Appendix R. Remedial Alternative Cost Estimates

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Acronyms and Abbreviations

EPA	U.S. Environmental Protection Agency
FS	feasibility study
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OMB	Office of Management and Budget
OSWER	Office of Solid Waste and Emergency Response
O&M	operation and maintenance
PV	present value

Section R1. Introduction

This appendix presents cost estimates developed for Alternatives 2 and 3 evaluated for feasibility at Parcel E-2, Hunters Point Shipyard in San Francisco, California. Alternative 1 is the no action alternative, and thus it has no costs associated with its implementation, and it does not call for any formal cost documentation. Alternative 3 includes two different options for treatment of captured landfill gas, which were separated into two alternatives: Alternatives 3A and 3B.

This appendix describes the methodology used to prepare these estimates. Following the text are tables documenting the estimated costs and the associated assumptions on which the costs for each remedial alternative were based. The tables are organized as follows:

- Tables R-1 through R-16 present the estimated costs for Alternative 2, Excavation and Disposal of Solid Waste, Soil, and Sediment (including monitoring and institutional controls)
- Tables R-17 through R-30 present the estimated costs for Alternative 3, Containment of Solid Waste, Soil, and Sediment (including monitoring and institutional controls)

Cost estimates were prepared in accordance with U.S. Environmental Protection Agency (EPA) guidance entitled "A Guide to Developing and Documenting Cost Estimates during the Feasibility Study" (EPA, 2000).

Section R2. Purpose of Estimates

Cost estimates developed for the detailed analysis of each alternative are used for comparative purposes in the feasibility study (FS), and to ultimately support remedy selection in the record of decision. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) includes the following language in its description of the cost criterion for the detailed analysis and remedy selection:

> "The types of costs that shall be assessed include the following: 1) Capital costs, including both direct and indirect costs; 2) Annual operations and maintenance costs; and 3) Net present value of capital and operation and maintenance (O&M) costs (Title 40 Code of Federal Regulations, Section 300.430 [e][9][iii][G])"

Accordingly, the estimates for each of the alternatives have been divided into these three main categories.

Section R3. Cost Estimate Components

Cost estimates for the remediation alternatives include capital costs, annual O&M costs and periodic costs. Costs are presented as present worth and as present value, to consider the present value calculated based on a discount factor. Each of these is discussed in further detail in the following subsections.

R3.1. CAPITAL COSTS

Capital costs include direct and indirect costs. Costs incurred for equipment, material, labor, construction, development, and implementation of remedial technologies are included as direct costs. Indirect costs include health and safety supplies, site supervision, engineering oversight, overhead, profit, and start up. Indirect costs are included in the estimate as either a separate line item or as a percentage of the direct capital cost.

R3.2. ANNUAL OPERATION AND MAINTENANCE AND/OR PERIODIC COSTS

Annual O&M costs include costs incurred after construction. These costs are necessary to assure the effectiveness of a remedial action. Annual O&M costs typically include operating labor, consumable materials, purchased services (for example, laboratory analyses), equipment replacement, maintenance, sampling, permit fees, annual reports, and site reviews.

Periodic costs occur once every few years or once during the entire O&M period. Examples include periodic reviews, equipment replacement or rehabilitation, site close out, and remedy failure and replacement. Periodic reviews include five-year reviews, as required by the NCP; however, because five-year reviews are performed for all of Hunters Point Shipyard under the environmental restoration program, these costs are a small component of the periodic costs. A small incremental cost was added to the annual O&M costs for each alternative to account for the five-year reviews.

R3.3. PRESENT VALUE ANALYSIS

Remedial action projects typically involve construction costs that are expended at the beginning of a project (capital costs) and costs in subsequent years (operation and maintenance and periodic costs). Present value (PV) analysis is a method to evaluate expenditures which occur over different periods of time. This standard methodology allows for cost comparisons of different remedial alternatives on the basis of a single cost figure for each alternative. This single value, referred to as the present value, is the amount needed to be set aside at the initial point in time (base year) to assure that funds will be available in the future as they are needed. PV analysis uses a discount rate and period of analysis to calculate the PV of each expenditure.

R3.3.1. Discount Rate

A discount rate is the difference between interest and inflation rates. When inflation is neglected, the discount rate is simply an interest rate, and is used to account for the time value of money. A dollar is worth more today than in the future because, if invested today, the dollar would earn interest. The choice of a discount rate is important because the selected rate directly impacts the present value of a cost estimate, which is then used in making a remedy selection decision.

EPA policy on the use of discount rates for cost analysis is stated in the preamble to the NCP (55FR8722) and in Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-20 (EPA, 1993). Discount rates used in economic analysis by the Federal government are specified in the Office of Management and Budget (OMB) Circular A-94. The current real discount rate for a 30-year stream of payments is 3.0 percent, as specified by OMB Circular No. A-94, Appendix C, Revised January 2006. A real discount rate is a forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the current fiscal year's budget. Real rates are to be used for discounting real (constant-dollar) flows, as is often required in cost-effectiveness analyses.

R3.3.2. Present Value

The PV of a series of equal annual future payments such as annual O&M payments is calculated using the following equation:

$$PV = \sum_{t=1}^{n} \frac{x_t}{(1+i)^t}$$

where

PV = Present value

x_t = payment in year t (t = 0 for present or base year)

i = discount factor

t = number of years following construction that expenditure start

n = number of years that the stream of equal annual future payments will run

The present value of a single periodic future payment is calculated using the following equation:

$$PV = \frac{x_t}{(1+i)^t}$$

where

PV = Present value

x_t = Payment in year t (t = 0 for present or base year)

i = Discount factor

t = Number of years following construction that expenditure occur

The PV of a remedial alternative represents the sum of the present values of all future payments associated with the project. PV for this cost estimate is determined using present dollars.

R3.4. CONTINGENCY ALLOWANCES

Contingency allowances are included in cost estimates to cover unknowns or unanticipated conditions associated with construction and O&M activities. Contingency is typically added as a percentage to the total cost of those activities. A common approach is to assign a contingency percentage to FS costs based on engineering judgment (EPA, 2000). A contingency allowance of 20 percent was included in each alternative's cost estimate.

Section R4. References

U.S. Environmental Protection Agency (EPA). 1993. Memorandum: Revisions to OMB Circular A-94 on Guidelines and Discount for Benefit-Cost Analysis. OSWER 9355.3-20. June 25.

EPA. 2000. A Guide to Developing and Documenting Cost Estimates during the Feasibility Study. EPA 540-R-00-002, OSWER 9355.0-75. July.

Tables

Table R-1 Cost Estimate Alternative 2 Summary[1] - Excavate and Backfill the Landfill and Adjacent Areas
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Remedial Alternative	Total Capital Cost	Total O&M Cost	Total Periodic Cost	Period of Analysis[(2)]	Total Cost	Present Value[(3)]
2	$ 342,124,985	$ 3,831,834	$ 139,285	34 years	$ 346,096,104	$ 330,489,065

Notes:

[(1)] Appended tables summarize backup calculations for all cost estimates provided

[(2)] Period of analysis includes a 4 year construction period and 30 subsequent years of long-term monitoring, including 5 years of stormwater discharge and wetands monitoring, and 30 years of groundwater monitoring

[(3)] Based on a 3% discount factor, as specified for Federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective January 2006 through January 2007, http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html)

Table R-2 Cost Estimate Alternative 2 - 30 Year Cash Flow Analysis
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

