Section 12. Development of Remedial Alternatives

This section describes remedial alternatives for Parcel E-2 developed from the technologies and process options retained in Section 11. The technologies and process options have been combined into two remedial alternatives, and are presented with a third "no action" alternative for a total of four alternatives. These alternatives have been paired with an appropriate wetlands mitigation strategy (as outlined in Appendix O). The three remedial alternatives developed for Parcel E-2 are:

- **Alternative 1 – No Action:** For this alternative, no remedial action would take place. Solid waste, soil, sediment, surface water, and groundwater would be left in place without any response actions (e.g., monitoring, institutional controls, containment, removal, treatment). The no action alternative is included throughout the FS process as required by the NCP to provide a baseline for comparison to and evaluation of other alternatives.
- **Alternative 2 – Excavate and Dispose of Solid Waste, Soil, and Sediment (including monitoring and institutional controls):** This alternative would involve excavation and off-site disposal of all solid waste, debris, and soil in the Landfill Area. Isolated solid waste locations, soil, and sediment in the adjacent areas (which consists of the Panhandle Area, East Adjacent Area, and Shoreline Area) would also be excavated and disposed of off site. Groundwater monitoring would also be included under this alternative to evaluate chemical concentrations in groundwater while the aquifers naturally recover. Additionally, groundwater monitoring would be used to confirm site conditions and to ensure that, over time, the potential exposure pathways would remain incomplete. This alternative would also include institutional controls (consisting of access restrictions, land use restrictions, and covenants to restrict use of property) that would be implemented across the entire parcel to prevent exposure to COCs in soil and groundwater. In the adjacent areas, wetlands disturbed during the excavation activities would be restored on top of the clean fill.

- **Alternative 3 – Contain Solid Waste, Soil, and Sediment (including monitoring and institutional controls):** This alternative would involve the removal of all radiological surface anomalies followed by containment of solid waste and soil in the Landfill Area as well as soil and sediment in the adjacent areas. The portions of the Landfill Area not already covered by the existing multilayer cap would be capped with a similarly designed multilayer cap. The isolated solid waste locations and soil in the Panhandle and East Adjacent Areas, as well as sediment within the Shoreline Area, would also be capped with a geosynthetic cap. The cap termination within the Shoreline Area would be protected with a revetment wall. In addition, this alternative would include installation, operation, and maintenance of an active landfill gas control system. Monitoring of landfill gas, stormwater, and groundwater would also be included under this alternative. This alternative would also include institutional controls (consisting of access restrictions, land use restrictions, and covenants to restrict use of property) that would be implemented across the entire parcel to prevent exposure to COCs in soil and groundwater. Wetlands disturbed during the construction of the containment systems would be restored on top of the cap in the Panhandle Area.

The purpose of this section is to describe, in detail, the remedial alternatives developed for Parcel E-2. The alternatives address the general RAOs and the nine evaluation criteria established in the NCP to varying degrees. The analysis of each alternative relative to the RAOs and NCP evaluation criteria is presented in Section 13.

Subsection 12.1 discusses the common components of the remedial alternatives, and Subsection 12.2 describes each of the remedial alternatives developed for Parcel E-2.

12.1. COMMON COMPONENTS FOR REMEDIAL ALTERNATIVES 2 AND 3

This subsection discusses components that are included in Alternatives 2 and 3. These component descriptions are not repeated in the individual alternative descriptions in Subsection 12.2. The common components include:

- institutional controls (Subsection 12.1.1)
- groundwater monitoring (Subsection 12.1.2)
- completion of the shoreline protection (Subsection 12.1.3)
- stormwater discharge management and monitoring (Subsection 12.1.4)
- wetlands mitigation (Subsection 12.1.5)

Table 12-1 summarizes the major components of the remedial alternatives presented in this FS.

12.1.1. Institutional Controls

Alternatives 2 and 3 would utilize institutional controls to restrict use of the property in order to prevent unacceptable exposure to solid waste, soil, sediment, landfill gas, and groundwater. A combination of legal and administrative mechanisms, as discussed in Subsection 11.4.1, would be used to enforce a variety of land use restrictions for Parcel E-2. The performance objectives of the institutional controls are summarized as follows:

- Restrict the use of the parcel to open space
- Require maintenance of control systems
- Maintain the integrity of covers (or access restrictions where covers are not present)
- Ensure compliance with 27 CCR postclosure land use requirements for structures within 1,000 feet of a landfill
- Require development of a soil and groundwater management plan to be implemented during all intrusive site activities (e.g., subsurface construction)
- Restrict the use of groundwater within the Parcel E-2 boundaries
- Prohibit the installation of wells that have the potential to affect the migration of contaminated groundwater within Parcel E-2

The institutional controls would be applied throughout Parcel E-2 under Alternatives 2 and 3. Exceptions include restrictions specific to landfill containment and control systems, which would not apply within the Landfill Area under Alternative 2 because complete excavation of the Parcel E-2 Landfill is being considered under this alternative. Additionally under Alternative 2, restrictions on B-aquifer groundwater use may be removed once chemical concentrations have attenuated to less than the remediation goals. Implementation, monitoring, and enforcement of the institutional controls are expected to be required for a minimum period of 30 years, or until it can be demonstrated that waste materials no longer pose a threat to human health or the environment.

The remedial design would identify the specific implementation actions necessary to ensure compliance with all institutional controls, and would identify the roles and responsibilities for implementing, monitoring, and enforcing the institutional controls. The remedial design would be provided to the Federal Facilities Agreement signatories and the transferee for review and concurrence.

12.1.2. Groundwater Monitoring

Groundwater at Parcel E-2 is subject to regulations designed to ensure protection of human health and the environment. The RAOs were developed based on these requirements and require that the final remedy prevent unacceptable risk to human health or the environment. Long-term groundwater monitoring will be performed for Alternatives 2 and 3 to verify that groundwater constituent concentrations do not exceed concentrations designated by the RAOs at the compliance boundary. Selection of the compliance boundary for both A-aquifer and B-aquifer groundwater at Parcel E-2 is discussed in Appendix N (Subsection N2.1.1).

A final plan for long-term groundwater monitoring will be developed during the remedial design as part of the closure plan for Parcel E-2. Prior to publishing the final monitoring plan, groundwater monitoring will continue to be performed under the existing groundwater monitoring plan, which will be modified as appropriate to address the data gaps discussed in Subsection 8.5.1.

Groundwater elevations will continue to be monitored under the existing plan to assess flow patterns in the A- and B-aquifers. Horizontal groundwater flow patterns in the A-aquifer may change as the storm drain and sanitary sewer lines are removed throughout HPS (as part of a basewide removal action). Many of these lines are submerged below the water table and likely acting as preferential pathways for groundwater flow. The placement of the monitoring well network may be adjusted, if necessary, based on any changes in groundwater flow patterns; however, it is expected that changes in A-aquifer flow patterns will result in more uniform flow towards the Parcel E-2 shoreline where a well network will already be in place.

The monitoring frequency and specific suite of monitoring parameters will be developed during the remedial design phase in consultation with the regulatory agencies, and will utilize ongoing monitoring results. Monitoring results will be reported on a regular basis, and will be evaluated on an annual basis. The groundwater monitoring plan will also be subject to CERCLA 5-year reviews. During the post-closure period (anticipated to be at least 30 years), the frequency of monitoring may decrease to one event per year, chemical concentrations remain stable or decrease over time. Changes to the monitoring frequency or the suite of monitoring parameters will be made in consultation with the regulatory agencies during either the annual evaluations or the CERCLA 5-year reviews.

For the purposes of costing and evaluating alternatives in this FS, it is assumed that 13 A-aquifer and 3 B-aquifer monitoring wells located in and around the Landfill Area will require long-term monitoring and will be sampled for the same parameters as specified in the current monitoring plan. In addition, it is assumed that 22 A-aquifer and 7 B-aquifer wells in the adjacent areas will require long-term monitoring, and will be sampled for chemical parameters specific to the area of concern (e.g., metals, PCBs, SVOCs, and TPH). For evaluation purposes, the monitoring frequency is assumed as semi-annually for 5 years and annually for 25 years; this assumption would allow for changes to the monitoring frequency to be integrated with the CERCLA 5-year reviews. The 30-year monitoring period was selected based on the assumed post-closure monitoring period; however, this monitoring period may be adjusted, as appropriate, to account for quarterly pre-closure monitoring.

12.1.3. Completion of the Shoreline Protection

Shoreline protection will be required under Alternatives 2 and 3 to control erosion from tidal and wave action from the Bay. Under Alternative 2, the shoreline protection would consist of a combination of soil and/or rock revetment and intertidal vegetation, with the objective of maintaining the integrity of the restored surfaces following remediation.

Under Alternative 3, a more extensive shoreline protection system would be required to maintain the integrity of the containment systems. At the southeastern portion of the landfill, where the solid waste is located in close proximity to the shoreline, a multilayer geosynthetic cap will be installed (see Figure 12-2) and will be tied in to the existing landfill cap to provide a continuous containment system (Figure 12-3). The existing concrete rubble and solid waste along the shoreline will be removed as necessary to establish the new exterior landfill slope. The toe of the new landfill slope will generally be inward of the existing slope to allow placement of the shoreline protection and minimize filling of the

Bay. The landfill slope will be reconstructed at a 3:1 (horizontal:vertical) slope extending upward to where it intersects a future perimeter road. A 15- to 20-foot-wide bench will be provided for the future perimeter road that will dually serve as a maintenance access road and pedestrian walkway along the shoreline perimeter. South of the future perimeter road, the slope will be constructed to a 3:1 slope down to existing ground along the Bay shoreline. Waste removed from this area will be placed on uncapped portions of the landfill before the cap is installed.

Shoreline erosion protection for Alternative 3 would include compacted soil and rock revetment, on the outer face of the soil, to an elevation above the highest observed water level in the Bay (approximately 8.16 feet above the mean lower low water). The toe of the shoreline protection will generally match the existing toe to minimize filling of the Bay. The design will also include sufficient soil fill to provide buttress support to the solid waste along the perimeter. The shoreline protection will be designed for stability under static loading conditions and during earthquakes. Cross-sections of the proposed shoreline protection are shown in Figures 12-4 through 12-7.

12.1.4. Stormwater Discharge Management and Monitoring

Existing stormwater discharge from Parcel E-2 is subject to the requirements of the SWDMP (TtEMI, 2003c; TtEMI, 2005a; AFA and EEC, 2005b). This plan specifies implementation of BMPs and monitoring to ensure that surface water discharges from the Parcel E-2 Landfill do not pose an unacceptable risk to aquatic receptors in the Bay. The SWDMP is updated on an annual basis based on site inspection and monitoring results. Under Alternatives 2 and 3, this process is anticipated to continue through remedial action implementation and long-term operation and maintenance.

Additional short-term considerations will be required during the construction phase of Alternatives 2 and 3, in accordance with the substantive provisions of SWRCB Order 99-08 entitled "Stormwater Discharge Associated with Construction Activities." These provisions include the implementation of BMPs to prevent stormwater from contacting construction pollutants and prevent erosion products from migrating off site. The BMPs likely to be used during construction include the minimization of bare soil areas, use of topsoil conservation, straw bale/straw waddle placement, mulching, seeding, slope cultivation, stabilization of construction entrances, use of temporary crushed rock roads, temporary berms, filter screens, and sedimentation basins. The specific measures to be used will be determined as part of the remedial design and associated planning documents (e.g., a stormwater pollution prevention plan).

Stormwater and erosion controls are required for the closed landfill under 27 CCR Sections 20365(c) and (d), which require that diversion and drainage facilities be designed, constructed, and maintained to accommodate the anticipated volume of precipitation and peak flows. Solid waste will not be exposed to stormwater in capped areas, and erosion controls will be used to maintain the integrity of the containment structures and prevent sediment discharge above allowable limits. These goals will primarily be accomplished through vegetation and site grading to control stormwater overland flow velocities (slower flow velocities generally have less erosion potential). The final Parcel E-2 grades will be designed to prevent stormwater run-on onto the cap from surrounding areas and to prevent ponding (except in wetland areas) and erosion in other areas. Drainage from capped areas will be directed to designated locations that discharge into the replaced wetlands, existing drainage facilities, or the Bay. Stormwater from Parcel E-2 is not expected to require treatment prior to discharge.

Long-term erosion protection and stormwater controls associated with Alternative 3 include the following (shown on Figures 12-1, 12-8, and 12-9):

- Vegetative cover on shallow slopes and flatter areas
- Concrete- or riprap-lined ditches in high-velocity flow areas
- Shallow ditch side slopes and flow lines
- Concrete inlets and drop structures for significant grade changes
- Vegetative mats to establish growth in concentrated flow areas

For Alternative 2, erosion protection in the Shoreline Area was described in Subsection 12.1.3. Erosion protection and stormwater controls in the Landfill, Panhandle, and East Adjacent Areas include vegetative cover and mats to maintain the integrity of the restored surfaces following remediation. These controls are considered adequate because the final slopes for Alternative 2 will be designed to eliminate areas with steep slopes, thereby minimizing potential erosion.

12.1.5. Integration with Ongoing Wetlands Restoration and Offshore Feasibility Study

For Alternatives 2 and 3, the remediation and associated restoration efforts proposed in the Shoreline Area will be adjusted, as appropriate, to be consistent with the approaches being developed for the Metal Slag Area and the offshore Parcel F.

A wetlands mitigation plan is currently being developed as part of the restoration efforts for the Metal Slag Area removal action. The plan is currently being reviewed by the regulatory agencies, and is subject to change; however, the basic components of the plan are not expected to change. These components include restoration of tidal wetlands in and around the Metal Slag Area, and installation of erosion protection measures on the outboard edge of the restored wetlands. The shoreline protection measures required for Alternatives 2 and 3 will be integrated with the restoration plans in the Metal Slag Area in order to minimize damage to wetlands during implementation of the remedial action.

