S. Eng

Chevron USA Inc.
Western Region

# Santa Clara Unit
# Plan of Development
# Parcel OCS P–0215, 0216, 0217

Standard Oil Company of
California, Operator



Prepared by:
Standard Oil Company of California Staff
October 1976

PLAN OF DEVELOPMENT

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## SECTION I

### FORWARD

Standard Oil Company of California is operator for the Santa Clara Unit. Other participants include Exxon U.S.A., Union Oil Company of California, and Atlantic Richfield Company. The Unit is located in Federal waters in the Santa Barbara Channel, southwest of Ventura, California, and totals 46,080 surface acres on eight parcels (Parcels 0204, 0205, 0203, 0209, 0210, 0215, 0216, and 0217).

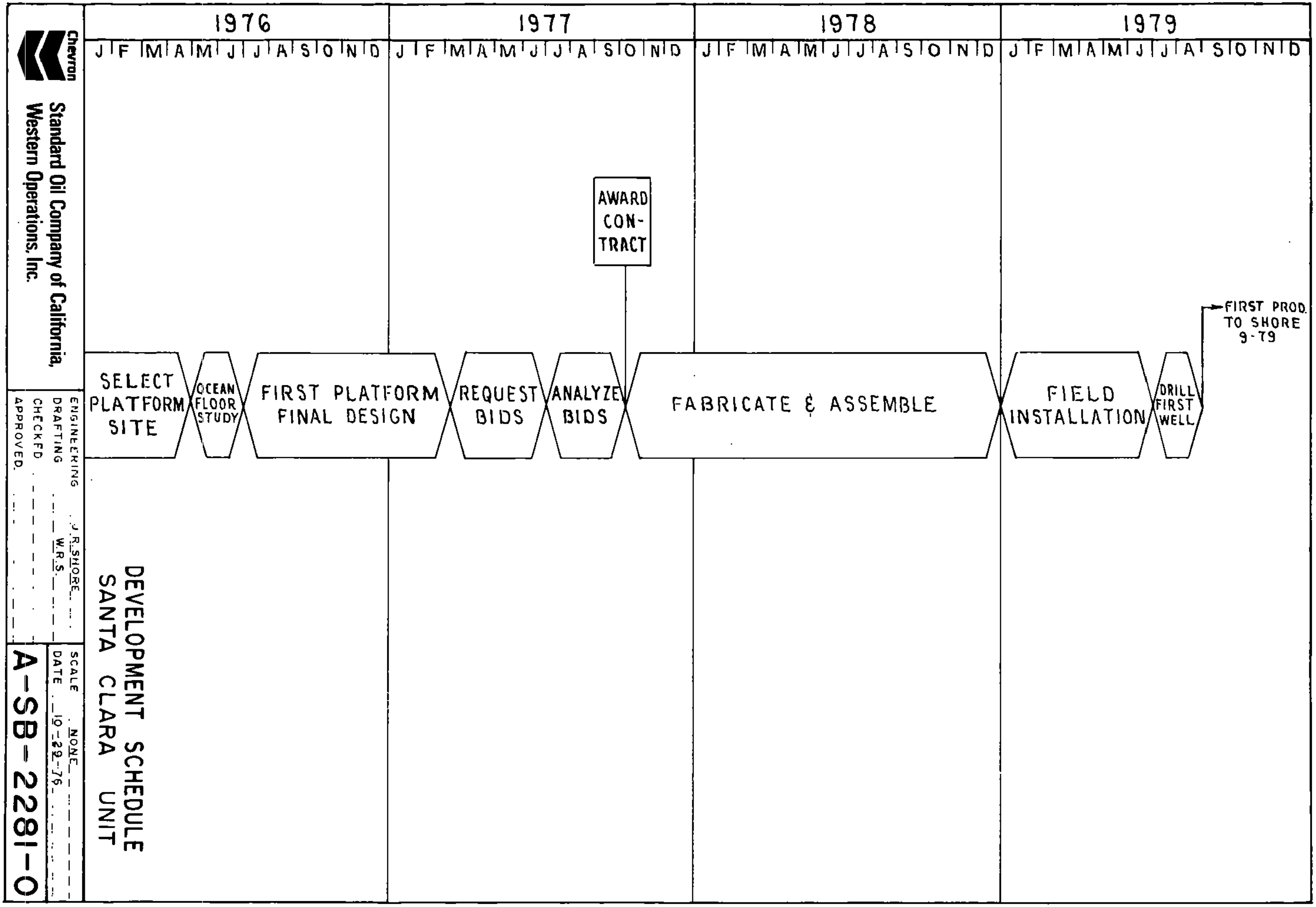
In accordance with Title 30, Codes of Federal Regulation, Section 250.34, and O.C.S. Order No. 8, Pacific Region, a Plan of Development for the Santa Clara Unit is being submitted for approval. It includes the following: a geotechnical review of the area; field history and reservoir data; drilling plans; platform and platform facilities; subsea pipelines; onshore sites and facilities; an offshore production loading system; and contingency plans. Contingency plans are included as a separate attachment.

This Plan covers overall development of the north portion of the Santa Clara Unit on Parcels 0215, 0216, 0217. Three platforms are required to fully develop these Parcels. As a first step one platform is planned. It is a 48 well drilling-production structure on Parcel P-0217, on the so-called Montalvo Trend, in 313 feet of water. Platform installations for the remaining portions of the Trend, Parcels 0215 and 0216, await further delineation drilling. Water depths on these three parcels range from about 60 feet to 600 feet.

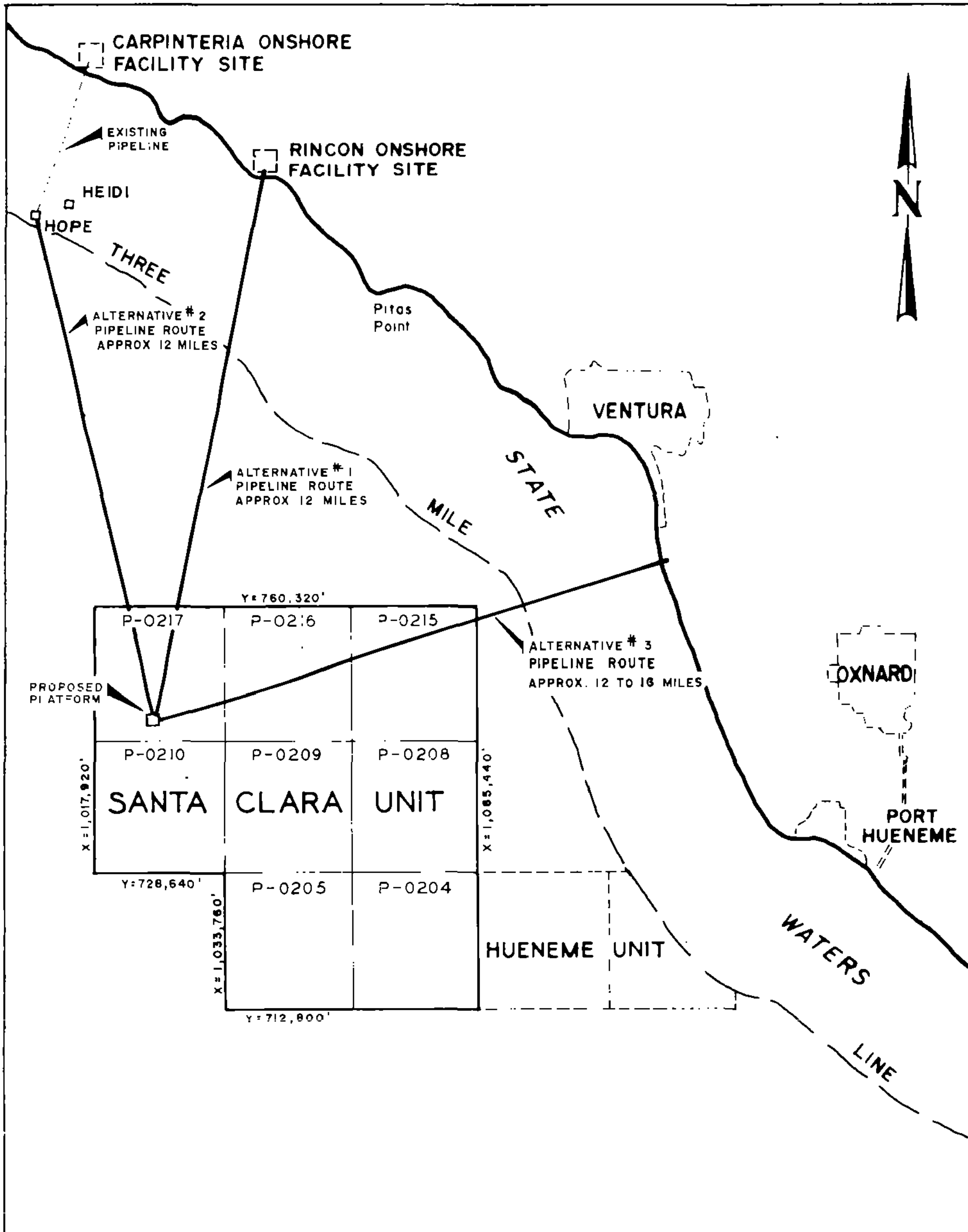
Additional steps toward accomplishment of the overall development of the Montalvo Trend will be the installations of the remaining two platforms. Detailed plans for these additional platforms will be covered by amendments to this overall plan. No firm plans have been established for development work other than those proposed for the Montalvo Trend.

The discovery well for the Santa Clara Unit was drilled by Union Oil Company of California on Parcel 0216 in 1970. Since then, four follow-up wells have been drilled on these three parcels, including the 1975 discovery by Standard Oil Company of California of the extension of the oil field onto Parcel P-0217.

There are no production facilities presently installed within the Santa Clara Unit. A projected schedule for the proposed single platform, shown on attached Drawing No. A-SB-2281-0, indicates installation and initial production beginning in 1979. Peak production is anticipated to be 16,000 B/D oil and 16,000,000 CF/D gas during 1982 or 1983, with field life estimated at about 30 years. Production is proposed for shipment to shore through subsea pipelines to an onshore site; oil can then be transshipped by tanker or pipeline to refineries and the gas sold to a utility. To assist in determining the most viable alternative for transshipment of crude, Standard Oil Company of California is participating in an industry study of tanker emissions during loading operations (Western Oil and Gas Association) and also is planning to participate in a study for moving Santa Barbara Channel production to market by means of a new onshore pipeline (Santa Barbara County Board of Supervisors, December 1976). A composite drawing showing proposed facilities has been attached (Drawing No. A-SB-2404-0).



Chevron
Standard Oil Company of California, Western Operations, Inc.
1976
1977
1978
1979
J F M A M J J A S O N D
SELECT PLATFORM SITE
OCEAN FLOOR STUDY
FIRST PLATFORM FINAL DESIGN
REQUEST BIDS
ANALYZE BIDS
AWARD CON-TRACT
FABRICATE & ASSEMBLE
FIELD INSTALLATION
DRILL FIRST WELL
FIRST PROD. TO SHORE 9-79
DEVELOPMENT SCHEDULE
SANTA CLARA UNIT
ENGINEERING J.R. SHORE
DRAFTING W.R.S.
CHECKED
APPROVED
SCALE NONE
DATE 10-29-76
A-SB-2281-0




## FACILITIES
## SANTA CLARA UNIT

| | | |
|---|---|---|
| Chevron — Standard Oil Company of California, Western Operations, Inc. | ENGINEERING J. B. SHORE<br>DRAFTING W.R.S. & D.P.P.<br>CHECKED<br>APPROVED | SCALE 1" = 16,000'<br>DATE 10-29-76<br>A-SB-2404-0 |

SECTION II

# GEOTECHNICAL REVIEW

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## SECTION II

## GEOTECHNICAL REVIEW

### 2.1 Introduction

Boundaries of the Santa Clara Unit within the Santa Barbara Channel and the Unit's location relative to major faults are shown on attached Drawing Nos. A-SB-2380 and 2381. The Santa Barbara channel is a submerged west-trending topographic and structural depression in the westernmost part of the Transverse Range province. It is also considered to be an extension of the onshore Ventura Basin, which lies to the east.

Discussion of regional and area geology, and geotechnical conditions for the Unit may be found in the paragraphs below.

### 2.2 Regional Geology

The regional geology of the Santa Barbara Channel has been described in considerable detail by Vedder and others (1969) and the U.S. Geological Survey (1976) (Refer Appendix 10.1 and 10.2). These reports provide a comprehensive geologic summary of the stratigraphy and structure in the channel. On Drawing No. D-SB-2382, the relationship of the Santa Clara Unit to the significant structural features within the Santa Barbara Channel has been shown. It can be seen that most of these dominant structural features also generally trend nearly east-west as does the channel area. The Santa Clara Unit lies astride one of these features, the Montalvo or 12-Mile trend. This structural feature is part of an anticlinal trend that extends westward from the offshore part of the West Montalvo oil field for about 20 miles. Offshore, this broad anticlinal trend is bounded at depth on the north by a reverse vault that is referred to in numerous reports as the Oak Ridge fault. The history of tectonic activity along this trend as well as within the Santa Barbara Channel has been discussed in reports by Greene (1976), Vedder and others (1969), and two reports by Dames and Moore referenced in the Appendix (10.4 and 10.6).

### 2.3 Area Geology - Santa Clara Unit

The Montalvo Trend oil accumulation is located in OCS Parcels P-0215, P-0216, and P-0217. The trapping structure is comprised of an asymetrical east-west anticline. Reverse faults dipping to the north lie along the south flank of the fold and probably represent the southerly limits of the field (Drawing Nos. B-SB-2383 and B-SB-2384). Folding within the structure extends from over minus 10,000 ft. sub-sea to sea level based on geophysical data and limited well control. The reverse faulting associated with the structure and shown on Drawing No. B-SB-2384 extends from Sespe depth upward into the Pico formation where the faults die out. There is no evidence based on the shallow and deep geophysical data that these faults extend above minus 4,000 ft. sub-sea. Also, within the Santa Clara Unit no significant shallow faults have been noted from any of the shallow high resolution geophysical surveys. Based on limited drilling information, the deeper portion of the structure appears to be cut by an occasional northeast trending tension fault which likewise does not extend above minus 4,000 ft. sub-sea. The sedimentary strata penetrated in the Unit area range from upper Cretaceous to Recent. The deepest stratigraphic penetration on the Unit is in the Exxon Well, P-0205, No. 1, which bottomed in Cretaceous age interbedded marine sandstones, siltstones, and shales. The accompanying generalized columnar section Drawing No. A-SB-2385 is a composite of the formations and rock types penetrated in wells drilled to date on the Unit. Sediments older than Pliocene in age have been dated by faunal methods. The shallow young Pleistocene and Holocene stratigraphic units are based on the work by Greene (1976). Greene has identified these units on the basis of unconformities that have been identified in the shallow, high resolution geophysical profiles made by the U.S.G.S. The shallowest unconformity seen in the profiles has been used to define the base of the Holocene sediments.

