potential effects on human and aquatic populations upon project completion. A description of the methods used for each evaluation is presented below. Additional details are included in "Post-Development Risk Evaluation Methodology," in Appendix I.

For both Mission Bay North and Mission Bay South, the risk evaluation assumed that any locations with identified contamination ultimately would be covered with pavement, buildings, landscaping, or fill. In addition, site development conditions, covenants, deed restrictions, or other appropriate post-development measures identified in the RMP would be imposed where necessary. The combination of these physical and administrative controls would substantially limit public exposure to remaining contaminants. As stated in the Setting, the near-shore ecosystem of China Basin Channel and San Francisco Bay, with the possible exception of the free product area in the southeastern portion of the Project Area, are not affected under existing conditions. Potential effects on the ecosystem have been evaluated as part of the analysis to account for post-development conditions.

Human Health Risk Assessment

The human health risk evaluation was conducted by developing site-specific target levels (SSTLs) for each of the chemicals present in the soil and groundwater to which humans may be exposed. The SSTLs were developed using standard risk assessment techniques and regulatory assumptions; they represent the concentrations of individual chemicals that could be present in the soil or groundwater that are protective of the human populations that might be present in Mission Bay South. A comparison of the concentration of chemicals detected in the soil and groundwater to the health-based SSTLs provides the basis for determining whether the chemicals present in the Mission Bay South area would pose a risk to human health and provides a basis for identifying areas where risk management measures may be needed. The SSTLs developed for Mission Bay South were applied also to Mission Bay North because the populations that would be present in Mission Bay North at build-out and the type of development would be generally the same as that proposed for Mission Bay South./144/

The SSTLs were developed using methods consistent with the Risk-Based Corrective Action (RBCA) methodology, as developed by the American Society for Testing and Materials (ASTM) and described in ASTM E-1739, *"Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, 1995."* RBCA represents a streamlined process for assessing and responding to releases of chemicals, including hydrocarbons and, therefore, is appropriate for assessing potential risk due to contaminants that have been detected in soil and groundwater in the Project Area. The RBCA approach integrates U.S. EPA risk assessment practices with traditional site investigation and remedy selection activities in order to determine cost-effective measures for protection of human health and environmental resources. ENVIRON used the RBCA Guidance, combined with specific methods and assumptions developed and/or recommended by U.S. EPA, RWQCB, and DTSC in the development of SSTLs.

The human health risk evaluation was conducted under the assumption that RMPs would be used to guide the development and subsequent management of activities in the Project Area with respect to contaminated soil and groundwater. The RMPs would provide a framework to manage residual chemicals in soil and groundwater in a manner consistent with intended land use and to be protective of both human health and the environment.

For the purposes of the quantitative human health risk analysis, SSTLs developed to be protective of the cancer and chronic noncancer health risks were calculated for potentially exposed populations based on exposure pathways and exposure assumptions identified for all chemicals of concern. The approach used in the development of SSTLs was based on health-protective agency guidelines and criteria that are specifically designed to overestimate risk. Risk criteria used in the development of the SSTLs were 10 excess cancer cases per 1 million (1×10^{-5}) and a Hazard Index of 1, consistent with policies of the RWQCB and CalEPA; DTSC has deferred to the RWQCB's decision on this matter./145/ Based on the contaminants identified in the Project Area, the RWQCB staff has formally concurred with these levels as the acceptable risk levels for the evaluation of human health effects in Mission Bay./146/ These risk criteria are also consistent with risk management levels used in such programs as the state's Proposition 65 program and the BAAQMD Risk Management Policy for controlling toxic air contaminants./147/ For estimated risk values above these levels, risks would be considered significant. Appendix I contains additional information about the methodology used to develop the SSTLs for the health risk evaluation under "Development of Health-Based Site-Specific Target Levels."

Ecological Risk Assessment

As discussed in the Setting (see "Existing Ecological Risks"), contaminants identified in groundwater do not currently pose an adverse risk to the near-shore aquatic environment, with the possible exception of the petroleum free product area. "Analysis of Potential Adverse Ecological Effects Associated with Current Conditions in the Project Area," in Appendix I, contains additional information about the quantitative risk assessment process used to support that conclusion. The approach used to determine ecological impacts for post-development conditions is based on the evaluation of existing ecological risks.

The Project Area does not provide habitat for any rare or endangered terrestrial or nesting avian species that could be affected by project development. Therefore, the following analysis of ecological effects focuses on potential effects on the near-shore aquatic environment during post-development conditions. Potential effects are qualitatively evaluated based on anticipated future land uses, compared to existing conditions, and assumes implementation of post-development RMPs.

Risk Management Plan for Post-Development Conditions

The analysis of post-development effects assumes that RMPs prepared for site development construction activities would also include measures that would be implemented after project development is complete. All relevant risk management measures would be presented in the RMP and submitted to the RWQCB staff for review and approval. If additional or alternative risk management measures are identified by the RWQCB staff, then the RMP would be revised and resubmitted to the RWQCB staff for its consideration.

As with project construction, implementation of specific measures identified in the RMP is expected to be required as a condition of project occupancy and is assumed for purposes of the following analyses. The measures specified in the RMP must be adhered to in order to ensure that the conditions in the Project Area remain protective of human health and the environment after project development. The main components of the post-development RMP are:

- Covering of the Project Area;
- Limitations on future development within the Project Area specifying that no residences with unrestricted access to soil in single-family residences with frontyards or backyards would be allowed;
- Prohibition of use of shallow groundwater within the Project Area for domestic, industrial, or irrigation purposes; and
- Establishment of protocols for future subsurface activities by workers involved in maintenance, construction, or repair.

Additional detail regarding these mechanisms as they would apply after project completion is presented in Measures J.11 through J.1o in Section VI.J, Contaminated Soils and Groundwater.

POST-DEVELOPMENT IMPACTS

The following analysis evaluates potential human health and ecological risks from residual chemical constituents in the soil and groundwater within the Project Area after development is complete.

Potential Effects on Human Health After Development

Based on the planned uses of Mission Bay Project Area, the human populations who could be present once development has occurred include:

- On-site and off-site retail and commercial workers (including maintenance and construction workers);
- Visitors to and shoppers at commercial and retail establishments;
- Child care and school facility attendees (both adults and children);
- Students, faculty, and support staff of UCSF;
- On-site and off-site residents (both adults and children); and
- Park visitors (both adults and children).

Potential human health impacts could occur in the future if these populations were exposed to elevated levels of constituents present in the soil and groundwater. The pathways through which exposure to the constituents in the soil and groundwater could occur include the following:

- Building occupants (which includes on-site and off-site retail and commercial workers; child care and school facility attendees; and students, faculty, and support staff of UCSF): inhalation of soil and groundwater vapors that have migrated into the indoor environment;
- Park and open space visitors: inhalation of soil and groundwater vapors, and direct contact with soils or groundwater;
- Visitors to and shoppers at commercial and retail establishments: inhalation of soil and groundwater vapors that have migrated into the indoor environment;
- On-site residents: inhalation of soil and groundwater vapors, and direct contact with soils or groundwater; and
- Construction and subsurface workers: inhalation of soil and groundwater vapors, and direct contact with soils or groundwater.

After development, the Project Area would be covered by buildings, structures, parking areas and roadways, and parks and landscaping. Accordingly, direct access to the existing soil by workers, residents, or visitors in the Project Area would be precluded. There would be no single-family residences with front yards or back yards where soil disturbance and direct contact with the native subsurface soil could occur.

As noted in "Approaches to Analysis of Potential Effects After Build-out (Post Development)," a human health risk evaluation was conducted to determine whether the levels of chemicals measured in the soil and groundwater in Mission Bay South would pose a risk to the human populations that could be present once the development of the Project Area is complete. The human health risk evaluation is presented in the 1998 Mission Bay South report./148/ As further noted in the analysis approach discussion, the SSTLs developed for Mission Bay South are also applicable to Mission Bay North.

A comparison of the soil and groundwater SSTLs to the concentrations detected in the soil and groundwater in the Project Area provides the basis for determining whether the levels of constituents present in the Project Area would pose a risk to the populations that may be present in the area under future development plans.

The future residents of the Mission Bay Project Area were assessed using the longest time period of exposure (assumed to be 30 years) of any of the risk analyses, and represents the population most vulnerable to long-term exposure effects. Therefore, they have the lowest SSTLs. Other future populations that may be present in the Mission Bay Project Area, such as on-site commercial workers or park visitors, have higher SSTLs because they would be less likely to receive long-term exposures.

As previously stated, the SSTLs developed for and conclusions of the risk evaluation for Mission Bay South are equally applicable to Mission Bay North. Overall, the maximum concentrations of chemicals detected in the soils and groundwater in the Project Area were found to be well below the calculated SSTL chemical concentrations that would present a risk to future residents, commercial workers, or park visitors. One exception is in boring C35 (northeast of 16th and Illinois Streets, in Mission Bay South), where the maximum levels of TPH-gasoline (36 mg/L) detected in the groundwater exceeds the SSTL developed for the on-site child resident (29 mg/L). However, that portion of Mission Bay South is proposed for commercial/industrial, retail, and open space land uses rather than residential development and is located in an area that would be remediated as part of the free product study already underway. The maximum level of TPH-gasoline detected in groundwater is below the concentration that would present a risk to the commercial workers, park visitors, or off-site residents who may be exposed to chemicals present in the vicinity of boring C35./149/

The levels of chemicals detected throughout the area and the pattern of the locations where they were detected are such that the cumulative exposures for all populations considered in the risk assessment are well within EPA's defined acceptable risk range, and are below the cancer risk level established for the Mission Bay Project Area.

As part of the proposed project, the following components of the RMP would be implemented for long-term risk management of the Project Area: covering of the Project Area; limitations on future residential development of the Project Area; restricting the future use of groundwater; providing protocols for future subsurface activities; and developing and implementing a long-term compliance program. These components of the post-development RMP are presented in greater detail in Measures J.1a, and J.1l to J.1o in Section VI.J, Mitigation Measures: Contaminated Soils and Groundwater.

In summary, the RMP would specify that any changes in development plans maintain the result that direct contact with existing native soil by humans be prohibited or obstructed, by using buildings, pavement or appropriate fill for landscaping. The RMP would specify that no single-family residences with unrestricted access to soils in front yards or backyards would be allowed anywhere in the Project Area, and residents would not have access to the soils underneath the privately owned landscaped areas. If the proposed land uses in the Redevelopment Plans were to change, further analysis would be conducted before residences could be built in areas currently planned for commercial uses. The RMP would also specify a process to be used to assess potential location before child care facilities or schools could be built in nonresidential areas (see discussion below in "Process for Selecting and Approving a Child Care Center and/or School Location"). The RMP would prohibit the use of shallow groundwater within the Project Area for domestic, industrial, or irrigation purposes. Groundwater wells would not be installed within the Project Area except for environmental monitoring purposes. Environmental wells installed within the Project Area would be secured and locked to prevent unauthorized access to the groundwater. The shallow groundwater within the Project Area would remain unused unless at some point in the future an assessment of the risks from direct exposure to the groundwater is evaluated and the RWQCB and other appropriate regulatory agencies approve the use of the shallow water. If disturbance of subsurface soil is necessary for maintenance or repair, activities would be conducted in accordance with the worker training and health and safety requirements meeting Cal/OSHA standards, as outlined in the RMP.

Future human populations in the Project Area could only be exposed to residual contaminants through the inhalation of vapors that have migrated from the soil or groundwater, up through the soil column, into the indoor or outdoor air. The SSTLs were developed assuming that the Project Area would not have any special barriers such as paving or buildings in order to present a conservative approach. Using these SSTLs, VOCs were not shown to pose a human health risk. Based on the proposed uses for the Project Area, other potential exposure routes such as direct contact with soils or groundwater would be eliminated through implementation of the RMP. Therefore through implementation of the RMP, potential adverse human health risks after project completion would not be significant.

Process for Selecting and Approving a Child Care Center and/or School Location

The Redevelopment Plans allow for the siting of child care centers in each of the major land use districts. In addition, it is anticipated that a single site could be developed as a school, most likely a primary school.

As described in the 1998 Mission Bay South report and in Appendix C of *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*/150/, environmental conditions in areas proposed for residential development have been evaluated and have been shown to be safe for future children and adult residential populations. Children present at a child care center or school could be exposed to chemicals in the soils and groundwater through the same exposure pathways as the child residents evaluated in the human health risk assessment. The primary difference in assessing potential risk for child residents as compared to children present at a child care center or school is that the residential children are assumed to be present in their home 24 hours per day, whereas the children that could be present at the child care center or school are assumed to be present at the child care center or school only a fraction of the day. Therefore, SSTLs established as protective of child residents would also be protective of children that could be enrolled at the child care center or school. Because the portions of the Project Area planned for residential development have been shown to be safe for on-site residents, including on-site children, any of the residential areas would also be considered safe for children that could be enrolled in the child care center or school.

If a child care center or school were to be proposed within an area designated other than residential, the RMP would call for additional risk analyses to be conducted to evaluate the appropriateness of the proposed location for that use (see Measure J.2 in Section VI.J, Mitigation Measures: Contaminated Soils and Groundwater). Once a specific location has been proposed, the chemical concentrations detected in local soil and groundwater would be compared to the risk-based residential SSTLs. If the cumulative exposures resulting from the presence of chemicals in both the soil and groundwater around the proposed location were below the residential SSTLs, then the proposed location would be appropriate for the children at the child care center or school. If the cumulative exposures were above the residential SSTLs, then other approaches, such as the development of SSTLs specific for a child at a child care center or a child at a school, could also be used to assess whether the use of a particular nonresidential area for either a child care center or a school would be safe for the proposed use. Risk evaluations conducted to support the use of a particular area for either a child care center or a school would be submitted to the RWQCB staff for review and approval.

If the evaluation of the site-specific SSTLs for children at a child care center or school indicates that the proposed site would pose an unacceptable risk to child populations, the proposed site could either be: 1) remediated so that contaminant concentrations would not pose a risk to child populations, based on the SSTL criteria; or 2) another site would need to be selected. In the event remediation is determined to be appropriate, cleanup levels appropriate to the intended use would be established for review and approval by the RWQCB based on the SSTLs established for the site's proposed use. For a discussion of potential effects related to investigation and remediation, please see the "Additional Investigation or Hazards Remediation" section below. In addition, relevant elements of the project development RMP, discussed above under "Approach to Analysis of Potential Effects during Project Development," would also be implemented to ensure that potential construction-related effects were minimized.

Potential Effects on the Ecological Environment

The potential for chemicals in soil and groundwater in the Project Area to pose a risk to aquatic organisms through the flow of groundwater to the adjacent water bodies was evaluated as part of the Project Area investigations, as discussed in "Existing Ecological Risks " in the Setting subsection, above. Except possibly in the free product area, the continued presence of these chemicals in the groundwater is not considered to be adversely affecting aquatic organisms at the present time./151/ Chemicals evaluated included VOCs, metals, and petroleum hydrocarbons (naphthalene, BTEX compounds, TPH-gasoline, TPH-diesel, and TPH-motor oil). A reasonable estimate of the characteristics of stormwater runoff from the Project Area is discussed under "Volume and Quality of Direct Stormwater Discharge to Bay," in Section V.K, Hydrology and Water Quality: Impacts.

Once development of the Project Area was complete, areas with currently exposed soils would be covered. Thus, exposure of terrestrial and avian species to any remaining soils containing elevated levels of contaminants would be eliminated. In addition, covering of the soils in the Project Area either with pavement or buildings or placement of additional soil layers in new landscaped areas would reduce the amount of rainwater infiltration through the soils into the underlying groundwater. A reduction in infiltration would reduce the potential for chemicals present in existing soils to migrate down through the soil column into groundwater. To the extent infiltration would be reduced, the potential for chemicals to migrate to nearby surface water bodies would be reduced. Further, the potential for chemicals in soil to migrate to aquatic habitats through surface water runoff would be eliminated. Depending on the development that would occur on each site, the proposed project could result in the removal of some soil and fill materials. New fill material would be placed in some areas, as described in "General Soil Movement and Transport During Construction" section, above. Removing old fill and replacing it with building foundations or new fill would remove or reduce the older metals-containing materials that have been identified as likely sources of metals in groundwater in the Project Area. Because metals concentrations would be reduced in subsurface materials, there would be a commensurate reduction in metals that could migrate to groundwater under future conditions.

Long-term management measures identified in the RMP would ensure that there would be no adverse effects on the ecological environment due to project occupancy and maintenance.

CHANGED CONDITIONS

The following subsection addresses potential changes in circumstances or conditions which could affect the project-related impacts previously addressed in this section. This subsection discusses how various scenarios would change the impacts of contaminated soil or groundwater in the Project Area.

Additional Investigation or Hazards Remediation

Change in Nature and Extent of Free Product Cleanup

In the event that subsequent site investigations reveal that remediation activities are required on-site in the free product area, such activities would not substantially alter the human health risks in the Project Area. This is due to the extensive regulatory structure governing clean-up activities. The primary health risk from remediation activities would come from exposure to toxic air contaminants (TACs) generally in the form of volitile organic compounds generated by remediation activities. TACs are regulated by BAAQMD. Remediation of contaminated soils is regulated by source specific rules. BAAQMD Regulation 8, Rule 40 sets standards for aeration of contaminated soils and removal of underground storage tanks. Regulation 8, Rule 47 sets standards for air stripping and soil vapor extraction operations. These rules limit the emissions of organic compounds from the remediation process and also reduce the risk associated with TAC emissions. In addition to these source specific rules, BAAQMD has a Risk Management Policy that sets limits on acceptable risk from toxic air contaminants. BAAQMD may deny a permit to a proposed operation that would create risks above significance thresholds, defined as an increased cancer risk greater than 10 in 1 million or acute or chronic noncancer risks with Hazard Indices greater than 1./152/ For a project with potentially significant risks, BAAMQD requires Toxic Best Available Control Technology (TBACT), and may approve a project with an increased cancer risk between 1 in 1 million and 10 in 1 million, if TBACT is used. (An increased cancer risk of less than 1 in 1 million is insignificant.) An increased cancer risk of 10 in 1 million is the same risk level approved by the RWQCB for the Project Area. In addition to the BAAQMD requirements, the RWQCB sets health-based standards and standards for ecological risk for remediation activities. Based on these requirements, remediation activities in the free product area would not substantially alter the human health effects and would, therefore, not change the conclusions of the impact analysis prepared for the project.

Additional Remediation Requirements

The 1990 FEIR assumed that remediation would be necessary within the Project Area to reduce contaminant levels in soils in some locations prior to development, to protect residents, workers, and visitors. The impact analysis presented in the 1990 FEIR recognized that remediation could result in adverse human health or environmental effects, if not properly managed./153/ Such activities could include excavation and transport of contaminated soils to an off-site treatment or disposal facility, in-situ treatment of soils (e.g., soil vapor extraction or bioremediation), or groundwater extraction and treatment. Table V.J.2, modified slightly from Table XV.L.1 in the 1990 FEIR, provides an overview of the types of remediation activities and potential human health and environmental effects associated with each activity. In addition, site controls that could be implemented to minimize the potential hazards associated with the effects are also shown. The analysis of potential impacts related to remediation activities assumed under the 1990 FEIR would still be applicable to remediation activities that could be implemented in conjunction with project construction because the types of cleanup methods that could be used would not be expected to vary substantially from those noted in the 1990 FEIR.

As discussed in the Setting and in the "Impacts During Project Development" subsections, above, with the exception of potential ecological impacts associated with the petroleum free product in the southeast portion of Mission Bay South, subsequent studies have established that there are no immediate risks to human health that require immediate corrective action. Further, no ecological effects to aquatic communities from chemicals in the groundwater have been identified in the near-shore areas of China Basin Channel or San Francisco Bay that require remediation, with the possible exception of the free product area. As further described in that subsection, however, the potential exists for some soils or groundwater to contain hazardous materials in amounts that could present an increased risk to construction workers or future site occupants, visitors, or workers in the event the soils were disturbed during construction in the Project Area. Site-specific investigations required by the Article 20 requirements or performed as part of RMPs may identify the need to perform remediation activities for certain development sites in the Project Area.

If additional subsurface sampling in the Project Area, in accordance with Article 20 requirements or as part of RMP implementation, revealed contamination that would require risk management to ensure public safety during construction, remediation of soil or groundwater could be necessary in certain locations to reduce contaminant levels so that they would not present a human health hazard during

TABLE V.J.2
POTENTIAL ENVIRONMENTAL EFFECTS AND SITE CONTROLS ASSOCIATED WITH REMEDIATION TECHNIQUES

Types of Remediation Techniques	Potential Environmental Effects	Site Controls
Soils Remediation		
Excavation and Treatment and/or Off-Site Disposal	Short-term air emissions during excavation	Air monitoring and engineering controls, dust control
Temporary Stockpiling	Short-term air emissions	Covering the pile with low-permeability liners
	Contact with soils	Secured fencing, covering the pile, posting warning signs
	Leaching to groundwater	Liners and monitoring
	Visual	Contouring and fencing
Treatment		
Aeration	Air emissions	Aerating only when wind is blowing away from sensitive receptors
		Controlling emission rate by limiting amount of soil aerated per BAAQMD rule
	Contaminated dust	Dust control and air monitoring
Landfarming (Bioremediation)	Same as those for aeration	Same as those for aeration
Extraction and Filtration	Water use	Using engineering design to minimize water use
	Noise	Temporary noise berms or portable sound barriers
	Visual	Fencing
Combustion	Air emissions	Efficient design, controls, and monitoring
	Energy	Efficient design, controls, and monitoring
	Noise	Portable sound barriers
	Visual	Fencing
Off-Site Disposal	Truck traffic	Selecting best truck route
	Contaminated dust	Dust control measures including underfilling and tarping of trucks
	Spreading contamination	Decontaminating equipment leaving the site

(Continued)

TABLE V.J.2 (Continued)

Types of Remediation Techniques	Potential Environmental Effects	Site Controls
In Situ Treatment		
Soil-Gas Extraction	Noise	Using mufflers on equipment
	Air emissions	Using filtration equipment to comply with BAAQMD standards
Flushing as Part of Groundwater Treatment	Area kept wet by recharge	Recharging several feet below ground surface to keep surface dry
Capping or Containment Wall	Area with restricted use	Notifications required by law
	Noise/dust associated with construction activities	Same as regular excavation activities
Groundwater Remediation		
Monitoring Wells	Potential conduit for contaminant migration	Proper installation of wells
	Visual and noise	Short-term (one day per well)
Treatment System		
Activated Carbon for Some Organics	Transport of used carbon replacements	Using Department of Transportation-approved transportable carbon vessels
	Visual	Fencing
	Noise	Walls or other noise barriers around system
Ion Exchange for Some Metals	Generation of liquid waste	Infrequent; using licensed haulers to remove liquid wastes for treatment and/or disposal
Ultraviolet Light and Ozone or Peroxide	None	None
Air Stripping for Some Volatiles	Transport of used carbon replacements	Using Department of Transportation-approved transportable carbon vessels
	or	
	Carbon regeneration would yield a liquid waste requiring removal	Infrequent; using licensed to remove liquid wastes
Precipitation and Filtration	Disposal of hazardous sludge	Appropriate off-site disposal, probably at a Class I facility

Source: 1990 FEIR, Volume Four, pp. XV.L.14-XV.L.15.

construction. In that case, additional measures beyond those identified in the RMP would be developed and implemented. The RMP would be revised to reflect such changes and be re-submitted to the RWQCB staff for approval. The RWQCB staff has the authority to impose additional measures or to modify them as necessary, applying the same standards — a cancer risk below 1×10^{-5} and a Hazard Index of 1.

Potential construction-related effects on the aquatic environment would be minimized through the implementation of Stormwater Permit Stormwater Pollution Prevention Plans (SWPPPs). Measures specified in the SWPPPs would establish controls to minimize sediment from stockpiled soils, dust, or other exposed soils that could contain elevated levels of contaminants in construction site runoff, so that surface water quality and the aquatic environment in China Basin Channel or San Francisco Bay would not be adversely affected.

The type of remediation and methods, site controls, and monitoring activities appropriate to a specific remedial activity would be included in individual plans developed for remedial activities. Remedial activities would be subject to various laws and regulations. Depending on the remedial action being undertaken, these statutes and regulations would include, but would not be limited to, hazardous waste management laws and regulations administered by the DTSC, water quality protection laws and regulations under the jurisdiction of the SWRCB and RWQCB, air quality management regulations administered by the BAAQMD, OSHA workplace safety requirements, hazardous waste transportation regulations and standards, and others that may apply. Similar to RMPs, each remediation plan developed to meet Article 20 requirements or to achieve RMP risk-reduction objectives would include an assessment of the potential hazard and would describe the health and safety measures designed to protect the construction workers and general public who could be exposed to potential hazards associated with the type of remedial activity at that particular location. Methods to control site access, to minimize airborne contaminants, to reduce the potential for spills or inadvertent releases of contaminated soil or groundwater, transportation and disposal (e.g., if excavated materials are to be removed from the Project Area), and emergency procedures would be specified in the plans. The remediation plans would be required to fulfill the provisions of Article 20, and would require RWQCB review, as appropriate, prior to implementing the remedial action plan. Further, all remedial actions would be required to comply with applicable federal, state, and city laws and regulations. As described in "Change in Nature and Extent of Free Product Cleanup," the regulatory requirements of the BAAQMD and RWQCB would sufficiently protect human health and the ecological environment from any additional remediation activities. Risk-based standards would be enforced on any new remediation activities. Therefore, there would be no significant effect on people or the environment.

Delay of Build-out or Incomplete Build-out

The analysis in this SEIR assumes that the project is built out by the year 2015. It is possible that build-out could take longer than the approximately 20 years assumed, or that some sites would remain vacant for the foreseeable future. These changes in circumstances would not change the impact of contaminated soils in the Project Area.

One of the risk assessments prepared for the project was conducted to determine whether the current conditions that exist in the Project Area would pose an immediate risk to human populations in the area (see "Summary of Existing Human Health and Ecological Risks from Contaminants Detected in Soil and Groundwater in the Project Area," in the Setting). Based on that evaluation, existing conditions do not pose an immediate risk to human populations./154/

Although areas that are presently covered by buildings, paving, or other materials could become exposed during the course of the development, exposure to each of the areas under construction would be controlled through the implementation of risk management measures. The process that would be used in implementing the RMP to analyze whether the presence of vacant, uncovered areas during the period between the existing situation and full build-out would pose a risk to potentially exposed populations would protect human health regardless of the duration of development. Development of the ITLs and implementation of management practices described above under "Exposure from Vacant, Undeveloped Sites" are not dependent on a specific duration of construction of development activity but are based in part on the length of time an individual may be present in the Project Area and exposed to the chemicals on the vacant undeveloped parcels. For ITLs, this reasonable maximum exposure is assumed to be 30 years, and would be sufficient to establish approaches that protect human health while a site was uncovered regardless of the length of time that a new site was uncovered. Further, the 20-year exposure assumption used in assessing construction dust impacts would remain appropriate for a longer build-out period because the construction dust analysis assumes continuous exposure to dust over the entire 20 years, while under the extended scenario there would be some periods when no construction was occurring, such that the total exposure would be reasonably likely to be 20 years. Therefore, if a delay of build-out or incomplete buildout occurred, implementation of the RMP would reduce human health risk to less-than-significant levels.

Changes in Land Use

Throughout the life of the project, uses in the Project Area may change from those that were originally approved such that the applicability of the SSTLs to support the conclusion that a particular area would not pose a risk may no longer be valid. For example, residential uses could be proposed to be extended into areas now designated for commercial/industrial use. Location of residential uses in nonresidential areas would not have been assumed for the evaluation of human health effects under post-development conditions.

Changes in land use that would cause exposure to soil or groundwater contaminants at levels above those expected based on the 1997 Mission Bay North and Mission Bay South reports and above those assumed in analyses carried out under the project development and post-development RMPs, could cause impacts not analyzed in this SEIR. Proposals to amend the Redevelopment Plan, or otherwise approve a use in a location for which an appropriate site-specific target level has not been established and applied to the proposed new occupancy, should not be approved without a review of the potential effects on human health associated with the new use at the location.

GLOSSARY AND ACRONYMS

BAAQMD	Bay Area Air Quality Management District
BTEX	benzene, toluene, ethylbenzene, and xylenes
Cal/EPA	California Environmental Protection Agency
COPEC	chemical of potential ecologic concern
COPIC	chemical of potential immediate concern (human health effects)
DTSC	Department of Toxic Substances Control
HASP	Health and Safety Plan
HI	Hazard Index
ITL	interim target level
MEI	maximally exposed individual
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	Preliminary Remediation Goal
RBCA	Risk-Based Corrective Action
RMP	Risk Management Plan
RWQCB	Regional Water Quality Control Board
SSTL	site-specific target level
SVOC	semivolatile organic compound
TAC	toxic air contaminant
TBACT	toxics best available control technology
TDS	total dissolved solids
TPHs	total petroleum hydrocarbons
UCL	upper confidence limit
U.S. EPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

Acute exposure: One-time or very limited exposure to a substance over a relatively short period of time (i.e., a few days versus many years).

Attenuation: Decrease in the concentration or quantity of a substance resulting from physical, chemical, and/or biological reactions or processes that act on the substance.

Bioaccumulation: An increase in the concentration of a substance in living tissue relative to the exposure concentration when the rate of intake into the organism is greater than the rate of excretion or metabolism.

Cancer risk: Calculated approximation of the probability of an individual developing cancer as a result of exposure to a cumulative dose of a potential carcinogen based on estimated or measured concentrations in soil, groundwater, or air and a potency factor specific to that carcinogen.

Carcinogen: Cancer-causing.

Chronic exposure: Repeated doses of or exposure to a substance over a relatively prolonged period of time (i.e., many years versus a few days).

Cumulative exposure: Exposure to multiple chemicals that may be present in both soil and groundwater.

Dose: The amount of a chemical substance to which an organism is exposed.

Downgradient: Groundwater water surface levels that are lower in elevation relative to areas with higher water surface elevation, as measured against a standard datum (e.g., mean sea level). Similar to downstream in the context of surface water movement, the term can also be used to refer to a groundwater flow direction.

Exposure pathway: The course a chemical or pollutant takes from the source to the organism exposed. A complete exposure pathway consists of four elements: chemical sources, migration routes (i.e., transport in the environment), an exposure point for contact (i.e., soil, air, or, water); and exposure routes. An exposure pathway is not complete unless all four elements are present.

Exposure route: The way a chemical or pollutant enters the organism after contact. Four exposure routes are recognized in risk evaluation methods - ingestion, inhalation, dermal (skin and eye), and injection.

Free product: Petroleum not confined in a tank or pipeline that can be found floating on groundwater. The free product includes both visible project (a sheen on the water surface) that is not of measurable thickness (i.e., less than 0.01 inches) and product that is present in measurable depths (greater than 0.01 inches thick).

Hazard: Any situation that has the potential to cause damage to human health or the environment.

Hazard Index (HI): The calculated ratio of predicted acute or chronic exposure of noncarcinogenic substance to a toxicity reference dose level for that particular substance. A Hazard Index (HI) threshold of 1 has been established by most regulatory agencies, including the RWQCB and BAAQMD for comparison purposes. Adverse health effects are not anticipated when chronic and acute hazard indices are less than one.

Hazardous material: Any material that, because of its quantity, concentration, or physical, or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. "Hazardous materials" include, but are not limited to, hazardous substances, hazardous waste, and any material which a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment (California Health and Safety Code, Section 25501).

Hazardous materials release site: Any area, location, or facility where a hazardous material has been released or threatens to be released to the environment (California Health and Safety Code, Section 25260(e)).

Hazardous substance: See "hazardous material."

Hazardous waste: Waste that, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may either cause, or significantly contribute to an increase in mortality or an increase in serious illness, or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed (California Health and Safety Code, Section 25117.

Interim target level: Calculated site-specific concentration of a chemical in soil that would be used to identify locations in the Project Area that could require risk management measures during project development.

Maximally exposed individual: Person exposed for a finite amount of time to airborne contaminant emissions at a location where the maximum ground-level concentrations of the emissions would occur.

Native soil: Soil that exists in Project Area prior to project approvals.

Point source: Any discernible, confined, and discrete discharge from a pipe, channel, or other conveyance to a waterway.

Polycyclic aromatic hydrocarbon: Organic chemical byproduct formed by the incomplete combustion of raw fuel materials, typically present as a constituent of heavy-end fuels (e.g., diesel) or other petroleum-based products such as asphalt.

Preliminary Remediation Goal: Concentrations of chemicals in soil that are protective of humans, including sensitive groups such as children, over a lifetime. PRGs were developed by U.S. EPA Region IX and they combine current U.S. EPA toxicity values for chemicals with "standard" exposure factors.

Reasonable maximum exposure: The maximum exposure that is reasonably expected to occur. As an example, the reasonable period of time that one individual would be likely to remain in one location and could be exposed to chemicals in the Project Area is 30 years.

Remedial action or **remediation**: Actions required by state or local laws, ordinances, or regulations necessary to prevent, minimize, or mitigate damage that may result from the release or threatened release of a hazardous material (California Health and Safety Code, Section 25260(g)). These actions include the cleanup of the site, monitoring, testing and analysis of site conditions, site operation and maintenance, and placing conditions or restrictions on the land use of the site upon completion of remedial actions.

Risk: The probability of exposure to hazardous material and severity of harm that exposure would pose to human health or the environment, where the degree of risk is a function of the means of exposure, in addition to the inherent toxicity of the material.

Semivolatile organic compound: An organic chemical that readily, but only partially, evaporates or changes from a liquid to gas at temperatures normally found at the ground surface and at shallow depths.

Site specific target level: Calculated site specific maximum concentration of an individual chemical in the soil or groundwater based on potential exposure pathways and duration of exposure that would be protective of human populations that could be present in the Project Area after project completion.

Total petroleum hydrocarbons: Fuel products such as diesel, gasoline, and motor oil containing organic chemical compounds of varying types and concentrations that are specific to type product.

Toxic: Concentration of a substance that would be lethal or produce other adverse responses detrimental to the health of an organism.

Upgradient: Similar to upstream in the context of surface water movement. Upgradient refers to water surface levels in groundwater that are higher in elevation relative to areas with lower water surface elevations, as measured against a standard datum (e.g., mean sea level).

Volatile Organic Compound: An organic chemical that readily evaporates at temperatures normally found at the ground surface and at shallow depths.

NOTES: Contaminated Soils and Groundwater

1. Val F. Siebal, Chair, Site Designation Committee, Cal EPA, letter to James Adams, Director of Environmental Services, Catellus Development Corporation, July 15, 1997.

2. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p .2-8.*

3. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p .2-8.*

4. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California,* April 1997, p. 3-2.*

5. ENVIRON International Corporation, *Technical Memorandum #3, North of Channel Screening-Level Ecological Risk Evaluation, Mission Bay Project Area,* April 1998, Section 4.2.

6. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 5-21.

7. ENVIRON International Corporation, *Technical Memorandum #3, North of Channel Screening-Level Ecological Risk Evaluation, Mission Bay Project Area,* April 1998, Section 4.2.

8. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, Appendix G.

9. ENVIRON International Corporation, *Technical Memorandum #3, North of Channel Screening-Level Ecological Risk Evaluation, Mission Bay Project Area*, April 1998, Section 4.2.

10. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 6.2.3.

11. Regional Water Quality Control Board, San Francisco Bay Region, *Proposed Regional Toxic Hot Spot Cleanup Plan*, December 1997.

12. San Francisco Planning Department, *Mission Bay Final Environmental Impact Report*, Planning Department File No. 86505E, State Clearinghouse No. 86070113, certified August 23, 1990, Volume Two, p. VI.N.7.*

13. 1990 FEIR, Volume Two, pp. VI.N.7-VI.N.8.*

14. 1990 FEIR, Volume Two, pp. VI.N.7-VI.N.8.*

15. 1990 FEIR, Volume Two, p. VI.N.8; Environmental Science Associates, *Mission Bay Hazards Mitigation Program*, Volume I Final Report, August 1990, p. 27.*

16. Of the approximately 50 USTs listed in the 1990 FEIR as being located in the Project Area, several were found to be duplicate listings or are in properties no longer included in the Project Area. Therefore, Figure V.J.2 and Appendix Table I.3 show the status of the 43 USTs known or suspected to be in the Project Area.

17. 1990 FEIR, Volume Two, pp. VI.5-VI.9, and Volume Three, Table XIV.L.2, pp. XIV.L.10.*

18. Copies of these reports are available for review at the San Francisco Planning Department, 1660 Mission Street.

19. ENVIRON International Corporation, *Technical Memorandum #2, Development and Screening of Remedial Alternatives for Free Product Area in Region of Former Oil Storage Facilities*, April 1998, Section 2.3.2.

20. Roberta Jones, Manager, Environmental and Safety Section, Port of San Francisco, personal communication with EIP Associates, August 1997; ENVIRON International Corporation, *Technical Memorandum #2, Development and Screening of Remedial Alternatives for Free Product Area in Region of Former Oil Storage Facilities*, April 1998, Section 2.3.2.

21. ENVIRON International Corporation, *Technical Memorandum #2, Development and Screening of Remedial Alternatives for Free Product Area in Region of Former Oil Storage Facilities*, April 1998, Section 2.3.3.

22. ENVIRON International Corporation, *Technical Memorandum #2, Development and Screening of Remedial Alternatives for Free Product Area in Region of Former Oil Storage Facilities*, April 1998, Attachment C.

23. Loretta K. Barsamian, Executive Officer, and Stephen I. Morse, Chief, Toxics Cleanup Division, San Francisco Bay Regional Water Quality Control Board, "Request for Revised Work Plan and Project Schedule for Environmental Activities in the Vicinity of Pier 64, San Francisco, California," letter to various oil companies, January 9, 1998; Michael Hurd, Senior Geologist, Pacific Environmental Group, Inc., "Response to Comments on Joint Assessment Work Plan," letter to various oil companies, February 5, 1998.

24. 1990 FEIR, Volume Two, p. VI.N.19.*

25. Acumen Industrial Hygiene, Inc., *Asbestos Survey Report,* prepared for Levine-Fricke, May 29, 1992.

26. Law/Crandall, Inc., *Report of Phase II Environmental Site Assessment, Castle Metals, 1900 Third Street, San Francisco, California*, January 20, 1994, p. 12 and Appendix F.

27. 1990 FEIR, Volume Two, pp. VI.N.21-VI.N.26, and Volume Three, Appendix L.*

28. 1990 FEIR, Volume Two, pp. VI.N.5-VI.9, and Volume Three, Table XIV.L.2, p. XIV.L.10.*

29. Environmental Science Associates, *Mission Bay Hazards Mitigation Program, Volume I Final Report,* August 1990, pp. 28-29.*

30. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California,* February 1998.

31. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California,* April 1997.

32. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 2.3.1.

33. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 2.3.1.

34. ENVIRON International Corporation, *Work Plan for Preliminary Survey, Mission Bay North of Channel, San Francisco, California,* October 24, 1996.

35. ENVIRON International Corporation, "Sampling Program for Subsurface Investigation Mission Bay: Area South of Channel, San Francisco, California," letter submitted to Vic Pal and Mark Johnson, California Regional Water Quality Control Board San Francisco Bay Region," April 9, 1997.

36. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 2.3.1.

37. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California*, April 1997, pp. 2-1 to 2-3; see also ENVIRON International Corporation, *Technical Memorandum #3, North of Channel Screening-Level Ecological Risk Evaluation, Mission Bay Project Area*, April 1998, for more information on this topic.

38. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California,* April 1997.

39. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California*, April 1997, p. 4-1.

40. As discussed in Section 2.3.3.3 of *Technical Memorandum #1, Approach to a Plan for Risk Management*, prepared by ENVIRON in April 1998, the detection of acetone (or methylene chloride, another common laboratory chemical) in field and laboratory control samples does not compromise the accuracy or precision of any other analytical result for any other chemical constituent.

41. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 2.3.3.2.

42. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California*, April 1997, p. 3-8.

43. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 2.3.3.4.

44. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California*, April 1997, p. 3-12.

45. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 2.3.3.5.

46. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California*, April 1997, pp. 3-12 to 3.13.

47. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California*, April 1997, p. 3-5; ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 2.3.3.2.

48. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California*, April 1997, p. 3-9.

49. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California*, April 1997, pp. 3-6 to 3-7.

50. ENVIRON International Corporation, *Results of Investigation Mission Bay North of Channel, San Francisco, California*, April 1997, pp. 3-10 to 3-11; ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 2.3.3.4.

51. Loretta K. Barsamian, Executive Officer, and Stephen I. Morse, Chief, Toxics Cleanup Division, California Regional Water Quality Control Board, San Francisco Bay Region, "Mission Bay, North of China Basin Channel, San Francisco," letter to Jim Adams, Catellus Development Corporation, June 8, 1997.

52. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California,* February 1998.

53. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 3-2 to 3-6.

54. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California,* February 1998.

55. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 4-7.

56. As discussed in Section 2.3.3.3 of *Technical Memorandum #1, Approach to a Plan for Risk Management* prepared by ENVIRON in April 1998, the detection of acetone (or methylene chloride, another common laboratory chemical) in field and laboratory control samples does not compromise the accuracy or precision of any other analytical result for any other chemical constituent.

57. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 4-5.

58. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 4-11 to 4-12.

59. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 4-4.

60. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 4-9 to 4-10.

61. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 4-16.

62. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 4-5 and 4-6.

63. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 4-12 to 4-13.

64. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 4-10.

65. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 5-28 to 5-29.

66. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 4-13.

67. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 4-14.

68. Andrew Detsch/Landscape Studies, *Petroleum Facility History, Mission Bay; Site History, Parcel #3940-1*, July 1997.

69. Loretta K. Barsamian, Executive Officer, and Stephen I. Morse, Toxics Cleanup Division, San Francisco Bay Regional Water Quality Control Board, "Mission Bay, South of China Basin Channel, San Francisco, California," letter to Douglas Stimpson, Catellus Development Corporation, August 12, 1997.

70. ENSR Consulting and Engineering, *Esprit de Corp Phase II Site Investigation, 499 Illinois Street*, September 1990.

71. LAW/Crandall, Inc., *Report of Phase II Environmental Site Assessment, Castle Metals, 1900 3rd Street, San Francisco, California*, January 1994. This report summarized the results of the Phase I Environmental Site Assessment prepared in 1993.

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73. LAW Engineering and Environmental Services, Inc., *Report of Phase I Environmental Site Assessment Update, 1900 3rd Street, San Francisco, California*, November 1996, pp. 23 through 25.

74. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 2.3.

75. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 4.1.

76. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 4.2.1.

77. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 4.2.1.3.

78. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 5-17, 5-18; and ENVIRON International Corporation, *Technical Memorandum #3, North of Channel Screening-Level Ecological Risk Evaluation, Mission Bay Project Area*, April 1998, Section 2.

79. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 5-17, 5-18; and ENVIRON International Corporation, *Technical Memorandum #3, North of Channel Screening-Level Ecological Risk Evaluation, Mission Bay Project Area*, April 1998, Section 3.5.

80. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 5-26, 5-27. ENVIRON International Corporation, *Technical Memorandum #3, North of Channel Screening-Level Ecological Risk Evaluation, Mission Bay Project Area*, April 1998, Section 4.1; and ENVIRON International Corporation, *Addendum 2 to the Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, April 1998.

81. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 5-27-5-29; ENVIRON International Corporation, *Technical Memorandum #3, North of Channel Screening-Level Ecological Risk Evaluation, Mission Bay Project Area*, April 1998, Section 4.2.

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83. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 5-30; ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 4.3.

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87. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 5-39, ENVIRON International Corporation, *Technical Memorandum #3, North of Channel Screening-Level Ecological Risk Evaluation, Mission Bay Project Area, April 1998, Section 5.0.*

88. California Health and Safety Code, Section 25300 *et seq*.

89. California Health and Safety Code, Section 25317(a).

90. California Health and Safety Code, Section 25260(e).

91. California Health and Safety Code, Section 25260(g.)

92. California Health and Safety Code, Section 25260-25268.

93. California Health and Safety Code, Section 25264(b).

94. State Water Resources Control Board, Petition No. 01-02-97, Draft Policy for Cleanup of Petroleum Discharges to Soil and Ground Water.

95. The common risk level used is 10 excess cancer cases in one million. This risk level is used in such programs as California's Proposition 65 and the state's Air Toxics "Hot Spots" program.

96. Bay Area Air Quality Management District (BAAQMD), *Bay Area Air Quality Management District CEQA Guidelines: Assessing Air Quality Impacts*, p.13, 1996.

97. BAAQMD, Regulations, Rule 2-1-301, June 7, 1995.

98. BAAQMD, District Staff Risk Management Procedure, May 9, 1991.

99. Resource Conservation and Recovery Act, United States Code, Title 42, Part 6901 *et seq*, Code of Federal Regulations, Title 40, Part 260 and 261. Revised as of July 1, 1996.

100. California Health and Safety Code, Chapter 6.5, California Code of Regulations, Title 22.

101. The Clean Air Act asbestos regulations are found in Code of Federal Regulations, Title 40, Part 61, Subpart M (November 20, 1990); Cal/OSHA asbestos regulations are in California Code of Regulations, Title 8, Part 5208 *et seq.* Revised as of July 1, 1996.

102. Code of Federal Regulations, Title 40, Section 61.150(a). Revised as of July 1, 1996.

103. Federal OSHA lead standards are found in Code of Federal Regulations, Title 29, Section 1926.62. Revised as of July 1, 1996; Cal-OSHA lead standards are in 8 CCR 1532.1.

104. California Code of Regulations, Title 22, Section 66261.24(a)(1).

105. These limits are 5 ppm for liquids, 50 ppm for nonliquids. Code of California Regulations, Title 22, Section 66261.24.

106. Code of Federal Regulations, Title 40, Part 761, Subpart G. Revised as of July 1, 1996.

107. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 7.3.

108. ENVIRON International Corporation, *Technical Memorandum #4, Application of Risk-Based Corrective Action at Mission Bay*, April 1998, Section 3.6.

109. Stephen I. Morse, Regional Water Quality Control Board, letter to Phillip L. Fitzwater, ENVIRON International Corporation, January 16, 1998.

110. 1990 FEIR, Volume Two, pp. VI.N.27-VI.N.28.*

111. As discussed in Section 4.2.2.4 of *Technical Memorandum #1, Approach to a Plan for Risk Management Mission Bay Project Area*, prepared by ENVIRON, ITLs would be developed using conservative reasonable maximum exposure (RME) assumptions recommended by U.S. EPA for estimating the length of time that an individual may be present in the Project Area and may be exposed to chemicals present on the vacant undeveloped parcels. Because the U.S. EPA-recommended RME assumption for the length of time that an individual may be living in the same location is 30 years, this is the assumption that will be used in developing the ITLs for the undeveloped parcels and determining the need for interim risk management measures.

112. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 4.2.2.2; ENVIRON International Coroporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 5-9.

113. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 4.2.2.2.

114. Various DTSC and U.S. EPA guidelines are cited in ENVIRON International Corporation's "*Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*," April 1998, Section 4.

115. See, for example, ENVIRON International Corporation, "*Risk Management Plans, Six Former Underground Storage Tank Sites at the Mission Bay Site*," October 29, 1996.

116. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 6.2.1.

117. Stephen Morse, Chief, Toxics Cleanup Division, San Francisco Bay Regional Water Quality Control Board, Regional Water Quality Control Board (RWQCB), letter to Mr. Phillip Fitzwater, Principal at ENVIRON, Subject: Risk Management Levels for the Mission Bay Development Project, January 16, 1998.

118. ENVIRON used the following document in the preparation of the risk assessment presented in *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, Section 6. Department of Toxic Substances Control. *Supplemental Guidance for Human Health Multimedia Risk Assessments for Hazardous Waste Sites and Permitted Facilities*, Sacramento, California, July 1992.

119. ENVIRON used the following document in the preparation of the risk assessment presented in *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, Section 6. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part A), Interim Final*, EPA/540/1-89/002, Washington, D.C., December 1989.

120. ENVIRON used the following document in the preparation of the risk assessment presented in *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, Section 6: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual. Supplemental Guidance, Standard Default Exposure Factors*, March 25, 1991.

121. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 6.2.1.2.5.

122. Stephen Morse, Chief, Toxics Cleanup Division, San Francisco Bay Regional Water Quality Control Board, Regional Water Quality Control Board, letter to Mr. Phillip Fitzwater, Principal at ENVIRON, Subject: Risk Management Levels for the Mission Bay Development Project, January 16, 1998.

123. Bay Area Air Quality Management District, *Bay Area Air Quality Management District CEQA Guidelines: Assessing the Air Quality Impacts of Projects and Plans*, April 1996.

124. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 6.2.1.2.5.

125. Stephen Morse, Chief, Toxics Cleanup Division, San Francisco Bay Regional Water Quality Control Board, Regional Water Quality Control Board, letter to Mr. Phillip Fitzwater, Principal at ENVIRON, Subject: Risk Management Levels for the Mission Bay Development Project, January 16, 1998.

126. As discussed in Section 6.2.1.2 of *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, ENVIRON used the following document in preparing the risk assessment. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, *Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part A). Interim Final*, EPA/540/1-89/002, Washington, D.C., December 1989.

127. BAAQMD, *Bay Area Air Quality Management District CEQA Guidelines: Assessing the Air Quality Impacts of Projects and Plans*, April 1996.

128. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 6.2.1.2.6.

129. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 4.2.1 and Section 6.2.1.2.6.

130. The calculated value represents the 95% upper confidence limit (UCL) of the arithmetic mean. U.S. EPA recommends use of the 95% UCL of the arithmetic mean for quantifying reasonable maximum exposure.

131. ENVIRON used the following document in the preparation of the risk assessment presented in *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 6.0: Department of Toxic Substances Control, *Supplemental Guidance for Human Health Multimedia Risk Assessments for Hazardous Waste Sites and Permitted Facilities*: Chapter 7: Lead, Sacramento, California, July 1992.

132. ENVIRON used the following document in the preparation of the risk assessment presented in *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 6.0: Department of Toxic Substances Control, *Supplemental Guidance for Human Health Multimedia Risk Assessments for Hazardous Waste Sites and Permitted Facilities*: Chapter 7: Lead, Sacramento, California, July 1992.

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135. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 6.2.1.3.1.

136. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Section 6.2.1.3.2.

137. Barbara J. Cook, Chief, Northern California - Coastal Cleanup Operations Branch California Department of Toxic Substances Control, "Soil Reuse Within the Mission Bay Project," letter to Steve Morse, Chief, San Francisco Bay Regional Water Quality Control Board, December 10, 1997.

138. Steve Morse, Chief, Toxics Cleanup Division, California Regional Water Quality Control Board, San Francisco Region, "ENVIRON's Proposed Soil Reuse, Mission Bay Project Area, San Francisco, California," letter to Jim Adams, Catellus Development Corporation, February 26, 1998.

139. As discussed in Section 6.2.3 of *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, permeability ranges from 10^{-8} to 10^{-9} centimeters per second, which is considered extremely low.

140. San Francisco Public Works Code, Article 4.1, Section 123 (a), (b), (c) and (h), adopted March 17, 1997, and "Requirements for Batch Wastewater Discharges," May 23, 1997.

141. 1990 FEIR, Volume Two, pp. VI.N.33-VI.N.34.*

142. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, April 1998, Appendix D.

143. Steve Seligman, Department of Industrial Relations, Cal-OSHA Consultation Service, personal communication to EIP Associates, January 13, 1997.

144. ENVIRON International Corporation, *Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area*, Appendix C, April 1998, p. C-1.

145. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 4, 1998, p. 5-9. Barbara J. Cook, P.E., Chief, Northern California - Coastal Operations Branch, Department of Toxic Substances Control, California Environmental Protection Agency, letter of June 8, 1998, commenting on the Draft SEIR.

146. Loretta K. Barsamian, Executive Office and Stephen I. Morse, Chief, Toxic Cleanups Division, California Regional Water Quality Control Board, San Francisco Bay Region, "Risk Management Levels for the Mission Bay Project," letter to Philip L. Fitzwater, ENVIRON, January 16, 1998.

147. Proposition 65 requires public notification of the presence of hazardous chemicals and includes as one criterion a cancer risk of 1×10^{-5}. BAAQMD requires health risk assessments using a cancer risk level of 10×10^{-5} and a Hazard Index of 1.

148. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, Chapter 5.

149. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, p. 5-17 and Table 5-7.

150. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, Section 5.1, particularly Section 5.1.7.2.2; and ENVIRON International Corporation, Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area, April 1998, Appendix C.

151. ENVIRON International Corporation, *Site Investigation and Risk Evaluation Report, Mission Bay South of Channel, San Francisco, California*, February 1998, pp. 5-17 to 5-30.

152. BAAQMD, Risk Management Policy, May 9, 1991, p. 3.

153. 1990 FEIR, Volume Two, pp. VI.N.27-VI.N.38, with additional discussion provided in Volume Four, pp. XV.L.10-XV.L.13.*

154. ENVIRON International Corporation, Technical Memorandum #1, Approach to a Plan for Risk Management, Mission Bay Project Area, April 1998, Section 4.2.1.3.

* A copy of this report is on file for public review at the Office of Environmental Review, Planning Department, 1660 Mission Street, San Francisco.

K. HYDROLOGY AND WATER QUALITY

The Hydrology and Water Quality analysis for this SEIR updates the 1990 analysis based on changes to the proposed development and to water quality regulations that have occurred since certification of the 1990 FEIR. The three most important hydrology-related changes between the 1990 project and the project are that: 1) no wetlands are proposed to be constructed as part of this project; 2) a separated sanitary sewer and storm drain system, not a combined sewer system, is proposed for the central portion of Mission Bay and is analyzed in this SEIR; and 3) state and federal stormwater regulations, adopted after certification of the 1990 FEIR contain certain water quality requirements for stormwater discharges from municipalities, industrial businesses, and construction sites. This Hydrology and Water Quality section focuses the analysis on those changes and incorporates and summarizes the findings of the 1990 FEIR wherever applicable. Other aspects of this topic such as tidal flooding were covered completely in the 1990 FEIR and are focused out of this SEIR analysis (see "Water," in Appendix A, Initial Study). The endnotes for this section begin on p. V.K.64.

SETTING

SAN FRANCISCO'S COMBINED SEWER SYSTEM

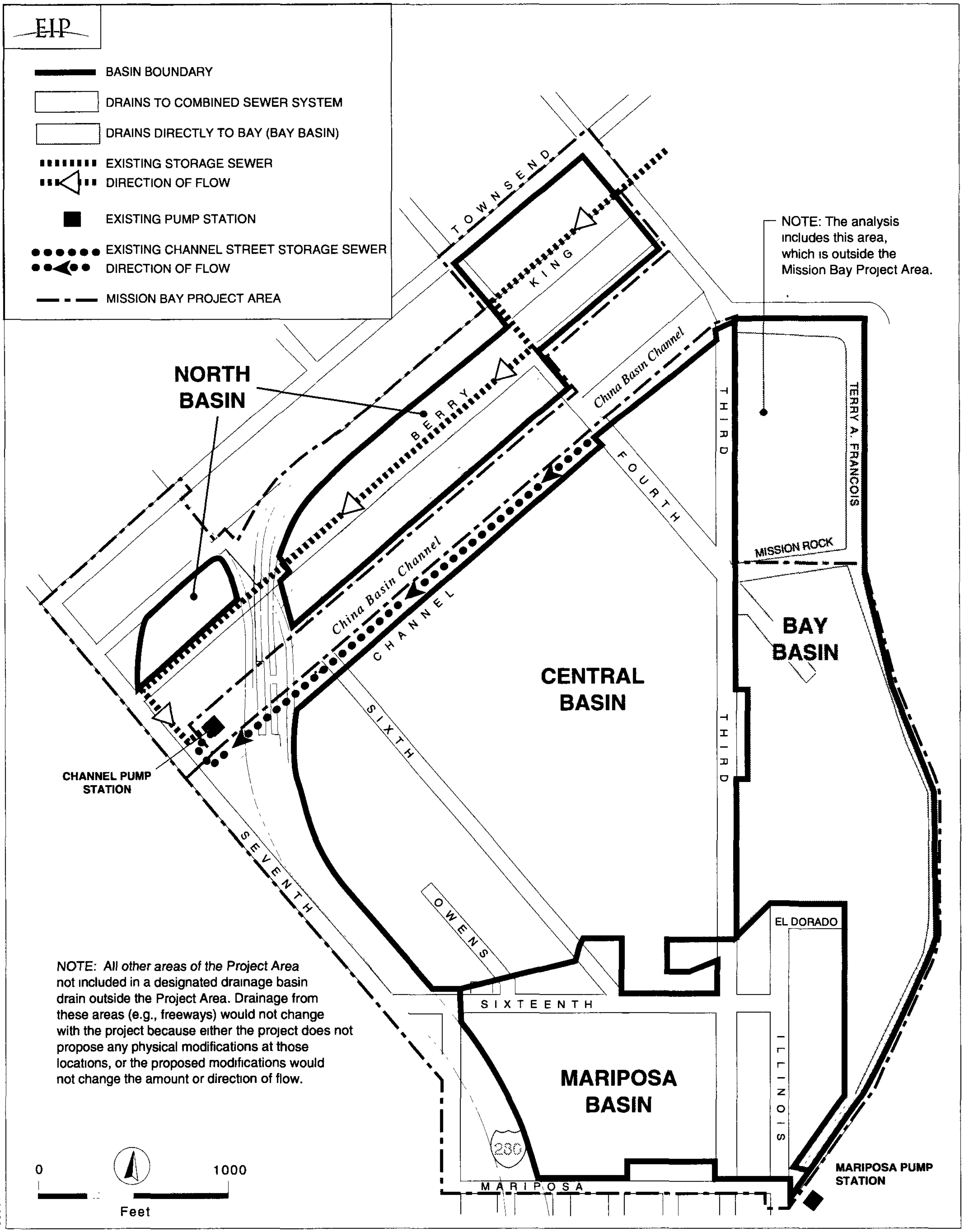
San Francisco operates a combined sewer system that collects sanitary sewage and stormwater (known as "combined sewage") in the same pipes. The topography of the City naturally divides the system into two watershed areas: the Oceanside and the Bayside. Combined sewage produced in the Oceanside watershed is collected and treated at the Oceanside Water Pollution Control Plant, located on the west side of the City near the San Francisco Zoo. Bayside combined sewage is collected and treated at the Southeast Water Pollution Control Plant in the southeast part of the City near Islais Creek, off Third Street at Jerrold Avenue and Phelps Street. Additional Bayside wet-weather facilities include the North Point Water Pollution Control Plant on Bay Street, which provides treatment for the northeast quadrant of the City and operates only during wet weather. The Project Area is in the Bayside drainage basin. Except for areas along the flatter waterfront of the City, including the Project Area, where combined sewage is pumped, the combined sewer system is largely operated by the force of gravity.

Of the approximate 84 million gallons per day (MG/day) of sanitary sewage produced in the City, about 67 MG/day are treated by the Southeast Water Pollution Control Plant and about 17 MG/day are treated by the Oceanside Water Pollution Control Plant. Under wet-weather conditions, the Southeast Plant can treat an additional 83 MG/day of combined sewage to a secondary-treatment level (a minimum of 85% removal of biochemical oxygen demand and total suspended solids) and an additional 100 MG/day at a primary-treatment level (30 to 40% removal of biochemical oxygen demand and total suspended solids), providing a combined 250 MG/day maximum wet-weather treatment capacity. (See Glossary for a definition of primary and secondary treatment, biochemical oxygen demand, and total suspended solids.) The North Point Water Pollution Control Plant is activated when it rains, providing 150 MG/day of primary treatment for the northern Bayside watershed and increasing total wet-weather treatment capacity for the Bayside to 400 MG/day. If treatment plant capacity is reached, excess combined flows are stored in storage/transport facilities for later treatment. The storage/transport facilities have a storage capacity of 125 million gallons. If the rainstorm is a large one, and the capacity of the storage/transport box sewers is exceeded, treated combined sewer overflows (CSOs) occur at outfalls along the City's shoreline. When combined sewage is temporarily stored in transport/storage structures, floating materials are removed from the water surface and some solids settle to the bottom of the structures. The accumulated solids are then flushed to the treatment plant after the storm has subsided. The treatment that occurs within the structures is approximately equivalent to primary treatment. See "Operation of Combined Sewer System," in Appendix J, Hydrology and Water Quality, for information on the operation of the City's combined sewer system.

EXISTING PROJECT AREA DRAINAGE PATTERNS

The drainage characteristics of the Mission Bay Project Area were described in the 1990 FEIR and are summarized as follows. Runoff in the Project Area is generated when rainfall runs off impermeable surfaces such as rooftops and paved areas. Compacted soil on land that has been used for parking, railroad, and industrial uses also is resistant to water penetration and may generate substantial runoff during heavy storms./1/ Because the Project Area is relatively flat, rainfall in very light storms may infiltrate permeable areas or evaporate before reaching the stormwater collection system. Due to the variation in soils found in the Project Area, the amount of infiltration reaching the groundwater table is variable. See "Subsurface Conditions" in Section V.H, Seismicity: Setting, for a description of the soil profile.

For the discussion purposes of this SEIR, the Project Area is divided into four watersheds that are shown in Figure V.K.1 as the North Basin, the Central Basin, the Bay Basin, and the Mariposa Basin. The Central Basin and the North Basin drain to the Channel Outfalls Consolidation Storage/Transports (shown in Figure V.K.1 as "Existing Channel Street Storage Sewer"), which flow to the Channel Pump Station. The Mariposa Basin drains to the Mariposa Transport, which flows to the Mariposa Pump Station. Both pump stations pump to the Southeast Water Pollution Control Plant. The approximate 65-acre Bay Basin currently drains directly to the Bay and not to the combined sewer system. The Bay Basin includes an approximately 20-acre, port-owned area bounded



SOURCE KCA Engineers, Inc

FIGURE V.K.1 EXISTING STORMWATER DRAINAGE BASINS IN THE PROJECT AREA

by Terry A. François Boulevard, Third Street, and Mission Rock Street, which is outside the Project Area (see Figure V.K.1). The portion of the Project Area that is south of the Channel does not receive wastewater or stormwater flow from basins outside the Project Area.

The drainage basin boundaries are not necessarily consistent with the Project Area boundaries. As shown on Figure V.K.1, not all of the Project Area lies within one of the designated drainage basins. Drainage from areas shown outside of a designated drainage basin (e.g., freeways, the thin strips of land along the Channel, and certain street intersections or small sections of parcels) would not change with the project because either the project does not propose any physical modifications at those locations, or the proposed modifications would not change the amount or direction of flow.

WATER POLLUTANTS

The Mission Bay Project Area currently produces three wastewater streams: municipal wastewater (and its effluent), treated CSOs, and urban stormwater runoff. Each wastewater stream contains similar constituents capable of affecting water quality and aquatic life in San Francisco Bay, but in different concentrations.

Municipal wastewater is a relatively strong waste stream containing high concentrations of organic matter that will decompose (measured as biochemical oxygen demand because the decomposition requires oxygen), inorganic particulates (measured as total suspended solids), nutrients (measured as total nitrogen and phosphorus), and pathogenic microorganisms. It also contains oil and grease and small quantities of toxic metals, pesticides, solvents, and plasticizers (additives in plastics that maintain softness and pliability). Conventional secondary treatment, as employed by San Francisco at its Southeast Water Pollution Control Plant, greatly reduces the concentrations of most substances in municipal wastewater. On the other hand, dissolved metals and organic substances that are resistant to breakdown by bacteria, may pass through the plant relatively unaltered. This waste stream, after treatment, is referred to as municipal wastewater effluent in this SEIR.

Urban stormwater is a large-volume wastewater stream. Pollutants contained in urban runoff include street litter, sediment (mostly inorganic particulates, measured as total suspended solids), oil and grease, oxygen-demanding substances, pathogenic microorganisms, toxic metals, and pesticides. The concentrations of oxygen-demanding substances, nutrients, and pathogenic microorganisms are much lower than in untreated municipal wastewater. CSOs exhibit a blend of the untreated characteristics of municipal wastewater and urban stormwater runoff.

Pollutants build up on impervious surfaces during dry periods when there is little or no rain to wash them away./2/ Sources of urban pollutants include vehicles, maintenance and landscaping practices, industrial activities, construction, non-stormwater connections to the drainage system (e.g., cross-connections from sanitary sewers and floor drains from businesses such as auto shops and restaurants), accidental spills, and illegal dumping. Sediment related to automobile use comes from pavement wear, atmospheric deposition, tire wear, and road maintenance. Atmospheric deposition contains sulfur, heavy metals, pesticides, organic compounds, fungi, pollen, and soil. Automobiles contribute other heavy metals such as chromium, copper, lead, zinc, iron, cadmium, nickel, and manganese, which are associated with tire wear, auto body rust, deterioration of chromium-plated surfaces, bearing and bushing wear, brake lining wear, diesel fuel and gasoline exhaust, motor oil, antifreeze, and other vehicle fluids./3/ The following paragraphs describe various water pollutants and their relevance for San Francisco Bay.

Total Suspended Solids

Suspended material is contained in both municipal wastewater effluent and urban stormwater runoff. Discharged suspended material can reduce water clarity in receiving waters. If the discharge occurs in quiescent waters, the material may settle to the bottom and could affect bottom-dwelling aquatic life. San Francisco Bay waters are well-mixed and naturally contain relatively high concentrations of suspended material. Discharges containing suspended material in concentrations typical for municipal, secondary-treated effluent and untreated urban runoff are unlikely to affect water clarity or settle to the bottom in substantial quantities. However, toxic metals, pesticides and other synthetic organic substances often adhere onto the surface of particulates and would enter the Bay waters in that manner. Thus, although suspended material itself is unlikely to be harmful to the aquatic environment, the substances associated with it are potentially harmful.

Oxygen-Demanding Substances

Oxygen-demanding substances include plant debris (leaves and lawn clippings), animal feces, street litter, and organic matter. Such substances depress the dissolved oxygen levels in streams, lakes, and estuaries. Lack of dissolved oxygen can asphyxiate aquatic organisms and shift the chemical reactions of certain compounds to more toxic forms. Hydrogen sulfide (H_2S), for example, forms primarily under anoxic (without oxygen) conditions. Dissolved oxygen levels in open waters of San Francisco Bay are usually close to saturation. Oxygen levels may be depressed in areas with limited water circulation such as the west end of China Basin Channel./4/

Nutrients

Plant nutrients, primarily nitrogen and phosphorus, are contained in both untreated and secondary-treated municipal wastewater and in urban stormwater. The concentration of nitrogen and phosphorus in secondary-treated municipal wastewater is typically many times greater than in stormwater because of the constituents in municipal wastewater and their breakdown products. Elevated nutrient levels in receiving waters can cause excessive growth of algae and other aquatic plants which can, in turn, lead to cycles of dissolved oxygen over-saturation and depletion. The problem is most apparent in poorly mixed or confined water bodies. Central San Francisco Bay does not experience elevated nutrient levels because of tidal-induced mixing and high volumes of tidal exchange.

Pathogenic Microorganisms

Pathogenic microorganisms are disease-causing parasites, bacteria, and viruses. They are usually present in stormwater but at much lower concentrations than in untreated municipal wastewater. The primary sources of pathogenic microorganisms in stormwater routed into a separate storm drainage system are typically the excrement from birds, domestic pets, and infiltration of sanitary sewage. Bacteria have the potential to contribute to exceedences of receiving water standards for contact recreation and shellfish harvesting.

Because there is no easy or inexpensive way to test water for the presence of these pathogenic organisms, a relatively easy test for a group of bacteria, called the total coliform test, is used instead. Coliforms are ubiquitous in soil and water. The test presumes that pathogenic organisms are present in general proportion to the concentration of total coliform organisms. During wet weather, most urban stormwater runoff contains high levels of coliform bacteria, often exceeding 10,000 Most Probable Number per 100 ml (MPN/100 ml) and may reach 1,000,000 MPN/100 ml./5/,/6/

Oil and Grease

"Oil and grease" is a measurement that includes a wide range of hydrocarbons, some of which may be toxic to aquatic organisms at low concentrations. Sources of oil and grease in municipal wastewater include food wastes, laundry waste, and illicit discharges of waste oil and solvents. Most of the oil and grease in municipal wastewater is removed by secondary treatment. Sources of oil and grease in urban stormwater include leakage of fuel and lubricants from vehicles, spillage at fueling stations, stormwater discharges from industrial and commercial activities, and illicit disposal of waste oils and solvents to the storm drain. Storm drain discharges containing oil may create an unsightly sheen on receiving waters, particularly in areas where circulation is limited.

Toxic Substances

Secondary-treated municipal wastewater and urban stormwater both may contain substances at low concentrations that are potentially toxic to aquatic life. They include ammonia, heavy metals, pesticides, and other synthetic organics. Ammonia is found in effluent from conventional secondary-treatment plants and, in its un-ionized form, can be toxic to aquatic life. Only traces of ammonia are typically found in stormwater runoff.

Heavy metals, particularly copper, zinc, and lead, are typically found in higher concentrations in urban stormwater runoff than in secondary-treated municipal wastewater. As discussed in "Impairment of Central San Francisco Bay," below, Central San Francisco Bay is regarded as impaired with respect to copper and mercury concentrations. It is also impaired with respect to diazinon, a pesticide found in low concentrations in urban runoff and treated municipal effluent and PCBs, or polychlorinated biphenyls, which are synthetic chemicals formerly used as coolants, insulating materials, and lubricants in electrical equipment.

