BASIS OF DESIGN FOR SOLID WASTE DISPOSAL NAVAL AIR STATION ALAMEDA, CALIFORNIA

HLA Job No. 2176,046.01
Contract No. N62474-80-C-9053

Prepared for

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Naval Facilities Engineering Command
San Bruno, California 94066

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I INTRODUCTION

A. General

This plan addresses the solid waste disposal site at the Naval Air Station in Alameda, California. It is prepared on behalf of the U.S. Navy's Western Division Naval Facilities Engineering Command (WESDIV) under Contract (N62474-80-C-9053), Fiscal Year 1982 MCON Project P-183.

The plan is directed toward satisfaction of the California Regional Water Quality Control Board (CRWQCB) Resolution No. 77-7, "Minimum Criteria for Proper Closure of Class II Solid Waste Disposal Sites". Applicable regulations considered in preparing this plan include Title 40, Code of Federal Regulations Part 241 and Executive Order 11752, the California Solid Waste Management and Resource Recovery Act, and the Alameda County Division of Environmental Health Permit.

B. Site Description

The Naval Air Station solid waste disposal occupies approximately 110 acres at the Air Station's southwest corner. Prior to 1956, this area was under 15 to 20 feet of water and underlain by 40 to 50 feet of soft silt and clay commonly known as bay mud intermingled with layers of sand. Filling began in 1956 with the construction of a seawall on the south and west sides and hydraulic placement of 15 to 20 feet of sand fill. Following the initial filling, dredged slurry was added in the southwest portion of the site (approximately 41 acres). The liquid portion of the slurry was decanted over two weirs that discharged through the west seawall. In the remainder of the site, sand was excavated to a depth of 10 to 20 feet and replaced as a mixture of sand and solid waste fill from the Air Station.

Disposal of refuse ceased in 1978 and the landfill area is presently covered with approximately 1 to 3 feet of sandy soil. The site slopes from about Elevation 120* in the southeast portion to Elevation 110 at the northwest side. The dredged slurry portion has a 400-foot-diameter depressed area at about Elevation 108. The landfill's surface is generally uneven and covered with natural grasses and weeds; some unpaved access roads traverse the area. Occasional refuse daylights through the thin cover soils.

During recent years of operation, solid waste at the landfill was limited to Class II and III material. However, during the early years (when no records were kept), various Class I items were disposed. Asbestos concrete pipe sections and/or asbestos-coated pipe were disposed at random throughout the site within the recorded past. According to Naval Air Station personnel, the total amount of this material did not exceed 1000 pounds.

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*All elevations are in feet using Naval Air Station Datum of Mean Lower Low Water plus 101.2 feet.

The zone within 750 feet of the adjacent runway centerline, as shown on Drawing No. SK-2, is a restricted air space for any structure above Elevation 115. Beyond 750 feet, the air space limit rises one foot vertically for every seven feet horizontal.

C. Background

In 1977 and 1978, Harding-Lawson Associates (HLA) performed a study entitled "Sanitary Landfill Site Study, Naval Air Station, Alameda, California," Contract N62474-76-C-7543. The study's purposes were to review the landfill's compliance with State and Federal regulatory guidelines; to evaluate the possible migration of landfill gases to adjacent areas; and to evaluate the seepage of subsurface water into San Francisco Bay. The scope of work included drilling test borings, installing observation wells, monitoring water quality and gas generation, laboratory testing, and analyses of information obtained. For borehole locations and logs, see Drawing SK-2.

Harding-Lawson Associates scope of work, under the present contract, is to design a closure plan and prepare construction plans and specifications for disposal of dredged spoils on the site. A concept study was presented to WESDIV on April 28, 1980, which reviewed closure design concepts and addressed two alternatives: (1) close the site conventionally with three feet of earth cover or (2) close it as a dredged material disposal site. On the basis of the concept study, the dredged material alternative was selected.

II DESIGN CONCEPT

A viable design concept is to use 104 acres of the 110-acre area for disposition of material from maintenance dredging operations at the nearby Naval Air Station ship channel, turning basin, and pier area. Three acres in the northeast corner of the landfill are within the air space encroachment zone and will be excluded for dredged disposal. This area and the northwest corner of the landfill will be covered in a conventional manner, as discussed in the next section.