A feasibility study is being prepared for Parcel F to evaluate remediation alternatives for the contaminated sediment offshore of Parcel E-2. Because the contaminated sediment located in the Shoreline Area of Parcel E-2 is subject to tidal action similar to the offshore sediments, the remedial approaches for both parcels need to be closely aligned. However, the extent to which these approaches can be aligned will increase as both the Parcel E-2 RI/FS and the Parcel F FS proceed through the review and revision process. Therefore, the current shoreline remediation approaches outlined in Alternatives 2 and 3 will be updated, as needed, to better integrate with the remediation approach for Parcel F and the overall site restoration plans. For example, the current alignment of the rock revetment wall for Alternative 3

(Figure 12-1) does not contain all contaminated sediment within the Shoreline Area. This alignment was selected in order to follow the existing shoreline and minimize filling of the Bay. Alternative 3 assumes that the containment approach evaluated in the Parcel F FS will be utilized in the Shoreline Area not currently covered by the revetment wall.

12.2. REMEDIAL ALTERNATIVES DEVELOPED FOR PARCEL E-2

This section describes each of the remedial alternatives selected for Parcel E-2. Common components for each alternative are discussed in Section 12.1, and are only referred to in the following sections as appropriate. Appendix R of this report contains the cost estimates associated with each alternative.

12.2.1. Alternative 1: No Action

For this alternative, no remedial action would be taken. Solid waste, soil, sediment, surface water, and groundwater would be left in place without implementation of any response actions (including monitoring, institutional controls, containment, removal, treatment, or other mitigating actions). The no action response is included throughout the FS process as required by the NCP to provide a baseline for comparison to and evaluation of other alternatives.

12.2.2. Alternative 2: Excavate and Dispose of Solid Waste, Soil, and Sediment (including monitoring and institutional controls)

Figures 12-10 through 12-12 present the site plans for Alternative 2. This alternative would involve the excavation of all solid waste and contaminated soil from the Landfill Area, excavation of solid waste and contaminated soil in the Panhandle Area and East Adjacent Area, and excavation of contaminated sediment from the Shoreline Area. Proposed excavation depths and extents are included in Figure 12-11. All removed solid waste and soil would be disposed of at an off-site facility permitted to accept wastes from a CERCLA site or at a licensed low-level radioactive waste disposal facility. The Landfill Area and adjacent area excavations would be backfilled with a combination of clean material reclaimed from the current landfill cover and imported clean fill. General fill would be used to backfill most excavated areas. Wetland areas in the Panhandle Area would be backfilled with wetland-compatible soils, and Shoreline Area excavations would be backfilled with a combination of sand and wetland-compatible soils. Site restoration activities would include backfilling and surface grading to prevent surface water ponding (except in wetland areas), and to provide appropriate drainage and vegetation to prevent erosion.

Alternative 2 would involve:

- Implementation of institutional controls (discussed in Subsection 12.1.1)
- Site preparation, including installation of a sheet pile wall and dewatering system
- Dewatering, treatment and disposal of extracted water
- Radiological control procedures, including pre-excavation surface screening, surgical excavation of radioactive material, and post-excavation screening of all excavated material
- Excavation of (non-radioactive) contaminated material

- Segregation, stockpiling, characterization and disposal of excavated material
- Backfilling of excavation areas and completion of final grades to allow restoration of freshwater and tidal wetlands (also includes shoreline protection, as discussed in Subsection 12.1.3)
- Construction and maintenance of freshwater and tidal wetlands
- Post-construction groundwater and stormwater monitoring (discussed in Subsections 12.1.2 and 12.1.4, respectively)

The subsequent subsections discuss the various component of this alternative in further detail (unless previously discussed in Subsection 12.1).

12.2.2.1. Site Preparation

Site preparation would be required prior to mobilization of all equipment, and would include construction of a wastewater treatment system, a rail spur, a soil staging and drying area, a laydown area, and a modular stormwater holding tank. The dry season (from April through the beginning of October) would provide the best construction time; however, because of the extended construction period required to complete this alternative (estimated to be 48 months), the remedial action would not be limited to this period. The detrimental effects of storm events would be mitigated by minimizing the area of excavation left open at any given time and by implementing engineering controls in active construction areas.

Approximately 400,000 cubic yards of the material to be excavated is below the water table, requiring installation of a dewatering system to be operated during excavation in these areas. Prior to dewatering, approximately 4,500 feet of sheet pile would be installed around the landfill to limit groundwater infiltration during excavation. The required sheet pile wall would be approximately 50 feet tall, and would be keyed into the Bay Mud below the landfill. The sheet pile wall would be designed to prevent collapse of soil in areas where sufficient cut-back slopes cannot be used. Isolated solid waste locations in the adjacent areas would be outside this sheet pile wall. The walls of excavations deeper than 4 feet at the isolated solid waste locations would be sloped back for stability, but no sheet pile would be required to adequately dewater excavations in the adjacent areas.

12.2.2.2. Dewatering, Treatment, and Disposal of Extracted Water

Dewatering well points would be installed several weeks before excavation of a given section to ensure that the water table elevation is below the expected bottom of the excavation. Continuous dewatering would be required until all excavated areas are backfilled to elevations above the water table. Excavation activities would be conducted to minimize the duration of excavation below the water table to limit the amount of contaminated water produced from dewatering. Other engineering controls would include berms along the perimeter of the excavations to divert surface water away from the excavations; silt fences along the excavation perimeters to control sediment in construction areas; and decontamination of all equipment leaving the site.

Liquid wastes generated by this alternative would include potentially contaminated water generated from dewatering excavations and saturated wastes and from decontamination activities. Over the course of the remediation effort (estimated at 48 months), it is assumed that an estimated 73 million gallons of potentially contaminated water would require treatment under this alternative. Contaminated water would be treated in an on-site treatment plant to meet appropriate discharge criteria for the publicly-owned treatment works. The treatment system would include settling chambers and filtration units for radiological sediment removal, an ion exchange unit for metals removal, and carbon adsorption units for removal of organic compounds prior to either surface water discharge or discharge to the on-site sanitary sewer.

12.2.2.3. Radiological Control Procedures

The potential presence of radionuclides must be assessed prior to and during excavation activities because the HRA (NAVSEA, 2004) identified the majority of Parcel E-2 as "radiologically-impacted". Radiological control procedures are required to protect the health and safety of site workers and the general public, and to comply with regulatory requirements and principles governing work at radiologically-impacted sites. The radiological control procedures would be consistent with the procedures established for the removal actions at the PCB Hot Spot and Metal Slag Area (TtFW, 2005a and 2005b). A summary of these procedures, excerpted from the above referenced work plans, are as follows:

- Pre-excavation surface surveys would identify radioactive materials near the surface (0 to 1 feet bgs). The surface surveys would consist of a high-density gamma scan performed over a 50-foot by 50-foot grid system. The resulting 100 percent surface survey would be supplemented, as necessary, with different instruments or soil sampling to confirm the presence of radioactive material.
- Locations with confirmed, elevated radiation levels would be excavated using a backhoe or excavator fitted with a smooth blade bucket and/or hand-digging tools. Soil removal would continue until the source of the elevated gamma activity reading is removed or a depth of 12 inches is reached. Following removal of the source of elevated gamma activity, a minimum of one foot of additional soil in all directions from the source would also be removed and segregated for disposal.
- After the radioactive material and surrounding soil is excavated, the resulting pit would be resurveyed and sampled. If elevated gamma activity persists, further examination of the soil would be made until the source of high gamma activity is found, removed, or a depth of 12 inches is reached. If the source of elevated radioactivity cannot be readily identified as a point source, the material would be segregated for disposal.
- Following the identification and removal of radioactive materials in the upper 12 inches of soil from a given work area, an excavator would be used to remove the soil from the upper 12-inch layer in the redefined excavation area.
- The protocol for removing the remaining (non-radioactive) contaminated materials from the excavation area would consist of conducting radiological surveys of each 12-inch lift surface and removing any confirmed radioactive materials prior to full excavation of each lift. This protocol would be repeated until the excavation reaches the final depth.

- All excavated material (with the exception of large debris) would be processed through a conveyor system featuring an array of beta/gamma detectors to identify radioactive materials that may not have been detected during the preliminary or subsequent surface surveys, and to detect any beta emitting sources that may be present. In addition, material leaving the conveyor system would be sampled for radioactivity levels that cannot be seen with the beta/gamma detectors. Large debris would be segregated from the surrounding and screened separately for potential radioactivity.
- Any sandblast grit encountered during excavation activities would be handled in accordance with a Navy-approved work instruction specifically written to govern this potentially radioactive material. In addition, one or more site workers, trained in recognizing sandblast grit, would be designated as a "spotter" during excavation activities.

Radioactive material, including any identified mixed waste, would be properly stored on site pending disposal by a certified waste broker through the Navy's Low-level Radioactive Waste Disposal Program.

12.2.2.4. Excavation of Contaminated Material

The following table summarizes the estimated volumes of material (including solid waste, soil, and sediment) that would be excavated from the different areas at Parcel E-2 during implementation of Alternative 2.

Area	Proposed Excavation Depth [a]	Estimated Excavation Volume [b]
Landfill Area	10 to >25 feet bgs	1,008,250 cubic yards
Panhandle Area	3 to 10 feet bgs	98,658 cubic yards
East Adjacent Area	3 to 10 feet bgs	38,453 cubic yards
Shoreline Area	2.5 to 3.5 feet bgs	16,639 cubic yards
	Total:	1,162,000 cubic yards

a Excavation depth in Landfill Area based on estimated depth of solid waste and surrounding soil; excavation depths in adjacent areas (outside of previously remediated areas) were based on the RAOs for soil and sediment, and were increased in some areas to facilitate wetlands mitigation (see Figure 12-11) .

b Estimated excavation volumes are based on data from geologic cross-sections, and thus may vary due to the uncertainty associated with those cross-sections.

In the Landfill Area, excavated material would include potentially contaminated soil beneath and above the solid waste, as well as potentially clean soil (cap material) above the existing landfill liner. The depth of excavation below the solid waste would be determined in the field through confirmation sampling; however, for cost estimating purposes, it was assumed that the excavation would extend 3 feet into clay formations and 5 feet into sand and gravel formations (an average of 4 feet below the bottom of the waste). Approximately 90,000 cubic yards of potentially clean soil from the existing cap would be stockpiled on site, screened for potential radiological contamination (as discussed in Subsection 12.2.3.3), and reused (as appropriate) as backfill material.

In the adjacent areas, the excavation depths would vary based on the RAOs established for soil and sediment. The assumed minimum excavation depths are 3 feet bgs in the Panhandle and East Adjacent Areas and 2.5 feet bgs in the Shoreline Area, which represent the maximum human or ecological exposure depths for open space reuse. In areas where wetland restoration is required (both in the Panhandle and Shoreline Areas), an additional foot of material, over the required minimum excavation depth, is proposed to facilitate final grading so adequately low surface elevations can be achieved to ensure periodic flooding of the tidal wetlands. In portions of the Panhandle and East Adjacent Areas where TPH or PCB concentrations exceed the specified RAOs, excavations may be extended to a maximum depth of 10 feet bgs. In areas where past removal actions have been implemented (i.e., the PCB Hot Spot and the Metal Slag Area), material removal is not required, but the regrading plan may require material in these areas to be moved.

Standard excavation equipment would be used to excavate material to design grades. Excavation and backfill operations within the sheet pile wall would be performed in sections to minimize the amount of open excavation, thereby limiting dewatering volume and improving excavation stability. Sections would only be wide enough to provided adequate slope stability for the excavation sidewalls. After the excavation within a given section is completed and confirmed by chemical sampling, it would be backfilled to several feet above the seasonal high water-table elevation before excavation begins in the next section. Dewatering, excavation, and initial backfilling would proceed in this manner until all areas below the water table are excavated and backfilled.

12.2.2.5. Segregation, Stockpiling, Characterization, and Disposal of Excavated Material

Dump trucks would transport excavated material to an on-site staging area for dewatering (as needed), post-excavation radiological screening, segregation, and stockpiling. Waste characterization would be achieved through either in-situ waste characterization or stockpile characterization, and would involve testing for various chemicals and other physical properties, in accordance with the specified waste characterization ARARs and any additional requirements of the off-site disposal facility.

The cost estimate was developed assuming that approximately 35 percent of the material excavated from the site would be disposed of as D008 (RCRA Lead) waste, 50 percent as non-RCRA hazardous waste, 10 percent as nonhazardous waste, and 5 percent as low-level radioactive waste (including mixed waste). These waste fractions were estimated using preliminary waste characterization data from the removal actions currently being conducted at Parcel E-2.

Following characterization of a given stockpile and acceptance of the waste profile by the disposal facility, waste would be loaded onto rail cars on site and transported for disposal at the off-site disposal facility. To estimate disposal costs for this alternative, it was assumed that the wastes would be disposed of at the American Ecology hazardous waste landfill in Grand View, Idaho. This facility accepts both all of the anticipated wastes types and allows for waste delivery by rail. Waste transportation by rail from the site offers a significant cost savings compared to conventional truck transport from the site to the local rail yard. It also reduces vehicular road traffic and associated noise in the surrounding neighborhoods located along the transportation route, as compared to truck transport. To accommodate the use of rail cars to transport waste off-site, a rail spur extension would be constructed to connect the planned soil segregation and stockpiling area to the existing rail line leading out of HPS. Assuming 40 miles round-trip to the closest rail yard using 23 ton trucks, approximately 48,000 trips would be required, costing approximately $8,000,000. The cost to install a rail spur that connects Parcel E-2 to the local rail line would be less than $1,000,000 (a significant cost and road trip generation savings).