Floatables

Floatables include litter, oils, or other large materials that float. They may contain significant amounts of heavy metals, pesticides, bacteria, or other pollutants. Floatables also create aesthetic problems and hazards to wildlife once they are discharged in waterways. Before the City installed baffling in its combined sewer system, floating solids and discoloration of the water surface were noticeable during CSOs and after the overflow events for approximately 12 to 25 hours (i.e., ½ to 1 tidal cycle). On the Bayside, the westerly winds tended to move the floatable material offshore into open waters, except at China Basin Channel, where houseboat dwellers have reported seeing overflow debris in the dock piling areas for a few days following CSOs./7/

POTENTIALLY AFFECTED RECEIVING WATERS

The Mission Bay project could affect water quality in San Francisco Bay, near-shore Bayfront waters, China Basin Channel, and Islais Creek. These receiving waters are discussed below.

San Francisco Bay

The San Francisco Bay is the largest estuary on the western coast of North America. It is used extensively for both recreational and commercial purposes and supports a strong ecological network of flora and fauna. Among the many beneficial uses of the Bay and the Bay-Delta Estuary are fishing and fisheries, non-contact and contact water recreation, transportation, cooling water supply, waste disposal, and aesthetics.

San Francisco Bay is very shallow; most of the Bay is less than 16 feet deep. The deepest parts are in the central Bay (approximately the area of the Bay bounded by the Golden Gate Bridge, a line extending east from Hunters Point to south Alameda, and the Richmond-San Rafael Bridge). The deepest point in the Bay, about 380 feet, occurs under the Golden Gate Bridge.

Water pollutants (measured in mass of pollutant per unit volume of water) enter San Francisco Bay from various sources, including municipal and industrial effluent, urban runoff, non-urban runoff, major tributaries (the Sacramento and San Joaquin rivers), dredging and disposal of dredged material, atmospheric deposition, spills, and marine vessel discharges. Some mixing of these inputs occurs through semi-diurnal (twice daily) tides. During each complete ebb-flood cycle in the Bay, 10 to 30% or more of Bay water is replaced by new ocean water. During dry weather each complete tidal cycle replaces about 24% of the volume of the Bay with new water. During wet weather, freshwater inflow from the Sacramento-San Joaquin Delta can increase the tidal exchange ratio to over 80%./8/ In the central part of the Bay near the Project Area, there is less flushing and mixing in the summer than in the winter.

Impairment of Central San Francisco Bay

The State Water Resources Control Board (SWRCB) has listed central San Francisco Bay as impaired on the basis of field surveys of the water column, sediments, sediment toxicity, bivalve bioaccumulation, and water toxicity./9/,/10/ The determination relates to mercury, copper, selenium, diazinon, and polychlorinated biphenyls (PCBs)./11/

- **Mercury**. The main source of mercury in the Bay is erosion and drainage from abandoned gold and mercury mines. Other sources include natural sources, atmospheric deposition, and various industrial and municipal sources.
- **Copper**. Copper enters the Bay through municipal sources, stormwater runoff (primarily through automobile brake pad dust), and other nonpoint sources (such as soils and abandoned mines). These are the three main sources, and they contribute roughly equivalent amounts.
- **Selenium**. Selenium enters the Bay through industrial point sources (e.g., oil refineries), agriculture, and natural sources. Control programs are in place to address selenium discharges from oil refineries.

- **Diazinon**. Diazinon is a pesticide that enters the Bay as runoff from agriculture and, to a lesser extent, residential land uses. Diazinon is a primary component of insecticides. Homeowner pesticide use peaks in late spring and early summer.
- **PCBs.** Although PCBs are no longer manufactured in the U.S., PCBs previously released to the environment enter the Bay through stormwater runoff and transport through the food chain. PCB levels in fish have resulted in health advisories for fish consumption.

Near-Shore Bayfront Waters

Water Quality and Aquatic Biota

Direct stormwater discharges enter the Bay in the near-shore tidal zone. Materials contained in stormwater discharges disperse throughout the Bay according to patterns of mixing and dispersion dictated by flow volumes, tidal currents, and vertical mixing./12/ Pollutants end up in different places in the Bay system (e.g., shallow water, deep water, sediments) depending upon their association with particulate matter, their solubility, and patterns of sediment resuspension, dispersion, and resettling.

Treated CSOs enter San Francisco Bay at shoreline locations, as well as in waterways and embayments with restricted water flow and mixing, such as China Basin Channel and Islais Creek. CSOs are subject to the same processes of dispersion, partitioning, and mixing as for discharges from stormwater outfalls (although CSOs are partially treated prior to discharge). Through these processes, pollutants from treated CSOs are integrated into the Bay system. The effects of existing stormwater discharges and CSOs are reflected, along with numerous other pollutant sources, in the existing water quality of the Bay.

Studies have evaluated the impacts of treated CSOs from the combined sewer system on aesthetics, water quality, shellfish contamination, fish populations, benthic populations, and the bioaccumulation of potentially toxic materials in San Francisco Bay biota. Studies of dispersion and mixing have shown that treated CSOs are diluted rather rapidly, and that dissolved oxygen concentrations are not affected greatly./13/ Neither the concentrations of pollutants, nor the duration of exposure to pollutants in treated CSOs appear to cause acute toxicity/14/ in the biota of the receiving water bodies./15/ Impacts due to treated CSOs were evaluated with regard to the long-term accumulation of pollutants in the tissues of fishes and invertebrates from the Bay. Where bioaccumulation of pollutants was noted,/16/ the dynamics of the biota considered, and the widespread transport of sediment-associated contaminants in San Francisco Bay, make it impossible to assign a specific source of the contaminants that caused the bioaccumulation.

Short-term effects of treated CSOs do not affect benthic and aquatic populations in the near-shore Bay to any great extent, primarily because the less-dense, freshwater CSOs remain on the surface of the near-shore water bodies, and do not penetrate to the bottom. Particulate material (settleable solids) from treated CSOs may settle to the bottom in areas where there is less water movement. The high organic content of the particulate material from treated CSOs generally leads to dense populations of pollutant-tolerant benthic organisms, relatively limited in species diversity. None of the studies that evaluated the effects of CSOs on benthic organisms found it possible to discriminate the direct effects of the CSOs from the overall, long-term impact of sediment deposition, resuspension, and re-deposition in the San Francisco Bay.

Water-Contact Recreation

Beneficial uses can sometimes be affected by near-shore discharges of treated CSOs./17/ Beneficial uses near the Project Area include navigation, non-contact water recreation, and fishing along the shoreline and in China Basin Channel. Beneficial uses along the San Francisco Bay shoreline, but not proximate to the Project Area, include navigation, non-contact water recreation, and fishing, and also water-contact recreation on the north shore near Crissy Field and Aquatic Park and on the southeast shore at Candlestick Point. While the Project Area shore and China Basin Channel are not necessarily attractive locations for water-contact recreation due to poor access and the generally industrial nature of the area, some water-contact recreation may occur there from time to time, particularly if houseboat residents swim in the Channel. Water-contact recreation is most likely to occur during dry weather; wet-weather conditions are normally less desirable for these activities.

As part of the City's permit requirements for its wet-weather facilities, the City conducts year-round monitoring, three times a week, including standard observations (including presence of foam, floating materials, odors or other evidence of pollutants) and tests for total coliform bacteria. The monitoring stations are located along the north shore near Crissy Field, St. Francis Yacht Club, and Aquatic Park, and along the southeast shore near the Candlestick Point State Recreation Area.

The coliform test data are used as an indicator of bacteriological water quality for public health protection at beaches with water-contact recreation. Upon commencement of a CSO event, the San Francisco Health Department requires that the City immediately post warning signs at the beaches. The signs are removed when the coliform concentrations are measured below the level of concern. The state-recommended water-contact recreation standard for total coliform is less than 1,000 MPN/100 ml./18/

China Basin Channel and Islais Creek

Hydrology

San Francisco Bay is east of the Project Area, and China Basin Channel separates Mission Bay North from Mission Bay South. As described in the 1990 FEIR, Mission Bay was an extensive shallow bay before it was gradually filled beginning in 1865. Fresh water drained into Mission Bay from springs on Rincon Hill and from what was then called Mission Creek./19/ China Basin Channel is the last remnant of Mission Creek and Mission Bay and is now a dead-end inlet of San Francisco Bay, used as a waterway for private and commercial boat traffic. The Channel is about 4,600 feet long and 150 feet wide through most of its length, and about 430 feet wide at its outlet to the San Francisco Bay at China Basin./20/ A marina community consisting of berths for about 20 houseboats and 35 pleasure craft occupies the south side of the Channel, approximately between Fifth Street and Sixth Street. The Channel receives treated CSOs from the City and County of San Francisco's combined sewer system (see "Project Area Wastewater System," under "Sewers and Wastewater Treatment" in Section V.M, Community Services and Utilities: Setting, for additional details on treated CSOs from the combined sewer system).

There is a moderate degree of undercutting and sloughing of the bank. More substantial erosion has occurred on the northern bank west of Fourth Street. Areas along the edges of China Basin Channel with riprap (see Glossary) or rubble are relatively protected from erosion, while other bare mud areas with little or no vegetation are more prone to erosion (see "Vegetation," in Section V.L, China Basin Channel Vegetation and Wildlife: Impacts, for additional detail on existing vegetation conditions along the Channel edges).

Tidal circulation in the Channel was discussed in the 1990 FEIR and is summarized here. The volume of water moving in and out during an average tidal cycle is large compared to the total volume of the Channel, which provides tidal circulation at the west end of the Channel, even though the Channel is more shallow at its inland terminus. As identified in the 1990 FEIR, another factor promoting water circulation in the Channel is that the Channel joins San Francisco Bay at a location where tidal currents are strong. Tidally-induced circulation is reduced during neap tides (tides of lowest range) when tidal flushing is weakest. Conversely, tidal flushing is most effective during the spring tide period (tides of highest range)./21/

Islais Creek is south of the Project Area between the Army Street Pier and Pier 90, on an east-west axis. The creek is about 5,000 feet long, and its width varies from 325 feet at the western end to about 650 feet at the mouth on the eastern end. Depth within the creek is about 25 feet from the head to the mouth. The total volume of Islais Creek at mean lower low water is about 55.5 million cubic feet. The sides of the creek are steep, and the upstream portion of the creek west of the bridge at Third Street is surrounded by heavy industry.

Islais Creek is a tidal inlet with a constriction at Third Street that confines circulation and makes the western end resemble a tidal lagoon. Circulation within the creek during dry weather occurs primarily through the action of tides and can also occur during high winds. The physical structure of the creek contributes to strong distinctions between saline and freshwater layers and weak mixing during periods of no freshwater input. Historically, Islais Creek was a seasonal stream. Today, the only substantial freshwater input to the creek is from treated CSOs, with minimal direct stormwater runoff into the creek during wet weather. When treated CSOs occur, there is minimal vertical mixing and dilution of the freshwater input with more saline Bay waters.

Water Quality

Water quality data from China Basin Channel and Islais Creek are limited. No significant new data have been collected since the 1990 FEIR. No comprehensive water quality data have been collected for China Basin Channel since the 1979 Bayside Overflow study, and the most recent data available for Islais Creek are from studies conducted by the City and County of San Francisco in 1985.

The *Bayside Overflow* study found low dissolved oxygen in China Basin Channel in the upper end of the Channel, with pH ranging from 7 to 8. Total coliform counts in China Basin Channel ranged from 200 to 500 MPN/100 ml. The *Bayside Overflow* study found that the depressed dissolved oxygen concentrations in China Basin Channel were unlikely to be directly attributable to the treated CSOs that occur there because dissolved oxygen concentrations in the CSO water have been measured at above background concentrations in the receiving water of the China Basin Channel. pH values between 7 and 8 are within the Basin Plan water quality objectives.

The Bay Benthic Report reported means and ranges of water quality characteristics for Islais Creek./22/ The lowest dissolved oxygen values measured in Islais Creek were during April, September, and November 1985, when minimum concentrations were measured at upstream stations below 5.0 μg/l. Mean dissolved oxygen during each sampling period followed expected patterns of temperature; concentrations were 5.8 μg/l in September, the warmest month, and greatest during January and February, the coolest months.

Measured pH in Islais Creek was lowest at upstream stations in March and April, reaching values of 6.4, slightly below Basin Plan water quality objectives. Mean pH values were between 7 and 8 in all sampling periods. Coliform concentrations varied both by sampling period and by station. In February, coliform values ranged from 40 to greater than 24,000 MPN/100 ml. Coliform counts were lowest in Islais Creek during the months with little or no rainfall (maximum values were less than 5,200 MPN/100 ml between May and October), whereas maximum values occurred in January-February, and again in December (maximum values of less than 24,000 MPN/100 ml).

When collection, storage, and treatment facilities reach capacity, treated CSOs occur approximately 10 times per year (long-term annual average) through six outfall structures along the north and south sides of China Basin Channel as well as from the outfall of the Division Street Sewer at the west end of the Channel. CSOs from these outfalls receive essentially the equivalent of primary treatment during wet weather.

When treated CSOs occur during wet weather, chemical concentrations in surface waters at the mouth of China Basin Channel reflect the chemical concentrations in the discharge water, as discussed in the 1990 FEIR./23/ The *Bayside Overflow* study found that concentrations of coliform bacteria and dissolved oxygen generally returned rapidly to background conditions after CSOs occurred.

Turning to Islais Creek, the main sources of freshwater flow to Islais Creek are three CSO structures that discharge into the head of the creek at Third Street, and the Quint Street Outfall, which discharges secondary-treated, wet-weather municipal wastewater effluent from the southern bank of the creek near the bridge at Third Street. CSOs to Islais Creek occur when the treatment, storage, and pumping capacity of the CSO system is exceeded by the combined sewage inflow. The Quint Street Outfall (secondary-treated) discharges only during wet weather when the capacity of the deep-water Pier 80 outfall from the Southeast Plant is exceeded.

The Bureau of Water Pollution Control of the City and County of San Francisco conducted a study in 1985 which included five sampling stations along the entire length of Islais Creek./24/ Dry-weather coliform concentrations in Islais Creek ranged from less than 20 to more than 5,400 MPN/100 ml. During wet weather, coliform concentrations ranged from 40 MPN/100 ml to greater than 24,000 MPN/100 ml. Distributions of coliform in the creek were similar in dry weather and wet weather—greater at upstream stations and less at stations closer to the Bay.

Sediment Quality

The sediment quality of China Basin Channel is degraded, which is likely primarily due to historic industrial discharges from nearby uses, and due to direct discharges of untreated sewage from the late 1800's to the mid-1900's into the western end of the Channel. For many years, there were no controls on the quality of discharges to surface water bodies like the Channel and the Bay. After the Southeast Plant was built in 1951, dry-weather flows from the Project Area received primary treatment and were discharged to the Bay near Pier 80. During wet weather, combined sewage continued to overflow to the Channel with no treatment, until completion of the Channel Outfalls Consolidation storage sewers in the late 1970's. Until the 1970's and early 1980's, completely untreated CSOs occurred at China Basin Channel and at other locations of the San Francisco Bay over 80 times per year./25/ While the San Francisco Clean Water Program has constructed major treatment and storage facilities that have reduced the number of CSOs to 10 or fewer per year, on average, and have improved the quality of those CSOs, the quality of sediment in the bottom of the Channel has been affected by the many earlier years of more numerous, previously untreated CSOs and other discharges.

Like China Basin Channel, the sediment quality of Islais Creek is degraded primarily due to historic discharges from industrial and urban activities, and the historic discharge of untreated sewage to the creek from the late 1800's to the mid-1900's. Present-day discharges contribute to the level of sediment in Islais Creek. Some studies have shown Islais Creek sediment to be highly toxic to aquatic organisms. Recent studies concluded that bioassay test organisms transplanted to Islais Creek were able to survive for as long as 10 days under extreme conditions./26/ The studies concluded that individual stations in the western end of the creek showed reduced survival of aquatic organisms but that there was no overall pattern of toxicity throughout the creek. Although degraded, both China Basin Channel and Islais Creek can support populations of living marine organisms (see "Wildlife," in Section V.L, China Basin Channel Vegetation and Wildlife: Setting)./27/,/28/

The RWQCB recently completed a Bay-wide survey of sediment chemistry and toxicity./29/ The survey included some limited sampling in China Basin Channel in which one sample each was collected at two locations in the Channel. The data suggest that sediment quality at upstream (western) locations may be more degraded than at the mouth of the Channel. This is consistent with information presented in the 1990 FEIR./30/ Because only a single sample was taken, and samples were collected under one condition, the sampling results are not conclusive. Nevertheless, the RWQCB has proposed the Channel for listing as a "candidate" toxic hot spot for clean-up. Islais Creek is also a candidate toxic hot spot./31/ The proposed listing is preliminary and is subject to revision as new information becomes available. "Candidate" toxic hot spots are not considered "known" toxic hot spots until hearings are held by both the RWQCB and the State Water Quality Control Board./31a/ China Basin Channel and Islais Creek would be considered "known" toxic hot spots if and when they are included in a Regional Toxic Hot Spot Cleanup Plan adopted by the RWQCB and approved by the State Water Quality Control Board. Both sites have been proposed for inclusion by the RWQCB./31b/

REGULATORY FRAMEWORK

In the Project Area, water resources policies are administered by several agencies, including the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB); the State Water Resources Control Board (SWRCB), and the U.S. Environmental Protection Agency (U.S. EPA). Development of Mission Bay is subject to the federal Clean Water Act, the California Porter-Cologne Water Quality Control Act (Porter-Cologne Act), applicable Water Code sections (plans and policies adopted by the SWRCB and RWQCB); and permitting and licensing requirements that occur during development review by the City and County of San Francisco.

San Francisco Bay Basin Water Quality Control Plan (Basin Plan)

The RWQCB regulates surface water and groundwater quality in San Francisco Bay through its *San Francisco Bay Basin Water Quality Control Plan* (Basin Plan)./32/ The Basin Plan is the master policy document describing the legal, technical, and programmatic bases of water quality regulation in the San Francisco Bay region. The Basin Plan fulfills the requirements of both the Porter-Cologne Act, which calls for water quality control plans in California, and the federal Clean Water Act. The plan identifies the beneficial water uses of surface waters (e.g., lakes, creeks, San Francisco Bay, etc.) and groundwater, the water quality objectives needed to protect those beneficial uses, and the strategies and schedules for achieving those objectives.

State policy for water quality control in California is directed toward achieving the highest water quality consistent with maximum benefit to the people of the state. Therefore, all water resources must be protected from pollution and nuisance that may occur as a result of waste discharges. Beneficial uses of surface waters, groundwaters, marshes, and mud flats serve as a basis for establishing water quality standards and discharge prohibitions to attain this goal. Beneficial uses that have been identified for San Francisco Bay include:

- Agricultural supply
- Areas of special biological significance
- Cold and warm freshwater habitat
- Ocean, commercial, and sport fishing
- Estuarine habitat
- Freshwater replenishment

- Groundwater recharge
- Industrial service supply
- Marine habitat
- Fish migration
- Municipal and domestic supply
- Navigation
- Industrial process supply
- Preservation of rare and endangered species
- Water-contact and non-water-contact recreation
- Shellfish harvesting
- Fish spawning
- Wildlife habitat

In accordance with the Clean Water Act, the U.S. EPA has promulgated the National Toxics Rule, which establishes water quality criteria for priority pollutants that could interfere with beneficial uses of U.S. waters. A similar rule is being developed specifically for California. Once these criteria are established, they will be incorporated in the Basin Plan.

Section 303(d) of the federal Clean Water Act requires states to list water bodies that are impaired despite existing technology-based controls implemented to achieve and maintain water quality standards. See "Impairment of Central San Francisco Bay," above. States are required to identify pollutants that cause exceedances of water quality standards, determine priorities among water bodies, and design, allocate, and implement water quality-based controls.

The State Water Resources Control Board has designated Central San Francisco Bay as impaired as a result of unacceptable levels of selenium, mercury, copper, diazinon, and PCBs. By specifically recognizing these pollutants, the RWQCB has indicated that a "total maximum daily load" process is technically feasible, and would likely result in different effluent limitations than are currently provided by the Basin Plan. "Total maximum daily load" calculations and regulatory processes are used to allocate among permitted dischargers the maximum load for a pollutant to be tolerated in the Bay. The RWQCB revises permits, as necessary, to ensure that established maximum pollutant loads are not exceeded. Implementing new load and waste load allocations (reflected in changes to permit conditions for San Francisco and other Bay Area dischargers that could be made by the RWQCB) would be expected to result in the attainment of water quality standards. The RWQCB intends to adopt schedules for completing "total maximum daily load" calculations and regulatory processes; however, the time frame for these processes will depend on the availability of funding, the availability of staff, watershed stakeholder group priorities, and further evaluation of the need for and feasibility of these efforts. If the RWQCB initiates a "total maximum daily load" regulatory process resulting in different effluent limitations than are currently provided by the Basin Plan. The City would have to comply with any changes to its permit that might result from RWQCB action.

National Pollutant Discharge Elimination System

The federal Clean Water Act prohibits the discharge of pollutants to navigable waters from a point source/33/ unless authorized by a National Pollutant Discharge Elimination System (NPDES) permit. As an implementation action to achieve water quality standards, NPDES requirements apply to discharges from wastewater treatment facilities and stormwater discharges. The U.S. EPA has delegated implementation of the NPDES to the SWRCB, which, in turn, has delegated implementation to the RWQCB. The RWQCB, therefore, issues and enforces NPDES permits for all dischargers in the San Francisco Bay Area, including the City and County of San Francisco.

Issued by the RWQCB in five-year terms, an NPDES permit contains discharge prohibitions, effluent limitations, and necessary specifications and provisions that ensure proper treatment, storage, and disposal of the waste. The permit often contains a monitoring program that establishes monitoring stations at effluent outfalls and receiving waters. NPDES permits are individually issued for point-source discharges, which usually refers to waste emanating from a single, identifiable location; a non-point source usually refers to waste emanating from diffuse locations. Stormwater is considered to be a non-point source if stormwater is discharged as overland flow, not from an identifiable location such as a pipe.

San Francisco NPDES Permits and Other Regulations

San Francisco discharges combined sewage from the Bay side of the City in accordance with the terms of two NPDES permits. The relatively minor discharges from separate storm drains that occur currently are not the subject of an NPDES permit. In the future, as the national stormwater permitting program expands, San Francisco expects to receive a separate NPDES stormwater discharge permit which would cover discharges from separate storm drains citywide, including any from Mission Bay.

To ensure that it is able to meet its permit conditions, San Francisco regulates the substances that may be discharged into the municipal combined sewer system. Under the terms of the City and County's Industrial Waste Ordinance, some industries and commercial operations must pretreat their waste before discharge to the sewer.

Combined Sewer System Permits

The water quality of the effluent discharged by the Southeast Plant and the North Point Plant on the Bay side of the City is regulated by two individual NPDES permits. Both NPDES permits set forth discharge prohibitions, effluent concentration limitations, receiving water limitations, and related operational requirements. Limitations are based on the operating conditions at the treatment plant; the plans, policies, and water quality objectives and criteria of the Basin Plan (see "San Francisco Bay Basin Water Quality Control Plan [Basin Plan]," under "Regulatory Framework" above; and federal water quality criteria, regulations, and rules, including those that specify how permit limitations are to be derived from the Basin Plan. The permits also specify the maximum flow to be processed at the treatment plant. One NPDES permit regulates all dry-weather and wet-weather discharges from the Southeast Plant, and the second regulates the quality of discharges from Bayside wet-weather facilities, including the North Point Plant./34/,/35/

The wet-weather requirements in the NPDES permit are based on water quality and technology goals, in accordance with the Federal Combined Sewer Overflow Control Policy. Water quality goals are defined in the Federal Clean Water Act, and technology goals are defined in the Nine Minimum Control technologies specified in the Federal Combined Sewer Overflow Control Policy.

Between 1970 and 1980, the City undertook a series of cost-benefit studies of CSO control measures. On the basis of these studies, the RWQCB found that adequate overall protection of beneficial uses, as identified in the Basin Plan, would be achieved if facilities were designed and constructed to meet a long-term average of four CSOs per year on the north shore, approximately from the Golden Gate Bridge to the Ferry Building; a long-term average of 10 CSOs per year on the southeast shore, approximately from the Ferry Building to Islais Creek; and an average of one CSO per year south of Islais Creek./36/

In accordance with these design criteria, the City designed and constructed substantial transport/storage boxes, treatment facilities, and pumping facilities. The transport/storage boxes temporarily store combined flows for gradual release to treatment plants as treatment capacity becomes available. The City has designed and constructed its combined sewer system so that during wet weather at least 85% of the combined flow is treated to the equivalent of primary treatment, which occurs in the box sewers, at the North Point Plant, and at the Southeast Plant. (See also "Operation of Combined Sewer System," in Appendix J, Hydrology and Water Quality.) Because this construction was completed as of March 4, 1997, the City is in compliance with this permit requirement.

The permit states, "these long-term design criteria will not be used to determine compliance or non-compliance with this prohibition."/37/ Instead, the permit provides that post-construction compliance is measured by adherence to operational criteria set forth in the permit. With regard to the long-term average criteria for treated CSOs, the permit provides that:

> The long-term average overflow frequency prescribed in this Order is based on information available at the time of adoption of this Order. If the Board finds that changes in the location, intensity or importance of affected beneficial uses or demonstrated unacceptable adverse impacts as a result of operation of the constructed facilities have occurred they may modify the long-term average overflow frequency. Such action could require the modification of constructed facilities, the modification of the operation of constructed facilities, or the construction of additional facilities./38/

In the event that beneficial uses in the discharge area were to change significantly or significant adverse impacts to Bay water quality were to occur, the RWQCB could choose to reassess these design criteria. The permits may also be modified when they are reviewed for renewal. The Southeast NPDES permit expires October 19, 1999, and the Bayside NPDES permit expires February 15, 2000.

Phase I Stormwater Regulations

With respect to pollutants in stormwater discharges, the Phase I stormwater regulations in the federal Clean Water Act require certain industrial activities, certain construction activities, and two sizes of municipalities—large (population of 250,000 or more) and medium (population 100,000 to 250,000)—to obtain NPDES permit coverage. The City and County of San Francisco does not currently operate under an NPDES Municipal Storm Water Permit because the majority of stormwater runoff in the City drains into the City's combined sewer system where it is treated and discharged in accordance with individual NPDES permits for each City sewage treatment plant (see "Operation of Combined Sewer System" in Appendix J, Hydrology and Water Quality, for additional detail about the sewer system). However, San Francisco's individual NPDES permits for its wastewater treatment plants specify similar requirements for stormwater quality as the municipal stormwater permits held by other stormwater dischargers in the Bay Area.

Most industrial and construction activities in the City are covered under the City's existing NPDES permits. The exceptions primarily include waterfront properties owned by the Port of San Francisco where runoff flows to a separate storm drain system. As appropriate, industrial businesses on these properties have filed Notices of Intent for coverage under the state's General Industrial Activities Storm Water Permit. Stormwater runoff draining directly to the Bay from construction sites of 5 acres or more must be covered under stormwater permits and must be managed by a Storm Water Pollution Prevention Plan (SWPPP). An SWPPP describes site controls for construction sites and industrial facilities that control or minimize pollutants from entering stormwater.

State guidelines for water quality control recommend the use of Best Management Practices to reduce pollutants in stormwater runoff./39/ A Best Management Practice (BMP) is defined as any program, technology, process, siting criteria, operating method, measure, or device that controls, prevents, removes, or reduces pollution. A source control BMP is an operational practice that prevents pollution at its source and typically does not require construction. A treatment control BMP is a method of treatment to remove pollutants from stormwater and typically requires construction and maintenance.

<u>Phase II Stormwater Regulations</u>

The U.S. EPA proposed Phase II stormwater regulations in January 1998 to regulate small municipal separate storm sewer systems/40/ not currently subject to the Phase I regulations, construction activities disturbing 1 to 5 acres of land, and other discharges designated by the local NPDES permitting authority, which, for San Francisco, is the RWQCB./41/ In effect, the proposed regulations would expand existing stormwater programs to these sources of stormwater discharge. The U.S. EPA anticipates these regulations to become final in March 1999. Areas of San Francisco not currently served by the City's combined sewer system, such as the Bay Basin described above, would be subject to these proposed regulations. The City and County of San Francisco is pursuing coverage under a general municipal NPDES permit under Phase I regulations and plans to be in compliance with Phase II regulations when those take effect./42/ The deadline proposed by the U.S. EPA for application under the general NPDES permit is May 2002.

The Phase II regulations would require San Francisco to develop and implement a stormwater management program that would include, at a minimum, control measures to address requirements concerning public education and outreach, public involvement, illicit discharge detection and elimination, construction site runoff control, post-construction stormwater management in new development and redevelopment, and pollution prevention and good housekeeping of municipal operations. The regulations would require that the program be designed to reduce the discharge of pollutants to the maximum extent practicable (MEP) and protect water quality. "MEP" is a technology-based control standard currently used in the existing municipal stormwater program against which permit writers and permittees assess whether or not an adequate level of control has been proposed in the stormwater management program. To meet the MEP requirement, the City's stormwater management program would need to include measurable goals besides these Best Management Practices. The proposed regulations state that implementation of BMPs consistent with the stormwater management program requirements and NPDES permit provisions would constitute compliance with the standard of reducing pollutants to the maximum extent practicable.

San Francisco Water Pollution Prevention Program

The City and County of San Francisco currently has a Water Pollution Prevention Program that encourages industries, commercial businesses, and residents to decrease the amount of pollutants in municipal wastewater and stormwater that enter the City's combined sewer system and are eventually discharged into either the San Francisco Bay or Pacific Ocean. Its activities include performing pollution prevention audits for industrial and commercial facilities and public education. The public education component consists of developing and distributing educational materials and conducting multicultural and multilingual outreach projects. In addition, the Water Pollution Prevention Program initiated a Storm Water Pollution Prevention Pilot Program in the Islais Creek drainage area to evaluate the implementation of storm water pollution prevention strategies. The program will be expanded City-wide on July 1, 1998.

Pretreatment Requirements and Industrial Waste Ordinance

Within the City and County of San Francisco's Industrial Waste Pretreatment Program, which regulates San Francisco industries and commercial businesses that discharge process wastewater into the City's combined sewer system, the City's Water Pollution Prevention Program identifies new and existing sources of toxic pollutants, guides the City's industries and commercial businesses through a mandated waste minimization approach, and implements a comprehensive public education campaign. Pollution prevention strategies focus on reducing the amount of pollutants discharged by industries, businesses, and residents, instead of treating the wastes at the discharge point. If necessary, the City may consider enforcement action for polluters./43/,/44/

Some discharges are allowed as overseen through industrial use discharge permits enforced by the Bureau of Environmental Regulation and Management of the San Francisco Public Utilities Commission. Under the authority of the San Francisco Industrial Waste Ordinance, the City may monitor and inspect industrial dischargers and may require sampling of process wastewater./45/ If necessary, the City may also mandate corrective actions in order to ensure that pollutants discharged into the City's combined sewer system do not exceed limits that might then cause the City to violate its NPDES permit for the Southeast Plant.

IMPACTS

Construction activities and operational activities of the project could potentially affect the quality of San Francisco Bay, including near-shore waters, because of changes in surface water runoff or effluent discharges. This analysis evaluates the potential for the project to substantially degrade water quality. Compliance with NPDES permits is assumed necessary to protect water quality. The analysis examines the project's potential effects as they relate to the three types of discharges: municipal wastewater effluent, treated CSOs, and stormwater. Pollutant loading of San Francisco Bay and near-shore waters are discussed. The potential discharge of construction-related pollutants to surface waters is also evaluated. Other hydrology and water quality issues, such as disposal of dewatered groundwater and tidal flooding, are discussed in "Water," in Appendix A, Initial Study. Groundwater contamination is discussed in Section V.J, Contaminated Soils and Groundwater.

STANDARDS OF SIGNIFICANCE

The proposed project would be considered to have a significant effect on hydrology or water quality if it would result in one or more of the following: substantially degrade water quality; contaminate a public water supply; or cause substantial flooding, erosion, or siltation. Criteria for evaluating surface and ground water quality in the San Francisco Bay area are based on beneficial uses and water quality objectives established by the RWQCB, as authorized under the Porter-Cologne Act.

QUALITY OF MUNICIPAL WASTEWATER FROM THE PROJECT

As proposed under the Redevelopment Plans for Mission Bay North and Mission Bay South, permitted uses in areas to be designated residential, retail, commercial industrial, and UCSF include businesses for dry-cleaning, car rental, restaurants, various neighborhood-serving business and professional services, light manufacturing, laboratories, research facilities, and printing shops (see "Proposed Land Uses," in Chapter III, Project Description, for additional discussion regarding proposed permitted uses). Among others, these commercial and industrial businesses have been identified by the Water Pollution Prevention Program as potential sources of problem pollutants, which include oil and grease, suspended solids, chemical oxygen demand (COD), asbestos, mercury, cadmium, chromium, copper, lead, nickel, silver, zinc, cyanide, and phenols. Thus, businesses that have been identified by the City to be associated with pollutants of concern potentially could locate almost anywhere in the Project Area.

In particular, the potential research and development activities associated with the Commercial Industrial and Commercial Industrial/Retail land use designations, and other research activities associated with UCSF land use designations could involve wet laboratories, which would likely use water in greater quantities than more typical office-based activities. On the other hand, laboratory facilities generally operate with a lower population density; therefore, traditional sewage would be discharged in relatively smaller quantities (or be more dilute).

The discharge of hazardous waste to the City's sewer system is regulated by City ordinance (see "Pretreatment Requirements and Industrial Waste Ordinance," in the Setting subsection). UCSF and Commercial Industrial operations may involve the discharge of some pollutants not typically associated with most other San Francisco discharges, which, if improperly handled, could discharge chemicals, radioactive materials, and biohazardous materials to the Southeast Plant (see Table H.1 in Appendix H, Health and Safety, which illustrates the range and nature of chemicals that could be used in the Project Area). Occasional violations are possible and could go undetected because of inconsequential effects on the operation of the Southeast Plant (in part due to the effect of dilution by the relatively large volume of City wastewater discharged to the plant, and in part due to the effectiveness of the treatment processes at the plant). If discharges are large enough to be detected (for example, if the inflow to the Southeast Plant experiences a sudden increase in concentration of a certain pollutant), the problem must be rapidly identified and isolated so that correction can be prescribed. If a problem occurs and this process is impeded, the NPDES permit for the City could be violated. At this time, no regulatory or legal authority requires that new facilities be equipped with sampling ports necessary for the collection of samples to determine specific sources of industrial and commercial pollutants. Mitigation Measure K.2 in Section VI.K, Mitigation Measures: Hydrology and Water Quality, addresses this impact.

