STATE OF CALIFORNIA RONALD REAGAN, Governor

STATE LANDS COMMISSION
STATE LANDS DIVISION
1600 L STREET
SACRAMENTO, CALIFORNIA 95814

File Ref.: W 9225

September 25, 1972

To: Federal, State and Local Agencies
Concerned with Environmental Quality

SUBJECT: Environmental Impact of a lease of tide and submerged lands at San Onofre, San Diego County for cooling water conduits, Units 2 and 3, San Onofre Nuclear Generating Station.

RESPONSE REQUESTED BY November 25, 1972

Section 6371 of the Public Resources Code requires the State Lands Commission to inventory State school, tide and submerged lands and to identify lands possessing unique environmental values, including scenic, historic, natural or aesthetic values of statewide interest.

Pending completion of the inventory and report to the Legislature, the Commission may not lease any lands unless it shall have a finding at a public meeting that such lease will not have a significant detrimental environmental effect and shall have made an environmental report.

The subject lease application is now in process for consideration by the Commission and assistance is needed in preparation of the final impact report. Attached herewith for your review, is a draft of the proposed report describing the proposal and containing environmental and other data relating to the project. Comments on the draft report are hereby solicited by the date shown above with emphasis on the following:

1. Environmental impact of the lease.
2. Unavoidable adverse environmental effects.
3. Mitigation measures proposed to minimize the impact.
4. Alternatives to the lease.
5. Relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.
6. Any irreversible environmental changes involved under the proposed lease.

Any comments that you may have should include suggested additions to the text of such report.

C. R. KIRKS
Land Agent

Attachments: Draft Environmental Impact Report
Distribution List

Rec'd Off/Dir. of Reg.
Date 10/12/72

STATE OF CALIFORNIA
STATE LANDS COMMISSION

DRAFT ENVIRONMENTAL IMPACT REPORT
(Section 6371, Public Resources Code)

Southern California Edison Company, and
San Diego Gas and Electric Company

W 9225

Installation of four underwater circulating water conduits for Units 2 and 3, San Onofre Nuclear Generating Station, San Diego County.

1. General Information

Purpose of Lease

The Companies named above have applied to the State Lands Commission for a lease of tide and submerged lands adjacent to San Onofre upon which to install four concrete conduits, having the following dimensions:

Two - 18' I.D. x 3400' Intake
One - 18' I.D. x 8500' Discharge
One - 18' I.D. x 6000' Discharge

The conduits are to run parallel with and adjacent to two existing 12-foot conduits (3200 and 2600 feet) now serving Unit 1.

Scope of Report

Although the lease will only cover the State land underlying the cooling water conduits, it is a fact that the Commission has the power of denial over planned expansion because it would be unfeasible without use of the tide and submerged land. This report, therefore, discusses the environmental impact of the proposed plant expansion by the addition of Units 2 and 3, two 3410 MWE pressurized water reactors, each producing a net electrical output of 1140 MWE.

Additional Information

This report is necessarily limited as to technical detail. Persons desiring access to additional technological and scientific data are welcome to review two large volumes at the Commission's Sacramento and Los Angeles offices.

Location

San Onofre Nuclear Generating Station is located in San Diego County, approximately 62 miles southeast of Los Angeles and approximately 51 miles northwest of San Diego. The site, of approximately 84 acres, is located entirely within the boundaries of the United States Marine Corps Base, Camp Pendleton, California, near the northwest end of its 18-mile shoreline. The topography of the area surrounding the site consists of a coastal terrace ranging from 60 to 80 feet above sea level, terminating in seacliffs at the shoreline. Existing Unit 1 occupies approximately 16 acres at the northern end of the site. Proposed Units 2 and 3, to be located southeast of and immediately adjacent to Unit 1, will require an additional 52 acres.

Need For Expansion at San Onofre

The applicants have submitted projections of their additional power needs for the years 1977-79 together with data to support their statement that San Onofre is the most suitable site for production. In addition, they have submitted argument to support the selection of nuclear energy as the source instead of oil or gas-fired units. This material is available at Commission offices as stated previously.

It is not the purpose of this report to discuss the merits of power plant siting. An overriding factor to be considered is the existence of reactor Unit No. 1 in operation.

Description of the Reactor and Steam-Electric System

San Onofre Units 2 and 3 are planned as an integrated two-unit, electric-generating facility. Each unit will be powered by a light water moderated and cooled pressurized water reactor (PWR). Each reactor is fueled with slightly enriched uranium in the form of sintered uranium dioxide (UO_2) pellets enclosed in Zircaloy-4 tubes. Approximately one-third of the core is replaced at each refueling, approximately one-year intervals.

Each unit has a reactor coolant system to remove heat from the reactor core and transfer it to the secondary steam system, and is arranged as two closed loops connected in parallel to the reactor vessel. Each loop contains one vertical shell, U-tube steam generator; two electric-motor-driven, single-suction centrifugal reactor coolant pumps; and connecting piping. An electrically heated pressurizer is connected to one of the loops, and a safety injection line is connected to both loops. All components of the reactor coolant system are located within the containment building.

The nuclear steam supply system (NSSS) for each unit consists of a reactor, a reactor coolant system, reactor auxiliary systems, and nuclear instrumentation. Each NSSS is designed to produce steam to drive an 1800 rpm turbine-generator. Each turbine-generator consists of a tandem-compound, impulse reaction-type turbine with two-stage reheat and a hydrogen- and water-cooled, four-pole generator.

Thermal power for each unit will be 3410 megawatts. Electric power for each unit will be 1140 megawatts net.

Water Use

Sea water is used as the source of cooling water for the plant. The circulating water flow is approximately 830,000 gallons/minute per unit. Most of this water is used for condensing steam in the main condenser on a once-through basis. Sea water is also converted into fresh water by the use of flash evaporators. The fresh water is then used for makeup water to the reactor coolant and condensate systems, for equipment cooling, and for general plant use.

Heat Dissipation System

San Onofre Nuclear Generating Station uses sea water to cool the condensers of the plant turbine-generators. Unit 1 presently has 12-foot ID intake and outfall conduits extending 3200 feet and 2600 feet offshore, respectively. These conduits bring the sea water into the plant pump and screenwell and, after the water has passed through the condenser, return it to the ocean at a single-point vertical terminal structure.

The cooling water facilities for Units 2 and 3 will use four conduits. Each unit will have one 18-foot ID intake conduit 3400 feet long, and there will be one discharge conduit 8500 feet long for Unit 2, and one discharge conduit 6000 feet long for Unit 3. The last 2500 feet at the offshore end of each discharge conduit will have thirty 2-foot ID vertical riser ports, which will serve to diffuse the thermal energy of the discharge into a greater volume of water. The diffuser portion will be progressively stepped down in diameter to balance the hydraulics of the flow in the diffusers and to produce a uniform discharge at each port. The smallest diameter of the main conduit is now set at 5 feet 6 inches ID. Final design, however, may alter this dimension as well as the port diameter by a small amount.

The diffuser-type of discharge structures will comply with the newly-established (approved 10/31/71) California thermal discharge policy. It was originally planned that Units 2 and 3 would have single-point discharges similar to Unit 1. Various alternative cooling methods were evaluated for cost and effectiveness and it was determined that the diffuser type outfalls described above would be the best means to comply with the new policy. The diffusers will be staggered to eliminate overlapping of the thermal plumes.

The circulating water system, under normal operating conditions, draws water from the ocean at a point approximately 3500 feet offshore. The ocean bottom at this point is about 30 feet below mean lower low water. The intake terminal structure rests on a foundation located 25 feet beneath the ocean bottom and rises vertically to a point 10 feet above the ocean bottom. A velocity cap is supported 3 feet 9 inches above the structure by columns. The top surface of the 1-foot 3-inch-thick velocity cap is 15 feet above the ocean bottom and 15 feet below mean lower low water.

The purpose of the velocity cap is to limit the number of fish drawn into the system. Without the velocity cap, fish swimming above the terminal structure would be caught in a downward current which they would be unable to sense. The velocity cap produces a horizontal current that fish recognize and can swim against. Paragraph 8.4.4 describes additional measures for protecting fish. In addition to the velocity cap, it is planned to place a rock revetment around the structure to further control the flow of water and to eliminate the intake of turbid water from the water strata near the ocean bottom.

Water entering the top of the terminal structure is accelerated to a velocity of 2.5 feet per second in its approach to the structure. This velocity remains at an average of 2.5 feet per second until the water mass is directed into the 18-foot ID reinforced concrete conduit connected horizontally to the shoreward side of the terminal structure. This conduit is buried beneath the ocean bottom with a minimum of four feet of sand cover over its top. As the water enters this concrete conduit, it is accelerated to a velocity of 7.3 feet per second. The circulating water system is designed to deliver 830,000 gallons per minute at this velocity to each unit onshore.

The offshore system joins the onshore portion of the circulating water system at the screenwell. The screenwell is located just inside the sea-wall on the station property. Cooling water entering the onshore system passes through a coarse bar screen and through finer traveling water screens and proceeds to four 207,500 gpm circulating water pumps. Water entering the screenwell structure is decelerated in a transition so that the velocity, as it passes through the screens, is approximately 1.0 feet per second.

Of the total 830,000 gpm per unit design flow, 795,000 gpm per unit is used for condenser cooling. Turbine plant cooling water requirements are 18,000 gpm and salt water cooling system requirements for the reactor are 17,000 gpm. Water passing through the onshore piping from the pumps and through the condensers will have a design velocity of 7 feet per second.

The condenser of each unit, under full operation, will raise the cooling water temperature 20F and transfer 7.628×10^9 Btu per hour to the cooling water. The time required for water to pass through the condenser is eight seconds.

Water leaving the condenser will flow back to the ocean at a velocity of 7.3 feet per second in an 18-foot ID conduit. The time required for the heated water to reach the beginning of the diffuser conduit is 15 minutes for Unit 2, 9 minutes for Unit 3. Assuming an average velocity of 6 feet per second in the diffuser conduit, it would take a particle of water an additional seven minutes to reach the extreme offshore end of the diffuser.

The diffuser will be designed hydraulically so that a nearly equal amount of water will be released from each vertical port. The ports will be concrete pipes projecting from the top of the main conduit, extending approximately 10 feet above the ocean bottom. Water will leave the diffuser ports vertically upward at an average velocity of 20 feet per second.

The ocean bottom at the Unit 2 diffuser is at an average of 45 feet below mean lower low water. The ocean bottom at the Unit 3 diffuser is at an average of 35 feet below mean lower low water.

Construction Timetable

Installation of the conduits is expected to begin on August 1, 1973 and end on August 1, 1978.