12.2.2.6. Backfilling and Final Grading

The site would be backfilled to establish positive surface drainage in the area and provide stable final slopes. The Landfill Area would be graded to match adjacent areas. Grading to an elevation lower than the existing landfill elevation would provide a more natural grade, reduce future settlement, and minimize the cost of purchasing, transporting, and placing fill soils. The surface of the backfilled areas would be graded to provide drainage toward the Bay as shown on Figure 12-12. A 6-inch-thick layer of topsoil would be placed and vegetated to provide erosion control. Railway lines, sheet piling, roads, and temporary drainage structures east of the landfill would require removal during excavation in these areas. Permanent drainage structures would be constructed as part of the site restoration.

12.2.2.7. Wetlands Restoration

Areas of wetlands damaged or destroyed by implementation of this alternative would be restored. Freshwater and tidal wetlands would be created on top of the Panhandle Area, the southern portions of the Landfill and East Adjacent Areas, and along the entire Shoreline Area. To ensure that the final surface elevations are adequately low as to ensure periodic flooding of the tidal wetlands, it is assumed that an additional foot of soil and sediment throughout the Panhandle Area (and adjoining portions of the Shoreline Area) will require excavation and off-site disposal. The freshwater wetlands would be restored in a similar location as the existing conditions, and would receive runoff from the western portion of the Landfill Area. It is anticipated that there will be sufficient water to replace the existing freshwater wetland at a 1:1 ratio, but there will not be sufficient water to support additional acreage of freshwater wetlands. Additional tidal wetlands may also be constructed on top of excavated areas within the Landfill and East Adjacent Areas. The shoreline would be restored in a manner to allow Bay water to periodically flood the tidal wetlands along the shoreline. Shoreline protection in the form of rock rip-rap and revegetation would be implemented along the entire Shoreline Area to protect the newly restored wetlands for erosion by the Bay. In addition, scouring of the mudflat along the shoreline would be controlled through the placement of rock revetment combined with intertidal vegetation.

Backfill for wetland areas (including both foundation and cover) would be screened against HPALs and guidance values established by the RWQCB. The thickness of the backfill material in the adjacent areas would be consistent with the potential exposure depths for ecological receptors (2.5 feet bgs in the Shoreline Area and 3 feet bgs in the Panhandle and East Adjacent Areas). Due to the removal of the wastes in the Landfill Area, there would be no constraints on the wetlands cover thickness above existing fill material. The wetlands would be maintained and monitored in accordance with a wetlands restoration plan.

12.2.3. Alternative 3: Contain Solid Waste, Soil, and Sediment (including monitoring and institutional controls)

Alternative 3 involves the excavation and disposal of isolated radiological anomalies followed by the containment of: 1) solid waste and soil in the Landfill Area, with a multilayer cap; 2) solid waste, soil, and sediment in the adjacent areas, with a geosynthetic cap; and 3) landfill gas, with an active collection and treatment system. This alternative would provide a comprehensive closure strategy for Parcel E-2 that extends the existing cap over the entire landfill, providing additional capping over the adjacent areas.

Figure 12-1 shows the conceptual grading plan for Alternative 3. The grading of solid waste, soil, and sediment would be required to create stable slopes in the Shoreline Area and allow for wetland creation in the Panhandle Area.

Two variations of Alternative 3, Alternatives 3A and 3B, are presented in the evaluation and cost tables in Appendix R. Alternative 3A and 3B are identical except for the method of treating collected landfill gas. Alternative 3A assumes that destruction by flare is used for landfill gas treatment. Alternative 3B assumes that adsorption by GAC and a potassium permanganate media (such as, Hydrosil®) would be used for landfill gas treatment. Subsection 11.5.4 describes these two landfill gas treatment options.

Alternative 3 would involve:

- Institutional controls (discussed in Subsection 12.1.1)
- Screening for and excavation of isolated radiological anomalies
- Grading of materials from the adjacent areas to create stable slopes and allow for wetland construction in the Panhandle Area
- Construction of a new multilayer geosynthetic cap over portions of the Landfill Area not already capped and a new geosynthetic cap over the adjacent areas
- Decommissioning of the existing gas control system and installation (and subsequent maintenance) of an active gas collection system with treatment using a flare (Alternative 3A) or GAC/potassium permanganate (Alternative 3B)
- Post-construction landfill cap inspection and maintenance, and monitoring of landfill gas
- Construction (and subsequent monitoring) of freshwater and tidal wetlands over the cap in the Panhandle Area
- Construction of a rock revetment wall for shoreline protection (discussed in Subsection 12.1.3)
- Post-construction monitoring of groundwater and stormwater (discussed in Subsections 12.1.2, and 12.1.4, respectively)

The subsequent subsections discuss the various components of this alternative in further detail.

12.2.3.1. Radiological Control Procedures and Anomalies Excavation

The potential presence of radionuclides must be assessed prior to and during clearing and grubbing, stripping, excavation, and grading activities because the HRA (NAVSEA, 2004) identified most areas within Parcel E-2 as radiologically-impacted. Radiological control procedures are required to protect the health and safety of site workers and the general public, and to comply with regulatory requirements and principles governing work at radiologically-impacted sites. The radiological control procedures would be consistent with the procedures established for the removal actions at the PCB Hot Spot and Metal Slag Area (TtFW, 2005a and 2005b). A summary of these procedures, excerpted from the above referenced work plans, are as follows:

- Pre-excavation surface surveys would identify radioactive materials near the surface (0 to 1 feet bgs). The surface surveys would consist of a high-density gamma scan performed over a 50-foot by 50-foot grid system. The resulting 100 percent surface survey would be supplemented, as necessary, with different instruments or soil sampling to confirm the presence and adequate removal of radioactive material.
- Locations with confirmed, elevated radiation levels would be excavated using a backhoe or excavator fitted with a smooth blade bucket and/or hand-digging tools. Soil removal would continue until the source of the elevated gamma activity reading is removed or a depth of 12 inches is reached. Following removal of the source of elevated gamma activity, a minimum of one foot of additional soil in all directions from the source would also be removed and segregated for disposal.
- After the radioactive material and surrounding soil is excavated, the resulting pit would be resurveyed and sampled. If elevated gamma activity persists, further examination of the soil would be made until the source of high gamma activity is found, removed, or a depth of 12 inches is reached. If the source of elevated radioactivity cannot be readily identified as a point source, the material would be segregated for disposal.
- Following the identification and removal of radioactive materials in the upper 12 inches of soil from a given work area, an excavator would be used to remove the soil from the upper 12-inch layer in the redefined excavation area.
- The protocol for removing the remaining (non-radioactive) materials from the excavation area would consist of conducting radiological surveys of each 12-inch lift surface and removing any confirmed radioactive materials prior to full excavation of each lift. This protocol would be repeated until the excavation reaches the final depth.
- All excavated material (with the exception of large debris) would be processed through a conveyor system featuring an array of beta/gamma detectors to identify radioactive materials that may not have been detected during the preliminary or subsequent surface surveys, and to detect any beta emitting sources that may be present. In addition, material leaving the conveyor system would be sampled for radioactivity levels that cannot be seen with the beta/gamma detectors. Large debris would be segregated from the surrounding and screened separately for potential radioactivity.
- Any sandblast grit encountered during excavation activities would be handled in accordance with a Navy-approved work instruction specifically written to govern this potentially radioactive

material. In addition, one or more site workers, trained in recognizing sandblast grit, would be designated as a “spotter” during excavation activities.

The lateral and vertical extent of excavations required to adequately remove isolated radiological anomalies at the surface would be through screening and sampling; however, for cost estimating purposes, it was assumed that surface radiological anomalies requiring disposal would be encountered within 10 percent of the material from 0 to 1 foot bgs during clearing and grubbing operations. In addition, it was assumed that radiological anomalies requiring disposal would be encountered within 5 percent of the material deeper than 1 foot bgs during grading operations. These assumptions resulted in an estimated 886 cubic yards of low-level radiologically impacted vegetation and soil being excavated, stockpiled on site, and further screened for disposal purposes. Radioactive material, including any identified mixed waste, would be properly stored on site pending disposal by a certified waste broker through the Navy’s Low-level Radioactive Waste Disposal Program.

12.2.3.2. Grading

Grading for this alternative would require approximately 78,000 cubic yards of material from the adjacent areas to be excavated and compacted on the west and north areas of the landfill. Approximately 15,000 cubic yards of existing soil cover on the north side of the landfill would be excavated to create capacity for placement of excavated materials within the proposed cap area. Existing soil cover would be stockpiled on site, screened for potential contamination, and used as foundation material under the cap (if radiological concentrations are acceptable). It is anticipated that all other fill required for the cap construction would be imported to the site from off-site borrow sources.

All grading activities would be performed using appropriate radiological control procedures similar to those outlined in Subsection 12.2.3.1. For the purposes of cost estimating, it was assumed that 5 percent of the material excavated during site grading activities will be radiologically impacted and require off-site disposal.

12.2.3.3. Segregation, Stockpiling, Characterization, and Disposal of Radiologically-Impacted Material

Radiologically-impacted material would be transported to an on-site staging area for waste characterization, segregation, and stockpiling. Waste characterization would be achieved through stockpile characterization, and would involve testing for various chemicals and other physical properties, in accordance with the specified waste characterization ARARs and any additional requirements of the off-site disposal facility. The cost estimate was developed assuming that approximately 10 percent of the material excavated from 0 to 1 foot bgs (during clearing and grubbing operations) and 5 percent of the material excavated from deeper than 1 foot bgs (during grading operations) would be disposed off-site as low-level radioactive waste and the remaining of the material would be used as foundation material under the cap.

Following characterization of a given stockpile and acceptance of the waste profile by the disposal facility, waste would be loaded into waste bins, place on trucks, and transported to the off-site disposal facility. To estimate disposal costs for this alternative, it was assumed that the low-level radioactive wastes would be disposed of at the American Ecology hazardous waste landfill in Grand View, Idaho.

12.2.3.4. Cap Construction

A multilayer geosynthetic cap would be constructed over the solid waste and soil in areas of the Landfill not already covered by the existing multilayer geosynthetic cap. The new cap would be contiguous with the existing multilayer geosynthetic cap, and the geosynthetic materials of both caps would be inter-connected to provide continuous containment over the landfill (Figure 12-3). A portion of the existing landfill cap would be removed to achieve the grades shown in Figure 12-1, and a new multilayer geosynthetic cap would be constructed in these areas.

A geosynthetic cap would be constructed over the adjacent areas. The cap in the adjacent areas would be constructed on prepared subgrade, which would serve as the foundation layer. The vegetative layer thickness would be 18-inches in the East Adjacent Area and 24-inches in the Panhandle Area. The geosynthetic cap would be connected to the existing and new multilayer geosynthetic cap as shown on Figures 12-1, 12-13, and 12-14. The new capped areas would be designed to meet landfill closure requirements as provided in 27 CCR. (The existing multilayer geosynthetic cap on the landfill exceeds these requirements.)

The landfill cap could allow small amounts of rain water infiltration through any defects or damage to the geomembrane layer of the final cap; however, compared to current on-site conditions, infiltration through the waste and down to the groundwater would be significantly reduced in the areas of the landfill currently uncapped. Rain water quantities infiltrating through any defects in a cap are expected to be insignificant. Any additional leachate generated by infiltration through defects in the landfill cap would have no significant effect on overall effectiveness of the remedy.

In the East Adjacent Area and the Panhandle Area outside the restored wetlands, the cap could allow small amounts of rain water infiltration through any defects or damage to the geomembrane layer of the cap. However, compared to current on-site conditions, infiltration in these areas would be significantly reduced. Rain water quantities infiltrating through any defects in the cap are expected to be insignificant.

In the restored wetlands within the Panhandle Area, the cap could allow small amounts of water to infiltrate from the wetlands through any defects or damage to the geomembrane layer of the cap. However, compared to current on-site conditions, infiltration in these areas would be significantly reduced. In addition, the cap in this area would also serve as a barrier separating any left-in-place contaminants from the clean vegetative soil cover in the restored wetlands. Any potential defects in the cap would have no significant effect on the overall effectiveness of providing a barrier for isolating residual contaminants from the restored wetlands vegetative soil layer.

12.2.3.5. Landfill Gas Control

Future landfill gas generated within the Landfill Area would be controlled by an active landfill gas collection system that would prevent landfill gas from exceeding regulatory thresholds at compliance points, thereby reducing risks from explosion. In the adjacent areas, landfill gas is not expected to be generated to a degree that requires collection. Based on the current understanding of the materials in the adjacent areas, there are neither substantial concentrations of volatile chemicals or biodegradable wastes that would create landfill gases. Further, it should be noted that wetlands and Bay mud can produce methane, hydrogen sulfide, and other gases similar in composition to landfill gases. These gases would not be subject to gas collection requirements.

As stated above, a landfill gas collection system would be installed to actively collect landfill gas from the Landfill Area. The appropriate landfill gas treatment technology, if necessary, will be determined during the remedial design based on landfill gas data collected from within the landfill. Landfill gas treatment by flare is assumed for costing and evaluating Alternative 3A, and GAC/potassium permanganate treatment is assumed for Alternative 3B. Figure 12-15 shows the conceptual landfill gas collection system. This system would draw landfill gas from the landfill and away from the landfill perimeter to control gas migration. The system would consist of a series of vertical extraction wells spaced sufficiently close together to ensure landfill gas removal from all solid waste areas, especially near the landfill perimeter. The vertical extraction wells would be connected to a header pipe that would tie the wells together. A blower would draw gas to the central collection point located in the southeast corner of the landfill. The collected gas would then be conveyed to the flare or GAC/potassium permanganate treatment system for destruction or treatment, respectively. The header pipe would be installed underground, and all extraction wells would be terminated flush with the ground and have vaults with lockable covers at the surface to discourage vandalism. The subgrade collection header pipe would daylight inside the collection and treatment compound. The area around the gas treatment system would be fenced to restrict public access.