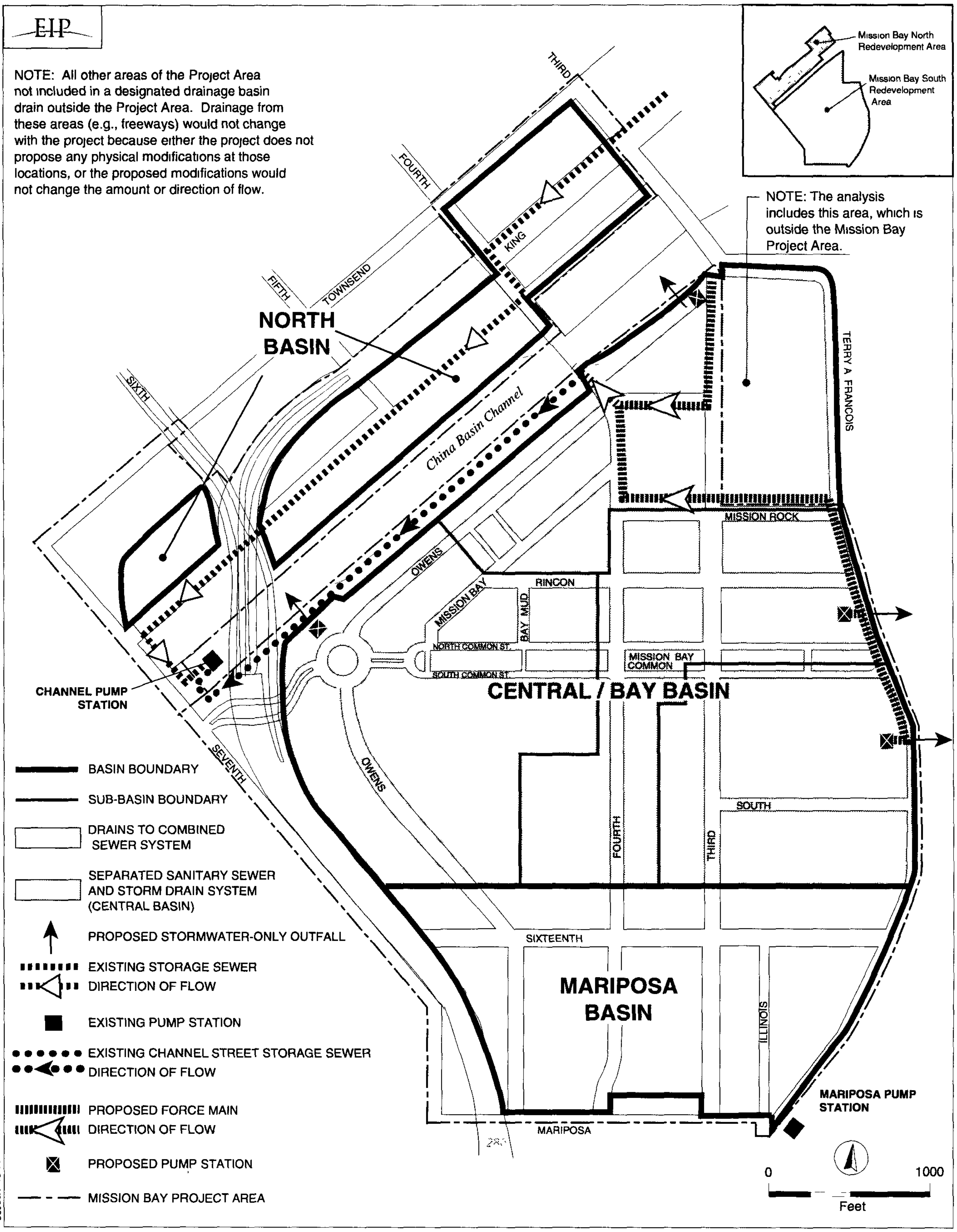
Because businesses in the Project Area would be similar to others existing in the City, and because the City conducts a wastewater pretreatment program to address problem pollutants, the concentrations of pollutants in wastewater from the Project Area are unlikely to differ substantially from other City wastewater. Therefore, the project is not expected to change the concentration of treated municipal wastewater effluent discharged from the Southeast Plant.

PROPOSED DRAINAGE PLAN

As described in detail in "Proposed Drainage Plan," in Section V.M, Community Services and Utilities: Impacts, the proposed development would need a new sewer system for a portion of the Project Area. The North Basin and the Mariposa Basin would be served by the City's existing combined sewer system (see Figure V.M.7 in Section V.M, Community Services and Utilities). For Mission Bay South, because stormwater on the existing Bay Basin would drain into new infrastructure and no longer directly into the Bay, the Central Basin would be enlarged with the addition of the Bay Basin, becoming the Central/Bay Basin. The reconfigured Central/Bay Basin as proposed by the project would be served by a separated sanitary sewer and storm drain system. All sanitary-only sewers in the Central/Bay Basin would connect to the existing combined sewer system for subsequent treatment at the Southeast Plant. All stormwater facilities would be sized to accommodate the City's standard 5-year design storm./46/

The separate storm drainage system in the Central/Bay Basin would include a special feature —diversion of the initial portion of the stormwater flow to the City's combined sewer system for treatment. Most urban areas in the United States built after the 1930's are equipped with separate sanitary and stormwater management systems. Conventional engineering practice is to separately collect sanitary sewage and convey it to a treatment plant. Separately collected stormwater can then be routed to the nearest convenient water body where it is discharged without treatment. These practices were developed to avoid the combined sewage overflow problems that plague older cities. At the time they were developed, urban stormwater runoff was considered an unpolluted waste stream. Now, urban stormwater is recognized as a large-volume, lightly contaminated waste stream requiring treatment before discharge to the environment, if that can be practically accomplished.

Initial flows from the Central/Bay Basin's storm-drain-only system would be conveyed to the City's combined sewer system for treatment and discharge, described below in "Diversion of Initial Flows to Combined Sewer System." Volumes greater than the initial flows up to a five-year storm in the Central/Bay Basin's storm-drain-only system would discharge stormwater directly to the Channel or Bay through four new stormwater outfalls—two outfalls to China Basin Channel and two to San Francisco Bay (see Figure V.M.7 in Section V.M, Community Services and Utilities, and Figure V.K.2 in this section). As is the existing City-wide practice, flows from storms greater than 5-year events would not be accommodated in the system and would pond or flow overland.) Stormwater from the Bay Basin is currently discharged through many drainage pipes located under the piers along the Bay shoreline adjacent to the Project Area.



SOURCE Hawk Engineers

FIGURE V.K.2 PROPOSED STORMWATER DRAINAGE BASINS IN THE PROJECT AREA

The drainage pattern in Mission Bay North would not change, as shown in Figure V.K.1 and Figure V.K.2, because no new major sewer infrastructure would be needed, the amount of impervious surfaces would not change substantially, and the freeway and commuter rail areas would not change with the project. The Mariposa Basin drainage area would increase slightly. Refer to "Sewers and Wastewater Treatment" in Section V.M, Community Services and Utilities, for a detailed description of proposed physical changes and additions to the system.

As shown in Figure V.K.2, the 173-acre Central/Bay Basin contains all of the Mission Bay South area east of I-280 and north of a line 300 feet north of 16th Street, plus an area bounded by Terry A. François Boulevard, Third Street, and Mission Rock Street that is outside the Mission Bay Project Area. This last area is the property of the Port of San Francisco and eventually would be developed in the future according to the Port of San Francisco *Waterfront Land Use Plan*. Interim land uses for the Project Area and for this port land are discussed in "Interim Uses," "Central Subarea," in Section V.B, Land Use, and "Existing and Planned Parks, Recreational Facilities, and Open Space," in Section V.M, Community Services and Utilities. An analysis of the proposed plans to accommodate drainage flows from interim uses is found below in "Proposed Drainage Plans for Interim Giants Ballpark and UCSF Parking."

Diversion of Initial Flows to Combined Sewer System

During rainfall events, rainwater may take several paths when it reaches the earth. As water fills surface depressions, it also seeps into the ground where the ground is permeable—a process known as infiltration. As the rate of rain falling on the ground exceeds the rate of water infiltration, a film of water builds up on the ground surface. Once this film is of sufficient depth, the water flows through topographically-defined flow corridors. This initial discharge of a storm is referred to as the "initial flow." Sometimes the initial flow of each storm contains the highest concentration of pollutants, but this is not always the case because the phenomenon is dependent on the duration of the preceding dry weather period, rainfall patterns, rainfall intensity (how hard and fast it falls), the chemistry of individual pollutants, and site-specific conditions.

The project proposes to divert a substantial amount of flow from each storm to the combined sewer system for treatment before discharge. Proposed pump stations would divert the initial-flow stormwater into the existing combined sewer system until treatment and storage capacity is reached. See "Infrastructure," in Section V.M, Community Services and Utilities: Impacts, for a detailed description of the proposed operation of the initial-flow diversion system.

Most other municipalities in the Bay Area operate separated sanitary sewer and storm drain systems./47/ Except for San Francisco, which captures and treats both sanitary sewage and stormwater, Bay Area wastewater treatment plants generally lack the hydraulic capacity to accept initial storm flows. The concept and the technology to capture and treat initial storm flows are not new, but its implementation at Mission Bay would be one of the first in the San Francisco Bay Area.

Volume Capture of Initial Flow

Treatment control BMPs are commonly designed to control small rainfall events, which generally are storms that occur more frequently than once per year on average, and to control the initial flows of larger rainfall events. Based on guidelines provided in the state's *Municipal Best Management Practice Handbook* and other sources, the initial-flow diversion system would be designed to capture 80% of the average annual runoff volume generated on the Project Area. The system would be designed and constructed to operate at a maximum pumping rate of 90 cubic feet per second, and the new system provided a storage capacity of 750,000 gallons./48/

Based on 70 years of rainfall records/49/, collecting about 1 inch of rainfall from each storm would capture about 80% of the City's average annual rainfall of 21 inches./50/ One inch of rainfall is equivalent to a 3-month storm return frequency for San Francisco./51/ This means that in general, for small storms, all of the resulting stormwater flows would be collected, stored, and pumped to the Channel box sewer for subsequent treatment. Only the early part of storm runoff from larger storms would be pumped to the Channel box sewer, either because the Channel box sewer storage capacity would be reached before the end of the storm or because the rainfall intensity would be such that resulting storm runoff rates would exceed the pumping rate to the Channel box. If the runoff rate in the Central/Bay Basin exceeded the pumping rate to the Channel box sewer before the Channel box was full, pumping and/or gravity flow to China Basin Channel and to the Bay would take place simultaneously. The system would be designed so that skimming and sediment removal would occur prior to discharge to the Channel or Bay. See "Sewers and Wastewater Treatment," in Section V.M, Community Services and Utilities, for a description of the system.

ALTERNATIVE WASTEWATER TREATMENT TECHNOLOGIES

The use of alternative wastewater treatment technologies for reducing wastewater pollutants is an area of interest in the City. Such technologies are alternative to the traditional technology of collection, treatment, and discharge to a water body. In late 1996, the Board of Supervisors adopted a resolution urging the San Francisco Public Utilities Commission (SFPUC) to conduct a feasibility study of "environmentally beneficial alternatives" for wastewater management on a citywide basis./52/ In early 1997, the SFPUC and a Technical Advisory Committee that reflected a wide range of interests prepared a draft report that identified the full range of alternative technologies available./53/ A brief summary of the draft report's findings is provided below. The San Francisco Public Utilities Commission has completed an independent assessment of these and other alternative technologies, and their applicability to Mission Bay. The report found that alternative stormwater treatment technologies potentially appropriate for Mission Bay include vortex gravity separators, sediment/oil trapping, and enhanced sedimentation, but does not make a specific recommendation for use of a specific technology. In addition, Catellus has prepared a feasibility assessment which is provided in "Catellus' Feasibility Assessment of Alternative Wastewater Treatment Technologies for the Mission Bay Project," in Appendix K, Hydrology and Water Quality. Also see Mitigation Measure K.4 in Section VI.K, Mitigation Measures: Hydrology and Water Quality.

Various alternative wastewater treatment technologies can be divided into "Source Control" (those that occur before runoff), "Treatment Optimization" (those that enhance existing treatment processes), and "Post-Secondary Treatment" (those that provide additional effluent treatment). Each is discussed below.

Source Control Technologies

Source control processes comprise methods such as: 1) downspout infiltration and graywater (see Glossary) reuse that segregate and re-use the better quality wastewater, and 2) non-structural BMPs, including public education and outreach, designed to educate the public about the importance of protecting stormwater, and regulating, at the City level, certain businesses likely to contribute pollutants to runoff. Non-structural BMPs are addressed in Mitigation Measure K.5 in Section VI.K, Mitigation Measures: Hydrology and Water Quality.

Other technologies in this group may not be feasible for the Mission Bay project. For example, downspout infiltration into the groundwater table would have limited utility because the existing groundwater table is relatively high (4 to 9 feet below the surface in many areas). However, downspout water could be diverted and stored for later irrigation use. If downspout infiltration was proposed, site-specific investigations would need to be conducted to determine feasibility.

Catellus has considered and rejected the use of graywater systems. Graywater may be reused in California for subsurface landscape irrigation of single-family dwellings./54/ A graywater reuse system must be located at the site on the building or structure that discharges the graywater and cannot be installed in geologically sensitive areas. Catellus has rejected this particular treatment technology because opportunities for onsite landscape irrigation are more feasible and appropriate in lower-density suburban areas, where individual homeowners can assume responsibility for operation and maintenance. Most residents (in condominiums, for example) who would occupy the Project Area would not generate sufficient demand for use of graywater. In addition, graywater systems would not be as effective during wet weather when irrigation demands would be lowest and the need to reduce flows to the combined and proposed separated systems would be highest.

Treatment Optimization Technologies

Secondary treatment modifications, such as adding ammonia removal and increased suspended solids removal, are actions that could be implemented at the Southeast Plant. Each of these treatment methods would have an effect on other parts of the plant and the plant site. The contribution of the project to the treatment plant volumes would be relatively small, and, therefore, the determination to implement one or more of these alternative treatments should be made in light of the other factors constraining treatment plant capacity and operations.

Other secondary treatment modifications, such as use of "living machine" algal ponds or floating aquatic plant ponds would require a relatively large area of land and routine maintenance. Catellus has considered the use of wetlands or ponds for the Central/Bay Basin and has rejected them for the Central/Bay Basin and the entire project due to space requirements. Catellus estimates that a pond treatment system would require surface area of up to 8 acres, including access and buffer zones. For wetlands, Catellus estimates that up to 50% more land surface would be required than for ponds, or about 12 acres. Another reason for Catellus' rejection of the use of wetlands is that wetland vegetation is dormant during the winter rainy months, reducing plant nutrient and metals-removal mechanisms when such mechanisms are needed the most. The 1990 FEIR evaluated a land use alternative that included three wetland areas, although they were not proposed or intended for the purpose of wastewater treatment./55/ No land is identified for wetland development under the current proposal.

Post-Secondary Treatment Technologies

Post-secondary treatment modifications, including additional flocculation and settling, constructed wetlands, advanced oxidation, activated carbon adsorption, membrane filtration, and selective ion exchange technologies (see Glossary), have the potential to improve effluent quality. These processes would most likely be implemented at the treatment plant location rather than at the project level, and are being considered by the SFPUC with regard to the overall needs and requirements of San Francisco's wastewater treatment, as part of the City's *Recycled Water Master Plan*.

Treatment of combined sewage produced at Mission Bay for re-use by Mission Bay as reclaimed water/56/ would require the project to include an on-site reclamation plant, which is not proposed. As discussed in "Reclaimed Water System," in Section V.M, Community Services and Utilities: Impacts, the City is planning a new non-potable water delivery system to which the Project Area could connect once the facilities are completed. The SFPUC is evaluating all options for providing reclaimed water for Mission Bay, including on-site reclamation "package plants" that would provide for on-site recycling ahead of the schedule for City-wide implementation of the recycled water system, as well as the amount of recycled water it could make available to the Project Area. Catellus believes that small-scale recycling facilities are not cost-effective. See "Use of Reclaimed Water," below, for a discussion of the water quality effects of reclaimed water use.

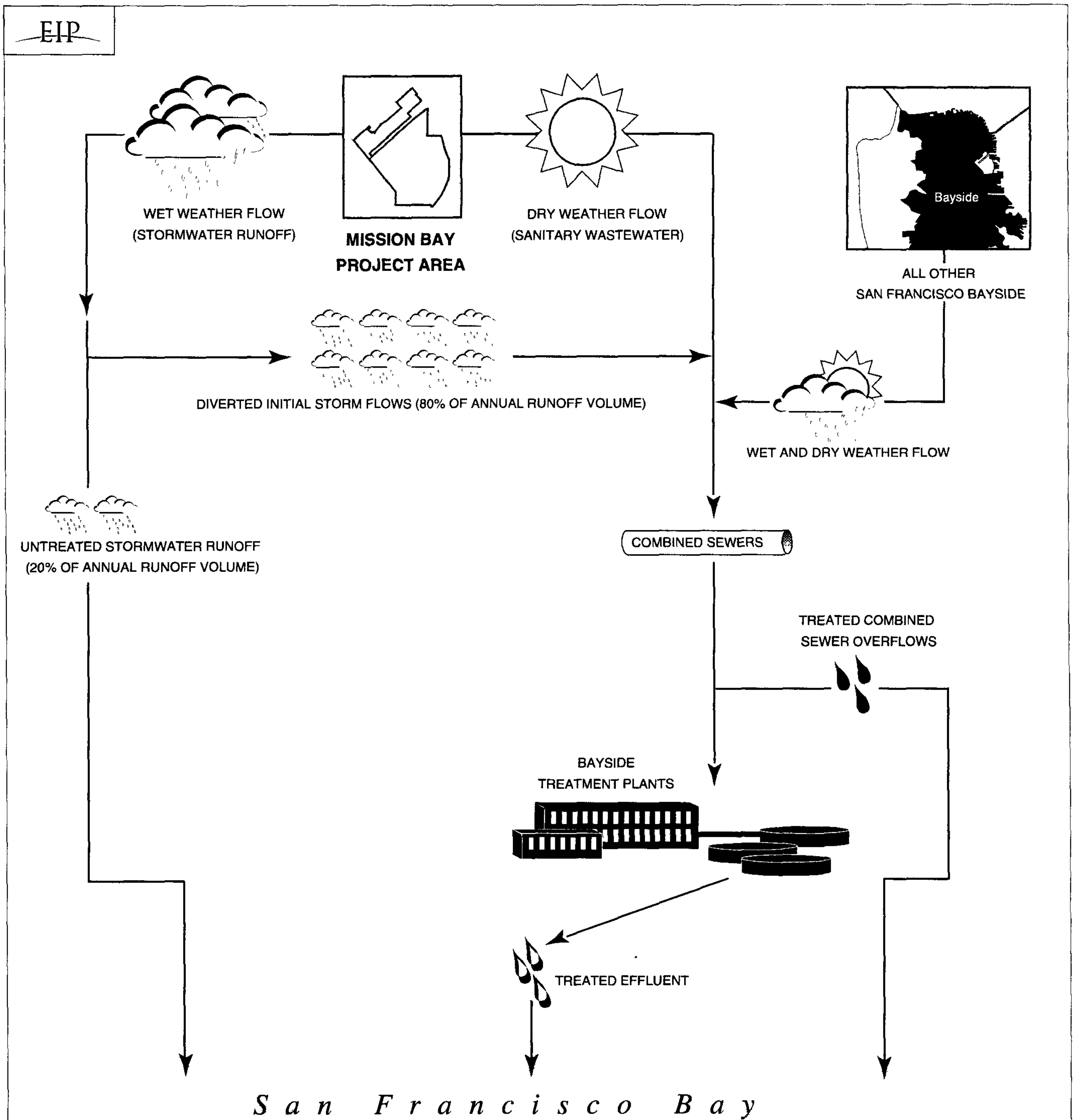
EVALUATION OF POTENTIAL WATER QUALITY IMPACTS

Changes in Discharges to Receiving Waters

The proposed project would contribute pollutant mass emissions to the Bay through the discharge of municipal wastewater effluent from the Southeast Water Pollution Control Plant, the discharge of treated CSOs, and the direct discharge of untreated stormwater to the Channel and Bay. Figures V.K.3 and V.K.4 show schematically the annual flows and selected pollutant loads attributable to the project under the Bayside Base Case plus Mission Bay Project condition and, for comparison, the Bayside Base Case plus Mission Bay 100% Combined Sewer System scenario; these scenarios are described below.

SFPUC staff used its Bayside Planning Model, a computer simulation program, to analyze the effects of Mission Bay and several reasonably foreseeable development projects on the City's Bayside wet-weather control facilities./57/ See "Bayside Planning Model," in Appendix J, for a description of the model. To assess the effects of the project and cumulative development on the City's treatment system, the following four scenarios were analyzed and the results presented and discussed in this SEIR:

- Bayside Base Case: Existing conditions with the inclusion of the new San Francisco Giants Ballpark and related parking, which is under construction, and the City's Sunnydale Flood Control Improvements project./58/
- Bayside Base Case plus Mission Bay Project: Separated sewer system for the Central/Bay Basin capturing 80% of average annual runoff volume by the initial-flow diversion system and discharging 20% to the Bay, combined sewers for the remainder of the Project Area; representing the project as currently proposed by Catellus.



POLLUTANT	BASE CASE	WITH PROJECT AS PROPOSED
Flow (MG/yr)	15 6	15 9
TSS (lb/yr)	8,300	6,600
Cu (lb/yr)	2.8	4 3
Ni (lb/yr)	3 1	4 8

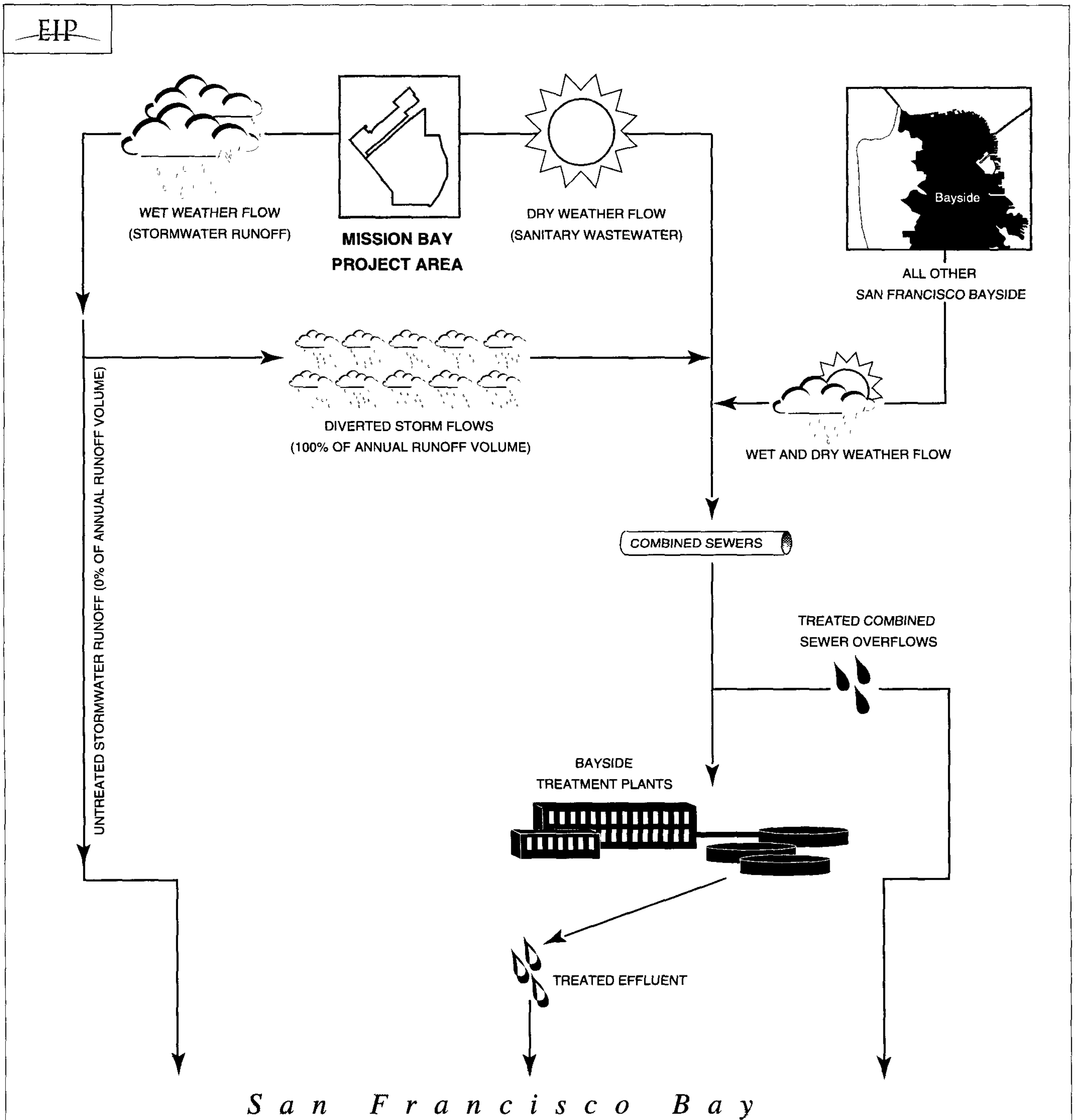
POLLUTANT	BASE CASE	WITH PROJECT AS PROPOSED
Flow (MG/yr)	30,203	31,045
TSS (lb/yr)	4,100,000	4,200,000
Cu (lb/yr)	2,100	2,200
Ni (lb/yr)	1,000	1,000

POLLUTANT	BASE CASE	WITH PROJECT AS PROPOSED
Flow (MG/yr)	910	912
TSS (lb/yr)	680,000	680,000
Cu (lb/yr)	300	300
Ni (lb/yr)	160	160

96555/8-20-98

SOURCE EIP Associates

FIGURE V.K.3 ANNUAL FLOWS AND SELECTED POLLUTANT LOADS ATTRIBUTABLE TO THE BAYSIDE BASE CASE PLUS PROPOSED SEWER SYSTEM FOR THE MISSION BAY PROJECT



POLLUTANT	BASE CASE	WITH 100% COMBINED SEWER SYSTEM
Flow (MG/yr)	15.6	0
TSS (lb/yr)	8,300	0
Cu (lb/yr)	2 8	0
Ni (lb/yr)	3 1	0

POLLUTANT	BASE CASE	WITH 100% COMBINED SEWER SYSTEM
Flow (MG/yr)	30,203	31,045
TSS (lb/yr)	4,100,000	4,200,000
Cu (lb/yr)	2,100	2,200
Ni (lb/yr)	1,000	1,000

POLLUTANT	BASE CASE	WITH 100% COMBINED SEWER SYSTEM
Flow (MG/yr)	910	928
TSS (lb/yr)	680,000	700,000
Cu (lb/yr)	300	300
Ni (lb/yr)	160	160

SOURCE. EIP Associates

FIGURE V.K.4 ANNUAL FLOWS AND SELECTED POLLUTANT LOADS ATTRIBUTABLE TO THE BAYSIDE BASE CASE PLUS 100% COMBINED SEWER SYSTEM SCENARIO FOR THE MISSION BAY PROJECT

- Bayside Base Case plus Mission Bay 100% Combined Sewer System: Combined sewer system for the Central/Bay Basin (100% discharge to the City's combined sewer system with no direct discharge to the Bay), representing a system similar to that previously proposed for the project analyzed in the 1990 FEIR, presented for comparison purposes.

- Cumulative Bayside: Mission Bay project (with separated sewer system) plus the proposed Candlestick Mills Stadium and Mall project, the Hunters Point Naval Shipyard Redevelopment Project, and proposed development of waterfront port properties (comprised primarily of piers). This list represents the major reasonably foreseeable projects in the City that could affect Bayside operations. To conservatively estimate effects on the City's combined sewer system the Bayside cumulative scenario assumes that these projects, except Mission Bay, will maximize flows to the City system.

The Bayside Planning Model includes the assumption that pumping rates at the various pump stations would be varied (within attainable limits) to distribute the inflow to as much of the Bayside system as possible, thus maximizing the use of every element in the system, before treated CSOs would be allowed to occur. Table V.K.1 shows estimated total combined sewage and CSO volumes for the Bayside facilities under the four scenarios. The cumulative impacts of the project, represented by the Cumulative Bayside scenario, are discussed later in this section in "Cumulative Issues."

Volume and Quality of Municipal Wastewater Effluent

Under the Bayside Base Case, about 30,000 MG/yr of municipal wastewater effluent is discharged from Bayside facilities to the Bay (see Table V.K.1). Under the proposed project (Bayside Base Case plus Mission Bay Project scenario), this volume would increase by about 3% to about 31,000 MG/yr largely due to the increase in dry-weather municipal wastewater. Under the Bayside Base Case plus Mission Bay 100% Combined Sewer System scenario, the volume of municipal wastewater effluent discharged to the Bay would also increase by about 3%, also largely due to the increase in dry-weather flow.

The City regularly monitors the quality of municipal wastewater effluent discharged to the Bay from the wastewater treatment plants and submits monthly monitoring reports to the RWQCB./59/ The City reports average monthly and average annual mass loads of various pollutants from its Southeast and North Point water pollution control plants. Southeast Plant data were used to estimate the total pollutant loads discharged in municipal wastewater effluent under various scenarios as shown in Table V.K.2. Municipal wastewater effluent flow volumes were obtained from the results of the Bayside Planning Model. Total pollutant loads were estimated by assuming that the quality of wastewater effluent would remain about the same under the proposed project as under the existing condition. This assumption is reasonable; however, actual pollutant loads could differ to the extent that the eventual mix of land uses in the project and other cumulative future projects differs from the existing San Francisco land use mix.

TABLE V.K.1
CHANGES IN EFFLUENT, OVERFLOW, AND STORMWATER VOLUMES

		Bayside Base Case + Proposed Sewer System for Mission Bay Project		Bayside Base Case + 100% Combined Sewer System for Mission Bay Project		Cumulative Bayside	
	Bayside Base Case	Flow Volume	Change from Existing (%)	Flow Volume	Change from Existing (%)	Flow Volume	Change from Existing (%)
Total Effluent (MG/yr)	30,203	31,045	2.8%	31,045	2.8%	31,496	4.3%
Total Overflows (MG/yr)	910	912	0.22%	928	2.0%	1,008	11%
Total Bayside Flow (MG/yr)/a/	31,113	31,957	2.7%	31,973	2.8%	32,504	4.5%
% of Flow Treated							
Secondary	87.3%	87.5%	—	87.4%	—	86.9%	—
Primary	9.7%	9.7%	—	9.6%	—	10.0%	—
Project Area Stormwater Flow (MG/yr)	15.6	15.9	2.3%	0	-100%	15.9	2.3%

Notes:

MG/yr = million gallons per year

a. Total Bayside Flow is the sum of Total Effluent and Total Overflows

Source: City and County of San Francisco, Public Utilities Commission, Clean Water Program, *Draft Bayside Cumulative Impact Analysis*, March 1998.
EIP Associates.

Each unit volume of discharge contains a certain concentration of pollutants, measured as mass per volume (e.g., milligrams per liter). Assuming the concentration stays the same, the pollutant mass, or load, is assumed to be roughly proportional to the volume of discharge in which it is contained. Therefore, if the volume of discharge changes, the pollutant mass load changes in proportion to the discharge volume. Thus, the pollutant load from effluent would increase by about 3% under the scenarios with a separated sewer system for part of Mission Bay and with a 100% combined system. The cumulative pollutant load from municipal wastewater effluent, due to all major reasonably foreseeable projects affecting Bayside operations, would increase by about 4%. The project and

TABLE V.K.2 ●
ESTIMATED ANNUAL MASS POLLUTANT LOADING TO BAY FROM BAYSIDE EFFLUENT DISCHARGES

	Bayside Base Case /a/	Bayside Base Case + Proposed Sewer System for Mission Bay Project	Bayside Base Case + 100% Combined Sewer System for Mission Bay Project	Cumulative Bayside
Effluent Volume (MG/yr) /b/	30,203	31,045	31,045	31,496
% Change in Volume from Base Case /c/	—	2.8%	2.8%	4.3%
Monitored Pollutant Load (lb/yr)				
Total Suspended Solids	4,100,000	4,200,000	4,200,000	4,300,000
Ammonia, Nitrogen	5,100,000	5,200,000	5,200,000	5,300,000
Oil and Grease	1,300,000	1,300,000	1,300,000	1,300,000
Polynuclear Aromatic Hydrocarbons	36	37	37	38
Arsenic	530	550	550	550
Cadmium	54	55	55	56
Chromium	250	260	260	260
Copper	2,100	2,200	2,200	2,200
Lead	880	910	910	920
Mercury	17	18	18	18
Nickel	1,000	1,000	1,000	1,100
Silver	530	550	550	550
Zinc	13,000	13,000	13,000	14,000
Selenium	180	190	190	190
Cyanide	2,500	2,600	2,600	2,600

Notes:

MG = million gallons
lb = pounds
yr = year

a. Derived from data in City and County of San Francisco, Public Utilities Commission, Bureau of Water Pollution Control - Southeast Plant, Southeast WPCP Monitoring Report December 1997, January 16, 1998. Polynuclear Aromatic Hydrocarbon data derived from City and County of San Francisco, Public Utilities Commission, Bureau of Water Pollution Control - Southeast Plant, Southeast WPCP Monitoring Report December 1996, January 17, 1997.
b. Derived from data in City and County of San Francisco, Public Utilities Commission, Clean Water Program, *Draft Bayside Cumulative Impact Analysis*, March 1998.
c. The percent change in volume is the same as for load. While the percent change reflects the incremental change that would occur in each analysis scenario, there is a level of imprecision associated with the load calculations. Therefore, all load values have been rounded to two significant figures to reflect the statistical uncertainty of the calculations. The significance of each change was evaluated by determining whether the change falls within the range of uncertainty.

Source: EIP Associates.

cumulative increase in treated effluent is expected and provided for, and would be well within the City's treatment plant capacity and NPDES permit limits. As discussed below under "Cumulative Issues," the estimated increase would be insignificant in the context of the entire Bay, would not affect beneficial uses, and is therefore not considered significant.

