ENVIRONMENTAL IMPACT REPORT / ENVIRONMENTAL ASSESSMENT

UNION OIL COMPANY

PLATFORM GINA AND PLATFORM GILDA PROJECT

LEASES OCS P-0202 and OCS P-0216

OFFSHORE VENTURA COUNTY, CALIFORNIA

VOLUME II

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May, 1980

VOLUME II

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12.0 ENVIRONMENTAL SETTING

12.1 GEOTECHNICAL

The following discussion of the geotechnical environment is based primarily on information found on topographic and geologic maps and in other widely available literature; Dames & Moore inhouse reports and files; and, observations made during field reconnaissance. Site-specific discussions for offshore areas are based on the following geotechnical and geophysical reports:

- Proposed Platform Gina site: Geotechnical Consultants, Inc., 1976; Geotec Engineering, Inc., 1979; and, McClelland Engineers, Inc., 1979.
- Platform Gina proposed and alternative pipeline corridors: McClelland Engineers, Inc., 1979.
- Proposed Platform Gilda site and pipeline corridor: McClelland Engineers, Inc., 1980.

The above-referenced site-specific shallow hazards survey reports (McClelland Engineers, Inc., 1979, 1980) for the proposed platform sites and associated pipeline routes are contained in reports prepared by Dames & Moore (1980a, 1980b). These reports are available for review, upon advance notification, at the City of Oxnard (Planning Department) and U.S. Geological Survey Los Angeles office.

12.1.1 Physiography

12.1.1.1 Regional Overview

The project region is located within the western part of the Transverse Ranges physiographic province of California (Figure 12.1-1). Topographic features and geologic structures within the Transverse Ranges have east-west trends as opposed to the predominantly northwest-trending structural patterns of the adjacent Coast Ranges and Peninsular Ranges physiographic provinces.

Total relief in the western portion of the Transverse Ranges is approximately 6,000 feet (1,830 m). Elevations range from over 4,000 feet (1,200 m) along the crest of the Santa Ynez Mountains to -2,050 feet (-625 m) in the Santa Barbara Basin.

The project region is situated within the Ventura Basin (Figure 12.1-2). The Ventura Basin is a structurally controlled, physiographic and depositional basin underlain by as much as 60,000 feet (18,000 m) of Cretaceous, Tertiary, and Quaternary sedimentary deposits (Greene et al., 1978). The Ventura Basin is one of the largest and most prolific oil-producing districts in California (Bailey and Jahns, 1954; Vedder et al., 1969).

The Oxnard Plain occupies the southwest portion of the Ventura Basin and is the most extensive lowland in the basin. The broad, relatively flat Oxnard Plain slopes southwesterly at about 0.2 to 0.3 percent and rises from sea level to an elevation of approximately 150 feet (45 m) near South Mountain. The alluvial surface of the Oxnard Plain was developed during the late Pleistocene and Holocene epochs by the prograding delta of the Santa Clara River, and is underlain by a very thick sequence of unconsolidated to poorly consolidated Quaternary sediments.

The Oxnard Shelf is the offshore extension of the Oxnard Plain. It varies in width from approximately 4 miles (6.5 km) near Port Hueneme to about 10 miles (16 km) offshore from Ventura. Slopes on the shelf are generally to the southwest on the order of 0.3 to 0.4 percent. The eastern end of the Oxnard Shelf is dissected by a series of south-trending submarine canyons, largest of which are Hueneme and Mugu canyons (U.S. Geological Survey, 1976).

12.1.1.2 Local Topography

12.1.1.2.1 Project Area

The project area extends along the coast from slightly north of the Santa Clara River to slightly south of Ormond Beach. It is approximately 1 mile (1.6 km) in width.

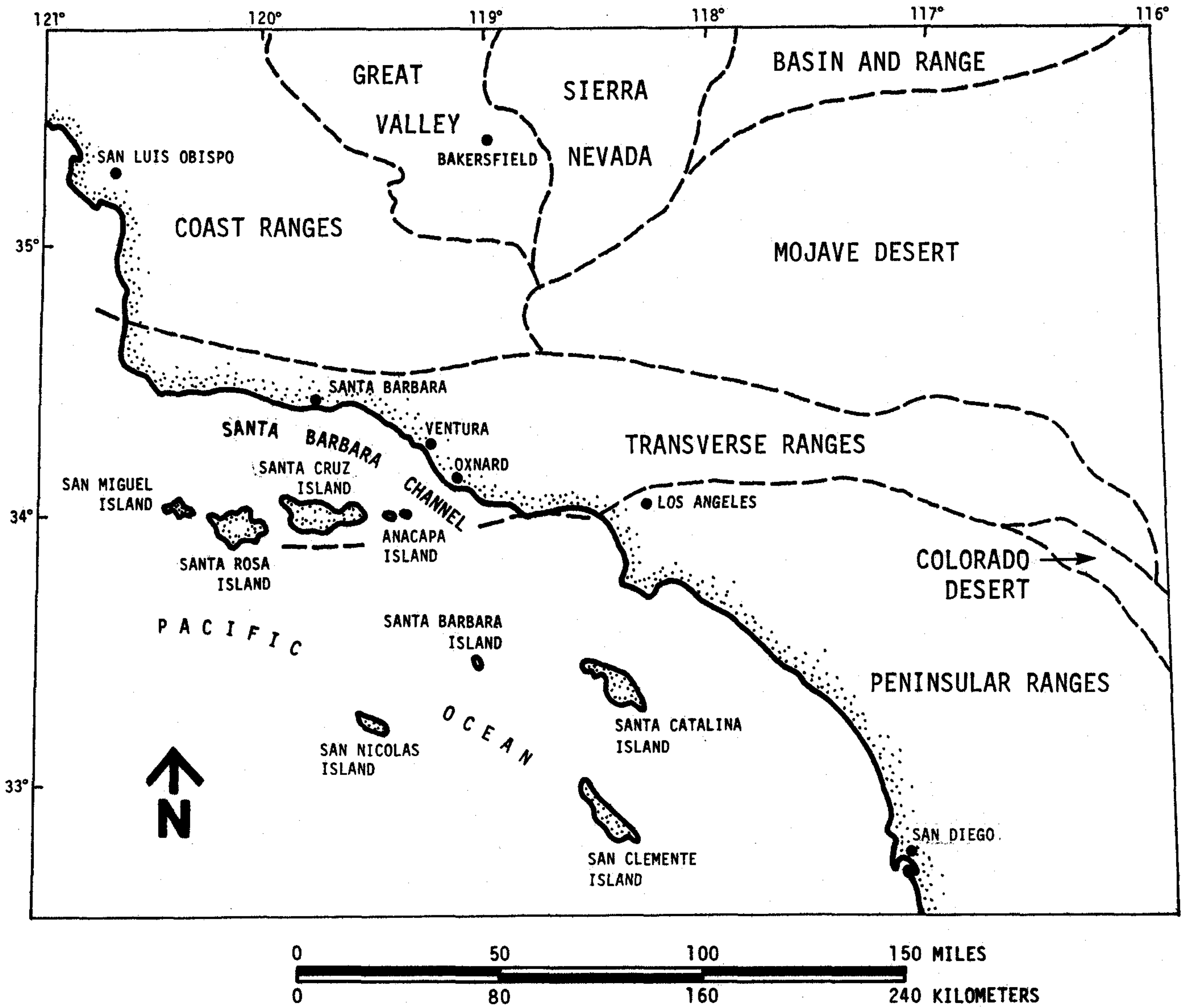
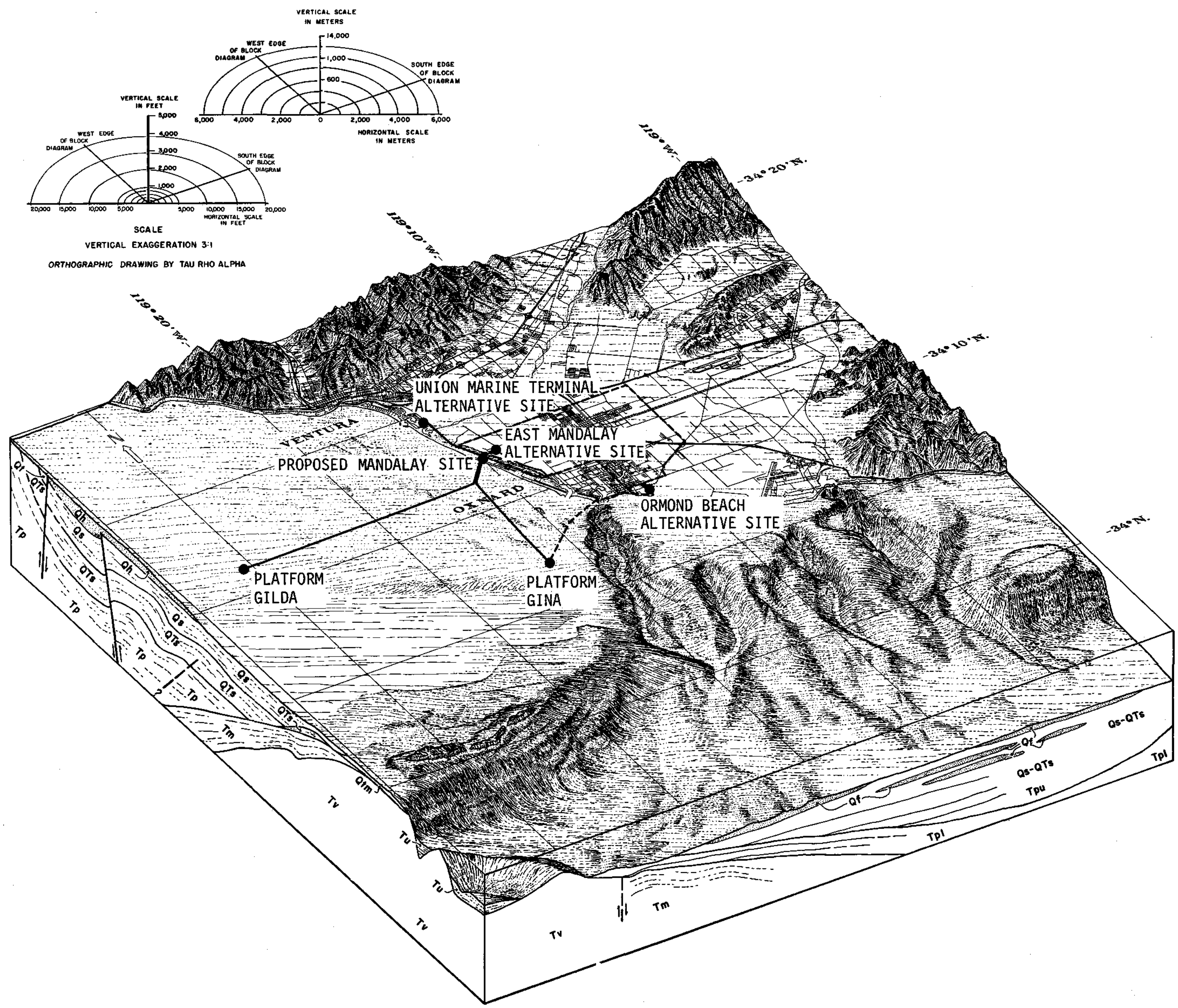


FIGURE 12.1-1

MAJOR PHYSIOGRAPHIC PROVINCES OF SOUTHERN CALIFORNIA

REFERENCE: MODIFIED FROM VEDDER ET AL. (1969)

DAMES & MOORE



REFERENCE: MODIFIED FROM GREENE ET AL. (1978)

EXPLANATION:

Qh - HOLOCENE SHELF DEPOSITS
Qt - HOLOCENE NON-MARINE TERRACE DEPOSITS
Qtm - HOLOCENE MARINE TERRACE DEPOSITS
Qf - FAN DEPOSITS
QTt - PLEISTOCENE TERRACE DEPOSITS
Qs - PLEISTOCENE? SAN PEDRO FM.
QTs - PLEISTOCENE SANTA BARBARA FM.
Tu - TERTIARY UNDIFFERENTIATED
Tp - PLIOCENE PICO FM.
Tpu - UPPER PLIOCENE
Tpl - LOWER PLIOCENE
Tm - MIOCENE MONTEREY FM.
Tv - MIOCENE CONEJO VOLCANICS

——— PIPELINE CORRIDOR- PROPOSED PROJECT

- - - - PIPELINE CORRIDOR- PRIMARY ALTERNATIVE PROJECTS

FIGURE 12.1-2

ORTHOGRAPHIC DRAWING OF THE OXNARD-VENTURA AREA

DAMES & MOORE

Topography is varied within the northern portion of the project area. At the extreme northern end, between Gonzales Road and the Ventura Marina, topography is dominated by the floodplain and delta of the Santa Clara River. The main course of the river is approximately 0.6 mile (1 km) wide and is characterized by anastomosing channels with interchannel sand bars. The average slope of the river channel within 3 miles (5 km) of the coastline is approximately 0.25 percent.

Along the shoreward half of the northern portion of the project area, the topography is dominated by a belt of coastal sand dunes. This 6.25-mile (10-km)-long coastal dune strip varies in width from 3,600 feet (1,100 m) at the north near Gonzales Road to approximately 985 feet (300 m) near Channel Islands Harbor. Cooper (1967) described this dune belt as containing three zones: an outer zone, including the foredune strip; a relatively flat, vegetated middle zone; and an inner zone. Maximum elevations are roughly 35 to 40 feet (10 to 12 m) within the foredune strip; 10 feet (3 m) or less in the middle zone; and, 50 feet (15 m) in the inner zone. Much of the coastal dune field has been disturbed by urbanization and industrialization. McGrath Lake, a fresh water remnant of the Santa Clara River, is located within the shoreward half of the northern portion of the project area.

The topography within the inland half of the northern portion of the project area is characterized by generally flat to gentle southwestward slopes (0.125 to 0.5 percent). One small drainage channel is present at the eastern end of Howe Road; however, no major drainages or topographic depressions interrupt this portion of the project area.

The southern portion of the project area is predominantly flat with southwesterly slopes of approximately 0.125 to 1.25 percent. This gently sloping surface is interrupted by several south- to southwest-trending drainage ditches. A belt of coastal sand dunes up to 400 feet (120 m) wide with a maximum elevation of approximately 10 feet (3 m) is present along Ormond Beach. A marshy area and several duckponds occur in the southeastern corner of the project area.

12.1.1.2.2 Proposed Mandalay Site and Pipeline Corridor

The major part of the site is situated astride the outer zone of the coastal dune field. Relief across these dunes is approximately 10 to 15 feet (3 to 4.5 m) with maximum elevations about 25 to 30 feet (7.5 to 9 m). The dunes are largely covered by European dune grass and do not appear to be active. The southeastern part of the site is situated on the middle zone of the dune field. In portions of this area, the deflation base has been exposed by past aeolian activity; the area is sparsely to moderately vegetated and does not appear to be experiencing aeolian erosion or deposition at present. Total relief is on the order of 2 to 3 feet (0.6 to 0.9 m).

Seaward of the foredune zone is a broad, gently sloping beach. The width of the beach is approximately 200 feet (65 m). The beach surface generally exhibits minor topographic irregularities which vary with the tides, season, and sea state.

The onshore pipeline corridor associated with the proposed Mandalay site would extend inland from the landfall point to Harbor Boulevard and north to the Union Oil Marine Terminal. From the landfall point to Harbor Boulevard, the corridor would extend across the outer and middle zones of the coastal dune field. Total relief along this portion of the route is approximately 10 to 15 feet (3 to 4.5 m). The topography along the Harbor Boulevard portion of the corridor is generally flat with slopes of less than 0.5 percent. The corridor crosses the floodplain of the Santa Clara River. The southern portion of the floodplain is flat and has been modified by agricultural activity. The Santa Clara River has been channelized along its southern bank by construction of an approximately 10-foot (3-m)-high earthen levee. The riverbed is generally flat with interchannel sand bars separating the active channels. The northern bank of the river is about 6 to 10 feet (1.8 to 3 m) high.

12.1.1.2.3 East Mandalay Alternative Site and Pipeline Corridor

Topography at the East Mandalay alternative site is characteristic of the inner zone of the coastal dune belt. In this area, the dunes form a band of irregular hills with a maximum elevation on the order of 40 feet (12 m) and total relief of 10 to 15 feet (3 to 4.5 m). The dunes are well vegetated and appear to be inactive at present. The topography along the southern boundary of the site appears to have been modified by emplacement of dredge spoil adjacent to the Edison Canal.

The onshore pipeline corridor associated with the East Mandalay alternative site would be identical to that for the proposed Mandalay site (Section 12.1.1.2.2) with one exception. A short segment would be required between Harbor Boulevard and the East Mandalay alternative site. This segment would cross portions of the middle and inner zones of the dune belt. Maximum relief along this portion of the corridor would be approximately 10 to 15 feet (3 to 4.5 m).

12.1.1.2.4 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

Topography at the Union Oil Marine Terminal alternative site has been extensively modified during previous development. The site, situated at an existing petroleum tank farm, has been graded to an approximately 1 percent northwesterly slope and is surrounded by a berm 4 to 8 feet (1.2 to 2.4 m) high. Portions of the site have been surfaced with asphalt and the earthen berms have been oiled.

The onshore pipeline corridor associated with the Union Oil Marine Terminal alternative site is the same as for the proposed Mandalay site (Section 12.1.1.2.2).

12.1.1.2.5 Ormond Beach Alternative Site and Pipeline Corridors

Topography at the Ormond Beach alternative site has been modified by grading and is flat. Soil, concrete, and asphalt have been dumped near the southeastern corner of the site in piles up to 10 feet (3 m) high. The presently undeveloped area east of the site is generally flat with a few gently rolling low hummocks. A number of shallow water-filled depressions are present, and the Oxnard Industrial Drain is located approximately 160 feet (50 m) east of the site.

The onshore pipeline corridor required for the pipelines to connect Platform Gina with the Ormond Beach alternative site traverses an urbanized area along Silver Strand Beach from landfall to the mouth of Port Hueneme. The route crosses the harbor channel within 1,000 feet (3,000 m) of its mouth and extends along an industrial and residential area parallel to Ormond Beach. Much of this area is currently being developed and a large portion of the generally flat topography has been graded. A narrow zone of coastal dunes approximately 15 feet (4.6 m) high occurs along the southwestern margin of the corridor south of the site.

Two alternative corridors have been identified for the pipelines connecting the Ormond Beach alternative site with points in the Mandalay Beach and Ventura Marina areas. Option A follows paved roadway along its route and the topography has been extensively modified by grading. Major portions of the corridor have been urbanized by residential and commerical development. The only area of natural topographic expression along the corridor is within the coastal dune belt along Mandalay Beach.

Topography along corridor Option B is generally flat and featureless. Segments along Harbor Boulevard, Gonzales Road, and Rice Road are used for agriculture and have been extensively graded. The corridor parallels the roadways which are typically elevated on berms slightly above the level of the surrounding fields. Other segments of the route along Gonzales, Pleasant Valley, and Hueneme roads have been urbanized. These segments are graded and, for the most part, have been paved with asphalt or concrete.

12.1.1.3 Local Bathymetry

12.1.1.3.1 Platform Gina Site and Pipeline Corridor

The proposed platform site is located on the Oxnard Shelf approximately 4.5 miles (7.2 km) southwest of Port Hueneme. Water depth at the site is approximately 95 feet (29 m). The seafloor at the site is generally smooth and has a 0.7 percent slope toward the southwest. Minor seafloor irregularities exist in the vicinity of the site which are believed to have been caused by previous exploratory drilling activities.

Water depths along the proposed Mandalay offshore pipeline corridor range from 95 feet (29 m) at the platform site to 0 at landfall. The seafloor is generally smooth; however, one area of clustered objects or small hummocks was noted on side-scan sonar records along the east side of the corridor near its midpoint (McClelland Engineers, Inc., 1979). The seafloor generally slopes to the southwest. Slopes range from about 0.1 percent in the northern part of the corridor to 0.7 percent near the platform site.

12.1.1.3.2 Platform Gilda Site and Pipeline Corridor

The proposed platform site is located on the Oxnard shelf approximately 10 miles (16 km) west of Oxnard. Water depth at the site is approximately 205 feet (63 m). The seafloor at the site is generally smooth and has a maximum slope of 1.3 percent toward the southwest.

Water depths along the proposed pipeline corridor range from 205 feet (63 m) at the platform site to 0 at landfall. The seafloor is generally smooth; however, there is a gradation from a very smooth bottom in the platform area to a rougher surface farther inshore. This gradation is suspected to be largely the result of biological activity on the seafloor (McClelland Engineers, Inc., 1980). Slopes along the corridor are toward the southwest and reach a maximum of about 1.0 percent in the platform vicinity.

12.1.1.3.3 Platform Gina Alternative Pipeline Corridor

Water depths along the Ormond Beach alternative pipeline route range from 95 feet (29 m) at the Platform Gina site to 0 at landfall. Near the landfall point, the seafloor slopes toward the south-southeast and the water depth increases over a short distance to 100 feet (30 m) adjacent to the head of Hueneme Canyon. At this location, seafloor slopes increase to about 4.5 percent within the corridor. Along the remainder of the alternative pipeline route, the seafloor slopes to the southwest at 0.3 to 0.8 percent and is generally smooth with only minor natural irregularities.

12.1.2 Geology

12.1.2.1 Regional Overview

The project region is located within the western portion of the Transverse Ranges physiographic province of California. The onshore portion of the project area is situated along the coastal margin of the Oxnard Plain, and the offshore portion is located on the Oxnard Shelf, within the Ventura Basin. The Ventura Basin is an elongate, highly folded synclinorium that includes the Oxnard Plain and the Santa Barbara Channel (Greene, 1976). This large tectonic depression is bounded on the north and south by major regional faults. The general geology in the project region is shown on Figure 12.1-3.

The structurally complex western Transverse Ranges province is characterized by east-west-trending topographic features and geologic structures which transect the predominantly northwest-southeast-trending structural pattern of California. Tectonic activity began in this area as much as 30 million years ago and is continuing at present. Most of the structural and geomorphic features evident in the region are the result of major north-south compressional tectonism which occurred during the middle Pleistocene (Greene, 1976).

12.1.2.1.1 Stratigraphy

The Ventura Basin-Santa Barbara Channel area is underlain by as much as 60,000 feet (18,000 m) of Cretaceous, Tertiary, and Quaternary sedimentary strata which overlie and locally are faulted against pre-Cretaceous plutonic and metamorphic basement rocks. Representative stratigraphic columns for the region are shown on Figure 12.1-4.

<u>Basement Rocks</u>

The basement rocks consist of two distinct assemblages. Those exposed in the Santa Ynez Mountains consist of graywacke, shale, and chert, and associated serpentenite and ultramafic rocks of the Franciscan Formation. The

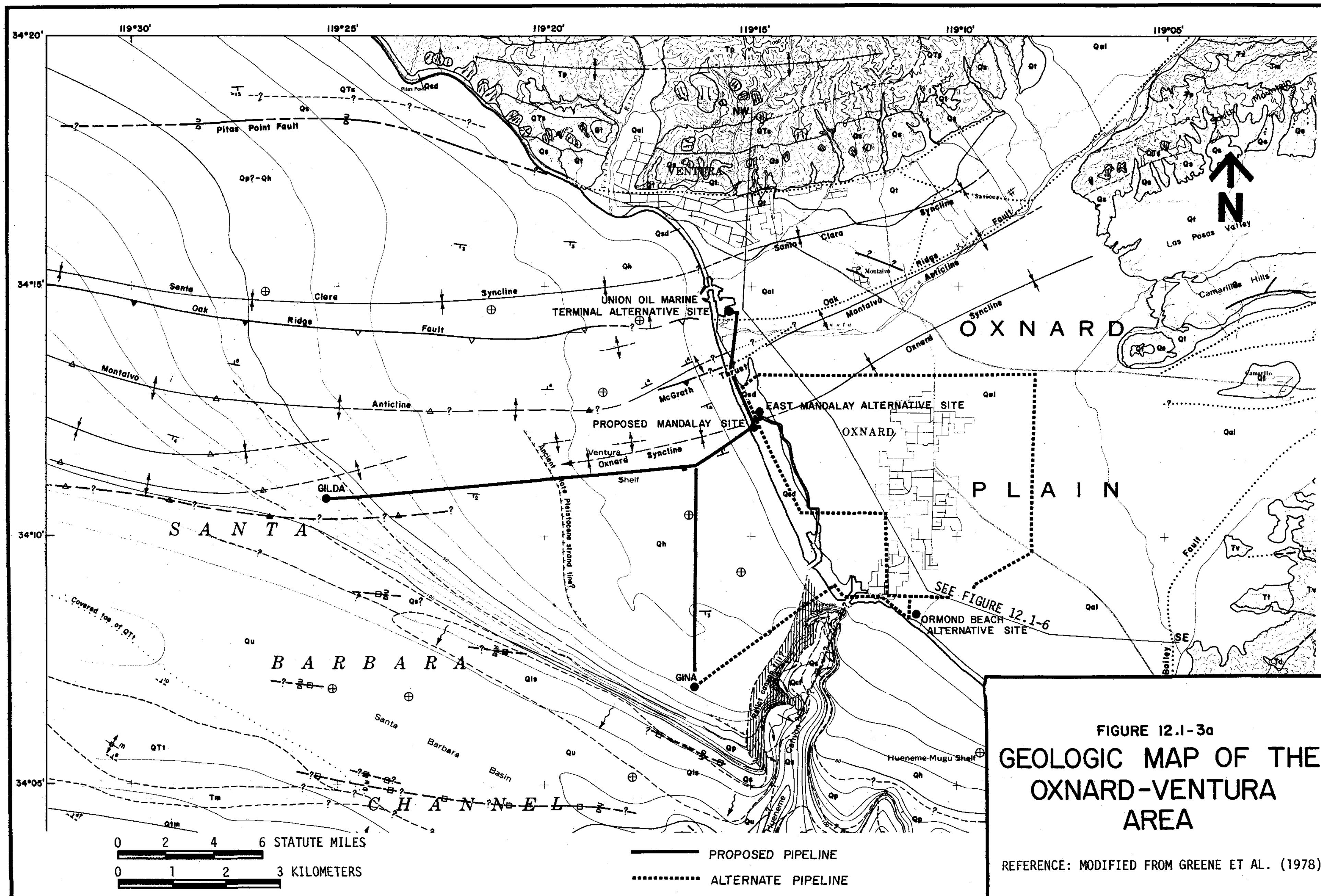


FIGURE 12.1-3a
GEOLOGIC MAP OF THE OXNARD-VENTURA AREA

REFERENCE: MODIFIED FROM GREENE ET AL. (1978)

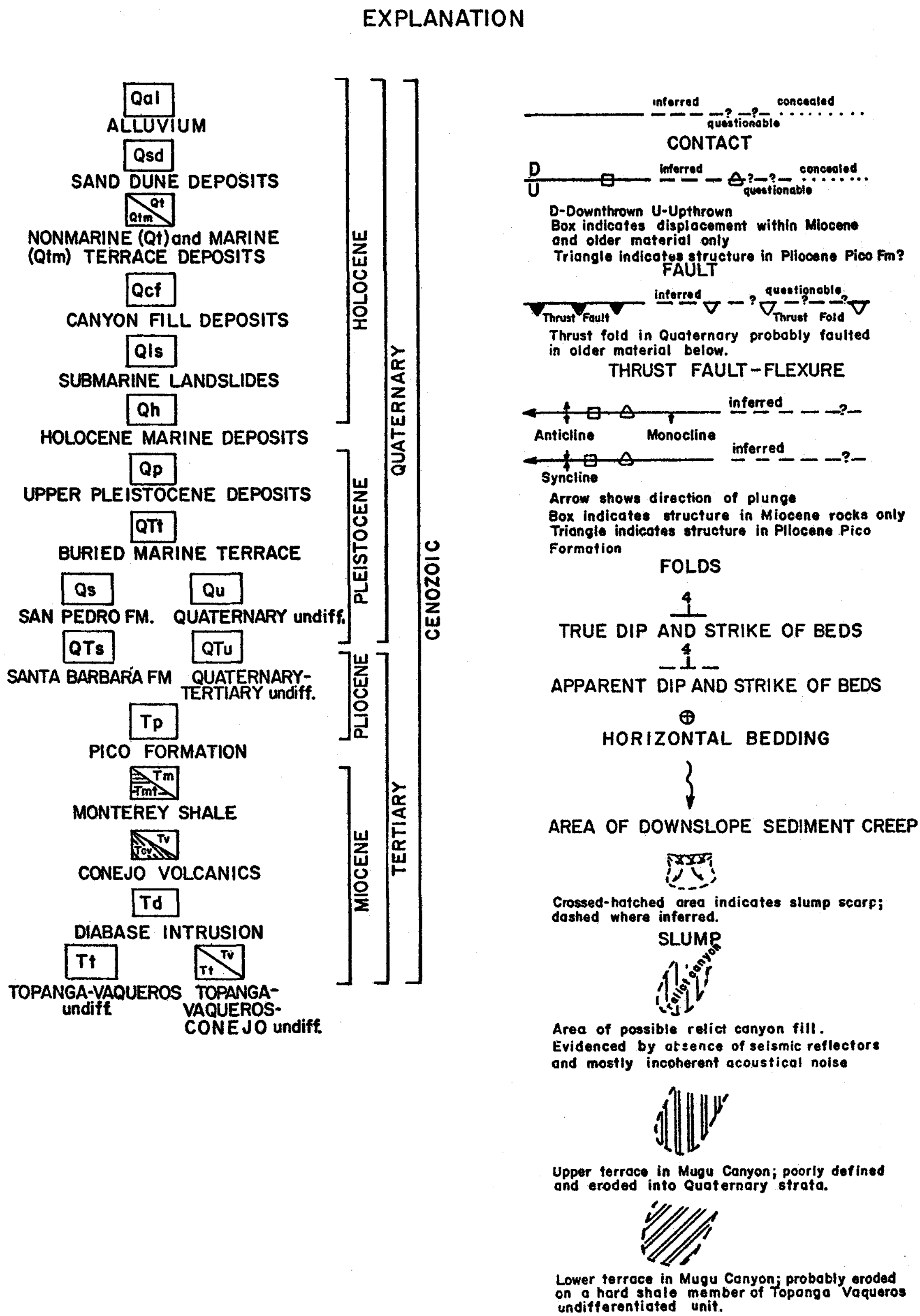


FIGURE 12.1-3b

GEOLOGIC MAP OF THE OXNARD-VENTURA AREA

REFERENCE: MODIFIED FROM GREENE ET AL. (1978)

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ONSHORE STRATIGRAPHY

Ventura—near mouth, Ventura River

Series	Formation	*Feet	Description	Aquifers
Pleistocene	Alluvium	400-800	Coarse sand, gravel, silty Clay	Aquiclude; Mugu
Pleistocene	San Pedro Formation	2200	Sandy silt, sand, conglomerate and clay. Nonmarine. Sand, silt, and gravel. Marine	Aquiclude; —?—; Hueneme; Aquiclude; Fox Canyon; —?—; Aquiclude
Pleistocene / Pliocene	Santa Barbara (Mud-Pit) Formation	2000	Fine sand, gravel. Massive mudstone, thick conglomerate lenses.	Grimes Canyon ?; None
Pliocene	Pico (lower part commonly called Repetto) Formation	11,000-12,500	Alternating thick conglomerate and siltstone. Siltstone with locally thick sandstone and conglomerate interbeds. Very thick to thin conglomerate and sandstone units interbedded with silt.	
Miocene	Santa Margarita Formation	1700-1800	Massive diatomaceous mudstone; thin limy beds and concretions	
Miocene	Monterey Shale	2200	Siliceous shale, laminated, organic. Alternating laminated shale, hard limestone.	
Miocene	Rincon Mudstone	2000-2500	Massive mudstone, dolomite concretions. Fine-grained sandstone locally near base.	
Miocene	Vaqueros S.S.		Sandstone and conglomerate.	
Oligocene	Sespe (nonmarine) Formation	3500-6000	Variegated mudstone; sandstone, grit, and conglomerate; massive to very thick bedding.	
Eocene	Coldwater Sandstone	2500	Hard, fine- to coarse-grained sandstone and silty claystone interbedded.	
Eocene	Cozy Dell Shale	3000-3300	Massive silty shale and micaceous mudstone.	
Eocene	Matilija Sandstone	2500-3000	Thin bedded hard sandstone; siltstone beds in upper and lower parts; middle part massive hard sandstone.	
Eocene	Juncal Formation	5000-6500	Thin bedded shale and mudstone; thin micaceous sandstone interbeds. Thin bedded, hard sandstone and shale; orbitoidal limestone locally at base.	
Upper Cretaceous	Unnamed	2300	Hard silty shale, massive 500 ft. conglomerate about 800 ft. below top. Shale, locally crushed in upper part; limy in lower.	

Oxnard Plain—near Port Hueneme

Series	Formation	Feet	Description	Aquifers
Holocene	Alluvium	160	Channel deposits, aeolian sands, gravel	Semi perched
Holocene	Clay cap	160	Silt and clay	Aquiclude
Holocene	Flood plain deposits	225	Fine to coarse sand and gravels	Oxnard
Holocene		130	Silt and clay	Aquiclude
upper Pleistocene		240	Fine to coarse sand and gravels	Mugu
upper Pleistocene		190	Silt and clay	Aquiclude
lower Pleistocene	San Pedro Formation	0-1220	Irregularly interbedded fine to coarse sand, silt and clay. (silt & clay) Fine to medium sand & thin gravel stringers. Interbedded silt & clay.	Hueneme; Aquiclude; Fox Canyon
lower Pleistocene	Santa Barbara (Mud - Pit) Formation	0-1600	Fine to coarse sand and gravel in upper part. Massive mudstone, thick conglomerate lenses.	Grimes Canyon; None
Pliocene	Pico Formation (Hiatus)	0 - 6500	Alternating thick conglomerate and siltstone. Siltstone with locally thick sandstone and conglomerate lenses. Fine-grained sandstone interbedded with coarse sandstone and conglomerate.	
Pliocene	Repetto Formation	0-1000	Very thick to thin conglomerate and sandstone units interbedded with silty shale.	
Miocene	Santa Margarita Formation	0-1200	Massive diatomaceous mudstone, thin limy beds and concretions	
Miocene	Monterey Shale	0-1800	Siliceous shale, laminated, organic. Alternating laminated shale, hard limestone.	
Miocene	Conejo Vol.	600-1400	Volcanics, interbeds of andesite, tuffs, and conglomerates	
Miocene	Topanga (Temblor?)	800-1600	Coarse sandstone and conglomerate.	
Oligocene	Sespe (nonmarine) Formation (Intrusives)	2400	Variegated mudstone, sandstone, grit, and conglomerate; massive to thick bedding.	
Eocene	Llajas Formation	2000	Conglomerate, fine sand, sandy siltstone, and shale.	
Eocene	Santa Susana	3800	Shale	
Paleocene	Martinez?	1400	Massive, basal conglomerate overlain by shale and sandstone.	
Upper Cretaceous	Chico (Intrusives)		Massive sandstone with thin beds of shale, calcareous sandstone and shale below sandstone.	

OFFSHORE STRATIGRAPHY

Ventura Shelf

Series	Formation	Maximum Thickness	Acoustic Description
Holocene	Marine & alluvial deposits	150	Poorly reflected, incoherent signal
upper Pleistocene	Qp	180	Weakly to strongly reflected energy, some incoherency
lower Pleistocene	San Pedro Formation Qs	1500	Weakly reflected seismic energy with much random, incoherent, acoustical energy and transparency. Reflectors are generally lacking or discontinuous.
lower Pleistocene / Pliocene	Santa Barbara Formation QTs	2500	Weakly reflected seismic energy with a large amount of acoustical incoherency and high seismic transparency or poor reflectivity. Prominent reflectors are discontinuous or lacking altogether.
Pliocene	Pico Formation Tp	>6000	Strongly reflected acoustical energy with little seismic incoherency. Reflectors are broad, continuous, and widely spaced with thin, fairly discontinuous reflectors in between.

Hueneme—Mugu Shelf

Series	Formation	Maximum Thickness	Acoustic Description
Holocene	Marine & alluvial deposits	200	Poorly reflected, incoherent signal
upper Pleistocene	Qp	200	Weakly to strongly reflected energy, some incoherency
lower Pleistocene	San Pedro Formation Qs	1000	Weakly reflected seismic energy with much random, incoherent, acoustical energy and transparency of the seismic signal. Reflectors are generally lacking or discontinuous.
lower Pleistocene / Pliocene	Santa Barbara Formation QTs	1500	Weakly reflected seismic energy with a large amount of acoustical incoherency and high seismic transparency or poor reflectivity. Prominent reflectors are discontinuous or lacking altogether.
Pliocene	Pico Formation Tp (Hiatus)	500?	Strongly reflected acoustical energy with little seismic incoherency Reflectors are broad, continuous, and widely spaced.
Miocene	Conejo Volcanics Tv	?	Strongly reflected seismic signal, continuous reflectors; little or no seismic incoherency; some internal reflectors beneath main reflector, hyperbolics.
Miocene	Topanga-Vaqueros undiff. Tt	?	Fairly strongly reflected seismic energy, few hyperbolics, some acoustical incoherency. Reflectors discontinuous and widely spaced.

FIGURE 12.1-4

STRATIGRAPHIC COLUMNS FROM THE OXNARD-VENTURA AREA

REFERENCE: MODIFIED FROM GREENE ET AL. (1978)

DAMES & MOORE

other assemblage of basement rocks within the region comprises schistose metamorphic rocks intruded by and faulted against igneous intrusive rocks on the south side of Santa Cruz Island.

Cretaceous Rocks

Strata of Cretaceous age crop out in several places around the Santa Barbara Channel area, but their distribution and thickness beneath the Channel are not known. Wherever they are exposed in the Channel region or are reported from the subsurface, the Cretaceous sedimentary rocks consist of interbedded marine mudstones, sandstones, and siltstones, with local conglomerates.

Paleocene and Eocene Rocks

Sedimentary rocks of Paleocene and Eocene age are believed to underlie most of the Santa Barbara Channel region; however, their distribution, thickness, and character are poorly known due to limited exposures around the edges of the Channel. In general, the Paleocene and Eocene strata are lithologically similar. The Paleocene and Eocene sedimentary sections are composed of interbedded marine mudstones, sandstones, and siltstones, with local conglomerates.

Oligocene Rocks

The Oligocene sedimentary section exposed in the eastern Santa Barbara Channel-Ventura Basin area consists of variegated nonmarine sandstones, conglomerates, mudstones, and siltstones of the Sespe Formation. On the Oxnard Plain, a short distance southwest of its point of maximum thickness, the Oligocene section has been locally removed by Miocene erosion (Dosch and Mitchell, 1964; Nagle and Parker, 1971).

Miocene Rocks

The lower Miocene has been divided into two formational units. The lower unit comprises shallow marine sandstones with lesser conglomerates, siltstones, and mudstones of the Vaqueros Formation. The Rincon Shale, consisting of claystone, mudstone, siltstone, and subordinate sandstone, forms the upper unit of the lower Miocene succession. The section is very thin or locally missing beneath the Oxnard Plain south of the Oak Ridge fault, where it appears to have been eroded prior to the deposition of middle Miocene strata. Beneath the central and eastern part of the Oxnard Plain, the lower to middle Miocene strata consist of coarse sandstone and conglomerate of the Topanga-Vaqueros undifferentiated unit.

Middle Miocene sedimentary strata assigned to the Monterey Formation are present beneath a thin cover of unconsolidated Holocene sediments on parts of the mainland shelf along the northern edge of the Channel. The laminated shales of the Monterey Formation are typically siliceous, diatomaceous, tuffaceous, phosphatic, or bituminous and are associated with subordinate sandstone, siltstone, chert, dolomite, limestone, and bentonite. The Monterey is reportedly 1,300 feet (400 m) thick beneath the Oxnard oil field, but thins and pinches out to the south.

The upper Miocene strata consist of diatomaceous mudstone, claystone, siltstone, and sandstone of the Sisquoc Formation. In the Ventura Basin, sedimentary strata of equivalent age are known as the "Santa Margarita" or Modelo Formation. Upper Miocene rocks pinch out and are not present in the southeastern part of the Oxnard Plain.

Extrusive and intrusive sequences of basaltic, andesitic, and rhyolitic volcanic rocks of lower to middle Miocene age occur in the Santa Barbara Channel-Ventura Basin area. These volcanic rocks thin rapidly northward from the Santa Monica Mountains and interfinger with the Topanga-Vaqueros undifferentiated unit.

Pliocene Rocks

The Pliocene marine sedimentary section in the Santa Barbara Channel-Ventura Basin area has been divided into two formational units, the "Repetto Formation" and the "Pico Formation". The two units lithologically are indistinct; both are composed of interbedded sandstone, siltstone, mudstone, and conglomerate and are characterized by both lateral and vertical textural variations.

Pliocene deposits are extremely thick along the axis of the Ventura Basin, become considerably thinner immediately to the south of the Oak Ridge fault, and pinch out beneath the southeastern Oxnard Plain. Pliocene strata have been the most prolific oil producers within the Ventura Basin.

Pleistocene Deposits

Pleistocene sedimentary deposits in the Santa Barbara Channel-Ventura Basin area comprise, from oldest to youngest, the Santa Barbara Formation (in part Pliocene in age), San Pedro Formation (early Pleistocene), and unnamed beds of late Pleistocene age.

The Santa Barbara Formation is composed of marine and nonmarine interbedded mudstone, siltstone, sandstone and conglomerate. The Santa Barbara Formation attains its maximum thickness on the Oxnard Shelf and thins to the southeast and west.

In the Oxnard Plain area, the marine and nonmarine strata of the San Pedro Formation consist of interbedded mudstone, sandstone, siltstone, and conglomerate. Its maximum thickness is on the Oxnard Shelf. Coarser-grained facies of the San Pedro Formation near the top and bottom of the unit have been termed the Hueneme and Fox Canyon aquifers in the Ventura-Oxnard area.

The upper Pleistocene deposits of the Santa Barbara Channel-Ventura Basin area are unnamed and occur in a variety of settings. In the Oxnard Plain area, they are composed of marine and nonmarine sand, gravel, clay, and alluvial deposits which unconformably overlie the San Pedro Formation. They have been divided lithologically into two units, an upper clay zone which forms an aquiclude and a lower sand and gravel zone which has been termed the Mugu Aquifer.

Holocene Deposits

Unconsolidated to poorly consolidated Holocene sediments cover the Oxnard Plain and most of the Oxnard Shelf. These deposits consist of sand, gravel, silt, clay, and mudstone with local concentrations of cobbles and boulders, lenses of carbonaceous material, peat, and shell debris. Three units are generally recognizable beneath the Oxnard Plain; an upper perched or semi-perched water zone, a "clay cap" aquiclude, and the Oxnard Aquifer zone. On the Oxnard Shelf, the Holocene deposits consist of clay, silt, and sand; these sediments grade from sand in the nearshore area to mud on the outer shelf.

12.1.2.1.2 Structure

The Santa Barbara Channel is a submerged east-west-trending tectonic depression representing the western extension of the sediment-filled Ventura Basin (Vedder et al., 1969; Greene et al., 1978). These structural basins are bounded to the north and south by major east-west-trending faults.

The Santa Ynez fault forms the northern structural boundary of the Santa Barbara Channel-Ventura Basin area. This fault is over 100 miles (160 km) in length and is thought to have experienced large-scale left oblique displacements (Page and others, 1951; Vedder et al., 1969; Greene, 1976). The Santa Monica fault system bounds the Santa Monica Mountains on the south and extends westward south of Anacapa Island forming the southern structural boundary of the Santa Barbara Channel-Ventura Basin area (Vedder et al., 1969; Greene et al., 1978; Junger and Wagner, 1977).

Many folds and faults have been recorded beneath the alluvial cover of the Oxnard Plain and Oxnard Shelf (Greene, 1976; Greene et al., 1978). The eastern portion of the Santa Barbara Channel is divided into subparallel segments by large east-west-trending faults. These individual segments contain numerous small faults and folds which are generally aligned with the east-west-trending structural grain (Vedder et al., 1969). These folds and faults are the result of structural deformation caused by north-south compressive stresses which began in middle Pleistocene time. This tectonic deformation is continuing at present, as indicated by the historic seismicity of the region, geodetically determined vertical movement, and deformation in Holocene strata (USGS, 1976).

Folds

Within the vicinity of the project area, major folds developed in strata of Tertiary and Quaternary age include the Santa Clara and Oxnard synclines and the Montalvo anticline (Greene, 1976). The Santa Clara syncline extends from the vicinity of Saticoy in the Santa Clara River Valley westward to the Ventura slope. Strata of the lower Pleistocene San Pedro Formation are exposed along the northern flank of the syncline and the southern flank is locally covered by alluvial deposits from the Santa Clara River and overthrust by the Oak Ridge fault (Greene, 1976; Greene et al., 1978).

The Montalvo anticline is located south of the Santa Clara syncline and the Oak Ridge fault. This structurally complex anticline parallels the Santa Clara River onshore and extends to the west offshore to the eastern Santa Barbara Channel where it is bounded by north-dipping normal faults (Greene, 1976). The Montalvo anticline is bounded on the north by the Oak Ridge fault and on the south by roughly parallel-trending anticlinal and synclinal structures (both are unnamed).

The Oxnard syncline is a broad east-west-trending, seaward-plunging structure extending offshore from between South Mountain and the Camarillo Hills. Lower Pleistocene strata of the San Pedro Formation are gently folded along this structure (Greene, 1976).

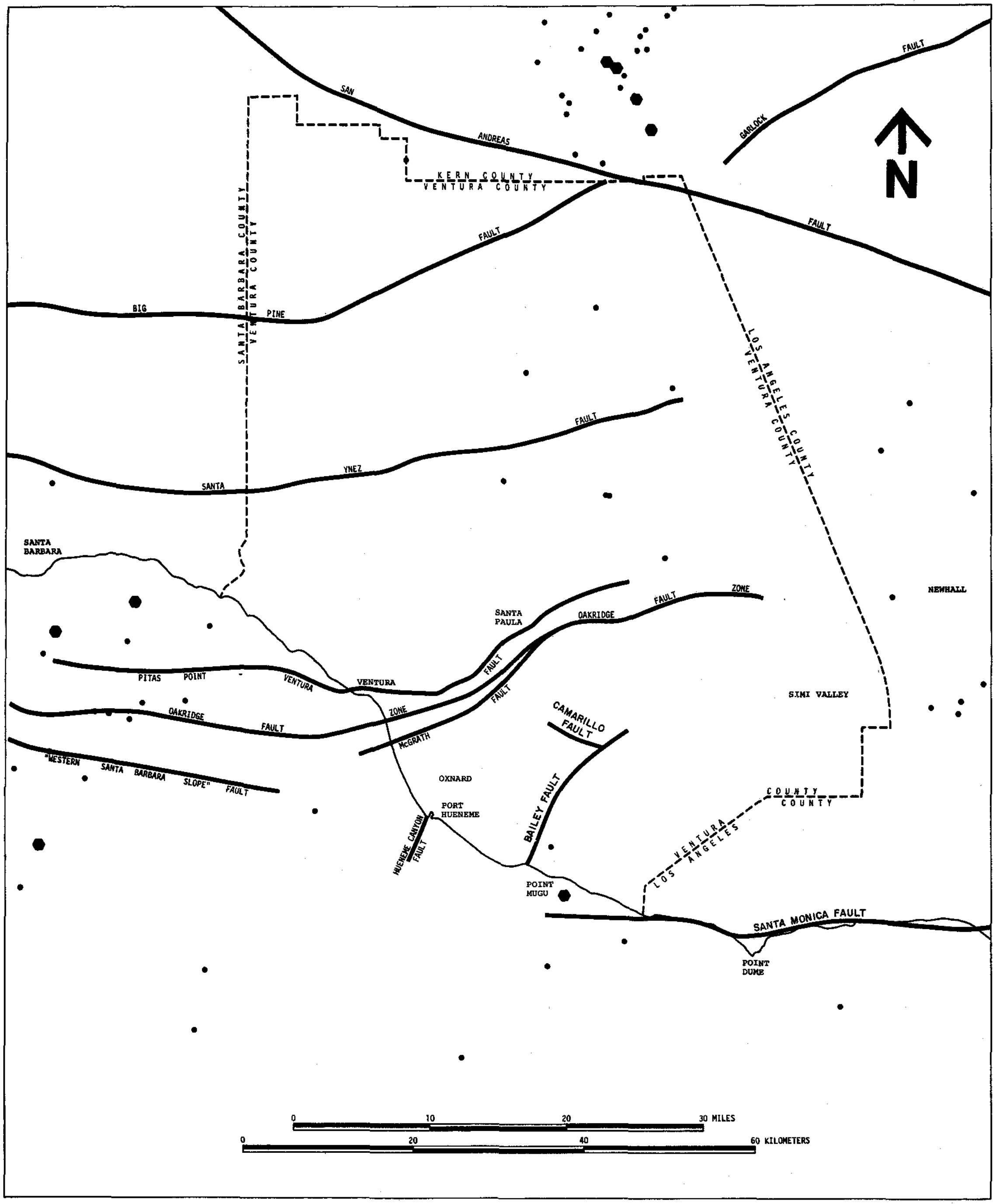
Faults

Three major faults which displace Tertiary and Quaternary strata have been recorded within the vicinity of the project area: the Pitas Point-Ventura fault; Oak Ridge fault; and, McGrath fault. In addition, a number of faults have been mapped by Greene (1976) and Greene et al. (1978) on the Oxnard (Ventura) Shelf, along the Oxnard slope, within the eastern Santa

Barbara Basin, and along the axis of Hueneme Canyon (Figure 12.1-5). These faults have been inferred largely on the basis of interpretations of seismic reflection profiles and oil field data.

The Pitas Point-Ventura fault is an east-west-trending, north-dipping reverse or thrust fault near Ventura and where it extends offshore into the Santa Barbara Channel. The Ventura fault extends from the coastline between the Ventura River and Pitas Point eastward for about 10 miles (16 km). The Pitas Point fault continues offshore in the eastern Santa Barbara Channel for more than 12 miles (20 km). Apparent vertical separation of about 80 feet (20 km), north side up, has occurred along the upper part of the fault since late Pleistocene time (Greene et al., 1978). In addition, Sarna-Wojcicki et al. (1976) have reported displaced Holocene deposits along the Ventura fault.

The Oak Ridge fault is an east-west trending zone of deformation that represents the major structural feature of the eastern Santa Barbara Channel (Greene et al., 1978). The fault extends westward from near Fillmore along the northern flank of Oak Ridge and South Mountain and along the Santa Clara River on the Oxnard Plain to the coast near the Ventura Marina. From that point, it extends offshore approximately 21 miles (35 km) into the Channel. The fault plane dips steeply to the south and displaces Pleistocene strata of the San Pedro Formation 450 feet (135 m) south side up. Evidence from seismic reflection profiles indicates that deformation is more prominent along the western portion of the fault, as faulting and discrete displacement of late Quaternary strata in the west changed into isoclinal folding to the east (Greene et al., 1978). Near the present coastline, flat-lying beds show no apparent deformation. Although Greene (1976) reports that strata of the San Pedro Formation of early Pleistocene age are the youngest strata displaced by the fault, disruption of near surface sediments along the western (offshore) end of the fault zone are suggestive of Holocene displacements (Dames & Moore, 1976).



EXPLANATION OF EPICENTER SYMBOLS:

- • RICHTER MAGNITUDE GREATER THAN, OR EQUAL TO, 4; LESS THAN 5.
- ⬢ RICHTER MAGNITUDE GREATER THAN, OR EQUAL TO, 5.

FIGURE 12.1-5

GENERALIZED FAULT AND EARTHQUAKE EPICENTER LOCATIONS IN THE VICINITY OF VENTURA COUNTY

REFERENCE: MODIFIED FROM CDMG (1976)

DAMES & MOORE

The McGrath fault is part of the Oak Ridge zone of deformation. This fault is located south of the main trace of the Oak Ridge fault and has similar structural characteristics. The McGrath fault probably connects with the McGrath thrust of Weaver et al. (1969) and extends offshore for a distance of only about 2 miles (3 km) (Greene, 1976). The youngest strata displaced along the McGrath fault are of late Pleistocene (?) age (Greene et al., 1978).

The Bailey fault extends from the Mugu Lagoon area to an apparent intersection with the Camarillo fault near Calleguas Creek and U.S. Highway 101. No surface evidence of the fault is known, nor have any recorded earthquakes been attributed to it.

A number of faults are recognized within the eastern Santa Barbara Basin. The "western Santa Barbara slope fault" of Greene et al. (1978) trends generally east-west along the southern limit of the Oak Ridge fold belt for over 10 miles (16 km). This fault displaces strata of Pliocene age and does not appear to displace Pleistocene or younger strata (Greene, 1979). Greene (1976) and Greene et al. (1978) have mapped a fault within the eastern Santa Barbara Basin between Anacapa Island and the northern slope of the Basin. This fault trends generally east-west and is over 7 miles (11 km) long. It displaces strata of Miocene age and older. Several other small faults have been mapped within the eastern Santa Barbara Channel and along the Oxnard slope; however, these faults do not affect strata younger than Miocene age. A fault mapped along the axis of Hueneme Canyon by Greene et al. (1978) trends northwest-southeast for about 3 miles (5 km). Although the age of movement along this fault is difficult to establish, there is no evidence for displacement of strata younger than Miocene in age (Greene, 1979).

12.1.2.2 Local Geology - Onshore

12.1.2.2.1 Project Area

The project area is located along the coastal margin of the Oxnard Plain, an extensive lowland area developed within the Ventura Basin. The Ventura

Basin has been a center of deposition for much of its geologic history and is underlain by as much as 60,000 feet (18,000 m) of predominantly marine Cretaceous through Quaternary sedimentary rocks. Nonmarine fluvial, deltaic and lagoonal and nearshore marine deposits associated with the pre-historic delta of the Santa Clara River and Calleguas Creek form the surficial and near-surface deposits of the Oxnard Plain and Oxnard Shelf (Weber and Kiessling, 1976; Sprotte and Johnson, 1976).

The Cretaceous, Tertiary, and Quaternary stratigraphy of the Santa Barbara Channel-Ventura Basin area including the project area, is summarized in Section 12.1.2.1.1.

The deposits underlying the Oxnard Plain area form one of the thickest accumulations of Quaternary sediments in the world, attaining a thickness of over 3,400 feet (1,000 m) in the Port Hueneme area. The lower part of the section, including the Santa Barbara and San Pedro formations, was described in Section 12.1.2.1.1. These units attain approximate maximum thicknesses of 2,000 feet (600 m) and 1,000 feet (300 m), respectively, beneath the Oxnard Plain (Sprotte and Johnson, 1976). These lower Pleistocene sediments consist of sandy gravels, sands, silts, and clays.

Late Pleistocene sediments beneath the Oxnard Plain include gravels, sands, silts, and clays, which were deposited in floodplain, estuarine, lagoonal, and nearshore marine environments (Sprotte and Johnson, 1976). These materials unconformably overlie the lower Pleistocene sedimentary units and attain an approximate maximum thickness of 480 feet (145 m).

The Holocene sediments beneath the Oxnard Plain consist of gravels, sands, silts, clays, mudstones, and local zones containing cobbles and boulders, as well as lenses of peat, carbonaceous materials, and shell debris (Sprotte and Johnson, 1976). The Holocene sequence disconformably overlies the upper Pleistocene sediments and attains an approximate maximum thickness of 390 feet (120 m). Beneath most of the Oxnard Plain, the Holocene sedimentary sequence comprises three stratigraphic units: a perched water zone; a "clay cap" aquiclude; and, the Oxnard Aquifer zone (Sprotte and Johnson, 1976). A generalized stratigraphic cross-section across the coastal portion of the Oxnard Plain is shown on Figure 12.1-6.

Geologic structure within the project area consists of the southern flank of the Santa Clara syncline, the Montalvo anticline, and the Oxnard syncline. The Oak Ridge fault and McGrath thrust are associated with this zone of deformation. Beneath the Oxnard Plain, the lower Pleistocene Santa Barbara and San Pedro formations have been deformed and folded (Sprotte and Johnson, 1976; Greene, 1976). These strata were deformed during the mid-Pleistocene and eroded prior to deposition of the upper Pleistocene sediments.

Several photolineaments have been mapped within the project area and along the Ormond Beach alternative pipeline corridors by Weber and Keissling (1976). These photolineaments typically consist of linear trends of vegetation, vegetation and/or soil contrasts, or linear topographic features. These lineaments may be the surface expressions of faults; however, these features have not been studied in detail and their origin remains uncertain.

Geomorphic processes active within the project area are limited to shoreline processes, fluvial erosion and deposition, and aeolian activity. Shoreline processes are discussed in Section 12.3. Fluvial processes are, for the most part, limited to the Santa Clara River and its floodplain. The Santa Clara River is the principal drainage for a large portion of the western Transverse Ranges. Consequently, the river carries large volumes of water after periods of sustained rainfall and the low-lying areas surrounding its floodplain are subject to inundation by flooding (Section 12.1.6.11). Erosion and/or downstream deposition may accompany periods of high flow. Aeolian processes are most active in the coastal dune belt. The dunes largely have been stabilized by vegetation, however, which limits the effects of aeolian activity.

Review of the California Division of Mines and Geology (CDMG) study concerning mineral resources in southern Ventura County (Weber et al., 1973) indicates that the only mineral resources known to exist near the project area are petroleum and sand and gravel. Petroleum is presently being extracted from the Oxnard and West Montalvo oil fields. Sand and gravel are produced from the alluvium of the Santa Clara River along a 10- to 11-mile (16- to 18-km)-stretch of the river extending eastward from U.S. Highway 101. To the west of the highway (in the area which includes the project area), the alluvium consists predominantly of sand. This area is not currently being mined for sand or gravel and it has not been identified as a potential future source.

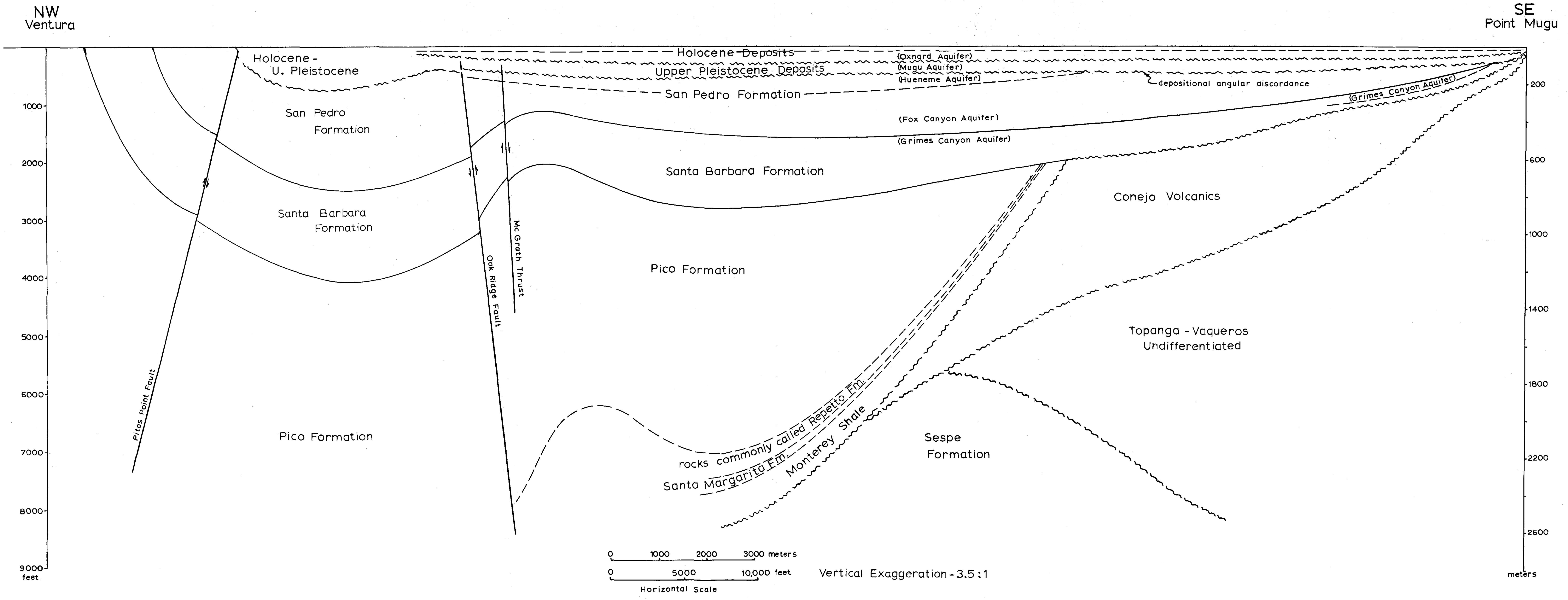
12.1.2.2.2 Proposed Mandalay Site and Pipeline Corridor

The proposed Mandalay site is situated adjacent to the coastline in the coastal dune field. Surficial materials at the site consist of fine- to medium-grained, well sorted sands. The site is situated along the axis of the Oxnard syncline, a broad, gently folded, seaward-plunging synclinal structure developed in lower Pleistocene and older strata. No faults or photolineaments suspected as fault-related are known on, or immediately adjacent to, the site.

The onshore pipeline corridor associated with the proposed Mandalay site traverses the coastal dune field and crosses the floodplain of the Santa Clara River. Along the southern portion of the corridor which traverses the dune field, surficial materials consist of fine- to medium-grained sands. A variety of materials may be expected along the portion of the corridor which crosses the floodplain of the Santa Clara River, including sands, silty sands, sandy silt, and gravel. Aeolian processes may be active along the southern portion of this corridor, and periodic fluvial erosion and/or deposition may be anticipated along the portion of the corridor which traverses the floodplain. The pipeline corridor crosses both the McGrath thrust (fault) and the Oak Ridge fault, structures which display evidence of late Quaternary deformation.

12.1.2.2.3 East Mandalay Alternative Site and Pipeline Corridor

The East Mandalay alternative site is situated within the inner zone of the coastal dune field. The sand dunes are extensively vegetated and thus are generally stable and inactive. Surficial materials at the site consist of



NOTE: SEE FIGURE 12.1-3 FOR AREAL EXTENT AND ORIENTATION OF CROSS-SECTION.

FIGURE 12.1-6

GENERALIZED STRATIGRAPHIC CROSS-SECTION ACROSS THE COASTAL PORTION OF THE OXNARD PLAIN

REFERENCE: MODIFIED FROM GREENE ET AL. (1978)

DAMES & MOORE

fine- to medium-grained slightly silty sands. This site is also situated along the axis of the Oxnard syncline. No faults or photolineaments suspected as fault-related are known on, or immediately adjacent to, the site.

The onshore pipeline corridor associated with the East Mandalay alternative site would be identical to that for the proposed Mandalay site (Section 12.1.2.2.2) with one exception. A short corridor would be required between Harbor Boulevard and the site. This corridor would cross portions of the middle and inner zones of the dune belt. Surficial materials along this segment of the route consist of fine- to medium-grained slightly silty sands. No faults are known or are suspected to exist along this segment of the route.

12.1.2.2.4 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

The Union Oil Marine Terminal alternative site is located within an existing complex of oil handling facilities adjacent to the Ventura Marina. The site has been graded and is largely covered by asphaltic pavement; thus, geologic materials are not exposed. Apparently, artificial fill immediately underlies the site. Since the site is located on the historic floodplain of the Santa Clara River, it is anticipated that the underlying geologic materials comprise alluvial sands, silts, gravel, and clay. The site is located within a zone of deformation referred to as the Oak Ridge fold belt by Greene et al. (1978) and is located immediately adjacent to, or above, the concealed trace of the Oak Ridge fault. The site is also located very near the designated floodway of the Santa Clara River.

The onshore pipeline corridor associated with the Union Marine Terminal alternative site is identical to that for the proposed Mandalay site (Section 12.1.2.2.2).

12.1.2.2.5 Ormond Beach Alternative Site and Pipeline Corridors

The Ormond Beach alternative site is located within an industrialized area, and its surface has been modified by grading. Surficial soils at the site are predominantly silty fine sands and fine sandy silts. Geologic structure within the Quaternary materials underlying the site essentially is flat.

No faults or photolineaments suspected as fault-related are known on, or immediately adjacent to, the site.

Two onshore pipeline corridors would be required in association with the Ormond Beach alternative site as described in Section 3.0.

Much of the area along the onshore corridor between Silver Strand Beach and the site has been urbanized and industrialized. Surficial materials along the route are predominantly fine- to medium-grained sands and silty sands. Where the corridor crosses the main channel of Port Hueneme Harbor, sandy silts and silts are anticipated. The presence of a narrow zone of coastal sand dunes along Ormond Beach indicates that aeolian processes may be active along this portion of the corridor. No areas of known faulting are traversed by the corridor, although the Hueneme Canyon fault may extend onshore in the area.

Pipeline corridor Option A traverses the coastal dune belt and an urbanized and agricultural area. Surficial materials consisting of fine- to medium-grained sands are present along the portion of the corridor which traverses the coastal dune field. Although specific information is not available, it is believed that the inland portion of the corridor, which traverses an urban and agricultural area, is underlain by surficial materials composed of silty sand and sandy silt. Aeolian processes may be active along the portion of the corridor which traverses the dune field. The corridor crosses the McGrath and Oak Ridge faults and the Santa Clara River.

Option B traverses areas characterized by both agricultural and urban development. Surficial alluvial materials along the corridor are extensively modified by agricultural activities and urban development. It is likely that predominantly silty sand and sandy silt with lesser gravels and clay deposits underlie the route. Option B crosses the McGrath and Oak Ridge faults, a number of photolineaments mapped by the CDMG (Weber and Kiessling, 1976), and the Santa Clara River.

12.1.2.3 Local Geology - Offshore

12.1.2.3.1 Platform Gina Site and Pipeline Corridor

The general stratigraphy and structural elements within the vicinity of the proposed Platform Gina site and pipeline corridor were described in Sections 12.1.2.1.1 and 12.1.2.1.2. Geologic materials exposed at the surface of the seafloor and within the shallow subsurface in the immediate vicinity of the platform have been investigated and discussed by Geotechnical Consultants, Inc. (1976), Geotec Engineering, Inc. (1979), and McClelland Engineers, Inc. (1979).

A generalized stratigraphic column for the site is shown on Figure 12.1-7 and additional lithologic information is given in Table 12.1.1.

The upper sedimentary unit identified beneath the platform site consists of generally flat-lying interbedded silty fine sands and fine sandy silts to a depth of 110 feet (33 m) beneath the seafloor. These materials have been inferred to represent floodplain and alluvial deposits of Holocene age (Geotechnical Consultants, Inc. 1976; McClelland Engineers, Inc., 1979). This upper sediment unit ranges in thickness from 130 feet (40 m) to 0 in the general platform area. The Holocene materials on the Oxnard Shelf unconformably overlie upper Pleistocene terrace deposits (Greene, 1976; Greene et al., 1978).

Two upper Pleistocene terrace deposits underlie the upper sediment unit. The terrace deposits consist of a sequence of gravelly sand overlying silty sand to sandy silt and clayey silt to silty clay to a depth of 225 feet (68 m) beneath the seafloor. The gravelly sand has been correlated with the Mugu Aquifer and the underlying silty sand to silty clay is correlated with the upper Pleistocene aquiclude (Geotechnical Consultants, Inc., 1976). The upper Pleistocene terrace deposits have gentle southerly dips and unconformably prograde over the underlying strata of the San Pedro Formation.

Table 12.1-1

NEAR-SURFACE GEOLOGIC UNITS - PLATFORM GINA SITE

Stratigraphic Unit	Geologic Age	Thickness (feet)	Lithologic Description
Alluvial Deposits	Holocene	110	Interbedded silty sand and sandy silt
Terrace Deposits	Upper Pleistocene	20	Gravelly sand
Terrace Deposits	Upper Pleistocene	95	Silty sand, sandy silt, and silty clay
San Pedro Formation	Lower Pleistocene	±625	Gravelly sand with clay lenses

Data from Geotechnical Consultants, Inc. (1976).

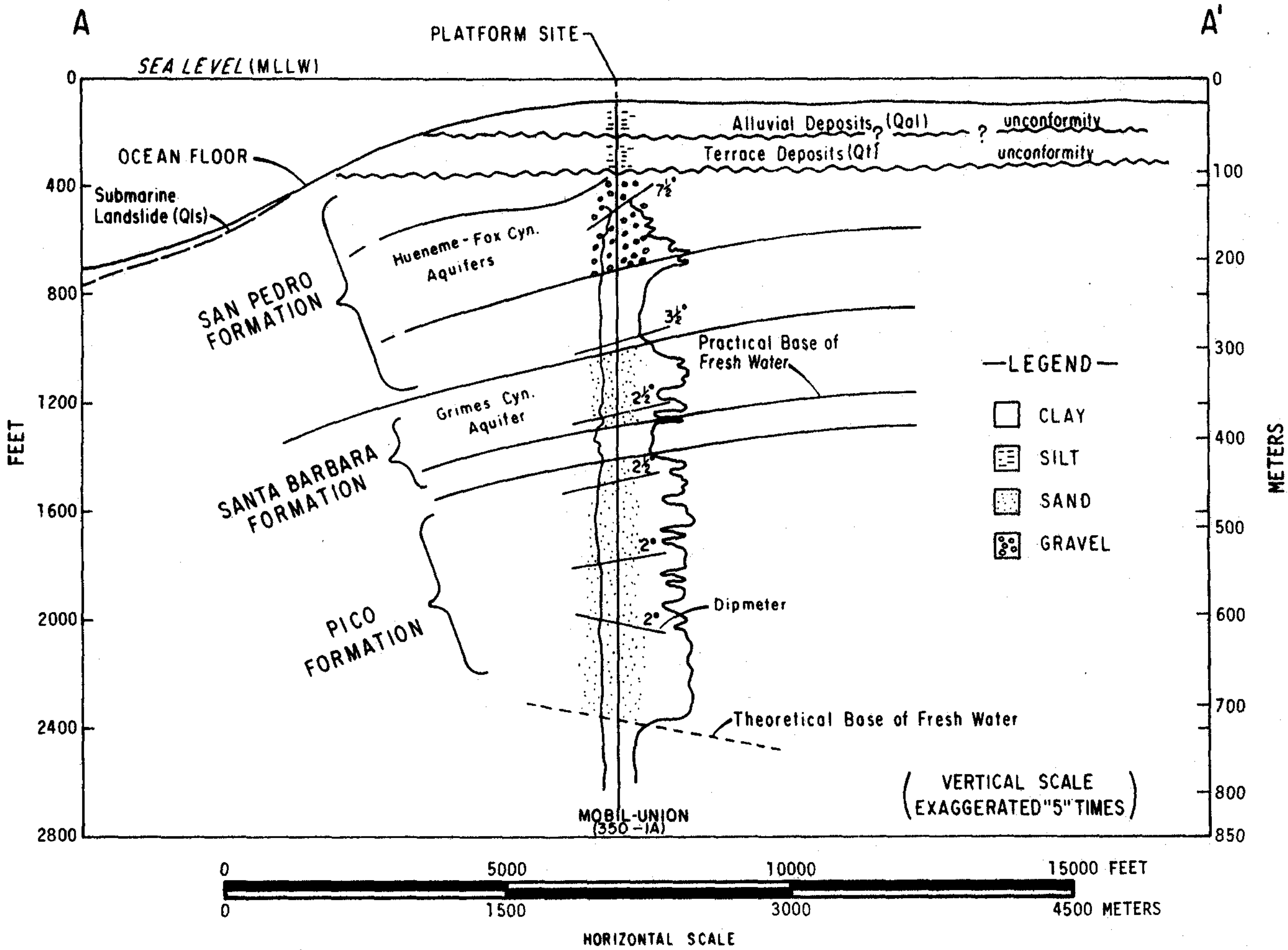


FIGURE 12.1-7

GENERALIZED STRATIGRAPHIC CROSS-SECTION AT THE PLATFORM GINA SITE

REFERENCE: MODIFIED FROM GEOTECHNICAL CONSULTANTS, INC. (1976)

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The San Pedro Formation of lower Pleistocene age underlies the terrace deposits and has an estimated thickness of 625 feet (190 m), extending to a depth of 850 feet (260 m) below the seafloor (Geotechnical Consultants, Inc., 1976). These materials consist of sandy gravel which grades downward to gravelly sand (Geotec Engineers, Inc., 1979). Strata of the San Pedro Formation were deformed during the middle Pleistocene and have southwesterly dips of 7 to 8 degrees (Geotechnical Consultants, Inc., 1976).

Conformably underlying the San Pedro Formation is a uniform sequence of unconsolidated sands assigned to the Santa Barbara and Pico formations. These materials are discussed in Section 12.1.2.1.1. The Santa Barbara Formation is present between 850 and 1,200 feet (260 to 365 m) below the seafloor and the Pico Formation extends from 1,200 to 2,200 feet (365 to 670 m) below the seafloor (Geotechnical Consultants, Inc. 1976).

Strata underlying the Pico Formation may include, from youngest to oldest, the Repetto Formation, Santa Margarita (Modelo) Formation, Monterey Formation, Conejo Volcanics(?), Rincon Formation, Topanga-Vaqueros formations undifferentiated(?), and the Sespe Formation. Detailed deep subsurface stratigraphic information specific to the platform site is considered proprietary and was not available for this investigation.

Stratification within the Holocene sediments and upper Pleistocene terrace deposits is generally horizontal to gently seaward-dipping (McClelland Engineers, Inc., 1979). Thus, the upper Pleistocene and Holocene deposits appear not to have been significantly deformed. A relatively flat-lying unconformity separates these deposits from the underlying, more steeply dipping sediments (apparent dips of 6.5 to 9 degrees to the south) of the San Pedro, Santa Barbara and Pico formations. No faults were recognized on any of the seismic records from the marine geophysical survey conducted in the platform area by McClelland Engineers, Inc. (1979).

The only geomorphic process expected to occur at the platform site is minor redistribution of sediments by bottom currents.

No mineral resources have been reported from the seafloor or within the shallow subsurface of the Oxnard Shelf area. However, oil and gas occur in deeper zones. Extraction of a portion of this oil and gas is an objective of the proposed project.

The upper sediment unit of Holocene age mapped beneath the platform site can be mapped at the seafloor surface in seismic reflection profiles 4,000 feet (1,200 m) north of the platform site along the Mandalay pipeline route (McClelland Engineers, Inc., 1979). Its thickness north of the platform area is about 120 to 125 feet (36 to 38 m). This unit consists of interbedded silty sand and sandy silt.

Along the northern one-third of the Mandalay pipeline route, a second upper sediment unit was mapped by McClelland Engineers, Inc. (1979). This unit ranges from 22 to 27 feet (6.7 to 8.2 m) thick where it is mapped immediately beneath the seafloor. This sediment unit is an acoustical horizon which appears in the seismic reflection profiles; its geologic and geotechnical significance is not known. It is probable that this upper sediment unit is a different facies of the floodplain and alluvial deposits of Holocene age which mantle the Oxnard Shelf. The near-surface geologic materials which underlie the upper sediment unit(s) are most likely the same as those which underlie the platform site, although they probably vary locally in thickness.

The sediments along the proposed Mandalay pipeline route are generally flat-lying within the upper 500 feet (150 m) below the seafloor (McClelland Engineers, Inc., 1979). Several angular unconformities are present between about 500 and 800 feet (150 to 240 m) beneath the seafloor. With the exception of the northern one-third of the pipeline route, sediments below about 800 feet (240 m) below the seafloor dip 4 to 8.5 degrees seaward (McClelland Engineers, Inc. 1979). No faults were identified on any of the seismic records from the marine geophysical survey along the pipeline corridor by McClelland Engineers, Inc. (1979).

The only geomorphic process expected to occur along the proposed pipeline corridor is redistribution of sediment by longshore drift and bottom currents.

No mineral resources have been reported from the seafloor or within the shallow subsurface of the Oxnard Shelf area; however, oil does occur in deeper zones as discussed above.

12.1.2.3.2 Platform Gilda Site and Pipeline Corridor

The general stratigraphy and structural elements within the vicinity of the proposed platform site are described in Sections 12.1.2.1.1 and 12.1.2.1.2. Geologic materials exposed at the surface of the seafloor and within the shallow subsurface in the immediate vicinity of the platform have been investigated by Fugro, Inc. and by McClelland Engineers, Inc. (1980). Results of the Fugro study and detailed deep subsurface information are considered proprietary and were not available for this investigation.

The upper sediments at the proposed platform site consist of silt and clayey silt. Seismic data suggest a similar composition of upper sediments along the pipeline route (McClelland Engineers, Inc., 1980).

A westerly trending anticline underlies the proposed platform site. Several possible faults trend westerly and northwesterly within the vicinity of the proposed platform. The possible fault nearest the platform site is about 600 feet (185 m) to the east-northeast; it is buried by at least 210 feet (65 m) of undisturbed sediment. No faults or possible faults were identified in the pipeline corridor east of the platform area (McClelland Engineers, Inc., 1980).

12.1.2.3.3 Platform Gina Alternative Pipeline Corridor

The upper sediment unit of Holocene age recognized beneath the platform site can be mapped northeastward and eastward along the Ormond Beach native pipeline corridor (McClelland Engineers, Inc., 1979). Northeast of the platform area, its thickness ranges from 115 to 120 feet (35 to 36 m). This unit consists of interbedded silty sand and sandy silt. A buried channel was mapped within the upper sediment unit in the central southeast part of the pipeline corridor. The base of the channel extends into the upper Pleistocene terrace deposits which underlie the upper sediment unit. The top of this channel is about 60 feet (18 m) below the seafloor, and its base is about 180 feet (55 m) below the seafloor (McClelland Engineers, Inc., 1979). The near-surface geologic materials which underlie the upper sediment unit(s) are most likely the same as those which underlie the Platform Gina site, although they probably vary locally in thickness.

The sediments along the Ormond Beach alternative pipeline route are generally flat-lying within the upper 500 feet (150 m) below the seafloor. Several angular unconformities are present between about 500 and 800 feet (150 to 240 m) beneath the seafloor, and sediments below about 800 feet (240 m) below the seafloor dip 4.5 to 8 degrees seaward (McClelland Engineers, Inc., 1979). No faults were identified on any of the seismic records from the marine geophysical survey by McClelland Engineers, Inc., (1979).

The only geomorphic process expected to occur along the alternative pipeline corridor is minor redistribution of sediment by longshore drift and bottom currents.

No mineral resources have been reported from the seafloor or within the shallow subsurface of the Oxnard Shelf area including the vicinity of the pipeline corridor.

12.1.3 Seismicity

12.1.3.1 Historic Seismicity

California is located within the circum-Pacific earthquake zone and is the most seismically active of the 48 contiguous states. All of California experiences earthquake activity to some degree. In recent years, the western

Transverse Ranges region has experienced several seismic events per year, although most have been small and detected only by instruments.

Information pertaining to the historic seismicity of the area was obtained from Dr. C. F. Richter of the California Institute of Technology (CalTech), Townley and Allen (1939), CalTech (1977), Gawthrop (1975), and Real, Toppozada, and Parke (1978). Significant earthquakes in the western Transverse Ranges region that have occurred between the years 1800 and 1979 which may have affected the project area are listed in Table 12.1-2.

The magnitude of an earthquake is a function of its energy release, as measured on a standard Wood-Anderson seismograph. Intensity, on the other hand, refers to subjective evaluation of the physical effects of ground motion at a specific location. The Modified-Mercalli Scale places these observations into a ranking scale (Wood and Neumann, 1931), as shown in Table 12.1-3.

Southern California's high degree of seismicity can, in general, be related to known fault systems. For example, the four areas of major earthquake epicenter concentration exhibited on Figure 12.1-8 can be related to major tectonic structures. The epicenters south of Los Angeles are related to activity on the Newport-Inglewood and associated faults. These events were primarily associated with the 1933 Long Beach earthquake and its aftershocks. The epicenters in the San Fernando Valley are related to the Sierra Madre fault system and primarily are due to aftershocks of the San Fernando earthquake of 1971. The Kern County earthquakes are due to activity on the White Wolf and related faults and are primarily aftershocks of the Arvin-Tehachapi earthquake of 1952. The epicenters in the Santa Barbara Channel are due to continuing movement on several offshore faults and an earthquake swarm in 1968.

Also shown on Figure 12.1-8 is the San Andreas fault. Few recent epicenters appear to be directly associated with this fault. However, the San Andreas fault has the potential to generate large earthquakes. For example, a

TABLE 12.1-2

SIGNIFICANT EARTHQUAKES IN THE SANTA BARBARA CHANNEL AREA, 1800-1979

Date[1]	Location	Area Felt Square Miles (km^2)	Magnitude (Richter)	Maximum Intensity (Modified-Mercalli)
21 December 1812	Off coast of southern California		7-7.25	X
27-30 November 1852	Northern Ventura County			IX-X (?)
9 January 1857	Near Fort Tejon		8-8.25	X-XI
5 September 1883	Ventura			V-VI
1 June 1893	Santa Barbara			VI
11 January 1915	Los Alamos	50,000 (129,500)		
22 October 1916	Tejon Pass	25,000-50,000 (64,750-129,500)	6	VII
12 April 1917	Santa Barbara Channel	8,000 (20,720)		V
29 June 1925	Vicinity of Santa Barbara		6.3	VIII-IX
18 February 1926	Southwest of Ventura			VI
28 September 1926	Ventura			IV-V (?)
4 November 1927	West of Point Arguello		7.3-7.5	IX-X
5 August 1930	Santa Barbara			VII
30 June 1941	Santa Barbara/Carpinteria	20,000 (51,800)	5.9	VIII
1 April 1945	Santa Rosa Island	1,000 (2,590)	5.4	IV
21 July 1952	Kern County	160,000 (414,400)	7.2	XI
18 March 1957	South of Oxnard	3,000 (7,770)	4.7	VI
22 October 1969	Near Santa Lucia Bank (Offshore)		5.4	
9 February 1971	Northeast of San Fernando		6.4	
21 February 1973	Southeast of Point Mugu		6.0	
6 August 1973	Anacapa Island		4.8	
13 August 1978	South of Santa Barbara		5.1	

[1]Data from several sources, see Section 12.1.3.1.

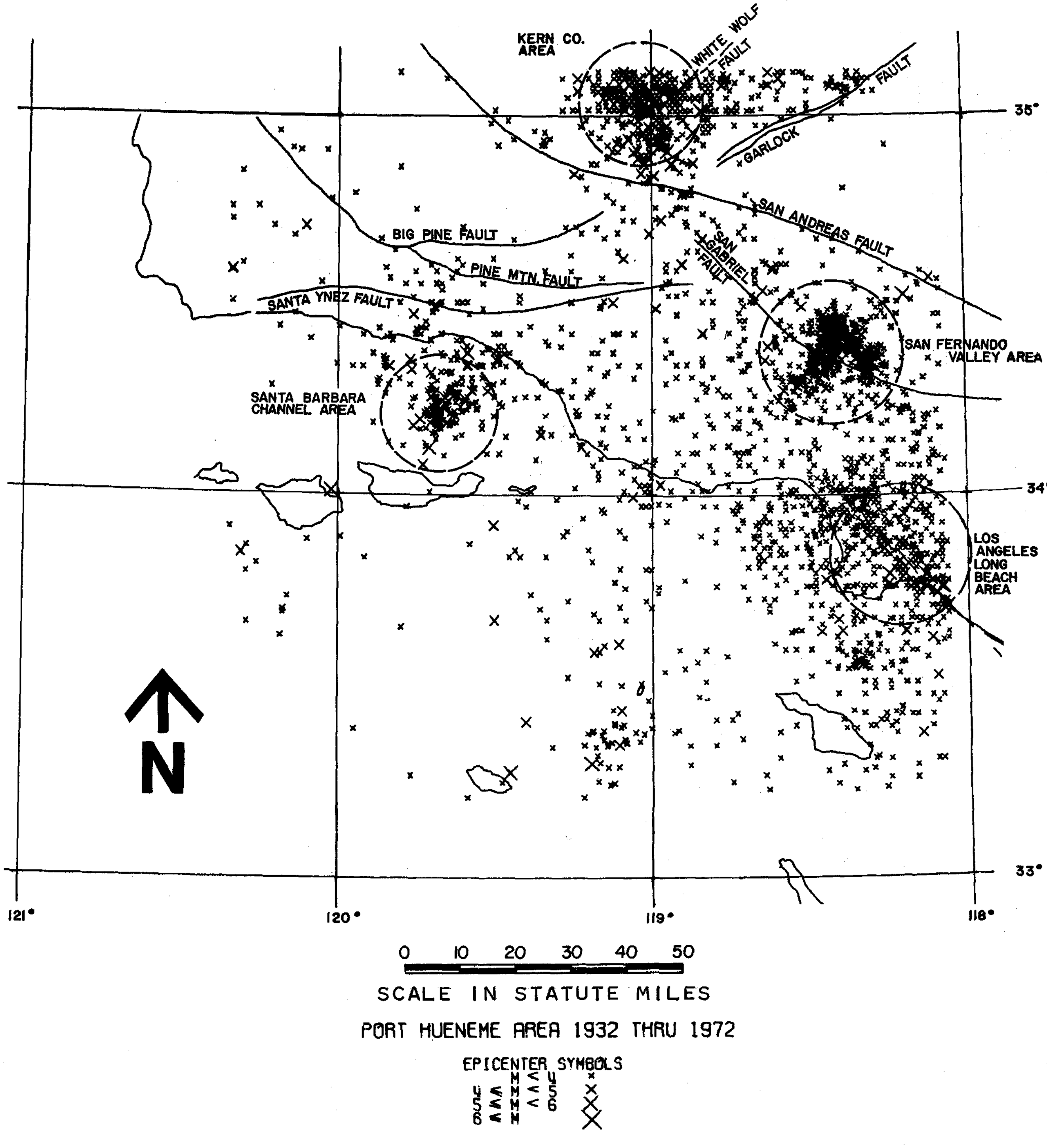

FIGURE 12.1-8

EARTHQUAKE EPICENTER LOCATIONS WITHIN A PORTION OF SOUTHERN CALIFORNIA, 1932 - 1972

REFERENCE: DATA FROM CALIFORNIA INSTITUTE OF TECHNOLOGY (1973)

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TABLE 12.1-3

MODIFIED-MERCALLI EARTHQUAKE INTENSITY SCALE

I. Detected only by sensitive instruments.

II. Felt by a few persons at rest, especially on upper floors; delicate suspended objects may swing.

III. Felt noticeably indoors, but not always recognized as a quake; standing autos rock slightly, vibration like passing truck.

IV. Felt indoors by many, outdoors by a few; at night some awaken; dishes, windows, doors disturbed; motor cars rock noticeably.

V. Felt by most people; some breakage of dishes, windows, and plaster; disturbance of tall objects.

VI. Felt by all; many are frightened and run outdoors; falling plaster and chimneys; damage small.

VII. Everybody runs outdoors; damage to buildings varies, depending on quality of construction; noticed by drivers of autos.

VIII. Panel walls thrown out of frames; fall of walls, monuments, chimneys; sand and mud ejected; drivers of autos disturbed.

IX. Buildings shifted off foundations, cracked, thrown out of plumb; ground cracked; underground pipes broken.

X. Most masonry and frame structures destroyed; ground cracked; rails bent; landslides.

XI. New structures remain standing; bridges destroyed; fissures in ground; pipes broken; landslides; rails bent.

XII. Damage total; waves seen on ground surface; lines of sight and level distorted; objects thrown up into air.

This scale is a subjective measure of the effect of ground shaking and is not an engineering measure of the ground acceleration.

great earthquake (Magnitude 8+) originated on the portion of the fault nearest the project region in 1857.

Several recent earthquakes have occurred offshore in the western Transverse Ranges region. Two of these occurred in 1973: the Point Mugu earthquake and the Anacapa earthquake. These earthquakes suggest continuing seismic activity. The Point Mugu event occurred on the Santa Monica fault. The Anacapa earthquake may have occurred on an extension of the Santa Cruz Island fault (USGS, 1976).

12.1.3.2 Potential for Future Earthquakes

The western Transverse Ranges region has experienced numerous historical earthquakes and the geologic record indicates a high level of tectonic activity with local and regional crustal deformation continuing into the Holocene. Therefore, seismic activity is expected to continue into the future with large events occurring along known major fault systems. Significant faults in the region are shown on Figure 12.1-5.

It is impossible to accurately predict earthquakes at this time. However, due to the frequency of earthquakes in the project region, it should be expected that during the design life of the proposed facilities, an earthquake would occur which could cause damage to improperly designed structures.

12.1.4 Soils

12.1.4.1 Regional Overview

Within the Ventura Area, 14 soil associations have been described by the USDA Soil Conservation Service (1970). Four of the associations are on alluvial fans and plains and in basins, two are on terraces, and eight are on uplands. Most of the individual soils belonging to these associations are relatively youthful and have been derived from sedimentary rocks or unconsolidated sedimentary deposits.

12.1.4.2 Local Soils

The soils developed in the vicinity of the proposed and alternative project sites and pipeline corridors are well drained to excessively drained loamy sands to silty clay loams on plains areas, and poorly drained loamy sands to silty clay loams in basins. They have formed in alluvium derived predominantly from sedimentary rocks. These soils are used extensively for cultivated crops and orchards, and for urban development. In uncultivated areas, the vegetation consists of annual grasses, forbs, brush, and scattered oaks.

Four soil associations occur within the project area. These include: (1) Pico-Metz-Anacapa Association; (2) Mocho-Sorrento-Garretson Association; (3) Camarillo-Hueneme-Pacheco Association; and, (4) Riverwash-Sandy Alluvial Land-Coastal Beaches Association.

Each of these soil associations comprises several individual soils, or mapping units. Mapping units are differentiated by texture of the surface soil, slope, stoniness, or other characteristics that affect the use of soils by man.

The distribution of the four soil associations that occur within the vicinity of the proposed and alternative onshore sites and associated pipeline corridors is shown on Figure 12.1-9. Characteristics of the individual soils that locally form the four associations are listed in Table 12.1-4. The four soil associations are discussed below.

Pico-Metz-Anacapa Association

The soils of the Pico-Metz-Anacapa association are level to moderately sloping, very deep, well drained sandy loams and very deep, somewhat excessively drained loamy sands. These soils have formed in deep alluvium derived predominantly from sedimentary rocks and are 60 inches (150 cm) or more deep. The plant cover in uncultivated areas consists of annual grasses, forbs, and scattered oaks.

TABLE 12.1-4

CHARACTERISTICS OF INDIVIDUAL SOILS

Mapping Unit[1]	Slope	Permeability	Runoff	Erosion Potential	Shrink-swell Potential	Index Rating	Soil[2] Grade	Characteristic[3] Association
Anacapa sandy loam	0-2%	Moderately rapid	Slow	None	Low	95	1	1
Camarillo sandy loam	Level	Moderate	Very slow to ponded	None	Moderate	71	2	3
Camarillo loam	Level	Moderate	Very slow to ponded	None	Moderate	71-75	2	3
Coastal beaches	0-5%	Very rapid	Slow	High	Low	0-5	6	4
Corralitos loamy sand	2-9%	Rapid	Slow	Slight	Low	57	3	1
Cropley clay	0-2%	Slow	Slow	None	High	57	3	1
Hueneme loamy sand	Level	Moderate	Slow	None	Low	47	3	3
Hueneme sandy loam	Level	Moderately rapid	Very slow	None	Low	60	2	3
Metz loamy sand	0-9%	Moderately rapid to rapid	Slow to very slow	Slight to none	Low	57-64	2-3	1
Mocho loam	0-2%	Moderate	Slow	None	Moderate	100	1	2
Pacheco silty clay loam	Level	Moderately slow	Very slow	None	Moderate	60	2	3
Pico sandy loam	0-2%	Moderately rapid	Slow	None	Low	86	1	1
Sorrento loam	0-2%	Moderate	Slow	None	Moderate	100	1	1
Sorrento silty clay loam	0-9%	Moderately slow	Medium	Slight	Moderate	81-90	1	1
Fill land	————	Properties vary locally	————	————	Low	0-9	6	4
Pits and dumps	————	Properties vary locally	————	————	Low	0-5	6	4

TABLE 12.1-4 (concluded)

Mapping Unit[1]	Slope	Permeability	Runoff	Erosion Potential	Shrink-swell Potential	Index Rating	Soil Grade[2]	Characteristic Association[3]
Sandy alluvial land	Nearly level	Very rapid	Slow	Slight	Low	10	5	4
Riverwash	Nearly level	Very rapid	Rapid	High	Low	0-5	6	4
Tidal flats	Level	Moderately slow	Ponded	None	Moderate	0-9	6	4
Water								

[1] Data from USDA Soil Conservation Service (1970).

[2] Soils are placed in grades according to their suitability for farm crops as shown by their Storie index ratings. The six grades and their range in index ratings are:

	Index rating
Grade 1	80 to 100
Grade 2	60 to 80
Grade 3	40 to 60
Grade 4	20 to 40
Grade 5	10 to 20
Grade 6	Less than 10

Soils of grade 1 have few or no limitations that restrict their use for crops. Soils of grade 2 are suitable for most crops and have few special management needs, but they have minor limitations that narrow the choice of crops. Grade 3 soils are suited to a few crops or to special crops and require special management. Grade 4 soils are severely limited for crops. If used for crops, they require careful management. Grade 5 soils are not suited to cultivated crops but can be used for pasture and range. Grade 6 consists of soils and land types that generally are not suited to farming.

[3] 1 = Pico-Metz-Anacapa Association
2 = Mocho-Sorrento-Garretson Association
3 = Camarillo-Hueneme-Pacheco Association
4 = Riverwash-Sandy Alluvial Land-Coastal Beaches Association
Individual soils may occur in more than one association. Only the primary association is listed for each soil as it occurs in the project vicinity.

The soils of this association are very productive. They are used for irrigated vegetables, citrus and field crops, strawberries, walnuts, avocados, and, to a lesser extent, for range. Some areas have been used for urban development.

Mocho-Sorrento-Garretson Association

The soils of the Mocho-Sorrento-Garretson association are level to moderately sloping, very deep, well drained loams to silty clay loams. These soils have formed in deep alluvium derived from sedimentary rocks and are 60 inches (150 cm) or more deep. The plant cover in uncultivated areas consists of annual grasses, forbs, and scattered oaks.

The soils of this association are very productive. They are used for irrigated vegetables, citrus and field crops, walnuts, and avocados. Some areas are used for range, and some for urban development.

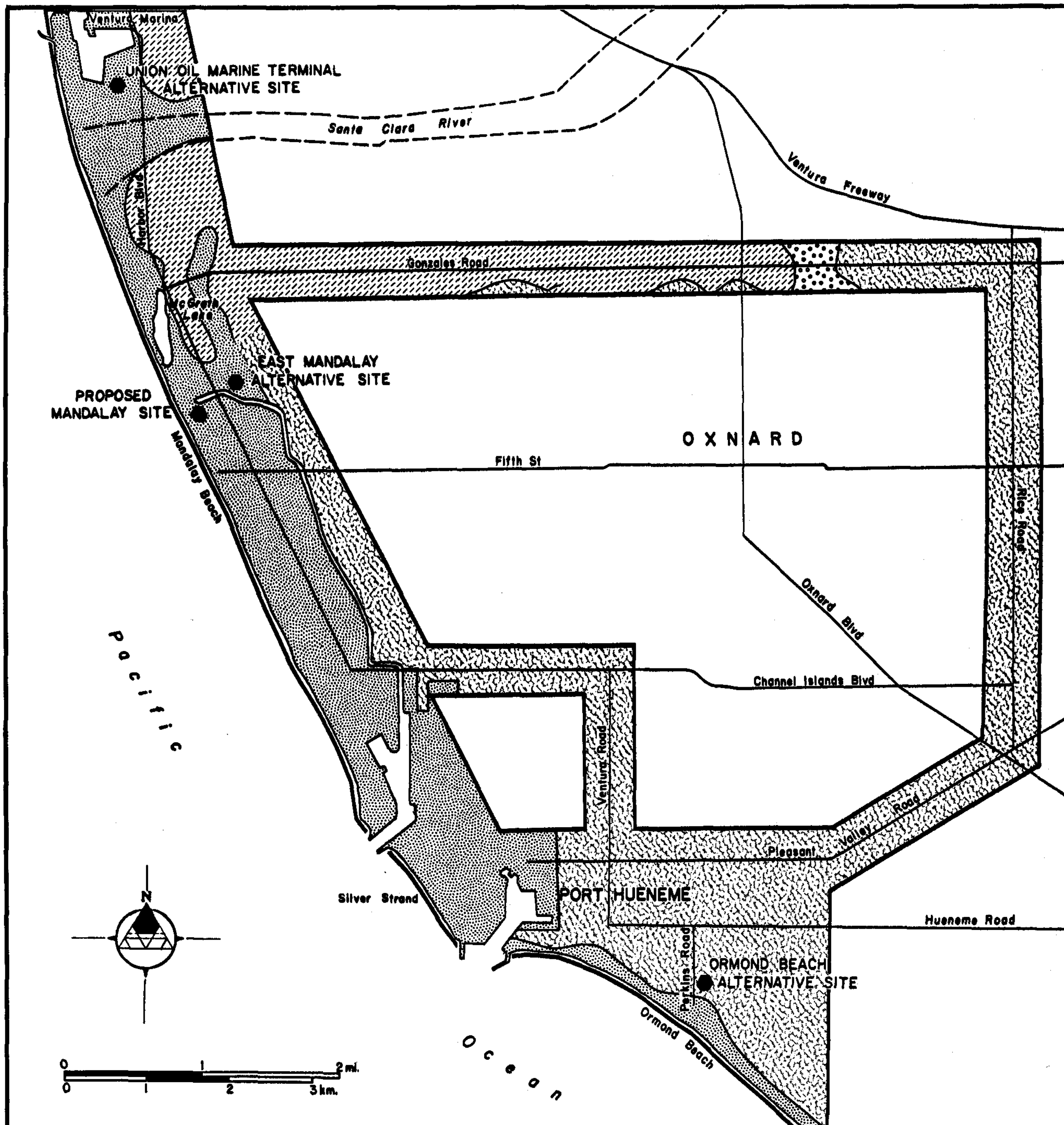
Camarillo-Hueneme-Pacheco Association

The soils of the Camarillo-Hueneme-Pacheco association are level to nearly level, very deep, poorly drained loamy sands to silty clay loams. The soils have formed in deep stratified alluvium derived predominantly from sedimentary rocks. Camarillo, Hueneme, and Pacheco soils are poorly drained and are 60 inches (150 cm) or more deep. The plant cover in uncultivated areas consists of salt-tolerant grasses, forbs, and shrubs.

The soils of this association are very productive. They are used for irrigated vegetables, field crops, lemons, and strawberries, and for urban development. Most areas are artificially drained. In undrained areas, there is a seasonal water table within a depth of 2 feet (0.6 m). Periodically the soils contain soluble salts.

Riverwash-Sandy Alluvial Land-Coastal Beaches Association

The soils of this association are level to gently sloping, excessively drained to poorly drained, stratified sandy, gravelly, and cobbly material.



EXPLANATION:

- Pico-Metz-Anacapa Association
- Mocho-Sorrento-Garretson Association
- Camarillo-Hueneme-Pacheco Association
- Riverwash-Sandy Alluvial Land-Coastal Beaches Association

FIGURE 12.1-9

DISTRIBUTION OF SOIL ASSOCIATIONS

REFERENCE: USDA SOIL CONSERVATION SERVICE (1970)

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Fill Land and Tidal Flats are included in this association. The plant cover consists of annual grasses, beach grasses, brush, willows, and scattered cottonwoods.

Riverwash and Sandy Alluvial Land are excessively drained. Coastal Beaches has variable drainage. All consist of highly stratified, water- and wind-deposited, stony, cobbly, and gravelly sand, loamy sand, and sandy loam. They contain only a small amount of silt and clay. Many areas are subject to flooding, scouring, and deposition during and immediately following storms.

The areas in this association have little or no value for farming. They are used mainly for recreation and watershed. Limited acreages of Sandy Alluvial Land are used for range, citrus crops, and urban development.

12.1.4.2.1 Proposed Mandalay Site and Pipeline Corridor

The proposed Mandalay site is located in a Coastal Beaches area of the Riverwash-Sandy Alluvial Land-Coastal Beaches association. Vegetation at the site consists of scattered dune scrub and introduced European dune grass. The site is presently utilized for limited recreation.

The onshore pipeline corridor associated with the proposed Mandalay site traverses soils of the Riverwash-Sandy Alluvial Land-Coastal Beaches and Pico-Metz-Anacapa associations. The portion of the corridor that extends from the landfall point at Mandalay Beach to Harbor Boulevard traverses a Coastal Beaches area. This area supports scattered dune scrub vegetation, introduced European dune grass and weeds, and is utilized for limited recreation. The remainder of the corridor follows an existing right-of-way along the east side of Harbor Boulevard across areas of Riverwash-Sandy Alluvial Land-Coastal Beaches and Pico-Metz-Anacapa soils. Plants along the corridor are generally scattered and belong to introduced weedy species. The corridor itself is utilized as a road and pipeline right-of-way, while surrounding areas are used for agriculture, recreation, and urbanization.

12.1.4.2.2 East Mandalay Alternative Site and Pipeline Corridor

The East Mandalay alternative site is located in a Coastal Beaches area of the Riverwash-Sandy Alluvial Land-Coastal Beaches association. Vegetation at the site consists of fairly well developed dune scrub. The site is presently utilized for open space.

The onshore pipeline corridor associated with the East Mandalay alternative site is the same as that for the proposed project, except for a short segment connecting the site with the Harbor Boulevard right-of-way. The soils encountered would be the same as those described in Section 12.1.4.2.1.

12.1.4.2.3 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

The Union Oil Marine Terminal alternative site is located in a Fill Land area of the Riverwash-Sandy Alluvial Land-Coastal Beaches association. This area is utilized for petroleum storage and transport activities. The site is extensively paved and oiled and supports essentially no vegetation.

The onshore pipeline corridor associated with the Union Oil Marine Terminal alternative site is the same as that for the proposed project; therefore, the soils encountered would be the same as those described in Section 12.1.4.2.1.

12.1.4.2.4 Ormond Beach Alternative Site and Pipeline Corridors

The Ormond Beach alternative site is located in an area of Camarillo sandy loam of the Camarillo-Hueneme-Pacheco association. Vegetation at the site consists of weedy species. Areas adjacent to the site are utilized for industrial activities while some nearby areas are used for agriculture.

Two onshore pipeline corridors would be associated with the Ormond Beach alternative site. The first would extend from the landfall at Silver Strand Beach to the site. This corridor would traverse Coastal Beaches and Fill Land areas of the Riverwash-Sandy Alluvial Land-Coastal Beaches association and a narrow portion of Camarillo sandy loam of the Camarillo-Hueneme-Pacheco association. These areas along this corridor have largely been developed for both commercial and residential uses. Along the beaches, recreation also occurs. Vegetation along the corridor is sparse and consists mainly of scattered dune plants and introduced ornamental and weedy species.

Two alternative routes have been identified for the corridor extending between the landfall at Mandalay Beach and the site. Option A traverses several soils belonging to the Riverwash-Sandy Alluvial Land-Coastal Beaches, Camarillo-Hueneme-Pacheco, and Pico-Metz-Anacapa associations. With the exception of the segment between the landfall point and Harbor Boulevard (see Section 12.1.4.2.1), the route follows existing road rights-of-way. The areas immediately adjacent to the rights-of-way are utilized primarily for urban activities and vegetation consists chiefly of introduced ornamental and weedy species. Some nearby areas are used for recreation or agriculture.

Option B traverses several soils belonging to the Riverwash-Sandy Alluvial Land-Coastal Beaches, Pico-Metz-Anacapa, Camarillo-Hueneme-Pacheco, and Mocho-Sorrento-Garretson associations. With the exception of the segment between the landfall point and Harbor Boulevard (see Section 12.1.4.2.1) the route follows existing road rights-of-way. The areas adjacent to the rights-of-way are utilized primarily for agriculture although some segments have been urbanized or are used for recreation. Vegetation consists chiefly of introduced crop, ornamental, and weedy species.

12.1.5 Hydrology

12.1.5.1 Regional Overview

12.1.5.1.1 Surface Hydrology

Within Ventura County, three principal stream systems--Ventura River, Santa Clara River, and Calleguas Creek--drain into the Pacific Ocean. The natural flow in all three streams is intermittent, dependent largely upon the rainfall, which is mainly confined to the period between November and April.

The Santa Clara River and its tributaries (including Santa Paula, Sespe, Piru, and Castaic creeks) constitute the major drainage system for the southern half of the county. This watershed is approximately 80 miles (128 km) in length and averages about 25 miles (40 km) in width. Flowing 65 miles (104 km) from its source to the Pacific Ocean, the Santa Clara River drains an area of over 1,600 square miles (4,150 km^2). Runoff from the drainage area is partially controlled by Santa Felicia Dam, Pyramid Dam, and Castaic Reservoir. Natural flows are affected by ground water withdrawals and the Freeman Diversion upstream from Montalvo. Average daily discharge between 1950 and 1975 was approximately 120 cubic feet (3.4 m^3) per second. The maximum instantaneous flow was 165,000 cubic feet (4670 m^3) per second on 25 January 1969 (Ventura County Flood Control District, 1979).

Diversion of river flows was begun in 1928 to provide additional replenishment to aquifers under the Oxnard Plain. Such artificial recharge has become increasingly important due to the extensive demand for well water. The ground water demand over the years has exceeded replenishment and has created a substantial overdraft problem (approximately 20,000 acre-feet (24.7 hm^3) per year) (California Department of Water Resources, 1976).

Sediment transport in the Santa Clara River has been evaluated by Brownlie et al. (1979). Their results indicate that the average annual sediment discharge is approximately 3,700,000 tons (3,300,000 tonnes) with roughly 28 percent of the load consisting of sand and larger particles (Table 12.1-5). Approximately 36 percent of the coarse load (10 percent of the total load) is

of an appropriate size to be potentially incorporated into beach sands. Most of the sediment is transported during a relatively short period of time during storms when discharge from the river system is high. Annual sediment discharge can therefore be extremely variable because it is dependent on the number, intensity, and duration of storms occurring each year.

The lower reach of the Santa Clara River crosses the Oxnard Plain. The flat topography has prevented development of a natural drainage system. This results in a condition of large areas of shallow flooding when the capacities

TABLE 12.1-5

AVERAGE ANNUAL SEDIMENT YIELD FROM THE SANTA CLARA RIVER

	Annual Sediment Yield in Million Tons (Million Tonnes)[a]		
	1928-1975[b]	1956-1975[c]	1969 Water Year[d]
Total Suspended Load	3.48 (3.16)	3.91 (3.55)	50.49 (45.80)
Estimated Bed Load	0.183 (0.166)	0.200 (0.181)	1.98 (1.80)
Total Sediment Load	3.67 (3.33)	4.11 (3.73)	52.47 (47.60)
Percent of Total Load Consisting of Sand and Gravel	28.7	29.0	29.0

[a] Data from Brownlie et al. (1979)
[b] Total period of record.
[c] Period of maximum control.
[d] Maximum yield for single water year during period of record.

of existing drainage and flood control improvements are exceeded. These facilities include:

(1) Concrete-lined channels with capacity equal to or greater than the 100-year flood ("J" Street Drain, Rice Road Drain, West Wooley Drain).

(2) Channels with levees designed to contain the 100-year or greater flood (Santa Clara River).

(3) Improved channels designed for 10-year or greater floods, but with capacities inadequate for the 100-year flood (Oxnard Industrial Drain, Oxnard West Drain, West Fifth Street Drain, Doris Avenue Drain).

(4) Natural water courses with minor stabilization improvements (Beardsley Wash, Santa Clara Drain, Santa Clara Diversion).

Within the project area, standing surface water is confined to McGrath Lake and "duck ponds" located near the mouth of the Santa Clara River and Ormond Beach. In addition, a lagoon periodically forms at the mouth of the Santa Clara River during conditions of low flow (see Section 12.5.5).

12.1.5.1.2 Subsurface Hydrology

The project area lies within the Santa Clara River basin. Seven ground water basins have been defined within the reaches of the river basin. Most of these basins are in hydraulic continuity and effectively function as one ground water system which extends offshore beneath the ocean. The significant ground water basins with respect to the proposed project are the Mound, Oxnard Forebay, and Oxnard Plain basins (Figure 12.1-10).

Mound Basin

Onshore, the Mound ground water basin covers approximately 19.4 square miles (50 km^2) to the north of the Santa Clara River. Water is contained principally in the Holocene and upper Pleistocene alluvial deposits which range from 100 to 500 feet (30 to 150 m) in thickness, and the upper 500 to

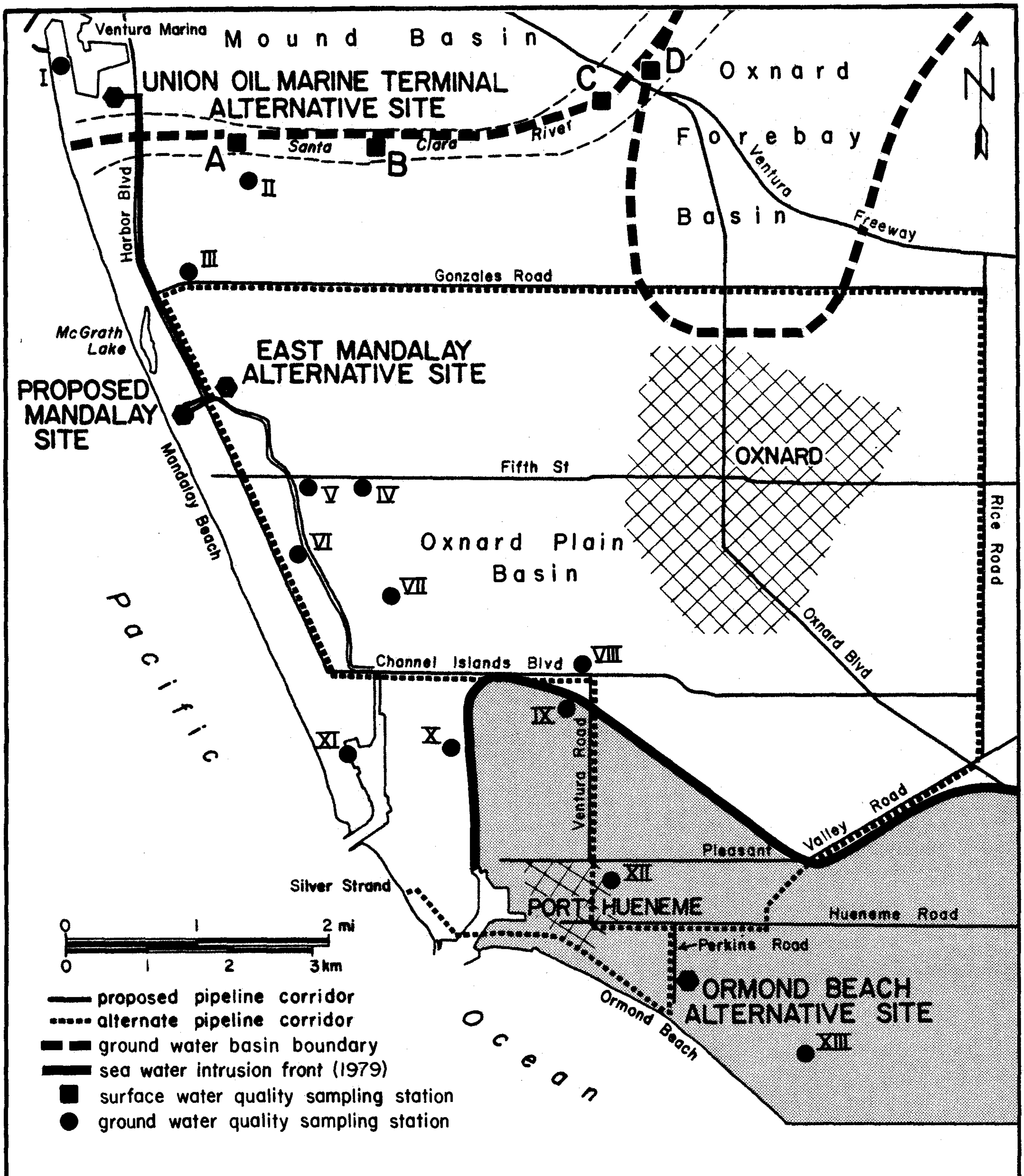

FIGURE 12.1-10

GROUND WATER BASINS, SEA WATER INTRUSION FRONT, AND WATER QUALITY SAMPLING LOCATIONS

REFERENCE: VCFCD (1979)

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1,000 feet (150 to 300 m) of the 4,000-foot (1,220-m)-thick San Pedro Formation which unconformably underlies the alluvium. The essentially impervious Santa Barbara Formation underlies the San Pedro Formation.

Recharge of the Mound basin is not well understood, although it is known that percolation from streams and deep penetration of rainfall are hindered by extensive clay layers. Underflow from the Santa Paula basin to the east is restricted by faulting. Overall ground water movement is in a westerly direction, toward the ocean.

The quality of ground water in the Mound basin is relatively poor due to excessive dissolved solids, hardness, and sulfates.

The offshore extension of the Mound ground water basin is a linear trough restricted to the north side of the Oak Ridge fault, which it parallels. The basin extends offshore for over 14 miles (22 km) and its width is about 5 miles (8 km). North and south boundaries of the basin are the seafloor where the Santa Barbara Formation appears to crop out, and the Oak Ridge fault, respectively.

Oxnard Forebay Basin

The Oxnard Forebay ground water basin serves as the primary unconfined area within the Oxnard Plain. Ground water is stored in Holocene and upper Pleistocene alluvial deposits, and in the San Pedro Formation. Recharge at the Forebay area is derived primarily from Santa Clara River surface flows and minor underflow from the Santa Paula basin. Surface flows are diverted, except during heavy floods, at the Freeman Diversion for delivery and/or recharge via the Saticoy and El Rio spreading grounds. Nominal contributions to the underlying ground water reservoirs are also made via percolation and irrigation return water. Resulting ground water movement is in a southwesterly direction toward the Oxnard Plain basin. Significant amounts of ground water in the Oxnard Forebay basin are pumped from wells at the El Rio spreading grounds and transported via the Oxnard-Hueneme pipeline to the Oxnard Plain basin.

Quality of the Forebay ground water is reflective of the water available for spreading, with wet years yielding relatively high quality water and dry years producing water with large concentrations of dissolved solids. Excessive nitrates may also be a potential problem in the shallow water-bearing sediments.

Oxnard Plain Basin

Onshore, the Oxnard Plain ground water basin covers approximately 70 square miles (190 km^2). The basin is bounded on the north along the Santa Clara River by the Mound basin and by the Oxnard Forebay basin, and on the south by non-water-bearing rocks in the Santa Monica Mountains. The basin extends eastward from the coastline about 10 miles (16 km).

Beneath the Oxnard Plain, fresh water is contained in six aquifer zones (semi-perched, Oxnard, Mugu, Hueneme, Fox Canyon, and Grimes Canyon), which are separated by clay-rich layers of low permeability. A generalized cross-section and a geologic column of the Quaternary deposits that form the ground water system are shown on Figures 12.1-11 and 12.1-12.

The semi-perched, Oxnard, and Mugu aquifer zones collectively have been designated the "upper" aquifer system, while the remaining aquifers have been grouped as the "lower" aquifer system. Both the upper and lower systems extend offshore and contain a considerable amount of offshore fresh water storage. The aquifers of both systems are recharged principally by flow from the Oxnard Forebay basin. The majority of the Forebay outflow is retained by the Oxnard Aquifer with smaller quantities reaching the underlying aquifers. The relatively large flow to the Oxnard Aquifer serves to reduce the severe overdraft condition in the aquifer which has led to sea water intrusion. Evidence also exists indicating an overdraft condition in the Fox Canyon Aquifer of the lower system. Although there is little recharge to the Fox Canyon Aquifer, the amount of fresh water in storage is substantial; consequently, the overdraft has not produced significant adverse effects to date.

