APPENDIX J

FINAL CLOSURE AND POST-CLOSURE MAINTENANCE PLAN

for the

BRISBANE LANDFILL
Brisbane, California

for

SUNQUEST PROPERTIES, INC.
150 Executive Park Blvd., Suite 4200
San Francisco, California 94134

Burns & McDonnell
SINCE 1898

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Prepared by

Burns & McDonnell Engineering Company, Inc.

Project No. 23680

OCTOBER 2002

SIGNATURE PAGE

This *Final Closure and Post-Closure Maintenance Plan, Brisbane Landfill, Brisbane, California,* dated October 2002 was reviewed and approved by:

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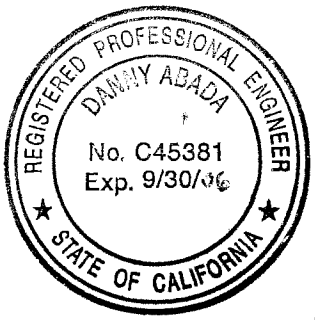
Program Manager



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1.0 INTRODUCTION

1.1 BACKGROUND

The Brisbane Landfill is located in San Mateo County, within the City of Brisbane, California. The entire landfill (See limits of refuse in Figure 1) consists of approximately 364 acres and has not received waste since 1967. In keeping with solid waste management practices of the time, an undocumented soil cover was placed over the landfilled areas after waste disposal operations ceased. As shown in Figure 1, the majority of the landfill property is owned by Sunquest Properties, Incorporated (Sunquest). Sunquest also owns the land immediately west of the landfill. This area, known as the Railyard Area because a railyard was formerly located there, is also shown on Figure 1 for reference.

The portion of the landfill currently owned by Sunquest is referred to as "the site" throughout the remainder of this document. The site is currently used for soil and aggregate materials recycling operations and non-irrigated open space. The land use of other parcels within the landfill footprint, but not owned by Sunquest, include commercial, industrial, and open space. Sunquest proposes new development for the site in phases over a period of several years. The proposed development will be mixed use, and may include commercial, retail, roadways, and open space areas.

1.2 REGULATORY REQUIREMENTS

Given the time period when closure occurred (1967) and Sunquest's current site uses, the Brisbane Landfill's existing cover does not need to be upgraded to conform to the additional closure requirements in Title 27 of the California Code of Regulations (27 CCR). However, Sunquest's proposed new development of the site constitutes "new post-closure activities that may jeopardize the integrity of previously closed disposal sites or pose a potential threat to public health and safety or the environment" (27 CCR 21100). Therefore, the closure and post-closure maintenance standards for disposal sites and landfills in 27 CCR 21100 through 21200 are applicable to any portions of the site that will be developed.

In addition, Order No. 01-041, adopted by the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB) in April 2001, constitutes final Waste Discharge Requirements (WDR) for the Brisbane Landfill (See Appendix A). The WDR includes a requirement that a Development Proposal will be prepared and submitted at least 60 days prior to the commencement of the construction of each individual development proposed for the landfill. The WDR also requires the placement of a Title 27-compliant cap over the entire development area.

1.3 PURPOSE AND SCOPE

The purpose of this Final Closure and Post-Closure Maintenance Plan is to propose Title 27 CCR compliant closure and post-closure activities that are commensurate with the proposed development of the site. Although the property will be developed in phases over an extended time period, this plan addresses ultimate site-wide closure. The detailed plan for each individual development will be submitted to the RWQCB as part of the Development Proposal required by the WDR for each development.

* * * * *

2.0 SITE DESCRIPTION

2.1 SITE LOCATION

The Brisbane Landfill is located in an area that was formerly part of the San Francisco Bay. The former Bayshore Railyard, located adjacent to the west side of the landfill, is also situated on fill that was once part of the San Francisco Bay. The landfill now consists of approximately 364 acres of reclaimed land on the eastern shore of the San Francisco peninsula in the city of Brisbane in San Mateo County, California. Brisbane Landfill is located approximately six miles south of downtown San Francisco in Township 3S, Range 5W, Section 3, Mount Diablo baseline and meridian. This landfill operated between 1932 and 1967 (Kleinfelder, 1992), when refuse from the City and County of San Francisco was received for disposal.

Information regarding the extent of the landfill footprint was previously compiled (Geosyntec, 2000a) and is shown in Figure 1. The western extent of the landfill footprint terminates just east of the Caltrain/Joint Powers Board rail line. The southwest portion of the landfill footprint extends into the nearby above-ground tank farm. The northern portion of the landfill footprint extends north of Beatty Avenue. The eastern edge of the landfill is separated from the San Francisco Bay by U.S. Highway 101, located on Caltrans easement. U.S. Highway 101 was constructed on engineered rock and soil fill imported from the area currently occupied by Candlestick Park (Kleinfelder, 1992). After completion of Highway 101 in 1955, the Brisbane Landfill became isolated from direct wave action from the Bay. Limited hydraulic communication beneath the freeway still occurs through a culvert under the highway embankment. The southern edge of the refuse is separated from the Guadalupe Canal (also referred to as Brisbane Lagoon) by an earthfill dike. A jet fuel pipeline parallels the lagoon shoreline, between the earthfill dike and Lagoon Way. This underground pipeline reportedly carries fuel from the above-ground tank farm to the San Francisco airport.

Two public roads are currently used within the landfill: Tunnel Avenue and Lagoon Way. Tunnel Avenue is a paved, two-lane roadway that trends north-south along the western portion of the site. Lagoon Way, located in the southern portion of the site, is an east-west paved two-lane

roadway that connects Tunnel Avenue with U.S. Highway 101.

The site (Sunquest's proposed development area) lies entirely within the footprint of the Brisbane Landfill but is bounded by the Sunquest property line (See Figure 1). Area inside the landfill footprint but outside of the proposed development includes portions of the above-ground tank farm located in the southwest part of the landfill, property north of Sunquest's north property line in the area of Beatty Avenue, and a small parcel of land on the southeast side of the landfill adjacent to U.S. Highway 101.

2.2 EXISTING SITE USE

Currently, two recycling companies are operating on Sunquest property within the former Brisbane Landfill. Both act as repository locations for inert waste materials from excavation and demolition projects. Brisbane Recycling Company operates a concrete recycling operation in the northern portion of the site. Ryan Engineering operates as a soil recycler in the southern portion of the site. Several buildings associated with the recycling operations are located on the northern portion of the site.

2.3 SITE TOPOGRAPHY

The site topography is shown on Drawing 1, and is based on a recent fly-over conducted on April 19 and June 27, 2000 (David Evans & Assoc., 2000). The ground surface elevation for the 35-acre parcel located between Tunnel Avenue and Caltrain rail tracks is approximately 7 feet mean seal level (msl), and is generally lower than the rest of the site (Woodward-Clyde, 1998). Soil cover is currently being added to this area and the area between Lagoon Way and the lagoon shoreline to increase cover thickness.

Numerous soil stockpiles have been placed around the landfill as part of the on-going recycling operations. Elevations range from near sea level along the southern boundary of the site to approximately 65 feet msl at the top of some of the soil stockpiles located in the north central portion of the site.

The central portion of the site is generally sloped toward a central drainage channel that trends roughly west to east. The southern portion of the site generally slopes to the south, toward the Brisbane Lagoon. The northern portion of the site undulates with no apparent general slope direction.

2.4 SITE DRAINAGE

Site drainage is characterized by sheet flow across the unimproved surface of the earthen cap, and is generally controlled by engineered basins, storm drains, or other structures. In general, storm water from the northern two-thirds of the property flows southward to a central drainage channel that bisects the landfill. This central drainage channel also receives storm water discharge from the railyard and other off-site areas west of the railyard. Flow from the drainage channel discharges easterly towards the San Francisco Bay and appears to be tidally influenced.

Surface drainage in the southern portion of the site flows south, toward Brisbane Lagoon. A small portion along the northwestern side of the site drains to the Beatty Avenue storm drain.

2.5 GEOLOGIC CONDITIONS

2.5.1 Regional Geology

The site is located on the San Francisco Peninsula which lies within the Coast Range Geomorphic Province of northern California (Norris and Webb, 1976). This province is characterized by a series of mountains and valleys that roughly parallel the northwest trending coastline of California.

The San Francisco Peninsula is underlain by bedrock consisting of the Franciscan Formation. The Franciscan Formation is a melange containing a heterogeneous combination of sandstone, siltstone, chert, and volcanic rock originating on the ocean floor and serpentinized ultramafic rocks in a sheared shale matrix (Kleinfelder, 1992). In addition, minor areas of limestone and intensely metamorphosed rocks are present. These rock types have been mixed together by tectonic activity during and after their origin.

Sediments within and on the margins of the Bay are derived from materials eroded from nearby highlands following uplift and tilting of the bedrock (Kleinfelder, 1992). These sediments are broadly divided into three units differing in strength and degree of consolidation. These three units are locally known as Bay Mud, aeolian/alluvial sands and Old Bay Clay.

Overlying the Franciscan bedrock, Old Bay Clay typically consists of marine deposits of clay with lenses of sandy clay, sand, and gravel. This clay is typically stiff to very stiff, and overconsolidated. Usually present in the geologic profile, the Old Bay Clay may be as much as 200 feet thick. In some areas, the thickness is highly variable due to erosion of its surface and/or irregularities on the top of the underlying Franciscan bedrock.

Aeolian and alluvial sands were deposited on top of the old bay clay during periods of lowered sea level. The sand unit tends to be dense and relatively incompressible. Where present, the sand unit may be up to 50 feet thick (Kleinfelder, 1992).

Bay Mud is a relatively recent marine deposit of highly compressible silty clay that contains considerable amounts of organic materials, commonly with lenses of shells, silt, and sand (Kleinfelder, 1992). In general, this deposit is soft to firm and normally consolidated. The thickness of the Bay Mud deposit ranges from 120 feet beneath San Francisco Bay to as little as one foot at the Bay margins.

The San Francisco Bay area is seismically active. Seismicity in the area is dominated by the San Andreas Fault, the Hayward Fault, and the Calaveras Fault systems. Smaller faults in the vicinity of the former Brisbane Landfill include the San Bruno Fault, the Hillside Fault, and the City College Fault (Kleinfelder, 1992).

2.5.2 Site Geology

The site is located on the eastern shore of the San Francisco Peninsula and consists of reclaimed land. The site overlies a depression in the bedrock which is partially filled with deposits of Old Bay Clay, sand, and Bay Mud, which has been covered with man-made fill consisting of soil and

refuse (Kleinfelder, 1992). The refuse was placed directly over the Bay Mud and has been covered by a soil cover of varied depth.

Depth to bedrock at the site ranges from surface outcrops near the tank farm at the southwest corner of the site to greater than 250 feet below msl in the eastern portion of the site near U.S. Route 101. Old Bay Clay was encountered beneath the site at a depth 103 feet below msl. The sand layer above the Old Bay Clay was not fully penetrated by deep well construction, but was found to be at least 20 feet thick (Kleinfelder, 1992).

The depth to Bay Mud ranges from 5 feet below msl near the southeastern corner of the lagoon shoreline, to depths between 10 and 20 feet below msl across the majority of the site. The depth to Bay Mud increases in the central portion of the site to depths exceeding 25 feet below msl (Burns & McDonnell, 2001). The thickness of Bay Mud ranges from less than 10 feet near the tank farm at the southwest corner of the site to greater than 60 feet near the southeast corner of the site. Laboratory tests performed on samples of the Bay Mud indicated permeability in the range of 10^{-7} to 10^{-8} centimeters per second (Kleinfelder, 1992).

The elevation of the top of refuse over most of the site ranges from 2 to 10 feet msl (See Figure 2). At a few isolated locations on the southern part of the site and along the central drainage channel, top of refuse was encountered at or below msl. On the north part of the site, the top of refuse peaked at several locations, with a maximum top of refuse elevation of 16 feet above msl. Comparing top of refuse and top of Bay Mud elevations over the site, refuse thickness varies between a few feet at the southern edge of the site to over 35 feet in some locations on the northern part of the site (Burns & McDonnell, 2001).

Similarly, soil cover over most of the site exceeds 10 feet, but varies from a few feet on the site boundaries to greater than 30 feet in some interior locations (Burns & McDonnell, 2001). Since most of the cover soil was not placed as engineered fill, the quality of the cover soil is likely to be highly variable.

2.6 HYDROGEOLOGIC CONDITIONS

2.6.1 Regional Hydrogeologic Conditions

Regional groundwater recharge occurs from runoff from the higher slopes of San Bruno Mountain as it is channeled into Visitacion Valley near the northern portion of the landfill, and into Guadalupe Valley at the southern portion of the site. Both of these alluvial channels trend eastward toward the Bay. Groundwater recharge occurs from surface water infiltration as the runoff enters the valleys and flows toward the Bay. This recharge may be limited due to the high degree of urbanization in the two valleys (HCI, 1989). On a regional scale, the highest groundwater conditions occur during the rainy season, and groundwater flow is generally to the east (HCI, 1989).

2.6.2 Site Hydrogeologic Conditions

Two water-bearing units are present beneath the landfill; the shallow groundwater and the deep groundwater zones. The Bay Mud separates the two zones. The shallow groundwater is present in the fill materials located above the Bay Mud, and the deep groundwater exists in the aeolian and alluvial sandy deposits located beneath the Bay Mud layer.

In the Railyard Area located west of the landfill, similar water-bearing units have been reported. The two units appear to be hydraulically separated throughout the majority of the Railyard Area by 10 to 15 feet of Bay Mud, which acts as a confining layer or aquitard (Burns & McDonnell, 1999).

2.6.2.1 Groundwater Level Data

2.6.2.1.1 Shallow Groundwater

Shallow groundwater level data obtained in July 2000 is summarized in the groundwater level contours shown in Figure 3. The shallow groundwater flow is towards the central drainage channel in the central part of the site. In general, the upper 3 to 6 feet of soil beneath the channel consist of recently deposited highly organic and plastic, silty to sandy clays. The flow of groundwater into the central drainage channel appears to be inhibited by these clayey materials

that form the channel bottom (Burns & McDonnell, 2002). Shallow groundwater flows also are towards Guadalupe Lagoon in the south and San Francisco Bay in the eastern and northern portions of the site. Comparing the 2000 groundwater surface elevations (Figure 3) with the top of refuse elevations (Figure 2) indicates that the shallow groundwater lies almost entirely within the landfill refuse. Therefore, the shallow groundwater at the site can also be considered as leachate.

Historical shallow groundwater surface elevations correlate fairly well with the recent data. Kleinfelder (1992) reported that the groundwater surface ranged from approximately 5 feet above msl at the intersection of Beaty Avenue with Tunnel Road to 3 feet below msl. The ground water elevations in 1995 ranged from approximately 7 feet above to 8 feet below msl (SCS Engineers, 1995).

2.6.2.1.2 Deep Groundwater

In 1991 and 1992, elevations of the deep groundwater surface ranged from approximately 11 feet above msl close to the intersection of Beaty Avenue with Tunnel Road to 7 feet above msl near the southeastern landfill boundary. In seven of eight nested well pairs evaluated over four quarters beginning in August 1991, water level elevations in the deep wells ranged from 4.10 to 13.83 feet above water elevations in the corresponding shallow wells. Deep groundwater was reported to have a flat gradient of 0.0006 feet/foot to 0.001 feet/foot and generally flow southeast towards the San Francisco Bay and Guadalupe Lagoon (Kleinfelder 1992). The hydraulic conductivity values for the deep groundwater were estimated through hydraulic testing to be 10 to 15 feet/day (Levine-Fricke, 1990).

2.6.2.2 Tidal Influence

Kleinfelder (1992) studied the influence of tidal changes on water levels in deep and shallow groundwater monitoring wells in 1987 and 1991. The purpose of these tidal studies was to evaluate the hydraulic communication between groundwater and the San Francisco Bay. In 1987 water levels were monitored continuously using automated equipment for 20 to 48 hours in 20 interior monitoring wells. Sixteen of the wells were screened in the shallow groundwater and six

of the wells were screened in the deep groundwater. The study concluded that only one deep groundwater well was influenced by tides and, therefore, both the shallow and deep groundwater generally were not hydraulically connected to the San Francisco Bay. In 1991, following the installation of the perimeter wells located to the east and south of the landfill boundary, the second tidal study was conducted by monitoring the water levels in one shallow and one deep groundwater well for a period of 18 hours. The study concluded that the shallow groundwater was not in hydraulic communication with the San Francisco Bay and that the deep groundwater, at least in the vicinity of the tested well, appeared to have some discharge to the San Francisco Bay.

2.6.2.3 Groundwater Use

Bodies of water and their potential uses are presented in the San Francisco Bay Regional Basin Plan (RWQCB, 1995). The RWQCB classifies groundwater in the San Mateo Plain (Department of Water Resources Basin No. 2-9A) with the following existing and potential beneficial uses:

- Existing beneficial uses identified were municipal and domestic water supply, industrial process water supply, and industrial service water supply.

- Potential beneficial use identified was agricultural water supply.

However, the site's shallow groundwater occurs in fill, and no current or anticipated future use of this groundwater exists.

2.7 SURFACE WATER

Surface waters in the vicinity of the landfill include the central drainage channel; the Guadalupe Lagoon; and, across U.S. Highway 101, the San Francisco Bay. All are tidally influenced.

The central drainage channel is an open trapezoidal earth channel. The central drainage channel serves as the main surface water drainageway for the site, and it also receives surface water runoff from other areas. The 840-acre Bayshore drainage basin that includes portions of Daly

City and Brisbane ultimately discharges to San Francisco Bay via the central drainage channel. Storm water run-off in the Bayshore basin is collected by an underground pipe network in Daly City that ultimately discharges to the central drainage channel (Brian Kangas Folk, 1992). Much of the surface drainage from Visitacion Valley passes to the north of the landfill and exits through a culvert beneath the freeway into San Francisco Bay. However, a portion of the drainage from Visitacion Valley also flows to the adjacent former railyard and then on to the central drainage channel (HCI, 1989). During high tidal stages, Bay water appears to enter the channel, and during the tide's ebb, the channel drains to the Bay. Previous observations along the channel at low tide indicate the presence of small seeps of liquid through the channel walls. Sunquest has submitted and the RWQCB has approved a work plan for the mitigation of the central drainage channel in compliance the WDR.

The Guadalupe Lagoon is connected to the San Francisco Bay via a culvert beneath U.S. Highway 101. The lagoon receives surface drainage from the Guadalupe Valley, a west-east trending valley of approximately 1,300 acres (Brian Kangas Folk, 1992). Sunquest has submitted a work plan to the RWQCB for the mitigation and long-term containment of lagoon perimeter leachate seeps in compliance the WDR.

The area is designated as the Lower San Francisco Bay in the South Bay Basin (Basin 4) of the Water Quality Control Plan for the San Francisco Bay Basin (RWQCB, 1995). Existing beneficial uses identified for the Lower San Francisco Bay are as follows:

- Ocean, commercial and sport fishing
- Estuarine habitat
- Industrial service supply
- Fish migration
- Navigation
- Preservation of rare & endangered species
- Water contact recreation

- Noncontact water recreation
- Shell fish harvesting
- Wildlife habitat

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3.0 HISTORICAL SITE OPERATIONS

The Southern Pacific Transportation Company (SPTC) owned the site prior to 1989, when it was purchased by Tuntex Properties, Inc.

3.1 PRE-LANDFILL SITE CONDITIONS

Prior to the start of landfill operations, the western portion of the site was a tidal marshland and the eastern portion was part of San Francisco Bay. Historical maps and photographs were reviewed during preparation of the Solid Waste Water Quality Assessment Test (SWAT) for the Site (Kleinfelder, 1990). This review indicated that the 1920 marsh shoreline was approximately coincident with the western boundary of the site.

3.2 LANDFILL OPERATIONS

The site was first used as a landfill in 1932 when Sanitary Fill Company began operating a municipal refuse disposal facility for the City and County of San Francisco (Kleinfelder, 1992). Sanitary Fill Company leased the site from SPTC and maintained control of or involved with the disposal activities from the beginning of operations in 1932 until the end of operations in 1967.

In the mid-1930s, the Easly and Brassy Company subcontracted with the Sanitary Fill Company to operate the landfill (Kleinfelder, 1992). Under this arrangement, Easly and Brassy performed the day-to-day operations at the landfill under the direction of the Sanitary Fill Company. The specifications for the landfill operations were established by the Sanitary Fill Company. Easly and Brassy was acquired by the Sanitary Fill Company in the late 1960s.

The refuse material was placed generally in three phases beginning in the northwestern corner of the site (Kleinfelder, August 1992). The refuse was deposited in the northwestern portion of the site from 1933 until 1952. This area extends eastward from the railroad tracks into San Francisco Bay. This area is estimated to contain approximately three million cubic yards of waste.

The refuse fill material was deposited in the northeastern portion of the site from 1953 until 1959. This area extended the landfill an additional 600 feet eastward into the Bay and completed filling the northern portion of the landfill. This area is also estimated to contain approximately three million cubic yards of waste.

The refuse fill material was deposited in the southern portion of the site from 1959 until landfill operations ceased 1967. In 1959, the landfill's southern boundary was extended south to its present location by construction of an earth fill dike. This area is estimated to contain approximately 6.5 million cubic yards of waste.

The Brisbane Landfill operated and closed before modern waste practices were developed or formal design for closure was required (Kleinfelder, 1992). Modern waste disposal design features such as liners, segregation of waste into disposal cells, and leachate collection systems are not components of this landfill. After landfill operations stopped, the operators covered the refuse area with one to three feet of compacted earthfill (Kleinfelder, 1990). Subsequently, additional fills were placed for the construction of Tunnel and Beatty Avenues.

3.3 SURCHARGING OPERATIONS

Since 1967 inert fill has been placed over the refuse on a continuing basis (Kleinfelder, 1992) as part of the ongoing recycling operations at the site.

Kleinfelder (1990) indicates that the earthfill and Old Bay Clay are incompressible relative to the refuse fill and Bay Mud. Compression of the refuse fill and Bay Mud are time dependent phenomena that may take months to years to substantially complete the process. Some portion of the total settlement of the Bay Mud has already taken place due to past fill placement (Kleinfelder 1990).

Settlement of the refuse fill is estimated to be from 5 to 15 percent of the thickness of the refuse (Kleinfelder, 1990). Additional settlement resulting from consolidation of the Bay Mud is estimated to be from one-half foot up to two feet with the addition of five feet of earthfill and from one to five feet with the addition of twenty feet of earthfill (Kleinfelder, 1990).

No formal surcharging plan has been engineered or implemented at the site. Surcharging operations at the site have been based on the random nature of the stockpiles placed by the two recycling operators. Thus, the amount of settlement induced in the compressible materials beneath the site is likely to be highly variable.

* * * * *

4.0 EXISTING MONITORING AND CONTROL SYSTEMS

4.1 LEACHATE/GROUNDWATER

A number of groundwater monitoring wells and piezometers are located on the landfill and its perimeter. The last groundwater monitoring event occurred in 1995 and the results are reported in a previous document (SCS Engineers, 1996).

A Detection Monitoring Plan and Monitoring Well Evaluation Report has been submitted by Sunquest in response to the WDR. Semi-annual groundwater and leachate monitoring will begin after the Detection Monitoring Plan and Monitoring Well Evaluation Report is approved, any required new monitoring wells are installed, and the integrity of each existing and new monitoring well is documented.

4.2 SURFACE WATER

A Notice of Intent in conformance with the California National Pollution Discharge Elimination System (NPDES) General Permit for Storm Water Discharges associated with industrial activities was filed on October 15, 1993 on behalf of the current reclamation activities. A storm water pollution prevention plan (SWPPP) that incorporated best management practices (BMPs) was submitted to the California State Water Resources Board (State Board) on October 1, 1993. Two addenda to the SWPPP were submitted to the State Board to address (1) an additional 35 acres to be included under the permit, and (2) temporary storm water pollution prevention improvements. The overall site SWPPP has recently been updated in accordance with conditions of the WDR.

In addition, the site Detection Monitoring Program includes provisions for annual reporting of the General Permit storm water monitoring and periodic observations to determine if leachate seepage is occurring to the surface of the central drainage channel, the Brisbane Lagoon sideslopes, or any other perimeter area of the landfill. A report by telephone to the RWQCB within five days of observing any seepage from the landfill is required.

4.3 VADOSE ZONE

Due to the presence of the upper groundwater, no vadose zone monitoring is done at the site.

4.4 LANDFILL GAS

A landfill gas collection system currently is operating on the site and is permitted through the Bay Area Air Quality Management District. The collection system consists of a combination of perimeter vertical and horizontal gas extraction wells that discharge to a flare. Additionally, gas probes at the site perimeter provide routine monitoring points. Recent operating data indicates that the gas system operates only 6 to 10 hours per day in order to maintain a minimum methane concentration of 20 percent at the flare in accordance with the existing permit.

* * * * *

5.0 CLOSURE

Closure of the site will be accomplished in a series of partial final closures as provided for in 27 CFR 21120. Each partial final closure will be associated with a site development phase. In conformance with the WDR, for each site development phase a Development Proposal describing and defining the proposed development phase, including the specific pre-closure and closure activities, will be submitted to the RWQCB and San Mateo County as the Local Enforcement Agency (LEA).

This section presents the concepts and details of the complete site closure. Individual Development Proposals may utilize alternative closure concepts and details depending on the specifics of the development (See Section 8.0). All Development Proposals, whether utilizing the general closure system described below or an alternative closure, will include closure details and a description of how the specific proposed partial closure is consistent with overall site closure.

5.1 PRE-CLOSURE

Some portions of the site will require that various pre-closure activities be carried out prior to Title 27 closure and subsequent development. These activities will be defined and described in the Development Proposal and may include building or roadway demolition, permitting, utilities modification, and groundwater monitoring well replacement, landfill gas system modification, or others. All removed structures and equipment may be disposed of in the on-site landfill in an area to receive final cover as part of the Development Proposal. Alternatively, existing structures and equipment removed from the surface of the landfill may be handled in accordance with the applicable construction and demolition debris requirements in force at the time of the removal. Likewise, removed structures and equipment that have been in contact with landfill leachate or landfill gas (e.g., removed monitoring wells and landfill gas equipment) may be disposed of in a permitted off-site Class III landfill.

5.2 SCHEDULE

Each Development Proposal will include a schedule that establishes a maximum closure construction period of 180 days unless Sunquest and the developer can demonstrate that the closure will, of necessity, take longer than 180 days. In such cases, Sunquest and the developer will propose an alternative schedule and methods and steps to prevent threats to human health and safety and the environment during the extended closure period.