## 2.4 Area Geotechnical Conditions - Santa Clara Unit

### 2.4.1 Earthquake Activity

The Santa Clara Unit is located within an area that is recognized as being seismically active. For the purpose of platform design, potential sources and probable levels of ground shaking from possible nearby earthquakes have been analyzed by Dames and Moore, a consulting soils and foundation engineering firm. Their findings, which predict soil liquifaction and earthquake ground motion in the Santa Clara Unit area are covered in a report referenced in the Appendix (10.4). It is their conclusion, based on their analysis of the foundation soils sampled at the proposed platform and regional earthquake studies, that the site can safely support the proposed platform. Some of these potential earthquake sources are shown on Drawing No. D-SB-2382. Further discussion of earthquake design criteria for the platform may be found in Section IV.

### 2.4.2 Surface Faults

No significant shallow surface faults have been located within the Santa Clara Unit by the numerous high resolution geophysical surveys run by Aquatronics Int. Inc. (10.7) and Dames and Moore (10.5) preparatory to drilling exploratory holes or in preparation for the proposed platform site. Both consulting firms report minor faulting on their anomaly maps of ocean bottom conditions. From these surveys, there is no indication that these faults extend to any depth as both consulting firms have been able to draw contour maps on a shallow geophysical reflector without encountering any discontinuities that might be associated with shallow faulting.

### 2.4.3 Bathymetry

The bathymetry shown on Drawing No. B-SB-2386 is from the USC&GS Soundings Map C&GS 5202 (Pt. Dume to Purisima Point); additional contours have been added and water depths converted to feet by Standard's staff. During 1974, Aquatronics International surveyed OCS Parcel P-0217 as part of a preliminary site study for proposed exploratory drilling. Their bathymetry map constructed from a Raytheon Echo Sounder survey is in close agreement with the USC&GS work (Drawing No. D-SB-2386).

### 2.4.4 Ocean Bottom Conditions

1. Slope: Most of the information concerning conditions at the mud line in the Unit area are from the Aquatronics Int. Inc. high resolution geophysical survey run for Standard during May to July, 1974 and from the Dames and Moore's site studies carried out during June and July of 1976 and referenced in the Appendix. Drawing No. D-SB-2387, a profile constructed near the proposed platform site, shows the slope conditions across the Santa Clara Unit from north to south. In the area of the proposed platform location and for waters of less than 350 feet, the slope is about 1/2°. Between 350 and 600 feet water depth, the slope increases to over 2-1/2°.

2. Landslide Potential: In water depths shallower than 350 feet, there are no signs of any scars or slump blocks, based on the bathymetry maps, the high resolution geophysical profiles, an echo sounder survey, and the side-scan sonar surveys. South of the proposed platform site and in deeper waters where the ocean bottom slopes at a higher rate, some minor local slumping and landslide scarring have been noted. Detailed geophysical studies by both Aquatronics and Dames and Moore over OCS Parcel P-0217 show the ocean floor to be very uniform and of low slope in the area of the proposed platform.

3. Scouring: From ocean floor studies made to date, there is no evidence of any scouring action in the vicinity of the proposed platform site. These studies were performed by Aquatronics Inc. and Dames and Moore (referenced in the Appendix) using a Raytheon echo sounder, sub-bottom profiler and EG&G side-scan sonar. Dames and Moore in their

report on soil boring and foundation investigation note that soils recovered at the proposed platform site consisted of silt with little or no cohesion. They conclude that soil of this type can be susceptible to scouring from turbulence or eddy currents created around the platform legs. They estimate a possible scour depth on the order of 1 leg diameter below the mud line if water velocities exceed 1 ft/sec. Design of the platform will account for this condition.

4. Hydrocarbon Seepages: No oil seeps have been noted or found in the Santa Clara Unit area. Insignificant gas plumes, however, are apparent at the mud line from the high resolution geophysical surveys run by both Aquatronics and Dames and Moore. Some slight gasification of shallow sediments probably exists, as noted by bright spotting in the shallow high resolution geophysical profiles. It is also noted that some 22 deep and shallow holes have been drilled on OCS Parcels P-0215, P-0216 and P-0217, yet no significant gas shows were reported within the shallow sedimentary section between the mud line and 800 feet in any of these holes. Below 1,000 feet, after surface casing has been set, mud logging units in operation on several of these holes have reported minor shale gas commencing at that depth.

### 2.4.5 Shallow Overburden Sediments

On OCS Parcel P-0217 and in particular at the proposed platform site the shallow overburden sediments are comprised of generally massive sandy to clayey silts, more than 400 feet thick (Drawing No. A-SB-2385). This lithology and thickness has been defined by numerous punch cores taken by Dames and Moore during the drilling of a 400 foot boring at the proposed platform site. Results of laboratory tests on the core material to determine their foundation bearing capacities are given in reports by Dames and Moore referenced in the Appendix. The age of these sediments has not been determined, however, they are probably of Recent Holocene and very young Pleistocene age. While bedding is not apparent in the punch core material the high resolution geophysical surveys, run and reported by Dames and Moore, show good shallow reflectors that are probably related to sedimentary bedding and shallow unconformities. Greene (1976) noted similar sedimentary characteristics from the extensive USGS high resolution geophysical surveys run at an earlier date in the Santa Barbara Channel.

### 2.4.6 Subsidence

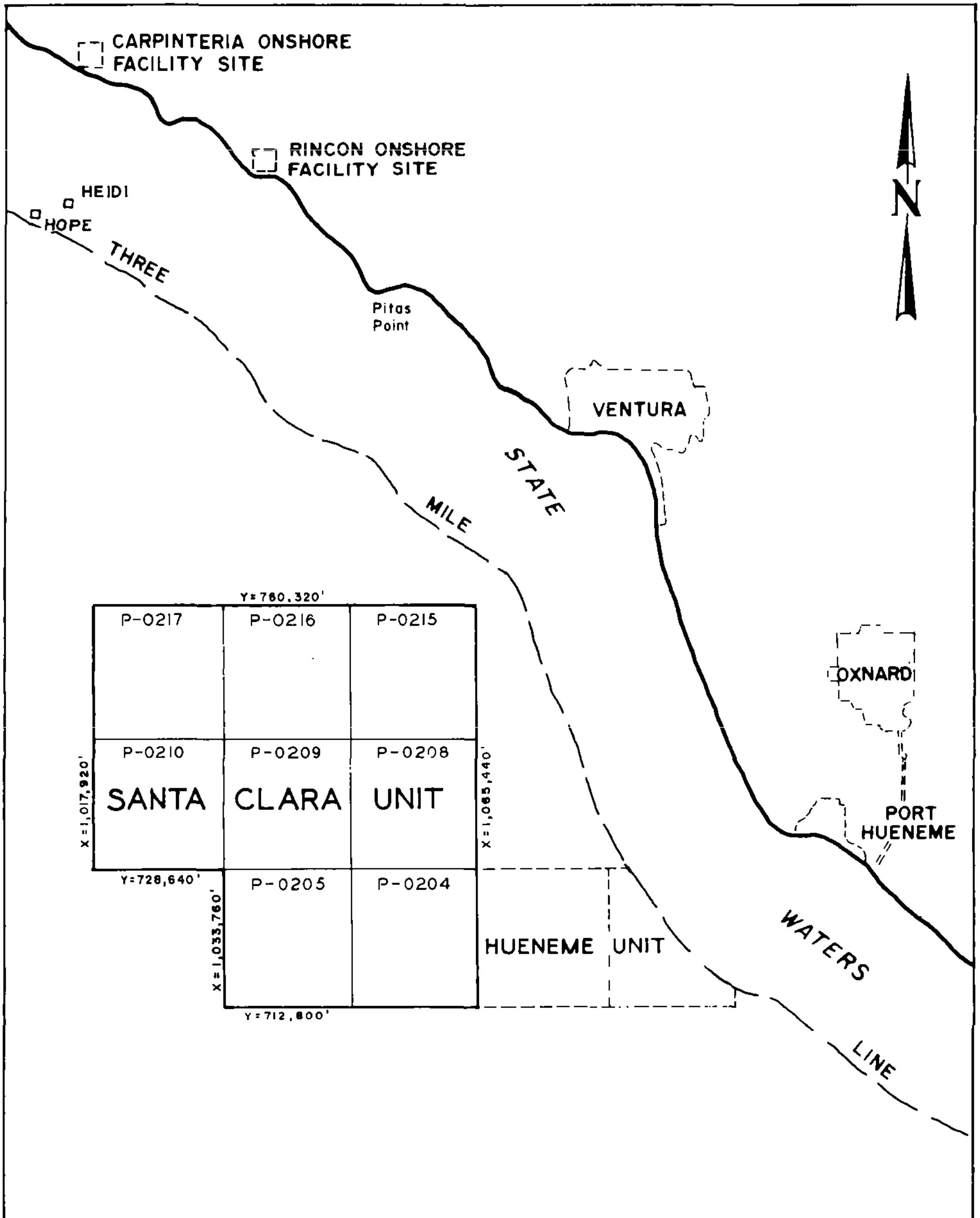
The potential for surface subsidence from deeper oil field fluid withdrawals appears to be negligible, based on: 1) the depth to production, which is over 7,000 ft.; 2) the competency of the producing formation; and 3) the nature of the trapping structure in an arch form that will lend support to the overlying sediments. These foregoing criteria have been observed and evaulated in considerable detail in Standard's urban area operations. They have been found to be important subsidence controlling factors (Erickson 1975 referenced in appendix 10.10).

### 2.4.7 Tsunami Hazards

Tsunamis, or seismic sea-waves, generated by earthquakes, submarine volcanic eruptions or large submarine land slides have been historically recorded along the California coastline. Damage due to tsunamis in California has almost always been restricted to the coastline area and is not anticipated to be of any consequence to offshore facilities, such as the proposed platform. The waves that are formed usually have great length from crest to crest and a very long period, but the amplitude from crest to trough may be only a few feet. This would hardly be noticeable at a facility in relatively deep waters. Damage from such waves occurs as a tsunami wave enters shallower waters along a converging coastline where the full impact of a long period wave can be concentrated.

### 2.4.8 Hydrology

Potable ground water supplies in the Santa Barbara Channel area vary considerably along the coastline. Most of this ground water supply is located in basins that contain relatively young, unconsolidated alluvial fill. Some of these basins, such as the Santa Clara River Valley, within Ventura County, extend offshore some distance. However, the Santa Clara Unit lies offshore beyond the westerly-most extension of these fresh water bearing sands. Electric logs from the several wells drilled on the Santa Clara Unit do not show the presence of any fresh water bearing sands. Therefore, no future involvement with the hydrological ground water problems of the nearby California coastal area are anticipated during the operation of this unit.




BOUNDARY

SANTA CLARA UNIT

| | | |
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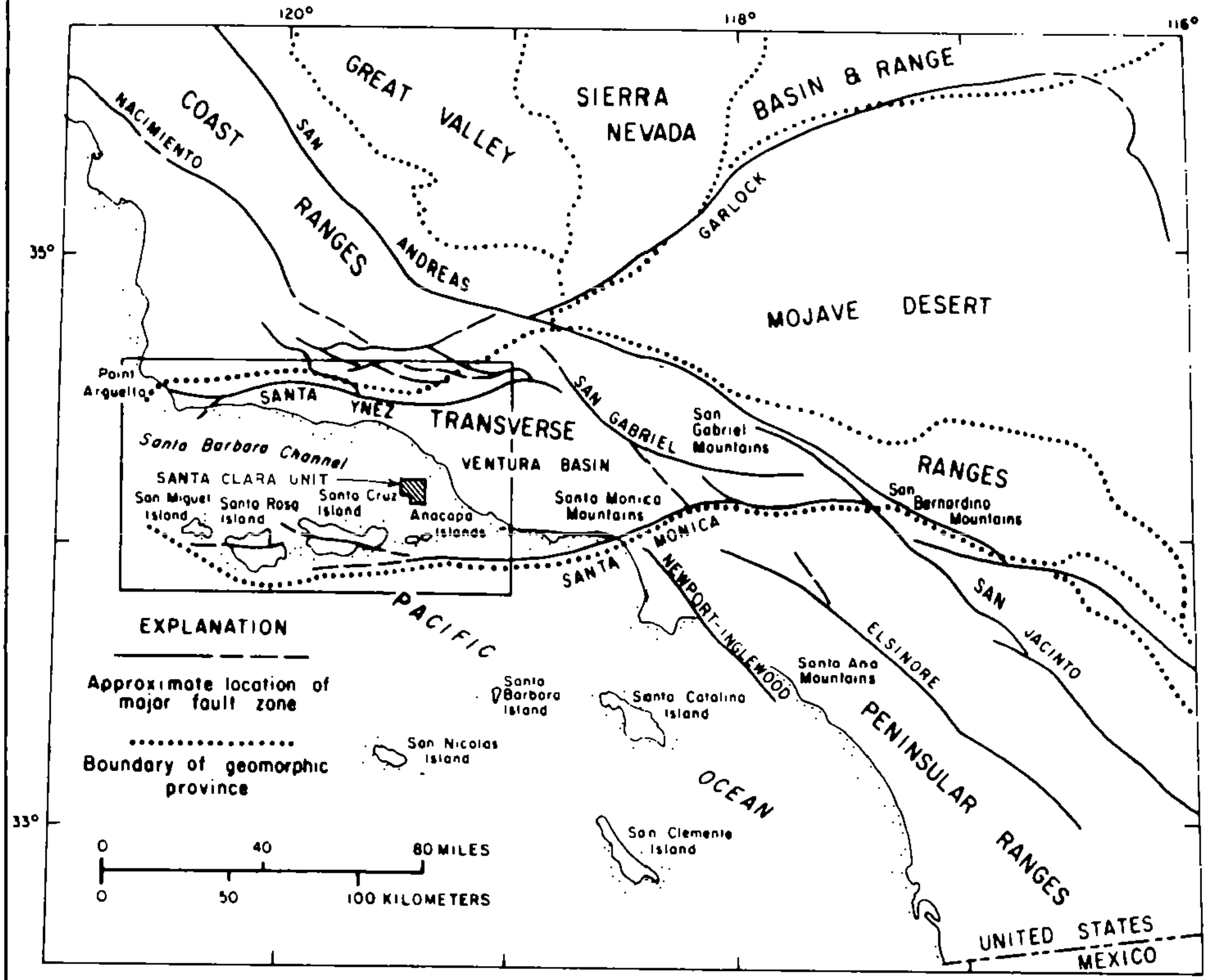
| Chevron<br>Standard Oil Company of California,<br>Western Operations, Inc. | ENGINEERING J. B. SHORE<br>DRAFTING W.R.S. & D.P.P.<br>CHECKED<br>APPROVED | SCALE 1" = 16,000'<br>DATE 10/29/76<br>A-SB-2380-0 |