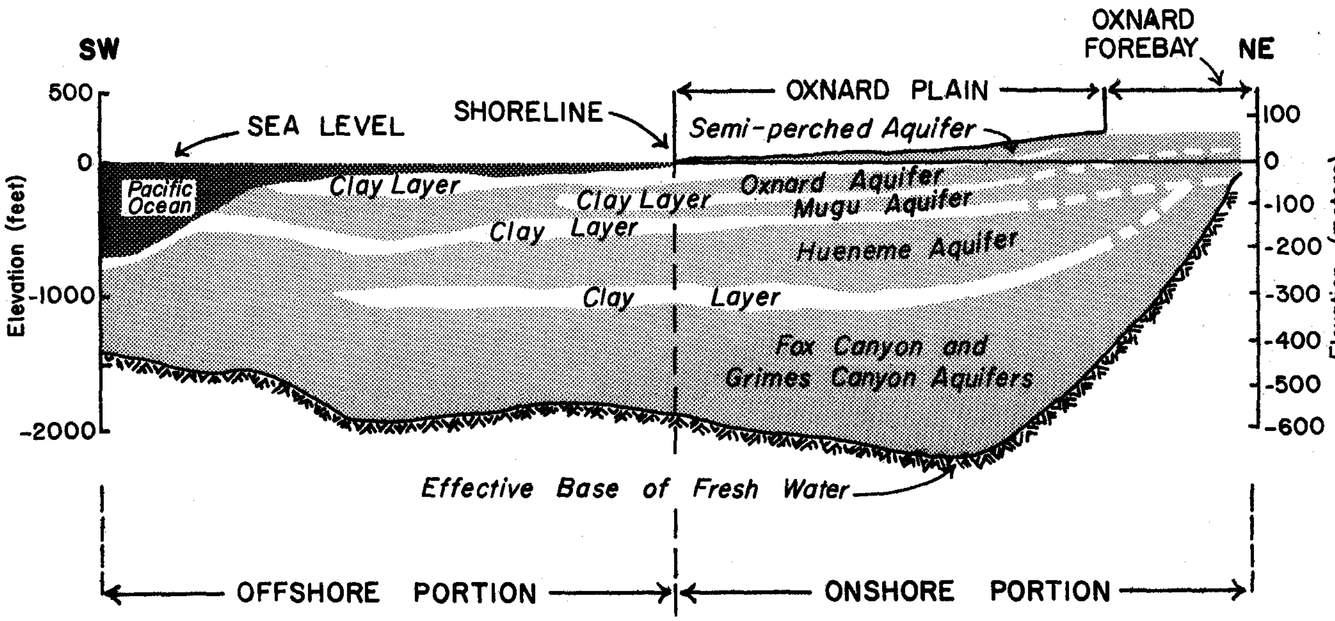

FIGURE 12.1-11

GENERALIZED STRATIGRAPHIC CROSS-SECTION OF THE OXNARD PLAIN GROUND WATER SYSTEM

REFERENCE: MODIFIED FROM CDWR (1976)

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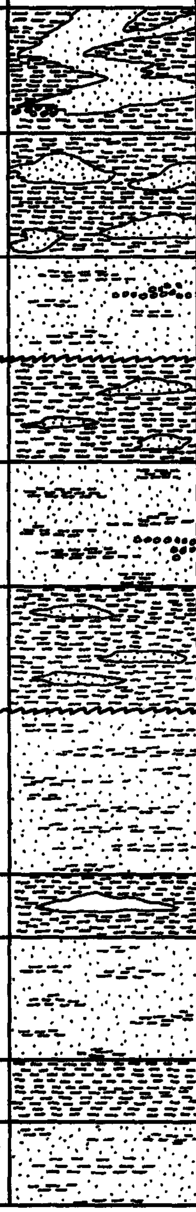
QUATERNARY AGE	AQUIFER UNIT	GRAPHIC COLUMN (NOT TO SCALE)	APPROXIMATE MAXIMUM THICKNESS IN FEET	GENERAL LITHOLOGIC DESCRIPTION AND REMARKS
HOLOCENE	PERCHED WATER ZONE		90	LOOSELY CONSOLIDATED SAND AND GRAVELLY SAND INTERBEDDED WITH LENSES OF SILT, CLAY AND MUD. OCCASIONAL LENSES OF PEAT, SEA SHELLS AND CARBONACEOUS MATERIAL. INCLUDES EOLIAN, LAGOONAL, LACUSTRIAN, FLUVIAL-FLOOD PLAIN AND MARINE DEPOSITS. PERCHED GROUND WATER IN SOME AREAS.
	AQUICLUDE		150	SILT, SANDY SILT, CLAY, SANDY SILTY CLAY AND MUDSTONE WITH ENCLOSED SAND AND SANDY GRAVEL LENSES. INCLUDES LAGOONAL, ESTUARINE(?) AND MARINE DEPOSITS. INTERVAL VARIES IN THICKNESS AND IS RELATIVELY IMPERMEABLE TO GROUND WATER MOVEMENT.
	OXNARD ZONE		150	FINE TO COARSE-GRAINED SAND, SANDY GRAVEL, OCCASIONAL COBBLES WITH LENSES OF SILT AND CLAY. INCLUDES FLOOD-PLAIN, ESTUARINE(?) AND NEAR-SHORE MARINE DEPOSITS. INTERVAL HAS A GENERALLY HIGH WATER PERMEABILITY.
DISCONFORMITY				
UPPER PLEISTOCENE	AQUICLUDE		140	SILT, CLAY AND SANDY SILTY CLAY WITH LENSES OF VERY FINE TO COARSE-GRAINED SAND. INCLUDES LAGOONAL AND MARINE DEPOSITS. INTERVAL IS RELATIVELY IMPERMEABLE TO GROUND WATER MOVEMENT.
	MUGU ZONE		250	FINE TO COARSE-GRAINED SAND, OCCASIONAL GRAVEL AND GRAVELLY SAND WITH SILT, CLAY AND SANDY SILTY CLAY LENSES AND INTERBEDS. INCLUDES FLOOD-PLAIN, ESTUARINE(?) AND NEAR-SHORE MARINE SEDIMENTS. INTERVAL HAS A GENERALLY HIGH WATER PERMEABILTY.
	AQUICLUDE		90	SILT, CLAY AND SANDY SILTY CLAY WITH LENSES OF SAND AND SILTY-SAND. INCLUDES LAGOONAL AND MARINE DEPOSITS. UNIT VARIES IN THICKNESS AND IS ABSENT IN SOME AREAS. WHERE PRESENT, UNIT IS RELATIVELY IMPERMEABLE TO WATER MOVEMENT.
UNCONFORMITY				
LOWER PLEISTOCENE SAN PEDRO FORMATION	HUENEME ZONE		300	FINE TO COARSE-GRAINED SAND WITH SOME GRAVEL AND INTERBEDS OF SILT AND CLAY, PROBABLY ALL OF MARINE ORIGIN. INTERVAL IS IRREGULARLY BEDDED WITH DIS-CONTINUOUS SANDS HAVING LOW TO MEDIUM PERMEABILITY. INTERVAL IS IN PART TRUNCATED AND IS GENERALLY ABSENT DUE TO EROSION OVER MOST OF THE SOUTHERN PORTION OF THE OXNARD PLAIN.
	AQUITARD		150	SILT AND CLAY WITH LENSES OF SAND. INTERVAL IS ABSENT IN SOME AREAS DUE TO TRUNCATION.
	FOX CANYON ZONE		550	FINE TO COARSE-GRAINED SAND AND GRAVELLY SAND WITH LENSES OF SILT, CLAY AND SANDY SILTY CLAY. ALL OF MARINE ORIGIN. UPPER PORTION OF UNIT ABSENT IN SOME AREAS, PARTICULARLY NEAR BASIN MARGINS, DUE TO TRUNCATION.
LOWER PLEISTOCENE	AQUITARD		50	SILT, CLAY AND SILTY CLAY OF VARYING THICKNESS AND LATERAL CONTINUITY.
SANTA BARBARA FORMATION	GRIMES CANYON ZONE		1500	FINE TO COARSE-GRAINED SAND AND OCCASIONAL GRAVELLY SAND WITH SILT, CLAY AND SILTY CLAY INTERBEDS, ALL OF MARINE ORIGIN.

FIGURE 12.1-12

GENERALIZED GEOLOGIC COLUMN OF QUATERNARY SEDIMENTS — OXNARD PLAIN

REFERENCE: MODIFIED FROM SPROTTE AND JOHNSON (1976)

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The offshore extension of the Oxnard Plain ground water basin lies south of the Oak Ridge fault and west of Mugu Canyon. The deeper, fresh water-bearing materials of the Santa Barbara and San Pedro formations may extend southwest, west of Hueneme Canyon, to Anacapa Ridge. Shallow upper Pleistocene and Holocene deposits in this area appear to extend offshore only to the northern slope of Santa Barbara Basin. Beneath the Hueneme-Mugu Shelf, the offshore limits of the ground water basin are difficult to determine.

Artesian conditions formerly existed in the Oxnard Plain area. At that time, ground water flowed to the ocean through the aquifers where they crop out offshore. However, deficient water conditions became apparent, as urban and agricultural activity expanded and annual extractions exceeded annual replenishment. This unbalanced condition caused water levels to drop to elevations below sea level, with the result that the upper aquifer system was intruded by sea water. Definite evidence of active intrusion was first found in the 1950's and during subsequent years the sea water front has consistently moved inland, with the exception of a temporary small reversal experienced in 1976 near Port Hueneme. Between 1963 and 1974, the rate of movement near Port Hueneme was measured as 500 feet (150 m) per year. The position of the intrusion front in 1979 is shown on Figure 12.1-10. Although some evidence of sea water has been found in the onshore portion of the lower aquifer system, it is not believed that active intrusion has occurred to date.

Historical progress of the intrusion problem emphasizes the need for a significant change in local ground water resource management to prevent further sea water intrusion. Results of the Ventura County 208 Plan study indicate that sea water intrusion in the Oxnard Aquifer will become increasingly serious unless a control plan is implemented. It was concluded in the 208 Plan study that by the year 2000, the sea water intrusion front in the Oxnard Aquifer zone will extend to the eastern boundary of the Oxnard Plain basin and north to within 0.5 mile (0.8 km) of Highway 101.

12.1.5.1.3 Water Quality

The general quality of water in the Santa Clara River basin is somewhat variable but, for the most part, is marginal for domestic supply. Chemical analyses of runoff in the Santa Clara River indicate a mineral content ranging from less than 300 to over 5,000 milligrams per liter and averaging around 1,000 milligrams per liter. Representative water quality analyses are presented in Table 12.1-6. The high quantities of dissolved solids are primarily a result of flow over and through the unconsolidated sediments and sedimentary rocks that underlie most of Ventura County.

The aquifers underlying the Ventura County area generally contain water of poor quality primarily because of the high contents of dissolved solids. This condition is due, in large measure, to natural conditions. Ventura County is underlain largely by loosely consolidated and unconsolidated sedimentary deposits. Many of these materials are easily eroded and/or dissolved by water flowing over or through them. This erosion and dissolution results in the county ground waters generally being high in hardness, sulfates, and boron, as well as total dissolved solids.

Degradation of ambient ground water quality due to man's activities can be traced chiefly to the following sources: agricultural waste water, sea water intrusion, urban runoff, domestic sewage, and industrial sewage.

Probably the most important source of ground water quality degradation that can be attributed to the activities of man is agricultural waste water. The use of water for irrigation tends to concentrate solutes in the water through evaporation and transpiration. The addition of fertilizers to the waters and fields also contributes to the solute load. As excess irrigation water returns to the ground water reservoirs, it degrades the overall quality of the ground water. When the water is repumped one or more times for further irrigation, this cyclic concentration process leads to considerable degradation of ground water quality through buildup of dissolved solids, nitrates, and other constituents. This process has occurred in the upper aquifer system

TABLE 12.1-6

GEOCHEMICAL ANALYSES - SANTA CLARA RIVER WATER

Chemical Constituent (mg/L)[a]	Sample Location and Number[b]							
	A-1	B-1	C-1	C-2	D-1	D-2	D-3	D-4
Ca	222	278	224	55	70	187	143	70
Mg	68	89	130	13	16	89	29	33
Na	190	195	546	62	39	290	148	47
K	7.3	7.0	12	4.3	4.3	7.5	6.0	4.0
$CaCO_3$	258	257	76	122	120	210	153	135
SO_4	823	1045	1850	225	176	1110	529	232
Cl	93	105	208	22	19	95	64	19
NO_3	0.5	2.5	4.3	7.2	3.0	5.6	6.0	1.7
TDS	1704	2006	3122	490	440	2018	1048	514
Hardness	835	1062	1094	191	241	836	479	308
pH(units)	7.9	7.3	9.0	7.8	7.6	8.2	7.5	7.6

[a] Data from CDWR (1979).
[b] See Figure 12.1-10 for sample locations.

beneath the Oxnard Plain, particularly in the semi-perched water zone. It is not yet a problem in the lower aquifer zones.

A second major water quality problem attributable to man's activities is sea water intrusion. As discussed in Section 12.1.5.1.2, ground water has been pumped at a rate in excess of recharge for a number of years. This has produced degradation of ground water quality in the upper aquifer zones near the heads of Hueneme and Mugu canyons.

Urban runoff, domestic sewage, and industrial sewage may also contribute to deterioration of ground water quality. However, due to the use of concrete-lined storm drains and extensive sewer systems, these sources produce a much smaller effect on ground water quality than do natural conditions, agricultural waste water, and sea water intrusion.

Representative ground water quality analyses are listed in Table 12.1-7.

12.1.5.1.4 Water Budget

Ventura County's water demands are met by a combination of surface water, ground water, and imported water resources. In 1975, approximately 340,000 to 350,000 acre-feet (420 to 430 hm^3) of water was utilized within the county to meet municipal, industrial, agricultural, and other demands (Toups, 1979). Nearly 35,000 acre-feet (45 hm^3) was derived from surface water sources and 48,000 acre-feet (60 hm^3) was imported from sources outside Ventura County. The remainder was obtained from local ground water resources at an overdrafted rate. Approximately 30 percent of the supply was distributed to municipal and industrial users, while 70 percent went to agricultural users.

Water deliveries to the Oxnard Plain area during 1975 are summarized on Figure 12.1-13. Oxnard Plain water supplies are derived principally from ground water extractions, while the balance is provided by the United Water Conservation District's (UWCD) Santa Clara River surface diversions and imported water supplied by the Calleguas Municipal Water District (CMWD). The

TABLE 12.1-7

GEOCHEMICAL ANALYSES - PROJECT AREA GROUND WATER

Chemical Constituent (mg/L)[a]	Well[b] I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Ca	166	204	135	124	274	120	126	140	160	140	126	744	274
Mg	262	97	42	44	327	38	45	34	50	43	29	212	75
Na	446	149	118	98	840	80	88	93	112	98	87	363	334
K	14	7.1	5.0	5.0	4.0	3.0	3.7	-	2.0	5.0	-	15	2.0
$CaCO_3$	618	245	210	203	120	191	200	210	205	226	215	140	220
SO_4	1669	800	452	428	2998	371	412	384	458	442	346	400	455
Cl	112	118	57	43	443	40	43	43	132	51	38	2115	725
NO_3	0.8	14.0	0.4	6.0	-	0.9	1.4	-	.0	.0	-	.0	.0
TDS	3205	1680	1090	934	5032	856	963	970	1210	1028	903	5803	2180
Hardness	1494	910	510	491	2030	456	500	489	605	525	434	2730	995
pH (units)	8.0	7.9	8.0	7.8	7.1	8.6	7.9	7.7	7.5	7.5	7.6	7.5	7.2

[a] Data from CDWR (1979).
[b] See Figure 12.1-10 for well locations.

combination of ground water resources and surface waters supplies the Oxnard Plain with approximately 110,000 acre-feet (135 hm^3) of water per year.

The surface waters of the Santa Clara River are stored by the Santa Felicia Dam, Lake Piru, and the Saticoy and El Rio spreading grounds, and are conveyed to Oxnard Plain users via the Oxnard-Hueneme pipeline owned and operated by the UWCD.

Approximately 11,000 acre-feet (14 hm^3) per year of imported water from the State Water Project is supplied by the CMWD principally to municipal and industrial users of the Oxnard Plain. Less than 10 percent of this total is used for agricultural purposes.

Agricultural use of reclaimed water is presently insignificant.

For 1980, the total demand for water in the Oxnard Plain area is projected by Ventura County to be 120,600 acre-feet (149 hm^3). Ground water and surface water resources are expected to provide 108,000 acre-feet (133 hm^3) which will leave a deficit of approximately 12,600 acre-feet (16 hm^3). It is anticipated that imported water will fulfill this requirement. Total estimated ground water extractions for 1980 are expected to overdraft the upper aquifer system by approximately 8,700 acre-feet (11 hm^3) with 87 percent (7,569 acre-feet (9 hm^3)) attributable to agricultural ground water pumping (Ventura Regional County Sanitation District, 1978).

12.1.5.1.5 Water Management Plans

In accordance with provisions of Section 208 of the Federal Water Pollution Control Act Amendments of 1972, Ventura County was identified in 1974 as an area with substantial water quality control problems. The portion of the Santa Clara River basin within Ventura County was subsequently designated as a 208 planning area. Planning efforts in Ventura County began in 1975 with the Ventura Regional County Sanitation District as the lead agency. In 1978, the Ventura County Board of Supervisors assumed responsibility as the lead agency.

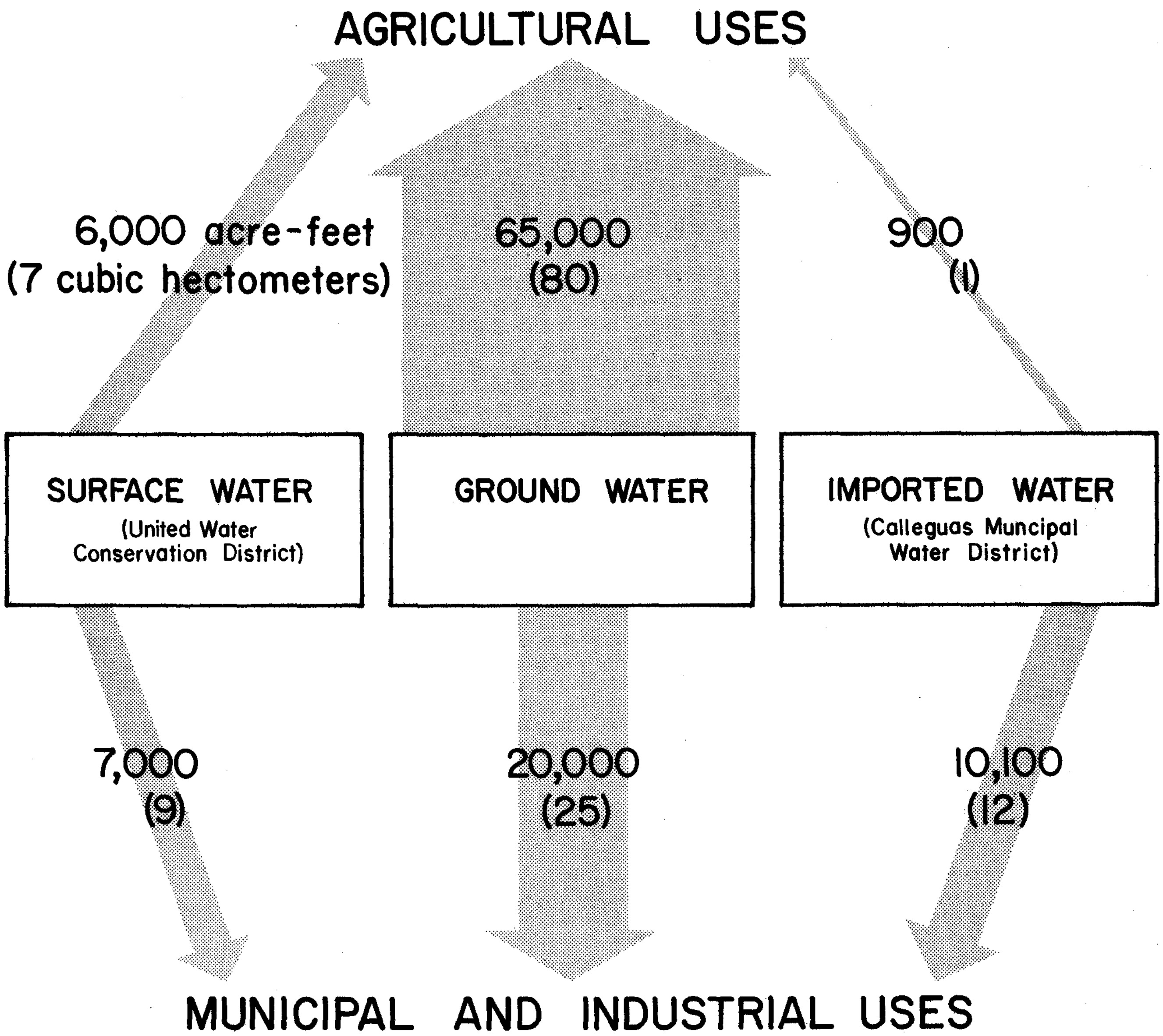

FIGURE 12.1-13

GENERALIZED WATER BUDGET FOR THE OXNARD PLAIN (1975)

REFERENCE: VCFCD (1979)

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The specific problems to be solved are increasing ground water mineralization and sea water intrusion into ground water supplies. Several plans were reviewed before a comprehensive plan was selected and submitted for adoption. The State Water Resources Control Board adopted the 208 Plan with the exception of the diversion structure improvements. Adoption of that aspect of the plan is being withheld pending completion of an environmental impact report and financial assessments, although the importance of diversion improvements with respect to solving the overdraft/intrusion problem was acknowledged.

In addition to the 208 Plan, Ventura County is preparing to begin a 201 Plan study effort. The 201 Plan will address the role of waste water reclamation in combatting sea water intrusion and mineralization of ground waters. Contractual details and the work program are presently being finalized (December 1979) and actual work on the plan is expected to begin in early 1980 (Settle, 1979).

12.1.5.2 Local Hydrology

12.1.5.2.1 Proposed Mandalay Site and Pipeline Corridor

The proposed Mandalay site is located in an area of coastal sand dunes. Rainfall percolates rapidly into the sand and, therefore, no surface drainage has developed. There is no perennially standing surface water within the site area.

The proposed site is located within the Oxnard Plain ground water basin. Historic water-level data indicate that depth to ground water beneath the site generally varies between approximately 5 and 30 feet (1.5 and 9 m). There are no ground water wells located at, or immediately adjacent to, the site.

The only significant hydrologic feature that occurs along the onshore pipeline corridor associated with the proposed Manadalay site is the Santa Clara River. McGrath Lake is located about 600 feet (180 m) west of the corridor and about 1,000 feet (305 m) north of the Mandalay Generating Station.

12.1.5.2.2 East Mandalay Alternative Site and Pipeline Corridor

The discussion presented in Section 12.1.5.2.1 for the proposed Mandalay site and onshore pipeline corridor also applies to the East Mandalay alternative.

12.1.5.2.3 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

The Union Oil Marine Terminal alternative site is located in an industrialized area that has been utilized for petroleum storage and transport facilities. Most of the area has been graded and surfaced with asphalt, concrete, or oil, and surface runoff is controlled by a man-made drainage system.

This alternative site is located at the southern margin of the Mound ground water basin. Historic water-level data indicate that depth to ground water beneath the site generally varies between approximately 10 and 50 feet (3 and 15 m). There are no ground water wells located at, or immediately adjacent to, the site.

The onshore pipeline corridor associated with the Union Oil Marine Terminal alternative is the same as that for the proposed Mandalay site (see Section 12.1.5.2.1).

12.1.5.2.4 Ormond Beach Alternative Site and Pipeline Corridors

The Ormond Beach alternative site is located in a vacant graded lot in a largely industrialized area. No surface drainage exists, and occurrence of surface water is largely restricted to minor ponding following storms.

This alternative site is located within the Oxnard Plain ground water basin and is within the area of sea water intrusion. Historic water-level data indicate that the depth to ground water generally varies between approximately 15 and 40 feet (4.5 and 12 m). There are no ground water wells located at, or immediately adjacent to, the site.

The onshore portions of the pipeline corridors associated with the Ormond Beach alternative site cross the Santa Clara River and a number of man-made drainage and flood control channels.

12.1.6 Geotechnical Design Considerations

The following sections include general discussions of geologic and hydrologic phenomena that should be considered during the design phase of the proposed project. The purpose of these discussions is identify the phenomena and briefly summarize their nature and extent. In some cases, additional detailed engineering investigations may be required to fully evaluate particular hazards.

12.1.6.1 Earthquake Ground Motion

Significant strong ground motion has been recorded in the western Transverse Ranges region. Strong ground motion can originate from a large event on a distant fault, such as the 1857 earthquake on the San Andreas fault, or as a smaller event on a fault within the western Transverse Ranges region. For example, a peak acceleration value of 0.18g was recorded in Santa Barbara during the June 30, 1941 earthquake and a value of 0.13g was recorded at Port Hueneme on February 21, 1973 during the Point Mugu earthquake. In addition, a maximum horizontal acceleration of 0.18g was reported at Port Hueneme from the March 18, 1954 Magnitude 4.7 earthquake recorded at an epicentral distance of approximately 5 miles (8 km). Based on these moderate earthquakes recorded at relatively short distances, it is apparent that significant ground motion can originate from nearby sources.

The California Division of Mines and Geology (1973) indicated that the project region is located in a zone that is expected to experience maximum shaking intensities of about IX or X on the Modified-Mercalli Scale. In addition, ground shaking is discussed in some detail in the Oxnard General Plan, Seismic and Safety Element, which indicates that the project area is expected to be subjected to strong ground shaking because of the deep alluvium.

In addition to naturally occurring earthquakes, it is possible that an earthquake or earthquakes could occur in the course of oilfield operations. Earthquakes of this nature have occurred associated with subsidence due to fluid withdrawal and have been triggered by fluid injection at several localities in the U.S. A well documented example of injection-induced earthquakes occurred at the Rocky Mountain Arsenal in Colorado where a disposal well penetrated an inactive fault zone at depth. Earthquakes occurred as the effective strength along the fault was reduced due to an increase in pore pressure. This allowed the ambient shear stresses to induce rupture. Earthquakes as large as Magnitude 5.5 were triggered as a result of the injection activity (USGS, 1976).

The proposed project elements, including the offshore platforms and pipelines, and onshore treating facility and pipelines, would be subject to future earthquake ground motion. Therefore, the design of all proposed structures should be based on a thorough evaluation of potential strong ground motion.

12.1.6.2 Surface Fault Rupture

Surface fault rupture is a relatively common occurrence in California during earthquakes of Magnitude 6 or greater. A recent example occurred on 15 October 1979, during the Magnitude 6.4 Imperial Valley earthquake. Although numerous events of Magnitude 6 and larger have been recorded in the western Transverse Ranges, no earthquakes of Magnitude 4.0 or greater have been recorded on any faults which might transect the Oxnard area. In addition, no faults have been mapped within the area of the City of Oxnard (City of Oxnard, 1975), which includes the proposed Mandalay site, the East Mandalay and Ormond Beach alternative sites, and major portions of the onshore pipeline corridors. However, the proposed Mandalay configuration onshore pipeline route (utilized for the three alternatives as well) crosses the Oak Ridge and McGrath faults.

The Union Oil Marine Terminal alternative site is believed to be situated within the zone of deformation referred to as the Oak Ridge fold belt and may be located adjacent to or above the concealed trace of the Oak Ridge fault. The potential for future surface faulting on the Oak Ridge fault is unknown. As discussed in the Oxnard General Plan, it is conceivable that past movements along this fault, and others in the Oxnard Plain (including the McGrath fault), have not resulted in surface displacement, but rather in broad warping or tilting of near-surface alluvial sediments.

Results of site-specific geophysical and geotechnical investigations conducted for the Platform Gina site and associated offshore pipeline corridors indicate that no near-surface faults exist in these areas. Several possible faults exist within the vicinity of the proposed Platform Gilda site. The possible fault nearest the platform site is about 600 feet (185 m) to the east-northeast; it is buried by at least 210 feet (65 m) of undisturbed sediment. No faults or possible faults were identified within the pipeline corridor east of the platform area (McClelland Engineers, Inc., 1980).

There appears to be little evidence at present which would suggest that surface fault rupture would represent a significant hazard to any of the proposed project elements. However, it is possible that unrecognized faults exist, particularly beneath the alluvial cover of the Oxnard Plain and Oxnard Shelf, along which surface rupture could potentially occur. Therefore, the potential for surface fault rupture should be evaluated in greater detail during final engineering design.

12.1.6.3 Liquefaction

Liquefaction is a process whereby granular sediments are altered from a solid state to a liquefied state as a result of increased pore-water pressure. Liquefaction by itself poses no particular hazard. Only when liquefaction leads to some form of permanent ground movement or ground failure does it become a serious problem. Ground failures produced by liquefaction have been a major cause of damage during past earthquakes and pose potential for damage and injury during future events. Such failures do not occur at random but are limited to certain geologic settings and levels of seismic shaking.

In order for liquefaction to occur, susceptible geologic materials must be present near the ground surface (within approximately 50 feet (15 m)); these materials must be saturated; and, they must undergo shaking of sufficient intensity to produce liquefaction. In the absence of any one of these conditions, liquefaction will not occur.

The susceptibility of Holocene sediments in the Oxnard Plain area to undergo liquefaction was investigated by Sprotte and Johnson (1976). Results of their study indicate that major portions of the project area have either a high-to-moderate or a moderate-to-low potential for liquefaction. Based on the region's historic seismicity and the occurrence of liquefaction in 1872 and 1973, the opportunity for liquefaction to occur appears to be significant.

Due to the relatively flat terrain, the most common liquefaction failure expected in the project area would be localized bearing capacity failures. Expected hazards associated with bearing capacity failures would be differential settlement of structures and possible flotation of buried pipelines. Lateral spreading and flow failures are not as common, but could be expected in local areas where the surface gradient is greater than approximately 2 percent.

Due to the recognized potential for liquefaction to occur in the onshore project area, it should be evaluated in greater detail during final engineering design.

Geotechnical Consultants, Inc. (1976) concluded that "liquefaction will not occur, even under the most critical earthquake conditions" at the Platform Gina site. In addition, liquefaction is not expected to represent a significant hazard to the offshore pipelines.

Information concerning liquefaction potential specific to the proposed Platform Gilda site and pipeline corridor were not available during this investigation. The potential for liquefaction should be evaluated during final engineering design.

12.1.6.4 Differential Settlement

Seismically induced differential settlement generally occurs in loose, granular soils. Cohesive or clay soils and sediments exhibit little or no settlement as a direct result of ground shaking. Theoretically, little damage to a structure will occur if it settles uniformly; the main problem will be damage to lifelines attached to the structure. Totally uniform settlement is rare and differential settlement can cause considerable damage to improperly engineered structures.

There are two types of settlement--compaction and consolidation. Compaction, as herein defined, occurs in dry or moist, cohesionless sediments, whereas consolidation occurs in water-saturated sediments. In general, vibratory motion causes granular sediments to be rearranged into a denser packing. The net result is reduction of void space, a corresponding reduction of the overall thickness of the cohesionless materials, and possible settlement of the ground surface. If the soil is dry, the settlement (compaction) is concurrent with the earthquake motion. Consolidation is a relatively slow process, compared to compaction, and is a function of the permeability of the soil. Results of a study by Sprotte and Johnson (1976) indicate that the potential for seismically induced differential settlement of Holocene sediments in the project area is high.

In addition, static differential settlement can also occur. There is insufficient information at this time to evaluate the potential hazard. However, it should be noted that significant peat deposits occur in the area of Channel Islands Harbor and in areas to the north (Sprotte and Johnson, 1976). Organic deposits are very susceptible to differential settlement due to static loads and oxidation.

Due to the recognized potential for differential settlement to occur, it should be evaluated in greater detail during final engineering design.

12.1.6.5 Subsidence (Due to Fluid Withdrawal)

Man-induced subsidence has been occurring in California for a number of years. The most common cause of subsidence is the withdrawal of fluids, including oil, gas, and water. Subsidence due to ground water withdrawal is the most extensive type of subsidence in California (CDMG, 1973). This type of subsidence has been observed only in valley areas underlain by thick alluvial deposits.

A large area of the Oxnard Plain has experienced subsidence. This area has been monitored by the U.S. Coast and Geodetic Survey since 1930 and has experienced as much as 0.04 to 0.05 feet (0.012 to 0.015 m) of subsidence per year. A single point located at Hueneme Road and Highway 1 dropped 1.5 feet (0.5 m) in 21 years. Records from 1968 show a dozen benchmarks that have settled one foot (0.3 m) in a 15- to 20-year period. The current level of subsidence is relatively small and may be obscured in the project area by other effects such as beach erosion and deposition. However, subsidence will probably continue and the rate and amount could increase if extraction of fluids from the area is maintained at its current level, or increases.

Due to the past occurrence of subsidence in the Oxnard Plain area, the possible future occurrence of subsidence should be considered during final engineering design of all project elements.

12.1.6.6 Expansive Soils

Expansive soils are those which greatly increase in volume when they absorb water and shrink when they dry out. Expansion is most often caused by clay minerals, primarily montmorillonite and illite. Expansive soils only represent a hazard when they are unrecognized prior to building, as effective mitigation measures can be implemented.

All of the soils occurring within the proposed and alternative onshore sites and associated pipeline corridors are rated low or moderate with respect to shrink/swell potential (see Table 12.1-4). Areas with low potential include the proposed Mandalay site, East Mandalay and Union Oil Marine Terminal alternative sites, and major portions of the onshore pipeline corridors. Areas with moderate potential include the Ormond Beach alternative site and minor portions of the onshore pipeline corridors.

12.1.6.7 Erosion and Deposition

Erosion is the removal and transport of weathered earth material and it is followed by deposition of the material at another location or locations. The two major agents of erosion are water and wind.

For the most part, erosion in urban areas of California is under control where appropriate engineering practices have been applied (CDMG, 1973). However, beach erosion still presents a major problem in many areas, including Ventura County.

Based on the history of southern California, as urbanization increases, incidents of beach erosion also increase. For example, the current level of beach erosion in the project area would accelerate if the natural flow of sand deposits along the Santa Clara and Ventura rivers were further decreased. The area immediately north and south of Channel Islands Harbor has undergone severe beach erosion. Beach erosion is also occurring north of the Harbor as far as the Santa Clara River.

In the future, erosion could constitute a problem to onshore facilities in the project area. Beach erosion could expose buried pipelines, and subject onshore facilities to potential flooding. Therefore, potential hazards created by erosion should be considered in detail during the design of the proposed onshore facilities.

12.1.6.8 Landsliding

Landsliding is a process by which earth materials move downslope under the influence of gravity. All areas under consideration for installation of onshore and offshore project elements are nearly flat. Therefore, landsliding is not expected to represent a significant hazard to the project.

12.1.6.9 Mineral Resources

Based on the results of a study conducted by the California Division of Mines and Geology, there are no significant mineral deposits in the project area that could be disrupted by the proposed treating facility and associated pipelines (CDMG, 1973). A similar situation is expected to exist in the offshore area. A possible commercial mineral resource in the vicinity of the project area is the sand and gravel deposits that exist along and near the Santa Clara River. No commercial production of sand and gravel exists at present in the project area. Past and continuing production of sand and gravel has been concentrated to the north and east of the project area, principally from the alluvium of a 10- to 12-mile (16- to 19-km)-stretch of the Santa Clara River that extends east-northeast from U.S. Highway 101 to Santa Paula.

12.1.6.10 Tsunamis

Tsunamis can be generated by submarine landslides, volcanic eruptions, or earthquakes in or near ocean basins. In the open ocean, these waves have a very long period and wavelength, and travel at speeds of hundreds of miles per hour. As a tsunami approaches the shoreline, the speed of the wave decreases and the wave height increases. The resulting wave can cause significant damage.

Historic records indicate that the severity of tsunami-generated damage varies greatly depending on factors such as coastal topography, the existence of offshore islands, and the direction of the incoming waves. Based on consideration of local factors, Houston and Garcia (1974) have estimated run-up heights of 5 and 8.5 feet respectively for the 100- and 500-year mean recurrence tsunamis (see Section 12.3.1.5). In addition, the Oxnard General

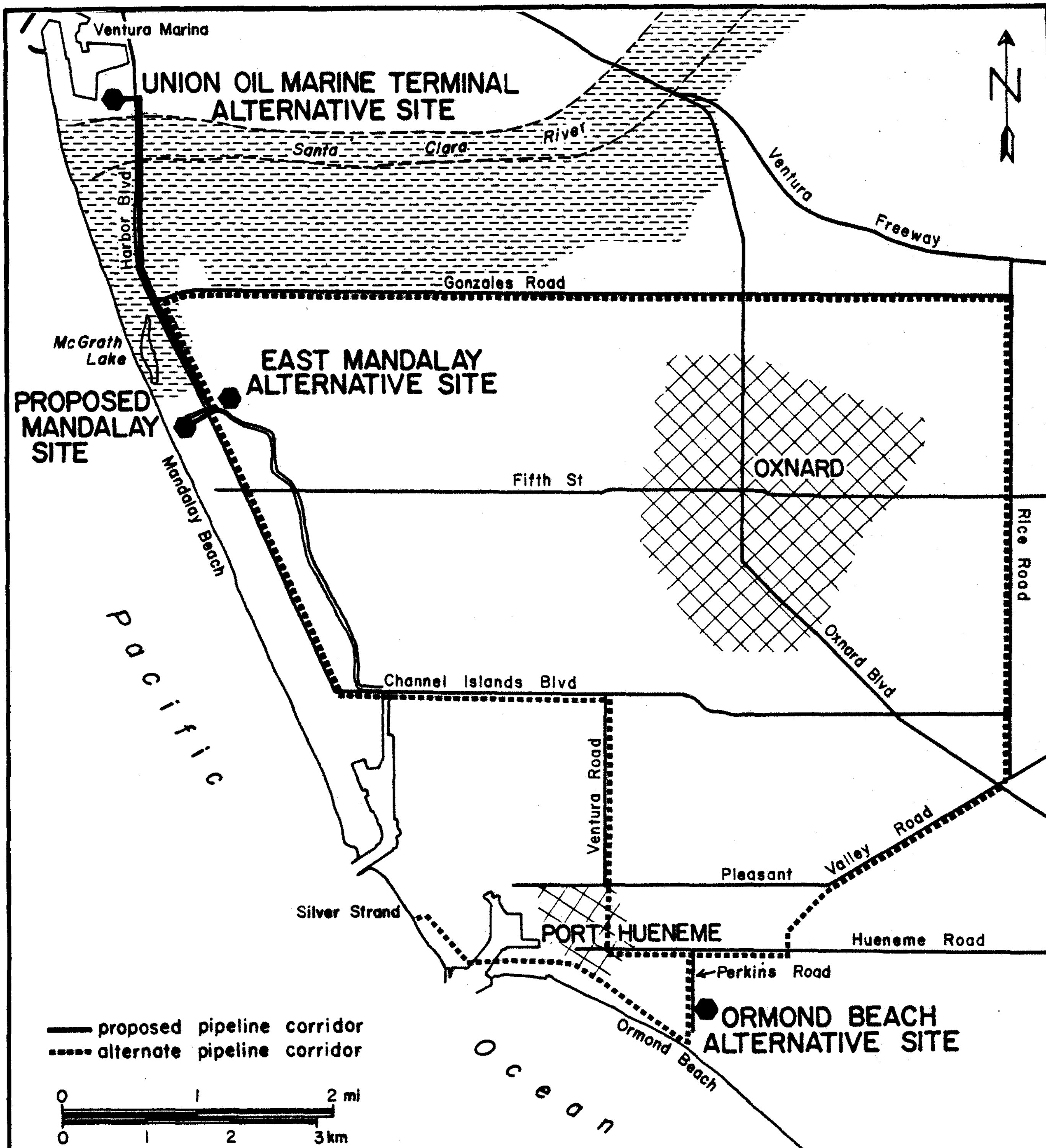

FIGURE 12.1-14

SANTA CLARA RIVER FLOODWAY

REFERENCE: VCFCD (1979)

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Plan indicates that the Mandalay Generating Station and the nearby oilfields are susceptible to possible damage from a major tsunami. The Oxnard Shores area, Hollywood Beach, and the marina are believed to be slightly less susceptible to damage. The area near the Ormond Beach Generating Station is believed to be susceptible to tsunamis originating from the south.

In the event of a major tsunami, significant property damage could occur within the coastal zone of the project area. Although the probability of such an event occurring during the lifetime of the proposed project is small, the potential for tsunami damage should be considered during design of the onshore facilities. Tsunamis should not pose a serious problem to the offshore facilities due to the depth of water and the distance from the shoreline.

12.1.6.11 Flooding

Parts of the project area lie within or near the flood zone of the Santa Clara River (Figure 12.1.14) and could be inundated by flood flows during periods of heavy runoff. In addition, localized areas may be affected by flooding due to storm drain problems.

Principal effects of flooding would be temporary inundation of facilities and equipment, and deposition of sediment and debris. It is expected that such occurrences could result in temporary shut-down and clean-up problems, but would have little effect on the long-term integrity of operations.

12.1.6.12 Offshore Dispersed Gas and Gas Zones

Geophysical survey records indicate an area of possible dispersed gas in the northeast part of the Platform Gina Ormond Beach alternative pipeline corridor. If gas is present in this area, it appears to be within about 10 feet (3 m) of the seafloor (McClelland Engineers, Inc., 1979).

Dispersed gas also exists in the shallow sediments of the entire proposed Platform Gilda site area and the western two-thirds of the pipeline corridor. The upper surface of the gas ranges from about 15 to 35 feet (5 to 10 m) below the seafloor (McClelland Engineers, Inc., 1980).

Possible gas zones exist in deeper sediments underlying the proposed Platform Gilda site vicinity. The possible gas zone nearest the site is 500 feet (150 m) to the south. However, the northern boundary of that zone is uncertain; it may extend northward and underlie the platform site (McClelland Engineers, Inc., 1980).

Shallow dispersed gas can cause problems related to structural foundations, and deeper gas zones present a potential drilling hazard. Therefore, these possible gas accumulations should be considered in detail during final engineering design and drilling program planning.

12.2 ATMOSPHERIC SCIENCES

12.2.1 Meteorology

12.2.1.1 Regional Climate and Climatic Controls

The climate of the southern California coast (the area from Point Conception to the Mexican border) is classified as mediterranean and is characterized by partly cloudy, cool summers without significant precipitation and mostly clear, mild winters during which precipitation falls with passing storms. This climate is controlled primarily by the semi-permanent Pacific High pressure system over the ocean to the west, thermal contrasts between land and adjacent ocean, and geographic factors. The latter include the change in the orientation of the coastline at Point Conception, the gradual curvature of the coastline between Santa Barbara and Point Mugu, and the orientation of the coastal mountains (Figure 12.2-1).

The Pacific High exercises its greatest control during summer. Subsiding and diverging air in the High produces a temperature inversion aloft, northwest air flow modified locally by topography and thermal contrasts between land and sea, and the advection of maritime air inland. Fog and low clouds often form in the layer of marine air over the ocean. They typically move (and form) on the coast and inland valleys during the evening. Fog usually lifts and low clouds evaporate as land areas are warmed in the morning. Afternoons are characterized by fair skies, cool temperatures, and a sea breeze. Extratropical storms are steered far to the north, and precipitation occurs infrequently when tropical moisture is advected into the region.

The Pacific High weakens and migrates southward during winter. During this season, three weather regimes generally prevail: (1) periods of low clouds/fog associated with dominance of the High; (2) periods of clear skies, cool nights, and warm days associated with continental controls; and, (3) periods of variable cloudiness, shifting and gusty winds, and precipitation associated with extratropical storms. The number of days of inclement weather varies significantly from year to year.

The dominant feature of the southern California coastal climate is its relative uniformity from day to day and its nonuniformity from place to place. Many mesoscale climatic zones exist within the coastal area due to coastline orientation and the proximity of mountainous terrain. At any location along the coast, marked discontinuities occur that in most climatic elements are associated with the interplay of marine and continental air. These features are discussed in the following sections.

12.2.1.2 Local Meteorology

The Pacific Ocean to the west and the mountains that border the Oxnard Plain are predominant influences on the local climate. The locations of meteorological data recording stations are shown on Figure 12.2-2. Onshore meteorological data are available from Ventura County Airport, Point Mugu, and Oxnard Air Force Base. There are few meteorological data available for offshore areas. The limited offshore meteorological data that are available, primarily from passing ships, are used to infer differences between onshore and offshore climatology. The following sections describe various climatic elements of the local area.

12.2.1.2.1 Wind

Seasonal and diurnal wind regimes markedly affect the horizontal transport of air in the local area. The streamline analyses shown in Figures 12.2-3 and 12.2-4 characterize the typical horizontal transport of air over the entire region during the daytime and nighttime hours in the winter and summer seasons. These analyses are based on available data and the consensus of 12 independent streamline analyses (DeMarrais, 1965). Inferences, interpolations, and extrapolations were necessary in some areas, especially over the ocean, because of data limitations.

Northwesterly airflow associated with the Pacific High is significantly modified by its interaction with terrain and local winds generated in response to thermal contrasts between land and ocean. The land-sea breeze is especially important in this respect. During the day, the sea breeze is

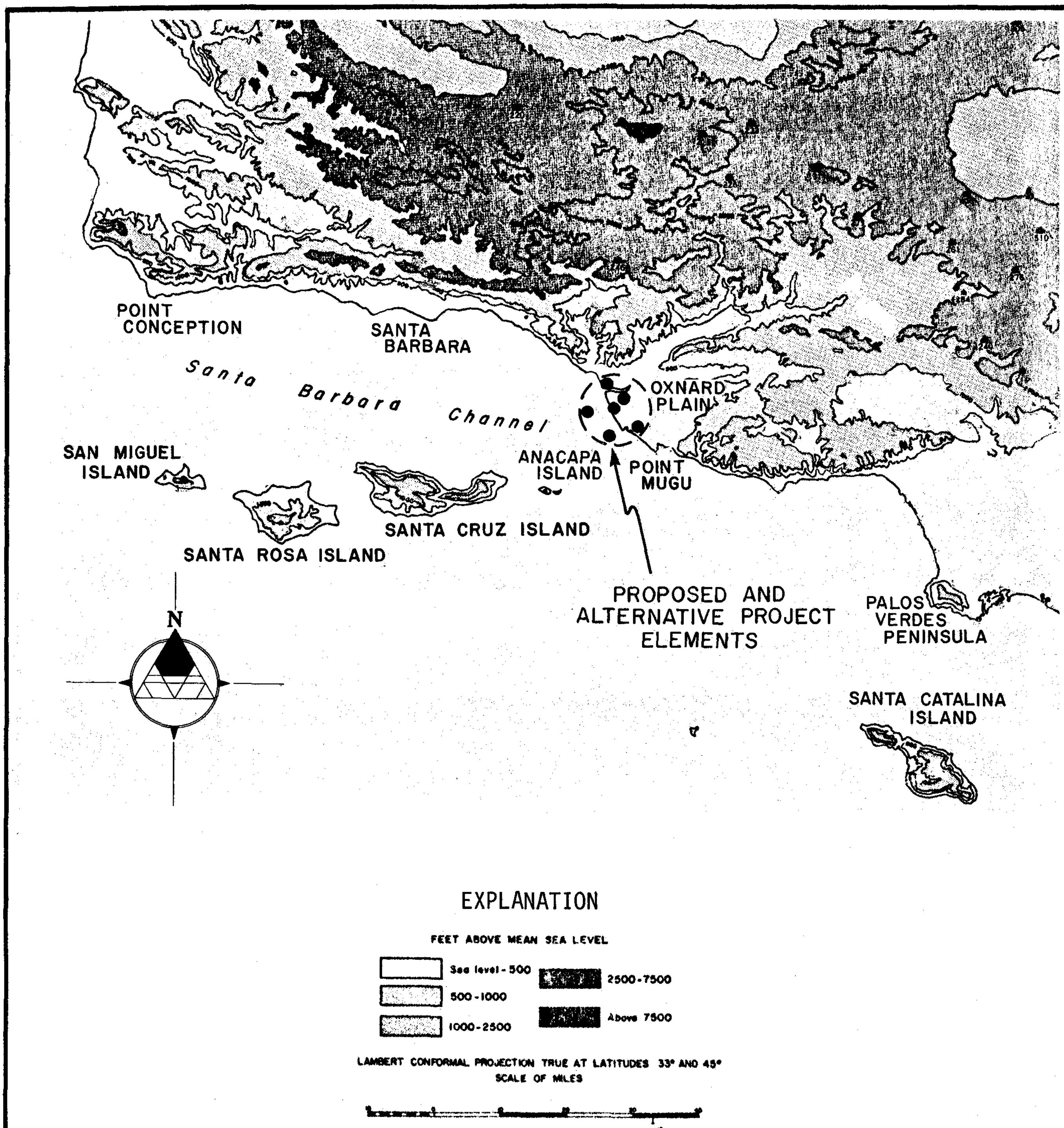


FIGURE 12.2-1

PHYSIOGRAPHIC FEATURES CONTROLLING REGIONAL METEOROLOGY

REFERENCE: DE MARRAIS ET AL. (1965)

DAMES & MOORE

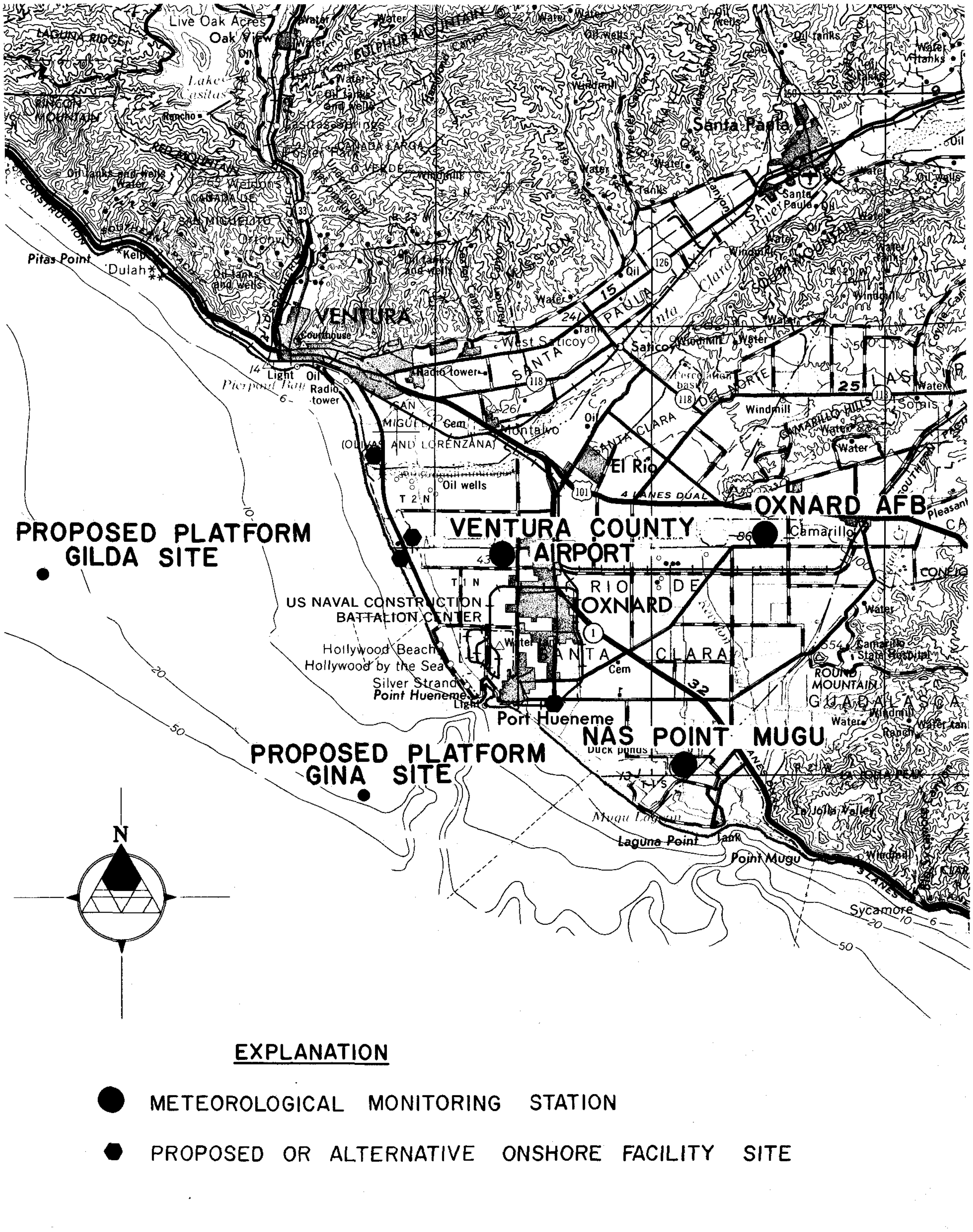
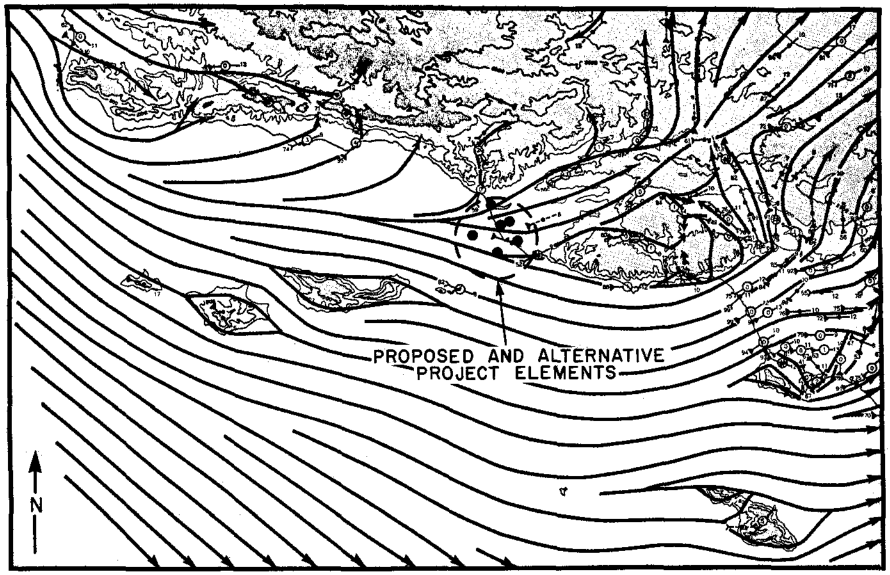


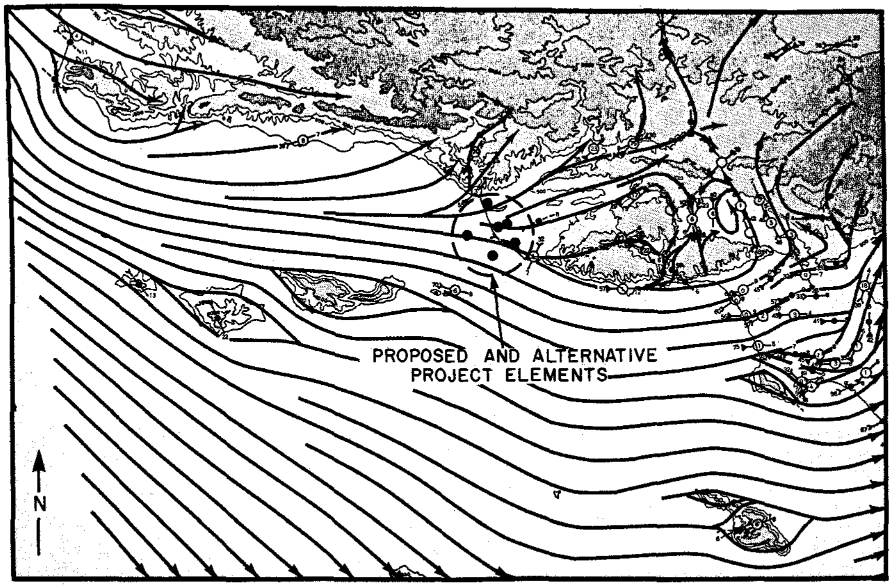
FIGURE 12.2-2

METEOROLOGICAL MONITORING STATIONS

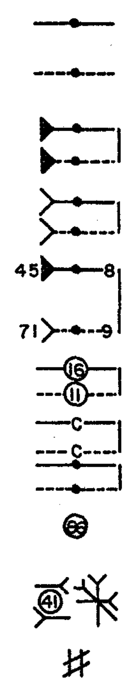
DAMES & MOORE



JULY 1200-1800 PST



JANUARY 1200-1700 PST

SYMBOL	EXPLANATION
	Solid shaft=based on 100 or more observations
	Discontinuous shaft=based on opinion of qualified observer or less than 100 observations
	Solid tail=one direction accounted for more than half of all directions in the 3-direction sector; shaft oriented with that direction
	Open tail=most frequent winds centered along shaft orientation
	Number at tail=percent frequency of most frequent three adjacent directions
	Number at head=average speed (mph)
	Number in large circle on shaft=percent frequency of calms
	Letter C on shaft=calms occurred frequently
	No large circle on shaft=calms not counted
	Number in large circle (no shaft)=calms prevailed; no percent of three adjacent directions totaled 10
	More than one direction shown=frequency of other directions within 5 percent of primary direction sector shown by solid tail
	Occurred less than 0.5 percent of time

Note: *Arrows are drawn through station circle and fly with the wind; i.e., wind blows from tail of arrow to head.*

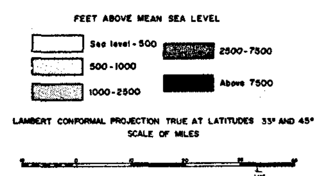
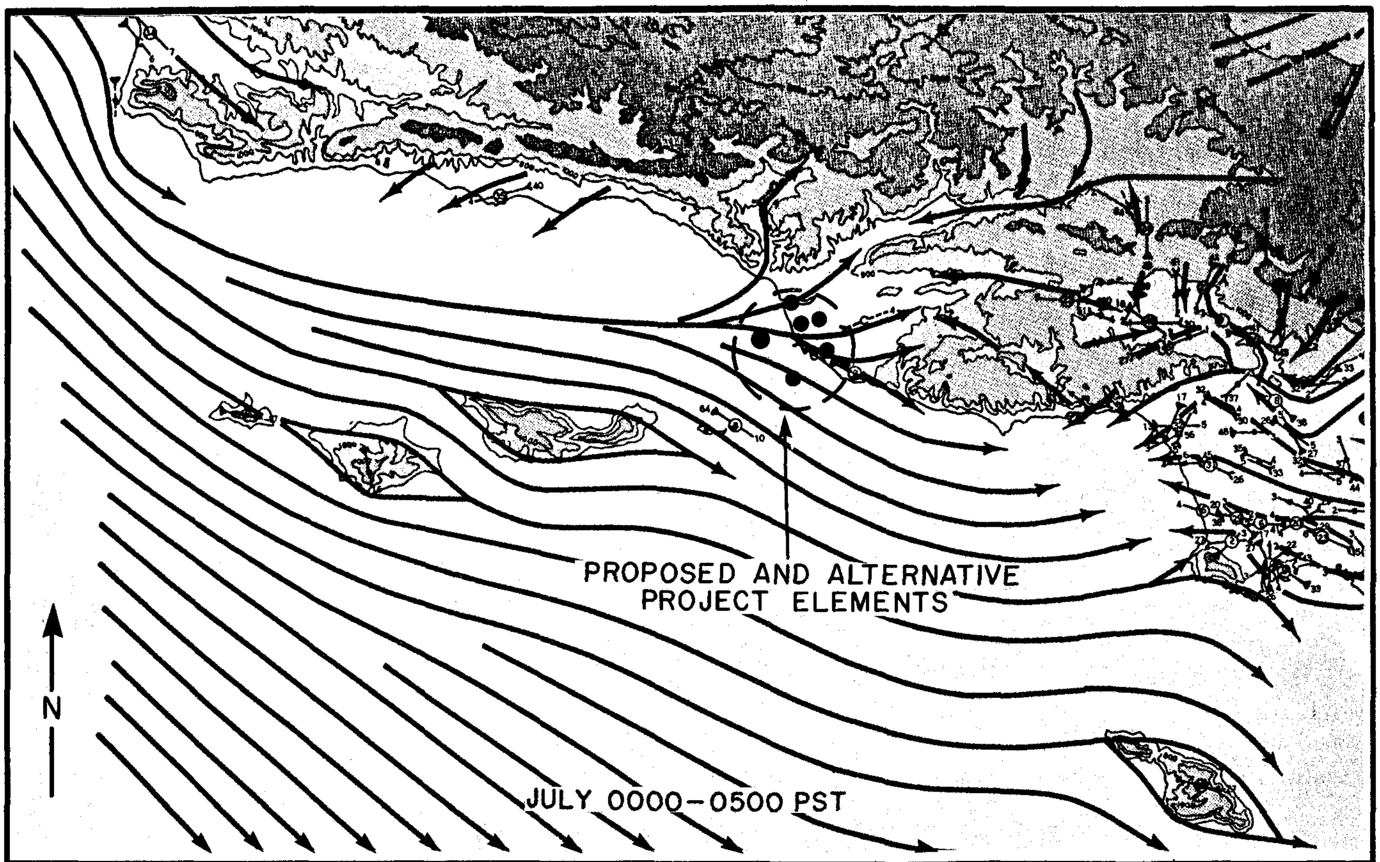


FIGURE 12.2-3

DAYTIME AIRFLOW IN THE SANTA BARBARA CHANNEL DURING SUMMER AND WINTER

REFERENCE: DE MARRAIS ET AL. (1965)

DAMES & MOORE



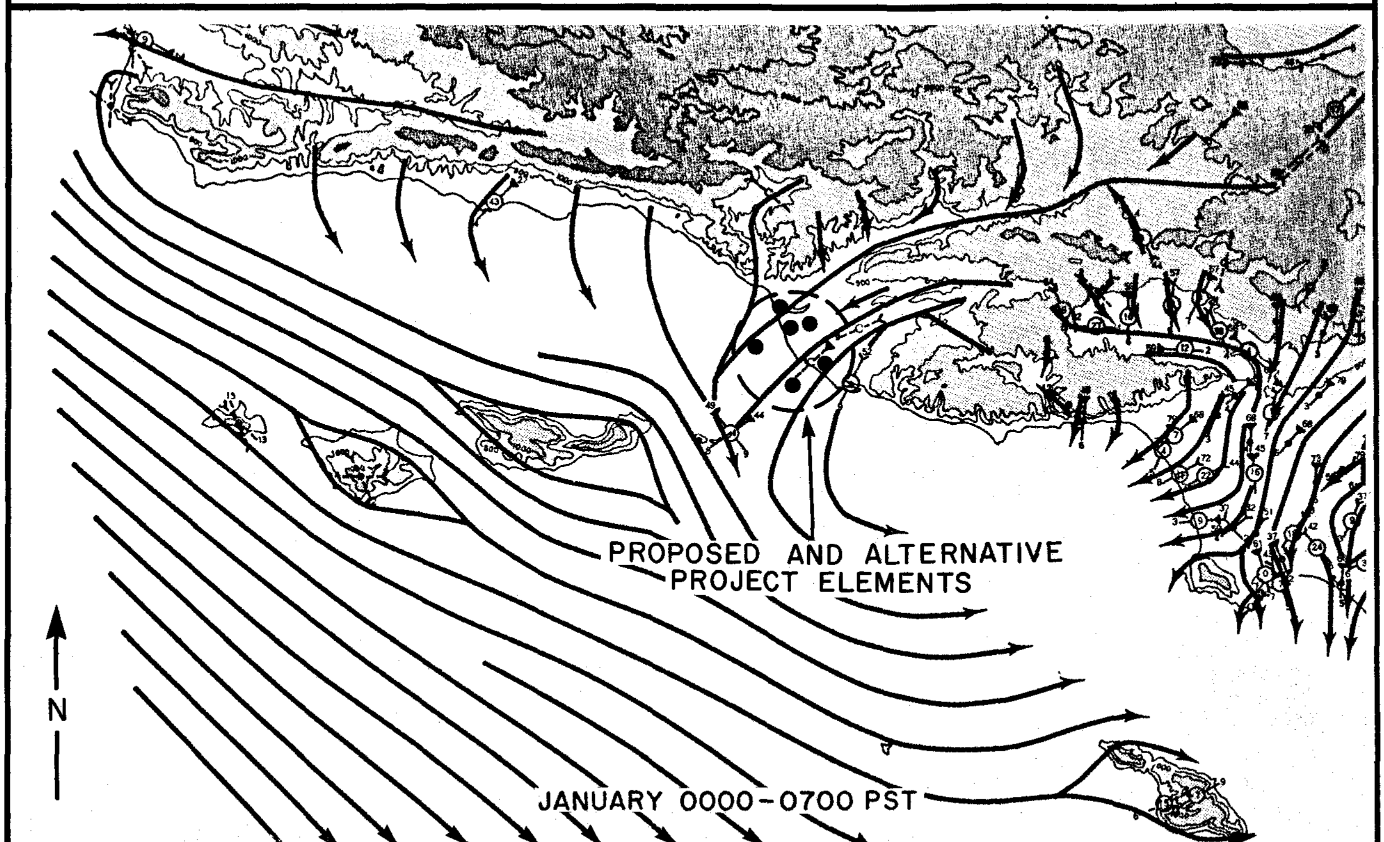


FIGURE 12.2-4

NIGHTTIME AIRFLOW IN THE SANTA BARBARA CHANNEL DURING SUMMER AND WINTER

DAMES & MOORE

NOTE: SEE FIGURE 12.2-3 FOR LEGEND AND REFERENCE complemented by upslope and valley winds over much of the area. At night, the land breeze downslope and mountain winds also complement one another.

Prevailing daytime airflow patterns during summer (July) and winter (January) are shown on Figure 12.2-3. The northwest wind incident upon the west-facing coastline turns counterclockwise in passage around Point Conception and assumes a more westerly direction through the Santa Barbara Channel. The sea breeze influence along the south-facing coast is stronger in the summer, which results in more southerly winds in that area. Diverging wind in the local area is associated with sea breeze effects and topography. This flow continues inland up the Santa Clara and Simi valleys. A portion of the air that moves over the offshore area is transported parallel to the coast toward Santa Monica Bay.

Prevailing nighttime wind patterns during summer and winter are shown on Figure 12.2-4. These patterns indicate pronounced differences in summer and winter airflow. On the south-facing coast, offshore winds are more northerly in winter than in summer because of the stronger cold air drainage during winter. In the local area, winds flow onshore at night in summer. A convergence zone occurs inland from the local area as onshore winds encounter land breezes. Winds are generally offshore during winter in the local area due to cold air drainage effects. Winds in the outer Santa Barbara Channel are generally westerly during both seasons. An offshore convergence zone occurs southeast of the local area during both seasons as offshore westerly flow encounters land breezes from the Los Angeles Basin.

Wind data from the Ventura County Airport are taken as representative of the local onshore area and are summarized in Tables 12.2-1 through 12.2-4. The sea breeze, from the west, is predominant in the summer daytime. During the afternoon hours, winds are from the southwest through northwest in

TABLE 12.2-1

FREQUENCY DISTRIBUTION FOR DAYTIME WINDS AT VENTURA COUNTY AIRPORT DURING SUMMER

	Frequency of Occurrence by Wind Speed Class (Percent)[a,b]									
Sector	0.75-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-7.0	7.0-10.0	10.0-15.0	>15.0	Total	Mean Speed
NNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S	0.0	0.0	0.0	0.0	1.7	0.2	0.0	0.0	1.9	5.9
SSW	0.0	0.0	0.2	0.7	1.3	0.0	0.0	0.0	2.2	5.1
SW	0.0	0.0	0.2	0.2	4.6	0.2	0.0	0.0	5.2	5.3
WSW	0.0	0.0	0.0	0.9	7.4	0.4	0.0	0.0	8.7	5.6
W	0.0	0.2	0.2	0.9	26.5	26.5	2.6	0.0	56.9	7.2
WNW	0.0	0.0	0.0	0.2	8.5	14.8	1.1	0.0	24.6	7.7
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	10.3
NNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.2	0.6	2.9	50.0	42.1	3.9	0.0	99.7[c]	7.0

[a] Data from June, July, and August, 1964 from 13:00 to 18:00 PST. Valid observations totaled 460 hours.
[b] All speeds given in meters per second (mps).
[c] Calm conditions (<0.75 mps) prevailed 0.3 percent of the time.

TABLE 12.2-2

FREQUENCY DISTRIBUTION FOR NIGHTTIME WINDS AT VENTURA COUNTY AIRPORT DURING SUMMER

	Frequency of Occurrence by Wind Speed Class (Percent)[a,b]									
Sector	0.75-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-7.0	7.0-10.0	10.0-15.0	>15.0	Total	Mean Speed
NNE	0.2	1.3	2.8	0.9	0.4	0.0	0.0	0.0	5.6	3.3
NE	0.0	2.0	1.1	1.3	0.2	0.0	0.0	0.0	4.6	3.3
ENE	0.2	1.8	2.6	0.9	1.1	0.0	0.0	0.0	6.6	3.5
E	0.2	3.5	1.1	1.3	1.3	0.0	0.0	0.0	7.4	3.4
ESE	0.2	0.7	0.4	0.0	0.0	0.0	0.0	0.0	1.3	2.7
SE	0.2	0.9	1.1	0.2	0.4	0.0	0.0	0.0	2.8	3.2
SSE	0.2	2.2	1.3	1.1	0.9	0.0	0.0	0.0	5.7	3.4
S	0.0	2.2	2.0	0.4	0.2	0.0	0.0	0.0	4.8	3.1
SSW	0.0	1.1	0.7	0.0	0.2	0.0	0.0	0.0	2.0	3.1
SW	0.2	0.7	0.7	0.0	0.0	0.0	0.0	0.0	1.6	2.6
WSW	0.2	2.4	1.1	0.2	0.2	0.2	0.0	0.0	4.3	3.0
W	0.2	2.2	3.7	1.1	0.2	0.0	0.0	0.0	7.4	3.2
WNW	0.7	4.8	2.0	3.1	1.1	0.0	0.0	0.0	11.7	3.3
NW	0.4	0.4	0.7	0.4	0.0	0.0	0.0	0.0	1.9	2.7
NNW	0.0	1.5	0.7	0.4	1.1	0.0	0.0	0.0	3.7	3.6
N	0.0	2.6	3.3	0.4	0.7	0.0	0.0	0.0	7.0	3.3
Total	2.9	30.3	25.3	11.7	8.0	0.2	0.0	0.0	78.4[c]	2.5

[a] Data from June, July, and August, 1964 from 01:00 to 06:00 PST. Valid observations totaled 458 hours.
[b] All speeds given in meters per second (mps).
[c] Calm conditions (<0.75 mps) prevailed 21.6 percent of the time.

TABLE 12.2-3

FREQUENCY DISTRIBUTION FOR DAYTIME WINDS AT VENTURA COUNTY AIRPORT DURING WINTER

Sector	Frequency of Occurrence by Wind Speed Class (Percent)[a,b]								Total	Mean Speed
	0.75-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-7.0	7.0-10.0	10.0-15.0	>15.0		
NNE	0.0	0.0	0.9	0.2	0.0	0.2	0.0	0.0	1.3	4.3
NE	0.0	0.0	0.0	0.9	0.5	0.5	0.0	0.0	1.9	5.5
ENE	0.0	0.2	0.0	0.0	0.2	1.1	1.6	0.5	3.6	10.5
E	0.0	0.2	0.0	0.2	0.7	0.9	3.3	0.5	5.8	10.7
ESE	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	3.6
SE	0.0	0.5	0.4	0.2	0.5	0.0	0.0	0.0	1.6	3.7
SSE	0.0	0.2	0.0	0.7	0.2	0.2	0.0	0.0	1.3	4.6
S	0.0	0.2	0.7	0.4	1.1	0.7	0.0	0.0	3.1	5.1
SSW	0.2	0.5	0.7	0.9	1.3	0.2	0.0	0.0	3.8	4.2
SW	0.0	0.5	1.3	0.9	2.7	0.2	0.0	0.0	5.6	4.6
WSW	0.0	0.7	0.9	1.6	5.8	1.3	1.1	0.0	11.4	5.8
W	0.2	0.9	2.5	3.8	12.0	9.4	4.0	0.0	32.8	6.7
WNW	0.0	0.5	1.1	1.1	7.5	10.0	3.8	0.0	24.0	7.3
NW	0.0	0.0	0.2	0.0	0.7	1.1	0.2	0.0	2.2	7.5
NNW	0.0	0.0	0.0	0.0	0.2	0.5	0.0	0.0	0.7	7.4
N	0.0	0.0	0.2	0.5	0.0	0.0	0.0	0.0	0.7	3.8
Total	0.4	4.4	9.1	11.4	33.4	26.3	14.0	1.0	100.0[c]	6.7

[a] Data from January, February, and December, 1964 from 13:00 to 18:00 PST. Valid observations totaled 449 hours.
[b] All speeds given in meters per second (mps).
[c] Calm conditions (<0.75 mps) prevailed less than 0.1 percent of the time.

TABLE 12.2-4

FREQUENCY DISTRIBUTION FOR NIGHTTIME WINDS AT VENTURA COUNTY AIRPORT DURING WINTER

Sector	Frequency of Occurrence by Wind Speed Class (Percent)[a,b]								Total	Mean Speed
	0.75-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-7.0	7.0-10.0	10.0-15.0	>15.0		
NNE	0.0	1.1	3.4	6.3	15.4	5.8	0.0	0.0	32.0	5.4
NE	0.0	0.9	2.0	4.5	10.7	5.1	0.5	0.0	23.7	5.6
ENE	0.0	0.5	1.6	2.0	4.2	2.0	2.9	0.2	13.4	6.8
E	0.0	0.5	0.0	1.1	0.5	0.7	0.5	1.3	4.6	8.9
ESE	0.2	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.7	4.1
SE	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.4	4.7
SSE	0.0	0.2	0.2	0.0	0.0	0.2	0.2	0.0	0.8	6.7
S	0.0	0.0	0.0	0.0	0.2	0.0	0.5	0.0	0.7	9.4
SSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WSW	0.0	0.5	0.0	0.0	0.7	0.0	0.0	0.0	1.2	4.1
W	0.0	0.7	0.5	1.1	1.1	0.5	1.3	0.0	5.2	6.5
WNW	0.0	0.5	0.0	0.0	0.9	0.0	0.0	0.0	1.4	4.3
NW	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	2.6
NNW	0.0	0.2	0.2	0.2	1.6	0.0	0.0	0.0	2.2	4.8
N	0.0	1.3	1.8	1.3	6.5	1.6	0.0	0.0	12.5	5.1
Total	0.2	6.6	9.9	16.5	42.5	15.9	5.9	1.5	99.0[c]	5.7

[a] Data from January, February, and December, 1964 from 01:00 to 06:00 PST. Valid observations totaled 448 hours.
[b] All speeds given in meters per second (mps).
[c] Calm conditions (<0.75 mps) prevailed 1.0 percent of the time.

95 percent of the observations, with an average speed of 15.7 miles/hour (7 m/sec) (Table 12.2-1). The data shown in Table 12.2-2 indicate that the sea breeze generally persists into the nighttime hours. Winds from the north through east indicate the presence of drainage winds, and those from the south-southeast reflect the presence of low-level, eddy-type circulations that form over southern California. Nighttime wind speeds average approximately 5.6 miles/hour (2.5 m/sec) with calm conditions occurring about 22 percent of the time.

During winter months, the sea breeze is not as persistent as in summer because of a diminished land-sea temperature gradient. However, the sea breeze dominates the winter daytime wind regime. Winds from the southwest through northwest occur 76 percent of the time (Table 12.2-3). During winter nights, drainage winds from the north through east are predominant (Table 12.2-4), occurring 86 percent of the time.

The Santa Ana winds in the project area are dry, northeasterly winds associated with a well developed high pressure center over the Great Basin. They typically are quite gusty and strong below coastal canyons. The winds of a moderate Santa Ana blow at speeds of 35 to 45 miles/hour (15 to 20 m/sec), with frequent gusts of up to 55 miles/hour (25 m/sec) (de Violini, 1967). Horizontal visibility near the surface can be reduced to less than 1 mile (1.6 km) by wind-blown sand and dust. Santa Ana winds may occur throughout the year but are most frequent from November to February.

The most potentially damaging winds in the project area are the prefrontal southeasters. These winds may be expected to occur on about 15 to 20 days from October through April. Wind speeds are usually less than 35 miles/hour (15 m/sec) but, on an average of once every 2 years, 55 miles/hour (25 m/sec) winds may be expected in exposed coastal locations. The most common duration of the southeaster is from 6 to 9 hours. Under certain conditions, with a quasi-stationary front or low pressure center to the west, it may persist for up to 3 days.

Reinforced by winds aloft, post-frontal westerly winds also may be quite strong. These winds are not likely to persist more than a day before shifting into the northwest and then to the north. Strong west to northwest winds are most frequent in April and May when intense low pressure commonly forms in the region of southern Nevada.

Offshore winds in the vicinity of the proposed platform locations are from the west to northwest, reflecting the gradient flow associated with the Pacific High pressure center (Figures 12.2-3 and 12.2-4) and minimal influence from the topographic factors which cause the nearshore sea breeze-drainage wind regime. In the vicinity of the offshore platform sites, winds are expected to persist from the west to northwest throughout most of the year. Winds from the south and southeast, representing eddy-type flow over offshore waters, and synoptic scale storms, are expected to occur occasionally. The platform sites also may experience a weak drainage-type flow during the early morning hours in winter. Average annual wind speeds near the proposed platform locations are expected to be greater than those onshore, since average wind speeds generally increase with distance from the coast (U.S. Navy, 1971). Fewer calms are expected to occur offshore than onshore.

12.2.1.2.2 Stability and Mixing Height

Stability is an atmospheric property that reflects atmospheric mixing. In general, greater turbulence and mixing are possible as the atmosphere becomes less stable. The mixing height, measured from the ground upward, is the height of the atmospheric layer in which convection and mechanical turbulence promote mixing. Good ventilation and dispersion result from a high mixing height, unstable conditions, and moderate to high wind speeds within the mixed layer. Mixing heights are generally marked by the base of an upper level inversion, a stable atmospheric layer within which temperatures increase with height.

Atmospheric stability information from Ventura County Airport (Table 12.2-5) is taken as representative of onshore stabilities in the local area. In all seasons, neutral conditions (Pasquill Class D) predominate. Neutral stability is associated with cloudy conditions, low sun angle, and moderate to high wind speeds. Unstable conditions (Classes A, B, and C) occur during daytime and are most common during spring and summer when days are longest and incoming solar radiation is greatest. Stable conditions (Classes E and F) occur primarily at night and are associated with surface cooling.

Stability measurements over the ocean are not available. However, it is expected that unstable conditions would occur less frequently over the ocean than onshore because the large heat capacity of the water has a stabilizing effect on the overlying air.

Low-level inversions that limit the height of the surface mixing layer occur frequently over the project area. Subsiding air associated with the Pacific High helps to maintain a semi-permanent inversion over most of southern California. On the Oxnard Plain, nocturnal cooling and the intrusion of drainage and marine air masses frequently cause inversions to form within 985 feet (300 m) of the surface (Lamb et al., 1977). Mean mixing heights over the onshore local area are given in Table 12.2-6.

12.2.1.2.3 Temperature

Marked temperature discontinuities occur throughout the region and are related to the interplay of marine and continental controls. In the local area, the proximity of the Pacific Ocean is a moderating influence. Also, the mountains that border the Oxnard Plain act as a barrier to the influence of warm, dry air masses of the continental interior.

TABLE 12.2-5

STABILITY FREQUENCY AT VENTURA COUNTY AIRPORT

Pasquill Stability Class	Frequency of Occurrence (Percent of Total Observations)[a]								
	December-February		March-May		June-August		September-November		
	Daytime[b]	Nighttime[c]	Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	Total
A	0.0	0.0	0.3	0.0	0.4	0.0	0.0	0.0	0.1
B	2.8	0.0	3.5	0.0	3.0	0.0	2.1	0.0	1.4
C	14.3	0.0	29.9	0.0	33.9	0.0	17.8	0.0	12.0
D	73.9	54.8	65.4	46.5	62.7	42.0	74.8	42.4	57.8
E	6.6	34.9	1.0	37.3	0.0	26.0	4.4	36.4	18.3
F	2.3	10.3	0.0	16.2	0.0	32.0	0.9	21.2	10.4

[a] Data based on surface observations taken from 1 January through 31 December, 1964 using Pasquill-Turner methodology (Turner, 1970).
[b] Daytime is the period from 07:00 to 18:00 PST.
[c] Nighttime is the period from 19:00 to 06:00 PST.

TABLE 12.2-6

MEAN MIXING HEIGHTS OVER THE LOCAL AREA

	Seasonally Averaged Heights (Meters)[a]			
	Spring	Summer	Fall	Winter
Morning	700	500	500	500
Afternoon	1000	600	800	800

[a]Data from Holzworth (1972)

Temperatures in the local area are summarized in Table 12.2-7. Mean maximum monthly temperatures at the Ventura County Airport range from 65°F (18°C) in January to 75°F (24°C) in September; mean minimum monthly temperatures range from 42°F (6°C) in January to 55°F (13°C) in August. The warmest month is September and the coldest is January. This station is taken as representative of the local onshore area.

In general, extremes in climatological parameters such as temperature and precipitation are associated with continental influences, while the ocean tends to be a modifying influence. Maritime air temperatures closely reflect ocean water temperatures which change slowly, while continental air reflects ground temperatures which may change 30°F (17°C) in a day. In the local area, this trend is evident in the differences in air temperatures between Point Mugu, only about 1 mile (1.6 km) from the ocean, and Oxnard AFB approximately 8 miles (12.8 km) inland (Table 12.2-7). In the offshore area, temperatures are expected to be similar to those at Point Mugu. However, diurnal ranges are expected to be smaller and temperature extremes less pronounced.

12.2.1.2.4 Precipitation

Approximately 95 percent of the precipitation in the local area occurs from November through April (Table 12.2-7), generally associated with storms that move eastward from the Pacific during this period. During the summer months, precipitation occurs infrequently from mid-level stratus clouds or orographic thunderstorms when tropical moisture is advected into the region. Drizzle is relatively common in summer, but seldom contributes more than a trace of precipitation.

The annual precipitation at Ventura County Airport is 14.75 inches (375 mm). Precipitation in the local area varies markedly from year to year. Approximately once in 20 years, precipitation will be less than 6 inches (152 mm) or greater than 27 inches (686 mm) in the local area. Precipitation

TABLE 12.2-7

MONTHLY TEMPERATURES AND PRECIPITATION IN THE LOCAL AREA

	Ventura County Airport			Point Mugu			Oxnard AFB		
	Mean Temperatures (°F)[a]		Mean Precipitation	Mean Temperatures (°F)[a]		Mean Precipitation	Mean Temperatures (°F)[a]		Mean Precipitation
	Maximum	Minimum	(Inches)[b]	Maximum	Minimum	(Inches)[b]	Maximum	Minimum	(Inches)[b]
January	65	42	3.33	62	45	2.68	64	42	2.70
February	66	43	2.99	63	45	2.46	65	43	3.02
March	67	44	2.27	62	45	1.63	65	43	1.31
April	68	46	1.13	63	49	0.83	67	46	1.24
May	70	49	0.13	64	51	0.15	69	49	0.18
June	71	52	0.05	67	54	0.03	72	53	0.07
July	74	55	T[c]	70	58	T	75	57	T
August	74	55	0.03	70	58	0.03	75	57	0.02
September	75	54	0.08	71	56	0.09	76	55	0.13
October	74	50	0.40	69	52	0.32	73	51	0.15
November	72	46	1.14	68	49	0.97	70	45	1.28
December	67	44	3.20	65	47	2.19	67	43	0.81
Absolute Extremes	104	26		101	30		101	25	
Annual Total			14.75			11.38			10.91

[a] Data from US Navy (1969).
[b] Data from Brendler (1979).
[c] T = trace amount

intensities for 2-, 50-, and 100-year return periods are listed for Ventura County Airport in Table 12.2-8. Precipitation in the vicinity of the offshore platform sites is expected to be less than at Ventura County Airport because of fewer orographic influences.

12.2.1.2.5 Cloud Cover, Visibility, and Humidity

Intermittent fog and low clouds are characteristic of the climate in the local area. Particularly in the summer months, a layer of cool, moist maritime air may be trapped near the surface by the subsiding air of the Pacific High pressure center. During nighttime hours, this maritime air cools and stratus or fog usually forms. Throughout the summer, overcast conditions may be expected to occur on 20 to 25 mornings each month, although these conditions usually break up or clear during the afternoon (de Violini, 1967). Observed sky conditions at Point Mugu are summarized in Table 12.2-9.

A summary of surface visibility observations from Point Mugu is given in Table 12.2-10. In addition to fog and low clouds, visibility at Point Mugu may be limited by smoke and haze or, infrequently, by rain, drizzle, or wind-blown dust, such as that caused by Santa Ana winds. Conditions of visibility restriction occur least frequently during the winter and spring and most freqently during the late summer and fall.

Humidity at Point Mugu is summarized in Table 12.2-11. Humidity values are highest in summer and lowest in winter. The extreme minimum values associated with most months occurred with Santa Ana winds.

In the local offshore area, cloudy conditions and visibility restrictions are expected to occur more often than in the onshore area. This is due to the tendency for fog and low clouds to dissipate early in the day in onshore areas while remaining in offshore areas into the afternoon or throughout the day. Fog and stratus dissipation in onshore areas is due to surface heating.

TABLE 12.2-8

RAINFALL INTENSITY FREQUENCIES AT VENTURA COUNTY AIRPORT

Rainfall Duration	Return Period		
	2 Years	50 Years	100 Years
5 minutes	0.17[a,b]	0.42	0.47
30 minutes	0.42	1.03	1.15
1 hour	0.64	1.58	1.75
6 hours	1.74	4.31	4.79
24 hours	2.60	6.45	7.16

[a] Rainfall, in inches.
[b] Data from Taylor (1979).

TABLE 12.2-9

SKY CONDITIONS IN THE LOCAL AREA

	Sky Conditions[a,b]		
	Clear	Partly Cloudy	Cloudy
January	49.5[c]	18.1	32.5
February	46.7	18.0	35.2
March	47.8	21.2	31.1
April	43.8	17.8	38.3
May	46.1	15.3	38.5
June	45.3	13.0	41.6
July	44.3	14.6	41.0
August	43.7	15.5	40.8
September	50.6	13.0	35.5
October	49.2	15.3	35.5
November	57.7	16.8	25.6
December	52.1	17.8	30.2
Annual	48.0	16.4	35.6

[a] Data from Point Mugu (de Violini, 1967).
[b] Clear = 0/10 to 2/10 cloud cover.
Partly Cloudy = 3/10 to 7/10 cloud cover.
Cloudy = 8/10 to 10/10 cloud cover.
[c] Percent of total observations; October, 1946 to September, 1963

TABLE 12.2-10

FREQUENCY OF CERTAIN VISIBILITY VALUES IN THE LOCAL AREA

	Visibility[a]			
	≤1/2 Mile	≤3 Miles	≥7 Miles	≥10 Miles
January	2.6[b]	13.7	76.0	67.4
February	3.2	15.4	73.9	64.4
March	1.9	8.6	79.6	68.7
April	2.9	14.2	71.6	59.1
May	1.3	13.7	72.7	59.3
June	2.4	19.2	62.1	46.2
July	2.9	22.9	53.2	34.3
August	5.4	27.9	49.3	32.9
September	6.6	28.2	51.9	36.6
October	5.4	28.3	56.0	44.6
November	5.0	19.5	69.4	59.7
December	3.6	16.2	74.6	66.5
Annual	3.6	19.0	65.8	53.2

[a]Data from Point Mugu (de Violini, 1967).
[b]Percent of observations; October, 1946 to September, 1963.

TABLE 12.2-11

RELATIVE HUMIDITY IN THE LOCAL AREA

	Humidity (Percent)[a]		
	Mean Maximum[b]	Mean Minimum[b]	Extreme Minimum (Year)[c]
January	87	47	4 (1961)
February	89	48	2 (1955)
March	92	53	3 (1956)
April	94	60	17 (1962)[d]
May	93	63	8 (1960)
June	95	67	9 (1957)
July	96	69	34 (1960)
August	96	68	30 (1959)
September	94	64	5 (1958)
October	93	61	7 (1958)
November	88	47	4 (1961)[d]
December	83	43	3 (1959)[d]
Annual	92	58	2 (Feb., 1955)

[a] Data from Point Mugu (de Violini, 1967).
[b] Period of record = January, 1952 to December, 1964.
[c] Period of record = January, 1952 to December, 1965.
[d] Also occurred in earlier year or years.

12.2.1.2.6 Severe Weather

Thunderstorms are observed in the local area approximately 3 or 4 times per year. They are usually associated with strong synoptic scale storms; however, they are also infrequently observed during the summer months in the mountains surrounding the Oxnard Plain.

12.2.2 Air Quality

Air quality is determined primarily by the type and amount of contaminants emitted into the atmosphere, the size and topography of the air basin, and the meteorological conditions. In the southern California coastal zone, the persistent temperature inversion and local topography tend to trap pollutants within the marine layer.

The effects of the ambient air quality within an air basin depend upon the characteristics of the receptors and the type, amount, and duration of exposure. Air quality standards specify the upper limits of concentrations and durations of pollutants in the ambient air consistent with the management goal of preventing specific harmful effects. The air quality standards, emissions inventory, and background air quality pertinent to the regional and local area are described in the following sections.

12.2.2.1 Air Quality Standards

Establishment of ambient air quality standards is the responsibility of the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board (CARB). The State of California air quality standards describe "adverse" conditions; that is, pollution levels must be below these standards before air quality is considered acceptable. National air quality standards describe acceptable conditions. Air quality is considered accpetable if pollutant levels are less than or equal to the national standards continuously or exceed them no more than once each year. Where differences in state and national standards exist, the more stringent standards apply. National and state air quality standards are shown in Table 12.2-12.

TABLE 12.2-12

AMBIENT AIR QUALITY STANDARDS[a]

		California Standards[b]		National Standards[c]		
Pollutant	Averaging Time	Concentration[d]	Method[e]	Primary[d,f]	Secondary[d,g]	Method[h]
Oxidant (Ozone)	1-hour	0.10 ppm ($200 \mu g/m^3$)	Ultraviolet photometry	$240 \mu g/m^3$ (0.12 ppm)	Same as primary standard	Chemiluminescent method
Carbon monoxide	12-hour	10 ppm ($11 mg/m^3$)	Non-dispersive infrared spectroscopy	--	--	
	8-hour	--		$10 mg/m^3$ (9 ppm)	Same as primary standard	Non-dispersive infrared spectroscopy
	1-hour	40 ppm ($46 mg/m^3$)	"	$40 mg/m^3$ (35 ppm)	Same as primary standard	"
Nitrogen dioxide	Annual average	--		$100 \mu g/m^3$ (0.05 ppm)	Same as primary standard	Proposed: Modified J-H Saltzman (O_3 corr.) Chemiluminescent
	1-hour	0.25 ppm ($470 \mu g/m^3$)	Saltzman method	--		
Sulfur dioxide	Annual average	--		$80 \mu g/m^3$ (0.03 ppm)	--	Pararosaniline method
	24-hour	0.05 ppm[i] ($131 \mu g/m^3$)	Conductimetric method	$365 \mu g/m^3$ (0.14 ppm)	--	"
	3-hour	--		--	$1300 \mu g/m^3$ (0.5 ppm)	"
	1-hour	0.5 ppm ($1310 \mu g/m^3$)	"	--	--	
Suspended particulate matter	Annual geometric mean	$60 \mu g/m^3$	High volume sampling	$75 \mu g/m^3$	$60 \mu g/m^3$	High volume sampling
	24-hour	$100 \mu g/m^3$		$260 \mu g/m^3$	$150 \mu g/m^3$	"
Sulfates	24-hour	$25 \mu g/m^3$	AIHL method No. 61	--	--	

TABLE 12.2-12 (Concluded)

Pollutant	Averaging Time	California Standards[b] Concentration[d]	California Standards[b] Method[e]	National Standards[c] Primary[d,f]	National Standards[c] Secondary[d,g]	National Standards[c] Method[h]
Lead	30-day	1.5 $\mu g/m^3$	AIHL method No. 54	--	--	--
	Calendar quarter	--	--	1.5 $\mu g/m^3$	Same as primary standard	High volume sampling
Hydrogen sulfide	1-hour	0.03 ppm (42 $\mu g/m^3$)	Cadmium hydroxide stractan method	--	--	--
Hydrocarbons (corrected for methane)	3-hour (6-9 a.m.)	--	--	160 $\mu g/m^3$ (0.24 ppm)	Same as primary standard	Flame ionization detection using gas chromatography
Ethylene	8-hour	0.1 ppm	--	--	--	--
	1-hour	0.5 ppm	--	--	--	--
Visibility reducing particles	1 observation	In sufficient amount to reduce the prevailing visibility[j] to less than 10 miles when the relative humidity is less than 70 percent.		--	--	--

Notes:
(a) From California Air Resources Board (1977).
(b) California standards are values that are not to be equaled or exceeded.
(c) National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once per year.
(d) Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. All measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of Hg (1,013.2 millibars); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.
(e) Any equivalent procedure which can be shown to the satisfaction of the Air Resources Board to give equivalent results at or near the level of the air quality standard may be used.
(f) National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. Each state must attain the primary standards no later than 3 years after that state's implemention plan is approved by the Environmental Protection Agency (EPA).
(g) National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each state must attain the secondary standards within a "reasonable time" after implementation plan is approved by the EPA.
(h) Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.
(i) 0.05 ppm (131 $\mu g/m^3$) (conductimetric) in the presence of oxidant in excess of state 1-hour standard or in presence of particulates in excess of state 24-hour standard (established June 29, 1977).
(j) Prevailing visibility is defined as the greatest visibility which is attained or surpassed around at least half of the horizon circle, but not necessarily in continuous sectors.

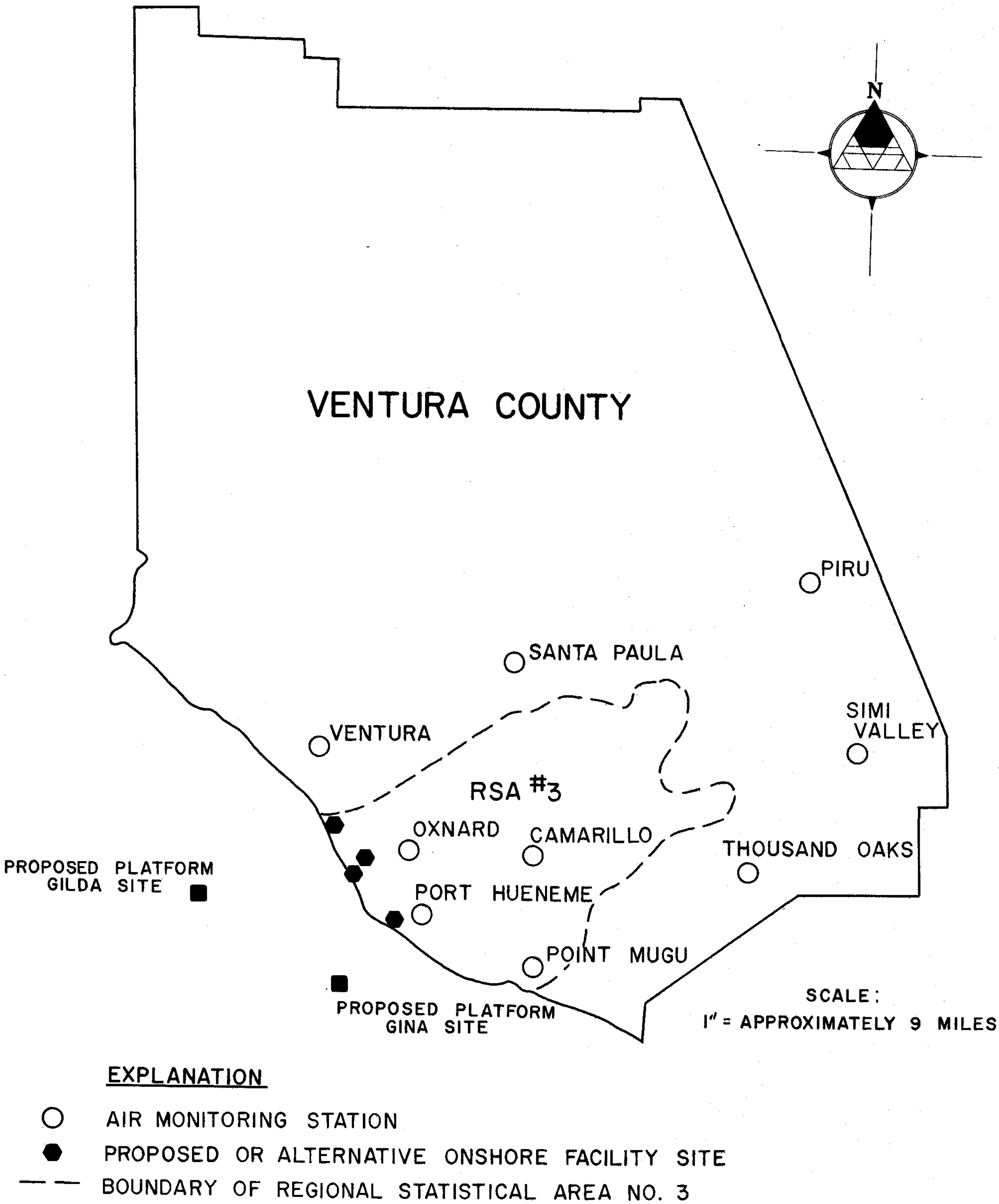


FIGURE 12.2-5

AIR MONITORING STATIONS

DAMES & MOORE

12.2.2.2 Regional Emissions Inventory

Ventura County is situated in the South Central Coast Air Basin. Recent emissions inventories are available for Ventura County and for Regional Statistical Area Number 3 (RSA#3) within the county. These areas are taken as the regional and local areas for the purpose of discussing emissions, and are shown on Figure 12.2-5.

The most recently available emissions inventories for the regional (Table 12.2-13) and local (Table 12.2-14) areas are for 1977 (Ventura County Air Pollution Control District (VCAPCD), 1979). Pollutant emissions tabulated include reactive hydrocarbons (RHC), oxides of nitrogen (NO_x), sulfur dioxide (SO_2), particulate matter (PM), and carbon monoxide (CO). The largest contributors of these pollutants are listed in Table 12.2-15. The data in this table indicate that the largest contributors of pollutants within the county are motor vehicles, power plants, and farming activities.

12.2.2.3 Existing Air Quality

Air pollutants in the regional and local areas are monitored by the VCAPCD and CARB. Locations of monitoring stations within Ventura County are shown on Figure 12.2-5. Pollutant concentrations at these stations have been summarized by the CARB in quarterly and annual reports (CARB, 1976-1978) and by the VCAPCD (1979). Not all pollutants are monitored at each station. In the following sections, air quality data from 1976 through 1978 are discussed. Where appropriate and available, both the highest and second-highest concentrations are given. National short-term standards are based on the second-highest concentration in a given year.

12.2.2.3.1 Oxidant (Ozone)

Photochemical oxidants are formed in the atmosphere in the presence of sunlight by a series of chemical reactions principally involving oxides of nitrogen and reactive hydrocarbons. For this reason, the distribution of oxidants is more regional than that of other pollutants. Maximum hourly concentrations are generally higher in rural areas than in adjacent urban areas,

TABLE 12.2-13

EMISSIONS INVENTORY FOR VENTURA COUNTY

Emission Source Category[b]	Reactive Hydrocarbons[a]		Oxides of Nitrogen[a]		Particulate Matter[a]		Sulfur Dioxide[a]		Carbon Monoxide[a]	
	SSE	ASE	SSE	ASE	SSE	ASE	SSE	ASE	SSE	ASE
Petroleum										
Production	1928[c]									
Refining	58						3			
Marketing	2037									
Combustion	345		8171		44		2		1218	
Organic Solvent Users										
Surface Coating	109	1509			8					
Dry Cleaning	17									
Degreasing	19	1036								
Chemical					7		1			
Metallurgical					19		2		5	
Mineral					247					
Food and Agricultural Processing	265				11					
Pesticides										
Agricultural		5334								
Governmental		193								
Structural		533								
Wood Processing					64					
Combustion of Fuels										
Power Plants	595		8648		1351		15,313		969	
Other Industrial	17		519		43		67		203	
Domestic/Commercial	3	63	53	806	7	80	8	1	8	160
Orchard Heaters		142								292
Waste Burning										
Forest Management		397				672				4518
Incinerators	2		3		8		3		11	

TABLE 12.2-13 (concluded)

Emission Source Category[b]	Reactive Hydrocarbons[a]		Oxides of Nitrogen[a]		Particulate Matter[a]		Sulfur Dioxide[a]		Carbon Monoxide[a]	
	SSE	ASE	SSE	ASE	SSE	ASE	SSE	ASE	SSE	ASE
Miscellaneous Area Source										
Wild Fires		132[c]		265		2248				17,188
Structural Fires		10		5		71				309
Farming Operations						8619				
Construction/Demolition						1710				
Unpaved Roads						2132				
Utility Equipment		172		14		4				1358
SUBTOTAL -- NON-MOBILE	14,916		18,484		17,345		15,400		26,239	
Motor Vehicles (On Road)		13,277		11,665		1549		613		125,130
Jet Aircraft		213		112		170		47		470
Piston Aircraft		370		50		5		2		1860
Railroads		49		198		13		31		70
Ships		2		3		5		5		3
Motor Vehicles (Off Road)		455		611		49		40		4931
SUBTOTAL -- MOBILE	14,366		12,639		1791		738		132,464	
TOTAL	29,282		31,123		19,136		16,138		158,703	

[a] SSE = Stationary Source Emissions
ASE = Area Source Emissions
[b] Data for 1977 (VCAPCD, 1979).
[c] All emissions reported in tons per year.

TABLE 12.2-14

EMISSIONS INVENTORY FOR REGIONAL STATISTICAL AREA #3

Emission Source Category[b]	Reactive Hydrocarbons[a]		Oxides of Nitrogen[a]		Particulate Matter[a]		Sulfur Dioxide[a]		Carbon Monoxide[a]	
	SSE	ASE	SSE	ASE	SSE	ASE	SSE	ASE	SSE	ASE
Petroleum										
Production	303[c]									
Refining	36									
Marketing	545									
Combustion	56		1387		8				193	
Organic Solvent Users										
Surface Coating	21	583								
Dry Cleaning	16									
Degreasing		467								
Chemical					7					
Metallurgical					16		2		5	
Mineral					94					
Food and Agricultural Processing	57				6					
Pesticides										
Agricultural		2930								
Governmental		106								
Structural		190								
Wood Processing					64					
Combustion of Fuels										
Power Plants	595		8648		1351		15,313		968	
Other Industrial	6		332		25		49		34	
Domestic/Commercial	1	22	13	280	1	28			2	56
Orchard Heaters										
Waste Burning										
Forest Management		218				368				2476
Incinerators	2		3		7		3		11	

TABLE 12.2-14 (concluded)

Emission Source Category[b]	Reactive Hydrocarbons[a] SSE	Reactive Hydrocarbons[a] ASE	Oxides of Nitrogen[a] SSE	Oxides of Nitrogen[a] ASE	Particulate Matter[a] SSE	Particulate Matter[a] ASE	Sulfur Dioxide[a] SSE	Sulfur Dioxide[a] ASE	Carbon Monoxide[a] SSE	Carbon Monoxide[a] ASE
Miscellaneous Area Source										
Wild Fires										
Structural Fires		3[c]		1		19				83
Farming Operations						6160				
Construction/Demolition						603				
Unpaved Roads						1169				
Utility Equipment		62		5		2				488
SUBTOTAL -- NON-MOBILE	6219		10,669		9928		15,367		4316	
Motor Vehicles (On Road)		5052		4274		567		224		47,234
Jet Aircraft		212		112		170		47		470
Piston Aircraft		362		49		5		2		1548
Railroads		17		70		5		11		24
Ships		1		2		2		2		2
Motor Vehicles (Off Road)		265		363		27		24		2749
SUBTOTAL -- MOBILE	5909		4870		776		310		52,027	
TOTAL	12,128		15,539		10,704		15,677		56,343	

[a] SSE = Stationary Source Emissions
ASE = Area Source Emissions
[b] Data for 1977 (VCAPCD, 1979).
[c] All emissions reported in tons per year.

TABLE 12.2-15

LARGEST CONTRIBUTORS OF POLLUTANTS IN VENTURA COUNTY

Pollutant[a]	Largest Contributor	Second Largest Contributor
Reactive Hydrocarbons	Motor Vehicles (On Road) (45%)[b]	Agricultural Pesticides (18%)
Oxides of Nitrogen	Motor Vehicles (On Road) (37%)	Power Plant Combustion (28%)
Particulate Matter	Farming Operations (45%)	Wild Fires (12%)
Sulfur Dioxide	Power Plant Combustion (95%)	Motor Vehicles (On Road) (4%)
Carbon Monoxide	Motor Vehicles (On Road) (79%)	Wild Fires (11%)

[a] Data derived from information contained in Table 12.2-13.
[b] Percent contribution to total amount of pollutant emitted.

probably because of the scavenging effect of urban nitric oxide emissions on oxidant concentrations. Moreover, oxidant concentrations tend to increase inland from coastal areas due to the cumulative effect of oxidant precursors transported inland by local onshore winds.

Maximum 1-hour oxidant concentrations in the local and regional areas are summarized in Table 12.2-16. These data indicate that both the state standard (0.10 ppm) and the national standard (0.12 ppm) were exceeded throughout both areas. The southern half of Ventura County, including RSA#3, has been designated by the EPA as a non-attainment area for photochemical oxidants (43 FR 8962).

12.2.2.3.2 Nitrogen Dioxide

NO_2 is an indirect product of fuel combustion in industrial sources and motor vehicles. The highest NO_2 concentrations generally occur in areas of high automobile traffic density when ventilation is poor.

Concentrations of NO_2 in the local and regional areas are summarized in Table 12.2-17. These data indicate that the state 1-hour standard (0.25 ppm) has been exceeded in Simi Valley. However, no exceedances of the state standard were recorded in the local area during the period between 1976 and 1978. In addition, data reported by the VCAPCD (1979) indicate no exceedances from 1972 to 1975. Annual data indicate that the national annual standard (0.05 ppm) was not exceeded at any of the monitoring stations from 1976 to 1978; or for the period between 1972 and 1975 (VCAPCD, 1979). The EPA has designated Ventura County as an attainment area for NO_2 (43 FR 8962).

12.2.2.3.3 Sulfur Dioxide

Power plants are the primary source of SO_2 emissions in the local and regional areas. Maximum SO_2 concentrations generally occur in proximity to these sources.

TABLE 12.2-16

ONE-HOUR OXIDANT CONCENTRATIONS

Station	1976 Highest	1976 Second Highest	1977 Highest	1977 Second Highest	1978 Highest	1978 Second Highest
Local Area						
Port Hueneme[a,b]	0.12	0.12	0.18	0.17	0.22[c]	0.17
Point Mugu[d]	0.18	0.18	0.16	0.15	NA[e]	NA
Camarillo	0.15	0.15	0.25	0.22	0.24[f]	0.14
Regional Area						
Thousand Oaks	0.16	0.16	0.23	0.22	0.25[g]	0.17
Simi Valley	0.16	0.16	0.26	0.21	0.23[c]	0.23
Piru	0.20	0.19	0.20	0.20	0.20[g]	0.19
Santa Paula	0.13	0.12	0.23	0.21	0.20[g]	0.18
Ventura	0.12	0.12	0.25	0.24	NA	NA
Ojai	0.15	0.14	0.18	0.18	0.18[c]	0.17

[a]Data from CARB (1976-1978).
[b]Concentrations (given in ppm) measured by UV photometry unless otherwise specified.
[c]Data available through September, 1978.
[d]Concentrations measured by chemiluminescence.
[e]NA = data not available.
[f]Data available through May, 1978.
[g]Data available through June, 1978.

TABLE 12.2-17

MAXIMUM NITROGEN DIOXIDE CONCENTRATIONS

Station	Averaging Time	1976	1977	1978
Local Area				
Port Hueneme[a,b]	One-hour	0.17	0.20	NA[c]
	Annual	0.024[d]	0.022[d]	NA
Camarillo	One-hour	0.17	0.23	0.17[e]
	Annual	0.025	NA	NA
Regional Area				
Simi Valley	One-hour	NA	0.30	0.25[f]
	Annual	NA	0.039[d]	NA

[a] Data from CARB (1976-1978).
[b] Concentrations (given in ppm) measured by chemiluminescence (Port Hueneme); Saltzman method (Camarillo); unspecified method (Simi Valley).
[c] NA = data not available.
[d] Data not statistically significant.
[e] Data available through February, 1978.
[f] Data available through September, 1978.

Maximum concentrations of SO_2 in the regional and local areas are summarized in Table 12.2-18. These data indicate low concentrations of SO_2 at all monitoring stations. No exceedances of state or national standards were recorded between 1976 and 1978 or from 1973 to 1975 (VCAPCD, 1979). Ventura County has been designated by the EPA as an attainment area for SO_2 (43 FR 8962).

12.2.2.3.4 Carbon Monoxide

The primary source of CO in Ventura County is motor vehicles. For this reason, CO concentrations are highest in urban areas during periods of high automobile traffic density and poor ventilation.

Maximum 1-hour and 8-hour CO concentrations in the local and regional areas are given in Table 12.2-19. These data show no exceedances of the state or national 1-hour standards (40 ppm and 35 ppm, respectively), or the national 8-hour standard (9 ppm). However, data reported by the VCAPCD (1979) indicate an exceedance of the national 8-hour standard at Simi Valley (in 1977) for both highest and second-highest concentrations. The reason for this difference is not known. No exceedances of state or national standards for the years prior to 1976 were reported by VCAPCD. Ventura County has been designated by the EPA as an attainment area for CO (43 FR 8962).

12.2.2.3.5 Total Suspended Particulates

The primary sources of particulate matter (reported as total suspended particulates - TSP) emitted in Ventura County are fugitive dust from farming operations; unpaved roads and construction activities; wild fires; and combustion of fuels at power plants.

TSP concentrations in the local and regional areas are summarized in Table 12.2-20. These data indicate widespread exceedances of the state 24-hour standard (100 $\mu g/m^3$). Exceedances of the national primary (260 $\mu g/m^3$) and secondary (150 $\mu g/m^3$) standards have been measured at most stations in the local and regional areas. Exceedances of the annual state standard

TABLE 12.2-18

MAXIMUM SULFUR DIOXIDE CONCENTRATIONS

Station	Averaging Time	1976	1977	1978
Local Area				
Camarillo[a,b]	One-hour	0.01	0.0[c]	NA[d]
	Three-hour	0.007	0.0[c]	NA
	24-hour	0.001	0.0[c]	NA
	Annual	0.0	0.0[c,e]	NA
Regional Area				
Ojai	One-hour	NA	0.06[f]	0.09[g]
	Three-hour	NA	0.053[f]	NA
	24-hour	NA	0.028[f]	NA
	Annual	NA	0.008[e,f]	NA
Simi Valley	One-hour	NA	0.03[f]	0.05[h]
	Three-hour	NA	0.030[f]	NA
	24-hour	NA	0.018[f,i]	NA
	Annual	NA	0.006[e,f]	NA

[a]Data from CARB (1976-1978).
[b]Concentrations (given in ppm) measured by flame photometry (Camarillo) and pulsed fluorescence (Ojai and Simi Valley).
[c]Data available for January, 1977 only.
[d]NA = data not available
[e]Data not statistically significant.
[f]Data available for October to December, 1977.
[g]Data available through June, 1978.
[h]Data available through September, 1978.
[i]The VCAPCD (1979) reported a maximum 24-hour concentration of 0.01 ppm for 1977.

TABLE 12.2-19

CARBON MONOXIDE CONCENTRATIONS

Station	Averaging Time	1976 Highest	1976 Second Highest	1977 Highest	1977 Second Highest	1978 Highest	1978 Second Highest
Local Area							
Camarillo[a,b]	One-hour	9	9	12	8	NA[c]	NA
	Eight-hour	3.9	3.9	4.6	4.5	NA	NA
Regional Area							
Ventura	One-hour	18	14	13	13	NA	NA
	Eight-hour	7.6	5.8	5.6	5.0	NA	NA
Simi Valley	One-hour	NA	NA	16[d]	15	13[e]	13
	Eight-hour	NA	NA	7.9[f]	7.6	NA	NA

[a]Data from CARB (1976-1978).
[b]Concentrations (given in ppm) measured by non-dispersive infrared spectroscopy.
[c]NA = data not available.
[d]The VCAPCD (1979) reported highest and second highest concentrations as 19 ppm and 16 ppm, respectively, for 1977.
[e]Data available from April to September, 1978.
[f]The VCAPCD (1979) reported highest and second highest concentrations as 10.3 ppm and 9.6 ppm, respectively, for 1977.

TABLE 12.2-20

TOTAL SUSPENDED PARTICULATE CONCENTRATIONS

Station	Averaging Time	1976 Highest	1976 Second Highest	1977 Highest	1977 Second Highest	1978 Highest	1978 Second Highest
Local Area							
Point Mugu[a,b]	24-hour	106	104	119	105	NA[c]	NA
	Annual[d]	55.0	—	51.9[e]	—	NA	—
Port Hueneme	24-hour	153	145	171	162	135[f]	129
	Annual	83.9[e]	—	81.7	—	NA	—
Oxnard	24-hour	269	158	120	118	124[f]	100
	Annual	72.8	—	69.1	—	NA	—
Camarillo	24-hour	131	125	283	202	129[g]	106
	Annual	74.1	—	78.9	—	NA	—
Regional Area							
Thousand Oaks	24-hour	239	113	134	119	98[f]	77
	Annual	55.9	—	59.3	—	NA	—
Simi Valley	24-hour	173	142	293	163	143[h]	139
	Annual	71.3	—	75.0	—	NA	—
Santa Paula	24-hour	227	154	177	139	156	136
	Annual	78.7	—	77.4	—	NA	—
Ventura	24-hour	125	123	106	102	NA	NA
	Annual	63.1	—	56.0	—	NA	—
Ojai	24-hour	144	124	133	123	137	121
	Annual	58.6	—	69.5	—	NA	—

[a]Data from CARB (1976-1978).
[b]Concentrations (given in $\mu g/m^3$) measured by high-volume sampling.
[c]NA = data not available.
[d]Annual concentrations are geometric means based on approximately 55 samples, unless otherwise noted.
[e]Data based on 30 to 40 samples; may not be representative of a year's average.
[f]Data available through June, 1978.
[g]Data available through May, 1978.
[h]Data available through September, 1978.

(60 $\mu g/m^3$), the national secondary standard (60 $\mu g/m^3$), and the national primary standard (75 $\mu g/m^3$) also have been measured in both the regional and local areas. The southern half of Ventura County has been designated as a non-attainment area for TSP by the EPA (43 FR 8962).

12.2.2.3.6 Sulfates

Suspended particulates containing sulfate ions ($SO_4^=$) have both anthropogenic and natural sources. Sulfates can result from the oxidation of SO_2, an industrial effluent. Sulfates are also natural components of soils and ocean-generated aerosols.

Concentrations of $SO_4^=$ in the local and regional areas are summarized in Table 12.2-21. These data indicate exceedances of the state 24-hour standard (25 $\mu g/m^3$). In Camarillo, the state standard was exceeded once in 1976 and once in 1977. In Simi Valley, this standard was exceeded once in 1977. There is no national standard for $SO_4^=$.

12.2.2.3.7 Lead

Motor vehicles are the primary source of suspended lead particles. High ambient lead concentrations generally occur in urban areas with dense automobile traffic during periods of poor ventilation.

Concentrations of lead in the local and regional areas are summarized in Table 12.2-22. These data indicate that the state 30-day standard and the national 90-day standard (both 1.5 $\mu g/m^3$) have been exceeded in Simi Valley. No exceedances of these standards were measured in the local area from 1976 to 1978. However, the state standard was exceeded in 1975 in Camarillo (CARB, 1975).

12.2.3 Environmental Acoustics

Sound levels are determined primarily by the noise-generating characteristics and distribution of noise sources within a given regional or local area. The effects of ambient sound levels on receptors depend on the charac-

TABLE 12.2-21

MAXIMUM 24-HOUR PARTICULATE SULFATE CONCENTRATIONS

Station	1976	1977	1978
Local Area			
Port Hueneme[a,b]	17.5	NA[c]	NA
Camarillo	25.3	25.5	NA
Regional Area			
Thousand Oaks	16.1	NA	NA
Simi Valley	19.9	27.5	21.8[d]
Santa Paula	19.0	NA	NA
Ojai	18.0	NA	NA

[a]Data from CARB (1976-1978).
[b]Concentrations (given in $\mu g/M^3$) measured by AIHL Method No. 61.
[c]NA = data not available.
[d]Data available through September, 1978.

TABLE 12.2-22

MAXIMUM LEAD CONCENTRATIONS

Station	Averaging Time	1976	1977	1978
Local Area				
Port Hueneme [a,b]	30-day[c]	0.15[d]	NA[e]	NA
	90-day[f]	0.15[d]	NA	NA
Camarillo	30-day	1.16	1.00[g]	NA
	90-day	1.05	0.94[g]	NA
Regional Area				
Thousand Oaks	30-day	0.63[d]	NA	NA
	90-day	0.62[d]	NA	NA
Simi Valley	30-day	1.91[d]	2.12[h]	1.19[i]
	90-day	1.47[d]	1.87[h]	0.91[i]
Santa Paula	30-day	0.69[d]	NA	NA
	90-day	0.57[d]	NA	NA
Ojai	30-day	0.31[d]	NA	NA
	90-day	0.31[d]	NA	NA

[a]Data from CARB (1976-1978).
[b]Concentrations (given in μg/m^3) measured by AIHL Method No. 54.
[c]Calendar month.
[d]Data available for July and August, 1976.
[e]NA = data not available.
[f]Calendar quarter (Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec).
[g]Data available for January through June, 1977.
[h]Data available for July through December, 1977.
[i]Data available through September, 1978.

teristics of the receptors and the intensity, frequency, duration, and spatial and temporal distribution of the sound sources. The direct effects of noise on people range from annoyance and inconvenience to hearing damage. Environmental noise guidelines and standards specify levels of sound consistent with the protection of the public health and welfare, including the prevention of annoyance or discomfort caused by noise. Representative environmental noise standards and guidelines and characteristics of the regional and local acoustic environment are discussed below.

12.2.3.1 Noise Guidelines and Standards

Noise guidelines and standards have been developed by several federal, state, and local agencies. Because these guidelines attempt to address subjective annoyance effects related to the characteristics of the receptors and noise sources in terms of quantitative sound levels using different statistical techniques, some variation in acceptability categories is apparent when guidelines developed by different agencies are compared.

The EPA and U.S. Department of Housing and Urban Development (HUD) have both developed exterior sound levels guidelines (Table 12.2-23). The adopted EPA guidelines suggest that ambient sound levels above an L_{dn} of 55 dB are inconsistent with the protection of the public welfare (EPA, 1974). However, in a recent strategy document, the EPA (1977) has recognized that present community sound levels often exceed this value, and suggested a short-term goal for community sound levels of $L_{dn} \leq L_{65}$ dB.

The California Government Code Section 65302 requires inclusion of a noise element in quantitative, numerical terms in the general plan of each city and county. The local governmental responsibility for, and policies concerning, noise control are established by the noise element and the passage of specific noise ordinances. The County of Ventura has not yet adopted a noise ordinance, and generally uses the EPA and HUD guidelines in their determination of sound level acceptability (Gilday, 1980). The noise ordinance

TABLE 12.2-23

FEDERAL EXTERIOR SOUND LEVELS GUIDELINES

	Sound Level (dB)[1]	Statistical Period[2]	Description of Area
US Environmental Protection Agency	70	L_{eq} (24)	All areas
	55	L_{dn}	Outdoors in residential areas, farms, and other outdoor areas where people spend widely varying amounts of time; areas where quiet is a basis for use.
	55	L_{eq} (24)	Outdoor areas where people spend limited amounts of time, such as school yards and playgrounds.
US Department of Housing and Urban Development	>80 >75	L_4 L_{33}	Unacceptable sound levels in new residential areas
	65 to 75	L_{33}	Discretionary-normally unacceptable exterior sound levels in new residential areas.
	65	L_{33}	Discretionary-normally acceptable exterior sound levels in new residential areas.
	45	L_2	Acceptable exterior sound levels in new residential areas.