During closure, if the approved schedule cannot be met because of reasons beyond the control of the developer, a revised schedule will be proposed, along with written justification, by Sunquest and the developer as soon as the need is realized.

5.3 FINAL COVER

Final covers associated with partial developments of the site will conform to the final cover plan described below unless a modified closure is approved by the RWQCB and LEA.

5.3.1 Foundation Layer

A foundation layer meeting the requirements of 27 CCR 21090(a)(1) is proposed. A minimum two-foot thick foundation layer consisting of existing on-site cover material will be used. Over most of the site, existing fill material will be removed to establish the foundation layer surface grade. This surface will be periodically probed to document a minimum of 2 feet of soil in the foundation layer. The surface will then be graded, compacted, and proof-rolled to document that a sufficiently solid surface is available to support the placement of the low-hydraulic-conductivity layer above it. If proof-rolling results in rutting or pumping of the soil surface, additional compaction of the foundation layer sub-grade will be performed until a solid surface is observed during proof-rolling.

This proposed preparation of the foundation layer is appropriate for the Sunquest site and should not affect the structural integrity of the final cover for the following reasons:

- The thickness of the entire final cover layer over the foundation layer will not represent a

major change in soil loading over the foundation layer in the existing condition.

- The major contributors to overall settlement of the landfill area will be settlement of refuse and/or the Bay Mud.

5.3.2 Low-Hydraulic-Conductivity Layer

A low-hydraulic-conductivity layer meeting the requirements of 27 CCR 21090(a)(2) will be constructed on top of the foundation layer. The low-hydraulic-conductivity layer will consist of a flexible membrane liner (FML) or a compacted clay liner (CCL) as appropriate and discussed in the following paragraphs. Drawing 2 presents the proposed grading plan for the top of the low-hydraulic-conductivity layer. Figures 4 through 10 contain the cross-sections indicated on Drawing 2 and show various details of the final cover. For clarity of presentation, the foundation layer and the thickness of the low-hydraulic-conductivity layer are not shown on these figures.

The following discussion addresses the low-hydraulic-conductivity layer in the three component areas of the site: pads, channels, and central drainage channel.

5.3.2.1 Pads

Pad areas (on Drawing 2, the relatively flat areas and the slopes connecting these areas) constitute the majority of the site. These pad areas will be lined with a one-foot thick CCL with a maximum hydraulic conductivity of 1×10^{-6} cm/sec. The clay material for the CCL is not presently available on-site. The Development Proposal for each site development will identify the clay materials to be used and document their suitability. The construction of the CCL will be in accordance with contract documents developed for each development and overseen in accordance with the Construction Quality Assurance (CQA) Plan for the site (See Appendix B).

5.3.2.2 Channels

The channel areas through the site serve the major functions of providing drainage for infiltration water and a location for major utility runs. The channels are located along the major streets planned for the site development. The locations are shown on Drawing 2 as the steeper graded areas along the edges of the pads. For shallow channels (see Figure 4), the proposed low-

hydraulic-conductivity layer is CCL or FML. For deeper channels (see Figures 7 and 8), an FML is the proposed low-hydraulic-conductivity layer. The proposed FML material is 60-mil (0.06-in.) high-density polyethylene (HDPE). All FML on the channel slopes will be anchored into the CCL at the top of the channels to provide for a continuous low-hydraulic-conductivity layer over the site. Figure 11 is a detail of a typical FML/CCL tie-in at the channel/pad interface showing the FML anchor trench in the Foundation Layer.

5.3.2.3 Central Drainage Channel

As discussed previously, the central drainage channel is the main surface drainage feature on the site. After final closure of the site, most storm water will continue to be transported off-site via this drainageway: however, most storm water will discharge into the channel from the site storm sewers in the east, west, and central parts of the channel.

Figure 5 is a cross section of the central drainage channel. As indicated in Figure 5, the low-hydraulic-conductivity layer in the lower portion of the central drainage channel is FML. This portion of the central drainage channel is shown in more detail in Figure 12 and has been addressed in the Central Drainage Channel Mitigation Work Plan submitted by Sunquest in conformance with the WDR.

The portions of the central drainage channel above the FML will utilize CCL for the low-hydraulic-conductivity layer.

5.3.3 Erosion-Resistant Layer

An erosion-resistant layer meeting the requirements of CCR 21090(a)(3) is proposed for placement over the low-hydraulic-conductivity layer. The top of the erosion-resistant layer is the final grading plan shown on Drawing 3. The final grading plan will be the rough grading plan for site development, such that fine grading of the various site pads will be defined in each Development Proposal to accommodate streets, buildings, and landscaping for that development. Therefore, the specific details of erosion resistance via vegetation (vegetative soils, types of vegetation, and final grading) or mechanical means (paving, rock, or other durable surfaces) will

be defined in the Development Proposals for each development.

The erosion-resistant layer will be constructed mainly of the existing site cover materials and will be of sufficient thickness to allow for the installation of utilities at the proper depths without harming the low-hydraulic-conductivity layer. Due to the relative lack of relief in the final grading plan, no benches on the final cover are proposed.

5.3.3.1 Pads

The cross-section of the erosion-resistant layer in the pad areas is relatively consistent and is shown typically in the right hand portion of the detail in Figure 11. Figures 4 through 10 show specific cross-sections throughout the site with the upper relatively flat portions of each cross-section corresponding to the pads. Local utilities will be installed in the erosion-resistant layer above the low-hydraulic-conductivity layer to serve buildings and facilities that will be located in the pad areas.

In the interior portions of the site, the erosion-resistant layer continues uninterrupted into the channel areas as discussed below. At certain external boundaries of the site, the infiltration water that drains along the interface of the low-hydraulic-conductivity layer with the erosion-resistant layer must drain through the erosion-resistant layer to a surface drainageway. These locations are represented in sections C and F on Drawing 2, and Cross Sections C and F are shown in Figures 6 and 9. A typical detail for this situation is shown in Figure 13. As indicated, the drainage through the erosion-resistant layer is provided by a double-sided geocomposite which daylights to the surface and extends up the sloping top surface of the low-hydraulic-conductivity layer.

The south end of the site represents a special pad area. The low-hydraulic-conductivity layer in this area slopes generally to the south at 1.33% (See Drawing 2). This area is projected as an open space with no building development, although Lagoon Way (See Drawing 1) will be reconstructed. When developed, this area will likely be irrigated; therefore, in conformance with Title 27, a geocomposite drainage layer is provided above the low-hydraulic-conductivity layer (See Figure 4) over the entire area. The water collected by the geocomposite layer will be

collected in a perforated pipe and discharged to Brisbane Lagoon using solid tee connections in the collector pipe to penetrate the lagoon cut-off wall (See Figure 10). The lagoon cut-off wall is the current concept for mitigation and long-term containment of the southern perimeter leachate seeps from the site. Mitigation and containment of the south perimeter seeps is being addressed through implementation of a work plan previously submitted in accordance with the WDR.

5.3.3.2 Channels

The depth of the erosion-resistant layer in the channels is variable as shown in Figures 4,7, and 8. The utilities shown in these figures are typical, except in the case of the storm sewers. The storm sewer locations and sizes are from the current storm water master plan for the developed site. The channel depths are established by the required storm sewer depths. Infiltration water entering the channel areas will drain through the storm sewer bedding to discharge in the central drainage channel or the Brisbane Lagoon along with the storm sewer water.

During the development of the site over time, it is expected that some changes to the current final grading plan (Drawing 3) will be required. In some cases these changes may be known before the final cover is installed, and appropriate changes will be submitted in the detailed Development Proposal. In some cases the final cover may be already installed in accordance with this Final Closure Plan, and the installed closure will be modified. The latter case would normally require that a channel be constructed in an area where a pad closure had already been installed. As shown schematically in Figure 14, this will require that the existing pad final cover be removed and an appropriate channel section be installed and tied into the existing cover.

5.3.3.3 Central Drainage Channel

As shown in Figure 12, the central drainage channel mitigation work in response to the WDR addresses erosion and uplift control of the erosion-resistant layer surface in the lower portions of the central drainage channel. The upper portions of the central drainage channel (See Figure 5) will be variably sloped and vegetated. Vegetative soils and types of vegetation will be specified in the appropriate Development Proposal.

5.4 STABILITY ANALYSIS

Some of the proposed final development slopes may need to be checked for slope stability in accordance with 27 CCR 21090. The required seismic analyses for all proposed developments will be included in associated Development Proposals submitted in conformance with the WDR.

5.5 DRAINAGE AND EROSION CONTROL

The closure system and final grading plan are designed to provide a series of pads across the site. The specific development within each of these pads will determine the final topography and features of each pad; however, all pad areas will be provided with storm water sewers or inlets. The storm sewer system has been designed based on the 100-year, 24-hour precipitation event.

The final grading plan includes no long steep side slopes; and much of the developed site surface will be pavement, buildings, walkways and other relatively impermeable and erosion-resistant features. These surface features and the depth of the erosion-resistant layer will provide exceptional protection of the low-hydraulic-conductivity layer, prevention of public contact with waste, and site safety.

5.6 LANDFILL GAS CONTROL AND LEACHATE CONTACT

The landfill gas control system currently in operation will remain in operation after closure. In addition, each Development Proposal will include specific features to control landfill gas in the development area. Leachate releases and contact will be controlled through the implementation of the previously submitted WDR-required work plans for the mitigation of the central drainage channel and the southern perimeter (Brisbane Lagoon) leachate seeps. Leachate collection and removal is neither practiced at the site nor expected to be practiced in the future because the shallow groundwater permeates the solid waste.

5.7 RECORDING

Upon final closure of the site, Sunquest will file a detailed description of the site with the LEA and the San Mateo County Recorder. The description will include the following elements:

- Site map
- Date final closure was completed
- Boundaries of the closed landfill
- Location where closure and post-closure plans can be obtained
- Statement that future use is restricted in accordance with the post-closure maintenance plan

5.8 CLOSURE COSTS

The estimated closure costs for the entire site are shown in Table 5-1.

5.9 SURVEYING MONUMENTS

The Development Proposal for initial proposed development will include the establishment of a system of at least three permanent surveying monuments to be located on the western side of the site outside of the waste disposal areas. These monuments will be installed by a licensed land surveyor or professional engineer and will be the reference for future landfill site surveying throughout closure and post-closure.

5.10 INITIAL TOPOGRAPHIC MAP

Each development area will be surveyed at the end of closure and development of the area. When the site is totally developed, the composite topographic map of the entire site will be provided to the RWQCB and LEA. This initial topographic map will be the basis for determining settlement of the site over time.

Table I-1
Closure Cost Estimate

	Quantity	Units	Unit Cost ($2002)	Cost per Item ($2002)	Subtotal ($2002)
REFUSE RELOCATION					
Cut to fill on-site	62,000	yd^3	5.00	310,000	
SUBGRADE PREPARATION					
Verification-2' Foundation Layer	340	each	250	85,000	
Cut to top of Foundation Layer	3,255,335	yd^3	3.00	9,766,005	
Fill required for Foundation Layer	197,830	yd^3	0.00	0	
Compact and Proof Roll Foundation Layer	340	Ac	2,000.00	680,000	
Volume stockpiled from cut	3,057,505	yd^3	0.00	0	
CCL LOW-PERMEABILITY LAYER					
1' Locally hauled from multiple sources	336,928	yd^3	10.00	3,369,280	
FML (not including CDC below 5' armor)	1,200,000	ft^2	0.55	660,000	
GEONET/GEOTEXTILE					
Double-Sided Composite	400,000	ft^2	0.45	180,000	
EROSION-RESISTANT LAYER					
Fill from stockpile	3,057,505	yd^3	3.00	9,172,515	
Fill from off-site	271,648	yd^3	6.00	1,629,888	
				SUBTOTAL:	**25,852,688**
CONTINGENCY 10%				2,585,269	
PROFESSIONAL SERVICES 10%				2,585,269	
				SUBTOTAL:	**5,170,538**
				TOTAL:	**31,023,226**

6.0 POST-CLOSURE MAINTENANCE

The purpose of the post-closure maintenance program is to provide a detailed plan for the inspection, maintenance and monitoring of the landfill during the post-closure maintenance period. The post-closure period for the Brisbane Landfill is 30 years after the complete closure and development of the landfill site. In addition, the post-closure maintenance activities will be carried out in each partial development starting immediately after the construction of each development is complete.

6.1 EMERGENCY RESPONSE PLAN

The site Emergency Response Contingency Plan has been recently updated in response to the WDR. This plan will be available to guide response actions to natural emergencies or other significant events throughout the closure and post-closure maintenance periods.

6.2 POST-CLOSURE MAINTENANCE RESPONSIBILITY

The following person is the point of contact regarding the post-closure maintenance program:

Mr. Ted Peng, Ph.D., R.G.
Universal Paragon Corporation.
150 Executive Park Blvd., Suite 4200
San Francisco, CA 94134
(415) 468-6676 extension 118

6.3 POST-CLOSURE LAND USE

New development over much of the site is planned for construction over a period of several years. The proposed development will be mixed use, and may include commercial, retail, roadways, and open spaces. As currently planned, a series of partial site developments will occur over time, and a Development Proposal detailing the specific closure and development activities for each partial development will be submitted to the RWQCB and LEA prior to initiating these activities.

Because development activities will be carried out nearly concurrently with closure, preserving the integrity of previously constructed final cover during subsequent development construction is not an issue. However, previously constructed drainage and environmental monitoring systems will exist, and the individual Development Proposals will take into account the preservation of these features during the subsequent development construction.

All structural improvements, buildings, and utilities constructed over the landfill or on the site within 1,000 feet of the waste boundary will incorporate the landfill gas control requirements of 21 CCR 21190. In addition, if any modification of land use, final cover, or other significant change in a previously constructed partial development is proposed, a revised Development Proposal will be prepared and submitted to the RWQCB and LEA for approval prior to carrying out the modifications.

6.4 MONITORING AND CONTROL SYSTEMS

Existing site monitoring and control systems are discussed in Part 4.0. The following paragraphs discuss future proposed changes to these monitoring and control systems.

6.4.1 Leachate Monitoring

Two leachate monitoring wells located in the central portion of the site will be monitored in accordance with Table A of Attachment A to the WDR (see Appendix A) and the Water Quality Sampling and Analysis Plan submitted in accordance with the WDR.

6.4.2 Groundwater Monitoring

The groundwater monitoring program will include shallow and deep groundwater monitoring and estimates of vertical hydraulic gradients at the site.

6.4.2.1 Shallow Groundwater

- MW-37A
- Mw-36A
- MW-34A

- MW-33A
- MW-31A

The shallow groundwater monitoring will be in accordance with Table A of Attachment A to the WDR (see Appendix A) and the Water Quality Sampling and Analysis Plan submitted in accordance with the WDR.

6.4.2.2 Deep Groundwater

Three deep upgradient and four deep detection monitoring wells will be used for assessment of quality and hydraulic gradients in the deep groundwater. The deep upgradient monitoring will include the following wells:

- MW-3B
- MW-6B
- MW-9B

Deep detection monitoring will include the following wells:

- MW-41B
- MW-38B
- MW-35B
- MW-32B

The deep groundwater monitoring will be in accordance with Table A of Attachment A to the WDR (see Appendix A) and the Water Quality Sampling and Analysis Plan submitted in accordance with the WDR.

6.4.2.3 Groundwater Gradient Well Pairs

Three upgradient monitoring well pairs and four detection monitoring well pairs will be used for

estimating vertical hydraulic gradients at the site. The upgradient monitoring will include the following well pairs:

- MW-4A and 3B
- MW-7A and 6B
- MW-10A and 9B

Detection monitoring will include the following well pairs:

- MW-40A and 41B
- MW-37A and 38B
- MW-34A and 35B
- MW-31A and 32B

Vertical hydraulic gradients will be calculated quarterly after obtaining water levels in accordance with the Water Quality Sampling and Analysis Plan submitted in accordance with the WDR.

6.4.3 Surface Water Monitoring

Two surface water monitoring stations are identified in the WDR (see Figure 2 in Appendix A). These stations will be monitored in accordance with Table A of Attachment A to the WDR (see Appendix A) and the Water Quality Sampling and Analysis Plan submitted in accordance with the WDR.

6.4.4 Storm Water Monitoring

The Storm Water Pollution Prevention Plan submitted in accordance with the WDR identifies eight storm water sampling points for the site. One grab sample will be collected from each sampling station during the first storm event of the wet season annually. One additional sample also will be collected from each station during a subsequent storm event during each wet season.

The sampling procedures, analytical procedures, data analysis, and reporting will be in accordance with the Storm Water Pollution Prevention Plan submitted in accordance with the WDR.

6.4.5 Landfill Gas Control

The existing landfill gas control system, operating as Plant #5691 under a permit from the Bay Area Air Quality Management District, will continue in operation in accordance with the existing permit conditions. The existing permit essentially establishes detailed operating procedures for the system. The current maintenance program, including inspections, purchase of supplies and equipment, and performance of repairs and upgrades, will continue to be performed regularly by Sunquest and/or subsequent developers' staff.

As discussed previously, each Development Proposal will address required modifications to the existing landfill gas control system and additional gas control requirements for the specific features of the development.

6.5 MAINTENANCE, MONITORING, AND INSPECTION OF FINAL COVER SYSTEM

The site will be inspected as required (minimum annually) for settlement, erosion, drainageway stoppages or obstructions, and vegetation establishment, as applicable. The inspection will be accomplished by walking the site and recording problems and their locations. Corrective action will be initiated to correct problems as soon as reasonably possible. If exposed solid waste is observed during inspections or if solid waste is exposed during post-closure maintenance activities, the waste will be disposed of in the landfill without destroying the integrity of the final cover.

Every 5 years the initial topographic map produced at the conclusion of each partial closure will be updated. The updated and initial topographic maps will be used to produce a five-yearly iso-settlement map that will show the total lowering of the site's surface elevation relative to the initial topographic map. The five-yearly iso-settlement maps will be used to evaluate the impacts of settlement on the on-going integrity of the final cover and the free drainage of surface water.

6.6 RECORD KEEPING

All inspection reports, work orders, invoices, test results, and other pertinent information generated during post-closure maintenance will be kept on file by Sunquest and subsequent developers. Certification of post-closure activities by a registered professional engineer will also be provided.

6.7 COSTS

The post-closure maintenance duties and costs will be dependent to a large extent on the types and density of the actual development of the site. These costs will be shared between Sunquest and subsequent developers.

* * * * *

7.0 FINANCIAL ASSURANCE

Title 27 does not require the site to show financial assurance because the landfill was closed prior to 1988. Sunquest and associated developers will pay the costs for up-graded closure and post-closure maintenance. If no development occurs on the site, upgraded closure and post-closure maintenance will not be required.

* * * * *

8.0 ALTERNATIVE CLOSURE

One specific development alternative that has been suggested for a portion of the site is an auto mall. Because of the unique nature of this development (large paved area with minimal green open area and buildings), an alternative closure plan generally consisting of the following elements is proposed:

- Use of the development paving as the general site cap
- Use of FML-lined trenches for site utilities
- Use of CCL or FML under all site buildings depending on foundation type

The RWQCB and LEA have preliminarily indicated that the Development Proposal to implement this type of development should incorporate the following additional conditions and/or elements:

- Maintenance plan addressing settlement and pavement cracking issues
- Condition that any subsequent land use change would require a reevaluation of the cap design and potential cap reconstruction
- Design of utility trench and building structure lining systems and their interfaces to prevent landfill gas migration and surface water infiltration
- Minimum 4- to 5-foot thick foundation layer for the pavement cap
- Design of storm water system to prevent accumulation of water on or adjacent to site
- Appropriate cap design for any landscaped and irrigated land
- Industrial activity construction storm water permit would be required for a site 5 acres or larger

A specific Development Proposal for an auto mall will include the elements and conditions discussed above in addition to the general requirements for closure and post-closure maintenance.

9.0 REFERENCES

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* * * * *

FIGURES

N 2,079,000
N 2,080,000
N 2,081,000
N 2,082,000
N 2,083,000
N 2,084,000
N 2,085,000
N 2,086,000
N 2,087,000

E 6,010,000
E 6,011,000
E 6,012,000
E 6,013,000
E 6,014,000
E 6,015,000

RAIL YARD AREA
(FOR REFERENCE ONLY)

CALTRAIN RAILROAD TRACKS

TANK FARM

TUNNEL AVE.

BEATTY AVENUE

BRISBANE
LANDFILL

CENTRAL DRAINAGE CHANNEL

LANDFILL
GAS LINE

BRISBANE
LAGOON
(GUADALUPE
LAGOON)

LAGOON WAY

JET
FUEL LINE

FRONTAGE ROAD

U.S. HIGHWAY 101

SAN FRANCISCO BAY

LIMITS OF REFUSE

N

600' 0' 600' 1200'
SCALE IN FEET

LEGEND

- SUNQUEST PROPERTY LINE
- R — LIMITS OF REFUSE (LANDFILL)
- J — JET FUEL LINE
- G — LANDFILL GAS LINE

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Figure 1
EXISTING SITE CONDITIONS

N 2,079,000
N 2,080,000
N 2,081,000
N 2,082,000
N 2,083,000
N 2,084,000
N 2,085,000
N 2,086,000
N 2,086,600
E 6,010,000
E 6,011,000
E 6,012,000
E 6,013,000
E 6,014,000
E 6,015,000

LEGEND

- PROPERTY LINE
- R — LIMITS OF REFUSE
- EXISTING CONTOUR
- 2' TOP OF REFUSE CONTOUR
- 10' TOP OF REFUSE CONTOUR

NOTES:

1. THE SITE TOPOGRAPHY IS BASED ON A FLY-OVER CONDUCTED ON APRIL 19 AND JUNE 27, 2000 BY DAVID EVANS & ASSOC.
2. TOP OF REFUSE ELEVATIONS WERE REFERENCED FROM BURNS AND McDONNELL'S FEBRUARY 2, 2001 "LANDFILL COVER THICKNESS INVESTIGATION REPORT FOR THE BRISBANE LANDFILL" AND BURNS AND McDONNELL'S MARCH 2002, "INVESTIGATION REPORT – CENTRAL DRAINAGE CHANNEL, BRISBANE LANDFILL" (DRAFT).
3. ALL ELEVATIONS REFERENCE MEAN SEA LEVEL.

N

600' 0' 600' 1200'
SCALE IN FEET

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Figure 2
TOP OF REFUSE

N 2,079,000
N 2,080,000
N 2,081,000
N 2,082,000
N 2,083,000
N 2,084,000
N 2,085,000
N 2,086,000
N 2,087,000

E 6,010,000
E 6,011,000
E 6,012,000
E 6,013,000
E 6,014,000
E 6,015,000

MW-17A 4.60
LF-3A 4.82
MK-2A 7.98
MW-13A 4.39
LF-8A 4.24
MK-7A 4.10
LF-7A 3.54
MW-15A 4.52
LF-4A 4.49
LF-5A 4.50
MW-3A 4.93
MW-4A 5.89
MW-9A 4.30
MK-8A 3.99
MW-8A 5.01
MK-5A 4.90
MW-7A 5.15
MW-6A 5.14
KMW-4A 4.65
MW-11A 4.78
MK-6A 4.72
MK-4A 5.13
MW-48A2 4.40
MW-47A1 4.58
MW-15A 2.47
MW-44A 1.86
MW-42A 1.68
MW-27A 1.86
MW-43A 1.79
MW-39A 5.50
MW-40A 2.48
MW-36A 1.29
MW-34A 3.74
MW-33A 3.86
MW-31A 4.00

5.0
4.0
6.0
7.0
3.0
2.0

600' 0' 600' 1200'
SCALE IN FEET

NOTES:

1. THE SITE TOPOGRAPHY IS BASED ON A FLY-OVER CONDUCTED ON APRIL 19 AND JUNE 27, 2000 BY DAVID EVANS & ASSOC.
2. WATER LEVEL ELEVATIONS FOR THE UPPERMOST SATURATED ZONE (MEASURED JULY 25, 2000) WERE REFERENCED FROM BURNS AND McDONNELL'S FEBRUARY 2, 2001 "LANDFILL COVER THICKNESS INVESTIGATION REPORT FOR THE BRISBANE LANDFILL."
3. ALL ELEVATIONS REFERENCE MEAN SEA LEVEL.