Index map showing relation of Santa Barbara Channel region to major faults and physiographic provinces of southern California

Source: - U.S. Geological Survey 1974

| | | |
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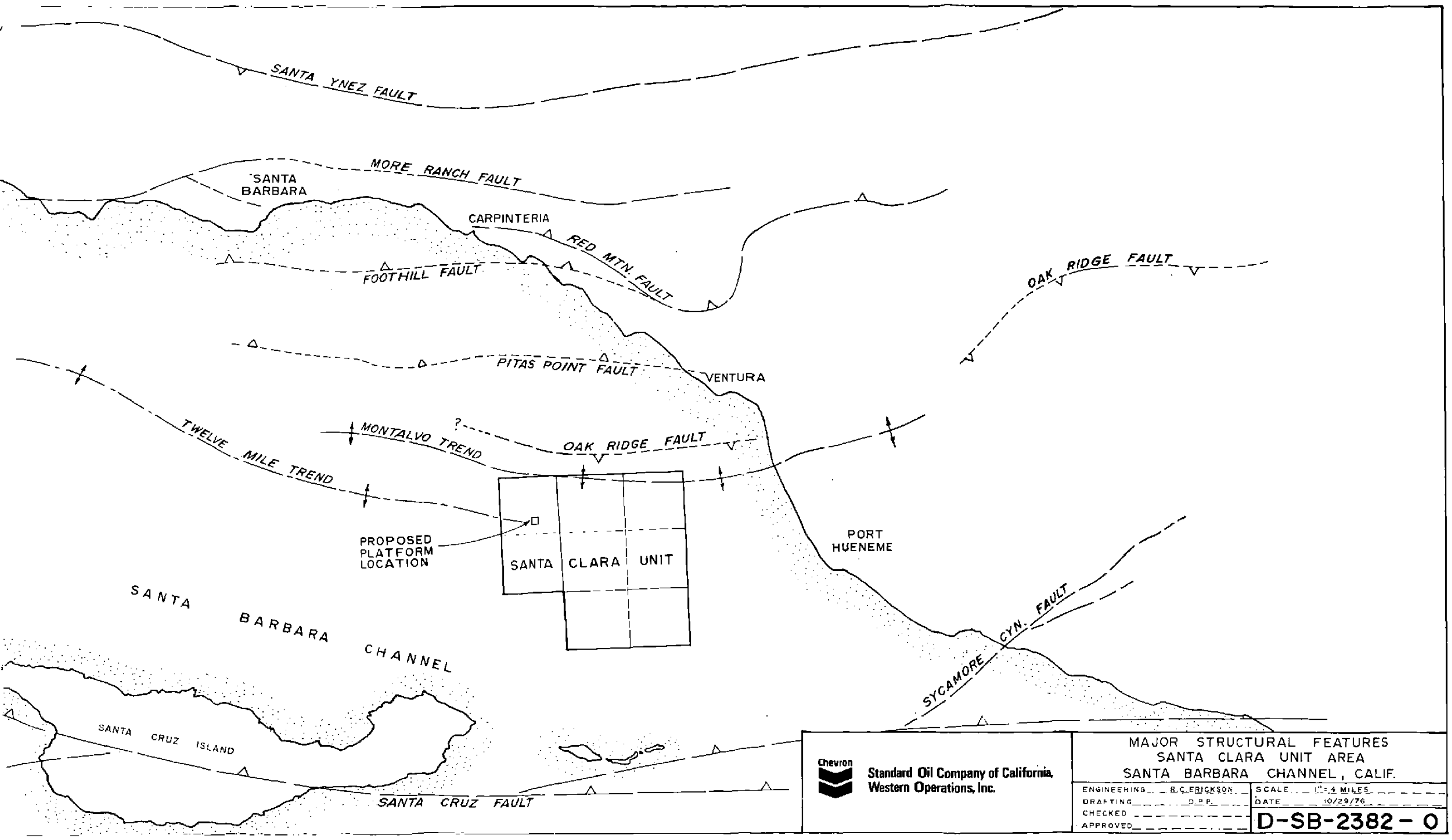

SANTA YNEZ FAULT
MORE RANCH FAULT
SANTA BARBARA
CARPINTERIA
RED MTN. FAULT
FOOTHILL FAULT
OAK RIDGE FAULT
PITAS POINT FAULT
VENTURA
TWELVE MILE TREND
MONTALVO TREND
OAK RIDGE FAULT
PROPOSED PLATFORM LOCATION
SANTA CLARA UNIT
PORT HUENEME
SANTA BARBARA CHANNEL
SYCAMORE CYN. FAULT
SANTA CRUZ ISLAND
SANTA CRUZ FAULT
Chevron
Standard Oil Company of California, Western Operations, Inc.
MAJOR STRUCTURAL FEATURES
SANTA CLARA UNIT AREA
SANTA BARBARA CHANNEL, CALIF.
ENGINEERING R.C. ERICKSON
DRAFTING D.P.P.
CHECKED
APPROVED
SCALE 1" = 4 MILES
DATE 10/29/76
D-SB-2382-0

| PERIOD | STAGE | FORMATION (Sea Bottom) | APPROXIMATE DRILLED DEPTH | ESTIMATED THICKNESS |
|---|---|---|---|---|
| Recent-Pleistocene | | Unconsolidated Sands and Mud | 320' | ±700' |
| Pliocene | Upper Pliocene | **Pico Fm.** Marine Sands, Clays and Siltstones | ±1000' | ±4000' |
| | Lower Pliocene | **Repetto Fm.** Marine Sands, Clays and Siltstones | | |
| Miocene | Delmontian | **Santa Margarita Fm. Siltstone and Shale** | ±5000' / ±7500'S.T. | ±2500' |
| | Mohnian | Monterey Fm. Marine Chert and Siliceous Shale with Limestone Interbeds Grading to Dark Brown Siltstones and Fine Sands at Base. | | |
| | Luisian | | | |
| | Relizian | | | |
| | | U. Topanga Sands | ±7500' / ±9500'S.T. | ±100' |
| | Saucesian | Conejo Vol. Not Present | | Not Present |
| | Zemorrian | Topanga Fm. Volcanic Breccia, Shale and Siltstone. | | ±300' |
| | | L. Topanga Sands | ±7900' / ±9900'S.T. | ±100' |
| Oligocene-U. Eocene | | Sespe Fm. Nonmarine Sands, Shales and Congl. | ±8000' / ±10000'S.T. | ±5000' |
| M-L Eocene | | Llajas Fm. Marine Sands and Siltstones. | ±15000' | ±1500' |
| Paleocene | | Santa Susana Fm. Marine Sands and Shales | ±16500' | ±500' |
| Cretaceous | | "Chico" Fm. Sands and Shales | ±17000' | ? |

S.T. = Sub Thrust

GENERALIZED COLUMNAR SECTION
SANTA CLARA UNIT

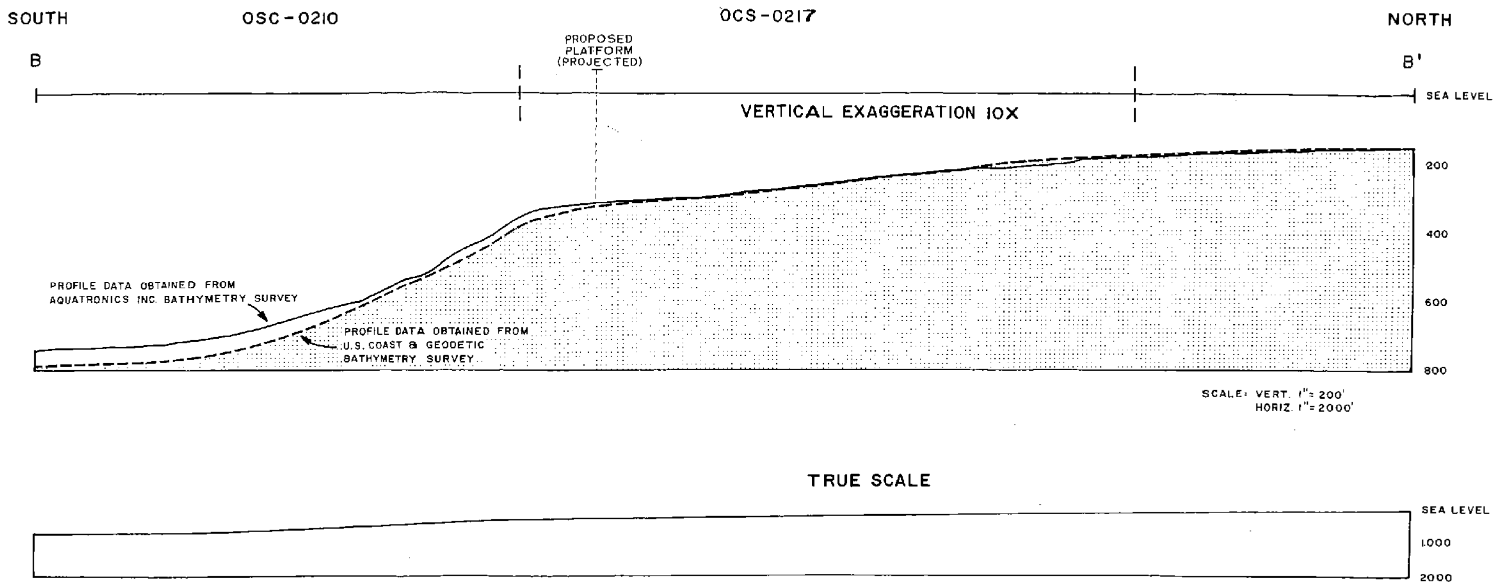
| | | |
|---|---|---|
| Chevron Standard Oil Company of California, Western Operations, Inc. | ENGINEERING<br>DRAFTING<br>CHECKED<br>APPROVED | SCALE NONE<br>DATE 10/29/76<br>A-SB-2385-0 |

Bathymetry Data

Pursuant to the Freedom of Information Act (5 U.S.C. 552) and its implementing regulations (43 CFR Part 2) and as provided in 30 CFR 550.199(b), the information contained in this section is deleted from the public information copy of this submission.

***Proprietary***

***Not for Public Release***




Standard Oil Company of California, Western Operations, Inc.

SEA FLOOR PROFILE
OCS PARCEL P-0217
SANTA CLARA UNIT

ENGINEERING F.W. SMITH
DRAFTING A.E.N.
CHECKED R.C.E.
APPROVED

SCALE HOR. & VER. 1"=2000'
DATE 10/29/76

D-SB-2387-0

SECTION III

# FIELD HISTORY AND RESERVOIR EVALUATION

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Section III – Reservoir Evaluation

Pursuant to the Freedom of Information Act (5 U.S.C. 552) and its implementing regulations (43 CFR Part 2) and as provided in 30 CFR 550.199(b), the information contained in this section is deleted from the public information copy of this submission.

***Proprietary***

***Not for Public Release***

SECTION IV

# PLATFORM STRUCTURE AND SITE

## TABLE OF CONTENTS

January 18, 1977

Correction to "Santa Clara Unit Plan of Development", Chevron USA,
October 1976

Page 4-2

2d line, first paragraph:

Change . . . fine sandy clayey silt . . . to . . . fine inorganic silt . . . .

3d line from bottom, last paragraph:

Change . . . occurrence of 0.10 during . . . to . . . occurrence of 0.18 during . . . .

Corrections per telecon, Terry McGillivary & M. V. Adams, 1-14-77.

cc: K. A. Yenne
M. Reitz
K. M. Minhas
M. S. Mansour — This Copy for
E. G. Kreppert
J. L. Holte

January 18, 1977

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M. Reitz
K. M. Minhas
M. S. Mansour
E. G. Kreppert
J. L. Holte

SECTION IV

# PLATFORM STRUCTURE AND SITE

## 4.1 Introduction

Presently, only one platform is scheduled for installation in the Santa Clara Unit, but one or two additional structures may be proposed in the future for the Montalvo Trend. This single platform, which will provide a foundation for the drilling of the development wells and for the offshore production facilities, is a conventional 12-leg template-type platform to be installed in approximately 318 feet of water. It will be located at the east end of the Santa Barbara Channel on Parcel P-0217, as shown in Drawing No. A-SB-2390.

The structure will be designed in accordance with the latest draft of OCS Order No. 8 for the most severe loads that might occur during launch and installation and, during operations, to safely withstand the loads caused by severe storm waves or the level of earthquake ground shaking appropriate for the seismic region. Any additional platforms for the Unit will be similary designed.

Elevation views of the platform are given in Drawings No. B-SB-2391 and No. B-SB-2392. Twelve main legs framed with diagonal and horizontal bracing comprise the basic structure. This bracing system provides a high level of redundancy and adds substantially to the stability of the platform under severe earthquake or wave loads. The structure will be secured to the ocean bottom with piles driven through the legs of the jacket and attached by welding and grouting. Decks of the platform provide space and load carrying capacity for drilling equipment and production facilities, with a capacity of up to 48 well conductors.

Further details on site conditions, design criteria, platform analyses, fabrication and installation, and other features are listed in the paragraphs below.

## 4.2 Site Foundation Conditions

Foundation borings and detailed geological-geophysical studies were conducted by Dames and Moore to: (1) determine if sediments at the platform site would be stable under earthquake loading conditions; (2) provide data for design of piling for the platform; and (3) determine if other ocean bottom hazards existed.

Soil boring results show that the foundation material is a uniformly fine sandy clayey silt and that liquifaction would not be a problem during an intense earthquake. Detailed soil information is given in the Dames and Moore report referenced in the Appendix (10.4).

The geophysical survey consisted of echo sounding, continuous acoustic reflection profiling, side scan sonar, and marine magnetic search. Approximately 27 nautical miles of survey lines were run in the platform site areas, with a 1000 ft. x 500 ft. grid, plus diagonals, in accordance with OCS regulations. An additional 75 miles of survey lines were run along the inferred trace of the nearby Oak Ridge fualt, investigating near-surface structural displacement to evaluate recency of activity. Survey navigation and positioning were performed with a precision, high-frequency radio-positioning system. Results of the surveys are given in the two Dames and Moore reports referenced in the Appendix (10.5 and 10.6). The survevs indicate no interpretable abnormal conditions or features having cultural significance.

Discussion of the Area Geotechnical Conditions may be found in Section II.

## 4.3 Earthquake Design Criteria

The location of the Santa Clara Unit within an area of recognized seismicity requires that the structure be designed for an earthquake environment. The Dames and Moore report which predicts earthquake ground motion vs. return period, is referenced in the Appendix (10.4). The following requirements and criteria will be satisfied in the design:

### 4.3.1 Level 1

Structural damage will be avoided in the event of ground acceleration of 0.15g (bedrock accel. also 0.15g), for which there is a probability of occurrence of 0.18 during the three to four years of drilling operations, with producing and drilling equipment installed. This corresponds to an estimated mean recurrence interval of 30 years.