Nuclear Fuel

Fuel to be used consists of uranium-238 that has been slightly enriched with uranium-235. Approximately 98.5 percent of the uranium used will be reclaimed by fuel reprocessing, including 30 percent of the original uranium-235.

In one year, one unit will consume approximately 0.730 metric tons of uranium-235. Over the expected 30-year life of the plant, it is anticipated that approximately 22 metric tons of uranium-235 per unit will be consumed.

2. Inventory of Environmental Factors

Preface

Reactor Unit 1 has been in operation at San Onofre for several years. This relates directly to the environment at the plant site and, therefore, this fact is recognized in the following discussion.

Human Activities in the Environs

The nearest boundary between the Marine Corps Base and any adjacent property is approximately 2-1/2 miles northwest of the site. Approximately 95 percent of Camp Pendleton is unimproved or semi-improved and is devoted to intermittent practice maneuvers, storage of equipment and supplies, and other uses.

The population of Camp Pendleton is extremely variable. The Marine Corps has indicated that the average population is approximately 40,000, and that no personnel will be quartered closer than two miles from the site. The Marine Corps Base camps nearest the site, Camp San Onofre, Camp San Mateo, Camp Horno, Camp Pulgas, and Camp Margarita, are located in excess of 2, 3, 4, 8, and 11 miles from the site, respectively. The principal administrative and personnel housing areas are located 12 to 15 miles southeast of the site. Except for maneuvers that involve the use of beach areas, most Marine Corps activities are conducted inland from Camp San Onofre and the range of coastal hills which parallel the coast near the site. With regard to amphibious landings, the Marine Corps has indicated that no landings will be made in the sector in which the generating station is located.

No firing of live ammunition is permitted by the Marine Corps in the strip between the foothills and the sea coast, which is approximately two miles wide at its narrowest point. This strip extends from the northern base boundary to approximately 10 miles south of the plant. Where firing or weapon impact is permitted, the training is conducted under very close

supervision. The nearest firing range, which is for infantry infiltration training, has fixed machine guns. This firing range is approximately 3500 meters from the plant and all firing is directed into a hillside. All other firing ranges are located so that maximum ranges of permissible weapons would not result in an impact closer than approximately two miles from the plant, assuming firing was directed toward the site rather than within the allowed sectors. Firing is directed into hillsides or valleys to avoid any danger of projectile skipping.

Aircraft practice firing and artillery bombardment are controlled at all times and are directed into impact areas located more than five miles inland. Aircraft approaches and pullouts are within a 15,000-foot altitude airspace also located more than 5 miles inland and do not pass near the plant. No bombardment from the sea is ever permitted, and the shore landing maneuvers do not involve the use of live ammunition.

No beef cattle grazing is now permitted on the base and it is intended that none will be permitted in the future. Only sheep grazing leases are planned to be allowed. A few small land parcels are leased to truck farmers on a one-year revocable basis.

Population centers near San Onofre are:

Name	Distance
City of San Clemente	2.5 miles
City of San Juan Capistrano	10+
Rancho Boca de la	5
Mission Viejo	10

The Pacific Ocean borders the site property line on the southwest. Beneficial uses of the ocean waters in this area, which are specified for protection by the California Water Resources Control Board, include:

- Sport and commercial fishing
- Pleasure boating
- Commercial and naval shipping
- Esthetic enjoyment
- Ocean water contact sports
- Industrial cooling

The waters adjacent to the site yield large quantities of fish. Pleasure boating is enjoyed along the coastline; however, commercial and naval shipping is generally more than a mile off the coast due to the shallowness of the coastal waters. Water contact sports, particularly surfing, are popular in the beach areas in the vicinity of the site. Sea water from the ocean also provides the heat sink for the San Onofre Unit 1 cooling systems in a manner compatible with the intended use of industrial cooling as specified by the California Water Resources Control Board. San Onofre Unit 1 is the only nuclear reactor within 50 miles.

Additional information on human activities in the environs is contained in Exhibit 1.

GEOLOGY

PHYSIOGRAPHY

The physiography of the area is typical of the region, with a rather narrow, gently sloping coastal plain extending seaward from the uplands. The plain is terminated at the beach at a line of seacliffs which have been straightened over long distances by marine erosion. Seacliffs in the immediate vicinity of the plant site are 60 to 80 feet above sea level, and are separated from the ocean by a narrow band of beach sand. In certain places, ephemeral streams are actively eroding gullies in the seaward portion of the coastal plain, and several deeply incised barrancas have been formed.

STRATIGRAPHY

Exposed within the plant site boundaries are the following geologic formations (from oldest to youngest): (1) San Mateo Formation of the Pliocene-Pleistocene age, (2) overlying Pleistocene terrace deposits, and (3) beach sand.

The San Mateo Formation consists of massive, buff-colored arkosic sandstones, scattered interbeds of rounded gravel, and layers of fine silty sandstone and siltstone. The dense sandstone is lightly cemented and forms steep canyon walls and near-vertical cliffs along the coast. The total continuous thickness of the formation below the plant site is approximately 1000 feet.

The overlying Pleistocene terrace deposits consist of: (1) a series of crudely stratified mixtures of brown to gray-brown sand, silt, and clay, with scattered lenses and layers of gravel, cobbles, and some boulders; and (2) a mixture of gravel, cobbles, and boulders in a red-brown silty sand matrix.

Along the north and south coast of the plant site, Pleistocene wave action has cut a gently seaward-sloping bench in the San Mateo Formation. Crudely stratified Pleistocene marine and stream terraces, varying from 30 to 50 feet in thickness, cover the wavecut beach.

STRUCTURES

San Onofre is located within the Peninsular Range Province, an area characterized by northwest-trending elongate mountain ranges and valleys. The site is located in the northwest portion of this Province, which extends southward into Mexico. Major drainage north and south of the site is provided by the Santa Ana and the Santa Margarita rivers, respectively.

The geology of Southern California is dominated by major, northwest-trending, right-lateral faults related to the San Andreas-San Jacinto fault systems. These and other major northwest-trending faults, including the Whittier-Elsinore and Newport-Inglewood zones, have a moderate-to-high degree of activity. Faults with other than northwesterly orientations have lower degrees of activity.

The nearest fault to the site is the Cristianitos Fault, which is exposed along the seacliff approximately one mile southeast of San Onofre Unit 1. This fault trends nearly north-south and exhibits evidence of vertical displacement in the San Mateo Formation. The fault does not penetrate the overlying Pleistocene terrace deposits, and is therefore, inactive.

The plant site is approximately 18 miles from the southeast terminus of the Newport-Inglewood Zone, 23 miles from the Whittier-Elsinore Fault, 45 miles from the San Jacinto Fault, and 60 miles from the San Andreas Fault.

GEOLOGICAL CONSIDERATIONS OF CONSTRUCTION

Units 2 and 3, like Unit 1, will be founded on the dense, lightly-cemented sandstone of the San Mateo Formation. In general, excavated slopes, except those in the switchyard, will be inclined at one-half horizontal to one vertical, with a 15-foot bench located at the interface between the San Mateo sands and the overyling terrace deposits. The excavated slopes for Units 2 and 3, except for those in the switchyard, will be consistent with those excavated for Unit 1 and will resemble very closely the nearly vertical slopes of the natural bluffs along the shoreline. The switchyard facilities will be constructed on multiple-terraces, stepped-down area from the bluff top to plant grade.

HYDROLOGY/OCEANOGRAPHY

SURFACE WATER

The San Onofre site is bordered on the southwest by the Pacific Ocean. Approximately one mile north of the site, San Onofre Creek crosses the coastal plain in a westerly direction and discharges into the ocean.

The main source of rainfall runoff at the site is from the coastal hills east and southeast of the site. The entire watershed of approximately 120 acres for the site is now collected by the storm runoff drainage system of the San Diego Freeway (Interstate Highway 5). Rainfall runoff from the area east of the site is routed by a 12-foot wide, unlined channel, parallel to the freeway along its eastern edge, emptying into San Onofre Creek approximately 1-1/4 miles northwest of the site. Rainfall runoff from the area southeast of the site is routed by a 72-inch diameter, reinforced-concrete pipe under the freeway extending from its eastern edge to its western edge to a point immediately south of the plant's southern property line, then passing under the railroad and former U. S. Highway 101 through two 36-inch box culverts onto the plant site at a point approximately at station 35 + 00. This runoff will be routed through the property south of Units 2 and 3 to the beach via closed conduit. The surface runoff from the freeway collects in numerous catch basins and discharges into cross-drains to the 12-foot-wide channel. Rainfall runoff from the plant will drain directly into an onsite storm drain system that will discharge onto the beach through the retaining wall/seawall and riprap toe protection.

The 72-inch-diameter, reinforced-concrete pipe under Interstate Highway 5 is sized to handle a flow of 520 cfs, which is the runoff that would result from a 1-in-100-year storm.

The plant drainage systems will be designed to accommodate onsite and offsite runoff resulting from a precipitation intensity of three inches per hour. This intensity is 1.83 times greater than the intensity of precipitation

that would result from a storm return frequency of 1-in-100 years. The maximum probable precipitation for the site is calculated to be 4.3 inches per hour, based on Hydrometeorological Report No. 36.[1]

Although the maximum probable precipitation intensity for the site is greater than the design intensity for plant drainage systems, a storm with greater precipitation intensity would not affect plant safety, because enclosures for all critical components located below plant grade will be constructed to provide sufficient freeboard to prevent any possible flooding. The plant area will drain directly to the beach before the water level could rise above this freeboard.

GROUND WATER

The gentle gradient of the terrain near the coast allows for lateral cutting of the banks of San Onofre Creek, and the formation of a valley nearly 1/4 mile in width. This valley forms a natural ground water basin furnishing water for the United States Marine Corps Recreation Area, and for truck farming in the valley.

Four observation wells are maintained and monitored by the applicants in the site vicinity to determine the ground water gradient and to detect fluctuations in the water table in the San Onofre Basin. In addition, the Office of Ground Water Resources at Camp Pendleton maintains logs on ground water gradient and water table levels from its own observation wells. Data from these sources indicate: (1) a ground water gradient toward the ocean of approximately 13 feet per mile between the ocean and the foothills, and (2) an average elevation of the water table at the plant site which is stable at approximately +5 feet MLLW datum. Marine Corps policy is to maintain the ground water table sufficiently above sea level to eliminate possibility of saline water intrusion from the ocean into the fresh water aquifiers.

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(1) Hydrometeorological Report No. 36 - Interim Report, Probable Maximum Precipitation in California, U. S. Department of Commerce, October 1961.

