ATTACHMENT 26

SAN DIEGO GAS & ELECTRIC COMPANY

THERMAL DISTRIBUTION AND BIOLOGICAL STUDIES

For The

SOUTH BAY POWER PLANT

FINAL REPORT

VOLUME 1

SUMMARY AND CONCLUSIONS

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SDG&E

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SECTION 1

INTRODUCTION

At the request of the California Regional Water Quality Control Board, San Diego Region (RWQCB), San Diego Gas & Electric Company has conducted extensive thermal discharge and biological studies at the South Bay Power Plant.

The State Thermal Plan [(1)] requires existing and future dischargers of thermal wastes to conduct a study to define the effect of the discharge on the beneficial uses as defined in the RWQCB Interim Water Quality Control Plan for the San Diego Basin, June 1971[(2)] and the addition of Clamming and Shellfish Harvesting was added as a Beneficial Use on January 22, 1973. Furthermore, existing dischargers shall determine design and operating changes which would be necessary to achieve compliance with the provisions of this plan.

Basic guildlines[(3)] for the study were established by the RWQCB to provide guidance in obtaining information on the extent and effects of the existing thermal discharges from the South Bay Power Plant. These guidelines are in accordance with the State Water Resources Control Boards (SWRCB) "Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California," (State Thermal Plan).[(1)]

For the purpose of clarity, the extensive data gathered during the duration of the study has been separated into five (5) separate volumes:

Volume 1 - Summary and Analysis
Volume 2 - Alternate Engineering Concepts
Volume 3 - Plant Operating Data
Volume 4 - Thermal Measurements
Volume 5 - Biological Measurements

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Volume I provides a summary and analysis of the thermal and biological data collected, the existing plant description and the alternate engineering concepts that were investigated. Volume 2 provides the background information in greater detail for the alternate engineering concepts reviewed in Volume I. Volume 3 provides actual plant operating data for the South Bay Power Plant from December, 1972 through February, 1973. This information supplements the plant operating data contained in Progress Reports Numbers 1 and 2. Progress Report No. I was submitted in October, 1972 and contained plant operating information beginning in May, 1972 and continuing through August, 1972. Progress Report No. 2 was submitted in January, 1973 and provided plant operating data from September 1972 through November, 1972. Volume 4 provides field information gathered during the various thermal monitoring programs over the study period. Volume 5 contains field information gathered during the various benthos sampling and intertidal surveys conducted over the period of the study.

SECTION II

SCOPE OF REPORT

Specific requirements for the "scope of the study" were presented in the State Thermal Plan [1] and reiterated in the "Guidelines for Thermal Distribution and Biological Studies for the San Diego Gas & Electric Compay's South Bay Power Plant". [2] Those requirements are recapitulated here and constitute the outline used in this report.

A. A description of all intake and discharge facilities with respect to location, capacity, type, size, depth, length, etc.; each type of waste water, including chemical and physical alternations; maintenance operations, including heat or chemical treatment of components of the system; dredging operations and spoil disposal; and wastes disposed of off-site.

B. Existing conditions in the aquatic environment.

C. Effects of the existing discharge on beneficial uses.

D. Predicted conditions in the aquatic environment from planned increased discharge volume.

E. Predicted effects of planned increased discharge volume.

F. An analysis of costs and benefits of various design alternatives.

G. The extent to which intake and outfall structures are located and designed so that the intake of planktonic organisms is at a minimum, waste plumes are prevented from touching the bay substrate or shorelines, and the waste is disposed into an area with the least deleterious effect.

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SECTION III

SUMMARY

Summary of Thermal Measurements

In order to determine the extent and effects of the existing discharge and to predict as accurately as possible the extent and effects of any planned increased volumes of discharges, it is necessary to characterize the temperature distributions and extent of the thermal plume generated by the South Bay power plant. When the warm condenser cooling water is discharged into the cooler natural waters from a channel which terminates at the shoreline, the thermal effect can be viewed as taking place in two regions. In the immediate vicinity of the discharge, the temperature distribution is dominated by the characteristics of the discharge flow itself. This region is designated the near field. Outside the near field and covering a much larger area is the far field of the thermal plume which is dominated by natural hydrodynamic processes. In deep natural waters the far field plume is usually located near the surface whereas in shallow waters, the plume can extend to the bottom.

Water surface temperature data were collected by aerial infra-red radiometry and by a surface vessel. The aerial infra-red data are primarily used for determining the plume extent in the far field, and the surface vessel temperature depth measurements are used to characterize the vertical temperature profile of the near and far field plumes. Aerial infra-red data and surface vessel data were obtained simultaneously.

Ancillary geophysical data were obtained simultaneously with all temperature measurements. Included in these observations were wind speed and direction, sea surface condition, cloud cover, weather type, air temperature and tidal cycle. These environmental data were obtained because of their expected influence on the character of the discharge plume.

The aerial infra-red data displayed maximum surface temperatures ranging from 15 to 25^{o}F above ambient, depending upon the thermal discharge load of the power plant. The surface vessel measurements indicated temperatures of 12 to 21^{o}F above ambient. The absolute temperature values and the range of the observed surface isotherms correspond closely to the intake and discharge temperatures recorded by the power plant for the months of September, October, November, December and January. Anomalous data was observed for the months of February, March and April. The plume was observed to occupy the total east-west extent of the bay at the southern extreme. The plume was observed to extend north from the end of the dike for distances of approximately 800 yards during incoming tide, 1700-3000 yards when the tide was receding, 1400-1800 yards at high tide and 2000-3200 yards at low tide.

The effect of the tidal conditions on the character of the surface plume can be assessed from the aerial infra-red data. These data suggest that the plume is not in hydrodynamic equilibrium at each point in the tidal cycle. That is, the large northerly extent of the plume observed at low tide is probably not the result of the low tide condition but is a consequence of the residual plume carried northward by the outgoing tide. The shorter extent of the plume at high and incoming tide results from the incoming natural waters pushing against the plume thus preventing its northern migration.

The temperature profile data indicate that the plume extends vertically to the bay bottom located less than 10 to 15 feet below the surface at most of the monitored stations. An essentially uniform temperature was observed within the water columns for both the near and far fields.

Summary of Biological Measurement

As in previous studies conducted in South Bay, the evidence obtained during 1972-1973 suggests that high temperatures caused by the thermal discharge in late summer-fall had adverse effects on benthic marine life within the cooling channel itself. However, these effects were much less obvious during the winter and spring periods when both ambient water temperatures and those within the thermal discharge pattern are lower. It is important to note that this cooling channel is considered to form part of the power plant discharge system, rather than a natural part of the bay.

Some evidence of adverse ecological effects within the outer discharge pattern located beyond the end of the cooling channel was obtained in the late summer-fall sampling period of high water temperatures. Both the numbers of species and the indices of species diversity were lower within the outer discharge pattern than within the control area, located farther north in the bay. These differences were statistically significant. As might be expected, the lowest numbers of species and index of diversity values were observed at stations closest to the end of the cooling channel and within the main path of thermal effluent flow. However, during this same sampling period, mean density and biomass values for major animal and plant groups showed little evidence of such adverse effects. In fact, both the mean total plant and animal biomass values, and the mean densities of some species and major groups were significantly higher within the outer discharge pattern than within the control area, suggesting the possibility that growth and biological production were enhanced by temperature conditions in the outer discharge at this time of year.

Similar evidences of enhancement within the outer part of the discharge pattern were obtained during the winter and spring sampling periods. In addition, there was no evidence of significant adverse ecological effects beyond the end of the cooling channel during these winter and spring periods of lower ambient and discharge water temperatures.

Summary of Alternate Cooling Concepts

Consideration has been given to the cessation and/or curtailment of the thermal discharge to the bay. Alternate cooling concepts for cooling the waste heat from the power plant have been investigated. Any one of the cooling concepts will meet the requirements prescribed by the California State Water Resources Control Board for thermal discharges to the San Diego Bay and the Pacific Ocean. Preliminary construction costs and operating costs were estimated for each concept. The alternative cooling methods considered will reduce the thermal waste discharge to the bay, but will introduce environmental problems related to human use of the land area near the power plant.

Summary of Beneficial Uses

A review of the beneficial uses of the Bay as defined by the Regional Water Quality Control Board was conducted to determine the effects of the existing discharge on the beneficial uses of the bay. The general assessment of this review is that the existing thermal discharge has no significant effects on the beneficial uses of the bay.

General Summary

The South Bay Power Plant thermal discharge to the San Diego Bay began in 1960 when Unit 1 was completed and commercial operation started. Units 2, 3 and 4 were added in 1962, 1964 and 1971, respectively. Since 1971, the discharge has been at the existing level without interference with the beneficial uses of the Bay. The employment of any of the alternate cooling methods described in this report will only slightly reduce the current insignificant effects on the beneficial uses of the Bay, but could create major environmental problems related to human use of the land area near the power plant.

SECTION IV

SUMMARY OF SOUTH BAY COOLING WATER FACILITIES - ENGINEERING DESCRIPTION

Item A of the "Guidelines for Thermal Distribution and Biological Studies for the San Diego Gas & Electric Company's South Bay Power Plant,"[1] restated here, is the subject of this section of the report:

A. A description of all intake and discharge facilities, with respect to location, capacity, type, size, depth, length, etc.; each type of waste water, including chemical and physical alterations; maintenance operations, including heat or chemical treatment of components of the system; dredging operations and spoil disposal; and wastes disposed of off-site.

General Plant Location

The South Bay cooling water intake and discharge structures are located in the southern portion of the San Diego Bay. The South Bay Power Plant is situated approximately 2,000 feet west-south-west of the interchange at L Street and Interstate Highway 5 in the City of Chula Vista. The general location of the South Bay Power Plant in relation to the City of Chula Vista and San Diego Bay is shown in Figure 1. The coordinates of the plant discharge are 32° -36'-33" north latitude and 117° -6'49" west longitude.

General Plant Description

The South Bay Power Plant is a gas and oil fueled generating plant with a total of four major steam cycle units. The combined net capability of the four condensing units at South Bay is 713,000 kilowatts. A non-condensing Gas Turbine, capable of producing 22,000 Kw is also located at South Bay Power Plant.

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(1) Appendix III

All units can generate independently or in conjunction with each other.

The quantity of cooling water circulated through the plant is dependent upon the number of units in operation. With all units in operation, the cooling water flow through the plant is 390,000 GPM or 562 MGD, based on nameplate rating of the cooling water pumps.

Cooling Water Facilities

South Bay Power Plant is located on the southern edge of San Diego Bay in the City of Chula Vista, as shown in Figure 2. Enlarged plans of the screenhouses, intakes and discharges for the four units at the South Bay Power Plant are shown in Figure 3. Sections of the intake screenhouse tunnels, and discharge structures are shown in Figure 4. Operation of the cooling water system is shown in the flow diagram, Figure 5.

Cooling water is withdrawn from the Bay in an intake channel extending into the Bay. The intake channel has a bottom width of 200 feet at its widest point and tapers to 50 feet near the unit number four screenhouse. The bottom elevation of the channel is approximately -15 feet (Elevation 0 being mean sea level, MSL). The channel was constructed by dredging and diking operations. Variations in the water surface due to the tide are from a low of -5.0 feet to a high of +5.7 feet.

The South Bay Power Plant has three separate screenhouse structures for its four units. Units one and two are served by one screenhouse structure and individual screenhouse structures have been constructed for units three and four. Water flowing in the intake channel approaches the screenhouse for units one and two, then unit three screenhouse and then unit four screenhouse. The horizontal distance between units one and two screenhouse to unit three screenhouse and unit three screenhouse to unit four screenhouse is approximately 131 feet and 93 feet, respectively.

The cooling water enters the screenhouse structures from the intake channel. The height of each screenhouse structure is 27'-6". The screenhouse for units one and two is 63'-6" wide with intake openings of 11'-3" wide. The screenhouse for unit three is 32 feet wide with 11'-3" wide intake openings. The screenhouse for unit four is 31 feet wide with intake openings of 11'-3" wide. As the cooling water flows through the screenhouses, it passes through trash racks and a 3/8 inch mesh travelling screen for removal of debris before entering the pump wells. Each unit has two cooling water pumps. The approximate combined capacity of the cooling water pumps for each unit is:

Unit one	-	72,000 GPM
Unit two	-	72,000 GPM
Unit three	-	117,000 GPM
Unit four	-	129,000 GPM

With all cooling water pumps operating, the total flow is approximately 390,000 GPM or 562 MGD.

Each pump discharges into a pipe that transports the water to the condenser. The pumps for units one and two discharge into 48 inch diameter pipes and the pumps for units three and four discharge into 60 inch diameter pipes. The length of the eight intake pipes, from the pumps to the power plant, is approximately 200 feet.

The cooling water enters the condensers where heat from exhaust steam is transferred to the circulating water. Based on the heat diagrams for the South Bay Power Plant, the four condensers will transfer approximately 3.40×10^9 Btu/hr. to 390,000 GPM of cooling water when the plant is producing 713,000 Kw.

The heated water discharges from the condensers to four separate discharge pipes. The size of the discharge pipes for units one through four are 72 inches, 72 inches, 84 inches and 84 inches, respectively. All of the discharge pipes cross under the intake channel to the discharge channel. The invert elevation of the discharge pipes for units one and two is -22.0 feet. The invert elevation of the discharge pipes for units three and four is -13.0 feet. The discharge structures for all discharge pipes are located on the north bank of the discharge channel.

The total plant flow returns to the Bay through the discharge channel which extends into the Bay. The bottom width of the channel varies from 50 feet near unit four discharge to approximately 1200 feet at its widest point in the Bay. The depth also varies from -15 feet at the discharge structures and slopes up to meet the existing bottom of the Bay. The channel was constructed by dredging and diking operations.

The intake and discharge channels are parallel and adjacent to each other. The two channels are separated by a man-made dike, as shown in Figure 2.

Daily thermal addition (BTU) to the receiving waters, calculated from intake and discharge temperatures and flow volume, are presented in Volume 3 of this report.

Maintenance Operations

Plant maintenance to remove scale, corrosion, prevent corrosion and stop leaks is practiced for efficient operation of the power plant. In some instances, chemicals are used and, in other instances, commercial by-products are used as the sustaining agent. Maintenance operations that contribute waste water are boiler cleaning, air preheater and boiler wash systems, closed cycle cooling systems and sawdust injection. Monthly chemical usage is presented in Volume 3 of this report and in Progress Report Numbers 1 and 2, dated October, 1972 and January, 1973, respectively.

Boiler Cleaning

Each boiler is acid cleaned every three years. The cleaning operation is staggered so that no two boilers are cleaned simultaneously. Cleaning of the boilers is a time consuming process which requires six consecutive operations. The following are the six operations practiced at the South Bay Plant for cleaning each boiler:

1. Acid Cleaning
2. Water Rinse
3. Citric Acid Rinse
4. Neutralizing
5. Rinse
6. Flushing

The estimated volume of water used for Units 1, 2, 3 and 4, for each cleaning operation, is 27,000 gal., 27,000 gal., 32,000 gal., and 27,000 gal., respectively, except for the last operation (flushing), which requires approximately 15,000 gal. for all units.

During the first cleaning operation, a five percent (5%) solution of hydrochloric acid with a copper inhibitor, in boiler water, is injected into the boiler. The wastes generated from this operation are pumped to a holding tank. The wastes are then disposed of by a commercial contractor.

The second operation during the cleaning procedure is to rinse the boiler, utilizing municipal water. The wastes are discharged to the municipal sewer system.

The third operation of the cleaning procedure is to inject citric acid mixed with municipal water into the boiler. Sufficient citric acid is used to raise the pH to between 3.5 and 4.0. The wastes generated from this operation are discharged to the municipal sewer system.

The fourth operation of the cleaning procedure is the injection of the neutralizing agent. Approximately 500 pounds of caustic soda and 1000 pounds of trisodium phosphate are used in the neutralizing operation. The wastes generated by this operation are pumped to a holding tank and are disposed of by a commercial hauler.

The fifth operation in cleaning the boilers is a water rinse, using condensate. The waste are discharged to a holding pond on the plant site and, after stabilization, they are discharged to the bay.

The sixth and last operation of the boiler cleaning process is flushing the boiler using approximately 15,000 gallons of condensate. The wastes are pumped to the holding pond and, after stabilization, are discharged to the bay.

In order to maintain efficient boiler operations, the boilers are intermittently blown down. During blowdown, water is discharged from the boiler in order to lower the suspended solids concentration in the boiler. When the suspended solids are high (greater than 200 ppm) a fast removal is required, and the blowdown is discharged to the intake channel. When the suspended solids in the boiler are between 50 and 200 ppm the blowdown is discharged to the bay after passing through a high pressure evaporator.

Air Preheater and Boiler Wash System

This maintenance operation removes the particulate matter formed during the combustion process in the combustion chamber and adhering to the boiler walls and tubes. The system is first washed, using salt water from the bay and immediately followed by a fresh water rinse, using municipal water.

All wastes, including particulates and water, are discharged to the Hopper Drain which drains to the bay. Each process, cleaning and rinsing, utilizes approximately 30,000 gallons of water.

Closed Cycle Cooling System

Fresh water is used in this system with the addition of sodium dichromate as a corrosion inhibitor. The system is maintained at 2000 ppm as chromate. Sodium hydroxide is also added to the system to maintain a pH between 7.0 and 8.0.

There is no discharge from this system, but minor leaks can occur occasionally. The leakage is collected in sumps along with plant wash water, bilge water, drips from boiler feed and service pumps and other miscellaneous discharges. All of the wastes in the sumps are pumped to the holding ponds where the oil is skimmed and the waste is allowed to settle and stabilize prior to release to the bay.

Sawdust Injection

Sawdust injection is used as a means of stopping leaks in the condensers. When a condenser leakage is detected, sawdust is injected into the intake of the cooling water pump serving the leaking condenser. Sawdust particles will lodge in the area of the leak and plug the opening until more substantial repairs can be made.

Sawdust is only injected when leaks are detected and no definite pattern can be established for its use. The sawdust introduced into the system will be discharged into the cooling water discharge tunnels.

Condenser Maintenance Operations

Ferrous sulfate is used as a sacrificial metal in the condenser tubes. Each condenser is treated separately and no two are treated simultaneously. The cooling water from the other units dilute the discharge concentration.