### 4.3.2 Level 2

Structural damage will be avoided in the event of ground acceleration of 0.20g (bedrock accel. 0.25g) for which there is a probability of occurrence of 0.10 during the anticipated life of the structure, with only producing equipment installed. This corresponds to an estimated mean recurrence interval of 200 years.

### 4.3.3 Level 3

The structure will have adequate ductility through inelastic deformation, to maintain structural integrity against collapse for a rare intense earthquake. This criterion, based on ground acceleration of 0.33g (bedrock accel. 0.50g), corresponds to an estimated mean recurrence interval of 20,000 years.

## 4.4 Wave and Wind Load Design Criteria

For the proposed platform the design wave load conditions are based on severe storms that have a probability of exceedance of one percent per year (100-year storm). The 100-year recurrence values and directions for the most severe wave, wind, currents, and tide are as follows:

### 4.4.1 Waves (South East)

| | |
|---|---|
| Maximum Height (Crest-Trough) | 47 ft.* |
| Period of Maximum Wave | 11-1/2 sec.* (approx) |
| Length of Maximum Wave | 733 ft.* (approx) |

*Additional studies are currently in progress to refine wave design criteria.

### 4.4.2 Winds (South East) at 30 ft elevation

| | |
|---|---|
| Maximum (fastest mile) | 74 kt.* |
| Peak Gust (2 sec.) | 108 kt.* |
| Wind Direction (from) | SE |

*Additional studies in progress to refine design criteria.

### 4.4.3 Currents

Total maximum currents (storm, tidal, background) are as follows:

| | |
|---|---|
| Surface | 2.0* |
| Mid-depth | 1.6* |
| Bottom | 1.3* |
| Current Direction | Toward NW |

*Additional studies in progress to refine design criteria.

### 4.4.4 Tides

| | |
|---|---|
| Total maximum (incl. storm) | 9.0 ft. (above MLLW) |

These data were derived from the oceanographic/meteorological study by Oceanographic Services, Inc., (OSI) of Santa Barbara, California. Their report is referenced in the Appendix (10.8). This study includes hindcasts of the most severe wind, wave, current, and storm tide conditions at three locations in the Santa Clara Unit from a data base covering the historical period from 1899 through 1975. These data were extrapolated to obtain values for recurrence intervals beyond the data base. Normal oceanographic/meteorological conditions were also studied and the data summarized in a Chevron Oil Field Research Company report referenced in the Appendix (10.9); normal conditions are generally favorable for operations.

## 4.5 Platform Analysis

The proposed platform will be designed and analyzed using two and three-dimensional models and analysis methods. Two methods, a spectral analysis and transient analysis, will be incorporated in the analysis of the structure's response to earthquakes. The spectral model analysis method, utilizing earthquake response spectra specifically developed by Dames and Moore for the platform site, will be used for member sizing for the Level 1 and 2 earthquakes. The transient analysis method, utilizing earthquake ground motion records, i.e., acceleration time history, will be used for the analysis of the response to the Level 3 (ductility) earthquake, with a nonlinear structural analysis program employed to model the elastoplastic behavior of the structure. A set of acceleration time histories were developed by Dames and Moore matching their site design response spectra.

To determine the structure's response to waves, static wave analyses, the position of the wave at which the greatest forces were exerted on the structure, will be determined and the structure will be loaded with the resulting wave pressures.

The platform will also be analyzed for loads that occur during launch and installation. Design requirements insure structural integrity under imposed loads occurring during launch from the barge and under hydrostatic loads occurring during either transportation or installation. Also, the platform will be designed to have adequate stability under launch and during installation until the piling are fully installed.

Standard Oil Company of California is currently funding soil-pile-structure interaction studies by an independent consultant using finite element analysis techniques. The objective is to insure that modeling the behavior of the foundation for the platform linear and nonlinear structural analysis is consistent with present "state of the art" techniques.

## 4.6 Fabrication and Installation

The jacket-type platform is a proven concept for such offshore structures. The principal components of an offshore platform are the deck, the jacket, and the piling. To implement this project, a contractor or contractors will fabricate and assemble these components, and barge transport them from the assembly yard to the offshore site for the installation. Sites for construction and assembly will be determined when contracts have been awarded, presently scheduled for the latter part of 1977. The jacket strucuure, after being transported to the site, will be launched from the barge, and installed by lowering to the ocean floor by controlled flooding. After the jacket is secured by piling, the modules that make up the deck sections will be set in place on the jacket. A completed platform ready for drilling and production has been tentatively projected for 1979.

## 4.7 Corrosion Control

The platform will be protected from corrosion by coatings above mean water level and by cathodic protection below mean water level.

The protective coating system planned is an established concept and employs standard materials used in accordince with conventional corrosion protection practices. It has been used successfully for over ten years in the Gulf of Mexico. Three types of protective coatings are used:

1. Galvanizing - applied to hardware, fencing, handrails, and grating.

2. Sheathing - synthetic rubber or monel sheathing is applied to members in the tidal and wave splash zones.

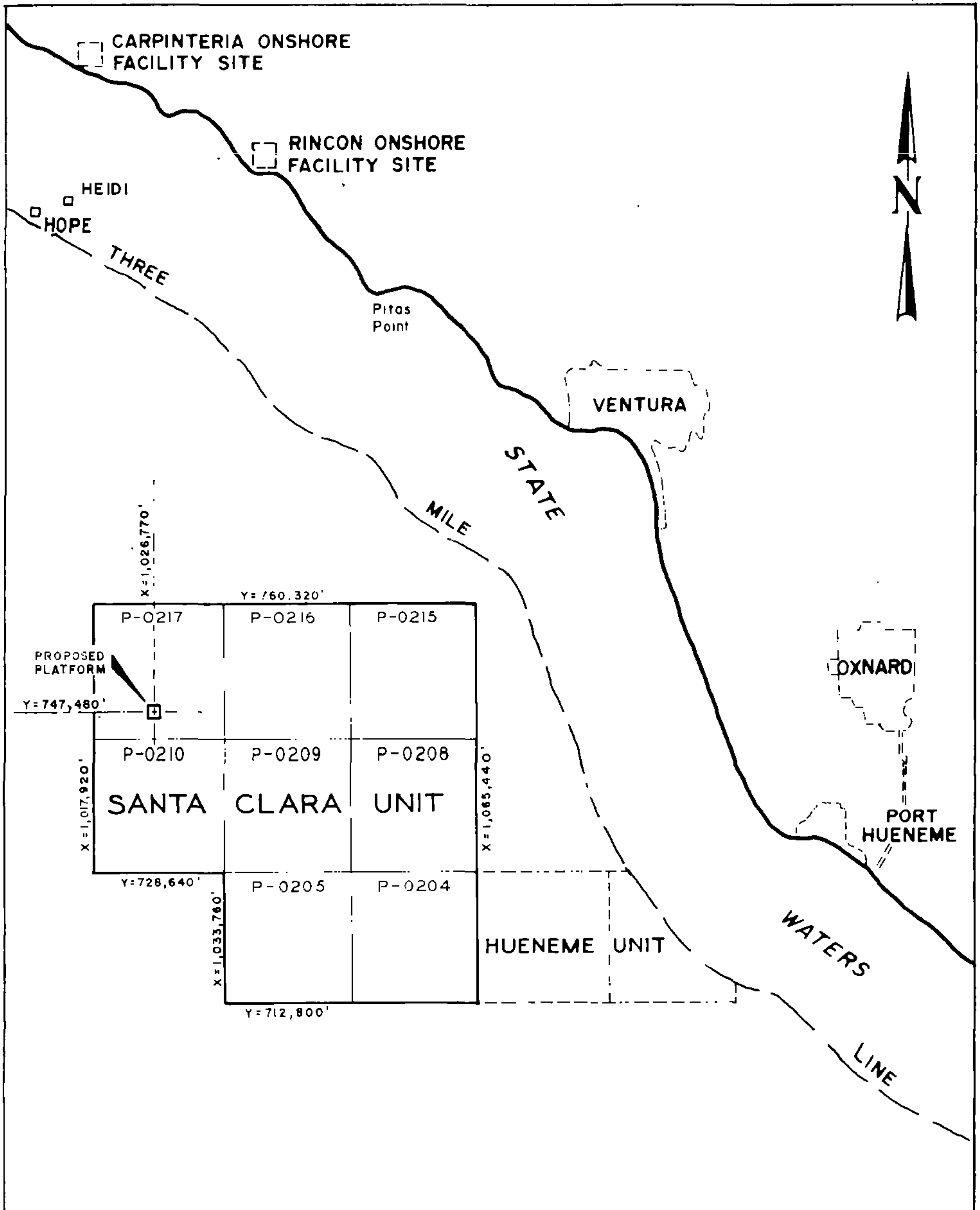
3. Painting - a multi-coat, inorganic zinc-vinyl system is applied to surface areas above mean water level not protected by galvanizing or sheathing.

An impressed current cathodic protection system will be provided for all underwater steel members and piling.

## 4.8 Platform Removal

Features that facilitate the removal of this platform will be incorporated in the design. Following the depletion of all producing zones developed from the platform, wells will be plugged and abandoned. Well conductors will be cut below the mudline and removed; drilling and production equipment will be dismantled and removed; and the deck units will be removed.

The method used for removal of the jacket involves cutting the piling below the mudline and refloating the jacket with auxiliary buoyancy tanks. The jacket would then be removed and the site restored in accordance with permit requirements.




PLATFORM LOCATION
SANTA CLARA UNIT

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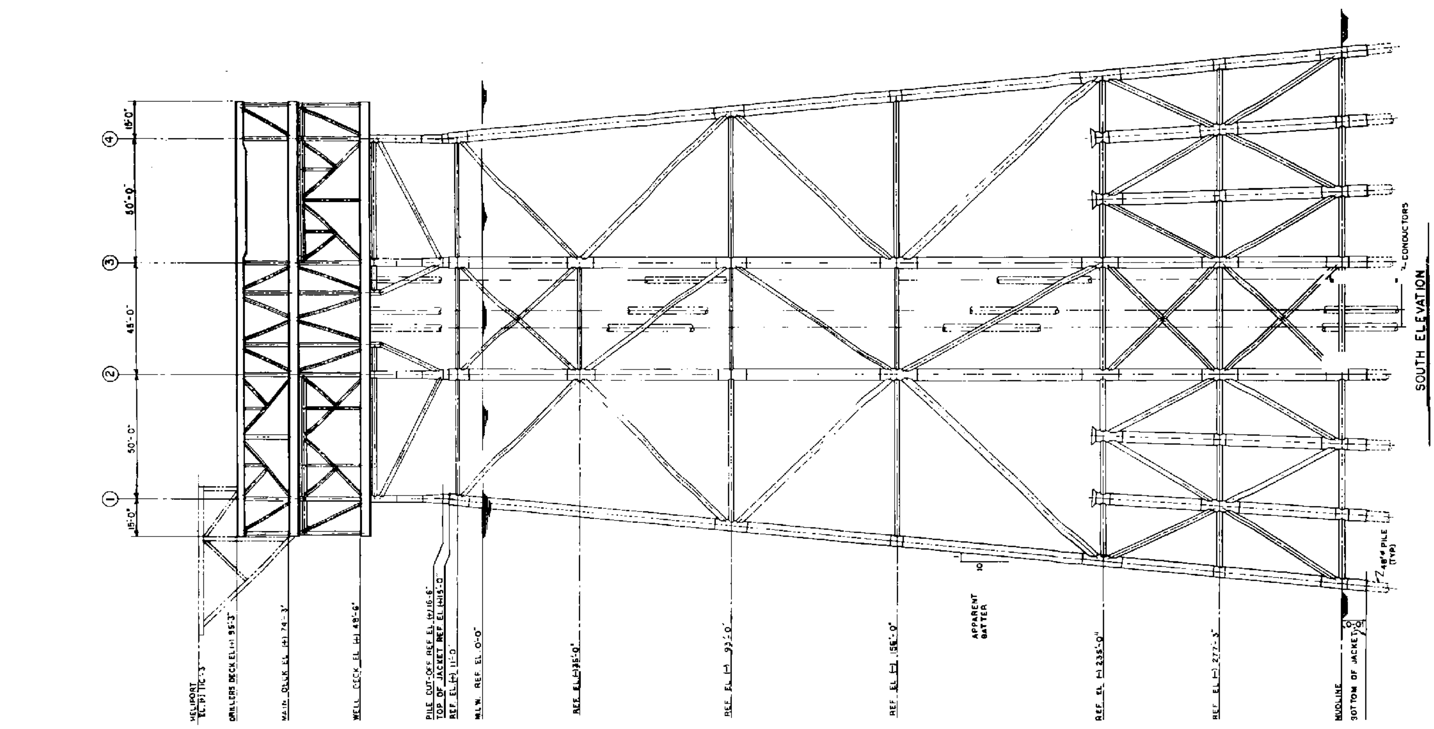


NOTES

BOATLANDINGS, BARGEBUMPERS AND OTHER MISC. APPURTENANCES ARE NOT SHOWN FOR CLARITY.

MEMBER SIZES AND PILE WALL THICKNESSES HAVE BEEN OMITTED UNTIL DESIGN CHECK IS COMPLETE.