OCEANOGRAPHY

Since the summer of 1963, an extensive oceanographic monitoring program has been conducted in the marine environment offshore of the San Onofre site in conjunction with the construction and operation of Unit 1. This work was conducted in compliance with the requirements of the California Resources Agency and the California Regional Water Quality Control Board, San Diego Region. The purpose of this monitoring program has been two-fold: (1) to quantitatively and qualitatively describe all important features of the ocean environment prior to plant operation, and (2) to evaluate any affect which the operation of Unit 1 might have on the marine biological community. The following paragraphs summarize the results of the physical oceanographic portion of this monitoring program.

Currents

Water movement at the shoreline and adjacent seaward area is the result of wind drift, wave action, and tidal, coastal, and residual currents. The major current affecting the area is the California current, a continuation of the southeast-flowing Aleutian current of the North Pacific. This current is a wide body of water extending approximately 420 miles seaward and moving sluggishly along the coast. During the months of November through January, the Davidson Current, a northerly-flowing surface current, predominates along the San Onofre coastline.

The near-shore current pattern is influenced primarily by the tidal cycle. Because of shore and shallow bottom boundary effects, the tidal currents are chiefly oscillatory, and move up and down the coast. One or more complete reversals in the direction of flow can be expected in each 25-hour tidal day.

Superimposed on the tidal cycle is the wind component, which strongly affects the surface current pattern. Surface currents induced by winds are commonly great enough to mask the flow produced by the tides. Surface currents are generally strongest in the afternoon and flow toward the east and southeast under the influence of the prevailing westerly sea breeze

During the night and early morning

hours, when the winds are significantly reduced in strength, the tidal current and wave transport current components exert a more pronounced influence. The wind exerts an influence on only the upper few feet of water. Surface current speeds vary from 0.1 to 1.0 knot, with maximum velocities to 7.2 knots in the littoral zone.

In general, the dominant circulation pattern at the San Onofre site is up and down the coast. Surface current velocities average 0.3 knot or less, while subsurface currents are usually less than 0.2 knot. Current flow perpendicular to shore, both onshore and offshore, is weaker and less frequent. In many cases, the subsurface currents have been observed to be flowing in different directions than the surface currents. This tends to increase the general vertical turbulence in the water column, thus increasing the dispersion of the discharge water. An increase in near-surface turbulence is also caused by the marked decrease in current velocities with increasing depth. Based on Rhodamine dye dispersion studies conducted at Unit 1 discharge, dilution of the discharge water is approximately 420 to 1 after two hours.

Beach and Bottom Conditions

Strong sea wave motion passing across the uniform gently-sloping sea floor in the San Onofre area causes fine-grained bottom sediments to be stirred up. This sediment becomes suspended and is then transported along the coast, alternately exposing and covering cobble or rocky areas on the ocean floor. Beach conditions also reflect this cyclic change in sediment distribution. During summer, small wave conditions transport sandbars shoreward and develop a sandy beach cover. During winter, when larger waves occur, wave cutting moves the beach sand seaward and forms a sandy sea bottom, leaving patches of cobbles on the beach. In addition, there are cycles of shorter periods which are the result of unseasonal storms or the change from neap to spring tides. A normal coastal sediment distribution pattern is found off San Onofre.

Tides and Waves

Tide tables for 1963 to 1969, published by U. S. Coast and Geodetic Survey, show a maximum high tide of +7.2 feet MLLW, with a record tidal excursion for a 17-year period of 8.8 feet. The average high-tide and mean-tide levels are +4.5 and +2.7 feet MLLW, respectively, for this period. The maximum wave height was 13 feet above MLLW (approximately 1000 feet offshore). At San Diego, 51 miles to the southeast, the maximum rise in sea level, caused by seismic sea waves generated by major earthquakes, has been recorded. The seismic waves occurred in 1946, 1952, 1957, 1960, and 1964. The maximum recorded rises corresponding to these dates were 1.2 feet, 2.3 feet, 1.5 feet, 4.6 feet, and 3.7 feet, respectively.

Tsunami

Extensive studies were undertaken in order to establish a safe design criterion for protection against a tsunami at Unit 1.

In relation to the southern California coast, the greatest tsunamis of remote origin are of the same order or smaller than the astronomical tides, except at known sensitive locations. It appears that there is no reasonable possibility that these tsunamis would form a bore. The possible superposition of a maximum high tidal stand of seven feet, a maximum storm surge of one foot, and a six-foot tsunami (which, significantly, exceeds the highest ever recorded at the adjacent tide station at Los Angeles, La Jolla, and San Diego), would create a maximum elevation of 11 feet. (The amplitude of a six-foot tsunami is taken as one-half the height, or three feet.) The additional superposition of large wind waves is not critical at the site of the San Onofre Nuclear Generating Station.

Scientific studies indicate that the largest likely local tsunamis would exceed the great distant tsunamis from very large sources. Protection of the plant site against the effects of tsunamis from any source (taking into account reasonable cases of waves and tides) up to 13 feet above MLLW is considered sufficient. However, to be consistent with the conservatism of the Unit 1 design, a retaining wall similar to the Unit 1 seawall will be provided to an elevation of 28 feet above MLLW.

Temperature

Ocean water temperatures at the San Onofre site have been monitored since the summer of 1963. The annual surface temperature cycle indicates a mean maximum of 73F occurring in August, and a mean minimum of 56F occurring in January. Significant deviations from this average annual hydrographic cycle commonly occur, however. Maximum summer surface temperatures vary annually by as much as 3 or 4F. Recorded water temperatures at depths of 15 and 30 feet may deviate by as much as 6F in summer months.

An additional significant feature of the San Onofre ocean temperature regime is the vertical thermal stratification or temperature gradient. This natural gradient has been observed to be as much as 0.3F per foot of depth.

Thermal Influence of Unit 1

Unit 1 at the San Onofre site utilizes 350,000 gallons of seawater per minute for cooling in the steam condensers. Two 12-foot diameter concrete conduits, buried beneath the ocean floor are used to convey the cooling water through the plant. The intake structure is located 3200 feet offshore in approximately 26 feet of water and the outfall is located 2600 feet offshore in approximately 26 feet of water. The sea water, in passing through the condensers, is raised in temperature approximately 18 degrees F and is then recirculated to the ocean. At the outfall the water effluent is directed vertically upwards forming a turbulent upwelling at the surface. The column of rising warm water entrains cooler water and is diluted as it extends to the surface. Upon reaching the surface, the warmed water spreads out in a thin layer and is diluted further and dissipated with ambient water as it is carried away from the outfall area by currents.

To monitor for the thermal addition to the marine environment due to Unit 1 operation, surface and subsurface water temperatures were measured regularly at 32 offshore stations, covering an area of approximately 3 1/2 square miles.

Surface temperatures were also monitored occasionally by an airborne infrared detector system. Isothermal contour lines were then plotted to show the thermal sphere of influence of Unit 1 operation. A survey in August 1969 showed the ambient surface temperature to be approximately 72F, and the sphere of influence of surface temperatures greater than 2F above ambient is approximately ½ mile. On this particular day surface currents were carrying the effluent downcoast and onshore. It should be noted that although the temperature of the water is raised 18F in passing through the plant, by the time it returns to the ocean the center temperature at the surface has been reduced to approximately 8 to 10F, or less, above ambient. On this particular day, for example, the center temperature was measured at only 4F above ambient. This reduction in outfall temperature is due to effective turbulent mixing with colder water as the effluent leaves the outfall structure and rises to the surface.

A comparable wintertime surface temperature with thermal discharge is approximately 15F colder than in the summer, while the center temperature remains approximately 8F above ambient.

A typical wintertime temperature profile depicting the isothermal conditions of the water column during the fall and winter months is illustrated in figure 2.5-9. The sphere of influence of the warmed effluent is restricted to the surface waters in the vicinity of the outfall. Water temperatures at the bottom are not affected by operation of the cooling system. The results of the ecological monitoring program for Unit 1 have demonstrated the lack of any adverse effects on the marine environment due to the thermal additive from Unit 1 (see subsection 2.7 for a discussion of the marine biological community).

Salinity

Salinity values of sea water at five selected stations near the outfall at San Onofre have been obtained on oceanographic surveys since May 1964.

The annual salinity cycle closely resembles the temperature curve. The seasonal salinity maximum generally occurs in either late spring during upwelling, or in August or September during the period of highest water temperature. In the fall, the sea water salinity decreases distinctly with the onset of the Davidson Current. The seasonal salinity minimum generally occurs during the months of December, January, and February, coinciding with the period of maximum precipitation along the southern California coast. The salinity gradually increases in the spring with the resumption of the California Current flowing to the south.

The deviations in the annual salinity cycle at San Onofre are apparently natural and appear to be associated with seasonal variations in insolation, regional circulation, and precipitation. Marine fauna and flora dwelling in the near-shore waters at San Onofre are subjected to these natural salinity variations.

Turbidity

Water turbidity in the near-shore is affected by a variety of natural factors. Water motion due to wind waves, or currents set up by winds or tides, may bring bottom sediment into suspension. Runoff from the land brings other suspended matter into the near-shore area. The rate at which this material either settles to the bottom or is carried away from the area is determined by the current and wave conditions. Inorganic debris and plankton blooms also tend to give the water a cloudy appearance. Any dissolved or suspended matter, regardless of origin, adds to the absorbtive and scattering capacity of sea water.

These suspended materials affect the available light energy which is important to the benthic plants and animals in near-shore waters. Transparency of the near-shore waters at San Onofre has been monitored for this reason. The purpose was to establish the natural levels of radiant energy in these waters prior to Unit 1 construction and operation.

Two parameters related to water turbidity have been monitored at San Onofre on a bimonthly basis since April 1964. These parameters or observations consist of Secchi disk depths and hydrophotometer readings.

The turbidity in the near-shore water at San Onofre determined by Secchi disk data appears to follow a general seasonal trend of low turbidity in summer and fall, and higher turbidity in winter and spring.

In addition, the Secchi disk readings have established a general pattern of decreasing water turbidity versus water depth or distance from shore at San Onofre. The distance from shore is roughly proportional to the bottom depth, but is not a valid reference parameter. Bottom depth, and not distance from shore, determines whether a particular location is within the surf zone or to what extent the bottom sediment is agitated by wind waves.

Using the hydrophotometer, turbidity measurements can be made in shallower water than that for the Secchi disk. These data show the erratic fluctuations in near-shore turbidity due to the surf zone. These relatively large variations are to be expected because of varying rip current patterns and shifts in the position of the surf zone. Near the surf zone, the variavility in water turbidity along this section of coast is large, and does not follow seasonal patterns suggested by the Secchi disk data in slightly deeper water.

Beyond the surf zone, the hydrophotometer readings show a general trend of percent light transmission increasing with total water depth which is consistent with Secchi disk results.