Chlorine is used in the cooling water system to prevent the formation of algae and slime on the condenser tube walls. Chlorine is injected at each cooling water pump for eight (8) minutes for every two hours of operation of the pump. During the eight (8) minute injection period, the feed rate is 1000 pounds per 24 hours. Therefore, the quantity of chlorine added in an eight (8) minute injection time is 5.6 pounds. A concentration of approximately 1 ppm is maintained at the inlet to the condenser.

The injection of chlorine at the cooling water pumps is staggered so that no two pumps are being chlorinated at the same time. The mixing of the cooling water from the other units results in a non-measurable chlorine residual in the cooling water discharged to the bay.

Intake and Discharge Tunnel Cleaning

Heat treatment of the tunnels and condenser units for removal of encrusting organisms is not practiced at the South Bay Power Plant. The encrusting organisms are manually cleaned from the intake and discharge pipes once each year. The wastes are mucked out at the screenhouse and discharged into the discharge channel via the screen debris trough.

SECTION V

SUMMARY OF EXISTING CONDITIONS IN THE AQUATIC ENVIRONMENT

Item B of the "Guidelines for Thermal Distribution and Biological Studies for the San Diego Gas & Electric Company's South Bay Power Plant"(1) is repeated here and will be the subject of this section of the report.

B. Existing Conditions In The Aquatic Environment

Biological Conditions in South San Diego Bay

One of the major purposes of this study and related, previous studies conducted by Environmental Engineering Laboratory was to establish the species composition, distribution, and abundance of marine organisms in south San Diego Bay as a baseline for assessing both past and present conditions and possible future ecological changes. The data which form the basis for this discussion are considered in detail both in previous reports and in Volume 5 of this final report series.

South San Diego Bay supports assemblages of marine organisms characteristic of the inner portions of relatively undisturbed bays and estuaries in California and Baja, California. Ecologically similar forms inhabit bays and estuaries in other temperate areas of the world. In general, the forms found in the South Bay are tolerant of moderately wide ranges of temperature, salinity, and dissolved oxygen content and thus are able to survive seasonal and short term changes in these factors that occur there. The species composition and relative abundances of these organisms vary seasonally.

Benthic Plants

The soft sediment bottom throughout much of south San Diego Bay is overlain by extensive mats of living plant material which are interspersed with

(1) Appendix III

areas of exposed sediment. The dense, heavily branched red algae. Gracilaria verrucosa forms the bulk of this mat throughout most of the area. In some areas, the mat is 1 - 2 feet thick during the warmer months of the year. It becomes markedly reduced during the winter months, presumably because of greater water turbidity caused by wind generated waves. Other less common species, including particularly the green algae Chaetomorpha aerea and Cladophora sp. and the red algae hpnea valentia and Griffithsia sp., form part of the mat at some locations.

Direct observations underwater have shown that these algal mats are an important microhabitat feature, because they provide cover and refuge from predators for many species of fishes and invertebrates, much as marsh vegetation does for ducks and other aquatic birds. The algae also serve as a major, primary food source for many animals, including the California killifish, crabs, isopods, gastropod molluscs, and some aquatic birds.

Periphytic diatoms, minute single celled plants that are attached to the surface of the sediment, probably are another significant primary food source for some fishes, such as the striped mullet, and a variety of small invertebrates. These animals feed by ingesting sediment or selectively removing the diatoms from its surface.

Benthic Invertebrate Animals

The invertebrate fauna living on and in the bottom sediment is dominated in terms of species composition, abundance, and biomass by molluscs and polychaete worms, as it is in San Diego Bay as a whole. Several groups of small crustaceans also appear to be important members of the benthic community. Some species of the common bivalve molluscs are used as food by man. These are the banded, smooth, and wavy cockles (Chione spp.) and the bentnosed clam, Macoma nasuta. Unfortunately, the size of most individuals is quite small compared with those in nearby areas, such as the TiaJuana Estuary. The jack-knife clam, Tagelus californianus, and other small bivalves are used commonly as bait for hook and line fishing.

While none of the other invertebrates are of direct value to man, they are extremely important to the biological economy of the area. The feeding of nematode and polychaete worms, gastropod molluscs, brittlestars, crabs, isopods, and a wide variety of smaller crustaceans serves to transform detritus and other organic material into usable food for larger invertebrates and fishes; the latter, in turn, are eaten by other large fishes and aquatic birds, most of which are of esthetic or sportfishing value to man. Bivalve molluscs and other suspension feeders serve a similar function in transforming plankton and suspended detrital material into usable food for fishes and birds.

An unusual bryozoan animal, Zoobotryon verticillatum is present in some parts of the study area, where it forms large, flexible, tree-like masses during the warmer months of the year. Some clumps are attached to shell material embedded in the sediment or to algae, while much of this material is moved around freely on the bottom. Like the benthic plants discussed above, it serves as food for a variety of invertebrates and as a refuge for both invertebrates and small fishes. Another unusual inhabitant is the large "wandering sponge", Tetilla mutabilis, a filter feeding animal that attaches loosely to the sediment. In some areas it is the major component of benthic biomass; but probably of little importance as a food organism. The small anemone Diadumene sp. is a dominant form throughout much of the South Bay area, where it lives primarily attached to the algal mats.

South San Diego Bay supports at least 25 species of bottom living and open water fishes, of which eight are important to man for recreational fishing and food. The latter are black croaker, California halibut, diamond turbot, three species of sand and kelp basses, striped mullet, and the queenfish. The mullet appears to be quite abundant throughout most of the South Bay and particularly so in the vicinity of the thermal discharge pattern. Fishermen in the area who were questioned about their catch indicated that all of these food fishes except mullet are taken fairly commonly in the South Bay and that fishing conditions there are generally good, despite the relatively small number of suitable species available.

As in the case of the invertebrate fauna, fish species "unimportant" to man are, in fact, vital to the biological economy of the ecosystem. Only the striped mullet and topsmelt utilize detritus and lower organisms directly by ingesting sediment. All others feed primarily on other smaller fishes and benthic or pelagic invertebrates. The three most common small fishes living near the bottom, the California killifish, shadow goby, and barred pipefish, as well as the larger and very abundant round stingray, all prey upon a wide variety of smaller invertebrates. The slough anchovy is a filter feeder on small plankton. Larger species, such as the black croaker and sand bass, feed primarily on fishes, large crustaceans, and molluscs, while the diet of the California halibut is almost exclusively smaller benthic and pelagic fishes. The smaller fishes generally live in holes or within the algal and bryozoan mats on the bottom and have similar protective pattern and coloration to avoid these predators. Although no studies were made of these fishes during the present 1972-1973 surveys, a rather complete description of their distribution and abundance is contained in earlier reports by Environmental

Engineering Laboratory.

Shore Birds

The dikes, mudflats, salt marsh areas, and sandy beaches in south San Diego Bay are an important refuge and feeding area for a large variety of resident and migratory shore birds and other aquatic bird species. Because they are generally isolated from public access, the shoreline and dikes of the South Bay Power Plant are particularly important in this regard. The most common shorebirds in the South Bay observed during mid to late August, 1968 were:

Brown Pelican	Western Sandpiper
Double-Crested Cormorant	Short-Billed Dowitcher
Unidentified Ducks	Marbled Godwit
Snowy Plover	Black-Necked Stilt
Black-Bellied Plover	Western Gull
Ruddy Turnstone	Forster's Tern
Willet	Caspian Tern
Least Sandpiper	Savannah Sparrow

These surveys did not include most of the salt pond property at the extreme southern end of the bay. It should be emphasized that the species composition will vary daily, particularly for less abundant birds, as well as seasonally. Thus the species for which population census data were obtained are not the only ones inhabiting the area. No bird surveys were conducted during the present 1972-1973 study.

Many additional migratory species appear in great numbers during the fall months, including the dunlin, which is very abundant after September.

Thus, shore birds are most abundant and diverse in species composition during the winter. Most leave on spring migration in May, and in the early to mid-summer only small groups of individuals from these winter and spring populations remain. A variety of gulls inhabit the study area during the winter months. Ducks which winter in large numbers in south San Diego Bay arrive in November. For example, the winter population of surf scoters in the San Diego Bay area may exceed 30,000 individuals.

These birds are important predators on a variety of benthic invertebrates and small to medium sized fishes. The brown pelican and double-crested cormorant feed almost exclusively on fishes by diving, while others utilize small fishes, crustaceans, molluscs, and polychaetes to varying degrees. Some birds, such as the herons, also feed on small terrestrial mammals and reptiles; many species also feed heavily on insects. In general, most sandpipers feed on the exposed mudflats by probing a few millimeters into the sediment for polychaetes, small molluscs, and limited amounts of plant material. Plovers and some sandpipers feed by picking similar food from the sediment surface. Gulls are scavengers that eat practically all aquatic life and associated organic detritus. They serve an important biological function in cleaning up detritus and animal remains from the exposed shoreline in the South Bay.

Other Seasonal Residents

A small group of sea turtles have been observed in the warm water areas off the South Bay Power Plant during most of the year, except the warmest summer water temperature period. This seasonal resident probably is the Pacific green turtle (*Chelonia mydas agassizii*) or the Pacific loggerhead turtle (*Caretta caretta gigas*). It is a spectacular, if minor, component of the South Bay marine community, and seems to be an example of the attractive influence of the thermal discharge during periods of lower ambient water temperatures. It probably feeds on a variety of fishes and larger invertebrates in the study area. Employees at the South Bay Power Plant also have observed a moderately large shrimp (*Penaeus californicus*) in the inner portion of the inlet channel during periods of cooler water temperature.

Present and Past Biological Conditions

As in nearly all other areas, there are few specific historical records of past biological conditions in south San Diego Bay that can be used to determine what the area was like under truly natural conditions. Prior to the summer of 1963, when sewage disposal into the bay was terminated, the study area was heavily polluted by the effluents from two treatment plants. The Chula Vista Sewage Plant outfall was located just north of the South Bay Power Plant. A report by Marine Advisers described conditions in this area during 1958. While the basic sediment types have not changed, extensive sewage sludge noted in 1958 no longer exists in the study area. The most evident difference is the marked increase in variety, abundance, and biomass of benthic animal and plant species at these stations. Fishes presumably showed a similar trend.

SECTION VI

SUMMARY OF EFFECTS OF THE EXISTING DISCHARGE ON BENEFICIAL USES

Item C of the "Guidelines for Thermal Distribution and Biological Studies for the San Diego Gas & Electric Company's South Bay Power Plant"[(1)] is presented here as the subject matter of this section of the report.

C. Effects Of The Existing Discharge On Beneficial Uses

The Interim Water Quality Control Plan, issued June, 1971,[(2)] by the San Diego Regional Water Quality Control Board, listed eight beneficial uses of the tidal waters of San Diego Basin specifically for San Diego Bay. On January 22, 1973, Clamming and Shellfish Harvesting was added as the ninth beneficial use.

Beneficial Uses

The nine beneficial uses defined in the Interim Water Quality Control Plan are the following:

A. Industrial Supply

B. Water Contact Recreation

C. Aesthetic Enjoyment

D. Commercial Fishing and Shellfish Harvesting

E. Navigation

F. Scientific Study, Research and Training

G. Marine Habitat

H. Military Exercises

I. Clamming and Shellfish Harvesting

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(1) Appendix III

(2) Appendix II

Each beneficial use will be restated and the effects of the existing discharge on that beneficial use will be discussed thereafter.

A. Industrial Supply

This beneficial use is defined as including cooling, washing and process water used for industrial purposes.

No significant effects have been observed on industrial operations located along the bulkhead line of the San Diego Bay due to the existing discharge from the South Bay Power Plant. Industries adjacent to the power plant are the Western Salt Company to the south, and Rohr Aircraft to the north.

B. Water Contact Recreation

This beneficial use is defined as including all recreational uses involving actual body contact with water, such as swimming, wading, water skiing, skin diving, surfing and sport fishing.

Due to the restrictions and safety precautions exercised by the various industries along the bulkhead, little or no beach-type activities are practiced near the existing discharge. The open area recreational activities, such as yachting, boating, aquaplaning, sailing, and water skiing are not affected by the existing discharge.

C. Aesthetic Enjoyment

Aesthetic enjoyment as a beneficial use includes uses which involve the presence of water but do not require contact with the water. Uses such as picnicing, sunbathing, hiking, beachcombing, tidepool and marine life study, camping, viewing, and pleasure boating.

The presence of the existing discharge has no significant effect on the aesthetic value of the bay. There are no turbid discharges, vapor plumes or other physical features that are discernable to the viewer from either pleasure boats or other vantage points for viewing the bay.

D. Commercial Fishing and Shellfish Harvesting

This beneficial use includes commercial collection of various types of fish and includes bait for commercial purposes.

Little or no commercial fishing and shellfish harvesting are practiced near the existing discharge of the South Bay Power Plant and no significant effect on this beneficial use of the bay is occurring.

E. Navigation

Navigation as a beneficial use is defined as including all commercial and naval shipping in the bay.

The existing discharge has no significant effect on commercial and naval shipping and navigation; mooring and berthing of vessels; and ship-building and repair.

F. Scientific Study, Research and Training

This beneficial use includes marine life refuges and ecological reserves.

A comprehensive series of studies concerning ecological effects of thermal effluent from the South Bay Power Plant was initiated by Environmental Laboratory, Inc. in August, 1968 and conducted annually or semi-annually through August, 1971, when Unit 4 was placed in operation. A detailed continuing ecological study involving quarterly sampling was started in September, 1972 and will continue through July, 1973.

The results of these studies, conducted before and after the addition of Unit 4 indicate that adverse effects of the thermal discharge on benthic intertidal and subtidal organisms are limited primarily to the area within the cooling channel before discharge to the receiving waters of the bay. In addition, the nature and the extent of these effects vary seasonally.

As in previous studies conducted at South Bay, the evidence obtained during the 1972-1973 study suggests that high temperatures caused by the thermal discharge in late summer-fall had adverse effects on benthic marine life within the cooling channel itself. However, these effects were much less obvious during the winter and spring periods when both ambient water temperatures and those within the thermal discharge pattern are lower. It is important to note that this cooling channel is considered to form part of the power plant discharge system, rather than a natural part of the bay.

G. Marine Habitat

This beneficial use of the bay is defined as providing habitat for fish, plant and animal propogation and sustenance, including shellfish, water-fowl and other water-associated birds; and providing mammal rookery and hauling grounds.

Waterfowl have been observed in the area of the discharge during the migratory seasons. The animal and plant life in the shallow areas provide food for the migratory fowl as well as a resting area.

A beneficial effect near the existing discharge is the attraction of perch, mullet and opaleye fish to the warmer water.

H. Military Exercises

Military exercises as a beneficial use of the bay includes rescue training, bridge building, and beach landings.

The North Island U.S. Naval Air Station is the nearest military facility to the existing South Bay discharge. The Naval Air Station is on Coronado Island, which is approximately eight (8) miles north and west of the existing discharge. No significant effects on military operations has been observed.

I. Clamming and Shellfish Harvesting

This beneficial use pertains to the clams and other shellfish harvested by individuals for their own consumption.

Since clamming and shellfish harvesting are not practiced near the existing discharge of the South Bay Power Plant, there are no significant effects of the discharge on this beneficial use of the bay.

SECTION VII

SUMMARY OF PREDICTED CONDITIONS IN THE AQUATIC ENVIRONMENT FROM PLANNED INCREASED DISCHARGE VOLUME

Item D of the "Guidelines for Thermal Distribution and Biological Studies for the San Diego Gas & Electric Company's South Bay Power Plant",[1] restated here, is discussed in this section.

D. Predicted Conditions In the Aquatic Environment From Planned Increased Discharge Volume

Planned Increased Discharge Volume

The San Diego Gas & Electric Company presently has no plans for increasing the discharge volume at the South Bay Power Plant.

Predicted Conditions In the Aquatic Environment From Planned Increased Discharge Volume

The predicted conditions in the aquatic environment will be the same as existing conditions, since no planned increase in discharge is contemplated at this time.

(1) Appendix III

SECTION VIII

SUMMARY OF PREDICTED EFFECTS OF PLANNED INCREASED DISCHARGE VOLUME

Item E of the "Guidelines for Thermal Distribution and Biological Studies for the San Diego Gas & Electric Company's South Bay Power Plant"[1], restated here, is discussed in this section of the report.

E. Predicted Effects of Planned Increased Discharge Volume

Planned Increased Discharge Volume

As previously stated in the preceding section of this report, San Diego Gas & Electric Company contemplates no future increased discharge volume at the South Bay Power Plant.

Predicted Effects of Planned Increased Discharge Volume

Since there exists no planned increase in discharge volume, there would be no effect due to a planned increase in discharge volume.

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[1] Appendix III

SECTION IX

SUMMARY OF COSTS AND BENEFITS OF VARIOUS DESIGN ALTERNATIVES

Item F of the "Guidelines for Thermal Distribution and Biological Studies for the San Diego Gas & Electric Company's South Bay Power Plant"[1] is restated here for the purpose of discussion in this section of the report.

F. An Analysis Of Costs And Benefits Of Various Design Alternatives.

Alternate Cooling Water Concepts

Five alternative methods of heat dissipation were investigated to determine their applicability to the South Bay Power Plant and their estimated construction costs. The five alternatives to be summarized in this section are:

1. Closed Cycle Mechanical Draft Cooling Towers
2. Closed Cycle Natural Draft Cooling Towers
3. Closed Cycle Cooling Ponds
4. Closed Cycle Spray Canal
5. Ocean Discharge

Both fresh and salt water systems were examined for each of the first four listed alternates. Each alternate was investigated to assure compliance with the Specific Water Quality Objectives for a "new discharge" as defined in the State Thermal Plan.[1]

The following is a summary of each alternate system and associated capital and operating costs. A more detailed description of each alternate is contained in Volume 2 of this report.