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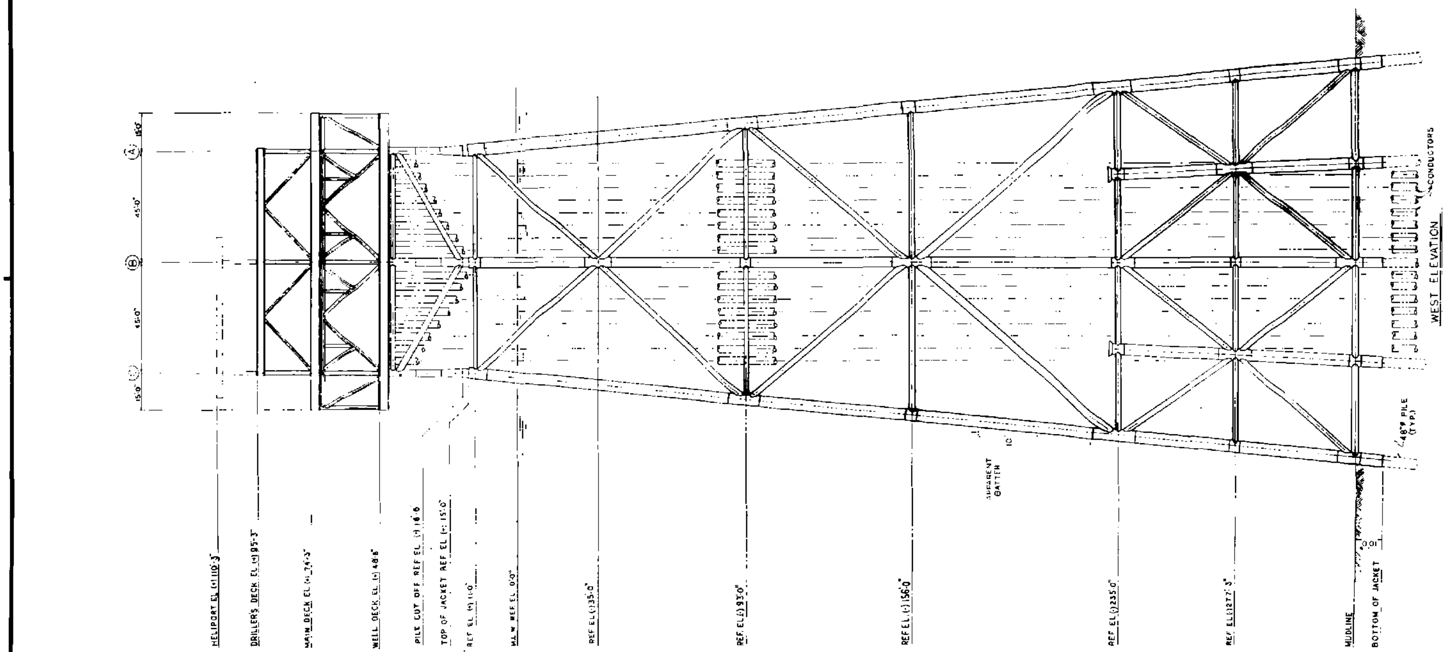
SCALE NONE

DATE 10-29-76

APPROVED

SOUTH ELEVATION PICTORIAL
SANTA CLARA UNIT PLATFORM
SANTA BARBARA AREA

B-SB-2391 - 0




NOTES

1. BOATLANDINGS, BARGE BUMPERS AND OTHER MISC. APPURTENANCES ARE NOT SHOWN FOR CLARITY.
2. MEMER SIZES AND PILE WALL THICKNESSES HAVE BEEN OMITTED UNTIL DESIGN CHECK IS COMPLETE.

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SCALE NONE

DATE 10-29-76

APPROVED

WEST ELEVATION PICTORIAL
SANTA CLARA UNIT PLATFORM
SANTA BARBARA AREA

B-SB-2392 - 0

SECTION V

# DRILLING FACILITIES

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SECTION V

# DRILLING FACILITIES

## 5.1 Introduction

The first Santa Clara Unit platform will have slots for a maximum of 43 wells. Two drilling rigs and associated crews and services will be contracted to drill the 36 wells presently planned.

Preliminary drilling equipment layouts are shown on drawings at the end of this section. It is anticipated that the rigs will be land-type with alterations necessary for this offshore adaption. The drilling contractor will have some flexibility in final equipment layouts, but equipment must be compatible with deck designs. Any additional Santa Clara Unit platforms are anticipated to be similarly equipped.

Drilling operations, pollution prevention systems, and safety systems will be in accordance with OCS and E.P.A. regulations and industry standards.

## 5.2 Drilling Equipment

All drilling equipment and services will be handled on a contract basis. Major drilling equipment will include:

### 5.2.1 Rig Components

Two land-type cantilever masts, 142 feet high with 15,000 foot drilling and 1,000,000 pound hook-load capacities, will be required. The masts will be designed in accordance with A.P.I. Standard 4D for freestanding masts.

The drawworks will be electrically powered (rated at 1500 HP) and be complete with sandreel and rotary table drive.

The hook, traveling block, and crown block will be of 500 ton load rated capacity to match the mast.

The drill string will be 4-1/2" or 5", grade G drill pipe, appropriate for wells where $H_2S$ is anticipated.

### 5.2.2 Substructures

A drilling subbase is to be provided to support the mast, drawworks subbase, and connecting stairways.

Each subbase will be supported on a sub-skidbase, which will rest on four elevated skidbeams. The sub-skidbase will be equipped with a hydraulic jacking system which will allow transition along the direction of the well rows. The subbase will also be equipped with hydraulic jacks to allow lateral skidding over the desired well.

Substructures will be capable of supporting the mast and setback loads. Mechanical restraint equipment will be provided to prevent substructure movement once positioned over the desired location. Drip pans will be incorporated into the substructure and drainage from these will be diverted into the cuttings waste tank for treatment and/or transport to shore.

### 5.2.3 Drilling Mud System

A separate mud system will be provided for each drill rig.

Each rig will be equipped with two mud pumps (1000 HP and 850 HP), a mud mixing tank (250 bbl+), a circulating tank (300 bbl±), and three mud storage tanks (400 bbl. each).

Return mud will be treated with separate high speed shale shakers, desanders, desilters, and degassers for each rig. The shale shaker units will be equipped with a cuttings washing system to clean any oil-contaminated cuttings before disposal. Cuttings that cannot be adequately cleaned by washing will be diverted to a 500 bbl. waste cuttings holding tank, to be hauled ashore for disposal.

Mud volumes will be closely monitored using a pit volume totalizer system, an incremental flowrate indicator, and a precision fill-up measurement system. These warning systems will have visual and audible alarm signals at the driller's console. A common bulk material handling system will be provided with 3000 cu. ft. storage capacity for clay and barite materials. Mud additives (chemicals, lost circulation material, etc.) will be palletized.

### 5.2.4 Cementing Unit

One diesel powered dual cementing unit and three 1000 cubic foot bulk storage tanks will be provided for well cementing operations.

### 5.2.5 General Layout

The drilling mud system equipment will be located on the main deck, with only the waste cuttings tank below, on the well deck (Drawing No. B-SB-2393).

The upper drilling deck will provide the area for the drilling contractors support facilities: power control rooms, emergency bunkrooms, wash and change rooms, offices and tool rooms (Drawing No. B-SB-2394).

The masts, subbases, drawworks, and associated equipment will be installed on the subskid bases above the upper drilling deck and pipe rack (Drawings No. B-SB-2395).

## 5.3 Drilling Operation

### 5.3.1 Casing Program

Casing selection and cementing will be in accordance with the requirements of OCS Pacific Region Order No. 2. The attached casing program (Drawing No. A-SB-2396) is based upon there being sufficient evidence from core hole drilling at the proposed platform site to justify a field rule that will preclude the necessity of installing the "structural casing". The 24" casing shown on the drawing meets the requirements for the "conductor casing".

### 5.3.2 Wellhead Equipment

Unitized wellheads will be used during the drilling phase and block type Christmas trees will be installed for production. The wellhead assemblies will be suitable for free flow, gas lift, and hydraulic pumping.

### 5 3.3 Blowout Preventer Equipment

Low and high pressure blowout preventer systems will be used as required by OCS Orders. These systems will be remotely controlled and hydraulically operated.

The low pressure system will consist of a 29-1/2" 500 psi annular-type blowout preventer with diverter system installed for drilling below cemented 24" conductor casing string. After 18-5/8" surface casing is landed and cemented, the unitized casing head will be installed with the 3000 psi B.O.P. equipment, including an annular preventer, a blind ram, and two pipe rams.

Both systems will have the appropriate choke manifold, kill and bleed lines, and fill-up lines as required by OCS Orders.

### 5.3.4 Pollution Prevention

Pollution prevention procedures are included as a portion of the overall contingency plan. This Plan for the Santa Clara Unit is based upon compliance with OCS Orders and is included in a separate attachment.

### 5.3.5 Safety

Appropriate OCS and OSHA Safety regulations will be followed. The presence of $H_2S$ in the produced gas requires detection and alarm devices not usually required for normal drilling operations.

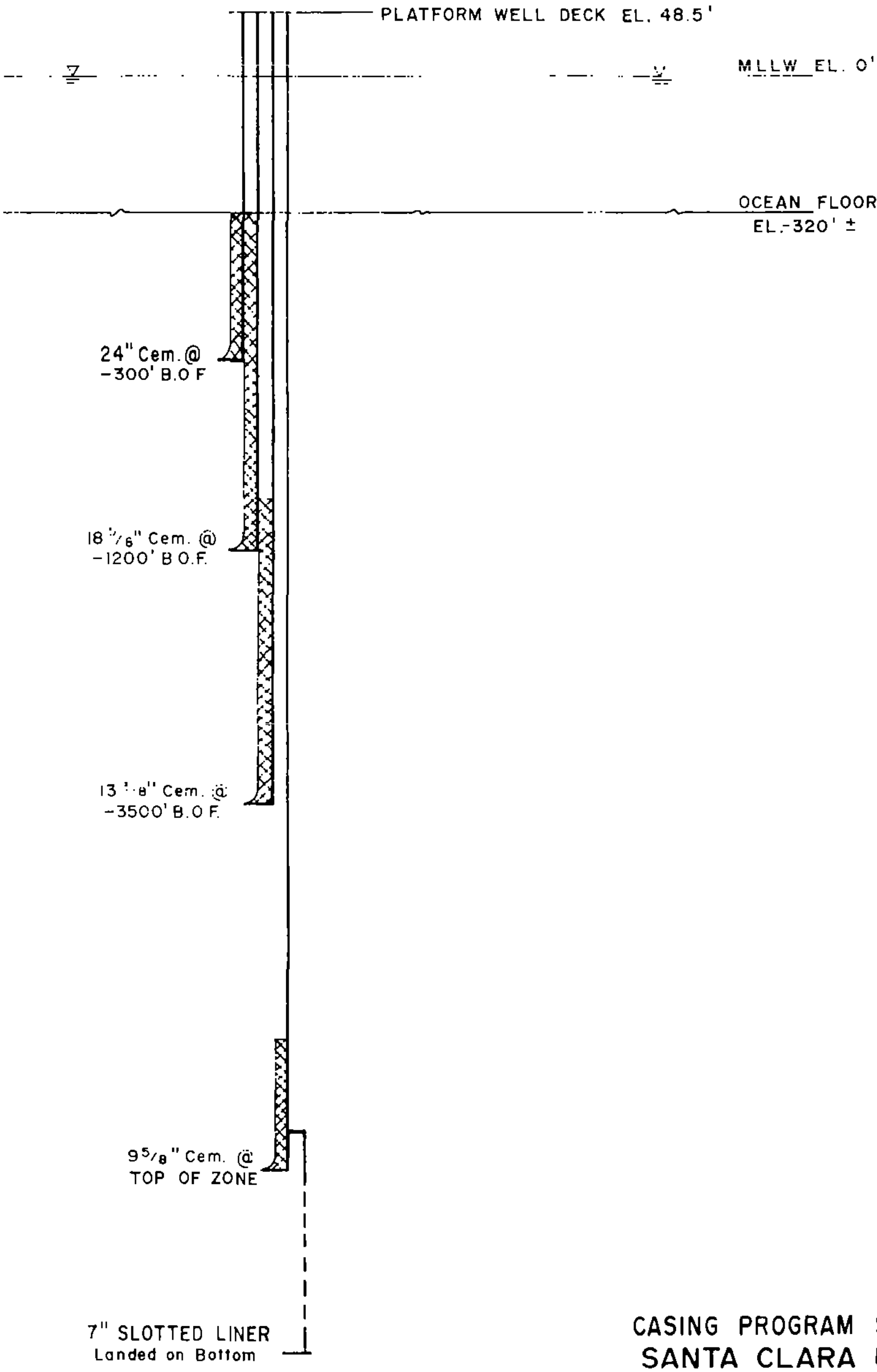
### 5.3.6. Fire Prevention and Suppression

In addition to the platform systems described in the Production Facilities section, portable fire extinguishers will be provided for the rig floor and BOPE areas.

### 5.3.7 Crew and Supply Transport

Drilling crews will work regular 8-hour shifts, and will be transported between shore and platform by helicopter. Day shifts are expected to contain 25 men and night shifts 18 men. Supply boats will transport supplies as required.

Weather should have little effect on helicopter or crew and supply boat operations, but emergency facilities and supplies will be provided to allow at least one week of normal operations under storm conditions.




CASING PROGRAM SKETCH
SANTA CLARA UNIT

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SECTION VI

## PLATFORM FACILITIES

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6.5 Attachments

Drwg. No. B-SB-2397 Flow Diagram, Sheet #1
Drwg. No. B-SB-2398 Flow Diagram, Sheet #2
Drwg. No. B-SB-2399 Production Forecast, Platform "A"
Drwg. No. B-SB-2393 Plan - Well Deck and Main Deck
Drwg. No. B-SB-2395 Elevation - Platform
Drwg. No. A-SB-2400 Wellhead - Manifold Arrangement

SECTION VI

# PLATFORM FACILITIES

## 6.1 Introduction

This section describes all production equipment and related facilities to be installed on the platform and is divided into the following three parts (1) Production Process Facilities; (2) Utility Systems; and (3) Support Facilities.

The platform will contain complete production facilities for the treatment of the produced oil, gas, and water. Treated oil and gas will be of marketable quality, needing no additional onshore treatment except for possibly LTS (hydrocarbon dew point control) treatment of the gas. Any additional platforms for the Santa Clara Unit are anticipated to be similarly equipped. Equipment, controls, monitors, safety devices, etc., will be installed in accordance with applicable O.C.S. Orders and industry standards.

All initial production will be from the Monterey Zone. Drill stem production tests made in this area indicate that the Monterey Zone consists of a number of permeable layers with varying hydrocarbon properties (G.O.R., gravity, $H_2S$ content, etc.). All tests indicated the presence of sulfur; levels were less than 3.5 percent in the oil but the gas varied from a few ppm $H_2S$ to as high as 3,000 ppm on Parcel P-0215.

Drawing Nos. B-SB-2397 and 2398, flow diagrams, show how the flow stream will be separated and treated. Produced gas will be collected at various system pressures, compressed, and treated. A Stretford process facility has been selected for gas treating ($H_2S$ removal) as shown on the attached equipment layout and flow diagram drawings. The sweet gas will then be used for fuel and gas lift, with the remainder to be piped to shore for sales. Produced water and deck drainage will be treated and cleaned, then disposed into the ocean.

Utility systems and support facilities will be provided to allow the platform to be as self-reliant as possible. Provisions for power generation, potable water production, emergency back-up power and safety systems, etc. have been made to allow operations to continue safely even though inclement weather might preclude platform resupply for several days.