LEGEND

- MONITORING WELL
- 3.99 UPPERMOST SATURATED ZONE SURFACE ELEVATION - 7/25/2000
- LINE OF EQUAL GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION
- PROPERTY LINE

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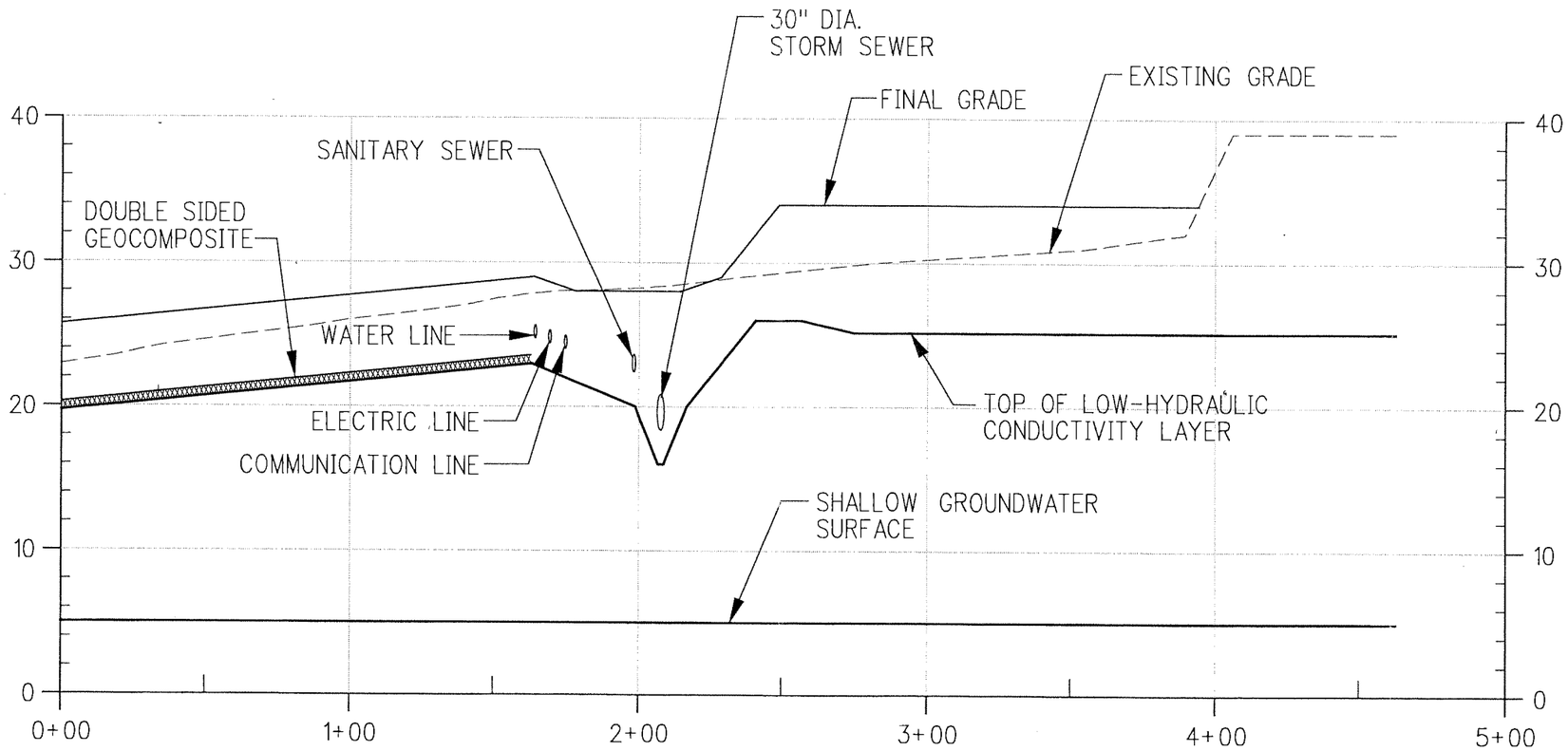
Figure 3

SHALLOW GROUNDWATER SURFACE MAP



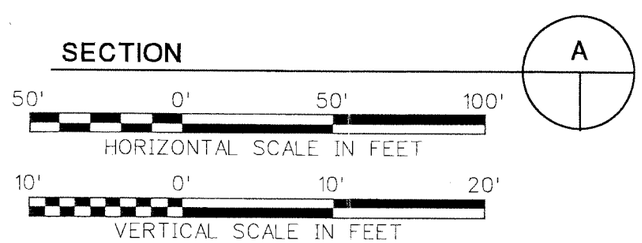


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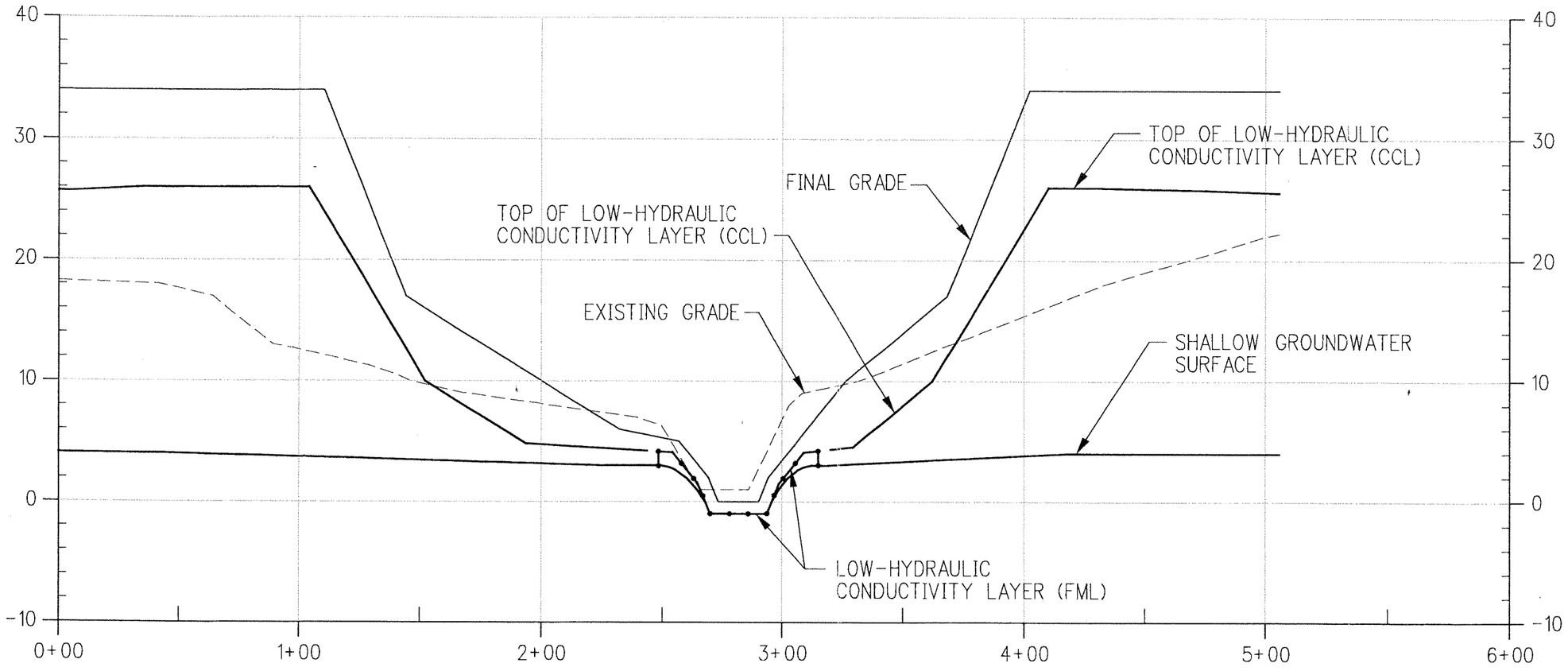
Figure 4

CROSS SECTION - A



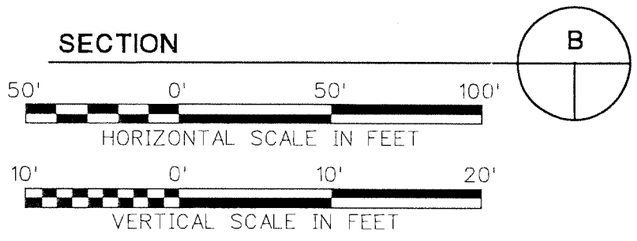


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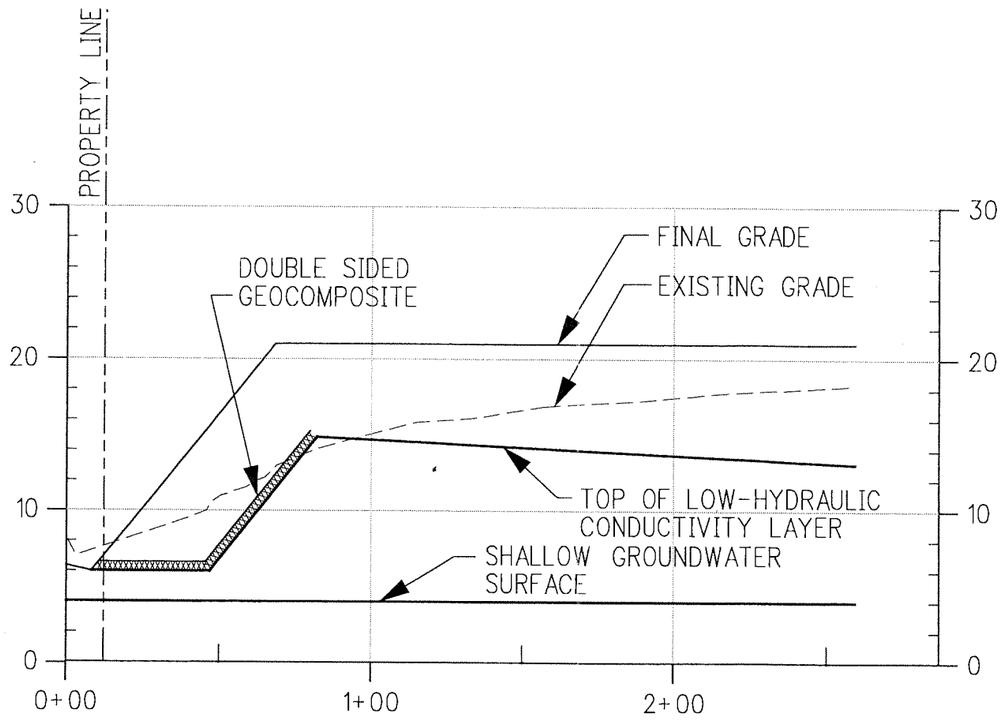
Figure 5

CROSS SECTION - B



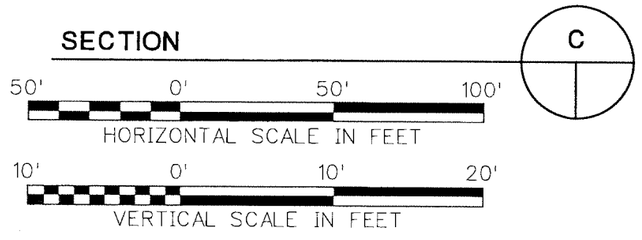
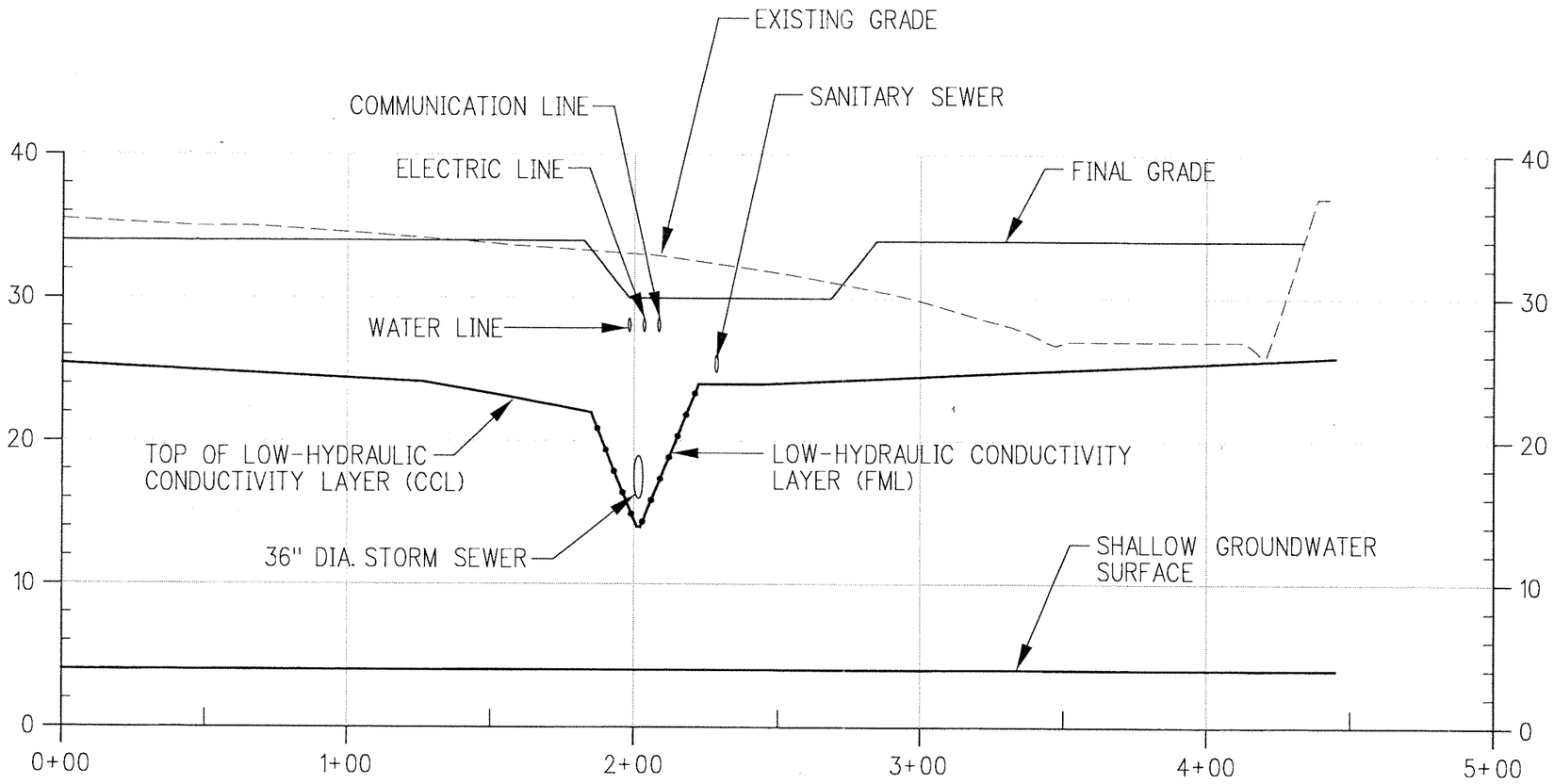


Figure 6

CROSS SECTION - C



SECTION D

50' 0' 50' 100'

HORIZONTAL SCALE IN FEET

10' 0' 10' 20'

VERTICAL SCALE IN FEET

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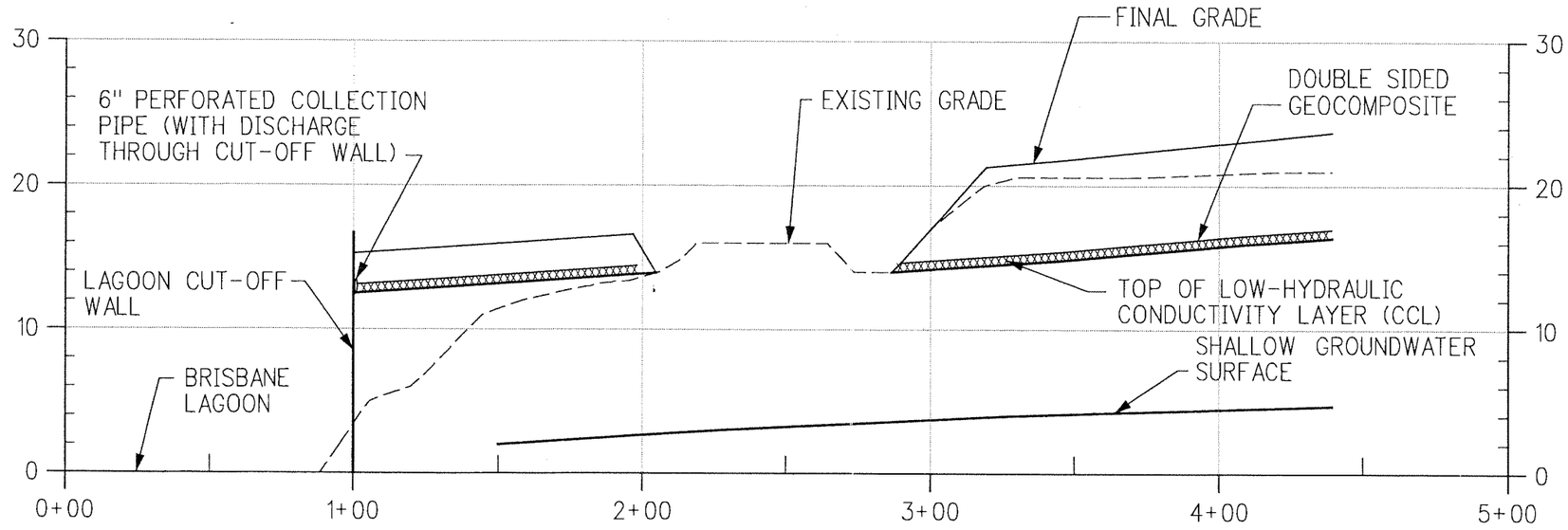
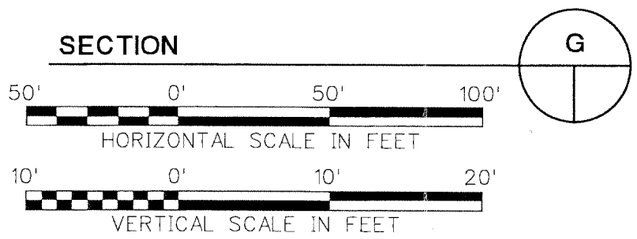
Figure 7

CROSS SECTION - D





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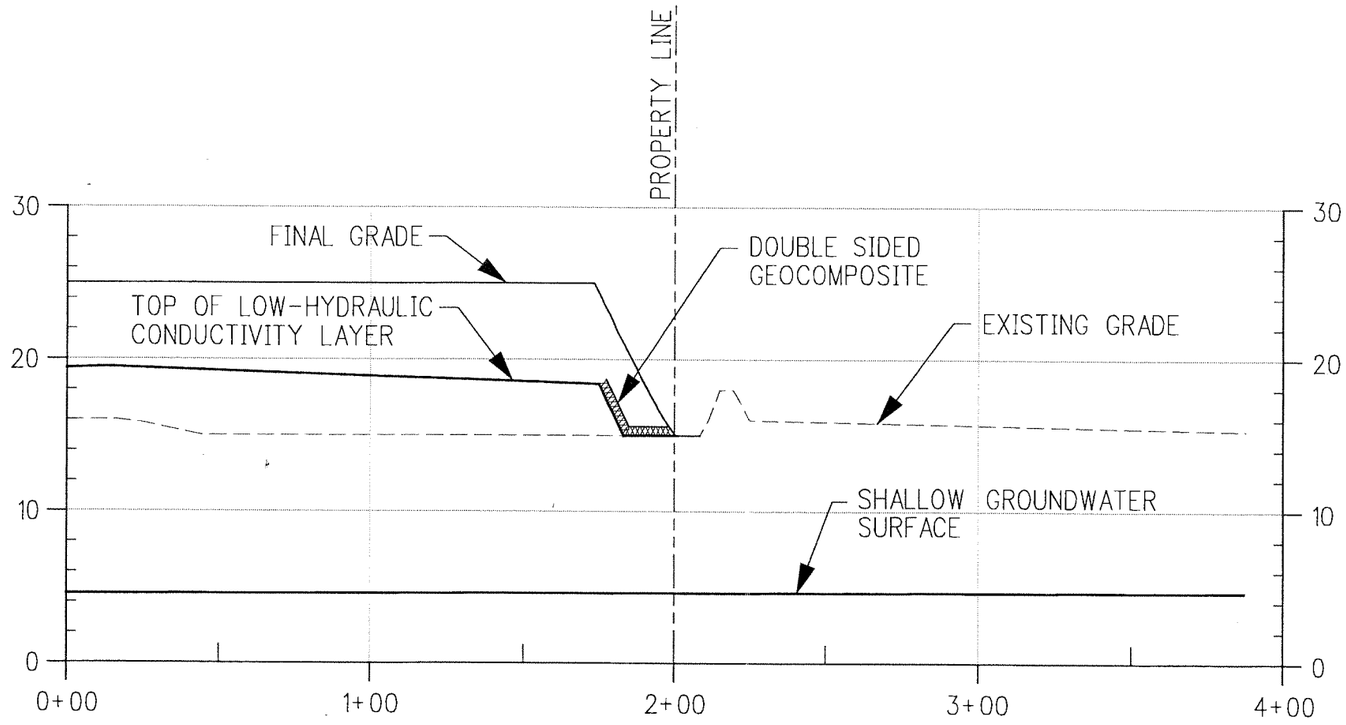
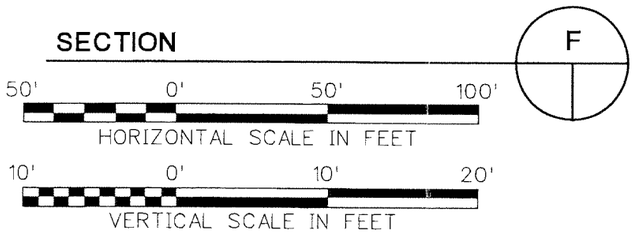
SINCE 1898

Figure 10

CROSS SECTION - G

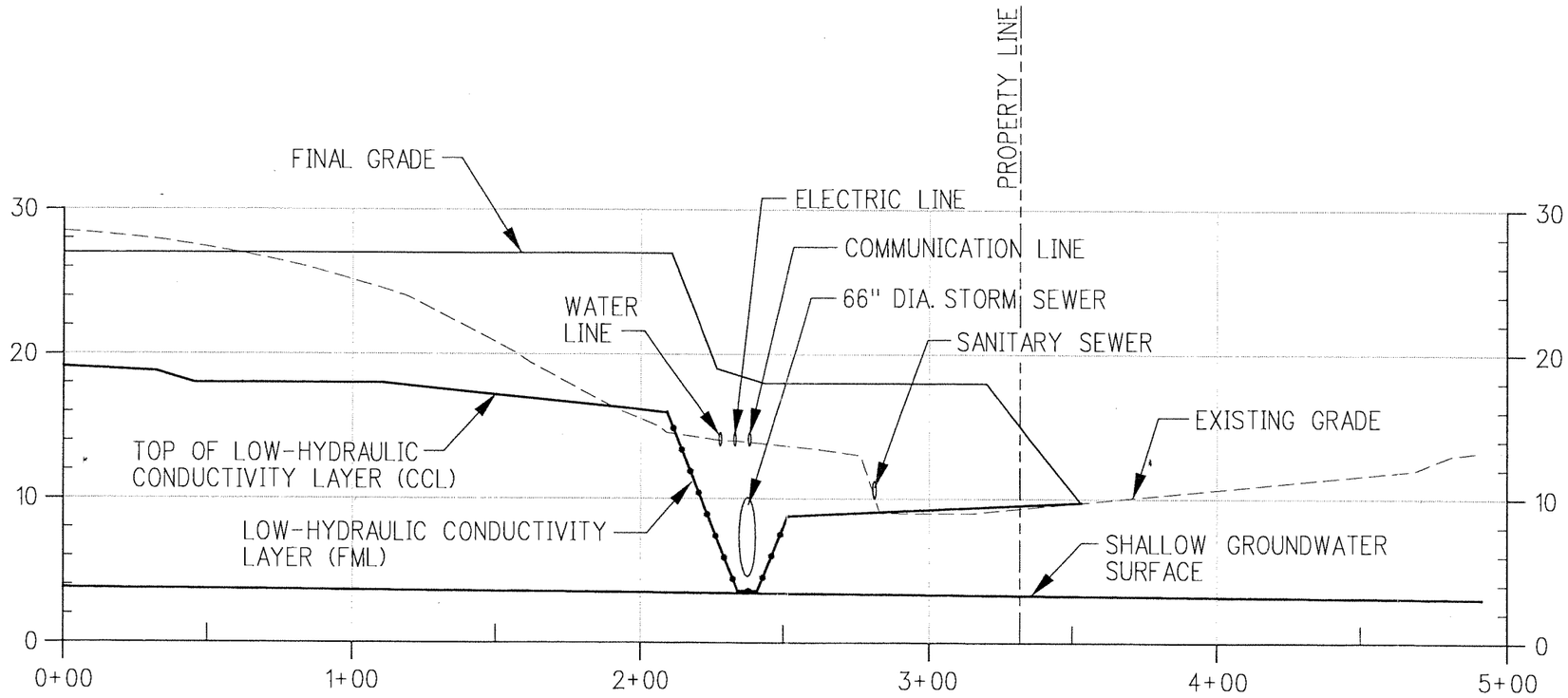




Burns & McDonnell
SINCE 1898

Figure 9

CROSS SECTION - F



SECTION E

50' 0' 50' 100'

HORIZONTAL SCALE IN FEET

10' 0' 10' 20'