Drawings SK-2 through SK-9 show the planned construction. The entire existing 69-acre landfill site would be stripped of grass and brush and covered with one foot of compacted low permeability material obtained from the existing dredged material pond. Sixty-three acres of the refuse fill area and all 41 acres of the existing dredge disposal area will be surrounded by dikes with a top elevation of 126 feet (approximately 10 to 14 feet high). This will provide a capacity for approximately 1 million cubic yards of dredged materials. Increased future capacity could be provided by raising the dikes using dried dredged materials.

A. Disposal Pond Operation

Design of the dredged disposal area is directed toward a steady-state discharge operation; that is, the site is large enough to allow sufficient settling of the dredged slurry's solid portion and allow a steady discharge of the clear liquid portion. This water will be discharged through a single metal pipe weir into an existing 42-inch storm drain outfall along the landfill's east boundary, as shown on Drawing SK-2.

The discharge point of the slurry would be into the present dredged spoil borrow area (outside the limits of refuse). This would result in the more permeable soils settling in this area and the less permeable soils settling over the landfill. Existing weirs will be filled with lean concrete and left in place.

B. <u>Surface Erosion</u>

The flat surface of dredged material will not be subject to erosion. The perimeter dike slopes will be planted with grass cover to minimize erosion.

C. <u>Settlement</u>

The entire landfill site will settle; however, the amount of settlement will vary depending on the thickness and composition of refuse, thickness of underlying bay mud, and thickness of new fill or dredged spoil. Settlement variations are not expected to be abrupt and should not result in cracking of the ground surface.

The debris fill will compress as dredged spoil is placed. The magnitude of this settlement is difficult to estimate because of the nonhomogeneity of the refuse. However, engineering judgment and past experience indicate that this settlement will be on the order of about one foot. It will be relatively rapid and should not be considered in regard to long-term settlement. Decomposition of organic matter in the land-fill debris will result in long-term surface settlement, which we estimate to be on the order of one foot or more. Consolidation of the bay mud is occurring due to the existing landfill weight and additional consolidation settlement will result from the load of the new dredged fill. The computed settlement from both fill loads will be on the order of about three feet over a period of approximately 30 years.

D. Usable Ground-Water Protection

Usable ground-water aquifers in the vicinity of the Air Station landfill are artesian and occur in the lower sections of the Alameda formation (located beneath the bay muds). They are protected from intermingling with the landfill subsurface water by the relatively impervious bay mud underlying the site and the impervious upper portions of the Alameda formation.

E. Future Site Use

The site life for placement of dredged spoil could be extended for about one more application of dredged material by raising the perimeter dikes. After filling operations are completed, the final surface would be graded to drain through the weirs into the storm drain system. No additional uses of the site are planned once filling is complete.

III DETAILED PLANS

This section presents information on detailed portions of the work as listed below:

	Specification	Item
A.	02201 -	Impervious Blanket
B.	02201 -	Disposal Dike Embankments
C.	05500 -	Decant Tower and Weirs
D.	02200 -	Methane Gas Control
E.	02200 -	Seepage Control Trench
F.	02883 -	Seawall Repair

A. 02201 - Impervious Blanket

The existing landfill area has an average of about one foot of sandy soil cover. Plans include placement of a one foot compacted impervious soil layer over the sandy soil throughout the site. This soil cover will be obtained from the existing dredged spoil area and will be comprised of slightly sandy bay mud.

The area has been intensely explored by excavating test pits and hand drilled auger holes to determine the extent of the clayey and sandy soils. Bulk samples from these explorations were tested in our laboratory for their physical properties. Our laboratory tests indicate that this material (compacted to 90 percent relative compaction*) has a coefficient of

*Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, as determined by the ASTM D1557-70(C) test procedure.

permeability on the order of 1 x 10^{-6} centimeters/second. An additional foot of soil cover will be placed outside the area diked for dredge slurry to meet the three-foot cover requirement.

Dredging operations will result in the deposition of additional cover material within the dikes consisting of both relatively impervious bay muds and more permeable sands. Eventually, eight feet or more of dredged material will be placed.

B. <u>02201 - Disposal Dike Embankments</u>

The landfill area does not contain refuse fill slopes within the confines of the seawall. HLA has performed stability analyses on the perimeter seawall; the results indicate a static factor of safety against slope failure of about 1.7. Under a pseudostatic seismic acceleration of 0.1g, the factor of safety reduces to near 1.0. During strong seismic shaking from a moderate earthquake the seawall may move laterally several feet toward the Bay. This deformation would be characterized by cracks behind the seawall and some subsidence, as would be typical of many similar structures throughout the San Francisco Bay Area. However, this deformation can be relatively easily repaired.