						Present Value Costs (3% Discount Factor Applied)				
Year	Capital Costs[1]	Annual O&M Cost	Periodic Costs[2]	Total Annual Costs	Discount Factor (3%)	Capital Costs	Annual O&M Cost	Periodic Costs	Total Present Value Cost (at 3% Discount Factor)	Comments
0	$ 100,624,009	$ -	$ -	$ 100,624,009	1.0000	$ 100,624,009	$ -	$ -	$ 100,624,009	Design, permitting, mobilization, site prep, construction startup costs, excavation and disposal
1	$ 75,550,556	$ -	$ -	$ 75,550,556	0.9709	$ 73,350,054	$ -	$ -	$ 73,350,054	Excavation and disposal
2	$ 75,550,556	$ -	$ -	$ 75,550,556	0.9426	$ 71,213,645	$ -	$ -	$ 71,213,645	Excavation and disposal
3	$ 90,399,863	$ -	$ -	$ 90,399,863	0.9151	$ 82,728,681	$ -	$ -	$ 82,728,681	Backfilling, site restoration, demobilization
4	$ -	$ 265,931	$ -	$ 265,931	0.8885	$ -	$ 236,276	$ -	$ 236,276	Groundwater monitoring (quarterly), stormwater monitoring and wetland monitoring
5	$ -	$ 265,931	$ 7,619	$ 273,550	0.8626	$ -	$ 229,394	$ 6,572	$ 235,966	Groundwater monitoring (quarterly), stormwater monitoring and wetland monitoring
6	$ -	$ 265,931	$ -	$ 265,931	0.8375	$ -	$ 222,713	$ -	$ 222,713	Groundwater monitoring (quarterly), stormwater monitoring and wetland monitoring
7	$ -	$ 265,931	$ 7,619	$ 273,550	0.8131	$ -	$ 216,226	$ 6,195	$ 222,421	Groundwater monitoring (quarterly), stormwater monitoring and wetland monitoring
8	$ -	$ 265,931	$ 5,000	$ 270,931	0.7894	$ -	$ 209,928	$ 3,947	$ 213,875	Groundwater monitoring (quarterly), stormwater monitoring and wetland monitoring
9	$ -	$ 100,087	$ 7,619	$ 107,706	0.7664	$ -	$ 76,709	$ 5,839	$ 82,548	Groundwater monitoring (semi-annual)
10	$ -	$ 100,087	$ -	$ 100,087	0.7441	$ -	$ 74,474	$ -	$ 74,474	Groundwater monitoring (semi-annual)
11	$ -	$ 100,087	$ 7,619	$ 107,706	0.7224	$ -	$ 72,305	$ 5,504	$ 77,809	Groundwater monitoring (semi-annual)
12	$ -	$ 100,087	$ -	$ 100,087	0.7014	$ -	$ 70,199	$ -	$ 70,199	Groundwater monitoring (semi-annual)
13	$ -	$ 100,087	$ 12,619	$ 112,706	0.6810	$ -	$ 68,155	$ 8,593	$ 76,747	Groundwater monitoring (semi-annual)
14	$ -	$ 100,087	$ -	$ 100,087	0.6611	$ -	$ 66,169	$ -	$ 66,169	Groundwater monitoring (semi-annual)
15	$ -	$ 100,087	$ 7,619	$ 107,706	0.6419	$ -	$ 64,242	$ 4,890	$ 69,133	Groundwater monitoring (semi-annual)
16	$ -	$ 100,087	$ -	$ 100,087	0.6232	$ -	$ 62,371	$ -	$ 62,371	Groundwater monitoring (semi-annual)
17	$ -	$ 100,087	$ 7,619	$ 107,706	0.6050	$ -	$ 60,554	$ 4,610	$ 65,164	Groundwater monitoring (semi-annual)
18	$ -	$ 100,087	$ 5,000	$ 105,087	0.5874	$ -	$ 58,791	$ 2,937	$ 61,728	Groundwater monitoring (semi-annual)
19	$ -	$ 100,087	$ 7,619	$ 107,706	0.5703	$ -	$ 57,078	$ 4,345	$ 61,423	Groundwater monitoring (annual)
20	$ -	$ 100,087	$ -	$ 100,087	0.5537	$ -	$ 55,416	$ -	$ 55,416	Groundwater monitoring (annual)
21	$ -	$ 100,087	$ 7,619	$ 107,706	0.5375	$ -	$ 53,802	$ 4,096	$ 57,897	Groundwater monitoring (annual)
22	$ -	$ 100,087	$ -	$ 100,087	0.5219	$ -	$ 52,235	$ -	$ 52,235	Groundwater monitoring (annual)
23	$ -	$ 100,087	$ 12,619	$ 112,706	0.5067	$ -	$ 50,713	$ 6,394	$ 57,107	Groundwater monitoring (annual)
24	$ -	$ 100,087	$ -	$ 100,087	0.4919	$ -	$ 49,236	$ -	$ 49,236	Groundwater monitoring (annual)
25	$ -	$ 100,087	$ 7,619	$ 107,706	0.4776	$ -	$ 47,802	$ 3,639	$ 51,441	Groundwater monitoring (annual)
26	$ -	$ 100,087	$ -	$ 100,087	0.4637	$ -	$ 46,410	$ -	$ 46,410	Groundwater monitoring (annual)
27	$ -	$ 100,087	$ 7,619	$ 107,706	0.4502	$ -	$ 45,058	$ 3,430	$ 48,488	Groundwater monitoring (annual)
28	$ -	$ 100,087	$ 5,000	$ 105,087	0.4371	$ -	$ 43,746	$ 2,185	$ 45,931	Groundwater monitoring (annual)
29	$ -	$ 100,087	$ 7,619	$ 107,706	0.4243	$ -	$ 42,472	$ 3,233	$ 45,705	Groundwater monitoring (annual)
30	$ -	$ 100,087	$ -	$ 100,087	0.4120	$ -	$ 41,235	$ -	$ 41,235	Groundwater monitoring (annual)
31	$ -	$ 100,087	$ 7,619	$ 107,706	0.4000	$ -	$ 40,034	$ 3,048	$ 43,081	Groundwater monitoring (annual)
32	$ -	$ 100,087	$ -	$ 100,087	0.3883	$ -	$ 38,868	$ -	$ 38,868	Groundwater monitoring (annual)
33	$ -	$ 100,087	$ 7,619	$ 107,706	0.3770	$ -	$ 37,736	$ 2,873	$ 40,608	Groundwater monitoring (annual)
TOTALS	**$ 342,124,985**	**$ 3,831,834**	**$ 139,285**	**$ 346,096,104**		**$ 327,916,390**	**$ 2,490,346**	**$ 82,329**	**$ 330,489,065**	

Notes:
[1] Capital costs include distributive costs
[2] Periodic costs include groundwater monitoring plan updates (1 update every 5 years) and monitoring well rehabilitation/replacement costs (1 well every 2 years)

Table R-3 Cost Estimate Alternative 2 - Capital Cost
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

San Francisco Location Factors		Means 2005
Material		112.60%
Labor & Equipment		133.80%
Assemblies		122%
Construction Project Duration:	1062	days
48.0 months or 1062 working days	48	months
Operations and Maintenance / Monitoring Period	7965	days
	360	months