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[1] Appendix III

1. Closed Cycle Mechanical Draft Cooling Towers

The mechanical draft cooling towers would be constructed to form a closed loop system of the cooling water facilities and would be oriented west-north-west to east-south-east, as shown in Figure 6. Makeup water would be required to replace water lost from the system due to evaporation, drift and blowdown. It is estimated that the heat rejected from the condenser would require evaporation of approximately 11 million gallons of water per day to provide the necessary cooling. Additional losses of approximately 28,000 gallons per day for salt water towers and 197,000 gallons per day for fresh water towers would be lost as "drift". Blowdown losses will vary from a very small amount to very large amounts depending upon the concentration of suspended solids in the water. Blowdown has been estimated at 2.8 million gallons per day. Detailed descriptions of each alternate are contained in Volume 2 of this report.

The advantages of the mechanical draft cooling towers are:

1. The discharge of waste heat from the plant to the bay would cease. Diluted blowdown to meet temperature requirements would be the only discharge to the bay.

The disadvantages of the mechanical draft cooling towers are:

1. The magnitude of makeup water required from the municipal system. The availability of fresh water from the municipality for this purpose is an unknown factor.
2. The cooling tower would reduce the plant generating capacity and would increase the operating costs.
3. Additional large structures would be required that would be visible to the general public and would not enhance the aesthetics of the

area.

4. Vacant land is not available and acquisition costs of the required area could be prohibitive.

5. A visible plume would be the result of the evaporated and entrained moisture from the cooling tower. Under certain atmospheric conditions, fog from the plume may cause hazardous driving on the roads in the vicinity of the plant.

6. Salt deposition would result from the drift dispersed by a salt water mechanical draft cooling tower. Based on a concentration of 35,000 parts per million salinity in sea water, the estimated quantity of salt deposited in the surrounding area would be 1,490 tons per year.

7. The air movement through the mechanical draft tower is maintained by large fans. The noise of the fans and the cascading water could be a nuisance in the area. Table 4[(1)] in the Appendix shows the noise output in decibels of the mechanical draft cooling tower at various distances from the tower.

The capital costs for the mechanical draft cooling tower alternates are shown in Table 1. These costs are based on 1973 prices with no provisions for inflation, overhead, interest on construction, engineering, etc. Property costs are not included in the estimate.

Estimated annual operating costs are listed in Table 2. Economic evaluation factors used for computation of annual operating costs are listed in Table 3.

[(1)] Appendix V

2. Closed Cycle Natural Draft Cooling Towers

The closed cycle natural draft cooling tower concept is similar to the mechanical draft cooling tower. Both will accomplish the required heat disposal and both will require the same quantity of makeup water lost to evaporation, drift and blowdown. The advantages and disadvantages will be the same, except for the following:

1. The size of the natural draft cooling tower will be much greater than the mechanical draft cooling tower. The required natural draft tower at the South Bay Power Plant would be 450 feet high, hyperbolic in vertical cross-section, and 395 feet in diameter at the base. The tower would dwarf all structures in the area. Figure 7 illustrates the size of the tower in comparison with the power plant.
2. The capital costs are higher than the mechanical draft cooling tower as shown in Table 1.
3. The noise output is less for the natural draft cooling tower. Fans are not used; therefore, the noise output of the natural draft cooling tower is a product of the cascading water. Table 5[1] in the Appendix shows the noise output for natural draft cooling towers.

Closed Cycle Cooling Pond

The closed cycle cooling pond concept would consist of a large cooling pond, utilizing either fresh or salt water, in a closed loop with the existing system. Figure 8 illustrates the area requirements for a square cooling pond.

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[1] Appendix V

A minimum pond area of approximately 900 acres would be required to dissipate the rejected heat from the South Bay Power Plant.

The advantages of a closed cycle cooling pond are:

1. The discharge of waste heat to the bay would be eliminated. Diluted blowdown, to meet temperature requirements, would be the only discharge to the bay.

The disadvantage of a closed cycle cooling pond are as follows:

1. For a fresh water system, the required makeup water from the municipal system may be unavailable in the large quantity required.
2. The plant generating capacity would be reduced and the operating costs increased.
3, The large tract of land required, approximately 900 acres, is not readily available.

Estimated capital costs are shown in Table 1 and annual operating costs are shown in Table 2 for both a fresh and a salt water cooling pond system.

The excessive construction and operating costs and the unavailability of land precludes this scheme as an acceptable alternate for dissipating the rejected heat from the South Bay Power Plant.

Closed Cycle Spray Canal

The closed cycle spray canal system would be constructed in a closed circuit with the cooling water pumps and the condenser discharge. The configuration of the system can be either a long, single canal or geometric in shape with dikes forming interior canals to control the flow of the water. An estimated surface area of 30 acres would be required for the pond. Figure 9 illustrates the area requirements for a rectangular spray canal.

Spray modules are spaced along the length of the canal to repeatedly spray the water into the air as the water flows along the canal. Cooling occurs by evaporation, conduction and convection.

The advantages of the spray canal concept are as follows:

1. The discharge of waste heat from the plant to the bay would be eliminated. Diluted blowdown to meet temperature requirements would be the only discharge to the bay.

The disadvantages of the spray canal concept are as follows:

1. The spray canal cooling would reduce the plant capacity and increase the operating costs.
2. Salt deposition would result from the drift dispersed by the sprays in the vicinity of the plant.
3. The required land is not available in the area (approximately 30 acres).

Table 1 and 2 present estimated capital costs and annual operating costs, respectively. The area required near the plant site is not available and this would preclude the spray canal system as an acceptable alternative.

Ocean Discharge

Ocean discharges are designed to disperse waste heat both horizontally and vertically. Dilution and mixing of the heated discharge with the ambient waters of the ocean results in smaller heated volumes and areas. This results in a minimal thermal effect on the surface of the ocean and the shoreline.

The advantage of the ocean discharge is as follows:

1. Waste heat discharges to the bay are completely eliminated.

The disadvantages of the ocean discharge are as follows:

1. Construction of the pipe would temporarily disrupt the substratum of both the bay and the ocean.
2. Construction of the pipe would have a significant effect on the marine environment.
3. The capital costs and annual operating costs, as shown in Tables 1 and 2, would be significant.

Summary of Costs of Alternate Cooling Concepts

Tables 1 and 2 provide an economic comparison between the different alternates investigated in this study.

Table 1 lists major construction items and an estimated construction cost for each. These costs are based on 1973 prices. No provisions for inflation, overhead, interest on construction, engineering, etc., have been added to the costs. The cost of property is not included in the estimated construction costs. The cost component of the property will be contingent upon its location, degree of improvement and availability of property in the area. However, the minimum acreage required is shown in Table 1.

Table 2 lists the estimated annual operating costs. Included in these costs are: loss of capability, increased heat rate, increased auxiliary power, cost of energy for increased auxiliary power, chemical treatment, and water costs. The levelized annual fixed charge rate, derived from the total construction cost, is added to establish a total estimated annual cost for the life of the facility.

Table 3 lists the economic evaluation factors used in the computation of the annual operating costs.

TABLE I

ESTIMATED CONSTRUCTION COST
(Cost in Thousands of Dollars)

PLANT	SOUTH BAY								
CONCEPT	Cooling Tower Mechanical Draft		Cooling Tower Natural Draft		Cooling Pond		Spray Pond		Ocean Discharge
	Sea Water	Fresh	Sea Water	Fresh Water	Sea Water	Fresh Water	Sea Water	Fresh Water	Sea Water
I. MECHANICAL									
Cooling Tower or Spray System	2,264	2,058	7,875	7,875	-	-	3,460	3,220	-
Pumps	809	809	1,242	1,066	158	115	158	115	2,386
Valves	73	73	73	73	23	6	23	6	108
II. STRUCTURAL									
Pumphouse	122	102	240	220	20	15	20	15	698
Channels & Earthwork	2,114	2,114	-	-	20,386	20,386	740	740	3,000
Piping	50	50	113	113	-	-	-	-	17,800
Cooling Tower Basin	848	848	3,530	3,530	-	-	-	-	-
III. ELECTRICAL	850	850	600	600	50	50	1,100	1,100	715
IV. CHEMICAL TREATMENT	50	50	50	50	-	-	-	-	-
V. CONTINGENCIES 15%	1,077	1,043	2,058	2,029	3,096	3,086	825	779	3,706
ESTIMATED CAPITAL COST*	8,257	7,997	15,781	15,556	23,733	23,658	6,326	5,975	28,413
LEVELIZED ANNUAL COST	1,156	1,120	2,209	2,178	3,323	3,312	886	837	3,978
MINIMUM REQUIRED LAND, ACRES	40	40	13	13	900	900	30	30	-

*Land Cost Not Included

TABLE 2

ESTIMATED OPERATING COSTS
(Cost in Thousands of Dollars)

PLANT	SOUTH BAY								
CONCEPT	Cooling Tower Mechanical Draft		Cooling Tower Natural Draft		Cooling Pond		Spray Pond		Ocean Discharge
	Sea Water	Fresh	Sea Water	Fresh Water	Sea Water	Fresh Water	Sea Water	Fresh Water	Sea Water
I. LOSS OF TURBINE CAPABILITY (10950 Kw)	257	257	257	257	257	257	257	257	-
II. INCREASED HEAT RATE	281	281	281	281	281	281	281	281	-
III. INCREASED AUXILIARY POWER	189 (8038kw)	179 (7638kw)	143 (6075kw)	133 (5675kw)	9 (392kw)	3 (121kw)	198 (8438kw)	189 (8045kw)	111 (4717kw)
IV. COST OF ENERGY FOR INCREASED AUXILIARY POWER	271	257	205	191	13	4	284	271	159
V. CHEMICAL TREATMENT	22	209	22	209	-	-	-	-	-
VI. MAKE-UP WATER	-	1,688	-	1,688	-	2,048	-	2,013	-
SUBTOTAL OPERATING COSTS AND PENALTIES	1,020	2,871	908	2,759	560	2,593	1,020	3,011	270
LEVELIZED FIXED CONSTRUCTION COST*	1,156	1,120	2,209	2,178	3,323	3,312	886	837	3,978
ESTIMATED ANNUAL COST	2,176	3,991	3,117	4,937	3,883	5,905	1,905	3,847	4,248

*Land Costs Not Included

TABLE 3

ECONOMIC EVALUATION FACTORS

Load Factor	64%
Life of Facilities	30 yr.
Interest	7.5%
Levelized Annual Fixed Charge Rate	14%
Capacity Charge	$167.50/yr.
Annual Capacity Charge	23.45/kw yr.
Cost of Fuel	$0.85/10^6$ BTU
Net Capability	713,000 kw
Municipal Water Costs *	

	Quantity	Cost
First	500 cu. ft., or less	$3.00
Next	1,000 cu. ft., per 100 cu. ft.	0.50
Next	23,000 cu. ft., per 100 cu. ft.	0.36
Next	475,000 cu. ft., per 100 cu. ft.	0.30
Over	500,000 cu. ft., per 100 cu. ft.	$0.25

*California - American Water Company
San Diego Bay Division, Sweetwater
District

Summary of Benefits

The existing discharge at the South Bay Power Plant has a minimal effect on the beneficial uses of the bay. The following is a summary of the minor adverse effects on the environment due to the existing discharge at South Bay.

1. The thermal plume extends vertically to the bay bottom located less than 10 to 15 feet below the surface. An essentially uniform temperature was observed within the water columns for both the near and far fields.

2. Some evidence of adverse ecological effects within the outer discharge pattern located beyond the end of the cooling channel was obtained in the late summer - fall sampling period of high water temperature. During this period, both the numbers of species and the indices of species diversity were lower within the outer discharge pattern than within the control area, located farther north in the bay.

3. The environmental effects on the marine community are detectable within the discharge channel. No effect has been noted in the total bay eco-system.

The following is a summary of the beneficial effects on the environment due to the existing discharge at South Bay:

1. Some species of fish and crustaceans are attracted to the warm water plume produced by the heated discharge.

2. Evidence of enhancement within the outer part of the discharge pattern were obtained during the winter and spring sampling periods. In addition, there was no evidence of significant adverse ecological effects beyond the end of the cooling channel during these winter

and spring periods of lower ambient and discharge water temperatures.

The installation of any of the alternate cooling concepts will also have certain adverse and beneficial effects on the total environment. The following is a summary of probable adverse effects on the total environment should one of the alternate cooling concepts be employed as a means of reducing waste heat discharged to the bay.

1. Most of the alternate cooling concepts considered would introduce major environmental problems related to the human use of the land area near the power plant. The factors associated with the cooling facilities causing public nuisances are drift, fogging, noise, land use, and aesthetics.

2. The installation of the ocean discharge concept would temporarily have an adverse effect on the marine organisms.

3. The length of the ocean discharge and the installation of additional pumps would have a serious adverse effect on the entrained plankton and fish larvae. This is because the likelihood of mechanical damage would be markedly increased by the need of a second pumping system and the much longer time that an individual organism would be exposed to high temperatures in the long discharge conduit.

   Entraining bay plankton and fish larvae and then discharging them into the ocean could also have more serious adverse effects on these organisms than does the existing cooling water system. Many of these plankters and fish larvae are restricted primarily to the bay. This is particularly true of larvae stages of invertebrates and some fish species whose adult bottom-living stages occur only in bays and estuaries. By drawing such plankton and fish larvae from the bay and then discharging them into the ocean, the ocean discharge system would literally pump these organism out of their natural habitat, probably resulting in high rates of mortality. This process occurs naturally to some extent as the result of tidal flow out of the bay, but its augmentation by an ocean discharge from the South Bay Plant would be undesirable from an ecological standpoint.

SECTION X

SUMMARY OF OTHER QUESTIONS

Item G of the "Guidelines For Thermal Distribution And Biological Studies For The San Diego Gas & Electric Company's South Bay Power Plant"[1] requests information pertaining to several design characteristics of the discharge. Item G is presented here for discussion in this section of the report.

G. The extent to which intake and outfall structures are located and designed so that the intake of planktonic organisms is at a minimum, waste plumes are prevented from touching the bay substrate or shorelines, and the waste is disposed into an area with the least deleterious effect.

Planktonic Organisms

Present Plant Cooling Water System

At the time of construction, the problem of damage and/or mortality of plankton, due to passage through the cooling water systems, was not a design consideration for power plant cooling water systems.

Plankton of San Diego Bay

San Diego Bay is an atypical large bay in that it has a minimal fresh-water inflow and a high evaporation rate (United States Navy, 1950). The Bay can be divided into two major sections: the deep northern section with water depths of 25 to 40 feet, and the shallow southern section with water depths of 1 to 15 feet. The northern section of the Bay is used

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(1) Appendix III

mostly for commercial shipping and military purposes; the southern section is used primarily for recreational purposes.

Early studies (for example, Esterly, 1905 and Allen, 1938) served to define the animal and plant species which form planktonic communities in the San Diego Region. This early work has been expanded upon by biologists at the Scripps Institution of Oceanography and elsewhere, particularly during the California Cooperative Oceanic Fisheries Investigation (CALCO FI) program conducted over the past twenty years. Unfortunately, most of these studies have involved offshore areas, and thus very little is known about the species composition or ecology of plankton in San Diego Bay. A limited study was conducted by Marine Advisors (1962). A more recent comprehensive investigation (Ford, 1968) considered the ecological effects on plankton and nekton of the cooling water system at the South Bay Power Plant. Some additional unpublished data are available from class field studies conducted by California State University, San Diego.

The phytoplankton and zooplankton found in San Diego Bay appear to be similar to those of other large bays and estuaries (Riley, 1967) in that individuals are volumetrically quite abundant, but the associations are relatively limited with regard to species composition. This is evident from previous qualitative and statistical comparisons of plankton samples obtained on the same day in outer and inner San Diego Bay (unpublished data, California State University, San Diego). The abundances of most species and the variety of species present both generally are lower in the inner than the outer portions of the Bay.

The dominant species of plant plankton are pennate and chain-forming diatoms, which serve as food for a variety of filter feeding bivalve molluscs and other benthic invertebrates, the slough anchovy and zooplankton (Ford, 1968). In shallow marine waters, such as the South San Diego Bay, the benthic animals and zooplankton utilize many of the same food resource, of which phytoplankton is a major component, to a much greater degree than in deeper water (Riley, 1967). Both dead phytoplankton and zooplankton also undoubtedly contribute significatly to the organic detritus in and on the sediment; which, in turn, is eaten by polchaetes and other benthic invertebrate. Phytoplankton blooms occur throughout the bay. The dynamics and environmental relationships of one such bloom have been reported by Marine Advisers (1969).

The major zooplankters include species of calanoid copepods, of which Acartia spp. are dominant forms. A large variety of harpacticoid copepods also are present in lesser abundance. Many of the copepod species feed on phytoplankton, while others rely to varying degrees on suspended detritus. Another presumed detrital feeder, the hypoplanktonic mysid crustacea, Meyamysidopsis californica, is relatively common near the bottom in some areas. The "temporary plankton" represents the most diverse zooplankton component in the bay, particularly its inner portions. These are larval and post-larval stages or benthic polychaetes, molluscs, crustaceans, and other groups whose adult stages inhabit the bay floor. In addition, many of the "temporary plankton" may be forms that are brought into the bay by tidal action, but do not successfully settle there. All of the species described above are important as food of larger benthic and pelagic animals.

Fish eggs and larvae present are primarily those of local bottom living species, such as gobies and flatfishes. These and other nektonic species, such as crab and mantis shrimp larvae, feed extensively on phytoplankton, zooplankton and suspended detritus.

Past And Present Studies

Planktonic organisms susceptible to the entrainment are: planktonic bacteria, phytoplankton, zooplankton, and free floating eggs. Each group differs with the respect to abundance, generation time, its place in the food chain, and other ecological characteristics.

The most severe stresses induced by power plant cooling systems in planktonic organisms are the abrupt changes in temperature and pressure, mechanical buffeting, and chemical treatment. Screening, pumping, pressure changes, and discharge turbulence have only recently been studied as separate causes of mechanical damage to plankton. Investigators have found that the effects on entrained organisms depend on the magnitude of the stress and the time exposed to the stress. Knowledge of these effects is scarce and, in some cases, inconclusive because this aspect of environmental impact has only recently become a major concern of aquatic biologists and regulatory agencies. There is a need for more precise quantitative data. Relatively few investigations have been made in this area.

Heinle (1969) investigated the effects of temperature on the ecology of zooplankton in the Potauxent River estuary. He concluded that the plankton populations of the estuary remained constant despite mortality losses through power plant cooling systems, suggesting that this source of mortality was not large enough to have a significant impact on the plankton community.