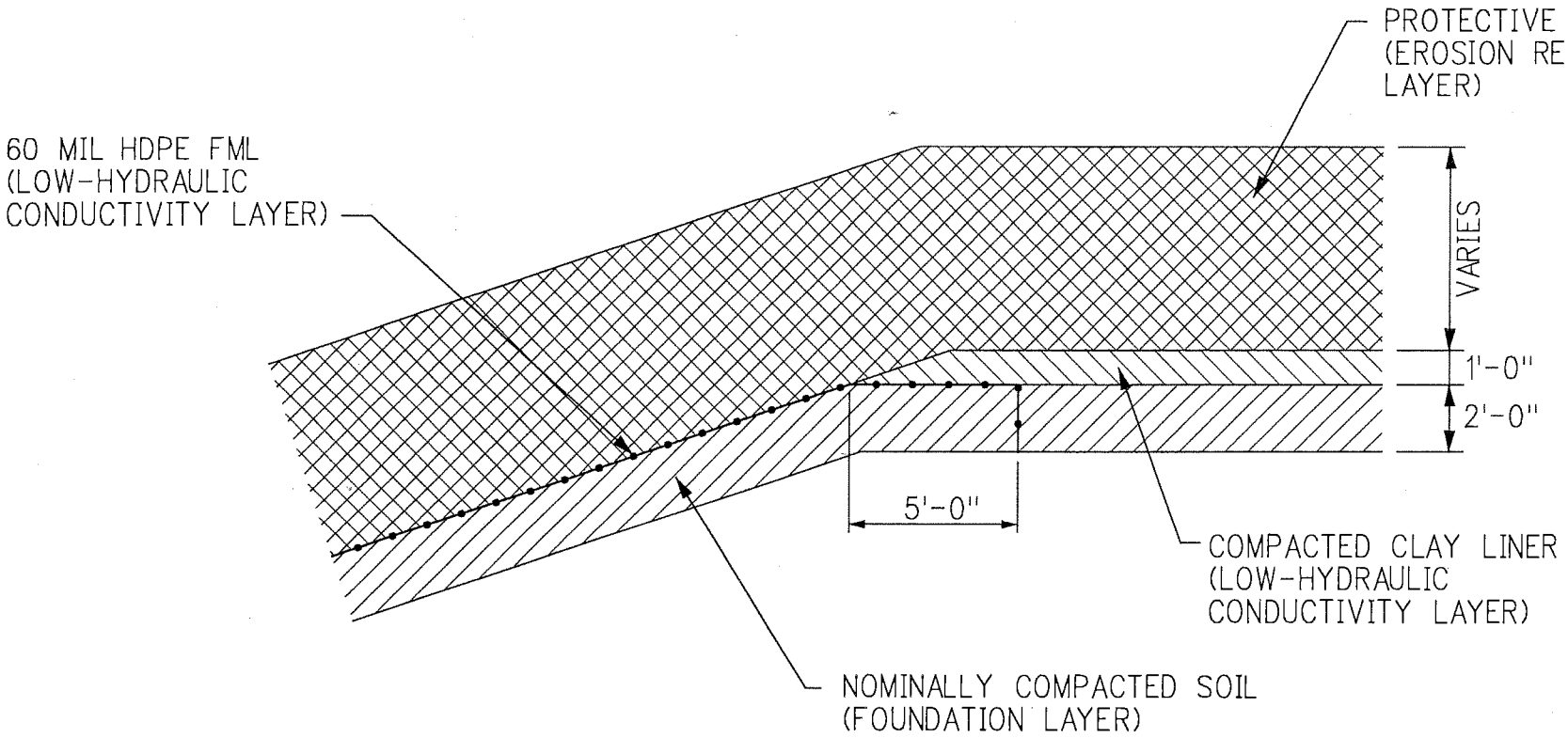
VERTICAL SCALE IN FEET

Burns & McDonnell SINCE 1898

Figure 8

CROSS SECTION - E

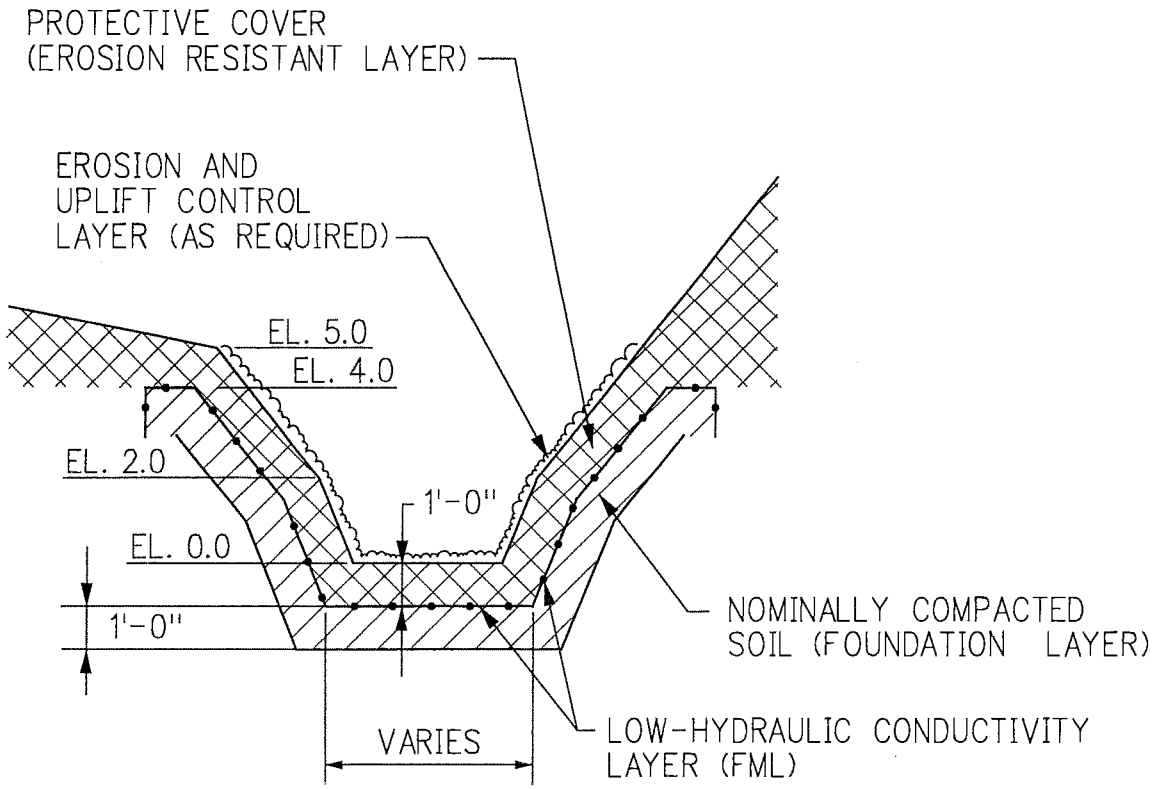
DRAWINGS



NOT TO SCALE

Figure 11

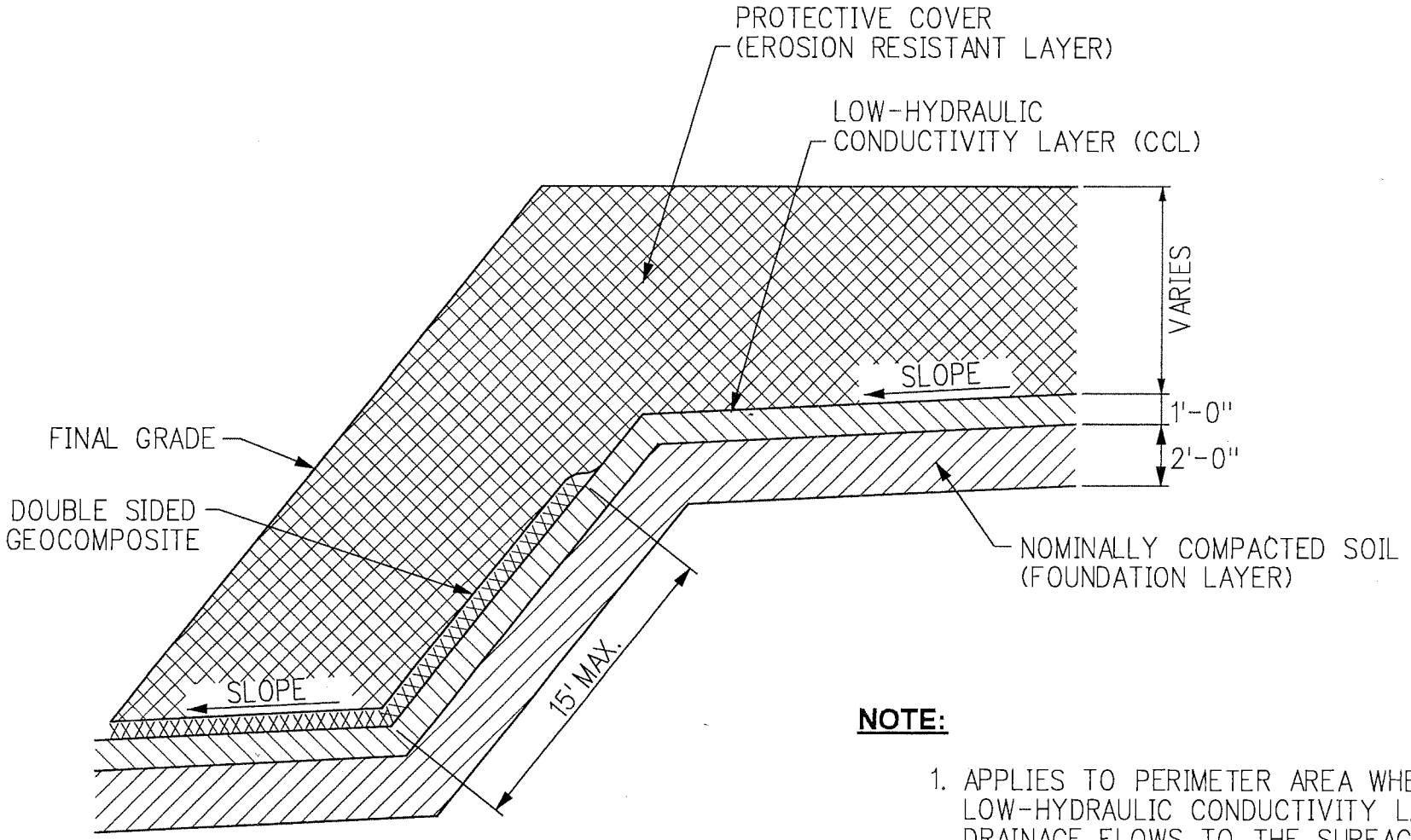
TYPICAL FML/CCL TIE-IN



NOT TO SCALE

Figure 12

CONCEPT CENTRAL DRAINAGE
CHANNEL MITIGATION



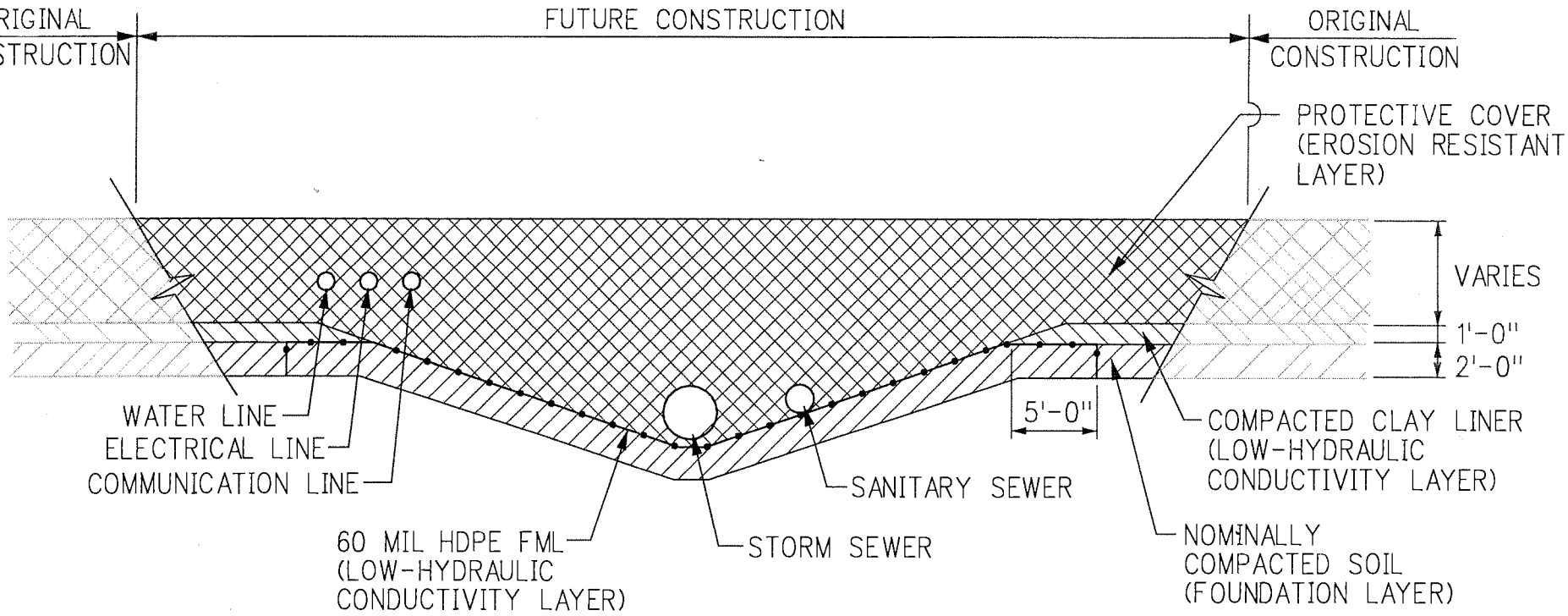
NOTE:

1. APPLIES TO PERIMETER AREA WHERE LOW-HYDRAULIC CONDUCTIVITY LAYER DRAINAGE FLOWS TO THE SURFACE.

NOT TO SCALE

Figure 13

TYPICAL DAYLIGHTING OF LOW-HYDRAULIC CONDUCTIVITY LAYER



LEGEND

ORIGINAL CONSTRUCTION

FUTURE CONSTRUCTION

NOT TO SCALE

Figure 14

TYPICAL FUTURE CHANNEL REQUIRED IN ORIGINAL PAD AREA

APPENDIX A

Brisbane Landfill Waste Discharge Requirements- Order No. 01-041

California Regional Water Quality Control Board
San Francisco Bay Region

H. Hickox
Secretary for Environmental Protection

Internet Address: http://www.swrcb.ca.gov
1515 Clay Street, Suite 1400, Oakland, California 94612
Phone (510) 622-2300 • FAX (510) 622-2460

Gray Davis
Governor

See Attached Mailing List

Date: APR 2 6 2001
File Number: 2179.7121 (TWB)

Subject: **Brisbane Landfill, San Mateo County – New Waste Discharge Requirements, Order Number 01-041**

To Whom it May Concern:

The Regional Water Quality Control Board adopted Order Number 01-041 (Enclosed) at its regular monthly meeting on Wednesday, April 18, 2001. Should you have any questions regarding this item, please call Thomas Butler of my staff at (510) 622-2309, or by email at twb@rb2.swrcb.ca.gov.

Sincerely,

Loretta K. Barsamian

Loretta K. Barsamian
Executive Officer

Enclosure: Order Number 01-041

CC: Greg Schirle
Environmental Health Services Division
San Mateo County Health Services Agency
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Hillsborough, CA 94010

Krzysztof S. Jesionek
GeoSyntec Consultants
1500 Newell Avenue, Suite 800
Walnut Creek, California 94596

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER NO. 01-041
WASTE DISCHARGE REQUIREMENTS AND
RECISION OF RESOLUTION 58-278 AND
CLEANUP AND ABATMENT ORDER 94-134:

SUNQUEST PROPERTIES, INC., OYSTER POINT PROPERTIES, INC., TUNTEX (USA), INC., SUNSET PROPERTIES, INC., SANITARY FILL COMPANY, SUNSET SCAVENGER COMPANY, MACOR, INC., THE CITY OF BRISBANE, BRISBANE PROPERTIES, LLC, DOUGLAS H. AND DIANE A. GALTEN, VAN ARSDALE-HARRIS LUMBER CO., ROBERT E. AND DOROTHY D. FEWER, AND, BRUCE R. AND KURT PAPENHAUSE

BRISBANE CLASS III LANDFILL
BRISBANE, SAN MATEO COUNTY

The California Regional Water Quality Control Board, San Francisco Bay Region, (hereinafter called the Board), finds that:

SITE OWNER AND LOCATION

1. Sunquest Properties, Inc., Oyster Point Properties, Inc., Tuntex (USA), Inc., Sunset Properties, Inc., Sanitary Fill Company, Sunset Scavenger Company, Macor, Inc., The City of Brisbane, Brisbane Properties, LLC, Douglas H. and Diane A. Galten, Van Arsdale-Harris Lumber Co., Robert E. and Dorothy D. Fewer, and, Bruce R. and Kurt Papenhause, hereinafter referred to as the Dischargers, currently own the Brisbane Landfill.

2. Potential refuse underlying approximately 4.55 and 0.26 acres of land located along the southeastern and northwestern portions of the site (Figure - 3) has not been delineated. The California Department of Transportation has been potentially identified as owning the southeastern (4.55 acres) easement while the City of San Francisco potentially owns the lot located along the northwestern terminus of the site (0.26 acres). Upon confirmation of the existence of waste debris, the owners of these properties shall comply with all of the provisions, specifications, and prohibitions of this Order.

3. The site encompasses an area of approximately 364 acres and is located in the City of Brisbane, as shown on Figure 1. The site is bounded on the east by U.S. Highway 101, on the west by the Caltrain/Joint Powers Board railroad tracks, and the south by the Guadalupe Lagoon. The northern edge of the site lies approximately midway between a row of properties located directly north of Beatty Avenue. Tunnel Avenue bisects the

western portion of the site. Figure 2 illustrates the location of the site and the proximity of the adjacent properties.

PURPOSE OF ORDER UPDATE

4. The primary purposes of this order are to bring the landfill into compliance with the appropriate portions of Title 27 of the California Code of Regulations (formerly known as Chapter 15, Title 23), referred to hereinafter as Title 27 and to establish a discharge monitoring program for the site.

SITE DESCRIPTION

5. The Brisbane Landfill is a closed, unlined Class III landfill. The landfill operated between 1932 and 1967, and was used for the disposal of primarily non-hazardous solid wastes composed principally of domestic, industrial, and shipyard waste, sewage, and rubble. No waste has been disposed of at the site since 1967. Prior to 1932, the area now occupied by the Brisbane Landfill consisted of a low-lying tidal marshland. Consistent with landfill practices at that time, no liner was installed at the site. Instead, the waste materials were placed directly into the water on top of a compressible silty clay unit (i.e., the Young Bay Mud).

6. Southern Pacific Transportation Company (SPTC) purchased the site in 1896 and by 1914 had filled and constructed a railroad along the western perimeter of the present day fill. In 1932, Sanitary Fill Company leased the property from SPTC and by the mid 1930s had subcontracted the day-to-day filling operations to the Easly and Brassy Company. Following the completion of land filling activities in 1967, Easly and Brassy ceased to operate at the landfill.

7. Upon completion of filling operations in each of the three disposal areas, the Brisbane Landfill was subdivided into multiple parcels currently owned by the Dischargers named above. Sunquest Properties, Inc., Oyster Point Properties, Inc., and Tuntex (USA), Inc., purchased the largest portion of the landfill from SPTC in 1989 and currently lease the corresponding land to Ryan Engineering, Inc., and Brisbane Recycling Co., Inc., for use as a stockpile yard for clean soil and crushed rock. The other identified Dischargers: Sunset Properties, Inc., Sanitary Fill Company, Sunset Scavenger Company, Macor, Inc., The City of Brisbane, Brisbane Properties, LLC, Douglas H. and Diane A. Galten, Van Arsdale-Harris Lumber Co., Robert E. and Dorothy D. Fewer, and, Bruce R. and Kurt Papenhause, are named due to the ownership of parcels on which the landfill exists. Figure 3 shows the location and Assessors Parcel Numbers for the properties located on the landfill. Table 1 includes ownership information for the parcels identified on Figure 3.

8. Current uses of the site include but are not limited to the following: lumberyards, office space, warehouses, stockyards, parking lots, vehicle repair facilities, a solid and a hazardous waste transfer station, a recycling facility, and an aboveground petroleum storage tank farm.

REGULATORY HISTORY

9. In 1958, the Regional Board adopted Resolution 58-278. The Resolution prohibited the discharge of waste directly to surface water and set criteria for sulfide, dissolved oxygen, and pH. The resolution called for the elimination of odors, unsightly floating or suspended solids, prevention of adverse effects on sport fishing, pleasure boating, and/or navigation at all points easterly of the James Lick Freeway (Highway 101), and called for the elimination of unsightly discoloration and adverse effects on fish and/or water fowl propagation in the waters of the State. The Resolution also required that a monitoring program be established and that periodic reports be submitted to the Board for review. This Order rescinds Resolution 58-278.

10. In 1992, a Solid Waste Water Quality Assessment Test (SWAT) was prepared for the Brisbane Landfill as required by Section 13273 of the California Water Code. The purpose of this statutory requirement was to rank all solid waste disposal sites in California by their potential adverse effects on water quality. The Brisbane Landfill was classified in the sixth rank and was thus required to submit a SWAT report to the RWQCB by July 1, 1992. The report concluded that there is evidence that constituents of concern may be leaving the site, particularly along the eastern and southern perimeters of the landfill, however, materials classified as hazardous did not appear to be present.

11. In 1994, the Board issued Cleanup and Abatement Order (CAO) No. 94-134. The CAO required that Tuntex Properties maintain a two-foot minimum cover of clean soil over the refuse and retain a positive drainage gradient to promote lateral runoff and to prevent ponding. Furthermore, CAO No. 94-134 required that the landfill comply with State Board Order 92-08, which required a Storm Water Pollution Prevention Plan for the site. This Order incorporates and rescinds CAO No. 94-134.

LANDFILL CONSTRUCTION HISTORY

12. The Brisbane Landfill operated and closed before either modern waste disposal practices were developed or formal regulatory designs for closure were required. Waste disposal design features such as liners, segregation of waste into disposal cells, and leachate collection systems were not components at the site. Waste containment was consistent with practices in the industry at that time where waste fill was placed directly on native soils.

13. In 1948, Highway 101 was constructed immediately to the east of the landfill. According to records, the highway was not constructed on refuse material but on constructed fill

derived from the Candlestick Point area. Following the completion of the highway, the Brisbane Landfill was isolated from the direct wave action from the San Francisco Bay.

14. Upon completion of disposal operations in each fill area, a soil cover of unknown hydraulic conductivity and thickness was installed covering the various fill areas. Clean cover materials continue to be added by the current operations of Ryan Engineering and Brisbane Recycling Co., Inc., who stockpile soil that surcharges the refuse on the largest portion of the site.

15. A monitoring well network was installed between 1988 and 1992 on the portion of the landfill owned by Sunquest Properties, Inc. Between 1990 and 1991 an active gas extraction system was installed which consisted of perimeter horizontal headers with vertical extraction wells and horizontal "finger" wells encircling Sunquest's portion of the site.

SITE WASTE DISPOSAL HISTORY

16. The landfill was filled in three areas with refuse composed of primarily non-hazardous solid wastes such as rubble, municipal, and shipyard waste. The total volume of waste disposed of at the landfill is estimated to be 12.5 million cubic yards. Of this volume an estimated 73 percent was produced by residential and commercial activities, with inert fill accounting for approximately 25 percent, and the remaining 2 percent was assumed to be liquid waste.

17. Fill Area I occupies the northwest portion of the site and was used for waste placement from 1932 until 1952. This fill area extended eastward about 1,000 feet into the San Francisco Bay from the area near Southern Pacific's railroad tracks. Fill Area II was used for waste disposal from 1953 to 1959 and extended the landfill an additional 600 feet eastward into the Bay and completed filling of the northern portion of the site. An access road built during the construction of Highway 101 (The Old Bayshore Freeway) defined the landfill's southern boundary and was located slightly north of the present location of the central drainage canal, which currently bisects the site. Fill Area III was created in 1959 when the landfill's southern boundary was extended to the south to its present location by construction of an earth fill dike. This area was used for waste placement from 1959 until the landfill stopped receiving waste in 1967.

SITE GEOLOGIC SETTING

18. The site is a relatively flat to slightly domed, artificial fill area, which overlies alluvium consisting of estuarine deposits referred to as the Young Bay Mud. The Young Bay Mud deposits are found throughout the San Francisco Bay region and generally consist of plastic, silty marine clays with high organic content and can range in thickness of up to approximately 120 feet. The Young Bay Mud typically has localized lenticular deposits

of poorly graded sand, silt, peat beds, and fossiliferous horizons. Beneath the Young Bay Mud, in the site vicinity, lies a group of young sedimentary units deposited in former topographic lows such as the Visitacion and Guadalupe Valley. This alluvium consists of dense silts, clays, and fine- to medium-grained sands, with occasional gravels and is likely representative of alluvial fan deposits which prograded during periods of glaciation that lowered sea level. These deposits can range in thickness up to approximately 50 feet. Underlying the unconsolidated alluvial material is the Old Bay Mud, which is compositionally similar to the Young Bay Bud with the exception that the Old Bay Mud is generally stiff to very stiff and overconsolidated. The Old Bay Mud can range in thickness up to approximately 200 feet, however due to erosion of its surface and/or irregularities on top of the underlying bedrock (Franciscan Complex) the Old Bay Mud can have highly variable stratigraphic thickness. Franciscan Complex bedrock, which underlies the young alluvial deposits near the landfill, is composed of sandstone, shale, conglomerate, chert, greenstone and serpentinite and is approximately Upper Jurassic to Lower Cretaceous in age and can be found to the west and north at ground surface and at depths greater than 250 feet towards the eastern extent of the landfill. All of the aforementioned geologic units are not present throughout the site. This is especially true in the northern portion of the landfill. In some areas, the Young Bay Mud immediately overlies Franciscan bedrock. At other locations in the northern portion of the site landfill materials are in direct contact with Franciscan bedrock.

19. There are four known faults located within 5 miles of the site. These faults include the San Andreas, Sierra, City College, and the Hillside. The San Andreas Fault is an active fault located approximately 5 miles to the southwest of the landfill and would likely represent the most concern for the site. This fault has a maximum expected Richter magnitude of 8.25 and was the source of historic earthquakes including the 1906 San Francisco Earthquake and the 17 October 1989 Loma Prieta Earthquake. The Sierra Fault was active in the Pleistocene (i.e., displacement < 1,800,000 years before present (bp)) and is located approximately 4 miles from the site. The City College and the Hillside Faults are both Pre-Quaternary (i.e., displacement > 1,800,000 years bp) in age. The City College Fault is inferred to transect the northern portion of the landfill while the Hillside Fault is located approximately 1.5 miles away to the southwest.

20. The Hayward and Calvaras Faults are located greater than 5 miles from the site. Both faults are considered active with an expected maximum Richter magnitude of 7.25, which could subsequently have a significant seismological impact on the site. The maximum credible bedrock acceleration from an earthquake on one of these faults would be in excess of 0.5 times the acceleration of gravity, which would be capable of extensive damage to improperly engineered structures.

SITE HYDROGEOLOGIC SETTING

21. The hydrogeologic units in the vicinity of the site include the Franciscan Complex, Old Bay Mud, alluvial fan deposits, Young Bay Mud, and the landfill itself. The landfill is an unconfined, water table, hydrostratigraphic unit. The landfill is located in a discharge area, an area, which is generally characterized by upward groundwater vertical hydraulic gradients. Groundwater above the Young Bay Mud is referred herein as "shallow groundwater" and in alluvial materials between the Young Bay Mud and the Old Bay Mud as "deep groundwater." Groundwater found in bedrock is also considered "deep groundwater."

22. A variable thickness of the Young Bay Mud, where present at the site, acts as a confining layer between the underlying alluvial deposits and Franciscan Complex bedrock and the landfill refuse. Wells, screened in the alluvial deposits below the Young Bay Mud, exhibit higher potentiometric surfaces than wells screened directly in refuse (i.e., vertical upward gradient). Although, one well pair MW-6B/MW-7A exhibits a vertical downward gradient, this well pair is located upgradient of the landfill and northwest of the aboveground petroleum tank farm. In addition well MW-6B is screened in alluvial materials and bedrock, and does not appear to be in close hydraulic connection with other deep wells at the site.

23. The regional upward vertical gradient, owing to recharge under confined conditions, is enhanced in some portions of the site by soil loading. Surcharging of the Young Bay Mud by soil loading can cause locally high pore pressure, which dissipates slowly because of the low hydraulic conductivity of the Young Bay Mud. High pore pressures of the Young Bay Mud would subsequently cause locally higher potentiometric surface of groundwater.

24. Water elevations that increase with depth, generally, are expected in the vicinity of groundwater discharge areas, such as the San Francisco Bay. The thick sequence of the Young Bay Mud and the observed upward vertical groundwater gradient likely act to prevent the downward migration of contaminants at the site.

25. Leachate flow south of the central drainage canal, which bisects the site, is generally towards the south (i.e., towards the Guadalupe Lagoon) or the southeast (i.e., towards the San Francisco Bay). Although leachate flow patterns north of the central drainage canal appear to be more complex, they are generally to the east, towards the San Francisco Bay. Leachate flow patterns in this northern area also exhibit complex mounding in the vicinity of former monitoring wells MW-17A and MW-18A.

26. Leachate hydraulic gradients within the landfill range from 0.0001 to 0.012 ft/ft. Leachate recharge appears to result from direct infiltration of precipitation, upward movement of deep groundwater into the Young Bay Mud and landfill, and from

infiltration from the central drainage canal. Tidal influence is not likely a significant contributor to recharge of leachate in the landfill.