Volume and Quality of Treated Combined Sewer Overflows

Under the Bayside Base Case, approximately 910 MG/yr is discharged to near-shore waters of the Bay through overflow structures located along the Bay (see Table V.K.3). The City's Bayside Planning Model was used to estimate the increase in treated CSO volumes attributable to the proposed project as discussed above and the Mission Bay 100% Combined Sewer System scenario. Under the proposed project, treated CSO volumes would increase by about 0.2%, to about 912 MG/yr. Under the 100% combined sewer scenario, the overflow volume would increase by about 2% to about 928 MG/yr. In the cumulative scenario, the overflow volume would increase by about 11% to 1,008 MG/yr.

Based on existing treated CSO characteristics,/60/ annual pollutant loads were estimated for existing conditions, proposed project conditions, conditions with the 100% combined sewer scenario, and cumulative conditions as shown in Table V.K.3. The pollutants shown in Table V.K.3 are those the City's NPDES permit requires to be monitored. An average concentration was estimated for each pollutant based on the three most recent years of treated CSO monitoring data (October 1994 to June 1997). The calculations assumed that the quality of combined sewage (i.e., pollutant concentration) would remain the same under all conditions. Therefore, the annual pollutant loads under the proposed project, and the 100% Combined Sewer scenario, would increase in rough proportion to the estimated increases in CSO volumes. The calculated increase is about 0.2% for the proposed project and about 2% for the 100% Combined Sewer System scenario.

Increases in CSO volumes would not constitute a violation of the City's NPDES permit. The project-related increase in pollutant loading (0.2%) is not significant because it represents such a small portion of total Bayside discharges. An increase of 0.2% would not represent a permit violation, result in a violation of water quality objectives, substantially degrade water quality, or substantially affect aquatic organisms. Cumulatively, the load from overflows would increase by about 11%. This estimated cumulative increase is discussed further below in "Cumulative Issues."

TABLE V.K.3 ●
ESTIMATED ANNUAL MASS POLLUTANT LOADING TO BAY FROM BAYSIDE TREATED OVERFLOWS

	Base Case Bayside/a/	Bayside Base Case + Proposed Sewer System for Mission Bay Project	Bayside Base Case + 100% Combined Sewer System for Mission Bay Project	Cumulative Bayside
Overflow Volume (MG/yr) /b/	910	912	928	1,008
% Change in Volume from Base Case /c/	—	0.22%	2.0%	11%
Monitored Pollutant Load (lb/yr)				
Total Suspended Solids	680,000	680,000	700,000	750,000
Ammonia, Nitrogen	9,600	9,600	9,800	11,000
Oil and Grease	61,000	61,000	63,000	68,000
Polynuclear Aromatic Hydrocarbons	4.1	4.1	4.2	4.6
Arsenic	60	60	61	66
Cadmium	17	17	17	19
Total Chromium	91	92	93	100
Copper	300	300	300	330
Lead	470	470	480	520
Mercury	2.9	2.9	2.9	3.2
Nickel	160	160	160	180
Silver	37	37	38	41
Zinc	2,400	2,400	2,500	2,700
Selenium	6.5	6.5	6.6	7.2
Cyanide	38	38	39	42

Notes:

MG = million gallons lb = pound yr = year

a. Derived from the following data sources provided by Jim Salerno, Laboratory Supervisor, Southeast Water Pollution Control Plant, September 5, 1997:
City and County of San Francisco, Department of Public Works, Bureau of Water Pollution Control, Bayside Wet Weather Overflow Monitoring Program Data Summary, October 1994 - June 1995.
City and County of San Francisco, Department of Public Works, Bureau of Water Pollution Control, Bayside Wet Weather Overflow Monitoring Program Data Summary, October 1995 - June 1996.
City and County of San Francisco, Department of Public Works, Bureau of Water Pollution Control, Bayside Wet Weather Overflow Monitoring Program Data Summary, October 1996 - June 1997.

b. City and County of San Francisco, Public Utilities Commission, Clean Water Program, *Draft Bayside Cumulative Impact Analysis*, March 1998.

c. The percent change in load is the same as the percent change in volume. While the percent change reflects the incremental change that would occur in each analysis scenario, there is a level of imprecision associated with the load calculations. Therefore, all load values have been rounded to two significant figures to reflect the statistical uncertainty of the calculations. The significance of each change was evaluated by determining whether the change falls within the range of uncertainty.

Source: EIP Associates.

Volume and Quality of Direct Stormwater Discharge to Bay

A few areas of San Francisco currently drain to separate storm sewers or directly to the Bay or Pacific Ocean. Most stormwater in the City is routed to the combined sewer system. As a consequence, the pollutant load discharged to surface waters via stormwater from San Francisco is small relative to the load contained in the City's other waste streams.

Under Bayside Base Case conditions at the Project Area, stormwater is discharged to the combined sewer with the exception of stormwater from the Bay Basin which drains directly to the Bay. The Bayside Base Case assumes development of the approved Giants parking lots in the Project Area, and assumes that drainage from the port-owned property outside the Project Area for up to a five-year storm would initially be routed to existing combined sewer lines along Third Street. Rainwater falling on this area either evaporates, percolates into the ground, or drains to the Bay. Based on an annual rainfall of 21 inches and a runoff coefficient of 0.62, the estimated total annual volume of stormwater runoff currently discharged to the Bay is about 15.6 MG/yr from the Bay Basin (see Table V.K.4)./61/

Under the proposed project, a larger area of the Central/Bay Basin would drain to near-shore waters, but only during large storms. The 173-acre Central/Bay Basin would drain to a separate storm drainage system discharging to the Bay during the latter portion of large storms. However, in smaller storms, runoff from the separate storm drainage system would be diverted to the combined sewer system. During larger storms, diversion of stormwater to the combined sewer system would stop after the Channel Street box sewer has reached its storage capacity, and all runoff would flow directly to the Bay through the four outfalls shown on Figure V.K.2. The diversion system would route about 80% of the total average annual runoff volume from the Project Area to the combined sewer system, with the remainder flowing to the Bay.

Under the project, the volume of stormwater discharged to near-shore waters of the Bay would increase slightly from 15.6 MG/yr to 15.9 MG/yr, an increase of about 2%. Under the Bayside Base Case plus Mission Bay 100% Combined Sewer System scenario, stormwater from the Project Area would be routed to the combined sewer system for treatment. No stormwater (and no stormwater pollutants) would be discharged directly to near-shore waters of the Bay, except overland flow which may occur in a greater than five-year storm.

No direct measurements of runoff quality from the Project Area or elsewhere in San Francisco are available. However, the concentrations of some pollutants in stormwater can be estimated using data from other Bay Area communities. Pollutant concentrations in urban runoff from different land use

TABLE V.K.4 ●
ESTIMATED ANNUAL POLLUTANT LOADING FROM DIRECT STORMWATER DISCHARGE TO THE BAY FROM PROJECT AREA

	Bayside Base Case /a/	Bayside Base Case + Proposed Sewer System for Mission Bay Project/b/
Stormwater Volume to Bay from Bay Basin of Mission Bay (MG/yr) /c/	15.6	15.9
Pollutant Load (lb/yr) /d/		
Total Suspended Solids	8,300	6,600
Cadmium	0.18	0.21
Total Chromium	1.5	2.2
Copper	2.8	4.3
Lead	6.6	10
Nickel	3.1	4.8
Zinc	24	27

Notes:

MG= million gallons lb = pound ac = acre
in = inch yr = year

a. The percent change in load is the same as the percentage change in volume. While the percent change reflects the incremental change that would occur in each analysis scenario, there is a level of imprecision associated with the load calculations. Therefore, all load values have been rounded to two significant figures to reflect the statistical uncertainty of the calculations. The significance of each change was evaluated by determining whether the change falls within the range of uncertainty.
b. The Cumulative Bayside scenario did not model direct stormwater discharges other than from the Project Area. The Mission Bay project would be the same under cumulative conditions as proposed. Thus, pollutant loads under the Cumulative Bayside condition would be the same as under the proposed project condition.
c. Based on drainage basin area and runoff coefficient data provided by KCA Engineers, Inc. and Hawk Engineers.
d. Derived from unit load data found in Bay Area Stormwater Management Agencies Association, *San Francisco Bay Area Stormwater Runoff, Pollutant Monitoring Data Analysis, 1988 - 1995, Final Report*, prepared by Woodward-Clyde Consultants, October 15, 1996, Table 5-2.

Source: EIP Associates.

types have been measured in several Bay Area locations during the last five to seven years. These data have been compiled and analyzed by the Bay Area Stormwater Management Agencies Association (BASMAA), which has estimated typical pollutant loadings for different land uses. Stormwater quality is influenced by the type of land use. For example, metals levels in stormwater runoff from industrial land uses and highways may be higher compared to residential acres. Data reflect stormwater concentrations prior to any treatment. Actual pollutant concentrations in Mission Bay stormwater may vary somewhat, but these are the best available data and are considered reasonable.

The available BASMAA data allowed the analysis of seven pollutants—cadmium, chromium, copper, lead, nickel, zinc, and total suspended solids (TSS). Table V.K.4 shows the pollutant loads in stormwater discharged from the Project Area directly to the near-shore waters of the Bay. As shown, mass loading to the Bay from the Project Area would increase for six of the pollutants and decrease for total suspended solids. The amounts are very small relative to those from municipal wastewater effluent and treated CSOs.

The degree of pollutant build-up on urban surfaces before a storm influences the amount of pollutants that might be transported by stormwater. For example, if a series of storms occurs, stormwater runoff from the storms in the beginning of the series would be expected to contain higher pollutant loads than the runoff at the end of the series. For the purposes of this analysis, an even distribution of pollutant concentration is assumed throughout the duration of each storm. As discussed in "Diversion of Initial Flows to Combined Sewer System" above, the pollutant concentrations in runoff generated by the initial flows of a storm could be higher in some cases than in runoff generated later in the storm, when the ground surface could be cleaner. This analysis conservatively assumes that runoff quality would remain the same throughout a storm. To the extent that initial storm flows may contain higher concentrations of pollutants than later flows, more of those pollutants would be captured by the combined sewer system, and the pollutant loads in stormwater discharged directly to the Bay would be less than those shown in Table V.K.4.

Effects on Receiving Waters

Potentially-affected receiving waters include the deep waters of central San Francisco Bay in the vicinity of the outfall from the Southeast Water Pollution Control Plant and near-shore waters of the Bay along the Bayside shoreline. Deep waters of the Bay could be affected by the discharge of municipal wastewater effluent from Southeast Water Pollution Control Plant that is attributable to Mission Bay. Near-shore water quality could be affected by increased volume of treated CSOs and new separate stormwater discharges from Mission Bay. Near-shore waters also include China Basin Channel and Islais Creek. The impact analysis below discusses potential effects on deep Bay waters, followed by a discussion of effects on near-shore waters, including China Basin Channel and Islais Creek.

The critical consideration regarding biological impacts due to pollutant discharge to an aquatic system rests not in the mass load, but in the extent to which discharges to the system serve to increase contaminant concentrations. A toxicological effect is inferred if contaminant concentrations increase to the extent that the survival, growth, and/or reproduction of sensitive species in the habitat are threatened, or if contaminant concentrations increase to the point that the allowable margin of error for estimates of the effects of the contaminants is exceeded.

Deep Water Effects of Increased Treated Effluent

Monitoring reports demonstrate that San Francisco complies with the pollutant concentration limits in its NPDES permit and with permitted loads specified./62/ The City also operates its wastewater treatment facilities within their permitted capacities. The City's NPDES permit specifies a maximum, allowable, dry-weather flow through the Southeast Plant of 85.4 MG/day./63/ The project would cause a 3% increase in effluent flow (as would the 100% Combined Sewer scenario). This increase in volume, added to the current dry-weather flow of 74 MG/day, would result in a total dry-weather flow to the Southeast Plant of 76.2 MG/day, which would be well within the allowed flow of 85.4 MG/day. Thus, compliance with the existing permit would continue with the project.

As discussed above, the proposed project would cause a slight increase in the total municipal wastewater effluent discharged from the Southeast Plant. Because of the increased flow, the project would also cause a 2% to 3% increase in the pollutant loading to San Francisco Bay. The waste stream from the Project Area is not expected to differ in any substantial way from the current waste stream flowing to the Southeast Plant.

The estimated contaminant concentrations are compared to water quality screening values to determine whether the concentrations in the current waste stream have any toxicological effects on aquatic or benthic organisms, and thus to provide a framework for consideration of whether a 2% to 3% increase in the volume of this waste stream would have any such effects. The water quality screening values are either the Water Quality Objectives (WQOs) adopted by the RWQCB, or where WQOs from the RWQCB are unavailable, U.S. EPA National Ambient Water Quality Criteria for the protection of salt-water aquatic life are used. WQOs are the "target" Bay-wide, open-water concentrations that the RWQCB has determined are suitable for maintaining beneficial uses./64/ WQOs are not used as discharge criteria. Near-shore stormwater discharges relate to WQOs in the sense that existing ambient pollutant concentrations in open-Bay waters are the result of long-term integration by the Bay ecosystem of natural inputs, industrial, domestic and urban discharges, atmospheric deposition, stormwater discharges, and a variety of other inputs. Therefore, this direct comparison of municipal wastewater effluent to WQOs is extremely conservative.

Studies show that the actual dilution achieved by the outfall's diffuser unit ranges from factors of 19 to 34 during slack water./65/ Dilution under prevailing currents are several times greater than at slack tide conditions. For analysis purposes, a conservative dilution factor of 20 was used. Table V.K.5 shows the estimated contaminant concentrations in the Southeast Plant effluent after initial dilution (20:1) with ambient Bay water at the diffuser outfall in San Francisco Bay. The calculated dilution assumes that 19 units of ambient Bay water are mixed with one unit of municipal wastewater effluent from the diffuser. (Because ambient Bay water may contain measurable quantities of the pollutant in question, the calculated diluted concentration is not a simple division by 20.) Table V.K.5 also presents recent data on ambient concentrations of metals in Bay water from the ongoing Regional Monitoring Program, and metals concentrations for use in screening the quality of the diluted effluent water.

As shown in Table V.K.5, the estimated contaminant concentrations in the current waste stream are far less than the acute water quality screening values. The addition of increased pollutant loads under project conditions does not result in a substantial change in ambient metals concentrations in San Francisco Bay in the vicinity of the treated effluent discharge. Therefore, the addition of increased loads of metals to the Bay in the treated municipal wastewater effluent from the Southeast Plant would not cause a substantial degradation of Bay water quality from the toxicological perspective. It should be noted that water quality screening values derived from the Basin Plan for copper and selenium may change; RWQCB staff are in the process of re-evaluating these metals relative to publication of Basin Plan WQO concentrations. San Francisco Public Utilities Commission staff do not expect the proposed changes to the copper and selenium objectives to cause compliance problems for the City./66/

Near-Shore Effects

The potential impacts of shoreline discharges of stormwater and treated CSOs on water quality in San Francisco Bay are estimated by evaluating the potential impacts of near-shore discharges on the biota of the Bay in the immediate vicinity of the discharges. Near-shore discharges are not subject to the same diffusive mixing as the deepwater Southeast Plant outfall. Concentrations of toxic pollutants near and in the tidal zone of the Bay may be substantially higher than concentrations occurring in the open Bay, adjacent to the diffuser outfall, and therefore exposure of biota could be greater near-shore than in the open Bay. In order to conservatively evaluate such conditions, concentrations were estimated "at the end of the pipe," assuming no dilution. In order to evaluate the project's contribution to CSOs and stormwater discharge, this section discusses the existing effects of CSOs and stormwater discharges to near-shore waters. The increase to CSOs and stormwater discharges contributed by the project is then discussed in this context.

TABLE V.K.5 ●
COMPARISON OF POLLUTANT CONCENTRATIONS IN EFFLUENT WITH AMBIENT BAY WATER QUALITY

Pollutant	Effluent Concentration (μg/l)/a/	Diluted Effluent (μg/l)/b/	Ambient Bay Concentration (μg/l)/c/	Acute Water Quality Screening Values (μg/l)
Arsenic	2.1	2.33	2.34	69 /d/
Cadmium	0.21	0.105	0.10	43 /d/
Chromium	1.0	0.81	0.80	1,100 /d/
Copper	8.3	2.6	2.29	4.9 /d/
Lead	3.6	0.48	0.32	140 /d/
Mercury	0.07	0.008	0.005	2.1 /d/
Nickel	4.0	2.82	2.76	74 /e/
Silver	2.1	0.11	0.006	2.3 /d/
Zinc	53	4.4	1.98	90 /e/
Selenium	0.72	0.22	0.19	290 /e/

Notes:

a. City and County of San Francisco, Public Utilities Commission, Bureau of Water Pollution Control - Southeast Plant, Southeast WPCP Monitoring Report December 1997, January 16, 1998.
b. These values assume a 20:1 dilution, or 19 parts of ambient Bay water to 1 part of effluent.
c. San Francisco Estuary Institute, *1995 Annual Report: San Francisco Estuary Regional Monitoring Program for Trace Substances*, 1996.
d. California Regional Water Quality Control Board, San Francisco Bay Region. *Water Quality Control Plan* (Basin Plan), June 27, 1995, Water Quality Objectives for Toxic Pollutants, for surface waters with salinities greater than 5 parts per thousand p. 3-9, Table 3-3; 1-hour average concentrations.
e. Corresponds to the U.S. EPA Acute Ambient Water Quality Criteria for the protection of saltwater life (40 CFR, Section 131.36).

Source: Dr. Joseph M. O'Connor.

Effects of Treated Combined Sewer Overflows

Treated CSOs from Bayside facilities currently occur in the near-shore environment at 29 overflow locations, including 7 overflow outfalls in China Basin Channel and 4 in Islais Creek. The proposed project would increase the volume of treated CSOs. The project would also contribute to increased flow of secondary-treated wet-weather effluent from the Southeast Plant into Islais Creek during very large storms when the combined sewage inflow into the combined sewer system exceeds the 100 MG/day discharge capacity of the deepwater outfall. The quality of secondary-treated wet-weather effluent to Islais Creek is similar to the quality of secondary-treated dry-weather effluent that is discharged from the Pier 80 deepwater outfall (see Table V.K.5). Generally, pollutant concentrations in secondary-treated effluent are lower than in treated CSOs. For the purposes of analyzing the impacts of discharges to the near-shore environment, it is conservatively assumed that the secondary-treated, wet-weather effluent discharge to Islais Creek carries contaminants at the same concentrations as other treated CSOs.

The prediction of dilution factors for pollutants in stormwater runoff and CSOs to the Bay is difficult, at best. Dye studies have been carried out to determine the dilution of CSOs from numerous sites along the San Francisco shoreline./66a/ Dilution measured from dye studies ranged from 1:1 to more than 300:1, and were affected by the physical location of the overflow, duration of the overflow, volume of the overflow, stage of the tide, direction and velocity of tidal currents, wind speed and wind direction. This analysis conservatively assumed that CSOs and stormwater discharges were not diluted at all by the time the biota of the Bay were exposed to them. Under this scenario the biota of the nearshore environment would be exposed to pollutants at the concentrations calculated from load and volume estimates at the "end of the pipe." In fact, the biota would be exposed to much lower concentrations.

The effects in the near-shore are not evaluated against water quality objectives or other water quality screening criteria because CSO and stormwater discharges are short-term, seasonal, variable in duration and volume, and scattered at a number of locations along the shoreline, although the pollutant contribution from CSOs and stormwater discharges may remain concentrated in the near-shore environment rather than being integrated into the Bay ambient background concentrations. Therefore, near-shore impacts are evaluated by comparing pollutant concentrations in discharges to known concentrations of pollutants that have been shown to cause some effect on the biota. While the acute toxicity concentration ranges as presented in Table V.K.6 are neither criteria nor standards, and carry no regulatory weight or authority, they are used for comparison purposes in that they show the range of concentrations shown by toxicological research to have effects on some saltwater organisms. Among studies considered by the U.S. EPA, the "low acute" value, therefore, is the lowest concentration of a particular contaminant shown to have had some acute impact on some marine organism./67/ The "low acute" value is a yardstick or screening tool useful in estimating whether the concentration of contaminants in the CSO and stormwater discharges begin to approach concentrations of concern.

Other discharges that are continuous, such as treated municipal wastewater effluent (see "Deep Water Effects of Increased Treated Effluent") and groundwater (see "Contaminated Groundwater" in Section V.M, Contaminated Soils and Groundwater: Setting), are conservatively compared to WQOs, whereas intermittent discharges, such as treated CSOs and stormwater runoff discharges, are more appropriately, and conservatively, compared to acute toxicity concentration ranges as a guideline.

TABLE V.K.6 ●
COMPARISON OF POLLUTANT CONCENTRATIONS IN TREATED OVERFLOWS WITH CONCENTRATIONS SHOWN TO CAUSE ACUTE AND/OR CHRONIC TOXICITY IN BIOASSAYS WITH MARINE/ESTUARINE ORGANISMS

		Acute Toxicity Concentration Ranges (μg/l) /a/	
Metal	**Mean Concentration (μg/l) /b/**	**High**	**Low**
Arsenic	7.9	16,030	232
Cadmium	2.2	135,000	15.5
Chromium	12	105,000	2,000
Copper	39	600	5.8
Lead	61	27,000	315
Mercury	0.38	1,678	3.5
Nickel	21	350,000	151.7
Silver	4.9	2.3	--
Zinc	320	320,000	191.5
Selenium	0.85	760 /c/	--
Cyanide	5.0	10,000	4.9

Notes:
μg/l = micrograms per liter
-- = No Data

a. U.S. Environmental Protection Agency, Office of Water, Water Quality Criteria, 1986.
b. Mean concentration derived from data sources provided by Jim Salerno, Laboratory Supervisor, Southeast Water Pollution Control Plant, September 5, 1997:
   City and County of San Francisco, Department of Public Works, Bureau of Water Pollution Control, Bayside Wet Weather Overflow Monitoring Program Data Summary, October 1994 - June 1995.
   City and County of San Francisco, Department of Public Works, Bureau of Water Pollution Control, Bayside Wet Weather Overflow Monitoring Program Data Summary, October 1995 - June 1996.
   City and County of San Francisco, Department of Public Works, Bureau of Water Pollution Control, Bayside Wet Weather Overflow Monitoring Program Data Summary, October 1996 - June 1997.
c. Toxicity data for selenium provided for freshwater bioassays only.

Source: Dr. Joseph M. O'Connor.

- Table V.K.6 shows that, with the exception of copper, silver, cyanide, and zinc, the total concentrations of pollutants in treated CSOs are well below the lowest concentrations of pollutants causing acute toxicity in saltwater organisms.

Zinc concentrations in treated CSOs were estimated to exceed the lowest zinc concentration causing acute toxicity. However, acute toxicity in water from metals is due almost exclusively to metals in the dissolved form. Studies show that zinc in CSOs is present primarily in the particulate form, and that 41.5% of the total zinc in CSOs would be in the dissolved, bio-available form./68/ The zinc measured in treated CSOs represents not 320 μg/l, but a value less than half of that, approximately 132 μg/l. Thus, the actual concentration available to biota that are exposed to treated CSOs would be below the acute toxicity concentration range.

- The total silver concentration in treated CSOs appears to be within the acute toxicity concentration range. Because the reported silver concentration is based on data near or below the analytical detection limit for silver (half the detection limit was assumed when no silver was detected), the silver data reflect substantial uncertainty. Only the dissolved portion of the total concentration would be potentially available to biota, and studies of metals in stormwater runoff show that roughly 23% of the silver would be in the soluble, biologically available phase./68a/ Therefore, the actual concentration of silver in treated CSOs to which biota might be exposed would be about 1.1 μg/l in the dissolved phase, and the actual concentration available to biota that are exposed to treated CSOs would be below the acute toxicity concentration range.

The total copper concentration in treated CSOs is within the acute toxicity concentration range. However, only the dissolved portion of the total concentration would be potentially available to biota. Studies of metals in overflow waters show that about 26% of copper in the waste stream is in the soluble, bioavailable phase./69/ Thus, the actual concentration of copper in treated CSOs to which biota might be exposed, would be about 10 μg/l in the dissolved phase. Although this concentration exceeds the lowest acute toxicity value by a small amount, it is at the low end of the range. Furthermore, the CSOs are an existing condition; the project's effects would increase the duration of the overflow for a few minutes and increase the overflow volume by about 0.2%. The project is not expected to materially affect the concentration of copper (or any other pollutant) in treated CSOs. The project effect would not be a significant impact.

- The total cyanide concentration in treated CSOs is slightly within the acute toxicity concentration range. For analysis purposes, all the cyanide is assumed to be dissolved and potentially available to biota, although this is a conservative assumption. Although the cyanide concentration exceeds the lowest acute toxicity value by a small amount, it is at the low end of the range. The project would not be expected to materially affect the concentration of cyanide in treated CSOs.

- CSOs are an existing condition; the project's effects would increase the duration of the overflow for a few minutes and increase the overflow volume by about 0.2%. Treated CSOs would undergo unquantified mixing and dilution in the near-shore environment. Mobile salt-water species would quickly move away from fresh water CSOs. The data presented in Table V.K.6 suggest that organisms in the near-shore environment of San Francisco Bay could tolerate exposure to treated CSOs, and would not experience acute toxicity. The incremental change as a result of the project would be relatively small compared to existing conditions (a roughly 0.22% increase in load) and probably impossible to measure. For these reasons, there would be no significant impact of treated CSOs on the aquatic biota in the near-shore environment on the Bayside.

Effects of Stormwater Discharges

As previously discussed in "Volume and Quality of Direct Stormwater Discharge to Bay," the proposed project would result in a small increase in stormwater pollutant load to the near-shore environment of San Francisco Bay. The incremental increased load would be integrated into the Bay sediment and into Bay water concentrations. Effects on sediment quality are discussed below in "Effects of Mass Pollutant Emissions on Sediment Quality," below. Large increases in concentrations of pollutants in receiving waters may have the potential to harm the biota of the local near-shore environment.

Two of the four new planned stormwater outfalls are proposed to discharge into China Basin Channel, and the other two are proposed to discharge to San Francisco Bay along the eastern margin of the Project Area (see Figure V.K.2). Estimates of mixing and dispersion for the proposed stormwater discharges from the Mission Bay project are not available. Studies of mixing/70/ and dispersion models/71/ suggest that mixing in the near-shore environment is substantial but slow. The potential for near-shore impacts from stormwater discharges was evaluated by determining whether concentrations of toxic pollutants in undiluted stormwater from the Project Area would have the potential to cause toxic effects in populations of biota in the Bay.

Table V.K.7 presents estimated concentrations of six pollutants measured in stormwater (cadmium, chromium, copper, lead, nickel, and zinc) and a range of concentrations known to be acutely toxic to saltwater and estuarine organisms gleaned from the U.S. EPA development documents for Water Quality Criteria./72/,/73/ As presented in Table V.K.7, except for copper and zinc, the total copper concentrations of pollutants estimated for stormwater from the Project Area were well below the lowest concentrations of pollutants causing acute toxicity in saltwater organisms. Zinc concentrations in stormwater were well in excess of the lowest zinc concentration causing acute toxicity. However, as with treated CSOs, toxicity from metals in water is due to metals in the dissolved form. The estimated concentration of dissolved zinc in Mission Bay stormwater is approximately 87.2 μg/l. Thus, the estimated zinc concentration available to biota exposed to the stormwater discharge would be below the acute toxicity value.

As was the case with treated CSOs, copper concentrations in stormwater discharges are within the acute toxicity concentration range. However, only the dissolved portion of the total concentration would be potentially available to biota. Studies of metals in CSO waters show that about 26% of copper in the waste stream is in the soluble, bioavailable phase. Thus, the actual concentration of copper to which biota might be exposed from treated overflows would be about 8.7 μg/l in the dissolved phase. Although this concentration exceeds the lowest acute toxicity value by a small amount, it is at the low end of the range. Furthermore, copper is currently discharged into the near-shore waters from San Francisco's Bayside. The project's effect would be increasing the stormwater runoff volume by 0.3 MG/yr, and increasing the copper loading by 1.5 lbs/yr. Stormwater runoff from the project would occur only an average of approximately 10 times per year. For these reasons, the project's contribution to copper in near-shore waters would not be a significant effect.

TABLE V.K.7 ●
COMPARISON OF POLLUTANT CONCENTRATIONS IN STORMWATER WITH CONCENTRATIONS SHOWN TO CAUSE ACUTE TOXICITY IN BIOASSAYS WITH MARINE/ESTUARINE ORGANISMS

		Acute Toxicity Concentration Ranges (μg/l) /a/	
Metal	**Concentration (μg/l)/b/**	**High**	**Low**
Cadmium	1.7	135,000	15.5
Chromium	18	105,000	2,000
Copper	35	600	5.8
Lead	83	27,000	315
Nickel	38	350,000	151
Zinc	220	320,000	192

Notes:
a. U.S. Environmental Protection Agency, Office of Water, Water Quality Criteria, 1986.
b. Concentration estimates derived from Bay Area Stormwater Management Agencies Association, *San Francisco Bay Area Stormwater Runoff, Pollutant Monitoring Data Analysis, 1988-1995, Final Report*, prepared by Woodward-Clyde Consultants, October 15, 1996, Table 5-2.

Source: Dr. Joseph M. O'Connor.

Based on the data presented in Table V.K.7, organisms from the near-shore environment of San Francisco Bay could tolerate exposure to stormwater and would not experience acute toxicity. Given that stormwater would undergo some unknown amount of mixing and dilution in the near-shore environment, the impact of stormwater discharges on the aquatic biota in the near-shore environment of the Project Area would be less than significant.

Effects of Mass Pollutant Emissions on Sediment Quality

As discussed in "Sediment Quality," in Section V.K, Hydrology and Water Quality: Setting. China Basin Channel has been identified by the RWQCB as a candidate toxic hot spot for sediment quality. Islais Creek, which receives treated CSOs and secondary-treated wet-weather effluent from the Southeast Plant, has also been identified as a candidate toxic hot spot./74/

The results of the Bayside Planning Model indicate that future flows of treated CSOs under the project would decrease slightly to China Basin Channel, but the project would result in increased CSO volumes elsewhere, most notably to Islais Creek. Direct stormwater discharges would increase to

China Basin Channel due to the two stormwater outfalls. Increased volumes of CSOs to Islais Creek with the project and under cumulative conditions would cause a corresponding increase in pollutant load, including an increased load of settleable solids, to Islais Creek. A corresponding increase in pollutant load to China Basin Channel would occur with the proposed direct stormwater discharges. This would result in more sediment deposition on top of the bottom sediments, and an increased load of pollutants.

Pollutant concentrations associated with suspended particulates in overflows would be expected to remain the same. The chemistry of the surface layer of sediments is determined by the chemistry of the materials deposited to form the surface layer. Since the chemistry of the settleable solids that are discharged through overflows would not change, measurable changes to the surface-layer chemistry would not be expected. Pollutant concentrations associated with suspended particulate in stormwater discharges may change due to more development, but the load discharged to China Basin Channel would likely be substantially reduced by diversion of the more-polluted initial stormwater flows to the combined sewer system, and therefore, stormwater discharges to China Basin Channel are not expected to measurably change the sediment chemistry of China Basin Channel. The benthic fauna of the central portions of San Francisco Bay are essentially confined to the uppermost layer of the Bay sediment. As measurable changes in the physical or chemical composition of this layer are unlikely, measurable changes to the benthic fauna are also unlikely.

In addition, the relatively small increase in sediment volume caused by the project would not be expected to affect the RWQCB's determination to designate China Basin Channel or Islais Creek as a toxic hot spot, nor would it be expected to cause any changes to the possible remediation approach. Therefore, the project would have a less-than-significant impact on the sediment quality of both Islais Creek and China Basin Channel.

Effects on Water-Contact Recreation

- Although water-contact recreation occurs infrequently in the Project Area, water-contact recreation on the Bayside primarily takes the form of swimming and windsurfing on the north shore (off Crissy Field and in Aquatic Park) and windsurfing on the southeast shore near the Candlestick Point State Recreation Area. Overflow occurrences affecting beach closures are discussed here to assess the impacts of the project on the beneficial use of water-contact recreation.

The Bayside Planning Model estimated that the Bayside Base Case plus Mission Bay Project scenario and the Bayside Base Case plus 100% Combined Sewer scenario would increase the volume of treated CSOs along the Bayside with a concomitant increase in the duration of CSOs at the Channel, Mariposa, and Islais Creek CSO facilities, and that the effect would be the same under either scenario. The duration of CSOs at other Bayside facilities would not be affected. Due to the way the system is operated to maximize efficiency, the average duration of treated CSOs at the Channel CSO facilities would decrease by about 0.4 hour per year, or about 2.4 minutes per overflow (24 minutes divided by 10 overflows). Therefore, neither scenario would have an adverse effect on treated CSO duration to China Basin Channel.

The Bayside Planning Model projected average annual increases in treated CSO durations at the Mariposa and Islais Creek facilities of 1.5 and 1.8 hours, respectively, under both scenarios. These increases translate to about 9 minutes and 11 minutes per CSO event. Water-contact recreation occurs infrequently at these locations on the Bayside. Therefore, no impact from the increased duration of CSOs would occur due to CSOs from the Mariposa and Islais Creek facilities.

Conclusion

Based on the above analysis, no significant impacts on water quality, aquatic organisms, sediment quality in China Basin Channel and Islais Creek, or water-contact recreation, from either loads or concentrations of pollutants, would occur in the near-shore Bay due to the project. The potential significance of cumulative impacts is discussed below in "Cumulative Issues."

CUMULATIVE ISSUES

Water Quality

As indicated above, project-related pollutants discharged into San Francisco Bay would disperse and combine with pollutants from other reasonably foreseeable projects in San Francisco and cumulative development in areas surrounding the Bay. Other foreseeable projects in San Francisco large enough to potentially affect Bayside operations include the proposed Candlestick Mills Stadium and Mall project, the proposed Hunters Point Naval Shipyard Redevelopment project, and proposed development of waterfront port properties. For these projects, the Bayside Planning Model, discussed previously in "Changes in Discharges to Receiving Waters," in the Impacts subsection, was used to analyze a cumulative scenario in which it was assumed, as a worst-case in terms of impacts to the City's combined sewer system, that all other projects except for the Mission Bay project would maximize use of the combined sewer system.