12.2.3.6. Monitoring, Operation and Maintenance

Landfill gas monitoring is required to meet the RAOs and to demonstrate compliance with 27 CCR, Sections 20917 through 20934, “Gas Monitoring and Control at Active and Closed Disposal Sites.” The specific landfill gas monitoring program will be determined during the remedial design and included as part of the Parcel E-2 closure plan. The gas monitoring program will be designed to account for:

- Local soil, rock, and hydrogeological conditions
- Locations of buildings and structures relative to the waste disposal area
- Adjacent land use and inhabitable structures within 1,000 feet of the landfill
- Manmade underground structures, such as vaults
- The nature and age of waste and its potential to generate landfill gas

At a minimum, monitoring will be quarterly for methane at wells around the perimeter of the landfill and at on-site structures, such as buildings, subsurface vaults, utilities, and any other areas where potential gas buildup can occur. The anticipated minimum monitoring period is 30 years, or until it is demonstrated that landfill gas no longer poses a threat to human health or the environment.

Several general assumptions were made to develop the FS costs for the landfill gas monitoring component. Landfill gas will not migrate below the groundwater table, which is between 6 to 20 feet bgs, so GMPs will not be screened below the water table; rather, the GMPs will be screened from 5 feet bgs (above the historic high groundwater elevation at the site) to the historic low groundwater elevation. Existing GMPs are located approximately 150 feet apart on the Parcel E-2 boundary north of the landfill and will continue to be used under Alternative 3. Under Alternative 3, it is assumed that additional GMPs will be installed at 150-foot intervals along the western Parcel E-2 boundary and along the eastern edge of the existing multilayer geosynthetic cap. Along the southern boundary of Parcel E-2, the landfill is bounded by the Bay; thus, landfill gas migration cannot occur in this direction and GMPs will not be required.

In addition, the cap across Parcel E-2 would be inspected and maintained to ensure the integrity of the cap and the vegetative layer.

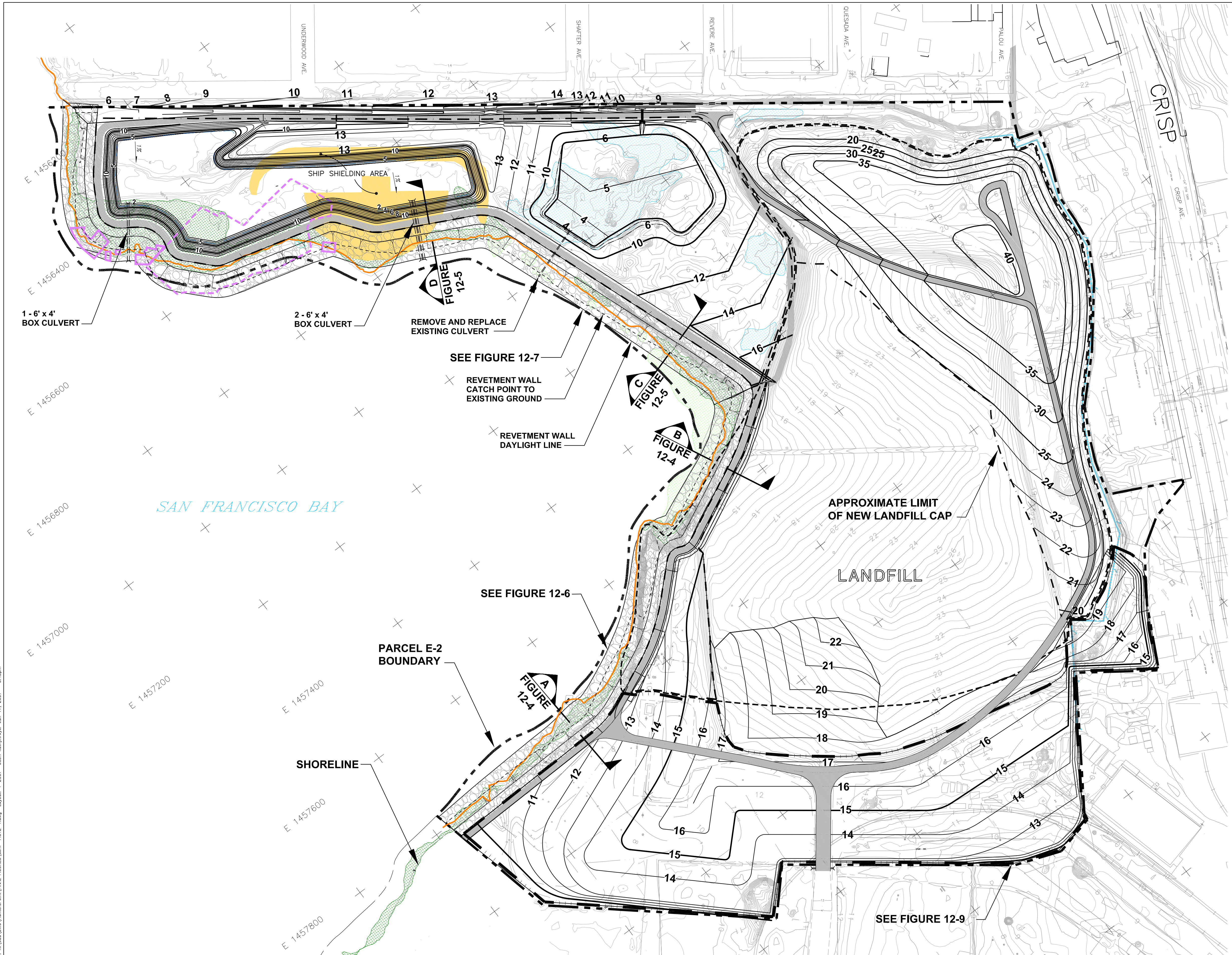
12.2.3.7. Wetlands Restoration

Freshwater and tidal wetlands would be restored on top of the geosynthetic cap in the Panhandle Area. Existing surface drainage to the freshwater wetland would be maintained. It is anticipated that there will be sufficient water to replace the existing freshwater wetland at a 1:1 ratio, but there will not be sufficient water to support additional acreage of freshwater wetlands. Tidal water would be allowed to flow through culverts in the revetment wall at selected points to create a tidal wetland on the inboard side of the shoreline protection. Scouring of the mudflat on the outboard side of the revetment wall would be controlled through design features of the wall, such as angles and sizes of culverts through the wall.

The wetlands vegetation used for restoration would meet the requirements for the vegetative layer (capable of sustained growth, root depth can be designed not to exceed the top of the low hydraulic conductivity layer, compatible with post-closure land use, can tolerate soil conditions), particularly the generation of landfill gas. Wetlands vegetation is resistant to adverse conditions of climate, disease, and pests; is self propagating; has a high percentage of surface area coverage, and minimizes the need for irrigation and maintenance. However, sustained freshwater and tidal wetlands are dependent on water and, in some cases (particularly the seasonal freshwater wetland) require ponded water to sustain the wetland vegetation.

Stormwater flowing toward Parcel E-2 from the UCSF compound would be intercepted by a drainage ditch north of the new cap, and either diverted to the existing storm sewer system north of Parcel E-2 or conveyed to a discharge point into the freshwater wetlands. Most of the stormwater flowing from the cap would flow south toward the Bay and be collected in perimeter ditches. The ditches would flow toward inlets located on the southern perimeter of the final cap for discharge to the Bay through culverts or for discharge to the wetlands. Wetlands would be maintained and monitored in accordance with a wetlands restoration plan.

Figures



LEGEND

- LANDFILL EXTENT
- EXISTING LANDFILL CAP
- APPROXIMATE LIMIT OF NEW LANDFILL CAP
- APPROXIMATE LIMIT OF NEW ADJACENT SOILS CAP
- APPROXIMATE LIMIT OF NEW PANHANDLE AREA CAP
- PARCEL E-2 BOUNDARY
- ROCK RIPRAP
- EXISTING FRESHWATER WETLANDS
- EXISTING INTERTIDAL WETLANDS
- EXISTING EMERGENT WETLANDS
- METAL SLAG AREA EXCAVATION LIMIT (ALREADY REMOVED)
- DISCONTINUOUS METAL SLAG AREA (ALREADY REMOVED)
- MEAN HIGH TIDE LINE EL. 2.98 ft msl (NGVD 29)
- PEDESTRIAN PATH / WALKWAY
- SHIP SHIELDING AREA

NOTES:

1. TOPOGRAPHIC BASE MAP PROVIDED BY TtEMI BASED ON AERIAL PHOTOGRAMMETRY DATED 3/13/02.
2. GROUND ELEVATIONS BASED ON NGVD 29.
3. COORDINATE SYSTEM BASED ON NAD 27.
4. TOPOGRAPHIC BASE COVERAGE DOES NOT GO BEYOND ELEVATION 2' (NGVD 29).

100 0 100 200

Scale in Feet

SHAW Environmental, Inc.

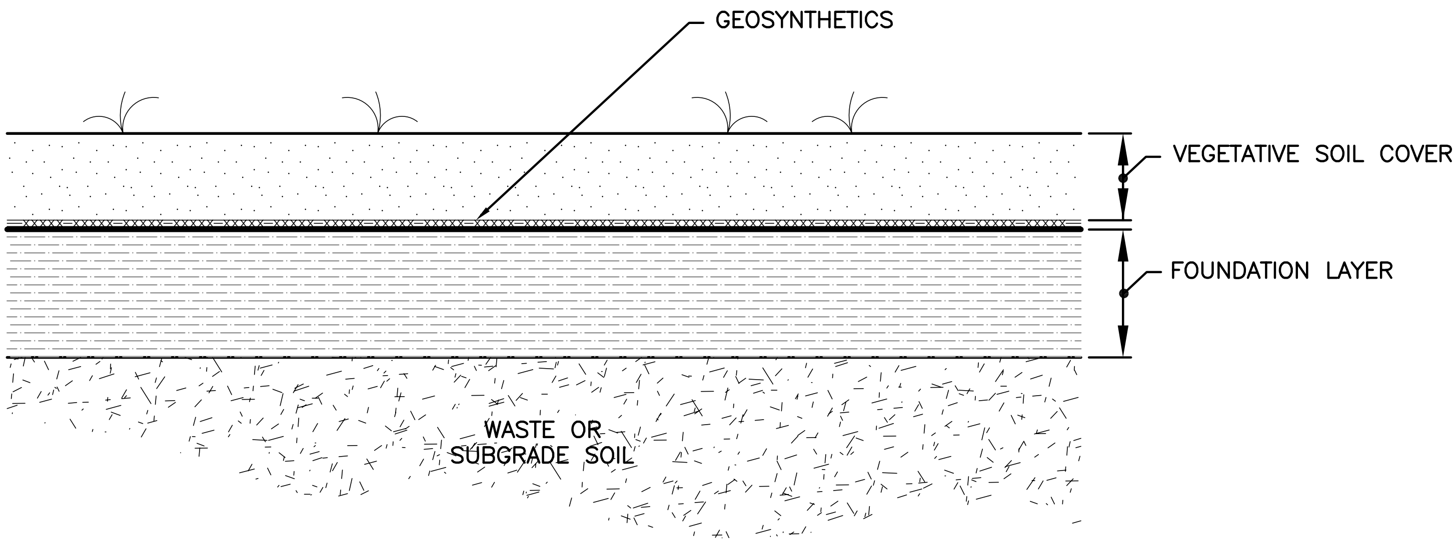
Hunters Point Shipyard, San Francisco, California

Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-1
CONCEPTUAL GRADING PLAN
ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2

XREF Files: IMAGE Files:
File: N:\cad\DWG\HuntersPoint\FINAL FIGURES\SJHP-FIG12-2.dwg Layout: 7-2005 User: kathy.troyer Jan 16, 2007 - 11:44am



PROPOSED CAP DESIGNS

	LANDFILL AREA	ADJACENT SOILS	PANHANDLE
VEGETATIVE LAYER	1.5'	1.5'	2.0'
DRAINAGE GEOCOMPOSITE	Y	Y	N
60-MIL HIGH-DENSITY POLYETHYLENE GEOMEMBRANE	Y	Y	Y
GEOSYNTHETIC CLAY LINER	Y	N	N
FOUNDATION LAYER	2.0'	1.0'	N