[1]Data from EPA (1974); Ventura County Environmental Resources Agency, Planning Division (1974); and, Olson Laboratories, Inc. (1978).

[2]This is the statistical description of the time period over which the listed sound level is not to be exceeded. An explanation of acoustics nomenclature is presented in Appendix C.1.

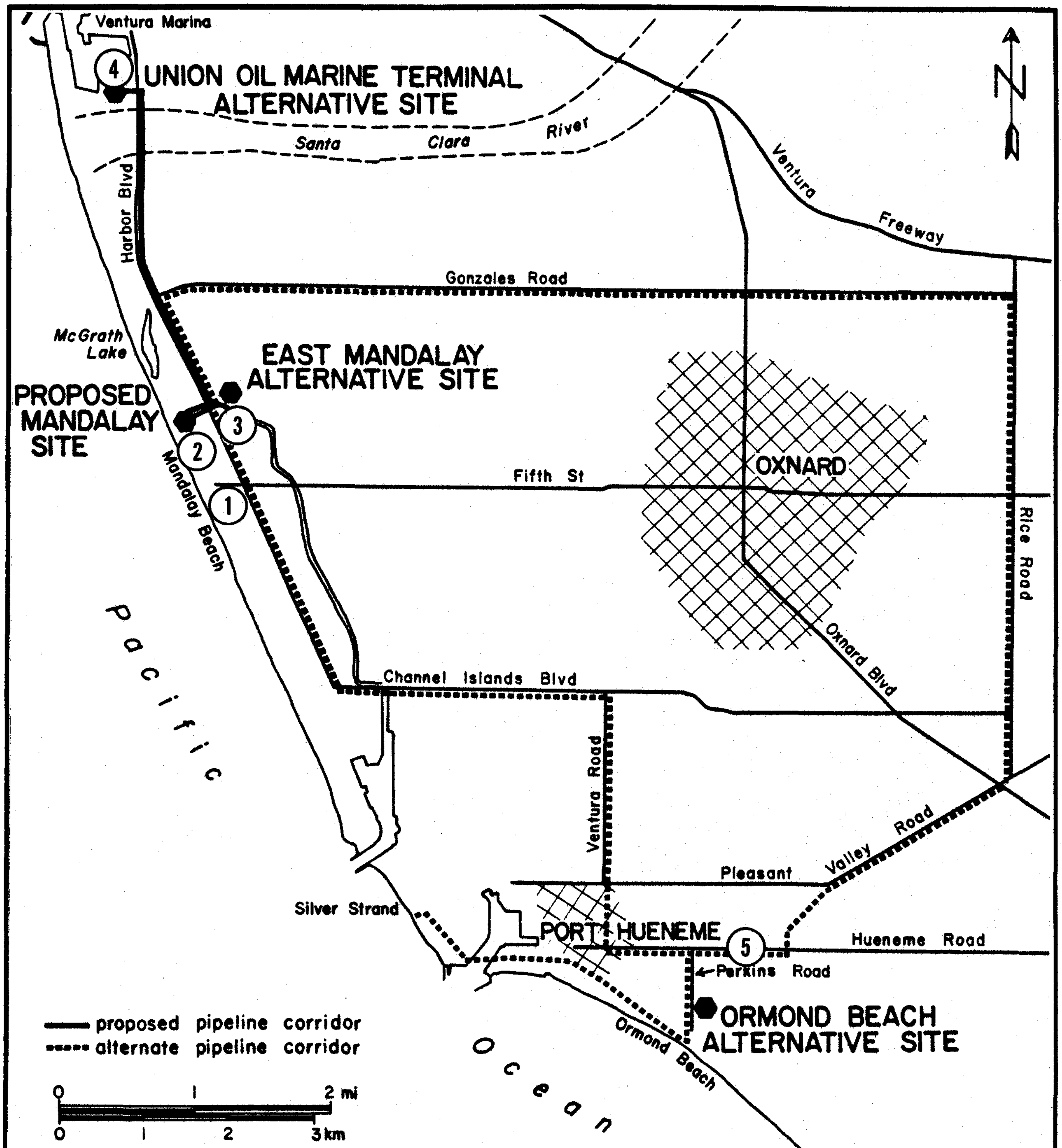


FIGURE 12.2-6

SOUND MEASUREMENT LOCATIONS

developed by the City of Ventura is directed toward the control of sound levels in residential areas, and establishes an exterior Community Noise Equivalent Level of 65 dB as a standard in the vicinity of single-family residences. The City of Oxnard's proposed noise ordinance divides the city into four noise zones on the basis of land use and existing noise levels and specifies allowable exterior noise levels during prescribed time periods. Oxnard's proposed exterior noise standards are listed in Table 12.2-24.

12.2.3.2 Regional Acoustical Environment

Sound levels in the project region are related to the regional land use patterns. The Ventura County Environmental Resources Agency, Planning Division (1974) has identified people, transportation, and machinery as the three major noise sources in the county. A summary of some specific types of noise generated in the project region is presented in Table 12.2-25.

12.2.3.3 Local Acoustical Environment

12.2.3.3.1 Sound Sources in the Project Area

The existing land uses contributing to the acoustical environment within the local area consist predominantly of open and vacant lands along the coast with a mixture of residential, industrial, agricultural, and recreational uses. Major noise sources within the project area include vehicular traffic on major roads such as Harbor Boulevard, West Fifth Street, and Ventura Road; the Southern California Edison Mandalay and Ormond Beach generating stations; recreational activities at the Ventura Marina and Channel Islands Harbor; and, commercial and industrial activities at Port Hueneme.

12.2.3.3.2 Existing Sound Levels

An ambient sound levels monitoring program was conducted by Dames & Moore to describe the local sound environment. Sound levels at four locations were monitored during this survey, and the resultant data were compiled along with data collected by Dames & Moore during an earlier survey at a fifth location in the project area. These locations, shown on Figure 12.2-6 and described in

TABLE 12.2-24

CITY OF OXNARD PROPOSED EXTERIOR NOISE STANDARDS

Noise Zone[1]	Type of Land Use	Time Interval	Allowable Exterior Noise Level
I	Single-, double-, or multiple-family residential (R-1, R-2, R-3, or R-4), located outside a CNEL contour of 60 dBA	10 pm to 7 am 7 am to 10 pm	50 dBA 55 dBA
II	Single-, double-, or multiple-family residential (R-1, R-2, R-3, or R-4), located within a CNEL contour of 60 dBA	10 pm to 7 am 7 am to 10 pm	55 dBA 60 dBA
III	Commercial (C-1, C-2, etc.)	10 pm to 7 am 7 am to 10 pm	60 dBA 65 dBA
IV	Industrial or Manufacturing (I-1, I-2, etc., or M-1, M-2, etc.)	Anytime	70 dBA

The City of Oxnard noise ordinance establishes it as unlawful to create any noise which causes the noise level on any other property to exceed:

(1) The noise standard for a cumulative period of more than 30 minutes in any hour; or,

(2) The noise standard plus 5 dBA for a cumulative period of more than 15 minutes in any hour; or,

(3) The noise standard plus 10 dBA for a cumulative period of more than 5 minutes in any hour; or,

(4) The noise standard plus 15 dBA for a cumulative period of more than 1 minute in any hour; or,

(5) The noise standard plus 20 dBA for any period of time.

[1]Data from Olson Laboratories, Inc. (1978).

TABLE 12.2-25

TYPES OF NOISE GENERATED IN THE REGIONAL AREA

		General Sound Character			
Noise Source[1]	How Generated	Frequency	Duration	Intensity	Uses Which Might Generate Noise
People	Noises generated by human effort without mechanical assistance might include talking, argument, children at play	Wide band middle frequencies	Intermittent	Moderate	Residential, parks, entertainment, elementary, junior and senior high schools, colleges, meeting centers, neighborhood commercials, churches, transit terminals
	Large mass events such as sporting events	Wide band middle frequencies	Intermittent	Moderate to loud	
	Musical instruments	Tonal-variable	Intermittent	Moderate to loud	
Transportation	Noises generated by transportation vehicle might include:				Primary Uses (uses where these noises are generated from): airports, railroad tracks, switching yards, and stations, roads, parking structures; Secondary Uses (uses which attract these vehicles: large residential tracts, multi-family, regional parks, high schools and colleges, office bldgs., strip commercial, heavy industry, warehousing, contract constr., oil storage fac., packing plants, hotels/motels, hospitals, service areas.
	Cars and Motorcycles	Wide band middle frequencies	Intermittent to constant	Moderate to high	
	Trucks and Buses	Wide band lower frequency	Intermittent to constant	High	
	Piston airplanes	Wide band lower frequency	Constant	High	
	Jet airplanes	Tonal lower frequency	Constant	High	
	Helicopters	Wide band middle frequency	Intermittent	High	
	Trains	Wide band lower frequency	Intermittent	High	
Machinery	Noises generated by machinery might include: power saws, planers, transformers	Narrow band	Constant	Moderate to high	Residential, police and fire stations, parks, schools, some meeting centers, office bldgs., grocery stores, wholesale/warehousing, auto and truck repair, constr., heavy industries, processing plants, mining oper., bus, truck, train and airplane terminals, harbors, oil drilling and compressor sites.
	Sirens	Narrow band	Intermittent	Moderate to high	
	Punch Pressor, riveting, pile drivers, hammers	Wide band	Impulse	High	
	Heavy constr. equipmt., loaders and compactors, power saws, chainsaws, sirens, radio, T.V., compressors, discharge ducts, cooling towers	Wide band	Intermittent	Moderate to high	

[1] Data from Ventura County Environmental Resources Agency, Planning Division (1974).

Table 12.2-26, were selected to represent the existing acoustic environment at noise-sensitive receptor areas near the proposed and alternative onshore sites.

The sound survey was conducted at Locations 1 through 4 during September 11 and September 12, 1979. Sound level recordings were made during the morning (0700 to 1200 hrs), afternoon (1200 to 1800 hrs), evening (1800 to 2200 hrs), and nighttime (2200 to 0700 hrs) periods. These time periods are compatible with the EPA's definition of the daytime period as 0700 to 2200 hours and the nighttime period as 2200 to 0700 hours used in the determination of the day-night sound level, L_{dn}. A description of the acoustics nomenclature used in this report is contained in Appendix C.1. Also presented is a description of the instrumentation and techniques used for acquisition and analysis of the ambient sound data. Baseline environmental acoustics data were collected previously in the vicinity of the Ormond Beach alternative site (Location 5) by Dames & Moore (1974).

A summary of ambient sound survey results for the five monitoring locations described above is presented in Table 12.2-27. These data represent the existing background sound levels near the proposed and alternative sites during the monitored periods. Detailed results of the ambient sound surveys are presented in Appendix C.1.

Present sound levels at Location 1 are predominantly due to local traffic on West Fifth Street, residential activities, and distant Mandalay Generating Station operations. Distant traffic along Harbor Boulevard also contributes to the background ambient sound levels at this location. Observed nighttime sound levels were much lower than daytime levels at Location 1 due to a reduction in automobile traffic and local activities.

TABLE 12.2-26

NOISE LEVEL MEASUREMENT LOCATIONS

Location 1	—	Residential area at Oxnard Mobile Home Park (5400 West Fifth Street); approximately 2500 feet south of the southern border of the proposed Mandalay site.
Location 2	—	Undeveloped park area at the southern border of the proposed Mandalay site.
Location 3	—	Vacant land at the western border of the East Mandalay alternative site.
Location 4	—	Recreational area at the Ventura Marina; north of the Union Oil Marine Terminal alternative site.
Location 5	—	Residential area at the southwest corner of the intersection of Courtland and Clara streets; north of the Ormond Beach alternative site.

TABLE 12.2-27

SUMMARY OF AMBIENT SOUND LEVELS

Location	Date	Time (Hours)	L_1	L_{10}	L_{50}	L_{90}	L_{99}	L_{eq}	L_d	L_n	L_{dn}
			Sound Level in dBA								
1	9/11/79 Morning	(0830-0850)	72	59	50	47	46	58			
	9/10/79 Afternoon	(1225-1245)	68	55	48	46	46	56			
	9/10/79 Evening	(1830-1850)	67	57	50	48	47	55			
	9/10/79 Night	(2235-2255)	55	46	44	43	42	45			
									57	45	56
2	9/11/79 Morning	(0800-0820)	64	53	51	51	50	54			
	9/10/79 Afternoon	(1300-1320)	65	52	50	49	48	53			
	9/10/79 Evening	(1800-1820)	61	55	53	52	52	54			
	9/10/79 Night	(2300-2320)	52	51	50	50	49	51			
									54	51	58
3	9/11/79 Morning	(0720-0740)	64	57	54	52	51	56			
	9/10/79 Afternoon	(1345-1405)	69	57	54	52	52	57			
	9/10/79 Evening	(1900-1920)	64	55	53	51	50	55			
	9/10/79 Night	(2225-2245)	56	54	52	51	50	52			
									56	52	59
4	9/11/79 Morning	(0910-0930)	59	54	52	51	51	53			
	9/10/79 Afternoon	(1430-1450)	64	55	53	51	50	55			
	9/10/79 Evening	(1935-1955)	54	51	50	48	47	50			
	9/10/79 Night	(2200-2220)	57	54	53	51	50	53			
									53	53	59
5	8/23/73 Morning		--	63	54	--	--	56			
	8/23/73 Afternoon		--	60	51	--	--	53			
	-- Evening		--	--	--	--	--	--			
	8/23-24 Night		--	50	46	--	--	51			
									54	51	58

Sound levels at Location 2 do not vary significantly during the daytime and nighttime periods due to the contribution of the nearby generating station. Distant traffic along Harbor Boulevard also contributes to the ambient sound levels at this location.

The sound environment near Location 3 is controlled by traffic along Harbor Boulevard and transmission line hum in the vicinity of the substation. Distant industrial noises were detected during the nighttime monitoring period due to reduced vehicular traffic along Harbor Boulevard.

Sound levels at the Ventura Marina did not change considerably during the day and night. This is primarily related to the presence of sounds generated by distant harbor mechanical equipment; a distant radio playing throughout the evening, night, and morning measurement periods; and, occasional nearby parking lot activity.

Daytime sound levels at Location 5 are governed by children and traffic. During lulls in traffic and during the nighttime periods, wind noise and animal noises become more detectable.

Onshore pipeline corridors associated with the proposed and alternative sites traverse primarily rural and open areas, although portions of some of the corridors cross commercial, residential, and industrial areas. Day-night sound levels along these corridors are not expected to differ greatly from those observed during the Dames & Moore survey. Expected levels are expected to generally vary between 50 and 65 dB.

12.3 OCEANOGRAPHY

12.3.1 Physical Oceanography

12.3.1.1 Tides

The long-period rise and fall of sea level along the coast is commonly referred to as the tide. These water level variations result primarily from astronomical and meteorological conditions. Astronomically related tidal fluctuations along the southern California coast are produced by the northwestward passage of two harmonic tide waves that propagate as edge waves. One of the waves has a period of approximately 12.5 hours while the second has a period of approximately 25.0 hours. There are normally two unequal high and two unequal low waters in a day caused by the interaction of the two harmonic waves. Maximum tides typically occur near the coastline and gradually decrease away from the shore.

Other long-term variations in sea level which can be superimposed upon the astronomical tide are regional and local meteorological conditions. Onshore winds and low barometric pressure both tend to cause higher water levels than those produced by astronomical tides acting alone. Conversely, offshore winds and high barometric pressure tend to produce lower water levels. In the vicinity of the Oxnard area coastline, sea level changes caused by meteorological phenomena are generally smaller (on the order of 1 foot (0.3 m)) and less significant than the astronomical tides (IRC, 1976).

Tidal heights representative of the project region are presented in Table 12.3-1. These data are for Port Hueneme, which is a subordinate station of the National Ocean Survey network of tide prediction stations. The datum used to gauge tidal heights is the 19-year mean of the lower of the two daily low waters (MLLW).

The predicted mean tide range (the difference between mean high water and mean low water) at Port Hueneme is 3.70 feet (1.13 m) (National Ocean Survey, 1979). The predicted diurnal range (the difference between mean lower low

TABLE 12.3-1

TIDAL DATUM HEIGHTS - PORT HUENEME

	Height Feet (Meters)[a]
Highest recorded tide (4 February 1958)	7.6 (2.3)
Mean higher high water	5.4 (1.7)
Mean high water	4.7 (1.4)
Mean tide level	2.9 (0.9)
Mean low water	1.0 (0.3)
Mean lower low water	0.0 (0.0)
Lowest recorded tide (7 January 1951)	-2.4 (-0.7)

[a] Data from National Ocean Survey (1979)

water and mean higher high water) is 5.40 feet (1.65 m). The highest observed tide at Port Hueneme was 7.6 feet (2.32 m) above MLLW and the lowest observed tide was 2.40 feet (0.73 m) below MLLW. These tidal ranges are representative of those that can be expected to occur in the vicinity of the Oxnard area coastline.

12.3.1.2 Waves

The area offshore of Oxnard is relatively sheltered from waves. As shown on Figure 12.3-1, the primary directions of wave approach to this area are from the west through the Santa Barbara Channel; from the southwest through the Santa Cruz basin between Anacapa Island and San Nicolas Island; and, from the south through the passage between San Clemente and San Nicolas islands.

The importance of these wave approach directions is reflected in the wave statistics calculated for the proposed Platform Gina site. These data are summarized in Tables 12.3-2, 12.3-3, and 12.3-4. These data, which represent deep water wave conditions, were derived from a hindcast using historical weather maps, visual observations, and instrument readings in shallow water near shore. Waves at the proposed Platform Gina site were inferred by accounting for the effects of refraction, shoaling, and local winds (IRC, 1976).

The wave data for the Platform Gina site show that, during the winter months, the majority of waves are less than 2 feet (0.6 m) in height and approach from the west. Greater than 50 percent of these waves have periods less than 8 seconds. During the summer months, the majority of waves are less than 3 feet (1 m) in height and have two predominant directions of approach: from the west; and, from the south-southeast through south-southwest. The groupings of wave approach directions are paralleled by two groupings of wave periods: 4 to 8 seconds approaching from the west; and 12 to 16 seconds approaching from southerly directions. During the transitional months of April, May, October, and November, the majority of the waves are less than

TABLE 12.3-2

FREQUENCY DISTRIBUTION FOR WAVES AT THE PROPOSED PLATFORM GINA SITE DURING WINTER

SEASON: DEC-JAN-FEB-MAR

SIG HT (FT)

SIG PER (SEC)	<2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
2- 4	.0	2.7	1.1	.0	.0	.0	.0	.0	.0	.0	3.8
4- 6	4.9	2.9	15.3	1.5	.1	.0	.0	.0	.0	.0	24.7
6- 8	11.6	5.7	2.9	1.7	.3	.2	.1	.0	.0	.0	22.5
8-10	10.8	1.9	1.7	.4	.1	.0	.0	.0	.0	.0	14.9
10-12	9.1	.7	.1	.0	.0	.0	.0	.0	.0	.0	9.9
12-14	7.7	.1	.0	.0	.0	.0	.0	.0	.0	.0	7.8
14-16	7.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	7.3
16-18	4.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	4.7
18-20	4.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	4.3
>20	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	60.4	14.0	21.1	3.6	.5	.2	.1	.0	.0	.0	99.9

SIG HT (FT)

DIR	<2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
N	.0	.0	.5	.0	.1	.0	.0	.0	.0	.0	.6
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.0	.6	.1	.0	.0	.0	.0	.0	.0	.0	.7
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	.0	1.9	.0	.2	.0	.0	.0	.0	.0	.0	2.1
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	.0	1.7	.0	.0	.0	.0	.0	.0	.0	1.7
SSE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
S	.0	.2	2.4	.0	.0	.0	.0	.0	.0	.0	2.6
SSW	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.1
SW	.0	.0	.7	.0	.0	.0	.0	.0	.0	.0	.7
WSW	22.3	.1	.0	.0	.0	.0	.0	.0	.0	.0	22.4
W	38.1	11.1	15.7	2.6	.4	.2	.0	.0	.0	.0	68.1
WNN	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NW	.0	.0	.0	.8	.0	.0	.1	.0	.0	.0	.9
NNW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

SIG PER (SEC)

DIR	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	>20	TOTAL
N	.5	.1	.0	.0	.0	.0	.0	.0	.0	.0	.6
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	.7
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	1.9	.2	.0	.0	.0	.0	.0	.0	.0	.0	2.1
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	1.7	.0	.0	.0	.0	.0	.0	.0	.0	1.7
SSE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
S	.0	2.6	.0	.0	.0	.0	.0	.0	.0	.0	2.6
SSW	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.1
SW	.5	.0	.1	.1	.0	.0	.0	.0	.0	.0	.7
WSW	.0	.0	.0	.0	.0	6.1	7.3	4.7	4.3	.0	22.4
W	.2	19.2	22.3	14.8	9.9	1.7	.0	.0	.0	.0	68.1
WNN	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NW	.0	.8	.1	.0	.0	.0	.0	.0	.0	.0	.9
NNW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	3.8	24.7	22.5	14.9	9.9	7.8	7.3	4.7	4.3	.0	99.9

Data from IRC (1976).

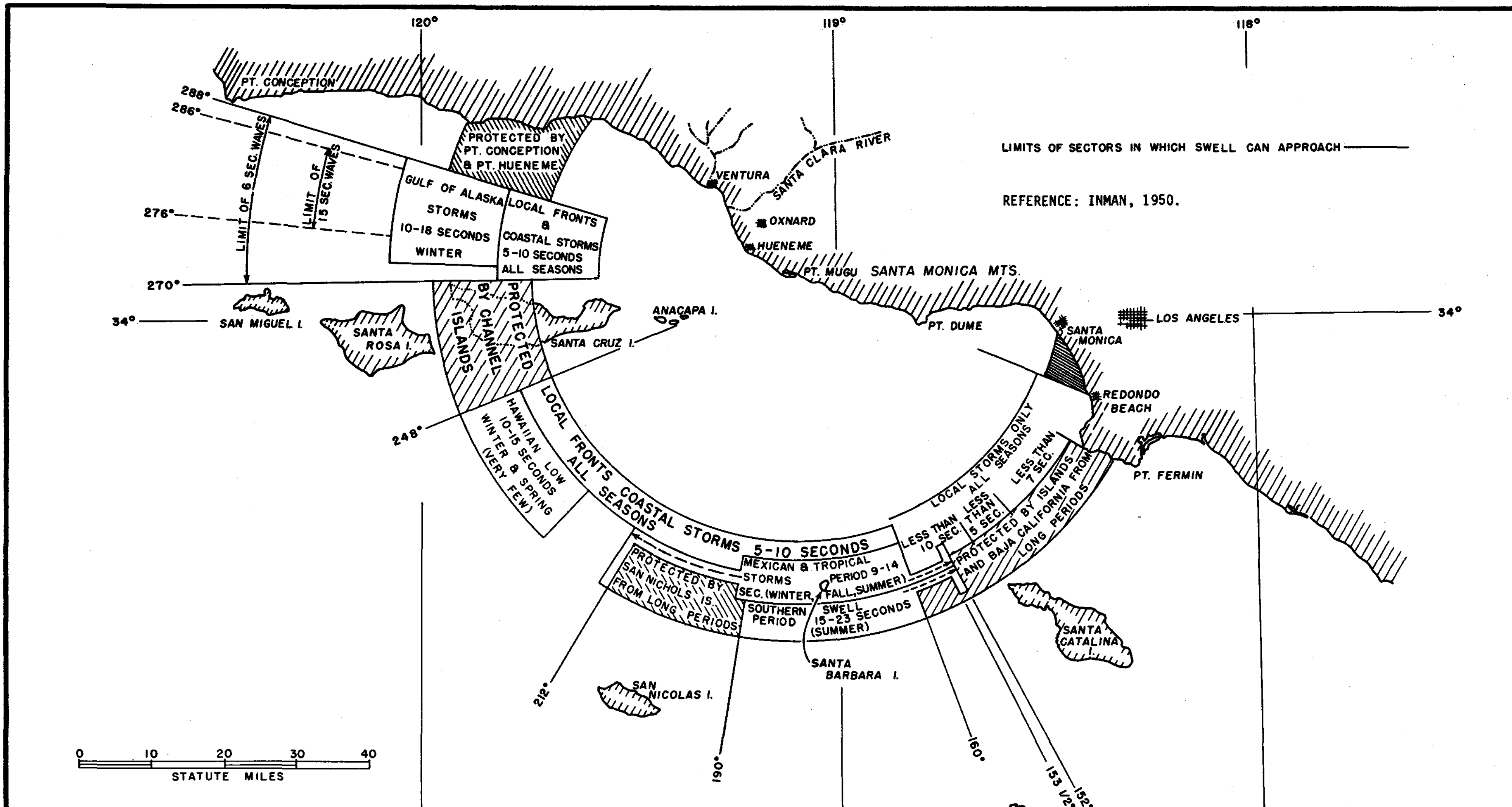


FIGURE 12.3-1

GENERALIZED PATTERN OF WAVE APPROACH

TABLE 12.3-3

FREQUENCY DISTRIBUTION FOR WAVES AT THE PROPOSED PLATFORM GINA SITE DURING SUMMER

SEASON: JUN-JUL-AUG-SEP

SIG PER (SEC)	SIG HT (FT) <2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
2- 4	.0	.1	.7	.0	.0	.0	.0	.0	.0	.0	.8
4- 6	.0	3.1	27.0	.5	.0	.0	.0	.0	.0	.0	30.6
6- 8	.0	7.7	2.3	.6	.0	.0	.0	.0	.0	.0	10.6
8-10	.0	1.6	.8	.0	.0	.0	.0	.0	.0	.0	2.4
10-12	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
12-14	10.6	4.5	1.0	.0	.0	.0	.0	.0	.0	.0	16.1
14-16	24.7	5.9	.2	.0	.0	.0	.0	.0	.0	.0	30.8
16-18	6.9	.4	.0	.0	.0	.0	.0	.0	.0	.0	7.3
18-20	1.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	1.1
>20	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
TOTAL	43.5	23.3	32.0	1.1	.0	.0	.0	.0	.0	.0	99.9

DIR	SIG HT (FT) <2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
N	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.2
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	.0	.8	.0	.0	.0	.0	.0	.0	.0	.8
SSE	.0	5.8	.4	.0	.0	.0	.0	.0	.0	.0	6.2
S	20.0	2.1	2.1	.0	.0	.0	.0	.0	.0	.0	24.2
SSW	15.7	2.9	.0	.0	.0	.0	.0	.0	.0	.0	18.6
SW	.0	.0	.5	.0	.0	.0	.0	.0	.0	.0	.5
WSW	6.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.9
W	.9	12.5	28.0	.7	.0	.0	.0	.0	.0	.0	42.1
WNN	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NW	.0	.0	.0	.4	.0	.0	.0	.0	.0	.0	.4
NNW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

DIR	SIG PER (SEC) 2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	>20	TOTAL
N	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	.8	.0	.0	.0	.0	.0	.0	.0	.0	.8
SSE	.0	.0	.0	.0	.0	2.8	3.0	.4	.0	.0	6.2
S	.0	1.3	.0	.0	.0	1.9	14.9	4.9	1.0	.2	24.2
SSW	.0	.0	.0	.0	.0	6.7	10.7	1.2	.0	.0	18.6
SW	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.5
WSW	.0	.0	.0	.0	.0	3.8	2.2	.8	.1	.0	6.9
W	.1	28.1	10.6	2.4	.0	.9	.0	.0	.0	.0	42.1
WNN	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NW	.0	.4	.0	.0	.0	.0	.0	.0	.0	.0	.4
NNW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	.8	30.6	10.6	2.4	.0	16.1	30.8	7.3	1.1	.2	99.9

Data from IRC (1976).

TABLE 12.3-4

FREQUENCY DISTRIBUTION FOR WAVES AT THE PROPOSED PLATFORM GINA SITE DURING TRANSITIONAL MONTHS

SEASON: APR-MAY-OCT-NOV

SIG HT (FT)

SIG PER (SEC)	<2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
2- 4	.0	.7	.7	.0	.0	.0	.0	.0	.0	.0	1.4
4- 6	.0	2.3	23.2	.5	.0	.0	.0	.0	.0	.0	26.0
6- 8	.0	5.8	2.7	.8	.0	.0	.0	.0	.0	.0	9.3
8-10	.0	2.3	2.1	.5	.1	.0	.0	.0	.0	.0	5.0
10-12	9.7	.8	.0	.0	.0	.0	.0	.0	.0	.0	10.5
12-14	19.9	1.1	.1	.0	.0	.0	.0	.0	.0	.0	21.1
14-16	15.7	.8	.0	.0	.0	.0	.0	.0	.0	.0	16.5
16-18	7.5	.5	.2	.0	.0	.0	.0	.0	.0	.0	8.2
18-20	1.4	.0	.3	.0	.0	.0	.0	.0	.0	.0	1.7
>20	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	54.2	14.3	29.3	1.8	.1	.0	.0	.0	.0	.0	99.9

SIG HT (FT)

DIR	<2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
N	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.2
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.2
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	.0	.5	.0	.0	.0	.0	.0	.0	.0	.0	.5
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	.0	.8	.0	.0	.0	.0	.0	.0	.0	.8
SSE	.0	.8	.1	.0	.0	.0	.0	.0	.0	.0	.9
S	18.6	.9	2.3	.0	.0	.0	.0	.0	.0	.0	21.8
SSW	8.1	.7	.4	.0	.0	.0	.0	.0	.0	.0	9.2
SW	.0	.0	.6	.0	.0	.0	.0	.0	.0	.0	.6
WSW	15.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	15.3
W	12.2	11.2	24.9	1.3	.1	.0	.0	.0	.0	.0	49.7
WNN	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NW	.0	.0	.0	.5	.0	.0	.0	.0	.0	.0	.6
NNW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

SIG PER (SEC)

DIR	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	>20	TOTAL
N	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.5
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	.8	.0	.0	.0	.0	.0	.0	.0	.0	.8
SSE	.0	.0	.0	.0	.0	.4	.3	.2	.0	.0	.9
S	.0	2.2	.0	.0	.0	8.5	7.4	3.5	.1	.0	21.8
SSW	.0	.0	.0	.0	.0	4.4	3.3	1.0	.5	.0	9.2
SW	.5	.0	.1	.0	.0	.0	.0	.0	.0	.0	.6
WSW	.0	.0	.0	.0	.0	5.3	5.4	3.5	1.1	.0	15.3
W	.0	22.5	9.2	5.0	10.5	2.5	.0	.0	.0	.0	49.7
WNN	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NW	.0	.5	.0	.0	.0	.0	.0	.0	.0	.0	.6
NNW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	1.4	26.0	9.3	5.0	10.5	21.1	16.5	8.2	1.7	.0	99.9

Data from IRC (1976).

2 feet (0.6 m). During these months there is also a bimodal distribution in wave approach direction and wave period. The southerly direction of approach accounts for a significant input of wave energy in the periods between 12 and 18 seconds, while the westerly approach directions show a distribution in wave periods from 4 to 12 seconds and from 12 to 20 seconds. The highest waves predicted for any season are less than 10 feet (3 m).

Similar wave data were computed for the proposed Platform Gilda location and are summarized in Tables 12.3-5, 12.3-6, and 12.3-7 (IRC, 1979a). The methods and procedures used in calculating these wave statistics are identical to those used for the Platform Gina site. A comparison of wave statistics for the proposed locations of Platforms Gina and Gilda reveals a general similarity in wave approach directions, wave period ranges, and wave height ranges. The greatest difference between the two sets of data is evident in the distribution of wave heights during the summer and transitional months. During these periods, the Platform Gilda location experiences a greater frequency of larger waves than does the Platform Gina site.

Wave conditions along the offshore pipeline routes associated with Platforms Gina and Gilda can be inferred from the wave statistics presented for the platform locations. However, as waves propagate from the platform sites toward shore, their characteristics may be altered by local effects of refraction, shoaling, and wind. Along the alternative offshore pipeline corridor connecting Platform Gina with the Silver Strand Beach area, the effects of wave refraction may be especially significant because of the proximity of Hueneme Canyon. In general, wave refraction over a submarine canyon produces a divergence of wave energy over the canyon and a concentration of wave energy at its sides. This effect may result in a concentration of wave energy along certain portions of the Ormond Beach alternative corridor.

TABLE 12.3-5

FREQUENCY DISTRIBUTION FOR WAVES AT THE PROPOSED PLATFORM GILDA SITE DURING WINTER

AREA: 1 SEASON:DEC-JAN-FEB-MAR

SIG PER (SEC)	SIG HT (FT) <2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
2- 4	.0	3.2	1.7	.2	.1	.0	.0	.0	.0	.0	5.2
4- 6	4.1	2.4	15.4	1.4	.1	.0	.0	.0	.0	.0	23.4
6- 8	11.9	4.9	3.7	1.4	.4	.1	.1	.0	.0	.0	22.5
8-10	9.9	2.3	1.9	.6	.2	.0	.0	.0	.0	.0	14.9
10-12	8.0	1.2	.6	.1	.0	.0	.0	.0	.0	.0	9.9
12-14	6.8	.8	.2	.0	.0	.0	.0	.0	.0	.0	7.8
14-16	6.8	.4	.1	.0	.0	.0	.0	.0	.0	.0	7.3
16-18	4.1	.5	.1	.0	.0	.0	.0	.0	.0	.0	4.7
18-20	3.7	.6	.0	.0	.0	.0	.0	.0	.0	.0	4.3
>20	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	55.3	16.3	23.7	3.7	.8	.1	.1	.0	.0	.0	100.0

DIR	SIG HT (FT) <2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
N	.0	.0	.5	.0	.1	.0	.0	.0	.0	.0	.6
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.0	.6	.1	.0	.0	.0	.0	.0	.0	.0	.7
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	.0	1.9	.0	.2	.0	.0	.0	.0	.0	.0	2.1
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	.0	1.7	.0	.0	.0	.0	.0	.0	.0	1.7
SSE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
S	.0	.1	2.4	.0	.0	.0	.0	.0	.0	.0	2.5
SSW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SW	.0	.0	.5	.0	.0	.0	.0	.0	.0	.0	.5
WSW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
W	41.2	7.4	14.3	1.6	.2	.0	.0	.0	.0	.0	64.7
WNN	14.1	6.0	3.9	1.0	.5	.1	.0	.0	.0	.0	25.6
NW	.0	.2	.2	.9	.0	.0	.1	.0	.0	.0	1.4
NNW	.0	.1	.1	.0	.0	.0	.0	.0	.0	.0	.2

DIR	SIG PER (SEC) 2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	>20	TOTAL
N	.5	.1	.0	.0	.0	.0	.0	.0	.0	.0	.6
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	.7
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	1.9	.2	.0	.0	.0	.0	.0	.0	.0	.0	2.1
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	1.7	.0	.0	.0	.0	.0	.0	.0	.0	1.7
SSE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
S	.1	2.4	.0	.0	.0	.0	.0	.0	.0	.0	2.5
SSW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SW	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.5
WSW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
W	.2	11.1	4.5	14.9	9.9	7.8	7.3	4.7	4.3	.0	64.7
WNN	.6	7.1	17.9	.0	.0	.0	.0	.0	.0	.0	25.6
NW	.5	.8	.1	.0	.0	.0	.0	.0	.0	.0	1.4
NNW	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
TOTAL	5.2	23.4	22.5	14.9	9.9	7.8	7.3	4.7	4.3	.0	100.0

Data from IRC (1979a).

TABLE 12.3-6

FREQUENCY DISTRIBUTION FOR WAVES AT THE PROPOSED PLATFORM GILDA SITE DURING SUMMER

AREA: 1 SEASON:JUN-JUL-AUG-SEP

****************************** SIG HT (FT) ******************************

SIG PER (SEC)	<2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
2- 4	.0	1.4	1.4	.2	.2	.1	.0	.0	.0	.0	3.3
4- 6	.0	2.8	23.8	.5	.0	.0	.0	.0	.0	.0	27.1
6- 8	.0	6.6	3.2	.4	.0	.0	.0	.0	.0	.0	10.2
8-10	.0	2.0	1.2	.1	.0	.0	.0	.0	.0	.0	3.3
10-12	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.1
12-14	19.8	1.1	.1	.0	.0	.0	.0	.0	.0	.0	21.0
14-16	24.7	.8	.0	.0	.0	.0	.0	.0	.0	.0	25.5
16-18	6.8	.6	.2	.0	.0	.0	.0	.0	.0	.0	7.6
18-20	1.1	.0	.3	.0	.0	.0	.0	.0	.0	.0	1.4
>20	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
TOTAL	52.6	15.4	30.2	1.2	.2	.1	.0	.0	.0	.0	99.9

****************************** SIG HT (FT) ******************************

DIR	<2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
N	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.2
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.2
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	.0	.5	.0	.0	.0	.0	.0	.0	.0	.0	.5
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	.0	.8	.0	.0	.0	.0	.0	.0	.0	.8
SSE	17.8	.8	.1	.0	.0	.0	.0	.0	.0	.0	18.7
S	.0	.8	2.3	.0	.0	.0	.0	.0	.0	.0	3.1
SSW	.0	.7	.4	.0	.0	.0	.0	.0	.0	.0	1.1
SW	.0	.0	.5	.0	.0	.0	.0	.0	.0	.0	.5
WSW	27.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	27.2
W	7.6	3.6	21.5	.2	.0	.0	.0	.0	.0	.0	32.9
WNW	.0	8.2	3.8	.3	.0	.0	.0	.0	.0	.0	12.3
NW	.0	.3	.3	.6	.1	.1	.0	.0	.0	.0	1.5
NNW	.0	.3	.3	.1	.1	.0	.0	.0	.0	.0	.8

****************************** SIG PER (SEC) ******************************

DIR	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	>20	TOTAL
N	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.5
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	.8	.0	.0	.0	.0	.0	.0	.0	.0	.8
SSE	.0	.0	.0	.0	.0	1.4	11.7	4.4	1.0	.2	18.7
S	.0	2.2	.0	.0	.0	.4	.1	.3	.0	.0	3.1
SSW	.0	.0	.0	.0	.0	.3	.3	.2	.3	.0	1.1
SW	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.5
WSW	.0	.0	.0	.0	.0	14.2	11.1	1.9	.0	.0	27.2
W	.0	20.1	1.6	3.3	.1	4.7	2.2	.8	.1	.0	32.9
WNW	.2	3.5	8.6	.0	.0	.0	.0	.0	.0	.0	12.3
NW	.9	.5	.0	.0	.0	.0	.0	.0	.0	.0	1.5
NNW	.8	.0	.0	.0	.0	.0	.0	.0	.0	.0	.8
TOTAL	3.3	27.1	10.2	3.3	.1	21.0	25.5	7.6	1.4	.2	99.9

Data from IRC (1979a).

TABLE 12.3-7

FREQUENCY DISTRIBUTION FOR WAVES AT THE PROPOSED PLATFORM GILDA SITE DURING TRANSITIONAL MONTHS

AREA: 1 SEASON:APR-MAY-OCT-NOV

SIG HT (FT)

SIG PER (SEC)	<2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
2- 4	.0	.3	1.0	.1	.1	.0	.0	.0	.0	.0	1.5
4- 6	.0	2.0	26.5	.4	.0	.0	.0	.0	.0	.0	28.9
6- 8	.0	4.8	3.7	.5	.0	.0	.0	.0	.0	.0	9.0
8-10	.0	2.7	2.2	.9	.4	.0	.0	.0	.0	.0	6.2
10-12	.0	3.2	.4	.2	.0	.0	.0	.0	.0	.0	3.8
12-14	14.2	4.2	1.0	.0	.0	.0	.0	.0	.0	.0	19.4
14-16	15.6	6.0	.2	.0	.0	.0	.0	.0	.0	.0	21.8
16-18	7.3	.6	.0	.0	.0	.0	.0	.0	.0	.0	7.9
18-20	1.3	.1	.0	.0	.0	.0	.0	.0	.0	.0	1.4
>20	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	38.4	23.9	35.0	2.1	.5	.0	.0	.0	.0	.0	99.9

SIG HT (FT)

DIR	<2	2-3	3-4	4-5	5-6	6-8	8-10	10-12	12-15	>15	TOTAL
N	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.2
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	.0	.8	.0	.0	.0	.0	.0	.0	.0	.8
SSE	9.1	5.8	.4	.0	.0	.0	.0	.0	.0	.0	15.3
S	.0	1.8	2.1	.0	.0	.0	.0	.0	.0	.0	3.9
SSW	.0	2.9	.0	.0	.0	.0	.0	.0	.0	.0	2.9
SW	.0	.0	.5	.0	.0	.0	.0	.0	.0	.0	.5
WSW	11.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	11.9
W	17.4	7.7	27.4	1.3	.4	.0	.0	.0	.0	.0	54.2
WNW	.0	5.4	3.3	.3	.0	.0	.0	.0	.0	.0	9.0
NW	.0	.2	.2	.5	.1	.0	.0	.0	.0	.0	1.0
NNW	.0	.1	.1	.0	.0	.0	.0	.0	.0	.0	.2

SIG PER (SEC)

DIR	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	>20	TOTAL
N	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
NNE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
NE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
ENE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
ESE	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
SE	.0	.8	.0	.0	.0	.0	.0	.0	.0	.0	.8
SSE	.0	.0	.0	.0	.0	3.1	8.6	3.5	.1	.0	15.3
S	.0	1.3	.0	.0	.0	1.6	1.0	.0	.0	.0	3.9
SSW	.0	.0	.0	.0	.0	.8	2.1	.0	.0	.0	2.9
SW	.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.5
WSW	.0	.0	.0	.0	.0	6.1	4.7	.9	.2	.0	11.9
W	.0	24.3	2.1	6.2	3.9	7.8	5.4	3.5	1.1	.0	54.2
WNW	.0	2.1	6.9	.0	.0	.0	.0	.0	.0	.0	9.0
NW	.6	.4	.0	.0	.0	.0	.0	.0	.0	.0	1.0
NNW	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2
TOTAL	1.5	28.9	9.0	6.2	3.8	19.4	21.8	7.9	1.4	.0	99.9

Data from IRC (1979a).

12.3.1.3 Currents

Offshore current patterns in the project region are influenced by two major ocean currents within the southern California bight as well as locally generated wind drift currents and tidal currents. The two major ocean currents within the southern California bight are the California Current and the southern California counter current (or eddy).

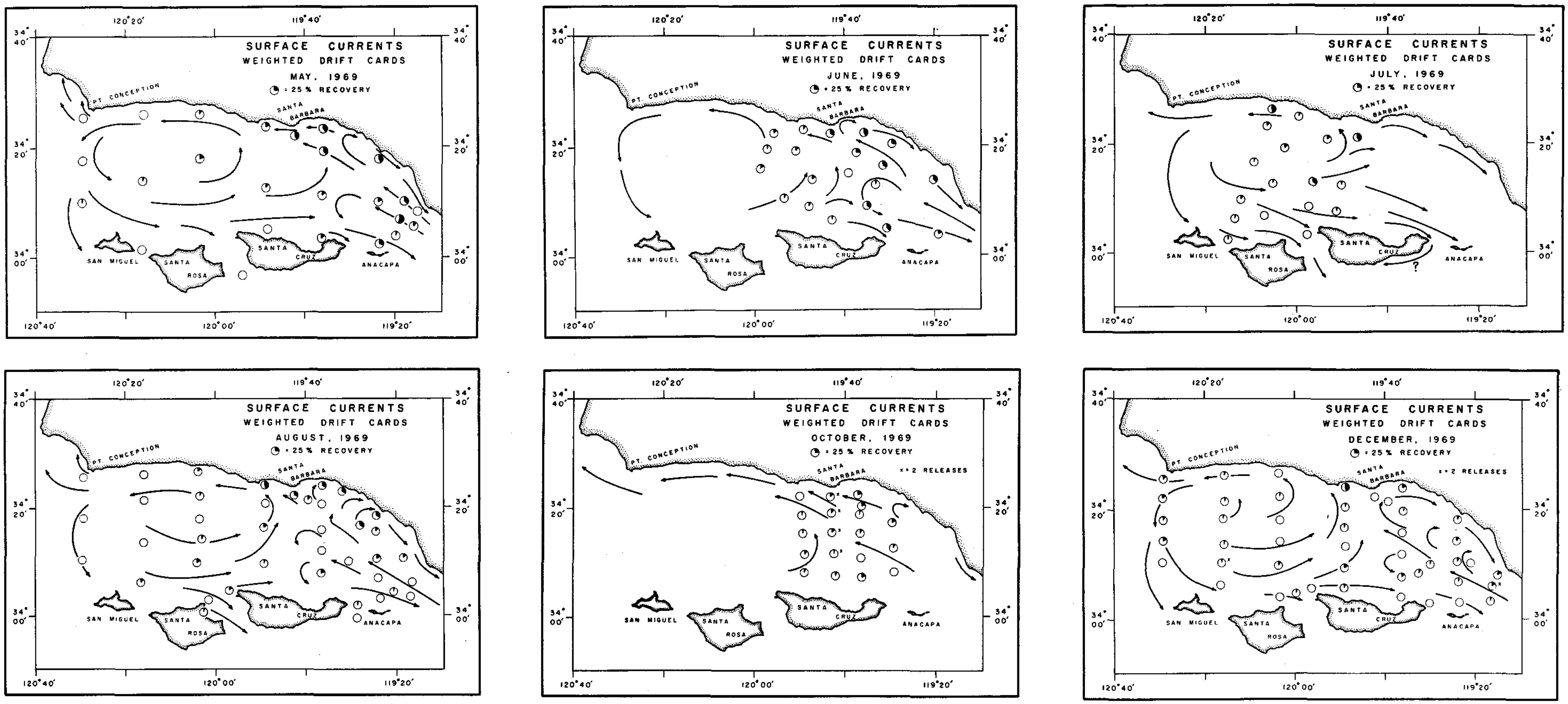
The California Current is part of the general clockwise pattern of surface water circulation in the northern Pacific Ocean. This current flows southeasterly along the California coast. Within the southern California bight, it lies mainly outside of the 5,000-foot (1,500-m) depth contour. Offshore of northern Baja California, the main portion of the California Current turns landward and splits into two branches (Jones, 1971). One branch continues southward. The other branch, the southern California counter current, turns northward and flows through the southern California bight, inshore of the California Current.

The strengths and interaction of the California Current and the southern California counter current vary seasonally in response to variations in large-scale meteorologic systems. The average speeds of these two currents are approximately equal, and range from 0.25 to 0.50 knot (0.46-0.93 km/hr) (Jones, 1971). The southern California counter current tends to be more strongly developed in late fall and winter, and weak or absent in the spring.

Within the Santa Barbara Channel, the southern California counter current produces a northwestward flowing current that enters the Channel through the passage between Point Mugu and Anacapa Island. Weighted drift card studies conducted in the Santa Barbara Channel between May 1969 and February 1970 indicate that there is a strong, well-developed, northwestwardly flowing current in the Santa Barbara Channel between Anacapa Island and Port Hueneme (Kolpack, 1971) (Figure 12.3-2). In addition, on either side of the Channel, there appear to be strong, southeastwardly flowing currents. The surface currents over the shelf in this region may be characterized by a series of eddies that break off from the southern California counter current (Kolpack and Straughan, 1972). However, the pattern, intensity, and seasonal variation of these eddies is undefined (Kolpack and Straughan, 1972).

Current measurements have been obtained during a number of different investigations spanning a total period of more than 10 years in the region offshore of Ormond Beach, Oxnard, and Mandalay Beach. These investigations have employed a wide range of instruments and methods; however, they all indicate the importance of the coastal tides and winds in determining the current patterns of the area. The data indicate that the predominant current directions are upcoast (northwest) and downcoast (southeast). The recorded current speeds range between 0 and 2.0 knots (0 and 3.7 km/hr) with average current speeds of less than 0.5 knot (0.93 km/hr) (IRC, 1972 and 1979b; MBC, 1979; Dames & Moore, 1977).

During oceanographic surveys of July 30 - August 2, 1979 and September 8 - 9, 1979, current data were taken at both of the proposed platform sites and at selected stations along the proposed and alternative offshore pipeline routes. The locations of the oceanographic stations are shown on Figure 12.3-3. Current profiles for the Platform Gina proposed and alternative offshore pipeline corridors (Figure 12.3-4), indicate the predominance of westerly and northerly flowing currents with speeds of 0.5 knot (0.93 km/hr) and less. Current speed and direction profiles for the proposed Platform Gilda site and associated offshore pipeline route (Figure 12.3-5) show the predominance of southerly flowing currents with speeds of 0.5 knot (0.93 km/hr) and less. The apparent difference in current direction at the two locations may be due to the field measurement during different tidal cycles rather than a real variation in net water flow.



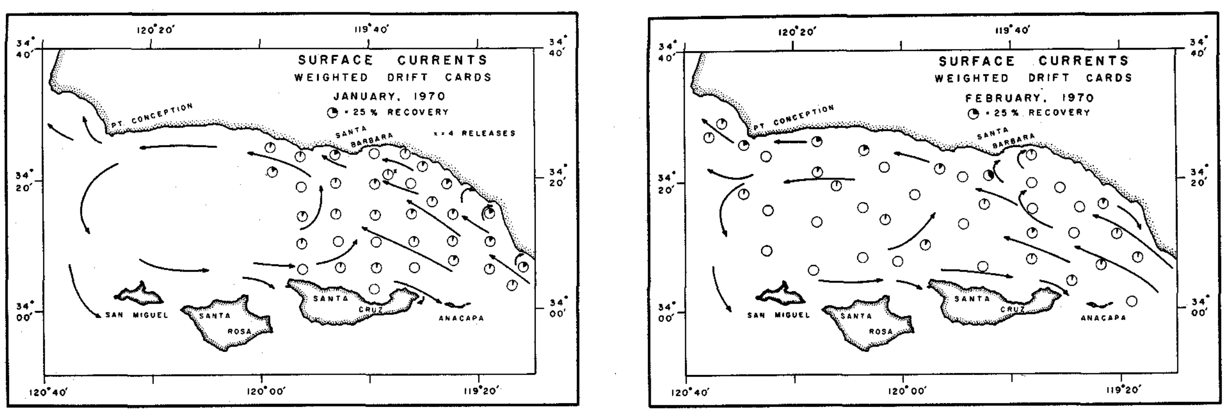


FIGURE 12.3-2

SURFACE CURRENTS
SANTA BARBARA CHANNEL

REFERENCE: KOLPACK (1971)

DAMES & MOORE

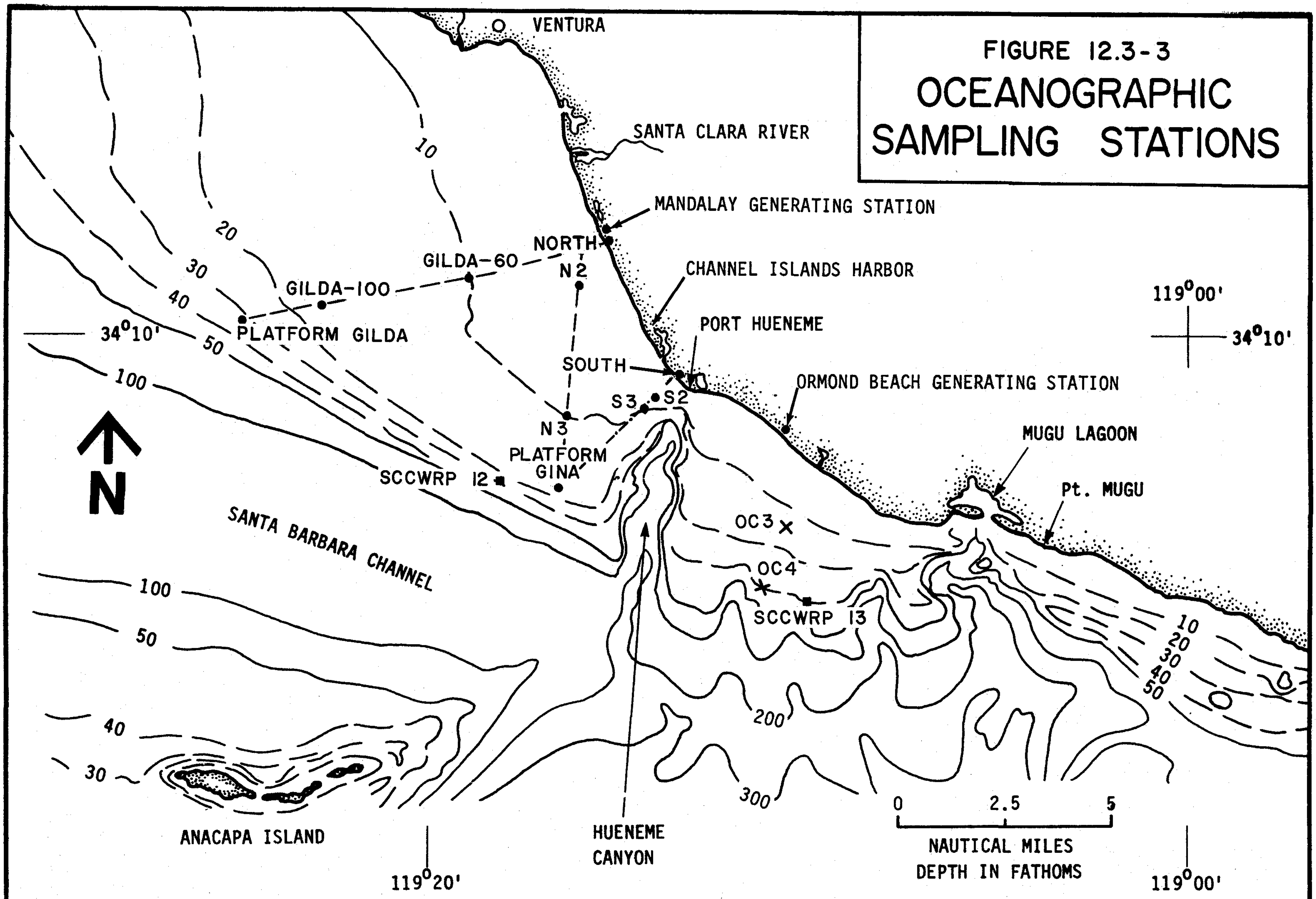


FIGURE 12.3-3
OCEANOGRAPHIC SAMPLING STATIONS
VENTURA
SANTA CLARA RIVER
MANDALAY GENERATING STATION
NORTH
N2
GILDA-60
GILDA-100
PLATFORM GILDA
CHANNEL ISLANDS HARBOR
PORT HUENEME
SOUTH
S3
S2
ORMOND BEACH GENERATING STATION
N3
PLATFORM GINA
SCCWRP 12
MUGU LAGOON
Pt. MUGU
OC3
OC4
SCCWRP 13
SANTA BARBARA CHANNEL
34°10'
119°00'
10
20
30
40
50
100
200
300
N
ANACAPA ISLAND
HUENEME CANYON
119°20'
0
2.5
5
NAUTICAL MILES
DEPTH IN FATHOMS

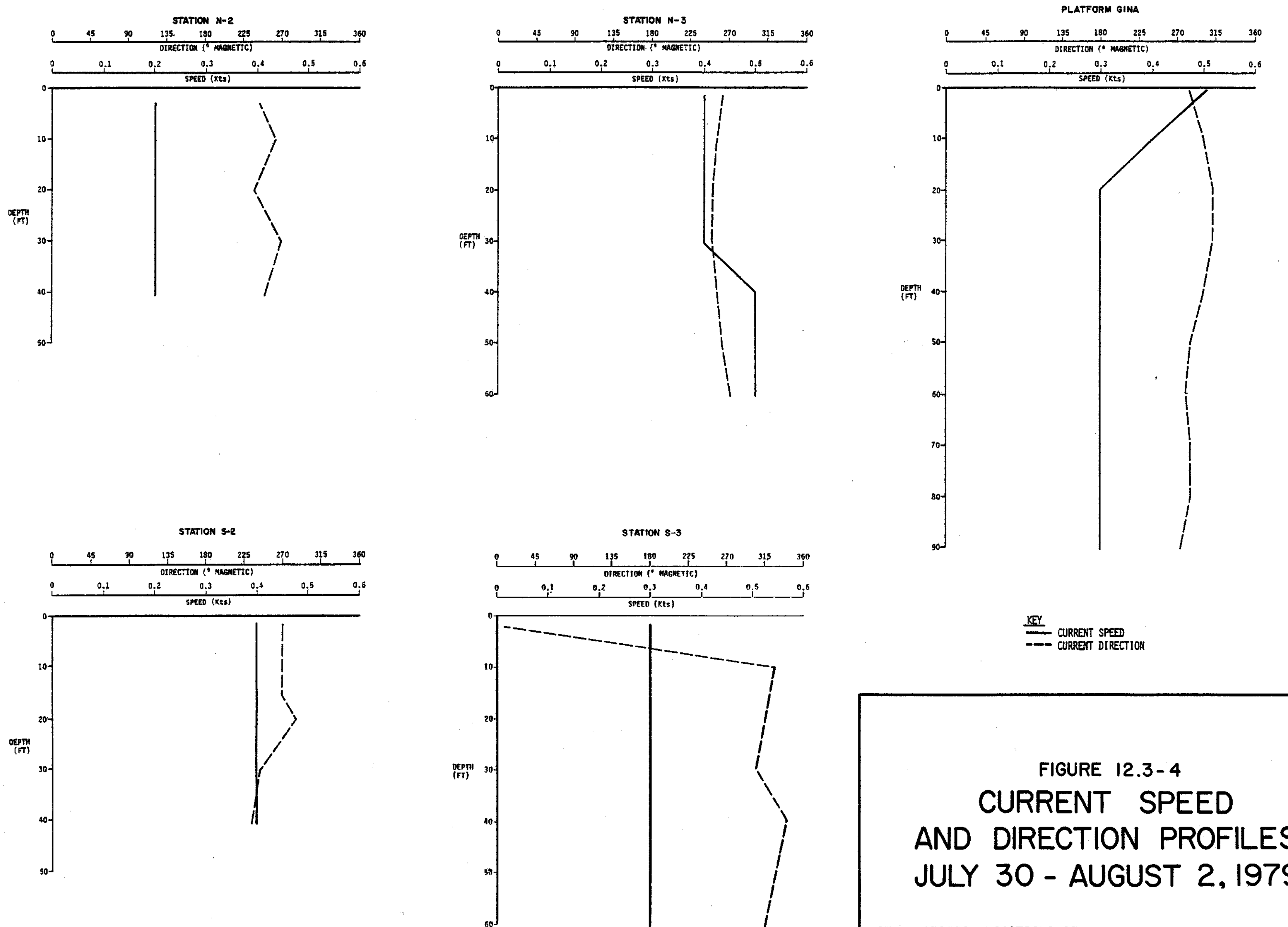


FIGURE 12.3-4

CURRENT SPEED AND DIRECTION PROFILES JULY 30 - AUGUST 2, 1979

NOTE: STATION LOCATIONS ARE SHOWN ON FIGURE 12.3-3

DAMES & MOORE

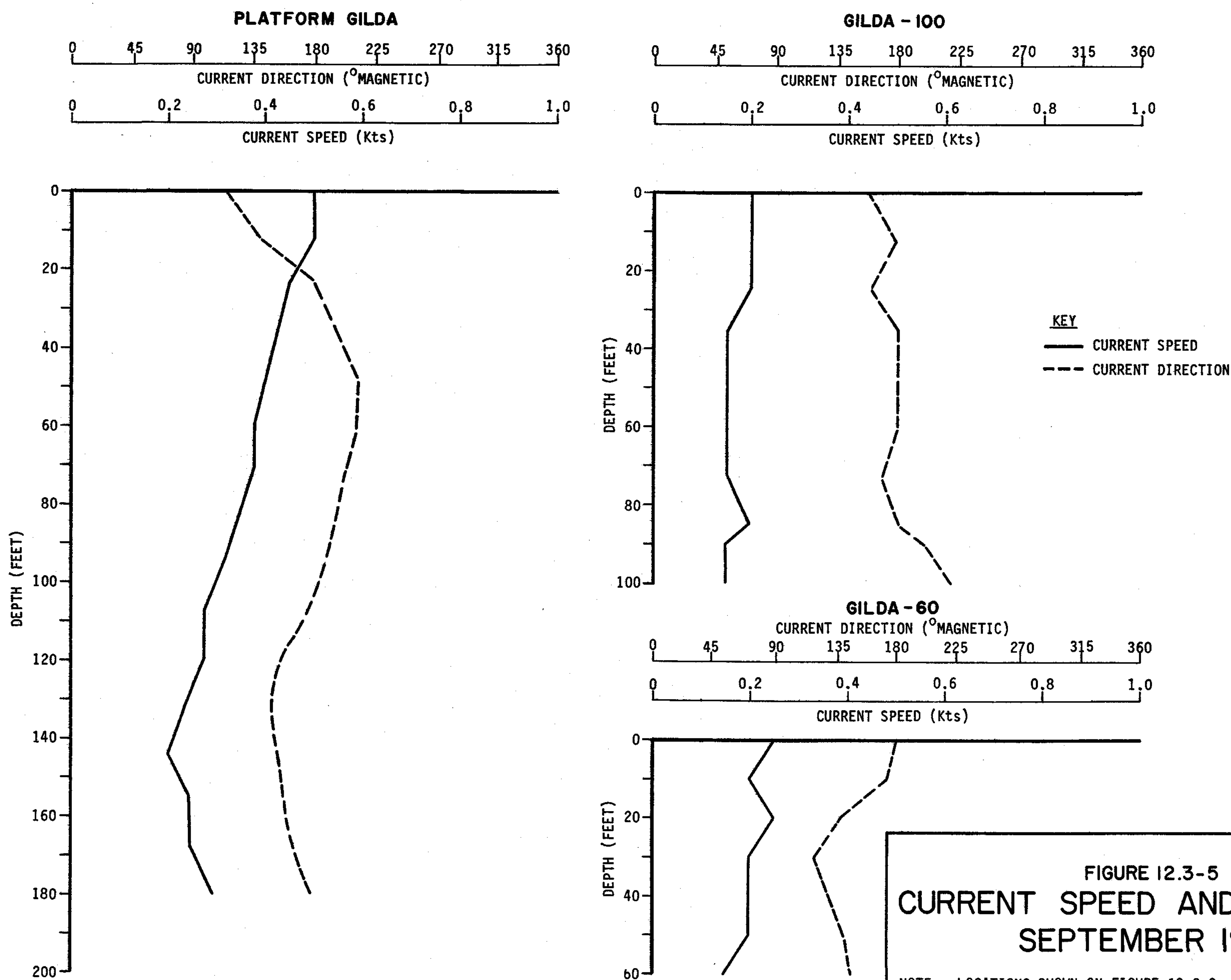


FIGURE 12.3-5

CURRENT SPEED AND DIRECTION SEPTEMBER 1979

NOTE: LOCATIONS SHOWN ON FIGURE 12.3-3

DAMES & MOORE

12.3.1.4 Longshore Sediment Transport

Most waves break against the shore at an angle, so that the swash of the breaking wave has a component of motion parallel to the shore. This produces a current along the beach--the longshore drift--which is capable of moving sediment.

The sand which maintains the Ventura County beaches is derived from the Santa Clara River, Ventura River, and by longshore drift from areas upcoast from the Ventura River. This sand is transported along the coast from north to south by the longshore drift, and most of it ultimately enters Hueneme and Mugu canyons. Therefore, it is not available for maintenance of beaches farther downcoast.

Review of the results of several studies (e.g., CDWR, 1969; USACE, 1978; Brownlie et al., 1979) suggests that the amount of sand transported annually along the beach between the Santa Clara River and Port Hueneme is approximately 1-2 million cubic yards (0.76 to 1.53 million m^3).

12.3.1.5 Tsunamis

A tsunami is a sea wave generated by any large-scale, short-duration disturbance of the sea floor, such as a fault displacement, submarine landslide, or volcanic eruption. Tsunamis are characterized by high propagation speeds, long periods, and low amplitudes. In the vicinity of the Oxnard area coastline, tsunamis could result from either local or distant generating mechanisms.

Reports exist of tsunamis generated by seismic events in southern California, but these accounts do not provide accurate information regarding tsunami damage in the project area. Written reports suggest that a tsunami of unknown height was generated during the December 12, 1812 earthquake and possibly could have run up in the region of Ventura to an elevation of 15 feet (4.6 m) above sea level. However, these reports have been shown to be generally exaggerated (Marine Advisers, 1965). Another tsunami, associated with the 1927 earthquake off Point Arguello, is reported to have been approximately 6 feet (1.8 m) high (Hamilton et al., 1969).

Since 1946, tsunamis generated at distant locations have been recorded at several stations along the Pacific coast. Major tsunami heights recorded at Port Hueneme and Rincon Island are presented in Table 12.3-8. The largest amplitude indicated in this table is for the May 22, 1960 Chilean tsunami which had an amplitude of 8.8 feet (2.68 m) at Port Hueneme. The March 28, 1964 tsunami generated by a seismic event in Prince William Sound, Alaska, may have actually had a greater height than that listed in Table 12.3-8; the gauge height limit at Rincon Island was exceeded during the event.

The tsunami inundation potential in the Santa Barbara Channel area has been calculated by Houston and Garcia (1974) with the aid of a finite difference numerical model. Run-up elevations with frequencies of occurrence of once every 100 years and once every 500 years caused by tsunamis of distant origin are expected to be 5.0 feet (1.5 m) (MSL) and 8.5 feet (2.6 m) (MSL), respectively (Houston and Garcia, 1974). The authors considered tsunamigenic sources in both the Aleutian and Peru-Chile trenches. The combined effects of astronomical tides and tsunamis, as well as local resonance effects, were accounted for in the numerical model.

12.3.2 Seawater Characteristics

12.3.2.1 Temperature

Surface water temperatures representative of nearshore waters in the project region are summarized on Figure 12.3-6. These measurements were recorded at Port Hueneme between 1920 and 1963 (National Ocean Survey, 1970) and are indicative of the long-term range and seasonal variation in nearshore surface water temperatures that can be expected for the project region. The data exhibit a clear cyclical pattern. The lowest mean temperature (55.8°F (13.2°C)) occurs during the months of February and March, while the highest mean temperature (62.2°F (16.8°C)) occurs during August.

TABLE 12.3-8

TSUNAMIS RECORDED IN THE EASTERN SANTA BARBARA CHANNEL

Date[a]	Tsunami Amplitude Feet (Meters)	Causal Event
1 April 1946	5.5 (1.7)	Magnitude 7.25 earthquake in the Aleutian Islands
4 November 1952	4.7 (1.4)	Magnitude 8.5 earthquake near Kamchatka
9 March 1957	3.5 (1.1)	Magnitude 8.5 earthquake in the Aleutian Islands
22 May 1960	8.8 (2.7)	Magnitude 8.5 earthquake off the coast of Chile
28 March 1964	5.9 (1.8)[b]	Magnitude 8.3 earthquake in Prince William Sound

[a] Data from Berkman and Symons (1964) and Spaeth and Berkman (1967).
[b] Recorded at Rincon Island; gauge limit exceeded.

Seasonal surface water temperature data are also available for two control stations established as part of the predischarge Oxnard Sewage Treatment Plant Oceanographic Survey. Surface water temperature ranges measured at these stations (designated OC3 and OC4; refer to Figure 12.3-3) are plotted together with the Port Hueneme data on Figure 12.3-6. The temperature measurements at the Oxnard control stations fall within the ranges of those for Port Hueneme.

Temperature profiles of the water column as a function of season at Oxnard Control Stations OC3 and OC4 are illustrated on Figure 12.3-7. The smallest temperature variation with depth was recorded during the December, 1973 survey, while the greatest variation was recorded during the June 1974 survey. An intense thermocline was measured during the June 1973 survey between depths of 60 and 75 feet (20 and 24 m) in 180 feet (55 m) of water, (Station OC4) and between depths of 45 and 60 feet (15 and 20 m) in 90 feet (27 m) of water (Station OC3). Slightly less intense thermoclines were recorded during the September survey. It should be noted that, with respect to the Port Hueneme surface water temperature data, the highest mean temperatures are, on the average, expected to occur during August and September and, associated with these high temperatures, intense thermoclines are likely to be present.

Surface water temperature measurements and temperature profiles of the water column were also taken during oceanographic surveys performed during 1979 as input to the Platform Gina and Platform Gilda Project EIR/EA. The range of surface water temperatures measured at the proposed Platform Gina site and along the associated Mandalay pipeline route are shown on Figure 12.3-6. These measurements are slightly higher than the mean August surface water temperatures for Port Hueneme. Temperature profiles recorded simultaneously with the surface measurements are presented on Figure 12.3-8. The profiles show a significant variation in water temperature between the surface and bottom of the water column. The surface to bottom temperature gradient measured at the proposed Platform Gina site was 0.1°F per foot (0.2°C per m).

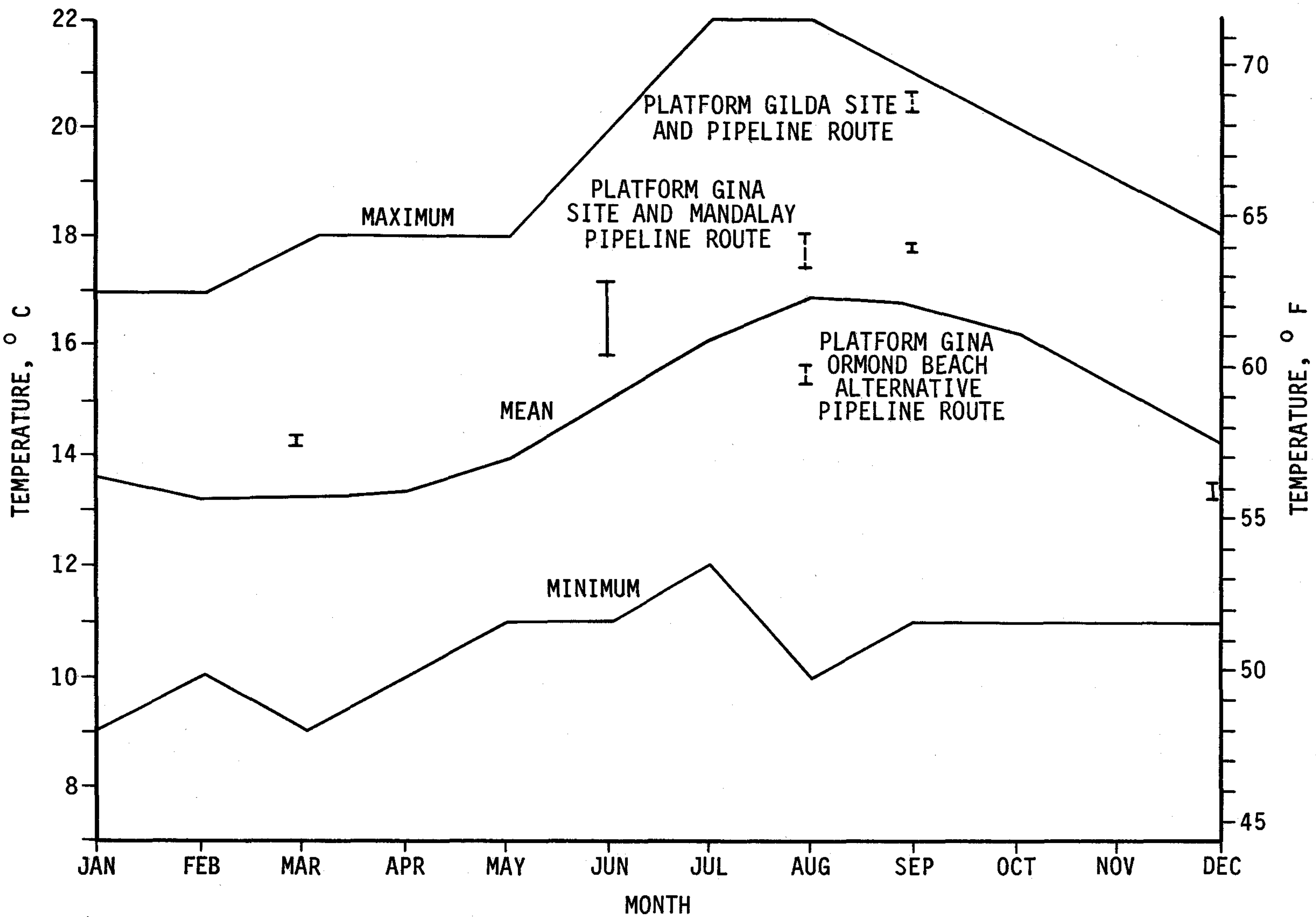


FIGURE 12.3-6

SURFACE WATER TEMPERATURE - PORT HUENEME

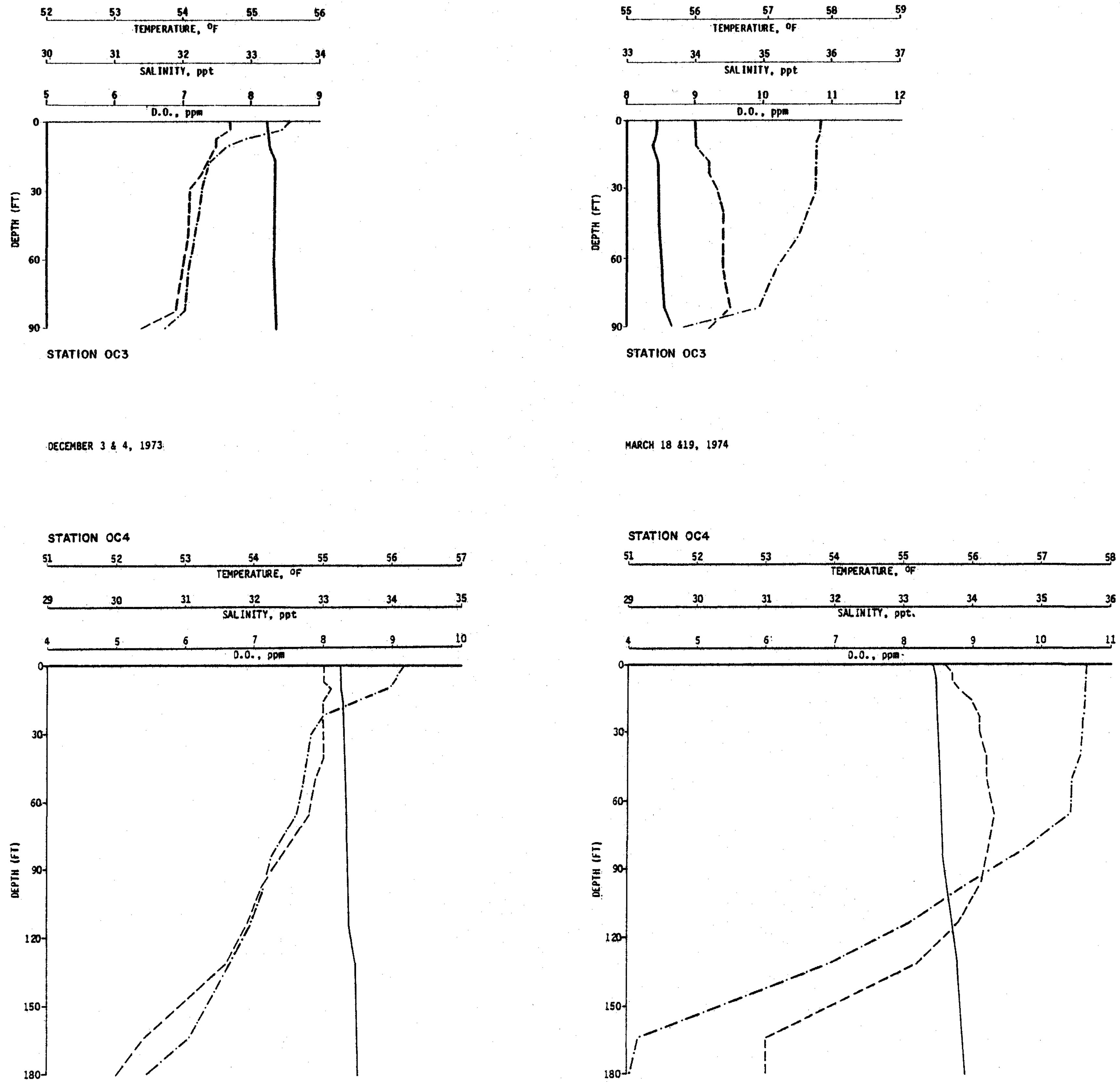
KEY:

├──┤ DATA RECORDED AT OC3 AND OC4

├--┤ DATA RECORDED DURING PROJECT SURVEYS

NOTE: STATION LOCATIONS ARE SHOWN ON FIGURE 12.3-3

REFERENCE: NATIONAL OCEAN SURVEY (1970); EQA & MCB (1975)



KEY:

-·-·- TEMPERATURE, °F

—— SALINITY, PPT

---- D.O., PPM

FIGURE 12.3-7a

SEASONAL TEMPERATURE, SALINITY, AND D.O. PROFILES OFFSHORE OF ORMOND BEACH

REFERENCE: EQA & MBC (1975)

NOTE: STATION LOCATIONS ARE SHOWN ON FIGURE 12.3-3

DAMES & MOORE

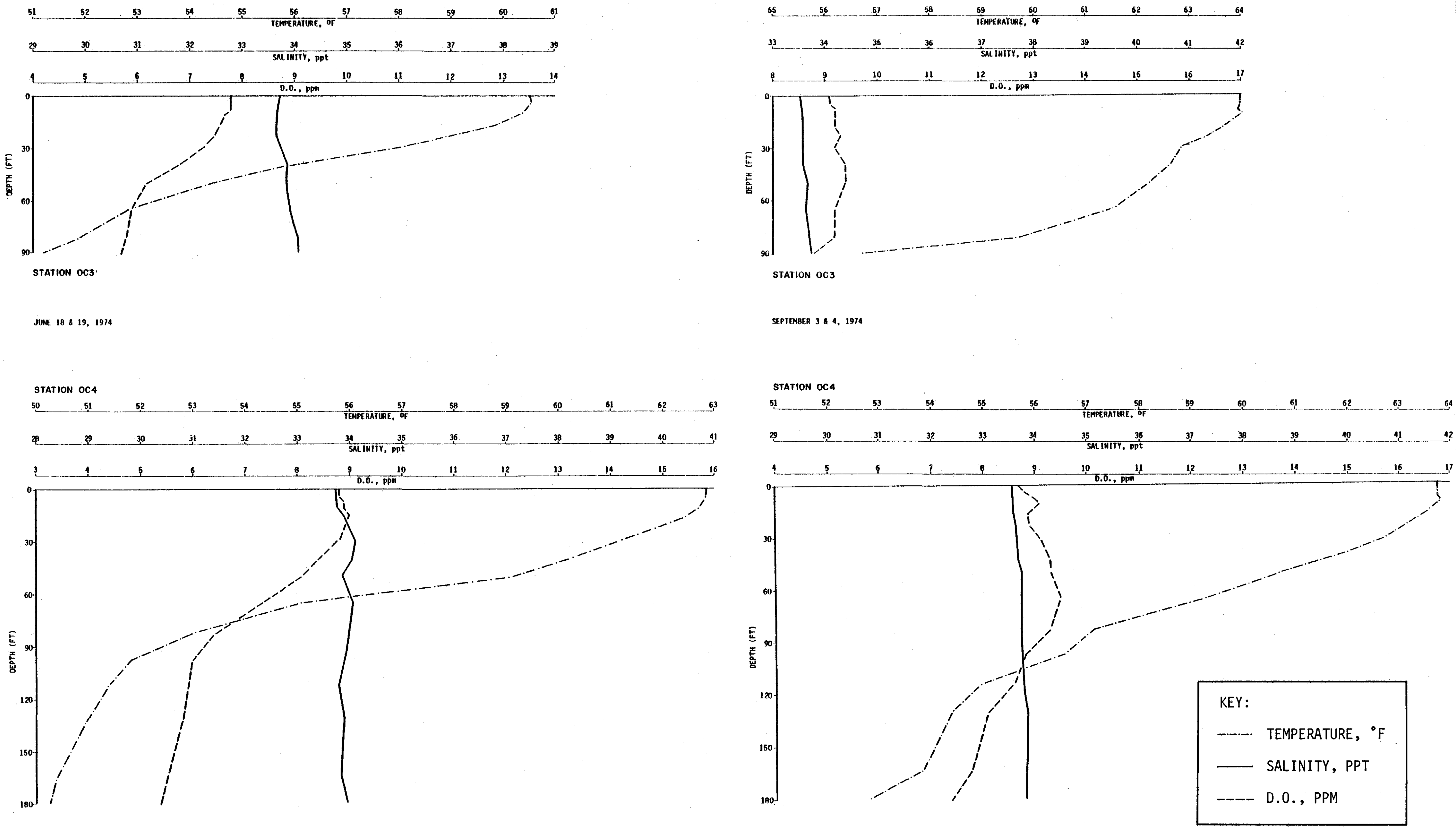
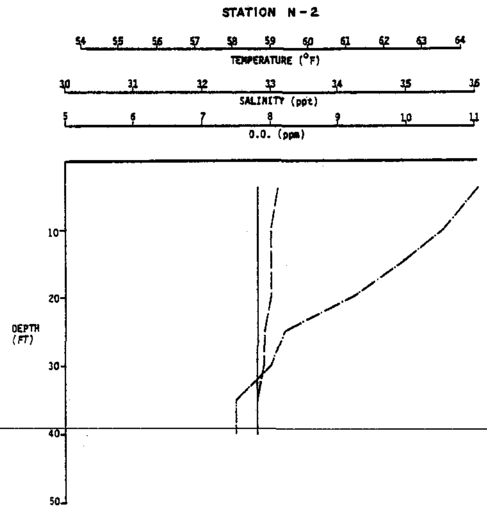


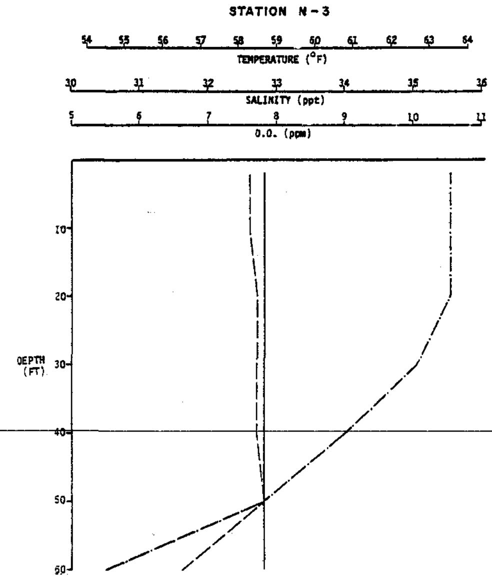
FIGURE 12.3-7b

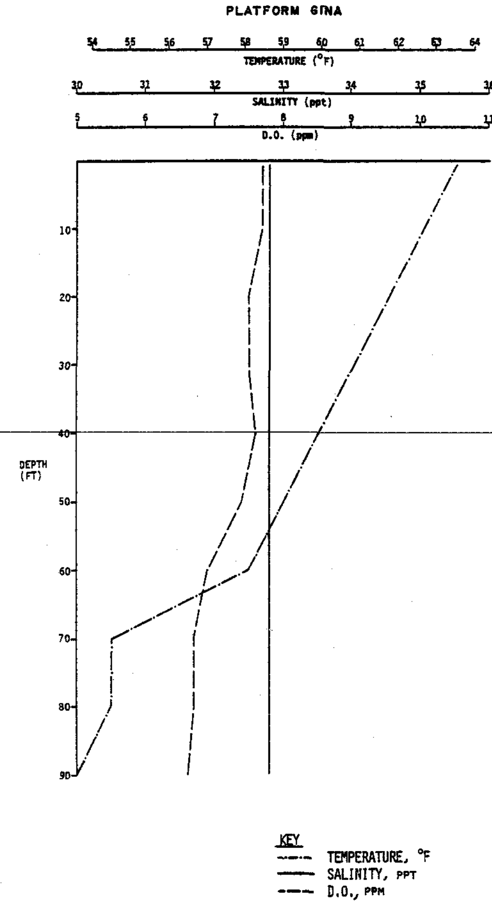
SEASONAL TEMPERATURE, SALINITY, AND D.O. PROFILES OFFSHORE OF ORMOND BEACH

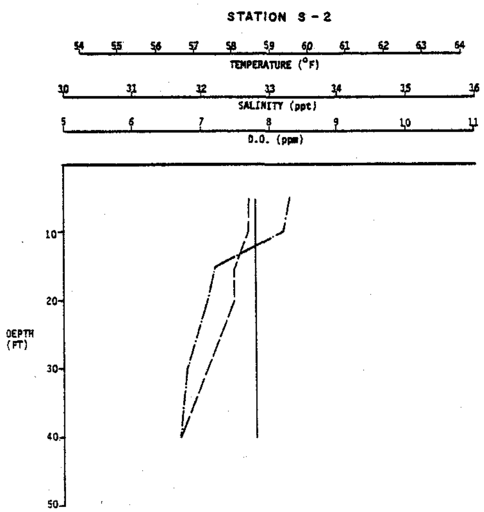
REFERENCE: EQA & MBC (1975)
NOTE: STATION LOCATIONS ARE SHOWN ON FIGURE 12.3-3

DAMES & MOORE









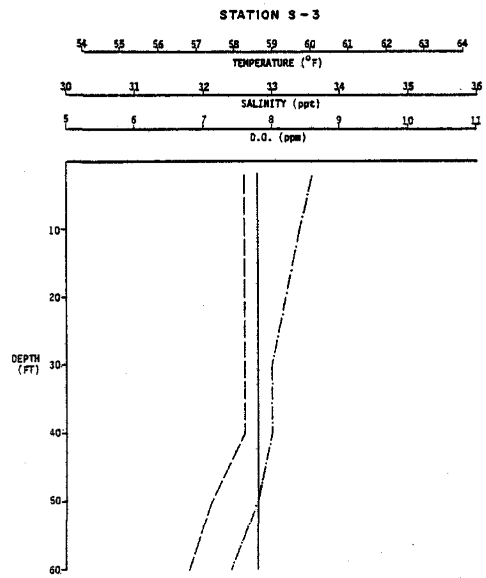


FIGURE 12.3-8

TEMPERATURE, SALINITY, AND D.O. PROFILES JULY - AUGUST 1979

NOTE: STATION LOCATIONS ARE SHOWN ON FIGURE 12.3-3

DAMES & MOORE

This compares with a maximum temperature gradient recorded in 90 feet (27 m) of water at Oxnard Control Station OC3 of 0.05°F per foot (0.1°C per m). The temperature profiles recorded at stations N2 and N3 along the proposed Platform Gina to Mandalay pipeline corridor are comparable to data previously recorded in the general area at similar water depths.

The range of surface water temperatures measured along the Platform Gina Ormond Beach alternative offshore pipeline corridor (Stations S2 and S3) is presented on Figure 12.3-6. These temperatures are slightly lower than the mean August values for Port Hueneme. Temperature profiles recorded simultaneously with the surface measurements are presented on Figure 12.3-8. These profiles are comparable to data previously recorded in the general area at similar water depths.

The range of surface water temperatures measured at the proposed Platform Gilda site and along its associated pipeline route is presented on Figure 12.3-6. These data indicate that the surface water temperatures were relatively warm, approaching the warmest recorded surface water temperatures at Port Hueneme for September. Temperature profiles simultaneously recorded with the surface measurements are presented on Figure 12.3-9. Again, significant variation in water temperature was recorded between the surface and bottom. The surface to bottom temperature gradient measured at the proposed Platform Gilda site was 0.1°F per foot (0.2°C per m). This compares with a temperature gradient measured in 180 feet (55 m) of water at Oxnard Control Station OC4 in June 1974 of 0.1°F per foot (0.2°C per m). The temperature profiles recorded along the pipeline route are comparable to data previously recorded in the general area at similar water depths.

12.3.2.2 Salinity

Surface salinity data measured at Port Hueneme are presented on Figure 12.3-10. These data represent measurements taken between 1920 and 1963

(National Ocean Survey, 1970). The mean salinities for each month show relatively small seasonal change, ranging from a low of 32.9 parts per thousand (ppt) in February to a high of 34.4 ppt in August.

Surface salinity measurements recorded at the Oxnard Sewage Treatment Plant Control Stations OC3 and OC4 (Figure 12.3-3) are also shown on Figure 12.3-10. These surface measurements fall close to the mean values for Port Hueneme.

Water column salinity profiles measured at Oxnard Control Stations OC3 and OC4 are plotted with the corresponding temperature profiles on Figure 12.3-7. The variation in salinity with depth is small for each season of the year. Nevertheless, there is a general tendency for salinity to increase with depth. During June 1974, when the maximum salinity gradient was observed at Oxnard Control Stations OC3 and OC4, the surface to bottom salinity gradient was 0.004 ppt per foot (0.013 ppt per m) in 90 feet (27 m) of water (Station OC3) and 0.001 ppt per foot (0.003 ppt per m) in 180 feet (55 m) of water (Station OC4). The extreme or more intense salinity gradients tend to occur at or near the water depths of intense temperature gradients.

Surface salinity measurements recorded at the proposed Platform Gina site and at stations along the Gina-to-Mandalay and Ormond Beach offshore pipeline corridors are presented on Figure 12.3-10. These measurements are close to the mean August values for Port Hueneme. Salinity profiles simultaneously recorded with the surface measurements are presented on Figure 12.3-8. These profiles did not exhibit salinity variation with depth within the limits of detection of the field instruments.

Surface salinity measurements recorded at the proposed Platform Gilda site and along the associated pipeline route are presented on Figure 12.3-10. These measurements are close to the mean September values for Port Hueneme. Salinity profiles simultaneously recorded with the surface measurements are presented on Figure 12.3-9. These profiles exhibited no significant variation with depth.

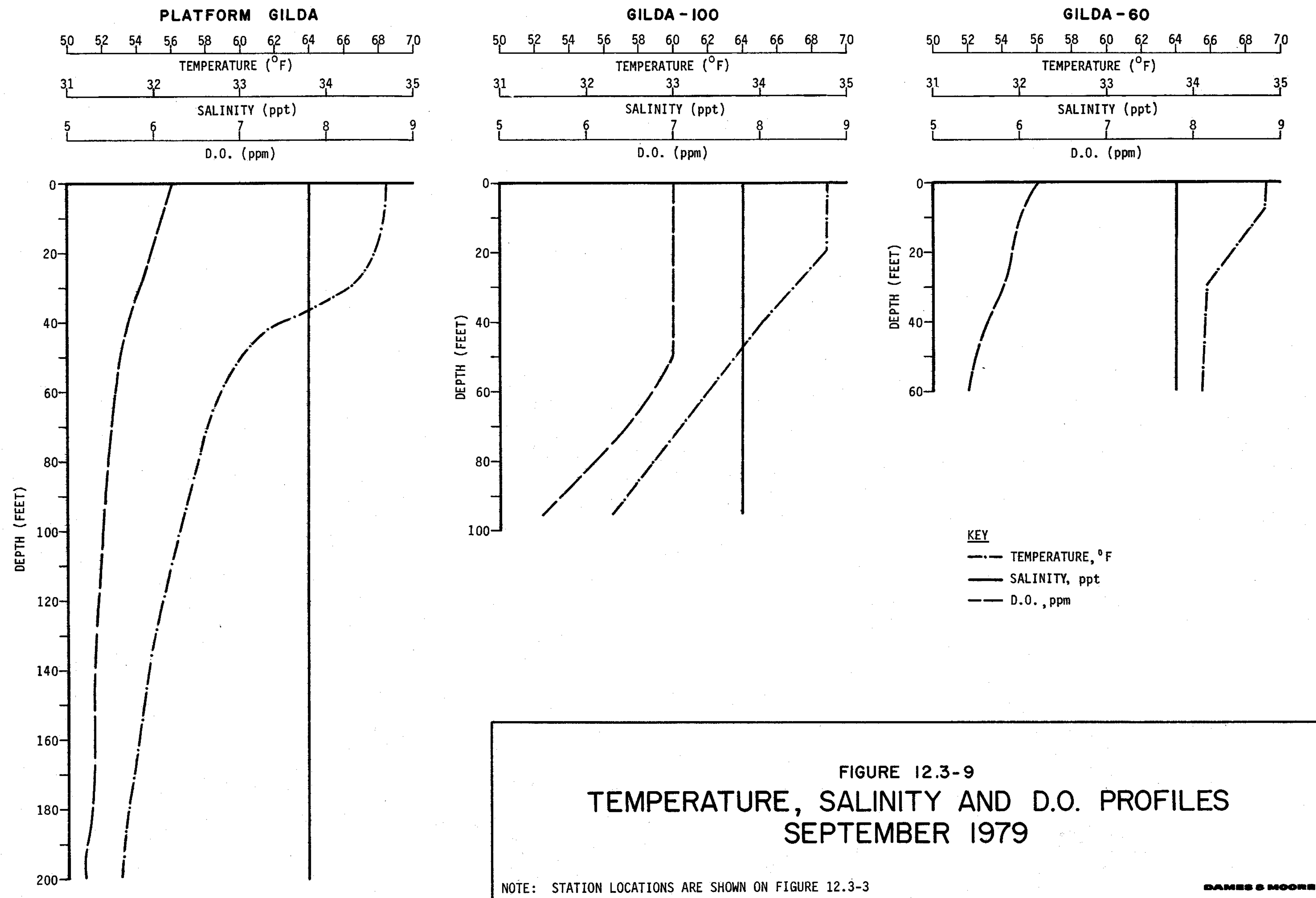


FIGURE 12.3-9

TEMPERATURE, SALINITY AND D.O. PROFILES SEPTEMBER 1979

NOTE: STATION LOCATIONS ARE SHOWN ON FIGURE 12.3-3

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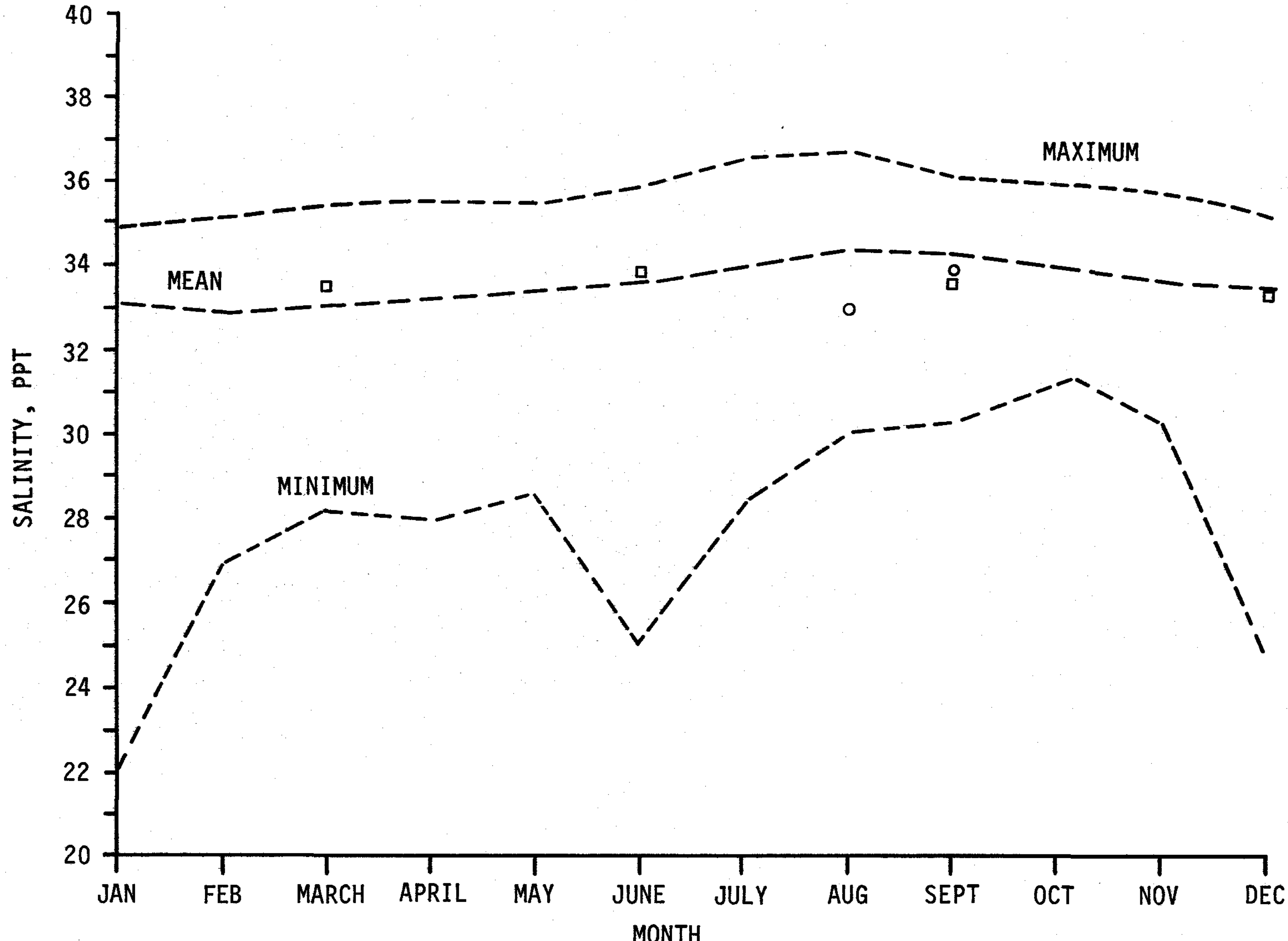

FIGURE 12.3-10

SURFACE WATER SALINITIES - PORT HUENEME

KEY:
- □ DATA RECORDED AT OC3 AND OC4
- ○ DATA RECORDED DURING PROJECT SURVEYS

NOTE: STATION LOCATIONS ARE SHOWN ON FIGURE 12.3-3

REFERENCE: NATIONAL OCEAN SURVEY (1970)

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12.3.2.3 Dissolved Oxygen

Dissolved oxygen has been measured in the vicinity of the proposed platforms and pipeline corridors by a number of different investigators. Surface dissolved oxygen concentrations measured during a predischarge receiving water monitoring study for the Oxnard Sewage Treatment Plant at four control stations between December 1973 and September 1974 ranged from 7.2 to 9.3 parts per million (ppm) (EQA and MBC, 1975). During four seasonal surveys, the general trend of the surface dissolved oxygen concentrations was for the lowest surface concentrations to occur at the shallowest water depths. Similarly, during the receiving water monitoring program for the Oxnard Sewage Treatment Plant conducted between July 1978 and April 1979, dissolved oxygen concentrations ranged from 7.7 to 10.7 ppm with a mean of 8.76 ppm (IRC, 1979b). These data indicate that a relatively high dissolved oxygen concentration occurs in the surface waters of the project region.

Profiles of dissolved oxygen concentrations in the water column recorded at Oxnard Control Stations OC3 and OC4 are presented on Figure 12.3-7. The overall trend of these profiles is for dissolved oxygen concentrations to decrease with increasing depth. Occasionally, however, there is a slight increase in concentration in near-surface waters followed by a decrease with the further increase in depth. The dissolved oxygen profiles tend to correlate with the temperature profiles.

Dissolved oxygen profiles taken at the proposed Platform Gina site and along the associated proposed Mandalay and Ormond Beach alternative offshore pipeline routes are illustrated on Figure 12.3-8. The measured surface water dissolved oxygen concentration at the proposed Platform Gina site was 7.7 ppm. At Stations N2 and N3 along the proposed Platform Gina Mandalay offshore pipeline corridor, surface dissolved oxygen concentrations of 7.6 and 5.1 ppm were measured. At Stations S2 and S3 along the Platform Gina Ormond Beach alternative offshore pipeline corridor, surface dissolved oxygen concentrations of 7.6 and 7.7 ppm were recorded. The profiles shown for the platform site and each of the pipeline corridors display the same general tendency for dissolved oxygen concentrations to decrease with increasing water depth.

Dissolved oxygen profiles recorded at the proposed Platform Gilda site and along the associated pipeline corridor to Mandalay Beach are illustrated on Figure 12.3-8. The surface dissolved oxygen concentration recorded at the proposed platform site was 6.2 ppm. At stations lying along the proposed pipeline route, surface dissolved oxygen concentrations of 6.2 and 7.0 ppm were measured. Profiles of the water column at all stations exhibit the general tendency for dissolved oxygen concentrations to decrease with depth.

12.3.2.4 pH

The pH of sea water is maintained primarily by the salts of carbonic acid, and is therefore inversely proportional to the carbon dioxide content. The concentration of carbon dioxide in sea water depends upon atmospheric absorption at the water surface, and upon the activities of living organisms.

Sea water is a well buffered solution whose pH exhibits little variation. Surface water measurements recorded during the Oxnard Sewage Treatment Plant predischarge receiving water study at the control stations exhibited a range in pH values of 8.05 to 8.38 (EQA and MBC, 1975). Similarly, the vertical distribution of pH exhibited a very small decrease with increasing depth. The pH at the Oxnard control stations remained relatively uniform throughout the year and did not exhibit a seasonal cycle.

Surface water pH values measured during 1979 at the proposed Platform Gina and Platform Gilda sites were 8.2 and 7.6, respectively.

12.3.2.5 Nutrients

The common inorganic nutrients considered to be necessary for organic productivity are nitrogen, phosphorus, and dissolved silica. The biologically available forms of nitrogenous nutrients are nitrate, nitrite, and ammonia.

Nutrient data for the Santa Barbara Channel region and waters offshore of Port Hueneme were compiled during five oceanographic surveys performed between May 1969 and January 1972. Data collected during these surveys are summarized in Table 12.3-9. The 1969 survey values were obtained after an oil spill that affected most of the Santa Barbara Channel and may not, therefore, be indicative of normally occurring nutrient concentrations. Surface nutrient concentrations often exhibit pronounced seasonal changes in response to variations in upwelling of deep ocean waters that are characteristically rich in nutrients.

Surface water nutrient concentrations measured at the proposed Platform Gina site and along the proposed Mandalay and Ormond Beach alternative offshore pipeline routes are presented in Table 12.3-10. Nitrate concentrations were found to be low, while the phosphorus concentrations were high, particularly at the proposed Platform Gina location.

Surface nutrient concentrations measured at the proposed Platform Gilda site and along its associated pipeline route are also reported in Table 12.3-10. Nitrate and phosphorus were not present in detectable quantities.

12.3.2.6 Transparency

Water clarity measurements were recorded during the Oxnard Sewage Treatment Plant receiving water monitoring study (EQA and MBC, 1975) by two methods. The first method involved measuring over the entire water column the percent transmittance of an artificial light source transmitted across a fixed 3-foot (1-m) path. The second method consisted of lowering a Secchi disc into the water column and recording the depth at which the disc was no longer visible.

At Oxnard Control Stations OC3 and OC4 the surface light transmittance varied from 22 percent to 79 percent. The bottom light transmittance varied from 36 percent to 67 percent. Seasonal profiles are presented in Table 12.3-11. Secchi disc measurements varied from 16.5 feet (5 m) to 45 feet (15 m) at Station OC3, and from 23.0 feet (7 m) to 45 feet (15 m) at Station OC4.

TABLE 12.3-9

SURFACE WATER NUTRIENTS, 1969-1972

	Silica	Phosphate	Nitrite	Nitrate
May 1969[a]				
Offshore Port Hueneme	0.42[b]	0.09	0.01	0.25
Santa Barbara Channel	0.12 - 0.96	0.05 - 0.12	0.01 - 0.04	0.06 - 0.74
August 1969[a]				
Offshore Port Hueneme	0.03	0.02	0.00	0.00
Santa Barbara Channel	0.03 - 0.42	0.02 - 0.07	0.00 - 0.02	0.00 - 0.43
December 1969[a]				
Offshore Port Hueneme	0.15	0.04	0.00	0.02
Santa Barbara Channel	0.12 - 0.21	0.03 - 0.04	0.00 - 0.2	0.02 - 0.12
December 1971[c]				
Offshore Port Hueneme	0.37	0.07	0.03	NA[d]
January 1972[c]				
Offshore Port Hueneme	0.23	0.05	0.03	NA

[a]Data from Kolpack (1971).
[b]Concentrations given in mg/L.
[c]Data from Kolpack and Straughan (1972).
[d]NA = data not available.

TABLE 12.3-10

SURFACE WATER NUTRIENTS, 1979

	Nitrate	Phosphorus
July 1979		
Platform Gina[a]	0.03[b]	1.80
North	<0.03	0.90
N-2	0.10	0.43
South	<0.03	1.50
S-2	0.05	0.57
September 1979		
Platform Gilda	<0.03	<0.7
Gilda - 100	<0.03	<0.7

[a]Sampling locations are shown on Figure 12.3-3.
[b]Concentrations given in mg/L.

TABLE 12.3-11

LIGHT TRANSMITTANCE VALUES

Station OC3[a]

Depth (Feet)	3-4 December 1973	18-19 March 1974	18-19 June 1974	3-4 September 1974
Surface	43[b]	62	22	73
3.28	44	62	22	74
6.56	45	63	21	72
9.84	47	63	21	74
16.40	46	63	21	75
22.96	47	63	25	75
29.52	47	64	29	76
39.36	58	64	33	72
49.20	59	65	40	72
65.60	58	64	51	70
82.00	58	60		56
98.40	57			
Bottom	54	53	54	60
Secchi Disc	16.5	-	20	45

Station OC4

Depth (Feet)	3-4 December 1973	18-19 March 1974	18-19 June 1974	3-4 September 1974
Surface	57	65	30	79
3.28	57	65	30	79
6.56	57	66	30	80
9.84	58	66	30	79
16.40	61	66	30	79
22.96	62	67	30	78
29.52	62	67	33	77
39.36	64	67	38	71
49.20	65	68	46	71
65.60	68	69	56	65
82.00	70	64	73	67
98.40	71	65	83	69
114.80	72	69	83	76
131.20	63	57	80	78
164.00	69	66	75	70
Bottom	67	64	36	53
Secchi Disc	23.0	-	20	45

[a]Data from EQA and MBC (1975).
[b]Percent of light transmitted.

During the project oceanographic surveys conducted in 1979, the Secchi disc measurements were 23 feet (7 m) at the proposed Platform Gina site and 38 feet (11 m) at the proposed Platform Gilda site.

12.3.2.7 Trace Metals

Surface water samples were collected at seven locations during oceanographic surveys for the Platform Gina and Platform Gilda project. These samples were tested for concentrations of barium, copper, cadmium, lead, nickel, and zinc. The results of these tests are presented in Table 12.3-12. In general, the trace mineral concentrations found in these water samples exhibit a relatively uniform range at both platform sites and along the proposed pipeline corridors. Also shown in Table 12.3-12 are trace metal concentrations obtained from a series of nearshore stations sampled in conjunction with the southern California baseline study (Bureau of Land Management, 1977). The trace metal concentrations measured during the southern California baseline study were higher for all constituents than the concentrations measured at the two proposed platform sites and associated offshore pipeline corridors.

During the Bureau of Land Management's baseline study for southern California, near-surface and near-bottom sea water samples were collected for petroleum hydrocarbon analyses at 41 stations throughout the bight. Offshore of Port Hueneme, a near-bottom sea water sample had a hydrocarbon concentration of 3.22 parts per billion (ppb); no near-surface samples were analyzed. The overall range in the southern California bight was from 0.03 ppb to 80 ppb. Tests of surface water samples obtained in the vicinity of the proposed Platform Gina and Platform Gilda sites did not yield detectable concentrations of hydrocarbons. The threshold for these analyses was 1 ppb.

12.3.3 Seafloor Sediment Characteristics

12.3.3.1 Sediment Distribution

When a stream or river enters the sea, its current velocity decreases and its sediment load is widely distributed over the seafloor. In most cases,

TABLE 12.3-12

TRACE METAL CONCENTRATIONS IN SURFACE WATERS

	Dames & Moore Sampling Location[a]							
Constituent	Platform Gina	North	N-2	South	S-2	Platform Gilda	Gilda-100	Southern Calif. Bight[b]
Zinc	0.06[c]	0.03	0.06	0.04	0.06	0.08	0.07	32.0
Nickel	0.25	0.40	0.25	0.40	0.25	0.20	0.20	<16
Lead	1.30	1.50	1.35	1.50	1.45	1.40	1.40	8.3
Copper	0.13	0.15	0.12	0.15	0.12	0.07	0.07	<9.7
Cadmium	0.06	0.08	0.06	0.08	0.06	0.04	0.04	5.2
Barium	<2	<1	<2	<1	<2	<1	<1	70.0

[a]Locations are shown on Figure 12.3-3.
[b]Nearshore average concentrations (BLM, 1977).
[c]Concentrations given in mg/L.

this leads to formation of a delta. However, due to the exposure of the coastline to vigorous wave action, some rivers (such as the Santa Clara) do not build a substantial delta. Instead, most of the sediment is rapidly transported offshore or along shore (see Section 12.3.1.4) away from the river's mouth.

In the Santa Barbara Channel, surface sediments generally grade outward from nearshore sand deposits to a mud bottom in deep water; however, this systematic arrangement of grain sizes is not ubiquitous, due to local variations in waves and currents--sediment does not everywhere become finer seaward.

During August and September 1979, Dames & Moore collected bottom sediment samples at the proposed Platform Gina and Platform Gilda sites and along the proposed and alternative offshore pipeline corridors. These samples were subsequently returned to the lab and the grain size distribution in each was determined by sieve analysis. The results of the sieve analyses are summarized on Figure 12.3-11.

The data shown on Figure 12.3-11 indicate that bottom surface sediments in the project region generally become finer seaward. There are, however, local deviations from the general trend, such as the increase in coarseness between tne 40- and 80-foot (12- and 25-m) stations along the proposed Platform Gina Mandalay pipeline corridor. This local variation probably is due to the effect of currents produced by the Santa Clara River as it enters the sea.

12.3.3.2 Sediment Chemistry

Sediment samples were obtained at the proposed Platform Gina site and at four oceanographic stations lying along the proposed Platform Gina Mandalay and Ormond Beach alternative offshore pipeline corridors. The samples were tested for concentrations of cadmium, copper, lead, nickel, and zinc. Results of the analyses are presented in Table 12.3-13. Also shown in Table 12.3-13 are the results of the analyses of two sediment samples obtained during a

TABLE 12.3-13

TRACE METAL CONCENTRATIONS IN SEDIMENTS

Constituent	Dames & Moore Sampling Location[a]						Southern California Bight[b]		
	Platform Gina	North	N-2	South	S-2	Platform Gilda	Station 12	Station 13	Survey Range
Zinc	20.70[c]	10.90	20.10	13.70	20.00	46.70	40	36	9.8 - 172
Nickel	6.90	5.40	6.90	5.00	6.90	15.00	15.00	12.00	3.20 - 51
Lead	11.10	9.30	9.60	8.70	9.80	12.50	4.10	4.10	2.70 - 12
Copper	3.90	5.80	4.20	5.70	4.20	25.70	5.50	3.00	2.30 - 40
Cadmium	0.45	0.45	0.59	0.47	0.59	0.80	0.50	0.21	0.10 - 1.40

[a]Locations shown on Figure 12.3-3.
[b]Survey of areas thought to be unaffected by man's activities (SCCWRP, 1979).
[c]Concentrations given in mg/L.

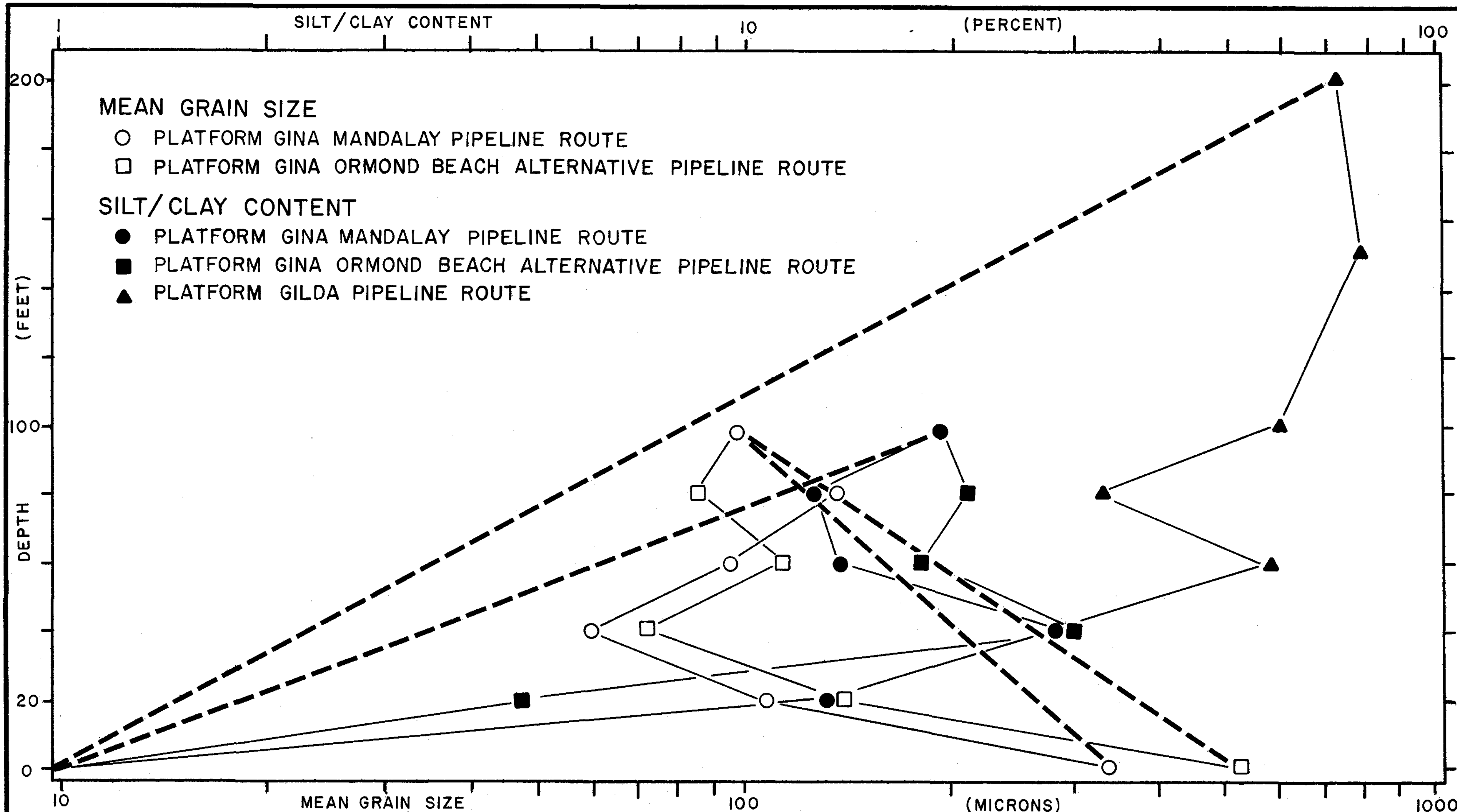

FIGURE 12.3-11

SEDIMENT GRAIN-SIZE DATA

NOTE: PLATFORM GINA SITE IS THE ENDPOINT FOR BOTH THE MANDALAY PIPELINE ROUTE AND THE ORMOND BEACH ALTERNATIVE ROUTE. PLATFORM GINA MANDALAY ROUTE AND THE GILDA ROUTE COINCIDE AT DEPTHS OF 0, 20, AND 40 FEET.

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survey by the Southern California Coastal Water Research Project (SCCWRP, 1979). The SCCWRP samples were obtained in 200 feet (60 m) of water offshore of Oxnard and Port Hueneme in an area which SCCWRP felt was unaffected by man's activities. These two sets of analyses show similar concentrations of trace metals. The concentrations found in the Dames & Moore samples, in general, fall within the range of concentrations determined during the southern California 200-foot (60-m) Control Survey for areas thought to be unaffected by man's activities.

Trace metal concentrations determined from a sediment sample obtained at the proposed Platform Gilda site also are presented in Table 12.3-13. These concentrations are higher than those measured in sediments from the proposed Platform Gina site, the Platform Gina offshore pipeline corridors, and the SCCWRP samples. However, these concentrations fall within the range determined by the 200-foot (60-m) survey with the exception of lead. The concentration of lead found in the proposed Platform Gilda sample was 12.5 ppm. A high of 12.0 ppm was measured during the 200-foot (60-m) control survey.

12.4 MARINE BIOLOGY

12.4.1 Introduction

The project region (Figure 12.4-1) includes gently sloping, sediment-bottom habitats, with sediment grain size decreasing from fine sands nearshore to coarse silts offshore. The major features of the region include two submarine canyons, two small harbors and Mugu Lagoon. Intertidal areas vary from steep to moderately sloped beaches with medium to coarse sands, frequently underlain by gravel. Natural rocky substrate is scarce in the region, both intertidally and subtidally.

The offshore site area is shown on Figure 12.4-2. Locations of the field surveys carried out by Dames & Moore within the site area are shown on Figure 12.4-3. Details of field methodology, sea state, weather conditions, and instrumentation are contained in the field logs for these surveys.

Comparisons were drawn, where possible, between the biotas associated with the two proposed and one alternative pipeline corridors. The plankton, pelagic fish, and marine mammals are not suited to such comparisons since their scale of movements is greater than the scale of the distances between the extremes of the proposed project elements.

For demersal fishes, the major regional feature is Hueneme Canyon. Northwest of the canyon, the Hueneme Shelf demersal fish fauna is relatively homogeneous, with gradients across depth contours being more pronounced than longshore gradients. Neither the literature nor Dames & Moore site-specific data indicate that the demersal fish fauna is different among the three sampled corridors at equivalent depths. Since the Platform Gilda route extends to considerably deeper water, its outer portions contain elements of deeper water faunas not found on either the proposed or alternative routes for Platform Gina.

For the macroepifauna, distinctions are also greater across depth contours than along them, with the richest populations occurring from about 50 to 60 feet (15 to 20 m). The Platform Gilda route had the greatest concentration of macroepifaunal species, but much of this fauna is mobile and capable of moving over distances greater than the distances between the pipeline corridors. Therefore, this distinction between routes is probably temporal rather than spatial.