General conclusions concerning natural turbidity in the San Onofre area may be summarized as follows:

A. Turbidity of near-shore waters at San Onofre is primarily a function of wave conditions, runoff from the land, and plankton blooms.

B. The monitoring program, including observations from Secchi disk and hydrophotometer, has established a general relationship between each of these parameters and the total water depth.

C. Secchi disk data suggest that turbidity is low in summer/fall, and somewhat higher in winter/spring.

D. No long shore gradients in turbidity have been detected.

A discussion of the turbidity condition created by operation of the Unit 1 outfall is discussed in Section 3.

Dissolved Oxygen, pH and Coliform

In the spring of 1967, a water quality sampling program was added to the survey program, monitoring the warm effluent water from San Onofre Unit 1. Four small surface water samples were collected bimonthly in the vicinity of the outfall to measure dissolved oxygen concentration, pH, and coliform concentration of the discharged coolant water. Additional samples were

collected at a reference station 10,000 feet south of the outfall to determine the ambient sea water values of these three parameters.

Surface current analysis indicates that surface waters near the outfall flow predominantly downcoast. Therefore, the water quality values, measured 300 feet downcoast from the outfall, were selected for the comparison with ambient values measured at the reference station.

The difference in sea water pH between the two sampling locations used in the comparison was generally less than 0.3 pH unit. The maximum pH deviation was 0.5 pH unit. The monthly variations in sea water pH appear to be random and not seasonal.

Fluctuations in sea water dissolved-oxygen concentrations near the outfall are closely similar to the variations in ambient sea water at the reference station. The difference in concentration values between the two sampling locations was generally less than 0.5 mg/l. The largest observed difference was 1.4 mg/l, which occurred when the outfall was inoperative.

Oxygen solubility in sea water is a function of temperature and salinity. Over the range of temperature and salinity in the coastal water, the temperature effect is several times larger than the effect of salinity. Near-shore waters along the southern California coast above the thermocline are saturated with oxygen. Oxygen is produced by plant photoshythesis in the upper levels of the ocean and is consumed by respiration and decay of organic matter. The seasonal variations of oxygen saturation level in surface water correlates with seasonal changes in water temperature. In cold months, the water has more oxygen than in warm months. At San Onofre, the variations in sea water oxygen content appear to be seasonal and a result of natural hydrographic changes of the marine environment.

For the 18 months of measurement at San Onofre, the coliform concentrations near the outfall and at the reference station were generally less than 3 MPN/100 ml (MPN denotes most probable number). These results are well below the water quality standard for limiting coliform in discharges in the San Onofre area, which is 1000 MPN/100 ml.

General Meteorological Conditions

Temperature

Long term temperature observations for the south coast area are available from the Camp Pendleton Marine Corps Surf and Weather Station near the San Onofre site. This information reveals that the average annual temperature is about 60F, while the average maximum in July is 72F, and the average minimum in February is 42F. The highest recorded was 108F, the lowest was 25F. Observations of a shorter nature that were recorded at the plant site itself are in good agreement with the Camp Pendleton data. With respect to the absolute maximum, it is likely that in a longer record the value would be exceeded; occasionally, the temperature at the site may reach 100F or more in extreme Santa Ana conditions. These very hot days, however, (and also the cool days with temperatures in the twenties) are quite unusual; the normal daily temperatures are about 40F to 60F in winter and from 60F to 72F in summer.

Precipitation

Long term precipitation records are available from the Camp Pendleton Surf and Weather Station and from the U.S. Weather Bureau station at Oceanside. These data correlate well with shorter term data from the plant site. The precipitation, averaging about 12 inches per year, occurs mostly in the winter; the total for the months of May through September averages one-half inch or less. The rainiest month is typically January, with an average of up to 3 inches; the driest is July, with an average less than 0.04 inch. The total number of days per year with measurable precipitation averages only about 40.

Air Mass

The absence of rain in the summer and its infrequency in the rest of the year is related to the presence, some distance above the ground, of an inversion or layer of air through which the temperature increases upward instead of decreasing as is normal. This inversion is associated with the semipermanent subtropical anticyclone. On the average, the inversion has its base at a height of about 1500 feet along the coast. It acts as a lid on moisture transport and convective activity. The anticyclone, a huge area of high pressure with slow outward clockwise spiralling movement of the air, occupies much of the eastern North Pacific ocean. (A similar separate anticyclone lies over the South Pacific ocean and produces similar conditions along the coast of South America.) Below the inversion base, stratus clouds form on many nights, particularly in summer, but usually clear in the morning along the coast.

Except for the relatively few occasions, mostly in winter when storm or Santa Ana conditions prevail, the site is subject to daily land and sea breezes on which an annual monsoon oscillation is superimposed.

This regime is characteristic of the subtropical west coast. In the summer, the sea breez begins shortly after sunrise and lasts until sometime after sunset; the land breeze lasts a much shorter period and is lighter. In winter, the land breeze has the longer duration, although the winds from the

ocean attain greater strength then also.

Dispersion Potential

The dispersion of air emissions from the plant depends on the wind movement and the hydrostatic stability of the air. These factors are discussed in the following paragraphs.

Atmospheric Stability

The upward dispersion of material introduced into the atmosphere near the ground depends largely on the rate of decrease of temperature with height or lapse rate. If the lapse rate is equal to or exceeds the dry adiabatic rate of one degree C per 102 meters, upward mixing proceeds unimpeded or is speeded by free convection. Smaller lapse rates are stable for vertical motions not involving saturation, and under these conditions turbulent diffusion is resisted. For the case of an inversion, where the temperature increases with height, the stability is so great that turbulent diffusion is severely damped or effectively prevented.

There are two essentially different kinds of inversion present at locations along the California coast, such as at the plant site. The one type is the surface layer inversion produced by cooling of the air in contact with the ground, which has lost heat by radiation during the night. This type is referred to as a radiation inversion or ground inversion and is a common phenomenon over all land masses. In some areas of the United States it occurs almost every clear night. Along the California coast it occurs principally at night only in the colder half of the year.

The second type is the subsidence inversion due to the sinking motion of the air spiralling outward from the subtropical anticyclone. It is present over the eastern subtropical portions of the oceans and overlaps onto the western coasts of the continents. It occurs principally and most persistently in the warm months of the year (April through September), but occasionally takes place during the rest of the year.

The subsidence inversion is present almost every day in the warm months. Radiational surface inversions are present on about half the days in the cool months. The remainder of the days in the cool months are divided among stormy periods when no low inversion is present and warm periods that often have a subsidence inversion. Among the warm periods are the Santa Ana situations, when anticyclones build up over the Great Basin in such a fashion that air spreads outward from the continent and subsides along the coast. In these periods, subsidence inversions develop similar to those associated with the oceanic anticyclone, but in these cases the inversion frequently extends right down to the ground. These are cases of very strong and persistent surface inversions that prevent almost all vertical diffusion of pollutants. Fortunately, so far as the plant site is concerned, in these cases the wind is directed seaward where extensive horizontal dilution occurs.

Wind Observations At Plant Site

A wind measuring system was installed at the plant site during late 1964 to record data that would be used to determine wind flow and diffusion characteristics of the air that passed over the plant site. The sensors were mounted at the top of a 64-foot mast about 500 feet northwest of the reactor site. The height of exposure of the sensors was chosen so that a conservative estimate of the wind speeds and dispersion conditions would be measured. The instrument system has been operated continuously and has accumulated sufficient data since the original installation to provide representative dispersion conditions for the site. A summary of the data is available.

Estimates of Site Diffusion

Short Term Releases

The atmospheric dispersion factor for a short term ground-level release is used in estimating potential doses to individuals due to airborne radioactive material released within the first day following a postulated accident.

A table was prepared from the onsite meteorological data listing percentages of occurrence for various wind speeds and directions. This was specifically done for the sea breeze sectors since these are the winds which will predominately effect the dispersion of airborne material from San Onofre to the population.

The sum of all of the percents of occurrence shows that approximately 53.3 percent of the time the wind is expected to blow past San Onofre toward the land. The average meteorolcgical condition for these sea breezes corresponds, then, to the situation wherein people on land would experience less favorable (i.e., more stable) diffusion conditions one half of the time that the wind is blowing toward the land (i.e., 26.65 percent of the total time).

The long-term atmospheric dispersion factors versus radial distance from the plant for all downwind sectors were calculated. Winds from the southeast would carry releases toward the nearest population center, San Clemente, principally in the northwest sector. For this reason, the long term atmospheric dispersion factors for the northwest downwind sector were used for estimating doses to individuals due to airborne releases for time periods beyond 24 hours.

Long Term Releases

The atmospheric dispersion factor for a long term ground level release is used in this report in estimating potential doses to individuals and to surrounding population due to airborne radioactive material under the following conditions:

A. Annual average releases due to normal and non-routine plant operations.

B. Releases occurring beyond 24 hours following a postulated accident.

Exhibit 2 contains long term dispersion factors for not only the northwest downwind sector but also the remaining 15 compass sectors. These may be applied in any direction to predict downwind concentrations of airborne material released from the plant. A prime example of an application of the estimated dispersion factors for all directions is that of calculating potential integrated whole body gamma doses to the surrounding population (man-rem). The midpoint of a segment of a given downwind sector is applied to calculate the integrated man-rem within that segment. The man-rem calculation is repeated for each segment of each downwind sector, out to a distance of 50 miles. The results are summed to arrive at a prediction of integrated man-rem within a 50-mile radius.

Marine Biota of the San Onofre Site

Monitoring of marine communities at San Onofre began in 1963, 10 months before the Unit 1 groundbreaking, and has continued through all phases of construction and operation of Unit 1. The objectives of the monitoring programs have been to (1) characterize the marine environment and (2) to understand and monitor the effects on the environment of all phases of plant construction and operation. Unit 1 began regular operation in September 1968, and has continued to operate since that time with only a few interruptions.

Intertidal and subtidal communities have been monitored at San Onofre. Since these two habitats are quite different in composition, they will be discussed separately.

Subtidal Communities

All species regularly present in any marine community fill a niche in that community and, therefore, are of some biological importance. For the purposes of this discussion, important species will be defined as those having commercial or sport interest, and those exerting sufficient structural influence on the community so that their removal or severe restriction would likely result in a measurable change in the community composition.

Kelp Beds

There are two kelp beds in the San Onofre area. The San Mateo bed is three miles north of San Onofre, and the Barn kelp bed is about six miles south of the site. In the past, both beds have been harvested commercially. In recent years, however, kelp beds off the California coast have decreased in size, and neither Barn kelp bed or San Mateo kelp bed has been harvested commercially for many years. However, both beds appear to be healthy. The San Mateo bed may be increasing in size.