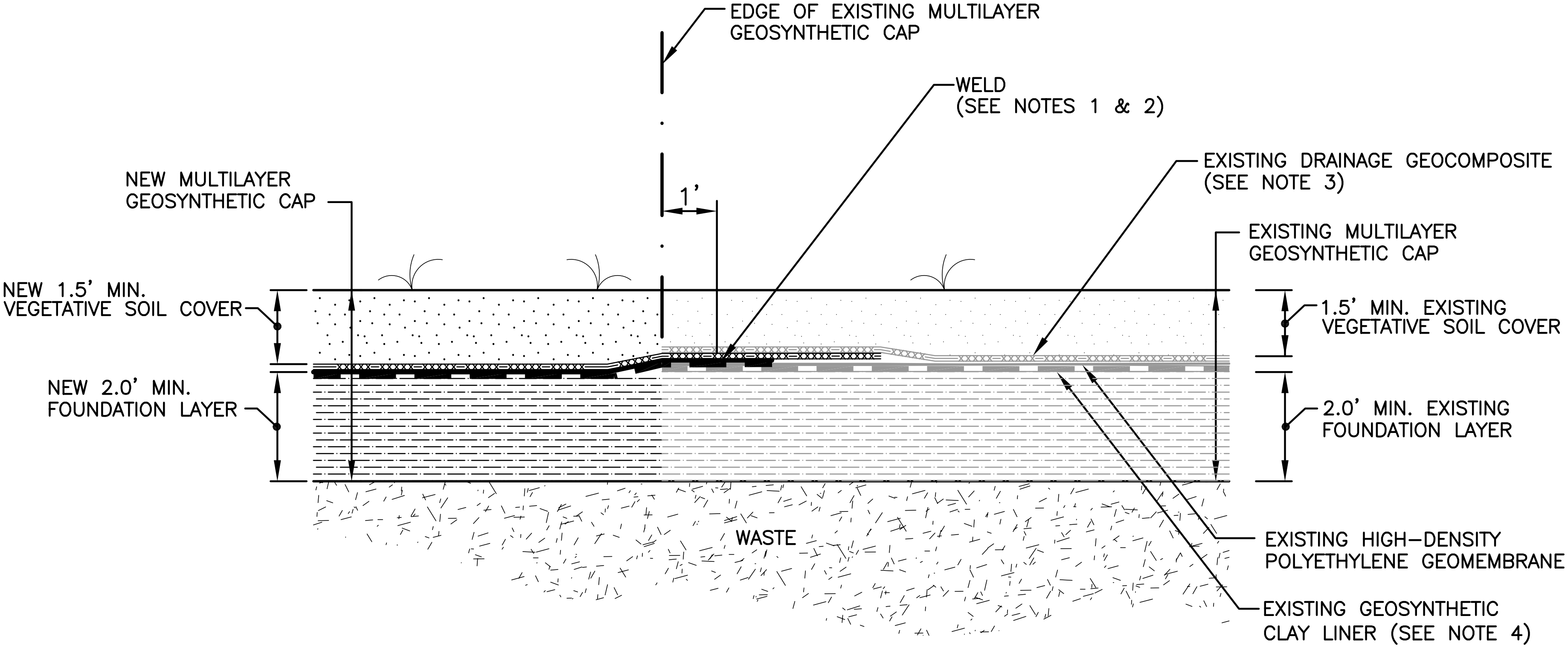
SHAW Environmental, Inc.

Hunters Point Shipyard, San Francisco, California
Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-2
CONCEPTUAL
CAP DESIGNS, ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2

XREF Files: IMAGE Files:
File: N:\cad\DWG\HuntersPoint\FINAL FIGURES\SJHP-FIG12-3.dwg Layout: 7-2005 User: kathy.troyer Jan 16, 2007 - 11:49am



LANDFILL CAP TIE-IN

NOTES

1. REMOVE EXISTING SOIL COVER AND LAY BACK EXISTING GEOSYNTHETICS FOR NEW GEOMEMBRANE CONNECTION.

2. EXPOSE AND CLEAN 1' MINIMUM WIDTH OF GEOMEMBRANE FOR OVERLAP CONNECTION WITH NEW GEOMEMBRANE. WELD AND SEAM.

3. PROVIDE 4' MINIMUM OVERLAP FOR NEW DRAINAGE GEOCOMPOSITE AND GEOSYNTHETIC CLAY LINER INSTALLATION.

4. GEOSYNTHETIC CLAY LINER WAS INSTALLED ON TOP DECK AREA ONLY AND NOT ON SIDESLOPE OF THE LANDFILL.

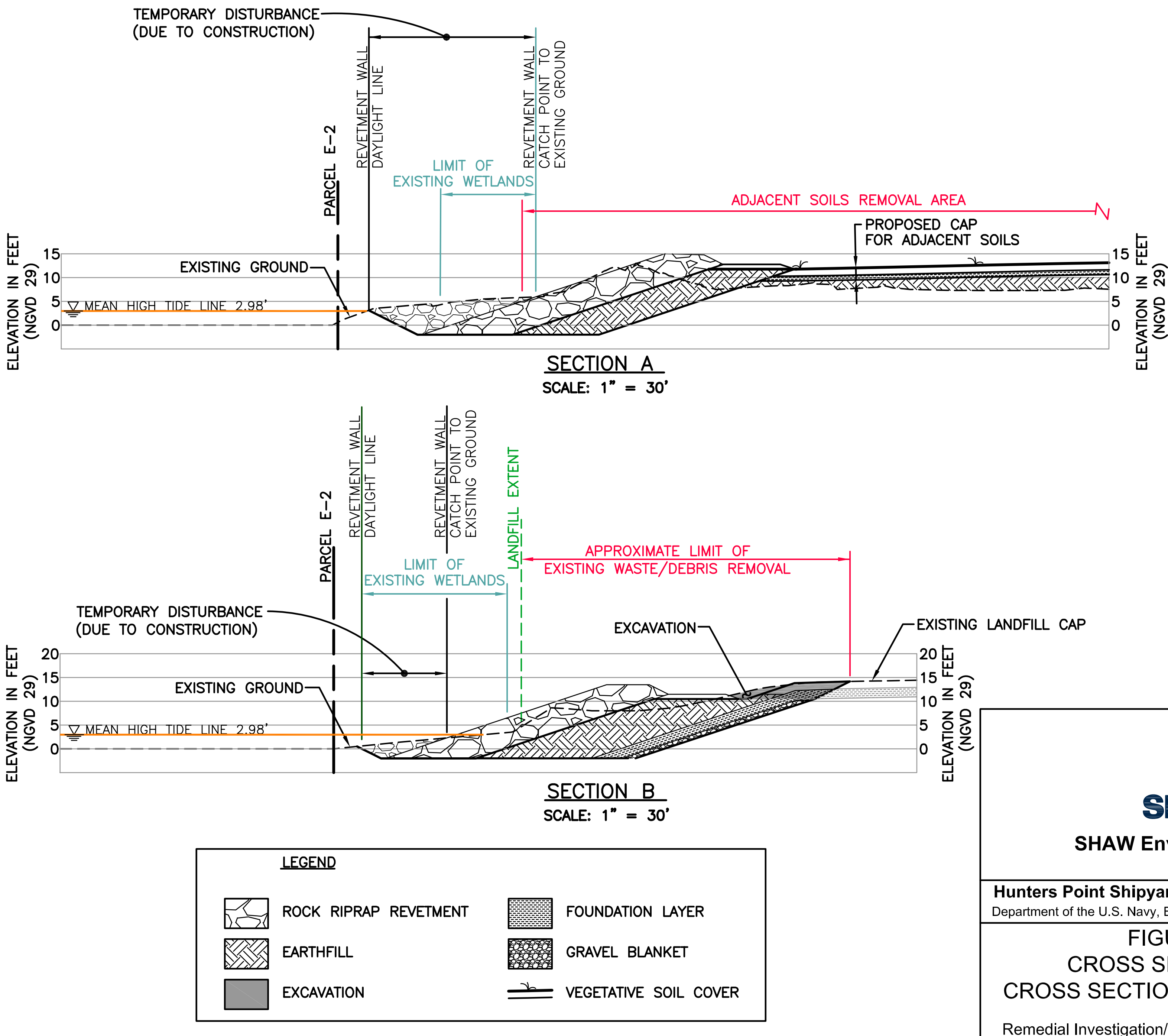
SHAW Environmental, Inc.

Hunters Point Shipyard, San Francisco, California
Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-3
LANDFILL CAP
TIE-IN, ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2

XREF Files: IMAGE Files:
File: N:\cad\DWG\HuntersPoint\FINAL FIGURES\SJHP-FIG12-4.dwg Layout: 7-2005 User: kathy.troyer Jan 17, 2007 - 4:54pm



Shaw®

SHAW Environmental, Inc.

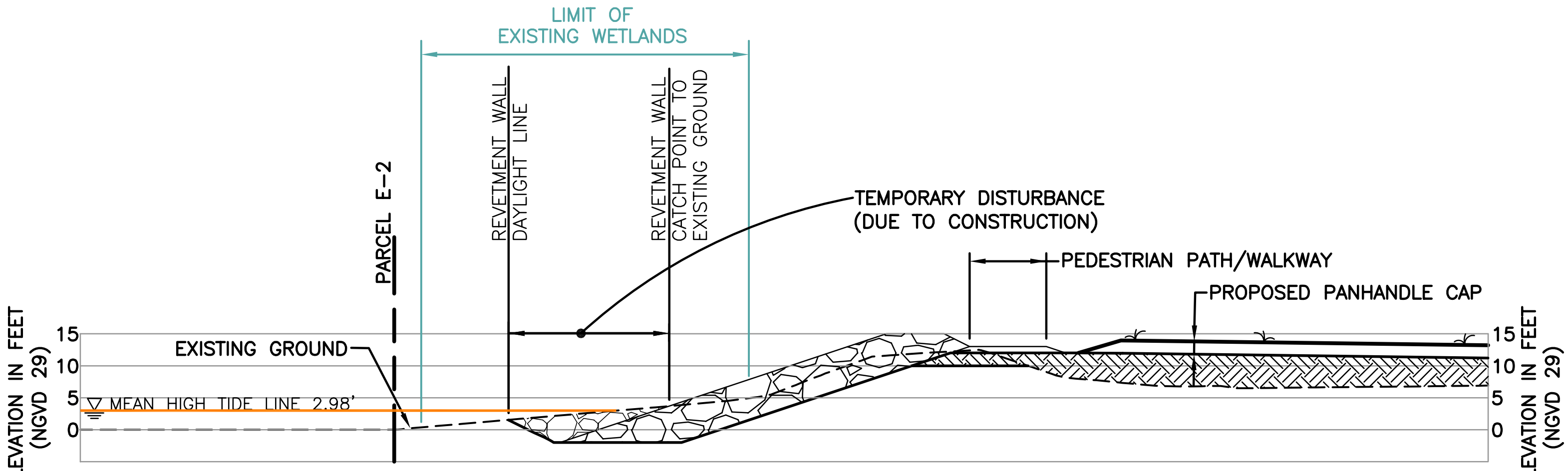
Hunters Point Shipyard, San Francisco, California

Department of the U.S. Navy, BRAC PMO West, San Diego, California

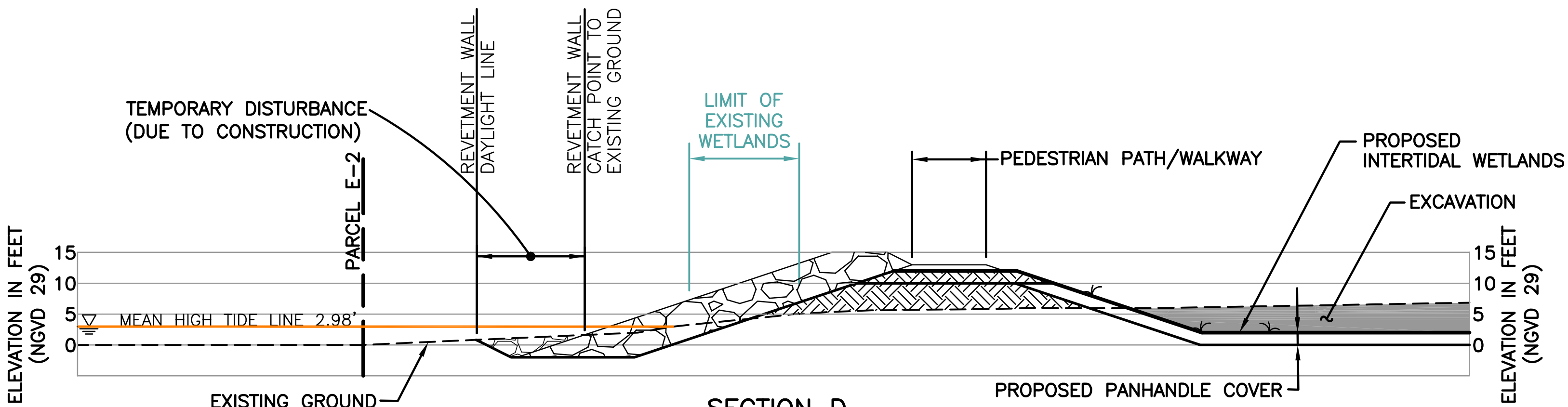
FIGURE 12-4
CROSS SECTION A AND
CROSS SECTION B, ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2

XREF Files: IMAGE Files:
File: N:\cad\DWG\HuntersPoint\FINAL FIGURES\SJHP-FIG12-5.dwg Layout: 7-2005 User: kathy.troyer Jan 17, 2007 - 5:25pm



SECTION C
SCALE: 1" = 30'



SECTION D
SCALE: 1" = 30'