Table V.K.8 provides the results of the Cumulative Bayside scenario and summarizes the cumulative effects of the cumulative projects on discharges and pollutant loads. As discussed earlier in "Evaluation of Potential Water Quality Impacts," increasing the volumes of municipal wastewater

TABLE V.K.8 ●
SUMMARY OF ANNUAL POLLUTANT LOADS TO BAY FROM BAYSIDE EFFLUENT AND OVERFLOWS

	Bayside Base Case	Bayside Base Case + Proposed Sewer System for Mission Bay Project	Change from Base Case	Bayside Base Case + 100% Combined Sewer System for the Mission Bay Project	Change from Base Case	Cumulative Bayside	Change from Base Case
Total Bayside Volume (MG/yr) /a/	31,113	31,957	844	31,973	860	32,504	1,391
Monitored Pollutant	**Load (lb/yr)**	**Load (lb/yr)**	**Change (%)/b/**	**Load (lb/yr)**	**Change (%)/b/**	**Load (lb/yr)**	**Change (%)/b/**
Total Suspended Solids	4,800,000	4,900,000	2.4%	4,900,000	2.7%	5,000,000	5.2%
Ammonia, as Nitrogen	5,100,000	5,300,000	2.8%	5,300,000	2.8%	5,300,000	4.3%
Oil and Grease	1,300,000	1,400,000	2.7%	1,400,000	2.8%	1,400,000	4.6%
Polynuclear Aromatic Hydrocarbons	40	41	2.5%	41	2.7%	42	4.9%
Arsenic	590	600	2.5%	610	2.7%	620	4.9%
Cadmium	71	72	2.2%	73	2.6%	75	5.8%
Total Chromium	340	350	2.1%	350	2.6%	370	6.0%
Copper	2,400	2,500	2.5%	2,500	2.7%	2,500	5.1%
Lead	1,300	1,400	1.9%	1,400	2.5%	1,400	6.5%
Mercury	20	20	2.4%	20	2.7%	21	5.2%
Nickel	1,200	1,200	2.4%	1,200	2.7%	1,200	5.2%
Silver	570	580	2.6%	590	2.7%	590	4.7%
Zinc	15,000	16,000	2.4%	16,000	2.7%	16,000	5.3%
Selenium	190	190	2.7%	190	2.8%	190	4.5%
Cyanide	2,500	2,600	2.8%	2,600	2.8%	2,700	4.4%

Notes:
See Table V.K.2 and Table V.K.3 for effluent and treated overflow loads, respectively.
MG = million gallons lb = pounds yr = year
a. City and County of San Francisco, Public Utilities Commission, Clean Water Program, *Draft Bayside Cumulative Impact Analysis*, March 1998.
b. The percentage change in load is assumed to be the same as the percentage change in volume. While the percentage change reflects the incremental change that would occur in each analysis scenario, there is a level of imprecision associated with the load calculations. Therefore, all load values have been rounded to two significant figures to reflect the statistical uncertainty of the calculations. The significance of each change was evaluated by determining whether the change falls within the range of uncertainty.

Source: EIP Associates.

effluent, treated CSOs, and direct stormwater discharges would increase the total mass pollutant load to receiving waters, but this would not cause significant water quality impacts with respect to toxicity on aquatic biota. The same conclusions for the proposed project apply to the cumulative effects of Bayside projects, in that the cumulative increase in pollutant mass load from these projects would have a less-than-significant effect on water quality.

As shown in Table V.K.8, the project would represent less than 3% of the increased total pollutant load from the Bayside./75/ The cumulative loads for pollutants would generally increase by 4-6%. Thus, the project would cause approximately half of this cumulative increase for the Bayside.

To put this in context, City discharges are a very small portion of the region-wide discharges to the Bay. Compared to municipal dischargers in the Bay Area, the load contribution of the Southeast Plant represents about 12% of all other municipal dischargers, and the Mission Bay project would represent less than 3% of that 12% (or 0.36% of all municipal wastewater discharged to the Bay)./76/,/77/

In addition, besides municipal wastewater, other sources of pollutant loading to San Francisco Bay include riverine inputs, nonurban runoff, urban runoff, point sources, dredging/sediment disposal, spills, and atmospheric deposition. Of these sources, point sources, including municipal dischargers and other permitted industrial dischargers, represent about 1-6% of the total load input to the Bay-Delta estuary./78/ Regarding stormwater discharges, San Francisco Bayside stormwater flows are about 1.8% of the total regional urban storm flow to the Bay./79/ Considering the contribution of the project and of the cumulative Bayside projects in the context of all the other pollutant inputs to the Bay, the cumulative pollutant loading from Bayside projects would be extremely small.

As previously discussed in "San Francisco Bay Basin Water Quality Control Plan (Basin Plan)," in the Setting subsection, the SWRCB has designated Central San Francisco Bay as impaired as a result of unacceptable levels of selenium, mercury, copper, diazinon, and PCBs. The RWQCB may initiate a "total maximum daily load" regulatory process which would likely result in different effluent limitations than are currently provided by the Basin Plan. The City would have to comply with any changes to its NPDES permits that might result from RWQCB action.

Aquatic Biota Effects

Bayside cumulative development would result in an increase in municipal wastewater effluent flows, treated CSOs, and stormwater discharges. Increased flows to San Francisco Bay necessarily mean that overall pollutant loads would increase; however, pollutant concentrations in treated effluent and treated CSOs would not change. As shown in Table V.K.5 through V.K.6, and explained above under the project analysis, the concentrations in existing treated effluent and treated CSOs would not cause a significant effect on aquatic biota. The lack of substantial effect is apparent even though the analysis and evaluation was performed using extremely conservative assumptions. Even though copper concentrations in stormwater discharges and CSO overflows might be just above the lowest copper concentration shown to cause acute toxic effects in saltwater biota, such an effect would be seasonal, intermittent, and short in duration. Therefore, none of the discharges from the Bayside Cumulative scenario would cause degradation in Bay water quality, an increase in toxicity, or degradation of sediment quality. Similarly, the cumulative development scenario would not cause a significant effect on aquatic biota.

As shown in Table V.K.7, and explained above under the project analysis, the project would change the concentrations of pollutants in stormwater discharges, but would not cause a significant impact on aquatic biota. Similarly, the cumulative development scenario would not cause a significant effect on aquatic biota.

Sediment Quality

As discussed in "Sediment Quality," in the Setting subsection. China Basin Channel has been identified by the RWQCB as a candidate toxic hot spot for sediment quality. Islais Creek, which receives treated CSOs and secondary-treated wet-weather effluent from the Southeast Plant, has also been identified as a candidate toxic hot spot./80/

As with the project, the results of the Bayside Planning Model indicate that future flows of treated overflow discharges under the Bayside Cumulative scenario would decrease slightly to China Basin Channel, but would result in increased flows of overflow discharges elsewhere, most notably to Islais Creek. Increased volumes of overflow discharges to Islais Creek with the project and under cumulative conditions would cause a corresponding increase in contaminant load, including an increased load of settleable solids. This would result in more sediment deposition on top of the bottom sediments, and an increased load of pollutants. As discussed with respect to the project, pollutant concentrations associated with suspended particulates in overflows would be expected to remain the same. As the chemistry of the settleable solids discharged to Islais Creek would not change, measurable changes to the surface-layer chemistry would not be expected. Effects on benthic organisms would not be significant.

The relatively small increase in sediment volume caused by the Bayside Cumulative scenario project would not be expected to affect the RWQCB's determination to designate Islais Creek as a toxic hot spot, nor would be expected to cause any changes to the possible remediation approach. (Treated combined sewer overflows, and therefore sediment deposition, in China Basin Channel would decrease due to the Bayside Cumulative scenario, and would similarly have no effect on the RWQCB's future actions.) Therefore, the Bayside Cumulative scenario would have a less-than-significant impact on the sediment quality of both Islais Creek and China Basin Channel.

Effects on Water-Contact Recreation

The Bayside Planning Model estimated that the Bayside Cumulative scenario would increase the average duration of treated CSOs from the North Shore overflow facilities by one-half hour during the year. Divided by an average of 4 CSOs per year, this translates to about 7 or 8 minutes per overflow. At the Yosemite overflow facilities, which discharge into Yosemite Slough, the long-term annual CSO duration was estimated to extend 0.9 hour per year, or 54 minutes per year for the single yearly (long-term average) overflow that occurs there. Because beaches are closed by daily increments, longer overflows at the north shore and at Yosemite would not have a measurable effect on beach closures under Bayside Cumulative scenario.

The long-term annual overflow duration at the Mariposa facilities was estimated to increase by 1.5 hours, translating to 9 minutes per overflow. At the Islais Creek facilities, the annual overflow duration was estimated to increase by 14.1 hours, or 1.4 hours per overflow. No water-contact recreation occurs in the waters near the facilities, and the increase in overflow duration would have no substantial impact in this area of the Bayside shoreline under the Bayside Cumulative scenario.

Conclusion

The above analysis finds that there are no significant cumulative impacts from the increased volume and pollutant load of treated municipal wastewater effluent, treated CSOs, and direct stormwater discharges, because there would be no substantial degradation in the water quality of the Bay or near-shore waters, there would be no toxic effect on aquatic biota, there would be no substantial change to sediment quality, and there would be no change to beneficial uses. CSOs generate a high degree of public concern, however, and conservative presumptions of significance are warranted when a setting may be degraded or impaired. For these reasons, and in an effort to provide for continued discussion regarding these concerns and to acknowledge the lack of conclusive evidence refuting a causal relationship between treated combined sewer overflows, stormwater discharges, and sediment quality, this report conservatively finds that the project would contribute to a potentially significant cumulative impact on near-shore waters of San Francisco Bay from treated CSOs, and direct stormwater discharges to China Basin Channel. The project contribution (0.2%) to the potential cumulative increase (11%) in Bayside CSO volumes, and the contribution of project-related stormwater discharges to possible cumulative impacts, would be reduced to a level of insignificance with the imposition of Mitigation Measures K.3 and K.4, described in Section VI.K, Mitigation Measures: Hydrology and Water Quality.

PHASED DEVELOPMENT AND INTERIM USES

Proposed Interim Drainage Plans for Phased Development

As discussed in "Review Process for Proposed Phases," in Chapter III, Project Description, and in "Phasing," in Section V.M, Community Services and Utilities: Impacts, development of a specific area or phase of Mission Bay would be accompanied by the development of adjoining infrastructure and improvements. The development of a drainage and sewer system, in particular, would occur simultaneously with roadway construction.

The Redevelopment Plans and related documents outline a review process whereby preliminary infrastructure plans, maps, and supporting documentation would be submitted to the Redevelopment Agency with each proposed phase of development (see "Review Process for Proposed Phases," in Chapter III, Project Description). The Redevelopment Agency would review the material for consistency with the Redevelopment Plans and related documents. The review process would continue with the Department of Public Works, which would conduct a review of the materials in conjunction with other responsible agencies, such as the San Francisco Public Utilities Commission Clean Water Program (Clean Water Program). For any proposed sewer or drainage plan, the Clean Water Program would analyze the proposed plans to determine whether the design plans are adequate and conform to the City's operational requirements.

As discussed in "Sewer Improvements: Central/Bay Basin," in Section V.M, Community Services and Utilities: Impacts, the drainage plan for each development phase would include directing stormwater flow from new buildings and permanently paved areas, including those in the existing Bay Basin that currently drains to the Bay, to the combined sewer system. A mitigation measure has been included in "Sewers and Wastewater Treatment," in Section VI.M, Mitigation Measures: Community Services and Utilities, calling for all new development in the Bay Basin to provide for stormwater drainage to the combined sewer system until the initial-flow diversion system is operational. As each phase of new development is proposed, the Clean Water Program staff would evaluate the volume of combined sewage expected to be discharged to the combined sewer system. The Clean Water Program staff would assess whether the combined sewer system has adequate capacity, such that operations, and compliance with the City's Bayside NPDES Permit would not be affected. A phase may include interim improvements, such as detention basins, to control drainage to the combined sewer system. The Clean Water Program staff would advise the Department of Public Works and the

Redevelopment Agency as to when the initial-flow stormwater diversion system would need to be fully functional for a defined area of the Mission Bay South Central/Bay Basin.

Proposed Drainage Plans for Interim Giants Ballpark and UCSF Parking

As described in detail in "Interim Uses," in Section V.M, Community Services and Utilities: Impacts, and shown on Figure III.B.4, one possible drainage scheme to accommodate interim Giants Ballpark and UCSF parking uses in the Project Area is proposed to include the use of a shallow surface detention basin. For purposes of analysis, one acre-foot of detention would be needed for every 10 acres of parking and would be located between the Giants and UCSF parking lots. The ultimate system, however, could vary and might include more than one basin. The detention basin would be graded to collect stormwater in the center of the basin, with a metered drain directing flows to the existing combined sewers in Third Street or Sixth Street. The metered drain would be designed with the capacity to handle stormwater flows up to the volume of a 3-month storm. Runoff generated from storms between a 3-month and a 5-year storm would be collected and stored in the basin, for gradual release to the City combined sewer system through the metered drain, with some pumping necessary to convey these low-flow volumes. The land would be graded such that flows beyond the 5-year storm would overflow the detention basin and flow north toward the Channel, across Channel Street and into the Channel until the metered drain to the sewer system lowered the water level in the detention basin below the elevation of Channel Street. As discussed above in "Proposed Interim Drainage Plans for Phased Development," the Clean Water Program staff would need to review and approve the plans once they are formally submitted.

Water Quality Effects of Phased Development and Interim Uses

The volume of stormwater discharge to the combined sewer system would increase with each phase of development, until it reaches the volumes discussed for the project at build-out, discussed above. Increased volumes of treated municipal wastewater effluent discharged to Islais Creek from the Southeast Plant and increased volumes of treated CSOs would result. Also, as discussed above, the increase in volume of effluent and CSOs would be accompanied by roughly proportional increases in pollutant load to the Bay.

The use of detention basins in the interim phase for Giants parking would tend to delay discharges of stormwater to the City's system, which would limit the possibility for increased CSOs as a result. However, if storm runoff volumes from interim parking lots for the Giants Ballpark and UCSF are great enough to occasionally (once every five years on average) flow overland into the Channel, oil and grease, metals and other pollutants from the parking lots would contribute to pollutant loads in the Channel on a short-term, temporary basis. Turbidity could increase from particulates on the parking lots.

As discussed in "Sewer Improvements: Central/Bay Basin," in Section V.M, Community Services and Utilities: Impacts, Sewers and Wastewater Treatment, infrastructure development of the proposed separated sewer system for the Central Basin and Bay Basin would occur with each phase, but would not necessarily be immediately operational. With each development phase, land use in the Bay Basin would become more intensified with additional buildings and higher automobile use. If the existing separated sewer system in the Bay Basin continued to be used to discharge stormwater runoff to the Bay, pollutant mass loading to the Bay could potentially increase from existing levels.

As discussed above in "Volume and Quality of Effects of Loading by Direct Stormwater Discharge to the Bay," it is expected that stormwater discharge from the Project Area eventually would be managed within a City-operated stormwater management program if the Phase II stormwater regulations become finalized. Although it is reasonable to assume that Mission Bay would eventually need to comply with stormwater regulations, the proposed regulations have not yet been finalized. Therefore, there is currently no regulatory requirement for a stormwater management program that addresses Mission Bay stormwater quality. Pollutant loading to the Bay could increase if stormwater continued discharging directly to the Bay. The main treatment control BMP proposed for the project is the initial-flow diversion system. Failing to implement other BMPs to minimize stormwater pollution could potentially conflict with the intent of proposed stormwater permit requirements and result in a significant impact.

Mitigation Measure M.5 in Section VI.M, Mitigation Measures: Community Services and Utilities. discusses conveying all stormwater runoff from newly developed areas in the Bay Basin to the combined sewer system prior to completion of the initial-flow diversion system. Mitigation Measure K.5 in Section VI.K, Mitigation Measures: Hydrology and Water Quality, discusses implementation of an individual stormwater management program that utilizes BMPs for Mission Bay until the Phase II regulations become final and Mission Bay is included in the City's stormwater management program. Mitigation Measure K.2, describes mandatory Mission Bay participation in the City's existing Water Pollution Prevention Program. Implementation of this mitigation measure would avoid a significant impact.

CONSTRUCTION ACTIVITY POLLUTANTS

As discussed in detail in "Proposed China Basin Channel Edge and Bridge Treatments," and shown on Figure V.L.2, in Section V.L, China Basin Channel Vegetation and Wildlife: Impacts, the project proposes to increase recreational opportunities along the edges of the Channel through improvements that include a pedestrian circulation system along the banks of the Channel on the north and south sides; promontory areas overlooking the Channel; a pedestrian bridge over the Channel linking Fifth Street to the future Owens Street, if permits can be obtained; stabilization of the banks of the Channel with riprap (see Glossary); and landscaping with salt-tolerant vegetation. The estimated quantities of riprap that would be placed along the north side of the Channel are 3,600 cubic yards from Fourth Street to Sixth Street, and about 400 yards from Fourth Street to Fifth Street. The area east of Third Street south of Mission Rock Street generally would be developed with residential and commercial industrial buildings. Open space would be developed along the west side of Terry A. François Boulevard. See Figure III.B.2 in Chapter III, Project Description. Because the edges of the Channel drain directly to the Channel, sediment and other construction-related pollutants associated with the proposed edge treatments, if not controlled, could be transported into the Channel water.

Erosion and Sediment

Unless mitigated, erosion in areas draining directly to surface waters could result in conflicts with Basin Plan WQOs for sediment, settleable and suspended material, and turbidity. Sediment is a pollutant in its own right, but is also a carrier for many other pollutants of concern, including oil and grease, heavy metals (such as copper, lead, nickel, and zinc), petroleum hydrocarbons, and pesticides. Such pollutants can be adsorbed onto the surface of individual soil particles.

Proposed riprap and landscaping of the Channel edges would potentially reduce existing erosion. During construction, soil surfaces along the Channel and in the area east of Third Street south of Mission Rock Street would be exposed to rainwater, and sediment could be discharged into the Channel and Bay. Along the Channel, loose soil could discharge into the water if there were no barriers. The slopes of the Channel would continue to be exposed to erosion until vegetation becomes established in areas where it is proposed. In the area east of Third Street, sediment-laden rainwater would enter the storm drains and be discharged to the Bay. Prevention of erosion and control of sediment would be addressed in the project's construction Storm Water Pollution Prevention Plan, discussed below.

Certain construction activities associated with installing and removing piles for the Channel-edge improvements could resuspend sediment. As shown on Figure V.L.2, three promontories on the north side of the Channel would extend over the Channel to provide overlooks. To provide reliable and safe support structures, construction crews may need to install new piles. Because they pose safety hazards, various piles and pilings primarily on the south side of the Channel would be removed or cut off at mud level (see "Proposed China Basin Channel Edge and Bridge Treatments" in Section

V.L, China Basin Channel Vegetation and Wildlife: Impacts, for a complete description of the proposed treatments). The project's Channel treatment proposal is subject to approval by the San Francisco Bay Conservation and Development Commission (BCDC) and authorization by the U.S. Army Corps of Engineers as described in "Loss of Salt Marsh Wetland Habitat," in Section V.L, China Basin Channel Vegetation and Wildlife: Impacts.

During pile-driving, sediment would be disturbed, producing a short-term increase in turbidity. In addition, contaminants that are adsorbed onto the surface of individual particles of sediment could re-dissolve in water. Bioaccumulation effects are discussed in "Resuspension of Contaminated Sediments," in Section V.L, China Basin Channel Vegetation and Wildlife: Impacts.

Other Construction-Related Pollutants

Other than sediment, pollutants associated with construction activities include nutrients, trace metals, other toxic chemicals, and miscellaneous wastes. Phosphorus, nitrogen, and potassium are the nutrients found in plant fertilizers, and if they were used heavily (e.g., to start plantings), they could result in discharge to waters where they may cause excessive growth of algae. Fertilizers would not be used for the salt-tolerant plants along the Channel, but could be used for landscaping of the proposed open space along Terry A. François Boulevard. Trace metals are associated with most construction activities and materials such as certain chemicals for cleaning, plumbing, painting activities, masonry and concrete, and floors and walls. Other toxic chemicals, including synthetic organic compounds (adhesives, cleaners, sealants, solvents, etc.), could cause adverse water quality effects if improperly stored and disposed. As discussed in "Water," in Appendix A, Initial Study, if hazardous materials are present in construction runoff that drains to the City's combined sewer system, the runoff would be subject to the pre-treatment regulations of the City's Industrial Waste Ordinance. Miscellaneous wastes from construction sites can include wash water from concrete mixers, paints and painting equipment cleaning activities, solid wastes, wood and paper packaging materials, and food containers. These pollutants would be addressed in the project's Construction Storm Water Pollution Prevention Plan, discussed below. Discharge of dewatered groundwater or any other batch discharge of wastewater into the City's combined sewer system would require a batch discharge permit from the City (see "Water" in Appendix A, Initial Study).

Storm Water Pollution Prevention Plan

Construction activities of at least 5 acres must obtain NPDES coverage under the state's General Construction Activity Storm Water Permit, administered by the RWQCB, and must prepare and implement a Storm Water Pollution Prevention Plan (SWPPP). The proposed Phase II stormwater regulations would extend existing stormwater requirements to construction activities disturbing more than 1 acre of land (see "Phase II Stormwater Permits" in the Setting subsection for a description of the proposed regulations). The new proposed regulations suggest that construction activities be addressed by each municipality's comprehensive stormwater management plan. Until the Phase II regulations are finalized, construction activities at Mission Bay would be subject to existing regulations.

In accordance with the requirements of the General Construction Activity Storm Water Permit, an SWPPP for construction must describe the site, erosion and sediment controls, means of waste disposal, implementation of approved local plans, post-construction control measures and maintenance responsibilities, and non-stormwater management controls. Management controls are BMPs and could include measures such as housekeeping practices (e.g., storing construction materials away from drainage courses, placing drip pans or absorbent materials under equipment when not in use); appropriate containment and disposal of waste; minimizing and stabilizing disturbed areas; and controlling the construction site perimeter and on-site erosion (e.g., surrounding the site with a silt fence or sandbag barrier). The project sponsor would also be responsible for having construction sites inspected by qualified individuals before and after storms to identify stormwater discharge from construction activity, and to identify and implement controls where necessary. The SWPPP would be prepared in accordance with guidelines contained in the general permit and in the *Construction Best Management Practices Handbook.*/81/ The SWPPP for the project would be prepared separately from this SEIR.

To ensure that appropriate BMPs are incorporated into the SWPPP, the SWPPP must contain, at a minimum, the BMPs listed in Mitigation Measure K.1 in Section VI.K, Mitigation Measures: Hydrology and Water Quality, or substantially equivalent measures, most of which would help protect the Channel from erosion and sediment during construction and installation. The monitoring and reporting requirements contained in the General Construction Activity Storm Water Permit allow changes and modifications to be made to the SWPPP, as necessary, based on experience during construction. The discharger must certify annually that its construction activity is in compliance with the requirements of the general permit and the SWPPP. Notification must be made to the RWQCB if certification cannot be made, or if there are other instances of noncompliance. SWPPPs are considered public reports under Section 308(b) of the Clean Water Act and must be made available to the RWQCB upon request.

USE OF RECLAIMED WATER

As discussed in "Reclaimed Water System," in Section V.M, Community Services and Utilities: Impacts, the project would provide a dual plumbing system for new commercial development greater than 40,000 square feet in the Project Area that would supply potable and non-potable (reclaimed) water through two separate delivery systems or else would meet goals associated with the use of reclaimed water and comply with the City's Reclaimed Water Use Ordinance through other methods./82/ Reclaimed water, if provided for the Project Area, would be used mainly for non-contact uses such as flushing toilets, landscape irrigation, or cooling water. Potential adverse impacts from public exposure to reclaimed water were analyzed fully in the *Recycled Water Master Plan and Groundwater Master Plan Final Environmental Impact Report*./83/ That report explains that reclaimed water is treated by disinfection and filtration to produce a high-quality recycled product. Treatment criteria and management and application criteria for reclaimed water are specified in Title 22 of the California Code of Regulations. These criteria include specifications for treatment plant reliability, monitoring, and contingencies. Additional criteria in Title 17 of the California Code of Regulations specify requirements for preventing cross-contamination to the public water supply. The RWQCB also implements regulations for water reuse./84/

Compliance with the water use measures in Title 22 and Water Reuse Requirements would avoid any runoff that would contribute to local surface water quality degradation. Groundwater on the site is 4 to 9 feet below ground surface, and contiguous with water in the adjacent San Francisco Bay. Monitoring wells throughout the site west of Third Street indicate groundwater is brackish (salinity that is intermediate between freshwater and sea water)./85/ There are no current or proposed uses of groundwater at Mission Bay. Adherence to regulations and criteria provided in Title 22, Title 17, and the Water Reuse Requirements of the RWQCB, which would be implemented by the San Francisco Water Department of the SFPUC, would avoid any significant impacts to hydrology and water quality from use of reclaimed water.

GLOSSARY

Activated Carbon Adsorption: A treatment technology which can remove insoluble or hydrophobic organic compounds from wastewater. A common method of use is to pass wastewater over granular activated carbon in a filter column. The operation utilizes a liquid-solid partitioning mechanism.

Advanced Oxidation: A treatment method involving several related processes in which hydroxide-free radicals are generated to decompose organic chemical contaminants. The hydroxide-free radicals can be formed in several ways, the most common being a combination of UV light and ozone, or UV light and hydrogen peroxide.

Best Management Practices (BMPs): Any program, technology, process, siting criteria, operating method, measure, or device which controls, prevents, removes, or reduces pollution, including schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Biochemical Oxygen Demand (BOD): The decomposition of organic substances by aerobic microbes. BOD measures the amount of oxygen consumed.

C Factor: The amount of rainfall that ends up as runoff from a given area, expressed as a fraction. Also known as "runoff coefficient."

Constructed Treatment Wetlands: Engineered systems that optimize the water-cleansing ability of natural wetlands. A wetland's ability to assimilate pollutants depends on physical and chemical characteristics of the soil.

Downspout Infiltration: A wastewater reuse practice in which uncontaminated stormwater collected on rooftops is conveyed through downspouts to a percolation system and is used to recharge a groundwater aquifer.

Effluent Limits (numeric effluent limits): Limitations on amounts of pollutants that may be contained in effluents. Can be expressed in a number of ways including as a concentration, as a concentration over a time period (e.g., 30-day average must be less than 20 mg/l), or as a total mass per time unit.

Five-Year Storm: A storm of a size that occurs an average of once every five years, a relatively rare occurrence.

Five-Year Storm Standard: The five-year storm standard is an industry standard used to size underground combined stormwater sewer lines. The five-year standard has evolved from analyses of the cost to enlarge sewer lines versus the benefit from capturing stormwater flows from larger storms. Typically, flows exceeding the conveyance capacity of the underground stormwater lines are carried overland to a nearby catch basin or open body of water (bay, river, etc.). Sizing stormwater lines to the five-year storm standard requires analysis of many complicated factors such as: regional rainfall averages and historic intensity of local rainfall; the position of a site in its watershed (downstream areas in a watershed receive more runoff than upstream areas, where runoff originates); and the runoff coefficient of the watershed.

Flocculation: One step in the wastewater treatment process where mechanical or air agitation is used to form aggregates, or flocs, from the finely divided matter, through the addition of a chemical such as alum to create a loose precipitate, floc, which forms around particulate matter to create larger more settleable particles. Settling is the ensuing step in which floc particles are settled from the treatment vessel.

Graywater: Water that has been used in residences in wash basins or for laundry, baths, or showers.

Initial Flow: Either the early portion of stormwater runoff from storms, or a 3-month return frequency or higher, or all stormwater runoff from storms smaller than a 3-month storm. Typically in San Francisco, it is equal to 1 inch of rainfall.

Membrane Filtration: A broad category that covers the range of treatment technologies including micro-screening, micro-filtration, ultra-filtration, nano-filtration, and reverse osmosis. The common theme in each technology is that wastewater is filtered through a porous material or membrane, and a permeate and reject stream are produced.

Non-Storm Water Discharge: Any discharge to municipal separate storm sewer that is not composed entirely of storm water. Discharges containing process wastewater, non-contact cooling water, or sanitary wastewater are non-storm water discharges.

Nonpoint Source Pollution: Pollution that does not come from a point source. Nonpoint source pollution originates from aerial diffuse sources that are mostly related to land use.

NPDES Permit: The national program for administering and regulating discharges to waterways according to the federal Clean Water Act (CWA). In California, the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCB) are responsible for administering the NPDES storm water program.

Outfall: The point where a storm drain or sewer discharges from a pipe, channel, ditch, or other conveyance to a waterway.

Point Source: Any discernible, confined, and discrete conveyance from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff.

Pretreatment: Treatment of wastewater before it is discharged to a wastewater collection system.

Primary Treatment: Physical operations, such as screening and sedimentation, used to remove the floating and settleable solids found in wastewater.

Process Wastewater: Wastewater that has been used in one or more industrial processes.

Reclaim (water reclamation): Planned use of treated effluent that would otherwise be discharged without being put to direct use.

Reuse (water reuse): See "Reclaim," above.

Riprap: A layer of loose rock or aggregate placed over an erodible soil surface to protect soil from the erosive forces of water. It is typically used on storm drain outlets, channel banks and bottoms, roadside ditches, shorelines, and any other place where soil may erode.

Runoff: Water originating from rainfall and other sources (e.g., sprinkler irrigation) that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes, wetlands, and shallow groundwater.

Secondary Treatment: Biological and/or chemical processes used to remove most of the organic matter found in municipal wastewater.

Selective Ion Exchange: The ion exchange process is carried out with small, synthetic, porous (plastic) resin beads that have been chemically modified to accept only positively or negatively charged ions.

Source Control BMPs: Operational practices that prevent pollution by reducing potential pollutants at the source. They typically do not require construction.

Tertiary (Advanced) Treatment: Combinations of unit operations and processes used to remove other constituents such as nitrogen and phosphorus that are not reduced significantly by secondary treatment.

Three-Month Storm: A storm that occurs an average of once every three months (four times a year).

Total Suspended Solids (TSS): The total particulate mass suspended in water.

Toxicity: Concentration of substance that would be lethal or would produce other responses detrimental to the health of organisms.

Trash Rack: A grated structure placed at the discharge point of an outfall that catches large-sized debris that may be in the stormwater and prevents the debris from being discharged into the receiving water.

Treatment Control BMPs: Methods of treatment to remove pollutants from storm water. Construction and maintenance are required for implementation.

Turbidity: Describes the ability of light to pass through water. The cloudy appearance of water caused by suspended and colloidal matter (particles).

NOTES: Hydrology and Water Quality

1. San Francisco Planning Department, *Mission Bay Final Environmental Impact Report*, Planning Department File No. 86.505E, State Clearinghouse No. 86070113, Certified August 23, 1990, Volume Two, p. VI.L.3.*

2. Bay Area Stormwater Management Agencies Association, *Start at the Source: Residential Site Planning & Design Guidance Manual for Stormwater Quality Protection*, prepared by Tom Richman & Associates, January 1997.

3. Storm Water Quality Task Force, *Municipal Best Management Practice Handbook*, prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, and Resources Planning Associates, March 1993.

4. City and County of San Francisco, *Bayside Overflows,* prepared by CH2M Hill, June 1979.

5. San Francisco Wastewater Program, *Bayside Wet-Weather Facilities - Revised Overflow Control Study*, May 1977.

6. "Most Probable Number" is a statistical measure and is not an exact count of the number of bacteria.

7. San Francisco Wastewater Program, *Bayside Wet Weather Facilities - Revised Overflow Control Study*, May 1979.

8. San Francisco Bay-Delta Aquatic Habitat Institute, *San Francisco Estuary Project, Status and Trends Report on Pollutants in the San Francisco Estuary*, March 21, 1991.

9. State Water Resources Control Board, *1996 California Water Quality Assessment Report*, January 1997, p. 2-1.

10. Thomas Mumley, Senior Water Resources Control Engineer, California Regional Water Quality Control Board -- San Francisco Bay Region, "Final Staff Report: Section 303(d) List of Impaired Water Bodies and Priorities for Development of Total Maximum Daily Loads for the San Francisco Bay Region," March 9, 1998.

11. Central San Francisco Bay is also impaired as a result of exotic species brought and released to the Bay in the ballast water of ships, but this issue does not relate to the Mission Bay project.

12. Water Engineering and Modeling, Numerical Modeling of San Francisco Effluent Disharges: Far Field Effects, 1993.

13. City and County of San Francisco, *Bayside Overflows,* prepared by CH2M Hill, June 1979.

14. Acute toxicity is measured as the concentration that caused mortality in 50% of test organisms over a fixed period of time (24-hr LC_{50}).

15. City and County of San Francisco, *Bayside Overflows,* prepared by CH2M Hill, June 1979.

16. City and County of San Francisco, *Bayside Overflows,* prepared by CH2M Hill, June 1979.

17. City and County of San Francisco, Planning Department, *Bayside Discharge Alternatives, Draft Environmental Impact Report*, Planning Department File No. 92.531E, State Clearinghouse No. 93023040, Certified May 20, 1994, Figure 14.*

18. California Code of Regulations, Title 17, Group 10, Article 4, Sections 7958-7959.

19. 1990 FEIR, Volume Two, p. VI.L.1.*

20. City and County of San Francisco, Planning Department, *Port of San Francisco Waterfront Land Use Plan, Final Environmental Impact Report*, Planning Department File No. 94.155E, State Clearinghouse No. 94123007, certified January 9, 1997, p. 272.*

21. 1990 FEIR, Volume Two, p. VI.L.6.*

22. City and County of San Francisco, Department of Public Works, Bureau of Water Pollution Control, *Bay Benthic Report*, November 1986.

23. 1990 FEIR, Volume Two, pp. VI.L.9-VI.L.10.*

24. City and County of San Francisco, Department of Public Works, Bureau of Water Pollution Control, *Bay Benthic Report, San Francisco Bay Outfall Monitoring, Southeast-Islais Creek*, November 1986.

25. City and County of San Francisco, Planning Department, *Bayside Discharge Alternatives, Draft Environmental Impact Report*, Planning Department File No. 92.531E, State Clearinghouse No. 93023040, May 20, 1994.*

26. MEC Analytical Systems, Inc., *Results of Laboratory and In Situ Bioassays Conducted at Islais Creek*, June 1997.

27. CH2M Hill, *Bayside Overflows*, prepared for the City and County of San Francisco, June 1979.

28. (a) MEC Analytical Systems, Inc., *Results of Laboratory and In Situ Bioassays Conducted at Islais Creek*, June 30, 1997.

(b) MEC Analytical Systems, Inc., *Sampling and Analysis of Sediment at Islais Creek, San Francisco, CA*, March 25, 1997.

29. Regional Water Quality Control Board (RWQCB), San Francisco Bay Region, *Proposed Regional Toxic Hot Spot Cleanup Plan*, December 1997.

30. 1990 FEIR, Volume Two, p. VI.L.10.*

31. RWQCB, San Francisco Bay Region, *Proposed Regional Toxic Hot Spot Cleanup Plan*, December 1997.

● 31a. Regional Water Quality Control Board, San Francisco Bay Region, *Proposed Regional Toxic Hot Spot Cleanup Plan*, December 1997, pp. 6-9.

● 31b. Regional Water Quality Control Board, San Francisco Bay Region, *Proposed Regional Toxic Hot Spot Cleanup Plan*, December 1997, p. 23.