6.2 Production Process Facilities

6.2.1 Design Criteria

1. Reservoir Data: Reservoir data utilized in the design of platform facilities have been obtained from several tests made on two evaluation wells in Parcel P-0217 and other wells within the Montalvo Trend.

   a. Maximum bottom hole pressure 3,650 psi.

   b. Bottom hole temperature 188°F.

   c. Flowing wellhead pressure (initial development) 800 psi.

   d. Maximum shut-in tubing pressure 2,900 psi.

   e. Flowing wellhead temperature 90°F (avg.).

   f. Gravity (avg.) @ 60°F 28° A.P.I.

   g. BS&W content 5% with trace of sand.

   h. Maximum well flowing rate 1,500 b.o.p.d.

   i. Sulfur in oil 2.3%.

   j. $H_2S$ content (gas), 50-3000 ppm

   k. A Production Forecast Curve is attached showing Total Oil, Gas and Water vs. Time (Drwg. No. B-SB-2399).

2. Production Treating Requirements - Crude Oil: Production is to be treated to provide a marketable crude with a BS&W content of 3% or less and a vapor pressure not to exceed 11 psia. The maximum anticipated shipping pressure for the crude oil leaving the platform is 600 psi.

3. Production Treating Requirements - Gas: The preliminary plan is to treat the gas on the platform to meet gas company specifications.

   Depending upon sales arrangements, platform discharge pressures could be as high as 900 psi or as low as 110+ psi. Some LTS facilities may be required on the platform if gas is to be sold directly to the gas company.

4. Production Treating Requirements - Waste Water: Produced and other waste waters are to be cleaned and discharged into the ocean. Cleaning facilities will provide water that meets the E.P.A. requirements for discharge into far offshore waters of the Pacific.

### 6.2.2 General Layout

As shown on Drawing Nos. B-SB-2393 and 2395, process equipment has been located to minimize the length of interconnecting piping and to segregate this equipment from personnel occupied areas. The wind rose illustrates that personnel will normally be upwind of the process equipment. The fire wall and doors on the well deck effectively divide the well deck into hazardous and non-hazardous areas, giving further protection to the personnel quarters.

### 6.2.3 Wellheads and Flow Manifolds

Forty-eight well conductors will be provided; thirty-six wells are presently planned, with the twelve remaining reserved for future use. The wells will be arranged in three rows, with short flowlines connecting each tree to a wall-mounted manifold system (See Drwg. No. A-SB-2400).

The manifold system will allow production to be switched between pool and test separators. Lines for future casing gas recovery, gas lift input, power water in and out, hydraulic and pneumatic control, etc., will also be provided. All wells will be equipped with downhole hydraulically controlled safety valves in accordance with OCS Order No. 5.

### 6.2.4 Artificial Lift

It is anticipated that artificial lift will eventually be required for all wells but that it may be necessary for producing some weaker wells immediately upon completion. Therefore, initial provisions for both gas lift and hydraulic pumping will be provided.

The gas lift system will have a designed capacity of 10,000 MCF/D at 1000 psi discharge pressure. Lift gas temperatures will be sufficient to preclude gas dehydration or final cooling.

The hydraulic pumping system will utilize clean, treated produced water and will have a designed capacity of 12,000 B/D at 2500 psi operating pressure. The hydraulic power water will be pressured by submersible pumps and be metered in and out of each well.

### 6.2.5 Oil and Gas Separation

Oil and gas separation is to take place at an operating pressure of approximately 125 psi. Prior to separation, production will be heated from approximately 90°F to 150°F to control foaming and accelerate the breakout of produced water.

The pool and test separators are to be three-phase with free water draw-offs. The well clean-up and blowdown separator will be a two-phase vessel and be used primarily for new wells contaminated with drilling fluids.

### 6.2.6 Oil Cleaning

Two electrostatic treaters, operating at approximately 40 psi, will be provided for oil cleaning. Prior to cleaning, the emulsified oil will be heated from approximately 140°F to 200°F. These treaters are intended to normally operate in parallel.

### 6.2.7 Oil Shipping

Clean oil from the treaters will be cooled prior to entering the LACT surge tank. The two LACT units will have flexibility to ship oil at rates of 4300 B/D to 23,000 B/D. Immediately after LACT metering, clean oil will be pumped via subsea pipeline to shore.

### 6.2.8 Gas Processing

The Stretford Sulfur Recovery System has been selected as being the most desirable process for removal of $H_2S$ and providing "sales quality" gas.

All vapors and low pressure (40 psi) gas streams will be boosted to 125 psi to join the casing gas and separator gas streams. The total gas stream will enter the Stretford Process at this 125 psi pressure. Sweetened gas will then be boosted to 200-350 psi. A portion of this stream will be boosted to 1000 psi for gas lift while the remainder will be dehydrated in a glycol contactor. Approximately 1000-2500 MCF/D of the dehydrated produced gas will be utilized as platform fuel for power generation, etc. and the balance will be compressed, as necessary, and piped ashore for sales.

### 6.2.9 Gas Compression

Motor driven compressors will be used for gas compression. The most desirable combination of screw, reciprocating and centrifugal compressors will be selected to provide both flexibility and efficiency.

### 6.2.10 Condensate Handling

Condensate collected from the gas scrubbers will be injected into the oil stream prior to LACT metering.

### 6.2.11 Stack and Flare Systems

All high pressure balanced relief valves on vessels and gas compressors, as well as stack regulators on the gas collection systems, will be manifolded together to a high pressure stack scrubber and flare. Low pressure relief valves from the vapor recovery system, tanks, compressor spacer block vents, etc., will be manifolded together to a vapor stack scrubber and flare.

Both the high pressure and vapor stack flares will be incorporated into a single flare boom. Liquids collected in the stack scrubbers will be drained into a waste oil tank or pumped back through the electrostatic treaters.

### 6.2.12 Waste Water Treatment

Produced water from the separators and treaters will be routed to a sediment separator tank before entering an areated flotation unit. The treated water will be continuously monitored for oil content and that containing more than 50 ppm will be divered back through the dirty water surge tank to be retreated. Clean treated water will be directed to the disposal pile. Solids from the sediment separator will be pumped to the 500 bbl. waste tank.

### 6.2.13 Platform Drainage

The platform will be divided into three drainage areas for separate handling. The well deck drainage will drain to a sump tank located on a lower auxiliary deck. This collected drainage will then be pumped into the sediment separator tank for waste water treatment. Drainage from the pipe rack and gas processing area of the main deck will gravitate directly to the sediment separator tank for treatment.

Drainage from the drilling area of the main deck, the upper drilling deck, and the drain pans in the drilling substructures will gravitate into the drilling waste tank.

All decks will have a 6" high curb around the perimeter to prevent any overflow into the ocean. Spray shields will also be included to prevent liquid spray from reaching the ocean.

## 6.3 Utility Systems

The platform design will include the following utilities:

### 6.3.1 Power

The layout provides space for three 2,500 KW dual fuel (gas and diesel) generators with associated controls and switch gear, high voltage switch gear to provide power for the two drilling rigs and motor starters and controls for process and production equipment.

The power system design will provide the possibility of providing standby capacity via submarine cable for other nearby platforms.

### 6.3.2 Emergency Power Generation

Emergency power generation will be supplied by a diesel-powered 400 KW± generator. This unit would provide electric power under emergency conditions for critical services such as B.O.P. accumulators, lights, fire pumps, air pressuring systems, sump pumps, etc. The diesel generator will have an air starter and a separate air reservoir tank.

### 6.3.3 Diesel Fuel

Diesel fuel will be utilized for the turbine generators until fuel gas becomes available from producing wells. Other diesel fuel usage will include the intermittent use of the cementing pumps, cranes, emergency generator and air compressor.

Permanent diesel storage will be provided by the larger crane pedestal (300 bbls.). Temporary storage tanks (totaling 1000 bbls.+) will also be provided initially. Transfer pumps, filters, distribution piping, and day tanks at each engine will be included. Connections at the boat landing level will be provided for the transfer of the diesel fuel from work boats to the pedestal storage tank, where the fuel may be overflowed into the temporary storage tanks.

### 6.3.4 Fuel Gas

The primary use of fuel gas on the platform is for the turbine generators. Once the initial wells have gone on production, the turbine generators will be switched from diesel to produced fuel gas consumption. Other potential uses for fuel gas on the platform include the flotation unit, vapor recovery makeup system, and blow case.

### 6.3.5 Desalinator

A desalinating unit will utilize waste heat to produce freshwater from seawater for the potable and freshwater systems.

Capacity of the unit will be based on estimated freshwater requirements and availability of surplus waste heat. The system will keep the potable water system charged, with surplus water going to freshwater storage.

#### 6.3.6 Potable Water System

Freshwater produced in the desalinator unit will continually resupply the potable water storage tank (small crane base, 100 bbls. ±). This water will be utilized in the personnel quarters and the washroom on the upper drilling deck. Drinking water fountains will also be installed in operating areas.

#### 6.3.7 Freshwater System

Approximately 3,000 bbls. of freshwater storage will be provided in 9 of the 12 jacket legs. These legs will be interconnected through braces at a depth of approximately 150 ft. Two 10" submersible pump casings will permit pumping the water to a surge tank and distribution system. This water will be used primarily for mixing drilling muds and also for makeup to the cooling system and wash water for the Stretford Sulfur Recovery Unit. Makeup into the system will be from the desalinator, with the balance transported by work boat from shore as required.

#### 6.3.8 Heating System

Heat for the process systems and desalinator will be obtained from the exhausts of the turbine generators by means of a waste heat recovery unit. Supplementary requirements will be met by utilization of electric heat (for such process loads as glycol regeneration, etc.).

#### 6.3.9 Cooling System

Process system cooling will be required for the gas streams, clean oil stream, Stretford process and certain other equipment (compressor cylinder jackets, etc.). Most of this cooling will be accomplished by utilizing three interconnected jacket legs for circulating a cooling media to the process exchangers. Additional cooling will be obtained, if necessary, by circulating seawater directly to process exchangers.

#### 6.3.10 Utility Air

A utility air system will be provided to distribute a supply of 125 psi air throughout the platform for such uses as air tools and hoists, air starting, flotation unit, etc.

One of the utility air compressors will be diesel-powered for initial start-up of the system. The system will also include adequate storage capacity, and facilities for cooling and scrubbing the air stream.

### 6.3.11 Instrument Air

An instrument air system will be provided to compress, dry, store and distribute an adequate supply of 100 psi instrument air throughout the platform process area.

### 6.3.12 Saltwater System

A saltwater system will be provided for fire suppression, washdown, cuttings cleaning, process cooling, and the desalinator.

Supply pumps will be one 150 GPM and two 500 GPM electric-powered pumps and one 500 GPM diesel-powered pump with a 150 psi discharge pressure.

### 6.3.13 Sewage Treatment

A packaged sewage treatment unit will be incorporated to process the sewage from the personnel building and drilling crew washrooms. The effluent from this unit will comply with EPA requirements and will be discharged into the disposal pile.

### 6.3.14 Hypochlorite Generator

The platform will include a hypochlorite generator for supplying chlorine to the saltwater intake system and sewage unit as required.

### 6.3.15 Lighting

Platform lighting will meet or exceed the I.E.S. Recommended Levels of Illumination. Indoor lighting will consist of fluorescent fixtures and outdoor lighting will consist of high pressure sodium vapor fixtures. Lighting circuits will be connected to a battery backup system to provide emergency lighting in the event of a power failure.

## 6.4 Support Facilities

### 6.4.1 Hydraulic Control System

A hydraulic pressure system will be provided for downhole and surface safety control valves. The system will include pneumatic-powered pumps, reservoir tanks, filters and distribution system.

### 6.4.2 Control and Monitoring Systems

All platform operations will be monitored and controlled from the central control room. All control functions and monitoring will be by a programmable controller system. Platform control systems will include:

a. Automatic control of waste heat recovery equipment.

b. Automatic balancing of electric heating with waste heat recovery for maximum efficiency.

c. Automatic control of process equipment and conditions.

d. Automatic monitoring of process and production equipment (supervisory control) with annunciator panels indicating equipment status and alarms. Alarms will be recorded by hard copy printout.

e. Emergency alarms transmitted to shore

f. Remote control of emergency systems from onshore

g. Leak detection system for pipelines running to shore

h. Semi-automatic well gauging system with operator input of well numbers and gauge times. Resulting totals will be recorded by hard copy printout.

i. LACT metering of oil for shipment to shore

j. Metering of produced gas

k. Gas and $H_2S$ detection systems with automatic emergency shutdown and fire suppression systems.

l. Fire detection systems with automatic emergency shutdown and fire suppression systems. Fire detection equipment will include ultra-violet type detectors and fusible plugs in the emergency shutdown system.

### 6.4.3 Personnel Quarters

Personnel quarters are to be sized for normal production activities. Facilities include sleeping accommodations for 9 with separate restroom facility, locker room, wash room, and lunch room.

Design of the quarters building will provide for a separate and isolated structure within the module framework to minimize transmission of vibration and noise.