LEGEND

ROCK RIPRAP REVETMENT

EARTHFILL

EXCAVATION

VEGETATIVE SOIL COVER

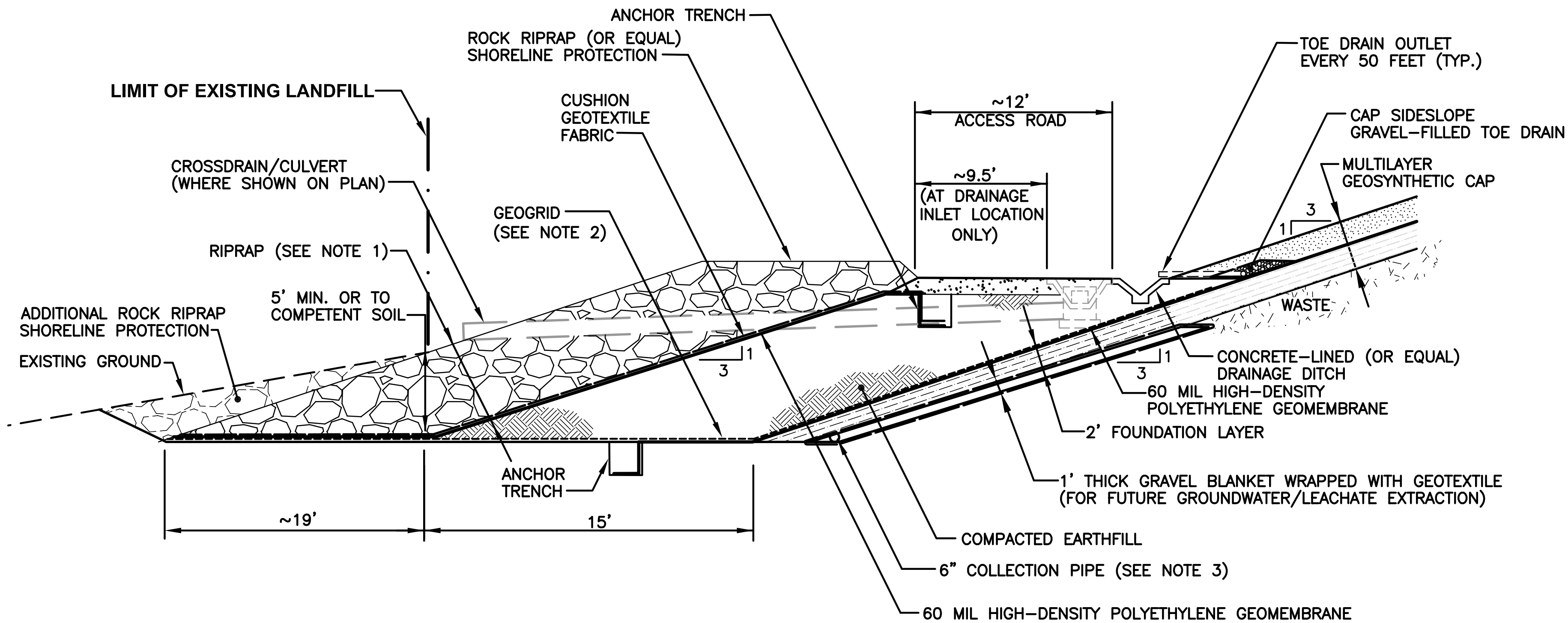
SHAW Environmental, Inc.

Hunters Point Shipyard, San Francisco, California
Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-5
CROSS SECTION C AND
CROSS SECTION D, ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2

XREF Files: IMAGE Files:
File: N:\cad\DWG\HuntersPoint\FINAL FIGURES\SJHP-FIG12-6.dwg Layout: FCTERM-SOUTH - 8.5x11 User: kathy.troyer Jan 16, 2007 - 12:05pm



SOUTH PERIMETER CAP TERMINATION WITH ROCK RIPRAP SHORELINE PROTECTION

NOTES

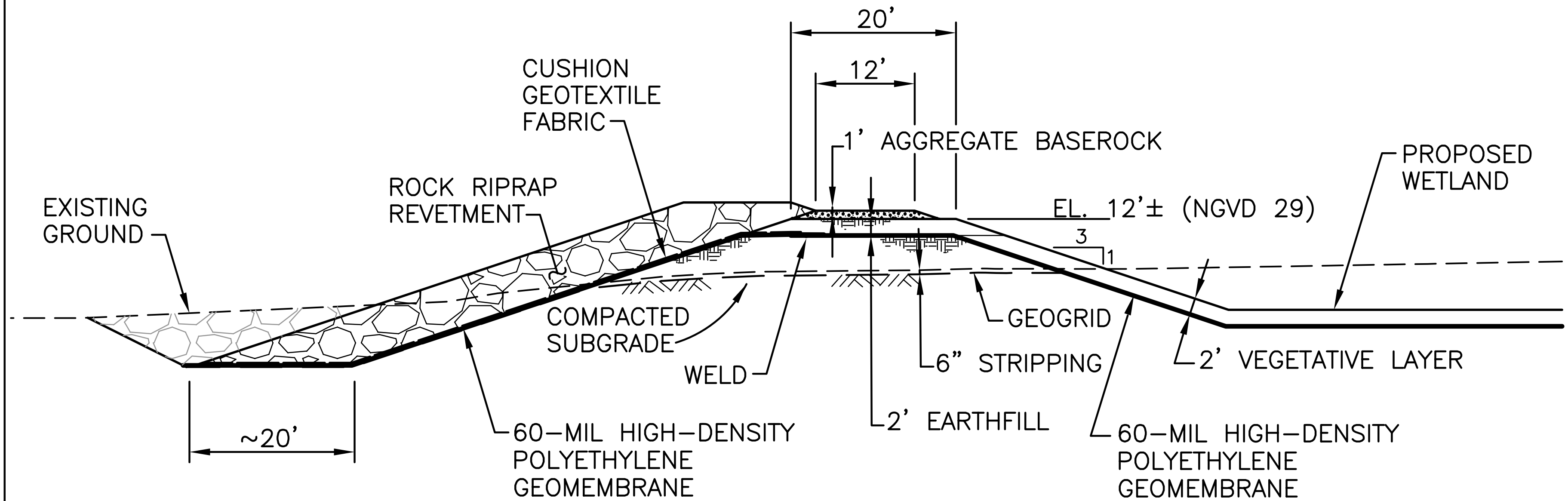
1. FOR COST ESTIMATING PURPOSES, RIPRAP IS 6 FEET THICK.
2. GEOGRID SHOULD BE TENSAR VX 1500 HS OR EQUIVALENT.
3. PROVIDE INSPECTION RISER PIPE AT EACH END AND EVERY 200 FEET.

SHAW Environmental, Inc.

Hunters Point Shipyard, San Francisco, California
Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-6
SOUTH PERIMETER CAP TERIMINATION WITH ROCK RIPRAP PROTECTION, ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2



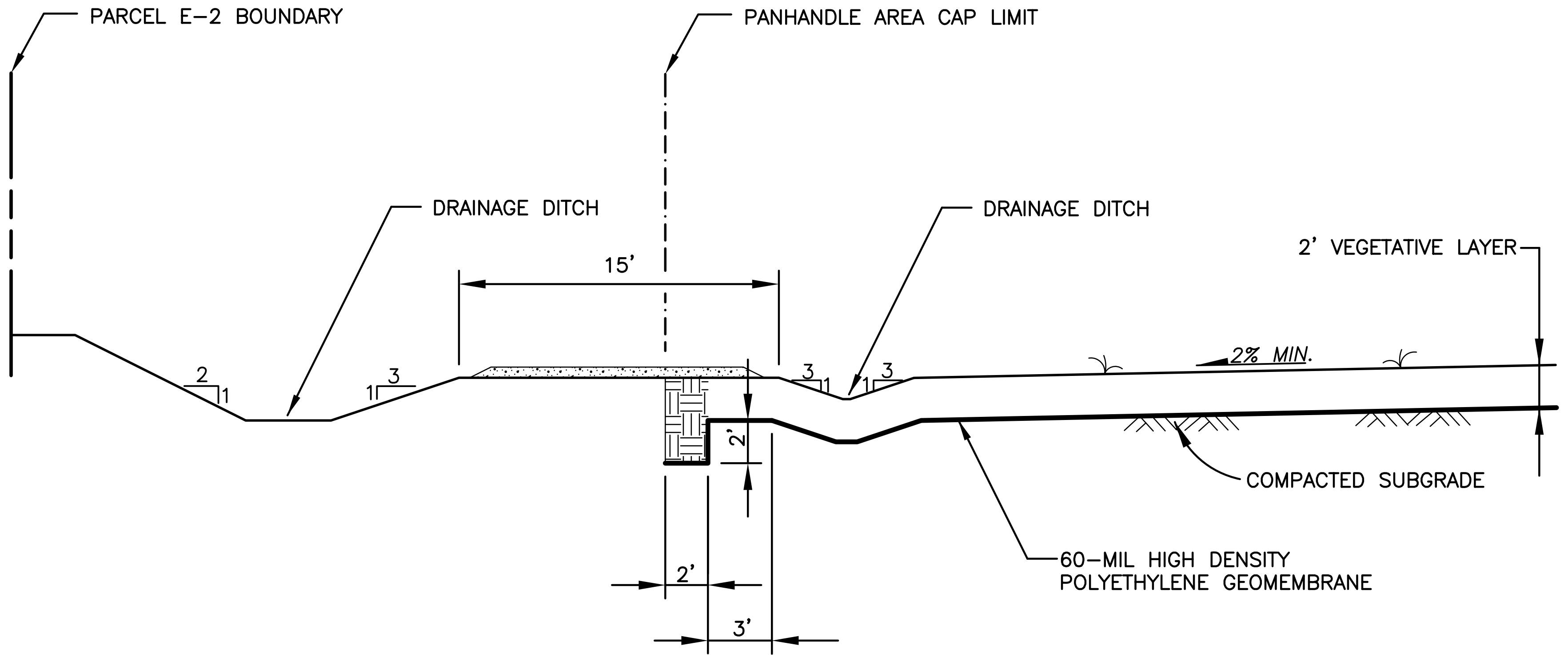
SHORELINE PROTECTION AT PANHANDLE AREA

SHAW Environmental, Inc.

Hunters Point Shipyard, San Francisco, California
Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-7
SHORELINE PROTECTION AT PANHANDLE AREA, ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2



PANHANDLE CAP TERMINATION (WEST BOUNDARY)

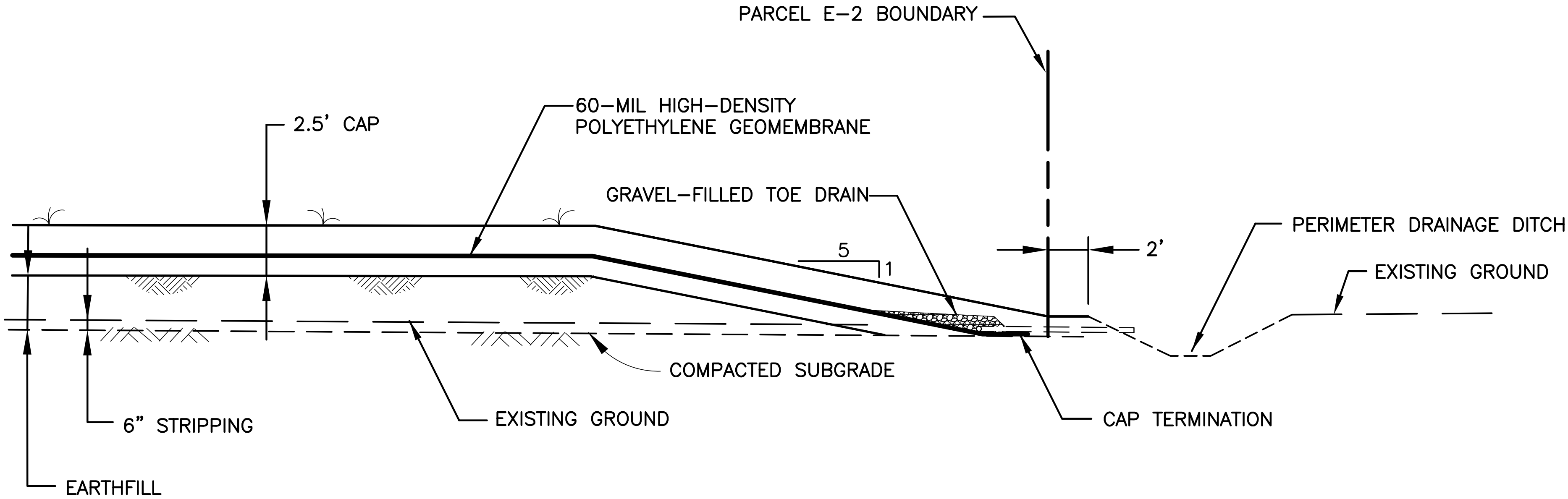
SHAW Environmental, Inc.