Description	Quantity	Unit	Unit Price	Cost	Project Years	Comments
DISTRIBUTIVE COSTS	**DISTRIBUTIVE COSTS SUBTOTAL =**			**$ 41,478,621**	**0-4**	Includes labor and temporary facilities
Labor	**Labor Subtotal =**			**$ 41,158,447**		
Total project labor cost				$ 41,158,447	0-4	See backup worksheet "LABOR"
Temporary Facilities	**Temporary Facilities Costs Subtotal =**			**$ 320,173**		
Furnished Field Office Trailer (50' x 10' w/ air conditioning) (2)	48	mo	$ 789.34	$ 37,888	0-4	Means 2005 Heavy Construction. Page 13. 01520 500 0450 + 0700
Office Equipment Rental	48	mo	$ 1,089.33	$ 52,288	0-4	See Backup Worksheet "OFFICE EQUIPMENT COST"
Office Supplies	48	mo	$ 114.07	$ 5,475	0-4	Means 2005 Heavy Construction. Page 13. 01520 550 0120
City Water Supply	48	mo	$ 76.86	$ 3,689	0-4	Means 2005 Heavy Construction. Page 12, 01510 800 0700
Telephone Bill	48	mo	$ 273.28	$ 13,117	0-4	Means 2005 Heavy Construction. Page 13. 01520 550 0140
Field Office Electrical Bill	48	mo	$ 131.76	$ 6,324	0-4	Means 2005 Heavy Construction. Page 13. 01520 550 0160
Portable Toilets (6)	48	mo	$ 2,515.64	$ 120,751	0-4	Means 2005 Heavy Construction. Page 24. 01590 400 6410
Rental Trucks (8) (for supervisory staff)	48	mo	$ 1,680.00	$ 80,640	0-4	Hertz Equipment Rental (http://www.hertzequip.com)
CAPITAL COSTS						
Mobilization and Demobilization	**Mobilization and Demobilization Subtotal =**			**$ 26,362**		Assume cost split equally between project years 0 and 4
Excavator, diesel hydraulic, crawler mounted, 2.5 CY capacity (6)	6	ea	$ 505.08	$ 3,030	0,4	Means 2005 Heavy Construction. Page 51. 02305 250 0020 (unit cost multiplied by 2 to account for mob & demob)
Backhoe-loader, 80 hp, 1.25 CY capacity (1)	1	ea	$ 505.08	$ 505	0,4	Means 2005 Heavy Construction. Page 51. 02305 250 0020 (unit cost multiplied by 2 to account for mob & demob)
Grader, self-propelled, 30,000 lb. (3)	3	ea	$ 757.62	$ 2,273	0,4	Means 2005 Heavy Construction. Page 51. 02305 250 0020 (unit cost multiplied by 2 to account for mob & demob)
Dump truck, 8.5 CY (12 ton payload) (8)	50	mi	$ 16.80	$ 840	0,4	Means 2005 Heavy Construction, Page 61. 02315 490 4700 (unit cost muliplied by 2 to account for mob & demob)
Office Trailers (assumed 100 mile haul) (2)	2	ea	$ 204.96	$ 410	0,4	Means 2005 Heavy Construction. Page 13. 01520 500 0800 (unit cost multiplied by 2 to account for mob & demob)
Modular tank, 21,000 gal. (5)	4	hr	$ 850.00	$ 2,975	0,4	Quote from Baker Tanks, 1/12/06; (925) 439-8251 (unit cost multiplied by 2 to account for mob & demob)
Crawler mounted crane 100 ton capacity (for lifting large debris) (1)	4	ea	$ 1,683.60	$ 6,734	0,4	Means 2005 Heavy Construction. Page 52. 02305 250 2200 (unit cost multiplied by 2 to account for mob & demob)
Feed pump (submersible 300 gpm 3-in outlet) (1)	1	ea	$ 250.00	$ 250	0,4	Quote from Wayne Friesell, TIGG Corporation (wfriesell@tigg.com), Jan 13, 2006
Conveyer system with misters and radialogical detectors (6)	6	ea	$ 1,515.24	$ 9,091	0,4	Means 2005 Heavy Construction. Page 51. 02305 250 0020 (unit cost multiplied by 2 to account for mob & demob)
Water truck for dust suppression, 6,000 gallon capacity (1)	1	ea	$ 252.54	$ 253	0,4	Means 2005 Heavy Construction. Page 51. 02305 250 0020 (unit cost multiplied by 2 to account for mob & demob)
Equipment Rental	**Equipment Rental Subtotal =**			**$ 7,479,156**		
Excavator, diesel hydraulic, crawler mounted, 2.5 CY capacity (6)	48	mo	$ 69,000.00	$ 3,312,000	0-4	Means 2005 Heavy Construction. Pg 21; 01590 200 0320
Backhoe-loader, 80 hp, 1.25 CY capacity (1)	48	mo	$ 2,250.00	$ 108,000	0-4	Means 2005 Heavy Construction. Pg 19; 01590 200 0460
Grader, self-propelled, 30,000 lb. (3)	12	mo	$ 13,125.00	$ 157,500	3-4	Means 2005 Heavy Construction. Pg 19; 01590 200 1910
Dump truck, 8.5 CY (12 ton payload) (8)	48	mo	$ 19,600.00	$ 940,800	0-4	Means 2005 Heavy Construction. Pg 21; 01590 200 5250
Modular tank, 21,000 gal. (5)	48	mo	$ 5,500.00	$ 264,000	0-4	Quote from Baker Tanks, 1/12/06; (925) 439-8251
Crawler mounted crane 100 ton capacity (for lifting large debris) (1)	6	mo	$ 15,300.00	$ 91,800	0-3	Assumed 2 months per year during years 1,2,3 Means 2005 Heavy Construction. Pg 26; 01590 600 1200
Feed pump (submersible 300 gpm 3-in outlet) (1)	48	mo	$ 300.00	$ 14,400	0-4	Means 2005 Heavy Construction. Pg 23; 01590 400 4800
Water truck for dust suppression, 6,000 gallon capacity (1)	48	mo	$ 6,275.00	$ 301,200	0-4	Means 2005 Heavy Construction. Pg 24; 01590 400 6950
Well points 25' with fittings and riser pipes, 2" diameter (12)	48	day	$ 372.00	$ 17,856	0-4	Means 2005 Heavy Construction. Pg 27; 01590 700 1100
Well point pump, 10-in suction, 75 hp	48	mo	$ 1,425.00	$ 68,400	0-4	Means 2005 Heavy Construction. Pg 27; 01590 700 1200
Well point header pipe, 4-in diameter, 150 gpm (max) (1,500 LF)	48	mo	$ 5,400.00	$ 259,200	0-4	Means 2005 Heavy Construction. Pg 27; 01590 700 0400
Conveyer system with misters and radialogical detectors (6)	48	mo	$ 6,300.00	$ 302,400	0-4	Means 2005 Heavy Construction. Pg 18; 01590 100 0800
Radiological monitoring equipment (16) for pre-excavation screening	48	mo	$ 7,200.00	$ 345,600	0-4	Ludlum Model 44-2 1"x 1" NaI GAMMA Scintillator (unit rental cost provided by Suntrac Services, 1-800-579-4513, 03-23-2006)
Radiological monitoring equipment (6) for post-excavation conveyor screening	48	mo	$ 27,000.00	$ 1,296,000	0-4	Assumed to be 10 times the cost of the portable scintillator
Health & Safety Equipment	**Health and Safety Equipment Subtotal =**			**$ 3,186,000**		
Includes PPE, First Aid Equipment, Fire Safety Equipment and Spill Control Equipment	1,062	ea	$ 3,000.00	$ 3,186,000	0-4	Assumed $50 per field worker per day
Site Preparation	**Site Preparation Subtotal =**			**$ 2,362,287**		
Sump pump, 25 gpm	1	ea	$ 3,423.32	$ 3,423	0-1	Means 2005 Environmental Remediation - Assemblies; Pg 3-91; 33 29 0401: Safety Level C
Soil staging area grading, 3 acres	14,520	sy	$ 1.46	$ 21,257	0-1	Means 2005 Heavy Construction. Pg 52; 02310 100 1100
Soil staging area liner, includes rad screening and stockpiling areas (3 acre, 80 mil	130,680	sf	$ 5.01	$ 655,256	0-1	Means 2005 Environmental Remediation - Assemblies; Pg 3-90; 33 08 0573; Safety Level C
Laydown area grading (200 x 100 ft)	2,222	sy	$ 0.77	$ 1,708	0-1	Means 2005 Heavy Construction. Pg 52; 02310 100 0100
Granular cover over laydown area (6 inch thick crushed stone)	2,222	sy	$ 8.30	$ 18,434	0-1	Means 2005 Heavy Construction. Pg 102; 02720 200 0100
Fence replcement/repair (6 ft galvanized chain link fence)	800	ft	$ 32.12	$ 25,698	0-1	Means 2005 Environmental Remediation - Assemblies; Pg 4-24; 18 04 0107; Safety Level C
Site security (24-hours uniformed watchman at entrance)	34,560	hr	$ 19.52	$ 674,611	0-1	Means 2005 Heavy Construction. Pg 17; 01560 800 0100
plates)	4,000	lf	$ 218.00	$ 872,000	0-1	Means 2005 Heavy Construction. Pg 203; 05655 700 1035
Rehabilitation of existing railroad track	1	ea	$ 87,200.00	$ 87,200	0-1	Assume to be 5-10% of cost for railroad extension
Land Surveying (3 person crew)	1	day	$ 1,450.00	$ 1,450	0-1	Means 2005 Heavy Construction. Pg 6; 01100 700 1200
Subsurface utility surveying	10	hr	$ 125.00	$ 1,250	0-1	Quote from Cruz Brothers Surveying (831) 461-1467 and Subtronic Surveying (800) 998-3463, February 2006.