Morgan and Stross (1969) conducted a study to determine the effects on phytoplankton of passage through a power plant cooling system. They concluded that planktonic algae passing through a cooling system are influenced by heat, chlorination, and a set of undefined factors which may include mechanical inhibition of activity. Further, they concluded that the thermal influence may either stimulate or inhibit rates of carbon uptake, and may be determined by the temperature of the intake water.

However, another investigator (Savage, 1970) found no significant difference in carbon assimilating capacity of phytoplankton in comparison between the intake and heated discharge of the Marchwood Power Station located on the estuary of the River Test in England. During a one-year period he did not detect a noticeable increase in damaged cells in the discharge. Savage concluded that some species of phytoplankton are able to tolerate comparatively intense thermal shocks without ill effects if exposure time is limited.

Lauer (1972) conducted plankton studies at twelve power plants, each covering a one-year period. No shifts in dominance of phytoplankton species were noted in any of the studies. In another study, over a three-year period at the Indian Point Plant on the Hudson River estuary, he observed no shifts in phytoplankton dominance due to intake and discharge plume entrainment. Patrick (1969) found no reduction in number of species of diatoms at the North Port Power Plant on Long Island Sound at discharge temperatures up to 94.1°F. Phytoplankton passing through this plant also exhibited no shifts in dominance or number of cells, but it was noted that photosynthetic rates were greatly reduced in summer when discharge temperatures sometimes exceeded 100°F.

A study was conducted by Marine Biological Consultants (1970) to determine the planktonic mortality caused by entrainment in the cooling water system at the San Onofre Generating Station. The results indicated that the mortality of zoolankton passing through the system was appreoximately 1.3%. Phytoplankton show little, if any, ill effects and productivity may actually have been enhanced by the increased temperatures.

Icanberry and Adams (1972) are presently conducting a one-year study of zooplankton survival during entrainment in the cooling water system of four thermal power plants on the northern California coast. In October, 1972, they issued an interim report on the first six months of that study. This study promised to be one of the most comprehensive and accurate concerning mortality of planktonic organisms. The investigators are using a new pump sampling system (Icanberry and Ricardson, 1972) which was developed to minimize zooplankton mortality caused by the sampling. The interim report on the zooplankton mortality indicates a mortality rate of approximately 10% at four power plants. Included in this study was a delayed mortality test which showed no statistically significant mortality change between intake (control sample) and discharge samples of zooplankton held in an ambient temperature bath for 24 hours. In contrast there was a statistically significant increase in mortality of discharge sample zooplankton held for 24 hours in a discharge temperature bath. These results support previous evidence that zooplankton exposed to elevated temperatures for prolonged periods of time will reach a lethal limit. The maximum discharge temperatures reached at the individual plants during the sampling were 78.8°F, 80.5°F, 83.3°F and 79.0°F. Total exposure time of organisms to the higher temperatures were 2.9, 0.5, 11.6, and 11.9 minutes, respectively.

Warren B. Jensen (1969) a noted marine biologist of John Hopkins University, in a paper delivered before the American Socity of Civil Engineers, made a number of recommendations concerning the problem of thermal pollution and planktonic mortality in power plant cooling systems. He suggested that the prospective receiving waters should be subdivided into biological zones, each with its own time-dependent temperature criteria based on the annual reproductive cycle of its ecologically important species. He also noted that in order to avoid expensive dismantling and reconstruction to modify the power plant's cooling water system, if it proves troublesome after it is commissioned, consideration should be given to assigning space in the initial siting layout for such features as variable level intakes, auxiliary pumping equipment, alternate directional discharges, and perhaps, even supplementary cooling facilities. Others have also made related suggestions. Levin (1972) recommended that an effort be made to establish the assimilative capacity of all waters to be utilized for cooling purposes. He further recommended that more extensive study programs be conducted on all major types of water bodies in an effort to develop the ability to predict the response of the aquatic eco-system, including its planktonic component. A systems approach to study the eco-system dynamics offers a valuable tool to those who make decisions concerning design criteria for power plants.

Coutant (1971) has suggested that power plant designers now have some effective quantitative biological models available for use in designing plant cooling systems in the form of models which are being developed at the Oak Ridge National Laboratory. He points out that these models allow selection of combinations of temperature rise at the condensers, and durations of exposure to warm water in the outlet system, which will assure that certain detrimental effects do not occur. Today the effects for which data are available on some species include mortality loss of equilibrium, and increased susceptibility to predation. Coutant further concludes that ecological research conducted with productive utility as a principal objective could help qualify other sub-lethal effects.

The general trend in the research literature is the recommendation that extensive investigations be made to determine the thermal assimilative capacity of various types of water bodies. These investigations must also determine how well the receiving water body and its eco-system can accept damage to the planktonic community. Fortunately, many private and governmental agencies have begun to study the various aspects of the problem.

The Federal Environmental Protection Agency, at its National Environmental Research Center in Corvallis, Oregon, is conducting engineering research to develop methods of reducing detrimental effects to the planktonic community in power plant cooling systems. Their efforts are directed for the most part at minimizing exposure to above normal water temperature. The U.S. Department of Commerce, at its Northwest Fisheries Center, in Seattle, Washington, is actively conducting tests on minimizing planktonic intake with screening equipment. They presently have two prototype units under evaluation. These units are designed to screen out the larger size zooplankton in fresh water bodies. Information on these units has not yet been published. The Center also has initiated an investigation of similar screening methods for marine plankton. (Snyder, 1973).

The Oak Ridge National Laboratory is currently making an effort to assemble all available information on minimizing planktonic intake into power plant cooling water systems. The laboratory intends to utilize this information in order to develop design criteria for cooling water systems. The Atomic Energy Commission has recently solicited the American Nuclear Society to investigate the study of problems of Marine Ecology in power plant cooling. The American Nuclear Society established a technical standards committee to investigate three major marine ecological problems related to power plant cooling systems. The committee was organized in three groups. One group will study the problem of intake screening and entrapment of fish. The second group will study entrainment and impingement of aquatic organisms. The third group will investigate the problem of cold shock. Each group has been charged with developing the information needed to establish power plant cooling system design criteria. From these, the AEC hopes to establish new standards for water bodies receiving heated water discharges.

In addition, other private and industrial groups are pursuing these problems. One group already noted in this report is Department of Engineering Research, Pacific Gas & Electric Company. Their study of mortality rates of zooplankton in passage through the cooling water systems of four power plants on the California coasts is continuing. The interim report results have already been noted in this study. Studies are also being conducted by the Johns Hopkins University in Baltimore, Maryland and the Laboratory of Environmental Studies at New York University Medical Center.

Summary and Discussion

Thus, the present status of knowledge on the effects of plankton due to passage through a power plant cooling water system is very incomplete. In general, however, it appears that the magnitude of such entrainment effects on aquatic communities is related to the relative quantity of plankton and nekton drawn from the water adjacent to the intake structure, the level of mortality or stress incurred during entrainment, the ecological roles of the entrained organisms and their metabolic and reproductive requirements. Because the relative importance of these factors is species-dependent, the effects of the entrainment must be considered separately for each species of for groups of species with similar requirements.

The San Diego Gas & Electric Company's South Bay Power Plant discharges its cooling water within a range comparable to other cooling water discharge temperatures throughout the United States. Plankton passing through the cooling water system would be exposed to an elevated temperature for approximately five minutes when all pumps are operating. Under this temperature/time operation condition, the South Bay Power Plant compares closely with operating conditions at power plants already investigated and reported in the literature.

Thus, zooplankton passing through its cooling water system probably experience a maximum mortality rate of approximately 15%.

Waste Plumes

At present, no precautions are exercised for preventing the waste plumes from touching the shore or by the bay substrate. The discharge is to the bay via the discharge channel. The depth of water beyond the discharge point is the same as the discharge channel. Heat is released from the water while traversing the discharge channel. The heated water is dissipated over the local surface area of the bay near the discharge point. This is demonstrated in Volume 4 of this report. The temperature at various depths were manually taken simultaneously with the infra-red photography for defining the surface temperature.

Waste Disposal

The wastes generated at the plant due to operations are disposed of by discharge either to the cooling water, to the municipal sewage system, to the holding pond on the site, or at an approved disposal site. These were previously discussed in the section containing the engineering description. All domestic wastes are discharged to the municipal sewage system for treatment.

Dredging, when required to clean the intake and discharge channels, is performed. The waste material generated from the dredging is used as fill material on the plant site. All necessary permits from the various agencies concerned with the bay are acquired prior to performing the dredging.

SECTION XI

F I G U R E S

LIST OF FIGURES

TITLE

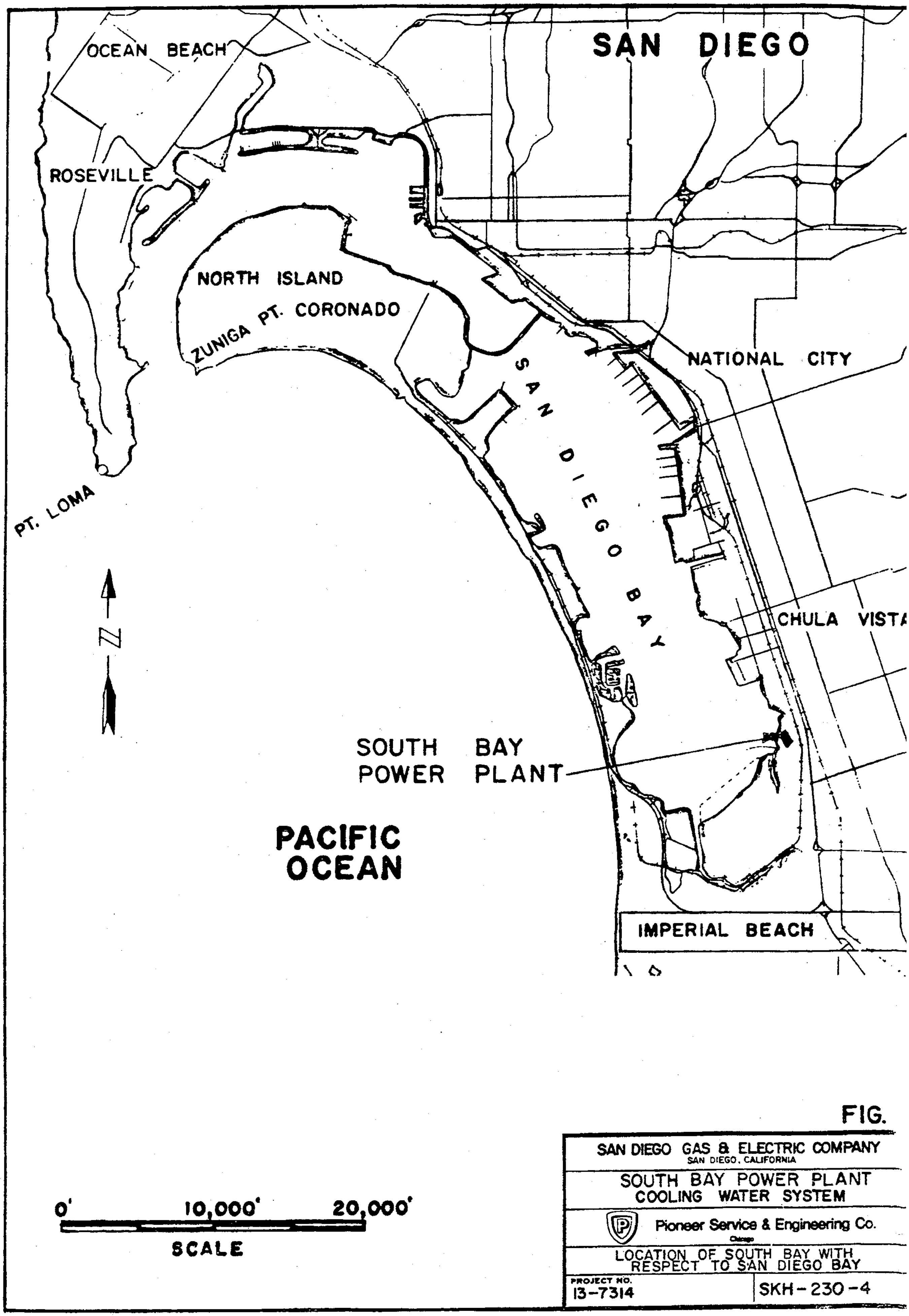

SAN DIEGO
OCEAN BEACH
ROSEVILLE
NORTH ISLAND
ZUNIGA PT.
CORONADO
NATIONAL CITY
SAN DIEGO BAY
PT. LOMA
N
CHULA VISTA
SOUTH BAY POWER PLANT
PACIFIC OCEAN
IMPERIAL BEACH
0'
10,000'
20,000'
SCALE
SAN DIEGO GAS & ELECTRIC COMPANY
SAN DIEGO, CALIFORNIA
SOUTH BAY POWER PLANT
COOLING WATER SYSTEM
Pioneer Service & Engineering Co.
Chicago
LOCATION OF SOUTH BAY WITH RESPECT TO SAN DIEGO BAY
PROJECT NO.
13-7314
SKH-230-4

FIG.

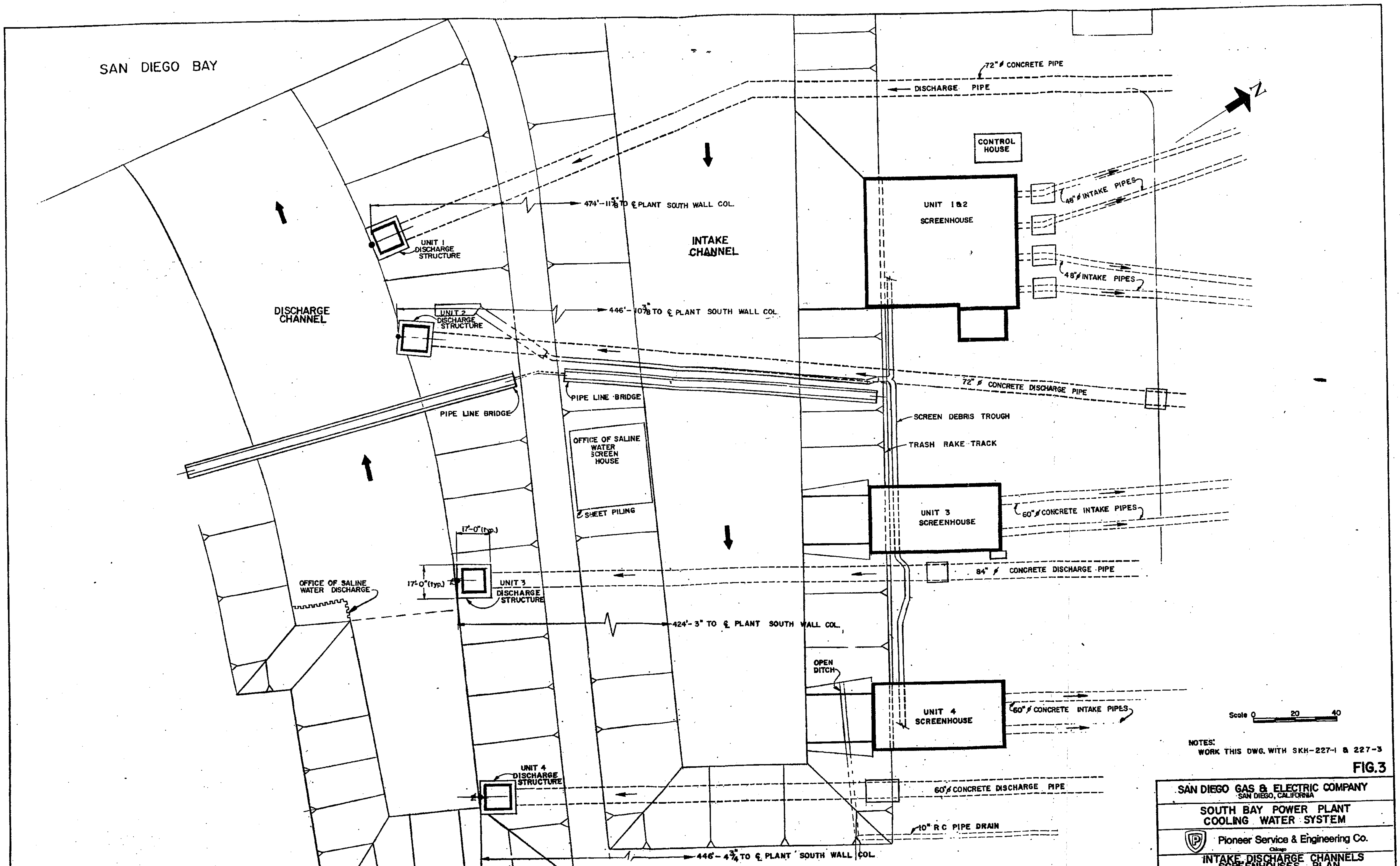


FIG. 3—INTAKE. DISCHARGE CHANNELS

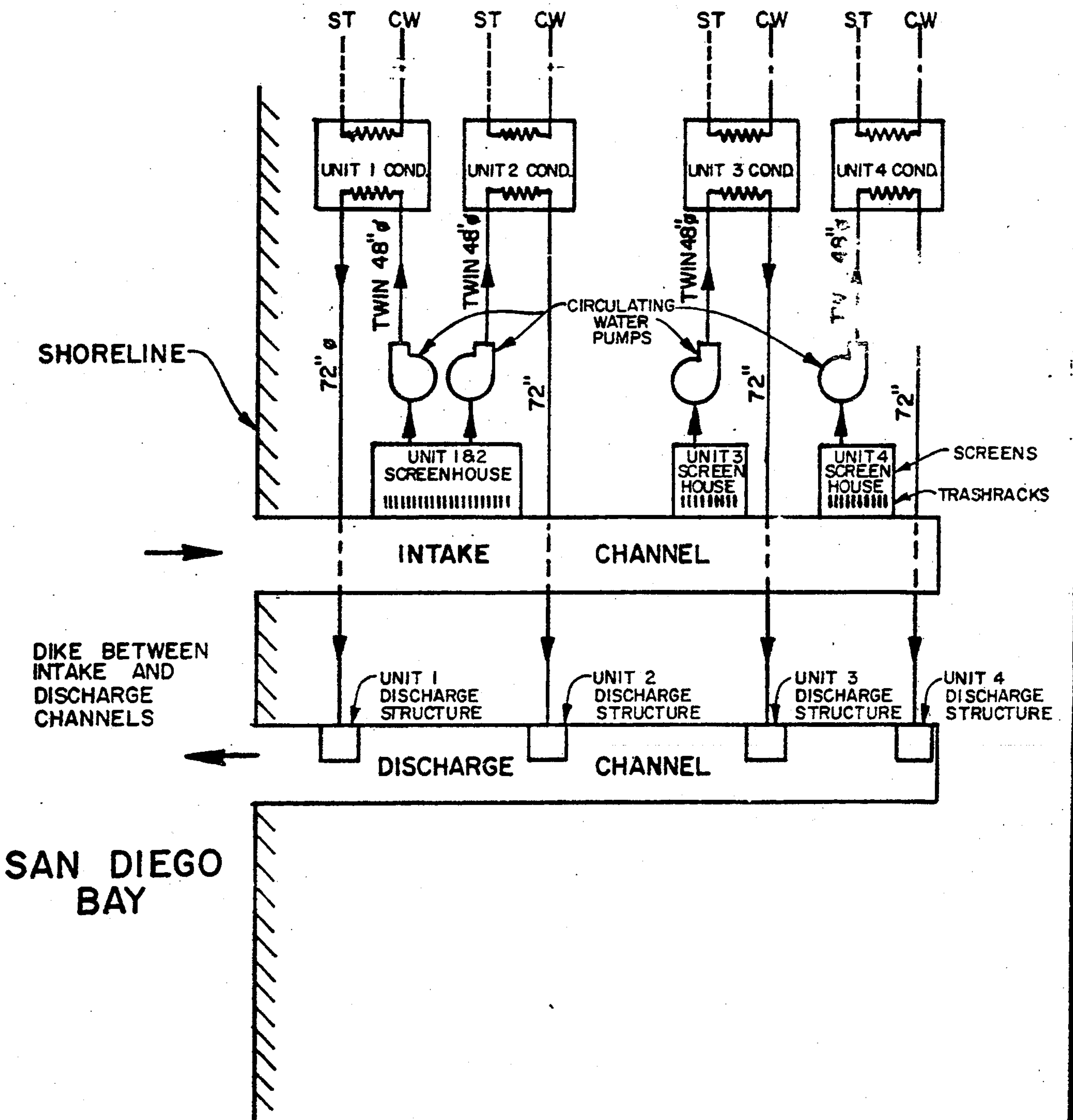


FIG. 5

LEGEND:

COND. — CONDENSER
CW — CONDENSED WATER LINE — · —
ST — STEAM LINE — — — —

SAN DIEGO GAS & ELECTRIC COMPANY
SAN DIEGO, CALIFORNIA

SOUTH BAY POWER PLANT
COOLING WATER SYSTEM

Pioneer Service & Engineering Co.
Chicago

SCHEMATIC

PROJECT NO. 13-7314

SKH 227-4

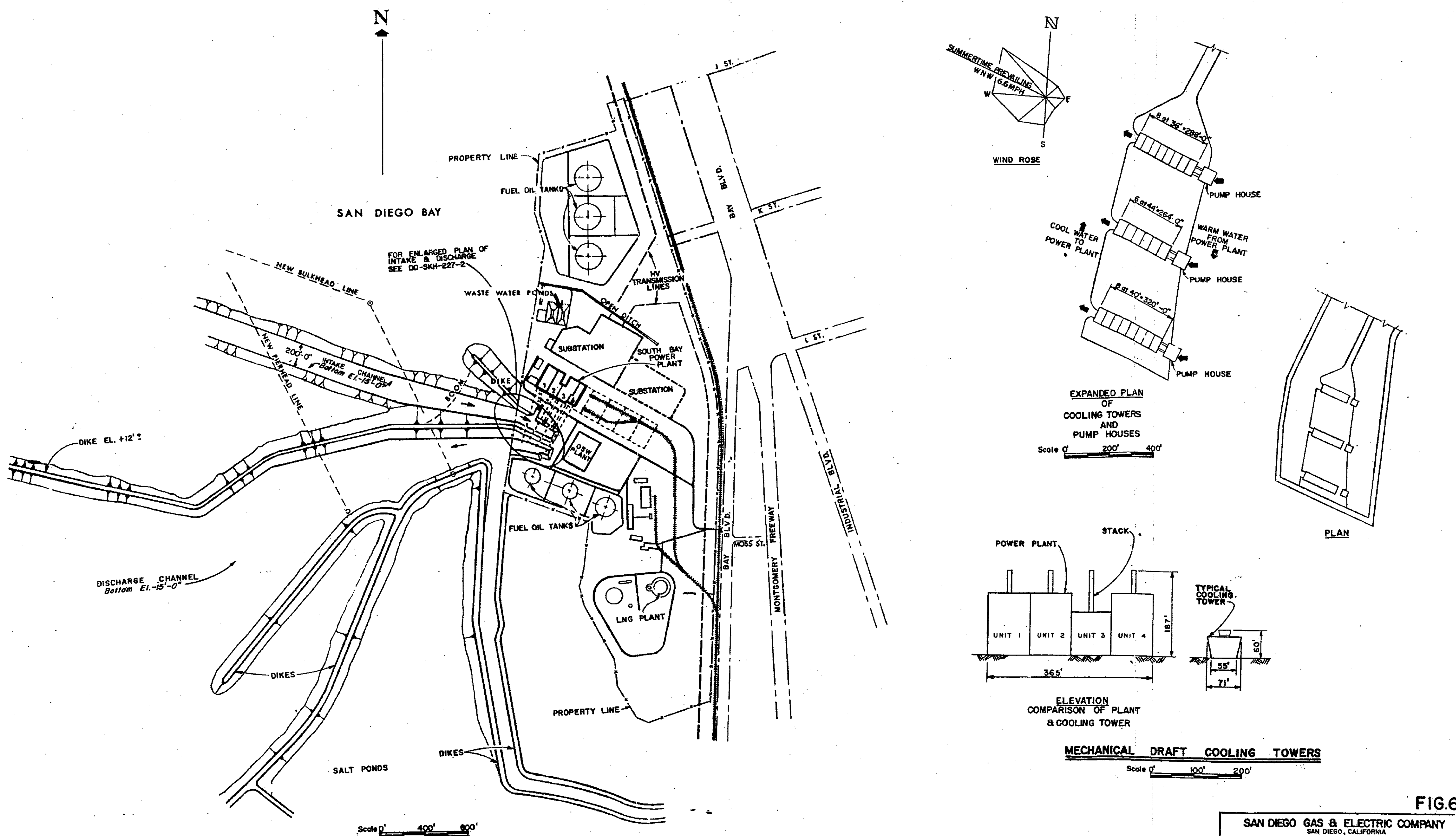


FIG.6

SAN DIEGO GAS & ELECTRIC COMPANY
SAN DIEGO, CALIFORNIA

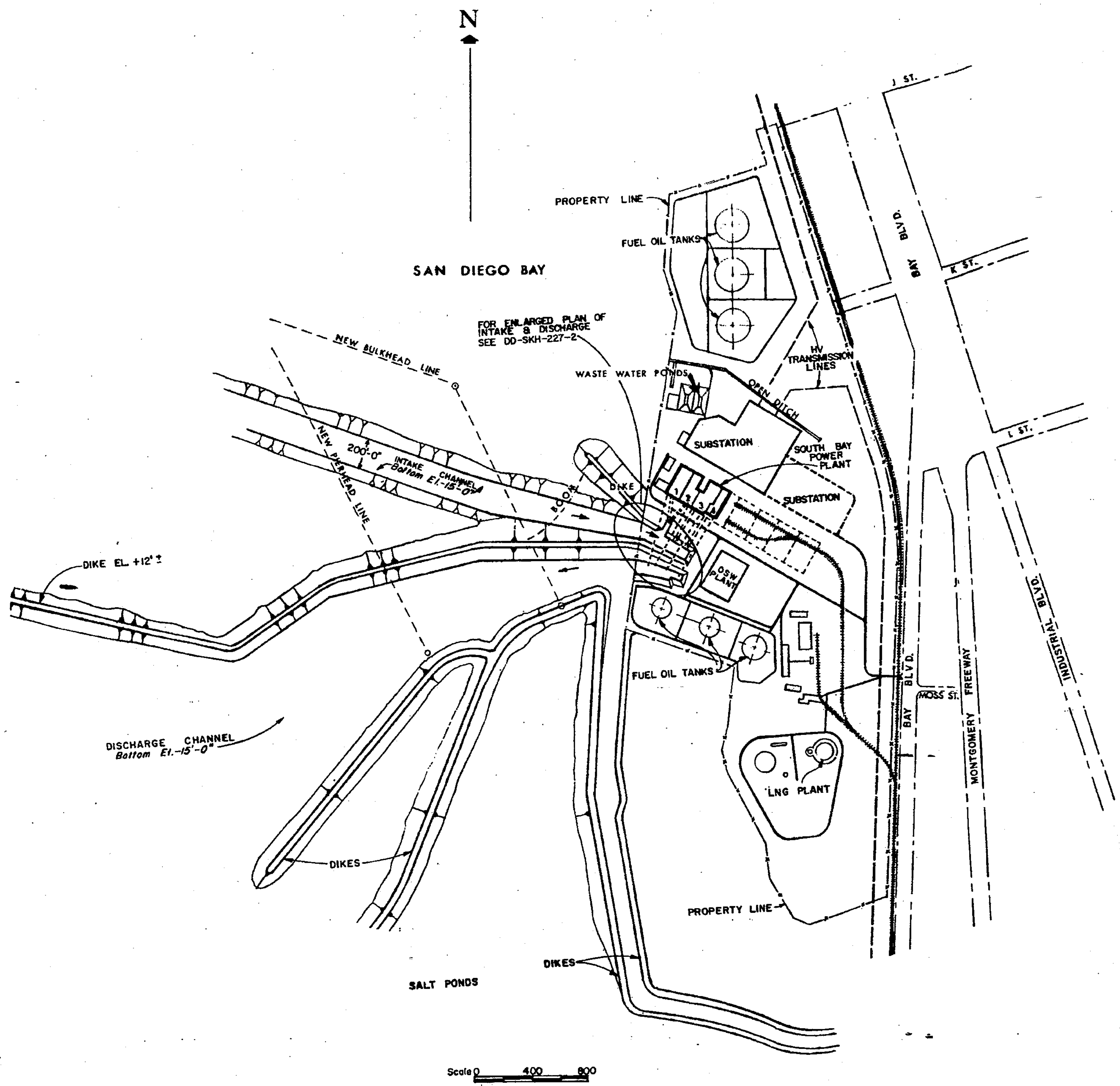
SOUTH BAY POWER PLANT
COOLING WATER SYSTEM

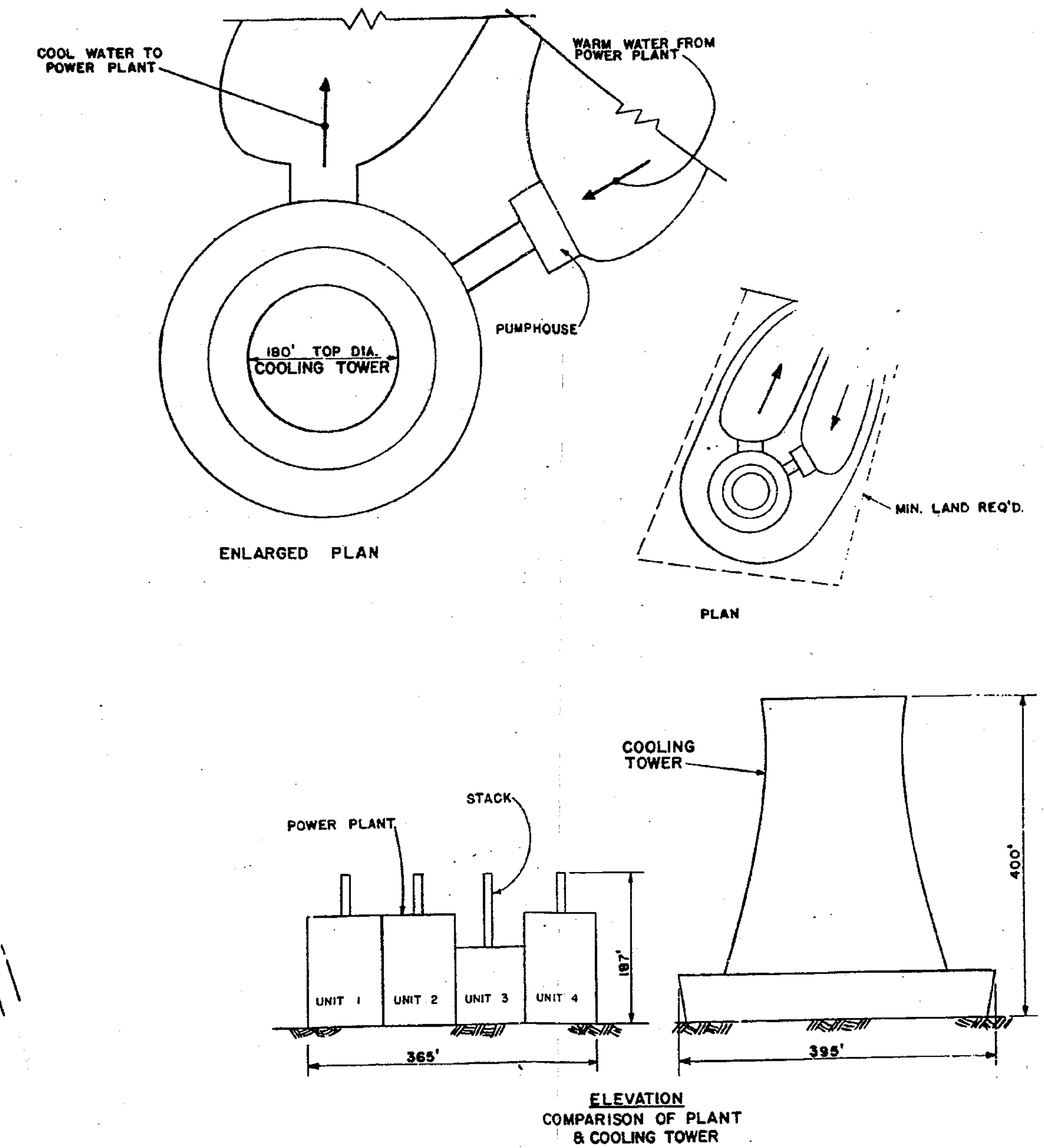
Pioneer Service & Engineering Co.
Chicago

CLOSED CYCLE MECHANICAL DRAFT COOLING TOWER CONCEPT

PROJECT NO.

FIG 6 - CLOSED CYCLE MECHANICAL DRAFT COOLING TOWER CONCEPT





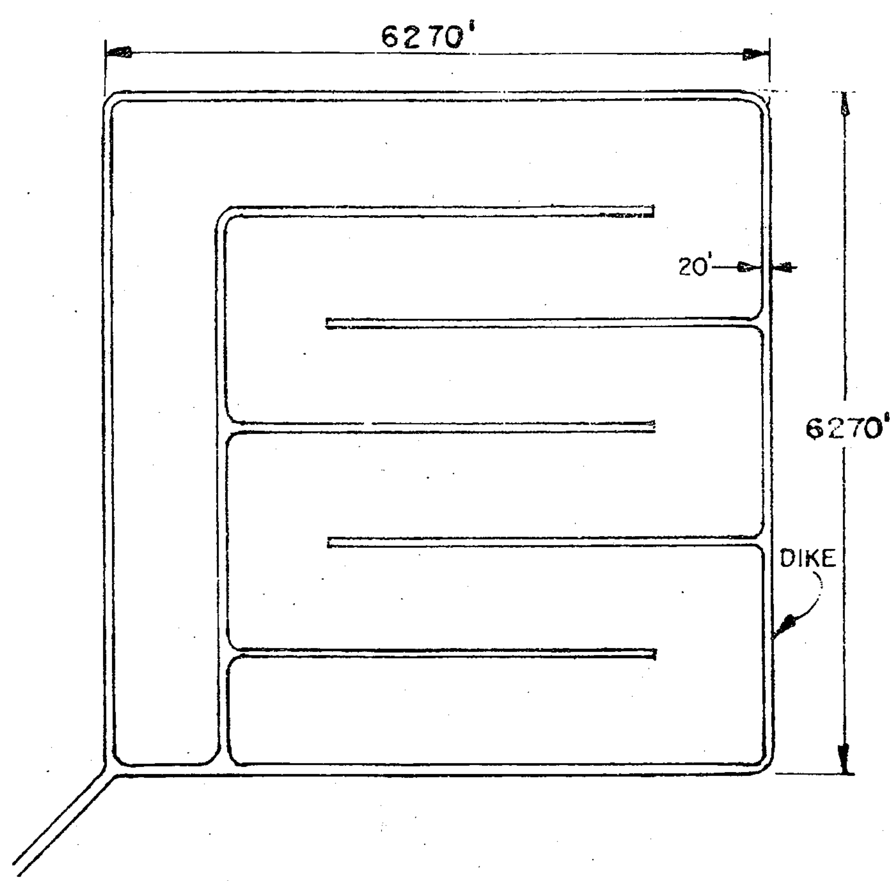
NATURAL DRAFT COOLING TOWER

Scale 0' 100' 200'

FIG.7

SAN DIEGO GAS & ELECTRIC COMPANY SAN DIEGO, CALIFORNIA
SOUTH BAY POWER PLANT COOLING WATER SYSTEM
Pioneer Service & Engineering Co. Chicago
CLOSED CYCLE NATURAL DRAFT COOLING TOWER CONCEPT
PROJECT NO. DD-SKH-230-2