27. Deep groundwater (i.e., below the Young Bay Mud) appears to be less complex than that observed in the overlying Young Bay Mud. Deep groundwater appears to be mounded in the vicinity of MW-35B and generally flows away from the mound towards the north and south during the dry season. Conversely, during the wet season the mound is less apparent and groundwater flows to the southeast towards the Guadalupe Lagoon and the San Francisco Bay. Groundwater gradients in the deeper zone have ranged from between 0.0006 to 0.0027 ft/ft. Recharge to groundwater in the deep zone appears to result from upward movement of groundwater from underlying geologic deposits.

GROUNDWATER CONTAMINATION AND WATER QUALITY

28. Landfill leachate contains dissolved metals, elevated ammonia, volatile organic compounds (VOCs), and semi volatile organic compounds (SVOCs). Landfill leachate is brackish to saline.

29. Shallow groundwater along the perimeter of the landfill indicates the presence of VOCs, SVOCs, metals, and elevated ammonia. The following are the maximum detected concentrations of organic compounds observed during the December 1995 monitoring event: Total petroleum hydrocarbons (TPH) as gasoline at 400 micrograms per liter (µg/L) detected in monitoring well MW-43A; TPH as motor oil at 1,130 µg/L detected in monitoring well MW-2A; TPH as diesel at 3,000 µg/L, TPH as bunker-C oil at 12,000 µg/L, and benzene at 6.2 µg/L detected in monitoring well MW-33A; and, ethyl-benzene, toluene, and total xylenes at 1.8, 3.9, and 10.3 µ/l, respectively, detected in monitoring well MW-10A. Total dissolved solids (TDS) within perimeter monitoring wells indicate that groundwater quality is fresh (i.e., TDS concentration ≤1,000 milligrams per liter (mg/L)) to brackish (i.e., TDS concentration from 1,000 to 20,000 mg/L) along the perimeter of the site. Furthermore, data from perimeter wells potentially indicates that constituents of concern may be leaving the site, particularly along the eastern and southern perimeter.

CURRENT AND FUTURE LAND USES

30. Current land use at the landfill is a mixture of open, industrial, and commercial space. Industrial land use includes stockpiling of soil and rock aggregate, warehouses, stockyards, parking lots, vehicle repair/maintenance facilities, a solid waste transfer station, a household hazardous waste collection facility, a recycling facility, and an aboveground petroleum storage tank facility. Commercial land use includes office space and a lumberyard.

31. Currently Sunquest Properties, Inc., plans to develop the largest portion of the site with a mixture of commercial and light industrial properties.

SITE INVESTIGATIONS

32. In 1977, John V. Lowney & Associates completed a preliminary geotechnical investigation for the landfill. The purpose of the investigation was to assess geotechnical issues associated with the development of the site for commercial and industrial use. The report concluded that development of the site for use as commercial and industrial land use was feasible. The primary concerns identified in the report for construction were to control methane gas, which had been measured at explosive levels within the landfill and to account for differential settlement.

33. In 1990, Kleinfelder, Inc., conducted a geotechnical investigation for the purpose of evaluating foundation requirements for future developments. They also conducted an evaluation of the extent of refuse at the site and installed soil gas and gas pressure probes to provide additional information for design of a landfill gas extraction system. In 1991, following the previous investigations, an active landfill gas extraction system was installed, the main header of which surrounds the 240 acre plot located east of Tunnel Avenue and west of Highway 101.

34. In 1992, Kleinfelder, Inc., conducted a Solid Waste Water Quality Assessment Test (SWAT) investigation to determine if the landfill had an adverse effect on water quality. The report concluded that organic compounds have been detected and have impacted the shallow water-bearing zone (i.e., above the Young Bay Mud). The report also concluded that the Young Bay Mud is an effective barrier and coupled with the observed upward vertical groundwater gradient, should prevent the downward migration of contaminants. Furthermore, the report concluded that the refuse layer of the landfill did not appear to be tidally influenced and that contamination at the site could not be classified as a hazardous waste under California State regulations.

35. In 2000, GeoSyntec Consultants, Inc., on behalf of Sunquest Properties, Inc., performed two investigations to identify property owners and to delineate the footprint of the Brisbane Landfill. Subsurface Consultants, Inc., on behalf of Sunset Properties, Inc., also completed in 2000 a technical review of geologic information to delineate the northern extent of the landfill.

MONITORING PROGRAMS

36. <u>Groundwater Monitoring</u> – There are a number of groundwater monitoring wells within the Brisbane Landfill. No formal groundwater-monitoring program exists, however, Provision 7 requires that the Dischargers develop a groundwater Detection

Monitoring Plan and establish an effective Detection Monitoring Program for groundwater monitoring. General groundwater monitoring program requirements are outlined in the Discharge Monitoring Program attached to this Order (Attachment A).

37. Leachate Monitoring - The leachate-monitoring program is outlined in the Discharge Monitoring Program attached to this Order (Attachment A). The Dischargers are required to analyze for the monitoring parameters as presented in the Discharge Monitoring Program.

38. Surface Water Monitoring – Surface water monitoring will be conducted as part of a General Industrial Storm Water Discharge Permit and through approved Industrial and Construction Storm Water Monitoring Plans.

39. Vadose Zone Monitoring – Vadose zone monitoring is not conducted at the site due to the presence of shallow groundwater.

40. Basin Plan - The Regional Board adopted a revised Water Quality Plan for the San Francisco Bay Basin (Basin Plan) in June 21, 1995. This updated and consolidated plan represents the Board's master water quality control planning document. The State Water Resources Control Board and the Office of the Administrative Law approved the revised Basin Plan on July 20 and November 13, respectively, of 1995. A summary of regulatory provisions is contained in Title 23 of the California Code of Regulations at Section 3912. The Basin Plan defines beneficial uses and water quality objectives for waters of the State, including surface waters and groundwaters.

41. Beneficial Uses - The beneficial uses of the South San Francisco Bay include:

a. Ocean, Commercial, and Sport Fishing;
b. Estuarine Habitat;
c. Industrial Service Supply;
d. Fish Migration;
e. Navigation;
f. Preservation of Rare and Endangered Species;
g. Water Contact Recreation;
h. Noncontact Water Recreation;
i. Shellfish Harvesting; and,
j. Wildlife Habitat.

The present and potential beneficial uses of the shallow groundwater are as follows:

a. Agricultural Supply;
b. Industrial Service Supply;
c. Municipal and Domestic Supply; and,
d. Industrial Process Supply.

The present and potential beneficial uses of the deeper groundwater are as follows:

a. Agricultural Supply;
b. Freshwater Replenishment;
c. Industrial Service Supply;
d. Municipal and Domestic Supply; and,
e. Industrial Process Supply.

42. Board Resolution No. 89-39, "Sources of Drinking Water," defines potential sources of drinking water to include all groundwater in the region, with limited exceptions for areas containing high TDS (i.e., >3,000 mg/L), high background contaminant levels, or those areas with a low-yield. In general, shallow and deep groundwater underlying the western perimeter of the site qualifies as a potential source of drinking water. Shallow groundwater underlying much of the remainder of the site has historically exhibited TDS in excess of 3,000 mg/L and/or electrical conductivity in excess of 5,000 micro-mhos per centimeter. Presently, there is no current use of the site's groundwater, nor any anticipated plans for its use.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

43. The Regional Board finds that this site is exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to §15308, Title 14 of the California Code of Regulations.

NOTIFICATION AND MEETINGS

44. The Board has notified the Dischargers and interested agencies and persons of its intent to issue waste discharge requirements for the Dischargers and has provided them with an opportunity for a public hearing and an opportunity to submit their written views and recommendations.

45. The Board, in a public meeting heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED that the Dischargers, its agents, successors and assigns shall meet the applicable provisions contained in Title 27, Division 2, Subdivision 1 of the California Code of Regulations and Division 7 of the California Water Code and shall comply with the following:

A. PROHIBITIONS

1. Waste shall not be in contact with ponded water from any source, to the extent that all jurisdictional agency requirements for existing ponded areas are attained.

2. No further waste shall be disposed at this landfill with the exception of properly approved and/or permitted facilities.

3. Leachate from waste and ponded water containing leachate or in contact with solid wastes shall not be discharged to waters of the State or of the United States.

4. Neither the treatment nor the discharge of waste shall create a condition of pollution, contamination or nuisance, as defined by Section 13050 of the California Water Code (CWC) (H & SC Section 5411, CWC Section 13263).

5. The Dischargers, or any future owners of the site, shall not cause the following conditions to exist in waters of the State at any place outside the waste management facility:

   a. Surface Waters

      1. Floating, suspended, or deposited macroscopic particulate matter or foam.

      2. Bottom deposits or aquatic growths.

      3. Alteration of temperature, turbidity, or apparent color beyond natural background levels.

      4. Visible, floating, suspended or deposited oil or other products of petroleum origin.

      5. Toxic or other deleterious substances to be present in concentrations or quantities that may cause deleterious effects on aquatic biota, wildlife or waterfowl, or that render any of these unfit for human consumption either at levels created in the receiving waters or as a result of biological concentrations.

   b. Groundwater

      Groundwater shall not be impacted as a result of the waste discharge.

a. SPECIFICATIONS

1. All reports pursuant to this order shall be prepared under the supervision of a California registered civil engineer, California registered geologist or California certified engineering geologist.

2. The site shall be protected from any washout or erosion of wastes or cover material and from inundation that could occur as a result of a 100-year, 24-hour precipitation event, or as the result of flooding with a return frequency of 100 years.

3. Surface drainage from tributary areas and internal site drainage from surface or subsurface sources shall not contact or percolate through wastes during the life of the site.

4. Any containment, drainage, monitoring systems and other environmental control facilities at the landfill, shall be maintained as long as leachate is present and poses a threat to water quality.

5. The Dischargers shall assure that existing and future structures, which control leachate, surface drainage, erosion, and gas, are constructed and/or maintained to withstand conditions generated during the maximum probable earthquake.

6. The final cover system shall be graded and maintained to promote lateral runoff and prevent ponding and infiltration of water.

7. The Dischargers shall analyze the samples from the groundwater wells included in the approved Detection Monitoring Plan (see Provision 7) as outlined in the Discharge Monitoring Program (Attachment A).

8. In the event of a release of a constituent of concern beyond the Point of Compliance (Section 20405, Title 27), the site begins a Compliance Period (Section 20410, Title 27). During the Compliance Period, the Dischargers shall perform an Evaluation Monitoring Program and a Corrective Action Program. The Point of Compliance is defined as the vertical surface located along the outer edge of the waste management unit and extending through the uppermost aquifer underlying the unit.

9. The Dischargers shall install any reasonable additional groundwater and leachate monitoring devices required to fulfill the terms of any future Discharge Monitoring Program issued by the Executive Officer.

10. Landfill gases shall be adequately vented, removed from the landfill, or otherwise controlled to minimize the danger of explosion, adverse health effects, nuisance conditions, or the impairment of beneficial uses of water.

11. The Dischargers shall maintain all devices or designed features installed in accordance with this order, such that they continue to operate as intended without interruption as

provided for by the performance standards adopted by the California Integrated Waste Management Board.

12. The Dischargers shall provide a minimum of two surveyed permanent monuments near the landfill from which the location and elevation of wastes, containment structures, and monitoring facilities can be determined throughout the post-closure maintenance period. A California licensed land surveyor or California registered civil engineer shall install these monuments.

13. The Regional Board shall be notified immediately of any failure occurring in the waste management unit. Any failure that threatens the integrity of containment features or the landfill shall be promptly corrected after approval of the method and schedule by the Executive Officer.

14. The Dischargers shall comply with all applicable provisions of Title 27 that are not specifically referred to in this Order.

15. The Dischargers shall maintain the facility so as to prevent a significant reduction in water quality at all points of compliance.

C. PROVISIONS

1. The Dischargers shall comply with all Prohibitions, Specifications and Provisions of this Order. All required submittals must be acceptable to the Executive Officer. The Dischargers must also comply with all conditions of these Waste Discharge Requirements. Violations may result in enforcement actions, including Regional Board orders or court orders requiring corrective action or imposing civil monetary liability, or in modification or revocation of these waste discharge requirements by the Regional Board. (CWC Section 13261, 13263, 13265, 13267, 13268, 13300, 13301, 13304, 13340, 13350).

2. All technical and monitoring reports required to be submitted pursuant to this Order are being requested pursuant to Section 13267 of the California Water Code. Failure to submit reports in accordance with schedules established by this Order or failure to submit a report of sufficient technical quality to be acceptable to the Executive Officer may subject the Dischargers to enforcement action pursuant to Section 13268 of the California Water Code.

3. The Dischargers shall submit **Semiannual and Annual Monitoring Reports**, acceptable to the Executive Officer, and in accordance with the attached Discharge Monitoring Program (Attachment A). The annual report shall be due no later than **April 30** of each year and shall cover the previous calendar year as described in Part A of the Discharge Monitoring Program. In addition to the requirements outlined in Attachment A, this report shall also include the following: location and operational condition of all leachate and groundwater monitoring wells; and groundwater and leachate contours for each

monitoring event. Additionally, the Dischargers shall submit semi-annual monitoring reports, to be submitted no later than October 30 and April 30 of each year; the April 30 semi-annual report may be combined with the annual report. The first semi-annual monitoring report shall be due following the issuance of a Revised Discharge Monitoring Program. The Revised Discharge Monitoring Program will be issued following review of the Detection Monitoring Plan and Monitoring Well Evaluation Report described in Provision 7.

REPORT DUE DATES:

ANNUAL REPORT– APRIL 30 (EACH YEAR)
SEMI-ANNUAL REPORTS – OCTOBER 31 AND APRIL 30 (EACH YEAR)

4. The Dischargers shall submit a letter report to the Board, acceptable to the Executive Officer, detailing the repair and maintenance activities that need to be completed prior to the commencement of the next rainy season (prior to October 15th of each year). This letter report shall also include a schedule for repair and maintenance activities, and a cost analysis detailing the anticipated expense for all repairs, maintenance and monitoring during the upcoming 12 months. Repair and maintenance estimates shall be based on rainy season inspections conducted throughout the winter as required in the Discharge Monitoring Plan. The report shall also contain a demonstration of the adequacy of the funds needed for the site repair and maintenance.

REPORT DUE DATE: JULY 31 OF EACH YEAR.

5. The Dischargers shall submit an **Emergency Response Contingency Plan**, acceptable to the Executive Officer, intended to stop and contain the migration of pollutants to receiving waters as the result of earthquakes, excessive rainfall, tidal action, or other significant events. The contingency plan shall describe the containment features, and groundwater monitoring and leachate monitoring facilities potentially impacted by such events. The plan shall also include methods of containment and cleanup of waste exposed or displaced at the site. Immediately after an event causing damage to the landfill structures, the corrective action plan shall be implemented and the Dischargers shall give immediate notification to the Regional Board as well as the Local Enforcement Agency (LEA) of any damage, including corrective actions and cleanup activities, and the environmental impacts of such. The plan shall also include a demonstration of the adequacy of the funds needed for the site contingency actions.

PLAN DUE DATE: October 31, 2001

6. The Dischargers shall submit a detailed **Post Earthquake Inspection and Corrective Action Plan** acceptable to the Executive officer to be implemented in the event of any earthquake generating ground shaking of Richter Magnitude 7 or greater at or within 60 miles of the landfill. The report shall describe the containment features, and groundwater monitoring and leachate control facilities potentially impacted by the static and seismic

deformations of the landfill. The plan shall provide for reporting results of the post earthquake inspection to the Board within 72 hours of the occurrence of the earthquake. Immediately after an earthquake event causing damage to the landfill structures, the corrective action plan shall be implemented and this Board shall be notified of any damage.

REPORT DUE DATE: **October 31, 2001**

7. The Dischargers shall submit a **Detection Monitoring Plan and Monitoring Well Evaluation Report**, acceptable to the Executive Officer, which shall include a description of each well and contain but not be limited to the following:

    1. The type of monitoring well (leachate or groundwater);
    2. The hydrological zone monitored (shallow or deep);
    3. Location with respect to groundwater flow direction (up-gradient, down-gradient, cross-gradient, interior);
    4. Depth, screened interval, casing material, diameter, survey coordinates, and top of casing elevation with respect to mean sea level;
    5. Well location map;
    6. Identification of well pairs that have the potential to monitor vertical gradient; and,
    7. An evaluation of each monitoring well's integrity.

In addition to the above requirements, all data for wells that contain hydrological information such as hydraulic conductivity, porosity, storativity, and transmissivity shall be included in the report. The report shall propose a Detection Monitoring Plan and present recommendations for the removal and/or replacement of wells found to be in poor working order and for the installation of new wells where data gaps are found to exist.

REPORT DUE DATE: **July 31, 2001**

8. For all new development within the landfill, the Dischargers shall assure that:

- A cap that is in compliance with the intent of Title 27 shall be placed within the entire development area and shall consist of no less than 2 feet of a foundation layer overlain by at least 1 foot of compacted clay liner, with a hydraulic conductivity of 10^{-6} cm/s or less, or alternative barrier layer design, which provides a corresponding low through-flow rate throughout the post-closure maintenance period. A minimum of 1-foot thick erosion resistant layer shall be installed on top of the clay liner, or equivalent barrier layer. The Regional Board must approve all proposed alternative barrier layers prior to their subsequent installation;

- A Cap QA/QC Report shall be submitted 30 days following the completion of any developing parcels cap reconstruction activities.

The report shall verify that the installed cap meets the requirements of this provision;

- Reconstructed clay caps that are neither irrigated nor paved shall be developed with a sufficient erosion resistant layer and/or engineering controls designed to maintain clay cap hydration;

- The cap integrity shall be maintained during and after construction;

- Any penetrations of the cap, such as from piles, utility pipes, foundations, plants, etc., shall be adequately sealed to prevent infiltration of water;

- The cap shall be graded with a slope of at least 2% to promote run off of storm and irrigated water;

- All irrigated portions of the landfill shall contain a sub-drain installed beneath the vegetative layer of the cap;

- Stormwater run-on and run-off shall be adequately controlled to prevent excessive erosion and damage to the cap. Any applied irrigation water shall likewise be controlled;

- All constructed buildings and utilities shall be built to accommodate the maximum anticipated settlement without structural damage; and

- New construction shall not promote additional standing water on top of the landfill with the exception of properly approved water features. All constructed water features shall contain a minimum of the following:

    - an impermeable layer, in addition to the cap barrier layer, to isolate ponded water from buried refuse; and
    - a sub-drain system designed to remove potential water leaks from the cap and the site.

  Plans for water features and sub-drains shall be submitted to the Regional Board for approval, prior to their construction.

9. All undeveloped (open space), non-irrigated, land shall contain a cap composed of at least 2 feet clean fill material with a graded slope of 2%.

10. The Dischargers are required to monitor leachate levels over time and implement a **Leachate Management Plan**, acceptable to the Executive Officer, to contain leachate within the waste management unit. Upon the detection of leachate buildup within the

waste unit, the Dischargers shall submit a schedule acceptable to the Executive Officer, to install a leachate collection, extraction, and disposal system.

REPORT DUE DATE: November 30, 2001

11. The Dischargers shall prepare and submit a **Development Proposal**, acceptable to the Executive Officer, for each individual development proposed for the landfill.

REPORT DUE DATE: **60 days prior to commencement of construction**

12. The Dischargers shall propose appropriate water quality criteria, acceptable to the Executive Officer, based on ecological protection of salt water where leachate is in contact with the Bay and no dilution is considered. If there are impacts to other beneficial uses, appropriate water quality criteria must be established.

REPORT DUE DATE: **October 31, 2001**

13. The Dischargers shall file with the Regional Board **Discharge Monitoring Reports** performed according to any Discharge Monitoring Program issued by the Executive Officer.

14. The Dischargers shall immediately notify the Board of any flooding, equipment failure, slope failure, or other change in site conditions that could impair the integrity of waste or leachate containment facilities or precipitation and drainage control structures.

REPORT DUE DATE: **Immediately following Changes in Site Conditions**

15. The Dischargers shall submit a **Water Quality Sampling and Analysis Plan** (SAP), acceptable to the Executive Officer, which gives a complete and detailed description of the physical process of obtaining field information, measurements, and water quality samples. The SAP should be usable as a stand-alone document and a copy of the current SAP must be available to each member of the sampling team. The SAP must contain sufficient detail for a sampler with limited experience to understand and follow to insure that sampling will be conducted in the same manner by different samplers.

REPORT DUE DATE: **June 30, 2001**

16. The Dischargers shall submit a work plan, acceptable to the Executive Officer, for the mitigation and long-term containment of the southern perimeter leachate seeps (Guadalupe Lagoon).

REPORT DUE DATE: **July 31, 2001**

17. The Dischargers shall submit a work plan, acceptable to the Executive Officer, for the mitigation of the central drainage canal.

REPORT DUE DATE : October 31, 2001

18. The Dischargers shall prepare, implement, and submit a **Storm Water Pollution Prevention Plan** for their associated properties in accordance with requirements specified in State Water Resources Control Board General Permit for Storm Water Discharges Associated with Industrial Activities (NPDES Permit No. CAS000001).

COMPLIANCE DUE DATE: **August 31, 2001**

19. For each proposed development, the Dischargers shall prepare, implement, and submit a **Storm Water Pollution Prevention Plan** in accordance with requirements specified in State Water Resources Control Board General Permit for Storm Water Discharges Associated with Construction Activities (NPDES Permit No. CAS000002).

COMPLIANCE DUE DATE: **45 days prior to commencement of construction**

20. The Dischargers shall submit a **Well Installation Report**, acceptable to the Executive Officer, that provides well construction details, geologic boring logs, and well development logs for all new wells installed as part of the attached Discharge Monitoring Program (Attachment A).

COMPLIANCE DUE DATE: **45 days following completion of well installation activities**

21. The Dischargers shall maintain a copy of these waste discharge requirements and these requirements shall be available to operating personnel at the facility at all times. (CWC Section 13263).

22. This Board considers the property owners to have continuing responsibility for correcting any problems that arise in the future as a result of the waste discharged or related operations.

23. In the event that the Dischargers-owned property adjacent to the landfill is developed into residential dwellings, the Dischargers will notify perspective home purchasers of the presence of the landfill.

24. The Dischargers shall permit the Regional Board or its authorized representative, upon presentation of credentials:

    a. Immediate entry upon the premises on which wastes are located or in which any required records are kept.
    b. Access to copy any records required to be kept under the terms and conditions of this order.

c. Inspection of any treatment equipment, monitoring equipment, or monitoring methods required by this order or by any other California State Agency.

d. Sampling of any discharge or groundwater governed by this Order.

25. The Dischargers shall notify the succeeding owners or operators of this Order by letter in the event of any change in control, ownership of land, or waste discharge facilities presently owned or controlled by the Dischargers. The Dischargers must notify the Executive Officer, in writing at least 30 days in advance of any proposed transfer of this Order's responsibility and coverage to a new discharger. The notice must include a written agreement between the existing and new dischargers containing a specific date for the transfer of this order's responsibility and coverage between the current Dischargers and the new dischargers. This agreement shall include an acknowledgment that the existing Dischargers are liable for violations up to the transfer date and that the new dischargers are liable from the transfer date on. (CWC Sections 13267 and 13263). The request must contain the requesting entity's full legal name, and the address and telephone number of the persons responsible for contact with the Board. Failure to submit the request shall be considered a discharge without requirements, a violation of the California Water Code.

26. This Order is subject to Board review and updating, as necessary, to comply with changing State and Federal laws, regulations, policies, or guidelines; changes in the Board's Basin Plan; or changes in the discharge characteristics (CWC Section 13263).

27. When the Dischargers becomes aware that they failed to submit any relevant facts in a Report of Waste Discharge or submitted incorrect information in a Report of Waste Discharge or in any report to the Regional Board, it shall promptly submit such facts or information (CWC Sections 13260 and 13267).

28. This Order does not convey any property rights of any sort or any exclusive privileges. The requirements prescribed herein do not authorize the commission of any act causing injury to persons or property, do not protect the Dischargers from his liability under Federal, State or local laws, nor do they create a vested right for the Dischargers to continue the waste discharge [CWC Section 13263(g)].

29. Provisions of these waste discharge requirements are severable. If any provision of these requirements is found invalid, the remainder of these requirements shall not be affected.

30. The Dischargers shall, at all times, properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Dischargers to achieve compliance with conditions of this Order. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this order [CWC Section 13263(f)].

31. Except for a discharge that is in compliance with these waste discharge requirements, any person who, without regard to intent or negligence, causes or permits any hazardous substance or sewage to be discharged in or on any waters of the State, or discharged or deposited where it is, or probably will be, discharged in or on any waters of the State, shall, as soon as (a) that person has knowledge of the discharge, (b) notification is possible, and (c) notification can be provided without substantially impeding cleanup or other emergency measures, immediately notify the office of Emergency Services of the discharge in accordance with the spill reporting provision of the state toxic disaster contingency plan adopted pursuant to Article 3.7 (commencing with Section 8574.7) of Chapter 7 of Division 1 of Title 2 of the Government Code, and immediately notify the State Board or the appropriate Regional Board of the discharge. This provision does not require reporting of any discharge of less than a reportable quantity as provided for under subdivisions (f) and (g) of Section 13271 of the Water Code unless the discharger is in violation of a prohibition in the applicable water Quality Control Plan [CWC Section 13271(a)].

32. The Dischargers shall report any noncompliance that may endanger health or the environment. Any such information shall be provided orally to the Executive officer within 24 hours from the time the Dischargers become aware of the circumstances. A written submission shall also be provided within five days of the time the Dischargers become aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected; the anticipated time it is expected to continue and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance. The Executive Officer, or an authorized representative, may waive the written report on a case-by-case basis if the oral report has been received within 24 hours [CWC Sections 13263 and 13267].

33. All monitoring instruments and devices used by the Dischargers to fulfill the prescribed monitoring program shall be properly maintained and calibrated as necessary to ensure their continued accuracy.

34. Unless otherwise permitted by the Regional Board Executive Officer, all analyses shall be conducted at a laboratory certified for such analyses by the State Department of Health Services. The Executive Officer may allow use of an uncertified laboratory under exceptional circumstances, such as when the closest laboratory to the monitoring location is outside the State boundaries and therefore not subject to certification. All analyses shall be required to be conducted in accordance with the latest edition of "Guidelines Establishing Test Procedures for Analysis of Pollutants" (40 CFR, Part 1360) promulgated by the U.S. Environmental Protection Agency (CCR Title 23, Section 2230).