The macroinfaunal species are distributed in relation to both depth and sediment grain size. Distinctions between pipeline routes exist, but in general, the longshore trends are more apparent between the Platform Gilda route and the proposed and alternative Platform Gina routes, than between the proposed and alternative Platform Gina routes.

Hueneme Canyon and Port Hueneme are major features with regard to the intertidal biota. The Mandalay area intertidal zone had a less varied fauna than the Silver Strand Beach area, but both are relatively depauperate faunas typical of coarse sand beaches.

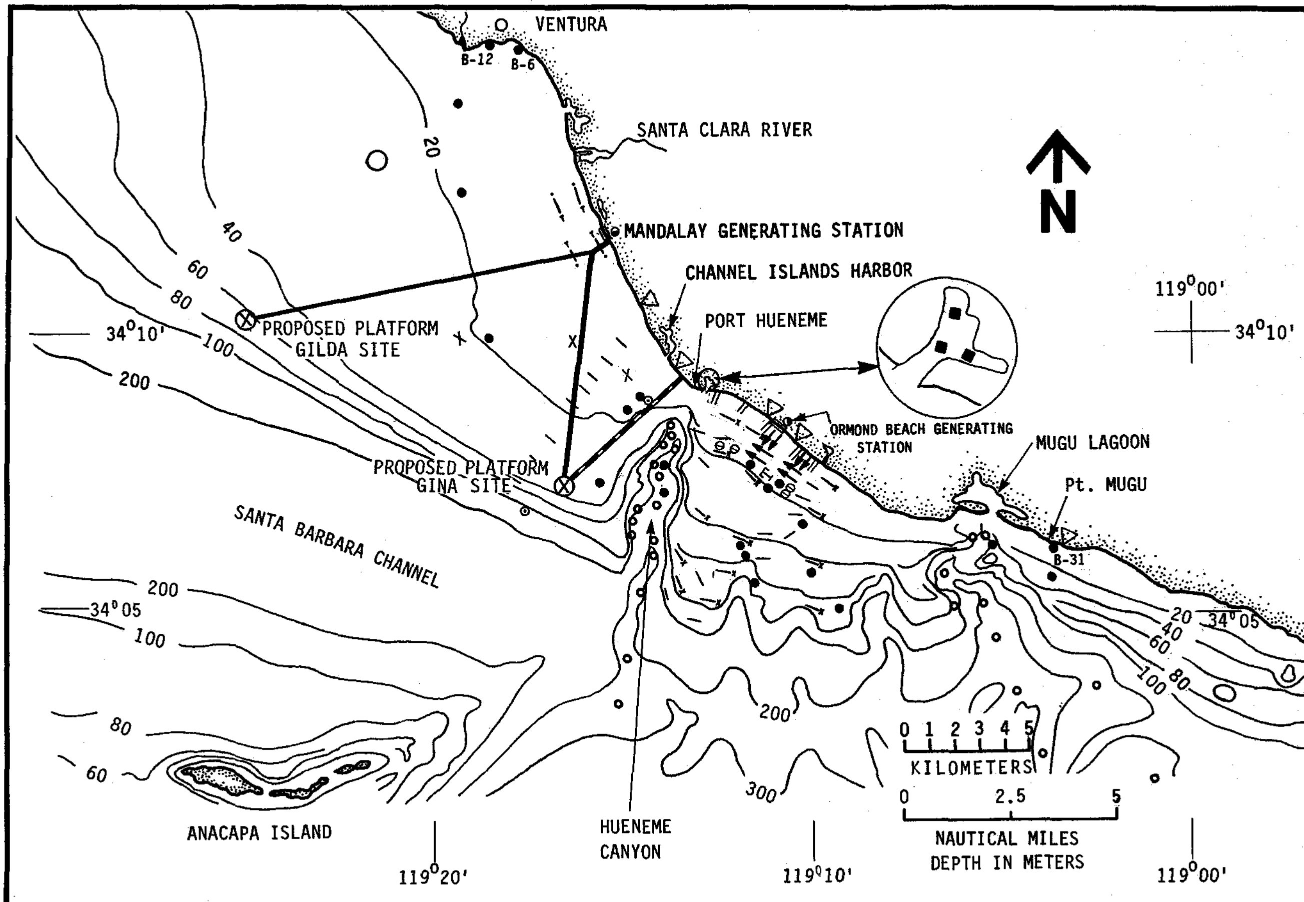
All of the data suggest that the biotas of the site area are of relatively homogeneous nature, offering little comparison between the three routes, and are typical of the southern California mainland shelf. No distinction can be made between the faunas of the corridors and those of the platform locations, as the depth gradations in the faunas are much broader than the difference between the depths of the outer portion of the corridors and the platform locations.

12.4.2 Marine Fishes

12.4.2.1 Demersal Fishes

12.4.2.1.1 Regional Characterization

The data collected during predischarge studies for the City of Oxnard Sewage Treatment Plant (EQA & MBC, 1975); NPDES receiving water monitoring for



- B-6● STATE OF CALIFORNIA (1965) INTERTIDAL STATIONS
- TRAWL AND BENTHIC SAMPLE STATIONS FOR MANDALAY NPDES STUDY (1979) AND THERMAL EFFECTS (IRC, 1972)
- TRAWL STATIONS FOR PREDISCHARGE STUDY, CITY OF OXNARD
- ● STATE OF CALIFORNIA (1965) BENTHIC INFAUNA STATIONS
- o HARTMAN (1963) SAMPLE STATIONS
- ⊙ FAUCHALD AND JONES (1977) SAMPLE STATIONS
- ■ CALIFORNIA DEPT. OF FISH AND GAME (1971) SAMPLE STATIONS
- MEARNS, et al (1973) TRAWL STATIONS
- ▷ KOLPACK AND STRAUGHAN (1972) SANDY INTERTIDAL SAMPLE STATIONS
- ▭ INTERTIDAL AREA COVERED IN THERMAL EFFECTS AND MONITORY STUDIES FOR ORMOND BEACH AND MANDALAY GENERATING STATIONS
- TRAWL STATIONS FOR ORMOND BEACH THERMAL EFFECTS STUDIES (IRC, 1972 et seq.)
- = TRANSECTS FOR OFFSHORE SURVEY, ORMOND BEACH GENERATING STATION (IRC, 1972 et seq.)
- ○ CAL COFI SAMPLE STATION 83.40
- X PLANKTON STATIONS (KOLPACK AND STRAUGHAN, 1972)
- ⊖ PLANKTON STATIONS (STATE OF CALIFORNIA, 1965)
- T PLANKTON STATION (AHF, UNPUBLISHED)
- ⊗ PROPOSED PLATFORM LOCATIONS
- PROPOSED PIPELINE ROUTES
- ALTERNATIVE PIPELINE ROUTE

FIGURE 12.4-1
PROJECT REGION

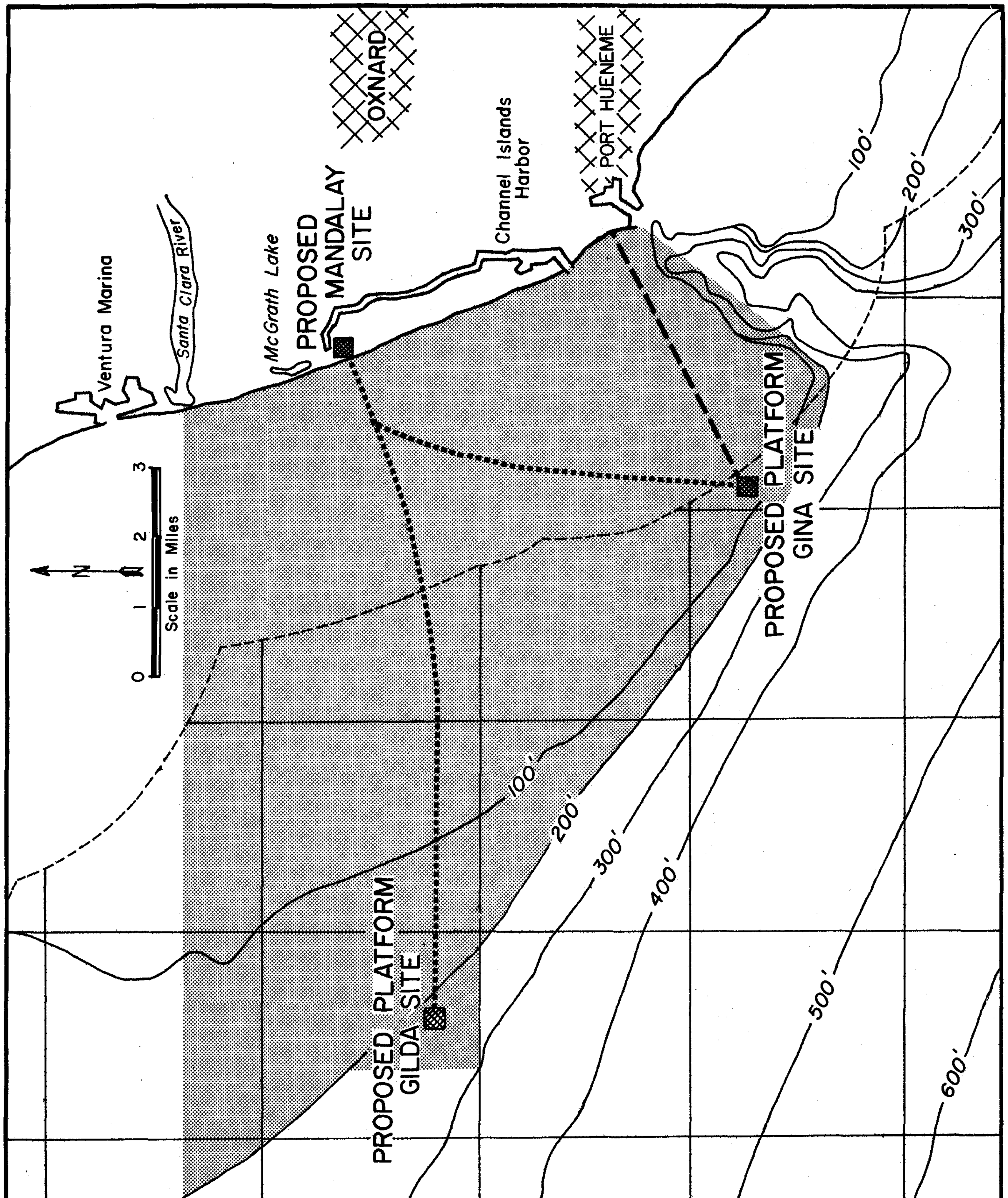


FIGURE 12.4-2

OFFSHORE PROJECT SITE

········ PROPOSED PIPELINE ROUTE
— — — ALTERNATIVE PIPELINE ROUTE

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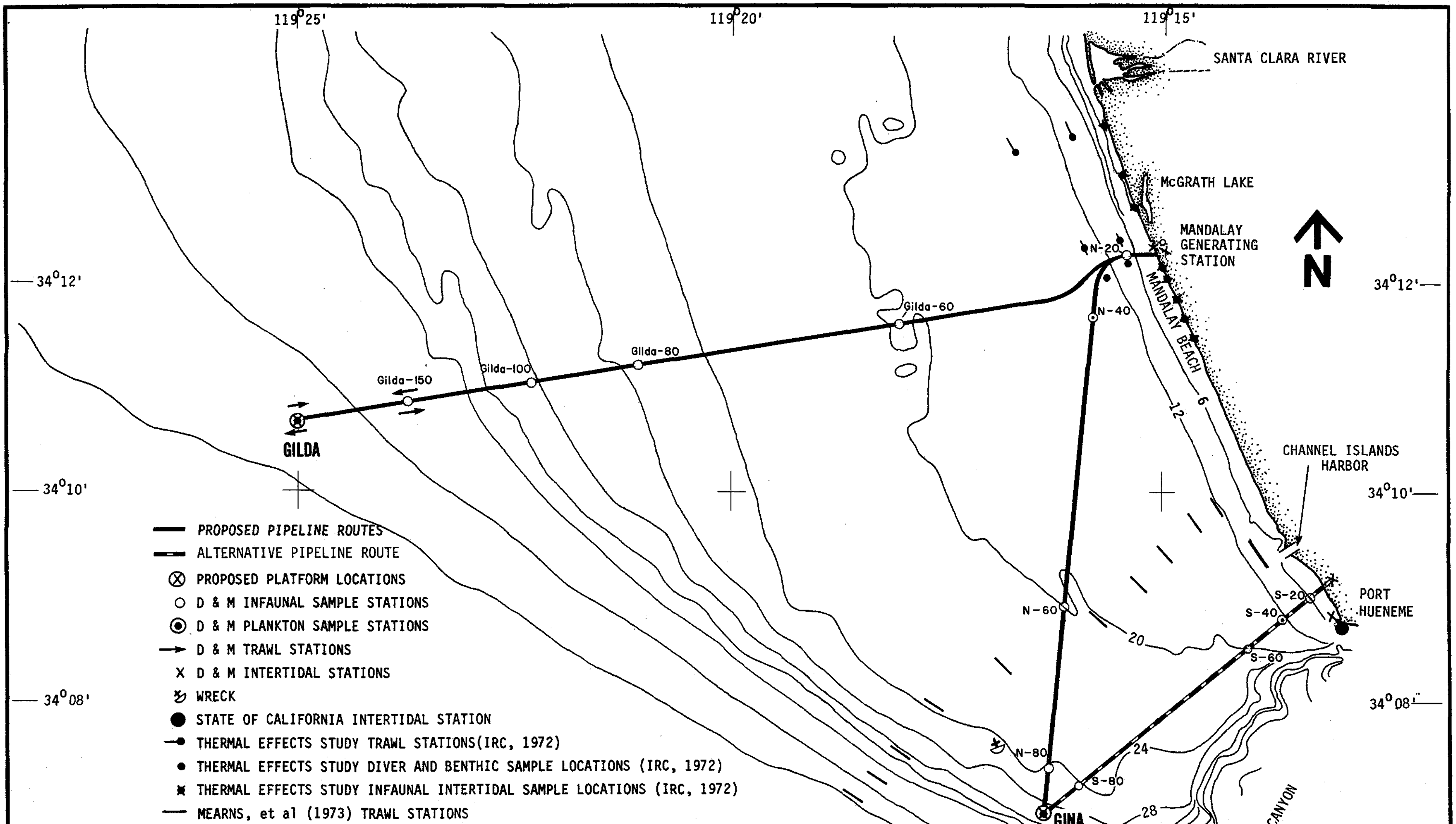

FIGURE 12.4-3
OFFSHORE PROJECT SITE SAMPLING LOCATIONS

Mandalay Generating Station (MBC, 1979); Thermal Effects Studies for Mandalay Generating Station (IRC, 1972); and trawl data gathered by Mearns et al. (1973) have been used in this regional characterization of the demersal (bottom-associated) fish. Data for these surveys were collected by otter trawls and diver observations.

Generally, the demersal ichthyofauna of the region is dominated by flatfishes, perch, and croakers. The sedimentary habitat is particularly conducive to the support of flatfishes. Speckled sanddabs and Pacific sanddabs (common names used in the discussion are in accordance with American Fisheries Society, 1970), are most abundant at depths to 300 feet (100 m). Some variation in species composition with depth, however, does occur.

Inshore (to 30 feet (10 m))

Data collected during trawling surveys southeast (downcoast) of Hueneme Canyon showed the demersal fish fauna dominated by two species of flatfishes: the speckled sanddab and hornyhead turbot. Northwest of Hueneme Canyon to the mouth of the Santa Clara River, common inshore demersal fish include white croaker, queenfish, walleye surfperch, white seaperch, and speckled sanddabs.

Mid-Depth (30 to 100 feet (10 to 30 m))

Speckled sanddabs, hornyhead turbots, California tonguefish, and English sole are the most common species at these depths within the region.

Deep Water (100 to 300 feet (30 to 100 m))

At this depth range the demersal fish assemblage is dominated by five species including Pacific sanddab, Dover sole, plainfin midshipman, pink seaperch, and shortspine combfish. This group of species characterizes the demersal ichthyofauna on both sides of Hueneme Canyon at these depths (Mearns et al., 1973). Figure 12.4-4 shows the distribution of recurrent fish groups in the region.

12.4.2.1.2 Site Characterization

In August and September 1979, Dames & Moore diver-biologists carried out visual surveys of the demersal fish populations along the two proposed and the alternate Ormond Beach pipeline routes to the 100-foot (30-m) contour and at the proposed location for Platform Gina. The deeper water portion of the pipeline to the proposed location of Platform Gilda was sampled at the 150-foot (50-m) and 200-foot (65-m) contours by duplicate 20-minute otter trawls. Figure 12.4-3 shows all of these sampling locations. The data gathered from these field surveys were used to characterize the demersal ichthyofauna of the site and, where possible, these data were compared with literature data from the site area. Table 12.4-1 lists the 39 fish taxa observed by Dames & Moore; 30 of these are considered demersal.

<u>Shore to 40 feet (15 m)</u>

Two species, the thornback ray and California lizardfish, were observed by divers at these depths. Poor visibility from 20 feet (6 m) to shore reduced the areal coverage of observations. Hook and line fishing at the 20-foot (6-m) and 45-foot (15-m) stations resulted in the collection of two additional species: white croaker and chub mackerel, the latter a pelagic species.

Literature data indicate the demersal fish assemblage at these depths within the site area is characterized by white croaker, queenfish, and white seaperch. Two of the three demersal species observed by Dames & Moore were also observed during previous otter trawl sampling in the area (IRC, 1972; Mearns et al. 1973).

<u>40 to 60 feet (15 to 20 m)</u>

Four species were observed at these depths (Table 12.4-1) along the proposed and alternative routes, with speckled and Pacific sanddabs the most commonly occurring species. Poor visibility along the common portion of the Mandalay pipeline route reduced the bottom area observed there. Trawl sampling at these depths by Mearns et al. (1973) collected 12 species, one of which (speckled sanddab) was also observed during Dames & Moore's field surveys.

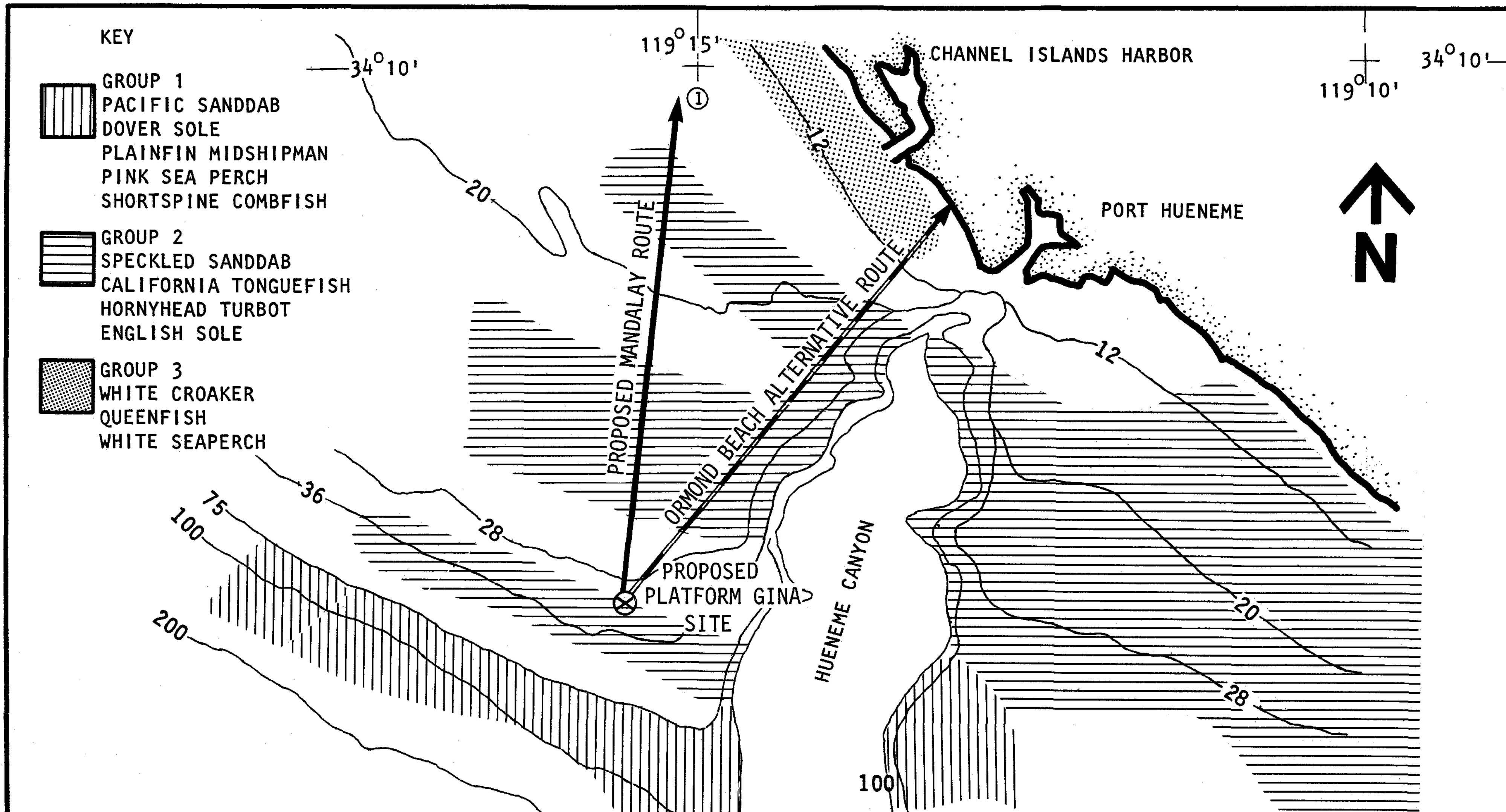

FIGURE 12.4-4

APPROXIMATE DISTRIBUTION OF RECURRENT FISH GROUPS DECEMBER 1971 AND FEBRUARY 1972

① PIPELINE AND PLATFORM GILDA SITE AREA NOT INCLUDED IN STUDY

REFERENCE: MEARNS ET AL.(1973)

0 1 2
SCALE IN NAUTICAL MILES

DEPTH IN METERS

TABLE 12.4-1

RELATIVE ABUNDANCE OF MARINE FISHES, AUGUST/SEPTEMBER 1979

Scientific Name	Common Name	Gina Ormond Beach Pipeline (South)[1] 20-40[2]	41-60	61-80	81-95	Gina Mandalay Pipeline (North) 20-40	41-60	61-80	81-95	Gina (Platform) 95	Gilda (Pipeline) 40-60[3]	61-80	81-100	Trawls[4] 150	200	Wreck 85
CHONDRICHTHYES	Sharks, Skates, Rays															
Myliobatus californica	Bat ray			P				P				P				
Platyrhinoides triseriata	Thornback skate	P														
Prionace glauca[6]	Blue shark				P									1		
Raja inornata	California skate															
Torpedo californica	Electric ray							P				P				
OSTEICHTHYES	Bony Fishes															
Acanthogobius flavimanus	Yellowfin goby														3	
Argentina sialis	Pacific argentine														3	
Chilara taylori	Spotted cusk-eel														1	
Chromis punctipinis	Blacksmith															C-A
Citharichthyes sordidus	Pacific sanddab			P						A						
Citharichthyes stigmaeus	Speckled sanddab		P										P		36	
Citharichthyes spp.[7]	Unid. Flatfishes				P		P	P	P							
Genyonemus lineatus[8]	White croaker			P	P	A										
Hippoglossina stomata	Bigmouth sole						P								1	
cf. Hyposetta guttulata	Diamond turbot												P			
Icelinus quadriseriatus	Yellowchin sculpin														40	
Ophiodon elongatus[9]	Lingcod															P
Oxylebius pictus	Painted greenling															P
Paralabrax clathratus[10]	Kelp bass															C-A
Paralabrax nebulifer[11]	Barred sandbass															P
cf. Paralichthyes californicus	California halibut			P	P		P									
Pimelometopon pulchrum	Sheephead															P
cf. Pleuronichthyes decurrens	Curlfin turbot			P												
Pleuronichthyes ritteri	Spotted turbot			P												
Pleuronichthyes verticalis	Hornyhead turbot														3	
Porichthys notatus	Plainfin midshipman														11	
Rhacochilus toxotes	Rubberlip surfperch															P
cf. Sardinops sagax caeruleus[12]	Pacific sardine															A
Scomber japonicus[13]	Chub mackerel			P-C	P	P										
Sebastes auriculatus	Brown rockfish															P
Sebastes brevispinis	Silvergray rockfish															C
Sebastes dalli	Calico rockfish														3	
Sebastes mystinus	Blue rockfish															C-A
Sebastes paucispinis	Bocaccio															P
Sebastes saxicola	Stripetail rockfish														27	
cf. Sebastes vexilaris	Whitebelly rockfish															P
Sygnathus sp.[14]	Unid. Pipefish															P
Synodus lucioceps	California lizardfish	P											P			
Zalembius rosaceus	Pink surfperch														3	

1Station locations shown on Figure 12.4-3
2Depths in feet along pipeline routes and platform locations
3Proposed pipeline routes overlap from 20 to 40 feet
4Combined total individuals for 2-20 minute trawls at each depth
5P = present C = common A = abundant
6Seen at surface
7Probably a combination of C. stigmaeus and C. sordidus
8All specimens caught on hook and line
91m in length
1050 to 75 individuals up to 1m in length
11Around base of wreck
12Large school observed approx. 20 ft below surface
13All individuals caught on hook and line, near surface
14With school of Sardinops near surface

Common and Scientific names in accordance with American Fisheries Society (1970) also observed during previous otter trawl sampling in the area (IRC, 1972; Mearns et al. 1973).

<u>40 to 60 feet (15 to 20 m)</u>

Four species were observed at these depths (Table 12.4-1) along the proposed and alternative routes, with speckled and Pacific sanddabs the most commonly occurring species. Poor visibility along the common portion of the Mandalay pipeline route reduced the bottom area observed there. Trawl sampling at these depths by Mearns et al. (1973) collected 12 species, one of which (speckled sanddab) was also observed during Dames & Moore's field surveys.

<u>60 to 80 feet (20 to 25 m)</u>

Flatfishes were the most ubiquitous taxa at these depths along all three routes. Of the eight species observed by Dames & Moore divers, five were flatfishes, including two species of sanddabs. The bat ray was also present at these depths along all three of the routes. Depressions in the sediment (up to 3 feet (1 m) deep), which are created during the feeding activities of this species, were also commonly observed. Literature data indicate that four species of flatfishes (see Figure 12.4-4) characterize the demersal ichthyofauna at these depths. One of these four species (Pacific sanddab) was observed by Dames & Moore divers.

<u>80 to 100 feet (25 to 30 m) and Platform Gina Location</u>

A total of five species was observed at these depths: all were flatfish including Pacific and speckled sanddabs except for one white croaker caught on hook and line. The proposed Platform Gina location supported a relatively abundant population of Pacific sanddabs. No other demersal fish species were observed at that site. Trawl data by Mearns et al. (1973) indicate that speckled sanddab and Pacific sanddab are the most abundant fish species (in numbers of individuals) in this depth range.

150 to 200 feet (50 to 65 m) including Platform Gilda Location

Duplicate otter trawl samples wree substituted for diver obsrevations in depths greater than 100 feet (30 m). Sampling by Dames & Moore was done at the 150-foot (50-m) and 220-foot (65-m) isobaths. Two tows were made at each depth.

A total of 131 individuals representing 12 species of demersal fishes were collected in the four trawls. The yellowchin sculpin, Pacific sanddab, and stripetail rockfish accounted for 78 percent of the total. Of the 12 species, three were flatfishes and two were rockfishes; these groups accounted for slightly over 50 percent of the total fish catch.

Literature data indicate a relatively homogeneous demersal ichthyofauna within the site area in this depth range. Mearns's data, collected from two trawls at these depths, indicate that Pacific sanddabs, plainfin midshipman, and longspine combfish are most abundant. Of the 15 species collected by Mearns at these depths, seven were collected by Dames & Moore.

Shipwreck Ichthyofauna

A sunken kelp cutter was observed in approximately 85 feet (26 m) of water, 0.75 nautical mile (1.25 km) northwest of the proposed location for Platform Gina. This shipwreck supports a fish fauna significantly different from the remainder of the site area. Dames & Moore diver-biologists made six dives to this vessel in August 1979. The 14 species of fishes observed at that location are listed in Table 12.4-1. Twleve of the 14 species were congregated around the vessel itself; the other two were in the water column above the wreck.

The most abundant species associated with the vessel were blue rockfish, blacksmith, and kelp bass. All of these species are common at artificial reefs in southern California (Turner et al. 1969). The ichthyofauna approximately 30 feet (10 m) away from the shipwreck was significantly different, with a composition similar to the sedimentary areas at this depth along the proposed and alternative pipeline routes. None of the 14 species observed at the shipwreck were observed at any location along the proposed and alternative pipeline routes or at either of the proposed platform locations.

12.4.2.2 Commercial and Sport Fisheries

California Department of Fish and Game (CDFG) has established a fish block system covering the marine waters off California. Commercial and sport fishermen (party boats) are required to complete forms issued by CDFG as to the locations, fish species and weight, or number of fish in their catch. These data are logged by CDFG and are plotted by fish block location. Each block is 10 minutes longitude by 10 minutes latitude, and catch statistics furnished by CDFG are listed by fish block number. The two platforms and associated pipeline corridors are within fish block numbers 664, 665, 682, 683, and 684 (see Figure 12.4-5).

12.4.2.2.1 Commercial Catch

Available data on the commercial catch from the five fish blocks within the region from the years 1964, 1967 and 1971 through 1975 (the latest available year) are shown in Appendix C.2, Table C.2-1. Twenty-one taxa and about 163 million pounds (74 million kg) have been recorded from the commercial catches for these fish blocks during the years mentioned. Three taxa account for 95 percent of this total catch: anchovy (86%); jack mackerel (5%); and Pacific bonito (4%). All of these species are pelagic (living within the water column as opposed to bottom-associated). Yearly data on the anchovy catch are shown in Figure 12.4-6. The southern California contribution to the total state anchovy catch averages 95 percent, ranging from approximately 95 to 355 million pounds (43 to 161 million kg) per year. The contribution of the five regional fish blocks for those years has ranged from a low of approximately 5,000 pounds (2,270 kg) in 1971 to a high of over 30,000 pounds (13,620 kg) in 1975, with a mean of approximately 12,000 pounds (5,884 kg). This represents approximately 10 percent (range 1.5 to 17 percent) of the total state anchovy catch from 1971 through 1975.

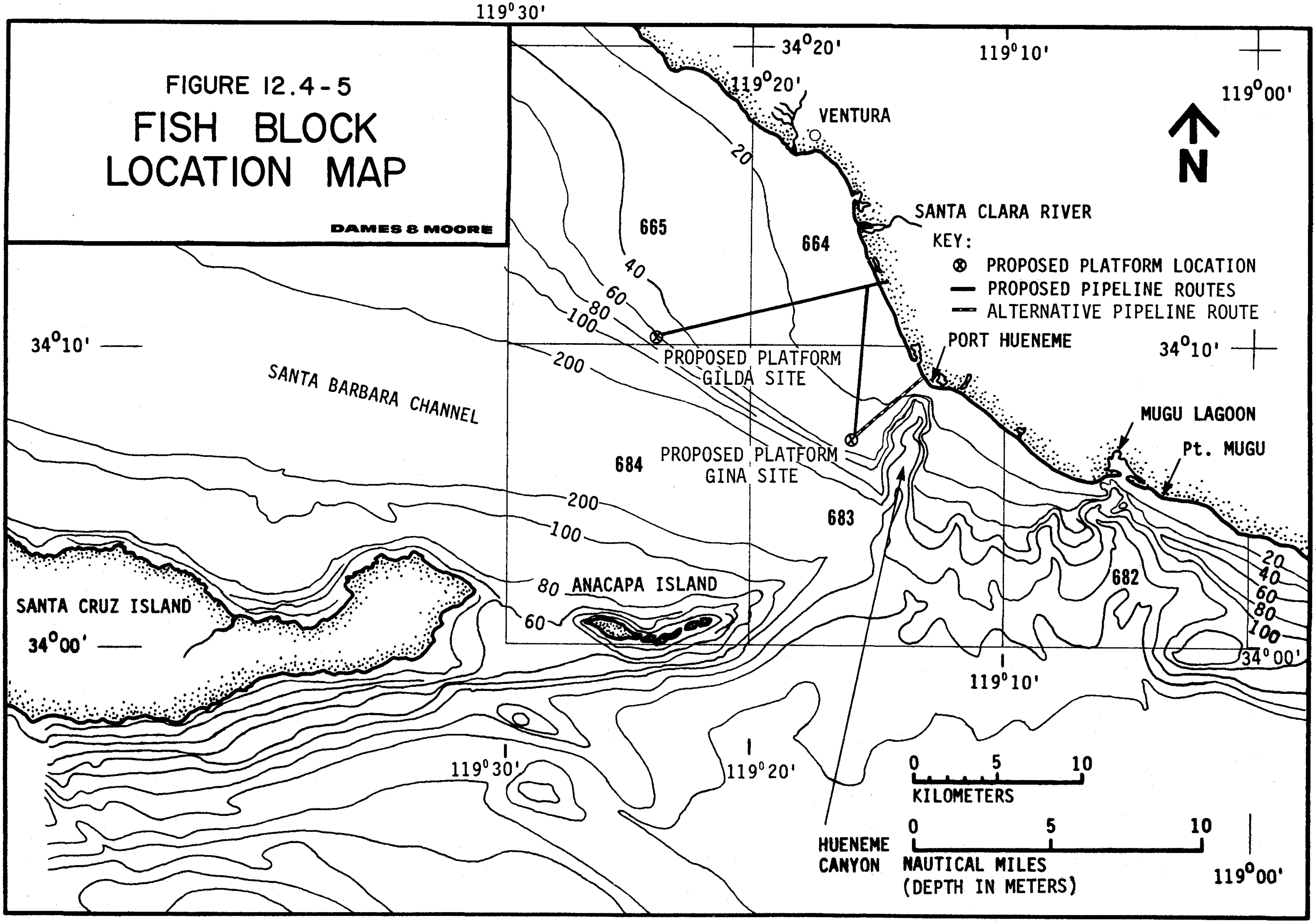

FIGURE 12.4-5
FISH BLOCK LOCATION MAP

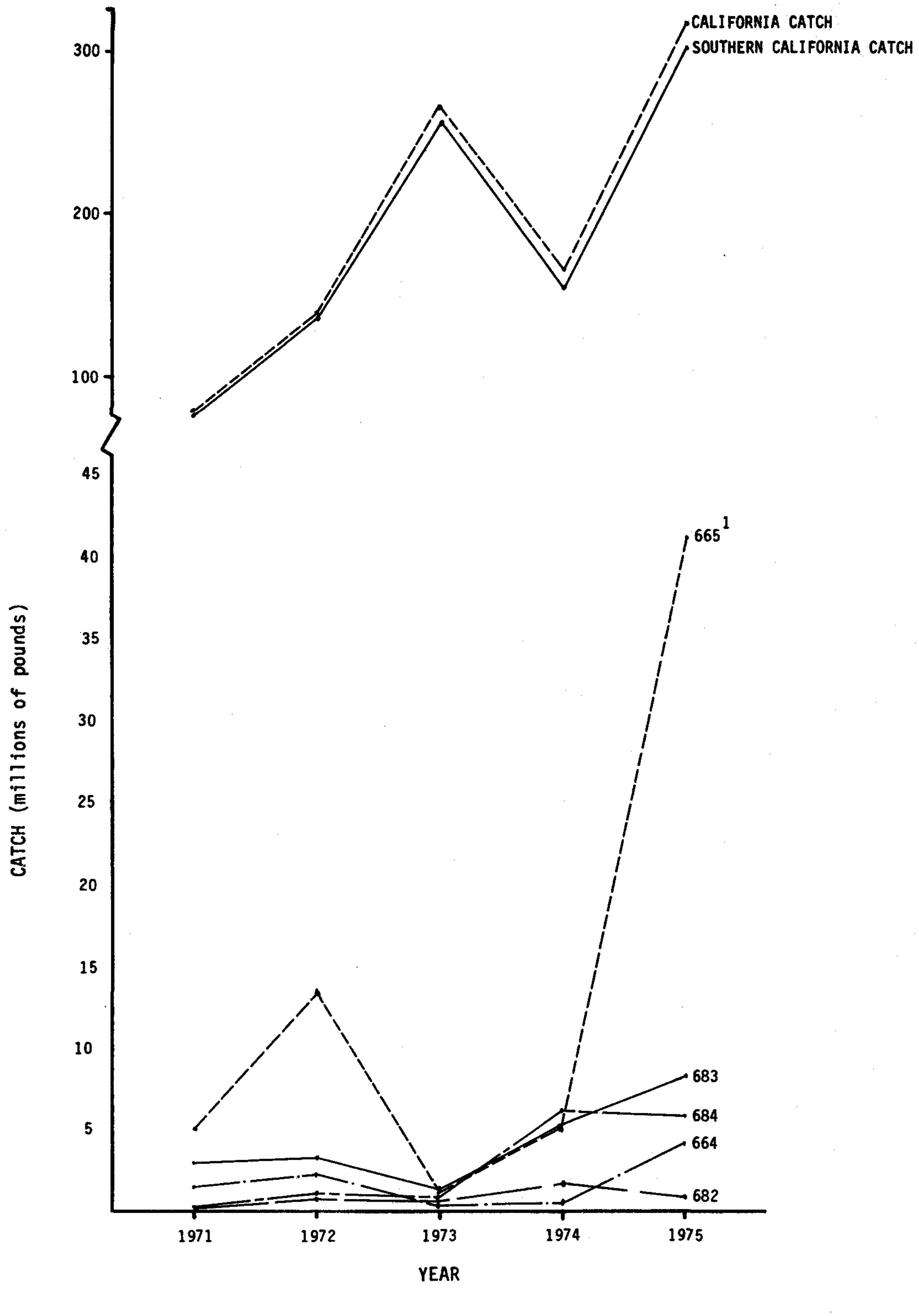

FIGURE 12.4-6

STATE AND LOCAL ANCHOVY CATCH

[1]FISH BLOCKS; LOCATIONS SHOWN ON FIGURE 12.4-5

REFERENCE: CDFG; U.S. DEPT. OF COMMERCE (1978)

DAMES & MOORE

According to Klingbeil (1979) and Wolf (1979), the most productive commerical anchovy areas in the region are between Channel Islands Harbor and Rincon Point, in depths from 60 to 190 feet (20 to 60 m); and, offshore at the edge of the Hueneme Shelf (to depths of approximately 1,300 feet (400 m)). Populations are highly variable and do not appear consistently in any particular location within the region.

12.4.2.2.2 Sport Catch

The weighted averages of sport fish caught within the five regional fish blocks are listed in Table C.2-2 in Appendix C.2. These data must be qualified when used in characterizing the region because Anacapa Island is included within one of the blocks. Species taken from that area would not generally be associated with sedimentary, low relief areas characteristic of the project site and region. Nine species characteristic of high relief areas, such as Anacapa Island, are included in the sport catch data from the regional blocks. Eliminating those species from the catch data, the most abundant species taken by sport fishermen for the years indicated are both pelagic (Pacific bonito, chub, (Pacific) mackerel), and demersal (flounders, California halibut, and white croaker).

12.4.3 Macroepifauna

12.4.3.1 Regional Characterization

Trawl surveys and diver observations completed during the following studies were the major data sources for this discussion: (1) the thermal effects of discharge waters from the Mandalay (IRC, 1972) and Ormond Beach (MBC, 1975) Generating Stations; (2) a predischarge baseline for City of Oxnard Sewage Treatment Facility (EQA/MBC, 1975); and, (3) the biota of the Hueneme Shelf, (Kolpack and Straughan, 1972; Mearns et al., 1973).

The number of macroepifaunal species within the region generally increases with increasing depth. Certain species (e.g., a sand starfish, _Astropecten verilli_, and a genus of tube building worm, _Diopatra_) show a wide depth range in which they form a major component of the macroepifauna, but most species are characteristic of relatively narrow depth ranges.

12.4.3.1.1 20 to 40 feet (6 to 12 m)

Sand dollars (Dendraster excentricus), tube building worms (Diopatra ornata), and seastars (Astropecten spp.) are the predominant macroepifaunal species within the region at these depths. The Pismo clam (Tivela stultorum) has been found in the nearshore areas off Ormond Beach. A shrimp (Crangon nigromaculata) and two species of crab (Loxorhyncus grandis and Cancer gracilis) are relatively common in the upcoast portion of the region at these depths.

12.4.3.1.2 40 to 60 feet (12 to 20 m)

The macroepifauna of this depth range is similar to that of the inshore region. Diopatra spp. and Astropecten verilli dominate the epifauna. An opossum shrimp, Neomysis kadiakensis, has also been observed and/or collected in relatively large numbers at these depths.

12.4.3.1.3 60 to 80 feet (20 to 25 m)

Relatively large numbers of geoduck clams (Panopea generosa) and salps (cf. Pyrosoma sp.) have been observed at these depths within the region. Astropecten verilli is also a characteristic species within this depth range.

12.4.3.1.4 80 to 100 feet (25 to 30 m)

Astropecten verilli is commonly observed at these depths. In addition, salps (cf. Pyrosoma sp.) are common to abundant. Sea cucumber (Parastichopus californica) and polychaete worms (Laonice conchilega) are common.

12.4.3.1.5 100 to 300 feet (30 to 100 m)

The macroepifauna of this depth range is substantially different from those of shallower areas in the region. Two species of shrimp (Sicyonia ingentis and Crangon alaskensis elongata), two species of seastars (Mediaster aequelis and Petalaster (Luidia) foliolata), a crab (Mursia guadichaudi), and an urchin (Allocentrus fragilis) were most abundant in trawls taken in this depth range. Sea cucumber (Parastichopus californica) is the only species common or abundant within this depth range which is also common in areas farther inshore. Little variation in species composition was observed within this depth range.

12.4.3.2 Site Characterization

In August and September, 1979, Dames & Moore biologists surveyed the proposed platform locations and the three pipeline routes by visual observations to depths of 100 feet (30 m) and by duplicate otter trawls at the 150- and 200-foot (50- and 65-m) isobaths along the proposed Platform Gilda pipeline route.

A similar bottom sediment pattern was observed along each of the three transects: medium, hard-packed sand with ripples up to 4 inches (10 cm) high inshore from the 20-foot (6-m) isobath grading into finer, less rippled sediments farther offshore. At depths greater than 60 feet (20 m), excavations (probably due to bat ray feeding activities) up to 3 feet (1 m) deep revealed underlying concentrations of clam shells. In addition to those excavations, numerous small sediment mounds deposited by polychaetes and clams occur on the generally smooth, gently sloping bottom.

12.4.3.2.1 Shore to 20 feet (6 m)

The macroepifauna at these depths in the site area is relatively depauperate, being dominated by three species. Tube-building worms (Diopatra spp.) and seastars (Astropecten armatus) were the most common species observed along the pipeline routes. Sand dollars (Dendraster excentricus) were not observed along the Platform Gina and Platform Gilda Mandalay pipeline route, but were locally abundant along the Ormond Beach alternative route. The bottom is characterized by medium to fine sands with ripples up to 2 inches (5 cm) high. Heavy surge and poor visibility at these depths restricted the areal extent of observations.

12.4.3.2.2 20 to 40 feet (6 to 12 m)

The number of epifaunal species at these depths is rather limited. The most characteristic taxa observed along the routes were starfish (Astropecten verilli) and tubeworms (Diopatra spp.). The augur shell, Terebra pedroana, was also commonly observed at these depths. The bottom sediments are finer and less rippled than the inshore areas.

12.4.3.2.3 40 to 60 feet (12 to 20 m)

The epifauna at this depth range is more varied than those farther inshore. Characteristic species at these depths include an augur shell (Terebra pedroana), starfish (Astropecten verilli), and colonial salps (Pyrosoma sp.). In the deeper portion of this area, other species were present although not abundant. These include cerianthid anemones, sea pens (Stylatula sp.), and tube-building worms (Diopatra spp.). Biotic patterns for all three pipeline routes are similar at these depths, however, epifaunal species are less abundant along the Platform Gilda pipeline route. The 40-foot (12-m) depth range appears to be a transition zone, supporting a mixture of species characteristic of areas farther inshore and offshore.

12.4.3.2.4 60 to 80 feet (20 to 25 m)

Five species are characteristic at these depths. They are the augur shell (Terebra pedroana), sea pens (Stylatula sp.), two species of crab (Randalia ornata and Heterocrypta occidentalis), and a seastar (Astropecten verilli). Clams and cerianthid anemones were quite common. Salps and tube worms (Diopatra spp.) were less abundant. The epifauna at this depth range is quite rich, both in number of species and number of individuals.

12.4.3.2.5 80 to 100 feet (25 to 30 m)

Cerianthid anemones, clams (exposed siphons up to 2 inches (5 cm) in diameter), and turrid shells (Megasurcula spp.) are the most characteristic epifaunal species at these depths. The number of species observed along the three pipeline routes is less than that along the 60- to 80-foot (20- to 25-m) portion. Starfish (Astropecten verilli), salps (Pyrosoma sp.), and tube worms

(Diopatra sp.) were substantially less abundant than farther inshore. Sediments from 60 to 100 feet (20 to 30 m) are fine sands and coarse silts and along the Platform Gilda route, are covered with a brown film of diatoms. The proposed location for Platform Gina (approximately 95 feet (29 m)) was surveyed by 4-replicate, 60-foot (20-m) transects. Observations indicate the epibiota of the platform location is essentially the same as that in the surrounding areas inshore to a depth of 90 feet (27 m). The most abundant epibiotal organisms include clams, cerianthid anemones, and snails (Megasurcula spp.).

12.4.3.2.6 150 and 200 feet (50 and 65 m)

Duplicate otter trawls were conducted at these depths. A total of 155 individuals, representing 13 species of invertebrates, were collected.

A shrimp (Crangon alaskensis elongatus) accounted for 40 percent of the total individuals, while a sea cucumber (Caudina sp.) and a penaeid shrimp (Scyionia ingentis) each represented 20 percent. Seventeen specimens of an octopus (Octopus californica) and five seastars (Astropecten verilli) were also collected. Of the 13 species, 4 were collected at both depths. Four species of brittle starfish (Ophiothrix spiculata, Ophiolis bakeri, Amphiodia urtica and Ophiura leutkeni) were associated with a log which was recovered during the trawling.

12.4.3.2.7 Shipwreck

The most abundant invertebrate encrusting the shipwreck is a colonial anemone (Corynactis californica). Barnacles, including Balanus pacificus, ectoprocts (Bugula sp. and Scrupocellaria sp.), hydroids, and sponges are also common. Two aggregations of seafan (Lophogorgia chilensis), numerous rock jingles (Pododesmus cepio), and two species of red alga (Polyneura latissima and Halymenia coccinea) were also observed. Although some of the species observed at the shipwreck (e.g., Pisaster brevispinis and Fabellinopsis iodinea) also occur on the sedimentary bottom, the epibiota associated with this high relief substrate reflects an assemblage significantly different from that of the surrounding area.

12.4.4 Benthic Infauna

12.4.4.1 Regional Characterization

Numerous studies on the benthic macroinfauna of the southern California mainland shelf (to a depth of 300 feet (100 m)) have been completed. Studies reviewed for this report include: thermal effects studies at Mandalay Generating Station (IRC, 1972); predischarge surveys of the City of Oxnard Sewage Discharge (MBC, 1975c and d); NPDES studies at Mandalay Generating Station (MBC, 1979); environmental impact statement for a proposed seawater effluent discharge (Dames & Moore, 1977); stations sampled during the mainland shelf (State of California, 1965), and Hueneme Shelf (Kolpack and Straughan, 1972) studies; and the BLM (1979) OCS study. The benthic infauna of Hueneme Harbor (California Department of Fish and Game, 1971) and the two submarine canyons in the area (Hartman, 1963) are discussed separately.

12.4.4.1.1 Shore to 20 feet (6 m)

Clams (Macoma inconspicua and Tellina modesta), snails (Nassarius perpinguis), and worms (Armandia bioculata, Apoprionospio pygmaea and Scoloplos armiger) are most conspicuous in samples from this depth range in the region.

12.4.4.1.2 20 to 100 feet (6 to 30 m)

Dominant taxa are polychaete worms, (Armandia bioculata and Apoprionospio pygmaea), and amphipods. Dominant infaunal species from 20 to 40 feet (6 to 12 m) include three species of polychaetes (A. bioculata, Goniada littorea, and A. pygmaea). From 45 to 60 feet (15 to 20 m), a brachiopod (Glottidia albida) and polychaete worms (A. pygmaea and Magelona sacculata) are most abundant. In the deeper areas (to about 100 feet (30 m)), an ostracod (Euphilomedes carcharodonta), an amphipod (Tricophoxus (Paraphoxus) fatigans), and polychaete worm species are most common. At least one species of clam

(*Tellina modesta*) is relatively abundant in the samples from 60 to 100 feet (20 to 30 m).

12.4.4.1.3 100 to 200 feet (30 to 65 m)

Amphipods, clams, and brittle stars are characteristic taxa within the region at these depths. Two species of amphipods (*Ampelisca* spp.), two ostracods (*Euphilomedes carcharodonta* and *E. producta*), and a brittle star (*Amphiodia urtica*) are most abundant. A clam (*Parvilucina* sp.) also appears in relatively high numbers.

This regional summary generally agrees with that of Jones (1969) (Figure 12.4-7).

12.4.4.1.4 Hueneme and Mugu Canyons

Hartman (1963) analyzed grab samples from 13 submarine canyons off southern California. She found a varied infauna consisting mostly of polychaetes, crustaceans, molluscs, and echinoderms. The largest number of species (most represented by a single or few individuals) occurred at shallow depths and where silty sand substrate was present.

Two submarine canyons exist within the project region: Hueneme Canyon approximately 2 nautical miles (4.5 km) east of the proposed Platform Gina location and 10 nautical miles (15 km) east of the proposed Platform Gilda location; and Mugu Canyon, approximately 10 and 20 nautical miles (15 and 30 km) east of the proposed Platform Gina and Gilda locations, respectively. Hartman's data from Hueneme Canyon indicate that 9 species of polychaetes and one echiuroid were most common in the silty sand samples from 300 to 600 feet (100 to 200 m). At greater depths, sea urchins, a scaphopod (tusk-shell mollusc), 2 species of clam, 5 species of polychaete worm, and an echiuroid dominated the samples. The occurrence of the polychaete worm (*Capitella capitata*) in significant numbers at about 1,500 feet (450 m) (the deepest sample station within Hueneme Canyon) indicated the area was "impoverished or nearly dead" (Hartman 1963).

Mugu Canyon was sampled at 10 stations, ranging in depth from about 350 to 2,600 feet (105 to 800 m). At the shallow depths, tube worms (Diopatra ornata) were most common. Other taxa (6 polychaetes, an anemone, and a brachiopod) were represented by only a few individuals. A different fauna, consisting almost exclusively of polychaetes, was found beyond the 500-foot (170-m) isobath. In Mugu Canyon, as in Huemene, the deepest station sample indicated that the area is impoverished.

12.4.4.1.5 Port Hueneme

As part of a predredging survey, California Department of Fish and Game (1971) made a survey of the rip-rap and sedimentary bottom within Port Hueneme. Their assessment of the existing association was that it was a "fairly healthy biota, typical to this habitat type" (California Department of Fish and Game, 1971). The species observed and their relative abundances are listed in Table C.2-3 of Appendix C.2.

12.4.4.2 Site Characterization

In August and September 1975, Dames & Moore collected replicate one-square-foot (0.1-m^2) grab samples at depths of 20, 40, 60, 80, and 100 feet (6, 12, 20, 25, and 30 m) along the proposed and alternative pipeline routes. Samples were also collected at depths of 150 and 200 feet (50 and 65 m) along the Platform Gilda route. Samples were field sieved and the retained fractions were examined by Marine Ecological Consultants, Inc. for determination of species composition and abundance.

Sediments were predominantly very fine sands, with fine sands near shore and coarse silts offshore. In general, grain size decreased and percent fines increased offshore and to the northwest.

Average number of species per sample was lowest for the inshore stations. No consistent trend in variety was apparent at depths beyond 40 feet (12 m), or between pipeline routes. Total number of species per station ranged from

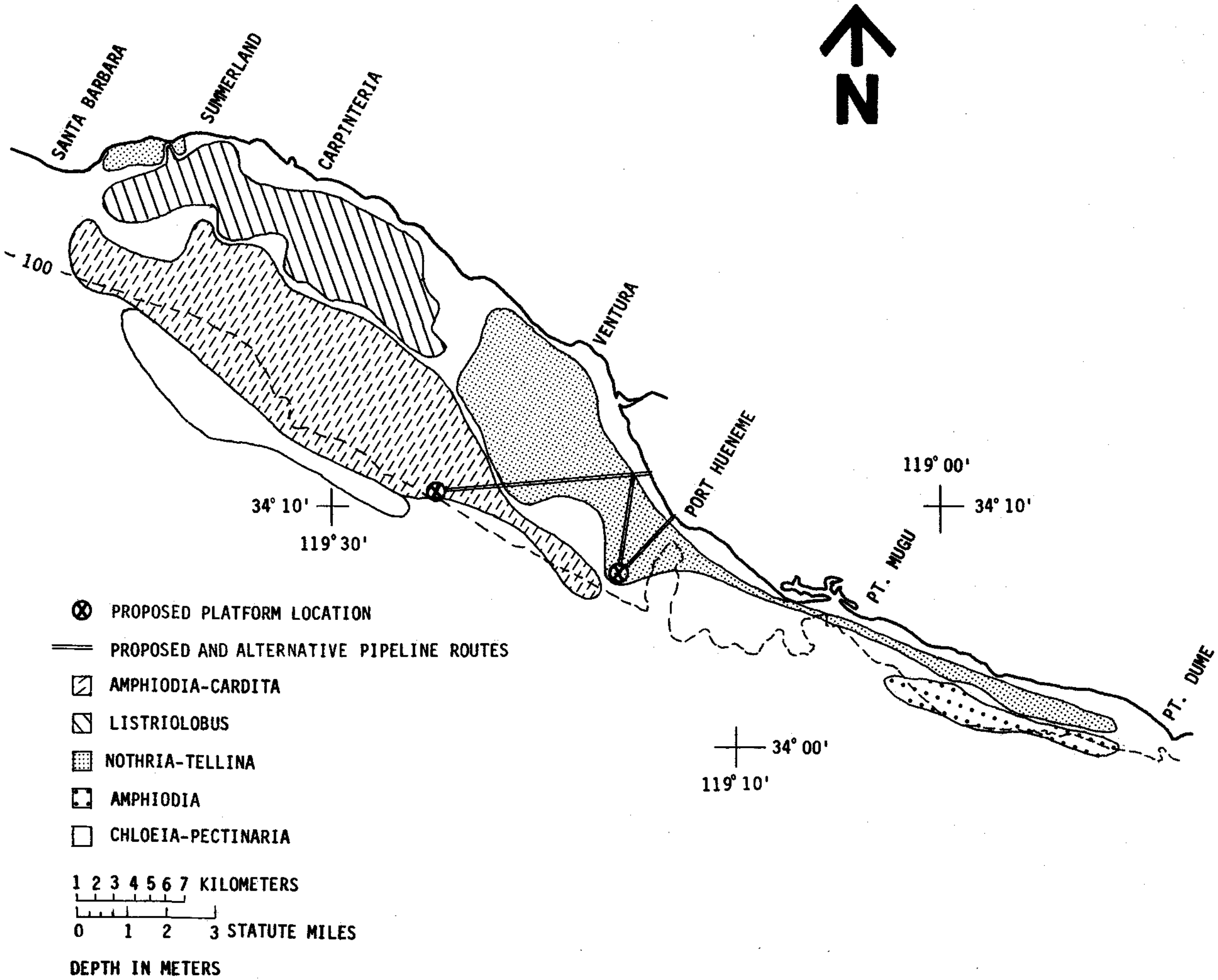

FIGURE 12.4-7

DISTRIBUTION OF MACROFAUNAL ASSOCIATIONS FROM SANTA BARBARA TO POINT DUME

REFERENCE: JONES (1969)

DAMES & MOORE

about 50 to 150; and, from 80 to 200 for each depth range. Both peaked at the 80-foot (25-m) contour.

Density of infauna ranged from 56 to 556/square foot (600 to 6,000/m^2), with the highest values at the 150- and 200-foot (50- and 65-m) stations. Density did not show any consistent pattern with depth, along shore, or with sediment parameters. The average number of individuals per species increased from about 2.5 to 3.5 inshore to 6.5 offshore and to the northwest.

Polychaete worms, clams, and amphipod crustaceans were the most abundant infaunal groups. There were more species, by a factor of 2 to 4, of polychaetes at every station than of any other infaunal group. At most stations, the density of polychaetes was equal to or greater than (typically by a factor of 2) that for clams.

The shallow stations were characterized by Owenia fusiformis and small clams (Nemocardium centifilosum) on the Mandalay route; a cumacean crustacean (Diastylopsis tenuis) and polychaete worms (Apoprionospio pygmaea) along the Ormond Beach alternative route; and, Tellina modesta, on both the Mandalay and Ormond Beach routes. Tellina modesta was common to depths of 80 feet (25 m).

Several species extend over depths between 40 and 100 feet (12 and 30 m), occasionally with distinct depth-dependent density maxima. The clam Cooperella subdiaphana has peak densities in the 40- to 60-foot (12- to 20-m) range, while the density of another common clam (Parvilucina tenuisculpta) is greatest at 100 feet (30 m). Two common polychaetes in this depth range are Axiothella rubrocincta and Spiophanes berkeleyorum. An amphipod (Amphideutopus oculatus, and an ostracod (Euphilomedes carcharodonta) are characteristic crustaceans. The latter species has its peak density at 150 feet (50 m), and is replaced beyond 200 feet (65 m) by another species of the same genus (E. producta). Depths from 150 to 200 feet (50 to 65 m) are also characterized by a tube building polychaete worm (Cistena (Pectinaria) californiensis) and a genus of long-armed brittle star, (Amphiodia).

The five most abundant species at each station are listed in Table 12.4-2. The more than 300 species identified from the survey and their abundances are listed in Appendix C.2, Tables C.2-4 through C.2-9. Based on volume displacement of settled samples and on the density data, the biomass for all stations is within the expected range of values for this region.

The general structure and composition of these infaunal assemblages corresponds to those expected based on prior studies in the region (IRC, 1972; State of California, 1965; Jones, 1969; Fauchald and Jones, 1977). Differences between this and other surveys nearby are related to the sampling methods used and to the natural variation of populations.

12.4.5 Plankton

12.4.5.1 Regional Characterization

Data on plankton for the Hueneme Shelf area are available from several sources, including: the California Cooperative Oceanic Fisheries Investigations; surveys conducted by the State of California between 1956 and 1960; surveys during 1971 and 1972 carried out by the Allan Hancock Foundation; a study carried out at the Ormond Beach Generating Station (OBGS) by Marine Biological Consultants during 1972, 1973 and 1975; and, additional studies at the OBGS in April 1976 by Dames & Moore.

The plankton community characteristic of ocean waters of the Hueneme Shelf is composed of elements associated with the California Current and with coastal water masses. The coastal area can be considered a mixing zone for waters contributed by ocean currents, coastal upwelling, and runoff of fresh water from terrestrial drainage systems. The California Current receives contributions from the subarctic Pacific, the eastern central Pacific, and equatorial Pacific water masses (McGowan, 1971).

12.4.5.1.1 Zooplankton

Extensive zooplankton studies along the California coast (southern, northern, and Baja) are conducted as part of the California Cooperative

TABLE 12.4-2

ABUNDANT SPECIES OF INFAUNA[1]

STATION S - 20[2]

Diastelopsis tenuis (46)[4]
Tellina modesta (45)
Olivella baetica (26)
Dendraster excentricus (22)
Owenia fusiformis collaris (14)

Common[3] = (2)

STATION N - 20

Nemocardium centrifilosum (601)
Owenia fusiformis collaris (171)
Tellina modesta (47)
Edotea sublittoralis (29)
Trichophoxus (Paraphoxus) epistomus (27)

Total = (8)

STATION S - 40

Lumbreneris sp. "D" (63)
Edwardsia sp. (62)
Cooperella subidiaphana (42)
Magelona sacculata (34)
Tellina modesta (31)
Tharyx sp. (31)

Common = (2)

STATION N - 40

Siliqua lucida (37)
Nothria irredescens (22)
Lumbrineris sp. "D" (13)
Lumbrineris sp. (11)
Tellina modesta (10)

Total = (8)

STATION S - 60

Euphilomedes carcharondonta (41)
Cooperella subdiaphana (29)
Erichthonius brazillenesis (29)
Edwardsia sp. (21)
Tellina modesta (20)
Pinnixa sp. (juv.) (20)
Spiophanes berkeleyorum (18)

STATION GILDA 60

Chione undatella (85)
Tellina modesta (38)
Macoma yoldiformis (35)
Chaetozone corona (30)
Cooperella subdiaphana (28)

STATION N - 60

Tellina modesta (43)
Cooperella subdiaphana (28)
Owenia fusiformis collaris (25)
Euphilomedes carcharodonta (23)
Siliqua lucida (21)

Common (3) = (2)[5]   Common (2) = (7)   Total = (12)

TABLE 12.4-2 (Concluded)

STATION S - 80

Parvilucina tenuisculpta (153)
Spiophanes berkeleyorum (106)
Axiothella rubrocincta (59)
Euphilomedes carcharodonta (29)
Acuminodeutopus heteruropus (28)

STATION GILDA (80 ft)

Parvilucina tenuisculpta (153)
Euphilomides carcharodonta (82)
Amphideutopus oculatus (67)
Tellina modesta (57)
Macoma yoldiformis (23)

STATION N - 80

Parvilucina tenuisculpta (160)
Spiophanes berkeleyorum (62)
Axiothella rubrocincta (41)
Acuminodeutopus heteruropus (23)
Amphideutopus oculatus (23)
Apoprionospio pinnata (22)

Common (3) = (1)   Common (2) = (8)   Total = (9)

Gina Platform (95 ft)

Parvilucina tenuisculpta (306)
Axiothella rubrocincta (91)
Sphiophanes berkeleyorum (77)
Euphilomedes carcharodanta (41)
Ampelisca brevisimulata (21)
Apoprionospio pinnata (21)

Gilda (100 ft)

Parvilucina tenuisculpta (232)
Euphilomedes carcharodonta (131)
Axiothella rubrocincta (60)
Amphideutopus oculatus (56)
Amphiodia spp. (juv.) (51)

Common = (3)   Total = (7)

Gilda (150 ft)

Euphilomedes carcharodonta (293)
Amphiodia spp. (juv.) (200)
Cistena (Pectinaria) californienis (164)
Amphiodia urtica (134)
Parvilucina tenuisculpta (66)

Gilda Platform (200 ft)

Euphilomedes producta (260)
Amphiodia spp. (juv.) (210)
Amphiodia urtica (152)
Bittium fetellum (70)
Euphilomedes carcharodonta (65)

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[1] Sum of 3 replicate 0.1 m^2 grabs sieved through a 1.0 mm screen.
[2] Station locations shown in Plate 3. (S = Ormond Beach pipeline route; N = Mandalay pipeline route with depths in feet)
[3] Number of species in common between (any two) pairs of stations at the same depth.
[4] Density / 0.3 m^2.
[5] Number of species in common between all three stations at 60 or 80 ft depths.

Oceanic Fisheries Investigations (CalCOFI). These monthly (approximately) investigations have been conducted since the late 1940's. The CalCOFI program has revealed that zooplankton volumes at given locality may vary by as much as an order of magnitude both seasonally and annually (Thrailkill, 1969). Plankton volumes were very large in southern CalCOFI areas between 1951 and 1956 and declined drastically between 1958 and 1959 (a period of relatively warm water along the Pacific Coast). Mean plankton volumes for 1960 were considered by Thrailkill (1969) to represent an average distribution of plankton volumes for all years CalCOFI had made plankton studies. None of the large, highly productive water pockets for that year were near the Platform Gina/Platform Gilda project region. Plankton volumes for the continental shelf area, including the area offshore from the region, generally range between 0.00017 and 0.00051 cubic inch of plankton per cubic foot of water strained (100 and 300 $cm^3/1,000\ m^3$).

Zooplankton biomass data for CalCOFI Station 83.43 (until 1974, the sampling point nearest the site) ranged from about 0.000017 to 0.0017 cubic inch per cubic foot (10 to 1,000 $cm^3/1,000\ m^3$). Copepods, thaliaceans, euphausiids, and chaetognaths generally comprise 75 percent or more of the zooplankton biomass in the CalCOFI samples during each season and over the years 1955 through 1959 (Fleminger et al., 1974).

Smith (1971) conducted an analysis and summary of CalCOFI plankton volume data for a pooled group of CalCOFI stations over a portion of the Southern California Bight oceanic waters which includes the project region. Thrailkill's (1969) data for the larger area bounded by CalCOFI cruise lines 80-107 summarized for the same period (1951-1960) are presented with Smith's data in Table C.2-10 of Appendix C.2 for comparison.

These data indicate a seasonal cycle with higher plankton abundances occurring during the spring. However, Smith (1971) has called attention to the extreme complexity and variability of the distribution of zooplankton in the California Current. Although the seasonal cycle of median volumes for pooled area 8.4 composed primarily of the waters of the gyre in the Los Angeles Bight) was well-defined with a mean of about 0.00022 cubic inch/cubic foot (130 cm^3/1,000 m^3) and an amplitude of about 0.00014 cubic inch/cubic foot (80 cm^3/1,000 m^3), he found that nearly a 1,000-fold range is possible between individual sample values in any month.

CalCOFI plankton volume data for Smith's (1971) pooled area 8.4 can be compared with pooled areas offshore and with the Pacific Ocean in general. With respect to the former, Smith (1971) reported a maximum zooplankton standing stock 80 to 120 miles (128 to 192 km) offshore from the vicinity of Port Hueneme, decreasing toward the coast as well as toward the central water mass. With respect to the Pacific as a whole, the range of median volumes for pooled area 8.4 (0.00010 to 0.00039 cubic inch/cubic foot (60 to 230 cm^3/1,000 m^3)), is small in comparison to Reid's (1962) figures for the range of variation over the entire Pacific (0.000017 to 0.0028 cubic inch/cubic foot (10 to 1,600 cm^3/1,000 m^3)). Reid selected a value of 0.000085 cubic inch/cubic foot (50 cm^3/1,000 m^3) as an average volume for calculating the total amount of plankton in the upper 500 feet (150 m) of water within the Pacific Ocean.

Fleminger (1964) summarized CalCOFI data on the most abundant group of zooplankton in the region, the calanoid copepods. Species of Calanus, Ctenocalanus, and Paracalanus were most abundant, with annual densities greater than 42 individuals/cubic foot (1,500 individuals /m^3). Similar data for other major plankton groups are summarized in Alvarino (1965), Berner (1967), Brinton (1967), and Isaacs et al. (1969). The most abundant fish larvae in the CalCOFI samples are those of northern anchovy, Pacific hake, and rockfish (Sebastes spp.).

The published CalCOFI data were used to determine macroplankton species that occur in the project region. Those species which occur between Santa Cruz Island and Ventura during any season were included and are listed in Appendix C.2, Table C.2-11. The CalCOFI Atlas series provides data on relative abundance by season. For the CalCOFI region as a whole, Fleminger (1964) reported 190 species and 65 genera of calanoid copepods. Of this total, 57 species and 30 genera occur in the project region.

Additional offshore plankton data are available for the western sector of the region (McGinnis, 1971). Four of the eleven stations occupied during this approximately one-year-long study fall within the project region. Copepods were dominant. Plankton abundances were highest in January, 1970 and lowest in September, 1969. High concentrations of thalacians (primarily Doliolum denticulatum) occurred in August, 1969.

Plankton data resulting from a short-term study in the area of Ormond Beach were reported by Kolpack and Straughan (1972). Cruises were conducted in December, 1971 and March, 1972. The most abundant species encountered belong to the groups Copepoda, Cladocera, and Larvacea (planktonic tunicates). Species collected during a study conducted in June 1975 just offshore from Ormond Beach involved (Allan Hancock Foundation; Dames & Moore, 1977) included copepods (Paracalanus parvus, Acartia tonsa, and Calanus helgolandicus), the cladoceran, Evadne nordmanni, and larvaceans.

Comprehensive data on plankton abundance and composition are available from studies carried out at the Ormond Beach Generating Station by Marine Biological Consultants (1975 a-d, 1976). Zooplankton species lists are provided in the cited references. Dames & Moore (1977) reviewed and summarized data from these studies and compared them with data from a plankton survey conducted on April 7 and 8, 1976 by Dames & Moore. Zooplanktonic organisms which were numerically dominant in both the Dames & Moore and Marine Biological Consultants studies included the copepods, Acartia tonsa, Paracalanus parvus, Calanus pacificus, Corycaeus anglicus, Oithona helgolandica, Oithona oculata; echinoderm larvae; the cladoceran, Evadne nordmanni; and the chaetognath, Sagitta euneritica. Dames & Moore (1977) reported that protozoa (mostly ciliates and radiolarians) accounted for

98 percent of the microplankton during the April, 1976 survey. These surveys were conducted in shallow water near shore; offshore plankton communities are generally of somewhat different composition.

12.4.5.1.2 Phytoplankton

Data on phytoplankton in the region exist as a result of early work by Allen (1941) and by the Allan Hancock Foundation (State of California, 1965). These studies do not provide information regarding changes in phytoplankton populations in response to seasonally variable environmental factors. Detailed studies of phytoplankton composition and dynamics were carried out in connection with investigations of the influence of the Ormond Beach Generating Station on nearshore communities (MBC, 1975b and 1976). The phytoplankton community was found to be generally typical of nearshore waters of southern California; however, several oceanic species and species with warm or cold water affinities were present. One hundred and thirty taxa of diatoms and dinwere recorded during August 1975. Diatoms accounted for 95 percent of the phytoplankton collected during late summer dominated by the genus Chaetoceros (55 percent of phytoplankton numbers). Nitzschia was the second most abundant taxon collected. Dinoflagellates contributed approximately 5 percent of the day catch and 2 percent of the night catch. Ninety-seven percent of the dinoflagellates collected were from four genera: Ceratium, Dinophysis, Prorocentrum, and Peridinium (MBC, 1975c).

The December 1975 samples yielded a total of 138 species, including 84 species of diatoms and 54 species of dinoflagellates. Diatoms constituted the greatest proportion of the phytoplankton (96.7 percent of the daytime and 98.6 percent of night samples). Chain diatoms of the genus Chaetoceros made up 54.8 and 66.1 percent of the day and night samples, respectively. C. debilis was the most abundant phytoplankter in daytime catches and was third overall in nighttime samples. The diatom Skeletonema costatum (20 percent of the total phytoplankton) was the most abundant phytoplankter in the night catches and was second in abundance in the daytime samples. The three most abundant genera of dinoflagellates were Ceratium, Peridinium, and Dinophysis. Total dinoflagellates contributed 3.3 and 1.4 percent to the day and night catches, respectively. In April 1976, the phytoplankton samples were dominated by three taxa of diatoms: Chaetoceros, Skeletonema costatum, and Coscinodiscus sp.

Data on phytoplankton standing crop and productivity for the region were reported by Marine Biological Consultants (1975b-c, 1976). They reported average chlorophyll a concentrations near OBGS during August, 1975 as 0.00000067± 0.00000017 ounce/cubic foot (0.67± 0.17 mg/m^3) for day samples and 0.00000059± 0.00000015 ounce/cubic foot (0.59± 0.15 mg/m^3) for night samples. Mean primary productivity was reported at 0.00000575± 0.00000225 ounce C/cubic foot (5.75± 2.25 mgC/m^3)/hour. For December, 1975, the chlorophyll a values averaged 0.00000768± 0.00000268 ounce/cubic foot (7.70± 2.68 mg/m^3)(day) and 0.00000539± 0.00000216 ounce/cubic foot (5.40 ± 2.16 mg/m^3)(night). December primary productivity averaged approximately 0.00000517 ounce C/cubic foot/hour (5.18 $mgC/m^3/hr$) at 6 feet (2 m) depth and 0.00000458 ounce C/cubic foot/hour (4.58 $mgC/m^3/hr$) at 20 feet (6 m) depth. In April, 1976, chlorophyll a values averaged 0.00000489 ± 0.00000140 ounce/cubic foot (4.89± 1.4 mg/m^3). Phaeopigment values averaged 0.00000080 ±0.00000060 ounce/cubic foot (0.18 ±0.6 mg/m^3).

Phytoplankton standing crop data for CalCOFI station 83.43 for 7 months in 1969 are presented in Owen and Sanchez (1974). Highest values (surface chlorophyll a, 0.00000190 ounce/cubic foot (1.90 mg/m^3)) were recorded during the month of August. In general, the component of phytoplankton smaller than 0.0008 inch (20 microns) (nannoplankton) exhibits a quantitatively more stable biomass in both offshore and nearshore euphotic zone waters of the California Current than does the component of larger phytoplankton (net phytoplankton), which varies markedly with seasonal upwelling episodes (Malone, 1971).

12.4.5.2 Site Characterization

12.4.5.2.1 Zooplankton

Zooplankton in the site area were sampled by Dames & Moore on August 1, 1979 and September 8, 1979. The August sampling entailed duplicate tows at three locations: the proposed Platform Gina location, and the 40-foot (12-m) stations along each of the Platform Gina pipeline routes (see Figure 12.4-3). The September sampling consisted of duplicate surface and oblique tows at the proposed Platform Gilda site.

Samples were quantitatively analyzed for all taxa that collectively accounted for approximately 95 percent of the biomass at any sampling location, and for all ichthyoplankton taxa. The numerical abundances for the taxa counted are given in Appendix C.2, Tables C.2-12 and C.2-13. Taxa present in the samples but not enumerated were noted and are listed in Appendix C.2, Table C.2-14.

The September samples were rich in doliolids and Oikopleura spp. Other organisms which were well represented include the cladoceran, Penilia avirostris; calanoid copepods of the genus Clausocalanus; cyclopoid copepods of the genus Corycaeus; the chaetognath, Sagitta euneritica, and anchovy (Engraulis mordax) larvae. Total zooplankton were higher in September samples (Platform Gilda) than in the August samples (Platform Gina). Total zooplankton in oblique tow samples were numerically similar at Platform Gilda and at the Mandalay 40-foot (12-m) station; however, these numbers were lower than those for the Ormond Beach alternative route 40-foot (12-m) station. Surface tows were richer in zooplankton at the Mandalay and Ormond Beach route stations than at the Platform Gilda station. Dominant species in the August samples include the copepods, Acartia tonsa, Clausocalanus spp., Paracalanus parvus, and Corycaeus anglicus; the chaetognath, Sagitta euneritica; and doliolids. The large numbers of ectoproct larvae at the Ormond Beach route 40-foot (12-m) station are probably indicative of the presence of water which has passed over shallower water close to shore, where breeding populations of ectoprocts are abundant.

In general, the zooplanktonic organisms occurring in these samples are typical representatives of coastal and nearshore oceanic water plankton communities.

12.4.5.2.2 Phytoplankton

Monthly measurements of chlorophyll a and productivity at six stations in the site area were reported by Oguri and Kanter (1971). In general, these investigators found higher productivity and productivity per unit chlorophyll (photosynthetic efficiency) inshore than offshore. They attributed this to possible nutrient enrichment of nearshore waters resulting from land runoff, mineralization in shallow waters, and sewage discharge. There data show a seasonal variability in standing crop and productivity, which is a normal feature of southern California coastal waters.

Productivity values were measured by Dames & Moore at the Platform Gina location on August 1, 1979 and at the Platform Gilda location on September 8, 1979. Values averaged 0.00000200 and 0.00000215 ounce C/cubic foot (2.00 and 2.15 mgC/m^3) per hour for August 1 and September 8, respectively. These values fall within the range of values (0.00000142 - 0.00005848 ounce C/cubic foot (1.42 - 58.48 mgC/m^3) per hour) reported by Oguri and Kanter (1971); however, they are lower than Oguri and Kanter's average August value (0.00000469 ounce C/cubic foot (4.69 mgC/m^3) per hour).

Chlorophyll a values measured by Dames & Moore averaged 0.0000021 ounce/cubic foot (2.1 mg/m^3) over the water column on August 1, 1979 (Platform Gina) and 0.0000029 ounce/cubic foot (2.9 mg/m^3) on September 8, 1979 (Platform Gilda). These values are slightly higher than average values reported by Oguri and Kanter (1971) (mean of all time periods of 0.00000133 ounce/cubic foot (1.33 mg/m^3); August mean, 0.00000145 ounce/cubic foot (1.45 mg/m^3)), and higher than values measured offshore at CalCOFI Station 83.43, as reported in 1974 by Owen and Sanchez (mean of seven time periods of 0.00000069 ounce/cubic foot (0.69 mg/ m^3); August mean of 0.00000190 ounce/cubic foot

($1.90\ mg/m^3$). In general, the values are lower than would be expected for waters closer to shore.

12.4.6 Intertidal Biota

12.4.6.1 Rocky Intertidal

12.6.4.1.1 Regional Characterization

Studies of the biota associated with rocky intertidal substrates within the region include: those conducted for OCS Lease Sale #48 (BLM, 1979); biological characterization studies for southern California (State of California, 1965); a study on the biological and physical parameters of the Hueneme Shelf (Kolpack and Straughan, 1972); and, thermal effects studies of the Mandalay Generating Station, (IRC, 1972).

Ricketts and Calvin (1966) divided the intertidal area of California into distinct zones: Zone 1--the splash zone, covered only during tides of +5.0 +7.0 feet (1.5 to 2.1 m)(in reference to mean lower low water); Zone 2--the hightide zone, covered during tides of +2.5 to +5.0 feet (0.8 to .5 m); Zone 3--the mid-tide zone exposed during tides from +2.5 to 0.0 feet (0.8 to 0.0 m); and, the lower zone (Zone 4) exposed only during negative tides. This zonation is used in the characterization discussed below.

Intertidal solid substrate within the region consists primarily of man-made jetties and piers. To the nothwest (upcoast) of the proposed Mandalay site, the discharge jetties of the Mandalay Generating Station occupy Zones 1 and 2. The other rocky areas within the region, breakwaters of Channel Islands Harbor and Port Hueneme, extend from Zone 1 through Zone 4. The Hueneme Fishing Pier (downcoast of Port Hueneme) includes vertical support pilings within the intertidal area.

Within the region, the macrobiota in Zone 1 areas is dominated by periwinkles (*Littorina* spp.), limpets (*Collisella* (=*Acmaea*) spp.), and barnacles (*Chthamalus fissus*). Small amounts of filamentous algae (e.g., *Enteromorpha* spp.) are found where standing water is present in this zone.

Zone 2 supports a greater number of taxa. The dominant invertebrates are similar to Zone 1, and include limpets and at least two genera of barnacles (Chthamalus and Balanus). Species of algae including sea lettuce (Ulva spp.) and the filamentous green algae, Enteromorpha, appear in this zone but are not abundant.

Zone 3 supports the greatest number of invertebrate taxa (Kolpack and Straughan, 1972). Numbers of algal species are also high, but reach a maximum in Zone 4. Dominant invertebrate taxa include barnacles (Chthamalus spp., Balanus spp., Pollicipes polymerus, and Tetraclita squamosa), limpets, mussels (Mytilus californianus), a tube building worm (Phragmatopoma californica), and anemones (Anthopleura spp.). Algal taxa characteristic of this zone include leafy red algae (Gigartina spp.), the feather-boa kelp (Egregia menziesii), and a branching red alga, Prionitis lanceolata.

In Zone 4, many of the true intertidal invertebrates are uncommon. The greater length of time this area is covered by water is not advantageous to those organisms adapted to the upper intertidal areas. Intertidal algae and marine flowering plants, however, reach their maximum abundance in this zone. Invertebrates characteristic of this lower zone include barnacles, some tube building worms (Phragmatopoma sp.), chitons (Mopalia spp.), seastars (Pisaster ochraceus), and anemones. Numerous species of intertidal algae are found in Zone 4. The most common for this region are the feather-boa kelp, an encrusting red algal complex (Lithophyllum-Lithothamnion), and erect coralline algae (Corallina spp. and Bossiella spp.). Surf grass (Phyllospadix spp.) is also common within this intertidal zone.

Comparing the data from rocky intertidal stations within the region to the characterization compiled for southern California by BLM (1979), it appears that the biota of the region reflects a pattern typical of the rest of southern California.

12.4.6.1.2 Site Characterization

As part of the thermal effects study, Intersea Research Corp. (IRC) surveyed the biota associated with the Mandalay Generating Station jetties. In August and November, 1972, IRC found a total of 27 taxa, of which seven were algae. A green alga (Enteromorpha sp.) was found during both surveys and two species of sea lettuce (Ulva spp.) and two species of red algae (Erythrotrichia sp. and Rhodochorton sp.) were found during one of the surveys. Two species of limpets (Collisella digitalis and C. ochracea), a periwinkle (Littorina planaxis), the bay mussel (Mytilus edulis), two species of barnacles, and the lined shorecrab (Pachygrapsus crassipes) were observed during both surveys. No notes on relative abundance were taken. IRC (1972) stated that the biota associated with these jetties is typical of a high intertidal-splash zone (Zones 1 and 2) assemblage for southern California. Data collected at the Mandalay jetty by Dames & Moore biologists indicate that the present species composition is the same as that noted by IRC in 1972.

Dames & Moore biologists observed a total of 11 taxa at the downcoast Mandalay jetty. Zone 1 is characterized by barnacles (Chthamalus fissus), limpets (Collisella digitalis), and periwinkles. Green algae (Enteromorpha sp. and unidentified species), gooseneck barnacles, and mussels are the most abundant taxa in Zone 2. Lined shore crabs and owl limpets (Lottia gigantea) were also present.

On August 10, 1979, Dames & Moore biologists surveyed the outer (northwest) breakwater at Port Hueneme and the downcoast (southeast) jetty of the Mandalay Generating Station discharge. The taxa observed during this survey are listed in Table 12.4-3. These areas are the only solid substrate areas in the intertidal zone within 1,650 feet (500 m) of the landfall points of the proposed pipelines. The Port Hueneme breakwater supports a small bed of brown algae (Egregia menziesii) in Zone 4. Zones 2 and 3 are characterized by a barnacle (Tetraclita squamosa rubescens), and the lined shore crab. Species of species limpets, the ochre seastar (Pisaster ochraceus), an anemone

TABLE 12.4-3

INTERTIDAL MACROBIOTA OBSERVED AT PORT HUENEME

NORTH BREAKWATER AND MANDALAY JETTIES, AUGUST 1979

		Mandalay	Hueneme
Algae			
Chlorophyta	Green Algae		
Enteromorpha sp.		(a)[1]	
Phaeophyta	Brown Algae		
Egregia menziesii	Feather Boa Alga		(a)
Rhodophyta	Red Algae		
Gigartina canaliculata			(c-a)
Gigartina exasperata			(p)
Gigartina leptorhyncus			(p)
Iridea flaccida			(p)
Microcladia coulteri[2]			(p)
Peysonnelia sp.			(p)
Prionitis lanceolata			(p)
Animals			
Cnidaria	Anemones, Hydroids		
Anthopleura xanthogramica	Anemone		(c)
Anthopleura cf. *elegantissima*	Anemone	(p)	
Mollusca	Clams, Mussels, Snails		
Gastropoda	Snails, Nudibranchs		
Collisella sp.	Limpet		(p)
Collisella digitalis	Limpet	(c)	(p-c)
Collisella scabra	Limpet	(p)	(p)
Littorina planaxis	Periwinkle	(p)	(p-c)
Littorina scutulata	Periwinkle	(p)	(p-c)
Lottia gigantea	Owl Limpet	(p)	(p)
Nucella (Thais) emarginata	Dogwinkle		(p)
Tegula funebralis	Black Turban Snail		(p)
Pelecypoda	Bivalves		
Mytilus edulis	Bay Mussel	(p)	
Mytilus californianus	California Mussel	(p)[4]	(p)[4]
Annelida	Segmented Worms		
Polychaeta	Bristle Worms		
Phragmatopoma californica	Tubeworm		(p-c)
Arthropoda	Joint-Legged Animals		
Cirripedia	Barnacles		
Chthamalus sp.	Barnacle	(a)[5]	(a)
Pollicipes polymerus	Gooseneck Barnacle	(a)	(c)[3]
Tetraclita squamosa rubescens	Barnacle		(a)
Decapoda			
Pachygrapsus crassipes	Lined Shorecrab	(p)	(c-a)
Echinodermata	Spiny Skined Animals		
Asteroidea	Sea Stars		
Pisaster ochraceus	Ochre Sea Star		(p)

1 Relative abundance: (a) = Abundant, (c) = Common, (p) = Present
2 Epiphyte on *G. exasperata*
3 Common only on seaward side of breakwater
4 With *Pollicipes polymerus*
5 On discharge side of east jetty

(Anthopluera xanthogrammica), and a tube building worm (Phragmatopoma californica) were also present in this zone. At the seaward side of this breakwater, the gooseneck barnacle (Pollicipes polymerus) was common. Barnacles (Chthamalus fissus) and limpets (Collisella cf. digitalis) are the most common species in Zone 1. Black turban snails (Tegula funnebralis), periwinkles, and the dogwinkle (Nucella (=Thais) emarginata) were also present.

12.4.6.2 Sandy Beach

12.4.6.2.1 Regional Characterization

As part of thermal effects studies on the Mandalay and Ormond Beach Generating Stations, predischarge and monitoring surveys of the City of Oxnard Sewage Outfall, and biological studies of the Hueneme Shelf, data on the biological characteristics of the sandy beach areas have been collected. Specific references for these studies are found in Section 12.4.3.

The beaches within the region range from those with a short, steep profile, and coarse sand to gently sloping, finer sand areas; the latter normally have a "gutter" below the low tide line running parallel to shore and holding water at the lowest tides (Kolpack and Straughan, 1972). Mean grain sizes for those sandy beaches ranged from 0.008 inch (0.204 mm) (at the midtide area of Port Hueneme Beach in a December sample) to 0.024 inch (0.601 mm) (at the upper tidal sample area of that same beach in January). Some samples contained gravel in the middle and upper tidal areas.

The general species distribution on southern California beaches is shown on Figure 12.4-8. This pattern is a compilation from samples taken thoughout southern California and on the Channel Islands. As in rocky areas, tidal level are reflected by zonation of species.

In the region, beach hoppers (Orchestoidea spp.) are the most characteristic species in the upper tidal zones, particularly where detritus (beach drift) is present. Upper-middle tidal areas are characterized by an isopod

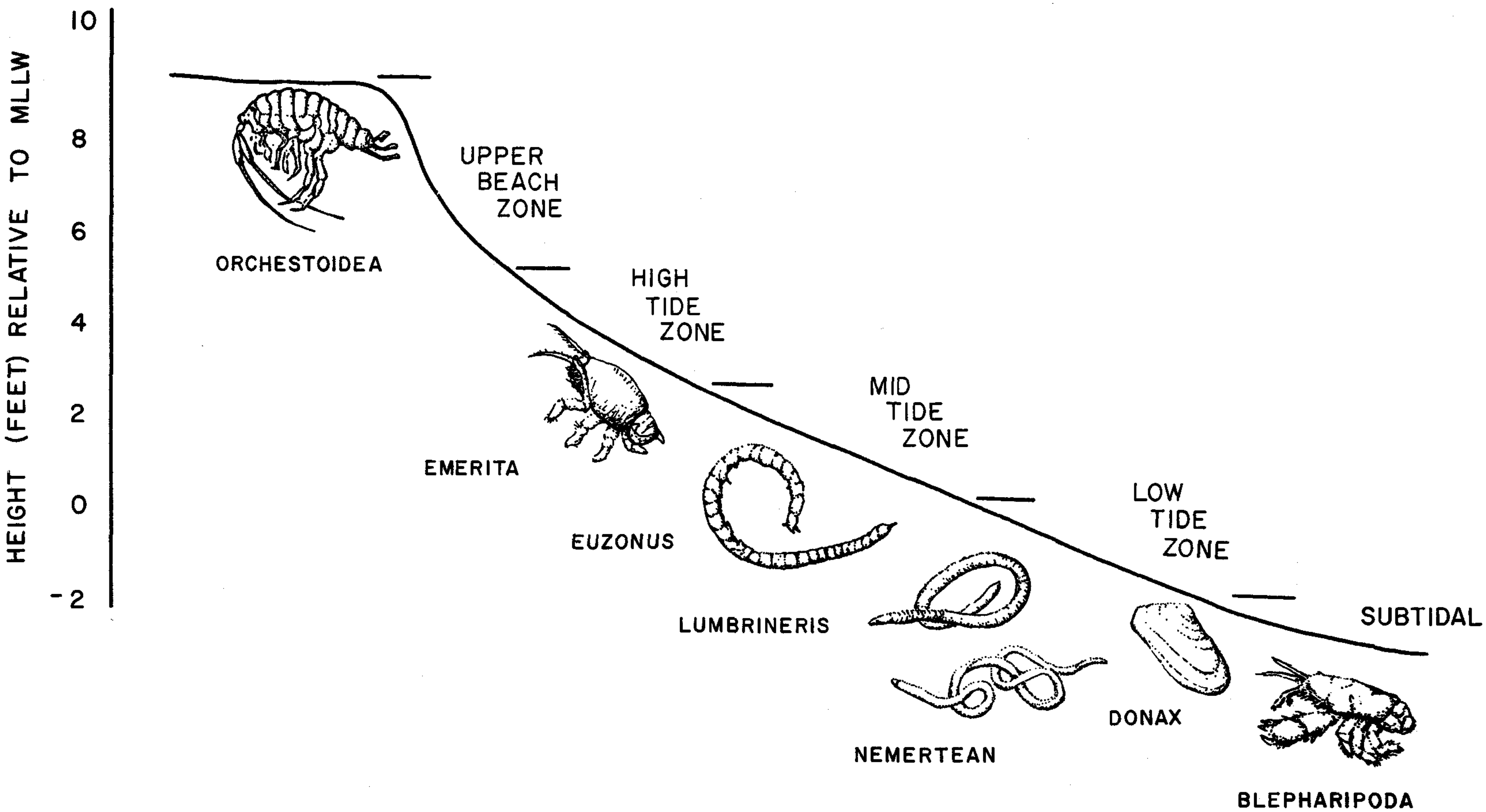


FIGURE 12.4-8

SCHEMATIC PROFILE OF A TYPICAL EXPOSED SANDY BEACH

REFERENCE: BLM(1979)

DAMES & MOORE

(Excirolana sp.) and a polychaete (Hemipodus sp.). Lower-middle tidal zone species include Excirolana that isopod and the sand crab, Emerita analoga. In lower tidal areas, the Pismo clam (Tivela stultorum) has been occasionally recorded downcoast of Hueneme Canyon. The bean clam (Donax sp.) and an amphipod (Synchelidium sp.) are typical of this low tide zone.

12.4.6.2.2 Site Characterization

On August 10, 1979 (tide: -0.6 feet (0.18 m) MLLW), a Dames & Moore field team observed and sampled two transects, one along Hollywood Beach, the other near the Mandalay Generating Station. These transect locations are shown on Figure 12.4-3.

The Hollywood Beach transect was along a steeply sloping, exposed beach consisting of medium to coarse grain sand to a depth of at least 4 inches (10 cm). Sieve analysis of the sand along the transect showed it to have mean grain size of 0.021 inch (0.53 mm) (range 0.016 to 0.028 inch (0.39 to 0.69 mm)), with the mid-tide station having the largest mean grain size. No beach drift was observed along this area.

Sampling at three tidal heights on the Hollywood Beach transect resulted in the collection of 10 sand crabs (Emerita analoga). Carapace lengths of these individuals ranged from 0.20 to 0.36 inch (5.1 to 9.1 mm) with a mean of 0.29 inch (7.2 mm). No other species were recorded from this transect. The absence of characteristic taxa (Orchestoidea spp. and Excirolana spp.) may have been related to the paucity of beach drift. No clams were taken or observed.

The Mandalay Beach transect was along a less steeply sloping, exposed beach also consisting of medium to coarse grain sand approximately 2 inches (5 cm) deep overlying a gravel base. Some beach drift, in the form of two large logs and scattered giant kelp (Macrocystis sp.), was observed upcoast of the transect.

Only one species was represented in the infaunal samples collected at the transect stations. A single sand crab (Emerita analoga) with a carapace length of 0.30 inch (7.6 mm) was collected at the mid-tide station. No Orchestoidea spp., Excirolana spp., or molluscs were collected along this transect, however, Orchestoidea spp. were observed around the beach drift east of the transect.

The gravel at the low water level along the Mandalay Beach transect and shallowness of the sand layer may have been contributing factors to the paucity of sand crabs. Patterson (1974) found that exposed beaches along southern California usually do not support a permanent upper intertidal fauna due to the lack of beach drift, and Trask (1971) stated that reduced numbers of Emerita, particularly in the winter, are due to the lack of sand. This observation was corroborated by Kolpack and Straughan (1972) and IRC (1972) for this area.

12.4.7 Marine Mammals

12.4.7.1 Regional Characterization

The most recent and comprehensive study of the relative abundance and distribution of the marine mammals within the Southern California Bight (SCB) was completed by the University of California, Santa Cruz for the Bureau of Land Management (1978). Other sources of data include a compilation of the marine mammals of California (Daugherty, 1966) and sitings of marine mammals by Dames & Moore biologists during the August and September 1979 field survey of the site.

It is difficult to characterize the project region using the BLM report, because the data are presented in terms of 10-minute longitude by 10-minute latitude "blocks". The nearshore regional area (corresponding to Fish Block Number 664) was not included in the BLM survey, and general patterns for all blocks included were interpolated from transects surveyed during different offshore of Santa Barbara (BLM, 1978). Within the project region, a density of 13 per square mile (5/km^2) has been recorded.

12.4.7.1.4 Winter Months (January through March)

Pinniped diversity within the Santa Barbara Channel is lowest during this season. Cetaceans, including gray whales, pilot whales, and common and Dall's porpoises, are relatively common in the western channel, while pinnipeds are common over the Ventura Shelf. Densities of 2.6 to 13 individuals per square mile (1 to 5 per km^2) were recorded within the region by BLM (1978) during the winter months.

12.4.7.2 Site Characterization

During the 7 days of field surveys (August and September, 1979) conducted by Dames & Moore biologists, two California sealions were observed. Both of these individuals were seen at the proposed location of Platform Gina. No marine mammals were observed on or around the beaches or breakwaters surveyed during the intertidal sampling period.

12.4.8 Rare and Endangered Species

All marine mammals and birds are protected under the Marine Mammal Protection Act and Migratory Bird Treaty Act (BLM, 1978). In addition to fully protected status, certain marine species have been placed on the rare or endangered species list by the State of California (1979). Of the six marine bird and mammal species on this list, two species of endangered marine-associated birds (California brown pelican and California least tern) occur within the region. The California gray, blue, fin, humpback, and sei whales, listed as endangered by BLM (1978) may also occur within the project region. Only the California gray whale would be expected regularly, particularly during its northerly (spring) and southerly (autumn) migrations through the Santa Barbara Channel.

12.4.9 Areas of Special Biological Significance

The State of California has designated certain coastal areas as protected environments. These areas are categorized into three specific groups: Areas of Special Biological Significance (ASBS); State Oil and Gas Sanctuaries (SOGS), and Ecological Reserves/Marine Life Refuges (OCS Task Force, 1976). ASBS's are areas "containing biological communities of such extraordinary value that no acceptable risk of change in their environments as a result of man's activities can be entertained" (OCS Task Force, 1976). SOGS's are areas extending from the mean high tide line to the 3-mile state boundary where oil development is prohibited in certain critical offshore areas. Marine life refuges and ecological reserves are areas designated by the State and the Department of Fish and Game as areas where the taking of intertidal organisms is prohibited. These areas are predominantly rocky intertidal areas along the California coastline.

No protected environments exist within the site or regional areas. The nearest protected area is an ASBS, the northwesternmost limit of which is at Laguna Point near Mugu Lagoon.

12.5 TERRESTRIAL BIOLOGY

12.5.1 Regional Overview

The project area is situated on the Oxnard Plain, much of which has been disturbed through agricultural use and urbanization. Within the region, undeveloped areas occur along the coastline north and south of the cities of Port Hueneme and Oxnard. These primarily consist of dune scrub vegetation, which occurs immediately inland of the coastline. Smaller components of coastal dune, riparian woodland, freshwater marsh, and salt marsh vegetation also occur within the region.

Undisturbed areas within the region support a variety of bird, mammal, reptile, and amphibian species. This relatively high variety results from the presence of a relatively complex mosaic of upland and coastal wetland habitats within the region. In addition, the coastline is within a portion of the Pacific flyway (California Department of Fish and Game, 1974). This adds to the variety of avian species.

12.5.2 Disturbance History

Cooper (1967) described the Oxnard Plain as an extensive coastal lowland bordered by an almost continuous dune belt. This lowland has resulted from the gradual migration of the Santa Clara River.

Comparison of United States Coast Survey Maps (1855), United States Geological Survey (USGS) topographic maps (1904, 1947, 1964, 1967), soil survey maps (1920, 1970), and recent aerial photographs (1975), indicates that the terrain and vegetation within the project area have been significantly altered by man's activities.

Early maps indicate that the project area consisted of numerous salt water lagoons, a fresh water lagoon (McGrath Lake), extensive salt marsh areas, an extensive coastal dune complex, and a riparian zone along the Santa Clara River. The coastal dune complex ranged in width from approximately

3,600 feet (1,100 m) near the Santa Clara River mouth to approximately 660 to 985 feet (200 to 300 m) in the vicinity of Port Hueneme (Cooper, 1967). Modification of the natural habitat in the project area has occurred primarily as a result of agricultural activity, urbanization, petroleum production activities, and the construction of harbors and marinas. These activities have required draining and filling of the salt water lagoons and much of the salt marsh habitat along the coastline. Elimination or modification of the coastal dune complex has also resulted from urbanization and industrialization along the coastline.

12.5.2.1 Proposed Mandalay Site and Pipeline Corridor

The proposed Mandalay site is located in the outer zone coastal dune complex. The vegetation in this area apparently has been modified by petroleum production activities associated with the West Montalvo oil field. These activities resulted in the grading of large portions of the dunes for road, pipeline, and well facilities. Within these facility locations, vegetation was periodically cleared (Conway, 1979), resulting in the establishment of a variety of native and introduced plant species. The site was also disturbed during construction of the Southern California Edison Company (SCE) Mandalay Generating Station.

Subsequent to construction of the Mandalay Generating Station, the remaining coastal dunes (including the proposed site) were stabilized by the introduction of European beachgrass, a common dune stabilizing species. Sea fig was also introduced on the flat southeastern portion of the site. Recently, the site and adjacent coastal strand have been visited by increasing numbers of fishermen, surfers, and beach enthusiasts. The site is traversed by numerous trails, and trash was noted within the site during the Dames & Moore field surveys.

The onshore pipeline corridor associated with the proposed Mandalay site traverses land historically disturbed by agricultural and petroleum production activities, industrialization, and urbanization. These activities have resulted in the elimination of much of the natural vegetation from the coastal dune areas, the Harbor Boulevard right-of-way, and the Ventura Marina area. These areas have been recolonized with a variety of native and introduced species commonly associated with disturbed areas.

12.5.2.2 East Mandalay Alternative Site and Pipeline Corridor

The East Mandalay alternative site is located within the inner zone of the coastal dune complex. Disturbance within this area has resulted primarily from petroleum production activities. Petroleum production activities resulted in terrain modification and the periodic clearing of vegetation within the oil field. These activities allowed the establishment of a variety of native and introduced species generally associated with disturbed areas.

Subsequent to the construction of the SCE Mandalay Generating Station, public access to the area was restricted. This has allowed vegetation within the site to return to a relatively natural state. Field reconnaissance indicates that recent disturbance has been limited.

The onshore pipeline corridor associated with the East Mandalay alternative site is the same as that associated with the proposed Mandalay site except for a short segment connecting the East Mandalay site with the Harbor Boulevard right-of-way. Disturbance is the same as was described for the Mandalay site pipeline corridor (Section 12.5.2.1).

12.5.2.3 Union Oil Marine Terminal Site and Pipeline Corridor

The Union Oil Marine Terminal alternative site is situated on the northern portion of the Santa Clara River delta. A coastal lagoon previously existed north of the site. Due to flooding by the Santa Clara River, land on and near the site was filled, and a number of duckponds were constructed between the Santa Clara River and the site. Industrial facilities were emplaced on this filled area. The former lagoon was developed into the Ventura Marina. Dredged material from construction of the marina was used to fill nearby low-lying areas.

The Union Oil Marine Terminal (in which the site lies) was constructed pm a portion of this filled area. The onshore pipeline corridor associated with the Union Oil Marine Terminal alternative site is the same as that for the proposed Mandalay site. Disturbance is the same as was described for the Mandalay site pipeline corridor (Section 12.5.2.1).

12.5.2.4 Ormond Beach Alternative Site and Pipeline Corridors

The Ormond Beach alternative site is located on or near the site of a former large intermittent lake which was located generally south and west of the site. Lowlands in the vicinity of this lake were filled and a drainage course leading into the lake was channelized. Subsequent to filling and channelization of the drainage course, industrial facilities were constructed on the fill material.

Recent disturbance to the site primarily has been the result of industrial use of the area. The proposed site recently was graded which eliminated vegetation present on the site. Inspection of dead plants indicated that the vegetation prior to grading consisted of native and introduced plant species generally associated with disturbed areas.

The corridor associated with the pipelines to/from proposed Platform Gina traverses areas that have been highly disturbed by urbanization, industrialization, and development of beach-oriented recreation facilities. The existing vegetation predominantly is characterized by scattered dune species and introduced ornamental and weedy species with little of the native vegetation remaining.

Disturbance associated with pipeline corridor Option A has occurred primarily as a result of urbanization activities. These activities have eliminated the native vegetation and it has been replaced with either landscape vegetation or paved surfaces. Portions of the pipeline corridor traverse coastal areas that historically have been disturbed by the filling of water lagoons and associated marshes. Recent disturbance in coastal areas has occurred primarily through urbanization and human disturbance, including beach and ORV use. These activities have resulted in the degradation or elimination of the native vegetation along and near this pipeline corridor.

Disturbance asociated with pipeline corridor Option B has occurred primarily as a result of agricultural activities. These activities have eliminated the native vegetation and it has been replaced with a variety of row and tree crops. Portions of the pipeline route that traverse coastal areas historically have been disturbed by filling of coastal salt water lagoons and associated marshes. Recent disturbances in the coastal areas along Harbor Boulevard have been described in Section 12.5.2.1.

12.5.3 Terrestrial Flora

12.5.3.1 Project Area

The species forming the terrestrial flora of the project area have been assigned to eight vegetation types based on species composition and environmental parameters. These types are foredune, dune scrub, salt marsh, fresh water marsh, riparian, ruderal, agricultural, and urban. Five of these vegetation types (foredune, dune scrub, salt marsh, fresh water marsh, and riparian) represent native vegetation units, while three (ruderal, agricultural, and urban) are a direct result of human activity. The distribution of these types is shown on Figure 12.5-1, and the species composition of each of the native types is shown in Table C.3-1 (Appendix C.3).

The primary factors controlling the species composition and distribution of the eight vegetation types within the project area include history (including human disturbance), geologic substrate, microtopography, and microclimate. The relationships of these factors to the different vegetation types are discussed below along with the species composition and distribution of each type.

12.5.3.1.1 Foredune

Along sandy beaches, this vegetation type is the first terrestrial plant community above the high tide line and is characterized by an environment of non-stabilized sand, direct winds, high soil and atmospheric salt contents, and low nutrient levels. It is characterized by low-growing succulent plants capable of existing in the shoreline environment.

Foredune vegetation within the project area formerly consisted of saltbush and verbena hillocks (Cooper, 1967). The present composition is somewhat different. Between the Mandalay Generating Station and the Ventura Marina, it generally is dominated by silver beachweed, sand verbena, and beach morning-glory. These plants form low mats that stabilize hummocks of sand. From the northern boundary of the Mandalay Generating Station south to Fifth Street, the foredune vegetation is dominated by European beachgrass, an introduced species, with a corresponding decrease in the native species listed above. The beachgrass was apparently planted subsequent to construction of the Mandalay Generating Station to serve as a dune stabilizer.

At Ormond Beach, the flat portion of the beach is devoid of terrestrial plants. Landward, small scattered dunes are covered primarily by silver beachweed and sea rocket. Beyond these scattered hummocks is a more or less continuous series of dunes which support silver beachweed, beach primrose, sea rocket, beach morning glory, sand verbena, and saltbush.

12.5.3.1.2 Dune Scrub

Dune scrub vegetation is located inland of the foredune type and is characteristic of areas where the sand is relatively stabilized. In these areas, there generally is less wind and salt spray aerosol, as well as more organic matter and nutrients in the soil. The inland boundary of this vegetation type generally corresponds to the inland limit of the coastal dune field.

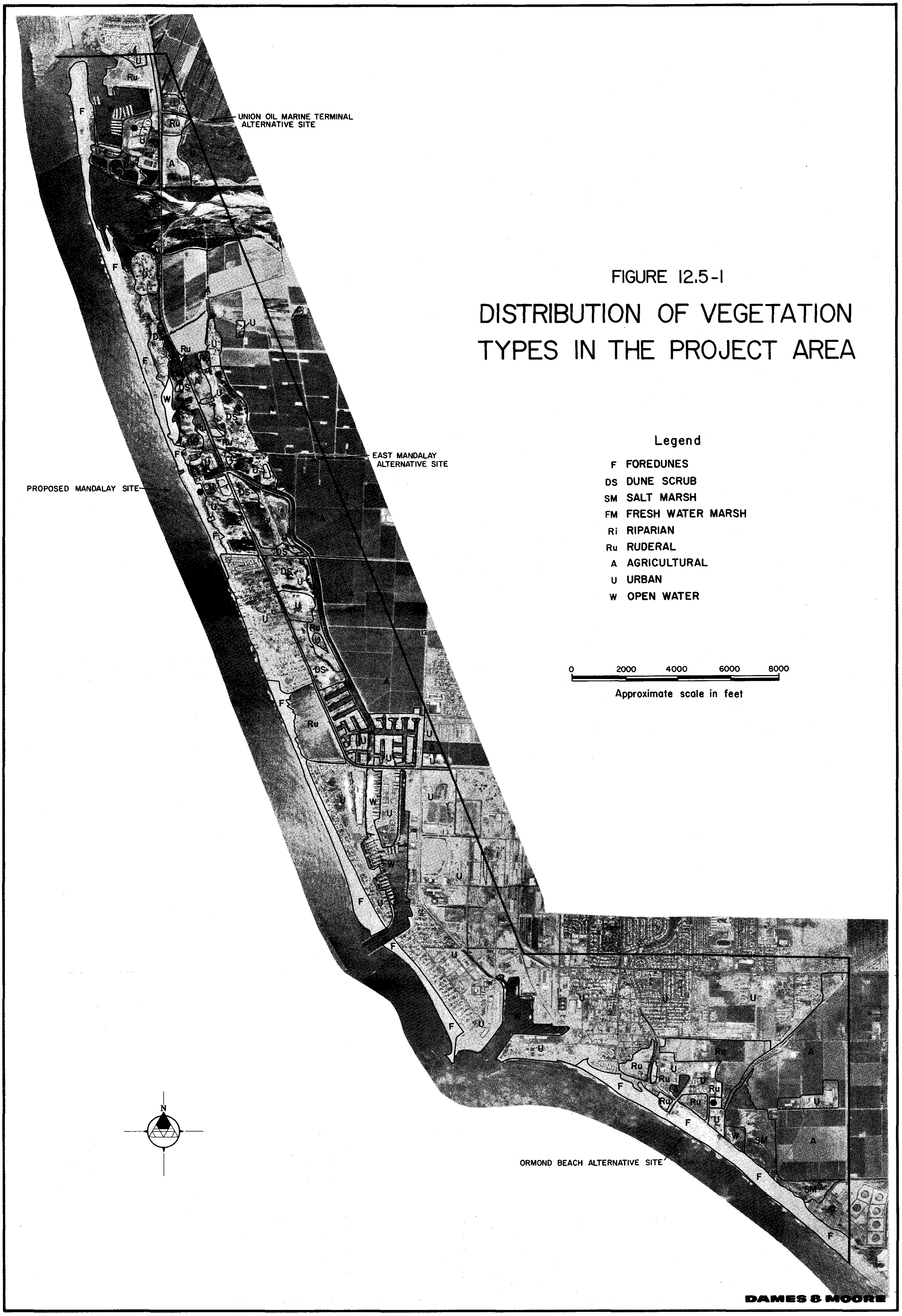


FIGURE 12.5-1

DISTRIBUTION OF VEGETATION TYPES IN THE PROJECT AREA

Much of the dune scrub vegetation within the project area has been disturbed by petroleum production and other activities. However, small areas of this vegetation type have remained relatively undisturbed. Within the project area, dune scrub vegetation is characterized by a variety of native and introduced species including yellow willow, mock heather, cudweed-aster, sea cliff buckwheat, coyote brush, telegraph weed, and European beachgrass.

Relatively undisturbed dune scrub vegetation in the project area generally is similar to backdune vegetation described by Barbour and Major (1977). The percent cover of the vegetation is high, with scattered shrubs and a cover of annual and perennial forbs and grasses. Yellow willows occur occasionally, either as individuals or in stands up to about 15 feet (5 m) tall, and generally indicate a high water table.

Disturbed dune scrub vegetation contains a greater number of weedy species than the vegetation in relatively undisturbed areas. These species include sea fig, telegraph weed, white sweet clover, red brome, and mustard. Disturbed dune scrub vegetation is characterized by a less dense cover of perennial and annual forbs and grasses. Shrubs are more widely spaced and generally occur as individuals or in smaller stands.

12.5.3.1.3 Salt Marsh

This vegetation type is restricted to the upper tidal zone of protected shallow bays, estuaries, and coastal lagoons (Barbour and Major, 1977). Salt marshes are characterized by poorly drained soils and high salt concentrations. Tidal influences are important, especially in determining distributions of individual species.

Within the project area, two salt marsh areas are present. One is located south of the Santa Clara River mouth in McGrath Beach State Park and the other is located northwest of the Ormond Beach Generating Station. The salt marsh south of the Santa Clara River mouth consists of approximately 10 to 20 acres (4 to 8 ha) (California Department of Parks and Recreation (CDPR), 1979; Massey, 1977). The vegetation is dominated by alkali weed, frankenia, saltbush, and pickleweed. In addition, this area also contains a variety of other salt-tolerant shrub and herbaceous plant species.

In the vicinity of the Ormond Beach Generating Station a degraded salt marsh is present. This marsh area has been disturbed, primarily by bulldozing and ORV use, and contains a number of weedy plant species in addition to native salt marsh species.

12.5.3.1.4 Fresh Water Marsh

This vegetation type is found in areas with a high water table. The water is generally fresh; however, it may be somewhat brackish and still support this vegetation type. Within the project area, fresh water marsh vegetation is present along the eastern, northern, and southern edges of McGrath Lake. The western boundary of the lake is characterized by foredune vegetation.

In the vicinity of McGrath Lake, the fresh water marsh vegetation is composed of up to three zones. The first zone is characterized by tall, dense stands of grass-like plants within and along the edge of the lake. Common bulrush and giant reed are the dominant species in this zone. Inland from this zone, standing water may be present. Characteristic species of this zone include cinquefoil, yerba mansa, marsh fleabane, saltgrass, water smartweed, and other low-growing perennial herbs. Inland of this zone, the vegetation may grade into stands of yellow willow, poison oak, evening primrose, and curly dock. Standing water generally is not present within this zone. However, there is generally a high water table.

12.5.3.1.5 Riparian

Riparian vegetation consists of trees and their associated understory found along streams. Within the project area, extensive stands of this vegetation type are located along the Santa Clara River. Riparian vegetation associated with the Santa Clara River can be subdivided into two types. The first type is a true riparian vegetation consisting of willow and poplar species with their associated understory, while the second type may be termed riverbed riparian vegetation. The latter type includes characteristic riparian species as well as fresh water marsh and ruderal species. This is due to the nature of flow in the river. During much of the year, there is very little flow which results in the riverbed being made up of several braided channels separated by interchannel bars. In addition, a lagoon often forms at the mouth of the river. In localized areas, these factors produce conditions which are suitable for the establishment of fresh water marsh species (standing fresh or brackish water) or ruderal species (frequent flood or human disturbance) in addition to the common riparian components of the vegetation.

Within the project area, true riparian vegetation consists of trees, including yellow willow and black cottonwood. Associated with these trees is an understory of shrubs and annual and perennial herbs. Representative shrub species include poison oak, mule fat, coyote brush, and black sage. Representative herbaceous species include mugwort, California blackberry, ricegrass, and white sweet clover. Riverbed riparian vegetation occurs at various locations in or near the Santa Clara River mouth. In addition to the true riparian species listed above, there is an associated component of fresh water marsh and ruderal species. These species include hard-stemmed bulrush, three-square, rushes, brass buttons, cattails, speedwell, water cress, duckweed, celery, reed grass, fennel, and white sweet clover.

12.5.3.1.6 Ruderal

This vegetation type can be found wherever disturbance has created open habitat. The disturbance can be of natural origin (e.g., landslide, flood), but is more often a result of human activity. Ruderal vegetation is characterized by a high proportion of weedy species. It occurs at various locations throughout the project area, including fallow agricultural fields and areas of heavy ORV use, petroleum production activities, or other human activities. Characteristic members belong to a variety of native and introduced plant including telegraph weed, white sweet clover, Russian thistle, tree tobacco, fennel, black mustard, and brome grasses.

12.5.3.1.7 Agricultural

Within the project area, a variety of agricultural crops are raised. Areas nearest the coast generally are planted with vegetable crops, including lima beans, cabbage, cauliflower, and broccoli. Further inland, crops favoring a drier climate are more prevalent (Dipping, 1979). These include row crops, such as tomatoes and strawberries, and tree crops, such as lemons, oranges, and walnuts. Sod is also cultivated in a number of locations.

Within the project area, some double and triple cropping is practiced. This may result in a continuation of production of one crop, or a rotation of different crops (Dipping, 1979).

12.5.3.1.8 Urban

Urban areas have been defined as those generally associated with constant human activity (e.g. residential developments, industrial areas, and parkland). Within the project area, urban vegetation generally consists of a large variety of cultivated ornamental plants and weedy species.

12.5.3.2 Proposed Mandalay Site and Pipeline Corridor

The majority of the proposed Mandalay site lies in an area of foredunes and is characterized by numerous small dunes. The southeastern portion of the site is located in an area of dune scrub vegetation and relatively flat topography. Foredune areas within the proposed site are dominated by European beachgrass, an introduced species commonly used as a dune stabilizer. Small numbers of native foredune species are also present, including silver beachweed and beach primrose. Dune scrub vegetation on the site is dominated by sea fig, an introduced dune stabilizer. Other dune scrub species include sea-cliff buckwheat, spiny rush, telegraph weed, and coyote brush.

The onshore pipeline corridor associated with the proposed Mandalay site traverses areas of foredune, dune scrub, ruderal, and urban vegetation types. Most of the areas crossed have been highly disturbed by human activity (see Section 12.5.2.1).

12.5.3.3 East Mandalay Alternative Site and Pipeline Corridor

This site is located in hummocky terrain characterized by dune scrub vegetation. Characteristic species associated with this site include yellow willow, mock heather, sea-cliff buckwheat, cud-weed aster, poison oak, and croton.

The onshore pipeline corridor associated with the East Mandalay alternative site is the same as that for the proposed Mandalay site except for a short segment connecting the site with the Harbor Boulevard right-of-way. Vegetation along this route is described in Section 12.5.3.2.

12.5.3.4 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

The Union Oil Marine Terminal alternative site is located in an asphalt-covered area generally devoid of vegetation. However, weedy species, including red brome, bermuda grass, and telegraph weed, occur in the vicinity of the site.

The onshore pipeline corridor associated with this site is the same as that for the proposed Mandalay site (see Section 12.5.3.2). However, because of the necessity to emplace pipelines in the bed of the Santa Clara River, riparian vegetation also would be affected.

12.5.3.5 Ormond Beach Alternative Site and Pipeline Corridors

This site is located in flat terrain and generally is devoid of vegetation because of recent grading. However, should this site be allowed to revegetate, it is expected that the resulting vegetation would be characterized as ruderal, consisting of a variety of native and introduced species generally associated with disturbed areas. Characteristic plant species could include Russian thistle, saltbush, telegraph weed, and a variety of introduced annual grasses.

The onshore corridor containing the pipelines to/from proposed Platform Gina could cross areas of foredune, ruderal, and urban vegetation types.

Pipeline corridor Option A would traverse primarily areas of ruderal and urban vegetation. However, smaller areas of dune scrub vegetation also would be traversed.

Pipeline corridor Option B would traverse primarily areas of ruderal, urban, and agricultural vegetation types. In addition, small areas of dune scrub vegetation also would be traversed.

12.5.4 Terrestrial Fauna

12.5.4.1 Project Area

The amphibians, reptiles, birds, and mammals observed or expected to occur within the project area are listed in Tables C.3-2 through C.3-4 (Appendix C.3). Investigative procedures are also described in Appendix C.3.

The vegetation types described in Section 12.5.3.1 (plus the category "Ocean") can be considered as animal habitat types, and will be used as a basis to discuss the occurrence of animals within the project area. In the course of their activities, animals actually or potentially move within and between the various habitat types. Therefore, most species are not regularly confined to one particular habitat, but the habitat types provide a useful framework within which to describe vertebrate faunal activity in the area.

12.5.4.1.1 Ocean

The Santa Barbara Channel area contains a varied and abundant marine bird fauna. This richness in numbers and species diversity is principally due to the presence of the Channel Islands (which provide breeding habitat for nine of the 12 seabird species that nest in the Southern California Bight area) and the Channel's position within a portion of the Pacific flyway.

A recent study of the Southern California Bight marine avifauna was conducted for the BLM (1978) by investigators from the University of California. Data gathered during this study indicate that over 60 species of seabirds occur within the Souther California Bight including nesting species, year-round visitors, summer visitors, winter visitors, transients, and strays. Because of their high mobility and migratory behavior, all of these species probably occur at least occasionally in the Santa Barbara Channel area.