### 6.4.4 Fire Suppression

The platform design provides a fire suppression system including:

a. A saltwater pumping system

b. Adequate 1" hard rubber hose reels to provide coverage at any point on the platform with two hoses

c. Fixed fog suppression system with automatic area controls capable of wetting critical surfaces with a water density of not less than 0.25 $GPM/ft^2$.

d. Two 250 GPM monitors on the main deck to cover the BOP stacks and the upper well bay area

e. Four 1-1/2" hydrants per deck

f. Dry chemical and $CO_2$ exchangers

g. Standpipe connections to both boat landings for fire boat use

### 6.4.5 Safety Equipment

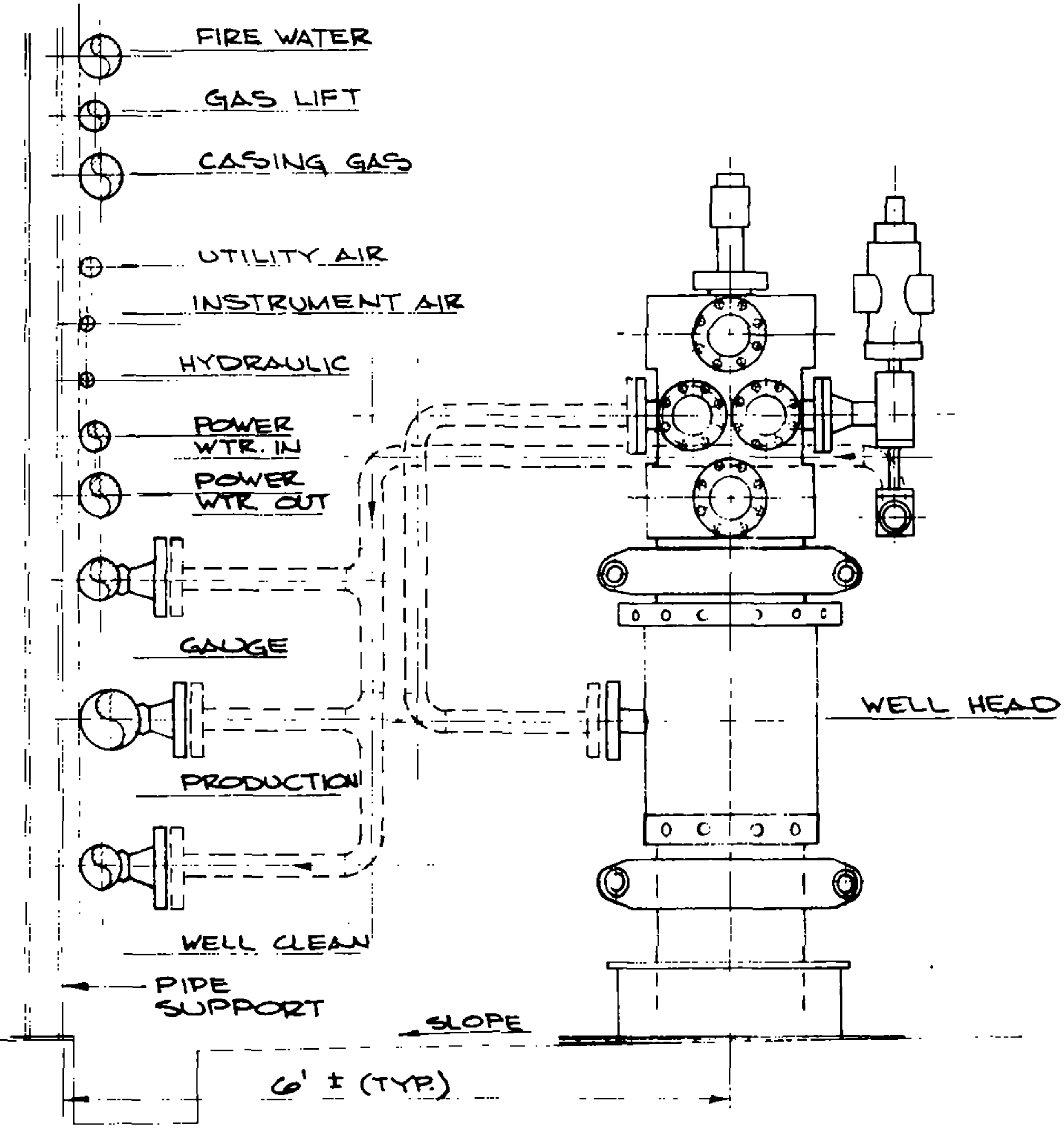
The platform will be equipped with escape capsules, life jackets and escape ropes for emergency egress. In areas where $H_2S$ contaminated gas is being handled, emergency air breathing equipment will be available. First-aid and other required safety equipment will also be provided. Further details are included in the attached Contingency Plan for the Santa Clara Unit.

### 6.4.6 Corrosion Control

Corrosion is to be controlled by using corrosion-resistant coatings on the topside structures and equipment, an underwater cathodic protection system, and internal coating for selected piping, vessels and tanks.

### 6.4.7 Navigational Aids

A navigational aid system will be provided in conformance with U.S. Coast Guard requirements including all necessary horns, lights, signs, etc.




WELLHEAD - MANIFOLD
ARRANGEMENT
SANTA CLARA UNIT

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SECTION VII

# SUBSEA PIPELINES

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SECTION VII

# SUBSEA PIPELINES

## 7.1 Introduction

Subsea pipelines for crude oil and for gas are planned for installation during mid-1978 or early 1979. Pipeline capacities will be sufficient for handling production from not only Parcel P-0217 but also from future Santa Clara Unit platforms and from other parcels which might logically be included in this system.

The choice of pipeline route will depend upon the location of the onshore processing facilities as discussed in Section VIII. It is not known at this time if both the crude and gas pipelines would be routed to the same onshore facilities. Alternate routes, shown on Drawing No. A-SB-2401, and pipeline design criteria are described in the paragraphs below. The maximum water depth for the pipelines would be 318 feet at the platform location.

## 7.2 Pipeline Routes

### 7.2.1 Alternate #1

This route, approximately 12 miles long, is in a primarily northerly direction from the proposed platform and routed directly to the Rincon onshore facility site near Sea Cliff. Currently, these onshore facilities serve Platforms A and B operated by Union in Parcel P-0241 and Platform Hillhouse operated by Sun in Parcel P-0240. An onshore tie-in would be made at an existing manifold.

### 7.2.2 Alternate #2

This route is also in a primarily northerly direction from the platform toward an existing Socal-operated onshore facility site at Carpinteria. The crude line would be either tied into an existing 10-inch submarine pipeline presently serving Socal platforms in State Parcel 21, or taken directly to shore. The gas line would be either tied into the present platform gas system going to shore, or also taken directly to shore. This route has a length of approximately 12 miles.

### 7.2.3 Alternate #3

This route is in an easterly direction from the platform toward a possible new onshore facility in the Ventura-Oxnard area. Depending on the actual site, approximately 12 to 16 miles of pipeline would be required, most of it being offshore.

### 7.2.4 Alternate #4

As an alternative to a crude oil pipeline to shore, a subsea pipeline to an offshore loading and storage terminal would be installed as a part of the overall system of transportation of oil to the refinery.

## 7.3 Design Criteria and Objectives

### 7.3.1 Basis for Design

Presently the oil line would be designed for a maximum throughput of approximately 60,000 barrels per day of sour crude, and the gas line for approximately 60 MMCF/day.

### 7.3.2 Applicable Regulations and Codes

The oil line will be designed in compliance with USGS, Conservation Division, Branch of Oil & Gas Operations, Pacific Region, OCS Order No. 9, dated June 1, 1971, ANSI B31.4-1974, "Liquid Petroleum Transportation Piping Systems", and Department of Transportation Regulation 49, Part 195, "Transportation of Liquids by Pipeline". The gas line will be designed in compliance with USGS, Conservation Division, Branch of Oil and Gas Operations, Pacific Region, OCS Order No. 9, dated June 1, 1971, ANSI B31.8-1975, "Gas Transmission and Distribution Piping Systems", and Department of Transportation Regulation 49, Part 192, "Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards". Portions of the pipeline routes within the jurisdiction of the State of California would be designed in compliance with any additional State regulations in effect at that time. In addition to the above, the pipeline design and operating procedures would follow API Recommended Practice RP 1111, Design, Construction, Operation and Maintenance of Offshore Hydrocarbon Pipelines, March 1976.

### 7.3.3 Stability

The offshore portions of both pipelines in water depths greater than 200 feet will be designed to resist movement under the action of on-bottom currents predicted to occur during the design 100-year storm. Stability will be achieved by proper design of submerged pipeline weight. Pipelines in water depths 200 feet or less will be buried.

### 7.3.4 Maximum Operating Pressure

Maximum operating pressures of the oil and gas lines would be approximately 600 psi and 900 psi, respectively. Each line will be designed to withstand this maximum operating pressure under applicable codes and regulations.

### 7.3.5 External Pressure

Both oil and gas pipelines will be designed to withstand external loads, including hydrostatic pressures with the pipelines void and with their absolute internal pressure equal to one atmosphere.

### 7.3.6 Other Stresses

Pipelines will be designed under applicable codes and regulations to withstand stresses which result from installation, thermal and fluid expansion effects, earthquake and other dynamic effects, dead loads, and surges.

### 7.3.7 External Corrosion Protection

The pipeline will be protected against external corrosion by means of external coatings and cathodic protection. Choice of coating materials and cathodic protection systems, impressed current or sacrificial anodes, will be based on detailed studies of the selected pipeline route.

### 7.3.8 Internal Corrosion Protection

Means of mitigating internal corrosion would include the use of inhibitors and/or internal pipe coatings. Corrosivity tests and monitoring of internal corrosion will dictate the extent of an inhibition control program.

### 7.3.9 Construction Method

The construction technique used for the offshore portion of the pipelines is influenced by relative economics and availability of equipment at the time of installation. The use of the stinger-laybarge method is planned at the present time but is subject to review.

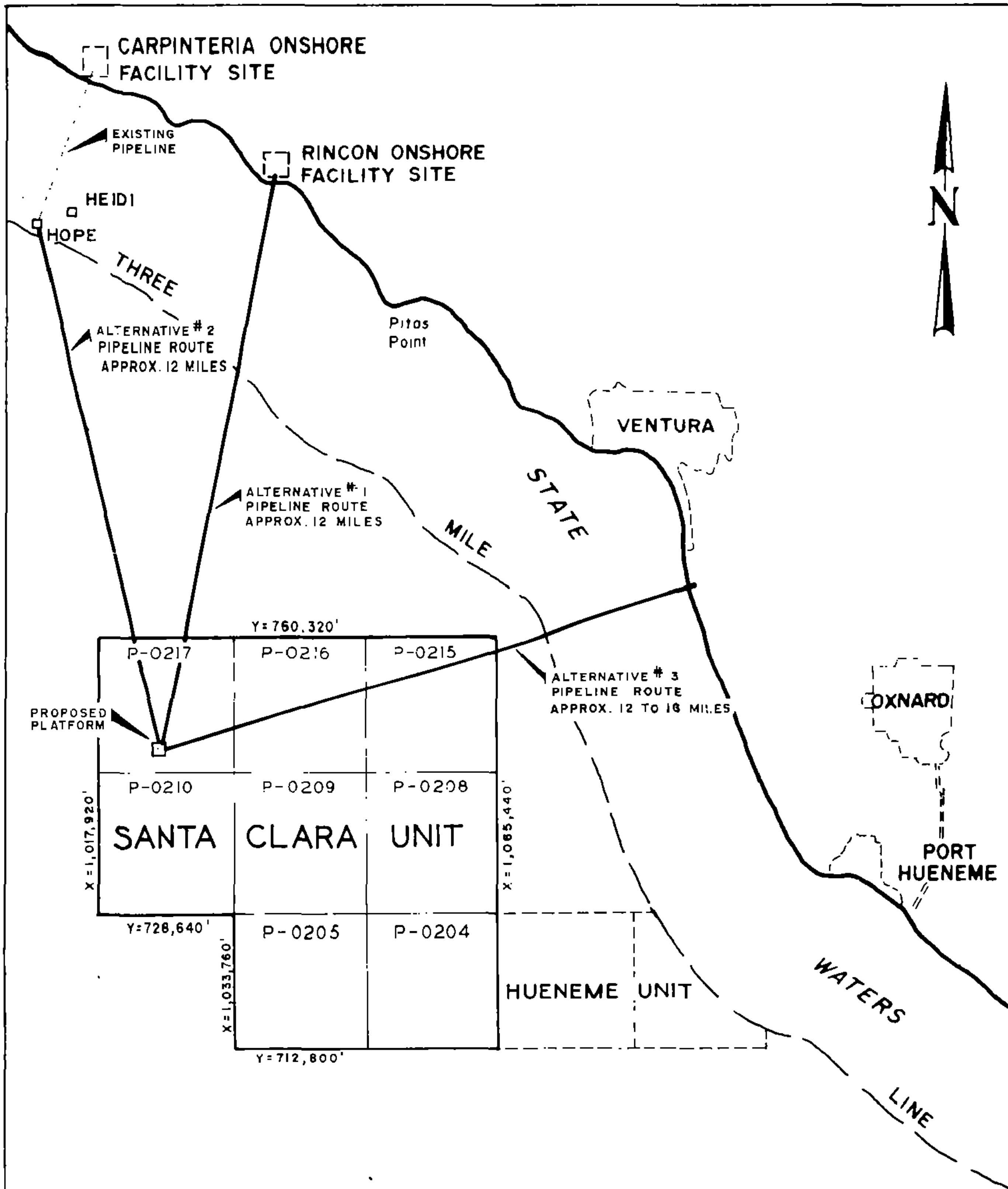
Pipelines terminating onshore would be buried in the section through the beach, surf zone and in waters to 200 feet deep.

The beach installation would be made by pulling the pipelines in a prepared trench.

Any onshore portions of the pipelines would be installed using conventional land-type pipeline construction methods and equipment. Testing and inspection of all sections of the pipeline would be in compliance with all applicable regulations.

### 7.3.10 Pipeline Operation

The pipelines will be operated and regularly inspected in compliance with USGS and DOT regulations. Safety and monitoring devices, such as leak detectors, shut-ins, etc. will be provided in accordance with OCS Order No. 9. Record keeping and reporting will be in accordance with all federal and state regulations.




SUBSEA PIPELINE ROUTES

SANTA CLARA UNIT

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SECTION VIII

# ONSHORE SITES AND FACILITIES

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SECTION VIII

# ONSHORE SITES AND FACILITIES

## 8.1 Introduction

Several alternates exist for handling Santa Cruz Unit oil and gas production at an onshore site, including the possibility that oil and gas could be handled separately, with oil going to one site and gas to another. Selection of an appropriate site(s) is the subject of ongoing investigations and remains to be determined. Use of existing facilities is favored where cost effective, with many factors influending this selection, including: pipeline sizes, routes, distances, and costs: availability/capacity/costs of onshore facilities; the commingling of sour crude; contractual negotiations with other companies; and approvals from regulatory and governing agencies. Anticipated production and site alternatives are outlined in the paragraphs below.

## 8.2 Anticipated Production

Production from this single platform during the first year (1979) is projected to be 2,000 barrels per day (maximum) of sour crude and 2,000,000 cubic feet per day (maximum) of sour gas. Peak production is anticipated during 1982 or 1983 and is forecast to be 16,000 barrels per day of crude and 16,000,000 cubic feet per day of gas, again both sour. Produced water is predicted to occur starting in 1980 and reach a peak of 16,000 barrels per day in 1989.

Present designs for the platform facilities include equipment for processing the production offshore, permitting pipeline quality oil and pipeline quality gas, except for hydrocarbon dew point, to be shipped ashore. This scheme simplifies and reduces onshore facility requirements and provides more options for onshore site selection.

## 8.3 Site and Facilities

The following sites are potential candidates for handling Santa Clara Unit production and are shown on attached Drawing No. A-SB-2402.

### 8.3.1 Carpinteria

This is a Standard Oil Company facility located in the city of Carpinteria and currently handling oil and gas production from four platforms in State waters (Hope, Heidi, Hilda and Hazel). Equipment consists of heaters, treaters, LACT's, storage tanks, and a gas processing plant.

At present, this facility has sufficient capacity for handling anticipated production from the single Santa Clara Unit platform. However, co-mingling restrictions, production accountability, etc., could require a modest increase in tankage and related equipment. Ultimately, increasing of facilities may be required depending upon production changes from the existing State platforms and the possible installation of additional Santa Clara Unit platforms.

Oil from this facility is shipped through an existing marine terminal to a refinery and the surplus gas is taken by Pacific Lighting Service Co.

### 8.3.2 Rincon

This facility is located near the community of Sea Cliff and is operated by Mobil Oil Corporation in behalf of seven owners, including Mobil. It processes oil, gas and water from three platforms in Federal waters (Hillhouse, Platform A and Platform B). Equipment consists of a freewater knock-out, heater-treaters, LACT's, storage tanks, and a gas processing plant.