35. This Board's Resolution 58-278 and Cleanup and Abatement Order No. 94-134 are hereby rescinded.

I, Loretta K. Barsamian, Executive Officer, do hereby certify that the foregoing is a full, complete, and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on April 18, 2001.

Loretta K. Barsamian
Executive Officer

Figures: Figure 1 - Site Location Map
Figure 2 - Landfill Map
Figure 3 - Parcel Location Map

Table: Table 1 - Parcel Ownership Information

Attachment: Attachment A - Discharge Monitoring Program

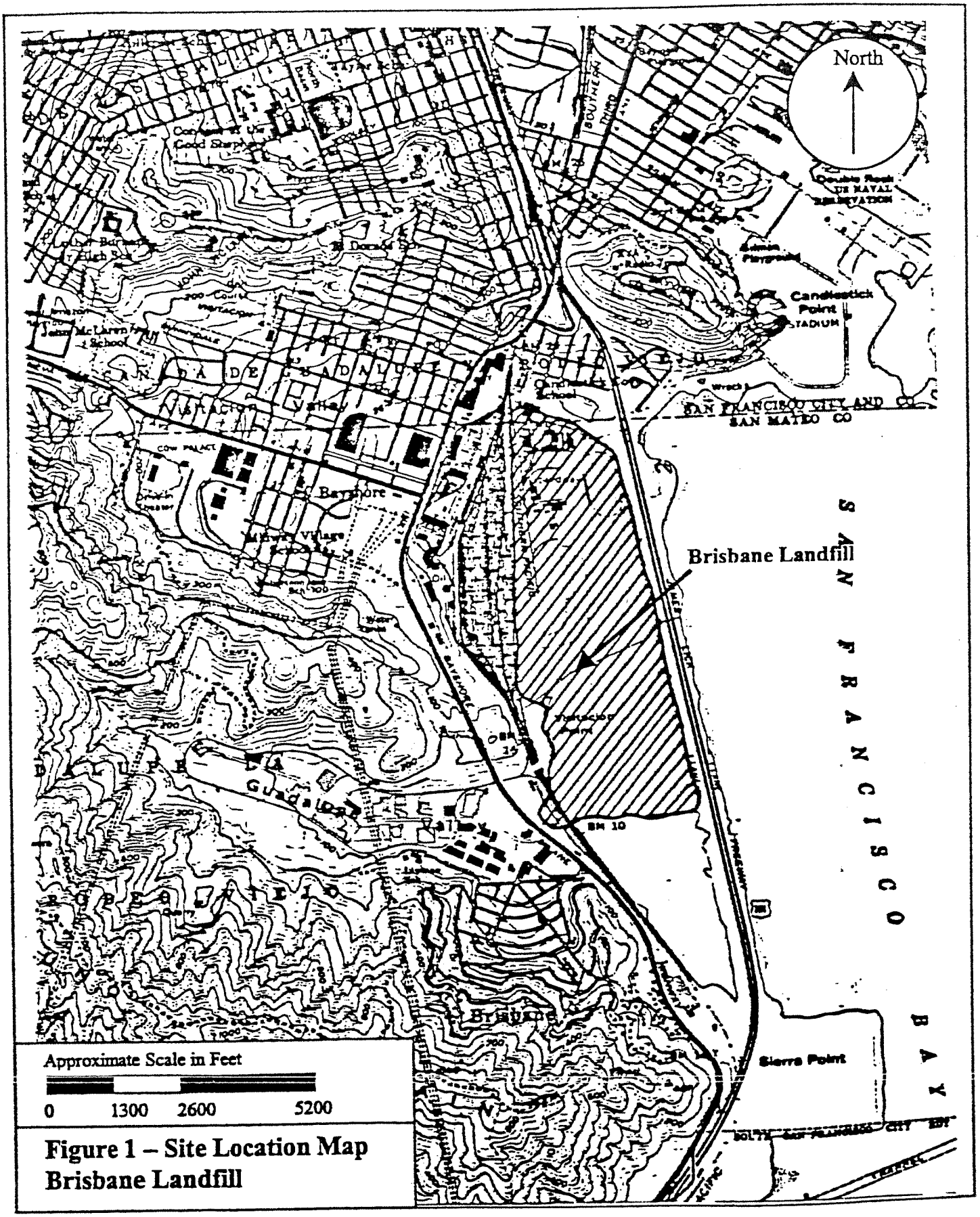

Figure 1 – Site Location Map
Brisbane Landfill

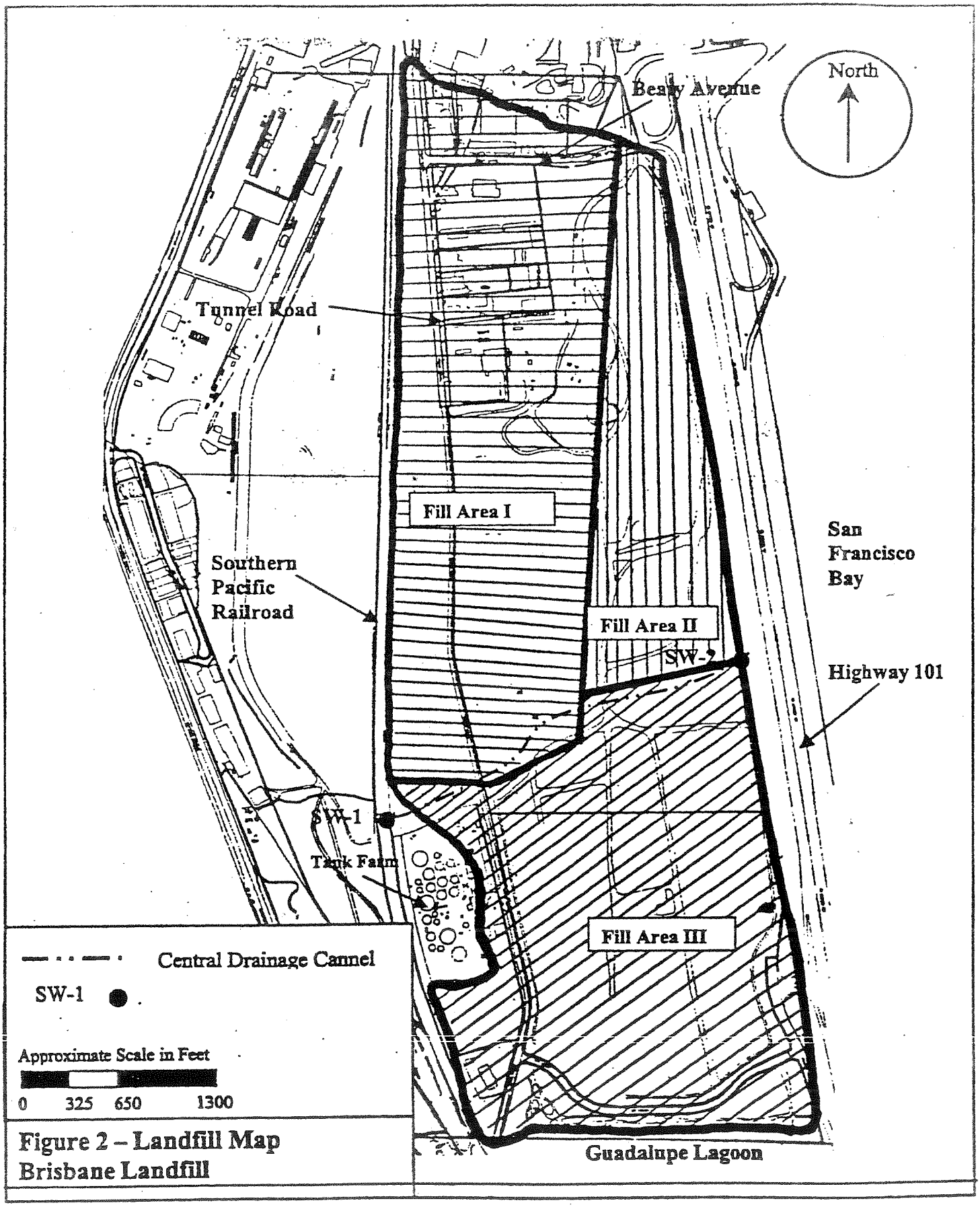

Figure 2 – Landfill Map
Brisbane Landfill

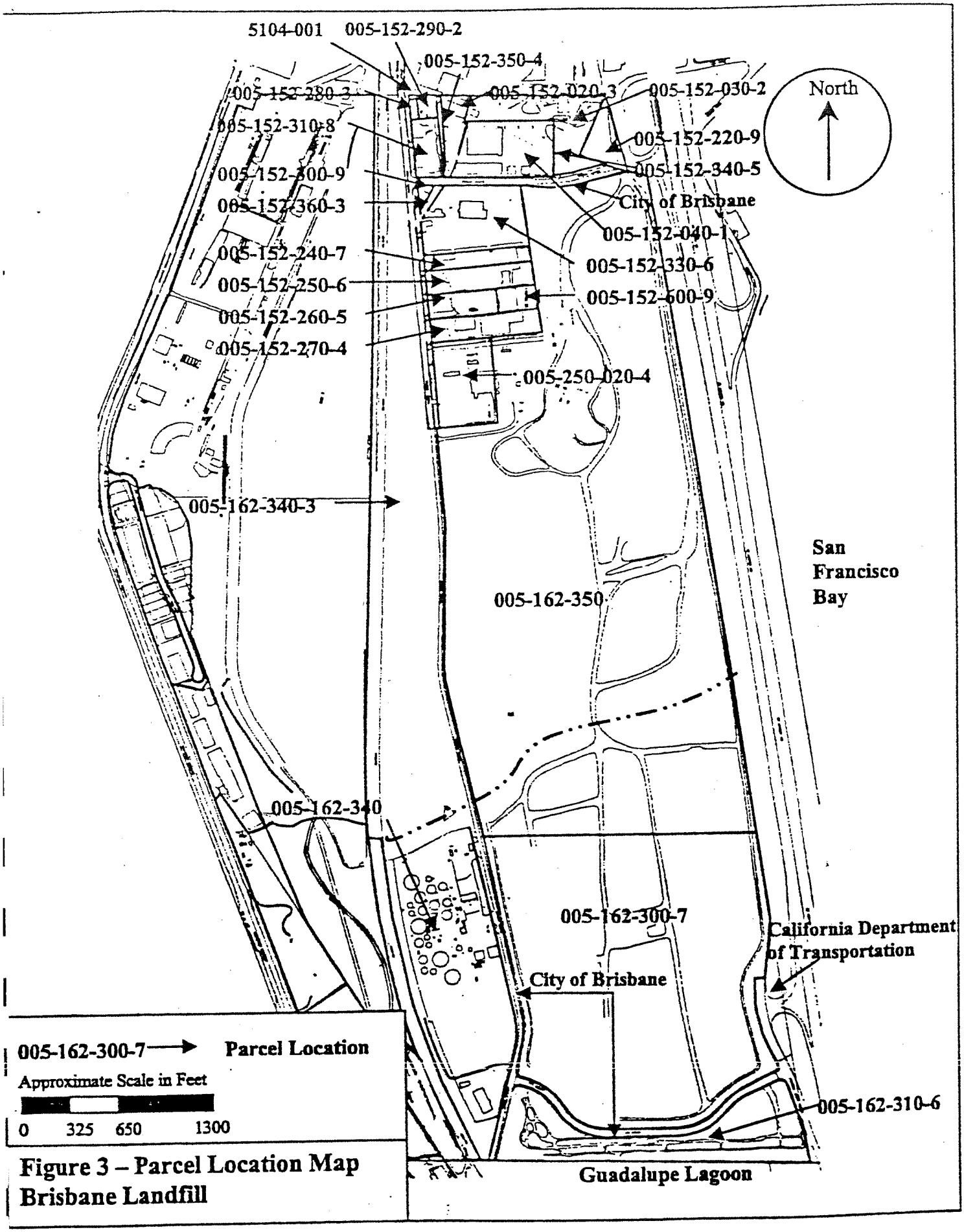

Figure 3 – Parcel Location Map
Brisbane Landfill

Table 1 - Parcel Ownership Information

Assessor's Parcel Number(s)	Owner's Name
005-152-020-3	Sanitary Fill Company
005-152-030-2	Sanitary Fill Company
005-152-290-2	Sanitary Fill Company
005-152-280-3	Sanitary Fill Company
005-152-330-6	Sanitary Fill Company
005-152-340-5	Sanitary Fill Company
005-152-040-1	Sunset Properties, Inc.
005-152-220-9	Sunset Scavenger Company & Macor, Inc.
5104-001	Macor, Inc.
005-152-310-8	Fewer, Robert E., and Dorthy D., TRS
005-152-300-9	Papenhause, Bruce R. and SM TRS & Kurt Papenhause
005-152-350-4	Papenhause, Bruce R. and SM TRS & Kurt Papenhause
005-152-360-3	Papenhause, Bruce R. and SM TRS & Kurt Papenhause
005-152-270-4	Van Arsdale-Harris Lumber Co.
005-250-020-4	Brisbane Properties, LLC, and Douglas H. and Diane A. Galten
005-162-350	Oyster Point Properties, Inc. (Sunquest Properties, Inc.)
005-162-300-7	Oyster Point Properties, Inc. (Sunquest Properties, Inc.)
005-162-310-6	Oyster Point Properties, Inc. (Sunquest Properties, Inc.)
005-162-340-3	Oyster Point Properties, Inc. (Sunquest Properties, Inc.)
005-152-260-5	Tuntex (USA), Inc.
005-152-250-6	Tuntex (USA), Inc.
005-152-600-9	Tuntex (USA), Inc.
005-152-240-7	Tuntex (USA), Inc.
005-162-340	Tuntex (USA), Inc.
	City of Brisbane
	California Department of Transportation

ATTACHMENT A

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

DISCHARGE MONITORING PROGRAM

FOR

BRISBANE LANDFILL
CITY OF BRISBANE, SAN MATEO COUNTY

ORDER NO. 01-041

CONSISTS OF

PART A

AND

PART B

PART A

A. GENERAL

Reporting responsibilities of waste discharger are specified in Sections 13225(a), 13267(b), 13383, and 13387(b) of the California Water Code and this Regional Board's Resolution No. 73-16. This Discharge Monitoring Program is issued in accordance with Title 27.

The principal purposes of a discharge monitoring program are: (1) to document compliance with waste discharge requirements and prohibitions established by the Board, (2) to facilitate self-policing by the waste Dischargers in the prevention and abatement of pollution arising from waste discharge, (3) to develop or assist in the development of standards of performance, and toxicity standards, (4) to assist the Dischargers in complying with the requirements of Title 27.

B. SAMPLING AND ANALYTICAL METHODS

Sample collection, storage, and analyses shall be performed according to the most recent version of EPA Standard Methods and in accordance with an approved sampling and analysis plan.

Water and waste analysis shall be performed by a laboratory approved for these analyses by the State of California. The director of the laboratory whose name appears on the certification shall supervise all analytical work in his/her laboratory and shall sign all reports of such work submitted to the Regional Board.

All monitoring instruments and equipment shall be properly calibrated and maintained to ensure accuracy of measurements.

C. DEFINITION OF TERMS

1. A grab sample is a discrete sample collected at any time.

2. Receiving waters refers to any surface water, which actually or potentially receives surface or groundwaters, which pass over, through, or under waste materials or contaminated soils. In this case the groundwater beneath and adjacent to the landfill areas, the surface runoff from the site, the Guadalupe Lagoon, and the San Francisco Bay are considered receiving waters.

3. Standard observations refer to:

a. Receiving Waters:

1) Floating and suspended materials of waste origin: presence or absence, source, and size of affected area;
2) Discoloration and turbidity: description of color, source, and size of affected area;
3) Evidence of odors, presence or absence, characterization, source, and distance of travel from source;
4) Evidence of beneficial use: presence of water associated wildlife;
5) Flow rate; and
6) Weather conditions: wind direction and estimated velocity, total precipitation during the previous five days and on the day of observation.

b. Perimeter of the waste management unit:

1) Evidence of liquid leaving or entering the waste management unit, estimated size of affected area and flow rate (show affected area on map);
2) Evidence of odors, presence or absence, characterization, source, and distance of travel from source; and
3) Evidence of erosion and/or daylighted refuse.

c. The waste management unit:

1) Evidence of ponded water at any point on the waste management facility;
2) Evidence of odors, presence or absence, characterization, source, and distance of travel from source;
3) Evidence of erosion, slope or ground movement, and/or daylighted refuse;
4) Adequacy of access road;
5) Condition of site drains, silt basin capacity; and
6) Standard Analysis and measurements (listed in the attached Table A).

D. SAMPLING, ANALYSIS, AND OBSERVATIONS

The Dischargers are required to perform sampling, analyses, and observations in the following media:

1. Storm drain discharges per Section 20415; and,
2. Groundwater and leachate per Section 20415.

E. RECORDS TO BE MAINTAINED

Written reports shall be maintained by the Dischargers or laboratory, and shall be retained for a minimum of five years. This period of retention shall be extended during the course of any unresolved litigation regarding this discharge or when requested by the Board. Such records shall show the following for each sample:

1. Identity of sample and sample station number;

2. Date and time of sampling;

3. Date and time that analyses are started and completed, and name of the personnel performing the analyses;

4. Complete procedure used, including method of preserving the sample, and the identity and volumes of reagents used;

5. Calculation of results; and

6. Results of analyses, and detection limits for each analysis.

F. REPORTS TO BE FILED WITH THE BOARD

1. Written detection monitoring reports shall be filed by **October 30** and **April 30** of each year. In addition an annual report shall be filed by **April 30** of each year. The reports shall be comprised of the following:

   a. Letter of Transmittal:

      A letter transmitting the essential points in each report should accompany each report. Such a letter shall include a discussion of any requirement violations found during the last report period, and actions taken or planned for correcting the violations. If the Dischargers have previously submitted a detailed time schedule for correcting requirement violations, a reference to the correspondence transmitting such schedule will be satisfactory. If no violations have occurred in the last report period this shall be stated in the letter of transmittal. Monitoring reports and the letter transmitting the monitoring reports shall be signed by a principal executive officer at the level of vice president or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge originates. The letter shall contain a statement by the official, under penalty of perjury, that to the best of the signer's knowledge the report is true, complete, and correct.

b. Each monitoring report shall include a compliance evaluation summary. The summary shall contain:

1) A graphic description of the velocity and direction of groundwater flow under/around the waste management unit, based upon the past and present water level elevations and pertinent visual observations.

2) The method and time of water level measurement, the type of pump used for purging, pump placement in the well; method of purging, pumping rate, equipment and methods used to monitor field pH, temperature, and conductivity during purging, calibration of the field equipment, results of the pH, temperature conductivity and turbidity testing, well recovery time, and method of disposing of the purge water.

3) Type of pump used, pump placement for sampling, a detailed description of the sampling procedure; number and description of equipment, field and travel blanks; number and description of duplicate samples; type of sample containers and preservatives used, the date and time of sampling, the name and qualifications of the person actually taking the samples, and any other observations.

c. A map or aerial photograph shall accompany each report showing observation and monitoring station locations.

d. Laboratory statements of results of analyses specified in Part B must be included in each report. The director of the laboratory whose name appears on the laboratory certification shall supervise all analytical work in his/her laboratory and shall sign all reports of such work submitted to the Board.

1) The methods of analyses and detection limits must be appropriate for the expected concentrations. Specific methods of analyses must be identified. If methods other than EPA approved methods or Standard Methods are used, the exact methodology must be submitted for review and approved by the Executive Officer prior to use.

2) In addition to the results of the analyses, laboratory quality assurance/quality control (QA/QC) information must be included in the monitoring report. The laboratory QA/QC information shall include the method, equipment and analytical detection limits; the recovery rates; an explanation for any recovery rate that is less than 80%; the results of equipment and method blanks; the results

of spiked and surrogate samples; the frequency of quality control analysis; and the name and qualifications of the person(s) performing the analyses.

e. An evaluation of the effectiveness of the leachate monitoring facilities, which includes an evaluation of leachate buildup within the disposal units.

f. A summary and certification of completion of all standard observations for the waste management unit, the perimeter of the waste management unit, and the receiving waters.

2. CONTINGENCY REPORTING

A report shall be made by telephone of any seepage from the disposal area immediately after it is discovered. A written report shall be filed with the Board within **five days** thereafter. This report shall contain the following information:

1) a map showing the location(s) of discharge if any;
2) approximate flow rate;
3) nature of effects, i.e., all pertinent observations and analyses; and
4) corrective measures underway, proposed, or as specified in the Waste Discharge Requirements.

3. REPORTING

By **April 30** of each year the Dischargers shall submit an annual report to the Board covering the previous calendar year. The annual report may incorporate the second semi-annual report of the previous year. The annual report shall contain:

a. Tabular and graphical summaries of the monitoring data obtained during the previous year; the report should be accompanied by a computer data disk, tabulating the year's data in Microsoft Excel.

b. A comprehensive discussion of the compliance record, and the corrective actions taken or planned which may be needed to bring the discharger into full compliance with the waste discharge requirements.

c. A written summary of the groundwater analyses indicating any change in the quality of the groundwater.

d. An evaluation of the effectiveness of the leachate monitoring/control facilities, which includes an evaluation of leachate buildup within the disposal units.

4. WELL LOGS

A boring log and a monitoring well construction log shall be submitted for each new sampling well established for this monitoring program, as well as a report of inspection or certification that each well has been constructed in accordance with the construction standards of the Department of Water Resources. These shall be submitted within 45 days after well installation.

Part B

1. DESCRIPTION OF OBSERVATION STATIONS AND SCHEDULE OF OBSERVATIONS

A. ON-SITE OBSERVATIONS – Observe Quarterly, Report Semi-annually

STATION	DESCRIPTION	OBSERVATIONS	FREQUENCY
Standard Observations:			
A-1 to A-'n'	Located on the area as delineated by a 500 foot grid network.	Standard observations for the waste management unit as defined in Part A, Section C	Quarterly
Interior Seeps:			
L-1 thru L-'n'	At each point of discharge. Include a map indicating locations of discharge(s)	All Parameters as outlined in Table A (perform analysis once per seep)	Weekly until remedial action is taken and seepage ceases.
Perimeter Observations:			
P-1 thru P-'n'	Located at equidistant intervals not exceeding 1000 feet around the perimeter of the waste management unit.	Standard observations for the waste management unit perimeter as defined in Part A, Section C	Quarterly
Perimeter Seeps:			
S-1 thru S-'n'	At any point(s) at which seepage is found occurring from the disposal area. Include a map indicating locations of discharge(s)	All Parameters as outlined in Table A (perform analysis once per seep)	Weekly until remedial action is taken and seepage ceases.

B. SURFACE, GROUNDWATER AND LEACHATE MONITORING - Report Semi-annually

i. Surface and Stormwater: Surface water shall be monitored as outlined below and in Table A (Attached). These monitoring points are also shown on Figure 2 (Attached). The results of the additional monitoring conducted as part of the General Permit for stormwater discharge shall be submitted as part of the annual report.

Monitoring Points:

Surface Water	Comply with the requirements of the General Industrial Storm Water Runoff Program

ii. Groundwater: Groundwater samples shall be analyzed as outlined below in accordance with Table A (Attached).

Monitoring Points:

Groundwater	Will be established following receipt of the **Monitoring Well Evaluation Report**

iii. Leachate: Leachate samples shall be analyzed as outlined below in accordance with Table A (Attached).

Monitoring Points:

Leachate	Will be established following receipt of the **Monitoring Well Evaluation Report**

C. FACILITIES MONITORING

The Dischargers shall inspect all environmental control facilities to ensure proper and safe operation once per quarter and report semi-annually.

D. Reports shall be due on the following schedule:

First semi-annual report:	**October 30 of each year**
Second semi-annual Report:	**April 30 of each year**
Annual Report:	**Combined with the second semi-annual report, due April 30 of each year**

I, Loretta K. Barsamian, Executive Officer, hereby certify that the foregoing Discharge Monitoring Program:

1. Has been developed in accordance with the procedures set forth in this Board's Resolution No. 73-16 in order to obtain data and document compliance with waste discharge requirements established in this Board's Order No. 01-041.

2. Is effective on the date shown below.

3. May be reviewed or modified at any time subsequent to the effective date, upon written notice from the Executive Officer.

Loretta K. Barsamian
Executive Officer

Date Ordered: April 18, 2001

Attachment: Table A – Discharge Monitoring Plan, List of Analytical Parameters, Surface, Stormwater, Leachate and Groundwater

Table A - Discharge Monitoring Plan, List of Analytical Parameters, Surface, Stormwater, Leachate and Groundwater

Field/Inorganic Parameters	Method[1]	Frequency
pH	Field	Semi-Annual
Electrical conductivity	Field	Semi-Annual
Leachate Elevation	Field	Quarterly
Groundwater Elevation	Field	Quarterly
Sulfate	300.0	Semi-Annual
Total Dissolved Solids	160.1	Semi-Annual
Ammonia (un-ionized)	350.1	Semi-Annual
Total organic carbon	415.1	Semi-Annual
Nitrate	9200	Semi-Annual

Organics/Pesticides/PCBs	Method[1]	Frequency
Volatile Organic Compounds (including MTBE)	8260	Semi-Annual[2]
Semi-volatile Organic Compounds	8270	Semi-Annual[3]
Organochlorine Pesticides & PCBs	8080	Semi-Annual[3]

Metals	Method[1]	Frequency
Arsenic	7060	Semi-Annual
Barium	6010	Semi-Annual
Lead	7421	Semi-Annual
Nickel	6010	Semi-Annual
Selenium	7740	Semi-Annual

Notes:

1 Test methods per Methods for Chemical Analysis of Water and Waste, USEPA 600/4/79/029, revised March 1983, or Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods, USEPA SW-846, 3rd edition, November 1986 and revisions. The Board staff can consider alternative EPA and/or Standard Methods, with comparable MDLs and PQLs, for use at the Brisbane Landfill.

2. Analysis of groundwater and leachate shall be conducted during the October 2001 sampling event. Any identified impacted monitoring wells shall be analyzed semi-annually, thereafter. All other monitoring wells shall be monitored, annually.

3. Analysis of groundwater and leachate shall be conducted during the October 2001 sampling event. Any identified impacted monitoring wells shall be analyzed semi-annually, thereafter. All other monitoring wells shall be monitored once every 5 years.

APPENDIX B

Construction Quality Assurance Plan

CONSTRUCTION QUALITY ASSURANCE PLAN FOR THE CONSTRUCTION OF THE FINAL COVER SYSTEM

for the

BRISBANE LANDFILL
Brisbane, California

for

SUNQUEST PROPERTIES, INC.
150 Executive Park Blvd., Suite 4200
San Francisco, California 94134

Prepared by

Burns & McDonnell Engineering Company, Inc.