Species expected to commonly occur in the Channel area include: Brandt's cormorant, western gull, and the endangered brown pelican (nesting species); California and ring-necked gulls (year-round visitors); pink-footed and sooty shearwaters (summer visitors); and, Arctic and red-throated loons, western and eared grebes, and surf scoters (winter visitors).

12.5.4.1.2 Foredune

The flat beach portion of this vegetation type provides suitable habitat for a variety of resident, migrant, and wintering bird species. Birds that commonly may utilize this area for resting and foraging include pelicans, gulls, terns, and sandpipers. Only a few bird species are expected to utilize the flat beach portion of this habitat type for nesting. These include the snowy plover, killdeer, and the endangered California least tern. Other bird species that may forage in this area throughout the year, but nest elsewhere within the project area, include the Brewer's blackbird and water pipit.

Few mammal species regularly utilize the flat beach portion of this habitat type. However, several larger mammals occasionally may forage in this area. These include the coyote, grey fox, raccoon and skunk. Reptile species that may utilize this area include the side-blotched lizard and California legless lizard. No amphibians are expected to utilize this area.

The dune portion of this vegetation type supports relatively few animal species due to the lack of food and cover. Resident, migrant, and wintering shore birds may utilize this habitat for resting, and the snowy plover, killdeer, and endangered California least tern may utilize this habitat for nesting. A variety of raptors and passerine birds that nest in other portions of the project area also may occasionally utilize this habitat for feeding and resting.

Mammals, reptiles, and amphibians that utilize the dune habitat are expected generally to be similar to those previously described for the flat beach portion of this habitat type. However, there may be a higher density of these species due to the larger amount of vegetation present.

12.5.4.1.3 Dune Scrub

Dune scrub habitat consists of a fairly dense cover of low shrubs, and perennial and annual grasses and forbs. Therefore, this habitat type provides a relatively high degree of cover and food for a variety of animal species. An abundant rodent population is present in this habitat type (as evidenced by numerous burrows) and is expected to include the harvest mouse, deer mouse, Beechey ground squirrel, Virginia opossum, and pocket mouse. Larger mammals that potentially may utilize this habitat include the Audubon's cottontail, brush rabbit, coyote, grey fox, and striped skunk.

Due to the presence of vegetation and the relatively high density of small mammals, dune scrub vegetation supports a varied and abundant avifauna. Resident species likely to nest in this habitat include the wrentit, brown towhee, rufous-sided towhee, Bewick's wren, and California quail. Raptors, including the red-tailed hawk, American kestrel, sharp-shinned hawk and white-tailed kite, are also expected to utilize this habitat for foraging.

Species of reptiles expected to occur in this habitat include the gopher snake, western fence lizard, Pacific rattlesnake, California legless lizard, and side-blotched lizard. The only amphibian expected to utilize this habitat type is the California slender salamander.

12.5.4.1.4 Salt Marsh

Salt marsh provides habitat for only a few resident bird species. These species include the endangered Belding's savannah sparrow and endangered light-footed clapper rail. However, this habitat is utilized by a large variety of migrant and wintering birds, including herons, egrets, a variety of shorebirds, and ducks. These species are expected to occur most commonly during the fall, winter, and spring months (October through May) when standing water is present (Small, 1974). Other bird species that occasionally may utilize this habitat for feeding and resting include the house finch, western meadowlark, and marsh hawk.

Few mammals reside in this habitat. Representative resident species include the western harvest mouse, California meadow mouse, and ornate shrew. Other mammal species expected to occur occasionally in this habitat include the striped skunk, opossum, Norway and black rats, and raccoon.

No amphibians are expected to occur in this habitat due to the high salinity. Reptiles, including the Pacific rattlesnake, may be present in drier areas of this habitat.

12.5.4.1.5 Fresh Water Marsh

Due to the variety and density of vegetation associated with the fresh water marsh and the abundant food present, a large number of avian species show exclusive adherence to this habitat (Small, 1974). Resident bird species that may nest in this habitat include the common yellowthroat, red-winged blackbird, yellow-headed blackbird, long-billed marsh wren, black phoebe, and song sparrow. In addition, a large number of migrant and wintering bird species are expected to utilize this habitat for feeding and resting. These species include grebes, herons, egrets, bitterns, a variety of ducks, and warblers. Raptors, including the marsh hawk and white-tailed kite, also utilize this habitat for foraging and resting.

Mammals expected to occur in the fresh water marsh habitat include the raccoon, muskrat, and the California meadow mouse. Other foraging species may include the striped skunk, ornate shrew, and long-tailed weasel.

Amphibians expected to occur in this habitat include the red-legged frog, Pacific tree frog, and bullfrog. Reptiles likely to be present in this habitat include two species of garter snake, western pond turtle, and gopher snake.

12.5.4.1.6 Riparian

Riparian vegetation occurs in the vicinity of the Santa Clara River and includes willow thickets, with their associated understory and marshy riverbed vegetation in areas of open or slow-moving water. The variety of this vegetation in association with the open water at the mouth of the river provides a degree of cover and food not common in the region. Thus, the riparian vegetation associated with the Santa Clara River probably supports the greatest number of avian, mammal, reptile, and amphibian species in the project area. The U.S. Fish and Wildlife Service (USFWS) has designated this area to be one of the most important shore and wading bird habitats in Ventura County, and one of the most attractive bird watching areas along the southern California coastline (VCERA, Planning Division, 1979).

Willow thickets attract a variety of resident, wintering, and migrant bird species. Migrant and wintering species, including small passerines (e.g., warblers, kinglets, vireos, and sparrows), may utilize this habitat. Resident nesting birds, as well as summer-only nesting visitors, include a variety of warblers, Hutton's vireo, plain titmouse, common bushtit, several fly-catcher species, woodpeckers, and hummingbids. Accipiters, kites, and owls may forage and nest in this habitat.

Avian species associated with the marshy portions of the riparian vegetation are expected generally to be similar to those previously discussed. However, fewer nesting birds and greater numbers of migrating and wintering shorebirds are expected due to the variable inundation of the area and its proximity to the ocean and open fresh or brackish water. Migrating and wintering species are expected to include western and eared grebes, scoters, phalaropes, dowitchers, ducks, gulls, and sandpipers. Resident bird species associated with this portion of the riparian vegetation include herons, egrets, belted kingfisher, red-winged blackbird, and black phoebe. Summer visitors include the California least tern and a variety of swallows.

Mammal species expected to be associated with the riparian vegetation in the vicinity of the Santa Clara River are expected to include the raccoon, dusky-footed woodrat, long-tailed weasel, muskrat, opossum, striped skunk, bats, and other foraging species. The primary mammal species associated with riparian vegetation is the raccoon, which forages extensively throughout riparian habitats. Riparian vegetation also provides cover for larger mammals, such as the mule deer, coyote, and grey fox, which are expected to occur in the area.

Reptile and amphibian species expected to occur in the riparian vegetation associated with the Santa Clara River include the garter snake, western skink, gopher snake, western fence lizard, Pacific tree frog, western toad, and California slender salamander.

12.5.4.1.7 Ruderal

This habitat type possesses many weedy plant species (primarily annual grasses and forbs) that provide cover and food for animal species. Small mammals typically constitute a major portion of the animal biomass in ruderal vegetation. The introduced house mouse, Botta's pocket gopher, and Beechey ground squirrel are the predominant small mammals, and the western harvest mouse is common. The cottontail rabbit, black-tailed hare, and common opossum also may be present.

Ground foraging birds, particularly the western meadowlark, Brewer's blackbird, and house finch are expected to occur regularly in ruderal habitat throughout the project area. Predatory bird species, such as the loggerhead shrike, American kestrel, barn owl, and scavenging gulls and crows, also utilize this habitat. The ground-nesting western meadowlark and savannah sparrow may breed in this habitat type.

The side-blotched lizard, western fence lizard, southern alligator lizard, and gopher snake are the only reptiles expected to be present. Because fresh water generally is absent, the only likely amphibian inhabitant is the terrestrial California slender salamander.

12.5.4.1.8 Agricultural

Few vertebrate species are expected to reside in these areas but many species may forage in this habitat. The only areas where species may nest is in the eucalyptus groves which line many of the agricultural fields. Birds which may nest in these trees include the American kestrel, white-tailed kite, red-tailed hawk, and, if near open water, black-crowned night herons, great blue herons, and egrets. Foraging vertebrate species are expected to include the Brewer's and red-winged blackbirds, killdeer, horned lark, western meadowlark, savannah sparrow, red-tailed hawk, and American kestrel. Mammal species are expected to include primarily rodents, such as Botta's pocket gopher. California ground squirrel, deer mouse, and California meadow mouse may forage here as well. Large mammals expected to forage in agricultural fields include the grey fox and coyote. Reptiles and amphibians may include foraging individuals from adjacent habitats, including the gopher snake, western fence lizard, and western toad.

12.5.4.1.9 Urban

The vegetation of urban areas in the project area consists primarily of trees, evergreen shrubs, and lawns. The presence of humans and domestic animals limits the use of these areas by wildlife, resulting in a fauna consisting of mostly small mammals and songbirds. Mammals probably are represented by the house mouse, rats, Botta's pocket gopher, and possibly the common opossum. Common birds include Anna's hummingbird, mockingbird, starling, house sparrow, and house finch, all of which breed in this habitat. Reptiles are expected to rarely occur. The only amphibian likely to be present is the garden slender salamander. The Pacific tree frog and western toad may occur if water is available for several weeks as a breeding site.

12.5.4.2 Proposed Mandalay Site and Pipeline Corridor

The proposed Mandalay site lies in an area of primarily foredune vegetation, with a smaller component of dune scrub vegetation in the southeastern portion of the site. The faunal composition of this site is expected to be similar to that described in Section 12.5.4.1 for the foredune and dune scrub habitats.

The onshore pipeline corridor would traverse foredune, dune scrub, ruderal, and urban habitats. Representative animal species associated with these habitats are described in Section 12.5.4.1.

12.5.4.3 East Mandalay Alternative Site and Pipeline Corridor

The East Mandalay alternative site is located in an area of slightly disturbed dune scrub vegetation. The fauna at this site is expected to be similar to that described in Section 12.5.4.1 for dune scrub habitat.

The onshore pipeline corridor traverses the same habitat types as does the corridor associated with the proposed Mandalay site (Section 12.5.4.2). Animal species expected to occur in these habitats are described in Section 12.5.4.1.

12.5.4.4 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

This site is covered with asphalt and no vegetation cover is present. Because of the location of the site, it is expected to be used only as a resting area by gulls and terns.

The onshore pipeline corridor traverses the same habitat types as does the corridor associated with the proposed Mandalay site (Section 12.5.4.2), plus riparian vegetation associated with the Santa Clara River.

Animal species expected to occur in these habitats are described in Section 12.5.4.1.

12.5.4.5 Ormond Beach Alternative Site and Pipeline Corridors

The Ormond Beach alternative site lies in an area with little vegetation (primarily as a result of recent grading activities) and provides little food or cover. For this reason, the site is not expected to be used significantly by mammals, reptiles, or amphibians. It is expected that it is used primarily as a resting area by birds such as gulls and terns.

The onshore corridor containing the pipelines to/from proposed Platform Gina would cross areas of foredune, ruderal, and urban habitat. Option A would traverse primarily areas of ruderal and urban habitat, although some dune scrub also would be involved. Option B would cross primarily ruderal, urban, and and agricultural areas. In addition, it would traverse small areas of dune scrub. Representative animal species expected to be associated with each of these habitats are described in Section 12.5.4.1.

12.5.5 Limnology

The nonmarine aquatic habitat in the project area consists of McGrath Lake and the Santa Clara River, including its associated coastal lagoon. The coastal lagoon periodically is formed during periods of low flow (primarily during the summer and fall seasons) when a sand bar builds up, blocking drainage of the river to the ocean. These fresh water habitats are discussed below.

Surveys were conducted August 27 and 29, 1979 to assess the limnological resources of McGrath Lake and the Santa Clara River and its associated coastal lagoon. Physical and chemical parameters were measured at three locations in McGrath Lake, two locations in the Santa Clara River and three locations in the coastal lagoon. These locations are shown on Figure 12.5-2. A more detailed discussion of field techniques is presented in Appendix C.3.

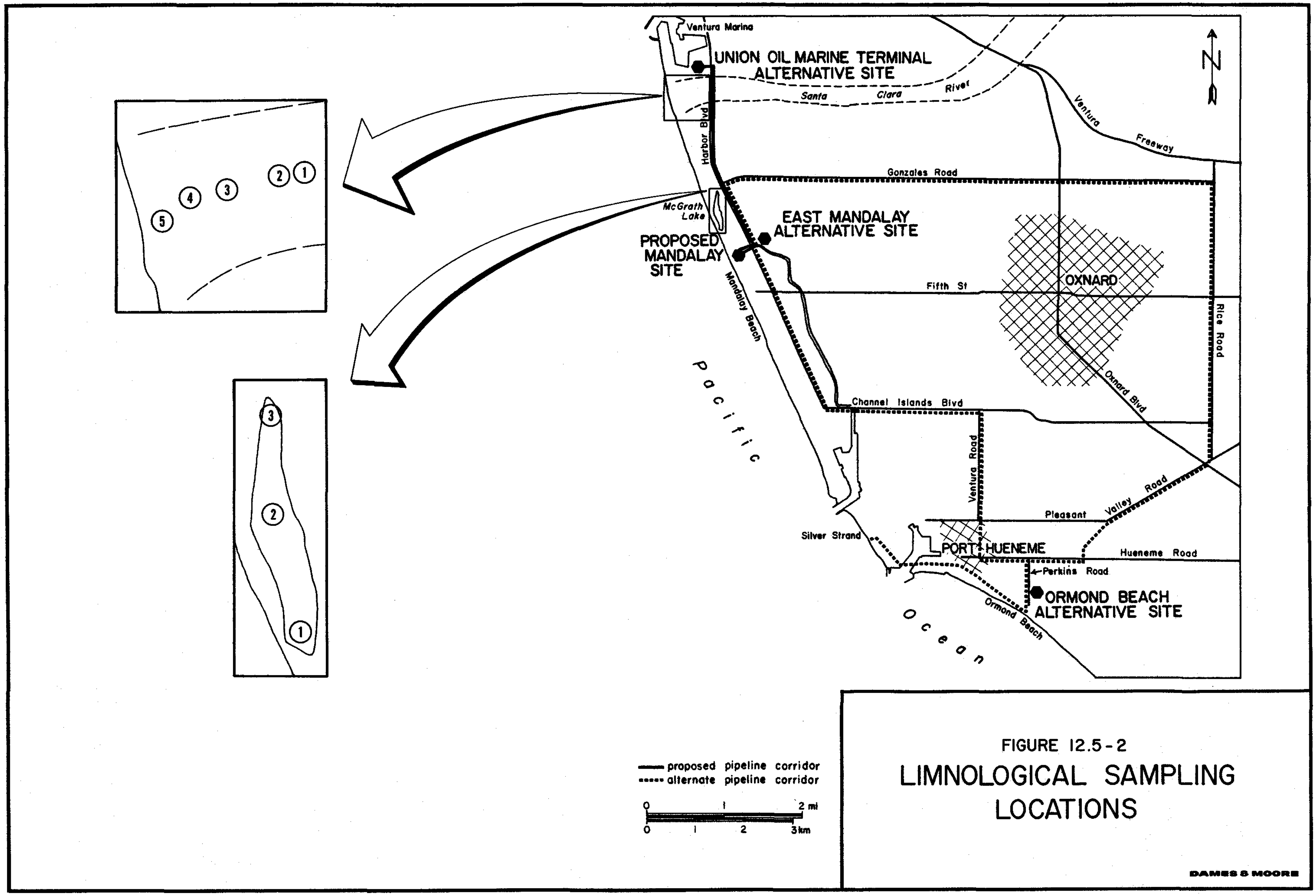


FIGURE 12.5-2
LIMNOLOGICAL SAMPLING LOCATIONS

DAMES & MOORE

12.5.5.1 McGrath Lake

McGrath Lake formed behind the coastal foredune ridge and apparently is a lagoonal remnant associated with the Santa Clara River (Cooper, 1967). The lake is approximately 3,000 feet (915 m) long and 500 feet (150 m) wide and is bounded on the west by coastal foredunes and on the north, east, and south by fresh water marsh vegetation. As a result of the 1969 floods, it was reduced in size by approximately one-third. Water levels in the lake currently are maintained by irrigation runoff and by a pump located at the north end of the lake (VCERA, Planning Division, 1979; CDPR, 1979; Conway, 1979).

Maximum depth within McGrath Lake is approximately 5 feet (1.5 m). It exhibits no evidence of extreme water level fluctuation. There is a gradual north-south depth gradient, with the deepest portion of the lake occurring in the southern end. The northern portion attains a maximum depth of 3 feet (1 m). Bottom composition in the shallow areas is primarily sand, while in the deeper portions of the lake, the bottom consists of mud. Water is clear, with Secchi disk depth at maximum for all stations surveyed.

Water chemistry data compiled during the field reconnaissance (Appendix C.3, Tables C.3-5 through C.3-7) indicate that the lake is relatively homogeneous and probably is mixed by winds throughout the day. However, in the deepest portion of the lake (Station 1), an inverse thermal stratification occurred throughout the day at a depth of approximately 4 feet (1.3 m). The bottom water exhibited a very high conductivity (26,000 μmhos) and salinity (12 o/oo) compared with the well mixed surface water (conductivity 6,000 μmhos; salinity 3.8 o/oo). An inverse thermal stratification was also noted at the northern station during the morning sampling period. This may be caused by fresh water entering the lake as a result of irrigation runoff. No stratification was noted at this location during the other sampling periods.

Zooplankton were extremely abundant in the lake, with water fleas composing the dominant element. Waterboatmen and snails dominated a relatively abundant and varied invertebrate fauna in the shallow portions of the lake and beetles were common on algal mats throughout the lake. Fish observed in the lake were primarily Gambusia affinis, introduced to the lake as a mosquito control measure.

12.5.5.2 Santa Clara River

The configuration of the river channel and the amount of flow vary throughout the year. The field investigations were conducted during a period of low flow. At the time of the field reconnaissance, the Santa Clara River was approximately 0.5 feet (0.15 m) deep and approximately 3 feet (1 m) wide. Isolated pools were located along the river course. Water was flowing slowly (approximately 1 ft/sec (0.3 m/sec)). Bottom composition was generally sand interspersed with gravel, pebbles, and cobbles. Water within the river was clear.

Water temperature was high and conductivity and salinity were low (Appendix C.3, Table C.3-8) at the most upstream section of the river (approximately 1 mile (1.6 km) east of the ocean), compared to the lagoon. The pH was slightly above neutral at all locations in the river.

Filamentous algae were present in areas of slow-moving and standing water, and on dry substrate surrounding these areas. Duckweed and duckweed fern were also present in areas of standing water. The invertebrate fauna was moderately diverse (Appendix C.3, Table C.3-9), with most organisms being found in pools and standing water. Midge larvae, waterboatmen, and snails dominated the invertebrate fauna.

Studies conducted by Bell (1978) indicated that approximately four species of fish may be present in the lower portions of the Santa Clara River. These species include the threespine stickleback, arroyo chub, mosquitofish, and fathead minnow. These species generally are found in areas of slow-moving or standard water.

12.5.5.3 Santa Clara River Lagoon

A lagoon occurs at the mouth of the Santa Clara River when water is trapped behind a sand bar that periodically forms during periods of low flow (primarily during summer and fall). During the field reconnaissance, the lagoon was approximately 200 feet (60 m) wide and approximately 800 feet (240 m) long, with a maximum depth of approximately 2 feet (0.6 m). However, the size, shape, and depth of the lagoon are expected to vary, depending on the season and water flow. Bottom substrate in the lagoon was firm sand.

Water temperature within the lagoon was relatively high and no thermal stratification was evident (Appendix C.3, Table C.3-8). Bottom water within the lagoon exhibited high salinity and conductivity and was overlain by a layer of fresh water supplied by the river.

No vegetation was observed in or near the edge of the lagoon. However, as water levels in the lagoon rise, water is expected to approach nearby riparian and salt marsh vegetation. Invertebrate faunal diversity was low. However, populations of those species present were high. Waterboatmen and midge larvae were the dominant invertebrate species. Fishes within the lagoon are expected to include the threespine stickleback, arroyo chub, mosquitofish, fathead minnow, tidewater goby, Pacific staghorn sculpin, and topsmelt (Bell, 1978; CDPR, 1979). The lagoon may also serve as a spawning ground for topsmelt and a nursery ground for striped mullet and the Pacific staghorn sculpin (CDPR, 1979). Due to the periodic breaching of the sand bar, a variety of marine fish occasionally may become trapped within the lagoon.

12.5.6 Rare or Endangered Species

12.5.6.1 Project Area

Two very rare and endangered plant species may occur within the project area. These are <u>Cordylanthus maritimus</u> (salt marsh bird's beak) and <u>Astragalus pycnostachyus</u> var. <u>lanosissimus</u> (Ventura marsh locoweed) (California Native Plant Society, 1974). <u>Cordylanthus maritimus</u> has been observed in salt marsh vegetation within McGrath Beach State Park (CDPR, 1979) and within a degraded salt marsh area northwest of the Ormond Beach Generating Station (Dames & Moore, 1974). During the Dames & Moore field reconnaissance of the project area, Cordylanthus maritimus was not observed on or near the proposed or alternative sites and their associated pipeline corridors.

Astragalus pycnostachyus var. lanosissimus was collected from an area east of Harbor Boulevard adjacent to McGrath Beach State Park (CDPR, 1979). However, the CDPR (1979) indicates that this species probably has been eliminated by agricultural activities. The California Native Plant Society (1974) indicated this species was last reported in 1967, and now may be extinct. Astragalus pycnostachyus var. lanosissimus was not observed during the Dames & Moore field reconnaissance on or near the proposed or alternative sites and their associated pipeline corridors.

Of the amphibians, reptiles, mammals, and fish that may occur within the project area, none are designated as threatened, rare, or endangered by the State of California or the United States Government (CDFG, 1978a; Title 50, Code of Federal Regulations, Chapter 1, Part 17, 1978). However, six endangered bird species (California least tern, California brown pelican, Belding's savannah sparrow, American peregrine falcon, southern bald eagle, and light-footed clapper rail) may occur within the project area (CDFG, 1978a). With the exception of Belding's savannah sparrow, all of these species have been listed as endangered by the federal government.

The California least tern (Sterna albifrons browni) is a summer visitor to the Pacific Coast and breeds on sandy beaches generally near estuaries or embayments (CDFG, 1978a). The CDFG (1978b) estimated that the total 1978 breeding population was approximately 800 pairs and utilized 27 known breeding locations. Unpublished data compiled during the summer of 1979 indicate that the total estimated breeding population was approximately 850 pairs (Kelly, 1979). The primary threat to this species is believed to be habitat elimination and human disturbance within the nesting locations.

The California least tern recovery team (CDFG, 1978b) indicated that least terns utilize two breeding locations within the project area. The first site is located at the mouth of the Santa Clara River. It was not utilized by least terns in 1976. No data are available for 1977. However, in 1978, approximately 10 to 15 breeding pairs nested at this location, and in 1979, approximately 15 to 20 pairs used the site (Kelly, 1979). During the Dames & Moore field reconnaissance, California least terns were observed feeding and resting at the Santa Clara River mouth and at McGrath Lake.

A second least tern breeding site is located northwest of the Ormond Beach Generating Station. During the summer of 1976, approximately 16 to 18 breeding pairs were observed nesting at this location. Breeding success during 1976 was classified as good (CDFG, 1976a). No data are available for 1977, and no nesting at this location was observed during the summer of 1978. However, during the summer of 1979, approximately 6 to 8 pairs of least terns nested at this location (Kelly, 1979). During the Dames & Moore field reconnaissance, no California least terns were observed in the vicinity of this nesting location. The CDFG suspects that human disturbance at this site caused least terns that would have nested here to use the Santa Clara River mouth site instead (Kelly, 1979).

The California brown pelican (Pelecanus occidentalis californicus) was formerly a common resident along the California coast but now is less abundant (Small, 1974). The primary threat to this species is food chain contamination with pesticides. Currently, this species nests on the Channel Islands and at several locations along the Mexican coastline.

In the project area, the California brown pelican is expected to occur commonly--feeding in offshore waters and harbors (Ventura Marina, Channel Islands Harbor, Port Hueneme); flying along the shoreline; and using shore areas for resting. Although California brown pelicans breed on the Channel Islands, it is expected that many of the birds present within the region were hatched at Mexican colonies.

The Belding's savannah sparrow (Passerculus sandwichensis beldingi) is listed as an endangered species by the State of California (CDFG, 1978a). However, it has been assigned no formal designation by the federal government. This bird occurs as a resident in tidal estuaries in southern California and northern Baja California. It is closely associated with pickleweed vegetation subject to tidal influence. A 1977 survey delineated 28 breeding sites in California.

Two breeding locations occur within the project area. The first location is situated within a salt marsh at McGrath Beach State Park and the second site is located in a salt marsh area northwest of the Ormond Beach Generating Station (CDFG, 1978a). Massey (1977) estimated that from the size of the marsh (10 to 20 acres (4 to 8 ha)) and number of birds observed, approximately 12 pairs of birds could nest in the salt marsh at McGrath Beach State Park. During the Dames & Moore field reconnaissance, Belding's savannah sparrows were observed at this location.

The Ormond Beach breeding site is located on a degraded salt marsh remnant located northwest of the Ormond Beach Generating Station. It has been estimated that approximately 17 pairs of Belding's savannah sparrows breed at this location (Massey, 1977).

The American peregrine falcon (Falco peregrinus anatum) and southern bald eagle (Haliaeetus leucocephalus leucocephalus) wander extensively along the California coast and could be observed within the project area. The southern bald eagle has historically nested on the Channel Islands (CDFG, 1978a), and the American peregrine falcon is known to breed along the California coastline. No breeding locations of either species are known to exist in the project area (Kelly, 1979). Primary threats to these species are believed to be food chain contamination by persistent pesticides, illegal shooting, and the disturbance of nesting sites by human activity.

The light-footed clapper rail (Rallus longirostris levipes) is known to occur in Mugu Lagoon, which is situated about 5 miles (8 km) south of the project area (CDFG, 1978a). This species generally is associated with salt marsh habitat. Although this habitat type occurs within the project area, its limited size and quality suggests that the light-footed clapper rail would not regularly utilize habitats within the project area. The primary threat to this species is believed to be habitat elimination.

12.5.6.2 Proposed Mandalay Site and Pipeline Corridor

The proposed Mandalay site is located in foredune habitat which typically may be utilized by two endangered bird species. The California least tern currently nests at locations north and south of this site. However, no breeding has been observed or is likely to occur on the site, primarily because of the high level of human activity. The California least tern may utilize offshore waters for feeding and occasionally may use the site for resting. The California brown pelican is expected to utilize the offshore waters for feeding, and occasionally may use the proposed Mandalay site for resting. The California brown pelican is not expected to breed on or near the proposed Mandalay site. No other rare or endangered animal species are expected to significantly utilize the site. No rare or endangered plant species are expected to occur on the proposed site.

Portions of the proposed pipeline corridor that would traverse the foredune habitat may be used occasionally by the endangered California least tern and the California brown pelican. However, these species are not expected to breed in this area. No other portions of the pipeline route are expected to be utilized significantly by any rare or endangered plant or animal species.

12.5.6.3 East Mandalay Alternative Site and Pipeline Corridor

No rare or endangered plant or animal species are expected to significantly utilize the East Mandalay alternative site. However, portions of the proposed pipeline corridor traverse foredune habitat. This habitat occasionally may be utilized by the California least tern and California brown pelican for resting. These species are not expected to breed in this area. No other portions of the pipeline route associated with this alternative are expected to be utilized significantly by any rare or endangered plant or animal species.

12.5.6.4 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

No rare or endangered plant or animal species are expected to significantly utilize this site. However, portions of the pipeline corridor traverse foredune habitat. This habitat occasionally may be utilized by the California least tern and California brown pelican for resting. These species are not expected to breed in this area. No other portions of the pipeline corridor are expected to be utilized significantly by any rare or endangered plant or animal species.

12.5.6.5 Ormond Beach Alternative Site and Pipeline Corridors

No rare or endangered plant or animal species are expected to significantly utilize the Ormond Beach alternative site. However, portions of the pipeline corridors traverse foredune habitat that occasionally could be used by California least terns and California brown pelicans as described in Section 12.5.6.2. No other portions of the pipeline corridors are expected to be utilized significantly by any rare or endangered plant or animal species.

12.5.7 Sensitive Habitats

12.5.7.1 Project Area and Vicinity

Within the project area, four locations and/or habitat types have been designated as sensitive by various regulatory agencies. These areas include the Santa Clara River mouth, McGrath Lake, salt marsh habitat, and coastal dune complexes.

12.5.7.1.1 Santa Clara River Mouth

The Santa Clara River mouth forms a 60-acre (24-ha) wetland area in the northern portion of the project area. The river mouth includes three distinct habitats--riparian, salt marsh, and open water. Due to the combination of the riparian and salt marsh vegetation in the vicinity of the river mouth, and the presence of a coastal lagoon (primarily during the summer months), the Santa Clara River mouth provides habitat for a highly diverse assemblage of animal species. The USFWS considers this area to be one of the most important shore and wading bird habitats in Ventura County, and one of the most attractive bird watching areas along the southern California coastline (VCERA, Planning Division, 1979). The Santa Clara River mouth and its associated vegetation provide habitat for three endangered bird species (California least tern, California brown pelican, and Belding's savannah sparrow). The California least tern and California brown pelican currently utilize this area for feeding and resting. In addition, the California least tern utilizes sandy habitat adjacent to the river mouth for nesting. The Belding's savannah sparrow utilizes the salt marsh habitat south of the river mouth for feeding, resting, and breeding activities.

The Santa Clara River mouth has a complex jurisdictional setting. Portions of it are under the jurisdictions of the City of Ventura, City of Oxnard, County of Ventura, and State of California. These public entities have designated the area as sensitive and have developed, or are developing, policies to reflect this status (City of Ventura, 1980; City of Oxnard, 1980; VCERA, 1979; CDPR, 1979).

12.5.7.1.2 McGrath Lake

McGrath Lake is situated approximately 1.5 miles (2.4 km) south of the Santa Clara River. Although the faunal composition is expected to be generally similar to that of the Santa Clara River mouth, McGrath Lake provides a stable fresh water marsh habitat that is not present at the Santa Clara River. The VCERA Planning Division (1979) indicated that faunal utilization of McGrath Lake may be closely associated with the Mandalay dune complex and Santa Clara wetland habitat. Because McGrath Lake may play an important role in the dynamics of the McGrath area ecosystem, the VCERA Planning Division includes McGrath Lake as an environmentally sensitive area. It has also been designated as a sensitive area by the City of Oxnard (1980).

Although no rare or endangered species of plants occur, or animals breed, in or closely adjacent to McGrath Lake (California Native Plant Society, 1974; CDFG, 1978a), two endangered bird species utilize the lake for feeding and/or resting. During the Dames & Moore field reconnaissance, California least terns were observed feeding in McGrath Lake and resting on the sand dunes adjacent to the lake. The California brown pelican was also observed bathing in the lake, as well as resting on the adjacent shoreline.

12.5.7.1.3 Coastal Dunes

Within the project area, coastal dunes occur from the Santa Clara River south to the Port Hueneme area and along Ormond Beach. The dunes north of the Oxnard Shores area form the Mandalay dune complex. Dunes in the Mandalay dune complex, as well as those at Ormond Beach, generally have been disturbed primarily through recreational use, urbanization, and petroleum production. These activities have resulted in disturbances or elimination of vegetation and/or the introduction of exotic plant species, such as European beachgrass, primarily as dune stabilizers (Barbour and Major, 1977). However, dunes within the project area provide substrate and microclimate for a variety of plant species and associated animals.

Dune habitat within the project area may be utilized by two endangered bird species. The California least tern is known to rest in sandy areas near the Santa Clara River mouth and the Ormond Beach Generating Station, and has been observed resting and feeding in other areas. The California brown pelican may utilize the dunes within the project area for resting.

The VCERA, Planning Division (1979) has designated those portions of the Mandalay dune complex under the jurisdiction of Ventura County as sensitive habitat. Similarly, portions of the dunes of Mandalay Beach, Oxnard Beach, and Ormond Beach have been designated as sensitive habitat by the City of Oxnard (1980).

habitat. Similarly, portions of the dunes of Mandalay Beach, Oxnard Beach, and Ormond Beach have been designated as sensitive habitat by the City of Oxnard (1980).

12.5.7.1.4 Coastal Salt Marsh

Coastal salt marsh occurs at two locations within the project area. These sites are located south of the Santa Clara River mouth and northwest of the Ormond Beach Generating Station. The coastal salt marsh present south of the Santa Clara River has been discussed previously. The coastal salt marsh present north of the Ormond Beach Generating Station consists of a highly degraded remnant of pickleweed marsh (Massey, 1979). It, as well as the salt marsh south of the Santa Clara River mouth, has been designated as sensitive habitat by the City of Oxnard (1980).

Coastal salt marsh within California has been reduced significantly by utilizing these areas for salt ponds, agricultural uses, and urbanization (Barbour and Major, 1977). Due to the relatively high salt content of the soils and water, coastal salt marshes support distinctive biotic communities. Salt marsh habitat within the project area supports one bird species designated as endangered by the State of California (Belding's savannah sparrow). Approximately 12 Belding's savannah sparrows breed in the salt marsh south of the Santa Clara River mouth and approximately 17 pairs nest within the Ormond Beach salt marsh area (Massey, 1977).

Mugu Lagoon is located approximately 3 miles (5 km) south of the project area. It is one of the largest (approximately 3,000 acres (1,200 ha)) and least disturbed wetland areas in the State of California and has been designated as sensitive habitat by Ventura County (VCERA Planning Division, 1979). Mugu Lagoon supports a variety of bird species (191 species have been identified) and forms an integral part of the Pacific flyway (CDFG, 1976b). Mugu Lagoon also provides habitat for a variety of mammal, reptile, and amphibian species. Five endangered bird species use Mugu Lagoon: the California least tern, California brown pelican, Belding's savannah sparrow, light-footed clapper rail, and American peregrine falcon (CDFG, 1976b).

The 75-acre (30-ha) Carpinteria slough is located approximately 19 miles (30 km) northwest of the project area. The slough is considered an ecological community of particular value (Santa Barbara County, 1979). This area supports two endangered bird species--Belding's savannah sparrow and the light-footed clapper rail--as well as a variety of shorebirds and waterfowl that pass through the slough during their annual migration. In addition, the slough supports a variety of mammal, reptile, and amphibian species characteristic of salt marsh habitats.

12.7.5.2 Proposed Mandalay Site and Pipeline Corridor

The proposed Mandalay site lies within the Mandalay dune complex in an area designated as sensitive habitat by the City of Oxnard. A portion of the proposed pipeline corridor traverses coastal dunes given the same designation. The majority of the pipeline route traverses areas that are not designated as sensitive.

12.5.7.3 East Mandalay Alternative Site and Pipeline Corridor

The East Mandalay alternative site is located in an area of the Mandalay dune complex that is not designated as sensitive by the City of Oxnard. However, a portion of the onshore pipeline corridor would traverse an area that is designated as sensitive. The majority of the pipeline route traverses areas not so designated.

12.5.7.4 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

This site is located in an industrialized area and is not considered sensitive. However, a portion of the onshore pipeline corridor would traverse areas included in the Mandalay dune complex that are considered sensitive. The majority of the pipeline route traverses areas not so designated.

12.5.7.5 Ormond Beach Alternative Site and Pipeline Corridors

The Ormond Beach alternative site is located in a generally disturbed area and is not considered sensitive. However, portions of the pipeline corridor would traverse areas included in the Ormond Beach and Mandalay dunes that are designated as sensitive habitat by the City of Oxnard. The majority of the pipeline corridors traverse areas which are not considered sensitive.

12.5.8 Commercially Important Species

Commercial plant species found within the project area are primarily agricultural varieties including lima beans, cabbage, cauliflower, broccoli, tomatoes, strawberries, and tree crops. Sod is also cultivated in some areas. No commercially important animal populations exist within the project area.

No commercially important plant or animal species are expected to significantly utilize the proposed or alternative sites or their associated pipeline corridors.

12.6 LAND USE

12.6.1 Land Use

12.6.1.1 Regional Overview

The project area is located on the Oxnard Plain. Generalized land use patterns throughout the Oxnard Plain region are shown on Figure 12.6-1. In 1959, the predominant land use within the region was agricultural/open space (Dames & Moore, 1974). At that time, cultivated land, pasture, and open space accounted for more than 80 percent of the land area. High economic intensity uses, such as commercial and industrial, occupied less than 20 percent of the total area. A high percentage of the latter was in service/government activities, the majority related to the Pacific Missile Range and Naval Construction Battalion Center. By 1971, agriculture/open space land had declined to less than 70 percent of the total area. Residential usage had expanded to almost 12 percent (approximately a 50 percent increase). By 1973, this pattern had changed only to a limited degree; less than 1 percent of the land had been converted from cultivated to residential and commercial uses. The trend in land use conversion for the region represents a slow change from a rural setting to a low density suburban environment.

12.6.1.2 Local Land Use

12.6.1.2.1 Project Area

The regional trend of urbanization is reflected in current land use patterns within the project area. The urban centers of Oxnard and Port Hueneme occupy most of the central and southern portions of the project area. Urbanization is expanding into the northern portion of the project area where agricultural land is being converted to residential and other urban uses. Coastal-related development and recreational use are also increasing in this area.

Major coastal-dependent land uses within the project area include the Ventura Marina, Channel Islands Harbor, Port Hueneme, and the Southern California Edison Company (SCE) Mandalay and Ormond Beach generating stations. Residential use occurs throughout the project area but primarily is centered in portions of Oxnard, Port Hueneme, Channel Islands Harbor, and Oxnard Shores. Major industrial facilities within the project area include a marine oil terminal and sewage treatment plant near the Ventura Marina; scattered oil production facilities and an SCE electric power generating station in the Mandalay area; commercial shipping facilities at Port Hueneme; and, a concentration of manufacturing and industrial facilities in the southeastern portion of the project area.

Recreational uses in the project area primarily are ocean-oriented. Major recreational facilities include San Buenaventura State Beach, McGrath State Beach, the Ventura Marina, Channel Islands Harbor, Silver Strand County Beach, Hollywood Beach Park, Port Hueneme City Beach Park, and Olivas Park.

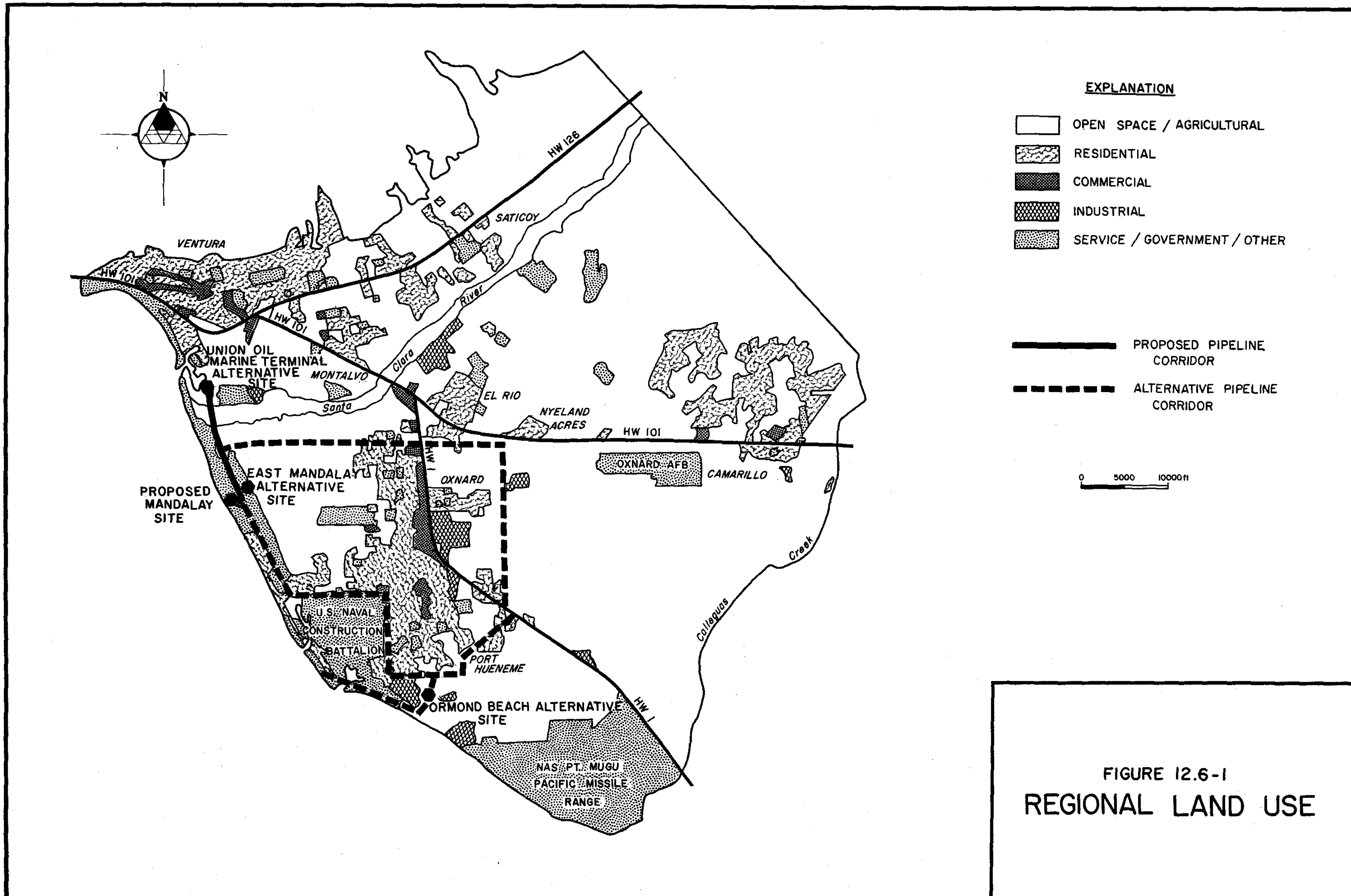
The only significant institutional land use within the project area is the U.S. Naval Construction Battalion Center which encompasses a large land area and utilizes the major portion of Port Hueneme Harbor.

12.6.1.2.2 Proposed Mandalay Site and Pipeline Corridor

The 1.8-acre (0.73-ha) proposed Mandalay site is a lease parcel within Lot 146 of the Patterson Ranch subdivision, title to which is held by the County of Ventura. The site is currently undeveloped and is bounded by the SCE Mandalay Generating Station on the north and east; the Pacific Ocean to the west; and, vacant sand dunes and two oil well sites to the south (121.89 acres (49 ha)).

Public access to the site and adjacent area to the south presently is limited. The county has plans to develop the latter area as the Mandalay Beach County Park (see Section 12.6.3.1.5 for further discussion). A medium-density mobile home residential development is located south of the park property and separated from the proposed Mandalay site by a distance of approximately 0.5 mile (0.8 km).

Pipelines connecting the proposed Mandalay site with proposed Platforms Gina and Gilda would reach shore immediately south of the Mandalay Generating



REFERENCE: MODIFIED FROM DAMES & MOORE (1974)

FIGURE 12.6-1
REGIONAL LAND USE

DAMES & MOORE

Station. From the landfall point to the proposed Mandalay site, the pipeline corridor would traverse approximately 460 feet (140 m) of beach and dune area.

The product oil and sales gas pipelines from the proposed Mandalay site would exit the treating facility and proceed east to Harbor Boulevard, traversing a small portion of undeveloped land on the planned Mandalay Beach County Park property. After crossing Harbor Boulevard, the pipeline corridor would turn northward and travel along the eastern edge of the Harbor Boulevard right-of-way to a point opposite the Union Oil Marine Terminal. There, the corridor would cross Harbor Boulevard and enter the Union Oil facility. Land uses along the Harbor Boulevard right-of-way from the proposed Mandalay site to the Union Oil Marine Terminal are summarized in Table 12.6-1.

12.6.1.2.3 East Mandalay Alternative Site

The East Mandalay alternative site is located to the east of Harbor Boulevard within SCE property. The site is undeveloped open space. Land use in the immediate vicinity of the proposed site is primarily devoted to electrical transmission facilities including high voltage transmission lines and a substation. The Edison Canal enters the SCE property immediately to the south of the site. SCE owns approximately 4 miles (6.4 km) of canal right-of-way between the Harbor Street Bridge and the generating station site. The right-of-way is 300 feet (91 m).

Land use to the east of the site is primarily agricultural (row crops and citrus orchards) with some small pockets of petroleum production use. To the north and northeast of the East Mandalay site, land use is a mixture of vacant land, disturbed sand dunes, oil wells, and agricultural land. Harbor Boulevard and the SCE Mandalay Generating Station are situated to the west of the site. An industrial waste dumpsite and disturbed sand dunes are located to the south.

The pipeline corridor associated with the East Mandalay alternative site would be essentially the same as that for the proposed Mandalay site (see Section 12.6.1.2.2.). The only difference would be a short segment across

TABLE 12.6-1

LAND USES ALONG THE PROPOSED ONSHORE PIPELINE CORRIDOR

Corridor Segment	Adjacent Land Uses
1. Harbor Boulevard between the Mandalay Generating Station and Gonzales Road	1. Vacant land; oil production facilities; public utility uses (SCE Mandalay Generating Station, substation, and transmission lines); undeveloped county property (Mandalay Beach County Park); recreational uses (McGrath State Beach Park)
2. Harbor Boulevard between Gonzales Road and the Union Oil Marine Terminal	2. Vacant land; agricultural land; recreation facilities (Olivas Park Golf Course, McGrath State Beach); industrial use (Ventura County Waste Treatment Facility)

undeveloped dunes needed to connect the site with the Harbor Boulevard right-of-way.

12.6.1.2.4 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

The Union Oil Marine Terminal alternative site is located within the boundaries of an existing Union Oil Company terminal and storage facility. The facilities area, including the location of the alternative site, is diked and fenced. The site itself is graded vacant land.

Land use in the immediate vicinity of the site includes oil terminal facilities to the north and east, vacant land to the south, and Ventura Marina to the west. The city of San Buenaventura (Ventura) Bio-Filtration Plant is located between the Union Oil Marine Terminal and Harbor Boulevard. The filtration plant includes wastewater treatment facilities and tertiary treatment ponds. A small parcel of vacant land exists to the north of the treatment plant between the Union Oil facility and Harbor Boulevard. To the east of Harbor Boulevard, land use consists of the Olivas Park Municipal City Golf Course, agricultural production, and vacant land. Land use to the south of the site includes vacant land and sand dunes.

The onshore pipeline corridor associated with the Union Oil Marine Terminal alternative site would be the same as that for the proposed Mandalay site (see Section 12.6.1.2.2).

12.6.1.2.5 Ormond Beach Alternative Site and Pipeline Corridors

The Ormond Beach alternative site is graded vacant land located within an existing industrial park. Western Kraft Corporation and Stauffer Chemical manufacturing and storage facilities are located to the north of the site. The Oxnard Waste Water Treatment Plant is located to the west. Land to the southwest is presently vacant. A Halaco Chemical Corporation facility is located to the south of the site acoss McWane Boulevard. Agricultural uses exist to the east of the site and there is some commercial/residential land use to the north across Hueneme Road.

The pipelines to/from Platform Gina would be emplaced in a corridor reaching shore at Silver Strand Beach. This pipeline route crosses the beach and parallels approximately 5 blocks of single-family housing before reaching Port Hueneme Harbor. The pipeline route traverses Port Hueneme Harbor within an existing SCE easement. The route then passes through the Harbor unloading and storage facilities area and a residential area within the city of Port Hueneme. The remainder of the route follows the SCE easement along the beach to a point directly south of the Ormond Beach alternative site where it turns northward and crosses a short expanse of vacant land before reaching the site.

A second pipeline corridor would be utilized to link the Ormond Beach alternative site with points in the Mandalay area. The City of Oxnard has identified two alternative routes for the corridor, Options A and B.

Option A passes through the Oxnard urban center and approaches the Mandalay area along Harbor Boulevard from the south. Option B traverses a more rural route around the eastern edge of the city and approaches the Mandalay area along Gonzales Road.

Land uses along Option A and Option B are listed in Tables 12.6-2 and 12.6-3. Both routes share a common corridor segment lying along the eastern edge of Harbor Boulevard between the Mandalay Generating Station and the Union Oil Marine Terminal. Land uses along this corridor segment, which is included within the proposed Mandalay onshore pipeline corridor, are presented in Table 12.6-1.

12.6.2 Public Policy

12.6.2. General

Public policy affecting the project area is formulated and adopted at different levels of governmental jurisdiction--federal, state, county, and city. There are four state- and federally-mandated regional programs which have policy implications on the project area. These are: (1) the areawide Waste Treatment Management Plan for Ventura County (208 Plan); (2) the Air Quality

TABLE 12.6-2

LAND USES ALONG THE ORMOND BEACH OPTION A ALTERNATIVE PIPELINE CORRIDOR

Corridor Segment	Adjacent Land Uses
1. Perkins Road between McWane Boulevard and Hueneme Road	1. Industrial and vacant
2. Hueneme Road between Perkins Road and Ventura Road	2. Vacant, commercial, and industrial
3. Ventura Road between Hueneme Road and Pleasant Valley Road	3. Vacant, commercial, multi-family residential, and public facilities (Hueneme School, Port Hueneme Medical Center, City of Port Hueneme Civic Center)
4. Ventura Road between Pleasant Valley Road and Channel Islands Boulevard	4. Single-family residential, U.S. Naval Construction Battalion Center, and Seabee Golf Course
5. Channel Islands Boulevard from Ventura Road to Harbor Boulevard	5. Vacant, agricultural, single and multi-family residential, strip commercial, U.S. Naval Construction Battalion Center, Seabee Golf Course
6. Harbor Boulevard from Channel Islands Boulevard to 5th Street	6. Vacant beach-related property, harbor residential, and single-family beach residential (Oxnard Shores)
7. Harbor Boulevard between 5th Street and the Union Oil Marine Terminal	7. Refer to listing in Table 12.6-1

TABLE 12.6-3

LAND USES ALONG THE ORMOND BEACH OPTION B ALTERNATIVE PIPELINE CORRIDOR

Corridor Segment	Adjacent Land Uses
1. Perkins Road between McWane Boulevard and Hueneme Road	1. Industrial and vacant
2. Hueneme Road from Perkins Road to 0.25 mile east of the Ventura County Railroad Track	2. Vacant, agricultural, strip commercial
3. Corridor segment connecting Hueneme Road and Pleasant Valley Road	3. Vacant and single-family residential
4. Northeast along Pleasant Valley Road to Rice Road	4. Commercial, mobile home, multi-family residential, vacant
5. Rice Road between Pleasant Valley Road and Gonzales Road	5. Vacant, agricultural, isolated rural single-family dwelling, oil field/open space, light industrial park (Sears, Procter and Gamble Paper Products)
6. Gonzales Road between Rice Road and Oxnard Boulevard	6. Agricultural, light manufacturing (Falcon Labware Division), residential
7. Gonzales Road between Oxnard Boulevard and Ventura Road	7. Strip commercial, single- and multi-family residential, public utility use (SCE high voltage transmission line right-of-way)
8. Gonzales Road between Ventura Road and Harbor Boulevard	8. Agricultural/open space, oil production
9. Harbor Boulevard between the Mandalay Generating Station and the Union Oil Marine Terminal	9. Refer to listing in Table 12.6-1

Management Plan (AQMP) for the Ventura County Air Pollution Control District; (3) the Local Agency Formation Commission (LAFCO) Spheres of Influence Program; and, (4) the Ventura County Regional Transportation Plan.

To coordinate these four regional programs and to integrate their individual plans and policies, Ventura County has established a Regional Land Use Program (RLUP). The RLUP developed a comprehensive set of base data (land use and population projections as well as urban growth boundaries) that was used in formulating the AQMP, the 208 Plan, the LAFCO Spheres of Influence Program, and the Regional Transportation Plan. Baseline population and land use projection information is updated annually in conjunction with the continuing 208 and regional transportation planning programs.

The proposed Mandalay site and East Mandalay and Ormond Beach alternative sites are located within the Oxnard Growth Area as delineated by the Ventura RLUP. The Oxnard Growth Area is projected to experience an increase in industrial land use from 1,640 gross acres (664 ha) in 1977 to 5,100 acres (2,064 ha) in the year 2000. This would represent a 210 percent increase as compared to an 89 percent increase in residential land use and an increase of 98 percent for total urban land use for the same time period.

The Union Oil Marine Terminal alternative site is located within the southeastern sector of the Ventura Growth Area. For the period between 1977 and 2000, this area is projected to experience a 110 percent increase in industrial land use from 662 acres (268 ha) to 1,394 acres (564 ha). Comparatively, residential land use is projected to increase by 80 percent and total urban land use by 73 percent (Ventura County, 1978).

12.6.2.1.1 Areawide Waste Treatment Management Plan (208 Plan)

The 208 Plan is a policy plan intended to identify water pollution sources and also to establish regulatory agency jurisdictional responsibilities with respect to water pollution problems. The lead agency for the plan is the Ventura County Board of Supervisors. The 208 policies are intended as a basis for federal and state grant proposals (other than sewer), future regional planning and monitoring efforts, joint powers agreements, and related coordination. The final 208 Plan was completed in 1978 (Ventura County, 1978). There are two basic components to the plan: (1) regional goals and their accompanying advisory guidelines; and, (2) detailed population, land use, and water demand projections for each growth area. These guidelines are to be considered in all land use decisions on a voluntary basis and are not binding on local jurisdictions. The County of Ventura, as the continuing local 208 planning agency, has adopted the Regional Advisory Guidelines as official county policies for evaluating all projects in unincorporated areas.

12.6.2.1.2 Air Quality Management Plan (AQMP)

The goal of the AQMP prepared by the Ventura County Air Pollution Control District (APCD) is to assess regional air quality as it relates to state and federal ambient air quality standards and identify significant sources of air pollution. The AQMP is implemented by the APCD in part through issuance of permits based on the AQMP standards (Ventura County APCD, 1979).

12.6.2.1.3 Local Agency Formation Commission (LAFCO) Spheres of Influence Program

The Spheres of Influence Plan is a state-mandated program which is intended to assist LAFCO in making boundary determinations pursuant to the Knox-Nisbet Act. A sphere of influence is defined as the probable ultimate physical boundaries and service areas of a local governmental agency. The Spheres of Influence Plan will provide projections of land use patterns with particular emphasis on municipal fringe area development and also will serve as a policy guideline for LAFCO in boundary and annexation review. It will also provide a basis for determination of jurisdictional responsibilities for cities and special districts. The Spheres of Influence Plan is currently scheduled to be considered by the Ventura Local Agency Formation Commission, to be followed by a series of public hearings in 1980.

12.6.2.1.4 Regional Transportation Plan

The Regional Transportation Plan is intended to coordinate transportation planning on a regional basis. It is especially relevant to land use planning in the future because of the necessity for providing viable transportation modes and other related services on a regional basis and to avoid duplication of effort. The initial Regional Transportation Plan was completed in 1973, with a new plan subsequently formulated every 2 years. The most recent Regional Transportation Plan was adopted in January 1979.

12.6.2.1.5 Local Coastal Program

The Local Coastal Program (LCP) is mandated by the California Coastal Act of 1976 which provided for the formation of the California Coastal Commission. The LCP involves the formulation, by local agencies, of a detailed analysis and plan for coastal areas with specific regional goals in mind. It is intended to guide local agencies and the Coastal Commission in making development determinations in coastal areas. Ventura County and the cities of Oxnard, Port Hueneme, and Ventura are required to complete LCP's by January 1, 1981. The deadline for certification of all LCP's is July 1, 1981.

12.6.2.1.6 Guidelines for Development

The Ventura County Board of Supervisors, LAFCO, and the majority of cities within the county, including Oxnard and Ventura, have adopted "Guidelines for Orderly Development". These guidelines, originally adopted in 1976, were refined and reaffirmed by the County Board of Supervisors in July, 1979, maintaining the consistent theme that urban development should be located within incorporated cities whenever and wherever practical. The guidelines, which apply only to those spheres of influence in which a city exists, serve to facilitate a better understanding concerning development standards and fees, and further identify the appropriate governmental entity responsible for making determinations on urban land use requests within its sphere.

12.6.2.2 Plans, Policies, and Regulations Applicable to the Onshore Sites and Pipeline Corridors

12.6.2.2.1 Proposed Mandalay Site and Pipeline Corridor

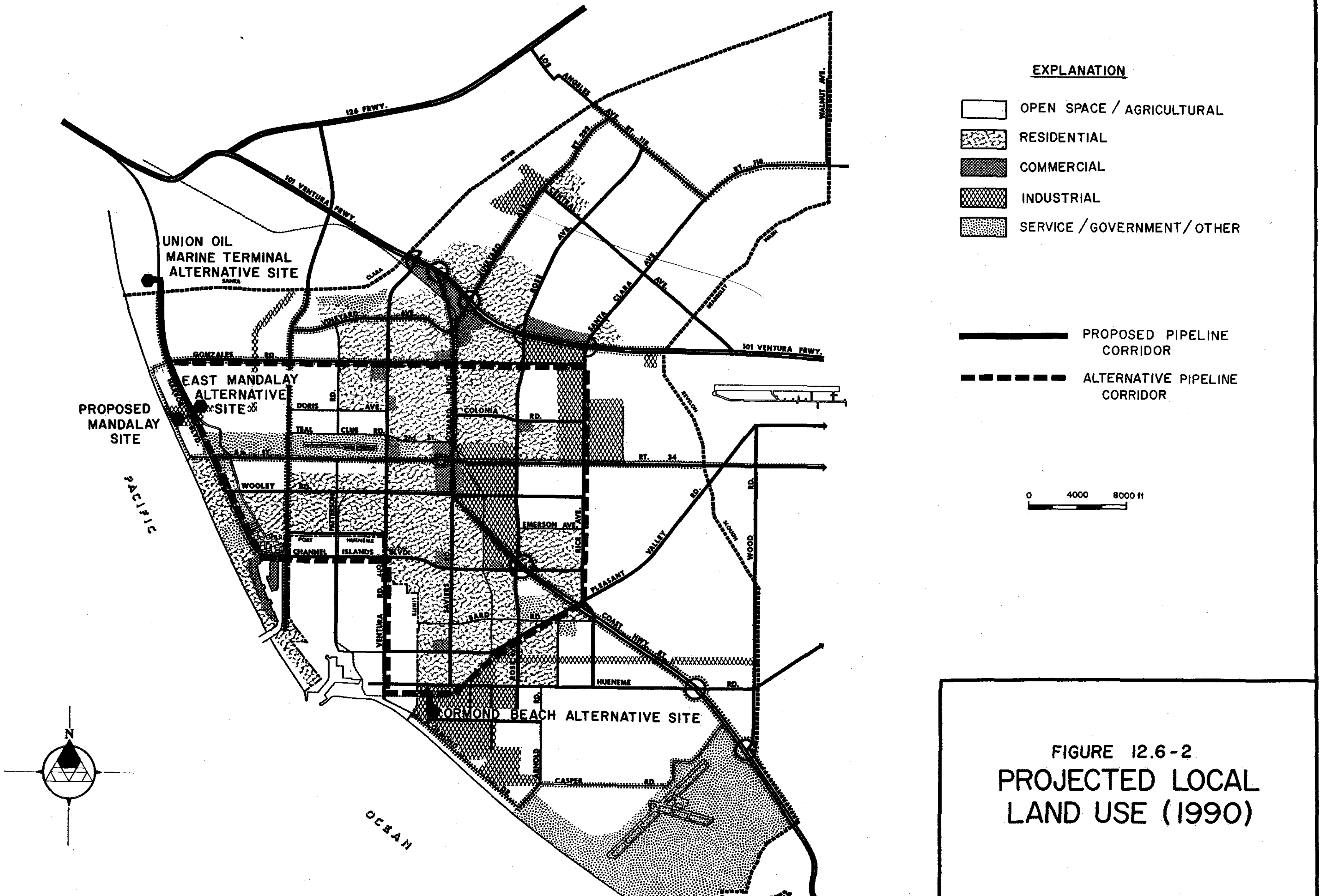
The proposed Mandalay site lies within the incorporated area of the City of Oxnard, Ventura County. For 1990, the City of Oxnard General Plan designates the area immediately south of the site for park use (Figure 12.6-2). It is adjacent to a designated Public Utility area presently occupied by SCE electrical generation facilities (City of Oxnard, 1978a). The proposed treating facility site is zoned CR, Community Reserve. The purpose of the CR zone "is to provide a district of predominantly open land which, in the public interest, should retain this character" (City of Oxnard Zoning Ordinance, City Code Division 12, Section 34-103). Permitted uses include primarily agriculture, plant and animal husbandry, grazing of livestock, and recreation facilities. Related uses which may be allowed within this zone, providing that the location and mode of operation is first approved by the Planning Commission, include oil drilling and public utility structures.

From the landfall point to Harbor Boulevard, the onshore pipeline corridor associated with the proposed Mandalay site traverses an area designated Parks in the City of Oxnard General Plan. This area is zoned CR. Along Harbor Boulevard, the route crosses areas designated Public Utility and Open Space.

The northern portion of the route traverses an area designated Existing Parks in the City of Ventura Land Use Plan (Olivas Park Golf Course) and through a small area designated PC-T, Tourist Commercial Orientation. The Union Oil Marine Terminal is designated HC-Harbor Commercial (City of Ventura, 1976).

12.6.2.2.2 East Mandalay Alternative Site and Pipeline Corridor

The East Mandalay alternative site is located within an area designated Public Utility for 1990 by the Oxnard General Plan. In the General Plan, it is stated that "Public utility uses are those which contain regional energy



REFERENCE: MODIFIED FROM CITY OF OXNARD (1978a)

FIGURE 12.6-2
PROJECTED LOCAL LAND USE (1990)

DAMES & MOORE

facilities and the regional waste water treatment plant. The property will be used for the development of these major facilities or will be kept in agriculture to buffer these facilities".

The East Mandalay site is zoned M-2, Heavy Manufacturing. Uses permitted within this zone include bulk storage and distribution of flammable liquids and liquified gases; petroleum refining; and, steam electric generating stations operated by gas or fuel oil (City of Oxnard Zoning Ordinance, City Code Division 10, Section 34-94).

Zoning and General Plan designations for the onshore pipeline corridor associated with the East Mandalay site are essentially the same as those for the proposed Mandalay onshore pipeline corridor (Section 12.6.2.2.1). In addition, a short segment would traverse M-2 and Public Utility areas between the site and Harbor Boulevard.

12.6.2.2.3 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

The Union Oil Marine Terminal alternative site is located within an unincorporated portion of Ventura County. It is bordered on the north, west, and east by the City of Ventura. The City of Ventura future land use plan designates future land use for the site, although the site is zoned by the County of Ventura. The site and surrounding area is designated Harbor Commercial (HC) by the City of Ventura (1976). The following explanation of the HC designation is exerpted from the City of Ventura land use plan:

> "The Harbor Commercial (HC) designation in the Ventura Marina area is intended to cause any new development in that area...to be compatible with existing and proposed uses in the Marina complex (as designated in the Marina Master Plan). Development in this area...should be designated to complement the existing visual and structural character of the marina complex, and the uses should be tourist- or marina-oriented " (City of Ventura, 1976).

The Union Oil Marine Terminal site is zoned HPD, Harbor Planned Development by the County. The Land Use Element of the Ventura County General Plan does not include the site area, but the site is designated Urban on the Ventura County Open Space Plan (Ventura County Planning Department, 1973). Land to the north, northeast, and west of the alternative site is zoned HC by the City of Ventura.

The pipelines to/from proposed Platforms Gina and Gilda would reach the Union Oil Marine Terminal alternative site utilizing the same corridor previously described for the Mandalay site. General Plan and zoning designations along this corridor are described in Section 12.6.2.2.1.

12.6.2.2.4 Ormond Beach Alternative Site and Pipeline Corridors

The Ormond Beach alternative site is located within an area designated Heavy Industrial for 1990 by the Oxnard General Plan. In the City of Oxnard General Plan, it is stated that "(t)his land use category is seen as containing capital intensive uses with low employer density and large acreage requirements. The heavy industrial designation shall contain the more objectionable types of industry and should be isolated with buffer or more restrictive industrial zones from other nonindustrial uses" (City of Oxnard, 1978a). The site is surrounded by areas designated Heavy Industrial with the exception of Public Utility to the west (Oxnard Waste Water Treatment Plant).

Zoning of the Ormond Beach alternative site and surrounding areas is M-2-PD, Heavy Manufacturing-Planned Development. Uses permitted within the Heavy Manufacturing zone include bulk storage and distribution of flammable liquids and liquefied gases; petroleum refining; and, steam electric generating stations operated by gas or fuel oil (City of Oxnard Zoning Ordinance, City Code, Division 10, Section 34-94). The Planned Development classification is "an additive zone which may be attached to the various zone designations within the city in order to provide reasonable controls for development" (City of Oxnard Zoning Ordinance, City Code Division 13.1, Section 34-106).

The pipelines from proposed Platform Gina to the onshore site would come on shore north of Port Hueneme Harbor within the City of Oxnard. The proposed pipeline route crosses areas designated Parks and Residential for 1990 by the City of Oxnard General Plan. The pipeline route crosses the Port Hueneme Harbor and portions of the port area designated for harbor-related uses by the Port Hueneme Land Use Plan. South of the harbor, the pipeline route traverses an area along the beach designated Parks/Open Space by the (City of Port Hueneme) (1977). South of the City of Port Hueneme, the pipeline route crosses beach and dune land designated Parks by the City of Oxnard General Plan.

Land use designations for areas traversed by the Ormond Beach Option A pipeline corridor are itemized by corridor segment in Table 12.6-4. Zoning along this corridor within the City of Oxnard corresponds to the General Plan designations; Heavy Industrial and Limited Industrial are zoned M-2-PD (Heavy Manufacturing-Planned Development), and Residential designations are zoned either RB-1 (Single-Family Residential Beach), R-2 (Multiple-Family), R-3 (Garden Apartment), or R-W-1, (Single-Family Water-Oriented). Zoning within the City of Port Hueneme along the route between Hueneme Road and Pleasant Valley Road does not correspond completely with the General Plan designations. Areas designated Public Facilities in the General Plan are zoned for Two-Family and Multiple-Family Residential-Commercial use and an area near the junction of Ventura and Hueneme Roads designated for Medium Density Residential is zoned for General Commercial Use. The remainder of the pipeline route within the City of Port Hueneme generally corresponds to the General Plan Land Use designations (City of Port Hueneme, 1977).

Land use designations for areas traversed by the Option B pipeline corridor are listed by corridor segment in Table 12.6-5. The corresponding City of Oxnard and County of Ventura zoning options for this route are as follows:

- Perkins Road: M-2-PD, Heavy Manufacturing-Planned Development;
- Hueneme Road: C-2, General Commercial, C-PD, Commercial Planned Development and M-1-PD, Light Manufacturing-Planned Development;

TABLE 12.6-4

LAND USE DESIGNATIONS ALONG THE ORMOND BEACH OPTION A ALTERNATIVE PIPELINE CORRIDOR

Corridor Segment	Land Use Designations
1. Perkins Road between McWane Boulevard and Hueneme Road	1. Heavy industrial and limited industrial (City of Oxnard)
2. Hueneme Road between Perkins Road and Ventura Road	2. Light industrial; parks/open space; high density residential (City of Port Hueneme)
3. Ventura Road between Hueneme Road and Pleasant Valley Road	3. Medium density residential; high density residential; local commercial; neighborhood commercial; general commercial; public facilities (City of Port Hueneme)
4. Ventura Road between Pleasant Valley Road and Channel Islands Boulevard	4. Low density residential; local commercial; neighborhood commercial; general commercial; public facilities; Naval Reservation (City of Port Hueneme)
5. Channel Islands Boulevard from Ventura Road to Harbor Boulevard	5. High density residential; medium density residential; local commercial; neighborhood commercial; general commercial; Naval Reservation (City of Port Hueneme) harbor related; residential-5 d.u./acre; residential-9.5 d.u./acre; residential-11 d.u./acre; special study area; parks; open space; public utility (City of Oxnard)
6. Harbor Boulevard from Channel Islands Boulevard to 5th Street	6. Residential 5 d.u./acre; residential 9.5 d.u./acre; residential 11 d.u./acre; special study area (City of Oxnard)
7. Harbor Boulevard from 5th Street to the Union Oil Marine Terminal	7. Refer to Section 12.6.2.2.1

TABLE 12.6-5

LAND USE DESIGNATIONS ALONG THE ORMOND BEACH OPTION B ALTERNATIVE PIPELINE CORRIDOR

Corridor Segment	Land Use Designations
1. Perkins Road between McWane Boulevard and Hueneme Road	1. Heavy industrial and limited industrial (City of Oxnard)
2. Hueneme Road between Perkins Road to 0.25 mile east of the Ventura County railroad track	2. Residential and light industrial (City of Oxnard)
3. Corridor segment connecting Hueneme Road and Pleasant Valley Road	3. Light industrial (City of Oxnard)
4. Northeast along Pleasant Valley Road to Rice Road	4. Residential (6-8 d.u./acre) (City of Oxnard)
5. Rice Road between Pleasant Valley Road and Gonzales Road	5. Open space; limited industrial; light industrial; residential — 5 d.u./acre (City of Oxnard)
6. Gonzales Road between Rice Road and Harbor Boulevard	6. Open space; residential (3.7 to 8.8 d.u./acre); limited industrial, public utility
7. Harbor Boulevard between the Mandalay Generating Station and the Union Oil Marine Terminal	7. Refer to Section 12.6.2.2.1

- Area between Hueneme Road and Pleasant Valley Road: M-1-PD, Light Manufacturing-Planned Development and R-3-PD, Garden Apartment-Planned Development;

- Pleasant Valley Road: R-1, One-Family Residential, R-3-PD, Garden Apartment-Planned Development, C-2-PD, General Commercial-Planned Development, and CR, Community Reserve;

- Rice Road: M-1-PD, Light Manufacturing-Planned Development; RA, Rural Agricultural, and AE, Exclusive Agricultural by the County of Ventura.

- Gonzales Road: Between Rice Road and Rose Avenue, County of Ventura zoning is AE-1, Exclusive Agricultural, one-acre minimum lots; the City of Oxnard zoning is CR, Community Reserve, M-1-PD, Light Manufacturing-Planned Development;

- Between Rose Avenue and Oxnard Boulevard: County of Ventura zoning is AE, Exclusive Agricultural and RA, Rural Agricultural;

- Between Oxnard Boulevard and Ventura Road along Gonzales Road: City of Oxnard zoning is R-1, One-Family Residential, R-PD, Residential Planned Development, R-3-PD, Garden Apartment-Planned Development, R-4, High Rise Residential, C-2-PD, General Commercial-Planned Development, and CO-PD, Commercial Office-Planned Development;

- West of Ventura Road to Gallatin Plaza: City of Oxnard zoning is R-1, Single-Family Residential and C-2-PD, General Commercial-Planned Development. The remainder of Gonzales Road west to Harbor Boulevard: AE, Exclusive Agricultural, and RA, Rural Agricultural, County of Ventura.

12.6.3 Recreation

12.6.3.1 Existing Facilities

Major recreational facilities located within the project region are listed in Table 12.6-6 and shown on Figure 12.6-3. Regional recreational facilities include parks (state, county, and city); marinas (public); deep sea sport fishing landings; piers (public); and golf courses (public, private, and government).

Within the project area, recreational use is primarily beach- and ocean-oriented. The major recreational facilities within the project area are San Buenaventura State Beach Park, Ventura Marina, Marina Park, McGrath State Beach Park, Channel Islands Park and Harbor, Hollywood Beach Park, Silver Strand Beach Park, and Port Hueneme City Beach Park.

12.6.3.1.1 San Buenaventura State Beach Park

San Buenaventura State Beach Park covers approximately 116 acres (47 ha) and is situated between the Ventura Freeway (Highway 101) and the Pacific Ocean. Approximately 11,630 feet (3,545 m) of ocean frontage is included in the day-use-only park. Approximately 1,232,564 people visited San Buenaventura State Beach in 1977. Popular visitor activities at the park include picnicking, swimming, surfing, fishing, and sunbathing.

The San Buenaventura/Ventura Coastal State Park System General Plan recommends upgrading and enhancement of the existing facilities, including the following specific actions: (1) reduction of parking; (2) addition of group picnic facilities; and, (3) addition of picnic sites (California Department of Parks and Recreation, 1979a).

12.6.3.1.2 Marina Park

Marina Park is located adjacent to the Ventura Keys north of the Ventura Marina entrance channel. This 15-acre (6.1-ha) City of Ventura Municipal Park has approximately 1,600 feet (490 m) of beach frontage and a small floating dock in the harbor entrance channel. The park is developed with picnic

TABLE 12.6-6

REGIONAL RECREATIONAL FACILITIES

Parks

State Beach Parks
- San Buenaventura (Ventura)
- McGrath (Oxnard)

County of Ventura Parks
- Mandalay Beach (Oxnard)
- Hollywood Beach (Oxnard)
- Silver Strand Beach (Oxnard)

City Parks
- Oxnard
  - Rudolph Beck
  - Joseph L. Bolker
  - Bubbling Springs Community
  - Cabrillo
  - Carty
  - Channel Islands
  - Colonia Memorial
  - W. Mark Durley Community
  - Eastwood Memorial
  - Walter Herbert Lathrop
  - Oxnard Shores
  - Plaza
  - Rose
  - Thompson
- Ventura
  - Anacapa
  - Arroyo Verde
  - Grant
  - Marina Park
  - Olivas
  - Plaza
  - Reynolds
  - Seaside Park and Ventura County Fairgrounds
  - Junipero Serra
- Port Hueneme
  - Hueneme City Beach
- Camarillo
  - Dos Caminos
  - Pleasant Valley

TABLE 12.6-6 (concluded)

Public Marinas

- Channel Islands Harbor (Oxnard)
- Ventura Marina (Ventura)

Deep Sea Sport Fishing Landings

- Channel Islands Sport Fishing (Oxnard)
- Port Hueneme Sport Fishing (Port Hueneme)
- Ventura Landing Sport Fishing (Ventura)

Public Piers

- Hueneme Public Fishing Pier (Port Hueneme)
- Ventura Pier (Ventura)

Golf Courses

- Public
  - Buenaventura (Ventura)
  - Olivas Park (Ventura)
  - Saticoy Public Links (Saticoy)
  - Silver K (Oxnard)
- Private
  - Hueneme Bay (Port Hueneme)
  - Las Posas CC (Camarillo)
  - Saticoy CC (Saticoy)
- Government
  - John E. Clark (US Navy, Point Mugu)
  - Seabee (US Navy, Port Hueneme)

tables, restrooms, and play equipment, and has parking capacity for 75 cars. The City of Ventura bicycle path system links the park to the Keys and the rest of the city (Cotton, 1979).

12.6.3.1.3 Ventura Marina

The Ventura Marina and harbor area provides commerical and recreational facilities for the surrounding region. The harbor has over 1,100 boat slips, including those of the yacht club, boat charter, and rental and sales facilities. A fueling dock, rigging docks, and launching ramps are available in addition to support services such as a sailing school.

The Ventura Harbor Development Plan designates various recreational and commercial uses for the harbor area. These areas include approximately 165 acres (67 ha) of land and 125 acres (50 ha) of water. Some of the designated uses are already in existence, such as boat slips and fishing facilities. Others, such as a mobile home park and hotel/convention center, are currently under development or are in the preliminary planning stages.

12.6.3.1.4 McGrath State Beach Park

McGrath State Beach Park is bounded on the north by the northern embankment of the Santa Clara River; on the east by Harbor Boulevard; on the south by the Southern California Edison Mandalay Generating Station; and, on the west by the Pacific Ocean. Two parcels located in the center and southeast corner of the unit are privately owned. The park covers 295 acres (119 ha), with approximately 2.0 miles (3.2 km) of ocean frontage.

Within the park are the Santa Clara River mouth and McGrath Lake. A lagoon is often present at the mouth of the Santa Clara River. This water area is used extensively by a number of water-associated birds and is a very popular site for birdwatching. McGrath Lake, located in the southern part of the park, provides an additional, slightly different, aquatic habitat.

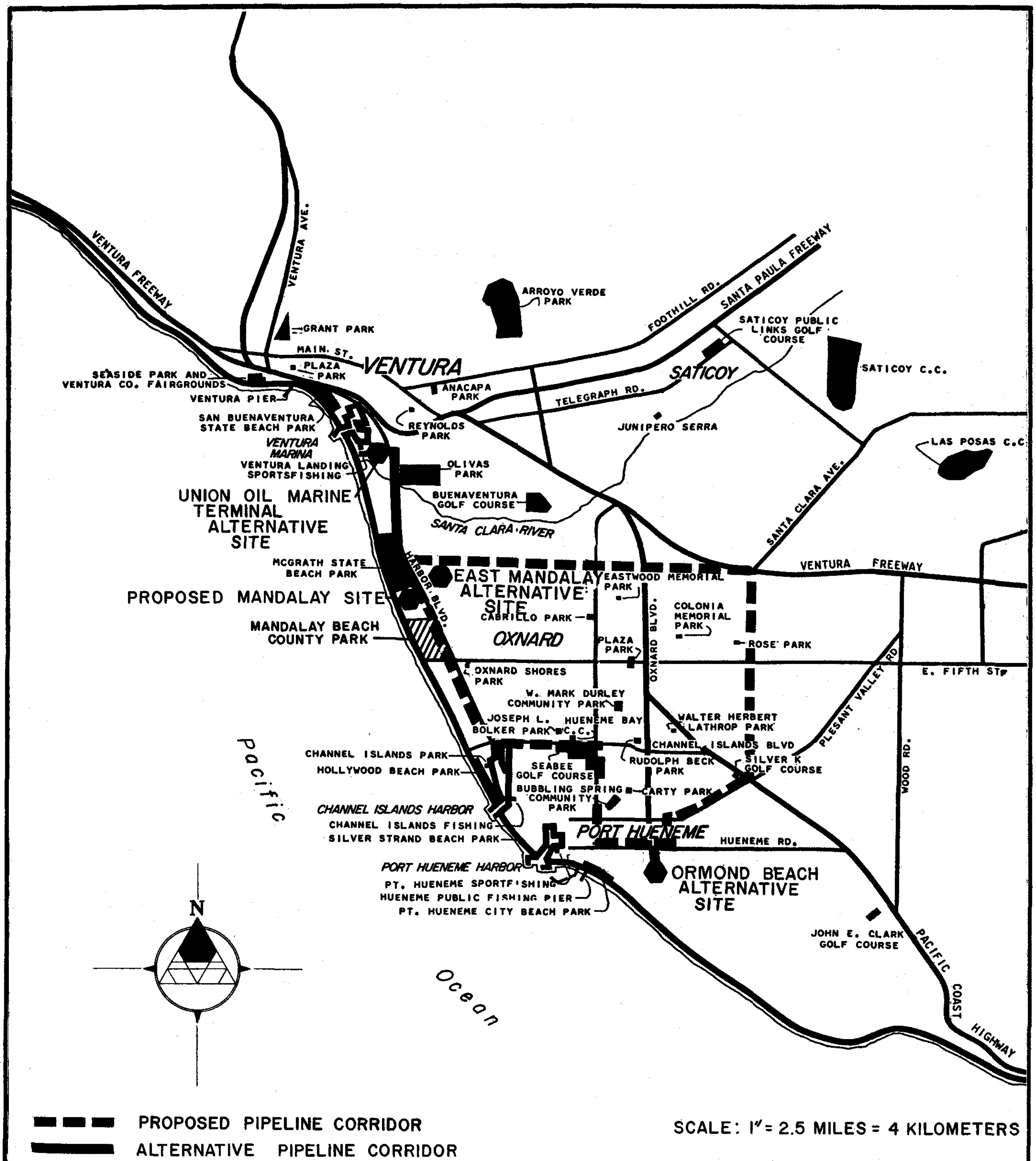


FIGURE 12.6-3

LOCATIONS OF RECREATIONAL FACILITIES

REFERENCE: MODIFIED FROM DAMES & MOORE (1974)

DAMES & MOORE

Recreation facilities at McGrath State Beach include developed campsites, restrooms with flush toilets and hot showers, a trailer sanitation station, temporary bike campground, and a campfire center. Facilities at McGrath State Beach served about 145,000 visitors during 1977.

The Santa Barbara/Ventura Coastal State Park System General Plan recommends upgrading and enhancing existing facilities and adding new facilities including campsites, combination buildings, day-use-only parking spaces, day-use-only picnic sites, a comfort station, sanitation station, and a permanent campfire center. When these proposed additions are completed, the Department of Parks and Recreation expects that annual visitation at McGrath State Beach Park will increase to nearly 200,000 persons (California Department of Parks and Recreation, 1979b). A natural preserve consisting of the main channel of the Santa Clara River and adjacent riparian shrubland and salt water marsh has been designated by the Department of Parks and Recreation. This preserve is within the boundaries of McGrath State Beach Park.

12.6.3.1.5 Mandalay Beach County Park

Property planned for the Mandalay Beach County Park is bounded on the east by Harbor Boulevard; on the west by the Pacific Ocean; on the north by the SCE Mandalay Generating Station; and, on the south by Fifth Street. The proposed treating facility site is not part of the area planned for development of the park. The planned park land is currently undeveloped and consists of 104 acres (42 ha) of disturbed sand dune and beach habitat with approximately 2,500 feet (762 m) of ocean frontage. The property is under the jurisdiction of the Ventura County Property Administration Agency. Detailed development plans for the park are currently being prepared that will include overnight primitive camping areas (no recreation vehicles), surf fishing, and picnic areas. The sand dunes and two existing oil drilling sites will be accommodated within the developed park property (Morton, 1979).

12.6.3.1.6 Hollywood Beach County Park

Hollywood Beach County Park is located north of the Channel Islands Harbor between Harbor Boulevard and the Pacific Ocean. The park contains 50 acres

(20 ha) of land area and 6,029 feet (1,838 m) of ocean frontage. It is a day-use-only facility with on-street parking available.

12.6.3.1.7 Channel Islands Harbor

Channel Islands Harbor is a recreational boating marina under the administration of the County of Ventura. The harbor has a total of 1,660 slips with an occupancy of 1,400 boats, plus 400 boats in dry-storage. After Phase III of the planned harbor expansion is completed, full occupancy would be 2,460 boats moored, and an estimated 600 boats in dry-storage (City of Oxnard, 1978b).

12.6.3.1.8 Silver Strand Beach County Park

Silver Strand Beach County Park is situated between Port Hueneme and Channel Islands Harbor. The park contains 41 acres (16.6 ha) of land area and has parking facilities to accommodate 70 vehicles. Silver Strand Beach has 4,900 feet (1,490 m) of ocean frontage.

12.6.3.1.9 Hueneme Beach Park

The City of Port Hueneme operates Hueneme Beach Park, located south of Port Hueneme Harbor. The park occupies 68 acres (27.5 ha) and includes approximately 90 percent of the usable beach area in the city (4,600 feet (1,400 m) of ocean frontage within the park). Facilities include parking for 384 cars, restroom buildings, a public fishing pier, and concessions.

12.6.3.2 Future Park Acquisition and Recreation Development

Proposed parks within the project area include: (1) a neighborhood park north of Pleasant Valley Road between Saviers and Ventura roads; (2) a neighborhood park south of Pleasant Valley Road, east of Saviers; and, (3) a city park along the coastal area of Ormond Beach (City of Oxnard, 1978a).

The State of California owns 13 small parcels of land in the area of the proposed City of Oxnard Beach Park. The California Department of Parks and

Recreation has recommended that the state relinquish the 13 lots to the City of Oxnard with the stipulation that the properties be available to the people of California as a recreational resource. The city already owns the remainder of the lots in this subdivision (Assessment Book No. 207) (California Department of Parks and Recreation, 1979c).

Within the Santa Barbara/Ventura Coastal State Park System General Plan, areas for possible acquisition to meet the projected recreational needs of the public have been identified. These areas include one land area of 164 acres (66.4 ha) located along the coast immediately south of the SCE Ormond Beach Generating Station. This area consists of a sandy beach backed by undeveloped low wetland. The site would be used for picnicking, hiking, natural and cultural history interpretation, swimming, and surfing.

Expansion of McGrath State Beach Park is proposed to include an additional 125 acres (50.6 ha) of land. Most of this area is near McGrath Lake, south of the existing park, and includes an existing go-cart racetrack. This would extend McGrath State Beach Park to the northern boundary of the SCE Mandalay Generating Station.

Another potential acquisition project within the project area encompasses an undeveloped piece of property known as Oxnard Shores. The potential park area covers land located northwest of the intersection of Harbor Boulevard and Channel Islands Road. The site could be used for day-use picnicking, swimming, sunbathing, and fishing (CDPR, 1979c).

A land use and recreation study of the Edison Canal area was undertaken by the City of Oxnard and County of Ventura pursuant to the Coastal Act of 1976 (however, this study will be superseded by the City of Oxnard LCP). The Edison Canal Recreation Plan characterizes the canal as a high use, multi-activity recreational corridor serving as a link between a variety of other recreational uses along its length. Planning recommendations for the SCE Generating Station and power line area are for trails to extend along both sides of the canal to the Harbor Boulevard undercrossing and join with trails extending north and south of the roadway. This would provide access for beach uses (City of Oxnard/County of Ventura, undated).

12.6.4 Water Use

Water use in the project area includes large-vessel marine transport and commercial and recreational boating traffic. Commercial and recreational fish catch data for the area are presented in Section 12.4.2.2. The economic value of the commercial fish catch is presented in Section 12.7.5.4. Water-related recreational uses of the project area coastline are described in Section 12.6.3.

12.6.4.1 Harbor Facilities

There are three marine transportation facilities within the project area: Ventura Harbor Marina, Channel Islands Harbor, and Port Hueneme. The Ventura Marina and Channel Islands Harbor are primarily recreation-oriented while Port Hueneme accommodates commercial and military uses.

12.6.4.1.1 Ventura Harbor

Ventura Harbor contains 1,170 slips for recreational boats and 25 slips for government and commercial vessels. The adjacent Ventura Keys residential development contains 315 waterfront lots, 250 of which are developed with boat slips. Approximately 60 percent of the boats within the harbor and the Ventura Keys are sailboats, and approximately 40 percent are power boats. When fully developed, the Ventura Harbor will contain 2,023 boat slips (1,929 recreational and 94 commercial), and the Ventura Keys will contain 315 recreational boat slips (Cotton, 1979).

12.6.4.1.2 Channel Islands Harbor

Channel Islands Harbor is used principally as a recreational port under the joint administration of the City of Oxnard and Ventura County. In 1977, the harbor contained 1,660 slips with an occupancy of 1,400 boats, plus another 400 boats in dry-storage. There were also approximately 400 boats associated with the adjacent residential marina (City of Oxnard, 1977a).

It has been projected that between 1980 and 1985, the addition of new berthing and storage facilities within, and connected to, the harbor will increase the total boating population to 4,740 craft (City of Oxnard/County of Ventura, undated).

12.6.4.1.3 Port Hueneme

Berthing space within Port Hueneme is principally operated by the U.S. Navy, with about 30 percent of the space (deep-water commercial berthing) being operated by the Oxnard Harbor District.

The Oxnard Harbor District presently owns and operates a total of 59 acres (23.9 ha) of waterfront and terminal facilities. In addition, port tenants lease more than 30 acres (12.2 ha) of land from the Navy. Berthing facilities include an 1,800-foot (550-m) long commercial deep-water berth and slips for smaller commercial and sport fishing craft. Shippage through the port increased from 1,154,764 tons (1,040,000 tonnes) in 1972-73 to 1,793,290 tons (1,614,000 tonnes) in 1976-77.

Future development plans for the port include major expansion of staging and berthing facilities for offshore oil industry use, as well as growth in ocean products harvesting and processing, lumber wholesaling and retailing, auto importation, and citrus produce shipping (Port Hueneme, 1979).

12.6.4.2 Boating Traffic

12.6.4.2.1 Ventura Harbor

Estimates of future boating traffic in the Ventura Harbor were developed for design purposes for the Harbor Master Plan Study. It is estimated that approximately 842 boats (power and sail) would sail from the marina on a typical Sunday (Cotton, 1979). Using the same use factors as the Harbor Master Plan Study, it is estimated that current levels of boating activity on a typical Sunday are approximately 600 boats sailing from the harbor.

12.6.4.2.2 Channel Islands Harbor

At Channel Islands Harbor, boat usage during most weekends rarely amounts to more than 15 to 25 percent of the total boat population (City of Oxnard/County of Ventura, undated). Applying an operational factor of 25 percent to the 1977 and projected (1985) estimates to the total boating population (see Section 12.6.4.1.2) results in the following estimates of peak daily boating activity for the harbor:

- 450 boats per day (1977)
- 1,185 boats per day (1985)

12.6.4.2.3 Port Hueneme

Estimates of one-way vessel movements generated at Port Hueneme are as follows (Elmore, 1979; Harmuth, 1979): 24 deep-water vessels per month; 15 naval vessels per month; 450 commercial and sport fishing boats per month; and, 450 crew and supply boat movements associated with offshore oil production activities. Total vessel movements including smaller fishing craft and crew boats in and out of Port Hueneme is approximately 940 movements per month, or an average of about 30 movements per day.

12.6.4.2.4 Large Vessel Movements in the Santa Barbara Channel

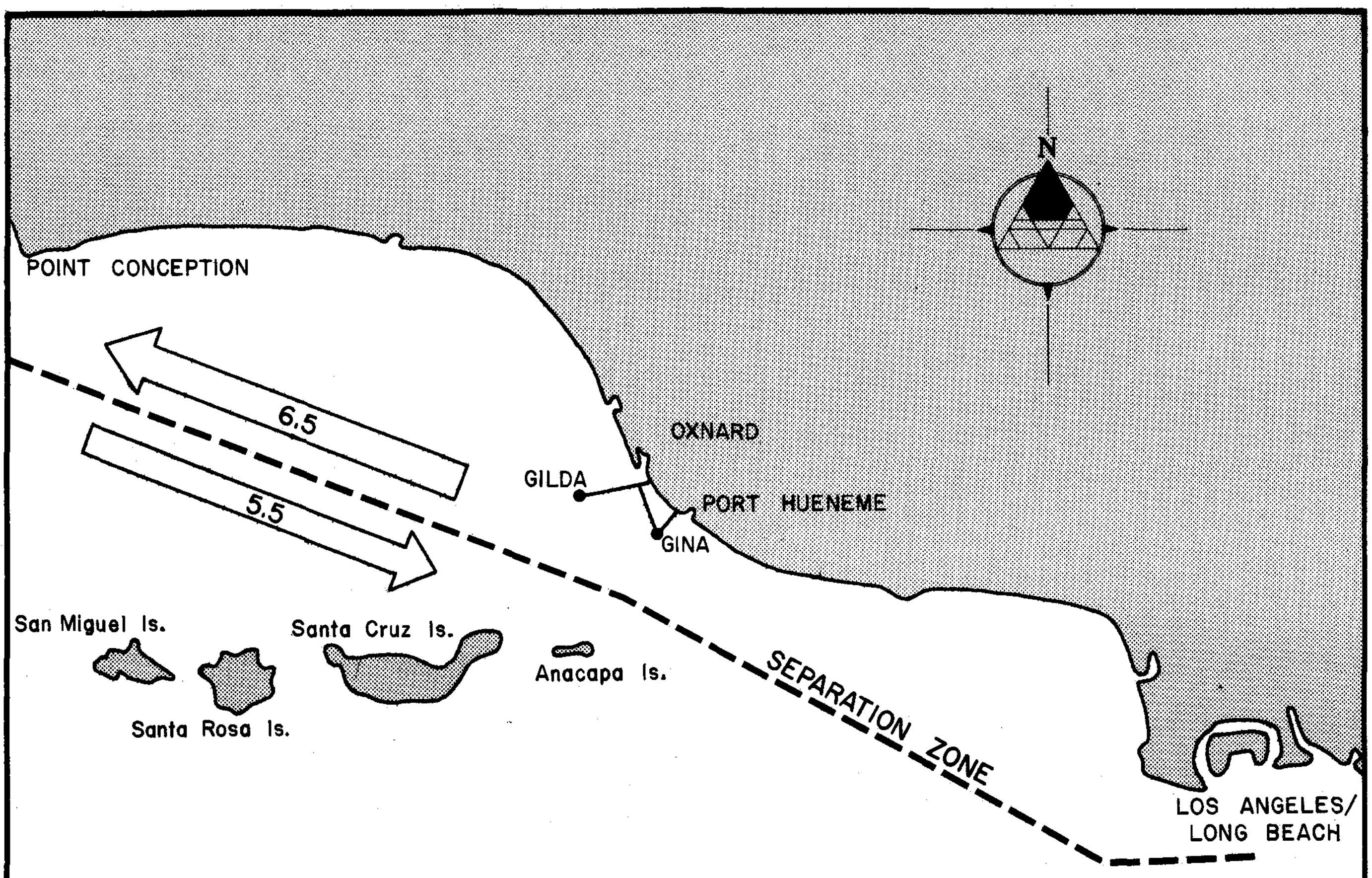
A study of vessel traffic for ships over 500 tons entering and departing the ports of Los Angeles and Long Beach was performed by John J. McMullen Associates, Inc. (1977). Approximately 40 percent of the total inbound movements and 45 percent of the outbound movements utilize shipping lanes through the Santa Barbara Channel. Average daily large vessel traffic through the Santa Barbara Channel during 1974 and 1975 was estimated to be 6.5 northbound movements and 5.5 southbound movements (Figure 12.6-4).

12.6.5 Transportation

12.6.5.1 Highways and Roads

12.6.5.1.1 Existing Facilities

The project region is served by two major highways and an extensive network of primary and secondary arterial roads. U.S. Highway 101, a four-lane, divided, limited-access freeway, provides the major transportation link between the Oxnard area and Los Angeles to south, and points northward such as



EXPLANATION

5.5 — ARROW INDICATES DIRECTION OF TRAVEL; NUMBER INDICATES AVERAGE TRIPS PER DAY IN THAT DIRECTION (DATA FROM 1976)

SCALE: 1" ≅ 20 MILES ≅ 32 KILOMETERS

FIGURE 12.6 - 4

COMMERCIAL MARINE TRAFFIC

REFERENCE: MODIFIED FROM McMULLEN AND ASSOCIATES, INC. (1977)

DAMES & MOORE

Santa Barbara and San Luis Obispo. State Highway 1, a two-lane highway, forms a link between Oxnard and points southward including Point Mugu, Malibu, and Santa Monica.

The existing arterial street system serving the project area and vicinity is shown on Figure 12.6-5. Traffic volumes and design capacities for major streets serving the project area are presented in Table 12.6-7.

During 1978, the City of Oxnard tabulated accident statistics for intersections within the city. Five of the 24 most accident-prone intersections are in areas that could serve as routes for traffic resulting from the proposed project. The corresponding 1978 accident rates for these intersections are as follows:

Ranking	Intersection	No. of Accidents	Accident Rate per Million Vehicles
1	Saviers Rd./Pleasant Valley Rd.	36	2.920
4	Harbor Blvd./Fifth St.	13	1.857
15	Fifth St./Highway 1	17	.994
17	Channel Islands Blvd./ Victoria Ave.	11	.940
19	Gonzales Rd./Highway 1	15	.8797

(Genovese, 1979)

12.6.5.1.2 Access to the Proposed and Alternative Onshore Treating Facility Sites

The proposed Mandalay site, and East Mandalay and Union Oil Marine Terminal alternative sites are accessible primarily from Harbor Boulevard. Harbor Boulevard can be reached via the Highway 101/Ventura Freeway exit onto Harbor Boulevard, or from 101 via: Victoria Avenue/Olivas Park Drive; Victoria Avenue/Gonzales Road; or, Oxnard Boulevard/Fifth Street. Harbor Boulevard is accessible from the south via Channel Islands Boulevard. The Ormond Beach alternative site and Port Hueneme are accessible from four primary routes and various combinations of Oxnard City streets. The four main

TABLE 12.6-7

TRAFFIC VOLUMES ON LOCAL ROADWAYS

Measurement Location[a]	Average Daily Traffic (ADT) (Vehicles/Day)[b]	Projected 1990 ADT (Vehicles/Day)[c]	Average AM Peak Traffic (Vehicles)[b]	Average PM Peak Traffic (Vehicles)[b]	Approximate Capacity (Vehicles/Day)[d]
1. Olivas Park Drive; west of Victoria Avenue	3,750	18,200	380	390	6,000-8,000
2. Olivas Park Drive; east of Harbor Boulevard	3,050	10,200	NA[e]	NA	6,000-8,000
3. Victoria Avenue; north of Olivas Park Drive	14,000	29,800	NA	NA	22,000-25,000
4. Victoria Avenue; south of Olivas Park Drive	9,680	36,000	860	880	6,000-8,000
5. Harbor Boulevard; north of Olivas Park Drive	14,630	23,300	1,170	1,330	22,000-25,000
6. Harbor Boulevard; north of Gonzales Road	13,690	17,000	1,150	1,250	6,000-8,000
7. Harbor Boulevard; south of Gonzales Road	15,910	13,700	1,490	1,460	6,000-8,000
8. Harbor Boulevard; north of West Fifth Street	13,720	13,700	1,380	1,190	6,000-8,000
9. Gonzales Road; east of Harbor Boulevard	6,950	3,800	580	630	6,000-8,000
10. West Fifth Street; east of Harbor Boulevard	4,910	5,900	NA	NA	6,000-8,000

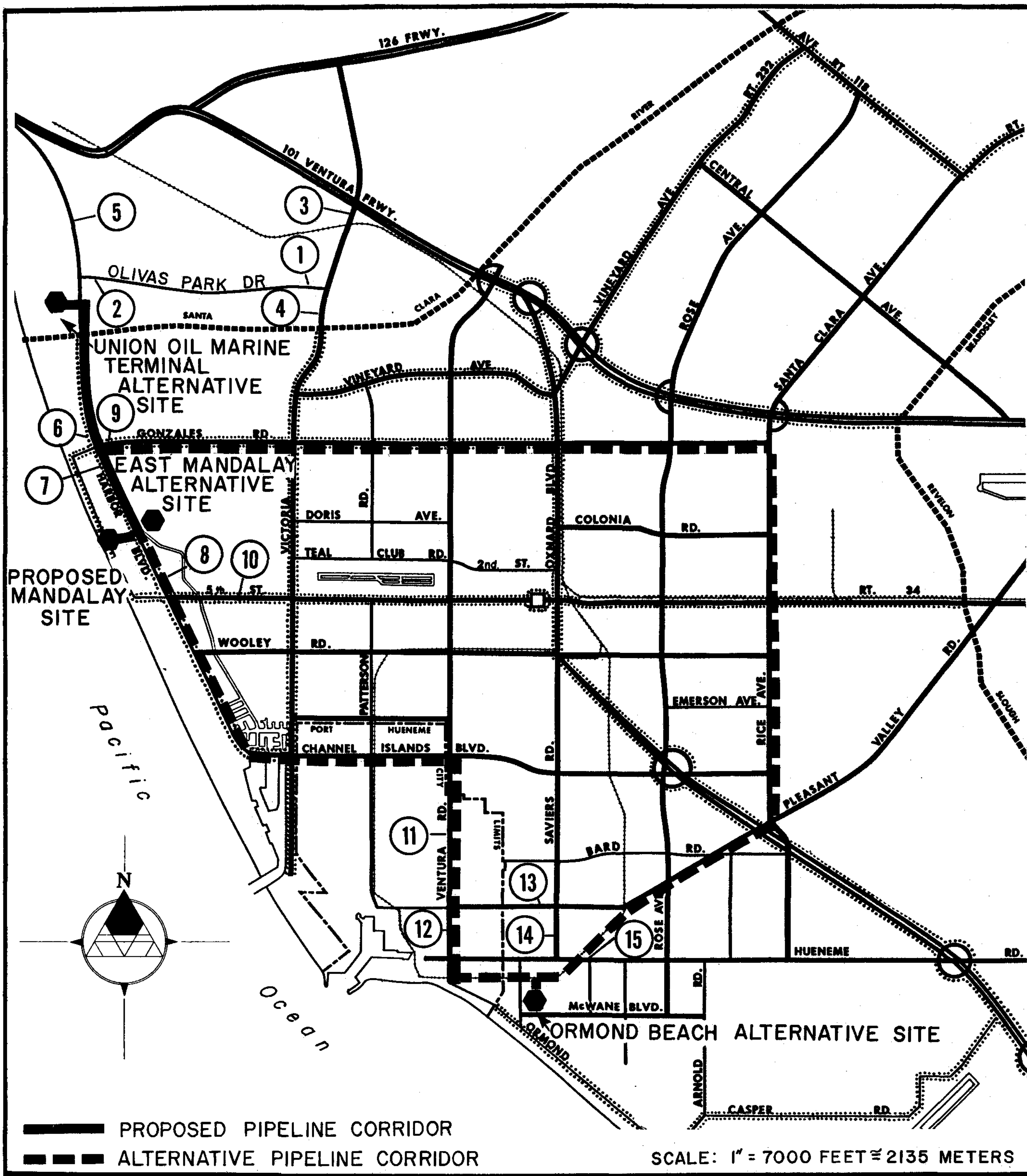


FIGURE 12.6-5

TRAFFIC COUNT LOCATIONS

NOTE: SEE TABLE 12.6-7 FOR DATA

DAMES & MOORE

TABLE 12.6-7 (concluded)

Measurement Location[a]	Average Daily Traffic (ADT) (Vehicles/Day)[b]	Projected 1990 ADT (Vehicles/Day)[c]	Average AM Peak Traffic (Vehicles)[b]	Average PM Peak Traffic (Vehicles)[b]	Approximate Capacity (Vehicles/Day)[d]
11. Ventura Road; south of Channel Islands Boulevard	24,162	37,100	NA	NA	22,000-25,000
12. Ventura Road; north of Hueneme Road	13,000	12,800	NA	NA	22,000-25,000
13. Pleasant Valley Road; west of Saviers Road	13,920	13,800	NA	NA	22,000-25,000
14. Saviers Road; north of Hueneme Road	18,130	3,100	NA	NA	22,000-25,000
15. Hueneme Road; east of Saviers Road	12,570	12,200	1,090	1,670	22,000-25,000
16. Hueneme Road; west of State Highway 1	6,190	4,700	640	830	6,000-8,000

[a]Locations are shown on Figure 12.6-5.
[b]Data from City of Oxnard (1977b, 1979); County of Ventura (1978b); City of San Buenaventura (1979); Leach (1979).
[c]Data from Leach (1979).
[d]Data from City of Oxnard (1977a).
[e]NA = data not available.

approaches are: Highway 1/Hueneme Road; Pleasant Valley Road/Saviers Road; Oxnard Boulevard/Saviers Road; and, Ventura Road/Hueneme Road.

12.6.5.1.3 Future Development

Future planned roadway development within the project area vicinity includes widening of Pleasant Valley Road within the City of Port Hueneme. This expansion is projected to take place by approximately 1982 (Leach, 1979). Victoria Avenue will be extended by the county from Gonzales Road south to the City of Port Hueneme. This federally funded facility will be four lanes along its entire length. It is expected to accommodate much of the traffic that presently utilizes Harbor Boulevard. Environmental review and approval has been completed and right-of-way acquisition is currently in progress. Portions of Victoria Avenue south of Gonzales Road are expected to be open by 1981 (Knuth, 1979).

Projected 1990 traffic levels based on future land use trends have been prepared by the County of Ventura. The 1990 traffic levels for roadways providing access to the proposed and alternative onshore treating facility sites and Port Hueneme are listed in Table 12.6-7.

12.6.5.2 Bus Service

Bus service in the Oxnard/Ventura area is provided by the South Coast Area Transit Company (SCAT). SCAT is a publicly owned bus company with an annual ridership of more than 1,500,000 passengers.

SCAT operates 11 bus routes throughout the Oxnard/Ventura area. Route 4 (Pierpoint-Loma Vista) comes within 0.5 mile (0.8 km) of the Union Oil Marine Terminal alternative site on Harbor Boulevard. Route 10 (Port Hueneme-Village) comes within approximately 0.5 mile (0.8 km) of the Ormond Beach alternative site at the intersection of Perkins and Hueneme roads. There are no bus routes in the vicinity of the proposed Mandalay or East Mandalay alternative sites.

12.6.5.3 Airports

There are four general aviation airports operating within Ventura County: Oxnard, Camarillo, Santa Paula, and Santa Susana.

The Oxnard and Camarillo airports are owned and operated by the County of Ventura. The Santa Paula and Santa Susana airports are privately owned. The Point Mugu Pacific Missile Test Center Airport is located southeast of Oxnard between Highway 1 and the Pacific Ocean. This airport is approximately 4 miles (6.5 km) south of the Ormond Beach alternative site.

Oxnard Airport is the airport closest to the project area and is situated on Fifth Street approximately 2 miles (3.2 km) east of the East Mandalay alternative site; 2.25 miles (3.6 km) east of the proposed Mandalay site; and 4 miles (6.5 km) southeast of the Union Oil Marine Terminal alternative site. In 1977, Oxnard Airport had about 295 daily landings or approximately 215,000 annual operations. Over 75 percent of the aircraft using Oxnard Airport are single-engine propeller aircraft.

Due to prevailing winds, 95 percent of all landings and takeoffs from Oxnard Airport are in a westerly direction. The remaining 5 percent are in an easterly direction (City of Oxnard, 1977a).

12.6.5.4 Rail Service

Two railroad companies currently operate within the Oxnard area--Southern Pacific Railroad and the local Ventura County Railroad.

The Southern Pacific Railroad line is located 1.5 miles (2.4 km) east of the Union Oil Marine Terminal alternative site and approximately 4 miles (6.5 km) east of the proposed Mandalay and East Mandalay alternative sites. At its closest point of approach, the Ventura County Railroad is approximately 3 miles (4.8 km) southeast of the proposed Mandalay and East Mandalay alternative sites. The Ventura County Railroad passes within 1,200 feet (365 m) of the Ormond Beach alternative site.

The Southern Pacific line is primarily a freight carrier, but also serves as the route for north/south passenger service along the coast. The Ventura County Railroad is connected to the Southern Pacific to provide freight service to the central industrial area, the Ormond Beach industrial area, the U.S. Naval Construction Battalion Center, and Port Hueneme.

12.6.6 Aesthetics

12.6.6.1 Region and Project Area

The project area is located on the Oxnard Plain, relatively gently sloping alluvial surface. It is bounded by foothills ranging from 6 to 15 miles (9.7 to 24.1 km) inland that form a visual backdrop for the coastal area. The Oxnard Plain possesses no visually prominent natural physiographic features, but it does contain a diversity of natural and man-made elements. These include agricultural row crops, orchards, wind rows, the Santa Clara River, major highways, urban central business districts (CBD), residential neighborhoods, sand dunes, harbors, industrial, strip commercial and recreational land uses, and the waterfront and beach area with the Pacific Ocean beyond. Consequently, within the context of the Oxnard Plain, there are many microvisual settings. Scenic quality or aesthetic appeal also varies throughout the plain.

Due to the low topographic relief in the landscape, viewing distances throughout the Oxnard Plain are limited to the foreground zone by intervening elements such as trees or buildings. However, much of the Oxnard Plain is visible in long-range vistas from the adjacent foothills 6 to 15 miles (9.7 to 24.1 km) inland. Along the coastline of the project area, the Pacific Ocean is visually dominant. Contributing to the visual dominance of the water are the contrasting sand dunes and expansive beaches, boating activity offshore, and views of the Channel Islands approximately 12.5 to 20 miles (20.1 to 32.2 km) offshore.

12.6.6.2 Aesthetic Character of the Onshore Sites and Pipeline Corridors

12.6.6.2.1 Proposed Mandalay Site and Pipeline Corridor

Photographs of the proposed Mandalay site are shown on Figure 12.6-6. The site consists of a sparsely vegetated, hummocky area of sand dunes adjacent to the beach and Pacific Ocean. The SCE Mandalay Generating Station borders the northern and eastern edges of the site. To the south is undeveloped land consisting primarily of sand dunes covered by scrub vegetation composed of both native and introduced species; two oil drilling sites are nearby.

The visual field in the vicinity of the proposed Mandalay site is dominated by the presence of the SCE Mandalay Generating Station. The main units are approximately 150 feet (46 m) tall with base dimensions of 220 by 220 feet (67 x 67 m). The stack is 214 feet (65 m) in height. Fuel oil storage tanks in the tank farm area bordering the eastern edge of the proposed site have diameters from 196 to 200 feet (59.7 to 60.9 m), with heights varying from 40 to 56 feet (12.2 to 17.1 m).

Other man-made visual elements in the vicinity of the site include two existing oil drilling sites to the south and Harbor Boulevard to the east. The overall character of the landscape in the vicinity of the site is one of coastal dune and ocean-oriented open space modified by the presence of man-made industrial, transportation, and residential elements.

Mandalay Generating Station to the north and east effectively screens potential views of the site from these directions. To the west and southwest, the site is visible from nearby locations in the dunes.

The pipelines from the two proposed platforms to the proposed Mandalay site reach shore in an area where the ocean, beach, and dunes create a general open space/recreational character. However, the adjacent SCE Mandalay Generating Station represents a dominant industrial element in the landscape.

The portion of the onshore corridor along the eastern edge of Harbor Boulevard to the Union Oil Marine Terminal traverses flat, open spaces devoted to agriculture, recreation, and oil production. Near McGrath State Beach, a portion of the roadway border is planted with vegetation which forms a visual barrier on the west side of the road. Other important visual features located along the northern segment of the route are the Santa Clara River, the Olivas Park Golf Course, the City of Ventura Bio-Filtration Plant, and the Ventura Marina. The general character of the landscape is predominantly that of open space with substantial agricultural, recreational, and industrial influence.

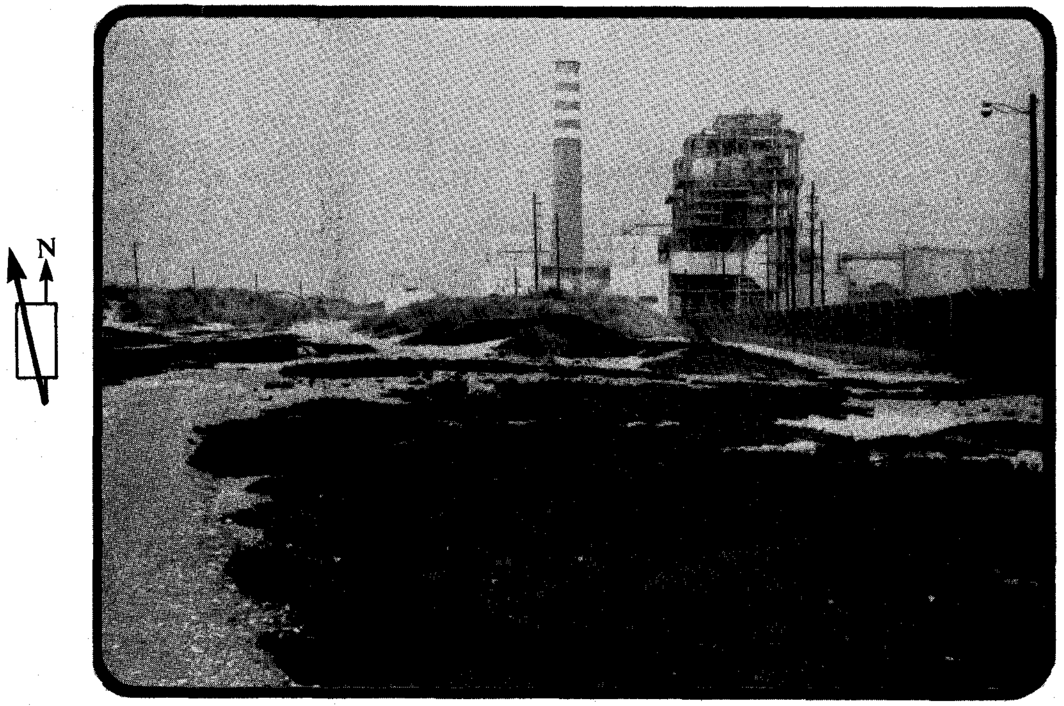
12.6.6.2.2 East Mandalay Alternative Site and Pipeline Corridor

Photographs of the East Mandalay alternative site are presented on Figure 12.6-7. The site is characterized by sand dunes with scrub vegetation. Visual elements in the immediate vicinity of the site include the Edison Canal, SCE high voltage transmission lines, an SCE substation, and miscellaneous oil production equipment. The general character of the immediate site vicinity is that of a man-altered, industrialized landscape. The surrounding area to the north is agricultural/open space/oil production; to the east, open space/ agricultural; to the west, public utilities (SCE Mandalay Generating Station); to the southwest across Harbor Boulevard, open space/disturbed sand dune (planned Mandalay Beach County Park); and to the south, an industrial waste dumpsite/open space.

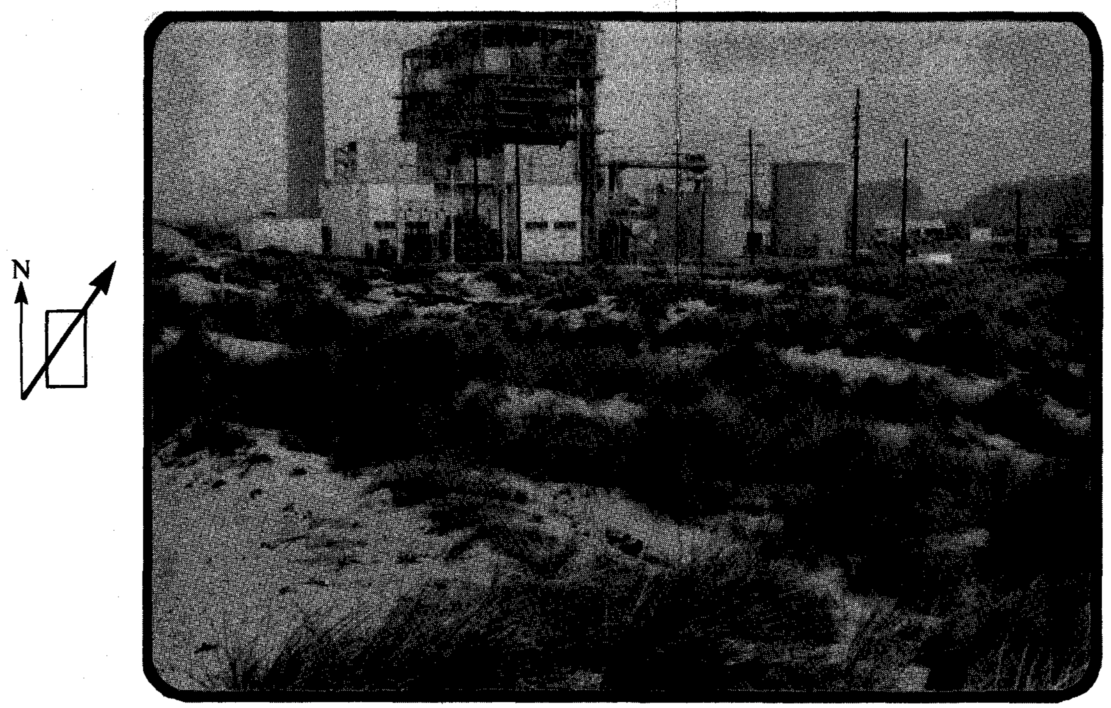
The onshore pipelines associated with the East Mandalay alternative site traverse essentially the same route as the proposed Mandalay site onshore pipelines (see Section 12.6.6.2.1).

12.6.6.2.3 Union Oil Marine Terminal Alternative Site and Pipeline Corridors

Photographs of the Union Oil Marine Terminal alternative site are shown on Figure 12.6-8. The site is situated within an existing Union Oil tank farm and has been previously graded and surfaced with oil or asphaltic pavement. The area is enclosed within a 4- to 8-foot (1.2 to 2.4-m) high berm. The City of Ventura Bio-Filtration Plant is located immediately to the southeast of the site.