32. RWQCB, San Francisco Bay Region, *San Francisco Bay Basin (Region 2), Water Quality Control Plan*, June 21, 1995.

33. A point source usually refers to waste emanating from a single, identifiable location, while a nonpoint source usually refers to waste emanating from diffuse locations. Stormwater is considered a nonpoint source, if stormwater is discharged as overland flow, not from an identifiable location such as a pipe.

34. RWQCB, San Francisco Bay Region, Order No. 94-149, NPDES Permit No. CA0037664, Reissuing Waste Discharge Requirements for City and County of San Francisco Southeast Water Pollution Control Plant, October 19, 1994.

35. RWQCB, San Francisco Bay Region, Order No. 95-039, NPDES Permit No. CA0038610, Reissuing Waste Discharge Requirements for City and County of San Francisco, Bayside Wet Weather Facilities Including the North Point Water Pollution Control Plant, San Francisco County, February 15, 1995.

36. RWQCB, San Francisco Bay Region, Order No. 95-039, NPDES Permit No. CA0038610, Reissuing Waste Discharge Requirements for City and County of San Francisco, Bayside Wet Weather Facilities Including the North Point Water Pollution Control Plant, San Francisco County, February 15, 1995, Section 10, p. 3; carried forward from NPDES Order No. 79-67.

37. RWQCB, San Francisco Bay Region, Order No. 95-039, NPDES Permit No. CA0038610, Reissuing Waste Discharge Requirements for City and County of San Francisco, Bayside Wet Weather Facilities Including the North Point Water Pollution Control Plant, San Francisco County, February 15, 1995, Section A.2, p. 7.

38. California Regional Water Quality Control Board, San Francisco Bay Region, Order No. 95-039, NPDES Permit No. CA0038610, Reissuing Waste Discharge Requirements for City and County of San Francisco, Bayside Wet Weather Facilities Including the North Point Water Pollution Control Plant, San Francisco County, February 15, 1995, Section E.5, p. 14.

39. Stormwater Quality Task Force, *Municipal Best Management Practice Handbook*, prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, and Resources Planning Associates, March 1993.

40. The existing regulations are written such that in effect, those areas of the City served by a separated sewer system are exempt from Phase I regulations because they have a population of less than 100,000.

41. Code of Federal Regulations, Title 40, Parts 122 and 123, National Pollutant Discharge Elimination System—Proposed Regulations for Revision of the Water Pollution Control Program Addressing Storm Water Discharges, January 9, 1998.

42. Geoff Brosseau, Executive Director, Bay Area Stormwater Management Agencies Association, memorandum to Daniel Rourke, SF PUC-BERM, March 2, 1998.

43. City and County of San Francisco, Department of Public Works, Office of the Director, Order No. 158170, December 18, 1991.

44. San Francisco Public Works Code, Article 4.1, Sections 118-138, adopted March 17, 1997.*

45. San Francisco Public Works Code, Article 4.1, Sections 118-138, adopted March 17, 1997.*

46. Sanitary-only sewers are sized based on land use wastewater generation rates.

47. The East Bay Municipal Utility District sewer and storm drain system is separated but often acts like a combined system.

48. To determine what proportion of annual average runoff could be accommodated in the combined sewer system from the initial-flow diversion system, the City performed a computer simulation of the proposed system given certain pumping rates and storage volumes, assuming that pumping to the Channel Street box sewer would stop when the sewer was full (see "Methodology for Selection of Initial Flow Design Volume," in Appendix J, Hydrology and Water Quality).

49. City and County of San Francisco, Clean Water Program, "Hydrometeorological Report for the City and County of San Francisco," prepared by Hydroconsult Engineers, Storm "Duration vs. Depth" Frequency Matrix, based on National Weather Service, Federal Office Building Hourly Rainfall for July 1907 - June 1978 (71 years) and the 6-Hour Between Storm Definition, Table 5-4, unpublished.

50. Beth Goldstein, Hydrologic Planning Group, Bureau of Engineering, Department of Public Works, City and County of San Francisco, memorandum to John Bouey, Branch Manager, Lee & Ro, November 10, 1997.

51. Roesner, L. A., E. H. Burgess, J. A. Aldrich, "The Hydrology of Urban Runoff Quality Management," presented at American Society of Civil Engineers (ASCE), Water Resources Planning and Management Conference, New Orleans, LA, May 20-22, 1991, 7 pp.

52. San Francisco Board of Supervisors, Resolution No. 876-96, File No. 53-96-1, adopted September 30, 1996.*

53. San Francisco Public Utilities Commission, *Draft Overview of Wastewater Management Alternatives for Reducing Pollutant Mass Discharge to the Bay*, prepared by CH2M Hill, April 1997.

54. San Francisco Public Utilities Commission, *Draft Overview of Wastewater Management Alternatives for Reducing Pollutant Mass Discharge to the Bay*, prepared by CH2M Hill, April 1997, p. 2-3.

55. 1990 FEIR, Volume Two, pp. VI.L.30 - VI.L.34.*

56. Reclaimed water is highly treated wastewater from the City's sewer system that has undergone an additional level of treatment so that it is acceptable for various non-potable uses. Non-potable water is water that is not safe for human consumption, and non-potable uses are those such as irrigation, toilet flushing, and industrial cooling with minimal human contact.

57. City and County of San Francisco, Public Utilities Commission, Clean Water Program, *Draft Bayside Cumulative Impact Analysis*, March 1998.

58. For the purposes of the Bayside Base Case scenario, the port-owned Ballpark parking area is included as part of the Central Basin because the area will drain to the existing combined sewer system. That area currently drains directly to the Bay, as part of the Bay Basin.

59. City and County of San Francisco, Public Utilities Commission, Bureau of Water Pollution Control - Southeast Plant, *Southeast Water Pollution Control Plant Monitoring Report December 1997*, January 16, 1998.

60. In addition to monitoring effluent quality, San Francisco monitors the quality of treated overflows discharged to near-shore waters of the Bay through overflow structures along the Bay.

61. For the purposes of the Bayside Base Case scenario, the port-owned Ballpark parking area is included as part of the Central Basin because the area will drain to the existing combined sewer system. That area currently drains directly to the Bay, as part of the Bay Basin.

62. City and County of San Francisco, Public Utilities Commission, Southeast WPCP Monitoring Report December 1996, prepared by Thomas J. Franza, Deputy Manager, submitted to Regional Water Quality Control Board, San Francisco Bay Region, January 17, 1997.

63. California Regional Water Quality Control Board, San Francisco Bay Region, Order No. 94-149, NPDES Permit No. CA0037664, Reissuing Waste Discharge Requirements for City and County of San Francisco Southeast Water Pollution Control Plant, October 19, 1994.

64. RWQCB, San Francisco Bay Region, *San Francisco Bay Basin (Region 2), Water Quality Control Plan*, June 21, 1995.

65. David A. Jones, Bureau of Engineering, Department of Public Works, memorandum to Files - Southeast WPCP NPDES Permit, August 9, 1994.

66. David Jones, Environmental Policy Analyst, Bureau of Systems Planning and Regulatory Compliance, San Francisco Public Utilities Commission, personal communication with EIP Associates, March 26, 1998.

● 66a. City and County of San Francisco, *Bayside Overflows*, prepared by CH2M Hill, June 1979.

67. U.S. Environmental Protection Agency, Office of Water, Water Quality Criteria, 1986.

68. Brown and Caldwell, Fresno Nationwide Urban Runnoff Program Project - Fresno Metropolitan Flood Control District - Final Report, May 1984, Table 4-9.

68a. Bay Area Storm Water Management Agencies Association, *San Francisco Bay Area Stormwater Runoff Monitoring Data Analysis, 1988-1995, Final Report*, prepared by Woodward-Clyde, October 15, 1996, Appendix E.

69. Brown and Caldwell, Fresno Nationwide Urban Runoff Program Project - Fresno Metropolitan Flood Control District - Final Report, May 1984, Table 4-9.

70. City and County of San Francisco, *Bayside Overflows*, prepared by CH2M Hill, June 1979.

71. Water Engineering and Modeling, Numerical Modeling of San Francisco Effluent Disharges: Far Field Effects, 1993.

72. United States Environmental Protection Agency, Office of Water Regulations and Standards, *Quality Criteria for Water, 1986*, EPA 440/5-86-001, May 1, 1986.

73. Chronic toxicity data comparisons would be applicable only if undiluted stormwater were to remain in the Bay for as long as 96 hours. In reality, occurrences of stormwater discharges are shorter in duration than chronic toxicity exposures of 96 hours.

74. RWQCB, San Francisco Bay Region, *Proposed Regional Toxic Hot Spot Cleanup Plan*, December 1997.

75. Regional municipal discharge flow data from RWQCB, San Francisco Bay Region, *Water Quality Control Plan*, June 21, 1995, Table 4-9.

76. Beth Goldstein, Bureau of Systems Planning and Regulatory Compliance, San Francisco Public Utilities Commission, memorandum to Hillary Gitelman and Kate Stacy, re: Dry and Wet Weather Flows to San Francisco Bay, March 13, 1998.

77. Regional municipal discharge flow data from RWQCB, San Francisco Bay Region, *Water Quality Control Plan*, June 21, 1995, Table 4-9.

78. San Francisco Estuary Project, *The Effects of Land Use Change and Intensification on the San Francisco Estuary*, August 1992, Figure 2.

79. Beth Goldstein, Bureau of Systems Planning and Regulatory Compliance, San Francisco Public Utilities Commission, memorandum to Hillary Gitelman and Kate Stacy, re: Dry and Wet Weather Flows to San Francisco Bay, March 13, 1998.

80. RWQCB, San Francisco Bay Region, *Proposed Regional Toxic Hot Spot Cleanup Plan*, December 1997.

81. Stormwater Quality Task Force, *Construction Activity Best Management Practice Handbook*, prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, and Resources Planning Associates, March 1993.

82. San Francisco Public Works Code, Article 22, Sections 1200-1210, adopted October 28, 1991.

83. City and County of San Francisco, Planning Department, *San Francisco Recycled Water Master Plan and Groundwater Master Plan Final Environmental Impact Report,* Planning Department File No. 92.371E, State Clearinghouse No. 94123049, certified August 7, 1997.*

84. City and County of San Francisco, Planning Department, *San Francisco Recycled Water Master Plan and Groundwater Master Plan Final Environmental Impact Report*, Planning Department File No. 92.371E, State Clearinghouse No. 94123049, certified August 7, 1997.*

85. 1990 FEIR, Volume Two, p. VI.L.5.*

* A copy of this report is on file for public review at the Office of Environmental Review, Planning Department, 1660 Mission Street, San Francisco.

L. CHINA BASIN CHANNEL VEGETATION AND WILDLIFE

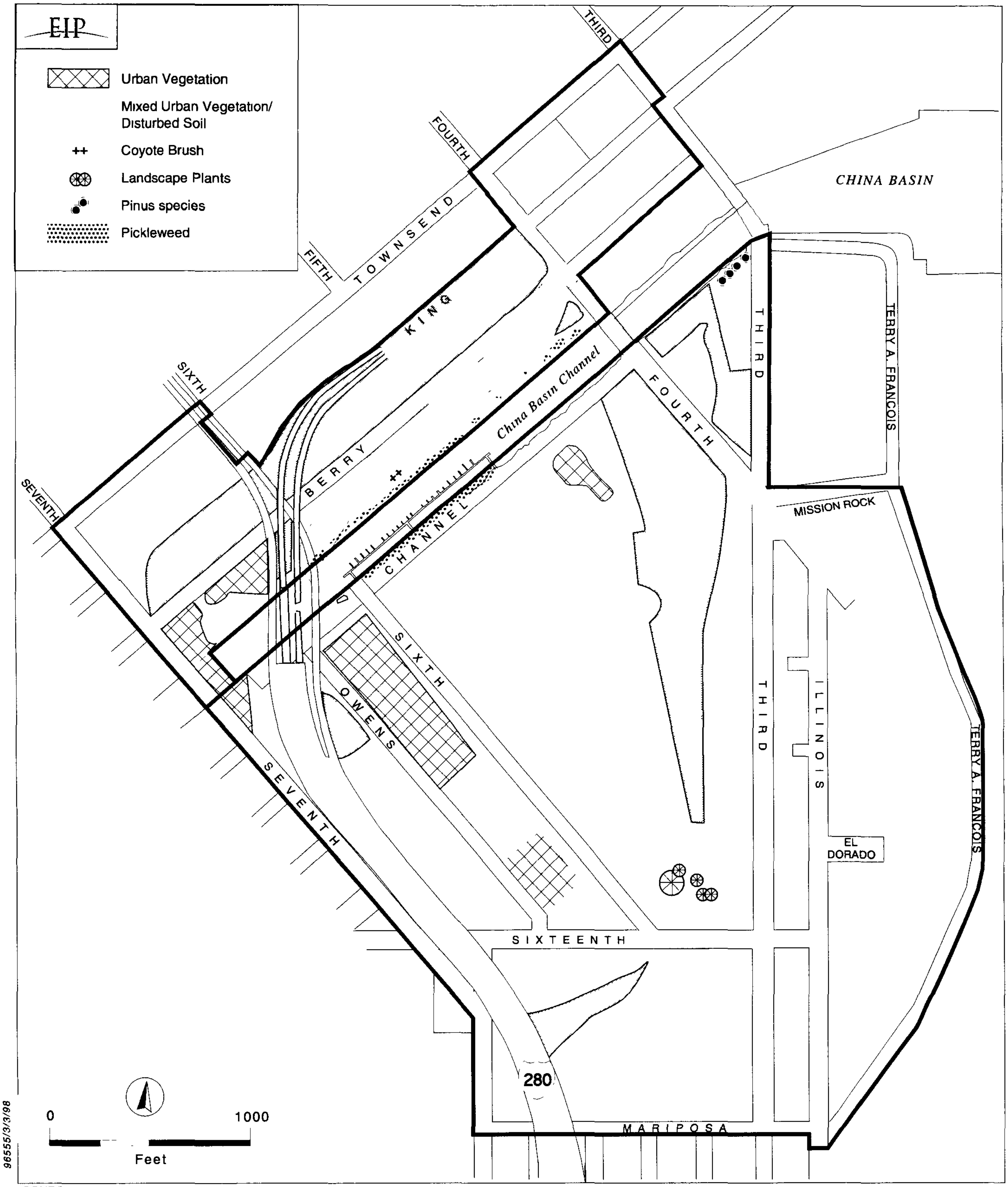
This analysis updates the 1990 FEIR analysis based on changes to the proposed development that have occurred since certification of the 1990 FEIR. The most important differences between the project alternatives analyzed in the 1990 FEIR and the project analyzed in this SEIR that are relevant to biological resources are: 1) the China Basin Channel edge treatments, and 2) a proposed pedestrian bridge at Fifth Street. The 1990 FEIR project proposed that most of the shoreline along the Channel be developed as rock and wire gabions, wooden decking, and concrete walls. The treatment now proposed for the project would be primarily a rock layer with plantings from the high tide line to the top of the bank, three promontories along the northern Channel edge, and primarily salt-tolerant plantings along the southern Channel edge. Storm drain outfalls along the Channel and Bay are now proposed (see "Sewer Infrastructure Improvements," under "Sewers and Wastewater Treatment: Impacts," in Section V.M, Community Services and Utilities, and Figure V.M.7). The 1990 FEIR did not evaluate any pedestrian bridges. The SEIR project proposes a pedestrian swing bridge crossing the Channel at Fifth Street. Finally, the 1990 FEIR discussed construction of substantial wetlands and dredging of the Channel, neither of which is now proposed.

The focus of this vegetation and wildlife analysis is on the effects of the proposed development on aquatic habitats in China Basin Channel and also considers development of two proposed storm drain outfalls on the Bay shoreline. Because the rest of the Project Area is highly urbanized and supports only urban landscaping or ruderal ("weedy") vegetation typical of disturbed areas (shown in Figure V.L.1), impacts of the project on terrestrial habitats of the Project Area were focused out in the Initial Study (see "Biology" in Appendix A, Initial Study). Urban landscaping and ruderal vegetation do not provide any significant habitat because they support only common and widespread plant and animal species adapted to urbanized environments./1/

The endnotes for this section begin on p. V.L.16.

SETTING

This section focuses on the aquatic and wetland habitats of China Basin Channel. China Basin Channel is not part of the Project Area, except for a small amount of water surface area. Treatment of the Channel edges is, however, proposed as part of the project. The Channel encompasses approximately 12 acres. It is an unlined waterway approximately 150 feet wide through most of its length, 430 feet wide at its outlet into San Francisco Bay, and 4,600 feet long, with earthen banks covered with concrete rubble or rip-rap in many areas. Although China Basin Channel itself is generally not part of the Mission Bay Project Area, the Project Area includes approximately 6,200



SOURCE EIP Associates

MISSION BAY SUBSEQUENT EIR

FIGURE V.L.1 EXISTING HABITAT TYPES IN THE MISSION BAY PROJECT AREA

linear feet of the Channel edges and a small amount of surface water area. Although periodically subject to occasional sewer overflows (usually during heavy storm events), the Channel supports a variety of aquatic plants, invertebrates, fish, and foraging water birds, as discussed below. (See "San Francisco's Combined Sewer System," and "Water Quality and Aquatic Biota," in Section V.K, Hydrology and Water Quality: Setting, for discussion of sewer overflows into the Channel.)

VEGETATION

At the Bay entrance to the Channel, immediately east of the Project Area, a marine plant community indicative of ambient Bay conditions occurs on the rocks and pilings. A green alga (*Enteromorpha* sp.)/2/ occurs seasonally in the outer and middle portions of the Channel and is visible at low tide. In June 1997, algae covered almost 100% of the mudflats exposed at low tide. The Channel sides support salt marsh vegetation, including a narrow fringe of native pickleweed (*Salicornia virginica*), approximately 2 to 5 feet wide, which has become established above the high tide line since the Channel was reconfigured by the Mission Bay landfill of the last century. Approximately 6,000 square feet (0.14 acre) of pickleweed occurs on the north bank of the Channel between 200 feet west of Sixth Street and the Peter Maloney (Fourth Street) Bridge, as shown in Figure V.L.1. Approximately 3,900 square feet (0.09 acre) of pickleweed occurs on the south bank of the Channel between 75 feet west of Sixth Street and the houseboat dock entrance near Fifth Street (see Figure V.L.1). Pickleweed is a dominant plant species of the northern coastal salt marsh community, a type of wetland that is considered sensitive because it has generally high wildlife values and has declined drastically in the region.

No pickleweed or other salt marsh wetland vegetation occurs along the Bay shoreline of the Project Area because of existing port development. The Bay shoreline consists of mudflats and open water.

The U.S. Army Corps of Engineers/3/ and the U.S. Environmental Protection Agency/4/ jointly define wetlands as: "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

This definition has been interpreted by the Corps for purposes of wetland delineation/5/ to require three criteria to be designated a wetland: 1) inundation or saturation for at least a portion of the growing season, 2) prevalence of "hydrophytic" vegetation adapted to growing in saturated soils, and 3) the presence of "hydric" soils, meaning those soils that are saturated for long periods resulting in low levels of free oxygen and the presence of iron and other metals in a chemically reduced (unoxidized) state. The pickleweed area on the shoreline of the Channel meets the three criteria because: 1) the pickleweed area is inundated by high tides for varying lengths of time at least twice every 24 hours, 2) the area supports pickleweed which is adapted for life in saturated soil conditions and considered an obligate wetland species/6/, and 3) the Bay muds underlying the pickleweed meet the characteristics of hydric soils as described above and defined by the Corps' *Wetland Delineation Manual*.

All wetlands, regardless of size, origin (natural or artificial) or quality, are codified in the Clean Water Act regulations as one of several "special aquatic sites."/7/ This term is defined as "geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted values. These areas are generally recognized as significantly influencing or positively contributing to the general environmental health or vitality of the entire ecosystem or region." The pickleweed areas on the banks of China Basin Channel meet the definition of wetlands, are a special aquatic site, and are a viable (capable of living and reproducing) wetland habitat used by wildlife for foraging. Evidence of the viability of this habitat is provided by the fact that the wetland plants have remained alive and reproducing and wildlife use has continued since at least 1990, when the habitat was described in similar terms in the 1990 FEIR./8/

On the south shore, non-native iceplant (*Carpobrotus* sp.) is encroaching on the pickleweed near the middle reach of the Channel. The upper Channel banks are vegetated with ruderal (weedy) non-native annual grasses and forbs.

WILDLIFE

The invertebrate, fish, and water-dependent wildlife species present in the Project Area are common to the margins of San Francisco and San Pablo Bays. The estuarine habitat of the Channel is mostly degraded,/9/ and the shoreline habitat is limited in extent. Sampling of the benthic (bottom-dwelling) invertebrate community for this SEIR in July 1997 (Appendix Table K.1) revealed results similar to previous studies from 1979, as documented in the 1990 FEIR./10/ Both studies showed reduced numbers of species and individuals in the upper portion of China Basin Channel (upstream of the Peter Maloney Bridge) when compared to the area closer to the Bay. The predominance of pollution-tolerant mollusks (such as mussels) and burrowing marine worms indicates a degraded ecological condition. Samples taken from the northeastern portions of the Channel near its mouth showed a species composition and density of benthic invertebrates more typical of the San Francisco Bay, including filter-feeding organisms that have low tolerance to pollution. The degraded conditions of the Channel are likely to be primarily a result of historic land uses. Prior to the era of environmental regulations, industrial and sewage wastes were routinely discharged into the waters of most major ports (including China Basin Channel). The pollutants (especially heavy metals) from past activities have accumulated in the sediments where they remain to this day.

The high numbers of grebes, cormorants, herons, and certain species of diving ducks observed in the Channel during previous bird surveys by the Golden Gate Audubon Society and surveys conducted for this SEIR consistently indicate that the Channel may provide important fish habitat. Pacific herring spawn near the mouth of the Channel during the months of December through March. Currently, a local commercial Pacific herring fishery specializes in herring roe. In addition to their economic value, herring are an important species in the ecology of San Francisco Bay because herring, along with sardines and anchovies, are a primary food source for salmon and other sport fish./11/

Fish species observed in China Basin Channel during fish trawl sampling conducted in 1979 were Pacific herring, shiner surfperch, northern anchovy, and speckled sanddab. When a trawl survey was conducted during both low and high tide under the direction of EIP Associates on July 10, 1997, seven fish species were caught in the Channel: northern anchovy, Pacific herring, top smelt, shiner surfperch, jack smelt, Pacific sardine, and walleye surfperch. All of these species, with the exception of Pacific sardine, are common and widespread in the San Francisco Bay. Sardines are somewhat less common, but they are not a rare or protected species, and it is not unusual to find them in the San Francisco Bay./12/

The 1990 FEIR noted that some changes in aquatic ecology from earlier observations are likely over time because wildlife conditions may improve in the inner Channel as a result of the reduction in annual overflows of raw sewage./13/ Because animal populations can be cyclic, based on many environmental factors, and because no conclusions other than a characterization of species composition can be made from only two sets of sampling data (1979 and 1997), these observed increases in the number of fish species and increases in the numbers of individuals in the inner Channel may or may not be related to water quality conditions. No threatened or endangered fish species are known to inhabit the waters of China Basin Channel nor the San Francisco Bay Estuary in the vicinity of the Project Area.

Bird surveys conducted during 20 days in the winter of 1987/1988 by a member of the Golden Gate Audubon Society (for the Mission Creek Conservancy)/14/, along with subsequent surveys performed in the summer of 1997 by EIP Associates for this SEIR, documented the use of China Basin Channel by 61 bird species. Results are given in Appendix Table K.2. The results of both studies are generally consistent in that the bird census data of both studies indicate that a wide range of species is present, although the numbers of individuals of most species are low.

China Basin Channel provides primary habitat for more than two-thirds (68%) of the bird species observed in the Project Area. Relatively high counts of migratory waterfowl and shorebirds indicate the Channel provides resting and foraging habitat (but no breeding or nesting habitat except possibly for common gulls adapted to urban environments) during spring and fall migrations. Waterfowl and shorebirds require a series of stopover sites along their migration routes to rest and forage. Resting and foraging habitat is, however, more available and less critical to water birds than nesting or breeding habitat. The Channel provides a minimal area of resting and foraging habitat for resident and migratory waterfowl, shelter from storms, and limited winter foraging opportunities for fish-eating ducks. Wading birds, including herons and egrets, find limited year-round foraging habitat along the sparsely vegetated sides of the Channel. Caspian and Forster's terns dive for fish. Thus, the Channel meets at least some habitat needs (foraging and resting, but not breeding habitat) of the observed species for at least some period of time.

Most of the bird species observed in the Channel are present in the San Francisco Bay Area during fall and winter, and leave in early spring to breed elsewhere. One species that was sighted frequently, the brown pelican, is listed as endangered by both the state and federal governments. The peregrine falcon, sighted once foraging over the Channel, is listed as endangered by both state and federal agencies. None of these species (or any other birds) were observed to nest in the vicinity of the Channel. From a regional wildlife management perspective, the Channel provides minimal support for wildlife and is not capable of sustaining significant populations of the species observed because of the lack of suitable breeding habitat and contamination in the sediments from historic industrial and sewage discharges.

Small numbers of marine mammals, including the California sea lion (*Zalophus californianus*) and the harbor seal (*Phoca vitulina richardii*), have been observed upstream into the Channel in the vicinity of the houseboats. Neither species is listed under the California or Federal Endangered Species Acts, but both are protected by the Federal Marine Mammal Protection Act. Harbor seals are often found at the mouth of the Channel in larger numbers./15/ The Channel provides resting and limited foraging habitat for these animals, but is not capable of supporting large numbers. The Channel has minimal habitat value, primarily because of contamination from past sewage overflows. No other sensitive mammals are known to occur in the Project Area.

IMPACTS

STANDARDS OF SIGNIFICANCE

A project is considered to have a significant effect on the environment if it would substantially affect a designated rare or endangered species of animal or plant or the habitat of the species; substantially diminish habitat for rare or endangered fish, wildlife, or plants, or interfere substantially with the movement of any resident or migratory fish or wildlife species; result in a substantial loss or degradation of wetlands; or require removal of substantial numbers of mature, scenic trees.

PROPOSED CHINA BASIN CHANNEL EDGE AND BRIDGE TREATMENTS

To understand potential project impacts on vegetation and wildlife, it is necessary to discuss the treatment of the Channel edges and the proposed Fifth Street pedestrian bridge. Figure V.L.2 shows the proposed modifications to the Channel edges. Proposed treatments are conceptual at this time and are subject to refinement or modification through more detailed planning./16/

The northern edge of the Channel between Fourth and Sixth Streets is currently bare ground or mud with a narrow fringe of pickleweed, which provides limited wetland habitat value. This site would be graded slightly to a slope of 4:1 or flatter in certain small areas where scouring has left an escarpment. The project proposes a primarily hard, slope-stabilizing, textured rip-rap system extending upslope from the mean low water line to the mean high water line, with unspecified ornamental plantings above the mean high water line, as shown in Figure V.L.2./17/ (Rip-rap consists of a layer of stones placed irregularly to stabilize or strengthen an embankment.) The rip-rap proposed for the northern Channel edge is intended to stabilize slopes and protect them from erosion where they are currently steeper than 4:1 and scouring is visible./18/ At the top of bank, a paved pedestrian circulation system would parallel the Channel edge. At three locations, promontory areas on pilings would be developed over the Channel bank edge. Both the pedestrian circulation system and the promontory areas are proposed to afford opportunities for passive recreation such as strolling, sitting, socializing, and viewing.

The proposed treatment for both edges of the Channel from Sixth Street to the western end near the Channel Pump Station has not yet been determined. It is likely to take the form of rip-rap because existing Caltrans freeway footings and column supports preclude grading, and shading from the I-280 overpass would limit establishment of vegetation/19/. There is no pickleweed habitat along the southern edge of the Channel from 75 feet west of Sixth Street to the west end of the Channel. The strip of pickleweed habitat on the northern Channel edge ends approximately 200 feet west of Sixth Street and does not extend farther west because of shading and disturbance by freeway construction. The rip-rap treatment between the end of the Channel and Sixth Street would probably eliminate 75 feet of pickleweed habitat on the southern edge of the Channel and 200 feet of pickleweed habitat on the northern edge.

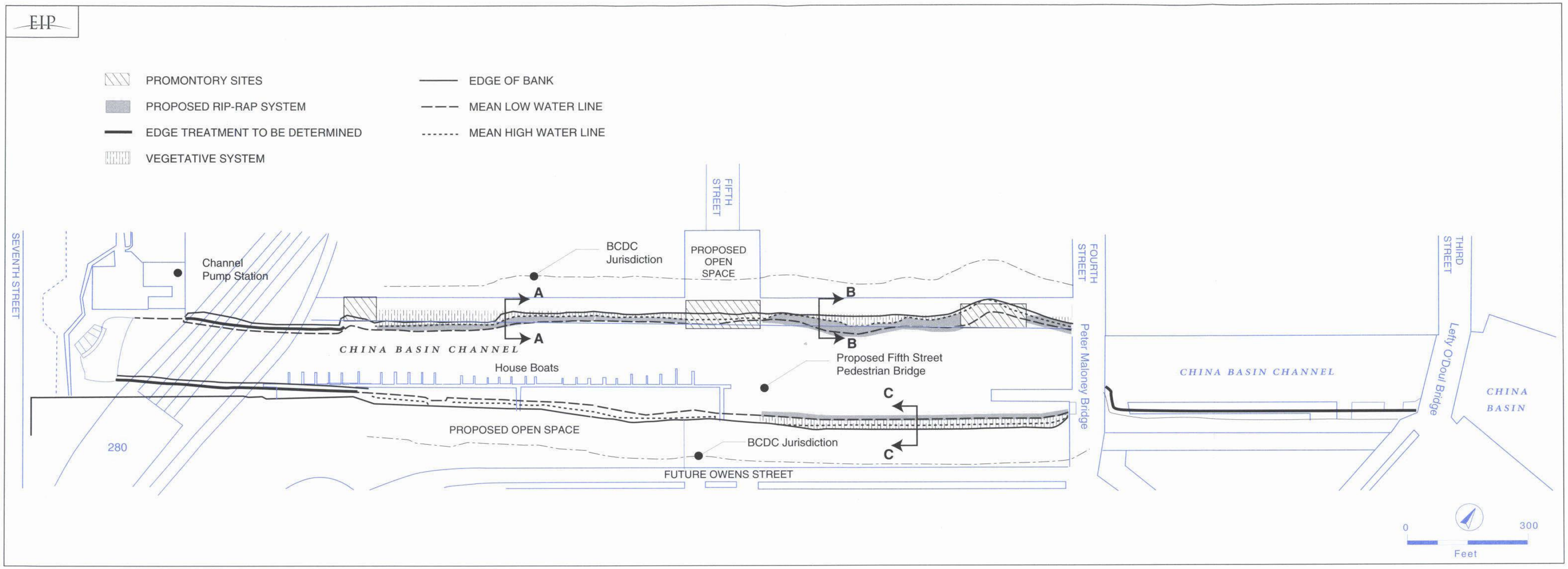
The southern Channel edge between Fourth and Fifth Streets, which is currently unvegetated and covered with loose rubble, would be treated with a vegetative system of salt-tolerant plantings (Figure V.L.2). To protect the toe of the slope from erosion and undercutting, rip-rap would be placed below the vegetative treatment from about 1 foot below the mean low water line to about 1 foot above the mean low water line./20/ Existing concrete rubble would have to be removed to plant this area successfully. Rip-rap is not planned over the entire southern edge slope, as is proposed for the north Channel shore, because the existing slopes are flatter and less scouring is visible.

The southern edge of the Channel between Third and Fourth Streets currently is covered with loose rip-rap and provides no habitat. The treatment for the southern Channel edge between Third Street and Fourth Street would likely be similar to that proposed for the southern edge between Fourth Street and Fifth Street (rip-rap near medium-low water, with salt-tolerant vegetation above the rip-rap).

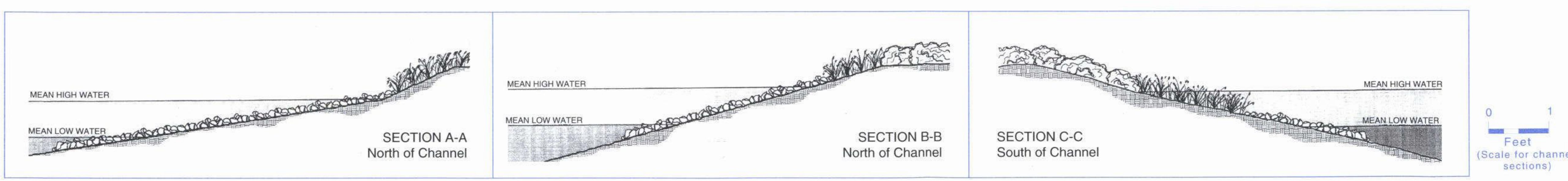
No treatment is proposed for the southern Channel edge between Fifth Street and Sixth Street. This area, where the houseboats are docked, supports a thin strip of pickleweed (Figure V.L.1) with ornamental plantings on top of the bank. This wetland vegetation would remain unaffected by the project.

The proposed Fifth Street pedestrian bridge crossing over the Channel would be approximately 220 feet long with a 10-foot-wide pedestrian walking surface. The bridge would consist of a movable span of approximately 70 feet, with a northern approach span of 30 feet resting on a quay wall (a wall that separates the land from the water) at the edge of the Channel. The 30-foot south approach begins on a similar quay wall and extends by two spans of 50 feet and 70 feet, respectively, to the movable span. The spans would be supported in the water on pier structures embedded in firm strata below the bay mud at least 120 feet deep, or as determined by a detailed geotechnical soils investigation report. The northern approach span would be positioned at the east end of the proposed promontory site on the northern edge of the Channel between Fourth and Fifth Streets. This area is currently bare ground or mud with a narrow fringe of pickleweed. The southern approach span would be positioned on the southern edge of the Channel between Fourth and Fifth Streets. This area is currently unvegetated and covered with loose rubble.

Promontory structures would be built on the northern edge of the Channel at Sixth Street (approximately 60 feet by 100 feet), Fourth Street (approximately 60 feet by 190 feet), and Fifth Street (approximately 60 feet by 250 feet). It is anticipated that they would be built as either wooden or concrete decking or a combination. The Sixth Street promontory would be cantilevered over an existing outfall structure and would not require piles. The Fourth Street promontory would be



SOURCE: Antonia Bava Landscape Architects, Catellus Development Corporation



MISSION BAY SUBSEQUENT EIR

FIGURE V.L.2 PROPOSED MODIFICATIONS TO CHINA BASIN CHANNEL

constructed on one or two rows of piles, each row consisting of 13 to 14 piles. The Fifth Street promontory would use a combination of existing piles and an existing outfall structure for support. About 10 new piles would be required for the Fifth Street promontory.