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San Francisco Location Factors		Means 2005
Material		112.60%
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Assemblies		122%
Construction Project Duration:	1062	days
48.0 months or 1062 working days	48	months
Operations and Maintenance / Monitoring Period	7965	days
	360	months

Description	Quantity	Unit	Unit Price	Cost	Project Years	Comments
Pre-Construction Demolition	**Pre-Construction Demolition Subtotal =**			**$ 22,948**		
Monitoring well abandonment	1.00	ea	$ 3,809.50	$ 3,810	0-1	See Backup Worksheet "LONG TERM GW MONITORING"
Size reduction for oversized debris (assumed 5% of total landfill volume)	58,100	cf	$ 0.33	$ 19,138	0-3	Means 2005 Heavy Construction. Pg 35; 02220 110 0650; assumed similar to masonry
Excavation (Operations)	**Excavation Subtotal =**			**$ 25,306,131**		
Sheetpile installation (around waste to 50 ft depth), removal and salvage	4,324	lf	$ 1,494.50	$ 6,462,218	0,4	Means 2005 Heavy Construction. Pg 44; 02250 400 0900; includes penetration below 40 ft.
Well points 25' with fittings and riser pipes, 2" diameter (12)	1,062	day	$ 29.40	$ 31,223	0-4	Means 2005 Heavy Construction. Pg 27; 01590 700 1100
Dewatering with contractor's pump (4 inch dia., 300 gpm)	1,062	day	$ 111.28	$ 118,175	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 4-31; 17 03 1004; Safety Level C
Land Surveying (3 person crew)	5	day	$ 1,450.00	$ 7,250	0-1	Means 2005 Heavy Construction. Pg 6; 01100 700 1200
Excavator, diesel hydraulic, crawler mounted, 2.5 CY capacity (6)	1,062	day	$ 7,290.00	$ 7,741,980	0-4	Means 2005 Heavy Construction. Pg 19; 01590 200 0320
Backhoe-loader, 80 hp, 1.25 CY capacity (1)	1,062	day	$ 256.40	$ 272,297	0-4	Means 2005 Heavy Construction. Pg 19; 01590 200 0460
Grader, self-propelled, 30,000 lb. (3)	266	day	$ 1,369.80	$ 364,367	3-4	Means 2005 Heavy Construction. Pg 19; 01590 200 1910
Dump truck, 8.5 CY (12 ton payload) (8)	1,062	day	$ 2,612.80	$ 2,774,794	0-4	Means 2005 Heavy Construction. Pg 21; 01590 200 5250
Modular tank, 21,000 gal. (5)	1,062	day	$ 5,500.00	$ 5,841,000	0-4	Quote from Baker Tanks, 1/12/06; (925) 439-8251
Crawler mounted crane 100 ton capacity (for lifting large debris) (1)	212	day	$ 1,519.00	$ 322,636	0-3	Means 2005 Heavy Construction. Pg 26; 01590 600 1200
Feed pump (submersible 300 gpm 3-in outlet) (1)	1,062	day	$ 27.20	$ 28,886	0-4	Means 2005 Heavy Construction. Pg 23; 01590 400 4800
Water truck for dust suppression, 6,000 gallon capacity (1)	1,062	day	$ 813.00	$ 863,406	0-4	Means 2005 Heavy Construction. Pg 24; 01590 400 6950
Well point header pipe, 4-in diameter, 150 gpm (max) (1,500 LF)	1,062	day	$ 450.00	$ 477,900	0-4	Means 2005 Heavy Construction. Pg 27; 01590 700 0400
Air Monitoring	**Monitoring Subtotal =**			**$ 1,796,152**		
Ambient air monitors (12 total -placement frequency biased towards prevailing winds and residential areas)	48	mo	$ 10,614.00	$ 509,472	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-10; 33 02 0315
Analysis - principal organic hazardous constituents (1 per monitor per week)	2,304	ea	$ 315.98	$ 728,018	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-38; 33 02 1802
Analysis - hydrocarbons (1 per monitor per week)	2,304	ea	$ 109.80	$ 252,979	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-39; 33 02 1811
Analysis - mercury (1 per monitor per wek)	2,304	ea	$ 37.21	$ 85,732	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-39; 33 02 1815
Analysis - cyanide (1 per monitor per week)	2,304	ea	$ 45.14	$ 104,003	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-39; 33 02 1816
Portable ambient air analyzer	48	mo	$ 1,952.00	$ 93,696	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-10; 33 02 0328
Portable combustible gas/oxygen indicator	48	mo	$ 463.60	$ 22,253	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-11; 33 02 0330
Soil Confirmation Sampling	**Confirmation Sampling Subtotal =**			**$ 1,104,235**		
Sample collection (1 sample per grid cell + 10% QC samples)	792	ea	$ 58.50	$ 46,332	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-24; 33 02 0648
TAL metals soil analysis	792	ea	$ 417.51	$ 330,667	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-33; 33 02 1707
Pesticides/PCBs analysis	792	ea	$ 205.34	$ 162,628	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-34; 33 02 1717
Polynuclear aromatic hydrocarbons analyisis	792	ea	$ 143.73	$ 113,833	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-34; 33 02 1722
Volatile organic compounds	792	ea	$ 169.58	$ 134,307	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-34; 33 02 1720
Semivolatile organic compounds analysis	792	ea	$ 305.00	$ 241,560	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-34; 33 02 1721
Waste extraction procedure	792	ea	$ 75.00	$ 59,400	0-4	Quote from Surinder Sidhu at STL, (925) 484-1919; See "SOIL LAB COST" Worksheet for Detail
Radioactivity screening	792	ea	$ 19.58	$ 15,508	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-9; 33 02 0223
Storm Water Control	**Storm Water Control Subtotal =**			**$ 47,290**		
2 ft. high and 2 ft. wide berm around open excav (assume 100x100 ft)	30	cy	$ 9.24	$ 277	0-1	Means 2005 Environmental Remediation - Unit Price; Pg 4-31; 17 03 9911; Safety Level C
Silt fences (vinyl, 3 ft high with 7.5 ft posts)	4,138	ft	$ 4.11	$ 17,013	0-1	Means 2005 Environmental Remediation - Unit Price; Pg 5-18, 18 05 0206; Safety Level C
Construction SWPPP implementation	1	ea	$ 30,000.00	$ 30,000	0-4	
Decontamination	**Decontamination Subtotal =**			**$ 92,944**		
Pressure washer (1,800 psi, 5gpm)	48	mo	$ 146.87	$ 7,050	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-167; 33 17 0814 (purchase price + localization, markup, maintenance
Pressure washer operation (assume 2 hr/day incl. cleaning exiting trucks)	2,124	hr	$ 40.44	$ 85,895	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-168; 33 17 0823
Contaminated Water Treatment	**Contaminated Water Treatment Subtotal =**			**$ 2,887,855**		
Structural slab on grade (8 in. thick; 60 x 40 ft.)	2,400	sf	$ 11.15	$ 26,762	0-1	Means 2005 Environmental Remediation - Assemblies; Pg 3-60; 18 02 0322
Feed pump (submersible 300 gpm 3-in outlet)	48	mo	$ 366.00	$ 17,568	0-4	Means 2005 Heavy Construction. Pg 23; 01590 400 4800
Bag filters (300 gpm; 3 parallel filter system)	48	mo	$ 475.00	$ 22,800	0-4	Quote from Wayne Friesell, TIGG Corporation (wfriesell@tigg.com). Jan 13, 2006
Filterbag changeout (assumed 1 changeout per week; 3 bags per changeout; 1, 10 or 25 micron bags)	576	ea	$ 18.00	$ 10,368	0-4	Quote from Wayne Friesell, TIGG Corporation (wfriesell@tigg.com). Jan 13, 2006
Carbon adsorption units (HP1020) rental (first month)	1	ls	$ 46,200.00	$ 46,200	0-1	Quote from Keith Jones, USFilter (510)639-7274. Jan 20, 2006
Carbon adsorption units rental (subsequent months)	47	mo	$ 3,300.00	$ 155,100	0-4	Quote from Keith Jones, USFilter (510)639-7274. Jan 20, 2006
Carbon changeouts (one year of operation with 490 lbs/day estimated usage)	18	ea	$ 26,400.00	$ 475,200	0-4	Quote from Keith Jones, USFilter (510)639-7274. Jan 20, 2006
Metals removal system rental (ion exchange)	48	mo	$ 8,250.00	$ 396,000	0-4	Quote from Keith Jones, USFilter (510)639-7274. Jan 20, 2006
Resin regeneration (assumed 2 per year)	8	ea	$ 88,000.00	$ 704,000	0-4	Quote from Keith Jones, USFilter (510)639-7274. Jan 20, 2006
Wastewater analysis (1 sample per day + 10% QC samples)	1,168	ea	$ 885.00	$ 1,033,857	0-4	Quote from Surinder Sidhu at STL, (925) 484-1919; See "DISCHARGE SAMPLE COST" Worksheet for Detail