At present, the facility has surplus capacity, with the surplus being allotted or pro-rated among the seven owners. Negotiations have been initiated between Standard Oil Company of California and Mobil Oil Corporation, representing the owners, to determine if Santa Clara Unit production could be processed through this facility and at what cost.

Oil from this facility is handled by the Ventura Pipeline Company. Surplus gas is taken by Pacific Lighting Service Company.

### 8.3.3 Ventura - Oxnard Area

Although Standard Oil Company of California has oil operations in the Oxnard area, the handling of Santa Clara Unit production would require separate facilities due to the nature of the crude and the limited capacity of existing facilities. New facilities would not be as extensive as those now installed at Carpinteria or Rincon and would consist of holding tanks, pumps, and dew point depression equipment for the gas.

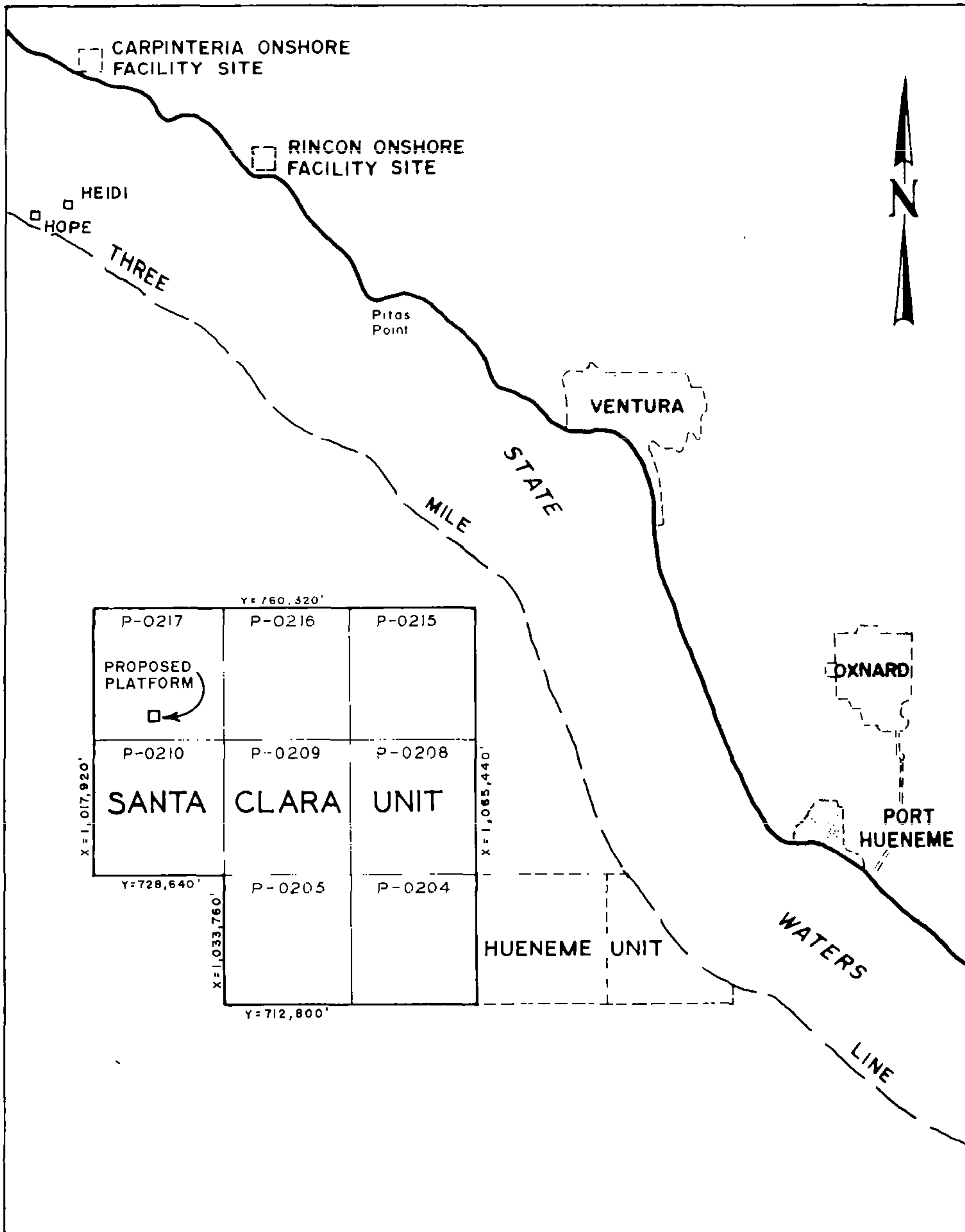
Standard has not acquired or taken options on any parcels of land for installation of new facilities, but could possibly join other oil operators in seeking a site for joint operations.

Present zoning and land use requirements pose special problems for this area.

Oil from this facility could be handled through an existing marine terminal or possibly by existing pipelines and the gas taken by a Utility.

### 8.3.4 Separate Sites for Oil and Gas Facilities

It was previously indicated that there was the possibility of oil and gas being handled separately, with oil going to one site and gas to another. This situation could develop if the Pacific Offshore Pipeline Company (POPCO), an affiliate of Southern California Gas Company, were to install a single coordinated gas gathering system for the Santa Barbara Channel. In this event, it might be proposed to install a gas line to the nearest tie-in point of the POPCO system while the oil would be routed to Carpinteria, Rincon or Ventura-Oxnard.




ONSHORE SITE LOCATIONS
SANTA CLARA UNIT

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SECTION IX

# OFFSHORE LOADING AND STORAGE SYSTEM

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SECTION IX

# OFFSHORE LOADING AND STORAGE SYSTEM

## 9.1 Introduction

As an alternative to using a pipeline to shore for crude transportation, an offshore loading and storage terminal with shuttle tankers would be used for shipping the produced crude oil. The mooring and loading concepts for the proposed system are based on the experience and proven equipment designs of similar single point mooring (SPM) tanker loading installations. With the offshore crude loading system, produced gas would be either re-injected into the reservoir, or pipelined to shore.

The facilities discussed herein describe the overall system concept, and are not intended to propose any one specific manufacturer's design. There are a number of proprietary designs for these loading facilities. Selection of the most appropriate design will be determined in future detail studies, with the objective of selecting the most reliable, safest and efficient system.

## 9.2 System Description

The design concept for the offshore loading and storage terminal is illustrated in Drawing No. A-SB-2403. The components comprising the system include a single point mooring (SPM), a continuously manned floating storage vessel, and a crude oil pipeline connecting the SPM to the production platform.

The single point mooring is designed to permanently moor a storage vessel for continuous receiving of produced crude in up to 100-year storm conditions. The system permits the storage vessel to weather vane about the terminal seeking the position of least resistance to wind, waves and current. The moored vessel is free to roll and pitch.

The single point mooring consists of an articulated buoyant column connected via a universal joint to a combination gravity/pile base structure. The top of the buoyant column is fitted with the tanker mooring yoke and with a fluid distribution unit. The mooring yoke transfers loads from the storage vessel to the buoyant column, and also carries cargo lines from the fluid distribution unit to the storage unit. The fluid distribution unit is designed to accommodate all movements of the moored vessel while simultaneously transferring oil production.

The floating storage vessel would be a barge or modified tanker, permanently moored at the terminal, with a capacity about equivalent to a 70,000 DWT tanker; it would be provided with crude storage and transfer facilities, but would not include processing facilities.

Crude oil stored aboard the vessel would be transferred to a shuttle tanker (about 35,000 DWT) for shipment to shore terminals. Loading of the shuttle tanker would be accomplished by mooring the tanker along the side of the storage vessel, using pneumatic fendering units between the vessels, and transferring the crude from vessel to tanker using cargo hoses. An alternative mooring arrangement is with the bow of the shuttle tanker moored to the stern of the storage vessel.

Forces generated during maximum operating conditions, with the shuttle tanker moored to the storage vessel, are much less than when the storage vessel experiences the 100-year design storm. With alongside mooring of the shuttle tanker, the limiting wave height during berthing is 8 feet, and the limiting wave height to remain moored is 10 feet. For shuttle tanker berthing astern of the storage vessel, the limiting wave heights for berthing and transfer operations are 15 feet and 25 feet respectively.

## 9.3 Terminal Location

The actual terminal location with respect to the proposed platform is determined by the following factors:

a. Required ship-handling room

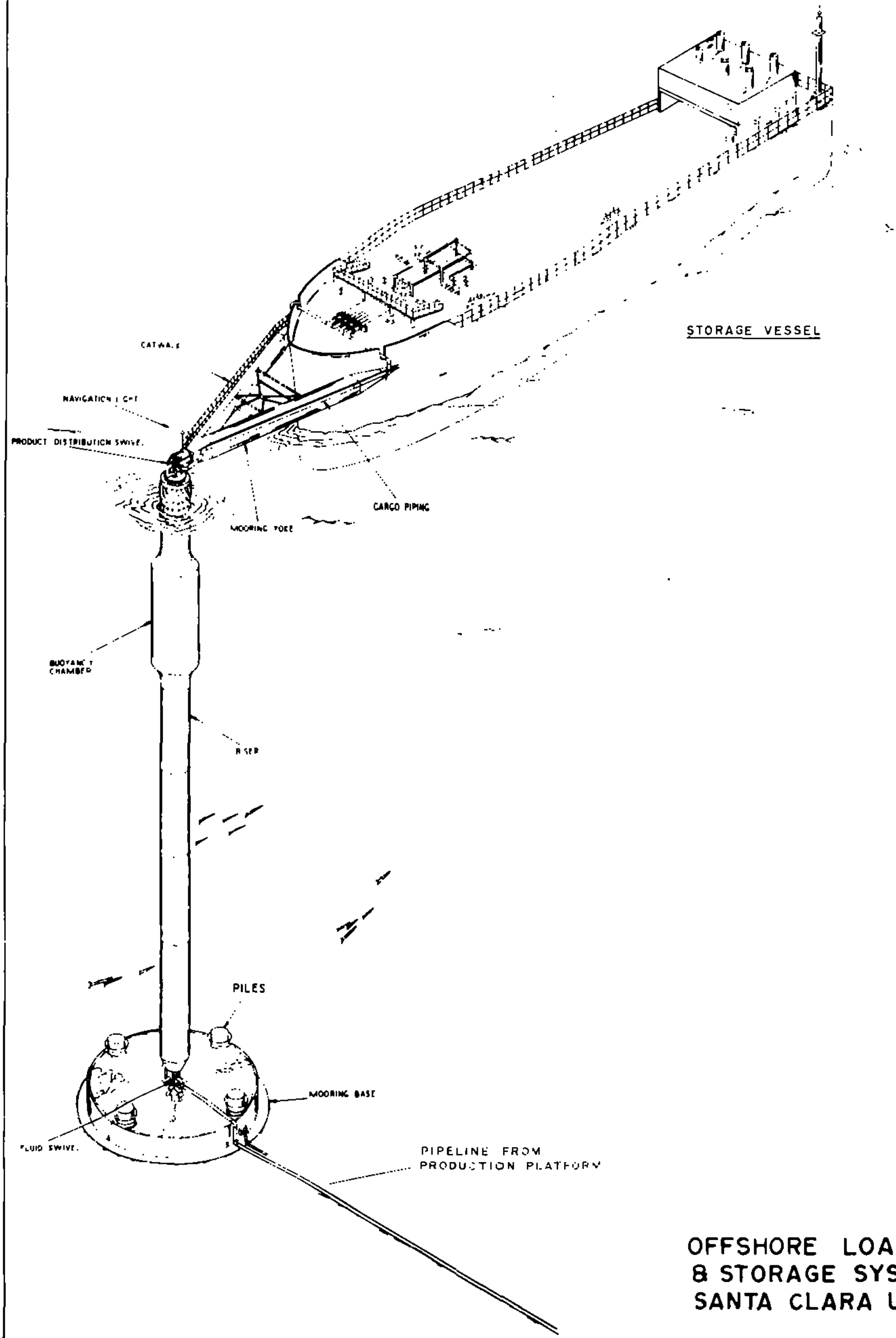
b. Water depth

c. Cost and length of interconnecting pipeline

It is anticipated that the offshore storage and loading terminal would be located one to four miles east of the platform on Parcel P-0217, in water depths of about 150 feet and about 7 miles from the coastline.

## 9.4 Connecting Pipeline

There will only be one pipeline, a crude oil line, connecting the storage terminal and the production platform. This pipeline would be designed in accordance with applicable codes and regulations as discussed in Section VII.




# OFFSHORE LOADING & STORAGE SYSTEM SANTA CLARA UNIT

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| | APPROVED | |

SECTION X

APPENDIX

The following reports and data, other than Governmental regulations and industry standards, were utilized and referenced in preparation of the Plan of Development for the Santa Clara Unit:


10.1 Vedder, J. G., et al (1969) Geologic Framework of the Santa Barbara Channel Region, "Geology, Petroleum and Seismicity of the Santa Barbara Channel Region, California", Geological Survey Professional Paper 679.

10.2 U.S. GEOLOGICAL SURVEY (1976) Oil & Gas Development in the Santa Barbara Channel Outer Continental Shelf Off California Final Environmental Statement, Washington, D.C.,U.S. Government Printing Office. 3 volumes

10.3 Greene, H. G. (1976) Late Cenozoic Geology of the Ventura Basin, California, Miscellaneous Publication 24, Pacific Section AAPG, pp 499-529.

10.4 Dames & Moore (October 1976) Geotechnical Services, Santa Clara Unit, Final Site Investigation for Standard Oil Company of California, Western Operations, Inc. Volume I.

10.5 Dames & Moore (October 1976) Geotechnical Services, Santa Clara Unit, Final Site Investigation for Standard Oil Company of California, Western Operations, Inc. Volume II, Platform Site Geophysical Surveys.

10.6 Dames & Moore (October 1976) Geotechnical Services, Santa Clara Unit Final Site Investigation for Standard Oil Company of California, Western Operations, Inc., Volume III, Oak Ridge Fault Geophysical Surveys.

10.7 Aquatronics International,Inc. (1974) Report on High Resolution Geophysical survey Santa Barbara Channel Offshore California. Houston, Texas. Unpublished Report in the Files of the Standard Oil Company of California.

10.8 Oceanographic Services, Inc. (August 1976) Report on Santa Clara Unit, Hindcast Study. Prepared for Standard Oil Company of California.

10.9 Chevron Oil Field Research Company (La Habra, October 1976) Report on Santa Clara Unit Normal Oceanographic/Meteorological Conditions. Prepared for Standard Oil Company of California.

10.10 Erickson, R. C. et al (1975) Urban Oil Production and subsidence control - a case history, Beverly Hills (East) Oil field, California, Society of Petroleum Engineers of AIME. Paper No. SPE 5603.