Project No. 23680

JULY 2002

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(OUTLINE)

SECTION 1 – CONSTRUCTION QUALITY ASSURANCE PLAN

1.0 INTRODUCTION

This Construction Quality Assurance Plan (CQA Plan) describes construction quality assurance procedures for the installation of the final cover system for the Brisbane Landfill. The goal of this CQA Plan is to: (i) define the responsibilities of parties involved with the construction; (ii) provide methods to verify that proper construction techniques and procedures are used in completion of the project; (iii) establish testing protocols; (iv) provide the means for assuring the project is constructed in conformance to the construction drawings and specifications; (v) and to define problems that may occur during construction and provide a mechanism for resolving these problems.

This CQA Plan is independent of any CQA Plan conducted by the earthwork and geosynthetic contractor. This CQA Plan consists of selected tests and inspections to be performed during construction that are intended to provide independent third party certification that the earthwork and geosynthetic contractor have met their obligations in the supply and installation of the final cover system components. This CQA Plan addresses the soils and geosynthetic component of the final cover system, and surface water management systems. This CQA Plan should be used in conjunction with the construction drawings and specifications prepared for the construction of the final cover system.

1.1 PROJECT REQUIREMENTS

Requirements for the final cover system at the Brisbane Landfill are set forth in the California Code of Regulations (CCR), Title 27, Subchapter 5, Closure and Postclosure Maintenance. To satisfy the requirements of these regulations, the components of the final cover system will be composed of the following components:

- 2' Thick Foundation Layer (minimum thickness)
- 1' Thick Low Hydraulic Conductivity Layer (maximum $1x10^{-6}$ cm/sec) or 60 mil High Density Polyethylene (HDPE)
- 1' Thick Erosion Resistant/Vegetation Layer (minimum thickness)

The thickness of the foundation layer and erosion resistant/vegetation layer may be increased to meet grading requirements of the construction drawings and specifications. The cover drainage system, when required, will consist of Geocomposite/Geonet Drainage Layer.

All materials used to construct the final cover system must meet or exceed the criteria established for each particular component of the system as indicated on the construction drawings and specifications. Any deviation from the construction drawings and specifications must be preapproved by the Engineer.

1.2 ORGANIZATION OF THE QUALITY ASSURANCE PLAN

The remainder of this CQA Plan is organized as follows:

- Section 2 presents CQA of Earthworks
- Section 3 presents CQA of Geosynthetics

SECTION 2 – CQA for Earthworks

2.0 INTRODUCTION

This section describes minimum CQA procedures for the installation of the soil and rock components used in the construction of the final cover system for the Brisbane Landfill.

Presented in this section are procedures for verifying that 1) the soil materials used in construction are adequate, 2) the methods of construction are acceptable, and 3) the soil materials are adequately protected during and after installation.

2.1 DEFINITIONS FOR EARTHWORKS

This section provides definitions for terms used in this section of the CQA Plan.

CQA Monitor

Site representative of the CQA Officer responsible for documenting field observations and tests.

CQA Officer

The third party firm or individual appointed by the Owner, having no financial interest in the construction, responsible for performing construction quality assurance tasks outlined in this CQA Plan. This person shall be responsible for performing tasks outlined in this CQA Plan. This person shall be a registered civil engineer or a certified engineering geologist.

Construction Quality Assurance Plan or CQA Plan

A written plan that addresses the qualifications and responsibilities of the CQA Officer, field guidelines for quality assurance, required laboratory and field tests, frequency of testing, and required documentation.

Design Engineer or Engineer

The individual or firm responsible for the design and preparation of the construction drawings and specifications.

Owner or Owner's (Field) Representative

Sunquest Properties Inc. or its designated contact person or representative.

Project Construction Drawings and Specifications

Includes all project-related drawings and specifications including design modifications and record drawings.

Project Documents

Construction drawings, contractor submittals, record drawings, specifications, shop drawings, construction quality assurance plans, and project schedule.

Record Drawings

Drawings recording the dimensions, details, and coordinates of the facility after construction is completed.

Earthwork

An activity involving the use of soil or rock materials as defined in the specifications.

Earthwork Contractor

Also referred to as the Contractor. The person or firm responsible for earthwork-related activities. This definition applies to any party performing work defined as earthwork even if it is not his primary function.

Quality Assurance

Verification that quality control functions have been performed in substantial compliance with the project construction drawings and specifications.

Quality Control

Functions performed by the Contractor or supplier to verify that work performed conforms to project construction drawings and specifications.

2.2 MEETINGS

To facilitate construction and to clearly define construction goals and activities, close coordination between the Owner, Engineer, CQA Officer, and Earthwork Contractor is essential. To meet this objective, design review and pre-construction, progress, and deficiency meetings will be held.

2.2.1 Design Review and Pre-Construction Meeting

A design review and pre-construction meeting will be held at the site prior to the start of construction. The Engineer, Owner's Field Representative, CQA Officer, Earthwork Contractor, and others designated by the Owner will attend this meeting. The purpose of this meeting is to discuss the following:

- Identify key personnel
- Confirm all parties possess relevant documents
- Review the construction drawings, specifications, CQA plan, work area security, construction procedures, and related issues.
- Confirm the responsibilities of all parties.
- Confirm lines of communications and authority.
- Review the project schedule.
- Review reporting and documentation procedures (i.e., test results and record drawings).
- Establish testing protocols and procedures for correcting and documenting construction deficiencies.

- Conduct a site inspection to discuss work areas, work plans, stockpiling, laydown areas, access roads, haul roads, and related items.
- Develop any required addenda to the project documents.

This meeting will be documented by the CQA Officer or the Owner's Field Representative and copies of the documentation will be distributed to all parties.

2.2.2 Progress Meetings

Periodic progress meetings will be held at the discretion of the CQA Officer. The purpose of these meetings may be any of the following items:

- Review scheduled work activities
- Discuss problems
- Review test data
- Other

These meetings will be documented by the CQA Officer. Typically, these meetings may occur more informally on a daily basis.

2.2.3 Deficiency Meetings

As required, special meetings will be held to discuss problems or deficiencies. At a minimum, these meetings will be attended by the CQA Officer or Monitor, and Earthwork Contractor. If the problem requires a design modification, the Engineer should also be present. These meetings will be documented by the CQA Officer.

2.3 EARTHWORK QUALITY ASSURANCE

Construction must be conducted in accordance with the construction drawings and specifications. Acceptable construction criteria for the compacted foundation layer, low hydraulic conductivity layer, erosion resistant/vegetation layer, and engineered fill will be detailed in the specifications. To monitor compliance, a two-part quality assurance testing program will be implemented that

includes material verification and construction testing. Material verification includes material testing prior to fill placement. Construction testing includes those activities that occur during material placement.

All quality assurance testing shall be conducted in accordance with this CQA Plan and the construction drawings and specifications. Where there is a discrepancy, the construction drawings and specifications will govern. All in-situ testing and sampling shall be observed by CQA personnel. Documentation shall meet the requirements of this CQA Plan.

The CQA Officer in charge of the CQA services for the project will be a registered professional engineer that has shown competency and experience on similar projects. The CQA Officer will be required to furnish a resume of his or her work experience relating to CQA. In addition, the CQA Officer will furnish the client names and telephone numbers for the projects completed.

Field personnel or CQA Monitors working under the direction of the CQA Officer will be trained in areas specific to the project specifications (geosynthetics and earthwork). Each monitor will provide a resume of their work experience and training related to CQA activities.

The CQA personnel will be familiar with the design of the closure cover system, be efficient in coordinating the efforts of all parties involved, have specific technical knowledge of final cover systems and details, and have an awareness of construction problems which can have an impact on the construction.

The personnel providing the CQA services shall be an integral part of the design, review, and construction teams.

The CQA Officer shall be experienced in earthwork and geosynthetic construction practices. He or she shall understand and be familiar with hydraulic conductivity testing and factors affecting the performance of liner systems. He or she shall also be familiar with nuclear testing practices.

2.4 SURVEYING

The Earthwork Contractor shall determine and record positions and elevations of a uniform grid with a maximum spacing between grid points of 50 feet for each of the following surfaces:

- Top of compacted foundation layer
- Top of low hydraulic conductivity layer
- Top of erosion resitant/vegetation layer

In addition, grid points shall be established at the top, mid-point, and base of all slopes. Also, the position and invert elevation of any drainage piping or ditches shall be determined every 100 feet or at changes in direction or termination. All measurements shall be made to the tolerances shown on the construction drawings or in the specifications. All surveys shall be performed or approved by a California Registered Professional Land Surveyor.

2.5 MATERIAL PLACEMENT

Material verification tests to confirm required properties of the soil materials shall be performed on material from each borrow source during construction and prior to placement. The test types (by ASTM designation where possible) and testing frequency for each material are presented in Table 1.

Material placement activities shall include observation of the work and field and construction quality assurance testing. This CQA testing may be conducted by the Owner's representative or the CQA Monitor. All testing shall be in accordance with ASTM procedures unless otherwise specified.

Observation of soil placement shall at a minimum include the following:

- Determining that the construction activities are not adversely impacting other items such as piping, concrete structures, etc.
- Monitoring lift thickness.

- Monitoring moisture content and dry density.
- Observing the effect of compaction equipment on the material placed (penetration, pumping, cracking, etc.).
- Observing placement for material segregation and uniformity of the moisture content.
- Observing the previously compacted material for desiccation cracking.
- Observing that the materials are placed to the lines and grades shown on the drawings.
- Monitoring protection of placed material.
- Observing construction surveys.

Testing frequencies are shown on Table 2.

2.6 SUBGRADE

Prior to placing any geosynthetic liner component, the entire subgrade shall be proof rolled. The CQA Monitor shall provide visual observation during proof-rolling. Soft or bumpy areas shall be removed and replaced with acceptable material.

2.7 SPECIAL TESTING

The testing frequencies provided in the preceding sections can be increased at the direction of the CQA Monitor when visual or other observations indicate a potential problem. Conditions which may warrant additional testing include, but are not limited to, the following:

- Compactors slip during operations
- Adverse weather
- Equipment breakdown
- Work conducted in difficult areas
- A high frequency of failed tests.

2.8 SUBGRADE PERFORATIONS

All perforations of the individuals soil layers and engineered fills, including nuclear density device probe and sand cone holes, and grab sample locations shall be repaired. Small perforations, such as nuclear density device probe holes, shall be repaired by placing dry, powdered bentonite in the hole and filling to the surface. Large perforations, such as sand cone holes and grab sample locations, shall be repaired by backfilling the holes with loose clay material at a similar moisture content as that being placed. The loose material shall be mixed with dry powdered bentonite and compacted in the perforation with a tamping rod until no further densification is observed.

2.9 DEFICIENCIES

When deficiencies (items that do not meet the specified values) are discovered, the CQA Monitor shall notify the Contractor and CQA Officer, and complete the required documentation. If the deficiency will cause construction delays of more than two hours or will necessitate substantial rework, the Monitor shall also notify the Owner.

The deficient area shall be reworked or the materials removed at the Earthwork Contractor's discretion. If the Earthwork Contractor chooses to rework areas that do not meet the requirements, the area shall be scarified, moisture conditioned as appropriate, re-compacted, and re-tested. The corrected deficiency shall be re-tested before additional work is performed. All re-tests and steps taken to correct the problem shall be documented by the Monitor.

2.10 DOCUMENTATION

Implementation of the CQA plan depends on thorough monitoring and documentation of the construction activities. Therefore, the CQA Officer shall document that the quality assurance requirements have been addressed and satisfied. Documentation shall consist of daily record keeping, construction problem resolutions, photographic records, design and specification revisions provided by the Engineer, weekly progress reports, and a summary report.

2.11 DAILY RECORD KEEPING

At a minimum, daily records shall consist of field notes, a summary of the daily meeting with the Earthwork Contractor (if any), observation and testing data sheets, and construction problem and resolution reports. This information shall be submitted regularly to the Owner's Field Representative. Sample forms are provided in Appendix A.

2.11.1 Observation and Testing Data Sheets

These sheets shall identify daily project information and include the following information:

- Date, project name, and location.
- General weather information.
- A reduced scale site plan showing work areas including sample and test locations.
- A description of construction performed.
- A summary of test results identified as passing, failing, or in the event of a failed test, retest results.
- Test equipment calibrations, if applicable.
- Off-site materials received including quarry certificates.
- A summary of decisions regarding acceptance of the work and/or corrective actions taken.
- The signature of the CQA Officer.

2.11.2 Construction Problem and Resolution Report

This report identifies and documents construction problems and resolutions. It is intended to document problems involving significant rework and is not intended to document items which are easily corrected unless the problems are reoccurring. At a minimum, this report shall include the following items:

- A detailed description of the problem
- The location and cause of the problem
- How the problem was identified
- How the problem was resolved

- Personnel involved
- Signature of the CQA Officer

2.11.3 Photographs

All construction activities will be photographed, including significant problems and remedial actions. The photographs shall be identified by location, time, date, and person taking the photograph.

2.11.4 Design and Specification Changes

Design and specification changes may be required during construction. In such cases, the CQA Officer shall notify the Owner's Field Representative, who will then notify the Engineer. Design and specification changes shall only be made with written agreement of the Owner's Field Representative and Engineer.

2.12 WEEKLY PROGRESS REPORTS

The CQA Officer shall prepare weekly progress reports summarizing construction and quality control activities. This report, which is submitted to the Owner's Field Representative, shall contain the following information:

- The date, project name, and location.
- A summary of work activities.
- A summary of deficiencies and/or defects and resolutions.
- The signature of the CQA Officer.

2.13 SUMMARY REPORT

At the completion of the project, the CQA Officer shall submit a summary report to the Owner's Field Representative. This report shall state that the work has been performed in substantial compliance with the construction drawings and specifications.

At a minimum this report shall contain the following:

- A summary of all construction activities.
- Observation and testing data sheets.
- Sampling and testing location plans.
- A description of significant construction problems and the resolution of these problems.
- A list of changes from the construction drawings and specifications and the justification for these changes.
- Record drawings.
- A statement of substantial compliance signed and sealed by a registered engineer.

The record drawings shall accurately locate all construction items, including the location of piping, anchor trenches, temporary liner terminations, etc.. All surveying and base maps required for the development of the record drawings will be prepared or approved by an independent registered surveyor contracted either by the Owner or the Contractor.

TABLE 1

Material Evaluation Testing Frequency

ASTM Test Designation	Earth Fill	Foundation Layer	Low Hydraulic Conductivity Layer
Sand Cone D1556, D2216	---	---	---
Compaction D1557 Modified Proctor	1 per source	1 per source	1 per source
Particle Size D422	1 per source	1 per source	1 per source
200 Wash D1140	1 per source	1 per source	1 per source
Atterberg Limits D4318	---	---	1 per source
Visual Description D2488	1 per source	1 per source	1 per source
Soil Classification D2487	1 per source	1 per source	1 per source
Nuclear Density D2922, D3017	---	---	---
Moisture Content D2216	1 per source	1 per source	1 per source
Permeability[2] D2434	---	---	1 per source
Clod Size[3]	---	---	---

[1]Minimum one test per material type.

[2]Constant-head, rigid wall permeability test ASTM D2434.

[3]Visual examination.

NOTE: These testing frequencies may be increased at the discretion of the Owner, Engineer, or CQA

TABLE 2

Minimum Conformance Testing Frequency

ASTM Test Designation	Earth Fill[1]	Foundation Layer[1]	Low Hydraulic Conductivity Layer[1]
Sand Cone D1556, D2216	10,000 cy	10,000 cy	10,000 cy
Compaction D1557 Modified Proctor	10,000 cy	10,000 cy	10,000 cy
Particle Size D422	10,000 cy	10,000 cy	10,000 cy
200 Wash D1140	10,000 cy	10,000 cy	10,000 cy
Atterberg Limits D4318	---	---	10,000 cy
Visual Description D2488	---	---	---
Soil Classification D2487	10,000 cy	10,000 cy	10,000 cy
Nuclear Density D2922, D3017	10,000 cy	10,000 cy	10,000 cy
Moisture Content D2216	10,000 cy	10,000 cy	10,000 cy
Permeability[2] D2434	---	---	10,000 cy
Clod Size[3]	---	---	---

[1]Minimum one test per noted volume.

[2]Constant-head, rigid wall permeability test ASTM D2434.

[3]Visual examination.

NOTE: These testing frequencies may be increased at the discretion of the Owner, Engineer, or CQA Officer.

SECTION 3 – CQA for GEOSYNTHETIC MATERIALS

3.0 INTRODUCTION

This section describes construction quality assurance (CQA) procedures for the installation of the synthetic components used in the final cover system. Synthetic components include high-density polyethylene (HDPE) geomembranes, geosynthetic clay liners (GCL), geocomposites, and geotextiles.

The overall goals of this manual are to outline procedures for verifying that proper materials, construction techniques, and installation procedures are used by the Contractor/Installer/Manufacturer and that the design intent is met.

3.1 DEFINITIONS FOR GEOSYNTHETICS

This section provides definitions for terms used in this section of the CQA Plan.

Construction Quality Assurance Plan or CQA Plan

A written plan that addresses the qualifications and responsibilities of the CQA Officer, field guidelines for quality assurance, required laboratory and field tests, frequency of testing, and required documentation.

Design Engineer or Engineer

The individual or firm responsible for the design, and preparation of the project construction drawings and specifications.

Earthwork

An activity involving the use of soil or rock materials as defined in the specifications.

Geocomposite

A geotextile heat-bonded to one or both sides of a geonet.

Geomembrane

A synthetic lining material, also referred to as flexible membrane liner (FML).

Geosynthetic Clay Liner

A lining material consisting of bentonite supported by a geomembrane or geotextile.

Geotextile

Any permeable textile material used for separation and/or filtration (with soil, rock, etc.) in civil engineering construction.

Installer

The individual or firm responsible for geosynthetic-related construction activities. This definition applies to any party performing work defined as geomembrane, geosynthetic clay liner, geocomposite, or geotextile installation.

Panel

A unit area of a geosynthetic that will be seamed in the field or in the fabricator's plant.

Construction Drawings and Specifications

Includes all project-related drawings and specifications including design modifications and record drawings.

Project Documents

Installer submittals, construction drawings, record drawings, specifications, shop drawings, and project schedule.

Owner or Owner's Field Representative

Sunquest Properties Inc. or its designated contact person or representative.

Construction Quality Control (CQC)

Functions performed by the contractor or supplier to verify that work performed conforms to drawings and specifications.

Construction Quality Assurance (CQA)

Verification that quality control functions have been performed in substantial compliance with the project construction drawings and specifications.

CQA Monitor

Site representative of the CQA Officer responsible for documenting field observations and tests.

CQA Officer

The third party firm or individual, appointed by the Owner, having no financial interest in the construction, responsible for performing tasks outlined in this CQA Plan. This person shall be a registered civil engineer or a certified engineering geologist. The CQA Officer's duties include the following activities:

- Reviewing Installer submittals
- Observing material delivery and unloading
- Observing placement and seaming operations
- Sampling materials for conformance testing
- Observing nondestructive seam testing
- Recovering and processing seam samples for destructive testing
- Observing and documenting repair operations

Record Drawings

Drawings recording the dimensions, details, and coordinates of the facility after construction is completed. These drawings will include the final locations of the geomembrane panels and seams, in addition to locations of destructive tests and repairs.

CQC Manager

Installer's representative in charge of Installer's Construction Quality Control Plan.

Testing Laboratory

A laboratory capable of conducting the tests required by this CQA Plan and the geosynthetic materials specifications. This laboratory may be retained by Engineer, CQA Officer, or the Owner and shall not be affiliated with the Installer.

3.2 MEETINGS

To facilitate construction and clearly define construction goals and activities, close coordination between the Engineer, Owner, CQA Officer, and Installer is essential. To meet this objective, design review, pre-construction, progress, and deficiency meetings will include the following meetings:

3.2.1 Design Review Meeting

Following completion of the design and after review and approval by the Owner and applicable state and federal agencies, a design review meeting will be held. The purpose of this meeting, which the Owner's Field Representative, and CQA Officer shall attend, is to accomplish the following activities:

- Identify key personnel
- Provide all parties with relevant documents
- Review design and permit drawings and CQA Plan
- Discuss impacts for project construction drawings and specifications
- Establish reporting and documenting procedures
- Define lines of communication
- Establish work area procedures
- Review sampling and testing procedures for nondestructive and destructive testing

The meeting will be documented by the CQA Officer or person designated by the Owner's Field Representative. Copies of the minutes and relevant documents will be provided to all parties.

3.2.2 Pre-Construction Meeting

A pre-construction meeting, which may be held concurrently with the design review meeting, will be held at the site prior to the start of construction. The Engineer, Owner's Field Representative, CQA Officer, Installer, and others designated by the Owner will attend this meeting. The purpose of this meeting is to accomplish the following activities:

- Review the construction drawings, specifications, CQA Plan, work area security, construction procedures, and related issues.
- Confirm the responsibilities of all parties.
- Confirm lines of communication and authority.
- Review the project schedule.
- Review documentation procedures (ie. testing and record drawings).
- Establish testing protocols and procedures for correcting and documenting construction deficiencies.
- Conduct a site inspection to discuss work areas, work plans, stockpiling, laydown areas, access roads, haul roads, and related items.

This meeting will be documented by the CQA Officer or the Owner's Field Representative and copies of the documentation will be distributed to all parties.

3.2.3 Progress Meetings

A progress meeting will be held daily before the start of work. At a minimum, this meeting will be attended by the CQA Officer and the Installer's on-site superintendent and CQA Manager. The purpose of this meeting is to accomplish the following activities:

- Review scheduled work activities.
- Discuss problems.
- Review test data.

This meeting will be documented on the Daily Meeting Report form by the CQA Officer, and copies of the documentation will be distributed to the Owner's Field Representative, Engineer, and Installer.

3.2.4 Deficiency Meetings

As required, special meetings will be held to discuss problems or deficiencies. At a minimum, this meeting will be attended by the CQA Officer and Installer's on-site superintendent and CQC Manager. If the problem requires a design modification, the Owner's Field Representative and Engineer should also be present. The meeting will be documented by the CQA Officer on the Daily Meeting Report.

3.3 GEOSYNTHETIC MATERIALS QUALITY ASSURANCE

Construction will be conducted in accordance with the project construction drawings and specifications. To monitor compliance, a QC program will be implemented that includes the following activities:

- Review of installer's QC submittals review
- Material conformance testing
- Construction testing (nondestructive and destructive)
- Construction observation

Conformance testing refers to those activities that can take place prior to material installation. Construction testing includes those activities that occur during and following geosynthetics installation.

All CQA testing of geosynthetics shall be conducted in accordance with this CQA Plan and the project construction drawings and specifications. Where there is a discrepancy, the project construction drawings and specifications will govern. Documentation shall meet the requirements of this CQA Plan.

The CQA officer in charge of the CQA services for the project will be a registered professional engineer that has shown competency and experience on similar projects. The CQA officer will be required to furnish a resume of his or her work experience relating to CQA. In addition, the CQA officer will furnish the client names and telephone numbers for the projects completed.

Field personnel or CQA monitors working under the direction of the CQA officer will be trained in the areas specific to the project specifications (geosynthetics and soil liners). Each monitor will provide a resume of their work experience and training related to CQA.

The CQA personnel will be familiar with the design of the landfill, be efficient in coordinating the efforts of all parties involved, have specific technical knowledge of the liner system details, and have an awareness of construction problems which can have an impact on the constructed facility.

The personnel providing the CQA services shall be an integral part of the design, review, and construction teams.

3.4 GEOMEMBRANES

3.4.1 Delivery

The CQA Officer shall verify that the following activities are done:

- Equipment used to unload the rolls will not damage the geomembrane
- Care is used to unload the rolls
- Manufacturer's QC documentation for each roll is received and includes the following information:
    - Roll number
    - Date of production
    - Resin identification
    - Material Dimensions (W x L)
    - Material Thickness
    - Year of Production & Manufacturer

At the CQA Officer's discretion, damaged rolls may be rejected. They shall be removed from the site or stored at a location, separate from accepted rolls, designated by the Owner's Field Representative. All rolls without proper manufacturer's documentation will be rejected.

A Material Received Log (see Appendix A) will be prepared by the CQA Officer for all geosynthetic material delivered to the job site.

3.4.2 Conformance Testing

The geomembrane material for this project will consist of high density polyethylene (HDPE). Both textured and smooth geomembrane surfaces will be utilized.

3.4.2.1 Tests

Unless otherwise specified, prior to or after delivery the CQA Officer or authorized representative shall obtain one geomembrane sample per 100,000 square feet of geomembrane. The samples shall be forwarded to the Testing Laboratory for the following tests:

- Density (ASTM D792)
- Carbon black content and dispersion (ASTM D1603)
- Thickness (ASTM D5199)
- Tensile Properties (ASTM D638)
    - Yield strength
    - Yield elongation
- Tear resistance (ASTM D1004)
- Melt Index (ASTM D123B)

Where optional procedures are noted in the test method, the Destruct specification requirements shall prevail. The CQA Officer shall review all test results and report any nonconformance to the Engineer and the Installer.

3.4.2.2 Sampling Procedures

Samples shall be taken across the entire roll width and shall not include the first 3 feet. Unless otherwise specified, samples shall be 3 feet long by the roll width. The CQA Officer or authorized representative shall mark on the sample the machine direction, manufacturer's roll identification number, and date the sample was obtained.

3.4.3 Geomembrane Installation

3.4.3.1 Surface Preparation

Prior to liner installation, the CQA Officer shall verify that the following conditions exist:

- All lines and grades have been verified by a qualified surveyor.
- The subgrade has been prepared in accordance with the earthwork specification.
- The surface has been rolled and compacted to be free of surface irregularities and protrusions.
- There is no desiccation cracking of the soil liner surface.
- There are no excessively soft areas that could result in liner damage.
- All construction stakes and hubs have been removed and holes filled with soil compacted to the minimum requirements for the adjacent soil.
- The certificate of soil subgrade acceptance has been completed and signed by the Installer.

3.4.3.2 Panel Placement

The Installer shall give each panel a permanent identification number. This number shall be used by the CQA Officer, CQC Manager, and all other parties for documentation and record drawings. The CQA Officer shall establish a chart showing correspondence between roll numbers, certification reports, and panel numbers. The CQC Manager shall maintain a Geomembrane Placement Log and form similar to that shown in the Appendix A.