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Table R-3 Cost Estimate Alternative 2 - Capital Cost
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

San Francisco Location Factors		Means 2005
Material		112.60%
Labor & Equipment		133.80%
Assemblies		122%
Construction Project Duration:	1062	days
48.0 months or 1062 working days	48	months
Operations and Maintenance / Monitoring Period	7965	days
	360	months

Description		Quantity	Unit	Unit Price	Cost	Project Years	Comments
Waste Analysis (4 pt. composite samples)				**Waste Analysis Subtotal =**	**$ 2,463,440**		
Pesticides/PCBs analysis (1 sample per 500 cy)		2,324	ea	$ 160.00	$ 371,840	0-4	Means 2005 Environmental Remediation - Unit Price; Pg 9-34; 33 02 1717
Waste extraction test (WET) (1 sample per 500 cy)		2,324	ea	$ 75.00	$ 174,300	0-4	Quote from Surinder Sidhu at STL, (925) 484-1919; See "SOIL LAB COST" Worksheet for Detail
WET leachate analysis (Metals, PCBs, PAHs, VOCs, SVOCs)		2,324	ea	$ 825.00	$ 1,917,300	0-4	Quote from Surinder Sidhu at STL, (925) 484-1919; See "SOIL LAB COST" Worksheet for Detail
Waste Hauling				**Waste Hauling Subtotal =**	**$ 97,608,010**		
Hauling to Grand View, Idaho (hauling by rail car)		1,626,800	ton	$ 60.00	$ 97,608,010	0-4	Quote from Alan Peterson, American Ecology, (800) 695-1195. 01/ 2006
Waste Disposal	**Assumed Waste Fractions**			**Waste Disposal Subtotal =**	**$ 125,670,313**		
D008 (RCRA Lead) at Grand View, Idaho	35%	569380	ton	$ 85.00	$ 48,397,305	0-4	Quote from Alan Peterson, American Ecology, (800) 695-1195. 01/ 2006
Non-RCRA Hazardous Waste at Grand View, Idaho	50%	813400	ton	$ 53.00	$ 43,110,204	0-4	Quote from Alan Peterson, American Ecology, (800) 695-1195. 01/ 2006
Diposal of non-hazardous waste at Grand View, Idaho	10%	162680	ton	$ 35.00	$ 5,693,801	0-4	Quote from Alan Peterson, American Ecology, (800) 695-1195. 01/ 2006
Disposal of radiologically impacted waste	5%	81340	ton	$ 350.00	$ 28,469,003	0-4	Varies between $200 -$500 per ton, assumed $350 per ton
Backfilling				**Backfilling Subtotal =**	**$ 8,213,791**		
Backfill landfill with unclassified fill (delivered, spread, compacted in 6-in. lifts)		270,123	cy	$ 11.87	$ 3,206,521	3-4	Means 2005 Environmental Remediation - Unit Price; Pg 4-23; 17 03 0423
Backfill adjacent areas (upland or wetland) with unclassified fill (delivered, spread, compacted in 6-in. lifts)		421,821	cy	$ 11.87	$ 5,007,270	3-4	Means 2005 Environmental Remediation - Unit Price; Pg 4-23; 17 03 0423
Site Restoration				**Site Restoration Subtotal =**	**$ 3,013,884**		
Fine grading and soil preparation		48	ac	$ 88.66	$ 4,249	3-4	Means 2005 Environmental Remediation - Unit Price; Pg 5-17; 18 05 0101
Spread imported topsoil (6 in. thick)		38,658	cy	$ 34.43	$ 1,330,945	3-4	Means 2005 Environmental Remediation - Unit Price; Pg 5-18; 18 05 0301
Seeding and vegetative cover		48	ac	$ 4,623.80	$ 221,591	3-4	Means 2005 Environmental Remediation - Unit Price; Pg 5-18; 18 05 0402
Soil staging area liner removal (assumed 1/2 of construction cost)		130,680	sf	$ 2.51	$ 327,628	3-4	Assumed half of installation cost
Treatment system slab removal (assumed 1/2 of construction cost)		2,400	sf	$ 5.58	$ 13,381	3-4	Assumed half of installation cost
Wetland restoration		3.65	ac	$ 97,400.00	$ 355,510	3-4	Unit cost derived from cost estimated by Shaw Environmental, Inc. (Alternative 4)
Shoreline revetment		1.00	ea	$ 648,230.00	$ 648,230	3-4	See Backup Worksheet "SHORELINE REVETMENT"
Replacement monitoring well installation with development		1.00	ea	$ 88,690.00	$ 88,690	3-4	See Backup Worksheet "LONG TERM GW MONITORING"
Land Surveying (topographical)		52	ac	$ 455.00	$ 23,660	3-4	Means 2005 Heavy Construction. Pg 6; 01100 700 0010
				Construction Subtotal =	**$ 322,759,419**		
Design				**Design Subtotal =**	**$ 19,365,565**		
Design assumed to be 6% of construction cost (including permitting)				$ 19,365,565		0-1	Includes: Remedial Design, Design Basis Report, H&S Plan, Contingency Plan, QA/QC Plan, QAPP, and Cost Estmates
TOTAL PROJECT CAPITAL COST				**TOTAL PROJECT CAPITAL COST =**	**$ 342,124,985**		
Total Construction Cost				$ 322,759,419			
Total Design Cost				$ 19,365,565			
				TOTAL COST PER CY OF SOIL EXCAVATED =	**$ 8,424**		

General Assumptions:

Four year project duration
Work will be performed in Level D PPE
Temporary sheetpiling will be installed around entire perimeter of landfill (extent of waste)
Sheetpile will be keyed in at 2/3 of total depth (approx. 60 ft.)
Excavation dewatering will be implemented as needed using a skid-mounted pump through dewatering points
Water from decontamination and dewatering activities will require treatment and discharge to a sanitary sewer line, or to the Bay under NPDES permit
Dewatering and treatment volume estimates provided in worksheet "DEWATER"
Waste excavation will include removal of a approximately 3 to 5 feet of clay or sand below waste
Waste fractions estimated based on PCB Hotspot TCRA and Metal Slag TCRA data
Contaminated water quality assumed to be average of samples obtained from wells IR01MW63A, 43A, 13A, 38A, 03A and IR01MWI-5
Carbon usage rate based on removal of 1,1-DCE and 1,1-DCA
Stripped landfill cap can be used as fill material
Finish grade will slope evenly from north to south in Landfill Area; backfill volume estimated by proposed grading plan, and includes a 20% contingency and a 20% fluff factor to account for compaction and consolidation
Assumed soil density of 1.4 ton/cy

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Table R-4 Cost Estimate Alternative 2 - Operation and Maintenance
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity	Unit Price	Cost	20% Contingency	Cost Including 20% Contingency	Remarks
Groundwater Monitoring (30 years)	ls	1	$ 1,650,125	$ 1,650,125	$ 330,025	$ 1,980,150	For details, see "LONG TERM GW MONITORING" worksheet
Institutional Controls (30 years)	ls	1	$ 1,080,000	$ 1,080,000	$ 216,000	$ 1,296,000	Includes monitoring, enforcement, and reporting
Stormwater Monitoring (5 years)	ls	1	$ 299,650	$ 299,650	$ 59,930	$ 359,580	For details, see "LONG TERM SW MONITORING" worksheet
Wetlands Monitoring (5 years)	ls	1	$ 163,420	$ 163,420	$ 32,684	$ 196,104	For details, see "LONG TERM WL MONITORING" worksheet
Totals				**$ 3,193,195**	**$ 638,639**	**$ 3,831,834**	

Notes:
(1) O&M present value is based on 3% discount rate for 30 years for groundwater monitoring and 5 years for stormwater and wetland monitoring.