VIEW TOWARD NNW FROM SOUTH OF SITE,
SCE MANDALAY GENERATING STATION IN BACKGROUND



VIEW TOWARD NNE FROM SOUTH OF SITE

VIEW TOWARD NORTHWEST FROM SOUTH OF SITE

FIGURE 12.6-6

PHOTOGRAPHS OF THE PROPOSED MANDALAY SITE

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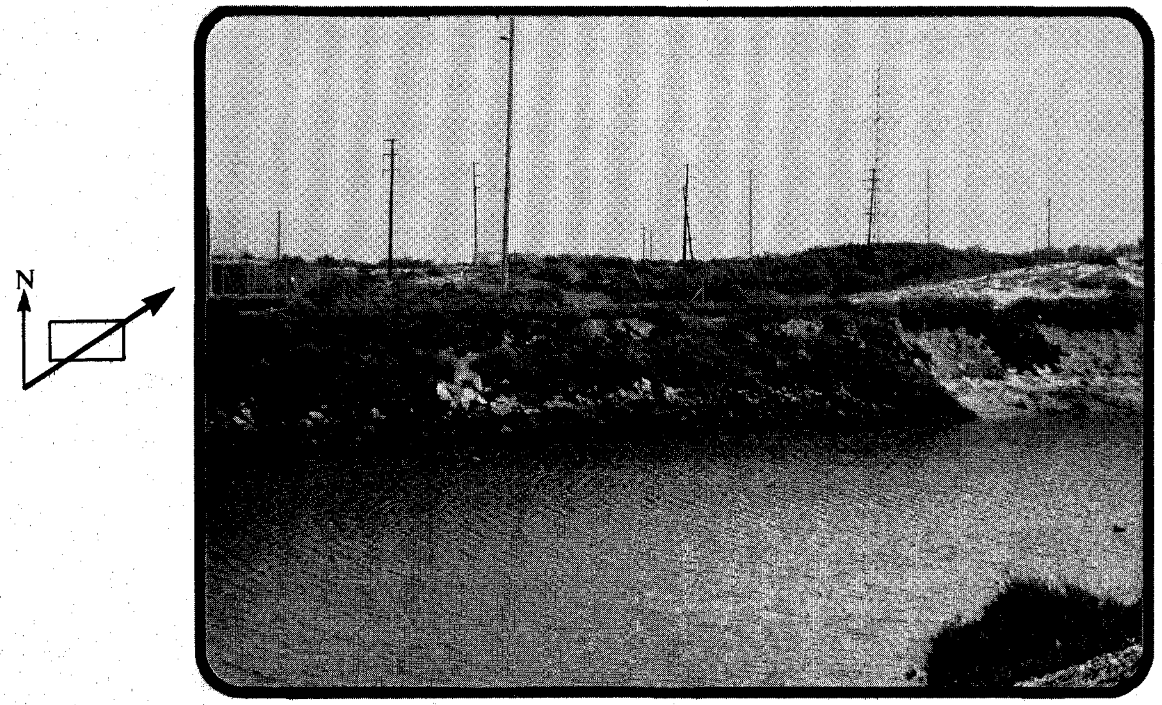
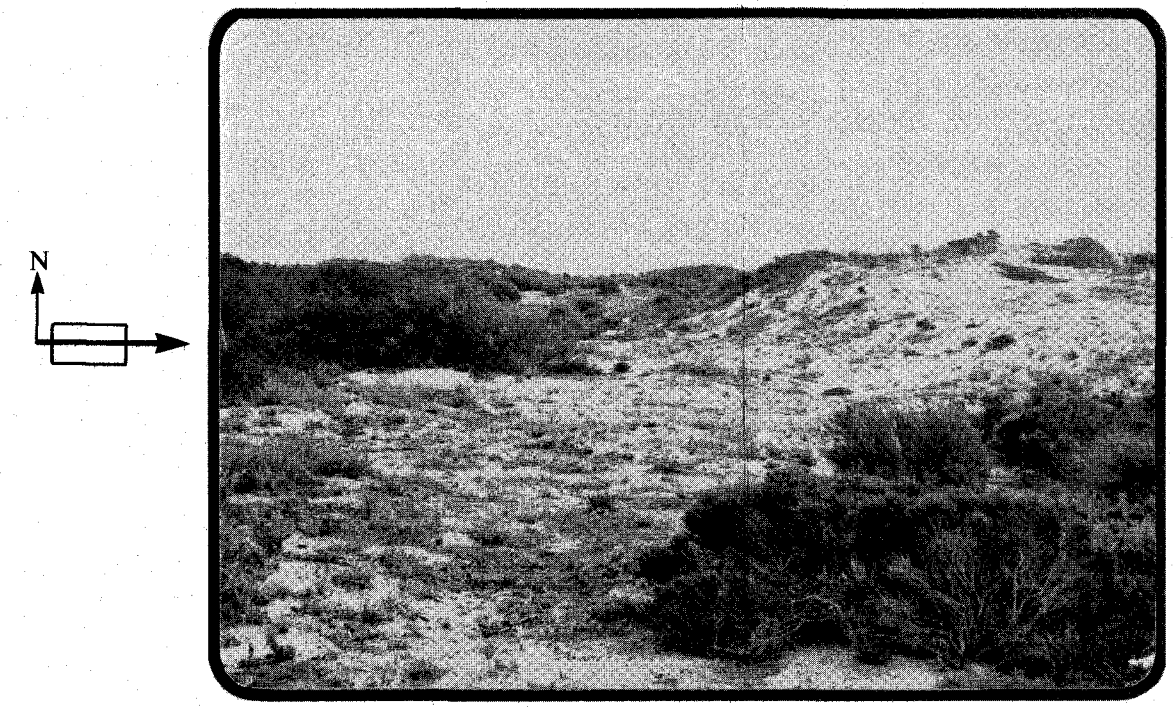


VIEW TOWARD NORTHEAST FROM SOUTHWEST OF SITE;
EDISON CANAL IN FOREGROUND



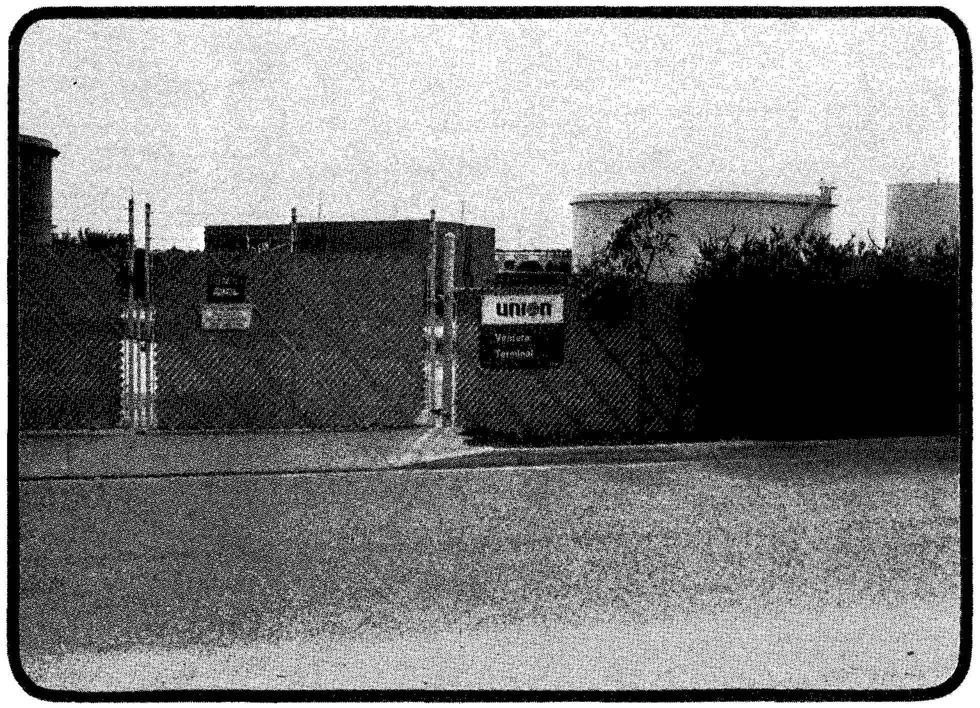
VIEW TOWARD EAST FROM WEST OF SITE

VIEW TOWARD NORTHEAST FROM SOUTHWEST CORNER OF SITE

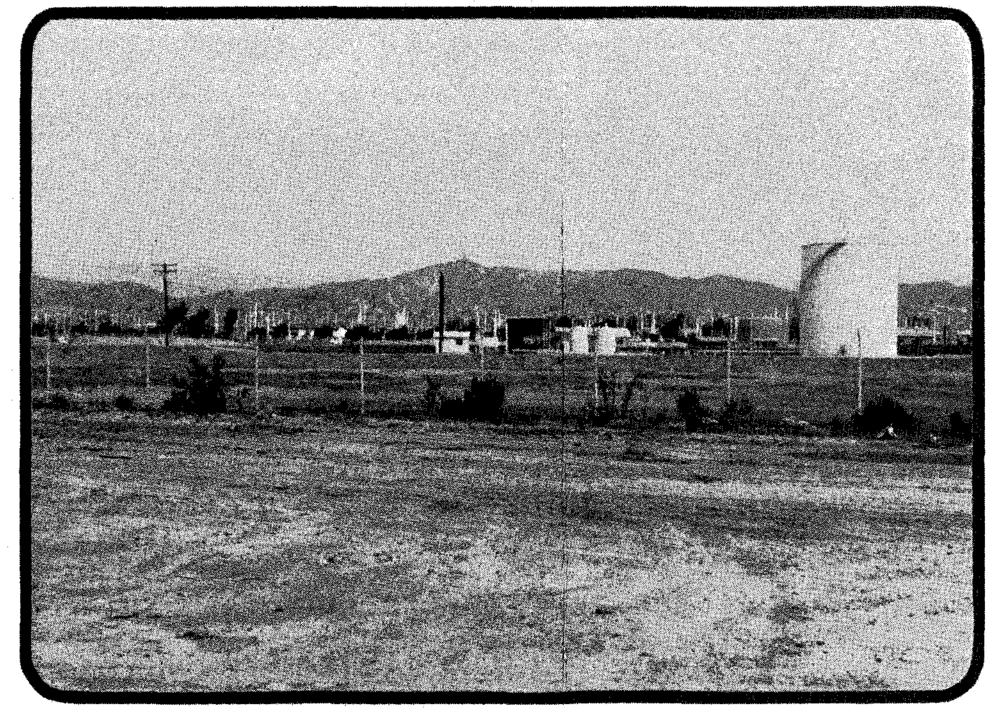
FIGURE 12.6-7

PHOTOGRAPHS OF THE EAST MANDALAY ALTERNATIVE SITE

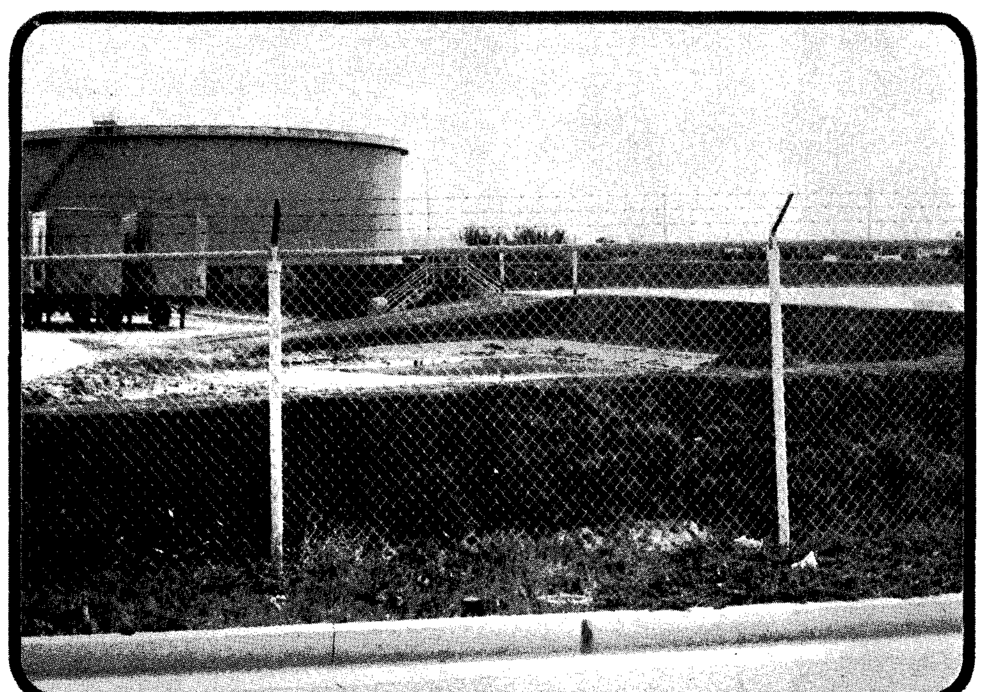
DAMES & MOORE



VIEW TOWARD EAST FROM WEST OF SITE;
SPINNAKER DRIVE IN FOREGROUND



VIEW TOWARD NORTHWEST FROM SOUTH OF SITE;
VENTURA MARINA IN BACKGROUND



VIEW TOWARD EAST FROM SPINNAKER DRIVE

FIGURE 12.6-8
PHOTOGRAPHS OF THE UNION OIL MARINE TERMINAL ALTERNATIVE SITE

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The existing visual character of the immediate site area is that of an industrialized landscape. This contrasts with the beach and sand dune areas to the south, the recreation-oriented Ventura Marina to the north and west, and the Olivas Park Golf Course to the east.

Onshore pipelines associated with the Union Oil Marine Terminal alternative site traverse the same route as the proposed Mandalay site onshore pipelines (see Section 12.6.1.2.2).

12.6.6.2.4 Ormond Beach Alternative Site and Pipeline Corridors

The visual character of the Ormond Beach alternative site area is dominated by localized industrial elements within a flat, open space/agricultural setting. The site itself is located on a vacant lot that has been graded. Photographs of the site are presented on Figure 12.6-9.

The overall visual character of the area is dominated by industrial elements. Land use to the immediate north, west, and south of the site is industrial. A small parcel of vacant land is located to the southwest, while open space agricultural land occurs to the immediate east, with additional industrial elements beyond. Distant views are blocked by the surrounding existing industrial facilities and mounds of solid refuse.

The onshore pipeline corridor connecting the proposed Platform Gina to the Ormond Beach alternative site traverses a beachfront residential area, Port Hueneme Harbor, and commercial/light industrial areas within the port. South of the port, the route traverses beach and dunes. The final segment of the pipeline route is located in the existing industrial area inshore from Ormond Beach.

Land uses along the Option A pipeline route are listed in Table 12.6-2. The landscape character along Hueneme and Ventura roads and Channel Islands Boulevard is predominantly urbanized. The visual character of Harbor Boulevard north of Channel Islands Boulevard to Fifth Street is suburban residential/sand dune open space. The landscape character along Harbor Boulevard north of Fifth Street is as described in Section 12.6.6.2.1.

The Option B pipeline corridor follows Perkins Road, Hueneme Road, Pleasant Valley Road, Rice Road, Gonzales Road, and Harbor Boulevard. Land uses along various segments of this corridor are listed in Table 12.6-3.

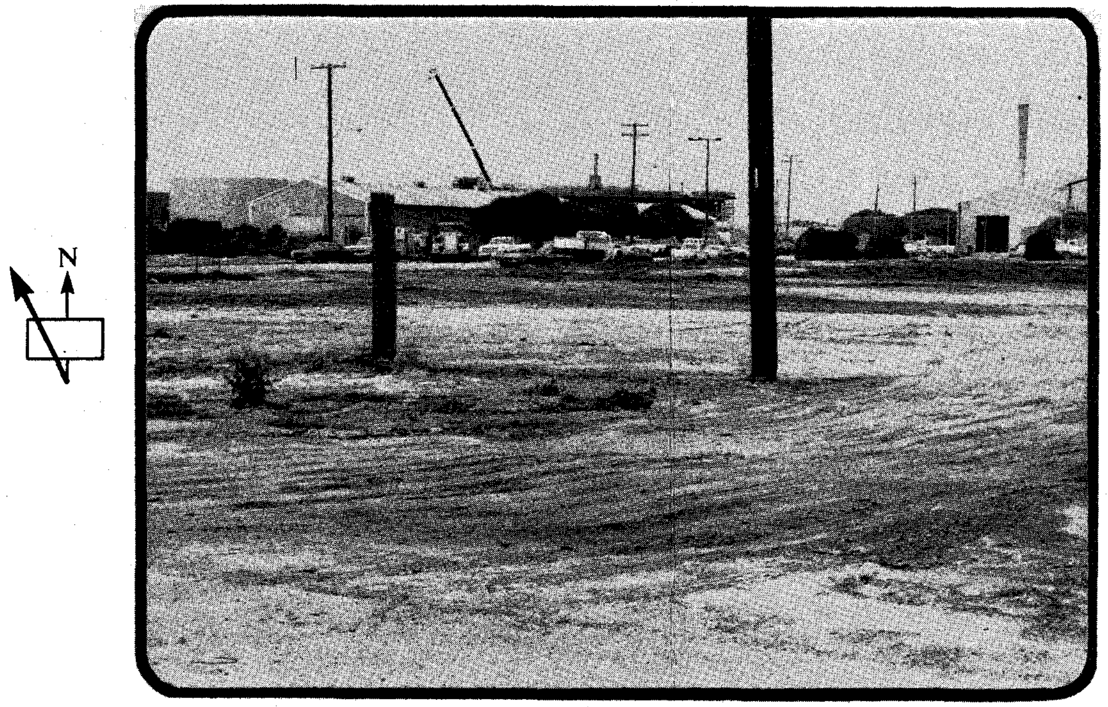
After passing through an industrialized area, the route traverses a short expanse of agricultural land before entering an area of single- and multi-family residential and commercial development along Pleasant Valley Road. The general visual character in this area is that of new suburban tract development with minimal mature vegetative cover and landscaping. Along Rice Road and Gonzales Road (between Rice Road and Oxnard Boulevard), the character of the landscape is predominantly rural open space/agricultural, with little diversity of visual elements. At Oxnard Boulevard, the visual character of the surroundings changes to an urbanized setting. Between Ventura Road and Harbor Boulevard, there exists a rural/open space landscape composed of agricultural land with occasional single-family dwellings. The visual character of the Harbor Boulevard portion of the route is described in Section 12.6.6.2.1.

12.6.6.3 Aesthetic Character of the Offshore Area

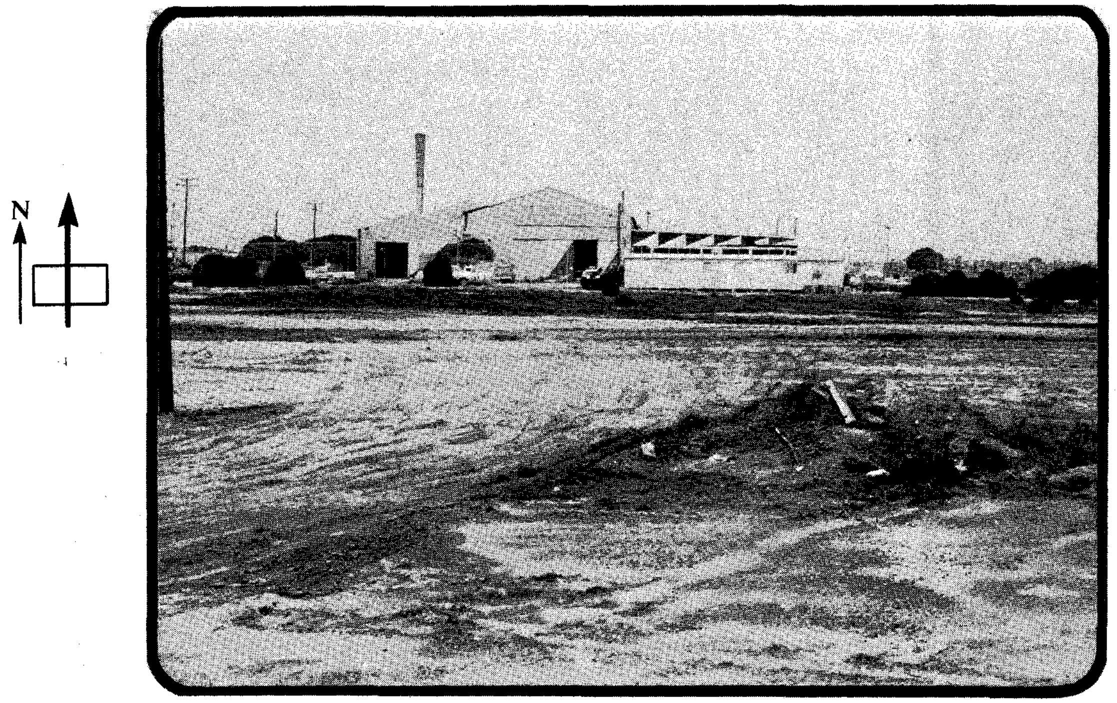
The proposed offshore platform locations are situated at the southeastern end of the Santa Barbara Channel. The Oxnard Plain and surrounding foothills beyond form the visual backdrop from the Channel looking inland. Conversely, the Channel Islands group (Anacapa, Santa Cruz, Santa Rosa, and San Miguel islands) dominate views to the south and west looking offshore.

Numerous oil production platforms exist within the Santa Barbara Channel including a group of 11 platforms in the area offshore of Carpinteria--Platforms Heidi, Hope, Hogan, Houchin, Henry, Hillhouse, Union A, B, C, Hilda, and Hazel. These platforms are approximately 12.5 miles (20 km) northwest of

VIEW TOWARD NORTHEAST FROM MC WANE BOULEVARD



VIEW TOWARD NORTHWEST FROM MC WANE BOULEVARD



VIEW TOWARD NORTH FROM MC WANE BOULEVARD

FIGURE 12.6-9

PHOTOGRAPHS OF THE ORMOND BEACH ALTERNATIVE SITE

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the proposed Platform Gilda site and 21 miles (34 km) northwest of the proposed Platform Gina site. Consequently, the proposed platforms would be situated within a visual field separate from these existing platforms. One platform exists in the general vicinity of the proposed platform locations--Platform Grace, situated approximately 4 miles (6.4 km) west of the Platform Gilda site and 13.5 miles (22 km) northwest of proposed Platform Gina. Platform Grace is located approximately 11.5 miles (18 km) offshore of Ventura.

Large vessels are often visible while passing through the Santa Barbara Channel. Numerous pleasure craft, particularly on weekends, are also visible offshore of Ventura/Port Hueneme.

There are no significant visual obstructions in the Santa Barbara Channel. Natural limitations on visibility in the Channel are weather conditions (fog, etc.) and declination of viewing field due to the curvature of the earth at substantial viewing distances.

Fog is the primary cause of low visibility in the Santa Barbara Channel area. Smog occurs less frequently and has a less pronounced effect on visibility. Based on ship reports from 1949 to 1973, visibility in the Channel was 2 miles (3.2 km) or more 87.2 percent of the time; 5 miles (8 km) or more 69.9 percent; and, 10 miles (16 km) or more 32.3 percent of the time (IRC, 1976). In general, the months of July through September have the lowest visibility. The months of December through March have the highest visibility. Based on past studies, the ocean area off Port Hueneme has the lowest visibility of any coastal area southeast of Point Conception (IRC, 1976).

Because of the curvature of the earth, visibility of objects offshore decreases as a function of the distance from the viewing point. The loss of visibility due to curvature is approximately 10 feet (3 m) at a distance of 5 miles (8 km); 19 feet (5.8 km) at 9 miles (14.5 km); and 44 feet (13.4 km) at 15 miles (24.1 km).

12.7 SOCIOECONOMICS

12.7.1 Population

12.7.1.1 Ventura County

Ventura County, as of January 1, 1979, had a total population of 488,900 persons (State of California Population Research Unit, 1979), approximately 2.2 percent of the total State of California population. Growth of the county's population since 1950 has been as follows:

Year	Actual Total County Population
1950	114,547
1960	199,138
1970	378,497
1975	432,407
1979	488,900

(County of Ventura Environmental Resources Agency (VCERA), 1975a; U.S. Department of Commerce, 1972; California Population Research Unit, 1979)

Future county population projections are as follows:

	Total County Population	
Year	Projection by the County of Ventura	Projection by the State of California
1985	583,455	578,600
1990	652,651	658,400
1995	721,178	735,900
2000	791,675	807,300
2010	No projection	943,900
2020	No projection	1,078,500

(County of Ventura, Environmental Resources Agency, 1978b; California Department of Finance, 1977)

Population growth of Ventura County during the period between 1950 and 1979 was 327 percent, surpassing the growth rate of the balance of the state, which was 110 percent during the same period. This trend is expected to continue into the future. The State of California predicts that Ventura County's population will grow by 65 percent between 1979 and 2000, while the rate for the balance of the State is predicted to be slightly less than 30 percent (California Department of Finance, 1977; California Population Research Unit, 1979).

12.7.1.2 Project Area

The proposed site for the onshore processing facility at Mandalay Beach and the three alternative sites are located within Regional Statistical Areas 2 and 3 of Ventura County. These statistical areas include the cities of Oxnard, Port Hueneme, Ventura, Santa Paula, Camarillo, and Ojai. The three cities within the project area are Oxnard, Port Hueneme, and Ventura. These cities have experienced historical growth as follows:

	Population					
	1950	1960	1970	1975	1979	% Growth 1950-79
Oxnard	21,567	40,265	71,225	85,104	97,800	353
Port Hueneme	3,024	11,067	14,295	17,767	18,400	508
Ventura (City)	16,534	29,114	57,964	62,938	69,700	321

(California Population Research Unit, 1979; VCERA, 1975a; U.S. Department of Commerce, 1972)

Projections of future growth have been made by the county in connection with the Areawide Waste Treatment Management Plan (208 Plan) for the county's designated growth areas. The growth areas include territory outside the presently incorporated cities, but which are likely to be annexed as growth occurs. For the cities directly involved in the proposed project, population projections are as follows:

	Population				
	1985	1990	1995	2000	% Growth 1985-2000
Oxnard Growth Area	125,400	141,400	158,900	177,400	41
Port Hueneme Growth Area	23,000	24,000	25,400	26,900	17
Ventura (City) Growth Area	85,000	89,000	97,000	107,000	26

(VCERA, 1978b)

The proposed and alternative onshore treating facility sites and associated pipeline routes are located within 16 census tracts in Ventura County (Figure 12.7-1). Population statistics for those tracts are shown in Table 12.7-1.

12.7.2 Housing

12.7.2.1 Ventura County

As of January, 1978, Ventura County reported the total housing unit inventory as 162,001 units, as follows:

	Population	Housing Units	Persons per Housing Unit
Single Family Dwellings	370,859	115,074	3.22
Multiple Family Dwellings:			
2 - 4 units	33,243	14,753	2.25
5+ units	39,236	22,425	1.75
Mobile Homes	16,941	9,749	1.74
Subtotal	460,279	162,001	2.84
Group Quarters	11,564	N.A.	
Total	471,843		

(VCERA, 1978a)

The county-wide household size was 2.84 persons in 1978, compared to 3.00 in 1975, and 3.36 in 1970. This reflects a significant change in occupancy characteristics (VCERA, 1975a).

TABLE 12.7-1

POPULATION AND HOUSING STATISTICS

Census Tract[a]	Population 1970[b]	Population 1975[c]	Population 1978[d]	Housing Units 1970[b]	Housing Units 1975[c]	Housing Units 1978[d]
25 - Pierpont Bay	4478	4766	4949	1914	2272	2369
29 - Mandalay Beach	2004	3656	3888	565	1181	1387
30 - Wagon Wheel	3246	4961	6143	1203	2376	2943
31 - Rio Lindo	2966	3302	3338	789	949	951
33 - Freemont	5050	5090	5624	1794	1920	2170
36.01 - Channel Islands	3774	4917	6784	1835	3092	3971
37 - McKinna	4529	4547	4448	1020	1170	1170
41 - Green	7163	7130	6965	1766	1954	1970
42 - Bubbling Springs	5427	4958	4812	1332	1318	1318
43.01 - Seabee	3567	5014	3810	505	500	500
43.02 - Hueneme Bay	1253	3109	3869	722	1854	2257
44 - Hueneme	4048	4683	4958	1588	2302	2471
45 - Hathaway	6150	7579	8346	2171	2753	2963
47 - Tierra Vista	7166	13,201	13,943	2152	4379	4735
48 - Revolon	49	24	26	14	14	13
49 - Rose Park	3350	3899	3857	667	880	880

[a] Locations are shown on Figure 12.7-1.

[b] Data from federal census (VCERA, 1975a).

[c] Data from special census (VCERA, 1975b).

[d] Estimate for January, 1978 (VCERA, 1978a).

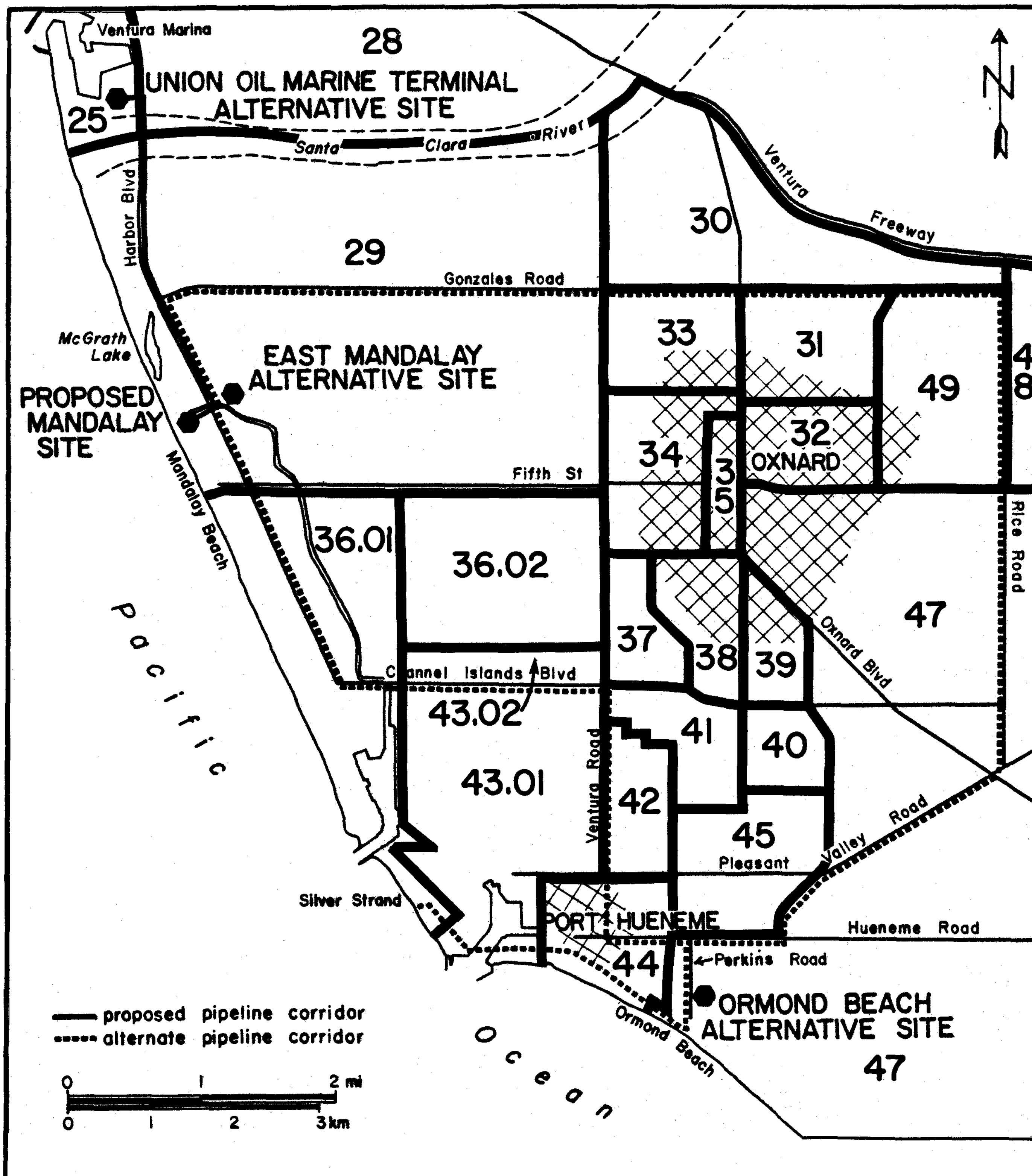

FIGURE 12.7-1

LOCAL CENSUS TRACTS

NOTE: SEE TABLE 12.7-1 FOR NAMES OF TRACTS POTENTIALLY
CONTAINING PROPOSED OR ALTERNATIVE PROJECT ELEMENTS.

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Future housing growth projections for the county indicate a household size of about 2.91 persons in 1990, with a slight increase occurring after that time. By year 2000, the household size is predicted to be 2.94 persons (VCERA, 1978b). Housing unit growth is projected as follows:

Year	Total County Housing Units	Projected Growth
1985	200,743	38,742
1990	224,238	62,237
1995	245,832	83,831
2000	269,229	107,228

(VCERA, 1978b)

12.7.2.2 Project Area

Portions of the cities of Oxnard, Port Hueneme, and Ventura are included within the project area. Housing counts and occupancy characteristics for 1978 are as follows:

	Population	Housing Units	Unadjusted Household Size
Oxnard	93,774	32,517	2.88
Port Hueneme	17,449	6,545	2.67
Ventura (City)	69,008	27,491	2.51

(VCERA, 1978a)

Housing vacancy rates in the three cities for the years between 1975 and 1978 are as follows:

	July 1975	July 1976	July 1977	Jan 1978
Oxnard	7.84	6.31	6.88	6.57
Port Hueneme	12.83	9.92	10.90	10.73
Ventura (City)	7.01	4.99	5.85	5.57

(VCERA, 1978b)

The proposed and alternative onshore treating facility sites and associated pipeline routes are located within 16 census tracts in Ventura County (Figure 12.7-1). Housing data for those tracts are shown in Table 12.7-1.

Projections of future housing growth have been made by the county in connection with their Areawide Waste Treatment Management Plan (208 Plan) for the county's designated growth areas. The growth areas include territory presently outside of existing city boundaries, but which are likely to be annexed as growth occurs. Projections of housing for the three cities associated with the project area are as follows:

	Housing Units				
	1985	1990	1995	2000	% Growth 1985-2000
Oxnard Growth Area	43,310	49,200	53,110	58,740	36
Port Hueneme Growth Area	7,945	8,280	8,630	8,980	13
Ventura (City) Growth Area	34,713	36,547	39,152	42,336	22

(VCERA, 1978b)

An estimated 1,644 rooms exist in the Oxnard-Port Hueneme-Ventura-Camarillo area for transient accommodations. (American Automobile Association, 1979; Oxnard Convention and Visitors Bureau, undated).

12.7.3 Utilities

12.7.3.1 Electricity

Electrical power and energy is provided to the Oxnard Plain, which includes the project area, by the Southern California Edison Company (SCE). SCE presently operates two major oil- and gas-fueled generating stations in Ventura County--the Ormond Beach Generating Station and the Mandalay Generating Station. The total electrical generating capacity of the two sources is approximately 2,000,000 kw. The energy is transmitted to various points in Ventura County and to other counties throughout SCE's service territory. In addition to SCE service, the naval bases at Port Hueneme and Point Mugu have standby electrical generators (City of Port Hueneme, 1977).

12.7.3.2 Natural Gas

All of the natural gas needs for the region are supplied by the Southern California Gas Company.

12.7.3.3 Water

Water supplies to the Oxnard Plain area are provided by municipal water systems, water utility districts, and private companies. Some of these supplies are also provided by the Southern California Metropolitan Water District (MWD) through local distributors.

The City of Oxnard blends water from city-owned wells with MWD supplies received through the Calleguas Municipal Water Distrct and with water purchased from the United Water Conservation District. The City of Port Hueneme buys its water from the United Water Conservation District; this water is transported to the city via a 24-inch (60-cm) line along Pleasant Valley Road (City of Port Hueneme, 1977).

Each of the naval bases in the region--Port Hueneme and Point Mugu--supplies about half of its needs from its own wells. The remainder of their water is purchased from the United Water Conservation District.

Existing water services in the vicinity of the project area are as follows:

Treating Facility Site	Provider and Location of Domestic Water Service
Proposed Mandalay East Mandalay Alternative	City of Oxnard: 8-inch line along Harbor Boulevard. (Both sites are within the boundaries of the Colonia Municipal Water District)
Union Oil Marine Terminal Alternative	City of Ventura: 8-inch line along Spinnaker Drive
Ormond Beach Alternative	City of Oxnard: (1) 8-inch line along Perkins Road/Alton Avenue, south of McWane Boulevard; (2) 12-inch line along McWane Boulevard.

(Maximous, 1979; City of Oxnard Department of Public Works, various dates; City of Ventura Department of Public Works, various dates)

The proposed Mandalay and East Mandalay alternative sites are presently within the Colonia Municipal Water District, a "paper district" without the physical capability to deliver water to users. Either site would have to be detached from the Colonia District and concurrently annexed to both the Metropolitan Water District and the Calleguas Municipal Water District (the major wholesaler of water to the city of Oxnard) in order for Oxnard to legally furnish water to the project (Steele, 1979; Berry, 1979).

12.7.3.4 Sanitary Sewer

In the City of Oxnard, the sewer system is the responsibility of the Department of Public Works. The Oxnard Waste Water Treatment Plant is operated and maintained by the Ventura Regional County Sanitation District under contract with the City of Oxnard (Reed, 1979). The treatment plant receives sewage from the cities of Oxnard and Port Hueneme and is presently handling approximately 17 million gallons per day (mgd) (Bishop, 1980). Current capacity of this facility is 25 mgd; however, when the planned addition of secondary treatment capabilities is completed, the capacity will be reduced to 22.6 mgd (Bishop, 1980).

The proposed Mandalay site and the East Mandalay and Ormond Beach alternative sites are within the service territory of the City of Oxnard. No sewer line exists in the vicinity of the Mandalay and East Mandalay sites, however. At Ormond Beach, a 210-inch (5-m) sewer line exists approximately 0.5 mile (0.8 km) east of the site along McWane Boulevard. This line feeds into a 1,500 gallon/per minute (5,700 L/minute) pumping station which boosts flow to the wastewater treatment plant. Other sewer lines exist near the Ormond Beach alternative site; however, these are pressurized lines and direct connections may not normally be made by users (Maximous, 1979; Yurko, 1979; City of Oxnard Department of Public Works, various dates).

The Union Oil Marine Terminal alternative site is served by a 10-inch (25-cm) sewer line along Spinnaker Drive, which is part of the City of Ventura's sanitary sewer system (City of Ventura Department of Public Works, various dates). This line feeds into the City of Ventura treatment facility. Current flow through this facility is approximately 7 mgd which represents one-half the design capacity (14 mgd) (Bishop, 1980).

12.7.3.5 Waste Disposal

Solid waste generated during construction and operation of the project would be disposed of at the Santa Clara landfill (Hasan, 1979). Oily wastes would be disposed of at a site located northeast of the intersection of Harbor Boulevard and Fifth Street. This site is licensed for such disposal by the California Regional Water Quality Control Board (Yacoub, 1980). The nearest Class I disposal site is the Simi Valley landfill.

12.7.4 Services

12.7.4.1 Police Protection

Police protection in the project area is furnished by four different agencies: the Oxnard Police Department, the Port Hueneme Police Department, the Ventura (City) Police Department, and the Ventura County Sheriff's Department. The present strength of these departments is as follows.

12.7.4.1.1 County of Ventura Sheriff's Department

The Sheriff's Department is presently staffed with 565 persons, 460 sworn and 105 civilian. The operations are presently headquartered in downtown Ventura on Poli Street; however, they are scheduled to be relocated to the new County Government Center when enlarged facilities are completed at that location. Substations are currently located at the County Government Center, Ojai, Camarillo, and Fillmore. Emergency response times are normally 8 minutes or less, while routine non-emergency response times are 20 minutes or less (Wurner, 1979).

12.7.4.1.2 City of Oxnard Police Department

The Oxnard Police Department has 149 full-time employees, 111 sworn and 38 civilian. The authorized level of sworn officers is 118. The department possesses approximately 45 pieces of equipment including patrol vehicles, motorcycles, and vans. The city is divided into six beat areas for patrol purposes. Emergency response time is less than 5½ minutes, except for the beach areas where the response time may reach 6 minutes. Response time for routine calls is normally 13 minutes or less. The department operates out of a headquarters facility at "C" and 3rd streets, adjacent to the City Hall complex (Owens, 1979).

12.7.4.1.3 City of Port Hueneme Police Department

The Port Hueneme Police Department has 23 full-time employees, 17 sworn and 6 civilian. It operates out of headquarters located in the City Hall building on Ventura Road in Port Hueneme (Anderson, 1979).

12.7.4.1.4 City of Ventura Police Department

The Ventura Police Department possesses a total personnel complement of 114 persons, 90 sworn and 24 civilian. All operations are handled from a single headquarters station at Garden and Santa Clara streets in the western portion of the city. A minimum of five patrol cars are on the streets at any given time. Emergency response time for life-threatening situations is less than 3 minutes, while routine non-emergency responses are generally achieved in less than 20 minutes (Klismet, 1979; Talbot, 1979).

12.7.4.2 Fire Protection

Fire protection in the project area is furnished by three municipal agencies--the Oxnard Fire Department, the Ventura (City) Fire Department, and the Ventura County Fire Department. The city of Port Hueneme is served by the county department under a contract agreement. In addition to these agencies, each of the naval facilities at Port Hueneme and Point Mugu maintains its own firefighting services. Mutual aid agreements have been executed among all of these fire departments so that emergency aid can be called for from other firefighting agencies both inside and outside of the county.

As a supplement to shore-based facilities, the U.S. Coast Guard, at Channel Islands Harbor, and the Harbor Patrol operate fireboats. For offshore rescue purpoes, the Ventura County Fire Department maintains a rescue/fireboat (Conley, 1979).

12.7.4.2.1 County of Ventura Fire Department

The Ventura County Fire Department is responsible for protective services in unincorporated territory and the city of Port Hueneme in the project area. In 1978, the department was staffed with 352 persons, of whom 321 were uniformed personnel. The department maintains 28 stations throughout the county. The firefighting equipment of the department includes 53 engines (including 25 reserves), 24 brush patrols, 5 heavy duty rescue trucks, 1 aerial ladder truck, 2 water tenders, 1 helitender, 1 rescue/fireboat, 1 airport crash truck, and numerous support vehicles (Ventura County Fire Department, 1979a).

In response to an emergency, either as the primary fire suppression organization or as backup to one of the city fire departments, engine companies would initially be dispatched from one or more of four county stations:

- Station 15 in the Saticoy area (10787 Darling Road, Ventura)
- Station 50 at the Camarillo Airport (275 East Pleasant Valley Road, Camarillo)
- Station 51 in Oxnard (230 West Vineyard Avenue)
- Station 53 in Port Hueneme (Pearl and 2nd Street)

Other engine companies could be called for additional support if needed (Hall, 1979).

12.7.4.2.2 City of Oxnard Fire Department

The Oxnard Fire Department currently has 81 personnel located in six stations throughout the city. The normal crew size and the major equipment housed at each station are listed in Table 12.7-2. In addition to city equipment, SCE possesses a foam truck which carries 2,500 gallons (9,500 L) of foam which can be mixed at a 600:1 ratio (water to foam) and pumped with its 1,000 gpm pump (Koog, 1979).

12.7.4.2.3 City of Ventura Fire Department

The total personnel complement of the Ventura Fire Department is presently 72 persons, of which 60 are engine company personnel. The Ventura Marina area is served from Stations 2 and 5 in the city. Their location, equipment, and personnel complements are as follows:

Station and Location	Normal Crew Size	Major Equipment
No. 2 41 South Seaward Avenue (vicinity of Seaward and Main)	4 persons	1,250 gpm pumper
No. 5 4300 block of E. Main Street (vicinity of Telephone Road and Main Street)	3 persons	1,500 gpm pumper Snorkel

In total, the city possesses 5 engines and 1 snorkel. The fire department's response time goal is 4 minutes; however, response times from Stations 2 and 5 to the Ventura Marina are approximately 6 to 7 minutes due to the lack of convenient access. Future response times would be less if Telephone Road is extended to Olivas Park Drive, or a fire station is constructed in the marina area. Both of these possibilities exist.

TABLE 12.7-2

OXNARD FIRE DEPARTMENT - STATION INVENTORY

Station Number[1]	Normal Crew Size	Major Equipment
1	1 engineer/operator;	Snorkel (85-foot); aerial ladder (100-foot)
	3-person crew	Heavy-duty squad/mini pumper (500-gal tank; 250-gpm pump)
2	4-person crew	Pumper (400-gal tank; 1250-gpm pump); Pumper[2] (500-gal tank; 1000-gpm pump)
3	4-person crew	Pumper (400-gal tank; 1000-gpm pump); Pumper[3] (400-gal tank; 1000 gpm pump)
4	4-person crew	Pumper (400-gal tank; 1250-gpm pump)
5	4-person crew	Pumper (500-gal tank; 1500-gpm pump); Pumper[4] (800-gal tank; 1000-gpm pump)
6	3-person crew	Pumper (400-gal tank; 1000-gpm pump)

[1] Data from Koog (1979).
[2] Reserve unit, to be replaced.
[3] Reserve unit, unmanned.
[4] Unit belongs to State of California Office of Emergency Services; manned and maintained by City of Oxnard.

12.7.4.3 Schools

The proposed and alternative onshore facility sites are located within four different school districts as follows:

Site	School District Jurisdiction	
	Elementary (K-8)	High School (9-12)
Proposed Mandalay	Oxnard S.D.	Oxnard Union High S.D.
East Mandalay Alternative	Oxnard S.D.	Oxnard Union High S.D.
Ventura Marina Alternative	Ventura Unified S.D.	Ventura Unified S.D.
Ormond Beach Alternative	Ocean View S.D.	Oxnard Union High S.D.

The Oxnard School District has experienced modest enrollment growth in the past 8 years, while the Ocean View School District has been stable during the same period. The Oxnard Union High School District enrollment has remained stable over the past 4 years, in spite of large residential population increases within its boundaries. The Ventura Unified School District attendance level in 1978 was only 1 percent above that of 7 years earlier. Attendance statistics are shown in Table 12.7-3.

The county has projected an increase in school age population over the next 20 years as a part of its Final Land Use Plan for the 208 Plan (VCERA, 1978b). Projections for each growth area of the county are as follows:

Growth Area	School Age Population					
	1977	1985	1990	1995	2000	% Growth 1977-2000
Oxnard	32,364	37,500	42,400	47,700	53,200	64
Port Hueneme	4,726	5,206	5,719	5,960	6,128	30
Ventura	16,982	1,885	20,150	22,230	24,310	43
Countywide Total	132,049	150,860	169,690	184,749	199,717	51

TABLE 12.7-3

AVERAGE DAILY ATTENDANCE - PROJECT AREA SCHOOLS

	School Year[a]						
	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Elementary (K-8)							
Oxnard SD	9383	9276	9344	9636	9880	9950	9956
Ocean View SD	2124	2177	2240	2182	2136	2076	2063
Secondary (9-12)							
Oxnard Union HSD	15,749	16,390	17,128	11,677[b]	12,038	12,153	12,189
Unified (K-12)							
Ventura Unified SD	17,973	17,568	17,346	17,840	18,456	18,353	18,153

[a]Data from Ventura County Superintendent of Schools (undated).
[b]Approximately one-third of this district became the Conejo Valley Unified SD on 1 July 1974.

12.7.4.4 Health Care

Two hospitals in the vicinity of the project area furnish basic emergency medical services as defined by the California Administrative Code (Title 22, Division 5, Section 3). These are St. John's Hospital in Oxnard and the General Hospital of Ventura. The Port Hueneme Adventist Hospital provides emergency care defined as "standby" by the code. The basic care classification requires a full-time emergency department with surgical services immediately available for life threatening situations (Ventura-Santa Barbara Health Systems Agency, 1979).

Paramedic services are not available in the project area. Emergency responses are furnished by private ambulance services, which provide basic life support capability using emergency medical technicians. The county is divided into service areas and one ambulance company is licensed for each service area. In Ventura, service is provided by Courtesy Ambulance while in Oxnard and Port Hueneme service is provided by Oxnard Ambulance (Mills, 1979).

Acute hospital facilities are also available in each community. A total of 604 acute beds are currently available in the Ventura-Oxnard-Port Hueneme area. These facilities and their 1977 occupancy statistics are listed in Table 12.7-4.

12.7.5 Economic Base

The economy of the Oxnard Plain area is based primarily upon agriculture, diversified manufacturing, and government. Although the economy is still oriented toward agribusiness, during the past decade this area has experienced growth of non-agricultural industries. This has created a trend toward a more diversified economy. Consequently, the labor force is rapidly changing in orientation from agricultural to commercial and industrial.

TABLE 12.7-4

ACUTE HOSPITAL FACILITIES

	Licensed Beds (31 Dec. 1977)[a]	Patient-days (1977)	Percent Occupancy (1977)
City of Oxnard			
St. John's Hospital	221	45,034	55.8
Oxnard Community Hospital	39	7,424	52.1
City of Port Hueneme			
Port Hueneme Adventist	45	6,734	40.9
City of Ventura			
Community Memorial Hospital	143	37,782	72.4
General Hospital	156	28,785	50.6

[a]Data from Ventura-Santa Barbara Health Systems Agency (1979).

12.7.5.1 Agriculture

In 1978, agriculture contributed approximately $460 million to the economy of Ventura County, an increase of $82 milion (21.7 percent) over 1977. Agriculture is the county's leading source of income. Of the total increase of $82 million, $46 million was derived from increases in income from lemons and Valencia oranges. Another $17 million increase was derived from celery, where unit price increases of nearly 43 percent offset a production decrease of 6 percent. Tables 12.7-5 and 12.7-6 detail 1978 performance by the Ventura County agricultural industry. The Agricultural Commissioner reports that although the area of county farmland has decreased from 432,621 to 307,501 acres (173,000 to 123,000 ha) between 1969 and 1974, irrigated land has decreased only from 91,928 to 91,331 acres (36,770 to 36,530 ha) during this same period (County of Ventura Agricultural Commissioner, 1979).

12.7.5.2 Government

12.7.5.2.1 Federal Military Bases

Much of the growth in the Oxnard Plain came after the outbreak of World War II with the establishment of military bases in the area. Thess include the Naval Construction Battalion Center ("Seabee" Base) in Port Hueneme, the Naval Air Station and Missile Test Center at Point Mugu, and Oxnard Air Force Base. Although the latter is not active, the two Navy facilities remain important contributors to the economic base of the region.

The Seabee Base occupies a major portion of the City of Port Hueneme. The base is located on approximately 1,640 acres (650 ha), or about 58 percent of the city's total incorporated area of 2,850 acres (1,140 ha). The base provides and maintains all of the receiving, storage, preservation, and shipping for the Pacific Construction Battalion. It also provides training and schooling facilities for naval construction battalions and other Navy construction personnel. The Civil Engineering Corps Officers' School is also located at the base.

TABLE 12.7-5

VENTURA COUNTY AGRICULTURAL PRODUCTION

	1977[a]		1978	
	Harvested Acreage	Value (Millions of dollars)	Harvested Acreage	Value (Millions of dollars)
Fruit and Nut Crops	52,393	163.3	52,934	209.2
Vegetable Crops	46,752	132.2	46,369	152.4
Field Crops	23,840	10.8	22,273	7.7
Livestock, Poultry, and Dairy	NA[b]	50.4	NA	66.0
Nursery Stock	NA	18.3	NA	22.4
Cut Flowers	NA	2.6	NA	1.9
Apiary Products	NA	0.4	NA	0.4
TOTAL	122,985	378.0	121,576	460.0

[a] Data from Ventura County Agricultural Commissioner (1979).

[b] NA = data not available or not applicable.

TABLE 12.7-6

VENTURA COUNTY AGRICULTURAL COMMODITIES, 1978

Crop[a]	Acreage or Yield	Value
Lemons	22,822	$104,866,500
Celery	9,481	67,087,600
Valencias	15,502	51,217,300
Eggs	72.2 M doz	34,544,700
Strawberries	3,230	30,581,600
Nursery Stock	-	22,386,700
Poultry Meat	39.6 M lbs	19,743,000
Misc. Vegetables	2,219	19,461,500
Tomatoes	6,284	19,038,000
Lettuce	6,157	17,929,500
Avocados	7,416	16,446,100
Livestock	-	7,740,000
Green Limas	10,022	5,920,000
Cauliflower	1,756	5,467,400
Cabbage	1,760	4,055,100
Dairy	-	3,916,100
Spinach	2,323	3,847,400
Broccoli	4,320	3,811,800
Seed	2,696	3,493,300
Grapefruit	1,567	3,376,600
Peppers	1,469	2,778,400
Dry Limas	3,700	2,516,000
Cucumbers	578	2,419,500
Navels	1,448	2,237,500
Cut Flowers	-	1,866,800

[a] Data from Ventura County Agricultural Commissioner (1979); listing of crops whose value exceeded one million dollars.

Point Mugu is headquarters of the Pacific Missile Range. The base was established as a Naval air station in 1946, and the Pacific Missile Range was established in 1957. It has become one of the world's most advanced missile testing centers and is presently the nation's principal testing station for the cruise missile (Security Pacific National Bank, 1978).

Total income from Ventura County-based military facilities was estimated at $242.9 million in 1978, compared to $240.8 million in the preceding year, making this the county's second largest source of income.

12.7.5.2.2 Local Revenues and Expenditures

A summary of revenues and expenditures for the County of Ventura and the cities of Oxnard, Port Hueneme, and Ventura appears in Table 12.7-7.

12.7.5.3 Manufacturing

In 1978, there were more than 112 manufacturing and distribution plants in the Oxnard Plain area, plus an additional 53 agricultural growers, processors, canners, packers, and shippers. Leading classes of manufactured products were aerospace components, electronics forgings, plastics, chemicals, and paper products.

The manufacturing payroll for 1978 in Ventura County totaled approximately $219.5 million, compared with $165.0 million for the previous year, making manufacturing Ventura County's third-ranking source of income (Ventura County Star-Free Press, undated).

12.7.5.4 Commercial Fishing

Commercial fishing activities and catches in the vicinity of the offshore project region are discussed in Section 12.4.2.2. In 1975, the economic value of the fish catches within the five fish blocks involved represented 21.5 percent of the total catch within the "Santa Barbara Area", as defined by the

TABLE 12.7-7

MUNICIPAL REVENUES AND EXPENDITURES

	City of Oxnard (FY 1977-78)		City of Port Hueneme (FY 1977-78)		City of San Buenaventura (FY 1977-78)		County of Ventura (General Funds) (FY 1977-78)	
	Thousands of Dollars	Percent of Total	Thousands of Dollars	Percent of Total	Thousands of Dollars	Percent of Total	Thousands of Dollars	Percent of Total
REVENUES[a]								
Property Taxes	5435	20.8			3561	27.3	48,030	35.2
Sales and Use Taxes			1145 (Property, Sales and Use, and Other Taxes combined)	44.3	3958	30.3	1899	1.4
Other Taxes	6334 (Sales and Use and Other Taxes combined)	24.3			2012	15.4	1681	1.2
Licenses and Permits	330	1.3	90	3.5	323	2.5	1164	0.9
Fines, Forfeits, and Penalties	298	1.1	8	0.3	550	4.2	438	0.3
Use of Money and Property	1058	4.1	193	7.5	254	1.9	1678	1.2
Other Agencies	8387	32.1	609	23.5	1432	11.0	60,055	44.0
Current Services	2395	9.2	264	10.2	771	5.9	18,185	13.3
Other	1853	7.1	277	10.7	202	1.5	3420	2.5
TOTAL	26,090	100.0	2586	100.0	13,063	100.0	136,550	100.0
EXPENDITURES								
General Government	6134	26.2	1286	41.9	3091	21.9	18,414	14.8
Public Safety	7479	32.0	666	21.7	5610	39.7	32,681	26.2
Public Works	5221	22.3	533	17.4	3159	22.4	747	0.6
Health	27	0.1	0	0.0	0	0.0	24,223	19.4
Libraries	507	2.2	0	0.0	0	0.0	41	0.06
Parks and Recreation	2597	11.1	333	10.9	2259	16.0	1164	0.9
Other Government Funds and Units	1414	6.1	250	8.1	0	0.0	0	0.0
Public Assistance	0	0.0	0	0.0	0	0.0	47,454	38.0
Other	0	0.0	0	0.0	0	0.0	24	0.04
TOTAL	23,379	100.0	3068	100.0	14,119	100.0	124,748	100.00

[a] Data from City of Oxnard Finance Department (1978), Ventura County Auditor-Controller (1978), and John R. Reed Accountancy Corporation (1979).

California Department of Fish and Game (California Department of Fish and Game, 1977). The "Santa Barbara Area" includes the ports of Santa Barbara, Morro Bay, Port Hueneme, Avila, Oxnard, and Ventura. Following is a summary of catch value for each fish block during 1974 and 1975:

Fish Block No.	Catch Value ($ thousands) 1974	Catch Value ($ thousands) 1975	% Change 1974 to 1975
664	116.1	80.1	-31.0
665	221.6	683.3	208.3
682	42.2	33.5	-20.6
683	150.5	156.0	3.7
684	165.9	181.0	9.1
Total	696.3	1133.9	62.8

The relationship between the fish blocks and the proposed and alternative offshore project facilities is shown on Figure 12.4-5.

12.7.5.5 Commercial Port Facilities

Port Hueneme contains commercial port facilities operated by the Oxnard Harbor District. Tonnage handled in fiscal year 1976-77 amounted to nearly 1.8 million tons (1.6 million tonnes) of cargo. Cargo statistics are shown in Table 12.7-8. The commercial port is situated on approximately 59 acres (24 ha) owned by the district adjoining the Navy's harbor property. In addition to presently owned land, port tenants are leasing over 30 acres (12 ha) of land from the Navy. New berthing facilities created by a recent expansion program consist of a deep-draft concrete wharf 1,800 feet (550 m) long, which comprises three 600-foot (180-m) long berths. A number of additional Navy berths are available for commercial use by the Oxnard Harbor District through a Use License Agreement. Approximately 80,000 square feet (7,440 m^2) of clear-span warehouse space is provided within the port. Rail access is provided by the Ventura County Railway Company (Oxnard Harbor District, 1978, 1979a, 1979b).

TABLE 12.7-8

PORT HUENEME — CARGO HISTORY

Fiscal Year[a]	Cargo Handled (Tons)
1972-73	1,154,764
1973-74	1,481,461
1974-75	1,219,211
1975-76	1,462,444
1976-77	1,793,290

[a]Data from Oxnard Harbor District (undated).

12.7.5.6 Personal Income

The 1976 per capita income of Ventura County was 16.2 percent below that of the State of California as a whole. Table 12.7-9 shows that per capita income in the county has not increased as rapidly as that of the state, thus widening the spread between the two since 1971.

12.7.5.7 Retail Sales

Taxable retail sales have shown a consistent, steady increase in the county (Table 12.7-10). Much of the increase from 1970 to 1978 can be attributed to inflation. Table 12.7-11 displays 1978 sales and outlet statistics for the four regional and project area jurisdictions. The very low 1978 annual retail sales per capita figure ($1,984) for Port Hueneme, as compared to the other jurisdictions, indicates that Port Hueneme residents tend to rely upon retail outlets in nearby communities.

12.7.6 Employment

The civilian labor force in Ventura County amounted to 212,300 persons in May 1979, compared with 216,400 persons in April 1978. During the same period, the unemployment rate declined from 6.9 percent (15,000 persons) in May 1978 to 5.4 percent (11,400 persons) in May 1979 (California Employment Development Department, 1979a). The May 1979 labor force breakdown for the county appears in Table 12.7-12. Major agricultural and manufacturing employers in the Oxnard Plain area are listed in Table 12.7-13. An estimated 5,951 military and 10,584 personnel are employed at the two military installations (Ventura County Star-Free Press, undated).

Table 12.7-14 shows the employment history of Ventura County from 1972 to 1979. During this 7-year period, employment in the county grew by 43.1 percent, while population rose 14.1 percent. Employment categories which grew faster than the total county rate are: construction (53.1 percent); manufacturing (49.3 percent); trade (44.4 percent); finance, insurance and real estate (69.4 percent); services (64.5 percent); and, agriculture, forestry,

TABLE 12.7-9

HISTORY OF PERSONAL INCOME

	1971	1972	1973	1974	1975	1976	Percent Increase 1971-76
VENTURA COUNTY[a]							
Aggregate Personal Income[b]	1545.6	1721.4	1943.6	2197.8	2463.2	2747.3	77.7
Per Capita Personal Income[c]	3925	4249	4669	5131	5589	6075	54.8
STATE OF CALIFORNIA							
Aggregate Personal Income	94,206	102,539	112,366	125,563	138,641	153,901	63.4
Per Capita Personal Income	4644	5017	5438	6006	6540	7246	56.0

[a]Data from VCERA (1976), Security Pacific National Bank (1978), and State of California (1972-78).
[b]Aggregate personal income in millions of dollars.
[c]Per capita personal income in dollars.

TABLE 12.7-10

HISTORY OF TAXABLE RETAIL SALES

	1970	1971	1972	1973	1974	1975	1976	1977	1978	Percent Increase 1970-78
State of California[a]	43,223[b]	46,815	53,714	61,738	68,071	73,476	83,822	99,482	113,468	162.5
Ventura County	613	675	787	903	1,001	1,144	1,319	1,561	1,858	203.1
City of Oxnard	171	185	210	243	262	285	320	382	444	159.6
City of Port Hueneme	5	5	7	8	10	13	21	32	36	620
City of San Buenaventura	NA[c]	160	186	212	230	257	299	361	396	147.5[d]

[a] Data from State of California (1972) and California State Board of Equalization (1973-1978).
[b] Retail sales in millions of dollars.
[c] Data not available.
[d] Percent increase 1971-78.

TABLE 12.7-11

TRADE OUTLETS AND TAXABLE RETAIL SALES, 1978

	Ventura County			City of Oxnard			City of Port Hueneme			City of San Buenaventura		
	Outlets	Taxable Transactions	Percent	Outlets	Taxable Transactions	Percent	Outlets	Taxable Transactions	Percent	Outlets	Taxable Transactions	Percent
Retail Stores[a]												
Apparel	311	59,764	3.2	79	16,947	3.8	NA[c]	NA	NA	51	10,741	2.7
General Merchandise	126	215,208	11.6	31	70,497	15.9				24	56,219	14.2
Drug Stores	88	42,790	2.3	21	7,553	1.7				14	8,074	2.1
Food Stores	306	138,543	7.5	60	22,979	5.2				48	22,690	5.7
Packaged Liquor	104	31,584	1.7	21	6,905	1.5				19	5,647	1.4
Eating and Drinking Places	775	152,792	8.2	185	34,620	7.8				149	34,985	8.8
Home Furnishings and Appliances	339	62,601	3.4	54	18,408	4.1				88	15,820	4.0
Building Materials and Farm Implements	161	102,141	5.5	37	42,166	9.5				23	11,560	2.9
Auto Dealers and Supplies	351	349,464	18.8	58	81,297	18.3				61	92,375	23.3
Service Stations	299	148,523	8.0	61	26.513	6.0				60	30,296	7.7
Others	952	117,294	6.3	188	36,268	8.1				236	43,927	11.1
SUBTOTAL	3,812	1,420,704	76.5	795	364,153	81.9	117	32,066	87.8	773	332,334	83.9
All Other Outlets[d]	7,162	437,131	23.5	1,041	80,330	18.1	135	4,440	12.2	1,100	63,676	16.1
TOTAL	10,974	1,857,835	100.0	1,836	444,483	100.0	252	36,506	100.0	1,873	396,010	100.0
Retail Sales Per Capita		3.920			4.620			1.984			5.815	

[a]Data from State of California, Population Research Unit (1979) and California State Board of Equalization (undated).
[b]Taxable transactions in thousands of dollars.
[c]Itemized data not available for the City of Port Hueneme.
[d]Includes business and personal services.

TABLE 12.7-12

VENTURA COUNTY LABOR FORCE — MAY, 1979

Labor Force by Place of Residence[a]	
Employed	200,900 (94.6%)
Unemployed	11,400 (5.4%)
TOTAL	212,300

Labor Force by Place of Employment	
Mining	2,400
Construction	7,500
Manufacturing	21,500
Transportation, Communication, and Public Utilities	6,200
Wholesale Trade	6,200
Retail Trade	28,300
Finance, Insurance, and Real Estate	6,100
Services	27,300
Government	
Federal	9,900
State and Local	26,700
Agriculture, Forestry, and Fisheries	19,300
TOTAL	161,400

[a]Data from State of California Employment Development Department (1979a).

TABLE 12.7-13

MAJOR EMPLOYERS — OXNARD PLAIN AREA

Employer[a]	Number of Employees (1978)[b]
Oxnard	
Abex Corporation (M)[c]	650
G. J. Aigner Company (M)	100
Allis Chalmers (M)	100
Architectural Fiberglass Co. (M)	50-100
Automation Industries (M)	290
Bioquest (M)	511
California Vegetable Concentrates (A)	100
Chase Brothers Dairy (A)	200
Coastal Chemical Co. (M)	100-120
Deardorff - Jackson Co. (A)	40-200
Del Mar Packing Co. (A)	200-600
Dual Wide Homes Incorporated (M)	220
Dullam Harvesting Co. (A)	75-160
Falcon Products (M)	550
Mel Finerman Co. Inc. (A)	50-1000
Gould Inc. (A)	650
Hiji Brothers Inc. (A)	80-135
Hueblein Inc. (A)	200-1200
Information Magnetics Corp. (M)	200
Interharvest Inc. (A)	50-200
Bob Jones Ranch Corp. (A)	50-300
Kaiser Aluminum and Chemical Corp. (M)	140
Oxnard Frozen Foods Cooperative (A)	75-500
Pleasant Valley Vegetable Co-op (A)	50-500
The Press Courier (M)	109
Procter and Gamble Paper Products Co. (M)	425
Raytheon Co. (M)	525
Richview Inc. (A)	2-150

TABLE 12.7-13 (concluded)

Employer[a]	Number of Employees (1978)[b]
Santa Clara Produce (A)	50-500
Seaboard Lemon Association (A)	125-325
Southern Pacific Milling Co. (M)	250
Stokely - Van Camp Inc. (A)	100-200
United Celery Growers (A)	10-140
Universal Packers Corp. (A)	15-125
Dave Walsh Co. Inc. (A)	120-900
Port Hueneme	
Golden State Steel Casting (M)	282
Grumman Aerospace Corp. (M)	350
Hughes Aircraft Co. (M)	170
Camarillo	
Clairol Inc. (M)	150
International Playtex Inc. (M)	250
Minnesota Mining and Manufacturing Co. (M)	1000
Power One Inc. (M)	225
Western Kraft Corp. (M)	125-140

[a]Data from Ventura County Economic Development Association (1978).
[b]Employers of 100, or more, persons.
[c](M) = Manufacturing
(A) = Agricultural

and fisheries (56.9 percent). The category of government employment was the slowest in growth during the 7 years (18.1 percent).

The wide variance between employed civilian labor force (200,900 persons) and employment within the county (161,400 persons) can be partially explained by the large number of county residents commuting to Los Angeles and Santa Barbara counties to work. An exact count of the persons involved in inter-county commuting is not available.

Construction employment in the county reflects cyclical conditions prevalent in this industry. Table 12.7-14 illustrates the "dip" which occurred in the 1974-1975 period as a result of the recession. Significant recovery has occurred since that time. A comparison of contract construction employment to total non-agricultural employment is shown below:

Year	Contract Construction Employment As a Percent of Total Non-Agricultural Employment
1972	4.9
1973	4.7
1974	3.9
1975	3.6
1976	4.1
1977	4.7
1978	5.1
1979 (May)	5.3

The State of California Employment Development Department (1979b) predicted that contract construction employment would grow to 7,800 persons and would account for about 5.2 percent of total non-agricultural employment by 1980.

TABLE 12.7-14

VENTURA COUNTY EMPLOYMENT

	1972	1973	1974	1975	1976	1977	1978	1979 (May)
Mining[a,b]	1.7[c]	1.7	1.8	2.0	2.1	2.2	2.3	2.4
Construction	4.9	5.0	4.3	4.1	4.8	6.0	6.9	7.5
Manufacturing	14.4	16.2	17.2	17.0	18.0	19.6	20.7	21.5
Transportation, Communication, and Public Utilities	4.4	4.5	4.4	4.3	4.6	5.2	5.9	6.2
Wholesale and Retail Trade	23.9	24.8	25.6	26.9	27.6	29.9	32.4	34.5
Finance, Insurance, and Real Estate	3.6	3.7	4.0	4.0	4.5	5.3	5.8	6.1
Services	16.6	18.2	18.9	19.8	20.5	22.9	25.4	27.3
Government:								
Federal	10.5	10.4	10.8	10.6	10.0	10.1	9.9	9.9
State and Local	20.5	21.5	23.5	25.4	25.7	27.1	26.8	26.7
Agriculture, Forestry, and Fisheries	12.3	12.6	13.5	13.7	13.9	14.7	15.2	19.3
	112.8	118.6	124.0	127.8	131.7	143.0	151.3	161.4

[a]Data from State of California Employment Development Department (1979a and 1979c).
[b]Employment by place of work.
[c]Thousands of persons employed.

12.8 CULTURAL RESOURCES

Detailed cultural resources studies have been conducted for the offshore and onshore areas associated with the proposed Mandalay project and the three primary alternatives (Dames & Moore, 1980a, 1980b, and 1980c). This section presents a summary of the findings from these studies related to baseline conditions. Locational and/or descriptive information that might place cultural resources in jeopardy (e.g., from unauthorized collection or looting) is not discussed. This type of information is described in the reports prepared for the original studies. These reports are on file with the City of Oxnard (offshore and onshore) and the U.S. Geological Survey, Los Angeles (offshore only). The reports are available for review at these two locations by appropriate regulatory agencies and members of the professional archaeological community.

12.8.1 Santa Barbara Mainland Coast Chronological Sequence

A major feature of the published archaeological research for the Santa Barbara mainland coast has been development and refinement of a regional chronological sequence. Although there is agreement that the chronological sequence reflects development of artifacts and social organization from simple to complex, various authors differ in their subdivision of the regional sequence. The major chronological frameworks for the mainland coast are shown on Figure 12.8-1. The following discussion focuses on four periods referred to here as Paleo-Indian, Early, Middle, and Late. These periods differ somewhat from those shown on Figure 12.8-1.

The lower limit of Paleo-Indian occupation of North America has not yet been determined. For the purpose of this discussion, the upper limit of the Paleo-Indian Period in the Santa Barbara Channel region is placed at about 10,000 years B.P., a date considerably earlier than the oldest dated Early Period manifestations in the region.

Given the lack of sufficient data for the Oxnard area, characteristics of early occupations elsewhere in southern California must be applied to the particular case of the Oxnard Plain. This procedure is defensible primarily because of the similarities of Paleo-Indian industries across broad geographic regions (Wallace, 1955). Evidence from the arid interior and the coast suggests that Paleo-Indian subsistence stressed hunting and the exploitation of terrestrial plant foods. Based on this subsistence economy, it can be postulated that the Paleo-Indian population was composed of small, kin-based mobile bands. Coastal sites of this period are usually surface or shallow lithic deposits situated on mesas and hilltops.

The lower limit of the Early Period is not yet established. For the purpose of this discussion, the lower limit is placed at 10,000 years B.P. (Owen et al., 1964); unpublished dates from Surf, near Point Conception (4-SBa-931), indicate Early Period sites may have existed on the coast as early as 9,000 years B.P. (Glassow, 1979). The transition to the Middle Period is thought to have taken place around 5,000 years B.P.

Much of the subsistence of Early Period communities was obtained from the harvesting of hard seeds. The high reliability of this resource offset its low yield per unit area. These communities also utilized coastal and estuarine resources. For example, some sites from the period 7,000 to 8,000 B.P. are associated with salt marshes near the Santa Barbara Channel mainland. Fishing became important during the Early Period, as evidenced by the presence of compound bone fishhooks and gorges. However, in comparison to both later mainland sites and Early Period sites on the islands of the Santa Barbara Channel, fish remains are scarce in Early Period sites at the Santa Barbara Channel coast. In the coastal Oxnard Plain area, Early Period sites may have been established in connection with the exploitation of grassland resources (such as seeds) and wetland resources.

There is a general lack of published data for the Middle Period. The local Middle Period culture is generally termed the "Hunting People" and began sometime between about 5,000 and 3,200 years B.P. During the early Middle Period, extensive exploitation of the nearshore fishery began. Seine net weights

ROGERS	OLSON (Mainland)	OLSON (Island)	WARREN	ORR	HARRISON	KING	DATE
HISTORIC	HISTORIC		Chumash	HISTORIC	Canalino	Late Period	ca. 1550 AD
Canalino	Late Mainland	Late Island		Late Canalino		Middle Period	
				Middle Canalino			3450 BP
		Early Island		Early Canalino	Rincon Phase		3950 BP
Hunting	Middle Mainland	?—?—?		Hunting	Del Mar Phase		
	Early Mainland		Campbell Tradition		Extranos Phase	Early Period	4900 BP
Oak Grove	Archaic		Encinitas Tradition	Oak Grove	El Capitan Phase		5350 BP
					Goleta Phase		7500 BP

FIGURE 12.8-1

COMPARATIVE CHRONOLOGICAL SEQUENCES FOR THE SANTA BARBARA CHANNEL

MODIFIED FROM HOOVER (1972)

DAMES & MOORE

are reported from this period, as well as curved single-piece fishhooks of bone and shell. Bone of inshore fish such as surfperch are common, while evidence of pelagic fish is virtually absent from sites of the early Middle Period. However, it is during this period that maritime fishing and sea mammal hunting became important. Parallel with the increased importance of fishing, there is evidence of an increase in the economic importance of soft seeds and nuts, such as acorns, kernels of Prunus spp., and berries of toyon.

Economic change during the Middle Period is reflected in the evidence of an expanding trade network which included the Santa Barbara Channel islands, coast, and interior valleys. This economic change is coupled with evidence of more permanent and larger settlements. Although there is no evidence of such sites in or near the coastal Oxnard Plain area, Middle Period settlements and associated special use sites should be expected to occur.

The Late Period culture is usually termed "Chumash" or "Canalino", and is generally agreed to have begun prior to the time of Christ. During the Late Period, material culture "underwent an independent, special, and uncommon development . . . which is displayed in an unusual wealth and variety of industrial and artistic forms" (Wallace, 1955).

The Late Period is associated with an efflorescence of material culture, an elaboration of social, economic, and politicial roles and organization, expansion of the trade network, and aggregation of the coastal population in large villages. No permanent villages of this period are known for the coastal Oxnard Plain area, but seasonal or special use sites, especially associated with the island trade and exploitation of estuarine resources, are likely to be present.

12.8.2 Offshore Cultural Resources

The principal data sources used to obtain baseline information concerning offshore cultural resources were published and unpublished literature, maps, professional contacts, and marine geophysical survey data (particularly magnetometer and side-scan sonar records). Offshore cultural resources include nautics (aboriginal and historic shipwrecks) and submerged aboriginal sites or artifacts.

Marine geophysical survey (remote sensing) records were interpreted to develop site-specific information regarding potential occurrence of cultural resources at and near proposed platform locations and along proposed/alternative pipeline corridors. As part of the interpretation procedures, lease history data were collected to identify previous well drillsite locations. Drillsites and debris associated with previous drilling activities are not considered cultural resources. When interpreting the remote sensing records, the latter were identified, mapped, and then excluded from further consideration. Attention was directed toward "possible anomalous returns" (i.e., signals on the remote sensing records that might indicate potential cultural resources). Possible anomalous returns occurred in two spatial configurations: large areas; and, discrete points or clusters. The large areas were termed "areas of possible anomalous returns"; the points or clusters were termed "loci of possible anomalous returns." There were three types of loci:

(1) Type 1, single or clustered magnetic residuals;

(2) Type 2, clustered or single side-scan sonar images with shadow; and,

(3) Type 3, co-occurring magnetic residuals and side-scan sonar images and shadows.

12.8.2.1 Project Area

12.8.2.1.1 Nautics

<u>Asian Vessels</u>

Although pre-Columbian Asian nautics are not well understood, records indicate that sophisticated ocean-going craft were in use in China before 1300 A.D. Scant evidence of pre-Columbian contact with North America in

Chinese records suggest that deliberate contact was rare or non-existent; however, accidental early Asian contacts may have occurred. European records after 1685 document Japanese junks drifting off the western coast of North America. Most of these vessels had lost both their rudder and mast. Thus helpless, they had drifted northward in the Japanese Current, then southeastward in the California Current (Brooks, 1875).

The California Current does not enter the Santa Barbara Channel. The western half of the Channel is dominated by a counterclockwise current which bifurcates near Point Conception (see Section 12.3.1.3). It can be assumed that the California Current and the current pattern operative in the western Santa Barbara Channel would tend to keep drifting vessels away from the Channel area. Thus, Asian shipwrecks are not expected to occur in or near the project area.

Aboriginal Vessels

Development of the sewn-plank canoe, or tomol, of the Chumash Indians is generally believed to have coincided with the development of a partially monetized regional economy during the Late Period, sometime around 1000 A.D. Canoe villages are known to have existed at Mitsqanaqan and Shisholop near Ventura; at Iqsha, the Santa Clara River village (Hudson et al., 1978); and at Weneme. The latter was a canoe camp at the landfall for trips to/from Anacapa Island and the east end of Santa Cruz Island. Chumash canoe stories retold by Hudson et al. (1978) frequently concern the loss of canoes at sea or near shore. Routes of tomol travel reconstructed from these stories are presented on Figure 12.8-2. Prevailing winds at the project area are westerly to northwesterly (Emery 1960) which may have caused craft to drift toward the beach near the project area. However, the pattern of surface currents near the Anacapa Pasage is complicated, and conditions favoring the beaching of lost canoes near the project area have co-existed with conditions favoring other areas along the shoreline. In the absence of better data, it is considered in the best interests of historic preservation to acknowledge the possibility that the remains of aboriginal craft may occur in or near the project area.

European and American Vessels

The earliest records of European shipping near the project area date from the Cabrillo voyage of 1542-3. Soon thereafter, the Manila trade was well established. A substantial increase in shipping near the project area occurred as the result of the establishment of the missions and Spanish settlements at Ventura and Santa Barbara during the late eighteenth century. The beginning of the American Period in California in the mid-nineteenth century produced another rapid increase in coastal traffic. However, the first documented shipwrecks occurring near the project area date from the early twentieth century.

Preservation of Vessels

Preservation of sunken ships varies markedly and is a function of several factors, including the following:

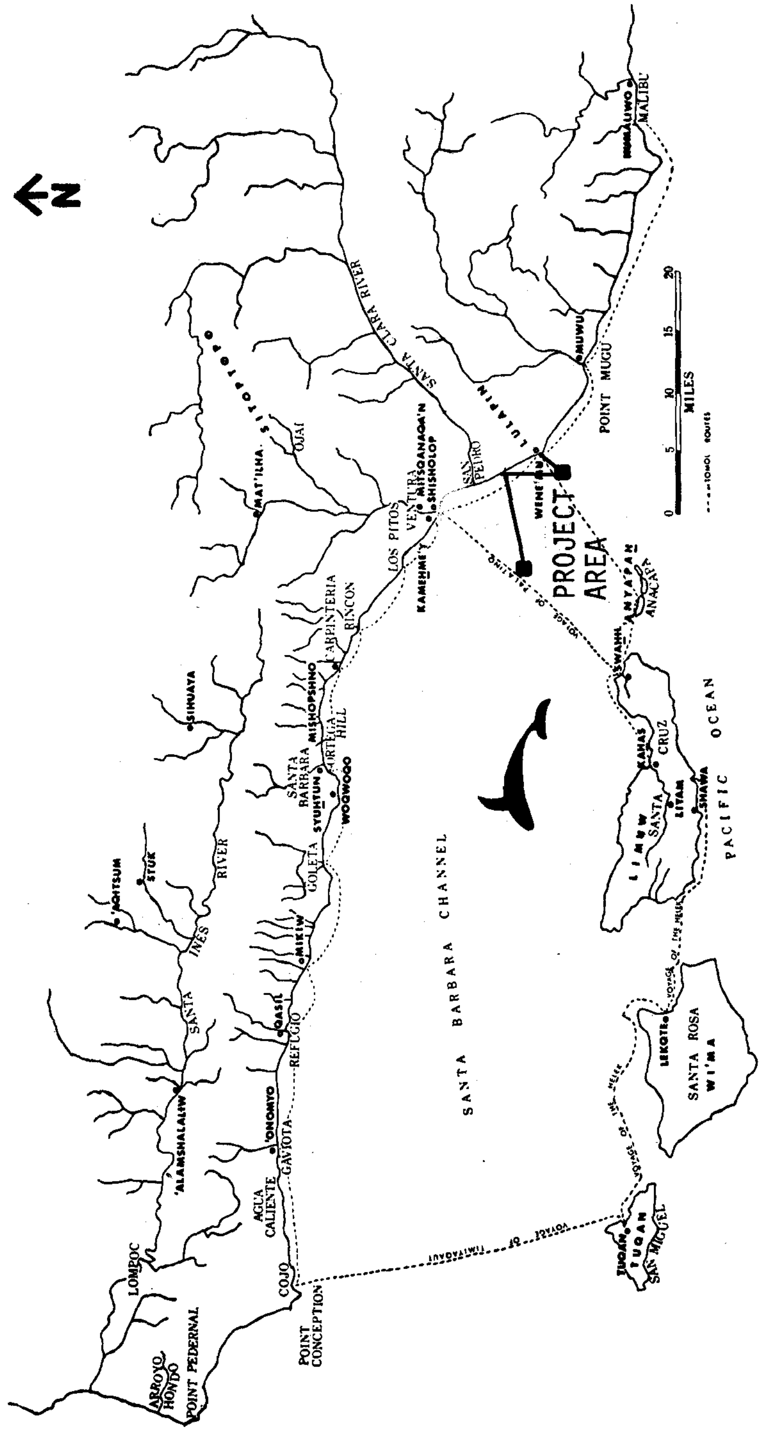
(1) Vessel construction - metal vessels generally have a greater potential for preservation than wooden or composite vessels;

(2) Degree of exposure to physical processes such as currents or waves - potential for preservation generally decreases as kinetic energy increases;

(3) Degree of slope - potential for preservation decreases markedly on slopes exceeding 6 degrees; and,

(4) Accessibility for salvage - vessels in water less than 45 feet deep are generally more accessible for listing or salvage than those in deeper water.

In general, the potential for preservation increases with increasing water depth and distance from shore. This is primarily due to the decrease in kinetic energy within the marine environment away from shore and the decreased accessibility for salvage within deeper waters. Therefore, the potential for preservation of sunken ships within the beach and nearshore areas is considered to be low. Potential for preservation is expected to increase with increasing water depth and distance from shore.



REFERENCE: HUDSON, TIMBROOK, AND REMPE (1978)

FIGURE 12.8-2

VILLAGES AND TOMOL ROUTES

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12.8.2.1.2 Aboriginal Sites or Artifacts

Recorded Sites or Artifacts

Numerous submerged artifacts have been found in the Santa Barbara Channel during the last 50 years. Hudson (1976) described the known finds through 1975. Since then, additional artifacts have been discovered at Point Conception (Stickel 1977a; Hudson, in press) and at Refugio Beach and Mohawk Reef. Additional underwater reconnaissance has been conducted at El Capitan Beach, Refugio Beach, Mohawk Reef, Arroyo Burro Beach, Anacapa Island, Santa Cruz Island, Carpinteria, and Santa Barbara Point (Horne, in preparation).

All artifacts outside of the surf zone reported by Hudson (1976) or by others have been found in association with rocky bottoms (either boulders or reefs or both). All artifacts within the surf zone have been reported associated with sandy substrate. Exclusive of finds in the surf zone, the submerged artifacts reported by Hudson (1976) occur in water depths ranging from 15 to 90 feet (4.6 to 27.5 m) with a mean of 44 feet (13.3 m). Aboriginal sites do not occur within marine sediments. Isolated artifacts may be so situated, but these are usually dissociated from their original place of deposition and are thus of little cultural resource importance.

No known aboriginal sites or artifacts are situated in the vicinity of the project area.

Paleoenvironmental Setting of Potential Submerged Aboriginal Sites

The upper limit of age of potential submerged aboriginal sites is equal to that of the arrival of humans in the local area. This limit is about 3,500 years B.P., the time at which the approximate present sea level was established. The lower limit (i.e., the time of earliest potential occupation) is a much debated subject among archaeologists.

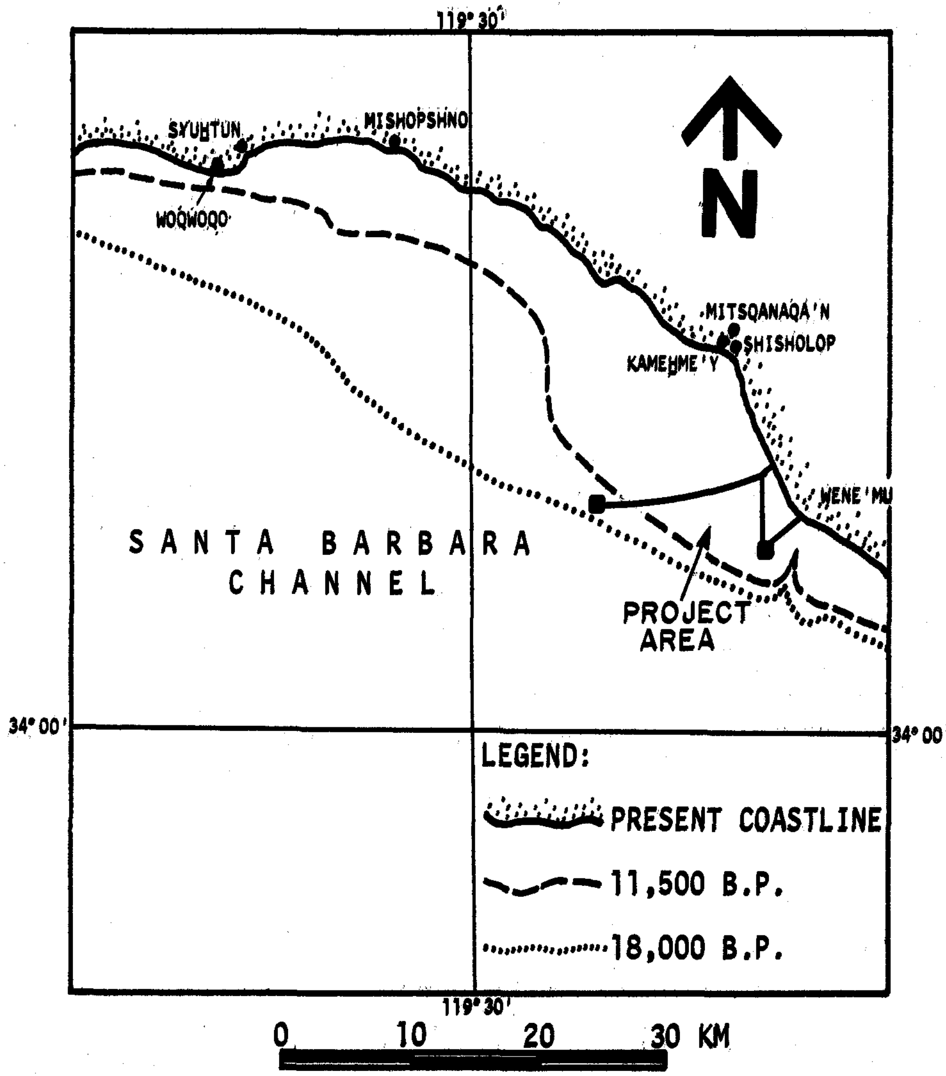
It is generally accepted that man entered the New World no earlier than 40,000 years B.P., during the latter part of the Wurm/Wisconsin glaciation, and perhaps as recently as 20,000 - 25,000 years B.P. Few reliable data are available which establish a period of occupation earlier than 30,000 years B.P.

The earliest unquestioned evidence of human occupation in coastal southern California comes from San Diego County (Warren 1968), San Luis Obispo County (Greenwood, 1972), and Santa Barbara County (Glassow, 1979). These manifestations have radiocarbon ages ranging from 10,000 - 8,000 years B.P.

Until incontrovertible evidence is discovered, it is in the best interests of historic preservation to assume a conservative lower limit of 30,000 years B.P. Thus, the time span associated with potential submerged aboriginal sites near the project area would be between 3,500 and 30,000 years B.P.

During this time span, sea level varied considerably. At about 30,000 years B.P., sea level was near its present level. Thereafter, sea level declined slowly until 21,000 years B.P., then more rapidly to its minimum level (approximately -436 feet (133 m)(Flint, 1971)) 16,000 years B.P. Subsequently, sea level began to rise rapidly until 7,000 years B.P., then more slowly until the present stillstand was reached approximately 3,500 years B.P. (Milliman and Emery, 1968). Both pericoastal and coastal settlements and camps could have occurred on the now-submerged Oxnard Shelf between 30,000 and 3,500 years B.P. (Figure 12.8-3).

Climate and vegetation also changed during the late Pleistocene and Holocene. Studies of marine sediments taken from the Santa Barbara Basin have contributed to an understanding of the local paleoclimatic record. Marine microfossils indicate three periods of ocean surface warming: 800 to 1,800 years B.P., 3,600 to 3,800 years B.P., and 5,400 to 8,000 years B.P. (Pisias, 1978). These periods of ocean surface warming are associated with moister climatic regimes. Environmental conditions during these moist intervals would have been favorable for human occupation along the coast.



REFERENCES: SCIENCE APPLICATIONS, INC. (1978); MILLIMAN AND EMERY (1968)

FIGURE 12.8-3

RECONSTRUCTED QUATERNARY SHORELINES IN A PORTION OF THE SANTA BARBARA CHANNEL

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Fossil pollen from the Santa Barbara Basin reflects trends of terrestrial vegetation change (Heusser, 1978). There has been a trend toward restriction of moist habitat (fresh water marsh, riparian) from the end of the Pleistocene to the present. A marked decline in upland coniferous forest began about 7,745 years B.P. and has continued to the present. Coastal sage scrub, mixed chaparral, and oak woodland began to increase in frequency about 7,745 years B.P. Chaparral and coastal sage scrub species surpassed oaks in frequency at about 2,250 years B.P. Coastal marshland reached its maximum extent by about 6,000 years B.P. These climatic and vegetational changes are correlated with the sequence of cultural development for the Santa Barbara coast on Figure 12.8-4.

The coastal environment during most of the Holocene probably would have been similar to the present coastline near the project area: extensive sand dunes with ponds or lakes and estuaries. The receptive coastline, prevailing favorable winds, and ample supply of sand probably produced a dune environment in the area during the Holocene transgression. Indeed, dunes dating from this period are reported in the Oxnard area by Cooper (1967). During some periods, fresh water dune lakes or ponds may have been present. Estuaries and salt marshes would have been formed during the Holocene transgression as the advancing sea drowned the channels of coastal drainages. The Santa Clara River and portions of Hueneme Canyon would have been thus inundated.

Preservation of Potential Sites

The preservation potential for aboriginal sites in the project area is expected to be low. If aboriginal sites occurred in the high energy active inshore environment, the site structure would likely have been either destroyed or altered by dispersal of the site matrix. Small artifacts would tend to be displaced by wave action and longshore sediment transport processes, although position of larger artifacts (e.g., metates, mortars) may not be altered substantially (Moriarty et al., 1975).

Aboriginal sites exposed to the open sea would probably not have been preserved because most of the coastline adjacent to the project area was an exposed coastline during the Wisconsin regression and the Holocene transgression. Such sites would have been preserved only if protected from the open sea during the Holocene transgression by burial under alluvium or estuarine silt, mud, peats, or by an intervening landform (e.g., sand bars, rocky outcrops, levees). Such protective situations, which only would be present along submerged stream channels and estuaries, may occur within the project area.

12.8.2.2 Platform Gina and Pipeline Corridors

12.8.2.2.1 Lease History

The locations of previous exploratory well drilling activities (drillsites) near the proposed Platform Gina site, proposed Mandalay pipeline route, and Ormond Beach alternative pipeline route are shown on Figure 12.8-5. Interpretation of the marine geophysical survey records: (1) confirmed the drillsite locations; and, (2) identified a zone approximately 0.5 mile (0.8 km) in diameter centered on drillsite locations, where potentially anomalous remote sensing returns would be reasonably interpreted as anchor dragmarks or drilling-related debris rather than cultural resources. Drillsites, anchor dragmarks, and drilling-related debris are not considered cultural resources.

12.8.2.2.2 Nautics

The approximate locations of documented shipwrecks near the proposed Platform Gina site, proposed Mandalay pipeline route, and Ormond Beach alternative pipeline route are shown on Figure 12.8-6. Table 12.8-1 provides descriptive information concerning these shipwrecks.

12.8.2.2.3 Possible Anomalous Returns

Interpretation of the marine geophysical survey records resulted in the identification of areas and loci of possible anomalous returns. These were evaluated to assess their potential as evidence of shipwreck occurrence. Three areas of possible anomalous returns were identified. These are

YEARS BEFORE PRESENT	CLIMATIC CHRONOLOGY (MORATTO, ET AL, 1978)	SOUTH COAST CLIMATIC CHRONOLOGY (PISIAS 1978)	SOUTH CENTRAL COAST CULTURAL CHRONOLOGY	SOUTH COAST VEGETATION CHANGES (HEUSSER 1978)
	WARM/DRY			
0	COOL/WET	DRY		
	WARM/DRY		LATE PERIOD	
1000	COOL/WET	WET		EVIDENCE OF MAXIMUM ADVANCE OF CHAPARRAL, ABUNDANT ROSACEAE, RHAMNACEAE, ANACARDIACEAE. ABUNDANT COASTAL SAGE SCRUB.
	WARM/DRY			
2000	WARM/WET			
	COOL/WET	DRY		
3000	WARM/DRY	WET	MIDDLE PERIOD	
4000				EVIDENCE OF OPEN COUNTRY, ABUNDANT ASTERACEAE, ERIOGONUM
	WARM/WET-DRY	DRY		
5000	COOL/WET			
	WARM/DRY			
6000	COOL/WET	WARMING, DRYING		SALT MARSHES ON COAST REACH MAXIMUM EXTENT
7000	WARMING		EARLY PERIOD	OAK WOODLAND, MIXED CHAPARRAL, COASTAL SAGE BEGIN TO REPLACE UPLAND FOREST AND WOODLAND
8000				
9000	COOL/WET	MOISTER		UPLAND CONIFEROUS FOREST, WOODLANDS; DEVELOPED MOIST HABITATS: STREAMS, LAKES, FRESHWATER MARSHES.
10000	COLD/DRY	?	PALEO-INDIAN	

FIGURE 12.8-4

CLIMATIC CHANGE AND CULTURAL CHRONOLOGY FOR THE SANTA BARBARA CHANNEL AREA

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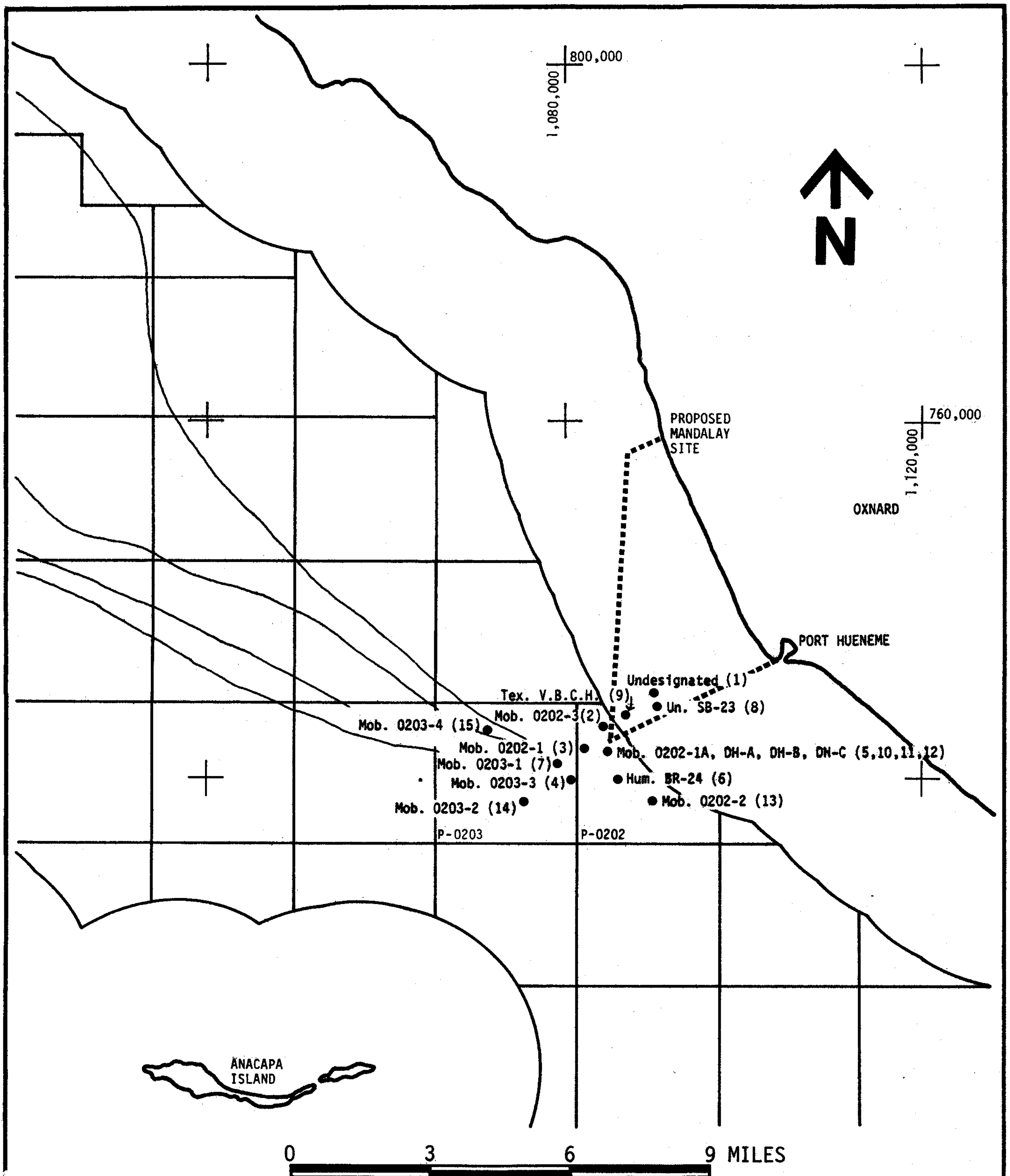

FIGURE 12.8-5

LEASE HISTORY

(PLATFORM GINA VICINITY)

NOTE: ( ) INDICATES DRILLSITE DESIGNATIONS.

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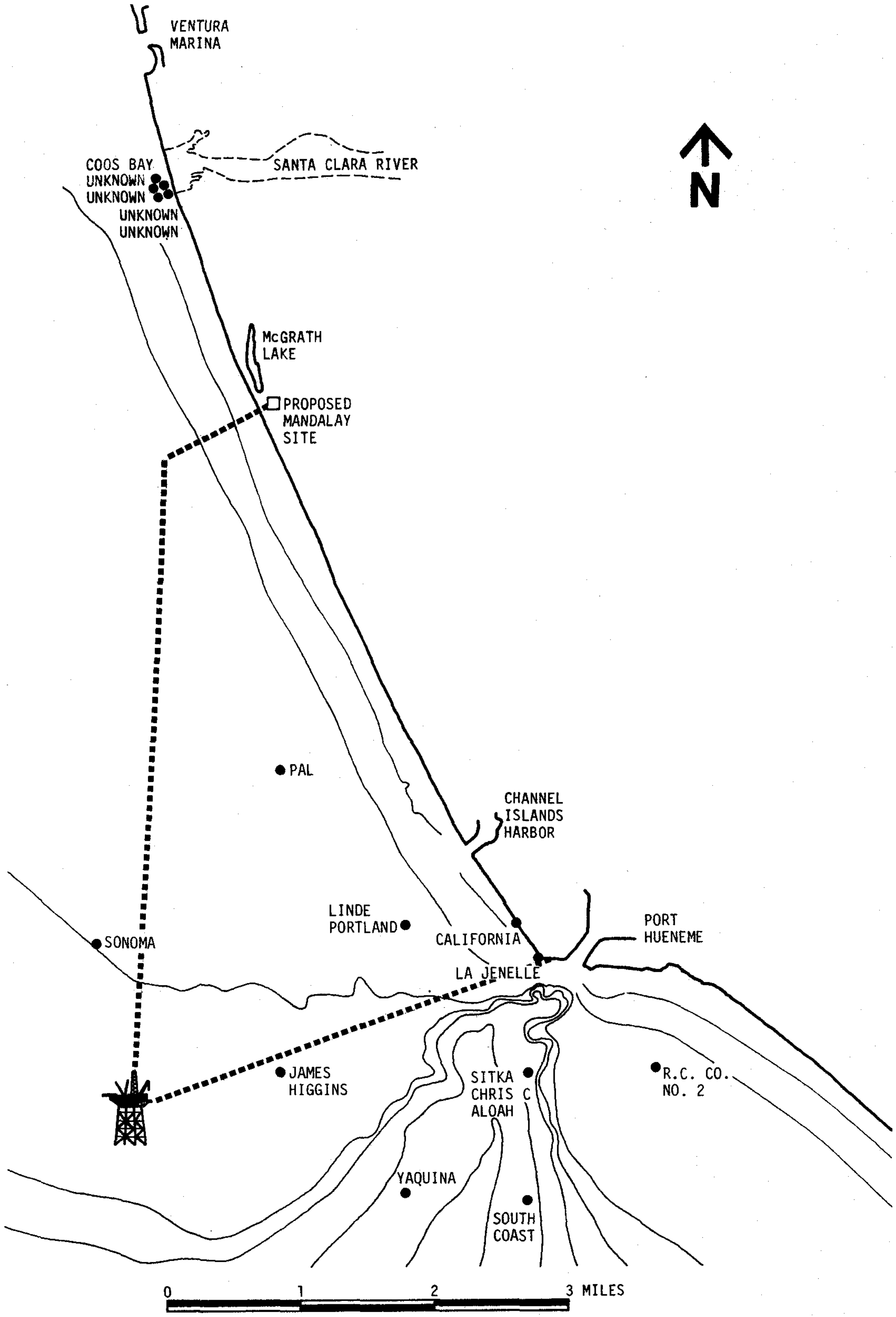

FIGURE 12.8-6

APPROXIMATE POSITIONS OF DOCUMENTED SHIPWRECKS NEAR PLATFORM GINA AND ASSOCIATED PIPELINE CORRIDORS

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TABLE 12.8-1

DOCUMENTED SHIPWRECKS NEAR PLATFORM GINA AND ASSOCIATED PIPELINE CORRIDORS[a]

BLM Site Number	Vessel Name	Type of Vessel	Built	Lost	Displacement	Significance[c]
315	South Coast	--	--	--	--	Moderate
060	California[b]	--	--	--	--	Significant
399	Yaquina	--	--	1883	--	Significant
257	Portland	Barkentine	1873	1906	493	Significant
158	James Higgins	--	--	1916	--	Moderate
312	Sitka	--	--	1934	--	Moderate
070	Chris C	Oil screw	1927	1937	--	Moderate
245	Pal	Oil screw	1926	1937	71	Moderate
553	R.C.Co. No. 2	Scow	--	1939	--	Moderate
314	Sonoma	Oil screw	1914	1949	196	Moderate
188	Linde	Oil screw	1928	1951	73	Moderate
016	Aloah	--	--	1952	--	Moderate
177	La Jenelle[b]	Steam screw	1931	1970	7000	Insignificant
078	Coos Bay[b]	Steam screw	1884	1914	--	Moderate
503	Unknown	--	--	--	--	Not determined
504	Unknown	--	--	--	--	Not determined
505	Unknown	--	--	--	--	Not determined
506	Unknown	--	--	--	--	Not determined

[a]Data from BLM, 1978; Berman, 1971; Gibbs, 1957.
[b]Reported as removed, floated, or extensive salvage.
[c]BLM, 1978.

described in Table 12.8-2 by (1) line:event marks which bracket the area; (2) estimated size of the area; and, (3) a narrative description, including shape of the area and range of amplitude of magnetic residuals. Interpretations of the areas are also provided. Loci of possible anomalous returns are described and interpreted in Tables 12.8-3 through 12.8-5.

Based on the interpretations listed in Tables 12.8-2 through 12.8-5, several areas and loci of possible anomalous returns have been identified as possible cultural resources. Areas or loci which are identified as drilling spoil or oil exploration-related losses of tools or equipment are not considered to be significant cultural resources.

Area 1. Area 1 is interpreted as debris from vessels associated with the mooring buoys located at the shoreward terminus of the Mandalay pipeline corridor. The possibility that Area 1 represents a shipwreck cannot be completely discounted. However, the area of ferromagnetic material is larger than that which would be expected to be associated with a shipwreck. Since the Pal, the nearest reported shipwreck, is a vessel of composite construction lost within the last 50 years, it is not expected to have been reduced to such a scattering of ferromagnetic material.

Area 2. Area 2 is interpreted as an unrecorded drilling site. The possibility that Area 2 is the remains of the Sonoma (1949), Pal (1937), or other vessel cannot be completely discounted. However, the large distribution of ferromagnetic material does not reflect the pattern expected of recent shipwrecks.

Area 3. Area 3 may be: (1) debris from vessels entering/departing Channel Islands Harbor and/or vessels associated with breakwater construction; or, (2) the buried wrecksite of the Linde (1951) and/or the Portland (1906). This area is larger than that which would be associated with shipwrecks. However, the Portland may have been constructed largely of wood and, given the duration of time since loss (74 years), may have been reduced to scattered ferromagnetic debris.

TABLE 12.8-2

DESCRIPTION AND INTERPRETATION OF "AREAS OF POSSIBLE ANOMALOUS RETURNS"

Designation	Line: Event Mark	Approximate Size of Area (sq.m)	Description of Area	Interpretation of Area
Area 1	022:11-12 023A:11-14 020:11-14 024:11-14.5 025:11-14.5 025:11.5-15 026:11.5-14.5 032(tie):3-3.5 033(tie):1-3.5	928,000	Sub-triangular area of clustered magnetic residuals not distinctive enough to map individually. Residuals range in size from about 6 to 20 g. Distribution of residuals is within a large area of sonar returns from the water column which may mask sonar reflections with shadows.	This area may be: (1) ferromagnetic debris from vessels tied to the mooring buoys situated at the end of the Mandalay pipeline corridor; or, (2) a shipwreck. The shape of the area may be the result of downcurrent distribution of lighter portions of the shipwreck. May be the *Pal* or an unrecorded shipwreck site.
Area 2	020:22-23.5 024:21-24 025:20.5-23 025:20-22.5 030(tie)2-4	557,000	A sub-rectangular area of clustered potential objects or seafloor topographic features (depressions or rises). An anchor dragmark (024:24) and pipe (024:21) (approx. 3 m long) occur in Area 2. One large, localized -1,000 g anomaly (024:23) and several broad, low amplitude anomalies also occur. The reflections are clustered in a 24,000 sq.m. area near the east side of the survey corridor (lines 025 and 026).	This site may be: (1) an unrecorded drillsite or (2) debris from the wreck of the *Sonoma* or *Pal*. The returns conform to the pattern expected from drilling. The reflections cover a larger area than would be expected from a wrecksite of a vessel of metal construction in the offshore wreck environment (14-m depth). The area is interpreted as an unrecorded drillsite but interpretation as a wreck site cannot be completely eliminated on the basis of available data.
Area 3	001:3-6 002:4-6 003:5-6 012(tie):1	214,000	A sub-rectangular area of clustered magnetic residuals ranging in size from about 6 to 20 g.	This site may be: (1) random loss of material from boats entering or leaving nearby harbors; or, (2) the shipwreck site of the *Linde* or *Portland*, or both.

TABLE 12.8-3

DESCRIPTION OF TYPE 1 LOCI OF POSSIBLE ANOMALOUS RETURNS

Designation	Line: Event Mark(s)	Nearest Project Element	Amplitude and Sense of Magnetic Residual (gammas)	Estimated Mass of Object (within order of magnitude)	Possibly Associated Acoustic Returns (Side-Scan Sonar)	Length (m)	Width (m)	Interpretation	Within Zone of Potential Impact?
1:1	031:2	Mandalay[a]	+10	> 900 kg	None			Buried ferromagnetic object	Yes
1:2	020:20	Mandalay[a]	-4/+5	100 kg	Linear seafloor target (no shadow)	15	> 1	Pipe (?)	Yes
1:3	022:24	Mandalay[a]	+6	100 kg				Related events: (a) possibly associated with Area 2 (refer to Table 8.0-1)	Yes
1:4	022:24,25	Mandalay[a]	+4/-3	100 kg	None				Yes
1:5	023A:24	Mandalay[a]	-5	100 kg					Yes
1:6	026:26	Mandalay[a]	+2/-2	100 kg	None			Noise - no corresponding anomalous return on tie line 29	Yes
1:7	024:29	Mandalay[a]	-7/+3	> 900 kg	None			Buried ferromagnetic object related to Drillsite 2	Yes
1:8	123:8	Platform	+10	> 900 kg	None			Buried ferromagnetic object related to Drillsite 4 or 7	No
1:9	123:4	Platform	+22	> 900 kg	None			Buried ferromagnetic object related to Drillsite 6	No
1:10	003:18,19	Platform	+15 & +70	> 900 kg	None			Buried ferromagnetic object related to Drillsite 9	Yes
1:11	002:18	Platform	+90	> 900 kg	None			Buried ferromagnetic object related to Drillsite 9	Yes
1:12	002:19	Platform	+10/-6	> 900 kg	None			Buried ferromagnetic object related to Drillsite 9	Yes
1:13	004:18	Platform	+4/-3	> 100 kg	Seafloor depression about 20 cm deep, 58 m off line	2	2	Capped well at Drillsite 9, casing blown off below mudline	Yes
1:14	003:15	Ormond Beach[b]	+7	450 to 900 kg	Seafloor target	2	2	Ferromagnetic object related to Drillsite 8 or 9	Yes
1:15	004:14	Ormond Beach[b]	+5/-3	450 to 900 kg	None			Buried ferromagnetic object related to Drillsite 8	Yes
1:16	002:13	Ormond Beach[b]	+14	> 900 kg	Numerous seafloor targets			Ferromagnetic object related to Drillsite 8	Yes
1:17	001:13	Ormond Beach[b]	-10					Ferromagnetic object related to Drillsite 8	Yes
1:18	004:11	Ormond Beach[b]	+10	> 900 kg	Rectangular to square seafloor target	3-4	3-4	Ferromagnetic object	Yes
1:19	011:2	Ormond Beach[b]	+10/-4	> 100 kg	None			Buried ferromagnetic object related to oil equipment transport	Yes
1:20	002:8	Ormond Beach[b]	-4/+5	100 kg	None			Buried ferromagnetic object related to oil equipment transport	No
1:21	001:8	Ormond Beach[b]	+6	> 450 kg	None			Buried ferromagnetic object related to oil equipment transport	Yes

TABLE 12.8-3 (Concluded)

1:22	002:7	Ormond Beach[b]	+7	> 450 kg	None	Buried ferromagnetic object related to oil equipment transport	No
1:23	003:8	Ormond Beach[b]	+6	> 450 kg	None	Buried ferromagnetic object related to oil equipment transport	Yes
1:24	005:3	Ormond Beach[b]	-20	> 900 kg	None	Buried ferromagnetic object, possibly related to wreck of La Jenelle, California, Linde, or Portland.	Yes

[a]Proposed Mandalay pipeline corridor.

[b]Ormond Beach alternative pipeline corridor.

TABLE 12.8-4

DESCRIPTION OF TYPE 2 "LOCI OF POSSIBLE ANOMALOUS RETURNS"

Designation	Line: Event Mark	Nearest Project Element	Size of Object(s) Length	Width	Height	Interpretation
2:1	010:2	Ormond Beach[a]	20 m	1 m	none	Ripple mark

[a]Ormond Beach alternative pipeline corridor.

TABLE 12.8-5

DESCRIPTION OF TYPE 3 "LOCI OF POSSIBLE ANOMALOUS RETURNS"

Designation	Line: Event Mark	Nearest Project Element	Amplitude and Sense of Residual	Size of Object(s) Length	Width	Height	Interpretation
3:1	104:2	Platform	-16/40 -12	19.2 m[a]	5.5 m	6.3 m	Vessel, confirmed by divers as kelp cutter.
3:2	006:12	Ormond Beach[b]	-10/+5	8 m	10 m	>1 m	Ferromagnetic object, small barge?
3:3	007:12	Ormond Beach[b]	-3	8.5 m	3.5 m	<1 m	Possible small vessel

[a]Dimensions estimated from acoustic record.

[b]Ormond Beach alternative pipeline corridor.

Locus 1:24. This locus may be: (1) ferromagnetic objects lost from vessels entering or leaving Channel Islands Harbor or Port Hueneme; or, (2) buried material related to the wreck of the *La Jenelle* (1970), *California* (1883), *Linde* (1951), or *Portland* (1906).

Locus 3:1. This locus is the site of a confirmed shipwreck identified as kelp cutter by Dames & Moore marine biology divers.

Locus 3:2. This locus has been interpreted as a possible small vessel.

Locus 3:3. This locus is interpreted as a possible small vessel.

Loci 1:3, 1:4, 1:5. These loci are identified as either returns of geologic origin or buried ferromagnetic objects associated with Area 2.

12.8.2.2.4 Aboriginal Sites or Artifacts

The upper Pleistocene and Holocene deposits are the geologic units that date from the period of eustatic sea-level changes of the Wisconsin regression and Holocene transgression. It was during this period that many workers believe the earliest occupation of North America began.

Little is known about the kinds of terrain which were favored by the earliest inhabitants. Early and Middle Period sites along the Santa Barbara Channel are situated on hills or knolls, and near wetlands, riparian areas, and strandlines. Thus, it appears likely that geologic deposits indicative of such environments would have the highest potential to contain archaeological resources.

Remote sensing data are of limited use in detecting buried archaeological deposits. Coring may provide confirmation of the presence of buried archaeological deposits, but such confirmation is generally difficult. Examination of the report of coring operations near the platform site (Geotechnical Consultants, Inc., 1976) revealed no evidence which could be taken as indicating archaeological deposits. However, these cores were not described by personnel familiar with identification of artifacts and thus cannot be taken as evidence confirming the absence of buried archaeological sites.

The probability of preservation of sites directly exposed to wave action is regarded as extremely low. Hills, knolls, strandlines, and stream channel margins are expected to have been exposed during the Holocene transgression. Wetlands, however, may have constituted an environment which was protective of inundated archaeological deposits.

Possible Buried Wetlands

Sparker records indicate an area of probable gas near the eastern terminus of the Ormond Beach alternative pipeline corridor. This gas may be related to buried organic matter. Such buried matter could be indicative of a former wetlands environment, perhaps an estuary or marsh similar to the Hueneme Slough.

Areas bordering coastal wetlands are regarded as potential localities for buried prehistoric archaeological sites, especially Early Period and Middle Period sites. Therefore, the terrace deposit in the vicinity of the area of possible gas should be regarded as a potential locality for buried archaeological sites.

Buried Channels

The margins of former terrestrial channels may represent localities for buried prehistoric archaeological sites, since they may have constituted a wetland or riparian environment. Two such channels were identified in the records of the geophysical survey:

(1) A buried channel is situated within the Holocene marine sediments in the central southeast part of the Ormond Beach alternative pipeline corridor. The base of this channel extends into the terrace deposits

which underlie the Holocene sediments and it is filled with marine sediments. The top of this feature is 60 feet (20 m) below the seafloor.

(2) A second buried channel occurs in lower Pleistocene sediments in the vicinity of the proposed platform site. This channel antedates the predicted earliest date (30,000 years B.P.) of human occupation in the New World. Therefore, the channel is not expected to contain any cultural resource materials.

12.8.2.3 Platform Gilda and Pipeline Corridor

12.8.2.3.1 Lease History

The locations of previous exploratory well drilling activities near the proposed Platform Gilda site and associated pipeline route are shown on Figure 12.8-7. This information was used in evaluating marine geophysical survey data for potential occurrence of cultural resources (see Section 12.8.2.2.1)

12.8.2.3.2 Nautics

The approximate locations of documented shipwrecks near the proposed Platform Gilda site and associated pipeline route are shown on Figure 12.8-8. Table 12.8-6 provides descriptive information concerning these shipwrecks.

12.8.2.3.3 Possible Anomalous Returns

All loci of possible anomalous returns within the Platform Gilda marine geophysical survey grid were evaluated for the presence of potential cultural resources. These loci were subsequently identified as drilling-related features based on: (1) presence of known drilling locations, the expected zone of accumulated debris, extent of bottom disturbance, or other recognized signatures of such sites; and/or, (2) the location of these loci on possible routes between drilling locations and onshore support facilities.

Two area of loci of possible anomalous returns were located within the pipeline corridor (Table 12.8-7). There are three possible hypotheses to explain these data:

TABLE 12.8-6

DOCUMENTED SHIPWRECK LOCATIONS[1]

BLM Site Number	Ship Name	Built	Lost	Type of Ship	Significance[3]
078	Coos Bay[2]	1884	1914	Steam screw	Moderate
0503	Unknown				Not Determined
0504	Unknown				Not Determined
0505	Unknown				Not Determined
0506	Unknown				Not Determined

[1]Data from USDI,BLM; 1978
[2]Salvaged
[3]BLM, 1978

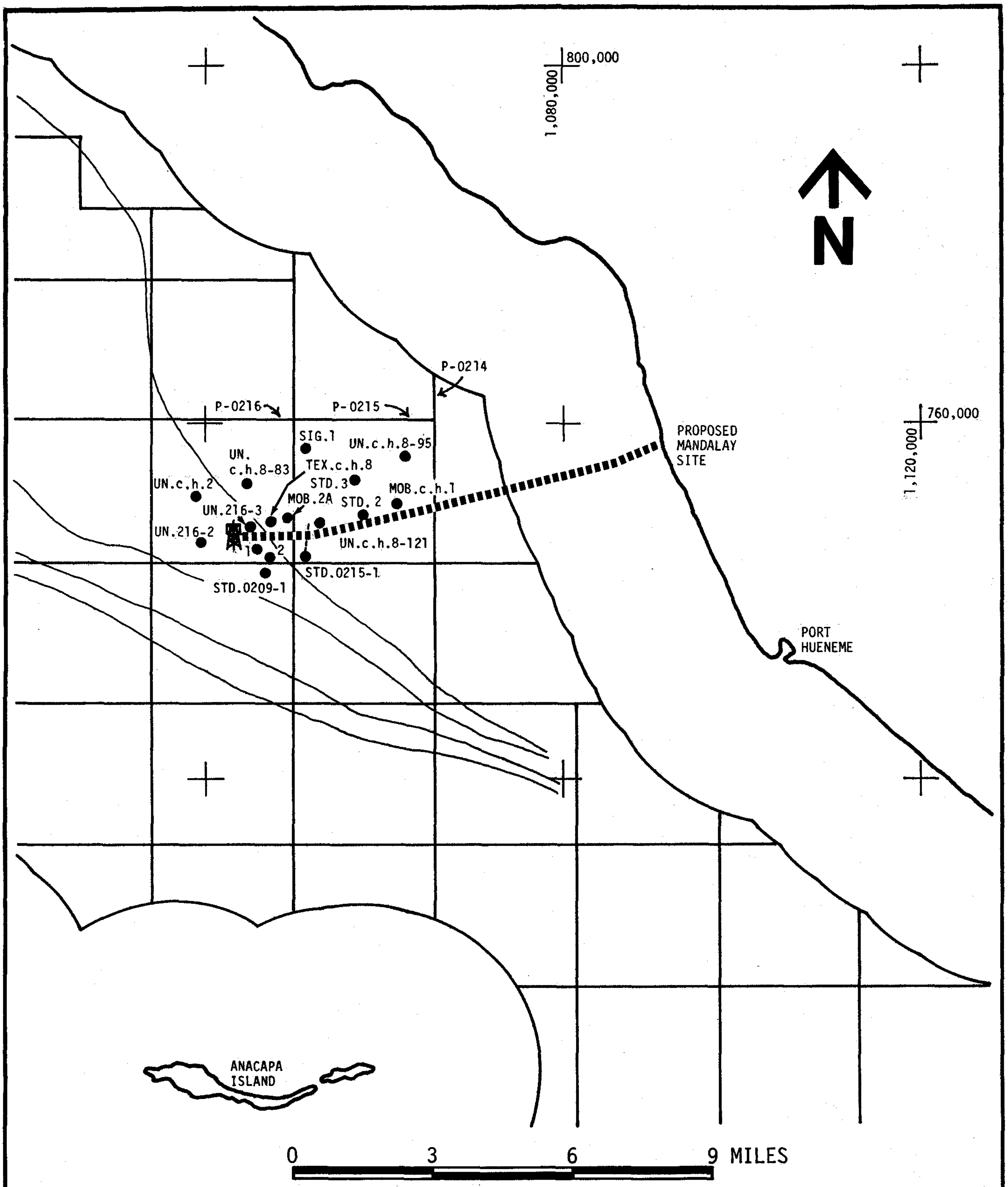

FIGURE 12.8-7

LEASE HISTORY
(PLATFORM GILDA VICINITY)

REFERENCE: USGS PUBLIC INFORMATION FILES AND
UNION OIL COMPANY MAP.