During panel placement, the CQA Officer shall perform the following activities:

- Observe the sheet surface as it is deployed and record all panel defects and disposition of the defects (panel rejected, patch installed, etc.). Large sections of damaged material shall be cut out and removed from the site. All repairs are to be made in accordance with the procedures given in this manual and the geomembrane specifications.

- Verify that equipment used does not damage the geomembrane by handling, trafficking, leakage of hydrocarbons, or by other means.

- Verify that the surface beneath the geomembrane has not deteriorated since acceptance by the Installer.

- Inspect the geomembrane for scratches and tears if it has been pulled across an unprotected surface.

- Record weather conditions including temperature, wind, and humidity. The geomembrane shall not be deployed in the presence of excess moisture (fog, dew, mist, etc.).

- Verify that people working on the geomembrane do not smoke, wear shoes and/or engage in activities that could damage the geomembrane.

- Verify that the method used to deploy the sheet minimize wrinkles and that the sheets are anchored to prevent movement by wind.

The CQA Officer shall inform both the Installer and Owner's Field Representative if the above conditions are not met.

3.4.3.3 Field Sampling

The Installer shall provide the Owner's Field Representative and CQA Officer with a panel layout drawing. This drawing may be modified, with approval of the CQA Officer, to meet job

site conditions. The Installer will maintain record drawings that will be updated by the Installer on a regular basis.

A seam numbering system shall be agreed to by the CQA Officer and Installer prior to the start of seaming operations. (One procedure is to identify the seam by adjacent panels. For example, the seam located between Panel 306 and 401 would be Seam No. 306/401.)

Prior to seaming, trial welds for each operator and seaming apparatus (welder) shall be tested in accordance with the geomembrane specification to determine if the equipment and operator are functioning properly. The CQA Officer shall observe all welding operations and the testing of the trial welds. Trial weld results will be recorded by the CQC Manager and on the forms provided by the Installer. All trial welds are to be completed under conditions similar to those existing when the panel will be seamed. Trial welds will be completed at the beginning of each morning and afternoon shift, and also at any time, the CQA Officer believes that an operator or seaming apparatus is not functioning properly. If there are large changes in temperature, humidity, or wind speed, the test weld is to be repeated.

During seaming operations, the CQA Officer shall verify that the following conditions exist:

- The Installer has the number of seamers and spare parts agreed to in the pre-construction meeting.
- Equipment used for seaming does not damage the geomembrane.
- The extruder is purged prior to beginning a seam until all the heat-degraded extrudate is removed (extrusion welding only).
- Seam grinding has been completed less than 30 minutes before seam welding (extrusion welding only).
- Seam edges are beveled and grind marks are perpendicular to the seam (extrusion welding only).
- Grind marks do not extend more than 1/4 inch from edge of weld.

- The ambient temperature measured within 6 inches of the geomembrane surface is between 32 and 105 degrees Fahrenheit, unless approved otherwise by the CQA Officer.
- The end of old welds, more than 5 minutes old, are ground to expose new material before restarting a weld (extrusion welding only).
- The weld is free of dust, dirt, moisture, or other contaminants.
- The seams overlap a minimum of 3 inches for extrusion welding and 4 inches for fusion welding.
- No solvents or adhesives are present in the seam area, unless approved otherwise by the CQA Officer.
- The procedure used to temporarily hold the panels together does not damage the panels and does not preclude CQA testing.
- The panels are seamed in accordance with the plans and specifications.

The CQC Manager shall prepare a Geomembrane Seaming Log for each seam.

3.4.4 Construction Testing

Two nondestructive testing procedures will be utilized, depending on the type of welding procedure used. For extrusion welded seams the vacuum box method will be employed for the full seam length. A vacuum of at least 3 psi will be maintained for at least 10 seconds. For the dual wedge (hot shoe) fusion welded seam, the air channel will be pressurized to a maximum pressure of 30 psi (GRI Test Method GM6). The air channel will be pressurized for at least 5 minutes. For 60 mil thick geomembrane, the pressure drop cannot be greater than 3 psi in 5 minutes.

3.4.4.1 Nondestructive Seam Testing

During nondestructive testing operations, the CQA Officer shall perform the following activities:

- Observe all nondestructive testing.
- Verify that the CQC Manager records the location, date, test number, technician name, and results of all nondestructive testing. These results shall be recorded on a

Geomembrane Nondestructive Test Record form similar to that shown in the Appendix A.

- Mark the location of any defects requiring repairs and record on the Geomembrane Repair Log form (Appendix A).
- Mark the failed areas with a waterproof marker compatible with the liner (spray paint should not be used), and inform the CQC Manager of any required repairs.
- Verify that all testing covers the entire length of all field seams and is completed in accordance with the project specifications.
- Verify that all repairs are completed and then tested in accordance with the project specifications.

3.4.4.2 Destructive Seam Testing

Destructive testing shall be performed concurrently with seaming operations, not at the completion of the installation. The types of destructive testing required during the liner installation are peel and shear tests.

The CQA Officer shall select locations where seam samples will be cut for laboratory testing. These locations shall be established in the following manner:

- A minimum of one test per 500 feet of seam length. This is a minimum frequency for the entire installation; individual samples may be taken at shorter intervals as determined by the CQA Officer.
- A maximum frequency shall be agreed to by the CQC Manager, CQA Officer, and Owner at the pre-construction meeting. However, if the number of failed samples exceeds 3 percent of the tested samples, this frequency will be increased at the discretion of the CQA Officer. Samples taken as the result of failed tests do not count toward the total number of tests.
- Test locations shall be determined by the CQA Officer. Locations selected may be prompted by liner distortion due to overheating, weld contamination, or any potential

cause of poor welds. The Installer shall not be informed in advance of the destructive test sample locations.

Samples shall be removed by the CQC Manager at locations identified by the CQA Officer. The CQA Officer shall perform the following activities:

- Observe sample cutting.
- Mark each sample with an identifying number containing the seam number.
- Record the sample location and reason sample was taken (e.g., random sample, visual appearance, result of a previous failure, etc.) on the Geomembrane Destructive Test Record.

Two types of samples shall be taken at each location, one for field tests and one for laboratory tests. For the field tests, two seam samples, 1 inch wide by 12 inches long with the seam centered across the length, shall be taken 42 inches apart. These samples shall be tested in the field by the CQC Manager using a tensiometer capable of quantitatively measuring shear and peel strengths. If one or both of these samples fail, the Installer has the following options:

- Reconstruct the seam between passing field test sample locations.
- Take another test sample 10 feet from the point of the failed field test in each direction and repeat this procedure. If the second test passes, the Installer can either reconstruct or cap strip the seam between the two passing field test locations. If subsequent tests fail, the procedure is repeated until the length of the poor quality seam is established. Repeated failures indicate that the seaming equipment and/or operator are not performing properly, and appropriate action will be taken.

Once the field tests have passed, a sample shall be recovered from between previously passing field sample locations for delivery to the Testing Laboratory. The sample shall be 42 inches long by 12 inches wide, with the seam centered along the length. This recovered sample shall be divided into three parts: one 12-inch section shall be given to the Installer, one 12-inch by 12-

inch sample shall be given to the Owner for storage, and one 12-inch by 18-inch sample shall be sent to the Testing Laboratory for testing. Samples for destructive analysis shall be shipped by the CQA Officer to the Testing Laboratory on the same day the sample is recovered.

Testing shall include the shear and peel test (ASTM D4437). At least five specimens shall be tested in peel and five specimens in shear. At least four of the five specimens tested by the Testing Laboratory using each method must meet the minimum test values presented in the geomembrane specification. The Testing Laboratory shall provide test results within 24 hours in writing or via telephone with the CQA Officer. Certified test results are to be provided within 5 days. The CQA Officer shall immediately notify the CQC Manager in the event of a failed test. Higher than normal failure rates (in excess of 3 percent of tested samples) shall be reported to the Engineer. No areas, except as necessary to provide temporary wind protection or to temporarily prevent water from getting under the geomembrane, are to be covered prior to receiving the laboratory test results.

A passing machine-welded seam will be achieved in peel testing when the following two conditions are met:

- Failure is by Film Tear Bond (FTB), National Sanitation Foundation (NSF) Standard 54, definition 2.15.
- The load at failure, when tested in accordance with ASTM D 4437, shall be at least 70 percent of the yield strength of the parent geomembrane material (in ponds per inch width) or greater for smooth HDPE and 62 percent of the yield strength of the parent geomembrane material or greater for textured HDPE.

A passing machine-welded seam will be achieved in shear when the following conditions are met:

- Failure is by FTB, National Sanitation Foundation (NSF) standard 54, definition 2.15.
- The load at failure, when tested in accordance with ASTM D 4437, shall be at least 95 percent of the yield strength (in pounds per inch width) of the parent geomembrane material (smooth and textured).

If the laboratory test fails in either peel or shear, the Installer may either reconstruct the entire seam or additional samples may be recovered. If additional samples are to be recovered, samples must be taken on either side of the failed sample for laboratory testing. These samples must be taken at least 10 feet from the location of the failed sample or at the end of the seam if it is less than 10 feet from the failed sample. Sample size and disposition shall be as described previously. This process shall be repeated until samples that pass the tests bracket the failed seam section. All seams shall be bounded by locations where samples passing laboratory tests have been taken. In cases involving more than 50 feet of reconstructed or cap stripped seam, the reconstructed or cap stripped seam must also be treated. Laboratory testing governs seam acceptance. In no case shall field testing of installed seams be used for final acceptance.

3.4.5 Repairs

Portions of the geomembrane with flaws or that fail a nondestructive or destructive test shall be repaired in accordance with the specifications. The CQA Officer shall locate and describe all repairs on the Geomembrane Repair Log form.

- Patching is used to repair large holes, tears, large panel defects, and destructive testing sample locations.
- Extrusion is used to repair small defects in the panels and seams. In general, this procedure should be used for defects less than 3/8 inch in the largest dimensions.
- Capping is used to repair failed welds or to cover seams where welds cannot be nondestructively tested.
- Removal is used to replace areas with large defects where the preceding methods are not appropriate. Removal is also used to remove excess material (wrinkles) from the installed geomembrane.

3.4.6 Wrinkles

Placing soil cover or drain materials over the geomembrane, temperature changes, or creep may cause wrinkles to develop in the geomembrane. Any wrinkles that can fold over shall be repaired either by cutting out excess material or, if possible, allowing the liner to contract due to temperature reduction. In no case shall material be placed over the geomembrane which could result in the geomembrane folding.

3.4.7 Bridging

Unless approved by the CQA Officer, bridging must be removed.

3.4.8 Folded Material

All folded HDPE geomembrane shall be removed.

3.4.9 Geomembrane Acceptance

The Installer shall retain all ownership and responsibility for the geomembrane until acceptance by the Owner. In the event the Installer is responsible for placing a protective cover over the geomembrane, the Installer shall retain ownership and responsibility for the geomembrane until the protective cover is placed. The geomembrane shall be accepted by the CQA Officer when the following activities have occurred:

- The installation is finished.
- All seams have been inspected and approved.
- All required laboratory tests have been completed and approved.
- One signed QC certificate for each roll of geomembrane has been supplied by the Installer and approved by the CQA Officer. Certificate shall include resin identification, roll number, date of production, and test results for density, melt index, and tensile strength (ASTM D638).
- All record drawings have been completed and approved.

3.5 GEOTEXTILE

Information contained in this section regarding the delivery, conformance testing, sampling procedures, and installation of geotextile will also apply to the geotextile component of geocomposite materials.

3.5.1 Delivery

The CQA Officer shall verify that the following activities are done:

- Equipment used to unload the rolls will not damage the geotextile
- Care is used to unload the rolls
- All documentation required by the specification has been received

At the CQA Officer's discretion, damaged rolls may be rejected. They shall be removed from the site or stored at a location, separate from accepted rolls, designated by the Owner's Field Representative. All rolls without proper manufacturer's documentation will be rejected.

3.5.2 Conformance Testing

3.5.2.1 Tests

Prior to or after delivery, the CQA Officer shall obtain one geotextile sample per 100,000 square feet of geotextile material. The samples shall be forwarded to the Testing Laboratory for the following tests:

- Traditional Tear (ASTM D4533)
- Mass per unit area
- Puncture resistance
- Wide strip tensile strength
- Permeability (ASTM D4491) (if material is used as a filter layer)
- Apparent opening size, AOS (if material is used as a filter layer)
- Grab Strength (ASTM D4632)

Where optional procedures are noted in the test method, the specification requirements shall prevail. The CQA Officer shall review all test results and report any nonconformance to the Owner's Field Representative and the Installer.

3.5.2.2 Sampling Procedure

Samples shall be taken across the entire roll width and shall not include the first 3 feet. Unless otherwise specified, samples shall be 3 feet long by the roll width. The CQA Officer shall mark on the sample the manufacturer's roll identification number, machine direction, and date.

3.5.3 Geotextile Installation

Prior to geotextile installation, the CQA Officer shall verify that the following conditions exist:

- All lines and grades have been verified by a qualified surveyor.
- The subgrade has been prepared in accordance with the earthwork specification.
- If the geotextile is to be placed over a geomembrane, the portion of the geomembrane installation to be covered by the geotextile, including all required documentation, has been completed.
- The supporting surface does not contain stones or other material that could damage the geotextile or, where applicable, an underlying geomembrane.
- There are no excessively soft areas that could result in damage to an overlying geomembrane.
- All construction stakes and hubs have been removed and holes are backfilled with similar soil and compacted to the requirements for the adjacent soil.

During panel placement, the CQA Officer shall perform the following activities:

- Observe the geotextile as it is deployed and record all defects and disposition of the defects (panel rejected, patch installed, etc.). All repairs are to be made in accordance with the specifications.

- Verify that equipment used does not damage the geotextile by handling, trafficking, leakage of hydrocarbons, or other means.
- Verify that people working on the geotextile do not smoke, wear shoes or engage in activities that could damage the geotextile.
- Verify that the geotextile is anchored to prevent movement by the wind. If geotextile is to be placed above a geomembrane, this must be done using sand bags or other similar means that will not damage the covered geomembrane in any way.

The CQA Officer shall inform the Installer and Owner's Field Representative if any of the above conditions are not met.

During geotextile placement, the CQA Officer shall verify that the following activities are done:

- The seams are overlapped a minimum of 6 inches.
- Any thread used to sew the panels of geotextile together meets specification requirements.
- The geotextile panels are joined in accordance with the plans and specifications.

Repair procedures include the following activities:

- Patching is used to repair holes, tears, and defects.

- Removal is used to replace areas with large defects where the preceding method is not appropriate.

Specific repair procedures are outlined in the specification.

3.6 GEONET

Information contained in this section regarding the delivery, conformance testing, sampling procedures, and installation of geonet will also apply to the geonet component of geocomposite materials.

3.6.1 Delivery

The CQA Officer shall verify that the following activities are done:

- Equipment used to unload the rolls will not damage the geonet
- Care is used to unload the rolls
- All documentation required by the project specifications has been received
- The geonet is covered to minimize contact with sunlight, dirt, and other contaminants

3.6.2 Conformance Testing

3.6.2.1 Tests

Prior to or after delivery, the CQA Officer or authorized representative will obtain geonet samples as required by the project specifications. The samples will be forwarded to the Testing Laboratory for conformance testing as required by the project specifications. The CQA Officer shall review all tests results and report any nonconformance to the Owner's Field Representative and the Installer.

3.6.2.2 Sampling Procedure

Samples will be taken across the entire roll width and shall not include the first three feet. Unless otherwise specified, samples will be three feet long by the roll width. The CQA Officer shall tag the sample with the manufacturer's roll identification number and the date sampled.

3.6.3 Geonet Installation

Prior to geonet installation, the CQA Officer shall verify that the following conditions exist:

- The geomembrane installation, including all required documentation, has been completed.
- The geomembrane surface is clean.

During geonet placement, the CQA Officer shall perform the following activities:

- Observe the geonet as it is deployed and record all defects and disposition of the defects (panel rejected, patch installed, etc.). All repairs are to be made in accordance with the specifications.

- Verify that equipment used does not damage the geonet or underlying geomembrane by handling, trafficking, leakage of hydrocarbons, or other means.

- Verify that people working on the geonet do not smoke, wear shoes that could damage the geonet, or engage in activities that could damage the geonet or underlying geosynthetics.

- Verify that the geonet is anchored to prevent movement by the wind (the Installer is responsible for any damage resulting to or from windblown geonet).

- Verify that the geonet remains free of contaminants such as soil, grease fuel, etc.

The CQA Officer shall inform the Installer and Owner's Field Representative if the above conditions are not met.

During geonet placement, the CQA Officer shall verify that the following conditions exist:

- The seams overlap a minimum of six inches.
- Ties are placed at five-foot intervals on adjacent seams and two-foot intervals on cross seams, at a minimum.
- Only plastic ties that will not damage the underlying geomembrane are used; metallic ties are not permitted.
- The panels are joined in accordance with the plans and specifications.

Repair procedures include the following activities:

- Patching is used to repair holes, tears, and defects.
- Removal is used to replace areas with large defects where patching is not appropriate.

3.7 DEFICIENCIES

When deficiencies (items that do not meet specified values) are discovered, the CQA Officer shall immediately determine the nature and extent of the problem, notify the Installer, and complete required documentation. In all cases, the CQA Officer will notify the Installer of the deficiency. If the deficiency will cause construction delays of more than four hours or will necessitate substantial rework, the CQA Officer shall also notify the Owner's Field Representative.

The Installer shall correct the deficiency to the satisfaction of the CQA Officer. If the Installer is unable to correct the problem, the CQA Officer will develop and present suggested solutions to the Owner's Field Representative for approval. If the solution requires a design revision, the Engineer shall also be notified.

The corrected deficiency shall be re-tested before additional work is performed. All re-tests and the steps taken to correct the problems shall be documented by the CQA Officer.

3.8 DOCUMENTATION

The CQA plan depends on thorough monitoring and documentation of all construction activities. Therefore, the CQA Officer shall document all QA requirements as they are addressed and satisfied. Documentation shall consist of daily record keeping, construction problem resolutions, photographic records, design and specification revisions, weekly progress reports, and a certification and summary report.

3.8.1 Daily Record Keeping

At a minimum, daily records shall consist of field notes, a summary of the daily meeting with the Installer, observations and data sheets, and construction problem and resolution reports. This information shall be submitted regularly to the Owner's Field Representative for review and approval. Sample forms are provided in the appendix.

A Daily Meeting Report will be prepared each day, summarizing discussions held with the Installer. At a minimum, the report will include the following items:

- Date, project name, and location
- Names of parties involved in discussions
- Scheduled activities
- Items discussed
- Signature of the CQA Officer

3.8.2 Observation and Test Sheets

Observation and test data sheets shall include the following information:

- Date, project name, and location
- General weather information
- Reduced-scale site plan showing work areas, including sample and test locations
- Description of ongoing construction

- Summary of test results identified as passing, failing, or in the event of a failed test, retest
- Test equipment calibrations, if applicable
- Summary of decisions regarding acceptance of the work and/or corrective actions taken
- Signature of the CQA Officer

3.8.3 Construction Problem Report

This report identifies and documents construction problems and resolutions. This report is intended to document problems involving significant rework and is not intended to document items easily corrected unless the problems are recurring. At a minimum, this report shall include the following items:

- Detailed description of the problem
- Location and cause of the problem
- How the problem was identified
- How the problem was resolved
- Personnel involved
- Signature of the CQA Officer and Owner's Field Representative

3.8.4 Photographs

Construction activities will be photographed, including significant problems and remedial actions. The photographs will be identified by location, time, date, and photographer.

3.8.5 Design and Specification Changes

Design and specification changes may be required during construction. In such cases, the CQA Officer shall notify the Owner's Field Representative, who will notify the Engineer. Design and specification changes shall only be made with written agreement of the Owner's Field Representative and Engineer.

3.8.6 Weekly progress reports

The CQA Officer shall prepare weekly progress reports summarizing construction and quality control activities. At a minimum, this report, submitted to the Owner's Field Representative, shall contain the following information:

- Date, project name, and location
- Summary of work activities
- Summary of deficiencies and/or defects and resolutions
- Signature of the CQA Officer

3.8.7 Certification Report

At the completion of the project, the CQA Officer shall submit a certification report to the Owner's Field Representative. This report shall certify that the work has been performed in compliance with the construction drawings and specifications. At a minimum, the report shall contain the following information:

- Summary of all construction activities
- Testing Laboratory test results
- Observation and test data sheets
- Sampling and testing location plans
- Description of significant construction problems and their resolution
- List of changes from the construction drawings and specifications and the justification for these changes
- Record drawings
- Certification statement signed and sealed by a registered engineer

The record drawings shall show all construction items, including the piping, anchor trenches, sumps, etc. All surveying and base maps required for the development of the record drawings shall be prepared by a California Registered Land Surveyor.

FORMS

BURNS & MCDONNELL WASTE CONSULTANTS INC.

DAILY MEETING REPORT

Client:

Project Location:

Project Number:

Date:

Attendees: _____

_____

Discussion:

_____

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Signature- CQA Monitor

BURNS & MCDONNELL WASTE CONSULTANTS INC.

DAILY FIELD ACTIVITIES REPORT

Client: **Date:**

Project Location:

Project Number:

Contractor:

Geosynthetics Installer:

Activities:

Equipment Used

Signature - CQA Monitor

BURNS & MCDONNELL WASTE CONSULTANTS INC.

SUBGRADE ACCEPTANCE REPORT

Client: **Date:**

Project Location:

Project Number:

Installer Representative:

Description of Inspected Area:

Remedial Action Required:

Signature - Installer

Signature- CQA Monitor

BURNS & MCDONNELL WASTE CONSULTANTS INC.

NUCLEAR DENSITY GAUGE STANDARD COUNT TEST RECORD

Client:

Project Location:

Project Number:

Sheet **of**

Gauge Model No.:

Serial No.:

Date	Time	Initials	Moisture Standard Count	Pass/Fail	Density Standard Count	Pass/Fail	Remarks

NOTE: Pass/Fail is based on ASTM D3017-88 for moisture and ASTM D2922-91 for density

BURNS & MCDONNELL WASTE CONSULTANTS INC.

NUCLEAR DENSITY GAUGE TEST RECORD

Client:

Sheet **of**

Project Location:

Project Number:

Date	Test No.	Time	Init.	Location	Lift No.	Probe Depth	Moisture Content (%)	Corrected Moisture Content %	Wet Density (pcf)	Dry Density (pcf)	Corrected Dry Density (%)	Pass/ Fail (Note)

BURNS & MCDONNELL WASTE CONSULTANTS INC.

GEOMEMBRANE MATERIAL RECEIVED LOG

Client: Sheet of

Project Location:

Project Number:

Material Type:

Date Received	Roll No.	Lot/ Batch	Roll Size			QC Docs Received	Panel Number(s)	Remarks
			W (ft)	L (ft)	Sq. Ft.			

BURNS & MCDONNELL WASTE CONSULTANTS INC.

GEOTEXTILE/GEONET MATERIAL RECEIVED LOG

Client:

Sheet **of**

Project Location:

Project Number:

Material Type:

Date Received	Roll No.	Lot/ Batch	Roll Size			QC Docs Received	Remarks
			W (ft)	L (ft)	Sq. Ft.		

BURNS & MCDONNELL WASTE CONSULTANTS INC.

HDPE PIPE MATERIAL RECEIVED LOG

Client: Sheet of

Project Location:

Project Number:

Material Type:

Date Received	Pipe Dia (in.)	SDR	Pipe Length	Total Length	Number of Pipes	Perforated (yes/no)	Remarks

BURNS & MCDONNELL WASTE CONSULTANTS INC.

GEOMEMBRANE SEAMING LOG

Client:

Sheet of

Project Location:

Project Number:

Date	Seam No.	Time	Length Seam (ft)	Machine Type and Number	Name of Operator	Machine Settings	
						Temperature	Machine Speed

BURNS & MCDONNELL WASTE CONSULTANTS INC.

GEOMEMBRANE PLACEMENT LOG

Client:

Sheet of

Project Location:

Project Number:

Panel #	Roll #	Date Placed	Panel		Panel Area (sf)	Remarks
			L (ft)	W (ft)		

BURNS & MCDONNELL WASTE CONSULTANTS INC.

GEOMEMBRANE NONDESTRUCTIVE TEST RECORD (Air Pressure Testing)

Client:

Sheet of

Project Location:

Project Number:

Seam No.	Date	Start Test Time/Pressure (psi)	End Test Time/Pressure (psi)	Pass/ Fail	Tester Name	Remarks

BURNS & MCDONNELL WASTE CONSULTANTS INC.

TRIAL WELD LOG

Client: Sheet of

Project Location:

Project Number:

Date of Trial	Time of Trial	Machine Type & No.	Machine Setpoint/ Speed	Machine Temp. (deg F)	Name of Operator	Ambient Temp. (deg F)	Peel (ppi)	Shear (ppi)	Pass/ Fail

BURNS & MCDONNELL WASTE CONSULTANTS INC.

GEOMEMBRANE DESTRUCTIVE TEST RECORD

Sheet of

Client:
Project Location:
Project Number:

Sample Number	Seam Number	Location	Date Seamed	Date Sampled	Oper.	Machine Number	Field		Laboratory		% Peel	Failure Type	Pass/ Fail	Note
							Peel (ppi)	Shear (ppi)	Peel (ppi)	Shear (ppi)				

BURNS & MCDONNELL WASTE CONSULTANTS INC.

PHOTOGRAPH LOG

Client:

Project Location:

Project Number:

Date	Photo No.	Taken By:	Description

Burns & McDonnell
ENGINEERS - ARCHITECTS - CONSULTANTS
090883 Form CSD-31

DISTRIBUTION
Project Manager
CSD

WEEKLY PROJECT WEATHER REPORT

Project Name _____ Report No. _____

Project No. _____ Contract No. _____

DATE	DAY	TEMP. F°		INCHES		WEATHER DESCRIPTION
		HIGH	LOW	RAIN	SNOW	
	MON.					
	TUE.					
	WED.					
	THUR.					
	FRI.					
	SAT.					
	SUN.					

ADDITIONAL COMMENTS

LEGEND

C	Clear
PC	Partly Cloudy
OC	Overcast
LR	Light Rain
HR	Heavy Rain
LS	Light Snow
HS	Heavy Snow

NOTES

1. Rainfall to tenths -- Snow to tenths. Record the time frames of each.
2. Identify the portion or area within the total project represented by this report if different from the total project.
3. Attach a copy of this report to each package of Contractor's Weekly Construction Construction Progress Reports.

REPORTED BY

_____
Resident Construction Manager