Table R-5 Cost Estimate Alternative 2 - Labor Classifications and Estimates
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

LABOR CLASSIFICATION	Position	LABOR RATE (per hour)	LEVEL OF EFFORT (% on Project)	STAFF REQUIRED (number)	LABOR HOURS (hours)	LABOR COST (project total)
Professional/Technical						
	Senior Project Manager	$ 165.00	10	1	850	$ 140,184
	Project Manager	$ 123.00	50	1	4,248	$ 522,504
	Senior Engineer, Geologist or Scientist	$ 165.00	10	1	850	$ 140,184
	Project Engineer, Geologist or Scientist	$ 123.00	100	2	16,992	$ 2,090,016
	Quality Control Officer	$ 95.00	100	1	8,496	$ 807,120
	Health and Safety Officer	$ 95.00	100	1	8,496	$ 807,120
	Assistant (Junior) Project Engineer, Geologist or Scientist (Soil segregation, profiling)	$ 79.00	100	8	67,968	$ 5,369,472
	Drafter/Designer	$ 67.00	50	1	4,248	$ 284,616
Field/Construction Operations						
	Superintendent	$ 142.60	100	1	8,496	$ 1,211,530
	Foreman	$ 123.60	100	1	8,496	$ 1,050,106
	Radiological Screening/Field Technician (pre-excavation screeners)	$ 91.00	100	16	135,936	$ 12,370,176
	Radiological Screening/Field Technician (post-excavation screeners)	$ 91.00	100	18	152,928	$ 13,916,448
	Treatment Plant Operator	$ 79.00	75	1	6,372	$ 503,388
Clerical/Administrative						
	Procurement Specialist	$ 123.00	100	1	8,496	$ 1,045,008
	Project Accountant/Billing	$ 55.00	100	1	8,496	$ 467,280
	Administrative Assistant/General Clerical	$ 51.00	100	1	8,496	$ 433,296
					Total Project Labor Cost	$ 41,158,447
					Average Annual Labor Cost	$ 10,289,612

Notes:

(1) Equipment operator rates are included in equipment operation estimates

(2) Labor rates are based on a 2006 rate schedule

Table R-6 Cost Estimate Alternative 2 - Excavation Volume Estimates
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Area Name	Area (ac)	Area (sf)	Avg Depth (ft)	Volume (cf)	Volume (cy)	
Estimated Backfill Volumes						
Landfill waste extent	22.0	958313	28.4	27,222,762	1,008,250	
Adjacent Areas	4.4	192805	0	0	0	
	0.7	29963	2.5	74,908	2,774	
	3.5	153986	3	461,959	17,110	
	2.5	106957	3.5	374,348	13,865	
	12.3	535876	4	2,143,502	79,389	
	2.5	109652	10	1,096,524	40,612	
Subtotal Adjacent Areas	25.9	1129239	-	4151240.836	153,750	
Totals	**48**	**2,087,551**	**-**	**31,374,003**	**1,162,000**	**= TOTAL EXCAVATION VOLUME**
Waste Layer Volume Calculations						
		37375	4	149500	5.54E+03	
		31903	12	382836	1.42E+04	
		72037	17	1224629	4.54E+04	
		7406	22	162932	6.03E+03	
		8444	23	194212	7.19E+03	
		51006	7	357042	1.32E+04	
		118150	15	1772250	6.56E+04	
		76685	18	1380330	5.11E+04	
		47183	20	943660	3.50E+04	
		82454	8	659632	2.44E+04	
		425532	13	5531916	2.05E+05	
					4.73E+05	
Cover Layer Volume Calculations						
		42825	3	128475	4.76E+03	
		162603	7	1138221	4.22E+04	
		112787	20	2255740	8.35E+04	
		53296	21	1119216	4.15E+04	
		84207	4	336828	1.25E+04	
		502457	11.25	5652641.25	2.09E+05	
					3.94E+05	
	Subtotal				8.66E+05	
Excavated Volume Below Waste						
*Assume overexcavation by 4 ft into layer below waste						
	3832700	958175	4		**1.42E+05**	
Total Volume of Material Excavated from Landfill					**1.01E+06**	

Table R-7 Cost Estimate Alternative 2 - Estimated Backfill Volumes[1]
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Area	Average initial elevation (ft)	Average excavation Depth (ft bgs)	Average final elevation (ft)	Approximate balance (ft)	Area (sq ft)	Volume (cu ft)	Volume (cy, with 20% fluff factor)
Landfill Area							
1	17	25	15	23	7,591	174,593	7,760
2	25	20	10	5	72,084	360,419	16,019
3	21	15	10	4	36,357	145,427	6,463
4	21	25	6.5	10.5	13,579	142,577	6,337
5	21	20	6.5	5.5	14,380	79,091	3,515
6	13	10	7.5	4.5	33,141	149,134	6,628
7	16.5	15	8.5	7	41,364	289,551	12,869
8	23	10	14	1	22,645	22,645	1,006
9	21	20	12	11	99,141	1,090,546	48,469
10	22	15	11	4	83,686	334,745	14,878
11	21	20	8.5	7.5	79,818	598,635	26,606
12	17	15	8	6	89,234	535,405	23,796
13	17	10	12	5	8,887	44,436	1,975
14	23	15	10	2	548,800	1,097,600	48,782
						Total	**225,102**
						Total + 20% contingency	**270,123**
Adjacent Areas							
15	6	4	5	3	535,876	1,607,627	71,450
16	12	10	11	9	27,375	246,377	10,950
17	12	10	12	10	49,429	494,290	21,968
18	12	10	10.5	8.5	33,159	281,855	12,527
19	7	3	7	3	71,398	214,193	9,520
20	2	3	2	3	136,920	410,759	18,256
						Total	**126,415**
						Total + 20% contingency	**421,821**

Notes:
[1] Approximate backfill volumes calcualted based on estimated excavation depths and average final grades; see figures 12.11 and 12.12 in the Parcel E-2 RI/FS, Section 12.