Hunters Point Shipyard, San Francisco, California

Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-8
PANHANDLE CAP TERMINATION
(WEST BOUNDARY), ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2



CAP TERMINATION (EAST BOUNDARY)

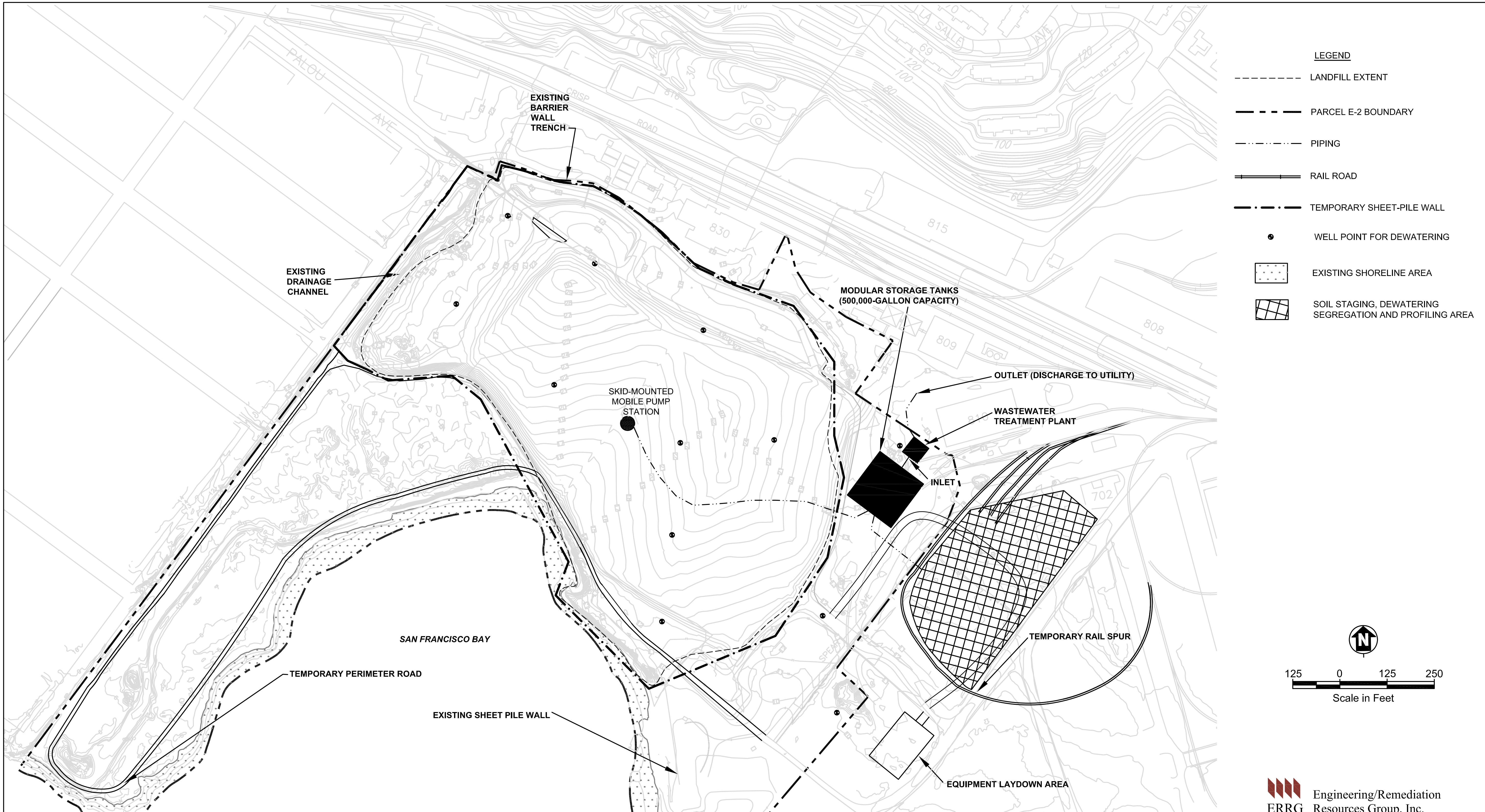
SHAW Environmental, Inc.

Hunters Point Shipyard, San Francisco, California

Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-9
EAST ADJACENT AREA CAP TERMINATION (EAST BOUNDARY), ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2



ERRG Engineering/Remediation Resources Group, Inc.

Hunters Point Shipyard, San Francisco, California

U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 12-10
CONCEPTUAL CONSTRUCTION PLAN
ALTERNATIVE 2

Remedial Investigation/Feasibility Study for Parcel E-2

P:\2005_Projects\25-049_Navy_HPS_E-2_RI-FS\N_Maps&Drawings\GIS\Projects\Landfill\PDFs\Section 12\12-10 and 12-12 rev2

Note:

1) All excavation depths shown within the Landfill Area are estimated. Final depths would be determined in the field. All excavation depths relative to ground surface.

2) Based on the exposure risk assessment, the minimum excavation depth must be 3 feet (bgs) in the Panhandle and East Adjacent Areas, and 2.5 feet (bgs) in the Shoreline Area.

3) To ensure that the final surface elevations are adequately low as to ensure periodic flooding of the tidal wetlands, it is assumed that an additional foot of soil and sediment throughout most of the Panhandle Area (and adjoining portions of the Shoreline Area) will require excavation and offsite disposal.

4) Excavation depths were increased to 10 feet (bgs) in areas where concentrations of TPH and/or PCBs exceed the remedial action objectives.

ERRG ENGINEERING/REMEDIATION RESOURCES GROUP, INC.

Hunters Point Shipyard, San Francisco, California

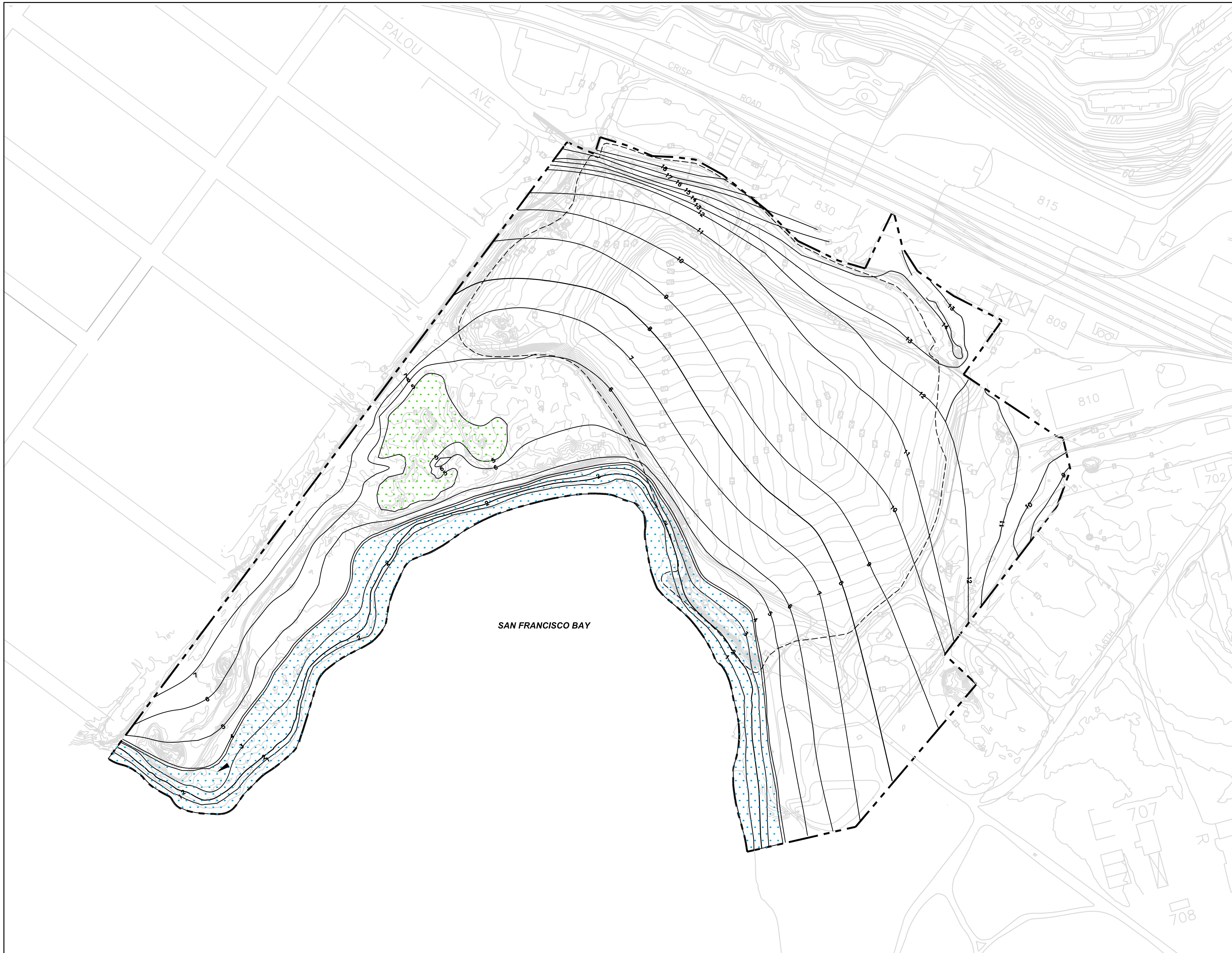
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 12-11

PROPOSED EXCAVATION DEPTHS ALTERNATIVE 2

Remedial Investigation/Feasibility Study for Parcel E-2

2006-04-03 C:\Documents and Settings\jmiller\Desktop\Work\12-11.mxd ERRG-Concord Jeremy Miller



LEGEND

- LANDFILL EXTENT
- PARCEL E-2 BOUNDARY
- GRADING CONTOUR LINE AND ELEVATION
- PROPOSED INTERTIDAL WETLANDS
- PROPOSED FRESHWATER WETLANDS

NOTE:
PROPOSED SHORELINE PROTECTION WILL BE INCLUDED TO MINIMIZE EROSION OF INTERTIDAL SEDIMENTS, AND DAMAGE TO PLANTED VEGETATION

150 0 150 250
Scale in Feet

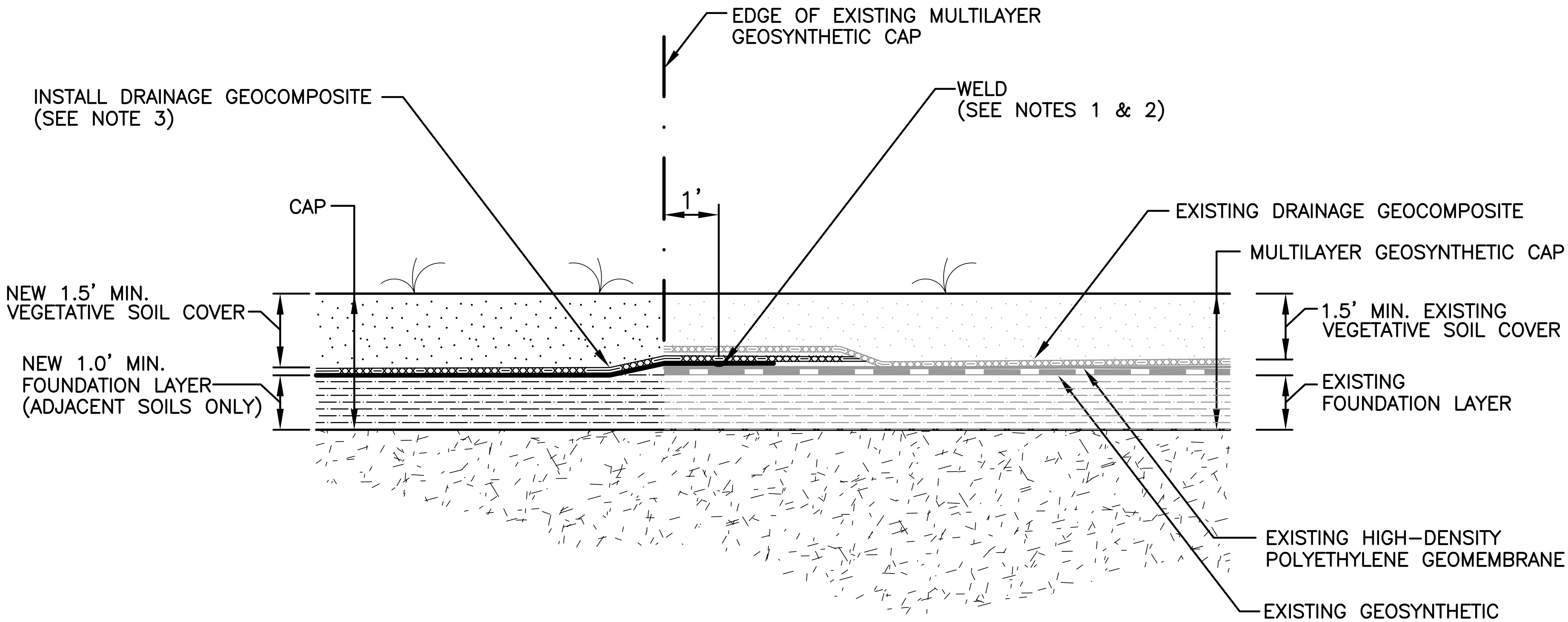
ERRG Engineering/Remediation Resources Group, Inc.

Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 12-12
CONCEPTUAL GRADING PLAN
ALTERNATIVE 2

Remedial Investigation/Feasibility Study for Parcel E-2

P:\2005_Projects\25-049_Navy_HPS_E-2_RI-FS\N_Maps&Drawings\GIS\Projects\Landfill\PDFs\Section 12\12-10 and 12-12 rev2



MULTILAYER GEOSYNTHETIC CAP TIE-IN

NOTES

1. REMOVE EXISTING SOIL COVER AND LAY BACK EXISTING GEOSYNTHETICS FOR NEW GEOMEMBRANE CONNECTION.
2. EXPOSE AND CLEAN 1' MINIMUM WIDTH OF GEOMEMBRANE FOR OVERLAP CONNECTION WITH NEW GEOMEMBRANE. WELD AND SEAM.
3. FOR AREA EAST OF LANDFILL ONLY, PROVIDE 4' MIN. OVERLAP FOR NEW DRAINAGE GEOCOMPOSITE INSTALLATION.
4. GEOSYNTHETIC CLAY LINER WAS INSTALLED ON TOP DECK AREA ONLY AND NOT ON SIDESLOPE OF THE LANDFILL.