Piles for the promontories are anticipated to be about 14 inches in diameter, constructed of prestressed, precast concrete. Piles would be driven in near the mean high tide line, in areas outside of the Channel right-of-way and on Catellus-owned property. In the case of the Fourth Street promontory, piles would likely be driven in the water. Approximately one-half of the piles are anticipated to be driven 125 to 130 feet deep to bedrock. This would provide an estimated 50-ton bearing capacity. Old piles that constitute hazards or obstructions would be removed. These have not been fully surveyed, but based on preliminary surveys, it is anticipated that all piles located in intertidal zones would be removed.

LOSS OF SALT MARSH WETLAND HABITAT

State/21/ and federal/22/ wetland policies call for "no net loss" of wetlands or wetland functions. The state policy goes beyond that by citing the intent of the State Legislature/23/ to increase wetland acreage by 50 % by the year 2000. These policies reflect the high values of wetland habitat, and the minimal remaining extent and quality of wetlands due to past losses. The project would replace a total of approximately 5,880 square feet (0.13 acre) of northern coastal salt marsh (pickleweed) wetland habitat on the north bank of the Channel, between 200 feet west of Sixth Street and the Peter Maloney (Fourth Street) Bridge and approximately 375 square feet (0.01 acre) of salt marsh on the south bank from Sixth Street to 75 feet west of Sixth Street, with a proposed rip-rap, hard-edge treatment. Installation of two proposed suction inlets for fire-fighting water supply on the north edge of the Channel near Fifth Street and Sixth Street would also have the potential for impacting salt marsh vegetation if they were not sited carefully. Construction of the proposed Fifth Street pedestrian bridge, the proposed fire-fighting suction inlets and two storm drain outfalls on the south edge of the Channel would not contribute an additional loss of northern coastal salt marsh wetland habitat in excess of what is being removed for the Channel edge treatments as discussed above. Construction of two proposed storm drain outfalls on the San Francisco Bay shoreline near Pier 52 and Pier 54 would also not impact salt marsh wetland habitat because none occurs there. The loss of even a small amount of northern coastal salt marsh wetlands or other special aquatic sites would cause a net loss of wetland area and functions, contrary to state and federal policies. Mitigation Measure L.1 in Section VI.L, Mitigation Measures: China Basin Channel Vegetation and Wildlife, addresses this impact.

If the outfalls proposed in the Bay and Channel were not designed properly, however, there would be a potential for losses of mudflat or bottom habitat for benthic organisms from scouring, as well as associated increases in turbidity.

Grading of the banks, placement of a rip-rap system for shore protection, and placement of pilings to support promontories, pivot piling to support a proposed swing pedestrian bridge at Fifth Street and the bridge itself, as proposed, and construction of suction inlets and stormdrain outfalls would require permits. As discussed in "Bay Conservation and Development Commission," in Section V.A, Plans, Policies, and Permits: Comparison with Existing Plans and Policies, the proposed Channel treatments and pedestrian bridge would require a BCDC permit because the placement of rock rip-rap, pilings, promontories, and bridge quay walls would constitute Bay fill. Placement of rip-rap, pilings, bridges, or other structural members in or over navigable waterways, such as the Channel, would require a permit under Section 10 of the Federal Rivers and Harbors Act. Grading, placement of rip-rap, or other discharges of fill materials below the high tide line would require a permit under Section 404 of the Federal Clean Water Act./24/ Section 404 of the Clean Water Act and implementing final rules/25/ require that a permit be obtained before placing fill in "waters of the United States," which include tidal waters below the high tide level and adjacent wetlands. Fill is defined as any material deposited which would change the bottom profile of the waterbody. Although a system of General Permits (Nationwide and Regional) exist to streamline permitting for specified activities believed to have minimal impacts, the proposed Channel edge rip-rap treatment does not meet the criteria for inclusion under any of these General Permits. Nationwide Permit 13 covers bank stabilization activities if the activity is less than 800 feet in length, but the proposed rip-rap system exceeds this by over 1,000 feet. Therefore, the proposed fill of areas below mean high water or adjacent wetlands with rip-rap would likely require an Individual Section 404 Permit.

Individual Section 404 Permits may be conditioned or denied based on substantive standards provided by the U.S. Environmental Protection Agency Clean Water Act Section 404(b)(1) guidelines and the U.S. Army Corps of Engineers' public interest review regulations. The 404(b)(1) guidelines require the evaluation of practicable upland alternatives to filling wetlands. The guidelines require that impacts of filling be fully analyzed and establish procedures that would apply to the proposed Channel edge treatments to minimize impacts through mitigation./26/ The Corps' public interest review regulations also require that impacts on fish and wildlife habitats (among other factors) be assessed and provide the District Engineers with authority to impose permit conditions to mitigate those impacts./27/ A condition of the 404 permit also requires water quality certification or a waiver from the San Francisco Bay Regional Water Quality Control Board (RWQCB) in accordance with Section 401 of the federal Clean Water Act. The RWQCB has recently been recommending replacement of wetland habitat at a ratio of 2 acres created to 1 acre lost in accordance with state wetland policy./28/

The loss of salt marsh wetland habitat would be a significant impact; Mitigation Measures L.1 and L.2 in Section VI.L, Mitigation Measures: China Basin Channel Vegetation and Wildlife, address this impact.

TURBIDITY AND RESUSPENSION OF CONTAMINATED SEDIMENTS

Suspension of sediments in the water column (turbidity) is a form of pollution even if the sediments are not otherwise contaminated. High amounts of turbidity can significantly degrade aquatic ecosystems. Turbidity can clog the gills of fish and other aquatic organisms, smother their spawning grounds and other bottom habitats, and kill vegetation by blocking sunlight. In addition, contaminants from historic industrial and sewage discharges concentrate over time in sediments by adsorbing onto the surfaces of individual particles as discussed in "Effects of Mass Pollutant Emissions on Sediment Quality," under "Construction Activity Pollutants" in Section V.K, Hydrology and Water Quality: Impacts.

Turbidity from Construction Activities

Any proposed grading, pile driving or removal, removal of rubble, construction of storm drain outfalls, suction inlets, use of large barges or tugboats to deliver equipment or materials, or other disturbance on the Channel edges or Bay outfall locations that extends below the water line or in the middle of the Channel would likely stir up bottom sediments and cause them to be resuspended in the water column. See "Effects of Mass Pollutant Emissions on Sediment Quality," in V.K, Hydrology and Water Quality: Impacts, for a discussion of changes in sediment quality due to water quality changes. Without mitigation, sediment resuspension in China Basin Channel or the Bay outfall locations could increase turbidity and concentrations of contaminants and potentially toxic substances in the water at the mouth of the Channel and, potentially, the open waters of San Francisco Bay, exacerbating an existing condition./29/ Contaminants from resuspended sediments could more readily enter the food chain through accumulation by benthic invertebrates and fish which are eaten by water birds and marine mammals./30/ Resuspension could increase contaminant levels to the point that they would be directly lethal to aquatic organisms, or contaminants could progressively bioaccumulate at non-lethal levels in lower organisms, such as benthic invertebrates and small fish, to reach concentrations that would eventually be lethal to organisms higher in the food chain, such as larger fish, water birds, and marine mammals. Without mitigation, this contamination could adversely affect certain beneficial uses of the Channel and Bay, including spawning of Pacific herring in the Bay and China Basin. Resuspension of contaminated sediments by this and other projects could cumulatively contribute to the death of animals such as brown pelicans, California sea lions, and harbor seals, protected under the Federal and State Endangered Species Act and the Marine Mammal Protection

Act. Turbidity and resuspension of contaminated sediments would be significant impacts; Mitigation Measures L.3 and L.4 in Section VI.L, Mitigation Measures: China Basin Channel Vegetation and Wildlife, and Mitigation Measure K.1 in Section VI.K, Mitigation Measures: Hydrology and Water Quality, address this impact.

Removal of old piles could occur typically by cutting them at the mudline (and leaving a stub under the mud) or by complete extraction. Complete extraction of the piles would cause temporary, but potentially substantial, turbidity in the water, and could disturb or destroy benthic organisms at each pile site. Cutting piles at the mudline would minimize disturbance of the bottom sediments. Both removal methods would permanently destroy sessile organisms that may be attached to the piles. When design plans for removal are finalized, they would be submitted to BCDC for approval before the piles are removed. Complete extraction of piles would be a significant impact (Mitigation Measures L.5 and L.6 in Section VI.L, Mitigation Measures: China Basin Channel Vegetation and Wildlife, address this impact). See "Loss of Salt Marsh Wetland Habitat," earlier in this section, for a discussion of the BCDC and Corps permits that would be required for the Channel-edge treatments.

The piles proposed for removal are likely preserved in creosote because creosote was used historically to prevent pileworms and other biotic growth from degrading wooden piles. Creosote is toxic to many kinds of aquatic biota. Removal of piles from the Channel could re-suspend small amounts of creosote in the aquatic environment with consequent adverse effects on beneficial uses. It is anticipated that all piles located in intertidal zones would require removal. On balance, removal of existing piles would pose a long-term benefit in that creosote-covered piles would be permanently replaced by inert, non-toxic precast concrete piles. The concrete piles would replace and add habitat for sessile marine organisms that attach themselves to structures and rocks.

Turbidity From Barge and Tugboat Activity

Barges moved by tugboats could be used to deliver equipment and building materials during building construction, construction of the proposed Fifth Street pedestrian bridge and other Channel edge improvements. Due to the shallow depth of China Basin Channel, the propellers of the tugboats would create currents (propwash) that could scour material from the bottom of the Channel and resuspend it, increasing turbidity. The implications for aquatic life would be the same as those previously described for turbidity caused by other construction activities in the Channel.

The amount of propwash that would induce resuspension of material depends on the speed of the propeller and its depth below the surface of the water. Most resuspended sediments would be carried away by currents and would re-deposit in areas of reduced current flow, either upstream of the construction site in the Channel or in nearby areas of San Francisco Bay. The turbidity and re-deposition of sediments from tugboat and barge activity would be considered a significant impact. Mitigation Measure L.4 in Section VI.L, Mitigation Measures: China Basin Channel Vegetation and Wildlife, addresses this impact.

DISRUPTION OF AQUATIC WILDLIFE (WATER-DEPENDENT BIRDS AND MAMMALS)

The value of the Channel habitat as a sheltered resting place for migratory water birds and marine mammals (seals and sea lions) could be adversely affected by construction and operation of the project. Construction-related noise such as noise from pile-driving could cause temporary abandonment of the Channel by resting or foraging waterbirds and mammals. During EIP surveys of the Channel for this SEIR, however, the occurrence and behavioral patterns of water birds and marine mammals did not appear to be substantially affected by seismic retrofit and construction of the I-280 freeway overpass at the west end of the Channel.

Human disturbance in the Channel area after build-out of the project could also result in displacement of water birds or mammals from China Basin Channel because of the addition of up to about 30,000 employees, about 11,000 residents, and other visitors in the Project Area, and resulting higher levels of human presence, litter, noise, pets, and potential harassment of wildlife. The proposed Fifth Street pedestrian bridge would enable an increased number of people to be closer to the Channel than is possible without the bridge. An increased number of people could result in increased opportunities and probability for wildlife harassment and additive wildlife displacement beyond what could occur without the bridge. Studies have been conducted that demonstrate that harassment of wintering water birds by people and their pets can result in losses of feeding opportunities, leading to reproductive failure during the next breeding season./31/

This potential impact must be analyzed in site-specific terms, by considering such factors as accessibility, habitat functions and extent, and the availability, location, and extent of similar habitat. For example, if habitat providing similar functions is available near the habitat affected, and is large enough to accommodate wildlife displaced from the impacted habitat, then impacts may not be significant./32/ China Basin Channel provides resting and feeding habitat for aquatic wildlife, but not nesting or breeding habitat. Feeding habitat for birds and marine mammals that eat fish, benthic invertebrates, and mollusks is prevalent in the San Francisco Bay in the immediate vicinity of the Channel. The open waters of the Bay provide ample opportunities for foraging on fish, and large expanses of mudflats on the nearby Bay shoreline provide benthic invertebrates for shorebirds. Because of their more exposed nature, these areas do not provide the same quality of resting habitat that is sheltered from unusually high tides, storms, and currents, as does China Basin Channel. The

Islais Creek Channel, on the other hand, provides similar, sheltered, resting habitat nearby (about 2 miles away) for mobile species such as birds and marine mammals. It also provides more habitat area than occurs in China Basin Channel. (Islais Creek Channel is from 325 to 650 feet wide and about 5,000 feet long.)

In summary, from a regional wildlife management perspective, the potential harassment and/or displacement of aquatic wildlife, primarily birds and marine mammals, does not constitute a significant effect. While some individuals could be displaced, including additive displacement as a result of the Fifth Street pedestrian bridge, it is not likely that displacement or harassment would result in mortality because suitable resting and foraging habitat is available nearby. This impact would not jeopardize the viability of populations of those species in the region.

It should be noted that harassment of endangered species or marine mammals is illegal and therefore mitigated by existing laws. Harassment of common wildlife species would not be likely to result in mortality or displacement because common animals are sensitive primarily during breeding activities, and there is no breeding habitat in the Channel. Therefore, impacts from increased human activity are considered less than significant.

As discussed in "Near-Shore Effects," in Section V.K, Hydrology and Water Quality, increases or changes in treated combined sewer overflows and stormwater discharges from the project or from cumulative development would not cause significant impacts on water quality or on benthic and aquatic biota in the Bay or in the near-shore waters, including China Basin Channel and Islais Creek.

Phasing of Development

Channel edge treatments, including viewing promontories, open space and park improvements would be developed in phases, as adjacent buildings were designed and constructed, as discussed in "Concept of 'Adjacency'" and "Open Space," under "Phasing of Construction of Infrastructure and Improvements in the Project Area," in Section III.B, Project Description. Impacts on wetlands or aquatic organisms from Channel edge treatments or other construction in the Channel would occur gradually during the development period, as described in the Impact subsection above.

Interim Uses

Channel edge treatments are not triggered by interim uses but instead will be constructed with adjacent, permanent development. Stormwater runoff from interim parking lots containing contaminants primarily from automobiles such as oil and grease, would flow into a detention basin for metered discharge into the City's sewage treatment system. See "Phased Development and Interim Uses," in Section V.K, Hydrology and Water Quality for a discussion of interim drainage plans and their effects on water quality.

NOTES: China Basin Channel Vegetation and Wildlife

1. See "Biology" in Appendix A, Initial Study.

2. Italicized names in parentheses are the scientific (Latin) names for flora and fauna. The abbreviation "sp." means one of various possible species of the genus named.

3. Code of Federal Regulations, Title 33, Section 3283(b), as of July 1, 1996.

4. Code of Federal Regulations, Title 40, Section 230.4(t), as of July 1, 1996.

5. U.S. Army Corps of Engineers, *Wetlands Delineation Manual*, Environmental Laboratory, 1987.

6. P.B. Reed, Jr., National List of Plant Species That Occur in Wetlands: California [Region 0], US Fish and Wildlife Service Biological Report 88, 1988.

7. Code of Federal Regulations, Title 40, Section 230.41, as of July 1, 1996.

8. San Francisco Planning Department, *Mission Bay Final Environmental Impact Report*, Planning Department File No.86.505E, State Clearinghouse No. 86070113, certified August 23, 1990, Volume Two, p. VI.M.1.*

9. 1990 FEIR, Volume Two, p. VI.M.1.*

10. 1990 FEIR, Volume Four, pp. VI.M.4-VI.M.5.*

11. *Estuary*, "Herring Pickles," Vol. 6, no. 3, June 1997.

12. C. Ryan, Fisheries Biologist, California Department of Fish and Game, telephone conversation with EIP Associates, August 18, 1997.

13. 1990 FEIR, Volume Four, pp. VI.M.4-VI.M.5.

14. Alan Hopkins, Mission Creek Channel Bird List, September 29, 1987 - February 26, 1988. Survey conducted for the Golden Gate Audubon Society. (Verified independently by EIP Associates wildlife biologists.)

15. 1990 FEIR, Volume Two, p. VI.M.3.*

16. Antonia Bava, Principal, Antonia Bava Landscape Architects, memorandum to EIP Associates, August 4, 1997.

17. Antonia Bava, Principal, Antonia Bava Landscape Architects, memorandum to EIP Associates, October 13, 1997.

18. Antonia Bava, Principal, Antonia Bava Landscape Architects, telephone conversation with EIP Associates, October 1, 1997.

19. Antonia Bava, Principal, Antonia Bava Landscape Architects, telephone conversation with EIP Associates, August 18, 1997.

20. Antonia Bava, Principal, Antonia Bava Landscape Architects, telephone conversation with EIP Associates, August 18, 1997.

21. Fish and Game Commission Wetlands Resources Policy, amended August 4, 1994.

22. J. Hendricks, Chief of South Coast Section, Regulatory Branch, U.S. Army Corps of Engineers, telephone conversation with EIP Associates, July 19, 1997.

23. California State Senate Concurrent Resolution 28, January 1, 1983.

24. J. Hendricks, Chief of South Coast Section, Regulatory Branch, U.S. Army Corps of Engineers, telephone conversation with EIP Associates, July 19, 1997.

25. Code of Federal Regulations, Title 33, Part 323, as of July 1, 1996.

26. Code of Federal Regulations, Title 40, Subpart H, Section 230.70, as of July 1, 1996.

27. Code of Federal Regulations, Title 33, Part 325, as of July 1, 1996.

28. C. Bean, Biologist, California Department of Fish and Game, telephone conversation with EIP Associates, July 19, 1997.

29. Aquatic Habitat Institute, Philip Williams & Associates, Ltd. "San Francisco Estuary Project, Status and Trends Report on Dredging and Waterway Modification in the San Francisco Estuary," March 29, 1990.

30. City and County of San Francisco, Planning Department, *San Francisco Giants Ballpark at China Basin Final Environmental Impact Report*, Planning Department File No. 96.176E, State Clearinghouse No. 96102056, certified June 26, 1997, Volume One, p. IV.313.*

31. C. Bean, Biologist, California Department of Fish and Game, telephone conversation with EIP Associates, July 19, 1997.

32. C. Bean, Biologist, California Department of Fish and Game, telephone conversation with EIP Associates, July 19, 1997.

* A copy of this report is on file for public review at the Office of Environmental Review, Planning Department, 1660 Mission Street, San Francisco.

M. COMMUNITY SERVICES AND UTILITIES

This section discusses Fire Protection, Police Protection, Public Health Services, Recreation and Parks, Schools, Solid Waste, Water Supply, Sewers and Wastewater Treatment, Energy Transmission Capacity and Infrastructure, and Telecommunications. Although the scope and characteristics of the proposed project differ from the alternatives analyzed in the 1990 FEIR, there are some similarities between Alternative A of the 1990 FEIR and the proposed project. For example, Alternative A from the 1990 FEIR included approximately 7,700 planned dwelling units and 25,000 projected employees/1/, compared to approximately 6,000 planned dwelling units and 30,000 projected employees for the proposed project analyzed in this SEIR./2/ Information from the 1990 FEIR has been incorporated by reference and is summarized when appropriate for each topic. In addition, relevant information for each topic has been updated and new information added when necessary to accurately describe the provision of services.

The organization of this section is different from the other Setting and Impact sections in this SEIR in that the Impact subsection follows the Setting subsection for each topic. The "Standards of Significance" discussion below applies to each of the topics. The endnotes for this section begin on p. V.M.56.

STANDARDS OF SIGNIFICANCE

The City has no formally adopted significance standards for potential impacts related to community services or public utilities. A project's demand for additional public services or utilities is not itself considered a significant environmental impact. However, to the extent that the demand may result in the expansion or construction of new utilities or community service facilities, the proposed project would be considered to have a significant effect on the environment if the new or expanded public facilities were in turn to result in a significant effect on the environment.

FIRE PROTECTION

SETTING

The 1990 FEIR described fire protection citywide and in the Mission Bay Project Area. Fire protection for the Project Area is provided by the San Francisco Fire Department (SFFD). Many aspects of the service provision for the proposed project are the same as they were for the 1990 FEIR./3/ The only important change is that the station at 416 Jesse Street has closed, and the units that were housed there have been moved to 676 Howard Street, which is now Station No. 1.

The SFFD consists of about 1,500 uniformed and 90 non-uniformed (civilian) personnel./4/ Fire department resources include engine companies, truck companies, rescue squads, fire boats, and other special purpose units./5/ These companies are organized into three divisions that are further divided into 10 battalions.

As shown in Figure V.M.1, the Project Area is located entirely within the Battalion 3 service area. This service area also includes the South of Market area and a small area north of Market Street between Union Square and Civic Center. The service area has an approximate western border of Seventh Street for Mission Bay North and Ninth and De Haro Streets for Mission Bay South, and has a southern border of 18th Street. The proposed project would overlap Division boundaries, with most of the proposed project in Division 1, and the southern part of the Mission Bay South Redevelopment Area (south of 16th Street) in Division 3.

Adjacent to the Project Area is China Basin Channel, Mission Creek Houseboat Marina, and various other maritime-related uses. The Port of San Francisco Fire Marshal conducts pier inspections and investigates fires, hazardous material incidents, and other emergencies occurring on port property./6/ The U.S. Coast Guard assists the SFFD along the waterfront and China Basin Channel when requested.

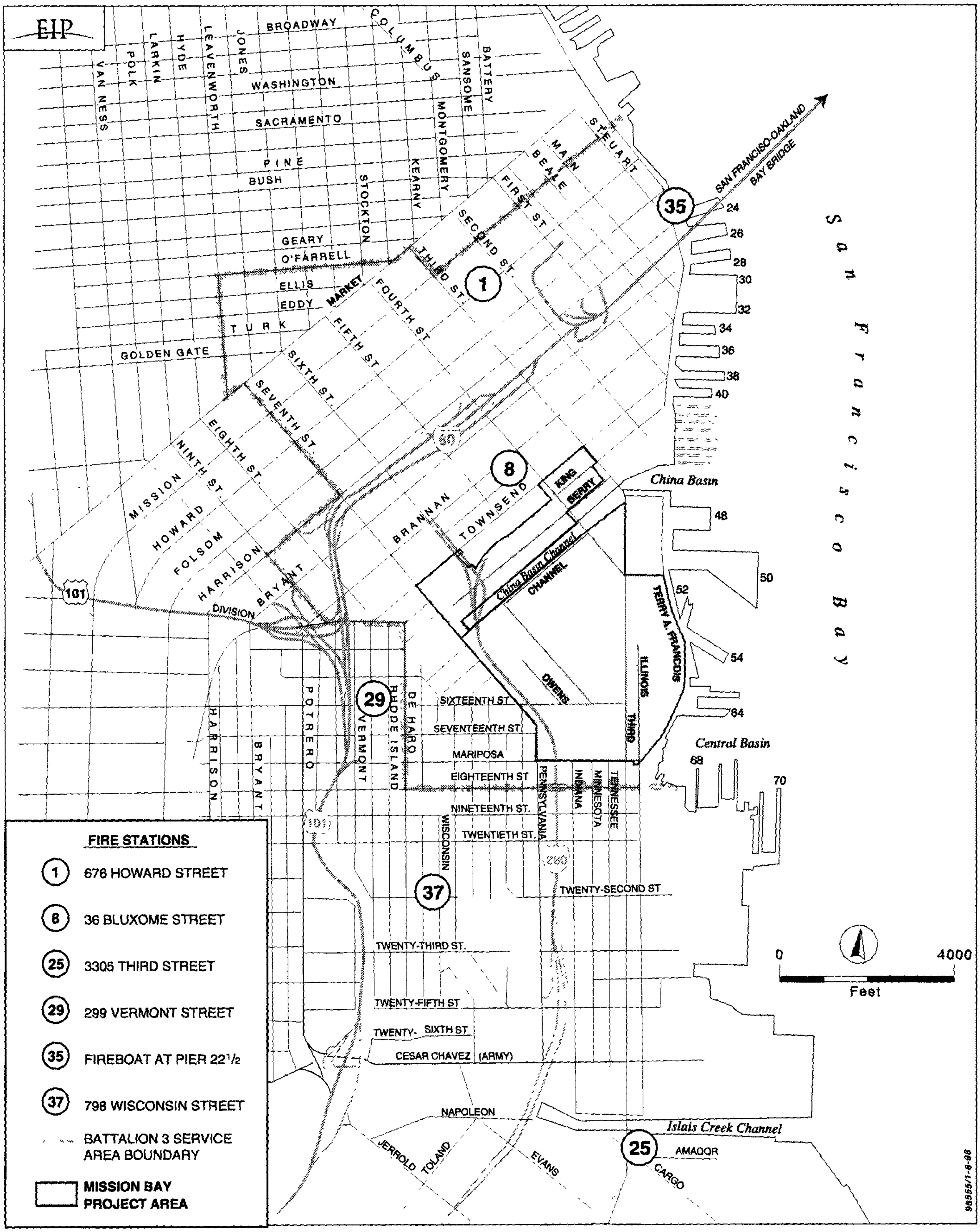
During fiscal year 1995-1996, the SFFD responded to a citywide total of 57,112 calls./7/ First response to a call from the Project Area comes from the closest station, which varies depending on the exact street location of the call. The closest station would likely be one of the following, as shown in Figure V.M.1:

- Station No. 1, 676 Howard Street
- Station No. 8, 36 Bluxome Street
- Station No. 25, 3305 Third Street
- Station No. 29, 299 Vermont Street
- Station No. 35, fireboat at Pier 22½
- Station No. 37, 798 Wisconsin Street

If the closest station is unable to respond, back-up comes from the next closest company./8/ The SFFD's targeted response time to fire and medical emergency calls is three minutes. The current average response time is slightly higher, but is considered acceptable./9/ The Fire Department is working to improve response times./10/

Hazardous Materials Response

The SFFD has a Hazardous Materials Response Unit that provides emergency response to incidents involving hazardous materials. The Hazardous Materials Response Unit (Haz Mat 1) is staffed by



SOURCE: EIP Associates, San Francisco Fire Department

MISSION BAY SUBSEQUENT EIR

FIGURE V.M.1 EXISTING FIRE STATIONS NEAR THE PROJECT AREA

members of Engine Company 36, and is housed at Station No. 36 on Oak Street, near the Civic Center. The Hazardous Materials Unit provides immediate response to chemical and biological spills at the request of a Fire Department Incident Commander or other city agency, and works in cooperation with the Department of Public Health. During fiscal year 1995-96, the SFFD responded to 179 hazardous materials calls. Of these calls, 15 (8.4%) were in the Battalion 3 area./11/

Fire-Fighting Water Supply

The fire-fighting water supply for the City and County of San Francisco includes both low-pressure and high-pressure water distribution systems. The low-pressure system serves the entire City and is the same as the drinking water supply distribution system. (See the discussion below under "Water Supply: Setting.") The high-pressure system, sometimes referred to as the Auxiliary Water Supply System (AWSS), is a specially dedicated system used only for fire-fighting. The high-pressure system can handle more volume, delivers water at a pressure of 10,000 gallons per minute (gpm), compared to 1,000 gpm that can be provided by the low-pressure system/12/, and can withstand seismic damage better than the low-pressure system./13/

In the Project Area, the high-pressure system is located under Third Street and around the perimeter of the Mission Bay Project Area./14/ Fire-fighters also have access to water from the Bay for fire-fighting purposes at specially installed suction connections. Water supply for the Project Area is discussed further under "Water Supply," below.

IMPACTS

The proposed project would increase demand on the San Francisco Fire Department. The number of incidents would be expected to increase as the number of dwelling units and office, research and development, commercial and retail uses in the area increase.

Fire Department personnel requirements would be expected to increase according to similar multipliers as described in the 1990 FEIR, despite the difference in the extent of development between the proposed project and the project alternatives analyzed in the 1990 FEIR./15/ The 1990 FEIR calculated staffing demands based on a five-step procedure. Briefly summarized, this procedure: 1) projected the number of incidents in the Project Area based on land use; 2) determined the average time to service a fire and non-fire incident for each land use category; 3) multiplied the projected number of incidents by the appropriate service time developing projections for fire service demands in terms of service time; 4) estimated the demand for additional fire service units based on average service time provided by engine and truck companies; and 5) estimated the number of personnel required to staff those units, conduct building inspections, and provide managerial and support services based on new commercial square footage./16/

The 1990 FEIR determined that in order to maintain the current level of fire protection in the Project Area, additional personnel, equipment, and a facility to house them would be needed. The amount of additional resources would vary depending on the alternative. For Alternative A, which consisted of a number of dwelling units (7,700) and projected employees (25,000) similar to the proposed project (6,090 and 30,000, respectively), the additional resources required would have included an engine company and the appropriate number of personnel to staff it, a truck company and appropriate personnel, and rehabilitation of closed Fire Station No. 30 or construction of a new station to house new personnel and equipment. Demand for these new resources was expected to occur over time as the project was built.

According to SFFD estimates and their review of the 1990 FEIR, the proposed project would generate similar personnel, equipment, and facility needs as for the alternatives analyzed in the 1990 FEIR. SFFD staff anticipate the need for a new engine company early on as development in the Project Area begins, and a new truck company later on. In addition, they foresee the possible need for a new rescue company to respond to hazardous materials incidents with the Hazardous Materials Unit. A new station would be required to house any new staff and equipment, including the Hazardous Materials Unit./17/

Development of a new fire station within the Project Area, south of China Basin Channel, would facilitate emergency access in the event of an earthquake. While emergency access from the west would be less likely to be a problem than assessed in the 1990 FEIR based on seismic upgrade of the elevated I-280 freeway structure, access from the north could be difficult without a station south of the Channel if one or both of the bridges that cross China Basin Channel were damaged or obstructed and access from the west could be difficult if any of the three underpasses under I-280 were obstructed. (See "Exposure of Concentrated Populations to Seismic Hazards" in Section V.H, Seismicity: Impacts, for further discussion.)

Another factor inhibiting emergency access to Mission Bay South from the north would be traffic associated with ballgames and special events at Pacific Bell Park. This new ballpark is under construction on King Street across Third Street, adjacent to the Project Area. Traffic before and after events is expected to cause jammed conditions on streets in Mission Bay near the ballpark site, making access for emergency vehicles more difficult for a few hours on large event and game days. For further discussion of traffic impacts, see "Impact of the New Giants Ballpark at China Basin" in Section V.E, Transportation: Impacts.

The proposed project includes 1.26 acres of land adjacent to the existing Fire Station No. 30 (which is no longer in service) to be given to the City for police and fire stations. Combined with the existing fire station, the total site would be approximately 1.5 acres. Potential impacts created by the construction and operation of a new fire station are included in the overall analysis of the proposed project contained in this SEIR. According to the San Francisco Fire Department, this would be a good location for a new station because it is located south of the Lefty O'Doul and Peter Maloney Bridges./18/ Funds would be contributed toward the construction of a fire station./19/ It is undetermined at this time whether there would be proceeds remaining to provide for additional Fire Department personnel and equipment to be housed in the proposed fire station. The addition of a large residential and commercial population south of the Channel without provision of Fire Department equipment located south of the Channel to serve this new community in the event of a major emergency would result in a potentially significant impact. Mitigation Measure M.6 in Section VI.M, Mitigation Measures: Community Services and Utilities, addresses this impact.

Hazardous Materials Response

Development of the UCSF biomedical instruction and research site and adjacent development of private research facilities, light industrial, and commercial uses would result in additional hazardous materials incidents and additional inspection requirements./20/ This would create additional workload for the SFFD Hazardous Materials Unit, which may require additional personnel and equipment. See "Emergency Response Capabilities" under "Other Issues" in Section V.I, Health and Safety: Impacts, for more information.

Fire-Fighting Water Supply

Proposed expansion of and improvements to the high-pressure (AWSS) water system are discussed below under "Water Supply: Impacts."

POLICE PROTECTION

SETTING

The 1990 FEIR discussed police protection provided by the San Francisco Police Department (SFPD), and analyzed staffing required to maintain the current citywide level of police protection in the Project Area. Since that analysis was done, the police district boundaries have changed. The Mission Bay North area is in the Southern District, which is served by the Southern Station. The Southern Station is located at 850 Bryant Street, which is approximately 1/4 mile from Mission Bay North at its closest point, and almost 1 mile away from the farthest point at the northeast corner. The Southern Station has 101 officers and is responsible for the South of Market neighborhood as well as Mission Bay North. All of Mission Bay South is now in the Bayview District, which is served by the Bayview Station. The Bayview Station is located at 201 Williams Street, which is just over 2½ miles from the southernmost tip of the Mission Bay South area, and almost 3½ miles from the northernmost point. The Bayview Station has 87 officers, and serves the area from China Basin Channel in the north to the city and county line in the south, including the Mission Bay South area, Potrero Hill, South Bayshore, Bayview/Hunters Point, and Candlestick Point.

Calls to the San Francisco Police Department are classified as either Priority A or Priority B. Priority A calls deal with life-threatening situations, severe assaults, and crimes in progress. Priority B calls concern urgent situations where the crime has already occurred. Total calls for service in 1996 and average response times for each district compared to citywide calls and response times are shown in Table V.M.1. As shown in the table, average response times for both the Southern and Bayview Districts were slightly shorter than average response times citywide in 1996.

The Project Area is currently an industrial area. The main issue noted by the Police Department is the homeless population located there./21/ As of the end of December 1997, citywide crime rates for 1997 were down 5.88% from last year. Crime rates are also down 8.89% from last year in the Bayview District. In the Southern District the year-to-date crime rate is up 1.75%./22/

It is more likely that the Project Area would remain accessible to police services in the event of an earthquake now than it was when analysis was done for the 1990 FEIR. The police station serving Mission Bay North is located north of the Channel, so obstruction or collapse of the Lefty O'Doul or Peter Maloney Bridges would not prohibit police access to proposed development north of the Channel. Similarly, Mission Bay South is now served by the Bayview Station, which is located such that police vehicles would not have to cross any bridges to gain access to proposed development south of the Channel. Routes west of Islais Creek that do not cross any bridges to reach Mission Bay South, would require vehicles to pass under I-280 on César Chavez Street, 25th, 20th, 18th, Mariposa, or 16th Streets. The typical route north to Mission Bay uses Third Street, crossing Islais Creek, and does not go under any freeway structures. For further discussion of the potential for disruption of emergency access to Mission Bay in the event of an earthquake, see "Exposure of Concentrated Populations to Seismic Hazards" in Section V.H, Seismicity: Impacts.

According to the *UCSF Long Range Development Plan Final Environmental Impact Report*, the UCSF Police Department (UCPD) has exclusive and primary responsibility for policing UCSF-controlled properties. The UCPD maintains a ratio of about 1.1 officers per 1,000 population (includes employees, students, vendors, and visitors)./23/