The surface canopies of these two beds and most others in Southern California sluff off in the late summer as surface waters warm. The extent of this die-off is nearly the same at the San Mateo bed and at the Barn kelp bed, both of which are out of the sphere of influence of the San Onofre Unit 1 thermal plume.

Lobster

The spiny lobster forms the basis for a large commercial fishery in Southern California, but is present in insufficient quantity at San Onofre to support more than a few traps. Traps were absent during the 1971 season, although the remains of lost traps and trap lines in the area indicate some previous effort. By far the greatest concentrations of lobster seen in this vicinity are those found in the rip-rap surrounding the present intake and outfall structures. This rip-rap provides the necessary shelter for the lobster. Therefore, two additional intake structures and the two diffuser type outfalls with their accompanying rip-rap will increase the amount of suitable habitat and possibly increase the lobster population to the extent that some commercial effort will be worthwhile.

Even at their present population level, these lobster have sportfishing importance. In spite of its general inaccessibility, the location offers the sport diver the opportunity to catch a legal-sized lobster ($3\frac{1}{4}$ inches carapace length). The addition of the new rip-rap should improve sportfishing.

Benthic Molluscs

In the San Mateo kelp bed, three species of abalone have been identified. They are the pink abalone (*Haliotis corrugata*), white abalone (*H. Sorenseni*), and red abalone (*H. rufescens*). The pink and the white abalone are of sufficient size and number to support a reasonable sport effort. No legal-sized specimens of red abalone have been seen at San Onofre, however, and the numbers are far too few to support either sport or commercial effort.

This station is the only one in the immediate vicinity of the plant with enough natural, contiguous, solid substrate for algal growth to support a population of abalone.

The Barn kelp has a much greater area of solid substrate than the area around Station F but supports only a minimal population of abalone. It may be, therefore, that this area is not suited for further development as a potential abalone habitat.

The Clip Semele is a large clam found in the cobble areas offshore of the present intake and in the kelp beds north and south of San Onofre. Their similar sizes and population in these areas would indicate that the present heated effluent has no detrimental effect on these clams.

Crabs

Two species of rock crab from the San Mateo kelp bed have been recorded. They are *Cancer antennarius* and *C. anthonyi*. Neither are present in sufficient abundance to be of either commercial or sport interest.

Intertidal Communities

The six intertidal stations shown on Exhibit 3 have been surveyed regularly since 1963. Stations 1, 3, 4, and 5 are sandy beaches; Stations 2 and 5.5 are

sand beaches with outer cobble reefs.

Exhibit 3 lists the marine species at the San Onofre intertidal stations. Those species deemed to be of commercial or sport fishery interest are indicated. However, most of these organisms are present in insufficient quantities to be of commercial or sport value.

Another category on Exhibit 3 includes those species judged to have a relatively large influence on community stability. It is recognized that this categorization involves considerable subjective judgment. Each species plays a role in its community. A consideration of the ecological niche filled by a species within its community must consider its temporal and spatial position within the habitat and its interaction with other species present. These interactions, particularly in diverse communities, are often subtle and complex. Consequently the effect of a particular species upon overall community stability is not easily determined. However, certain faunal and floral elements, by virtue of their prevalence within a particular trophic level, known food specificity, or their considerable influence on the physical nature of the habitat, can be judged as having a relatively great influence on the community, i.e., their removal would alter the composition and stability of the community.

Commercial and Sport Fisheries Statistics

Statistical data from the California Department of Fish and Game for the area surrounding San Onofre were analyzed for Commercial and Sport Fisheries for Blocks 737, 756, 757, 801, and 802. These data are compiled separately for commercial and sport fisheries catches. The ocean area adjacent to the San Onofre plant is in Block 756.

COMMERCIAL CATCH (IN POUNDS) FOR SPECIES RECORDED FROM BLOCKS 757, 737, 756, 801, AND 802 FOR 1970

Block Number	757	737	San Onofre 756	801	802
Species					
Pacific Bonito	75,084	40	1,355	56,089	115,385
Jack Mackerel	0	8,970	18,350	22,890	0
California Halibut	3,120	0	932	9,121	211
White Seabass	15,685	758	6,944	5,094	212
Spiny Lobster	2,168	1,236	439	2,273	307

(Sheet 1 of 2)

FAUNA OF THE COASTAL STRAND - COASTAL SCRUB
COMMUNITIES OF SAN ONOFRE

Birds:		
*C	Western Gull	(Larus occidentalis)
C	California Gull	(Larus californica)
C	Sanderling	(Crocethia alba)
C	Snowey Plover	(Charadrius alexandrinus)
R	Raven	(Corvus corax)
R-T	Cooper's Hawk	(Accipiter jamaicensis)
R-T	Barn Owl	(Tyto alba)
T	Roadrunner	(Geococcyx californicus)
T	Mourning Dove	(Zenaidura macroura)
Reptiles:		
R-T	California Red Rattlesnake	(Crotalus ruber)
R-T	Western Rattlesnake	(Crotalus viridus)
R-T	Banded King Snake	(Lampropeltis getulus)
R-T	San Diego Gopher Snake	(Pituophis catenifer)
Mammals:		
T	Desert Cottontail	(Sylvilagus audubonii)
T	Brush Rabbit	(Sylvilagus bachmani)
T	Black Tailed Jackrabbit	(Lepas Californicus)
T	California Ground Squirrel	(Citellus beecheyi)

*C - Coastal Strand
R - Ravines
T - Terrace

(Sheet 2 of 2)

FAUNA OF THE COASTAL STRAND - COASTAL SCRUB
COMMUNITIES OF SAN ONOFRE

T	Southern Pocket Gopher	(*Thomomys umbrinus*)
T	Kangaroo Rats	(*Dipodomys* sp.)
T	Field Mice	(unidentified species)
T	Spotted Skunk	(*Spilogale putorius*)
T	Coyote	(*Canis latrans*)
Crustaceans:		
C	Sand Crab	(*Emerita analoga*)
C	Beach Amphipods	(*Orchestoidea* spp.)
Insects:		
No attempt was made to identify the insects.		

*C - Coastal Strand
R - Ravines
T - Terrace

3. Environmental Impact of the Lease

Esthetics

The primary goal of the esthetics criteria is the assurance that the plant facilities and grounds will be, within the constraints and limits imposed by the function and scale of the project, visually pleasing and compatible with the surrounding environment. Since what is or is not visually pleasing is a subjective matter which varies widely among individuals, the following design objectives have been selected to obtain a pleasing appearance for the largest segment of the population.

A. Organize the various site components (structures, equipment, parking, railroad lines, etc.) in a neat, functional manner with a minimum of visual clutter.

B. Integrate and enhance the visual appearance of the plant by modification of the various structural and equipment forms, and the application of appropriate textural and color treatments.

C. Use building and plant materials that are appropriate and complimentary to the sea coast environment.

D. Where beneficial to the appearance of the plant, use techniques for scaping, earth massing, and decorating walls to reduce adverse visual impact of the units exposed to public view.

Units 2 and 3 plant facilities incur the greatest public exposure from the following sources:

- Motorists traveling on Interstate Highway 5 and Highway 101.
- Persons viewing the plant from the Visitors' Information Center located on the bluff above Unit 1.
- Persons viewing the plant from the beach area directly in front of Units 2 and 3 or from boats offshore in adjacent waters.

Photographs, plans and renderings are available which visually depict the present plant and proposed expansion.

Site Preparation

An area of 46 acres will be prepared for the construction of Units 2 and 3. An estimated 2,350,000 cubic yards of material will be excavated from the site bluff. It is planned to place the excavated material offsite in specific landfills.

The excavated material will consist of two predominant types:

A. Overlying Pleistocene terrace deposits consisting of silty, clayey fine to coarse sands, with layers of cobbles and boulders - approximately 2 million cubic yards.

B. Underlying San Mateo formation of very dense, fine to coarse sand - approximately 350,000 cubic yards.

The material excavated from the terrace deposits will be disposed of at specific sites on Camp Pendleton designated by the Units States Marine Corps. Two specific sites have been found to be satisfactory. The Las Pulgas (Las Flores Creek), seven miles south of the site, can accommodate a total of 250,000 cubic yards, creating a more usable training area for USMC. At Basilone Road adjacent to the San Mateo River and the freeway (2 miles north) over 2,250,000 cubic yards can be deposited. Alternative areas are currently under study by USMC personnel to meet the need for changing land requirements for military operations.

About 190,000 cubic yards of San Mateo Sand will be used in the construction of a temporary working area at elevation +20.0 MLLW at the seaward side of a proposed permanent seawall line. This area will be protected by a temporary sheet-pile wall for the duration of the offshore construction. The balance of the San Mateo Sand (approximately 160,000 cubic yards) remaining after construction of the temporary work area will be deposited on the beach south of the plant for beach replenishment and redistribution by wave action. All placement of sand will be landward of the MLLW contour of December 24, 1970. At the conclusion of construction activity, as indicated in the schedule, the temporary sheet pile will be removed and the remaining sand will be left to be redistributed by wave action. The temporary seawall will be replaced by a permanent seawall along the alignment where the bluffs meet the beach.

Plant Construction

Construction of the plant facilities will require an onsite concrete batching plant, an access road, a construction water supply line, an extension of the existing railroad spur, construction power service lines, transmission lines, and trash disposal facilities.

Dredging for Cooling Water Conduits

Excavation is required to install four 18-foot ID reinforced concrete conduits for the plant's cooling water intake and discharge system. Dredging operations will be conducted from a temporary steel trestle that will extend from the equipment laydown area to the intake riser, and continue on to the end of the discharge conduit. There will be two trestle systems; one for each pair of intake and discharge conduits. The work area along each trestle within the rough surf zone will be protected by sheet piles.

The dredging operations will require approval by the San Diego Regional Water Quality Control Board and the Army Corps of Engineers, and will comply with regulations in force at the time the work is initiated.

Each conduit will be buried beneath the ocean floor with a minimum sand cover of four feet. Most of the dredged material will be used as a back-

fill to cover the installed conduit sections. The sheet-piling protecting the work area along the trestles within 100 feet of the seaward face of the construction laydown area will be removed as soon as the conduit sections are in place and backfilled.

The offshore contractor will be confined to a 250-foot wide temporary work area easement along the centerline of each pair of conduits. As a general rule, dredged material will be immediately placed back in the trench in a continuous process so as not to disturb the surrounding ocean bottom. Occasionally, particularly at the beginning and end of each conduit line, a two-stage dredging program will be necessary requiring temporary storage of dredged material. These excess dredgings will be spread shoreward of the intake structure as previously indicated. It is anticipated that the dredging operation will disturb the naturally turbid water near the ocean bottom and that a brownish discoloration will occasionally be apparent on the ocean surface.