Table R-8 Cost Estimate Alternative 2 - Office Equipment
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Quantity	Unit	Unit Price	Subtotal	Markup	Maintenance	Total	Cost/Month
Dell Optiplex G520 Desktop Computer	10	ea	$ 1,234.00	$ 12,340.00	$ 1,851.00	$ 7,095.50	$ 21,286.50	$ 886.94
Dell W5300 Black & White Laser Printer	2	ea	$ 1,076.00	$ 2,152.00	$ 322.80	$ 1,237.40	$ 3,712.20	$ 154.68
Canon FAXPHONE L170 Plain Paper Laser Fax *Cost includes Canon S35/FX-8 Toner Cartridge ($119) Staples 7' USB 2.0 A/B Cables, Gold Series ($24.98)	1	ea	$ 413.96	$ 413.96	$ 62.09	$ 238.03	$ 714.08	$ 29.75
Iomega External CD-RW Drive *Cost includes 100 pk. Staples CD-R ($34.98)	2	ea	$ 124.96	$ 249.92	$ 37.49	$ 143.70	$ 431.11	$ 17.96
						Total Rental Cost/Month:		$ 1,089.33

Notes:

1 Cost estimate was calculated assuming items will be purchased and rented to the Navy

2 Each item is given a markup of 15%, in addition to 25% per year to account for maintenance costs

3 Costs for items from Dell were obtained from http://www.dell.com

4 Costs for the Canon FAXPHONE (with accessories) and Iomega External CD Drive were obtained from http://www.staples.com

Table R-9 Cost Estimate Alternative 2 - Dewatering (and Treatment) Volume
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

	Landfill Area (ft^2)	Saturated Depth (ft)	Effective Porosity					Volume (G)
Initial Dewatering	983000	10	0.24					17,646,816
	Sheet pile length (ft)	Saturated Depth (ft)	Total joint length (ft)	Leakage (ml/s/m)	Leakage (G/day/ft)	Leakage Rate (G/day)	Total Days	Total Volume (G)
Ongoing dewatering	4,324	10	21620	0.5	3.48	75237.6	730	54,923,448
	Rate (G/day)						Total Days	Total Volume (G)
Daily waste dewatering	25						730	18250
	Rate (G/day)						Total Days	Total Volume (G)
Daily decontamination	100						1460	146000
							Total Volume Requiring Treatment (G) =	**72,734,514**

Table R-10 Cost Estimate Alternative 2 - Discharge Water Sampling
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Analysis[1]	Cost per sample
Metals	$150.00
PCBs/Pesticides	$160.00
PAHs	$175.00
VOCs	$150.00
SVOCs	$250.00
Total Laboratory Analysis Cost per Sample	**$885.00**

Notes:
[1] Analytical costs provided by STL Laboratories, San Francisco, CA.

Table R-11 Cost Estimate Alternative 2 - Waste Extraction Test (WET)
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Analysis[1]		Cost per sample
Sample Extraction	**$**	**75.00**
Analysis	**$**	**825.00**
CAM 17 Metals	$	150.00
PCBs	$	100.00
PAHs	$	175.00
VOCs	$	150.00
SVOCs	$	250.00
Total Cost/Sample:	**$**	**900.00**
Other Analyses		
Pesticides/PCBs		$160.00

Notes:

[1] Analytical costs provided by STL Laboratories, San Francisco, CA.

Table R-12 Cost Estimate Alternative 2 - Production Rate Assumptions
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Activity	Production Rate	Units	Comments	Production per day	Assumptions
Preliminary rad screen (Pre-Excavation) 50'x50' grids	1250	sq ft per hr	2 hours per grid	16 grids to be excavated per day, over 795 work days	assumed crew of 4 could scan 1 grid cell per 2 hour, 4 crews working simultaneously at all times, 8 hour day
Excavate 1ft depth across 1 50'x50' grid	50	cu yd per hr	2 hours per grid	1488 cy/day	50'x50'x1' = 2500 cu ft of excavation = 93 cu yd, 16 grids = 93 cu yd x 16 = 1488 cy
Transport excavated 50'x50'x1' volume to secondary rad screening area / soil staging area in 8.5 cy loads	34	cu yd per hr per 8.5 cy truck	11 truck loads per grid (1)	175 truck loads per day, 6 trucks, 30 loads per truck per day, 1488 cy/day transported to screening area	30 loads per truck, per day = 6 trucks
Secondary rad screen by conveyor belt	250	cu yd per day per conveyor	6 conveyors required	1500 cy/day	6 conveyors working full time with crews of 3, assumed 250 cy/day/conveyor (average production rate)

Notes:
(1) Transport can occur during excavation

Total number of 50'x50' grid surfaces estimated to be 720

Approx 378 grids in landfill area with an excavation depth = 31 ft (weighted average from "Volumes" worksheet)
Approx 342 grids in adjacent areas with an excavation depth = 3 ft (from "Volumes" worksheet)
Total excavation volume = 1,115,805 cy (from "Volumes" worksheet)
Actual excavation time = 3 yrs

378 grids excavated to ~30 ft (in one foot intervals)	11340	equivalent grids
342 grids excavated to ~4 ft (in one foot intervals)	1368	equivalent grids
	12708	total equivalent grids
	16	grids excavated per day over a 3 year period (795 work days)

Table R-13 Cost Estimate Alternative 2 - Shoreline Revetment
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity	Unit Price	Cost	Remarks
Rock riprap	ton	20,600	$30.50	$628,300	Assumed 100lb. Average, Means 2005 Heavy Construction. Pg 64; 02370 450 0350
Subgrade Preparation	sf	199,319	$0.10	$19,930	Prepare ground surface prior to riprap placement
TOTAL				$648,230	

Notes:

Volumes and Areas:

Shoreline Protection - South Termination

Area requiring subgrade preparation and rock riprap SF 79,703

Shoreline Protection - Panhandle

Area requiring subgrade preparation and rock riprap SF 119,616

Table R-14 Cost Estimate Alternative 2 - Stormwater Monitoring
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Summary		
Average Annual Cost for Stormwater Monitoring	$	59,930.00
Total Per Year	**$**	**59,930.00**

Stormwater Monitoring	4 locations to sample during the rainy season (October to May)				
	Non-Storm Discharge Visual Observations (8 events total, per year)	Monthly Stormwater Visual Observations (6-8 monthly events, 8 months)	Stormwater Sampling Events (2 event per year, 4 samples per event)	Comprehensive Site Compliance Evaluation (1 per year)	Annual Reporting (1 per year)
Labor subtotal	$ 5,120.00	$ 35,840.00	$ 1,280.00	$ 750.00	$ 4,300.00
Equipment subtotal	$ -	$ -	$ 240.00	$ -	$ -
Laboratory Analysis Cost	$ -	$ -	$ 4,200.00	$ -	$ -
Reporting	$ 800.00	$ 5,600.00	$ 200.00	$ -	$ 1,600.00
Subtotal cost per year	$ 5,920.00	$ 41,440.00	$ 5,920.00	$ 750.00	$ 5,900.00
5 Year Present Worth Cost[(1)]					**$ 299,650.00**

Notes:
[(1)] Assumed 5 years of SMDP implementation

Laboratory Analysis Cost **Analysis[(1)]**	Cost per sample
PCBs by EPA Method 8082	$ 85.00
SVOCs by U.S. Environmental Protection Agency (EPA) Method 8270C	$ 225.00
Total metals by EPA Method 6010/7000	$ 125.00
TSS by EPA Method 160.2	$ 20.00
Oil and grease by EPA Method 1664 Revision A	$ 55.00
Specific conductance by EPA Method 120.1	$ 7.50
pH by EPA Method 9040B	$ 7.50
Total Laboratory Analysis Cost per Sample	**$ 525.00**

[(1)] Analytical costs provided by STL Laboratories, San Francisco, CA.

Table R-15 Cost Estimate Alternative 2 - Groundwater Monitoring
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Summary		
Average Annual Cost for Groundwater Monitoring	$	55,004.17
Well Abandonment Prior to Excavation	$	40,360.00
Replacement Well Installation w/ Development	$	88,690.00
Average Annual Cost for Well Rehabilitation/Replacement w/ Development	$	3,809.50
Average Annual Cost for Groundwater Monitoring Plan Updates	$	833.33

Groundwater Monitoring	30 wells to sample (semi annually for 5 years, annually for 25 years)			
		Semi-Annual Cost		Annual Cost
Labor subtotal per event	$	6,160.00	$	6,160.00
Lab subtotal per event	$	34,985.00	$	34,985.00
Interim reporting subtotal per event	$	4,444.00		--
Subtotal - Events plus reports (annual basis)	***$***	***86,734.00***	***$***	***41,145.00***
Annual report	$	6,261.00	$	6,261.00
Total monitoring costs per year	$	92,995.00	$	47,406.00
Total monitoring cost (for each sampling frequency)	$	464,975.00	$	1,185,150.00
30 Year Present Worth Cost			**$**	**1,650,125.00**

Well Abandonment	56 wells, total footage assumed to be 1,200 ft			
Labor subtotal	$	7,360.00		
Drilling subtotal	$	30,000.00		
Report subtotal	$	3,000.00		
Total Well Abandonment			**$**	**40,360.00**