The proposed dikes to retain dredged spoil material will be set back from the top of seawall about 50 feet such that they will not significantly reduce seawall stability. The disposal dike embankments will be approximately 7750 feet in length, averaging 13 feet in height, and will have 2 to 1 horizontal to vertical side slopes.

The dike will be constructed of random material from the southwest corner of the site. These materials are composed of clayey soils from previous dredging operations.

Slope stability analysis indicate that the dike slopes would be stable under all conditions.

C. 05500 - Decant Tower

During dredging operations a single tower will be used for decanting water. Once dredged spoil placement operations are completed, the weir will be converted to a storm drain to allow draining of collected rainfall. The decant tower and weir system consist of a single steel tower, 14 feet in height with two 4-foot-long removable wooden weir sections, and a 36-inch steel discharge conduit. The shell of the tower consists of 1/4 inch steel rolled plate. Structural stability is maintained with 1-1/4 inch extra strong pipe supports at 1-foot centers the full height of the tower. These pipe struts are also used as a ladder for easy access to the weir boards. The weir boards are 3"x6"x4' long for ease of handling and still maintain sufficient structural strength to resist bending under full hydrostatic head.

The reasons for selecting this design were as follows:

1. The eight-foot overflow section allows a low approach velocity of about 1 foot/second when one 16-inch pipe dredge is used. At higher

approach velocities, turbulence can occur which results in turbid overflow conditions.

2. A single overflow tower was selected over multiple towers to reduce initial costs, reduce labor and maintenance requirements during operations, assist in simplifying the drainage pattern during dormant periods, and ease renewal of the facility during subsequent dredging operations.

3. A steel fabricated decant tower was selected because of lower capital cost, ease of construction, and primarily because the tower will adjust to field conditions resulting from anticipated settlements without loss of structural integrity.

D. 02200 - Methane Gas Control

Methane gas is and will continue to be generated in decreasing amounts at the landfill site. Due to the thin pervious cover material, most of the gas is migrating vertically through the refuse and cover into the atmosphere. Methane gas readings taken during this and our previous study in the ammunition bunkers on the north and east sides of the fill have only recorded minute traces of methane. However, when the site is covered and dredged spoil material is placed, vertical migration will cease and the gas will migrate laterally.

To prevent lateral migration of methane to the north and east, a continuous gas vent will be installed along these sides of the landfill. A detail of the gas vent system is shown on Drawings SK-5 and SK-9. The vent will consist of a gravel-filled trench about 18 inches wide and extending to the groundwater level. A 20 mil PVC membrane will be installed on the outside wall of the trench to prevent gas from migrating through the surrounding porous sandy soils. Four-inch-diameter perforated plastic pipe will be installed vertically at about 50-foot intervals and extend approximately 10 feet above grade with an open top for venting. The top foot of the trench will be backfilled with an impervious cap to prevent surface water infiltration.

Subsequent methane gas readings will be obtained in the bunkers. If periodic readings indicate an increase in concentration, the methane gas venting system can be converted to an active system by installing a vacuum pump and gas burn off equipment.

E. <u>02200 - Seepage Control Trench</u>

Surface water infiltration occurs readily through the existing sandy cover. The placement of one foot of compacted impervious cover will virtually eliminate all infiltration, either due to rainfall or dredging operations. In addition, the dredge slurry deposited within the refuse disposal area will contain predominantly fine-grained particles which when dewatered will have a low permeability and will provide additional protection against infiltration.

HLA's previous study indicated that a relatively small amount of water is seeping from the site (estimated to be about two gallons per day per foot of seawall). Water quality of the seepage was monitored and found not to be significantly lower in quality than that of the adjacent Bay. This seepage results both from surface infiltration and subsurface water flow from the northeast toward the southwest corner of the landfill.

The location of 10 perimeter ground-water monitoring wells drilled during our previous study are shown on Drawing SK-2. These wells will most likely be destroyed when the perimeter levees are constructed. Replacement wells will be constructed to allow continued monitoring as required by the CRWQCB.

To prevent the seepage of leachate from the northwest portion of the landfill a bentonite slurry trench will be constructed in the area. A seepage control system will be installed by mixing bentonite* with the local sandy soils. Bentonite can be easily mixed with bay water and placed in a holding pond on-site for hydration prior to placing in the slurry trench. The trench must remain filled with the bentonite slurry at all times during excavation and backfill. A trench 2 feet in width is sufficient to develop an impervious barrier. During backfill of the trench a mixture of 5 percent bentonite by weight and sand will be placed in the trench. This method will require a minimum of sophisticated equipment and will maintain the integrity of the trench during construction. Addition of cement to the mixture is not required as increased strength is not required for the cutoff.