Dredging operations will have no effect on channels or boat basins, because the nearest such facilities are located at Dana Point, more than five miles away. The shallow nature of the inshore area generally prohibits large craft from traveling in the region where the work will take place. However, small boat coastal navigation will be temporarily affected by dredging operations. There is a possibility that the trestle system will be used as a receiving station for materials used in constructing the offshore conduits, intake and discharge structures.

During the dredging phase, as in all phases of plant construction, no sanitary wastes will be discharged in the ocean. Portable units will be used by construction workers, and a septic tank and leeching field will be developed and placed in service to accommodate the flush toilets used by construction office personnel.

Plant Operation

Radioactive Releases

There will be some, not necessarily significant, releases of radioactive materials to the environment. This will consist of airborne gaseous releases, liquid radwaste discharges into the ocean, and buildup of radioactivity on the adjacent beaches through ion exchange and other processes in the beach sand.

Release of Chemical and Sanitary Wastes

These releases include boron, nitrite, phosphate, sulfite, Californ, dissolved oxygen, suspended solids, sodium hypochlorite (marine growth control) and TDS (evaporator blowdown). Discharge to the environment is through the circulating water conduits. These ocean discharges are presently controlled by the Regional Water Quality Control Board. (Temperature of discharged water is controlled by the State Water Resources Control Board.)

Transport of Nuclear Fuel

Although the shipping of new and spent fuel is controlled by the most comprehensive and stringent of rules, there exists the possibility of accidental exposure to humans.

Transmission Lines

The construction of 309 miles of new transmission facilities will result in a negative esthetic impact to the environment.

Risk of Nuclear Accident

Though possibly remote, there is possibility of physical damage to the generating station with consequent radiation release, particularly in the event of submarine atomic warfare.

Creation of New Jobs

The construction of Units 2 and 3 will result in the creation of an average of 1000 jobs for a period of 65 months. The peak manpower requirement will be 1700. Personnel on the jobsite will comprise approximately 10 percent supervisory and administrative forces and 90 percent manual and skilled labor from the major crafts. The bulk of the labor force will be obtained from local unions in the San Diego, Los Angeles, and Orange County areas. The surrounding businesses are expected to benefit from the plant construction. Equipment manufacturer personnel temporarily assigned to jobsite, as well as temporary engineer-construction personnel, will provide increased business for nearby hotels, motels, and restaurants. Local machine shops, electrical shops, and other services will be employed as the scope of their operation permits.

The operation of Units 2 and 3 will create 70 new permanent jobs of primarily a technical and supervisory nature.

Increase of Tax Base of Area

When San Onofre Units 2 and 3 go into operation, the San Diego County tax base will be enlarged by $210,000,000, according to latest assessing procedures. Using the 1971-1972 tax rate, annual taxes would be as follows:

County General Administration (43.4%)	$ 6,180,000
County Library (2.2%)	320,000
Fallbrook Union School District (54.4%)	7,700,000
TOTAL	$14,200,000

The Fallbrook Union School District includes the elementary schools, high schools, and a community college.

4. Unavoidable Adverse Environmental Effects

In the construction and operation of San Onofre Nuclear Generating Station

Units 2 and 3, there will be certain unavoidable effects on the environment and population in the area. These will include the physical presence and appearance of the facilities; the excavation and dredging for the circulating-water conduits; and the excavation, construction, and operation of the facilities.

Preparation of the site for construction will require the excavation of approximately 2,350,000 cubic yards of material.

The dredging of the ocean for the conduits will result in the temporary removal of 284,000 cubic yards of material which will be used as backfill.

The transmission lines resulting from the expansion will have an undesirable esthetic effect on the environment.

There will be thermal, radwaste and chemical discharges to the environment.

A risk of nuclear accident will be present.

5. Mitigation Measures Proposed to Minimize the Impact

The lease will contain a covenant requiring the lessee to comply with every rule and regulation issued by cognizant federal, state and local governmental authority in the field of nuclear power plant construction and operation, and transport of fuel. An addition, the lessee will be required to comply with the following:

1. Take measures to mitigate the undesirable effects on adjacent waters and aquatic life due to construction and site preparation, to include the areas of flood and pollution control, siltation and runoff control, and habitat improvement.

2. Implement measures to minimize shore erosion and to protect adjoining property. Schedule work so that a minimum of sheet-piling will be required to protect the work area during conduit installation in the intertidal zone. Remove sheet-piling protecting the work area along the trestles within 100 feet of the seaward face of the construction laydown area as soon as the conduit sections are in place and backfilled.

3. Maintain control of air pollution by paving roads, sprinkling dust producing areas, and transport offsite all materials to be burned.

4. Utilize modern steel poles for transmission lines and design them so as to minimize effects on radio and TV reception.

5. Design the generating station so as to create a neat, functional appearance, and to integrate the overall visual appearance, using building materials which are appropriate and complimentary to the sea coast environment. Landscaping, earth massing, and decorative walls will be used to reduce the visual effect of the units.

6. Give constant and special attention to thermal, radwaste, and chemical discharges to the environment by monitoring and development of new safeguard techniques for maximum reduction or elimination.

7. Develop and use an efficient fish by-pass system for the conduits that will intercept and return live fish to the ocean.

6. Alternatives to the Lease

Alternative Means of Power Generation

Energy Sources Considered Not Available in the 1970's

Energy sources considered not technically feasible to develop in this decade are nuclear fusion, breeder reactors, solar, tidal, wind and, to a degree, geothermal.

For most of these energy sources, the technological limitations of the various types of conversion equipment available impose the major constraints. For some (such as geothermal, tidal, or wind), the limitations may be due to, or may be compounded by, the topography of the area, the unpredictability of the source, the environmental effect of the facility or the magnitude of the energy requirement. The latter is especially appropos for geothermal at this time, and is the major basis for its disqualification as an alternative for San Onofre.

While additional research and development may overcome existing problems of process controllability, prohibitively low efficiency, low reliability, short life, material unavailability, etc., it is not expected that practical implementation of new techniques to harness any of these sources of energy for power needs can be realized in this decade.

New Equipment Concepts Utilizing Conventional Fuels

Magnetohydrodynamic (MHD) systems and fuel cells of several designs exist in various stages of experimental development. With these systems, it is possible to convert the energy of a more conventional fuel sources directly into electrical energy. While encouraging test results with small laboratory models have been achieved, no sizable installation utilizing a type of fuel available in quantity has been demonstrated. Also, the environmental effect of these systems has not been adequately assessed, particularly for MHD. Again, the lack of proven techniques of eliminating or circumventing equipment limitations precludes early large-scale application of these conversion methods.

Energy Storage Concepts

The energy storage concepts discussed here are characterized by increased utilization of available conventional generating capacity, at a time not needed for supplying immediate demand, to produce electrical energy. This

electrical energy in turn is converted into some form of energy that can be stored. A method of reconverting the stored energy to electrical energy at a time of need is, of course, also required.

It is inherent that such a system will be energy-deficient in the sense that the conversion of once-produced electrical energy to another form of energy, and subsequent conversion back to electrical energy, must involve losses which cannot be recovered. However, economic and environmental benefits may be possible if the conversion facility costs are relatively low and are themselves environmentally desirable.

Pumped storage hydro is an example of such an energy storage technique. It is particularly significant in that it has proven feasibility and also has beneficial environmental features. Until proper amounts of capacity for production of stored energy and proper amounts of energy reserve with which to supply the inherent energy losses are available, such a facility could not be fully utilized. Base load units (such as nuclear units) are required to assure this pumping capability.

The use of batteries as a means of storing energy has been investigated. Here, as in fuel cells, the added problem of direct- and alternating-current conversions are involved. The possibility of using the process of electrolysis to form hydrogen and oxygen from water later to be used as completely clean burning fuels in gas turbines to produce both electricity and potable water has also been explored. Technological advances, especially in the area of hydrolyzer equipment, are required to implement this method. Both the battery and electrolysis methods are subject to the above-mentioned system capacity and energy reserve constraints and, hence, have limited practical application until after the addition of substantial amounts of base load generation.

Peaking and Semi-Peaking Units

Peaking or semi-peaking units are not considered adequate alternatives to San Onofre units 2 and 3 as they do not satisfy energy needs in a practical manner. The most common type of peaking or semi-peaking units being installed today are either gas-turbine powered, or a combination of gas-turbine and steam-turbine (combined cycle) powered.

Gas turbine peaking units are designed to be operated only a few hours a week. This type of operation is adequate when the need is to supply capacity and energy during the few hours of maximum weekly demand or, perhaps, to function for a short time as a temporary replacement for a unit forced out of service. However, when the percentage of peaking capacity installed is allowed to continually increase by arbitrary addition of gas turbine peaking units, all available peaking units are forced to carry high loads for long durations.

Although capital costs per kilowatt of gas turbine peaking units may be on the order of half that of a base load unit, rated load energy costs per kilowatthour may be two or three times higher. If peaking units are operated in the peaking mode, this is an economically sound arrangement.

However, technical problems aside, when these units are forced to operate as high-capacity-factor devices, economic comparisons show a number of other types of units to be superior.

The amount of maintenance required by gas turbines dramatically increases when they are heavily loaded for long periods. This not only increases maintenance costs, but also increases the amount of time the unit is unavailable, thereby increasing the total-system installed-capacity requirements.

It is neither economically sound nor environmentally desirable to operate gas turbine peaking units as base load units. Hence, if such units were to be installed in lieu of San Onofre Units 2 and 3, a majority of the energy that would have been produced by the San Onofre units would come from other existing system resources.

To obtain the energy from existing resources would necessitate increased generation by older, less efficient fossil-fueled units; would reduce system energy reserves; and would reduce the amount of available capacity that might be used to supply energy to the proposed pumped storage units. The pumped storage units would become less desirable and perhaps impractical resources.

To obtain energy from existing resources would require burning additional oil because no increases in gas allotments can be reasonably anticipated. Thus, current and future problems of oil fuel supply would be accentuated rather than alleviated. Furthermore, increased consumption of oil fuel would increase emissions of combustion products.

While combined-cycle semi-peaking units are capable of operating at higher capacity factors than conventional gas turbine peaking units, their use of gas turbines subject these units to similar operating constraints. The above comments pertaining to gas turbine peaking units, although to a lesser degree, also apply to combined-cycle units.

For either gas turbine peaking units or combined-cycle semi-peaking units, the same conclusion applies. Due to water storage constraints, conventional hydro units may often be in the peaking or semi-peaking class. The availability, the cost, and the difficulty of developing remaining sites are major deterrents to the construction of hydro resources. Conventional hydro is not a feasible alternative to San Onofre Units 2 and 3.