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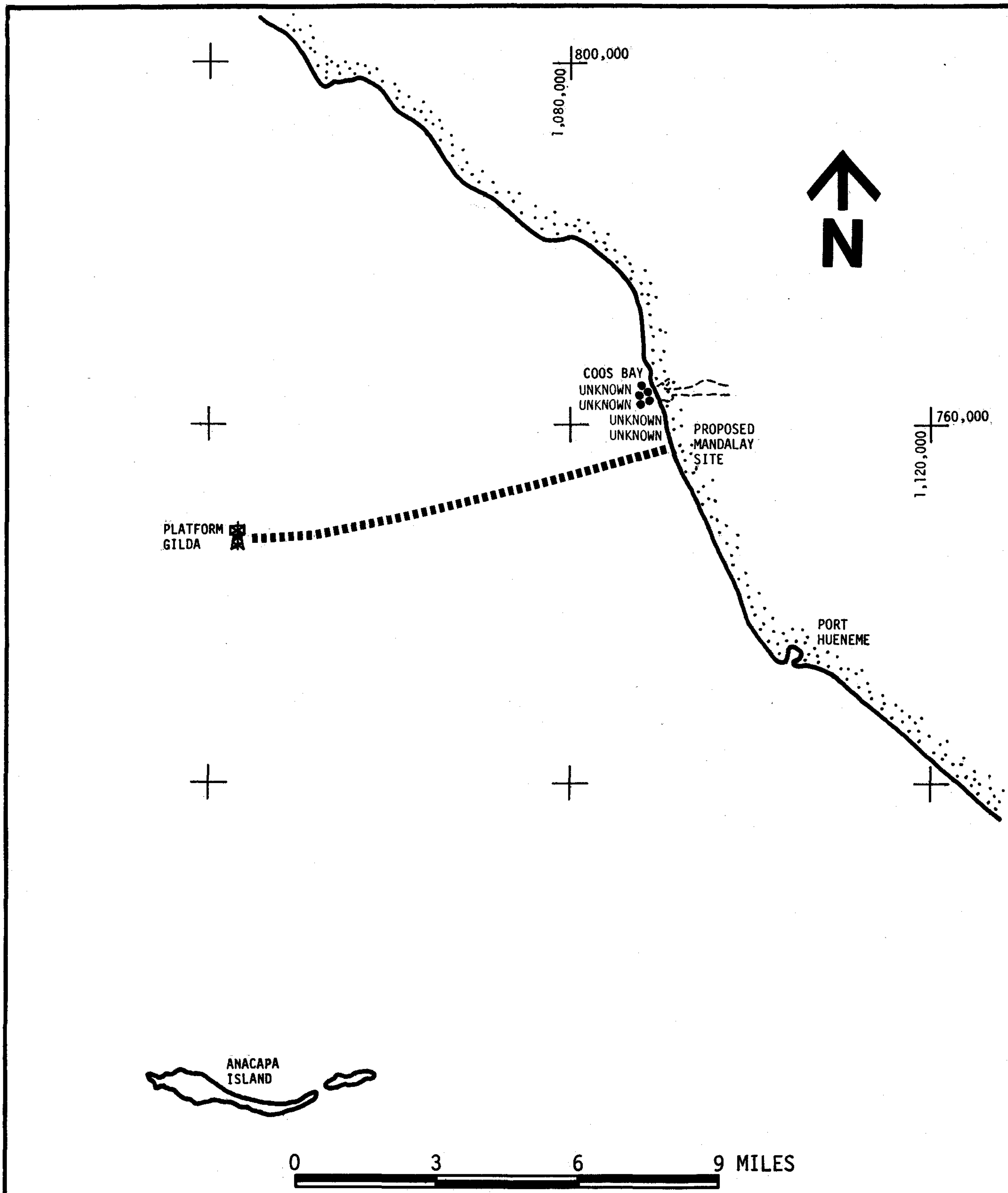

FIGURE 12.8-8

APPROXIMATE POSITIONS OF DOCUMENTED SHIPWRECKS NEAR PLATFORM GILDA AND ASSOCIATED PIPELINE CORRIDOR

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TABLE 12.8-7

LOCI OF POSSIBLE ANOMALOUS RETURNS - PIPELINE CORRIDOR

Designation		Water Depth	Line/ Shot Point(s)	Magnitude of Residual	Estimated Mass and/or Dimensions of Object	Association	Possible Interpretation
Area 1	1:1	55 ft	32/112	± 2 g	25 kg	None	Buried ferromagnetic object
	1:2	55 ft	31/114	- 2 g	25 kg	None	Buried ferromagnetic object
	1:3	55 ft	27/109-111 28/110-112 29/110-113	± 3 to 5 g ± 3 to 5 g + 2 to 3 g	25-900 kg	Related event	Buried ferromagnetic object
	2:1	55 ft	32/114	NA[2]	2.5 x 1 x 1.5 ft	None	Unknown object
	2:2	55 ft	32/115	NA	2.5 x 1 x 1.5 ft	None	Unknown object
Area 2	1:4	60 ft	31/132	- 2 g	20 kg	Coincident with change in bottom material indicated by numerous small targets lacking shadows.	Buried ferromagnetic object
	1:5	65 ft	30/135-136	± 5 g	30-50 kg	Coincident with change in bottom material indicated by numerous small targets lacking shadows.	Buried ferromagnetic object
	1:6/ 1:7	65 ft	27/132 28/133	± 5 g	30-50 kg	Related event, coincident with change in bottom material indicated by numerous small targets lacking shadows.	Buried ferromagnetic object

[1]All loci occur in Zone of Impact.

[2]Not applicable

(1) debris lost from vessels traversing the area;

(2) cultural resource; or,

(3) natural feature.

Area 1 consists of three broad low level magnetic residuals with no directly associated side-scan sonar targets. However, two small side-scan sonar targets measuring 2.5 x 1 x 1.5 feet (0.8 x 0.3 x 0.5 m) were located approximately 500 and 1,000 feet (150 and 300 m) from the magnetic residuals.

Area 2 consists of three broad magnetic residuals with no directly corresponding side-scan sonar targets. These residuals appear along three adjacent survey lines.

The magnetic residuals in Areas 1 and 2 were interpreted as possible buried ferromagnetic object(s). The depth of deposition of these potential object(s) within the sediments is unknown. Possible explanations for these residuals include:

(1) Debris. The Area 1 and Area 2 anomalies may be the result of deposition of debris from vessels trafficking the area. Such traffic could have been related to the Anacapa Passage, two commercial harbors and two marinas near the project area, the moorings offshore of Mandalay Generating Station, or previous drilling activities.

(2) Cultural Resource. The types of magnetic residuals observed in Areas 1 and 2 could represent a wood-hulled shipwreck. The potential for preservation of such a shipwreck this close to shore is low and there is no record of a shipwreck occurring at or near this location.

(3) Subsurface Natural Feature. The third possible explanation to account for the anomalies in Areas 1 and 2 is that these anomalies are associated with the presence of a subsurface natural feature.

Of the three explanations given above, the first is considered the most probable. It is highly unlikely that the magnetic residuals could be related to remains of an aboriginal habitation site. Deposition at such a site subsequent to its formation would have resulted in it being buried by at least 15 to 20 feet (5 to 7 m) of sediment. At this depth of burial, it could not have produced the magnetic residuals that were recorded.

12.8.2.3.4 Aboriginal Sites or Artifacts

Aboriginal sites or artifacts may be preserved in geologic deposits which are: terrestrial in origin; younger that at least 30,000 years B.P. (especially in those younger than about 10,000 years B.P.); and, indicative of favored habitation areas (e.g., high ground, strandline, or river bank). Geologic data from the marine geophysical survey were examined for evidence of such deposits; these data were supplemented by published information on the Ventura/Oxnard Shelf (USGS, 1978) and unpublished preliminary soil boring data for the Platform Gilda site. This analysis has resulted in the following interpretations:

<u>At the Platform Site</u>

(1) Subsurface sediments are probably all marine in origin to a depth of 400 feet (120 m) below mudline.

(2) The Holocene deposits are approximately 15 feet (5 m) thick; the upper Pleistocene, 100 feet (30 m).

(3) At the southwest corner of the platform survey grid there are possible terraces, suggesting an old shoreline, cut into the upper Pleistocene deposits.

<u>Along the Pipeline Corridor</u>

(1) The Holocene deposits thicken shoreward from the platform to a possible old strandline located near the midpoint, where they are about 130 feet (45 m) thick.

(2) Inshore of this, the Holocene deposits have a nearly uniform thickness of about 125 - 160 feet (40 - 50 m).

(3) The Holocene deposits probably grade from predominantly marine near the platform, to include terrestrial deposits at depth toward shore. However, the uppermost 15 to 20 feet (5 to 7 m) of sediments over the survey area are probably marine deposits.

(4) The zone offshore from the possible old shoreline exhibits shallow dispersed gas about 20 feet (7 m) below the seafloor.

Due to the presence of probable terrestrial deposits younger than 30,000 years B.P. beneath the platform site/pipeline corridor area, it is possible that buried aboriginal sites or artifacts may occur. The most likely area for such resources to occur is shoreward of the possible former strandline, where the Holocene sediments include relatively more terrestrial deposits. However, any aboriginal sites or artifacts which do occur are expected to be buried by at least 15 to 20 feet (5 to 7 m) of marine deposits.

12.8.3 Onshore Cultural Resources

The principal sources of baseline information concerning onshore cultural resources were published and unpublished literature, maps, archival records, professional contacts, consultation with descendants of the Chumash Indians, and field research data. Major information sources are listed in Table 12.8-8. Onshore cultural resources include prehistoric and historic archaeological sites, historic landmarks, and ethnographic sites.

Field research consisted of two types of investigations: (1) archaeological reconnaissance walkover surveying; and, (2) consultation with local Chumash descendants. The archaeological survey was designed to identify visible evidence of past activity such as prehistoric and historic archaeological sites and standing structures. Consultation with local Chumash descendants was designed to identify ethnographic or cultural resources such as sacred places and past or modern plant collecting sites.

TABLE 12.8-8

MAJOR INFORMATION SOURCES

Individuals

Ms. Sheila Callison, Ventura County Archaeologist.
Mr. Charles Conway, a manager of the agricultural lands of the McGrath family, who is knowledgeable about aspects of local history.
Honorable Tsujio Kato, Mayor of Oxnard and local resident of Japanese descent.
Mr. Izzy Otani, long-term area resident of Japanese descent.
Mr. Eugene Stafford, lifelong area resident of Indian descent, who is associated with the Port Hueneme Historical Museum.

Groups, Organizations, or Records Depositories

California Archaeological Survey, District Office, University of California, Los Angeles
California State Office of Historic Preservation, Sacramento
Candalaria American Indian Council, Oxnard
Command Historian, U.S.N. Construction Batallion, Port Hueneme
Cultural Heritage Board, Ventura County
Department of Public Works, U.S.N. Construction Batallion
Imagery Collection, University of California, Santa Barbara
Oxnard City Planning Department
Port Hueneme Historical Museum Commission
U.S. National Archives, Washington, D.C.
Ventura County Archaeological Society, Ventura
Ventura County Historical Society Museum, Ventura

Published and Unpublished Sources

California Department of Parks and Recreation, Inventory of Historic Resources
Historic ethnography notes of John P. Harrington
Historic ethnography and archaeological notes of Richard Van Valkenburgh
National Register of Historic Places, Annual Supplement of February 1979 and supplements to July 1979

Prehistoric and historic archaeological sites were assessed in terms of significance criteria established by the federal government (36 CFR 800) including: (1) the presence or absence of integrity (36 CFR 800.10 (a)); and, (2) the potential of any site to yield information of importance to prehistory (Criterion 4). To be considered significant, districts, sites, buildings, structures, and objects of national, state, or local importance must possess integrity. Attributes of integrity which are pertinent to prehistoric sites are, generally, location and association. Integrity of location was defined as the reasonable certainty that an archaeological site has not been redeposited. Integrity of association was defined as the reasonable certainty that spatial relationsips among intra-site components are substantially intact. Where significance resulted from information potential (Criterion 4), such information referred to archaeological research interests.

The concerns of local Chumash descendants were considered in assessing the significance of prehistoric archaeological sites. Chumash consultants who were interviewed expressed the conviction that all sites had some importance, but that burials or cemeteries were of particular significance. Local Chumash descendents also provided input for the determinations of ethnic significance.

12.8.3.1 Project Area and Vicinity

12.8.3.1.1 Prehistoric Physiographic and Biotic Setting

The project area is situated on the Oxnard Plain which consists of alluvium deposited by the Santa Clara River. A zone of sand dunes occurs along the coastal portion of the project area. Near the Santa Clara River, the dune belt is about 0.6 mile (1 km) wide and it narrows to a thin strip at Port Hueneme. Cooper (1967) indicated that dunes have been present in the area since at least about 15,000 years B.P. The presence of dunes and alluvial material strongly suggests the possibility that buried sites may occur within the project area.

The dunes would have been an attractive place for early inhabitants because of the several associated salt water and fresh water lakes and ponds which historic sources indicate were present (U.S. Coast Survey, 1855). These lakes were a source of abundant small game, waterfowl, and plant resources. Later maps (U.S. Coast and Geodetic Survey, 1933) show that these ponds had been drained by the 1930's, except for McGrath Lake, which is now smaller than its original size. The areas around these water bodies are expected to be high probability locations for prehistoric sites. Other available sources of fresh water, such as springs, also may have helped make the area an attractive place for prehistoric inhabitants.

The distribution of plant communities in and near the project area has been changed considerably by agriculture and development. The sand dunes were characterized by dune scrub and coastal strand communities. The prehistoric lakes and ponds can be expected to have had associated marsh communities, as well as small animals and a seasonal population of migrating birds. Landward of the dunes was coastal prairie grassland, comprising primarily perennial grasses. The coastal plant communities were generally low in production of such storable food resources as seeds and nuts. In addition, the absence of kelp beds, rocky foreshores, and reefs may also help to explain the apparent absence of permanent aboriginal occupation in the Oxnard-Port Hueneme area. The available resources would have been most attractive for seasonal occupation and use of the area by Indian populations.

12.8.3.1.2 Historic Overviews

Although the earliest documented European contact near the project area was Cabrillo's voyage in 1542-43, a significant Spanish presence was not established until the Portola expedition in 1769. A Spanish settlement was established in Ventura soon thereafter.

The Portola expedition passed north of the project area. They failed to note Indian settlements on the Santa Clara River below Santa Paula. However, Lopez (1978) stated that on "his journey down the valley, Portola encountered a number of large rancherias, in particular Kanaputequnon and 'Isha, both presumably located on the southern bank of the mouth of the Santa Clara River."

However, there is no evidence in published accounts that the Portola expedition crossed to the south bank of the river.

In 1837, the Mexican government granted El Rio de Santa Clara o La Colonia, now the Oxnard area, to a group of soldiers. In 1841, San Miguel was granted to R. Olivas and F. Lorenzana. The San Miguel grant is situated on the north bank of the Santa Clara River. The Santa Clara grant early became a producing agricultural region, a land use which has continued to the present day in most of the area. Further information is readily available in published references to the project survey area (e.g., Robinson, 1955; Sheridan, 1940; Smalley, 1976; Thompson and West, 1961).

12.8.3.1.3 Archaeological, Ethnographic and Historic Landmark Sites

A summary of potential archaeological, ethnographic, and historic landmark sites that occur within the project survey area and vicinity is provided in Table 12.8-9. Approximate locations of these resources are shown on Figure 12.8-9.

Two archaeological sites are reported from near the project survey area, 4-VEN-506 and an unrecorded site. The first, 4-VEN-506 is reported to be a burial site. Field reconnaissance confirmed the site's location, which is marked by soil slightly darker than surrounding soil and very sparse scatter of shell. No other obvious surface traces were present. The second, an unrecorded "midden-like" buried deposit, was reported by Holman and Chavez (1976) in sand dunes southeast of the Southern California Edison Company (SCE) Mandalay Generating Station (this deposit was recorded during the archaeological field survey and assigned the number 4-VEN-667). The nature of these two sites may indicate that sites in the project area can be expected to have more substantial buried components than surface components.

A reported "destroyed" midden appears in the records of the Ventura County Archaeological Society. This site is thought to have been situated north of Gonzales Road near the original McGrath homestead. Inspection of the site

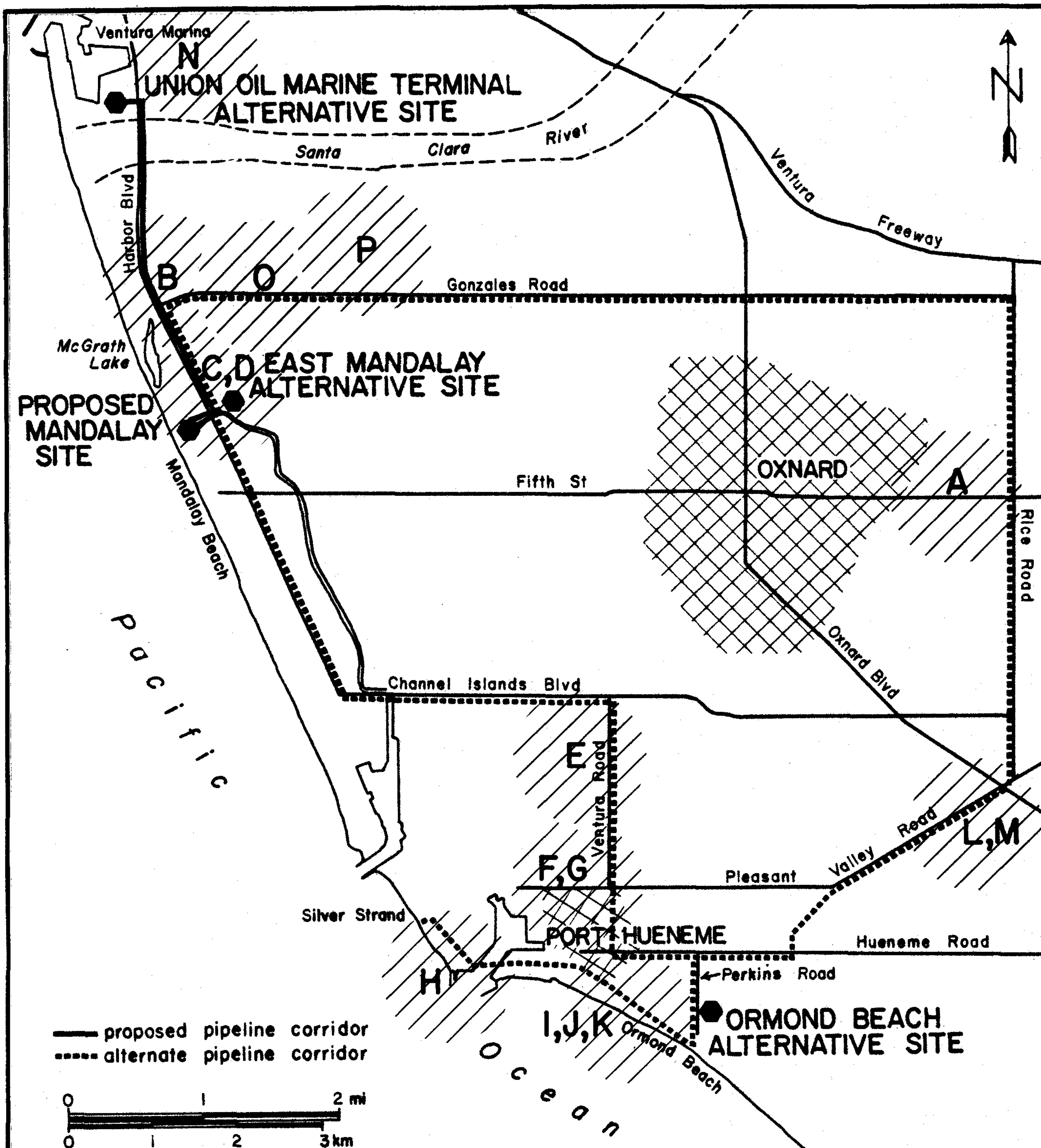

FIGURE 12.8-9

ZONES OF CULTURAL RESOURCE SENSITIVITY

NOTE: ZONES ARE NOT DRAWN TO SCALE.

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TABLE 12.8-9

SUMMARY OF POTENTIAL ARCHAEOLOGICAL, ETHNOGRAPHIC, AND HISTORIC LANDMARK SITES WITHIN PROJECT SURVEY AREA AND VICINITY

Identifier[1]	Name[2]	Location	Potential Resource Type
A	4-VEN-506 vicinity	Near Rice Rd. and East Fifth Ave.	Archaeological[3]
B	McGrath Lake-'iqsha area	West Gonzales Rd. and Harbor Blvd.	Archaeological and modern enthographic
C	4-VEN-667 vicinity	Near West Fifth Ave. on Harbor Blvd.	Archaeological
D	Mandalay Beach Basketry Material Site	Seaward of Harbor Blvd. south of SCE	Possible modern ethnographic
E	Ventura Road Eucalyptus Grove	West side of Ventura Ave. between Channel Islands Blvd. and Pleasant Valley Rd.	Local historic
F	Bard Memorial (Ventura Co. Landmark No. 20)	West side of Ventura Ave.	Local historic
G	Bard House area	Same as F	Archaeological
H	Wene'mu area	Silver Strand-Port Hueneme area	Archaeological
I	Ormond Beach	--	Archaeological, possibly ethnographic
J	Bubbling Springs area	Hueneme Rd.	Archaeological, past ethnographic
K	Barr Ranch	Pleasant Valley/ Perkins Avenue	Archaeological
L	Japanese Cemetery (Ventura County Landmark No. 18)	Pleasant Valley/ Etting Rd.	Local historic, ethnic
M	Naumann Eucalyptus Grove (Ventura Co. landmark No. 15)	Pleasant Valley near Hwy. 1	Local historic
N	Kanaputeknon area	Harbor Blvd.	Archaeological
O	McGrath Dairy No. 1	West Gonzales Rd.	Local historic
P	McGrath mound area	West Gonzales Rd.	Local historic, archaeological(?)

[1]Keyed to locations shown on Figure 12.8-9.
[2]Only sites that could be specifically located are listed.
[3]"Archaeological" refers here to potential sites of California Indian origin.

revealed no evidence of aboriginal occupation or use. Mr. Charles Conway recalls the removal of the mound. According to Mr. Conway, it was a natural mound and no artifacts were discovered during removal and no artifacts or other evidence of aborginal occupation have surfaced during cultivation in the area of the mound.

Table 12.8-10 provides information concerning Chumash placenames near the project area, including reconstructed location and nature of place. The approximate locations of the named places are shown on Figure 12.8-10. A potential plant collecting site (for basketry material) is located behind the foredunes south of the SCE Mandalay Generating Station.

An interview with Mr. Eugene Stafford of the Board of Governors of the Port Hueneme Museum indicated the following general areas of potential prehistoric archaeological or ethnographic significance with the project area.

(1) The Ormond Beach area (archaeological).

(2) Portions of Rice Road (archaeological).

(3) The sand dunes from Channel Islands Boulevard to the Santa Clara River (archaeological and ethnographic).

(4) The dunes on the east side of the road between the SCE Mandalay Generating Station and West Fifth Avenue (archaeological).

(5) The Silver Strand area (archaeological).

(6) The McGrath Lake area (ethnographic).

Details concerning historic landmark sites within the project area are provided in the following sections.

12.8.3.2 Proposed Mandalay Site and Pipeline Corridor

No previously recorded archaeological, ethnographic, or historic landmark sites occur on the proposed Mandalay site. The onsite reconaissance survey revealed no evidence of such resources.

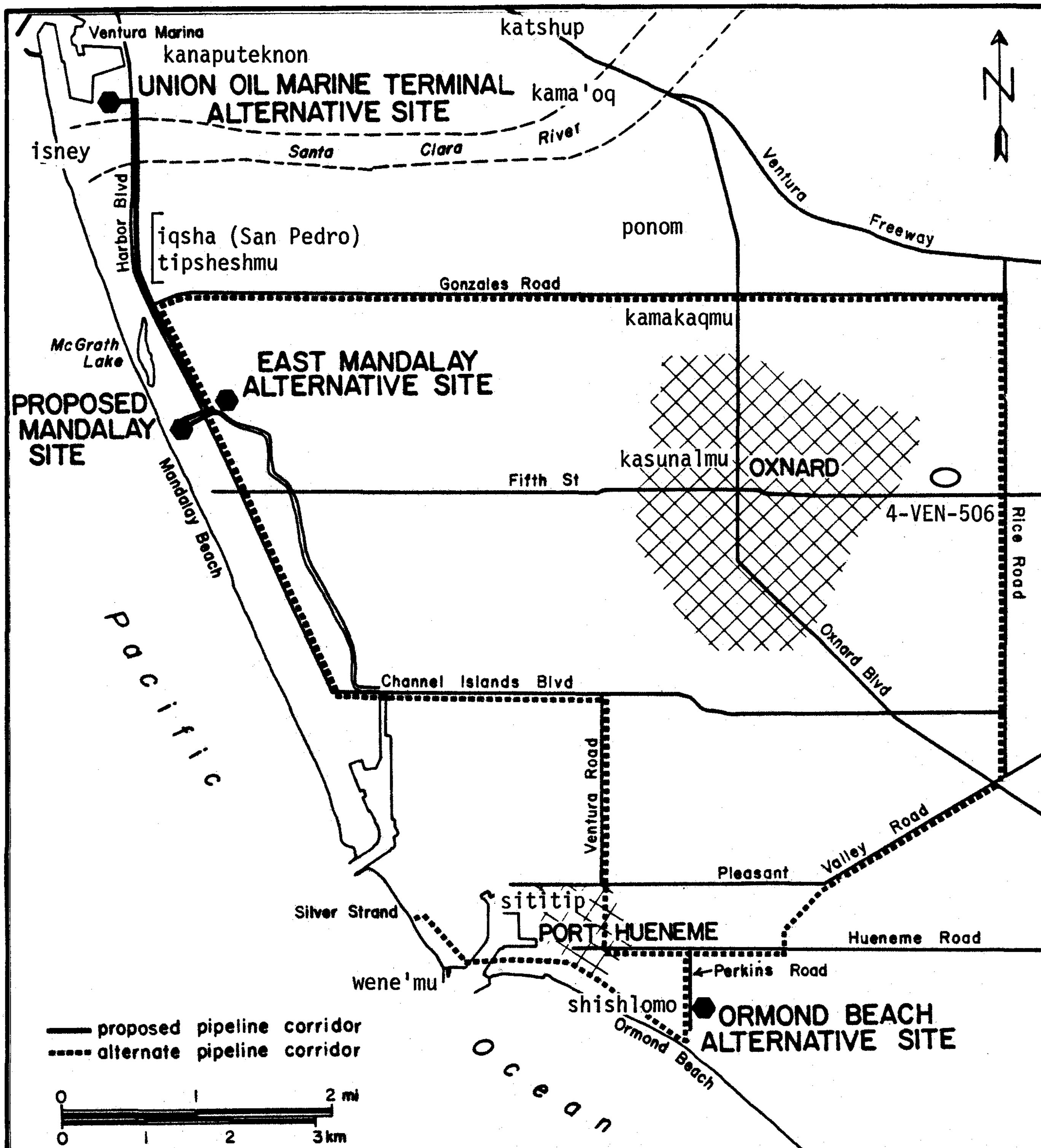

FIGURE 12.8-10

CHUMASH PLACE NAMES AND SITE PREVIOUSLY RECORDED IN THE LOCAL AREA

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TABLE 12.8-10

CHUMASH PLACENAMES NEAR THE PROJECT AREA

Placename	Reconstructed Location	Nature of Place
'iqsha (San Pedro)	East of McGrath State Beach	Unknown feature
'iswey	Mouth of Santa Clara River	Topographic feature
kamakaqmu	North of Oxnard	Unknown feature
kamo'oq	Toward Montalvo from Olivas Adobe	Unknown feature
kanaputeknon	On north side of Santa Clara River near mouth	Historic village[1]
kasunalmu	Near Union High School	Historic village
katshup	Montalvo Knolls	Topographic feature
malhohshi	Not placed	Unknown feature
ponom	Vicinity of Santa Clara Cemetery	Fresh water marsh?
shishlomo	Near Surfside Drive	Estuary or lagoon
tipsheshmu	Same as 'iqsha	Unknown feature
wene'mu	At entrance to Port Hueneme	Historic canoe and salt-making camp

[1] Historic villages are defined as those with baptisms recorded at Ventura Mission.

A potential ethnographic site occurs south of the proposed Mandalay site on the planned Mandalay Beach Park property. Two species of Juncus (J. textilis and possibly J. acutus), an important basketry material, occur at this potential site. The site was reported by Ms. Jessie Roybal of the Candalaria American Indian Council. However, according to the testimony of the local Chumash descendants who were interviewed, no basketry material collecting was done at Mandalay Beach (the consultants reported that basketry material was collected at the sloughs near Point Mugu). No evidence was elicited during ethnographic interviews which would indicate present ethnic significance of basketry material collecting at Mandalay Beach. However, this site would have significance to local Chumash descendants if it becomes a collecting site in the future.

No previously recorded archaeological, ethnographic, or historic landmark sites occur along the onshore pipeline corridor associated with the proposed Mandalay site. The onsite field reconnaissance survey revealed no evidence of the occurrence of such resources; however, the possibility of buried sites occurring along the corridor is high.

12.8.3.3 East Mandalay Alternative Site and Pipeline Corridor

No previously recorded archaeological, ethnographic, or historic landmark sites occur on the East Mandalay alternative site. The onsite field reconnaissance survey revealed no evidence of the occurrence of such resources; however, the possibility of buried sites occurring on the site is high.

The onshore pipeline corridor associated with the East Mandalay alternative site is essentially the same as that for the proposed Mandalay site (see Section 12.8.3.2).

12.8.3.4 Union Oil Marine Terminal Alternative Site and Pipeline Corridor

No previously recorded archaeological, ethnographic, or historic landmark sites occur on the Union Oil Marine Terminal alternative site. The onsite field reconnaissance survey revealed no evidence of the occurrence of such resources.

No buried sites are expected at this location because it is situated on recent fill.

The onshore pipeline corridor associated with the Union Oil Marine Terminal alternative site is the same as that for the proposed Mandalay site (see Section 12.8.3.2).

12.8.3.5 Ormond Beach Alternative Site and Pipeline Corridors

No previously recorded archaeological, ethnographic, or historic landmark sites occur on the Ormond Beach alternative site. The onsite field reconnaissance survey revealed the occurrence of an historic archaeological site, 4-VEN-664(H), which is described below. The possibility of buried sites occurring on the site is high.

4-VEN-664(H) consists of the remains of a mid-twentieth century farm building. It is situated across Perkins Avenue from the Oxnard wastewater treatment plant. Although the existing site deposit is considered to be primary, extreme deterioration and disturbance of the site deposit has resulted from earth moving. The vertical and horizontal context of artifacts and building material is clearly very disturbed and, thus, integrity of association is doubtful. Evidence of the date of the site is contradictory. No buildings are shown at the site on maps of the area prior to 1945. However, a fragment of glass at the site bore the date "1903." This glass may be evidence of earlier use, perhaps as a dump or a structure unnoticed by early mapmakers. Available evidence suggests that these remains are relatively recent.

The significance of such a site would normally be derived from its association with events that have made a contribution to the broad patterns of American history. While it may be that twentieth century farming on the Oxnard Plain is an event associated with the broad patterns of American history, the site lacks sufficient integrity to provide important evidence of such association; therefore, the site is not considered a signficant resource.

No previously recorded ethnographic or historic landmark sites occur along the onshore portion of the pipeline corridor connecting the site with Platform Gina. One previously recorded prehistoric archaeological site, 4-VEN-663, does occur. The onsite field reconnaissance survey confirmed this site, but did not reveal evidence of any other cultural resources. The possibility of buried sites occurring along the pipeline corridor is high.

Surface evidence of the remains of 4-VEN-663 is situated at the south end of Island View Drive. Buried deposit is predicted to be situated southeast of Building 465 on the U.S. Naval Construction Battalion Corps base. The site was originally described by Van Valkenburgh (1932-34) in 1933. Evidence suggests that this is the site of wene'mu, from which the name "Port Hueneme" is derived. The site is currently in both private and public ownership. Most of this site was removed for the construction of Port Hueneme. The remaining evidence is less than 2 percent of the original area as reconstructed. This remaining portion is badly disturbed from construction of roads, buildings, and other facilities. This site lacks sufficient integrity to be of value as a future scientific resource. However, it has, through prior documentation, contributed information important in regional prehistory and thus is considered significant. This site is also of importance to the local descendants of the Chumash Indians, and of local historic importance (city name).

No previously recorded ethnographic sites occur along the Ormond Beach Option A alternative pipeline corridor. One previously recorded prehistoric archaeological site (4-VEN-662), two Ventura County landmarks (Nos. 20 and 37), and one local historic landmark (Ventura Road Eucalyptus Grove) occur along or near the pipeline corridor. The onsite field reconnaissance survey confirmed these sites and revealed the occurrence of an additional prehistoric archaeological site, 4-VEN-667, and a potential prehistoric archaeological site (Field No. Oxnard 2). These sites are briefly described below. The possibility of buried sites occurring along the Option A pipeline corridor is high.

4-VEN-662 is situated on Hueneme Road west of the Moranda Park area. The site is in private ownership except under Hueneme Road (City of Oxnard). The site is a primary midden deposit consisting of shell, dark soil, ground stone artifacts, waste chert flakes, and fire-altered rock. The site was originally described by Van Valkenburgh (1932-34) in 1933. Except where recent construction (Hueneme Road, Talon Products-Donahue Sales Corporation Building, and an apartment-parking lot complex) has altered the site, its condition is good. Therefore, it is reasonably certain that the site possesses integrity. The site has the potential to yield information important to significant research interests. In addition, the site has significance to the local descendants of the Chumash Indians.

4-VEN-667 is a buried deposit situated in sand dunes on the east side of Harbor Boulevard between West Fifth Street and the SCE Mandalay Generating Station. The site is in public (Ventura County) and private (Standard Oil of California) ownership. The observed deposit consists of distinct strata of ashy sand with charcoal and unweathered shell. No artifacts or other evidence of culture were observed. There is some question about the cultural origin of the deposit. Holman and Chavez (1976), who originally observed the site in 1976, termed it a "possible archeological site" with "'midden-like' strata" Field observations support this characterization; the ashy deposits may be either cultural or natural in origin. Dune fires have characterized the coastal environment since the Pleistocene and leave deposits much like those observed here (Johnson, 1977). However, an unconfirmed report of a burial removed from the site area north of West Fifth Street was received from Mr. Eugene Stafford of the Board of Commissioners of Port Hueneme Historical Museum. On the basis of his report, this deposit is classified as an archaeological site. The integrity of the deposit on public land appears to be intact, except where erosion is occurring and where utility poles have been emplaced. However, the utility poles should not have significantly affected the deposit. Where the site may extend onto private land, damage may be extensive. Substantial earthmoving was observed at a petroleum fluids dump on the adjacent private land during the field work period, but was not investigated because access was denied. An assessment of the significance of the site must await testing of the deposit to determine its integrity and the nature of its origin.

Field No. Oxnard 2, a potential prehistoric archaeological site, is located near the intersection of Broad Street and Ventura Road in Port Hueneme. It is now in public ownership (City of Port Hueneme), recently acquired for urban redevelopment. The site consists of a deposit of possible aboriginal origin overlaid with a deposit of recent historic origin. The "aboriginal" deposit consists of shell and dark, sandy soil in a slightly raised area. No artifacts of aboriginal origin were identified in surface and subsurface inspections. The present condition of the site is good. However, urban redevelopment is endangering the deposit. Testing is required to identify the nature and extent, if any, of the "prehistoric" deposit. If the site is of Indian origin, it could contain evidence which would reflect on important research issues and it would be of significance to local descendants of the Chumash Indians. However, no assessment of significance can be made without data from a testing program.

The Bard Memorial (Ventura County Landmark 20) is a small rectangular plot surrounded by a fence of dressed stone and wrought iron situated on the west side of Ventura Road at Park Avenue in the City of Port Hueneme. The memorial is the cemetery of the Senator Thomas R. Bard family, prominent local pioneers. It contains the remains of Bard, his wife, and an infant son. The cemetery was transferred to its present site in 1951. The memorial itself is primarily commemorative in nature. Senator Bard's importance, while considerable, was restricted to the local or regional level--he was not a person of national significance. The Bard Memorial is probably not eligible for the National Register of Historic Places, but, according to the Board of Commissioners of the Port Hueneme Historical Museum and the Ventura County Cultural Heritage Board, the site is an important local historical resource.

The Hueneme Slough Site (Ventura County Landmark 37) is situated south of Hueneme Road; it is bounded by Santa Cruz Street, Ventura County Railroad, Avalon Street, and a flood control drainage ditch. This site is a portion of a now filled and developed slough. Prior to development, this area was an important food and materials resource area for local Chumash descendants and a recreational area for other local residents. According to the Ventura County Cultural Heritage Board, this site is an important local historic landmark. According to Anne Sandoval Parra, this area is significant to local Chumash descendants.

The Ventura Road Eucalyptus Grove occurs in a discontinuous, one-mile (1.6-km) long row of trees situated on the west side of Ventura Road between Channel Islands Boulevard and Pleasant Valley Road. According to Mr. Eugene Stafford of the Port Hueneme Historical Museum, this grove is over 70 years old and rivals the Naumann Grove in size, age, and local historic importance. This grove has not been declared an official landmark by the Ventura County Cultural Heritage Board. However, according to the Board of Commissioners of the Port Hueneme Historical Museum, the Ventura Road Grove is a significant local historic landmark.

No previously recorded archaeological or ethnographic sites occur along the Ormond Beach Option B alternative pipeline corridor. Two recorded Ventura County landmarks (Nos. 15 and 18) occur along or near the pipeline corridor. The onsite field reconnaissance survey confirmed the latter sites and revealed the occurrence of two prehistoric archaeological sites (4-VEN-665 and 4-VEN-666) and a potential prehistoric archaeological site (Field No. Oxnard 7). These sites are briefly described below. The possibility of buried sites occurring along the Option B pipeline corridor is high.

4-VEN-665 is three discontinuous clusters of shell and/or artifacts, apparently primary deposit. It is situated south of the intersection of Rice Road and Wooley Road. The portion probably situated beneath Rice Road is owned by Ventura County; the balance is privately owned. The site has been disturbed by construction of Rice Road, access roads to private residences and fields, utility lines, and agriculture. The surface of the site lacks integrity of association. The integrity and information potential of the subsurface deposit, if any, needs to be assessed by a program of testing. Based on available information, the site appears to have sufficient potential information to be a significant resource. If a subsurface deposit is present, the site would be of significance to local Chumash descendants.

4-VEN-666 is located along Rice Road north of East Fifth Street. It is an apparent primary deposit comprising a very low density scatter of shell and artifacts. Its proximity to 4-VEN-506 (outside of the pipeline corridor) suggests that the two sites may be functionally related. Site condition, integrity, and potential significance are the same as for site 4-VEN-665, above.

Field No. Oxnard 7, a potential prehistoric archaeological site, is a sparse shell scatter situated along Rice Road north of Pleasant Valley Road. No artifacts or other materials of aboriginal origin were observed. It is privately owned except for that portion under Rice Road which is owned by Ventura County. The deposit has been disturbed by construction of Rice Road, access roads to private residences and fields, utility lines, and agriculture. The surface of the site lacks integrity. Testing is required to identify the nature, integrity, and extent, if any, of a subsurface deposit. If the site is of Indian origin, it could contain evidence which would reflect on important research issues and would be of significance to local descendants of the Chumash Indians. However, no assessment of significance can be made without data from a testing program.

The Naumann Giant Gum Tree and Eucalyptus Grove (Ventura County Landmark 15) is situated on the southeast side of Pleasant Valley Road between Highway 1 and Etting Road. According to the Board of Commissioners of the Port Hueneme Historical Museum and the Ventura County Cultural Heritage Board, this grove is a significant local feature or landmark.

The Japanese Cemetery (Ventura County Landmark 18) is situated in a triangular plot at the intersection of Pleasant Valley Road and Etting Road. The gravemarkers date from 1908 to 1960 and are either Japanese or American in style. The cemetery does not contain the grave of any historical figures of outstanding importance. According to the Board of Commissioners of the Port Hueneme Historical Museum, this cemetery is known to have significance to the local Japanese-American community and is a significant local landmark. Honorable Tsujio Kato has affirmed the signficance of the cemetery to the local Japanese-American community.

12.8.3.5 Summary

Table 12.8-11 provides a summary of the cultural resources identified in the area surveyed for the proposed and alternative sites and associated pipeline corridors. The prehistoric archaeological sites (4-VEN-662, -663, -665, -666, and -667) warrant additional consideration as described below.

The absence of datable artifacts on the surface at these prehistoric archaeological sites prevents the identification of contemporaneous sites. However, the probability is high that a program of site testing would yield absolute or relative dates for all or most sites. Taken together, the prehistoric sites could provide information on important regional research issues. However, the present level of knowledge of these sites does not permit a precise statement of information potential. There is, for example, a lack of demonstrated chronological or functional linkage among the sites. However, evidence of such linkages could result from a program of testing or mitigative excavation. The prehistoric sites which possess integrity of location and association can provide important information on regional cultural development and on the synchronic functioning of vanished cultural systems. Although the boundaries of such prehistoric systems are unknown, the sites logically form a part of an archaeological district in the sense of the National Register of Historic Places.

TABLE 12.8-11

SUMMARY OF CULTURAL VALUES IDENTIFIED IN THE FIELD SURVEY AREA

	Cultural Value			
	Scientific Value			
Resource	Demonstrated	Potential	Local Historic	Ethnic, Other
Archaeological Site				
4-VEN-662	X	X		X
4-VEN-663	X		X	X
4-VEN-665		X		X
4-VEN-666		X		X
4-VEN-667		X		X
4-VEN-664(H)				
Ethnographic Site				
Mandalay Beach Basketry Material Site				Potential
Landmarks				
15			X	
18			X	X
20			X	
37			X	X
Ventura Road				
Eucalyptus Grove			X	

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APPENDIX C

ADDITIONAL BASELINE DATA

APPENDIX C.1

ENVIRONMENTAL ACOUSTICS

C.1.1 ACOUSTICS NOMENCLATURE

It is necessary to document background ambient (baseline) sound levels in a study area in order to assess potential noise impact. The assessment is accomplished by comparing noise due to construction and operations with baseline noise levels, and then comparing these levels with federal, state, and local guidelines, standards, and regulations, as applicable.

The effects of excessive noise are both physiological and psychological. A common physiological effect is the loss of hearing, either temporarily or permanently. The psychological effects range from mild annoyance to distress, to interference with speech and sleep. Environmental noise levels are usually not high enough to cause hearing damage or other physiological effects. The most common effects of environmental noise are behavioral and subjective in nature such as discomfort, nervous tension, or loss of sleep. Another effect of noise is the interference with communication including conversation, television, and radio.

The range of sound pressures that can be heard by humans is very large. This range varies from two ten-thousand-millionths (2×10^{-10}) of an atmosphere for sound barely audible to humans, to two-thousandths (2×10^{-3}) of an atmosphere for sounds which are so loud as to be painful. The decibel notation system is used to present sound levels over this wide physical range using a logarithmic scale. Zero decibels is assigned to the level for a minimal sensation of hearing, and 140 decibels to sound which is painful. Thus a range with an upper limit ten million times greater than its lower limit is expressed on a scale of zero to 140. Figure C.1-1 presents the A-weighted sound levels of typical noise sources.

The human ear does not perceive sounds of low frequencies in the same manner as those of higher frequencies. Sounds of low frequency do not seem as loud as those of equal intensity but higher frequency. The A-weighting network is provided in sound analysis systems to simulate the human hearing response. A-weighted sound levels are expressed in units of decibels (dB).

These levels in dB are used to evaluate hearing damage risk and community annoyance impact. These values are also used in federal, state, and local noise ordinances. Sound level, as used in this report, refers to A-weighted sound levels unless otherwise noted.

Sound is not constant in time. Statistical analysis is used to describe the temporal distribution of sound, and to compute single number descriptors for the time-varying sound. This report contains the following statistical A-weighted sound levels:

L_x — Sound level exceeded x% of the time during the measurement period. For example, L_{10} is the sound level exceeded 10% of the time during the measurement period.

L_{eq} — Equivalent sound level which provides an equal amount of acoustical energy as the time-varying sound.

L_d — Day Sound Level, L_{eq}, for the daytime period (0700-2200) only.

L_n — Night Sound Level, L_{eq}, for the nighttime period (2200-0700) only.

L_{dn} — Day-night Sound Level, as defined as

$$L_{dn} = 10 \log_{10} ([15 \times 10^{L_d/10} + 9 \times 10^{(L_n+10/10)}]/24)$$

Note: A 10 dB correction factor is added to the nighttime equivalent sound level when computing L_{dn}.

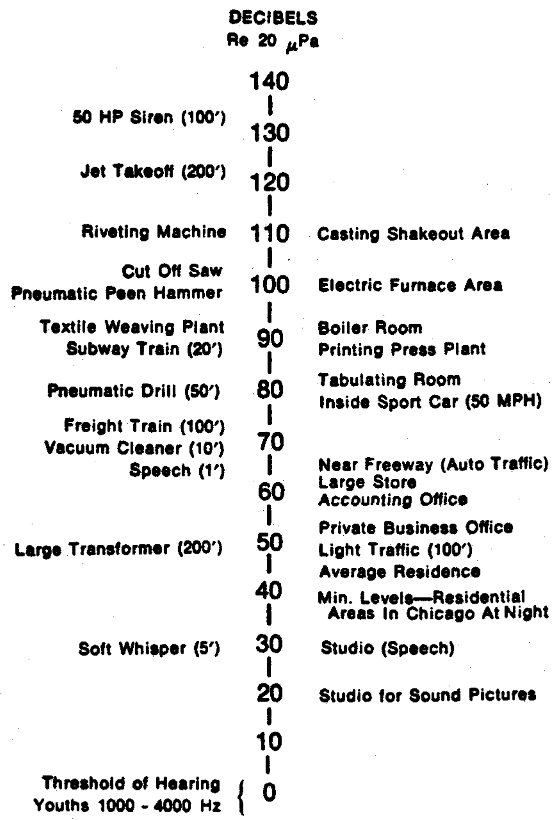


FIGURE C.1-1

SOUND LEVELS OF TYPICAL NOISE SOURCES

REFERENCE: PETERSON AND GROSS (1972)

DAMES & MOORE

C.1.2 DATA ACQUISITION AND ANALYSIS

The data acquisition system used in the Dames & Moore Survey consisted of a GenRad omnidirectional one inch electric condenser microphone with windscreen, a GenRad Type 1933 Sound Level Meter and Octave Band Analyzer, and a Nagra Model E single track magnetic tape recorder. The GenRad Type 1933 Sound Level Meter and Octave Band Analyzer were used as a linear amplifier and step attenuator. Ambient sound was recorded on Scotch 177 magnetic tape. The data acquisition and analysis system are shown schematically in Figure C.1-2.

The above system was calibrated before each recording by means of a reference signal at 100 Hertz of 144 dB generated by a GenRad Type 1562A Sound Level Calibrator.

The microphone was mounted on a tripod five feet above the ground surface and at least 30 feet from any sizable sound reflecting surfaces in order to avoid major interference with sound propagation. Recordings of the background ambient sound were 20 minutes in length.

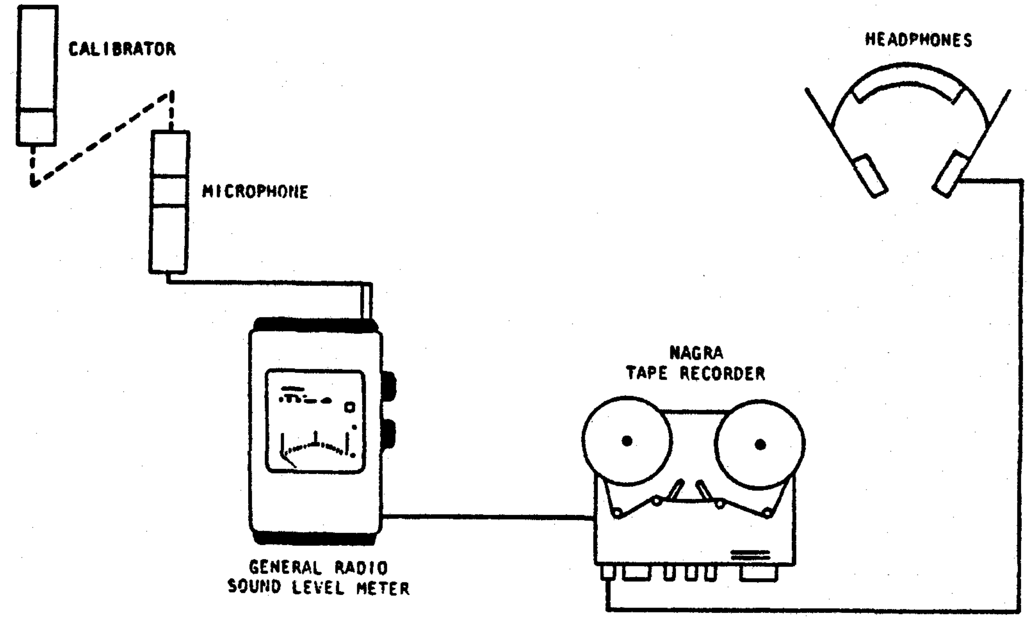
Meteorological parameters, such as wet bulb and dry bulb temperatures with wind speed, were noted and logged during each recording period (Table C.1-1). If high relative humidity (over 90%) or excessive wind speed (over six meters per second) occurred during the measurement period, the recording session would have been terminated. As shown in Table C.1-1, no such conditions were encountered. The tape recorded data were returned to the acoustic laboratory at Dames & Moore for analysis, using a GenRad Real-Time Analyzer and a Digital Equipment Corporation mini-computer shown schematically in Figure C.1-2.

During the recording sessions, any unusual intrusions, such as wind pop over the microphone or clipping due to overloads, were noted by the engineer monitoring the signal input to the tape. Such intrusions are not characteristic of the acoustic environment and are deleted during the analysis phase. Each sample tape is used to obtain a cumulative distribution of A-weighted sound levels.

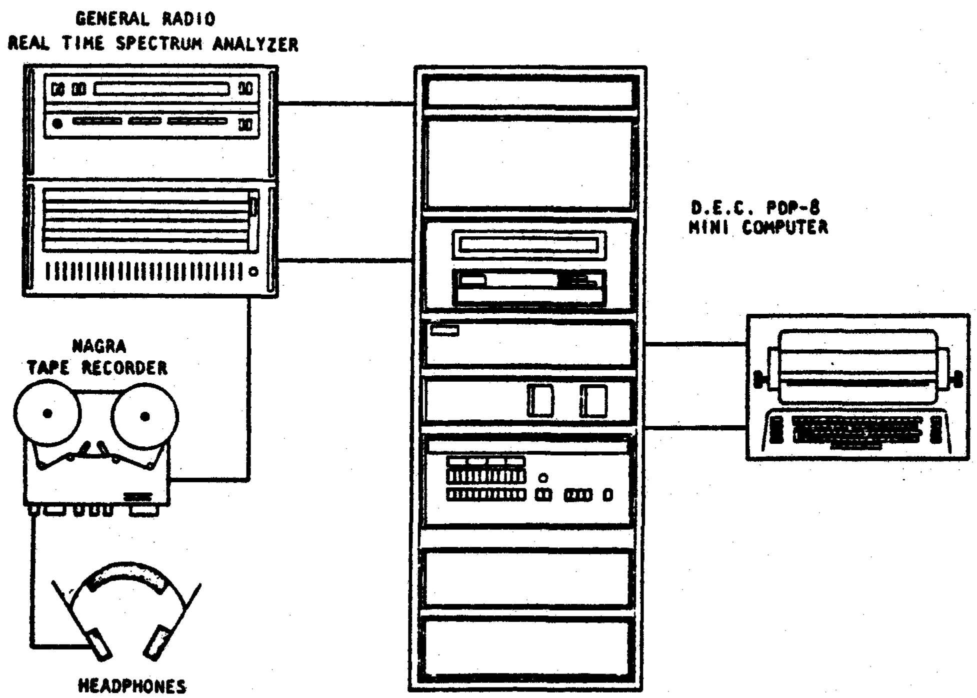
TABLE C.1-1

METEOROLOGICAL CONDITIONS DURING MONITORING PERIODS

Location	Date	Time (Hour)	Temperature (^{o}C)	Relative Humidity (%)	Wind Speed (m/sec)
1	9-10-79	1225	28	74	2-4
2	9-10-79	1300	28	74	2-4
3	9-10-79	1345	26	80	3-4.5
4	9-10-79	1430	28	74	1
1	9-10-79	1830	23	78	1
2	9-10-79	1800	25	79	2.5
3	9-10-79	1900	22	78	1
4	9-10-79	1935	23	78	1
1	9-10-79	2335	20	84	0
2	9-10-79	2300	20	84	0
3	9-10-79	2225	21	78	0
4	9-10-79	2200	21	78	0
1	9-11-79	0830	25	65	0
2	9-11-79	0800	23	78	0-0.5
3	9-11-79	0720	20	84	0
4	9-11-79	0910	25	65	0



DATA ACQUISITION SYSTEM



COMPUTER CONTROLLED DATA ANALYSIS SYSTEM

FIGURE C.1-2

DATA ACQUISITION AND ANALYSIS SYSTEMS

DAMES & MOORE

Detailed results of the ambient sound survey conducted at Locations 1 through 4 during 10 and 11 September, 1979 are shown on Tables C.1-2 through C.1-17. These tables contain an A-weighted sound level histogram, indicating the number of times a particular sound level occurred during the measurement period, and the cumulative distribution of A-weighted sound levels, indicating the percentage of time a sound level is exceeded. Also included are the L_{99}, L_{50}, L_{10}, L_1 and L_{eq} sound pressure levels at octave band center frequencies and A-weighting.

TABLE C.1-2

AMBIENT SOUND-LEVEL DATA - LOCATION 1 (MORNING)

FILE UOFH14.DA

OCTAVE BAND HZ.	LEQ DB	L_{1}	L_{10}	L_{50}	L_{90}	L_{95}	L_{99}
31.5	63.1	75	63	60	58	58	57
63	66.2	77	69	62	60	60	59
125	64.9	75	67	59	57	57	56
250	57.1	68	60	50	47	46	46
500	55.5	70	55	44	41	40	40
1000	52.3	67	52	40	37	37	36
2000	45.1	57	47	36	34	34	34
4000	39.3	51	41	34	34	34	34
8000	35.3	43	35	34	34	34	34
A-WT.	58.2	72	59	50	47	47	46

A-Weighted Sound Level - dB re 20 µPa

```
46  **********  3.5 %
47  ********************************************  15.3 %
48  ****************************************************  18.2 %
49  *******************************  10.7 %
50  ********************  6.8 %
51  *****************  5.8 %
52  ***************  5.2 %
53  ***************  5.3 %
54  ****************  5.6 %
55  **********  3.6 %
56  *******  2.3 %
57  *********  3 %
58  **********  3.5 %
59  ******  2 %
60  *****  1.6 %
61  ******  1.8 %
62  ****  1.4 %
63  ***  1.2 %
64  *  0.3 %
65  **  0.5 %
66  *  0.2 %
67  *  0.3 %
68  *  0.3 %
69  *  0.4 %
70  *  0.2 %
71  *  0.2 %
72  *  0.3 %
73  *  0.2 %
74  *  0.3 %
75  *  0.2 %
76  *  0.1 %
77  *  0.1 %
```

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	47
90	47
85	47
80	48
75	48
70	48
65	48
60	49
55	49
50	50
45	51
40	51
35	52
30	53
25	54
20	56
15	57
10	59
5	62

EQUIVALENT SOUND LEVEL = 58.2 DB

TABLE C.1-3

AMBIENT SOUND-LEVEL DATA - LOCATION 1 (AFTERNOON)

FILE UCPH01.DA

OCTAVE BAND HZ.	LEQ DB	L 1	L 10	L 50	L 90	L 95	L 99
31.5	64	70	67	63	60	59	59
63	66.2	76	67	63	61	61	60
125	65.5	79	66	60	58	58	57
250	57.4	69	56	49	47	47	47
500	52	63	50	42	39	39	38
1000	46.1	58	47	35	34	34	34
2000	40.9	53	40	34	34	34	34
4000	37.9	48	35	34	34	34	34
8000	34.9	42	34	34	34	34	34
A-WT.	55.5	58	55	49	46	46	46 ?

A-Weighted Sound Level - dB re: 20 µPa

```
45  *  0.5 %
46  *************************  11.2 %
47  ***************************************************  22.9 %
48  ********************************************  19.6 %
49  *******************************  13.6 %
50  ************  5.5 %
51  ************  5.3 %
52  *******  2.9 %
53  ********  3.5 %
54  ********  3.3 %
55  *******  2.8 %
56  ***  1.2 %
57  ***  1.1 %
58  ***  1.2 %
59  **  0.8 %
60  **  0.8 %
61  **  0.9 %
62  **  0.6 %
63  *  0.3 %
64  *  0.3 %
65  *  0.3 %
66  *  0.1 %
67  *  0.4 %
68  *  0.2 %
69  *  0.3 %
70  *  0.2 %
71  *  0.1 %
72
73  *  0.2 %
74
75  *  0.1 %
76
77
78  *  0.1 %
```

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	46
90	46
85	47
80	47
75	47
70	47
65	48
60	48
55	48
50	48
45	49
40	49
35	49
30	50
25	51
20	52
15	53
10	55
5	59

EQUIVALENT SOUND LEVEL = 55.5 DB

TABLE C.1-4

AMBIENT SOUND-LEVEL DATA - LOCATION 1 (EVENING)

FILE UOPH06.DA

OCTAVE BAND HZ.	LEQ DB	L 1	L 10	L 50	L 90	L 95	L 99
31.5	54.5	71	67	63	60	59	58
63	57.4	79	69	62	59	58	57
125	64.4	74	66	59	56	55	55
250	56.6	69	58	50	46	45	45
500	52.8	63	53	46	44	43	42
1000	45.7	55	49	42	40	40	39
2000	40.9	51	43	37	36	35	35
4000	37.2	47	38	34	34	34	34
8000	35.1	43	34	34	34	34	34
A-WT.	55.3	67	57	50	48	48	47

A-Weighted Sound Level - dB re 20 µPa	%
47	2.9 %
48	18.3 %
49	21.3 %
50	13.3 %
51	11.9 %
52	7.3 %
53	4.1 %
54	3.7 %
55	3.6 %
56	2.7 %
57	2.3 %
58	1.6 %
59	1.6 %
60	1.2 %
61	0.7 %
62	0.6 %
63	0.7 %
64	0.4 %
65	0.3 %
66	0.3 %
67	0.4 %
68	0.3 %
69	0.3 %
70	0.2 %
71	
72	
73	0.3 %

EQUIVALENT SOUND LEVEL = 55.3 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	48
90	48
85	48
80	49
75	49
70	49
65	49
60	49
55	50
50	50
45	50
40	51
35	51
30	52
25	52
20	54
15	55
10	57
5	60

TABLE C.1-5

AMBIENT SOUND-LEVEL DATA - LOCATION 1 (NIGHT)

FILE UOPH10.DA

OCTAVE BAND HZ.	LEQ DB	L_1	L_{10}	L_{50}	L_{90}	L_{95}	L_{99}
31.5	55.9	59	58	56	53	53	52
63	55.7	61	57	55	54	53	52
125	53.4	62	54	52	51	50	50
250	44.1	51	45	43	42	41	40
500	41.9	50	43	41	39	39	38
1000	39.5	49	41	37	35	35	34
2000	33.6	43	35	31	29	28	28
4000	27.3	38	26	24	24	24	24
8000	24.8	30	24	24	24	24	24
A-WT.	45.4	55	46	44	43	42	42

A-Weighted Sound Level - dB re 20µPa

```
41  *  0.3 %
42  ***************  9.3 %
43  ***********************************************  28.8 %
44  ************************************************  29.4 %
45  ***************************  16.3 %
46  ************  7.3 %
47  *****  2.8 %
48  ***  1.7 %
49  **  1 %
50  *  0.2 %
51  *  0.3 %
52  *  0.6 %
53  *  0.5 %
54  *  0.3 %
55  *  0.5 %
56  *  0.4 %
57  *  0.1 %
58  *  0.1 %
59  *  0.2 %
```

EQUIVALENT SOUND LEVEL = 45.4 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	42
90	43
85	43
80	43
75	43
70	43
65	43
60	44
55	44
50	44
45	44
40	44
35	44
30	45
25	45
20	45
15	46
10	46
5	48

TABLE C.1-6

AMBIENT SOUND-LEVEL DATA - LOCATION 2 (MORNING)

FILE UOPH13.DA

OCTAVE BAND HZ.	LEQ DB	L 1	L 10	L 50	L 90	L 95	L 99
31.5	63.9	66	65	64	62	62	61
63	67.1	68	68	67	66	66	65
125	61.6	70	62	60	59	59	59
250	54.3	67	53	50	49	49	48
500	51.6	61	50	47	45	45	44
1000	46.2	55	47	45	43	43	42
2000	40.7	51	41	38	37	37	36
4000	31.3	41	30	29	28	28	27
8000	24.3	27	24	24	24	24	24
A-WT.	53.9	64	53	51	51	50	50

A-Weighted Sound Level - dB re 20µPa

```
50  *********  8 %
51  *******************************************************  46.5 %
52  *********************************  27.3 %
53  ************  10 %
54  **  1.9 %
55  *  0.9 %
56  *  0.8 %
57  *  0.3 %
58  *  0.4 %
59  *  0.3 %
60  *  0.4 %
61  *  0.7 %
62  *  0.9 %
63  *  0.5 %
64  *  0.3 %
65  *  0.3 %
66  *  0.2 %
67  *  0.2 %
68
69  *  0.1 %
70  *  0.1 %
71  *  0.2 %
```

EQUIVALENT SOUND LEVEL = 53.9 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	50
90	51
85	51
80	51
75	51
70	51
65	51
60	51
55	51
50	51
45	52
40	52
35	52
30	52
25	52
20	52
15	53
10	53
5	56

TABLE C.1-7

AMBIENT SOUND-LEVEL DATA - LOCATION 2 (AFTERNOON)

FILE UOPH02.DAK

OCTAVE BAND HZ.	LEQ DB	L_{1}	L_{10}	L_{50}	L_{90}	L_{95}	L_{99}
31.5	64.2	69	66	64	62	62	61
63	66.1	69	67	66	65	64	64
125	62.1	68	63	61	60	60	59
250	56.7	69	55	53	51	51	50
500	49.7	63	46	43	41	41	40
1000	42.6	55	41	39	38	38	37
2000	36.8	47	37	35	34	34	34
4000	34.4	37	35	34	34	34	34
8000	34	34	34	34	34	34	34
A-WT.	53.2	65	52	50	49	49	48 ?

A-Weighted Sound Level - dB re 20 µPa

```
48  **  1.6 %
49  ********************  16.4 %
50  **********************************************  37.7 %
51  *************************************  30.3 %
52  ********  6.6 %
53  **  1 %
54  **  1 %
55  *  0.4 %
56  *  0.8 %
57  *  0.4 %
58  *  0.7 %
59  *  0.2 %
60  *  0.6 %
61  *  0.2 %
62  *  0.2 %
63  *  0.5 %
64  *  0.5 %
65  *  0.3 %
66  *  0.2 %
67  *  0.3 %
68  *  0.3 %
69
70  *  0.1 %
```

EQUIVALENT SOUND LEVEL = 53.2 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	49
90	49
85	49
80	50
75	50
70	50
65	50
60	50
55	50
50	50
45	50
40	51
35	51
30	51
25	51
20	51
15	51
10	52
5	56

TABLE C.1-8

AMBIENT SOUND-LEVEL DATA - LOCATION 2 (EVENING)

FILE UOPH05.DA

OCTAVE BAND HZ.	LEQ DB	L 1	L 10	L 50	L 90	L 95	L 99
31.5	66.3	72	69	65	63	63	62
63	66.8	70	68	67	65	65	64
125	61.8	68	63	61	60	59	59
250	55.9	64	58	54	52	52	51
500	49.5	58	50	49	48	47	47
1000	46.9	51	48	47	46	46	45
2000	41.7	44	43	42	41	40	40
4000	35.9	38	37	36	35	35	35
8000	34	34	34	34	34	34	34
A-WT.	53.9	61	55	53	52	52	52

A-Weighted Sound Level - dB re: 20uPa

```
51  *  0.3 %
52  ********************  16.9 %
53  ******************************************************  45.1 %
54  ****************************  23.8 %
55  *********  7.3 %
56  ****  3 %
57  **  1.1 %
58  *  0.6 %
59  *  0.5 %
60  *  0.3 %
61  *  0.3 %
62  *  0.4 %
63  *  0.3 %
```

EQUIVALENT SOUND LEVEL = 53.9 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	52
90	52
85	52
80	53
75	53
70	53
65	53
60	53
55	53
50	53
45	53
40	53
35	54
30	54
25	54
20	54
15	54
10	55
5	56

TABLE C.1-9

AMBIENT SOUND-LEVEL DATA - LOCATION 2 (NIGHT)

FILE UOPH09.DA

OCTAVE BAND HZ.	LEQ DB	L_1	L_{10}	L_{50}	L_{90}	L_{95}	L_{99}
31.5	63.7	66	65	64	62	62	61
63	65.3	67	66	65	64	64	63
125	58.4	61	59	58	57	57	56
250	50.8	55	53	50	49	48	47
500	46	48	47	46	45	45	44
1000	44.9	47	46	45	44	44	43
2000	37.2	38	38	37	36	36	36
4000	34.9	41	38	33	32	32	32
8000	25.6	30	28	25	24	24	24
A-WT.	50.5	52	51	50	50	50	49

A-Weighted Sound Level - dB re: 20 µPa

```
49  *****  4.9 %
50  **************************************************  48.7 %
51  *******************************************  41.1 %
52  *****  4.7 %
53  *  0.4 %
54  *  0.1 %
55  *  0.1 %
56
57  *  0.1 %
```

EQUIVALENT SOUND LEVEL = 50.5 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	50
90	50
85	50
80	50
75	50
70	50
65	50
60	50
55	50
50	50
45	51
40	51
35	51
30	51
25	51
20	51
15	51
10	51
5	52

TABLE C.1-10

AMBIENT SOUND-LEVEL DATA - LOCATION 3 (MORNING)

FILE UOPH15.DAK

OCTAVE BAND HZ.	LEQ DB	L 1	L 10	L 50	L 90	L 95	L 99
31.5	67.6	71	69	67	66	66	65
63	65.7	70	68	65	63	63	62
125	65.4	74	68	63	61	61	60
250	57	65	59	55	52	52	51
500	51.9	64	52	48	45	44	43
1000	46.7	55	48	46	43	43	42
2000	41.9	49	43	41	40	40	39
4000	37	42	38	36	36	36	35
8000	33.7	36	34	34	33	33	33
A-WT.	55.5	64	57	54	52	51	51

A-Weighted Sound Level - dB re 20 µPa

```
50  *  0.5 %
51  ***************  6.8 %
52  ******************************  14 %
53  ************************************************  22.3 %
54  *********************************************  21 %
55  *****************************  13.3 %
56  *****************  8 %
57  **********  4.2 %
58  ******  2.6 %
59  ****  1.7 %
60  ***  1.4 %
61  ***  1.1 %
62  ***  1.3 %
63  **  0.8 %
64  *  0.4 %
65  *  0.3 %
66  *  0.4 %
67
68  *  0.1 %
```

EQUIVALENT SOUND LEVEL = 55.5 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	51
90	52
85	52
80	52
75	53
70	53
65	53
60	53
55	54
50	54
45	54
40	54
35	55
30	55
25	55
20	56
15	56
10	57
5	60

TABLE C.1-11

AMBIENT SOUND-LEVEL DATA - LOCATION 3 (AFTERNOON)

FILE UOPH03.DA

OCTAVE BAND HZ.	LEQ DB	L 1	L 10	L 50	L 90	L 95	L 99
31.5	69.3	73	71	69	68	67	66
63	68.2	74	70	67	65	65	64
125	64.1	69	66	63	62	61	61
250	57.3	63	59	56	55	54	54
500	48.8	59	51	46	45	44	44
1000	47.7	55	48	44	44	44	44
2000	49.7	64	45	44	44	44	44
4000	45.8	56	44	44	44	44	44
8000	44	44	44	44	44	44	44
A-WT.	56.5	69	57	54	52	52	52 ?

A-Weighted Sound Level - dB re 20 uPa

```
51  *  0.5 %
52  *************************  13.8 %
53  ****************************************************  28.8 %
54  ***************************************  21.9 %
55  ************************  13.4 %
56  *****************  9.2 %
57  **********  5.2 %
58  *******  3.7 %
59  ***  1.3 %
60  **  0.7 %
61  *  0.2 %
62  *  0.2 %
63
64  *  0.1 %
65  *  0.1 %
66
67
68
69  *  0.2 %
70  *  0.1 %
71  *  0.5 %
72  *  0.1 %
73  *  0.1 %
74  *  0.2 %
```

EQUIVALENT SOUND LEVEL = 56.5 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	52
90	52
85	53
80	53
75	53
70	53
65	53
60	53
55	54
50	54
45	54
40	54
35	54
30	55
25	55
20	56
15	56
10	57
5	58

TABLE C.1-12

AMBIENT SOUND-LEVEL DATA - LOCATION 3 (EVENING)

FILE UOPH07.DA

OCTAVE BAND HZ.	LEQ DB	L 1	L 10	L 50	L 90	L 95	L 99
31.5	67.7	70	69	68	66	66	65
63	63.3	69	65	63	61	61	60
125	61.8	71	63	60	58	58	57
250	54.7	64	56	52	50	50	49
500	51.7	63	51	46	44	44	44
1000	47.4	58	48	45	43	43	42
2000	45.5	54	46	43	42	41	41
4000	40.8	45	41	40	39	39	38
8000	37.6	39	38	38	37	37	36
A-WT.	55.1	64	55	53	51	51	50

A-Weighted Sound Level - dB re 20μPa

```
50 ***  1.8 %
51 **********************************  17.1 %
52 **********************************************************  29.1 %
53 ****************************************  19.8 %
54 *********************************  16.3 %
55 **************  7.2 %
56 ***  1.3 %
57 **  1.2 %
58 **  0.8 %
59 ***  1.5 %
60 **  1.2 %
61 **  0.9 %
62 *  0.4 %
63 *  0.4 %
64 *  0.3 %
65 *  0.1 %
66 *  0.2 %
67 *  0.2 %
68
69 *  0.1 %
70 *  0.2 %
71
72 *  0.3 %
```

EQUIVALENT SOUND LEVEL = 55.1 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	51
90	51
85	51
80	52
75	52
70	52
65	52
60	52
55	52
50	53
45	53
40	53
35	53
30	54
25	54
20	54
15	55
10	55
5	59

TABLE C.1-13

AMBIENT SOUND-LEVEL DATA - LOCATION 3 (NIGHT)

FILE UOPH11.DA

OCTAVE BAND HZ.	LEQ DB	L 1	L 10	L 50	L 90	L 95	L 99
31.5	68.6	71	70	69	66	66	65
63	63.1	65	64	63	62	61	61
125	61.6	68	64	60	58	58	57
250	53.2	60	56	51	50	49	49
500	45.9	53	47	45	44	43	43
1000	44.1	47	45	44	42	42	42
2000	42.5	45	44	42	41	41	41
4000	40.1	41	41	40	40	39	39
8000	37	38	37	37	37	37	36
A-WT.	52.4	56	54	52	51	51	50

A-Weighted Sound Level - dB re: 20µPa

```
50  *******  4.3 %
51  **************************************************  31.3 %
52  ****************************************************  32.3 %
53  *******************************  19.3 %
54  *************  8 %
55  ****  2.3 %
56  **  1.3 %
57  *  0.3 %
58  *  0.3 %
59
60  *  0.3 %
```

EQUIVALENT SOUND LEVEL = 52.4 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	51
90	51
85	51
80	51
75	51
70	51
65	51
60	52
55	52
50	52
45	52
40	52
35	52
30	53
25	53
20	53
15	53
10	54
5	54

TABLE C.1-14

AMBIENT SOUND-LEVEL DATA - LOCATION 4 (MORNING)

FILE UOPH16.DA

OCTAVE BAND HZ.	LEQ DB	L 1	L 10	L 50	L 90	L 95	L 99
31.5	71.2	72	72	71	70	70	70
63	63.8	69	65	63	62	62	61
125	62	65	63	62	60	60	59
250	54.1	59	56	53	52	51	51
500	50.5	56	52	50	48	48	47
1000	43.7	51	45	43	41	40	39
2000	37.3	45	38	36	35	35	34
4000	34.5	40	35	34	34	34	34
8000	34	35	34	34	34	34	34
A-WT.	52.8	59	54	52	51	51	51

A-Weighted Sound Level - dB re: 20μPa

```
50  *  0.7 %
51  ********************  16.9 %
52  **************************************************  43 %
53  ********************************  27 %
54  ********  6.8 %
55  ***  2.1 %
56  **  1 %
57  *  0.7 %
58  *  0.5 %
59  *  0.7 %
60  *  0.3 %
61  *  0.3 %
```

EQUIVALENT SOUND LEVEL = 52.8 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	51
90	51
85	51
80	52
75	52
70	52
65	52
60	52
55	52
50	52
45	52
40	52
35	53
30	53
25	53
20	53
15	53
10	54
5	55

TABLE C.1-15

AMBIENT SOUND-LEVEL DATA - LOCATION 4 (AFTERNOON)

FILE UOPH04.DA

OCTAVE BAND HZ.	LEQ DB	L_{1}	L_{10}	L_{50}	L_{90}	L_{95}	L_{99}
31.5	71.4	74	73	71	70	70	70
63	64.3	67	66	64	63	62	62
125	63.8	70	63	61	59	59	58
250	55.6	65	56	54	52	51	51
500	52.1	60	54	51	49	48	47
1000	46.2	54	48	45	43	42	41
2000	42.4	51	44	40	37	37	36
4000	36.1	42	37	34	34	34	34
8000	34.2	36	34	34	34	34	34
A-WT.	54.7	64	55	53	51	51	50

A-Weighted Sound Level - dB re 20 uPa

```
50 **  1 %
51 ********************  9.9 %
52 ****************************************************  25.8 %
53 **************************************************  24.8 %
54 ******************************************  20.8 %
55 ******************  8.8 %
56 *******  3.3 %
57 *****  2.4 %
58 **  0.8 %
59 *  0.5 %
60 *  0.5 %
61 *  0.3 %
62 *  0.1 %
63
64 *  0.3 %
65 *  0.3 %
66
67 *  0.2 %
68
69 *  0.1 %
70
71 *  0.1 %
72
73
74 *  0.1 %
```

EQUIVALENT SOUND LEVEL = 54.7 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	51
90	51
85	52
80	52
75	52
70	52
65	52
60	53
55	53
50	53
45	53
40	53
35	54
30	54
25	54
20	54
15	55
10	55
5	57

TABLE C.1-16

AMBIENT SOUND-LEVEL DATA - LOCATION 4 (EVENING)

FILE UOPH08. DA

OCTAVE BAND HZ.	LEQ DB	L_1	L_{10}	L_{50}	L_{90}	L_{95}	L_{99}
31.5	69.6	70	70	70	69	69	69
63	60	68	60	58	57	57	57
125	57.7	64	59	57	55	55	54
250	50.8	56	52	50	49	48	48
500	46.7	50	48	46	44	44	43
1000	42.7	47	45	42	40	39	38
2000	38.3	44	41	37	35	34	34
4000	36.3	41	39	35	34	34	34
8000	34.1	37	34	34	34	34	34
A-WT.	50.1	54	51	50	48	48	47

A-Weighted Sound Level - dB re 20μPa

```
47. **  1.1 %
48  *******************  12.3 %
49  ******************************************  27 %
50  **********************************************  29.8 %
51  ***********************************  22.3 %
52  *******  4.3 %
53  ***  1.4 %
54  **  1 %
55  *  0.6 %
56  *  0.2 %
```

EQUIVALENT SOUND LEVEL = 50.1 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	48
90	48
85	49
80	49
75	49
70	49
65	49
60	49
55	50
50	50
45	50
40	50
35	50
30	50
25	51
20	51
15	51
10	51
5	52

TABLE C.1-17

AMBIENT SOUND-LEVEL DATA - LOCATION 4 (NIGHT)

FILE UOPH12. DA

OCTAVE BAND HZ.	LEQ DB	L_1	L_{10}	L_{50}	L_{90}	L_{95}	L_{99}
31. 5	69. 5	71	70	69	69	69	69
63	62. 2	69	63	61	60	59	58
125	60. 1	64	62	60	58	58	57
250	56. 2	60	58	56	54	54	53
500	48. 2	56	50	47	46	45	44
1000	43. 9	50	46	43	41	40	40
2000	40. 5	47	44	39	35	34	32
4000	37	45	40	35	32	31	29
8000	30. 8	38	34	29	25	24	24
A-WT.	53	57	54	53	51	51	50

A-Weighted Sound Level - dB re: 20 µPa

```
49  **  0. 8 %
50  *****  2. 6 %
51  ********************************  17. 6 %
52  **************************************************  27. 8 %
53  ****************************************************  28. 7 %
54  ************************  12. 9 %
55  **********  5. 3 %
56  *****  2. 4 %
57  ***  1. 3 %
58  *  0. 2 %
59  *  0. 4 %
60
61  *  0. 2 %
```

EQUIVALENT SOUND LEVEL = 53 DB

CUMULATIVE DISTRIBUTION

(%) EXCEEDED	SOUND PRESSURE LEVEL-DB
95	51
90	51
85	51
80	51
75	52
70	52
65	52
60	52
55	52
50	53
45	53
40	53
35	53
30	53
25	53
20	54
15	54
10	54
5	55

APPENDIX C.2

MARINE BIOLOGY

TABLE C.2-1

REGIONAL COMMERCIAL FISH CATCH

Species	Fish Block 683							Fish Block 682						
	1964	1967	1971	1972	1973	1974	1975	1964	1967	1971	1972	1973	1974	1975
Pacific Bonita	2.6[a]	784.0	3.5		268.8	96.0	132.9		118.2	97.2		761.6		102.7
Bluefin Tuna							33.9							
Pacific Mackerel	153.2							47.5						
Jack Mackerel	120.4	22.5		658.0								2.2		
Pacific Pompano														
Swordfish				10.4							7.4		2.5	
Sardine								15.8						
Anchovy		1002.2	2880.2	3276.6	1389.0	5420.5	8198.1			205.0	929.4	610.4	1881.6	936.7
Unidentified Shark	5.3								.3					
Soupfin Shark														
English Sole			23.7		18.2	15.0								
California Halibut	36.6							2.9	1.1					5.1
Unidentified Rockfish[b]		131.0	34.3	8.0	75.2	192.7	21.1	.5	.5	.2	3.3	1.3	6.6	9.9
Bocaccio						23.5	29.8	.5			5.2		1.3	
White Seabass					20.8				1.6					
White Croaker														
Pink Abalone														
Squid				352.3						1729.7	103.9	16.2		
Sea Urchin													13.9	6.0
Rock Crab										.3				
Animal Food[c]		48.9	29.7											
% TOTAL YEARLY CATCH FOR FISH BLOCK	98.0	98.6	99.8	99.6	96.2	99.3	99.2	99.2	99.1	100.0	99.8	99.8	99.8	99.8

Species	Fish Block 684							Fish Block 664						
	1964	1967	1971	1972	1973	1974	1975	1964	1967	1971	1972	1973	1974	1975
Pacific Bonita	53.0	203.0			145.5	77.0			236.2	19.7	53.0	266.1	725.1	
Bluefin Tuna							198.9							
Pacific Mackerel								4.4						
Jack Mackerel	5695.6	1018.1		47.9				409.7						
Pacific Pompano														
Swordfish														
Sardine	111.6													
Anchovy		2059.5	249.4	1083.2	837.1	6210.4	5932.7		71.7	1468.9	2286.7	343.3	581.4	4281.3
Unidentified Shark								8.5	6.7	6.4	8.3	5.1	14.6	11.1
Soupfin Shark											1.6			
English Sole			103.6	56.1		33.4		3.8	7.7					
California Halibut			26.4					64.4	49.7	37.8	23.0	10.9	9.8	6.3
Unidentified Rockfish	82.2	324.0	179.4	162.1	404.9	95.6	147.1							6.0
Bocaccio							169.0							
White Seabass													3.0	
White Croaker														25.1
Pink Abalone	108.1													
Squid														
Sea Urchin					235.3	203.3	209.6							
Rock Crab												.8		
Animal Food[2]		170.3	84.6	60.1	72.4					5.3				
% TOTAL YEARLY CATCH FOR FISH BLOCK	96.4	94.4	90.1	94.3	92.8	99.2	97.9	97.4	97.8	99.1	99.8	99.9	99.6	99.9

TABLE C.2-1 (Concluded)

Species	Fish Block 665							Total Pounds
	1964	1967	1971	1972	1973	1974	1975	
Pacific Bonita		456.2	42.0	686.7	635.5	500.8	5.6	6,474.9
Bluefin Tuna							115.8	348.6
Pacific Mackerel								205.1
Jack Mackerel	125.1		53.0			512.2		8,664.6
Pacific Pompano				2.0				2.0
Swordfish								20.3
Sardine								127.4
Anchovy		560.9	5056.1	13302.3	1252.4	5434.1	41131.8	139,452.9
Unidentified Shark								66.3
Soupfin Shark								1.6
English Sole	85.2	30.9		3.1	8.3			389.0
California Halibut	223.5	83.6	37.6	24.8	52.0	29.4	16.0	740.9
Unidentified Rockfish	59.1					13.8	3.8	1,962.6
Bocaccio								229.3
White Seabass					7.5			32.9
White Croaker								25.1
Pink Abalone								108.1
Squid								2,202.1
Sea Urchin								668.1
Rock Crab								1.1
Animal Food[2]	152.9	238.9	21.7					884.8
% TOTAL YEARLY CATCH FOR FISH BLOCK	82.4	98.2	99.1	100.0	99.1	85.1	100.0	162,607.2

[a]Data from CDFG (unpublished); catch in thousands of pounds.

[b]Although rockfish represent a significant portion of the commercial fish catch for years listed, they are not expected to be found on the site because those species are normally associated with rocky and/or high relief areas.

[c]The animal food category consists of a variety of low value species caught by trawling. An example of the species composition is shown in Department of Fish and Game, Fish Bulletin 161, 1974, Page 6.

TABLE C.2-2

REGIONAL SPORT FISH CATCH
(Fish Blocks 683, 684, 682, 664 and 665 combined)

	1964[a,b]	1967	1971	1972	1973	1974	1975	1976	1977	1978
Invertebrates										
Octopus									0.1	
Fish										
Barracudas										
Pacific Barracuda	18.6	4.8	0.1	9.2	1.7	0.6	0.1	0.3	0.3	1.3
Codfish										
Pacific Cod							0.1			
Croakers										
White Croaker	2.7	6.4	29.4	1.9	9.7	23.9	8.4		2.6	1.0
White Seabass	0.8		0.8	18.0	0.5	0.9	12.6	0.1		0.2
Yellowfin Croaker	0.1									
Unid. Croaker	0.1			0.2						
Damselfishes										
Blacksmith						1.0	0.4			
Flatfishes										
Calif. Halibut	44.8	10.2	7.9	10.9	1.6	2.2	1.6	2.0	0.2	2.0
Flounder	8.1	11.9	7.1	10.8	12.3	13.8	12.8	10.1	3.2	3.2
Petrale Sole					0.1		0.1			0.1
Sanddab	0.5	0.1			1.7		0.6		0.1	0.2
Turbot	0.1									
Hake										
Pacific Hake	0.2			0.1	0.3	0.3	0.9		0.4	0.1
Halfmoons										
Halfmoon[c]			353.4	123.4	172.4	1.2	12.8	0.9	0.3	49.1
Jacks										
Jack Mackerel	0.5	0.1		0.1	0.1	0.1	0.1	10.3		2.6
Yellowtail	2.1	0.1		2.5	0.5	0.1	0.1	0.2		0.2
Mackerels										
Pacific Bonito	247.5	28.9	0.1	30.0	25.7	2.5	0.1	3.4		13.3
Pacific Mackerel	3.3	3.1	4.6	4.9	5.2	0.1	0.6	15.5	10.2	140.5
Ocean Whitefishes										
Ocean Whitefish	0.9	0.5	8.3	6.6	5.6	1.4	1.0	0.7		8.3
Opaleyes										
Opaleye							0.1	0.1		
Perches										
Barred Surfperch		0.2				0.1				
Black Perch						0.1				
Rubberlip Perch									0.1	
Ratfishes										
Ratfish						0.1				0.1
Rays										
Bat Ray								0.1		

TABLE C.2-2 (Concluded)

	1964[a,b]	1967	1971	1972	1973	1974	1975	1976	1977	1978
Rockfishes										
Cow Rockfish[c]	0.1	0.2	3.5	2.1	5.8	4.2	9.6	3.2	1.6	0.6
Salt Water Perch			0.5							
Unid. Rockfish[c]	959.7	914.8	606.7	1012.5	1539.6	1745.8	1890.8	1490.9	1303.5	1118.7
Sablefishes										
Sablefish	0.1	0.1	4.5	6.1	10.7	19.3	17.5	5.7	1.9	4.0
Salmon										
King Salmon		5.2			0.1	0.1	0.1	0.1		0.1
Silver Salmon	0.2	2.0	0.2					0.1		
Unid. Salmon		12.7	2.8	0.6	0.1	0.1	72.1	0.1	0.1	0.1
Sculpins										
Cabezon[c]	7.9	2.0	11.7	5.8	3.5	1.6	3.4	1.3	1.6	1.5
Lingcod[c]	14.2	3.0	10.2	6.5	4.0	11.0	24.3	21.2	21.7	12.7
Sculpin[c]	19.9	8.7	9.0	14.8	12.3	2.5	2.0	2.8	3.1	11.1
Sea Basses										
Giant Sea Bass	0.1	0.1	0.1	0.5	0.2	0.1	0.1		0.1	
Kelp Bass[c,d]	1.7	47.9	10.9	21.4	8.7	147.4	137.0	516.3	193.9	299.4
Rock Bass[c,d]	443.7	433.9	519.5	501.4	544.6	299.2	1.4	0.3		0.8
Sand Bass[c,d]	9.1	69.6	38.3	44.7	9.5	142.6	20.3	24.4	170.2	14.3
Sharks										
Shark					0.1				0.1	
Blue Shark										0.1
Bonito Shark						0.1			0.1	0.1
Soupfin Shark	0.1				0.2		0.1	0.1		0.1
Spiny Dogfish					0.1	0.3				
Thresher Shark		0.1				0.1	0.1	0.1		
Silversides										
Jacksmelt					0.1					
Wolfeels										
Wolfeel									0.1	
Wrasses										
Calif. Sheepherd[c]	4.7	5.0	18.2	10.5	21.2	4.1	3.2	2.8	4.6	10.4
Total	1851.3	1846.9	2054.4	1946.9	2064.5	2429.8	2234.8	2113.7	1858.7	1695.9

---

[a]Data from CDFG (unpublished); number of fish caught per 1,000 angling hours.
[b]Due to the unequal sizes of the fish blocks, the values of the fish blocks in determining the average number of fish landed are as follows: 664 (0.5), 665 (1.0), 682 (0.75), and 684 (1.0). Therefore, the total number of fish caught in these blocks was divided by 3.25 to get the weighted average of the five fish blocks.
[c]Although these fish represent a significant portion of the sport fish catch for years listed, they are not expected to be found on the site, because those species are normally associated with rocky and/or high relief areas.
[d]Rock bass and kelp bass are synonymous. Rock bass is an older term in California Department of Fish and Game records, which refers principally to kelp bass (Pinkas, 1974).

TABLE C.2-3

INFAUNAL SPECIES COLLECTED WITHIN PORT HUENEME[a]

	Station 1	Station 2	Station 3
Polychaetes			
Armandia bioculata	127[b]	3	2
Cossura sp.	---	2	3
Nephtys cornuta franciscana	17	6	7
Glycera sp.	---	---	2
Cistena (Pectinaria) californiensis	---	1	---
Prionospio cirrifera	---	1	50
Prionospio sp.	---	1	3
Unid. Syllidae	---	1	---
Unid. Nereidae	---	1	---
Unid. Hessionidae	---	1	---
Unid. Opheliidae	---	6	1
Unid. Polynoidae	---	---	1
Molluscs			
Chione undatella	2	---	---
Polinices draconis	---	1	---
Tellina sp.	1	---	---
Unid. Clam	1	---	---
Arthropods			
Unid. Cumacean	1	---	---
Total	6/149[c]	11/24	8/69

[a]Data from CDFG (unpublished).
[b]number per single 0.1m^2 ponar grab sample
[c]number of taxa/number of individuals

TABLE C.2-4
INFAUNAL SPECIES

Locations: Station S1 on the 20' isobath of the Ormond Beach alternate pipeline route from Platform Gina and Station N1 on the 20' isobath of the joint Gina/Gilda proposed route.[a]

Taxonomic Group	Replicate Number (Volume of Sample in Liters)[b]					
	S1-3(5)[c]	-4(6)	-5(5)	N1-1(4)	-2(3)	-3(3)
Platyhelminthes						
Flatworm (unid.) "A"	-	-	-	-	1	-
Flatworm (unid.) "B"	-	1	-	-	-	-
Nemertina						
Carinoma mutabilis	-	2	-	2	-	-
Micrura spp.	-	1	-	-	-	-
Tubulanus spp.	-	-	-	1	-	2
Cnidaria						
Anthozoa						
Anthozoan (unid.) "A"	1	2	2	4	1	3
Edwarsia spp.	-	-	-	-	1	-
Phoronida						
Phoronis spp.	-	-	-	2	1	-
Mollusca						
Pelecypoda						
Chione sp.	-	-	-	-	1	-
Cooperella subdiaphana	1	1	1	1	-	9
Macoma yoldiformis	-	3	-	-	1	1
Macoma cf. inquinata	-	2	-	-	-	-
Macoma sp.	-	-	-	1	-	-
Nemocardium centifilosum	-	3	1	173	215	213
Siliqua lucida	1	2	2	6	6	4
Solen rosaceus	1	1	1	-	2	-
Tellina bodegensis	-	2	-	-	-	-
Tellina modesta	26	10	9	10	22	15
Trachycardium quadragenarium	-	-	1	-	-	-
Gastropoda						
Neverita reclusiana	-	-	-	2	-	-
Odostomia (Evalea) sp. ("A")	-	-	-	2	-	-
Olivella baetica	21	3	2	-	1	-
Rictaxis punctocoelata	-	-	1	-	-	-
Annelida						
Polychaeta						
Acesta catherinae	-	-	-	-	-	1
Amaeana occidentalis	1	-	1	-	-	-
Amphicteis scaphobranchiata	-	-	-	1	-	-
Apoprionospio pygmaea	7	5	1	1	-	-
Chaetozone setosa	1	-	-	-	-	-
Chone albocincta	-	-	-	4	-	-
Chone gracilis	-	-	-	-	1	-

TABLE C.2-4 (Continued)

Taxonomic Group	Replicate Number (Volume of Sample in Liters) S1-3(5)[c]	-4(6)	-5(5)	N1-1(4)	-2(3)	-3(3)
Cistena (Pectinaria) californiensis	1	1	2	4	5	15
Dispio uncinata	10	-	-	-	-	1
Glycera convoluta	-	1	-	-	-	-
Glycinde armigera	-	-	-	-	1	-
Goniada littorea	2	-	-	8	8	7
Harmothoe priops	1	-	-	-	-	-
Lumbrineris sp. ("D")	-	1	-	4	4	7
Lumbrineris sp.	-	-	-	-	3	-
Magelona pitelkai	1	-	-	-	-	-
Magelona sacculata	5	1	1	-	4	-
Nephtys caecoides	3	1	-	-	1	-
Nothria iridescens	-	-	-	1	1	-
Owenia fusiformis collaris	4	1	9	59	69	43
Scolelepis foliosa occidentalis	1	2	-	-	-	-
Scoloplos armiger	6	3	1	-	-	-
Spiochaetopterus costarum	1	-	-	-	-	-
Spionidae (unid.)	-	-	-	1	-	-
Spiophanes berkeleyorum	-	-	1	-	-	1
Spiophanes bombyx	8	4	-	-	2	-
Sthenolepis fimbriarum	-	-	-	-	-	2
Thalenessa spinosa	1	-	-	-	2	-
Arthropoda						
Crustacea						
Ostracoda						
Euphilomedes carcharodonta	-	-	-	1	-	-
Euphilomedes longiseta	-	10	-	-	-	-
Parasterope hulingsi	-	-	-	1	-	-
Mysidacea						
Acanthomysis costata	1	-	-	1	1	-
Mysidopsis intii	-	1	-	-	-	-
Cumacea						
Anchicolorus occidentalis	1	3	1	-	-	-
Cyclaspis nubila	-	-	-	-	1	-
Diastylopsis tenuis	18	16	12	13	8	1
Lamprops quadraplicata	-	1	-	-	-	-
Leptocuma forsmani	1	-	-	-	-	-
Isopoda						
Edotea sublittoralis	2	-	-	9	19	1

TABLE C.2-4 (Concluded)

Taxonomic Group	Replicate Number (Volume of Sample in Liters) S1-3(5)[c]	-4(6)	-5(5)	N1-1(4)	-2(3)	-3(3)
Amphipoda						
Eohaustorius sp.	3	1	-	1	2	1
Erichthonius brasiliensis	-	-	1	3	-	-
Megaluropus longimerus	2	-	1	-	1	-
Photis brevipes	1	-	-	-	-	-
Photis californica	-	-	-	2	-	-
Photis spp. (juv.)	-	-	-	-	2	-
Synchelidium sp.	1	-	-	-	-	-
Tiron tropakis	-	1	-	-	-	-
Trichophoxus bicuspidata	3	2	4	5	-	1
Trichophoxus daboius	1	-	-	-	-	-
Trichophoxus epistomus	2	3	-	12	9	6
Trichophoxus lucubrans	2	-	-	-	-	-
Decapoda						
Callianassa sp. (juv.)	-	-	-	1	-	-
Isocheles pilosus	-	-	-	3	1	1
Ogyrides sp.	-	-	-	3	-	1
Pycnogonida						
Nymphon sp.	2	-	-	-	-	-
Echinodermata						
Echinoidea						
Dendraster excentricus	8	6	8	-	-	-
Ophiuroidea						
Amphiodia sp. (juv.)	-	-	-	1	-	-
Ophioderma panamense	-	-	-	1	-	-

[a] See Figure 12.4-3 for station locations.

[b] Based on triplicate samples and sorted through a 1mm mesh screen.

[c] Three largest volume samples of each set of five collected.

TABLE C.2-5
INFAUNAL SPECIES

Locations: Station S2 on the 40' isobath of the Ormond Beach alternate pipeline route from Platform Gina and Station N2 on the 40' isobath of the joint Gina/Gilda proposed route.[a]

Taxonomic Group	Replicate Number (Volume of Sample in Liters)[b]					
	S2-1(4)[c]	-2(4)	-4(4)	N2-1(3)	-2(3)	-3(4)
Platyhelminthes						
Flatworm (unid.) "A"	-	-	1	-	-	-
Flatworm (unid.) "B"	-	1	-	-	-	-
Flatworm (unid.) "D"	-	1	-	-	-	-
Nemertina						
Carinoma mutabilis	3	-	4	1	1	-
Micrura spp.	1	-	1	-	-	-
Nemertine (unid.) "A"	2	-	-	1	-	-
Nemertine (unid.) "B"	1	-	-	-	-	-
Nemertine (unid.) "C"	-	1	-	-	-	-
Tubulanus spp.	1	5	-	-	-	-
Zygeupolia sp.	-	-	-	-	-	1
Cnidaria						
Anthozoa						
Anthozoan (unid.) "A"	1	2	1	-	-	2
Edwarsia spp.	22	15	25	1	1	1
cf. _Nematostella vectensis_	-	-	1	-	-	-
Phoronida						
Phoronis spp.	-	-	-	-	1	-
Brachiopoda						
Glottidia albida	-	1	1	-	-	-
Mollusca						
Pelecypoda						
Chione sp.	1	2	7	-	1	-
Cooperella subdiaphana	17	16	10	-	1	4
Hiatella arctica	-	-	1	-	-	-
Macoma yoldiformis	4	5	4	1	-	-
Modiolus neglectus	-	-	1	-	-	-
Modiolus sp. (juv)	3	-	-	-	-	-
Nucula tenuis	1	-	-	-	-	-
Nuculana taphria	-	3	1	-	-	-
Pandora filosa	-	1	-	-	-	-
Pandora punctata	-	-	-	-	-	1
Parvilucina tenuisculpta	1	1	1	-	-	-
Siliqua lucida	3	4	8	11	9	17
Solen sicarius	2	6	4	-	-	-
Tellina modesta	12	7	12	2	8	-

TABLE C.2-5 (Continued)

Taxonomic Group	S2-1(4)[c]	-2(4)	-4(4)	N2-1(3)	-2(3)	-3(4)
	Replicate Number (Volume of Sample in Liters)					
Paraprionospio pinnata	1	1	5	2	2	1
Phyllodoce hartmannae	-	2	1	1	1	-
Phyllodoce papillosa	1	-	-	-	-	-
Pista fasciata	1	-	1	1	-	-
Podarkeopsis brevipalpa	-	-	-	1	-	-
Polynoidae (unid.)	-	1	-	-	-	-
Prionospio steenstrupi	3	2	2	-	-	-
Scoloplos armiger	1	-	-	-	-	-
Spiophanes berkeleyorum	2	6	2	-	-	-
Spiophanes bombyx	-	-	-	1	-	-
Sthenolepis fimbriarum	1	-	2	1	1	-
Tauberia gracilis	-	1	-	-	-	-
Terebellidae (juv.)	1	-	-	-	-	1
Thalenessa spinosa	1	1	2	-	-	2
Tharyx sp.	5	14	12	-	-	-
Typosyllis hyalina	1	-	1	-	-	-
Sipunculida						
Sipunculids (unid. frag.)	-	1	-	-	-	1
Arthropoda						
Crustacea						
Ostracoda						
Cycloleberis dentata	-	-	1	-	-	-
Euphilomedes carcharodonta	24	17	16	8	14	14
Parasterope hulingsi	2	1	-	-	-	1
Mysidacea						
Acanthomysis costata	-	-	-	-	-	1
Mysidopsis intii	-	1	-	-	-	-
Cumacea						
Anchicolorus occidentalis	2	-	1	-	-	-
Diastylopsis tenuis	4	6	10	9	2	7
Hemilamprops californica	5	3	6	1	-	2
Oxyurostylis pacifica	-	-	-	-	1	1
Isopoda						
Edotea sublittoralis	4	5	4	2	2	4
Munna ubiquita	-	-	-	-	-	1
Amphipoda						
Ampelisca compressa	-	-	1	-	-	-
Ampelisca cristata	-	-	-	3	1	1
Aorides columbiae	-	-	-	-	-	1
Argissa hematipes	2	-	1	-	-	-
Cerapus tubularis	1	-	-	-	-	1
Erichthonius brasiliensis	1	-	-	-	-	-
Megaluropus longimerus	-	-	1	1	-	-
Parapleustes pugettensis	-	-	-	-	-	1
Photis brevipes	-	-	4	-	-	-

TABLE C.2-5 (Continued)

Taxonomic Group	S2-1(4)[c]	-2(4)	-4(4)	N2-1(3)	-2(3)	-3(4)
	Replicate Number (Volume of Sample in Liters)					
Gastropoda						
Acteocina culcitella	2	1	2	-	-	-
Aeolidae (unid.)	-	-	2	-	-	-
Cylichna attonsa	2	-	-	-	-	2
Dirona albolineata	3	-	-	-	-	-
Epitonium bellastriatum	-	1	-	-	-	-
Nassarius perpinguis	-	-	1	1	-	-
Odostomia (Evalea) sp.	-	-	-	-	1	1
Olivella baetica	-	1	1	1	-	-
Ophiodermella halcyonis	-	-	1	-	-	-
Rictaxis punctocoelata	5	1	6	-	-	-
Sulcoretusa xystrum	1	-	4	-	-	-
Turbonilla (Chemnitzia) sp. ("A")	-	-	1	-	-	-
Turbonilla (Chemnitzia) sp. ("B")	-	-	1	-	-	-
Annelida						
Polychaeta						
Amaeana occidentalis	-	-	-	-	2	1
Amphicteis scaphobranchiata	-	-	-	1	-	-
Apoprionospio pygmaea	6	2	3	1	1	1
Axiothella rubrocincta	2	1	1	-	-	-
Chaetozone corona	1	4	-	-	-	-
Chaetozone setosa	5	10	3	-	-	-
Chone veleronis	-	-	2	-	-	-
Cistena (Pectinaria) californiensis	2	1	2	2	1	2
Eupolymnia congruens	-	-	1	-	-	-
Glycera convoluta	1	2	3	1	-	-
Glycinde armigera	6	10	3	-	1	1
Goniada brunnea	1	-	-	-	-	-
Goniada littorea	2	2	2	2	4	3
Haploscoloplos elongatus	1	1	1	2	-	1
Harmothoe priops	2	2	1	2	1	1
Laonice cirrata	2	3	-	-	-	-
Lumbrineris californiensis	3	1	1	-	-	-
Lumbrineris sp. ("D")	28	21	14	6	-	7
Lumbrineris sp.	-	-	-	2	6	3
Magelona pitelkai	7	3	3	1	-	-
Magelona sacculata	11	13	10	-	1	1
Magelona sp.	-	-	-	-	1	-
Mediomastus californiensis	14	3	2	-	-	-
Minuspio cirrifera	-	-	2	-	-	-
Nephtys caecoides	1	-	-	-	-	1
Nephtys sp. (juv.)	1	7	2	-	-	-
Nereis procera	6	8	-	-	-	-
Nothria iridescens	2	1	5	8	6	8
Notomastus sp.	-	-	1	-	-	-

TABLE C.2-5 (Concluded)

Taxonomic Group	Replicate Number (Volume of Sample in Liters) S2-1(4)[c]	-2(4)	-4(4)	N2-1(3)	-2(3)	-3(4)
Synchelidium sp.	-	1	2	-	-	-
Tiron biocellata	-	3	1	-	-	-
Tiron tropakis	-	-	2	-	-	-
Trichophoxus epistomus	1	-	1	-	-	-
Trichophoxus variatus	1	1	1	-	-	-
Decapoda						
Callianassa sp. (juv.)	1	-	-	-	-	-
Cancer sp. (juv.)	-	2	-	-	-	-
Heterocrypta occidentalis	-	-	1	-	-	-
Pinnixa fabia	-	-	1	-	-	-
Pinnixa franciscana	-	-	2	-	-	-
Pinnixa sp. (juv.)						
Pycnogonida						
Nymphon sp.	3	-	1	-	-	-
Echinodermata						
Echinoidea						
Dendraster excentricus	1	1	-	-	-	-
Holothuroidea						
Eupentacta quinquesemita	-	1	1	-	-	-
Ophiuroidea						
Amphiodia sp. (juv.)	-	-	1	1	-	1
Hemichordata						
Hemichordates (unid.)	-	1	-	-	-	-

[a]See Figure 12.4-3 for station locations.

[b]Based on triplicate samples and sorted through a 1mm mesh screen.

[c]Three largest volume samples of each set of five collected.

TABLE C.2-6
INFAUNAL SPECIES

Locations: Station S3 on the 60' isobath of the Ormond Beach alternate pipeline route from Platform Gina, Station N3 on the 60' isobath of the Gina Mandalay route, and Station G3 on the 60' isobath of the Gilda route.[a]

	Replicate Number (Volume of Sample in Liters)[b]								
Taxonomic Group	S3-1(5)[c]	-3(5)	-5(5)	N3-2(2.5)	-3(4)	-5(4)	G3-2(7)	-3(7)	-4(7)
Platyhelminthes									
Flatworm (unid.) "A"	3	1	-	-	-	1	1	-	-
Flatworm (unid.) "C"	-	-	-	2	-	-	-	-	-
Flatworm (unid.) "D"	-	-	-	1	-	-	-	-	-
Nemertina									
Carinoma mutabilis	-	-	-	-	-	1	1	-	-
Cerebratulus spp.	-	-	-	-	1	-	-	1	-
Micrura spp.	1	-	-	-	-	-	1	-	1
Nemertine (unid.) "A"	-	-	1	-	1	-	-	-	-
Nemertine (unid.) "D"	-	-	-	1	-	-	-	-	-
Nemertine (unid.) "F"	-	-	-	-	-	-	-	1	-
Paranemertes spp.	-	-	-	-	-	1	-	-	-
Tubulanus spp.	-	-	-	-	-	-	1	-	4
Zygeupolia sp.	-	-	-	-	2	1	-	-	-
Cnidaria									
Anthozoa									
Anthozoan (unid.) "A"	1	-	-	-	-	-	-	-	-
Cerianthidae (unid.)	-	2	-	-	-	-	-	-	-
Edwarsia spp.	3	9	9	-	1	1	-	6	4
Phoronida									
Phoronis spp.	-	-	-	-	1	1	1	1	-
Brachiopoda									
Glottidia albida	2	3	-	-	1	-	-	-	1
Mollusca									
Pelecypoda									
Chione undatella	-	-	-	-	-	-	22	31	32
Chione sp.	-	-	-	1	2	-	-	-	-
Compsomyax subdiaphana	-	1	-	-	1	1	5	3	10

TABLE C.2-6 (Continued)

Taxonomic Group	S3-1(5)[c]	-3(5)	-5(5)	N3-2(2.5)	-3(4)	-5(4)	G3-2(7)	-3(7)	-4(7)
	Replicate Number (Volume of Sample in Liters)								
Mollusca									
Pelecypoda									
Chione undatella	-	-	-	-	-	-	22	31	32
Chione sp.	-	-	-	1	2	-	-	-	-
Compsomyax subdiaphana	-	1	-	-	1	1	5	3	10
Cooperella subdiaphana	9	14	6	10	7	11	7	9	12
Crassinella ? branneri	-	-	-	-	-	-	-	1	-
Crenella divaricata	-	-	-	-	-	-	-	2	1
Cyathodonta dubiosa	-	-	-	-	-	-	-	1	-
Ensis myrae	-	-	-	1	1	1	1	2	-
Gari endentula	-	-	-	1	-	-	-	-	-
Lepton meroeum	-	-	-	-	-	4	-	-	-
Leptopecten latiauratus	-	7	-	-	1	-	-	-	1
Lyonsia nesiotes	-	-	-	-	-	-	1	1	2
Macoma yoldiformis	3	1	-	4	5	4	6	13	16
Macoma ? sp. (unid.)	-	-	-	-	-	-	-	1	-
Modiolus neglectus	-	4	1	1	-	-	4	7	6
Modiolus sp.	-	-	-	-	-	-	-	1	1
Mysella tumida	2	-	-	-	1	1	-	-	2
Nuculana taphria	-	1	1	-	-	3	4	8	4
Nuculana sp.	-	-	-	-	1	-	-	-	-
Pandora bilirata	-	-	-	-	-	-	2	-	-
Paramya sp. ("A")	-	-	-	-	-	-	-	-	3
Parvilucina tenuisculpta	1	1	3	-	-	-	4	4	13
Siliqua lucida	1	1	-	10	7	6	2	1	3
Solen rosaceus	1	-	-	-	-	-	-	-	-
Solen sicarius	3	1	-	5	-	2	5	4	9
Solen sp.	-	-	2	-	-	-	-	-	-
Tellina modesta	6	5	9	18	11	14	12	12	14
Thracia sp.	-	-	-	1	-	-	-	-	-

TABLE C.2-6 (Continued)

Taxonomic Group	S3-1(5)[c]	-3(5)	-5(5)	N3-2(2.5)	-3(4)	-5(4)	G3-2(7)	-3(7)	-4(7)
	Replicate Number (Volume of Sample in Liters)								
Scaphopoda									
Cadulus fusiformis	-	-	-	-	-	3	-	1	1
cf. Cadulus sp.	-	-	1	-	-	-	-	-	-
Gastropoda									
Acteocina harpa	-	-	-	-	-	-	-	1	-
Agalja diomedea	-	-	-	-	-	-	-	-	1
Balcis mycans	-	-	-	-	-	1	-	-	-
Balcis rutila	-	-	-	-	-	2	-	-	-
Cylichna attonsa	-	1	-	-	-	2	1	2	-
Neverita reclusiana	-	-	-	1	-	-	-	-	-
Rictaxis punctocoelata	2	3	-	-	-	-	3	5	3
Turbonilla (Chemnitzia) sp. ("A")	-	3	-	-	-	-	-	1	1
Turbonilla (Chemnitzia) sp. ("D")	-	-	-	-	-	-	-	1	1
Turbonilla (Pyrgolampros) sp. ("A")	-	-	-	2	-	-	-	-	-
Volvulella panamica	-	-	-	-	-	-	1	-	-
Annelida									
Polychaeta									
Amaeana occidentalis	-	1	-	-	-	1	-	-	1
Ampharete labrops	-	5	-	-	-	-	-	-	11
Amphicteis scaphobranchiata	1	-	1	1	-	-	10	11	1
Apoprionospio pygmaea	1	1	-	2	1	1	1	-	-
Arabella iricolor	-	-	-	1	-	1	-	-	-
Aricidea wassi	-	-	-	-	-	-	-	1	-
Axiothella rubrocincta	1	-	-	-	-	-	1	5	10
Brada plurobranchiata	-	-	-	-	-	-	-	1	1
Chaetozone corona	-	1	-	-	-	-	8	13	9
Chaetozone setosa	-	1	-	1	1	-	-	-	-
Chone albocincta	-	-	-	2	-	-	-	-	-
Cirratulidae (unid.)	-	-	-	3	1	1	-	-	-
Cistena (Pectinaria) californiensis	-	-	-	-	-	-	2	1	14
Diopatra ornata	-	1	1	-	-	-	-	-	-

TABLE C.2-6 (Continued)

Taxonomic Group	S3-1(5)[c]	-3(5)	-5(5)	N3-2(2.5)	-3(4)	-5(4)	G3-2(7)	-3(7)	-4(7)
	Replicate Number (Volume of Sample in Liters)								
Diopatra sp. (juv.)	-	-	-	-	-	-	-	1	1
Drilonereis falcata	-	1	-	-	-	-	-	-	-
Eteone dilatae	-	-	-	-	-	-	1	-	-
Euchone hancocki	-	-	-	1	-	-	1	-	-
Glycera branchiopoda	-	1	-	-	-	-	-	-	-
Glycera convoluta	-	-	-	-	1	-	-	-	-
Glycinde armigera	1	-	1	-	-	-	2	-	1
Goniada brunnea	1	3	-	-	-	-	-	-	-
Goniada maculata	-	-	-	-	-	-	1	1	4
Goniadidae (unid.)	-	-	-	-	-	1	-	-	-
Haploscoloplos elongatus	1	-	-	-	-	1	-	-	-
Harmothoe priops	-	1	-	2	-	-	-	2	1
Hesperonoe sp.	2	-	-	-	-	-	-	-	-
Laonice cirrata	-	-	-	-	-	-	1	-	-
Lepidasthenia sp.	-	-	-	-	-	1	-	-	-
Lumbrineris californiensis	1	3	1	-	-	-	-	-	-
Lumbrineris sp. ("D")	4	6	1	4	2	1	1	3	1
Lumbrineris sp.	-	-	-	3	8	2	-	2	2
Magelona pitelkai	-	2	-	-	-	-	2	2	5
Magelona sacculata	1	-	-	-	-	-	-	-	-
Magelona sp.	-	-	1	-	-	-	-	-	-
Mediomastus californiensis	-	13	4	-	3	1	-	-	1
Melinna occulata	-	-	-	-	-	-	-	2	-
Minuspio cirrifera	1	-	-	-	-	-	-	-	-
Nephtys caecoides	-	-	-	1	-	-	1	-	-
Nephtys sp. (juv.)	1	1	-	-	-	-	1	1	2
Nereis latescens	-	1	-	-	-	-	-	-	-
Nereis procera	1	2	-	-	1	-	-	2	2
Nereis sp.	-	-	-	-	-	-	2	-	-
Nothria iridescens	1	-	-	7	3	3	1	-	2
Notomastus sp.	-	-	1	-	-	-	-	-	-
Owenia fusiformis collaris	-	-	4	14	10	1	1	1	9

TABLE C.2-6 (Continued)

Taxonomic Group	Replicate Number (Volume of Sample in Liters)								
	S3-1(5)[c]	-3(5)	-5(5)	N3-2(2.5)	-3(4)	-5(4)	G3-2(7)	-3(7)	-4(7)
Paraprionospio pinnata	3	5	1	1	2	2	1	9	7
Phyllodoce hartmannae	2	5	–	1	2	1	–	1	–
Phyllodoce papillosa	–	–	1	–					
Pista fasciata	8	1	1	–	–	2	1	2	3
Pista sp. (frag.)	–	–	1	–	1	–	–	–	–
Polydora sp.	–	–	–	–	–	–	–	–	4
Prionospio steenstrupi									
Sigambra tentaculata	–	–	–	–	–	–	–	1	3
Spiochaetopterus costarum	4	5	5	1	2	–	–	–	1
Spionidae (unid.)	–	–	1	–	1	–	–	–	–
Spiophanes berkeleyorum	8	5	5	4	7	3	5	4	12
Spiophanes bombyx	–	–	–	1	2	–	–	–	–
Spiophanes sp.	–	–	–	–	–	–	–	–	1
Sternaspis fossor	–	–	–	–	–	–	–	3	–
Sthenelais verruculosa	–	–	–	–	–	–	1	–	–
Stenelanella uniformis	–	–	–	–	–	–	1	2	4
Sthenolepis fimbriarum	–	2	–	–	–	1	–	2	1
Streblosoma crassibranchia	1	–	–	2	3	–	–	1	–
Tauberia gracilis	–	–	–	–	–	–	2	1	13
Thalenessa spinosa	5	4	1	5	1	6	–	–	–
Tharyx tesselata	–	–	–	1	–	–	1	–	4
Tharyx sp.	8	8	1	–	–	–	–	1	3
Trochochaeta franciscanum	–	1	–	–	–	–	–	–	–
Typosyllis hyalina	–	1	–	2	2	1	–	–	–
Echiurida									
Listriolobus pelodes	–	–	–	–	–	–	2	–	5
Arthropoda									
Crustacea									
Ostracoda									
Euphilomedes carcharodonta	13	24	4	6	5	12	7	5	3
Rutiderma rostrata	–	–	–	–	–	1	–	–	–

TABLE C.2-6 (Continued)

Taxonomic Group	S3-1(5)[c]	-3(5)	-5(5)	N3-2(2.5)	-3(4)	-5(4)	G3-2(7)	-3(7)	-4(7)
	Replicate Number (Volume of Sample in Liters)								
Nebaliacea									
Nebalia pugettensis	-	-	-	2	2	2	-	-	-
Mysidacea									
Mysidopsis intii	-	-	-	-	-	-	-	1	-
Neomysis kadiakensis	-	-	-	-	-	-	2	2	-
Cumacea									
Cumella sp. ("A")	-	-	-	-	-	-	-	-	1
Diastylopsis tenuis	2	2	1	-	-	1	-	-	-
Hemilamprops californica	7	1	1	7	2	4	1	-	-
Isopoda									
Edotea sublittoralis	1	4	-	3	1	-	1	1	-
Gnathia crenulatifrons	-	-	-	-	-	-	2	-	-
Idarcturus allelomorphus	-	1	-	-	-	-	-	-	-
Jaeropsis dubia	-	1	-	-	-	-	-	-	-
Tanaidacea									
Leptochelia dubia	-	1	-	-	-	-	-	-	-
Amphipoda									
Ampelisca brevisimulata	2	-	-	3	2	1	2	1	-
Ampelisca compressa	-	-	1	-	-	-	1	-	-
Ampelisca cristata	2	4	4	1	3	2	3	1	1
Amphideutopus oculatus	-	4	5	1	-	-	3	10	6
Aorides columbiae	-	4	-	-	-	-	-	-	-
Argissa hamatipes	-	-	-	4	-	1	1	2	2
Erichthonius brasilensis	-	25	4	-	-	-	-	-	-
Listriella eriopisa	-	-	-	-	-	-	1	-	-
Listriella goleta	-	-	-	-	-	-	2	1	3
Listriella melanica	-	-	3	-	-	-	-	-	-
Monoculodes cf. *hartmanae*	-	-	-	1	-	-	-	-	-
Paraphoxus spinosus	-	-	-	-	-	-	-	1	-
Photis brevipes	-	13	-	-	-	-	3	-	1
Synchelidium sp.	-	-	1	2	2	2	2	1	2
Tiron biocellata	-	1	-	-	1	1	-	-	-
Trichophoxus daboius	1	4	1	4	-	7	-	-	-

TABLE C.2-6 (Concluded)

Taxonomic Group	Replicate Number (Volume of Sample in Liters)								
	S3-1(5)[c]	-3(5)	-5(5)	N3-2(2.5)	-3(4)	-5(4)	G3-2(7)	-3(7)	-4(7)
Trichophoxus epistomus	3	2	1	6	4	5	-	-	-
Trichophoxus floridanus	-	-	-	1	-	-	-	-	-
Trichophoxus stenodes	-	-	-	1	2	-	3	1	-
Trichophoxus variatus	-	3	2	-	-	-	-	-	-
Decapoda									
Callianassa sp. (juv.)	-	-	1	-	1	-	-	-	-
Cancer gracilis	-	-	-	-	-	-	1	-	1
Cancer sp. (juv.)	1	2	-	-	-	-	-	-	-
Crangon alaskensis elongata									
Pinnixa franciscana	2	3	-	-	-	-	-	-	-
Pinnixa cf. *schmitti*	3	-	-	-	1	-	-	-	-
Pinnixa cf. *tomentosa*	-	-	-	-	-	-	-	-	1
Pinnixa sp. (juv.)	7	8	5	1	2	-	-	-	-
Echinodermata									
Holothuroidea									
Eupentacta quinquesemita	1	1	-	-	-	-	1	1	-
Ophiuroidea									
Amphiodia digitata	-	-	-	-	-	-	2	3	3
Amphiodia occidentalis	-	-	-	-	-	-	1	-	-
Amphiodia urtica	-	-	-	-	-	-	1	-	3
Amphiodia sp. (juv.)	-	-	2	1	2	1	5	6	6
Ophilopsila californica	1	-	-	-	-	-	-	-	-
Hemichordata									
Hemichordates (unid.)	2	5	2	1	1	-	-	-	1

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[a]See Figure 12.4-3 for station locations.