FIG 7 - CLOSED CYCLE NATURAL DRAFT COOLING TOWER CONCEPT



AREA REQUIREMENTS
FOR
SQUARE COOLING POND

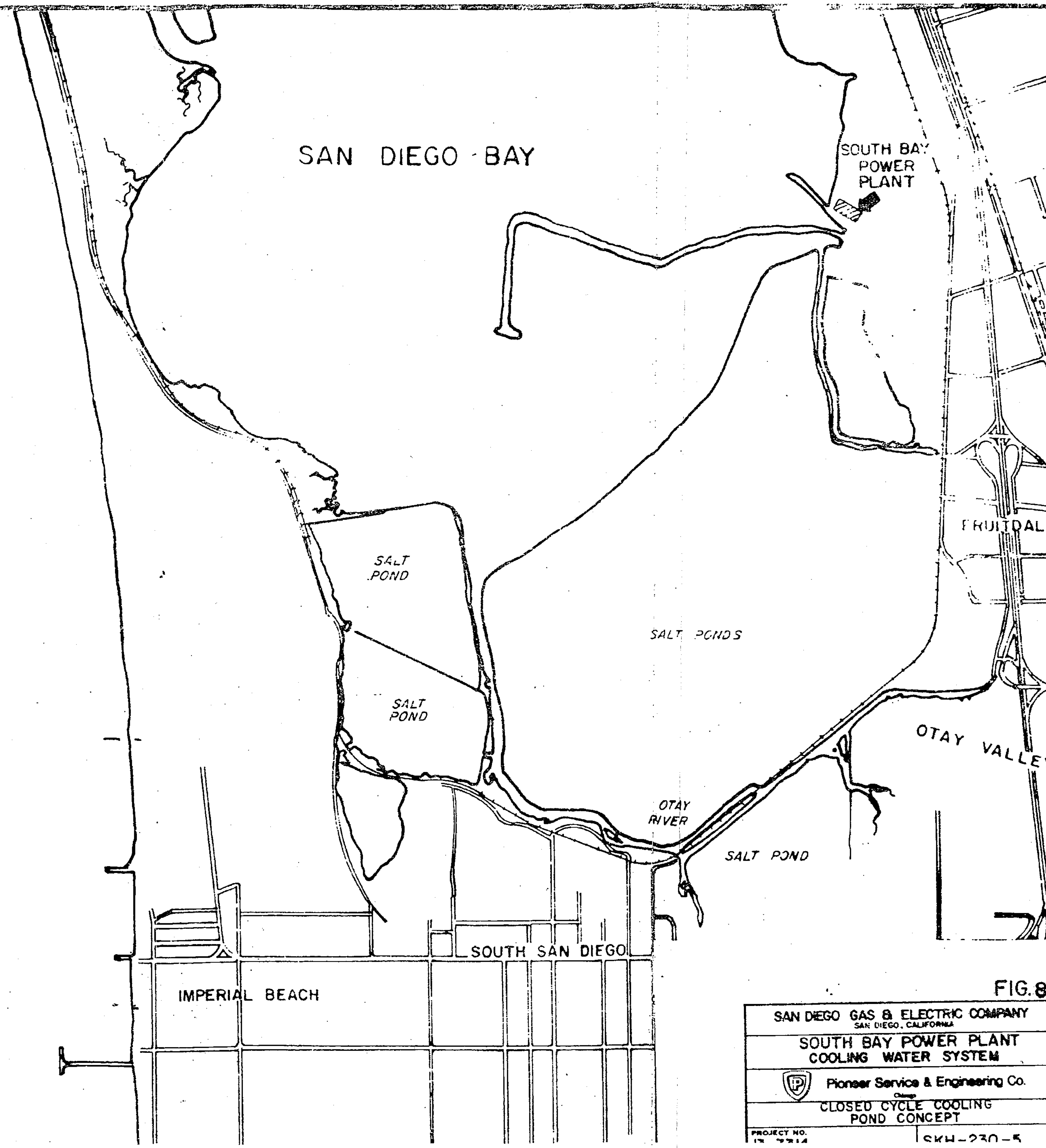


FIG. 8

SAN DIEGO GAS & ELECTRIC COMPANY
SAN DIEGO, CALIFORNIA

SOUTH BAY POWER PLANT
COOLING WATER SYSTEM

Pioneer Service & Engineering Co.
Chicago

CLOSED CYCLE COOLING
POND CONCEPT

PROJECT NO.

SKH-230-5

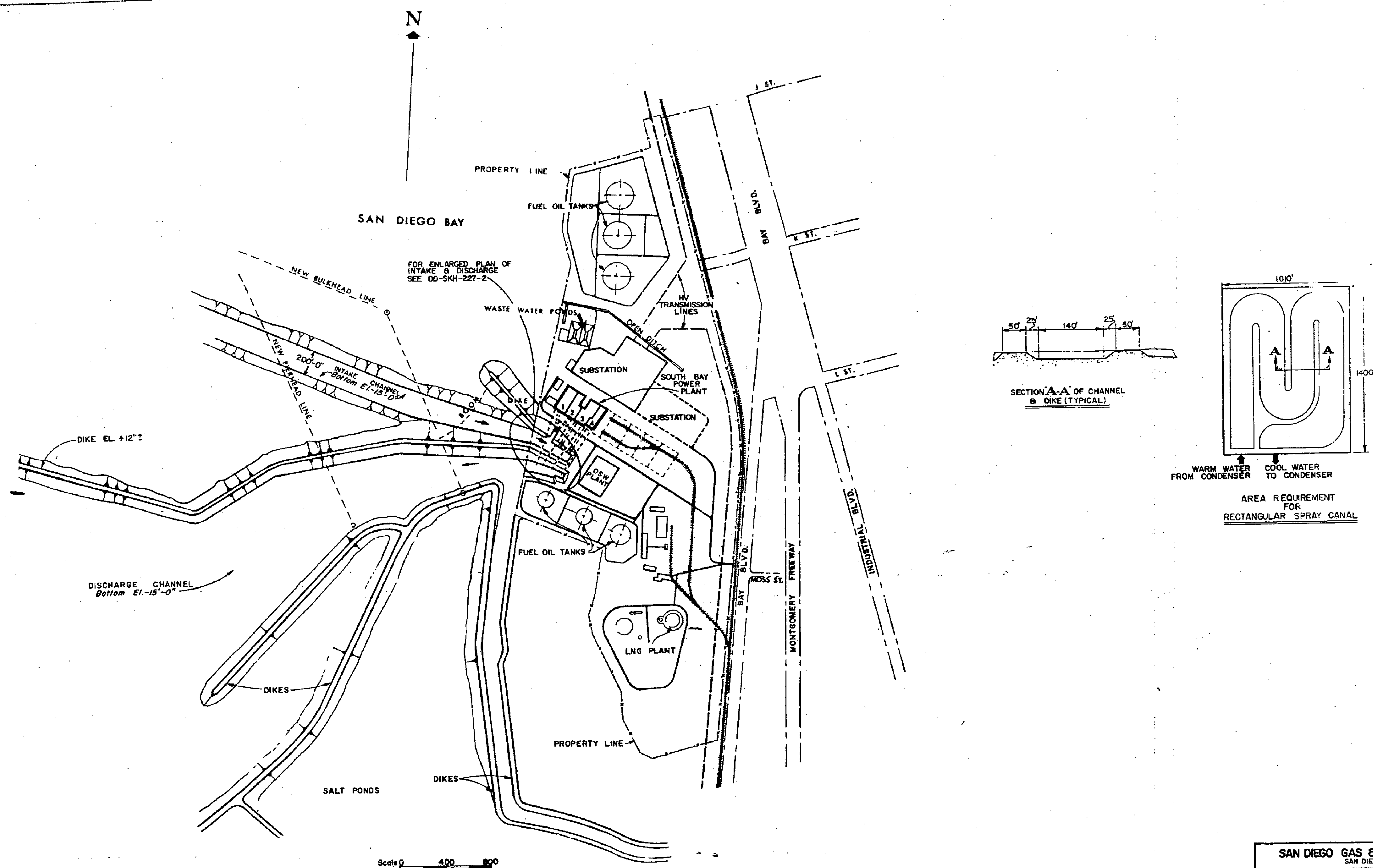


FIG 9- CLOSED CYCLE SPRAY CANAL CONCEPT

FIG.9

SAN DIEGO GAS & ELECTRIC COMPANY
SAN DIEGO, CALIFORNIA

SOUTH BAY POWER PLANT
COOLING WATER SYSTEM

Pioneer Service & Engineering Co.
Chicago

CLOSED CYCLE SPRAY CANAL CONCEPT

PROJECT NO. 13-7314 | DD-SKH-230-6

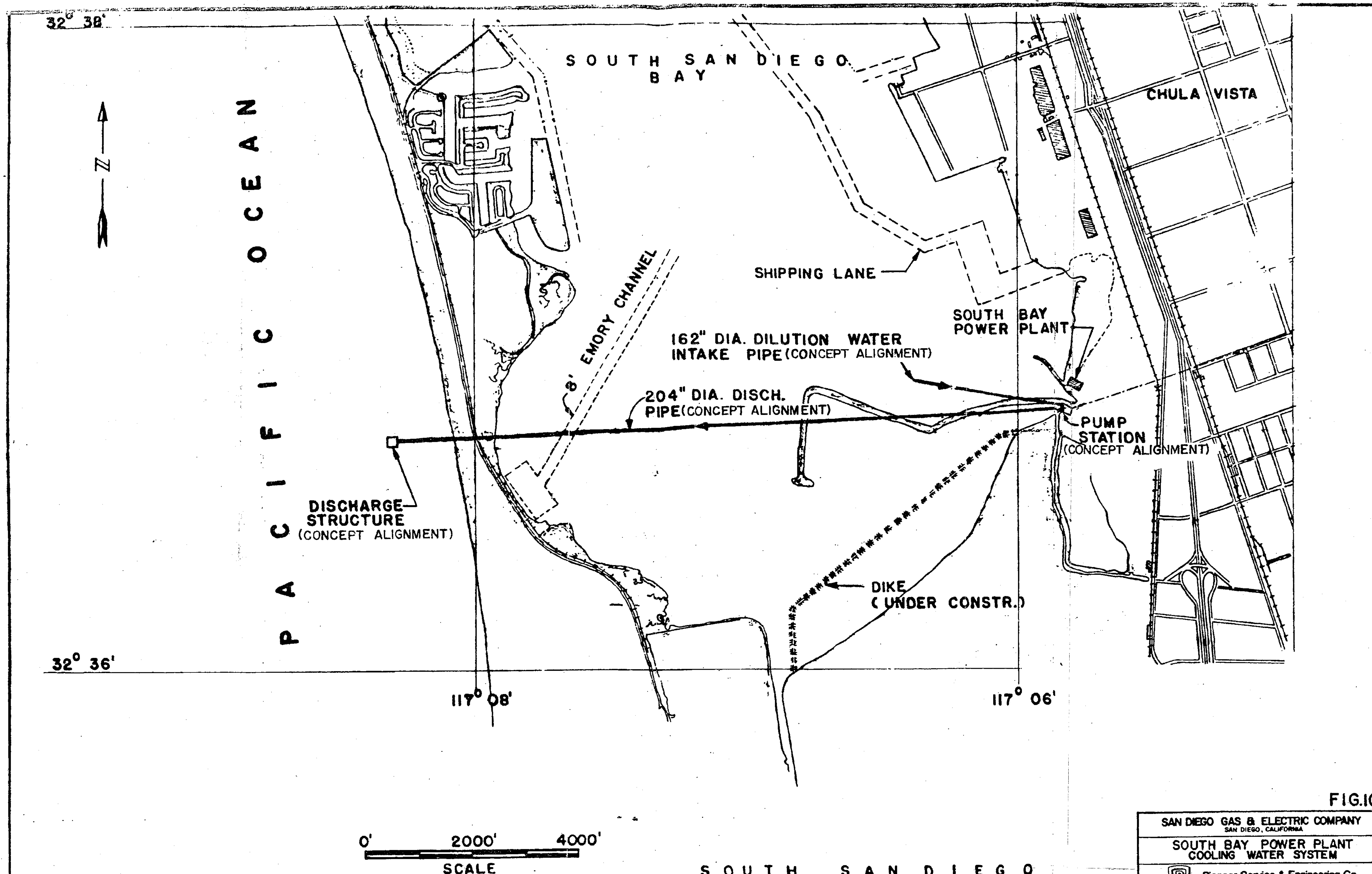


FIG.10

SAN DIEGO GAS & ELECTRIC COMPANY
SAN DIEGO, CALIFORNIA

SOUTH BAY POWER PLANT
COOLING WATER SYSTEM

Pioneer Service & Engineering Co.
Chicago

OCEAN DISCHARGE CONCEPT

PROJECT NO. 13-7314 | SKH-230-3

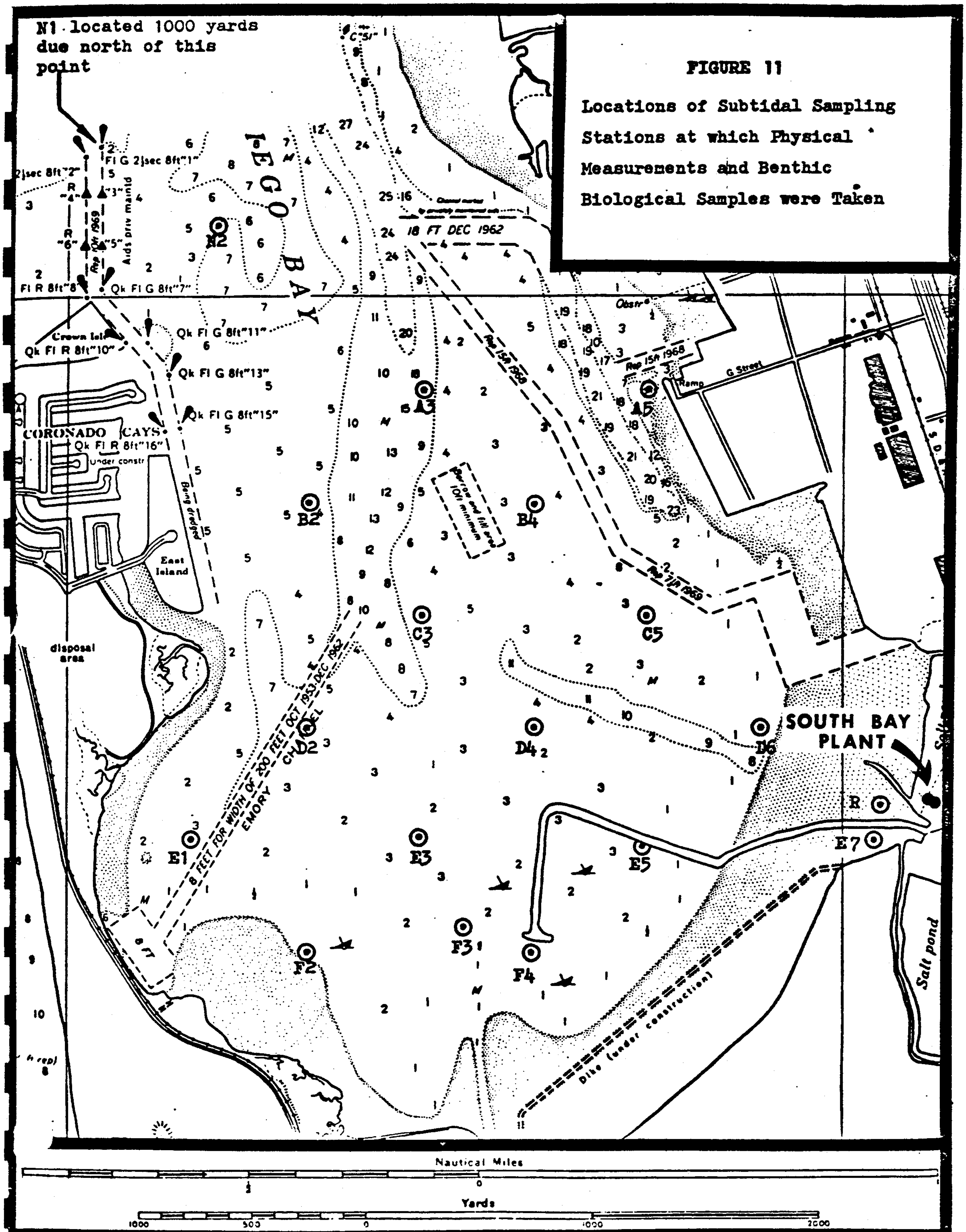


FIGURE 11

Locations of Subtidal Sampling Stations at which Physical Measurements and Benthic Biological Samples were Taken

SECTION XII

A P P E N D I X

APPENDIX I

State Water Resources Control Board

WATER QUALITY CONTROL PLAN FOR CONTROL OF TEMPERATURE IN THE COASTAL AND INTERSTATE WATERS AND ENCLOSED BAYS AND ESTUARIES OF CALIFORNIA[1/]

DEFINITION OF TERMS

1. Thermal Waste - Cooling water and industrial process water used for the purpose of transporting waste heat.

2. Elevated Temperature Waste - Liquid, solid, or gaseous material including thermal waste discharged at a temperature higher than the natural temperature of receiving water. Irrigation return water is not considered elevated temperature waste for the purpose of this plan.

3. Natural Receiving Water Temperature - The temperature of the receiving water at locations, depths, and times which represent conditions unaffected by any elevated temperature waste discharge or irrigation return waters.

4. Interstate Waters - All rivers, lakes, artificial impoundments, and other waters that flow across or form a part of the boundary with other states of Mexico.

5. Coastal Waters - Waters of the Pacific Ocean outside of enclosed bays and estuaries which are within the territorial limits of California.

6. Enclosed Bays - Indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays will include all bays where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes but is not limited to the following: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Carmel Bay, Morro Bay, Los Angeles Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

1/ This plan revises and supersedes the policy adopted by the State Board on January 7, 1971 and revised October 13, 1971.

7. Estuaries and Coastal Lagoons - Waters at the mouths of streams which serve as mixing zones for fresh and ocean water during a major portion of the year. Mouths of streams which are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open ocean to the upstream limit of tidal action but may be considered to extend seaward if significant mixing of fresh and saltwater occurs in the open coastal waters. The waters described by this definition include but are not limited to the Sacramento-San Joaquin Delta as defined by Section 12220 of the California Water Code, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge and appropriate areas of Smith River, Klamath River, Mad River, Eel River, Noyo River, and Russian River.