Conventional Fossil-Fired Steam Units

Conventional fossil-fired steam units are capable of operating at the high-capacity factors needed to supply forecast increases in consumer demands and remain as possible alternatives to San Onofre Units 2 and 3.

It would be technically feasible to install additional large oil- and gas-fired units at other locations by 1978-1979. This alternative is not considered environmentally acceptable because of air pollution considerations. Moreover, it is undesirable to install large, high-capacity-factor, fossil-fired units in the South Coast Air Basin, until significant advances in air

pollution control are achieved.

The ability to develop additional remote coal-fired capacity in the amounts required in the 1978-1979 time period appears very limited. The most likely site for further development is Kaiparowits in southern Utah. The first units at that site are scheduled for operation, concurrent with San Onofre Units 2 and 3, in 1978 and 1979. All units at Kaiparowits must be shared with other utilities and the rate of site development must be compatible with the needs of the other participants. Therefore, to construct additional units at this location for operation in 1978 and 1979 is not feasible.

Development at other locations is equally unlikely because of the multiplicity of negotiations involved. Moreover, Arizona and New Mexico are becoming increasingly reluctant to make any resources in their states available for export of power to California. Indian residents are increasing their opposition to coal plants in their locale. Rights-of-way for the required transmission lines are increasingly difficult to obtain. Furthermore, it is not desirable to disproportionately develop resources in such remote locations. For the above reasons, it does not appear possible to provide alternative coal-fired facilities.

There does remain the possibility of oil- and gas-fired units outside the South Coast Air Basin. Of the sites investigated, a site near Boron, California, appears to be the best suited for development. Water rights, transmission permits, rights-of-way, and other regulatory approvals would, of course, have to be acquired. In addition, the proposed units at Boron would be 790 MW each. Two of these would not be adequate replacement for the total Edison share of 1824 MW from San Onofre Units 2 and 3. Therefore, the comparison study that was made included not only the two 790 MW units at Boron, but also two 121 MW peaking units, representing a comparable total capacity of 1822 MW. For the alternative plan, San Onofre Unit 2 was replaced with Boron Unit 1 (790 MW) and one gas turbine unit (121 MW) scheduled for operation on June 1, 1978. Similarly, Boron Unit 2 (790 MW) and a second gas turbine unit (121 MW) scheduled for operation on June 1, 1979, replaced San Onofre Unit 3.

Gas Turbine Generation

The cost to install this type of generation in 1978 is estimated to be $142 per kW.

This is less than the cost to install the San Onofre units. This difference would, however, be more than offset by the difference in cost between the fuel for the San Onofre units and the fossil fuel required by the gas turbines. If it is assumed that gas turbines can be operated continuously to reliably supply the energy needs of the area (this has not yet been demonstrated adequately), then, as with gas/oil-fired steam units, the operation of these units will require the combustion of large quantities of fossil fuel. To date, it has not been demonstrated that gas turbines can continuously burn residual fuel oil; therefore, it must be assumed that gas turbine generation would have to be fueled with natural gas and higher cost No. 2 diesel oil. Again, because of the unavailability of natural gas, diesel oil would be burned almost exclusively. The cost of this oil is currently about $1.00 per MMBtu.

The operation of gas turbines would not require cooling water for dissipating waste heat. Waste heat from gas turbines is dissipated to the atmosphere with the emission of combustion products. Conversely, the continuous operation of gas turbine generation would, as with conventional steam generation, result in a major increase in the quantity of combustion products emitted to the atmosphere.

Gas-Turbine Combined-Cycle Generation

Still another alternative to the construction of San Onofre Units 2 and 3 is the installation of gas-turbine combined-cycle generation. With this alternative, fossil fuel (natural gas or diesel oil) is utilized to power gas-turbine generators. The waste heat from the gas turbines is then fed to waste heat boilers, which use it to generate steam for a steam-turbine generator.

Like conventional gas turbines, combined-cycle generating units must be fueled with either natural gas or diesel oil (the technical feasibility of operating this type of generation continuously on residual fuel oil has not yet been demonstrated). Again, because of the shortage of natural gas for use in power plants, by 1978 it must be assumed that combined-cycle generation would have to be fueled exclusively with diesel oil.

Like other fossil-fueled generation, combined-cycle units would emit combustion products. The use of diesel fuel, however, with its inherently low-sulfur content would result in a minimum emission of sulfur compounds. Unlike conventional gas turbines, combined-cycle units require cooling water for waste-heat dissipation. The quantity required is about half that required by a conventional steam unit. All other environmental effects from the installation of combined-cycle generation would be similar to those of San Onofre Units 2 and 3.

Alternative Heat Dissipation

The San Onofre site was selected for construction of a nuclear generating station because, among other reasons, its coastal location offered the Pacific Ocean as an obvious source of cooling water for dissipation of heat from the plant condenser.

In order to develop a circulating water system that complies with new regulations, a number of alternatives have been considered. In general, the alternatives considered utilization of the ocean as a source of cooling water and as a heat sink for all, or at least part of, the heat to be dissipated. Any alternative that does not utilize the ocean for cooling purposes ignores the fact that one of the accepted beneficial uses of the coastal waters is that of industrial cooling.

The practicable alternatives considered are divided into two groups: (1) onshore systems which provide lower outfall discharge temperatures by greater flow rates through the condenser, by supplementary dilution of condenser discharge water with non-heated sea water, or by supplementary cooling from cooling towers, cooling ponds, or spray ponds; and (2) offshore systems which meet the new regulations but still discharge the same amount

of heat to the ocean, such schemes are deep-water, single-point discharge structures and multipoint (diffuser) discharge systems.

For completeness, also presented are alternatives which do not discharge heat into the ocean. These alternatives utilize fresh water for cooling. Because sufficient quantities of fresh water are unavailable, these alternatives are not considered feasible.

The results of this study show that the offshore diffuser discharge system will minimize the environmental effect of the thermal discharge and will also be the most economical alternative.

Onshore Alternatives

The onshore alternatives assume partial cooling of the circulating water followed by single-point discharges to the ocean 2600 feet offshore. The discharge temperature from proposed Units 2 and 3 was lowered until its heat contribution to the thermal structure offshore met the water quality criteria. It was determined that eight degrees above ocean ambient would be the maximum allowable discharge temperature for a single-point discharge, as described above. Since the proposed circulating-water system increases the cooling water temperature by 20 degrees, the onshore alternatives were sized to supply 12 degrees of supplementary cooling.

Cooling Towers

Ocean water theoretically could be used as makeup to an evaporative cooling system. Sufficient land, however, is not available within the existing plant boundaries. Approximately 2300 lineal feet of 70-foot high cooling towers would be required to provide the appropriate supplementary cooling. The problem of disposing of blowdown is of concern, since the salt content of the waste water may be about twice the ocean water concentration. Fogging would be a problem during certain ambient atmospheric conditions. The principal drawbacks to this approach are severe corrosion caused by using concentrated ocean water and large quantities of salt that will be released to the environment by drift losses. Fouling or corrosion of electrical switchgear and control equipment would cause serious operating and maintenance problems. The quantity of salt released through drift could result in dramatic adverse environmental effects. This application would be an extension of existing technology, with related unknown problems of design and operation. A salt water cooling tower system approaching this scale has not been built or designed to date.

Hyperbolic natural draft cooling towers might reduce the land area required, but would still exceed the area now available. Three individual natural draft towers of about 400 feet in diameter and 400 feet high are estimated to be required with a minimum center-to-center spacing of two tower diameters. The very height of natural draft towers is considered by many people to be unsightly. Even if sufficient land was available, these types of cooling tower structures would have an adverse esthetic effect on the naturally scenic coastline.

Cooling Ponds

Cooling ponds were dismissed from consideration due to their adverse effect on the environment and because of the extremely large amount of land required. To satisfy the cooling requirements, between 1300 and 2600 acres would be required. Spray ponds require much less land; however, these too have been dismissed from consideration since approximately 120 acres would be required to provide a workable system. There is essentially no land available on the existing plant property for development of cooling ponds or spray ponds. Other land, if it were available, would have to be acquired from the U.S. Marine Corps and approval for its use would have to be obtained from the United States government; however, because Federal approval may take years to obtain, such action probably would not allow construction to proceed within the present time frame.

The use of salt water for this method of cooling is feasible, but the environmental effects of such ponds would be very objectionable from both an esthetic and biological standpoint. Evaporation from the ponds would leave salt encrustation all about the perimeter of the ponds and would create numerous maintenance problems.

Deep Water Single Point Discharge

In considering the offshore alternatives, the deep water, single-point discharge system was determined not to be economically feasible. One goal of the proposed State requirements is to design discharges so that initial cooling is achieved primarily from mixing with the receiving water and not from heat transfer to the atmosphere. To achieve the required degree of initial dilution cooling, the single-point discharge must be located in water depths in excess of 100 feet. To reach a depth of 100 feet, the discharge conduit would extend at least 15,000 feet offshore. This alternative would have a much greater effect on the marine environment during construction because of the greater length of time required to install the longer conduit system and because of the greater area temporarily disrupted by construction activities. Operation of this system would meet the thermal discharge regulations, but the prolonged entrainment of marine organisms in the heated discharge water might cause greater mortality of such organisms.

7. Relationship Between Local Short-term Uses of the Environment and the Maintenance, and Enhancement of Long-term Productivity

The construction and operation of San Onofre Nuclear Generating Station Units 2 and 3 will involve the commitment and use of land, air, and water resources involving the discharge of warm water and treated chemical and sanitary wastes to the ocean, and the release of some radio-activity to the surrounding environment. The short-term effect of these activities on the environment is expected to be minimal.

Comprehensive monitoring programs will be required to closely observe any changes in the surrounding environment resulting from plant construction and operation. These monitoring programs will provide a basis for detecting and evaluating any effect which might lead to long-term effects such that timely and appropriate corrective action can be taken.

8. Any Irreversible Environmental Changes Involved Under the Proposed Lease

The only irreversible change effect resulting from the construction or operation of the proposed units will be the alteration of the cliffs and barrancas in the site area. After decommissioning of the facility, all other aspects of the site and the associated transmission line rights-of-way could be returned to their natural undisturbed state. Also, the ultimate decommissioning of the units can be accomplished in a manner which will make the excavated site a benefit to the surrounding area.

Important Notice

If the State Lands Commission finds that the lease authorizing the cooling water conduits will not have a significant detrimental environmental effect, such finding will be based not only on this report but on the following specific premises:

(1) That the lease is effective only if the U.S. Atomic Energy Commission authorizes the plant expansion, recognizing that this Commission is the fountainhead of technological expertise in the field of radiation hazard for the human environment;

(2) That the expansion will have been approved by the State Public Utilities Commission after determining that the additional electricity is in fact required with due thought given to the conservation of energy.