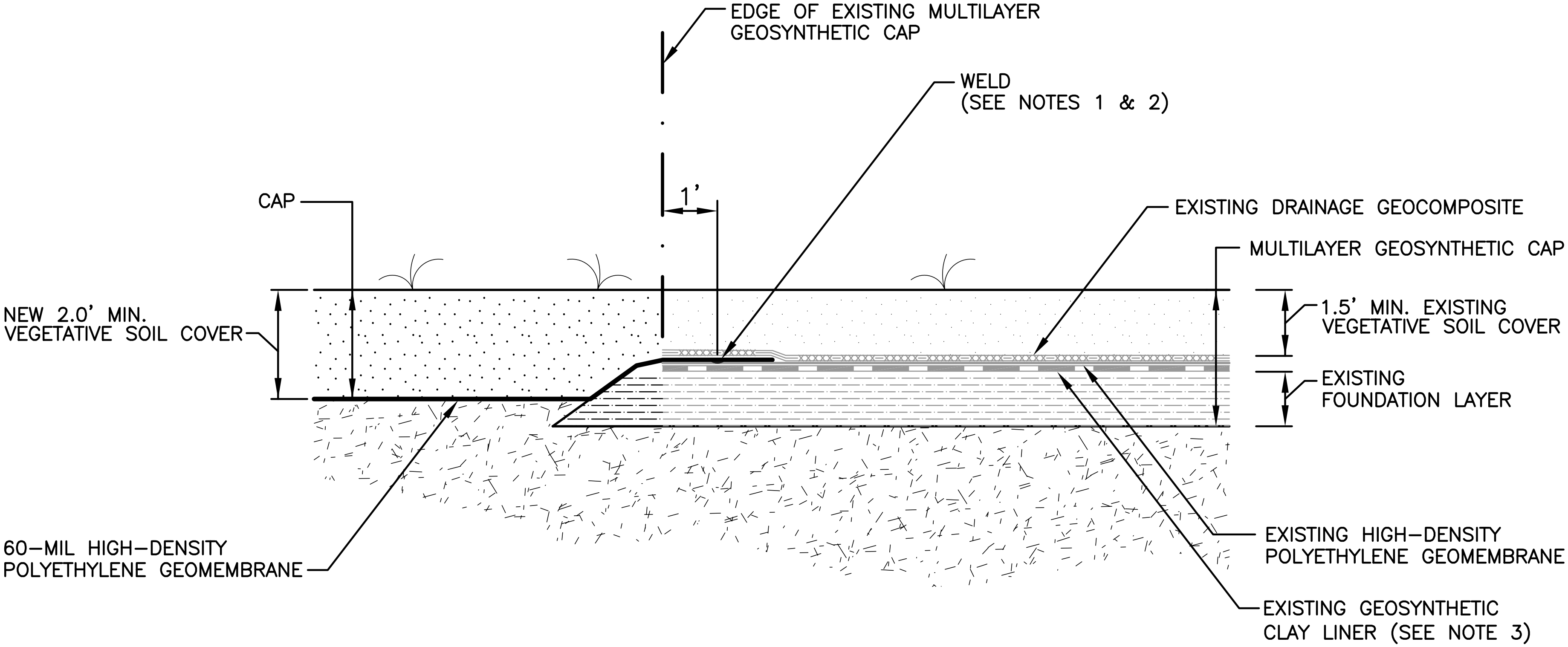
SHAW Environmental, Inc.

Hunters Point Shipyard, San Francisco, California
Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-13
MULTILAYER GEOSYNTHETIC
CAP TIE-IN, ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2

XREF Files: IMAGE Files:
File: N:\cad\DWG\HuntersPoint\FINAL FIGURES\SJHP-FIG12-14.dwg Layout: 7-2005 User: kathy.troyer Jan 16, 2007 - 12:29pm



PANHANDLE CAP TIE-IN

NOTES

1. REMOVE EXISTING SOIL COVER AND LAY BACK EXISTING GEOSYNTHETICS FOR NEW GEOMEMBRANE CONNECTION.
2. EXPOSE AND CLEAN 1' MINIMUM WIDTH OF GEOMEMBRANE FOR OVERLAP CONNECTION WITH NEW GEOMEMBRANE. WELD AND SEAM.
3. GEOSYNTHETIC CLAY LINER WAS INSTALLED ON TOP DECK AREA ONLY AND NOT ON SIDESLOPE OF THE LANDFILL.

Shaw®

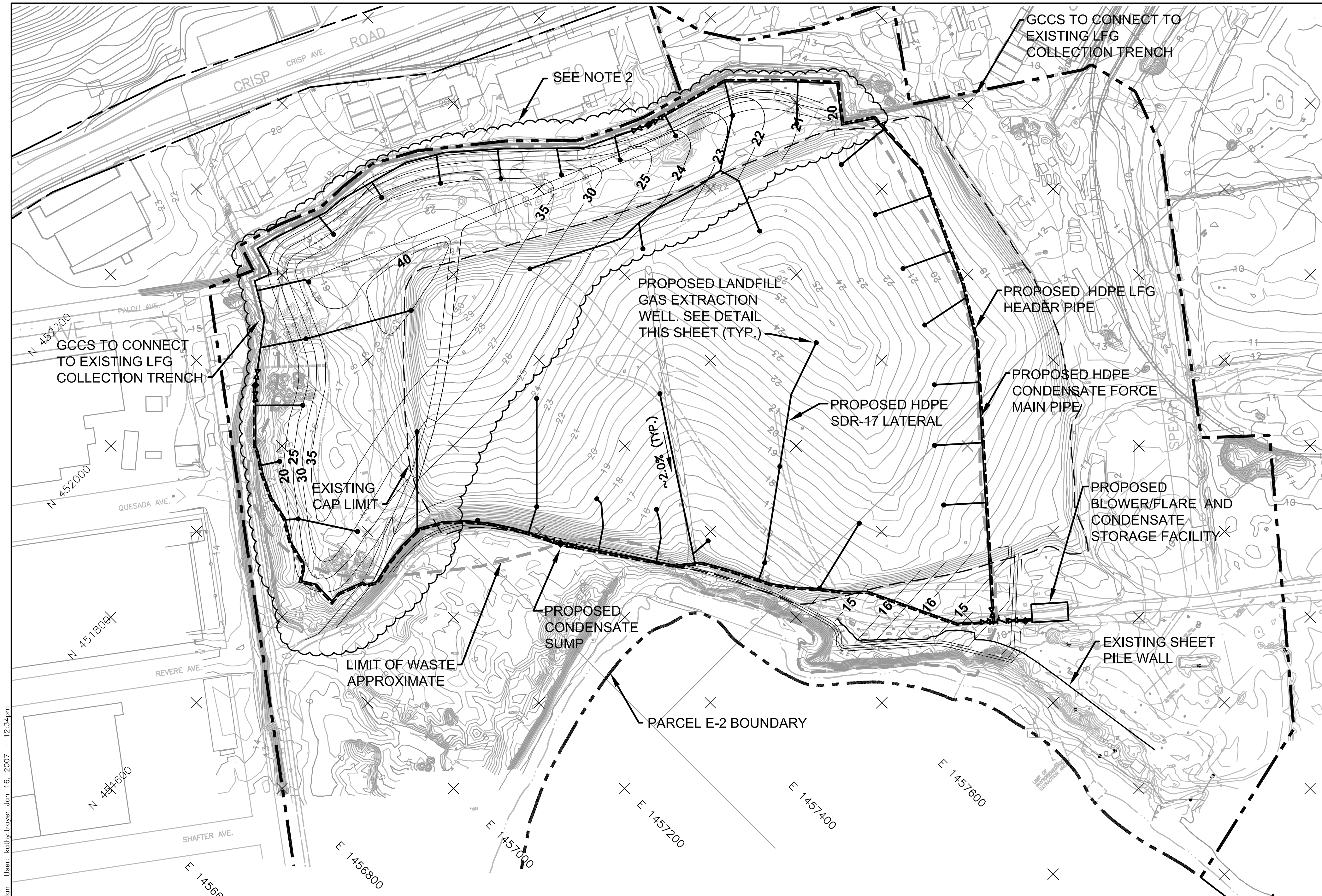
SHAW Environmental, Inc.

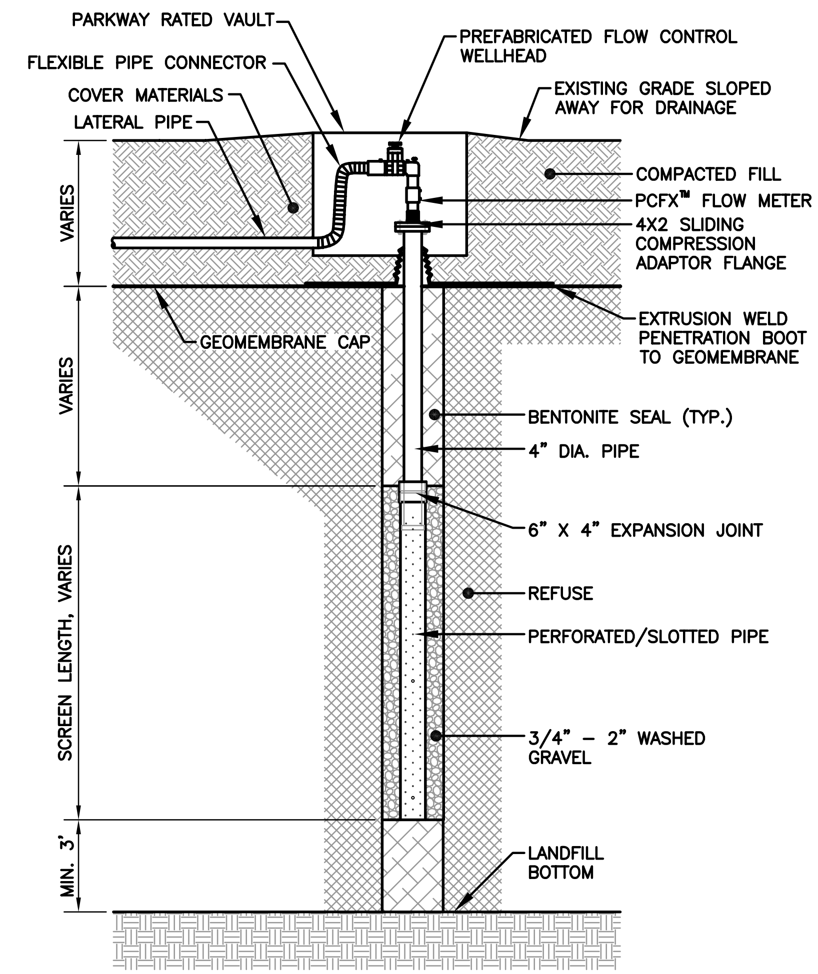
Hunters Point Shipyard, San Francisco, California

Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-14
PANHANDLE CAP TIE-IN,
ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2





CONCEPTUAL LFG EXTRACTION WELL

SCALE: NOT TO SCALE

100 0 100 200

Scale in Feet

LEGEND

- EXISTING CONTOUR
- APPROXIMATE LIMIT OF WASTE
- LIMIT OF EXISTING CAP
- PROPOSED LFG HEADER/LATERAL
- PROPOSED CONDENSATE FORCE MAIN
- PROPOSED LFG EXTRACTION WELL
- PROPOSED ISOLATION VALVE
- PROPOSED CHECK VALVE
- PROPOSED CONDENSATE SUMP

NOTES:

1. TOPOGRAPHY INFORMATION PROVIDED BY TETRA TECH EMI BASED ON AERIAL PHOTOGRAMMETRY 3-13-2002.
2. ADDITIONAL COVER MATERIAL WILL BE PLACED IN CLOUDED AREA. MATERIAL PLACED TO BE PROPERLY GRADED TO SUPPORT POSITIVE DRAINAGE FROM FIELD TO SUMP LOCATIONS.
3. LIMITS OF WASTE PROVIDED BY U.S. NAVY SOUTHWEST DIVISION NAVAL, SAN DIEGO.
4. GROUND ELEVATIONS ARE BASED ON NGVD 29. COORDINATE SYSTEM BASED ON NAD 27.
5. INFORMATION REGARDING EXISTING LANDFILL GAS FEATURES MAY NOT REFLECT CURRENT CONDITIONS AND SHALL BE VERIFIED BY CONTRACTOR PRIOR TO CONSTRUCTION.
6. SCREENED BACK FEATURES CORRESPOND TO EXISTING FEATURES OR FUTURE LAYERS.
7. ALL EXISTING WELLS, HEADERS, LATERALS, AND OTHER LANDFILL GAS COLLECTION AND CONTROL SYSTEMS APPURTENANCES SHALL BE PROTECTED, EXTENDED AND/OR AVOIDED AS DIRECTED BY THE OWNER PRIOR TO AND DURING CONSTRUCTION.
8. SLOPE HEADER IN NATIVE SOIL A MINIMUM OF 0.5 PERCENT AND LATERALS OVER REFUSE A MINIMUM OF 2.5 PERCENT.

SHAW Environmental, Inc.

Hunters Point Shipyard, San Francisco, California

Department of the U.S. Navy, BRAC PMO West, San Diego, California

FIGURE 12-15
CONCEPTUAL LANDFILL GAS
COLLECTION PLAN, ALTERNATIVE 3

Remedial Investigation/Feasibility Study for Parcel E-2

XREF Files: 3-13-02 HP-BASE IMAGE Files:
File: N:\cad\DWG\HuntersPoint\FINAL FIGURES\SJHP-FIG12-15.dwg Layout: LFG Plan User: kathy.troyer Jan 16, 2007 – 12:34pm

Tables

Table 12-1 Summary of Remedial Alternatives for the Parcel E-2 Feasibility Study
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

General Response Action	Remedial Technology	Process Options	Alternative No. 1	2	3A	3B
No action	None	None	✓			
Institutional actions	Institutional controls	Legal mechanisms		✓	✓	✓
		Administrative mechanisms		✓	✓	✓
	Site monitoring	Short-term monitoring		✓	✓	✓
		Long-term monitoring		✓	✓	✓
Containment	Caps/Covers	Multilayer geosynthetic cap (Landfill Area)			✓	✓
		Geosynthetic cap (adjacent areas)			✓	✓
	Landfill gas collection (and Treatment)	Active gas collection			✓	✓
		Destruction (via combustion)			✓	
		Adsorption (via GAC and potassium permanganate)				✓
Removal	Excavation and off-site disposal	RCRA Facility		✓		
		Non-RCRA Facility		✓		
		LLRW Facility		✓		

Notes:

GAC granular activated carbon
LLRW low level radioactive waste
RCRA Resource Conservation and Recovery Act