8. Cold Interstate Waters - Streams and lakes having a range of temperature generally suitable for trout and salmon including but not limited to the following: Lake Tahoe, Truckee River, West Fork Carson River, East Fork Carson River, West Walker River and Lake Topaz, East Walker River, Minor California-Nevada Interstate Waters, Klamath River, Smith River, Goose Lake, and Colorado River from the California-Nevada stateline to the Needles-Topoc Highway Bridge.

9. Warm Interstate Waters - Interstate streams and lakes having a range of temperatures generally suitable for warm water fishes such as bass and catfish. This definition includes but is not limited to the following: Colorado River from the Needles-Topock Highway Bridge to the northerly international boundary of Mexico, Tijuana River, New River, and Alamo River.

10. Existing Discharge - Any discharge (a) which is presently taking place, or (b) for which waste discharge requirements have been established and construction commenced prior to the adoption of this plan, or (c) any material change in an existing discharge for which construction has commenced prior to the adoption of this plan. Commencement of construction shall include execution of a contract for on site construction or for major equipment which is related to the condenser cooling system.

    Major thermal discharges under construction which are included within this definition are:

    A. Diablo Canyon Units 1 and 2, Pacific Gas and Electric Company.

    B. Ormond Beach Generating Station Units 1 and 2, Southern California Edison Company.

    C. Pittsburg No. 7 Generating Plant, Pacific Gas and Electric Company.

    D. South Bay Generating Plant Unit 4 and Encina Unit 4, San Diego Gas and Electric Company.

11. New Discharge - Any discharge (a) which is not presently taking place unless waste discharge requirements have been established and construction as defined in Paragraph 10 has commenced prior to adoption of this plan or (b) which is presently taking place and for which a material change is proposed but no construction as defined in Paragraph 10 has commenced prior to adoption of this plan.

12. Planktonic Organism - Phytoplankton, zooplankton and the larvae and eggs of worms, molluscs, and anthropods, and the eggs and larval forms of fishes.

13. Limitations or Additional Limitations - Restrictions on the temperature, location, or volume of a discharge, or restrictions on the temperature of receiving water in addition to those specifically required by this plan.

SPECIFIC WATER QUALITY OBJECTIVES

1. Cold Interstate Waters

   A. Elevated temperature waste discharges into cold interstate waters are prohibited.

2. Warm Interstate Waters

   A. Thermal waste discharges having a maximum temperature greater than 5°F above natural receiving water temperature are prohibited.

   B. Elevated temperature wastes shall not cause the temperature of warm interstate waters to increase by more than 5°F above natural temperature at any time or place.

   C. Colorado River - Elevated temperature wastes shall not cause the temperature of the Colorado River to increase above the natural temperature by more than 5°F or the temperature of Lake Havasu to increase by more than 3°F provided that such increases shall not cause the maximum monthly temperature of the Colorado River to exceed the following:

January	-	60°F	July	-	90°F
February	-	65°F	August	-	90°F
March	-	70°F	September	-	90°F
April	-	75°F	October	-	82°F
May	-	82°F	November	-	72°F
June	-	86°F	December	-	65°F

D. Lost River - Elevated temperature wastes discharged to the Lost River shall not cause the temperature of the receiving water to increase by more than 2°F when the receiving water temperature is less than 62°F, and 0°F when the receiving water temperature exceeds 62°F.

3. Coastal Waters

A. Existing discharges

(1) Elevated temperature wastes shall comply with limitations necessary to assure protection of the beneficial uses and areas of special biological significance.

B. New Discharges

(1) Elevated temperature wastes shall be discharged to the open ocean away from the shoreline to achieve dispersion through the vertical water column.

(2) Elevated temperature wastes shall be discharged a sufficient distance from areas of special biological significance to assure the maintenance of natural temperature in these areas.

(3) The maximum temperature of thermal waste discharges shall not exceed the natural temperature of receiving waters by more than 20°F.

(4) The discharge of elevated temperature wastes shall not result in increases in the natural water temperature exceeding 4°F at (a) the shoreline, (b) the surface of any ocean substrate, or (c) the ocean surface beyond 1,000 feet from the discharge system. The surface temperature limitation shall be maintained at least 50 percent of the duration of any complete tidal cycle.

Alternate water quality objectives may be specified in waste discharge requirements if such objectives would assure full protection of the aquatic environment. Such objectives may be specified in waste discharge requirements only after receipt by the regional board of written concurrence from the State Board and the Environmental Protection Agency.

4. Enclosed Bays

A. Existing Discharges

(1) Elevated temperature waste discharges shall comply with limitations necessary to assure protection of beneficial uses.

B. New Discharges

(1) Elevated temperature waste discharges shall comply with limitations necessary to assure protection of beneficial uses. The maximum temperature of waste discharges shall not exceed the natural temperature of the receiving waters by more than 20°F.

(2) Thermal waste discharges having a maximum temperature greater than 4°F above the natural temperature of the receiving water are prohibited.

5. <u>Estuaries</u>

A. Existing Discharges

(1) Elevated temperature waste discharges shall comply with the following:

a. The maximum temperature shall not exceed the natural receiving water temperature by more than 20°F.

b. Elevated temperature waste discharges either individually or combined with other discharges shall not create a zone, defined by water temperatures of more than 1°F above natural receiving water temperature, which exceeds 25 percent of the cross-sectional area of a main river channel at any point.

c. No discharge shall cause a surface water temperature rise greater than 4°F above the natural temperature of the receiving waters at any time or place.

d. Additional limitations shall be imposed when necessary to assure protection of beneficial uses.

(2) Thermal waste discharges shall comply with the provisions of 5A(1) above and, in addition, the maximum temperature of thermal waste discharges shall not exceed 86°F.

B. New Discharges

(1) Elevated temperature waste discharges shall comply with item 5A(1) above.

(2) Thermal waste discharges having a maximum temperature greater than 4°F above the natural temperature of the receiving water are prohibited.

(3) Additional limitations shall be imposed when necessary to assure protection of beneficial uses.

GENERAL WATER QUALITY PROVISIONS

1. Additional limitations shall be imposed in individual cases if necessary for the protection of specific beneficial uses and areas of special biological significance. When additional limitations are established, the extent of surface heat dispersion will be delineated by a calculated 1-1/2°F isotherm which encloses an appropriate dispersion area. The extent of the dispersion area shall be:

   A. Minimized to achieve dispersion through the vertical water column rather than at the surface or in shallow water.

   B. Defined by the regional board for each existing and proposed discharge after receipt of a report prepared in accordance with the implementation section of this plan.

2. The cumulative effects of elevated temperature waste discharges shall not cause temperatures to be increased except as provided in specific water quality objectives contained herein.

3. Areas of special biological significance shall be designated by the State Board after public hearing by the regional board and review of its recommendations.

4. An exception to the specific water quality objectives of this plan may be authorized by a regional board for a specific discharge upon a finding following public hearing that:

   A. An elevated temperature waste discharge in compliance with modified objectives will result in the enhancement of beneficial uses as compared to predischarge conditions, or

   B. The use of heat on an intermittent basis to control fouling organisms in intake and discharge structures will result in less potential for deleterious effects upon beneficial uses than other alternative methods (heat, in addition to that required for cleaning of intake and discharge structures, shall not be used for cleaning of condenser units), or

   C. Changes in existing discharge structures or their operation to obtain compliance with water quality objectives would result in an environmental impact greater than would occur with modified water quality objectives, or

D. Compliance by existing dischargers with specific water quality objectives would require modification of operations or facilities not commensurate with benefit to the aquatic environment.

Such authorization shall be effective only upon concurrence by the State Board and the Environmental Protection Agency.

5. Natural water temperature will be compared with waste discharge temperature by near-simultaneous measurements accurate to within 1°F. In lieu of near-simultaneous measurements, measurements may be made under calculated conditions of constant waste discharge and receiving water characteristics.

IMPLEMENTATION

1. The State Water Resources Control Board and the California Regional Water Quality Control Boards will administer this plan by establishing waste discharge requirements for discharges of elevated temperature wastes.

2. This plan is effective as of the date of adoption by the State Water Resources Control Board and the sections pertaining to temperature control in each of the policies and plans for the individual interstate and coastal waters shall be void and superseded by all applicable provisions of this plan.

3. Existing and future dischargers of thermal waste shall conduct a study to define the effect of the discharge on beneficial uses and, for existing discharges, determine design and operating changes which would be necessary to achieve compliance with the provisions of this plan.

4. Waste discharge requirements for existing elevated temperature wastes shall be reviewed to determine the need for studies of the effect of the discharge on beneficial uses, changes in monitoring programs and revision of waste discharge requirements.

5. Completed studies for existing discharges shall be submitted to the appropriate regional board prior to July 1973. The regional board shall review all studies and make necessary revisions to waste discharge requirements prior to January 1974 to assure compliance with all applicable provisions of this plan.

   Revised waste discharge requirements shall include a time schedule which assures compliance at the earliest possible date but not later than January 1976.

6. Completed studies for existing discharges of thermal wastes, existing waste discharge requirements, and proposed revised waste discharge requirements will be submitted by the State Board to EPA for review and comment prior to September 1973 and prior to adoption of revised waste discharge requirements.

7. Proposed dischargers of elevated temperature wastes may be required by the regional board to submit such studies prior to the establishment of waste discharge requirements. The regional board shall include in its requirements appropriate post-discharge studies by the discharger.

8. The scope of any necessary studies shall be as outlined by the regional board and shall be designed to include the following as applicable to an individual discharge:

   A. Existing conditions in the aquatic environment.

   B. Effects of the existing discharge on beneficial uses.

   C. Predicted conditions in the aquatic environment with waste discharge facilities designed and operated in compliance with the provisions of this plan.

   D. Predicted effects of the proposed discharge on beneficial uses.

   E. An analysis of costs and benefits of various design alternatives.

   F. The extent to which intake and outfall structures are located and designed so that the intake of planktonic organisms is at a minimum, waste plumes are prevented from touching the ocean substrate or shorelines, and the waste is dispersed into an area of pronounced along-shore or offshore currents.

APPENDIX II

EXCERPTS FROM CHAPTER IV OF INTERIM WATER QUALITY CONTROL PLAN FOR THE SAN DIEGO REGION

BENEFICIAL USES

Beneficial uses are those uses of water which are necessary to or enhance the quality of man's well-being and are affected by the quality of the given body of water. Inasmuch as different beneficial uses may be best served by a specific set of water quality conditions, the enumeration of the beneficial uses for a given body of water is the basis for establishing water quality objectives. All beneficial uses which are known to be enjoyed at this time and, additionally, those which may be enjoyed in the reasonably near future have been listed in Table 5.

Table 5 is divided into two sections separating inland waters from those subject to tidal action. With respect to the beneficial uses for inland waters, it should be noted that because of the relatively limited extent of the various hydrologic subunits, each beneficial use enunciated for protection will be protected throughout the entire subunit. In addition, the small geographic distance, time of travel, and volumes of water involved may require protection of a given beneficial use in areas adjacent and upstream of the area of actual use.

Following is a list of standardized beneficial uses used throughout the state, the abbreviation used in Table 5 for each beneficial use, and a brief definition or example of the beneficial use.

Municipal and Domestic Supply (MUN)

Includes the full range of a usual community public water supply and all domestic uses needed by an individual with an independent water supply.

Agricultural Supply (AGR)

Includes crop, orchard and pasture irrigation; stockwatering; and all uses in support of farming and ranching operations.

Industrial Supply (IND)

Includes cooling, washing and process water.

Water Contact Recreation (REC)

Includes all recreational uses involving actual body contact with water, such as swimming, wading, water skiing, skin diving, surfing, and sport fishing.

Aesthetic Enjoyment (AES)

Includes uses which involve the presence of water but do not require contact with water, such as picnicking, sunbathing, hiking, beachcombing, tidepool and marine life study, camping, viewing, and pleasure boating.

Commercial Fishing and Shellfish Harvesting (COM)

Includes the collection of various types of fish, including bait for commercial purposes.

Navigation (NAV)

Includes commercial and naval shipping.

Scientific Study, Research and Training (SCI)

Includes marine life refuges and ecological reserves. See Appendix C.

Marine Habitat (MAR)

Provides habitat for fish, plant and animal propagation and sustenance, including shellfish, waterfowl and other water-associated birds; provides mammal rookery and hauling grounds.

Freshwater Habitat (FRE)

Provides freshwater habitat for fish, waterfowl and wildlife.

Military Exercises (MIL)

Includes rescue training, bridge building, and beach landings.

Beneficial uses enunciated in previously adopted water quality control policies, with appropriate modification in terminology, have been incorporated into this plan. In addition, the following beneficial uses also have been incorporated into the Interim Plan:

San Diego Hydrologic Unit	Surface Waters, added beneficial uses: Agricultural Supply, Industrial Supply.
Tia Juana Hydrologic Unit	Surface Waters, added beneficial uses: Agricultural Supply, Industrial Supply, Groundwaters, added beneficial use: Industrial Supply.
Pacific Ocean	Added beneficial use: Extend water contact recreation outward to three mile limit.
Sorrento Lagoon, San Dieguito Lagoon, San Elijo Lagoon, Batiquitos Lagoon, Buena Vista Lagoon, Loma Alta Slough, Mouth of San Luis Rey River, Santa Margarita Lagoon, Mouth of San Onofre Creek, Mouth of San Mateo Creek, Mouth of San Juan Creek and Mouth of Aliso Creek	Added beneficial use: Water Contact Recreation.

TABLE 5 (cont'd)

BENEFICIAL USES

WATERS SUBJECT TO TIDAL ACTION

SAN DIEGO BASIN

WATER AREA	Beneficial Uses							
	IND	REC	AES	COM	NAV	SCI	MAR	MIL
Pacific Ocean, including Dana Point Boat Harbor, Oceanside Harbor and Camp Pendleton Boat Harbor	X	X	X	X	X	X	X	X
Mission Bay	X	X	X			X	X	
San Diego Bay, including the tidal prisms of the Otay and Sweetwater Rivers	X	X	X	X	X	X	X	X
Coastal Lagoons								
Mouth of Tia Juana Slough		X	X				X	
Mouth of San Diego River		X	X				X	
Sorrento Lagoon		X	X				X	
San Dieguito Lagoon		X	X				X	
San Elijo Lagoon		X	X				X	
Batiquitos Lagoon		X	X				X	
Agua Hedionda Lagoon	X	X	X				X	
Buena Vista Lagoon		X	X				X	
Loma Alta Slough		X	X				X	
Mouth of San Luis Rey River		X	X				X	
Santa Margarita Lagoon		X	X				X	
Mouth of San Onofre Creek		X	X				X	
Mouth of San Mateo Creek		X	X				X	
Mouth of San Juan Creek		X	X				X	
Mouth of Aliso Creek		X	X				X	

APPENDIX III

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN DIEGO REGION

GUIDELINES FOR THERMAL DISTRIBUTION
AND BIOLOGICAL STUDIES
FOR THE
SAN DIEGO GAS & ELECTRIC COMPANY'S
SOUTH BAY POWER PLANT

GENERAL PROVISIONS

These basic guidelines are established to provide guidance in obtaining information on the extent and effects of the existing discharges from the South Bay Power Plant and to provide basic background data to enable differentiation between the effects of the existing discharge and those which might be caused by increased discharges associated with any units planned for construction in the relatively near future, in accordance with the State Water Resources Control Board's "Policy Regarding the Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California." The basic intent of the studies is to determine the extent and effects of the existing discharge and to predict as accurately as possible the extent and effects of any planned increased volumes of discharges.

Revisions in this program may be made by the Executive Officer of the Regional Board. Information gained through this study will be used in the revision of the monitoring program for the discharge. This study fulfills the requirements of the study called for by Resolution 69-R3.

All work shall be performed by or under the direct supervision of qualified marine biologists and oceanographers. The names and professional resumes of all persons associated with the work shall be submitted for approval by the Executive Officer of the Regional Board prior to the work being performed. Unless otherwise noted, all sampling, sample preservation, and analyses shall be in accordance with the current edition of "Standard Methods for the Examination of Water and Waste Water," the procedures of the American Society for Testing Materials, modified for the marine environment, or with the approval of the Executive Officer.

Aerial infrared temperature determinations and temperature-depth profiles shall be synoptically acquired on at least the high and low tides of the same tidal cycle. Data acquisition shall be such that at least 95 percent of the required information is obtained during each synoptic sampling period.

Receiving water sampling shall not be conducted during or immediately following periods of storm or when storm runoff may be present in San Diego Bay waters.

Temperature measuring equipment for use in the water column shall be referenced or calibrated to thermometers which have been certified by the National Bureau of Standards and all temperatures shall be reported accurately to at least one degree Fahrenheit.

A complete record of time, tidal conditions, depth, weather conditions, sea conditions, etc. shall accompany each series of measurements.

Sampling and analysis of benthic communities and fish populations shall be conducted using principles and techniques similar to those used by the State Department of Fish and Game. All organisms shall be identified to species insofar as possible.

The studies shall be initiated by July 1972 and quarterly summary progress reports shall be submitted to the Regional Board.

The final report shall be submitted not later than May 1, 1973, and shall be comprehensive in nature covering in narrative detail at least the following:

A. A description of all intake and discharge facilities with respect to location, capacity, type, size, depth, length, etc.; each type of waste water including chemical and physical alterations; maintenance operations including heat or chemical treatment of components of the system; dredging operations and spoil disposal; and wastes disposed of offsite.

B. Existing conditions in the aquatic environment.

C. Effects of the existing discharge on beneficial uses.

D. Predicted conditions in the aquatic environment from planned increased discharge volume.

E. Predicted effects of planned increased discharge volume.

F. An analysis of costs and benefits of various design alternatives.

G. The extent to which intake and outfall structures are located and designed so that the intake of planktonic organisms is at a minimum, waste plumes are prevented from touching the bay substrate or shorelines, and the waste is disposed into an area with the least deleterious effect.

All raw data collected in these studies shall be included as appendices to the report. Applicable data from sources other than this study may be used to complement or corroborate information derived in this study but cannot be used in lieu of any required information. Any such data used must be clearly referenced and copies of the data must be included in the report as appendices.