HUMAN ACTIVITIES IN THE ENVIRONS

*CURRENT CAMP PENDLETON BASECAMP POPULATION

Basecamp	Population	Approximate Distance to Site (miles)
Camp San Onofre	4637	3
Camp San Mateo	4337	3-3/4
Camp Horno	4321	4-1/2
Camp Pulgas	3169	8-1/4
Camp Margarita	3614	11-1/2

*November 1971

INDUSTRY WITHIN THE SITE VICINITY

Industry	Approximate Distance From Site (miles)
TRW Systems Group, Capistrano Facility (rocket test site; 2800 acres; 85 presently employed; 350 peak employment)	5-3/4
Philco Ford (weapons testing; 960 acres; 2 to 15 employed)	7-1/2
Industrial areas within the city of San Clemente, as indicated in figure 2.2-4	6
Industrial areas within the city of San Juan Capistrano, as indicated in figure 2.2-5	10-1/2
Industrial area within the Camp Pendleton Marine Corps Base, as indicated in figure 2.2-3	11-1/2

SCHOOLS WITHIN THE SITE VICINITY

School Name	Enrollment	Approximate Distance From Site (miles)
Concordia School	624	3-1/4
Our Lady of Fatima School (parochial)	265	5-1/8
Las Palmas School	222	5-1/2
Hanson School	522	5-3/4
San Clemente High School	2,707	6
Palisades School	581	9
Dana Hills High School (under construction; estimated completion date: September 1972; no projected enrollment available)		10-3/4
Forster Junior High School	1,297	11
Richard Henry Dana School	485	11

AGRICULTURE WITHIN THE SITE VICINITY

Agricultural Use	Number of Acres	Approximate Distance From Site (miles)
Seasonal raw crops and flowers	600 20	2-1/8
Tomato crops	224	6-1/4
Seasonal grazing (beef cattle)		7
Dairy cattle pasture*		16

RECREATION FACILITIES WITHIN THE SITE VICINITY

Facility	Approximate Distance From Site (miles)
San Onofre State Beach	1/4
Recreation Areas within Camp Pendleton Marine Corps Base, as indicated in figure 2.2-3	1
San Clemente Beach State Park	3
Recreation areas within the city of San Clemente, as indicated in figure 2.2-4	2-1/2
San Clemente High School Football Stadium (seating capacity: 5000)	6
Doheny State Beach	9
Dana Point Harbor	10
Recreation areas within the city of San Juan Capistrano, as indicated in figure 2.2-5	10-1/2

HOSPITALS WITHIN THE SITE VICINITY

Hospital Name	Number of Beds	Approximate Distance From Site (miles)
Beverly Manor Convalescent Hospital	126	7-3/4
San Clemente General Hospital	116	8
Capistrano-by-the-Sea Hospital (sanitarium)	82	10-1/4

LONG-TERM ATMOSPHERIC DISPERSION FACTORS BY DOWNWIND SECTORS

Sector	Downwind Distance, Meters										
	400	700	800	1000	2000	4000	5000	7000	10000	20000	40000
S	2.11E-05	7.68E-06	6.12E-06	4.08E-06	1.24E-06	4.05E-07	2.92E-07	1.77E-07	1.02E-07	3.85E-08	1.48E-08
SSW	2.33E-05	8.54E-06	6.83E-06	4.60E-06	1.42E-06	4.74E-07	3.44E-07	2.09E-07	1.22E-07	4.69E-08	1.83E-08
SW	1.32E-05	4.80E-06	3.83E-06	2.58E-06	7.86E-07	2.59E-07	1.87E-07	1.14E-07	6.64E-08	2.53E-08	9.85E-09
WSW	4.26E-06	1.53E-06	1.21E-06	8.13E-07	2.46E-07	8.14E-08	5.88E-08	3.56E-08	2.08E-08	7.89E-09	3.06E-09
W	1.15E-05	4.22E-06	3.37E-06	2.28E-06	7.03E-07	2.34E-07	1.70E-07	1.04E-07	6.08E-08	2.34E-08	9.13E-09
WNW	1.18E-05	4.33E-06	3.46E-06	2.34E-06	7.22E-07	2.41E-07	1.74E-07	1.06E-07	6.22E-08	2.38E-08	9.29E-09
NW	1.31E-05	4.82E-06	3.85E-06	2.60E-06	8.02E-07	2.67E-07	1.94E-07	1.18E-07	6.91E-08	2.65E-08	1.03E-08
NNW	1.54E-05	5.65E-06	4.52E-06	3.06E-06	9.52E-07	3.20E-07	2.33E-07	1.43E-07	8.45E-08	3.29E-08	1.30E-08
N	1.48E-05	5.45E-06	4.36E-06	2.94E-06	9.15E-07	3.07E-07	2.23E-07	1.36E-07	8.03E-08	3.10E-08	1.21E-08
NNE	9.85E-06	3.63E-06	2.91E-06	1.95E-06	6.03E-07	2.01E-07	1.46E-07	8.88E-08	5.19E-08	1.98E-08	7.71E-09
NE	1.14E-05	4.20E-06	3.36E-06	2.25E-06	6.95E-07	2.32E-07	1.68E-07	1.03E-07	6.01E-08	2.30E-08	8.98E-09
ENE	1.35E-05	4.97E-06	3.98E-06	2.68E-06	8.31E-07	2.78E-07	2.02E-07	1.23E-07	7.25E-08	2.79E-08	1.09E-08
E	2.30E-05	8.48E-06	6.79E-06	4.56E-06	1.41E-06	4.71E-07	3.43E-07	2.09E-07	1.23E-07	4.72E-08	1.85E-08
ESE	1.44E-05	5.31E-06	4.25E-06	2.85E-06	8.79E-07	2.93E-07	2.13E-07	1.30E-07	7.55E-08	2.88E-08	1.12E-08
SE	7.91E-06	2.91E-06	2.32E-06	1.56E-06	4.75E-07	1.56E-07	1.13E-07	6.78E-08	3.88E-08	1.44E-08	5.47E-09
SSE	6.97E-06	2.55E-06	2.03E-06	1.36E-06	4.14E-07	1.35E-07	9.70E-08	5.81E-08	3.32E-08	1.22E-08	4.60E-09

NOTE: E-05 means 10^{-5}

SOME IMPORTANT SPECIES OF THE SAN ONOFRE AREA

I. Sand Stations 1, 2, 3, 4, 5, 5.5.

A. Commercial value

No commercial interests in these areas.

B. Sport value

Donax gouldii (Bean clam) - Once sufficiently abundant in Southern California to be of commercial interest. Its presence at most San Onofre sand stations could be of sport value.

C. Esthetic value

Equal to that of other sand beach areas.

D. Community stability

The beach sand communities are relatively simple. The dominant organisms are not primarily carnivorous and consequently have little direct influence upon each other. Primarily, they are instrumental in removing organic matter from sand and water in the form of detritus, unicellular algae, bacteria, and san infauna (psammon). These dominant organisms are:

1. *Donax gouldii* (Bean clam) - Mollusca
2. *Euzona (Thoracophelia) mucronata* - Polychaeta
3. *Nepthys californiensis* - Polychaeta
4. *Orchestoidea* spp. (Beach hoppers) - Amphipoda
5. *Excirolana chiltoni* - Isopoda

II. Cobble Stations 2 and 5.5.

A. Commercial value

No commercial interests in these areas.

HISTORICAL POINTS OF INTEREST WITHIN THE SITE VICINITY

Historical Site Name	Approximate Distance From Site (miles)
Los Cristianitos Historical Site (Registered Historical Landmark No. 562)	4-1/2
Las Flores Ranch House and Asistencia Ruins (National Monument)	7-1/2
Mission San Juan Capistrano	13
Mission San Luis Rey	24

NUMBER OF COWS

Distance from Site	Orange County	San Diego County	Riverside County
0-15 miles	0	0	0
15-20 miles	0	300	0
20-25 miles	0	1,225	50
25-30 miles	700	4,260	1,030

The current commercial practice in Southern California dairy farms is to feed milking cows with commercial feed which is produced in the Imperial Valley (80 miles from the site) and the San Joaquin Valley (150 miles from the site).

POINTS OF INTEREST

Point of Interest	Approximate Distance From Site (miles)
Western White House	2-3/4
Palisades Reservoir (open reservoir)	8-1/2
[illegible]	Onsite

SOME IMPORTANT SPECIES OF THE SAN ONOFRE AREA

COELENTERATA

11. *Anthopleura xanthogrammica*
12. *Anthopleura elegantissima* (Station 5.5 only)

ECTOPROCTA

13. Encrusting ectoprocts (including *Caulorhamphus spiniferum*)

MOLLUSCA

14. *Protothaca staminea*
15. *Tegula funebralis*
16. *Tegula gallina*
17. *Acanthina spirata*
18. *Notoacmaea fenestrata*
19. *Lepidozona californiensis*
20. *Stenoplax conspicua*
21. *Aplysia californica*
22. *Lithophaga plumula* (Station 5.5 only)
23. *Octopus bimaculatus* (Station 5.5 only)

ARTHROPODA

24. *Pachygrapsus crassipes*
25. *Petrolisthes cabrilloi*
26. Amphipods

ECHINODERMATA

27. *Piaster ochraceus*
28. *Patiria miniata*

CHORDATA

29. *Clinocottus analis*

SOME IMPORTANT SPECIES OF THE SAN ONOFRE AREA

B. Sport value

The following species are sufficiently abundant to be of sport value.

1. *Protothaca staminea* - Littleneck clam
2. *Octopus bimaculatus* - Octopus (Station 5.5 only)

The following species possess sport value at other localities, but low abundance at San Onofre precludes sport interest.

3. *Saxidomus nuttallii* - Washington clam
4. *Semele decisa* - Clip semele clam
5. *Tresus nuttallii* - Gaper clam (Station 5.5 only)
6. *Cancer* spp. - Rock crabs

C. Esthetic value

The flora and fauna are extremely pleasing in this area.

D. Community stability

PLANTS

1. *Phyllospadix* sp.
2. *Ulva californica*
3. *Enteromorpha* sp.
4. *Corallina* spp.
5. *Egregia laevigata*
6. *Zonaria farlowii*
7. *Gelidium pucillum*
8. *Gelidium purpurascens*
9. *Laurencia* sp.
10. Assemblage of filamentous red algae *Pterosiphonia* sp., *Spermothamnion snyderae*, and *Centroceras clavulatum*

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