[b]Based on triplicate samples and sorted through a 1mm mesh screen.

[c]Three largest volume samples of each set of five collected.

TABLE C.2-7
INFAUNAL SPECIES

Locations: Station S4 on the 80' isobath of the Ormond Beach alternate pipeline route from Platform Gina, Station N4 on the 80' isobath of the Gina Mandalay route, and Station G4 on the 80' isobath of the Gilda route.[a]

Taxonomic Group	Replicate Number (Volume of Sample in Liters)[b]								
	S4-1(6)[c]	-3(7)	-5(6)	N4-1(4)	-2(4)	-4(5)	G4-1(4)	-3(4)	-5(5)
Platyhelminthes									
Flatworm (unid.) "A"	-	-	1	-	-	-	-	-	-
Nemertina									
Carinoma mutabilis	-	1	-	-	-	-	-	3	-
Cerebratulus sp.	-	-	-	1	-	-	-	-	-
Lineus bilineatus	-	1	-	-	-	1	-	1	-
Micrura spp.	1	4	1	1	-	-	-	1	-
Nemertine "A"	-	-	-	1	-	1	-	1	-
Nemertine "D"	-	-	1	-	1	1	1	-	-
Nemertine "E"	-	-	1	-	-	-	-	-	-
Tubulanus spp.	2	1	1	2	1	1	2	1	1
Zygeupolia sp.	-	-	-	-	-	-	-	1	-
Cnidaria									
Anthozoa									
Anthozoan (unid.) "A"	1	3	6	2	-	-	-	-	-
Cerianthidae (unid.)	3	6	5	1	3	2	-	-	-
Edwarsia spp.	2	-	1	3	1	3	-	5	2
Stylatula elongata	-	-	-	-	-	-	1	-	-
Phoronida									
Phoronis spp.	6	9	5	4	4	2	1	1	1
Brachiopoda									
Glottidia albida	1	6	3	-	1	1	7	2	1

TABLE C.2-7 (Continued)

Taxonomic Group	Replicate Number (Volume of Sample in Liters) S4-1(6)[c]	-3(7)	-5(6)	N4-1(4)	-2(4)	-4(5)	G4-1(4)	-3(4)	-5(5)
Mollusca									
Pelecypoda									
Asthenothaerus villosior	-	-	-	-	-	-	-	2	2
Axinopsida serricata	-	-	-	-	-	-	-	-	1
Chione undatella	-	-	-	-	-	-	-	2	4
Chione sp.	-	-	-	-	-	-	1	-	-
Compsomyax subdiaphana	5	6	-	1	6	7	5	2	5
Cooperella subdiaphana	-	-	2	1	1	4	3	2	4
Cyathodonta dubiosa	-	-	1	1	-	2	-	3	1
Ensis myrae	1	-	-	-	-	-	2	1	-
Gari edentata	-	-	1	-	-	-	-	-	-
Leptopecten latiauratus	-	-	2	-	-	-	-	-	1
Lyonsia nesiotes	-	-	-	-	-	-	1	-	-
Lyonsia sp. ("A")	-	-	-	-	-	-	-	1	-
Macoma yoldiformis	6	5	1	5	1	4	6	7	10
Megacrenella columbiana	-	-	-	-	2	-	-	-	-
Modiolus neglectus	-	1	-	-	2	1	4	-	4
Mya ? sp. (unid.)	-	-	-	-	-	-	-	-	1
Mysella tumida	3	4	2	2	1	1	2	1	-
Nuculana taphria	9	9	1	2	-	1	4	4	5
Nuculana sp.	-	-	-	-	1	-	-	-	-
Paramya sp. ("A")	-	-	-	-	-	-	-	1	1
Parvilucina tenuisculpta	60	59	34	63	42	55	21	28	47
Solen sicarius	3	1	1	2	2	-	6	12	-
Tellina carpenteri	-	-	-	-	-	-	-	-	1
Tellina idae	1	-	-	-	1	-	1	-	-
Tellina modesta	4	4	3	4	4	4	15	15	27
Trachycardium quadragenariam	-	-	-	-	-	-	-	1	-
Scaphopoda									
Cadulus fusiformis	1	-	3	-	1	-	-	-	1
cf. *Cadulus* sp.	-	-	-	-	-	1	-	-	-

TABLE C.2-7 (Continued)

Taxonomic Group	S4-1(6)[c]	-3(7)	-5(6)	N4-1(4)	-2(4)	-4(5)	G4-1(4)	-3(4)	-5(5)
	Replicate Number (Volume of Sample in Liters)								
Gastropoda									
Acteocina culcitella	2	-	-	-	-	-	-	-	-
Aeolidae (unid.)	1	-	-	-	-	-	-	-	-
Agalja ocelligera	-	-	-	1	-	-	-	-	-
Armina californica	-	2	-	-	-	-	-	-	-
Bittium subplantum	1	1	1	-	-	-	-	-	-
Bittium sp.	-	-	-	-	2	-	-	-	-
Cylichna attonsa	-	2	2	1	-	1	1	1	-
Eulima raymondi	1	-	-	-	-	-	-	-	-
Gastropteron pacificum	-	1	-	-	-	-	-	-	-
Haminoea virescens	-	-	-	-	-	1	-	-	-
Kurtzia arteoga	-	1	1	1	1	-	-	-	-
Nassarius perpinguis	1	-	-	-	-	-	-	-	-
Odostomia (*Evalea*) sp.("A")	-	1	-	-	-	-	-	-	-
Odostomia (*Evalea*) sp.("B")	-	1	-	-	-	-	-	-	-
Odostomia (*Evalea*) sp. ("E")	-	-	-	-	-	-	2	3	1
Olivella baetica	-	-	1	-	-	-	-	-	-
Ophiodermella halcyonis	-	1	-	-	-	-	-	-	-
Rictaxis punctocoelata	3	1	2	6	1	-	3	2	1
Sulcoretusa xystrum	-	1	1	3	-	-	2	-	-
Tenaturris sp.	-	1-	-	-	-	-	-	-	-
Turbonilla (*Chemnitzia*) sp. ("A")	-	1	1	1	-	1	1	-	-
Turbonilla (*Chemnitzia*) sp. ("B")	-	-	-	1	-	1	-	-	-
Turbonilla (*Pyrgiscus*) sp. ("A")	-	-	1	-	-	-	-	-	-
Volvulella cylindrica	1	1	1	1	-	-	-	-	-
Annelida									
Polychaeta									
Acesta catherinae	5	1	-	-	-	-	-	-	-
Acesta horikoshi	-	-	2	-	-	-	-	-	-

TABLE C.2-7 (Continued)

Taxonomic Group	Replicate Number (Volume of Sample in Liters)								
	S4-1(6)[c]	-3(7)	-5(6)	N4-1(4)	-2(4)	-4(5)	G4-1(4)	-3(4)	-5(5)
Amaeana occidentalis	-	-	-	1	-	1	-	1	-
Ampharete labrops	-	-	-	-	-	-	1	1	2
Ampharetidae (juv.)	-	-	-	-	-	-	-	1	-
Amphicteis scaphobranchiata	5	8	6	6	6	2	7	3	3
Apoprionospio pygmaea	1	2	-	-	-	-	-	-	1
Arabella iricolor	-	-	-	-	-	1	-	-	-
Arabellidae (frag.)	-	-	-	-	-	-	-	1	-
Aricidea wassi	1	1	-	-	-	-	-	-	-
Asychis disparidentata	-	3	1	1	1	2	-	-	-
Axiothella rubrocincta	22	17	20	19	11	11	3	3	2
Brada pleurobranchiata	1	9	-	1	1	-	1	3	3
Chaetozone corona	-	-	1	1	-	-	4	2	3
Chaetozone setosa	-	-	1	1	-	-	-	-	-
Chloeia pinnata	-	-	-	-	-	-	-	1	-
Chone albocincta	-	2	-	1	-	-	-	1	2
Chone gracilis	-	-	-	-	1	-	-	-	-
Chone veleronis	2	1	-	2	-	-	3	2	2
Cistena (Pectinaria) californiensis	2	4	-	4	4	-	6	5	13
Cossura candida	-	-	-	-	-	-	-	1	-
Diopatra ornata	-	1	-	-	-	-	-	-	-
Diopatra tridentata	-	1	-	-	-	-	-	1	-
Diopatra sp. (juv.)	-	-	-	-	-	-	1	-	-
Drilonereis falcata	-	2	-	-	-	-	-	-	-
Euchone hancocki	2	-	-	-	-	-	-	-	-
Eupolymnia congruens	-	4	1	1	1	-	1	1	-
Exogone gemmifera	-	1	-	-	-	-	-	2	-
Glycera branchipoda	-	-	1	-	-	-	-	1	-
Glyceridae (juv.)	-	-	-	-	1	-	-	-	-
Glycera convoluta	-	-	-	-	-	1	-	-	-
Glycinde armigera	1	4	3	1	-	-	1	4	2
Goniada brunnea	-	-	1	1	-	-	-	-	-

TABLE C.2-7 (Continued)

Taxonomic Group	Replicate Number (Volume of Sample in Liters)								
	S4-1(6)[c]	-3(7)	-5(6)	N4-1(4)	-2(4)	-4(5)	G4-1(4)	-3(4)	-5(5)
Goniada maculata	-	-	-	-	-	-	-	1	1
Goniadidae (juv.)	-	-	-	1	-	-	-	-	-
Haploscoloplos elongatus	1	3	-	-	-	-	-	-	-
Harmothoe priops	-	2	1	1	2	2	-	1	-
Hesperone sp.	-	-	-	-	1	-	1	-	-
Laonice cirrata	1	-	-	-	-	-	1	2	-
Lumbrineris californiensis	-	1	1	2	-	-	4	2	5
Lumbrineris sp. ("D")	6	4	-	1	-	1	-	-	-
Lumbrineris sp.	-	-	-	1	-	-	-	-	-
Magelona pitelkai	7	4	-	-	1	2	-	-	-
Mediomastus californiensis	5	3	-	1	1	-	1	12	1
Megaloma circumspectum	1	-	1	-	-	-	-	-	-
Megaloma sp.	-	-	-	-	-	-	-	-	1
Melinna oculata	1	-	-	-	-	-	-	-	-
Minuspio cirrifera	1	2	-	1	-	-	-	-	2
Nephtys caecoides	-	1	1	1	3	4	2	-	-
Nephtys ferruginea	-	-	1	-	-	-	1	-	-
Nephtys sp. (juv.)	9	7	-	-	1	1	1	-	1
Nereis procera	2	6	1	-	-	-	-	-	-
Nereis sp.	-	2	1	-	-	-	-	-	-
Nothria iridescens	3	-	3	2	2	2	2	2	2
Onuphis nebulosa	1	2	1	1	2	1	-	1	-
Paraprionospio pinnata	7	8	7	8	2	12	5	7	3
Phyllodoce hartmannae	5	1	2	6	1	2	1	-	1
Phyllodoce papillosa	2	3	2	-	-	-	-	4	-
Phyllodocidae (unid.)	-	-	1	-	-	-	-	-	-
Pista fasciata	1	-	2	-	-	-	5	1	-
Platynereis bicanaliculata	-	-	-	-	-	-	-	-	1
Polydora sp.	-	1	-	-	-	-	-	-	5
Prionospio steenstrupi	3	-	1	-	-	-	-	-	1
Sabellidae (juv.)	-	-	-	1	-	-	-	-	-

TABLE C.2-7 (Continued)

Taxonomic Group	Replicate Number (Volume of Sample in Liters)								
	S4-1(6)[c]	-3(7)	-5(6)	N4-1(4)	-2(4)	-4(5)	G4-1(4)	-3(4)	-5(5)
Scoloplos sp.	1	-	-	1	-	-	-	-	-
Sigambra tentaculata	-	-	-	1	-	-	-	-	-
Spiochaetopterus costarum	4	1	1	2	2	4	6	4	7
Spiophanes berkeleyorum	30	44	32	17	16	29	-	3	-
Spiophanes bombyx	1	2	2	-	1	-	1	2	-
Sternaspis fossor	1	1	2	2	-	2	1	2	1
Sthenelanella uniformis	1	-	1	-	-	2	2	6	7
Sthenolepis fimbriarum	1	-	-	1	1	1	1	-	2
Streblosoma crassibranchia	-	1	-	1	-	1	-	-	-
Tauberia gracilis	2	2	-	1	-	-	1	-	-
Thalenessa spinosa	1	2	-	-	2	1	1	-	1
Tharyx tesselata	-	-	-	2	-	-	-	-	-
Tharyx sp.	2	2	3	-	-	1	1	5	4
Travisia gigas	-	-	-	-	-	-	1	-	-
Hirudinea									
Leech (unid.)	-	1	-	-	-	-	-	-	-
Echiurida									
Echiuroid (unid.)	-	2	-	-	-	-	-	-	-
Listriolobus pelodes	-	-	-	-	-	-	2	-	1
Arthropoda									
Crustacea									
Ostracoda									
Asteropella sltteryi	-	-	-	-	-	-	-	1	-
Euphilomedes carcharodonta	3	10	16	7	9	5	12	40	30
Parasterope barnesi	1	-	-	-	-	-	-	-	-
Rutiderma rostrata	1	-	-	-	1	-	-	-	-
Sarsiella sp. ("A")	-	-	-	-	-	-	-	1	-
Nebaliacea									
Nebalia pugettensis	-	1	-	-	-	1	1	-	-

TABLE C.2-7 (Continued)

Taxonomic Group	S4-1(6)[c]	-3(7)	-5(6)	N4-1(4)	-2(4)	-4(5)	G4-1(4)	-3(4)	-5(5)
	Replicate Number (Volume of Sample in Liters)								
Cumacea									
Hemilamprops californica	-	6	-	2	3	1	-	-	1
Isopoda									
Edotea sublittoralis	-	1	-	-	-	-	-	-	1
Gnathia crenulatifrons	1	4	4	-	1	3	3	12	10
Haliophasma geminata	2	2	-	1	-	2	-	-	-
Munnogonium tillerae	-	1	-	-	-	-	-	-	-
Serolis carinata	-	-	-	-	-	1	-	-	-
Tanaidacea									
Leptochelia dubia	1	1	-	1	1	-	1	1	-
Amphipoda									
Acidostoma hancocki	1	-	1	-	-	2	-	-	-
Acuminodeutopus heteruropus	-	-	2	-	-	-	-	-	-
Ampelisca brevisimulata	13	5	5	2	10	6	3	4	3
Ampelisca compressa	-	-	-	-	-	-	-	2	-
Ampelisca cristata	11	14	3	6	7	10	6	9	9
Amphideutopus oculatus	8	7	2	5	11	6	33	14	20
Argissa hamatipes	1	3	-	-	-	-	-	-	-
Gaviota podophthalma	-	-	3	1	1	-	-	-	-
Hippomedon zetesimus	-	-	1	-	-	-	-	-	1
Listriella eriopisa	-	-	-	-	1	-	-	-	-
Listriella goleta	-	-	-	-	-	-	-	-	1
Listriella melanica	-	-	-	-	-	-	1	-	-
Mayerella banksia	1	-	-	-	-	1	-	-	-
Metaphoxus frequens	-	1	-	-	-	-	-	-	-
Orchomene holmesi	-	-	-	-	-	-	-	1	-
Pachynus barnardi	-	-	-	-	-	-	-	1	-
Paraphoxus cognatus	-	2	4	-	-	2	2	1	3
Paraphoxus obtusidens	-	-	-	-	2	-	-	-	-
Photis brevipes	-	-	-	1	-	-	-	-	-
Prachynella lodo	-	-	-	1	1	-	-	-	-
Rudilemboides stenopropodus	3	1	-	2	1	1	-	1	3

TABLE C.2-7 (Continued)

Taxonomic Group	Replicate Number (Volume of Sample in Liters)								
	S4-1(6)[c]	-3(7)	-5(6)	N4-1(4)	-2(4)	-4(5)	G4-1(4)	-3(4)	-5(5)
Synchelidium sp.	3	3	1	-	2	1	-	1	1
Tiron biocellata	-	-	-	-	-	-	1	-	-
Trichophoxus abronius	-	1	-	-	-	-	-	-	-
Trichophoxus daboius	-	1	-	-	-	-	-	-	2
Trichophoxus epistomus	5	3	-	3	5	3	-	2	1
Trichophoxus floridanus	1	-	-	-	1	-	-	-	-
Trichophoxus stenodes	4	11	1	5	2	3	4	-	4
Westwoodilla caecula	1	3	1	-	-	1	-	1	1
Decapoda									
Heptacarpus stimpsoni	-	-	-	-	1	-	-	-	-
Heterocrypta occidentalis	-	-	-	-	-	1	-	-	-
Opisthopus transversus	-	-	1	-	-	-	-	-	-
Pinnixa schmitti	-	2	-	-	1	-	-	-	-
Pinnixa tomentosa	-	-	-	-	-	-	1	-	-
Pinnixa sp. (juv.)	-	3	-	-	1	-	-	1	-
Randalia ornata	-	-	-	-	-	1	-	-	-
Shrimp (unid.)	-	-	-	-	-	1	-	-	-
Pycnogonida									
Nymphon sp.	-	-	-	1	-	-	-	-	-
Echinodermata									
Asteroidea									
Astropecten sp. (juv.)	5	4	1	2	2	3	-	-	-
Echinoidea									
Lytechinus anemesus	-	1	-	-	-	-	-	-	-
Holothuroidea									
Holothuroid (unid.)	-	1	-	1	1	-	-	-	-

TABLE C.2-7 (Concluded)

Taxonomic Group	S4-1(6)[c]	-3(7)	-5(6)	N4-1(4)	-2(4)	-4(5)	G4-1(4)	-3(4)	-5(5)
	Replicate Number (Volume of Sample in Liters)								
Ophiuroidea									
Amphiodia digitata	-	-	-	1	-	5	-	2	-
Amphiodia occidentalis	1	2	2	-	1	3	1	-	-
Amphiodia cf. *psara*	3	4	2	-	1	-	-	-	-
Amphiodia urtica	-	-	-	-	-	1	-	-	1
Amphiodia sp. (juv.)	2	-	-	-	-	2	3	-	3
Hemichordata									
Hemichordates (unid.)	-	1	1	1	1	-	-	1	-

[a]See Figure 12.4-3 for station locations.

[b]Based on triplicate samples and sorted through a 1mm mesh screen.

[c]Three largest volume samples of each set of five collected.

TABLE C.2-8
INFAUNAL SPECIES

Locations: Station P, the site of Platform Gina at a depth of 95' and Station G5 on the 100' isobath of the Gilda pipeline route.[a]

Taxonomic Group	Replicate Number (Volume of Sample in Liters)[b]					
	P-2(4)[c]	-3(4)	-6(4)	G5-1(12)	-2(11)	-3(11)
Platyhelminthes						
Flatworm (unid.) "B"	-	-	1	-	-	-
Nemertina						
Carinoma mutabilis	-	-	1	-	1	-
Cerebratulus spp.	-	-	-	-	2	-
Micrura spp.	2	-	1	-	-	-
Nemertine (unid.) "A"	-	-	2	1	1	-
Nemertine (unid.) "B"	-	-	-	1	-	1
Nemertine (unid.) "D"	-	-	-	1	-	-
Paranemertes spp.	-	-	1	-	1	1
Tubulanus spp.	-	-	1	-	4	-
Cnidaria						
Anthozoa						
Anthozoan (unid.) "A"	-	-	-	2	-	-
Cerianthidae (unid.)	3	6	6	4	6	6
Edwarsia spp.	-	-	2	6	5	9
Phoronida						
Phoronis spp.	6	2	4	3	2	2
Brachiopoda						
Glottidia albida	2	4	1	2	4	3
Mollusca						
Pelecypoda						
Asthenothaerus villosior	-	-	-	2	1	-
Axinopsida serricata	1	1	-	1	-	1
Compsomyax subdiaphana	2	3	2	15	13	13
Cooperella subdiaphana	-	1	-	3	-	2
Crassinella sp. ("A")	1	-	-	-	-	-
Cyathodonta dubiosa	-	-	-	1	-	-
Ensis myrae	1	-	2	-	-	-
Gari edentala	-	-	-	1	-	-
Lepton meroeum	-	-	1	-	-	-
Lyonsia nesiotes	-	-	-	1	-	1
Macoma carlottensis	-	-	-	-	1	1
Macoma yoldiformis	5	4	7	5	3	3
Megacrenella columbiana	-	-	1	-	-	-
Modiolus neglectus	-	-	-	-	1	-
Mysella tumida	1	-	-	4	1	2
Nemocardium centifilosum	-	-	-	-	-	1
Nuculana taphria	3	10	5	3	3	8

TABLE C.2-8 (Continued)

Taxonomic Group	P-2(4)	-3(4)	-6(4)	G5-1(12)	-2(11)	-3(11)
	Replicate Number (Volume of Sample in Liters)					
Paramya sp. ("A")	-	-	-	2	-	-
Parvilucina tenuisculpta	113	100	93	81	77	74
Periploma discus	-	-	-	-	1	-
Solen rosaceus	1	-	-	-	-	-
Tellina carpenteri	-	-	-	15	12	8
Tellina idae	1	-	-	-	-	-
Tellina modesta	5	4	9	-	2	-
Gastropoda						
Acteocina culcitella	-	5	3	-	-	3
Acteocina exima	-	-	-	1	-	-
Aglaja diomedea	-	-	-	-	1	-
Balcis micans	-	-	-	1	-	-
Balcis rutila	-	-	-	1	-	-
Bittium larum	-	-	-	-	-	1
Bittium subplantum	-	5	-	-	-	-
Crepidula sp.	-	-	-	-	1	-
Epitonium sp.	-	-	-	-	1	-
Eulima raymondi	3	-	-	3	1	-
Gastropteron pacificum	-	-	-	1	-	-
Haminoea virescens	-	-	-	-	1	-
Kurtzia arteaga	-	3	-	-	-	-
Odostomia (Evalea) sp. ("E")	-	-	-	1	-	-
Rictaxis punctocoelata	-	3	1	-	-	1
Sulcoretusa xystrum	-	-	1	-	-	-
Turbonilla (Chemnitzia) sp. ("A")	1	1	-	-	-	-
Volvulella cylindrica	-	-	1	-	-	-
Volvulella panamica	-	3	-	3	2	-
Annelida						
Polychaeta						
Acesta catherinae	-	-	1	-	-	-
Amaeana occidentalis	-	-	1	-	-	-
Ampharete labrops	-	-	2	-	-	-
Ampharetidae (juv.)	-	-	-	-	1	-
Amphicteis scaphobranchiata	2	2	2	-	-	-
Anaitides groenlandica	2	1	1	-	-	-
Ancistrosyllis hamata	-	-	1	-	-	-
Apoprionospio pygmaea	2	-	1	-	-	-
Aricidea wassi	-	1	1	-	-	-
Asychis disparidentata	1	1	3	4	2	-
Axiothella rubrocincta	29	27	25	21	24	15
Brada pluribranchiata	5	1	5	-	3	4
Capitella capitata	-	-	-	1	2	-
Chaetopteridae (unid)	-	-	-	-	1	-
Chaetozone corona	1	-	-	1	1	1
Chone albocinata	3	1	1	-	-	-
Chone veleronis	4	2	4	-	-	-
Chone sp.	-	-	-	1	-	-
Cirratulidae (unid.)	-	-	-	1	3	-

TABLE C.2-8 (Continued)

Taxonomic Group	Replicate Number (Volume of Sample in Liters) P-2(4)	-3(4)	-6(4)	G5-1(12)	-2(11)	-3(11)
Cistena (Pectinaria) californiensis	11	5	4	15	5	6
Cossura candida	-	-	-	8	10	4
Diopatra tridentata	2	1	1	-	-	-
Diopatra sp. (juv.)	-	-	-	1	-	-
Dispio uncinata	-	1	-	-	-	-
Drilonereis falcata	-	-	-	1	1	-
Euchone hancocki	4	-	4	-	-	-
Euphrosine sp.	-	-	1	-	-	-
Eupolymnia congruens	1	2	1	-	-	-
Exogone gemmifera	2	-	2	1	1	-
Glycera branchiopoda	1	-	-	-	1	2
Glycinde armigera	3	-	-	-	-	-
Goniada brunnea	-	1	1	-	-	-
Goniada maculata	-	-	-	1	1	1
Gyptis brevipalpa	-	-	-	1	1	-
Haploscoloplos elongatus	-	-	1	-	-	-
Harmothoe priops	-	-	4	4	4	-
Hesperonoe sp.	1	-	-	-	-	1
Lumbrineris californiensis	-	-	2	-	-	4
Lumbrineris sp. ("D")	-	-	1	1	-	-
Lumbrineris sp.	-	-	1	1	1	-
Magelona pitelkae	-	-	1	-	1	2
Marphysa belli oculata	-	-	-	-	1	2
Mediomastus californiensis	2	1	4	1	5	7
Megalomma circumspectum	2	1	1	-	-	-
Melinna oculata	-	-	1	-	-	-
Minuspio cirrifera	-	-	1	-	3	1
Nephtys caecoides	1	1	1	1	-	-
Nephtys ferruginea	-	-	2	1	-	-
Nephtys parva	2	-	-	-	-	-
Nephtys sp. (juv.)	1	-	5	1	-	1
Nereis procera	2	-	-	3	4	3
Nereis sp.	-	1	-	-	-	-
Nothria iridescens	1	-	-	-	1	-
Nothria pallida	-	-	1	-	-	-
Onuphis nebulosa	1	5	3	-	-	-
Onuphidae (juv.)	-	-	1	-	-	-
Owenia fusiformis collaris	1	-	1	-	-	-
Paraprionospio pinnata	2	3	16	5	3	1
Pholoe glabra	-	-	-	-	-	3
Phyllodoce hartmannae	1	8	4	-	1	-
Phyllodoce papillosa	-	-	1	-	-	-
Phyllodocidae (unid.) "A"	-	1	-	-	-	-
Phyllodocidae (unid.) "B"	-	1	-	-	-	-
Pista vasciata	3	-	-	-	-	-
Poecilochaetus johnsoni	-	-	-	1	1	-

TABLE C.2-8 (Continued)

Taxonomic Group	P-2(4)	-3(4)	-6(4)	G5-1(12)	-2(11)	-3(11)
	Replicate Number (Volume of Sample in Liters)					
Polydora sp.	4	-	-	1	-	-
Prionospio steenstrupi	-	-	-	-	3	-
Sigambra tentacalata	-	-	-	-	1	2
Spiochaetopterus costarum	3	-	2	-	-	-
Spiophanes berkeleyorum	26	30	21	1	2	10
Spiophanes missionensis	-	-	2	-	-	-
Sternaspis fossor	2	1	-	6	8	8
Sthenelanella uniformis	5	1	1	3	3	5
Sthenolepis fimbrianrum	-	-	-	2	7	-
Tauberia gracilis	-	1	5	1	1	2
Terebellidae (juv.)	1	-	-	1	1	-
Terebellides stroemii	1	-	-	4	2	4
Tharyx tesselata	-	2	2	-	-	-
Tharyx sp.	1	-	-	-	-	3
Hirudinea						
Leech (unid.)	-	1	-	-	-	-
Sipunculida						
Sipunculid (unid.)	-	-	-	1	-	2
Echiurida						
Listriolobus pelodes	-	-	-	4	2	1
Arthropoda						
Crustacea						
Ostracoda						
Bathyleberis californica	-	-	-	1	1	2
Euphilomedes carcharodonta	15	16	10	43	41	47
Parasterope barnesi	1	2	-	-	-	-
Rutiderma rostrata	-	-	2	-	-	-
Nebaliacea						
Nebalia pugettensis	-	-	1	-	-	-
Mysidacea						
Acanthomysis nephrophthalma	-	-	-	1	2	1
Neomysis kadakiensis	-	-	-	-	1	-
Cumacea						
Anchicolorus occidentalis	1	-	-	-	-	-
Diastylis californica	-	-	-	-	-	2
Hemilamprops californica	-	2	1	-	-	-
Leptostylis sp. ("B")	-	-	-	2	-	-
Leucon subnasica	-	-	-	-	1	-
Oxyurostylis pacifica	1	-	-	-	-	-
Isopoda						
Gnathia crenulatifrons	1	2	2	1	6	3
Haliophasma geminata	-	2	5	-	2	-
Munnogonium erratum	1	-	-	-	-	-
Tanaidacea						
Leptochelia frequens	3	-	2	1	2	1

TABLE C.2-8 (Concluded)

Taxonomic Group	Replicate Number (Volume of Sample in Liters) P-2(4)	-3(4)	-6(4)	G5-1(12)	-2(11)	-3(11)
Amphipoda						
Acidostoma hancocki	-	1	-	-	1	-
Ampelisca brevisimulata	12	3	6	3	9	3
Ampelisca compressa	-	3	1	-	1	-
Ampelisca cristata	4	2	4	2	-	3
Ampelisca pugetica	-	-	-	1	1	1
Amphideutopus oculatus	2	1	4	20	17	19
Aorides columbiae	-	-	-	-	1	-
Argissa hamatipes	3	-	-	-	1	-
Byblis veleronis	-	-	-	-	3	-
Caprella equilibra	-	-	1	-	-	-
Gaviota podophthalma	11	2	4	-	-	-
Hippomedon zetesimus	1	-	-	-	-	-
Listriella eriopisa	-	-	-	1	1	-
Listriella goleta	-	-	-	2	5	5
Mayerella banksia	1	-	3	-	3	-
Metaphoxus frequens	2	-	2	-	-	-
Orchomene holmesi	-	-	1	-	-	-
Paraphoxus cognatus	1	-	-	-	2	2
Paraphoxus spinosus	2	-	2	-	-	-
Photis brevipes	-	-	-	1	2	1
Photis sp. (juv.)	1	-	2	-	-	-
Rudilemboides stenopropodus	1	-	-	-	-	-
Synchelidium sp.	3	2	3	-	1	1
Trichophoxus bicuspidatus	-	-	-	5	2	1
Trichophoxus epistomus	1	-	5	-	-	-
Trichophoxus stenodes	3	1	1	2	-	-
Westwoodilla caecula	1	1	1	2	2	2
Decapoda						
Callianassa sp. (juv.)	-	-	-	-	1	-
Cancer sp. (juv.)	-	-	-	-	1	-
Heterocrypta occidentalis	1	-	-	-	-	-
Pinnixa tomentosa	1	1	-	-	-	-
Pinnixa sp. (juv.)	-	-	1	-	1	-
Echinodermata						
Asteroidea						
Astropecten sp. (juv.)	8	-	6	1	-	-
Echinoidea						
Lytechinus anemesus	4	2	-	-	-	-
Holothuroidea						
Holothuroid (unid.)	-	1	-	-	-	-
Molpadidae (unid.)	-	-	-	1	-	-
Ophiuroidea						
Amphiodia digitalis	-	3	-	1	2	11
Amphiodia occidentalis	-	8	1	3	2	2
Amphiodia cf. *psara*	5	-	-	-	-	-
Amphiodia urtica	3	-	-	12	14	9
Amphiodia sp. (juv.)	1	4	1	12	25	14
Hemichordata						
Hemichordates (unid.)	1	1	1	-	-	-

[a]See Figure 12.4-3 for station locations.

[b]Based on triplicate samples and sorted through a 1mm mesh screen.

[c]Three largest volume samples of each set of five collected.

TABLE C.2-9
INFAUNAL SPECIES

Locations: Station G6 on the 150' isobath of the Gilda pipeline route and Station P2 at the Platform Gilda site at a depth of 200'[a]

Taxonomic Group	Replicate Number (Volume of Sample in Liters)[b] B6-1(10)[c]	-2(9)	-4(10)	P2-2(9)	-3(8)	-4(8)
Platyhelminthes						
Flatworm (unid.) "C"	1	-	2	1	-	-
Nemertina						
Cerebratulus spp.	-	-	-	-	-	1
Lineus bilineatus	-	-	-	-	1	-
Nemertine (unid.) "B"	-	-	3	2	2	1
Nemertine (unid.) "G"	1	-	3	-	1	-
Paranemertes spp.	-	-	6	1	-	-
Tubulanus spp.	2	3	-	-	1	4
Cnidaria						
Anthozoa						
Cerianthidae (unid.)	1	3	3	2	-	2
Edwarsia spp.	2	1	4	-	1	2
Phoronida						
Phoronis spp.	-	1	1	4	5	2
Brachiopoda						
Glottidia albida	-	1	-	-	-	-
Mollusca						
Pelecypoda						
Asthenothaerus villosior	-	1	-	-	-	-
Axinopsida serricata	4	9	4	6	6	5
Compsomyax subdiaphana	2	2	1	-	-	-
Cooperella subdiaphana	1	-	-	-	-	-
Cyclocardia ventricosa	-	-	-	3	9	6
Felaniella ? sp.	-	-	1	-	-	-
Lepton meroeum	-	-	-	-	1	-
Macoma yoldiformis	1	-	-	-	-	-
Macoma sp.	-	-	1	-	-	-
Mysella tumida	10	28	18	14	13	3
Nemocardium centifilosum	-	1	3	-	-	1
Nuculana taphria	-	-	2	-	-	-
Paramya sp. ("A")	-	5	2	27	16	11
Parvilucina tenuisculpta	16	31	19	6	2	4
Periploma discus						
Psephidia cymata	1	-	1	-	-	-
Tellina carpenteri	8	5	9	1	1	2
Gastropoda						
Acteocina culcitella	-	-	-	-	3	-
Acteocina harpa	-	-	1	-	-	-

TABLE C.2-9 (Continued)

Taxonomic Group	Replicate Number (Volume of Sample in Liters) P-2(4)	-3(4)	-6(4)	G5-1(12)	-2(11)	-3(11)
Admete rhyssa	-	-	-	-	1	-
Alia carinata	-	-	-	-	3	-
Bittium fetellum	-	-	-	-	3	-
Bittium larum	-	-	1	-	-	-
Bittium quadrifilatum	-	9	-	-	-	-
Cylichna attonsa	-	-	1	-	-	1
Epitonium sp.	-	-	-	-	1	-
Gastropteron pacificum	-	1	-	-	-	-
Kurtziella beta	4	15	6	4	7	-
Kurtziella sp.	-	-	-	-	1	-
Odostomia (Chrysallida) sp. ("A")	-	-	-	-	1	-
Odostomia (Evalea) sp. ("A")	-	-	-	-	1	-
Odostomia (Evalea) sp. ("D")	-	-	-	-	1	-
Pseudomelatoma sp.	-	1	-	-	-	-
Volvulella californica	-	-	1	-	-	-
Volvulella panamica	2	6	8	5	5	-
Annelida						
Polychaeta						
Aglaophamus dicirrus	-	1	1	-	1	2
Allia ramosa	-	-	1	-	-	-
Amaeana occidentalis	-	2	-	-	-	-
Ampharete goesi	-	-	-	2	1	1
Ampharete labrops	1	-	-	-	-	-
Ampharete sp.	-	-	-	1	-	-
Ampharididae (juv.)	-	-	1	-	-	-
Apoprionospio pygmaea	1	-	-	1	-	3
Axiothella rubrocincta	1	3	-	5	-	-
Capitella capitata	-	-	-	-	-	1
Ceratocephala crosslandi americana	2	-	1	-	1	-
Chaetopteridae (unid.)	1	-	-	-	-	-
Chloeia pinnata	-	5	4	14	4	13
Cirratulidae (unid.)	2	1	2	-	-	-
Cistena (Pectinaria) californiensis	54	43	67	20	25	17
Cossura candida	3	-	6	3	5	4
Diopatra tridentata	1	-	-	-	-	-
Drilonereis falcata	-	-	-	-	1	-
Drilonereis sp.	-	-	1	-	-	-
Euchone hancocki	-	-	-	-	1	-
Eunoe ? sp.	-	-	-	-	-	1
Glycera americana	-	-	-	-	-	1
Glycera branchiopoda	2	4	6	5	2	3
Glycera sp. (juv.)	1	2	-	-	-	-
Goniada maculata	2	-	1	-	-	1
Goniada sp.	-	-	-	1	1	-
Gyptis brevipalpa	1	1	2	-	1	-
Haploscoloplos elongatus	1	-	7	-	-	-

TABLE C.2-9 (Continued)

Taxonomic Group	Replicate Number (Volume of Sample in Liters)					
	P-2(4)	-3(4)	-6(4)	G5-1(12)	-2(11)	-3(11)
Harmothoe lunulata	-	2	-	3	2	3
Harmothoe priops	1	2	4	-	1	-
Harmothoe sp.	-	-	-	-	4	1
Hesperonoe sp. ("A")	-	-	-	2	-	-
Isocirrus campanula	-	-	-	1	-	-
Laonice cirrata	-	-	1	-	-	-
Lumbrineris californiensis	-	-	-	9	9	-
Lumbrineris sp. ("D")	2	-	-	-	-	3
Lumbrieneris sp.	-	2	-	2	6	5
Magelona nr. pacifica	3	2	1	-	-	-
Maldane cristata	-	-	-	1	-	-
Maldane sarsi	1	-	-	-	-	-
Marphysa belli oculata	1	-	-	-	-	-
Mediomestus californiensis	4	3	22	-	7	4
Minuspio cirrifera	-	6	20	5	17	1
Nephtys caecoides	-	-	1	-	-	-
Nephtys ferruginea	2	1	-	-	2	-
Nephtys sp. (juv.)	-	-	4	-	-	-
Nereis procera	-	1	-	-	-	-
Nereis sp.	-	-	1	-	-	-
Ninoe gemmea	-	-	-	-	-	2
Ophelina acuminata	-	-	1	-	-	-
Paraprionospio pinnata	2	1	1	2	1	3
Perinereis sp.	-	1	-	-	-	-
Pholoe glabra	-	-	-	-	2	8
Phyllodoce hartmannae	-	1	-	-	-	-
Phyllodoce papillosa	-	-	-	2	1	1
Pista vasciata	-	1	-	-	-	-
Poecilochaetus johnsoni	1	-	-	1	-	-
Polydora sp.	-	-	-	1	-	-
Prionospio steenstrupi	2	-	-	1	1	-
Scalibregma inflatum	-	-	-	1	-	-
Scolelepis ? squamata	-	-	-	1	-	-
Scolelepis sp.	-	-	1	-	-	-
Sigambra tentacalata	1	8	3	-	1	-
Sphaerodoropsis (?) sphaerulifer	-	-	-	-	1	1
Spio punctata	-	-	-	-	-	2
Spiochaetopterus costarum	-	-	-	-	1	-
Spionidae (unid.)	-	-	-	-	1	-
Spiophanes berkeleyorum	3	3	2	16	10	11
Spiophanes bombyx	-	-	-	-	1	-
Sternaspis fossor	7	2	4	5	2	-
Sthenelanella uniformis	-	1	-	-	-	-
Sthenolepis fimbrianrum	3	7	9	-	-	-

TABLE C.2-9 (Continued)

Taxonomic Group	P-2(4)	-3(4)	-6(4)	G5-1(12)	-2(11)	-3(11)
	Replicate Number (Volume of Sample in Liters)					
Tauberia gracilis	2	-	5	1	6	2
Terebellides stroemii	3	3	3	1	2	3
Tharyx sp.	-	-	-	2	4	1
Sipunculida						
Sipunculid (unid.)	-	-	-	1	2	-
Echiurida						
Listriolobus pelodes	1	4	1	4	7	4
Arthropoda						
Crustacea						
Ostracoda						
Bathyleberis californica	-	-	3	1	1	1
Euphilomedes carcharodonta	94	78	121	31	17	17
Euphilomedes producta	10	26	15	95	97	68
Rutiderma lomae	-	3	2	2	-	-
Sarsiella sp. ("A"(	-	1	-	-	-	-
Nebaliacea						
Nebalia pugettensis	-	-	-	1	-	-
Mysidacea						
Acanthomysis nephrophthalma	1	-	-	-	-	-
Cumacea						
Cumella sp.	-	-	2	-	-	-
Diastylis californica	-	-	-	1	-	-
Eudorella pacifica	2	5	10	5	7	2
Hemilamprops californica	-	-	-	1	-	-
Leptostylis sp. ("B")	1	-	3	6	2	-
Leucon subnasica	-	4	8	14	1	2
Isopoda						
Gnathia crenulatifrons	-	4	2	4	2	-
Haliophasma geminata	-	1	-	1	-	1
Munnogonium tillerae	-	-	1	-	-	-
Tanaidacea						
Leptochelia sp.	-	1	2	3	1	-
Amphipoda						
Ampelisca brevisimulata	3	3	3	4	7	2
Ampelisca compressa	1	1	1	-	3	-
Ampelisca macrocephala	-	-	-	-	1	2
Ampelisca pugetica	-	3	2	-	-	-
Ampelisca shoemakeri	-	-	-	1	-	1
Amphideutopus oculatus	2	8	14	1	-	-
Aorides columbiae	2	2	2	-	2	-
Byblis veleronis	-	-	1	1	2	1
Corophium baconi	-	1	-	-	-	-
Heterophoxus oculatus	4	8	7	4	5	5
Listriella goleta	1	-	2	4	-	-
Lysianassa oculata	-	-	-	-	1	-

TABLE C.2-9 (Concluded)

Taxonomic Group	P-2(4)	-3(4)	-6(4)	G5-1(12)	-2(11)	-3(11)
	Replicate Number (Volume of Sample in Liters)					
Mayerella banksia	-	-	-	-	-	1
Metaphoxus frequens	-	-	-	1	-	-
Monoculodes cf. *hartmannae*	-	-	-	1	-	-
Paraphoxus csimilis	1	-	-	-	-	2
Photis bifurcata	1	3	7	3	3	2
Photis cf. *conchicola*	-	-	-	8	-	11
Rudilemboides stenopropodus	2	-	-	-	-	-
Synchelidium sp.	1	1	1	3	-	-
Trichophoxus bicuspidatus	4	10	12	5	6	5
Tritella pilimana	-	-	-	-	-	1
Westwoodilla caecula	1	1	-	-	-	-
Decapoda						
Callianassa sp. (juv.)	-	2	-	-	-	-
Pinnixa franciscana	2	1	1	-	-	-
Pinnixa occidentalis	1	-	-	1	1	1
Pinnixa tomentosa	-	1	-	-	-	-
Pinnixa spp. (juv.)	7	1	1	2	-	-
Echinodermata						
Holothuroidea						
Molpadidae (unid.)	-	-	-	-	1	-
Ophiuroidea						
Amphiodia digitalis	2	1	-	-	-	-
Amphiodia occidentalis	5	8	2	1	2	1
Amphiodia urtica	29	56	49	42	56	54
Amphiodia spp. (juv.)	59	75	66	59	95	56
Hemichordata						
Hemichordates (unid.)	2	-	1	3	-	1

[a]See Figure 12.4-3 for station locations.

[b]Based on triplicate samples and sorted through a 1mm mesh screen.

[c]Three largest volume samples of each set of five collected.

TABLE C.2-10

PLANKTON VOLUMES

- Average monthly CalCOFI plankton volume[a] is in the area off southern California and adjacent northern Baja California for January through July, and October, 1951-60 (Thrailkill, 1969).
- Median monthly plankton volumes in pooled CalCOFI area 8.4 for January through July, and October 1951-60 (Smith, 1971).

	Year	Jan cc[b]	Feb cc	Mar cc	Apr cc	May cc	Jun cc	Jul cc	Oct cc
a. region bounded by lines 80 - 107									
	1951-56 ave.	163	193	166	185	264	362	514	137
	1951	198	140	98	133	143	187	70	68
	1952	109	317	205	151	152	228	234	130
	1953	122	150	247	231	448	621	1369	129
	1954	97	199	144	134	193	331	255	147
	1955	102	157	135	195	230	353	350	114
	1956	351	195	169	264	420	453	808	234
	1957	--	267	424	518	188	134	128	87
	1958	61	53	72	62	90	91	97	36
	1959	37	41	31	62	63	100	102	111
	1960	81	132	186	158	374	239	86	92
b. pooled area 8.4 (median volumes),									
	1951-60	63	114	121	221	234	210	166	94

[a]Volume of smaller organisms after removal of larger (5cc individual volume) organisms, such as cnidarians, squid, salps, pyrosomes, larger molluscs, and larger crustaceans.

[b]per 1000 m^3

TABLE C.2-11

MACROZOOPLANKTON FROM THE HUENEME SHELF AREA

FISH LARVAE

- *Bathylagus ochotensis*
- *Bathylagus wesethi*
- *Citharichthys* spp.
- *Citharichthys stigmaeus*
- *Engraulis mordax*
- *Glyptocephalus zachirus*
- *Leuroglossus stilbius*
- *Lyopsetta exilis*
- *Paralichthys californicus*
- *Parophrys vetulus*
- *Pleuronichthys* spp.
- *Sardinops caerulea*
- *Sebastes* spp.
- *Stenobrachius leucopsarus*
- *Trachurus symmetricus*
- *Triphoturus mexicanus*
- *Vinciguerria lucetia*

EUPHAUSIACEA

- *Euphausia eximia*
- *Euphausia gibboides*
- *Euphausia pacifica*
- *Euphausia recurva*
- *Nematoscelis difficilis*
- *Nyctiphanes simplex*
- *Stylocheiron abbreviatum*
- *Stylocheiron affine*
- *Stylocheiron longicorne*
- *Stylocheiron maximum*
- *Thysanoessa gregaria*
- *Thysaneossa spinifera*

CALANOID COPEPODS

- *Acartia danae*
- *Acartia tonsa*
- *Artideus armatus*
- *Calanus gracilis*
- *Calanus helgolandicus*
- *Calanus lighti*
- *Calanus minor*
- *Calanus pacificus*
- *Calanus tenuicornis*
- *Calocalanus stylieremis*
- *Candacia aethiopic*
- *Candacia bipinnata*
- *Candacia curta*
- *Centropages bradyi*
- *Clausocalanus arcuicornis*
- *Clausocalanus farrani*

TABLE C.2-11 (Continued)

CALANOID COPEPODS (Concluded)

Clausocalanus paululus
Clausocalanus pergenes
Ctenocalanus vanus
Euaetideus acutus
Euaetideus bradyi
Eucalanus attenuatus
Eucalanus bungi californicus
Eucalanus crassus
Eucalanus longatus hyalinus
Euchaeta spp.
Euchaeta acuta
Euchaeta media
Euchirella galeata
Euchirella pulchra
Gaidius pungens
Haloptilus longicornis
Heterorhabdus papilliger
Labidocera trispinosa
Lucicutia flavicornis
Mecynocera clausi
Metridia lucens
Metridia pacifica
Palacalanus parvus
Pleuromamma abdominalis
Pleuromamma borealis
Pleuromamma gracilis
Pleuromamma piseki
Pleuromamma xiphias
Pontellopsis occidentalis
Racovitzanus antarcticus
Rhincalanus nasutus
Scalphocalanus echinatus
Solecithariacella abyssalis
Solecithariacella dentata
Solecithariacella ovata
Scolecithrix bradyi
Scolecithrix danae
Scottocalanus persecans
Temora discaudata
Undeuchaeta intemedia

CHAETOGNATHS

Pterosagitta draco
Sagitta bierii
Sagitta bipunctata
Sagitta enflata
Sagitta euneritica
Sagitta hexaptera
Sagitta minima
Sagitta scrippsae
Sagitta posendoserratodentata

TABLE C.2-11 (Concluded)

PELAGIC MOLLUSCS
- *Atlanta* sp.
- *Atlanta peroni*
- *Carinaria japonica*
- *Cavolina inflexa*
- *Clio pyrimidata*
- *Creseis virgula*
- *Desmopterus pacificus*
- *Limacina helicina*
- *Limacina inflata*
- *Limacina lesueri*
- *Peraclis* sp.

THALIACEANS
- *Cyclosalpa bakeri*
- *Dolioletta gegenbauri*
- *Doliolina mulleri*
- *Doliolum denticulatum*
- *Pagea confoederata*
- *Salpa fusiformis*
- *Thalia democratica*

Data from Fleminger, 1964; Alvarina, 1965; Fleminger, 1967; McGowan, 1967; Brinton, 1967; Berner, 1967, Kramer and Ahlstrom, 1968; Ahlstrom, 1969; Kramer, 1970; Alhstrom, 1972; Bowman and Johnson, 1973, Brinton, 1973; Ahlstrom and Moser, 1975; Brinton and Wyllie, 1976; Ahlstrom et. al., 1978.

TABLE C.2-12

ZOOPLANKTON ABUNDANCE

ORGANISM	SURFACE	OBLIQUE	EPIBENTHIC
ORMOND BEACH ALTERNATIVE PIPELINE ROUTE STATION 2			
ECTOPROCTA			
Cyphonautes Larvae	715.32 ± 245.22[a]	700.84 ± 126.71	80.02 ± 78.52
ARTHROPODA			
CRUSTACEA			
Copepoda			
Calanoida			
Acartia tonsa	703.20 ± 362.91	348.48 ± 380.78	208.79 ± 40.95
Clausocalanus spp.	16.19 ± 21.91	8.22 ± 7.75	199.46 ± 116.50
Paracalanus parvus	62.39 ± 2.98	97.76 ± 21.50	111.71 ± 11.93
Cyclopoida			
Corycaeus anglicus	39.73 ± 0.66	27.69 ± 6.78	91.56 ± 19.91
CHAETOGNATHA			
Sagitta euneritica	16.21 ± 1.12	5.39 ± 0.45	24.88 ± 1.60
CHORDATA			
UROCHORDATA			
Thaliacea			
Doliolids, unidentified	34.53 ± 0.74	13.46 ± 4.45	2.85 ± 1.69
VERTEBRATA			
Pisces			
Gobiidae Type D	0	0	0.05 ± 0.06
Gobiidae unidentified	0	0	0
Engraulis mordax	0.02 ± 0.02	0.03 ± 0	0.05 ± 0.06
Paralabrax spp.	0	0	0
Seriphus politus	0	0	0
Triphoturus mexicanus	0	0.04 ± 0.05	0
Unidentified damaged larvae	0.02 ± 0.02	0	0.05 ± 0.06
Engraulis mordax eggs	0.20 ± 0.02	0.22 ± 0.02	0
Unidentified eggs	3.10 ± 0.85	6.38 ± 2.35	0.49 ± 0.29
OTHER ZOOPLANKTON	54.10 ± 36.02	52.09 ± 48.20	57.76 ± 5.83
TOTAL ZOOPLANKTON	1645.41 ± 658.84	1260.35 ± 594.19	776.46 ± 211.76

TABLE C.2-12 (Continued)

ORGANISM	SURFACE	OBLIQUE	EPIBENTHIC
PLATFORM GINA LOCATION			
ECTOPROCTA			
Cyphonautes larvae	0.24 ± 0.22	24.26 ± 26.47	1.21 ± 0.30
ARTHROPODA			
CRUSTACEA			
Copepoda			
Calanoida			
Acartia tonsa	61.32 ± 3.15	59.08 ± 16.98	64.16 ± 61.45
Clausocalanus spp.	19.26 ± 25.80	124.16 ± 18.34	134.75 ± 2.94
Paracalanus parvus	35.39 ± 4.49	100.05 ± 5.45	6.16 ± 4.80
Cyclopoida			
Corycaeus anglicus	24.33 ± 12.39	49.52 ± 12.46	82.96 ± 15.17
CHAETOGNATHA			
Sagitta euneritica	5.28 ± 4.77	145.04 ± 60.40	65.57 ± 17.76
CHORDATA			
UROCHORDATA			
Thaliacea			
Doliolids, unidentified	7.70 ± 7.33	97.35 ± 47.93	0.99 ± 0.56
VERTEBRATA			
Pisces			
Gobiidae Type D	0	0	0
Gobiidae unidentified	0.02 ± 0.03	0	0
Engraulis mordax	0	0.28 ± 0.11	0
Paralabrax spp.	0.02 ± 0.02	0.08 ± 0.01	0
Seriphus politus	0	0	0
Triphoturus mexicanus	0	0	0
Unidentified damaged larvae	0	0	0
Engraulis mordax eggs	0.06 ± 0.08	0	0.06 ± 0.08
Unidentified eggs	0.07 ± 0.10	0.04 ± 0	0.18 ± 0.25
OTHER ZOOPLANKTON	15.03 ± 1.53	45.80 ± 13.42	11.47 ± 2.20
TOTAL ZOOPLANKTON	168.62 ± 50.57	643.88 ± 84.56	367.48 ± 63.76

TABLE C.2-[illegible] (Concluded)

ORGANISM	SURFACE	OBLIQUE	EPIBENTHIC
MANDALAY PIPELINE ROUTE STATION 2			
ECTOPROCTA			
Cyphonautes larvae	1.59 ± 0.58	0.97 ± 0.18	5.64 ± 6.05
ARTHROPODA			
CRUSTACEA			
Copepoda			
Calanoida			
Acartia tonsa	560.22 ± 2.55	903.29 ± 371.66	7654.21 ± 7986.04
Clausocalanus spp.	7.53 ± 7.60	2.10 ± 2.29	147.45 ± 96.65
Paracalanus parvus	75.79 ± 34.45	58.38 ± 18.84	424.50 ± 146.39
Cyclopoida			
Corycaeus anglicus	44.83 ± 13.86	12.56 ± 9.65	212.16 ± 57.09
CHAETOGNATHA			
Sagitta euneritica	4.85 ± 0.38	5.24 ± 2.85	129.12 ± 77.12
CHORDATA			
UROCHORDATA			
Thaliacea			
Doliolids, unidentified	0	0.03 ± 0	0.09 ± 0.13
VERTEBRATA			
Pisces			
Gobiidae Type D	0	0	0
Gobiidae unidentified	0	0	0
Engraulis mordax	0	0	0.05 ± 0.06
Paralabrax spp.	0	0	0
Seriphus politus	0	0	0.09 ± 0.13
Triphoturus mexicanus	0	0	0
Unidentified damaged larvae	0	0	0
Engraulis mordax eggs	0.32 ± 0.11	0.39 ± 0.01	0.05 ± 0.06
Unidentified eggs	1.79 ± 0.25	1.16 ± 0.18	0.27 ± 0.13
OTHER ZOOPLANKTON	13.57 ± 3.08	5.20 ± 3.39	25.36 ± 2.49
TOTAL ZOOPLANKTON	712.53 ± 52.46	989.31 ± 402.27	8572.73 ± 8389.95

[a] Mean number of individuals per cubic meter ± standard deviation for taxa comprising 95 percent of the biomass and for ichthyoplankton.

TABLE C.2-13

ZOOPLANKTON ABUNDANCE, PLATFORM GILDA SITE

ORGANISM	SURFACE	OBLIQUE
PROTOZOA		
Foraminifera	13.74 ± 1.03[a]	27.84 ± 14.08
COELENTERATA		
Medusae, unidentified	20.26 ± 9.81	23.63 ± 5.03
Siphonophora	14.04 ± 7.39	16.94 ± 3.30
ECTOPROCTA		
Cyphonautes larvae	0.71 ± 0.47	15.30 ± 0.26
ARTHROPODA		
CRUSTACEA		
Cladocera		
Evadne nordmanni	12.35 ± 4.71	6.48 ± 1.05
Evadne spinifera	29.72 ± 8.10	7.32 ± 1.60
Penilia avirostris	8.56 ± 8.02	86.23 ± 32.89
Copepoda		
Calanoida		
Acartia danae	0.25 ± 0.35	14.06 ± 8.34
Acartia tonsa	5.09 ± 2.22	2.93 ± 0.35
Calanus spp.	0.16 ± 0.02	36.16 ± 4.90
Clausocalanus spp.	14.82 ± 5.98	150.86 ± 3.21
Paracalanus parvus	3.12 ± 2.75	1.48 ± 0.54
Pleuromama spp.	0	18.44 ± 5.06
Pontellids, unidentified	2.27 ± 1.39	0.42 ± 0.08
Cyclopoida		
Coryceaus spp.	87.78 ± 19.45	35.29 ± 4.65
Oithona plumifera	0.09 ± 0.01	21.94 ± 4.49
CHAETOGNATHA		
Sagitta euneritica	11.91 ± 4.99	129.28 ± 1.02
CHORDATA		
UROCHORDATA		
Thaliacea		
Doliolids, unidentified	110.04 ± 43.92	231.28 ± 1.02
Larvacea		
Oikopleura spp.	12.62 ± 10.12	115.14 ± 65.88

TABLE C.2-13 (Concluded)

ORGANISM	SURFACE	OBLIQUE
VERTEBRATA		
PISCES		
Engraulis mordax	1.50 ± 2.12	7.5 ± 0.71
Pleuronichthys sp.	0.50 ± 0.71	0
Sebastes type II	0.50 ± 0.71	0
Unidentified yolk sac larvae	0	0.50 ± 0.71
Engraulis mordax eggs	0	0.16 ± 0.22
Unidentified fish eggs	20.00 ± 2.71	3.30 ± 0.10
OTHER ZOOPLANKTON	18.69 ± 8.50	29.28 ± 10.09
TOTAL ZOOPLANKTON	385.75 ± 133.88	991.60 ± 34.75

[a]Mean number of individuals per cubic meter ± standard deviation for taxa comprising 95 percent of biomass and for ichthyoplankton.

TABLE C.2-14

ADDITIONAL ZOOPLANKTON TAXA, SEPTEMBER 1979

PLATFORM GILDA SITE

CTENOPHORA
- *Pleurobrachia bachei*

MOLLUSCA
- Gastropod veligers
- Lamellibranch veligers

Annelida
- Polychaete larvae

ARTHROPODA
- CRUSTACEA
  - Ostracoda
  - Copepoda
    - Calanoida
      - *Eucalanus* spp.
      - *Labiodocera trispinosa*
      - *Lucicutia flavicornis*
      - *Rhincalanus nasutus*
      - *Candacia* spp.
      - *Calocalanus* spp.
      - unid. calanoids
    - Cyclopoida
      - *Oncea* spp.
      - unid. cyclopoids
    - Harpacticoida
      - unid. harpacticoids
    - Cumacea
      - unid. cumaceans
    - Other Crustacea
      - Cirripedia larvae
      - Cypris larvae
      - Amphipoda
      - Isopoda
      - Zoea larvae
      - Euphausia larvae

ECHINODERMATA
- Unid. larvae

TABLE C.2-15

ADDITIONAL ZOOPLANKTON TAXA, AUGUST 1979

PLATFORM GINA STATIONS[a]

ANNELIDA
- Polychaete larvae

ARTHROPODA
- CRUSTACEA
  - Cladocera
    - *Evadne nordmanni*
  - Ostracoda
  - Copepoda
    - Calanoida
      - *Acartia clausi*
      - *Calanus pacificus*
      - *Eucalanus* spp.
      - *Labidocera jollae*
      - *Labidocera trispinosa*
      - *Lucicutia flavicornis*
      - *Rhincalanus nasutus*
      - unid. calanoids
  - Cyclopoida
    - *Oithona plumifera*
    - *Oncea media*
    - unid. cyclopoids
  - Harpacticoida
    - *Euterpina acutifrons*
    - unid. harpacticoids
  - Mysidacea
    - unid. mysids
  - Cumacea
    - unid. cumaceans
  - Other Crustacea
    - Cirripedia larvae
    - Amphipoda
    - Isopoda
    - Megalopa larvae
    - Zoea larvae
    - Euphausia larvae

CHORDATA
- UROCHORDATA
  - unid. salps
  - *Oikopleura* spp.

COELENTERATA
- Medusae
- Siphonophora

ECHINODERMATA
- unid. larvae

MOLLUSCA
- Gastropod veligers
- Lamellibranch veligers

[a]See Table C.2-12 for stations.

APPENDIX C.3

TERRESTRIAL BIOLOGY

INVESTIGATIVE PROCEDURE

Botanical and faunal surveys of the project area, proposed and alternative sites, and associated pipeline corridors were conducted on 16 and 17 August 1979. Additional reconnaissance of the proposed and alternative sites was conducted on 15 September 1979.

Vegetation was categorized and mapped on the basis of physical environmental factors and species associations. Taxonomic identifications of and flowering plants were made, as well as for dead or flowerless specimens whenever possible. Garden plants and landscape species occurring in urban areas were not included in this investigation. Considering the types of vegetation involved, only a few species are expected to occur in other seasons of the year.

During the field surveys, animal habitats were systematically explored, and all animals (or their signs) observed were identified. Subsequently, species lists were prepared including both observed and expected amphibian, reptile, bird, and mammal species. These lists are based on: the field survey observations; available literature; professional contacts; data from the Los Angeles and San Fernando chapters of the Audubon Society; and, Dames & Moore in-house reports and files.

Limnological surveys were conducted at McGrath Lake and the Santa Clara River mouth on 27 and 29 August 1979. Water samples were taken with a Van Doren bottle, and the following analyses were performed:

Parameter	Instrument
Transparency	Secchi Disc
Dissolved Oxygen	Yellow Springs Instrument Y51; Model 51A
pH	Marksen Science, Inc. Model 85 pH meter
Temperature, Conductivity, and Salinity	Hach conductivity meter; Model 2200

Three stations were established at McGrath Lake (Figure 12.5-2) and samples were taken at each station (8 a.m., 1 p.m., 5 p.m., and 9 p.m.). Temperature, conductivity, salinity, and pH were measured during each of the four periods. Transparency was not measured after dark (9 p.m.). Dissolved oxygen was measured at stations 1 and 2 during the 8 a.m. period only.

A visual survey of the lake was also conducted to determine the composition and distribution of the invertebrate faunal species. Sampling was performed with a fine-mesh dip net at several locations along the perimeter of the lake. The distribution of aquatic plant species was also noted.

Water and invertebrate faunal sampling was also conducted at the Santa Clara River mouth (Figure 12.5-2). Water samples were taken at 3 p.m. at various locations within the river, and the pH, temperature, conductivity, and salinity of each were measured. Invertebrate faunal sampling was also conducted at these stations.

TABLE C.3-1

VEGETATION OF THE PROJECT AREA

Scientific Name[1]	Common Name	Status[2]	Distribution and Abundance by Location[3,4] PA	M	EM	UMT	OB
FOREDUNE							
Abronia maritima	Sand verbena	PN	2	1			
Ambrosia chamissonis	Silver beachweed	PN	3	2			
Ammophila arenaria	European beachgrass	PI	2	3			
Cakile maritima	Sea rocket	AI	2	2			
Calystegia soldanella	Beach morning-glory	PN	2	1			
Camissonia cheiranthifolia var. suffruticosa	Beach primrose	PN	2	1			
Carpobrotus aequilaterus	Sea-fig	PU	2	2			
Gasoul orystallinum	Die-plant	PU	1				
Tetragonia tetragonioides	New Zealand spinach	AI	1				
DUNE SCRUB							
Abronia umbellata	Sand verbena	PN	2	1	1		
Ambrosia chamissonis	Silver beachweed	PN	1		1		
Ambrosia psilostachya var. californica	Western ragweed	PN	1	1			
Ammophila arenaria	European beachgrass	PI	2	1			
Baccharis pilularis ssp. consanguinea	Coyote brush	SN	2	1	1		
Brassica nigra	Black mustard	AI	1	2	1		
Bromus rubens	Red brome	AI	1		2		
Cakila maritima	Sea rocket	AI	1	2			
Camissonia bistorta		AN	1				
C. cheiranthifolia ssp. suffruticosa	Beach primrose	PN	1		1		
Carpobrotus aequilaterus	Sea-fig	PI	3	3	1		
C. edulis	Hottentot-fig	PI	1	1	1		
C.aequilateris X edulis	Hybrid	PI	1	1			
Chrysopsis villosa var. sessiliflora	Golden-aster	PN	1		1		
Cirsium occidentale	Western thistle	BN	1		1		
Corethrogyne filaginifolia var. latifolia	Cudweed-aster	PN	3	2	3		
Croton californicus var. californicus	Croton	PN	2	1	2		
Cuscuta californica	Dodder	ZN	1		1		
Datura meteloides	Jimsonweed	PN	2		1		
Dudleya caespitosa	Live-forever	PN	2		1		
Elymus condensatus	Ryegrass	PN	1				
Eriogonum parvifolium var. parvifolium	Seacliff buckwheat	PN	3	1	3		
Gnaphalium ramosissimum	Pink everlasting	PN	2		1		
Haplopappus ericoides ssp. ericoides	Mock heather	SN	3	2	3		
Heliotropium curassavicum	Heliotrope	PN	1				

TABLE C.3-1 (Continued)

Scientific Name[1]	Common Name	Status[2]	Distribution and Abundance by Location[3, 4] PA	M	EM	UMT	OB
DUNE SCRUB (continued)							
Heterotheca grandiflora	Telegraph weed	BN	2	2	2		3
Juncus acutus var. *sphaerocarpas*	Spiny rush	PN	1				
Lotus scoparius var. *scoparius*	Deerweed	PN	1	2			
Lupinus arboreus	Lupine	SN	2				
Opuntia sp.		SN	2		2		
Phacelia ramosissima var. *austrolitoralis*	Phecelia	PN	3		2		
Salix lasiandra	Yellow willow	S/T N	3		2		
Solanum douglasii	Nightshade	SN	1				
Stephanomeria virgata var. *virgata*	Stephanomeria	AN	2		2		
Toxicodendron diversilobum	Poison oak	SN	3		2		
Urtica holosericea	Nettle	PN	1				
Verbesina encelioides var. *exauriculata*	Crown-bread	AN	1		1		
SALT MARSH							
Atriplex patula ssp. *hastata*	Saltbush	AN	3				
Cressa truxillensis var. *vallicola*	Alkali weed	PN	3				
Cuscuta sp.	Dodder	ZN	1				
Distichlis spicata var. *spicata*	Saltgrass	PN	2				
Frankenia grandiflora		PN	3				
Rumex crispus	Curly dock	PI	2				
Salicornia virginica	Pickleweed	PN	3				
Suaeda californica var. *taxifolia*	Sea-blite	PN	2				
S. depressa	Sea-blite	AN	2				
FRESH WATER MARSH							
Anemopsis californica	Yerba mansa	PN	2				
Arundo donax	Giant reed	PN	2				
Azolla filiculoides	Duckweed fern	FN	1				
Baccharis glutinosa	Mule fat	SN	2				
Bromus mollis	Soft chess	AI	1				
Cotula coronopifolia	Brass buttons	PI	1				
Cynodon dactylon	Bermuda grass	PI	2				
Distichlis spicata var. *spicata*	Saltgrass	PN	2				
Equisetum sp.	Scouring rush	PN	1				

TABLE C.3-1 (Continued)

Scientific Name[1]	Common Name	Status[2]	Distribution and Abundance by Location[3,4] PA	M	EM	UMT	OB
FRESH WATER MARSH (continued)							
Hydrocotyle verticillata	Marsh pennywort	PN	1				
Jaumea carnosa		PN	2				
Juncus textilis	Rush	PN	2				
Lolium perenne ssp. perenne	English rye	PI	1				
Medicago polymorpha	Bar clover	AI	2				
Melilotus albus	Sweet clover	AI	1				
Myriophyllum brasiliense	Parrots feather	PN	1				
Oenothera hookeri	Evening primrose	BN	1				
Pluchea purpurascens	Marsh fleabane	PN	2				
Polygonum amphibium	Water smartweed	PN	2				
Polypogon Monspeliensis	Rabbit's foot grass	AI	2				
Potentilla egedei var. grandis	Cinquefoil	PN	3				
Scirpus acutus	Hardstem bulrush	PN	1				
S. californicus	Common tule	PN	3				
Urtica hol sericea	Nettle	PN	1				
Xanthium strumarium	Cocklebur	AI	1				
RIPARIAN							
Ageratina adenophora		SI	1				
Ambrosia psilostachya	Western ragweed	PN	2				
Apium graveolens	Celery	AI	1				
A. californica	Coastal sage	SN	1				
Artemisia douglasiana	Mugwort	PN	2				
Atriplex dentiformis ssp. breweri	Atriplex	SN	1				
Azolla filiculoides	Duckweed fern	FN	1				
Baccharis glutinosa	Mulefat	SN	2				
B. pilularis	Coyote brush	SN	2				
Calystegia macrostegia	Morning-glory	VN	1				
Camissonia bistorta		AN	1				
Chenopodium ambrosioides	Mormon-tea	AI	2				
Clematis ligusticifolia	Virgin's bower	VN	1				
Cortaderia atacamemsis	Pampas grass	PI	1				
Cotula coronopifolia	Brass buttons	PI	2				
Cynodon dactylon	Bermuda grass	PI	2				
Cyperus esculentus	Nut-grass	PI	2				
Distichlis spicata	Saltgrass	PN	2				
Eleocharis parishii	Spikegrass	PN	2				
Eragrostis orcuttiana		AI	1				
Foeniculum vulgare	Fennel	BI	1				
Heliotropium curassavicum var. oculatum	Heliotrope	PI	1				
Juncus torreyi	Rush	PN	2				

TABLE C.3-1 (Continued)

Scientific Name[1]	Common Name	Status[2]	Distribution and Abundance by Location[3,4] PA	M	EM	UMT	OB
RIPARIAN (continued)							
J. xiphioides	Rush	PN	2				
Lemma sp.	Duckweed	AN	1				
Malacothrix saxatilis var. *saxatilis*		PN	1				
Malva sp.		AI	1				
Marrubium vulgare	Horehound	AI	1				
Medicago polymorpha	Bur clover	AI	2				
Melilotus albus	White sweet clover	AI	2				
M. indicus	Yellow sweet clover	AI	2				
Mimulus cardinalis	Red monkey flower	PN	1				
Oenothera californica	Evening primrose	PN	1				
Oryzopsis miliacea	Ricegrass	AI	1				
Paspalum dilatatum		AI	1				
Polygonum amphibium	Water smartweed	PN	2				
Polypogon monspeliensis	Rabbit's foot grass	AI	2				
Populus trichocarpa	Black cottonwood	TN	2				
Rubus ursinus	California blackberry	VN	2				
Salix lasiandra var. *lasiandra*	Yellow willow	S/T N	3				
S. hindsiana		S/T N	3				1
Salvia mellifera	Black sage	SN	1				
Scirpus acutus	Hard-stem bulrush	PN	1				
S. americanus			1				
S. californicus	Common tule	PN	2				
S. robustus	Three-square	PN	2				1
Solanum douglasii	Nightshade	SN	2				1
Sonchus oleraceus	Sow thistle	AI	1				
Toxicodendron diversilobum	Poison oak	SN	2				
Typha sp.	Cattail	PN	2				
Urtica holosericea	Nettle	PN	2				
Verbena lasiostachys		PN	1				
Veronica anagallis-aquatica	Speedwell	PN	1				
Xanthium strumarium	Cocklebur	AI	2				1
RUDERAL							
Ambrosia psilostachya	Western ragweed	PN	2				1
Arundo donax	Giant reed	PI	2				
Atriplex dentiformis ssp. *breweri*		SN	1				
A. patula var. *hastata*		AN	2				2
A. semibaccata		PI	2				
Baccharis pilularis	Coyote brush	SN	2				2
Brassica nigra	Black mustard	AI	2				1
Bromus diandrus	Ripgut	AI	1				1

TABLE C.3-1 (concluded)

Scientific Name[1]	Common Name	Status[2]	Distribution and Abundance by Location[3,4] PA	M	EM	UMT	OB
RUDERAL (continued)							
B. mollis	Soft chess	AI	2				1
B. rubens	Red brome	AI	2				1
Centaurea melitensis	Tocalote	AI	2				
Chenopodium sp.		AI	2				
C. ambrosiodes	Mormon-tea	AI	2				2
Conyza canadensis	Horseweed	AI	2				1
Cynodon dactylon	Bermuda grass	PI	2				1
C. coulteri		AI	1				1
Euphorbia polycarpa var. *polycarpa*	Spurge	PN	1				1
Foeniculum vulgare	Fennel	BI	2				
Heliotropium curassavicum	Heliotrope	PI	2				1
Heterotheca grandiflora	Telegraph weed	BN	3				
Lobularia maritima	Sweet alyssum	PN	1				1
Lolium perenne ssp. *perenne*	Ryegrass	PI	1				
Malva sp.		AI	2				1
Medicago polymorpha	Bur clover	AI	2				
Melilotus albus	White sweet clover	AI	3	1			2
M. indicus	Yellow sweet clover	AI	2				
Nicotiana glauca	Tree tobacco	S/T N	1				2
Oryzopsis miliacea	Ricegrass	AI	1				
Pennisetum setaceum	Feathertop	PI	1				
Polypogon monspeliensis	Rabbit's foot grass	AI	2				1
Raphanus sativum	Wild radish	AI	1				1
Rumex crispus	Curly dock	PI	2				1
Salsola iberica	Tumbleweed	AI	2				1
Silybum marianum	Milk thistle	AI	1				
Sonchus oleraceus	Sow thistle	AI	2				1
Suaeda californica	Sea-blite	PN	2				2
S. depressa	Sea-blite	AN	2				2

[1] Nomenclature follows Munz (1974).
[2] Status: A=Annual; B=Biennial; P=Perennial; N=Native; I=Introduced; U=Uncertain; Z=Parasite; S=Shrub; T=Tree.
[3] Abundance: 1=Present; 2=Abundant; 3=Dominant.
[4] Location: PA=Project Area; M=Proposed Mandalay Site; EM=East Mandalay Alternative Site; UMT=Union Oil Marine Terminal Alternative Site; OB=Ormond Beach Alternative Site.

TABLE C.3-2

REPTILES AND AMPHIBIANS OF THE PROJECT AREA

		Occurrence in the Project Area															
		Habitat[2]								Site[3]				Potential[4]			
Scientific Name[1]	Common Name	F	DS	FM	Ri	SM	Ru	A	U	M	EM	UMT	OB	L	P	U	O
CLASS AMPHIBIA: AMPHIBIANS																	
ORDER CAUDATA: SALAMANDERS																	
FAMILY SALAMANDRIDAE: NEWTS																	
Taricha torosa	California Newt			X	X										X		
FAMILY PLETHODONTIDAE: LUNGLESS SALAMANDERS																	
Aneides lugubris	Arboreal Salamander	X		X	X					X					X		
Batrachoseps attenuatus	California Slender Salamander		X	X	X		X		X		X				X		
Ensatina eschscholtzi	Ensatina		X	X	X		X		X		X				X		
ORDER ANURA: FROGS AND TOADS																	
FAMILY PELOBATIDAE: SPADEFOOT TOADS																	
Scaphiopus hammondi	Western Spadefoot Toad			X	X										X		
FAMILY BUFONIDAE: TRUE TOADS																	
Bufo boreas	Western Toad			X	X									X			
B. microscaphus	Southwestern Toad			X	X										X		
FAMILY HYLIDAE: TREEFROGS																	
Hyla californiae	California Treefrog			X	X												
H. regilla	Pacific Treefrog			X	X									X			
FAMILY RANIDAE: TRUE FROGS																	
Rana aurora	Red-legged Frog			X	X										X		
R. catesbeiana	Bullfrog			X	X									X			
CLASS REPTILIA: REPTILES																	
ORDER CHELONIA: TURTLES AND TORTOISES																	
FAMILY TESTUDINIDAE: WATER & BOX TURTLES, TORTOISES																	
Clemmys marmorata	Western Pond Turtle			X										X			
ORDER SQUAMATA: SNAKES AND LIZARDS																	
FAMILY GEKKONIDAE: GECKOS																	
Coleonyx variegatus	Banded Gecko			X	X										X		
FAMILY IGUANIDAE: IGUANIDS																	
Phrynosoma coronatum	Coast Horned Lizard	X	X				X			X	X			X			
Sceloporus occidentalis	Western Fence Lizard	X	X				X			X	X						X
Uta stansburiana	Side-blotched Lizard																X
FAMILY SCINCIDAE: SKINKS																	
Eumeces skiltonianus	Western Skink		X	X	X		X				X				X		
FAMILY TEIIDAE: WHIPTAILS																	
Cnemidophorus tigris	Western Whiptail		X				X				X				X		
FAMILY ANGUIDAE: ALLIGATOR LIZARDS																	
Gerrhonotus multicarinatus	Southern Alligator Lizard		X				X				X			X			

TABLE C.3-2 (concluded)

		Occurrence in the Project Area															
		Habitat[2]								Site[3]				Potential[4]			
Scientific Name[1]	Common Name	F	DS	FM	Ri	SM	Ru	A	U	M	EM	UMT	OB	L	P	U	O
ORDER SQUAMATA: SNAKES AND LIZARDS (continued)																	
FAMILY ANNIELLIDAE: CALIFORNIA LEGLESS LIZARDS																	
Anniella pulchra	California Legless Lizard	X	X				X			X	X			X			
FAMILY LEPTOTYPHLOPIDAE: SLENDER BLIND SNAKES																	
Leptotyphlops humilis	Western Blind Snake		X	X	X						X				X		
FAMILY COLUBRIDAE: COLUBRIDS																	
Coluber constrictor	Racer		X	X	X		X				X			X			
Diadophis punctatus	Ringneck Snake		X	X	X		X				X				X		
Hypsiglena torquata	Night Snake		X	X	X		X				X				X		
Lampropeltis getulus	Common Kingsnake		X	X	X		X				X			X			
Masticophis flagellum	Coachwhip		X	X	X		X				X				X		
M. lateralis	Striped Racer		X	X	X		X				X				X		
Pituophis melanoleucas	Gopher Snake		X				X				X			X			
Rhinocheilus lecontei	Long-nosed Snake		X				X				X				X		
Salvadora hexalepis	Western Patch-nosed Snake		X				X				X				X		
Tantilla planiceps	Western Black-headed Snake		X				X				X				X		
Thamnophis couchi	Western Aquatic Garter Snake			X	X						X			X			
T. sirtalis	Common Garter Snake		X	X	X		X				X			X			
Trimorphodon vandenburghi	California Lyre Snake		X				X				X				X		
FAMILY VIPERIDAE: VIPERS																	
SUBFAMILY CROTALINAE: PIT VIPERS																	
Crotalus viridis	Western Rattlesnake		X								X				X		

1 Nomenclature follows Stebbins (1966).
2 Habitat: F=Foredune; DS=Dune Scrub; FM=Fresh Water Marsh; Ri=Riparian; SM=Salt Marsh; Ru=Ruderal; A=Agricultural; U=Urban.
3 Site: M=Proposed Mandalay; EM=East Mandalay alternative; UMT=Union Oil Marine Terminal alternative; OB=Ormond Beach alternative.
4 Potential for occurrence; L=Likely; P=Possible; U=Unlikely; O=Observed during Dames & Moore field surveys;
Potential for occurrence based on geographic range, presence of suitable habitat, and proximity of recruit populations.

TABLE C.3-3

BIRDS OF THE PROJECT AREA

Scientific Name[1]	Common Name	Occurrence in Project Area: Season[2] W	Sp	S	F	A	O[3]	Frequency[4] C	F	U	R	Habitat[5] Ob	F	DS	FW	Ri	SM	Ru	A	U	Site[6] M	EM	UMT	OB
ORDER GAVIIFORMES: LOONS																								
FAMILY GAVIIDAE: LOONS																								
Gavia arctica	Arctic Loon	X						X				X				X								
G. immer	Common Loon	X						X				X			X	X								
G. stellata	Red-Throated Loon	X						X				X				X								
ORDER PODICIPEDIFORMES: GREBES																								
FAMILY PODICEPIDIDAE: GREBES																								
Aechmophorus occidentalis	Western Grebe	X					X	X				X			X	X								
Podiceps auritus	Horned Grebe	X							X			X			X	X								
P. nigricollis	Eared Grebe	X					X	X				X			X	X								
Podylimbus podiceps	Pied-billed Grebe					X	X	X				X				X								
ORDER PROCELLARIIFORMES: ALBATROSSES, SHEARWATERS, AND PETRELS																								
FAMILY DIOMEDEIDAE: ALBATROSSES																								
Diomedea nigripes	Black-footed Albatross					X				X		X												
FAMILY PROCELLARIIDAE: FULMARS, PETRELS, AND SHEARWATERS																								
Fulmarus glacialis	Northern Fulmar	X								X		X												
Puffinus creatopus	Pink-footed Shearwater		M							X		X												
P. griseus	Sooty Shearwater					X		X				X												
P. puffinus	Manx Shearwater			M					X			X												
FAMILY HYDROBATIDAE: STORM PETRELS																								
Oceanodroma homochroa	Ashy Petrel	X	X	X						X		X												
O. melania	Black Petrel		M						X			X												
ORDER PELICANIFORMES: PELICANS, FRIGATE BIRDS, AND ALLIES																								
FAMILY PELICANIDAE: PELICANS																								
[e,f]Pelecanus occidentalis californicus	Brown Pelican					X	X					X	X		X	X					X			
FAMILY PHALACROCORACIDAE: CORMORANTS																								
Phalacrocorax auritus	Double-crested Cormorant					X	X	X				X				X								
P. pelagicus	Pelagic Cormorant					X			X			X				X								
P. penicillatus	Brandt's Cormorant					X		X				X				X								
ORDER CICONIIFORMES: HERONS, STORKS, IBISES, AND ALLIES																								
FAMILY ARDEIDAE: HERONS AND BITTERNS																								
Ardea herodias	Great Blue Heron					X	X	X							X	X	X							
Butorides virescens	Green Heron					X									X	X	X							
Botarus Lentiginosus	American Bittern					X				X					X	X	X							
Bubulcus ibis	Cattle Egret					X				X					X	X	X		X					
Egretta thula	Snowy Egret					X	X	X							X	X	X							
Ixobrychus exilis	Least Bittern		X							X					X	X	X							
Nycticorax nycticorax	Black-crowned Night Heron		X				X		X			X			X	X	X		X					
FAMILY THRESHKIORNITHIDAE: IBISES AND SPOONBILLS																								
Plegadis chihi	White-faced Ibis		X								X				X	X	X							
ORDER ANSERIFORMS: SCREAMERS, SWANS, GEESE, AND DUCKS																								
FAMILY ANATIDAE: DUCKS, GEESE, AND SWANS																								
SUBFAMILY ANSERINAE: GEESE																								
Anser albifrons	White-fronted Goose	X									X				X	X								
Branta canadensis	Canada Goose	X							X						X	X								
B. nigricans	Black Brant	X						X				X												
SUBFAMILY ANATINAE: SURFACE-FEEDING DUCKS																								
Anas acuta	Pintail	X					X	X							X	X	X							
A. americana	American Wigeon	X						X							X	X	X							
A. crecca carolinensis	Green-winged Teal	X						X							X	X	X							
A. cylpeata	Northern Shoveler	X						X							X	X	X							
A. cyanoptera	Cinnamon Teal		X				X	X							X	X	X							
A. discors	Blue-wing Teal		X				X			X					X	X	X							
A. platyrhynchos	Mallard					X	X	X							X	X	X							
A. strepera	Gadwall					X				X					X	X	X							
Aythya affinis	Lesser Scaup	X						X							X	X	X							
A. americana	Redhead	X							X						X	X	X							
A. collaris	Ring-necked Duck	X							X						X	X	X							
A. marila	Greater Scaup	X									X				X	X	X							
A. valisineria	Canvasback	X							X						X	X	X							
Bucephala albeola	Bufflehead	X							X						X	X	X							
B. islandica	Barrow's Goldeneye	X									X				X	X	X							
Clangula hyemalis	Oldsquaw	X									X				X	X	X							
Histrionicus histrionicus	Harlequin Duck	X								X					X	X	X							
SUBFAMILY ANTHYINAE: SEA DUCKS																								
Melanitta deglandi	White-winged Scoter	X							X			X			X	X								
M. perpicilata	Surf Scoter	X						X				X			X	X								
Oedimia nigra	Black Scoter	X									X	X			X	X								
SUBFAMILY MERGINAE: MERGANSERS																								
Laphodytes cucullatus	Hooded Merganser	X									X	X												
Mergus merganser	Common Merganser	X							X			X												
M. serrator	Red-breasted Merganser	X						X				X												
SUBFAMILY OXYURINAE: STIFF-TAILED DUCKS																								
Oxyura jamaicensis	Ruddy Duck					X	X	X							X	X	X							
ORDER FALCONIFORMES: DIURNAL BIRDS OF PREY																								
FAMILY CATHARTIDAE: AMERICAN VULTURES																								
Cathartes aura	Turkey Vulture					X	X	X				X		X	X	X	X		X			X		X
FAMILY ACCIPITRAIDE: HAWKS, EAGLES, AND KITES																								
SUBFAMILY ELANINAE: KITES																								
Elanus leucurus	White-tailed Kite					X			X							X			X			X		
SUBFAMILY ACCIPITINAE: ACCIPITERS																								
Accipiter cooperii	Cooper's Hawk					(X)	X		X				X	X								X		
A. striatus	Sharp-shinned Hawk	X							X			X	X	X								X		

TABLE C.3-3 (Continued)

		Occurrence in Project Area																						
		Season[2]						Frequency[4]				Habitat[5]									Site[6]			
Scientific Name[1]	Common Name	W	Sp	S	F	A	O[3]	C	F	U	R	Ob	F	DS	FW	Ri	SM	Ru	A	U	M	EM	UMT	OB
SUBFAMILY BUTEONINAE: HAWKS AND EAGLES																								
Buteo jamaicensis	Red-tailed Hawk					(X)	X	X						X	X	X	X	X	X			X		X
B. lineatus	Red-shouldered Hawk					(X)				X				X	X	X	X	X	X			X		X
e,f Haliaeetus leucocephalus leucocephalus	Bald Eagle					X					X			X	X	X	X							
SUBFAMILY CIRCINAE: HARRIERS																								
Circus cyaneus	Marsh Hawk					(X)		X							X	X	X							
FAMILY PANDIONIDAE: OSPREYS																								
Pandion haliaetus	Osprey					X					X	X			X	X								
FAMILY FALCONIDAE: FALCONS																								
e,f F. peregrinus anatum	Peregrine Falcon					X					X	X		X	X	X								
F. sparverius	American Kestrel					(X)	X	X					X	X	X	X	X	X	X		X	X		X
ORDER GALLIFORMES: FOWL-LIKE BIRDS																								
FAMILY PHASIANIDAE: QUAILS AND PHEASANTS																								
Lophortyx californicus	California Quail					(X)	X			X				X		X						X		
ORDER GRUIFORMES: CRANES, RAILS, AND COOTS																								
FAMILY RALLIDAE: RAIL-LIKE BIRDS																								
Coturnicops noveboracensis	Yellow Rail					X					X					X	X							
Fulica americana	American Coot					X	X	X							X	X	X							
Gallinula chloropus	Common Gallinule					X				X						X	X							
Porzana carolina	Sora					X				X						X	X							
Rallus limicola	Virginia Rail					X				X						X	X							
e,f R. longirostris levipes	Light-footed Clapper Rail					X				X						X	X							
ORDER CHARADRIIFORMES: SHOREBIRDS																								
FAMILY CHARADRIIDAE: PLOVERS																								
Charadrius alexandrinus	Snowy Plover					(X)	X	X				X	X		X						X			
C. semipalmatus	Semipalmated Plover	X	X		X				X			X	X											
C. vociferus	Killdeer					(X)	X	X				X	X	X			X	X	X	X	X	X		
Squatarola squatarola	Black-bellied Plover	X			X		X	X				X	X		X									
FAMILY SCOLOPACIDAE: SANDPIPERS																								
Actitus macularia	Spotted Sandpiper	X	X				X		X			X	X											
Apriza virgata	Surfbird	X							X			X	X											
Arenaria interpres	Ruddy Turnstone	X					X	X				X												
A. melanocephala	Black Turnstone	X		X				X				X												
Calidris alba	Sanderling	X	X		X		X					X				X								
C. alpina	Dunlin	X	X		X		X	X				X												
C. bairdii	Baird's Sandpiper		M		M						X	X												
C. canutus	Knot	M	M		M						X	X												
C. mauri	Western Sandpiper	X	X		X		X		X			X												
C. melanetus	Pectoral Sandpiper		X		X						X	X												
C. minutilla	Least Sandpiper					X	X	X				X												
Capella gallinago	Common Snipe	X								X		X				X								
Catoptrophorus semipalmatus	Willet					X	X	X				X				X	X							
Heterocelsus incanum	Wandering Tattler	X								X		X												
Limnodromus griseus	Short-billed Dowitcher					X	X	X				X				X	X							
L. scolopaceus	Long-billed Dowitcher					X	X	X				X				X	X							
Limosa fedoa	Marbled Godwit	X	X		X		X	X				X				X	X							
Numenius americanus	Long-billed Curlew	X			X		X	X				X				X	X							
N. phaeopus	Whimbrel	X			X		X	X				X				X	X							
Tringa flavipes	Lesser Yellowlegs	X								X		X				X	X							
T. melanoleucus	Greater Yellowlegs	X							X			X				X	X							
Tringa solitaria	Solitary Sandpiper		M		M						X	X				X	X							
FAMILY PHALAROPODIDAE: PHALAROPES																								
Lobipes lobatus	Northern Phalarope		M		M		X		X			X			X	X								
Phalaropus fulicarius	Red Phalarope		M		M				X			X			X	X								
Steganophus tricolor	Wilson's Phalarope		M		M		X			X		X			X	X								
FAMILY RECURVIROSTRIDAE: AVOCETS AND STILTS																								
Himantopus mexicanus	Black-necked Stilt					(X)	X	X							X	X								
Recurvirostra americana	American Avocet					(X)	X	X							X	X								
FAMILY STERCORARIIDAE: JAEGERS																								
Stercorarius parasiticus	Parasitic Jaeger	X	X		X					X		X												
FAMILY LARIDAE: GULLS AND TERNS																								
SUBFAMILY LARINAE: GULLS																								
Larus argentatus	Herring Gull	X							X			X	X			X					X			
L. atricilla	Bonaparte's Gull	X	X		X			X				X	X			X					X			
L. californicus	California Gull					X	X		X			X	X			X					X			
L. canus	Mew Gull	X								X		X	X			X					X			
L. delawarensis	Ring-billed Gull					X		X				X	X			X					X			
L. glaucescens	Glaucous-winged Gull	X							X			X	X			X					X			
L. heermanni	Heermann's Gull					X	X			X		X	X			X					X			
L. occidentalis	Western Gull					X	X	X				X	X			X					X			
L. pipixcan	Franklin's Gull		X		X					X		X	X			X					X			
Rissa tridactyla	Black-legged Kittiwake	X								X		X	X			X					X			
Xema sabini	Sabine's Gull		X							X		X	X			X								
SUBFAMILY STERNINAE: TERNS																								
Chlidonias niger	Black Tern	X	X		X					X		X	X		X	X					X			
Hydroprogne caspa	Caspian Tern					X	X		X			X	X		X	X					X			
e,f Sterna albifrons browni	Least Tern			(X)			X				X	X	X		X	X					X			
S. forsteri	Forster's Tern					X	X	X				X	X		X	X					X			
S. hirundo	Common Tern		M		M		X		X			X	X		X	X					X			
S. paradisea	Arctic Tern		M		M						X	X	X		X	X					X			
Thalsseus elegans	Elegant Tern			X	X		X			X		X	X		X	X					X			
T. maximus	Royal Tern	X			X		X			X		X	X		X	X					X			

TABLE C.3-3 (Continued)

Scientific Name[1]	Common Name	Season[2] W	Season Sp	Season S	Season F	Season A	O[3]	Frequency[4] C	Frequency F	Frequency U	Frequency R	Habitat[5] Ob	Habitat F	Habitat DS	Habitat FW	Habitat Ri	Habitat SM	Habitat Ru	Habitat A	Habitat U	Site[6] M	Site EM	Site UMT	Site OB
FAMILY ALCIDAE: AUKS																								
Uria aalge	Common Murre		X	X	X						X	X												
Cepphus columba	Pigeon Guillemot		X	X	X						X	X												
Brachyramphus marmoratum	Marbled Murrelet		X	X	X						X	X												
Endomychura hypoleuca	Xantus' Murrelet		X	X	X					X		X												
Synthliboramphus antiquum	Ancient Murrelet	X									X	X												
Ptychoramphus aleutica	Cassin's Auklet		X	X	X					X		X												
Cerorhinca monocerata	Rhinoceros Auklet	X								X		X												
ORDER COLOMBIFORMES: PIGEONS AND DOVES																								
FAMILY COLUMBIDAE: PIGEONS AND DOVES																								
Columba fasciata	Band-tailed Pigeon					(X)				X				X	X	X			X			X		
C. livia	Rock Dove					(X)	X	X						X				X	X	X	X	X	X	X
Streptopelia chinensis	Spotted Dove					(X)			X					X				X	X	X		X	X	X
Zenaida macroura	Mourning Dove					(X)	X	X						X				X	X	X		X	X	X
ORDER STRIGIFORMES: OWLS																								
FAMILY TYTONIDAE: BARN OWLS																								
Tyto alba	Barn Owl					(X)				X				X		X		X	X			X		
FAMILY STRIGIDAE: TYPICAL OWLS																								
Asia flammeus	Short-eared Owl					(X)				X				X	X	X						X		
Bubo virginianus	Great-horned Owl					(X)			X					X	X	X						X		
Otus asio	Screech Owl					(X)				X				X	X	X						X		
Speotyto cuniculario	Burrowing Owl					(X)					X			X								X		
FAMILY CAPRIMULGIDAE: GOATSUCKERS																								
Chordeiles acutipennis	Lesser Nighthawk			(X)						X				X	X	X						X		
ORDER APODIFORMES: SWIFTS AND HUMMINGBIRDS																								
FAMILY APODIDAE: SWIFTS																								
Aeronautes saxatalis	White-throated Swift					(X)			X					X	X	X								
Chaetura pelagica	Vaux's Swift			X						X				X	X	X								
FAMILY TROCHILIDAE: HUMMINGBORDS																								
Archilochus alexandri	Black-chinned Hummingbird			X				X						X	X	X				X		X		
Calypte anna	Anna's Hummingbird					(X)	X	X						X	X	X				X		X		
C. costae	Costa's Hummingbird			X							X			X	X	X				X		X		
Selasphorus rufus	Rufous Hummingbird		X							X				X	X	X				X		X		
S. sasin	Allen's Hummingbird			(X)		(X)	X		X					X	X	X				X		X		
ORDER CORACIIFORMES: KINGFISHERS																								
FAMILY ALCEDINIDAE: KINGFISHERS																								
Megaceryle alcyon	Belted Kingfisher					(X)	X		X						X	X								
ORDER PICIFORMES: WOODPECKERS AND FLICKERS																								
FAMILY PICIDAE: WOODPECKERS AND FLICKERS																								
Colaptes auratus	Common Flicker					(X)	X	X						X	X	X						X		
Dendrocopus nuttalli	Nuttall's Woodpecker					(X)			X							X								
D. pubescens	Downy Woodpecker					(X)			X							X								
D. villosos	Hairy Woodpecker					(X)			X							X								
ORDER PASSERIFORMES: PERCHING BIRDS																								
SUBORDER TYRANNI: FLYCATCHERS																								
FAMILY TYRANNIDAE: TYRANT FLYCATCHERS																								
Contopus sordidulus	Western Wood Pewee		(X)							X				X	X	X						X		
Empidonax difficilis	Western Flycatcher		(X)								X			X	X	X						X		
Myiarchus cinerascens	Ash-throated Flycatcher		(X)				X		X					X	X	X						X		
Sayornis nigricans	Black Phoebe					(X)	X	X							X	X								
S. Saya	Say's Phoebe	X							X					X	X	X						X		
Tyrranus verticalis	Western Kinghird		(X)				X		X					X	X	X						X		
T. vociferans	Cassin's Kingbird		X							X				X					X			X		
SUBORDER PASSERES: SONGBIRDS																								
FAMILY ALAUDIDAE: LARKS																								
Eremophila alpestris	Horned Lark	X					X		X					X				X	X			X		X
FAMILY HIRUNDINIDAE: SWALLOWS																								
Hirundo rustica	Barn Swallow		(X)				X		X					X	X	X						X		
Iridoprocne bicolor	Tree Swallow	M									X			X	X	X						X		
Petrochelidon pyrrhonta	Cliff Swallow		(X)				X		X							X								
Progne subis	Purple Martin		X								X					X								
Stegidopteryx ruficollis	Rough-winged Swallow		(X)				X		X					X	X	X						X		
Riparia riparia	Bank Swallow		(X)							X						X								
Tachycineta thassalina	Violet-green Swallow		(X)						X						X	X								
FAMILY CORVIDAE: JAYS AND CROWS																								
Aphelocoma coerulescens	Scrub Jay					(X)	X	X						X	X	X		X	X	X		X		X
Corvus brachyrhynocos	Crow					(X)	X	X						X				X	X	X		X	X	X
C. corax	Common Raven					(X)			X					X				X	X	X		X	X	X
FAMILY SITTIDAE: NUTHATCHES																								
Sitta corolinensis	White-breasted Nuthatch		X						X							X								
FAMILY PARIDAE: TITMICE AND BUSHTITS																								
Parus inornatus	Plain Titmouse					(X)		X						X	X	X						X		
Psaltriparus minimus	Bushtit					(X)	X	X						X	X	X						X		
FAMILY CHAMAEIDAE: WRENTITS																								
Chamae fasciata	Wrentit					(X)	X	X						X	X	X						X		

TABLE C.3-3 (Concluded)

Scientific Name[1]	Common Name	Season[2] W	Sp	S	F	A	O[3]	Frequency[4] C	F	U	R	Habitat[5] Ob	F	DS	FW	Ri	SM	Ru	A	U	Site[6] M	EM	UMT	OB
FAMILY TROGLODYTIDAE: WRENS																								
Telmatodytes palustris	Marsh Wren					⊗	X	X							X	X								
Thyomanes bewicki	Bewick's Wren					⊗	X		X					X	X							X		
Troglodytes aedon	House Wren					⊗			X					X	X	X								
FAMILY MIMIDAE: MOCKINGBIRDS																								
Mimus polyglottus	Mockingbird					⊗	X	X						X	X	X		X		X		X		X
FAMILY TURDIDAE: THRUSHES AND BLUEBIRDS																								
Catharus guttata	Swainson's Thrush			X						X				X								X		
H. mustelina	Hermit Thrush	X							X					X	X	X						X		
Ixoreus naevius	Varied Thrush	X								X				X	X	X						X		
Sialia mexicana	Western Bluebird					⊗			X					X								X		
Turdus migratorius	American Robin	X						X						X	X	X		X	X	X		X		X
FAMILY SYLVIIDAE: KINGLETS																								
Popioptila caerulea	Blue-grey Gnatcatcher					⊗				X					X	X								
Regulus calendula	Ruby-crowned Kinglet	X							X					X	X	X						X		
FAMILY MOTOCILLIDAE: PIPITS																								
Anthus spindetta	Water Pipit	X							X				X	X				X	X		X	X		
FAMILY BOMBYCILLIDAE: WAXWINGS																								
Bombycylla cedrorum	Cedar Waxwing	X						X						X	X	X				X		X		
FAMILY PTILOGONATIDAE: SILKY FLYCATCHERS																								
Phainopepla nitrens	Phainopepla			X					X					X	X	X						X		
FAMILY LANIIDAE: SHRIKES																								
Lanius ludovicianus	Loggerhead Shrike					⊗	X	X					X	X				X			X	X		
FAMILY STURNIDAE: STARLINGS																								
Sturnus vulgaris	Starling					⊗	X	X					X	X				X	X	X	X	X		X
FAMILY VIREONIDAE: VIREOS																								
Vireo bellii	Bell's Vireo			⊗							X				X	X								
V. gilvus	Warbling Vireo			⊗					X						X	X								
V. huttoni	Hutton's Vireo					⊗				X					X	X								
V. solitarius	Solitary Vireo	M									X				X	X								
V. vicinior	Gray Vireo			⊗						X					X	X								
FAMILY PARULIDAE: WARBLERS																								
Dendroica coronata	Yellow-rumped Warbler	X						X						X	X	X						X		
D. nigrescens	Black-throated Gray Warbler			X						X				X	X	X						X		
D. townsendi	Townsend's Warbler	X								X				X	X	X						X		
D. occidentalis	Hermit Warbler	M		X						X				X	X	X						X		
D. petechia	Yellow Warbler			X					X					X	X	X						X		
Geothlypis trichas	Yellowthroat Warbler					⊗	X		X						X	X						X		
Icteria virens	Yellow-breasted Chat		M	X							X			X	X	X						X		
Oporornis tolmiei	MacGillivary's Warbler		M	X						X				X	X	X						X		
Vermivora celata	Orange-crowned Warbler		M	X					X					X	X	X						X		
V. ruficapilla	Nashville Warbler		M	X						X				X	X	X						X		
V. virginiae	Virginia Warbler		M	X					X					X	X	X						X		
Wilsonia pusilla	Wilson's Warbler		M	X				X						X	X	X						X		
FAMILY PLACEIDAE: WEAVER FINCHES																								
Passer domesticus	House Sparrow					⊗	X	X						X				X	X	X		X		X
FAMILY ICTERIDAE: BLACKBIRDS																								
Aegulius phoenicius	Red-winged Blackbird					⊗	X	X							X	X								
A. tricolor	Tricolored Blackbird					X			X						X	X								
Euphagus cyanocephalus	Brewer's Blackbird					⊗	X	X					X	X	X	X		X	X	X	X	X	X	X
Icterus galbula	Northern Oriole			⊗					X						X	X								
I. cucullatus	Hooded Oriole			⊗					X					X	X	X								
Molothrus ater	Brown-headed Cowbird					⊗		X						X				X	X			X		
Sturnella neglecta	Western Meadowlark					⊗	X	X					X	X				X	X			X		
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	M					X				X				X	X								
FAMILY FRINGILLIDAE: GROSBEAKS, FINCHES AND SPARROWS																								
Aimophila ruficeps	Rufous-crowned Sparrow					⊗				X				X				X				X		
Ammodramus savannarum	Grasshopper Sparrow					X				X				X								X		
Amphispiza belli	Sage Sparrow	X								X				X								X		
Carpodacus mexicanus	Housefinch					⊗	X	X						X				X	X	X		X		X
Chondestes grammacus	Lark Sparrow					⊗			X				X	X				X	X			X		X
Junco hyemalis	Dark-eyed Junco	X						X						X	X	X						X		
Melospiza lincolni	Lincoln's Sparrow	X								X				X										
M. melodia	Song Sparrow					⊗	X	X						X	X	X						X		
e Passerculus sandwichensis	Savannah Sparrow					⊗	X	X						X	X	X	X							
P. s. beidingi	Belding Savannah Sparrow					⊗	X				X						X					X		
Passerella iliaca	Fox Sparrow	X							X					X								X		
Passerina amoena	Lazuli Bunting			X						X					X	X								
Pipilo fusces	Brown Towhee					⊗	X	X						X								X		
P. erythropthalmus	Rufous-sided Towhee					X	X		X					X								X		
Pheutictus melanocephalus	Black-headed Grosbeak		⊗				X		X					X								X		
Pooecetes gramineus	Vesper Sparrow	X									X			X								X		
Spinus lawrenci	Lawrence's Goldfinch					⊗				X				X	X	X						X		
Spinus pinus	Pine Siskin	X								X				X	X	X						X		
S. psaltria	Lesser Goldfinch					⊗		X						X	X	X						X		
S. tristis	American Goldfinch					⊗		X						X	X	X						X		
Spizella passerina	Chipping Sparrow					⊗				X				X				X	X	X		X		X
Zonotrychia atricapilla	Golden-crowned Sparrow	X								X				X								X		
Z. leucophoryx	White-crowned Sparrow	X						X						X				X	X	X		X		

Occurrence in Project Area: Season, O, Frequency, Habitat, Site.

[1] Scientific and common names follow American Ornithologists' Union (1957,1973); e = Endangered species (CDFG, 1978); f = endangered (CFR, 1978)
[2] Season: W = Winter; Sp = Spring; S = Summer; F = Fall; A = All year; ⊗ = Possibly breeding in area; M = Migratory.
[3] Observed during Dames & Moore field surveys.
[4] Frequency: C = Common; F = Fairly Common; U = Uncommon; R = Rare.
[5] Habitat: Ob = Ocean/Beach; F = Foredune; DS = Dune Scrub; FW = Fresh Water Marsh; Ri = Riparian; SM = Salt Marsh; Ru = Ruderal; A = Agricultural; U = Urban.
[6] Site: M = Proposed Mandalay; EM = East Mandalay alternative; UMT = Union Oil Marine Terminal alternative; OB = Ormond Beach alternative.

TABLE C.3-4

MAMMALS OF THE PROJECT AREA

Scientific Name[1]	Common Name	Occurrence in the Project Area: Habitat[2] F	DS	FM	Ri	SM	Ru	A	U	Site[3] M	EM	UMT	OB	Potential[4] K	P	U
ORDER MARSUPIALIA: MARSUPIALS																
FAMILY DIDELPHIDAE: OPOSSUMS																
Didelphis marsupialis	Common Opossum	X	X	X	X	X	X	X		X	X	X	X	X		
ORDER INSECTIVORA: INSERTIVORES																
FAMILY SORICIDAE: SHREWS																
Sorex ornatus	Ornate Shrew			X	X	X								X		
FAMILY TALPIDAE: MOLES																
Scapanus latimanus	Broad-handed Mole		X	X			X	X			X		X			
ORDER CHIROPTERA: BATS																
FAMILY VESPERTILIONIDAE: EVENING BATS																
Antrozous pallidus	Pallid Bat															
Eptesicus fuscus	Big Brown Bat															
Lasiurus borealis	Red Bat															
L. cinereus	Hoary Bat	Local distributions of bats are poorly known. These species are among the most likely, but it is doubtful whether more than two or three are seen in these habitats with any degree of regularity.														
Myotis californicus	California Myotis															
M. yumanensis	Yuma Myotis															
Pipistrellus hesperus	Western Pipistrelle															
Plecotus townsendii	Lump-nosed Bat															
FAMILY MOLOSSIDAE: FREE-TAILED BATS																
Eumops perotis	Western Mastiff Bat															
Tadarida brasiliensis	Brazilian Free-tailed Bat															
ORDER LAGOMORPHA: COTTONTAILS, HARES, AND RABBITS																
FAMILY LEPORIDAE: HARES AND RABBITS																
Lepus californicus	Black-tailed Hare	X	X	X	X	X	X	X		X	X		X			
Sylvilagus audubonii	Audubon Cottontail	X	X	X	X	X	X	X		X	X		X			
S. bachmani	Brush Rabbit		X	X	X	X	X	X			X		X			
ORDER RODENTIA: RODENTS																
FAMILY SCIURIDAE: SQUIRRELS AND MARMOTS																
Otospermophilus beecheyi	Beechey Ground Squirrel		X	X	X	X	X	X			X		X			
FAMILY GEOMYIDAE: POCKET GOPHERS																
Thomomys bottae	Botta Pocket Gopher		X	X	X	X	X	X			X		X			
FAMILY HETEROMYIDAE: POCKET MICE AND KANGAROO RATS																
Perognathus californicus	California Pocket Mouse		X		X			X			X					X
P. fallax	San Diego Pocket Mouse		X		X			X			X					X
P. longimembris	Little Pocket Mouse	X	X		X			X		X	X					X

TABLE C.3-4 (concluded)

Scientific Name[1]	Common Name	Occurrence in the Project Area: Habitat[2] F	DS	FM	Ri	SM	Ru	A	U	Site[3] M	EM	UMT	OB	Potential[4] K	P	U
ORDER RODENTIA: RODENTS (continued)																
FAMILY CRICETIDAE: RATS AND MICE																
Microtus californicus	California Meadow Mouse		X	X	X	X	X				X			X		
Neotoma fuscipes	Dusky-Footed Wood Rat		X	X	X						X			X		
N. lepida	Desert Wood Rat		X	X	X						X			X		
Ondatra zibethicus[2]	Muskrat			X												
Peromyscus boylii	Brush Mouse			X			X				X					X
P. californicus	California Mouse			X			X				X					X
P. eremicus	Canyon Mouse			X			X				X				X	
P. maniculatus	Deer Mouse			X			X				X			X		
Reithrodontomys megalotis	Western Harvest Mouse			X			X				X			X		
FAMILY MURIDAE: OLD WORLD RATS AND MICE																
Mus musculus	House Mouse	X	X		X	X	X		X	X	X				X	
Rattus norvegicus	Norway Rat			X	X	X	X				X				X	
R. rattus	Black Rat			X	X	X	X				X				X	
ORDER CARNIVORA: TERRESTRIAL CARNIVORES																
FAMILY CANIDAE: FOXES AND COYOTES																
Canis latrans	Coyote		X	X	X	X	X	X			X		X		X	
Urocyon cinereoargenteus	Gray Fox		X	X	X	X	X	X			X		X		X	
FAMILY PROCYONIDAE: RACOONS																
Procyon lotor	Racoon	X	X	X	X	X				X	X		X		X	
FAMILY MUSTELIDAE: WEASELS, SKUNKS, AND BADGERS																
Mephitis mephitis	Striped Skunk	X	X	X	X	X	X	X	X	X	X		X		X	
Mustela frenata	Long-tailed Weasel			X	X										X	
Spilogale putorius	Spotted Skunk		X		X	X					X				X	
FAMILY FELIDAE: CATS																
Lynx rufus	Bobcat		X	X	X						X					X
ORDER ARTIODACTYLA: EVEN-TOED HOOFED MAMMALS																
FAMILY CERVIDAE: DEER																
Odocoileus hemionus	Mule Deer		X	X	X						X					X

1 Nomenclature follows Ingles (1965).
2 Habitat: F=Foredune; DS=Dune Scrub; FM=Fresh Water Marsh; Ri=Riparian; SM=Salt Marsh; Ru=Ruderal; A=Agricultural; U=Urban.
3 Site: M=Proposed Mandalay; EM=East Mandalay alternative; UMT=Union Oil Marine Terminal alternative; OB=Ormond Beach alternative.
4 Potential: K=Known; P=Possible; U = Unlikely.

TABLE C.3-5

LIMNOLOGICAL MEASUREMENTS DATA — McGRATH LAKE STATION 1

	Depth (feet)	8 a.m.	1 p.m.	5 p.m.	9 p.m.
Temperature (°C)	0	23.0	24.5	25.0	25.0
	1	23.0	24.5	25.0	25.0
	2	23.0	24.5	25.0	25.0
	3	23.0	24.5	25.0	25.0
	4	24.0	24.5	25.0	27.0
	4.5	30.5	28.0	28.5	29.5
Dissolved Oxygen (mg/L)	0	10.2	–[a]	–	–
	1	9.8	–	–	–
	2	9.8	–	–	–
	3	9.8	–	–	–
	4	9.8	–	–	–
	4.5	–	–	–	–
Conductivity (μmho)	0	5800	6000	6500	6200
	1	5800	6000	6500	6200
	2	5800	6000	6500	6200
	3	5900	6000	6500	6200
	4	6000	10,000	7000	12,000
	4.5	26,000	19,500	19,500	19,200
Salinity (0/00)	0	3.5	3.5	3.5	3.5
	1	3.5	3.5	3.5	3.5
	2	3.8	3.5	3.5	3.5
	3	3.8	3.5	3.5	3.5
	4	3.8	4.0	4.0	7.8
	4.5	12.0	8.2	11.5	11.5
pH (units)	0	8.2	7.0	7.1	7.4
	1	8.2	7.0	7.1	7.4
	2	8.2	–	–	–
	3	–	–	–	–
	4	8.2	7.1	7.0	7.4
	4.5	–	–	–	–

[a] Not observed.

TABLE C.3-6

LIMNOLOGICAL MEASUREMENTS DATA — McGRATH LAKE STATION 2

	Depth (feet)	8 a.m.	1 p.m.	5 p.m.	9 p.m.
Temperature (^{o}C)	0	23.5	25.0	25.0	25.0
	1	23.5	25.0	25.0	25.0
	2	23.5	25.0	25.0	25.0
	3	23.5	25.0	25.0	25.0
	3.5	23.5	25.0	25.0	25.0
Dissolved Oxygen (mg/L)	0	10.8	–[a]	–	–
	1	10.6	–	–	–
	2	10.6	–	–	–
	3	10.6	–	–	–
	3.5	10.6	–	–	–
Conductivity (μmho)	0	5600	5900	6500	6200
	1	5600	5900	6500	6500
	2	5600	5900	6200	6500
	3	5800	5900	6000	6500
	3.5	5800	5900	6800	6500
Salinity (0/00)	0	3.5	3.5	3.5	3.5
	1	3.5	3.5	3.5	3.5
	2	3.5	3.5	3.5	3.5
	3	3.5	3.5	3.5	3.5
	3.5	3.5	3.5	4.2	3.5
pH (units)	0	7.2	7.0	7.0	7.2
	1	7.2	7.0	7.0	7.2
	2	–	–	–	–
	3	7.2	7.0	7.0	7.2
	3.5	–	–	–	–

[a] Not observed.

TABLE C.3-7

LIMNOLOGICAL MEASUREMENTS DATA — McGRATH LAKE STATION 3

	Depth (feet)	8 a.m.	1 p.m.	5 p.m.	9 p.m.
Temperature (°C)	0	21.0	25.0	25.0	25.0
	1	21.0	25.0	25.0	25.0
	2	23.0	25.0	25.0	25.0
	3	23.0	25.0	25.0	25.0
	3.5	23.0	25.0	—[a]	25.0
Conductivity (μmho)	0	2450	5800	5000	6100
	1	2350	5800	6100	6100
	2	5200	5800	6100	6100
	3	5200	5800	6100	6100
	3.5	5000	5800	—	6100
Salinity (0/00)	0	1.0	2.5	2.8	3.5
	1	1.0	2.5	3.5	3.5
	2	2.2	2.5	3.5	3.5
	3	2.2	2.5	3.5	3.5
	3.5	2.2	2.5	—	3.5
pH (units)	0	6.5	7.0	7.0	7.0
	1	6.5	7.0	7.0	7.0
	2	6.7	-	-	-
	3	6.7	6.9	7.0	7.0
	3.5	6.7	-	-	-

[a] Not observed.

TABLE C.3-8

LIMNOLOGICAL MEASUREMENTS DATA — SANTA CLARA RIVER

	Depth (feet)	St. 1 Santa Clara River	St. 2 Santa Clara River Mouth	St. 3 Lagoon (East)	St. 4 Lagoon (Center)	St. 5 Lagoon (West)
Temperature (^{o}C)	0	31.0	32.0	29.0	28.0	27.0
	1	–[a]	–	29.0	27.0	27.0
Conductivity (μmho)	0	3500	8200	15,000	21,500	20,000
	1	–	–	44,000	43,000	36,500
Salinity (0/00)	0	1.2	4.2	8.0	11.0	11.0
	1	–	–	24.0	23.5	25.5
pH (units)	0	7.2	7.8	7.5	7.3	7.3
	1	–	–	7.3	7.3	7.3

[a] Not observed.

TABLE C.3-9

INVERTEBRATE FAUNAL SPECIES AT McGRATH LAKE AND THE SANTA CLARA RIVER

Classification	Common Name	Occurrence[1] McGrath Lake	Lagoon	Santa Clara River
PHYLUM: ARTHROPODA				
Class: Insecta				
Order: Ephemenoptera	Mayfly			
Family: Baetidae		A		P
Order: Odonata				
Suborder: Anisoptera	Dragonfly			
Family: Cordulegastridae				C
Suborder: Zygoptera	Damselfly			
Family: Coenagrionidae		C		
Order: Hemiptera	Bug			
Family: Notonectidae	Backswimmer	P		C
Corixidae	Water Boatman	A+	A+	A
Belostomatidae	Giant Water Bug			P
Veliidae	Water Strider	C		C
Order: Coleoptera	Beetle			
Family: Dytiscidae		A		C
Order: Diptera	Fly			
Family: Chironomidae	Midge	A	A+	A+
Stratiomyiidae	Soldier Fly	P		
Tabanidae	Horse Fly			P
Superclass: Crustacea				
Class: Ostracoda	Seed Shrimp			
Order: Podocapa				
Class: Branchiopoda				
Order: Cladocera	Water Flea			
Family: Daphnidae		A+		
Class: Malacostraca				
Order: Amphipoda	Scud	C		
PHYLUM: ANNELIDA				
Class: Oligochaeta	Worm			
Order: Lumbriculidae		P		
PHYLUM: MOLLUSCA				
Class: Gastropoda	Snail			
Order: Basommatophora				
Family: Physidae		A+		A

[1] A+ = Very Abundant; A = Abundant; C = Common; P = Present;