Each report shall contain the following completed declaration:

> "I declare, under penalty of perjury, that the foregoing is true and correct and contains all data collected during the study.
>
> Executed on the ______day of ___________ at ____________________.
>
> ________________________Signature
>
> ________________________Title"

STUDY PROGRAM

1. Intake and Discharge Sampling

A. The volume and temperature of each cooling water intake and each thermal discharge to the receiving waters shall be continuously measured and recorded in a manner which shall be representative of the true volume and temperature. At least hourly volume and temperature values for each intake and each discharge shall be reported, with periods of heat treatment being prominently noted in the report. Total flow and average temperature for each day shall also be reported.

B. At least daily, thermal addition (BTU) to the receiving waters shall be calculated and reported, with periods of heat treatment being prominently noted in the report. Hourly values of intake temperatures, discharge temperatures, and flow volumes shall be used to compute thermal addition.

C. If wastes other than cooling waters are being discharged, a complete record of the volume and constituents of each along with the times of discharge shall be included in the report.

(BTU)=British Thermal Unit

D. A complete record shall be compiled and reported of species, numbers, and pounds of fish killed during heat treatment and during normal operations.

E. The mean daily intake and discharge temperatures shall be shown as a graph for the entire study period along with the daily range of each.

II. Receiving Water Sampling

A. Station Location

Stations shall be located at the intersection of a grid with axis 500 yards apart. The grid shall be lettered A thru G on the east to west axis and numbered 1 thru 7 on the north to south axis. Stations shall be designated by letter and number. Station F4 shall be located 50 yards south of the end of the jetty (measured from MSL) which separates the intake and discharge channels.

A natural (ambient) temperature station shall be located at a point where water temperatures can be measured and are unaffected by any elevated temperature waste discharge.

This station shall be located 1000 yards due north of the northernmost marker of the entrance to the Coronado Cays boat channel and shall be designated N (Natural).

B. Temperature Measurements of the Water Column

Temperature-depth profiles shall be obtained at high and low tide at each receiving water station during a tidal cycle corresponding to the extreme high and extreme low for the month. Surface temperatures shall be taken within one foot of the surface and bottom temperatures within one foot of the bottom. Vertical temperature measurements between the surface and the bottom shall be made at appropriate intervals to enable plotting of temperature-depth profiles. Temperature-depth profiles shall be graphically presented for each station and shown in comparison with the profile for the ambient temperature station. Within the extent of the area surveyed by the receiving water stations, distribution of temperatures shall be identified graphically by plotting 1°F isotherms. Cross-sectional isotherms shall be plotted for each east-west axis (A thru G) and each north-south axis (1 thru 7). Graphs shall be plotted to scale and shall show distribution for both the high and low tidal conditions for each month separately.

MSL=Mean Sea Level

C. Areal Extent of Temperature Effects

At least monthly, the areal extent of the effects of the thermal discharge shall be determined by infrared radiometer during the same high and low tides of the tidal cycle on which the temperature-depth profiles are obtained. Areal coverage shall be adequate to include all waters which record temperatures of 1°F above natural. Distribution and ultimate reach of temperature above natural in the receiving waters shall be identified graphically by plotting 1°F isotherms ranging from maximum temperature at the outfall to natural water temperatures at the ambient temperature station. Figures shall be drawn to scale and shall show distribution for both the high and low tidal conditions for each month separately.

D. Wind

A continuous record of wind direction and velocity shall be obtained at a location which is representative of that which occurs near the bay surface in South San Diego Bay. Wind roses for each sampling period shall be presented separately along with a composite rose for all sampling periods and a composite rose for each seasonal period.

III. Benthos Sampling

A. Station Location

Benthic stations shall be located on the previously established grid at coordinates A3, A5, B2, B4, C3, C5, D2, D4, D6, E1, E3, E5, E7, F2, F4 and one station in the middle of the intake channel 250 yards northwest of the intake screen; and one station located at the natural temperature station.

B. Sampling Methods

Benthos shall be sampled with a Petersen dredge, Ponar dredge, Van Veen grab or any standard bottom sampling device with a minimum sampling area of 60 square inches (388 cm^2). The same sampling device shall be used throughout the study.

Each sample shall consist of a composite of three random grabs taken at each station. The temperature of each grab shall be taken in the upper 1 cm of sediment and reported separately. Benthic stations shall be sampled quarterly.

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cm^2=square centimeters

C. Sample Analyses

Each sample shall be analyzed separately and the lithological description of the substrate reported. The area (cm^2) and volume (liters) shall be shown for each sample. All plants and animals retained on a 1 mm. mesh screen shall be identified to as low a toxon as possible and enumerated. Where feasible, size frequency distribution shall be shown for large populations and, if possible, their reproductive condition assessed. Appropriate graphs showing the relationship between species frequency and population shall be plotted for all samples and for all stations. Species shall be reported in rank order of abundance and shall show percent frequency of occurrence for each station (three samples combined) and for each study period (all stations combined).

The diversity index (Shannon-Wiener) shall be computed for each station.

To the extent practical, samples shall be stored for future reference.

IV. Intertidal Survey

A. Intertidal surveys shall be conducted at the following locations:

1. On the cooling channel jetty, 250 yards from the discharge on both the intake and discharge sides.

2. On the cooling channel jetty, 1000 yards from the discharge on both the intake and discharge sides.

3. At the end of the cooling channel jetty.

4. South of station F1.

5. Off the point near station C1.

B. Intertidal surveys shall be conducted along transects which are normal to shore at the sampling locations. The samples shall consist of cores approximately 700 cm^2 in area and 20 cm deep taken quarterly during a daylight rising tide across the beach. Three replicate core samples shall be taken haphazardly within 1 meter of the sampling point at each of the following locations: Mean lower low water, mean lower high water and mean sea level. Initial and subsequent sampling runs shall be made as close to the same tidal stage as practical, and complete tidal information shall be submitted for each run.

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mm=millimeter

In rocky or cobble areas, instead of core samples, three one-quarter meter square quadrat samples, 20 cm deep where possible, may be substituted.

For core samples or quadrat samples, temperature shall be measured at the surface (1 cm) 6 cm, 12 cm, and 20 cm depths. The temperature of the bay at the transect intersection shall also be measured.

Intertidal surveys shall be conducted quarterly.

APPENDIX IV

STATE OF CALIFORNIA
THE RESOURCES AGENCY

SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD

RESOLUTION 69 - R3

A RESOLUTION PRESCRIBING REQUIREMENTS FOR THE DISCHARGE OF COOLING WATERS FROM THE SAN DIEGO GAS & ELECTRIC COMPANY SOUTH BAY POWER PLANT INTO SAN DIEGO BAY

WHEREAS, in compliance with the provisions of Section 13054 of the Water Code of the State of California, Mr. C. M. Laffoon, Vice President, did, on August 30, 1968, submit in behalf of the San Diego Gas and Electric Company a Report on Waste Discharge wherein is proposed a discharge of 424,500 gallons per minute of cooling water into San Diego Bay.

WHEREAS this Regional Board has caused the following investigation with respect to the aforesaid proposal to be made:

1. Field inspections of the proposed site and adjacent and downstream areas were made by members of the staff of this Board.

2. Comments and recommendations were requested from all known interested agencies and the following were received and reviewed:

(a) Memorandum from the State Department of Public Health, Bureau of Sanitary Engineering dated October 28, 1968;

(b) Letter from the San Diego County Department of Public Health dated November 4, 1968;

(c) Memorandum from the State Department of Water Resources dated November 4, 1968; and

(d) Memorandum from the State Department of Fish and Game dated November 6, 1968.

3. The following were reviewed by staff insofar as they pertained to the proposed discharge:

(a) Resolution 66-22 of this Regional Board, "A Resolution Setting Forth in Detail Water Quality Control Policy for San Diego Bay."

(b) "Recommendations on Thermal Objectives for Water Quality Control Policies on the Interstate Waters of California, A Report to the State Water Resources Control Board." State Department of Fish and Game, August 1968.

(c) Regional Board staff surveillance records for San Diego Bay.

(d) Information submitted in past years by the San Diego Gas & Electric Company.

(e) "Water Quality Criteria", 2nd Edition, State Water Quality Control Board.

(f) Marine Organisms of South San Diego Bay and the Ecological Effects of Power Station Cooling Water Discharge, prepared for San Diego Gas & Electric Company by Environmental Engineering Laboratory, December 1968.

(g) A Study of the Distribution of Heat Additions to South San Diego Bay, California, prepared for San Diego Gas & Electric Company by Marine Advisors, December 1968.

WHEREAS, on January 13, 1968, tentative waste discharge requirements were submitted to the San Diego Gas & Electric Company with a letter stating that objections thereto would be considered by the Board if submitted at or before the time of this meeting; and

WHEREAS, based upon the foregoing, the Board finds that:

1. The San Diego Gas and Electric Company's South Bay Power Plant is located on the shoreline of San Diego Bay adjacent to the north side of "L" Street, prolonged, in the City of Chula Vista.

2. At the present time, the South Bay Power Plant has three units in operation which have a reported combined electrical generating capacity of approximately 530,000 Kilowatts (KW).

3. Bay water is used for cooling purposes throughout the plant at the present rate of 274,500 gallons per minute (GPM).

4. The temperature of the incoming bay water is raised an average of 12.5 degrees Fahrenheit (^{o}F) in the plant prior to being discharged to the Bay. During peak operating conditions discharge Temperature may be 18.5^{o}F higher than the incoming cooling water.

5. A fourth generating unit with a reported capacity of 230,000 KW is being designed and is expected to be operational by 1971.

6. Usage of bay water for cooling purposes is expected to increase to approximately 425,000 gpm when Unit No. 4 is put into operation. The rise in temperature of the cooling water is expected to remain the same.

7. Boiler slowdown containing relatively small concentrations of water treatment chemicals will be mixed with the cooling water returned to the bay. The total quantity of phosphate discharged to the bay from the operation will be less than 100 pounds per month according to information submitted with the report on Waste Discharge.

8. The cooling water intake and discharge areas are separated by a dike which extends approximately 3600 feet almost due west into the day from the foot of "L" Street prolonged. The cooling water intake is located north of the dike and the discharge is made south of the dike.

9. The purpose of the Dike, which was constructed by the San Diego Gas & Electric Company within their lease boundary, was to provide a cooling channel to reduce the temperature of the discharge so that the temperature of the intake water would not be raised significantly resulting in a loss of cooling efficiency.

10. Acid cleaning of the Boilers is performed approximately every three years, but effluents from this operation are either hauled from the site or are drained to an evaporation basin located at the site.

11. Approximately 100 pounds per day of ferrous sulfate is used for corrosion control purposes.

12. All domestic wastes are discharged into the community sewer system.

13. The discharge is made into Zone 11 of San Diego Bay, as defined in Resolution 66-22 of this Regional Board.

14. Resolution 66-22, a Resolution setting forth in detail Water Quality Control Policy for San Diego Bay, protects Zone 11 of San Diego Bay for uses involving body contact with water, such as swimming, water skiing, diving, boating, etc.; uses which result in food product or additive, such as salt and chemical production, saline water conversion, etc.; uses relating to fish and wildlife propagation and sustenance; Industrial uses; Maritime uses; and uses involving esthetic considerations.

15. Staff of the San Diego Unified Port District has indicated an interest in establishing a bird and wildlife refuge in South San Diego Bay in the vicinity of the South Bay Power Plant. The refuge being tentatively considered would be created by filling 100 acres, more or less, and establishing wetland conditions suitable for bird life. Now, therefore, be it

RESOLVED, That in order to protect San Diego Bay for the beneficial uses enunciated in Resolution 66-22 and summarized in Finding No. 14 above, and to prevent nuisances as defined in Section 13005 of the Water Code of the State of California, this Regional Water Quality Control Board, in accordance with the authority granted by Division 7 of said Code, hereby prescribes the following requirements with regard to the discharge of approximately 425,000 gallons per minute of cooling water (including boiler blowdown) in Zone 11 of San Diego Bay by the San Diego Gas & Electric Company:

1. The discharge shall not impair the beneficial uses of San Diego Bay as enunciated in Resolution 66-22.

2. All industrial wastes, other than cooling water and boiler blowdown, are to be excluded from the discharge.

3. The discharge of domestic wastes, either treated or untreated, into San Diego Bay is hereby prohibited.

4. The discharge shall not reduce the dissolved oxygen concentration below 6.0 mg/l in Zone 11 of San Diego Bay exclusive of the cooling water discharge channel.

5. The concentration of oil and grease in the discharge shall not exceed 0.01 mg/l increase over that of the incoming cooling water.

6. The pH of the discharge shall not be less than 7.5 nor more than 8.5

7. The total amount of phosphate added to the discharge shall not exceed 100 pounds per month, and there shall be no increase in the total nitrogen content.

8. There shall be no measurable increase in the suspended solids concentration in the discharge as compared to the incoming cooling water.

9. Temperature of the discharge shall not average more than 12.5% above that of the incoming bay water, nor shall it at any time exceed 18.5% above that of the incoming bay water, provided that if marine biota of San Diego Bay are altered by temperature changes to the extent that beneficial uses associated therewith are adversely affected, or biota stimulated so as to produce turbid, unsightly or malodorous conditions, temperatures shall be reduced to levels commensurate with satisfactory conditions.

10. The discharger shall submit technical reports concerning the quantity and quality of the discharge in accordance with the following specification and schedule:

SPECIFICATION

Measurement, sample collection and analyses shall be in accordance with "Standard Methods for the Examination of Water and Wastewater", 12th Edition, or edition current at the time of testing, wherever applicable. Determinations, with the exception of field analyses, shall be made in a laboratory certified for the purpose by the State Department of Public Health.

Cooling water and discharge samples shall be representative composite samples. Results of analyses shall be submitted to this Regional Board Monthly.

SCHEDULE

The temperature of the cooling water and discharge shall be continuously measured and recorded and a copy of the log submitted to this Regional Board Monthly.

The cooling water and discharge shall be analyzed monthly for the following constituents:

Grease and Oil	mg/l
Total phosphorus	"
Suspended solids, Total and volatile	"
pH	

A log shall be kept of all chemicals used for cooling and/or boiler water treatment and a copy shall be submitted monthly to this Regional Board.

Dissolved oxygen concentration in the discharge and incoming cooling water shall be determined at least weekly.

The ecological study conducted in 1968 by the San Diego Gas & Electric Company in South San Diego Bay shall be repeated during the second year of operation at the increased discharge rate for the purpose of comparing conditions. The repeat study shall be performed during the same months of the year as the initial study. The repeat study may be modified by the Regional Board upon the recommendation of the Department of Fish & Game. At least two copies of the study report shall be submitted to the Regional Board during the month of January following the study.

During the first year of operation after the increased discharge has been initiated, temperature and dissolved oxygen concentration shall be measured at least monthly in San Diego Bay at least at the following locations as determined from the map submitted with the Report on Waste Discharge.

1. Inlet channel at intake to cooling water lines
2. Center of cooling channel outlet
3. 1500 feet due west of Station 2 above
4. 1500 feet due north of Station 2 above
5. 1500 feet due north of Station 3 above
6. 1500 feet due west of Station 5 above
7. 1500 feet due north of Station 6 above
8. 1500 feet due north of Station 5 above
9. 1500 feet due north of Station 4 above

The temperature and dissolved oxygen concentration shall be measured at the surface, mid-depth, and within one foot of the bottom. Air temperature for each station shall also be recorded as well as the time of the day when the measurements were made. Measurements shall be on both an incoming and outgoing tidel cycle each month, and be it further

RESOLVED, that the discharger be notified that:

1. The above prescribed requirements may be revised from time to time as changes or conditions make necessary such revision.

2. Significant change in point of disposal or characteristics or volume of discharge shall be promptly reported to this Board.

3. The discharger shall grant admission to the premises to members of the staff of this Regional Board at such times as may be necessary in the conduct of their duties in connection with the waste discharge requirements established herein.

4. Before significant physical alterations of South San Diego Bay are made, studies shall be made to determine the effect of such alterations on the thermal distribution of the discharge from the power plant.

5. Section 13001, Division 7 of the California Water Code states:

"No provision of this Division or any ruling of the State Water Resources Control Board or a Regional Water Quality Control Board is a limitation:

(A) On the power of a city or county to adopt and enforce additional regulations not in conflict therewith imposing further conditions, restrictions or limitations with respect to the disposal of sewage or other waste or any other activity which might result in the pollution of water.

(B) On the power of any city or county to declare, prohibit and abate nuisances.

(C) On the power of a state agency in the enforcement or administration of any provision of law which it is specifically permitted or required to enforce or administer.

(D) On the right of any person to maintain at any time any appropriate action for relief against any private nuisance as defined in the Civil Code or for relief against any contamination of pollution."

Be it further resolved, that a certified copy of this Resolution be forwarded by mail to the San Diego Gas & Electric Company and to all known interested agencies or persons who may have need therefor or who may request same.

UNANIMOUSLY approved this 14th day of January, 1969.

/signed/
J. B. Askew, M.D.
Chairman

I hereby certify that the above and foregoing is a full, true and correct copy of Resolution 69-R3 of the San Diego Regional Water Quality Control Board, passed and adopted by said Board on January 14, 1969.

/signed/
Dennis A O'Leary
Executive Officer

APPENDIX V

COOLING TOWER NOISE

Tables 4 and 5 are results of tests performed by the Marley Corporation on the noise produced by cooling towers. Table 4 results are for four cells or more.

TABLE 4

NOISE PRODUCED BY MECHANICAL DRAFT TOWER
(In Decibels (db)

	Octave Band Frequency							
	1	2	3	4	5	6	7	8
LOCATION	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
100 Feet from Louver Face	72	71	69	68	64	60	53	55
400 Feet from Louver Face	63	62	60	59	55	51	44	46
100 Feet from Cased Endwall	63	60	59	54	50	43	32	34
400 Feet from Cased Endwall	54	51	50	45	41	34	23	25

Note:
At distances greater than 1600 feet, the ambient noise dominates.

TABLE 5

NOISE PRODUCED BY NATURAL DRAFT TOWER
(In Decibels (db)

	Octave Band Frequency							
	1	2	3	4	5	6	7	8
DISTANCE in feet	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
50	60	58	59	61	64	65	68	69
100	59	57	57	56	59	61	63	63
200	58	56	52	54	57	58	59	56

APPENDIX VI

REFERENCES FOR PLANKTONIC ORGANISM DISCUSSION

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