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*The bentonite slurry method was selected over other methods on the basis of least cost and best sealing characteristics.

The placement of a plastic PVC membrane was considered as a viable alternate with comparable costs to the slurry trench; however, after review of the drill logs and estimation of the depth required for an effective impervious barrier, it was concluded that it would be impossible to maintain an open trench during the time period required to install the membrane.

F. 02883 (CSI) - Seawall Repair

U.S. Army Corps of Engineers data indicate that the 100-year high tide at Alameda Naval Air Station is 6.4 feet above Mean Sea Level or about Elevation 110.6 Naval Air Station Datum. Waves generated by sustained strong winds will be on the order of 5 feet on the south side and 3 feet on the west side. The combined effects of the 100-year flood tide and waves generated by sustained strong winds suggest a minimum elevation of 115.6 feet for the south seawall and 113.6 feet for the west seawall.

The existing seawall has settled with time due to consolidation of the underlying bay mud and localized areas of the slope protection are in need of repair. Present seawall crest elevations are approximately 112 feet on the south side and between 109 and 112 feet on the west side. Repairs and additions to the seawalls to raise their crest height will result in minor long-term settlements due to consolidation of the underlying bay muds.

The toe of slope for the dredge dikes will be placed a minimum of 50 feet from the crest of the existing seawall for slope stability reasons. The sands available at the site appear to assume natural beach slopes of from 4 to 6 percent depending on their grain sizes. If the south seawall is raised approximately 1.5 feet to Elevation 113.5 and a 5 percent beach slope is maintained from the seawall crest to the toe of the dredge dike at approximately Elevation 116.0, no additional armor rock protection is necessary. If waves should break over the top of the seawall at Elevation 113.5, the water would run up on the sandy "beach" behind the seawall and little or no erosion is anticipated.

Raising of the south seawall will consist of placing a layer of rubble 18 inches thick by 10 feet wide of angular stone or broken concrete along the crest of the seawall. The material will have a minimum of 50 percent of the angular rock having a weight of at least 500 pounds.

On the west side of the solid waste disposal area it is estimated that an elevation of 111.5 feet would be required at the seawall to maintain a 5 percent beach slope up to the toe of the dike at about Elevation 114 feet. It is estimated that 50 percent of the west dike is at Elevation 109; therefore, about 2.5 feet of rubble fill similar to the material described above would be required in these areas. No work would be required where the existing seawall is above Elevation 111.5 feet.

IV ILLUSTRATIONS

SECTION IV – ILLUSTRATIONS

DRAWING SK-1 – SOLID WASTE DISPOSAL SYSTEM TITLE PAGE

BASIS OF DESIGN FOR SOLID WASTE DISPOSAL

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SECTION IV – ILLUSTRATIONS

DRAWING SK-2 – SOLID WASTE DISPOSAL SYSTEM GENERAL PLAN

BASIS OF DESIGN FOR SOLID WASTE DISPOSAL

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SECTION IV – ILLUSTRATIONS

DRAWING SK-3 – SOLID WASTE DISPOSAL SYSTEM PLAN – NORTHEAST QUADRANT

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SECTION IV – ILLUSTRATIONS

DRAWING SK-4 – SOLID WASTE DISPOSAL SYSTEM PLAN – SOUTHEAST QUADRANT

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FOR SOLID WASTE DISPOSAL

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SECTION IV – ILLUSTRATIONS

DRAWING SK-5 – SOLID WASTE DISPOSAL SYSTEM PLAN – NORTHWEST QUADRANT

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SECTION IV – ILLUSTRATIONS

DRAWING SK-6 – SOLID WASTE DISPOSAL SYSTEM PLAN – SOUTHWEST QUADRANT

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SECTION IV – ILLUSTRATIONS

DRAWING SK-7 – SOLID WASTE DISPOSAL SYSTEM CROSS SECTIONS

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SECTION IV – ILLUSTRATIONS

DRAWING SK-8 – SOLID WASTE DISPOSAL SYSTEM WEIR SECTIONS AND DETAILS

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SECTION IV – ILLUSTRATIONS

DRAWING SK-9 – SOLID WASTE DISPOSAL SYSTEM SECTIONS AND DETAILS

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