Replacement Well Installation w/ Development	30 new wells			
Labor subtotal	$	10,990.00		
Drilling subtotal	$	65,100.00		
Surveyor	$	5,600.00		
Utility clearance	$	3,500.00		
Report subtotal	$	3,500.00		
Total Well Installation Cost			**$**	**88,690.00**

Well Rehabillitation/Replacement Cost w/ Development				
One Shallow Well	$	6,994.00		
One Deep Well	$	8,244.00		
Average cost per well	$	7,619.00		
Average cost per year assuming 1 well every 2 years			$	3,809.50
30 Year Present Worth Cost				**$ 114,285.00**

Groundwater Monitoring Plan Updates[(1)]				
Average cost per update	$	5,000.00		
Average cost per year assuming 1 update every 5 years (5 updates total)			$	833.33
30 Year Present Worth Cost				**$ 25,000.00**

Notes:
(1) Assumed cost to create base monitoring plan is included in the project design cost

Table R-16 Cost Estimate Alternative 2 - Wetland Monitoring
Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Summary		
Average Annual Cost for Wetland Monitoring	$	32,684.00
Total Per Year	**$**	**32,684.00**

Wetland Monitoring	Wetland Surveys (4 events total, per year)	Monthly Visual Observations (12 events)	Water Quality Sampling Events (2 event per year, 4 samples per event)	Annual Reporting (1 per year)
Labor subtotal	$ 2,944.00	$ 10,800.00	$ 1,280.00	$ 4,300.00
Equipment subtotal	$ -	$ -	$ 240.00	$ -
Laboratory Analysis Cost	$ -	$ -	$ 4,920.00	$ -
Reporting	$ 800.00	$ 5,600.00	$ 200.00	$ 1,600.00
Subtotal cost per year	***$ 3,744.00***	***$ 16,400.00***	***$ 6,640.00***	***$ 5,900.00***
5 Year Present Worth Cost[1]				**$ 163,420.00**

Notes:
[1] Assumed 5 years of wetland monitoring plan implementation

Laboratory Analysis Cost Analysis[1]	Cost per sample
PCBs by EPA Method 8082	$85.00
SVOCs by U.S. Environmental Protection Agency (EPA) Method 8270C	$225.00
Total metals by EPA Method 6010/7000	$125.00
TSS by EPA Method 160.2	$20.00
Oil and grease by EPA Method 1664 Revision A	$55.00
Specific conductance by EPA Method 120.1	$7.50
Anion Scan by EPA Method 300	$90.00
pH by EPA Method 9040B	$7.50
Total Laboratory Analysis Cost per Sample	$615.00

[1] Analytical costs provided by STL Laboratories, San Francisco, CA.

Table R-17 Cost Estimate Alternative 3 Summary[1,2,3] - Cap the Landfill and Adjacent Areas and Install an Active Gas Control and Collection System

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Alternative 3A

Cap the Landfill and Adjacent Areas
Install an active Gas Control and Collection System (GCCS) in the Landfill Area
Close northern gas control system
Treat the landfill gas with a flare unit

Items	Estimated Cost
Capital Cost	$58,674,529
Inspection, Maintenance, and GCCS O&M	$12,205,100
Groundwater Monitoring Cost	$1,325,782
Periodic Cost	$588,580
Total Cost for Alternative 3A (Flare Unit)	$72,793,990

Alternative 3B

Cap the Landfill and Adjacent Areas
Install an active Gas Control and Collection System (GCCS) in the Landfill Area
Close northern gas control system.
Treat the landfill gas with a GAC/$KMnO_4$ adsorption unit

Items	Estimated Cost
Capital Cost	$58,364,277
Inspection, Maintenance, and GCCS O&M	$13,643,734
Groundwater Monitoring Cost	$1,325,782
Periodic Cost	$588,580
Total Cost for Alternative 3B (Adsorption)	$73,922,372

Notes:

[1] Appended tables summarize backup calculations for all cost estimates provided

[2] Period of analysis is 32 years which includes 2 years of engineering, permitting and construction periods, and 30 years of long-term monitoring.

[3] Based on a 3% discount factor, as specified for Federal facility sites in Appendix C of Office of Management and Budget Circular A-94 (effective January 2006 through January 2007, http://www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html)

Abbreviations:
GAC/KMnO4 = Granular Activated Carbon/Potassium Permanganate

Table R-19 Cost Estimate Alternative 3A - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
General							
Mobilization and Demobilization	ls	1	$	1,781,000.00	$	1,781,000.00	Based on 5% of construction cost excluding CQA, Permitting, H&S, and SWPPP implementation costs.
Health and Safety	ls	1	$	50,000.00	$	50,000.00	
Engineering and Regulatory Compliance	ls	1	$	1,070,000.00	$	1,070,000.00	Includes preparation of construction documents, construction certification report, regulatory coordination, and local permits.
Temporary Erosion Control and SWPPP Implementation	ls	1	$	30,000.00	$	30,000.00	
Demolition							
Remove existing drainage structures	ls	1	$	10,000.00	$	10,000.00	Dispose spoils on-site at Landfill IR-01/21.
Remove existing concrete rubble (shoreline protection)	cy	8,500	$	30.00	$	255,000.00	Includes concrete rubble along the southern perimeter of the Landfill and Adjacent Areas. Dispose spoils on-site at Landfill IR 01/21.
Temporary Works							
Sheetpile installation	lf	3,195	$	1,495.00	$	4,776,525.00	Along Landfill and Panhandle shoreline
Dewatering	days	120	$	5,640.00	$	676,800.00	
Air Monitoring							
Ambient Air Monitors	mo	4	$	10,614.00	$	42,456.00	
Portable Ambient Air Analyzer	mo	4	$	1,952.00	$	7,808.00	
Portable Combustible Gas/Oxygen Indicator	mo	4	$	464.00	$	1,856.00	
Landfill IR-01/21							Includes the north, west, and southeast section of Landfill IR 01/21
Earthwork							
Excavated Waste and Debris Consolidation	cy	107,660	$	10.00	$	1,076,600.00	Stripped soils, waste, and concrete rubble excavation along the southerly limit of the Landfill and Adjacent Areas bordering SF Bay minus PCB impacted soil and LLRW. Place excavated material on-site at Landfill IR-01/21.
Earthfill	cy	140	$	4.50	$	630.00	Moisture condition and compact
Import Soil	cy	80,160	$	25.00	$	2,004,000.00	Purchase and deliver soil for foundation layer and vegetative soil cover. Includes fluff factor.
Geosynthetic Cover Subgrade Preparation	sf	395,700	$	0.10	$	39,570.00	Remove rock protrusions and level ground surface prior to geosynthetics placement
2.0' Foundation Layer	cy	29,100	$	4.50	$	130,950.00	Moisture condition and compact
1.5' Vegetative Soil Cover	cy	22,400	$	4.50	$	100,800.00	Moisture condition and compact
Final Grading	ac	22.2	$	2,000.00	$	44,400.00	Track walk prior to hydroseeding

Table R-19 Cost Estimate Alternative 3A - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
Landfill IR-01/21 (continued)							Includes the north, west, and southeast section of Landfill IR 01/21
Geosynthetic Final Cover							
Geosynthetic Clay Liner (GCL)	sf	405,300	$	0.60	$	243,180.00	Includes additional landfill closure area only
60-mil HDPE geomembrane	sf	414,900	$	0.50	$	207,450.00	Includes additional landfill closure area only
Drainage Geocomposite	sf	403,500	$	0.75	$	302,625.00	Includes additional landfill closure area only
4"perforated HDPE pipe, SDR 11, including pipe fittings, and geotextile wrap	lf	3,440	$	12.00	$	41,280.00	
Toe of Slope Gravel Fill	cy	510	$	25.00	$	12,750.00	
Gravel Blanket Drain	lf	700	$	20.00	$	14,000.00	Blanket drain for leachate extraction and/or protection against head build-up on final cover liner/earthfill
Geosynthetic Termination and Tie-ins							
North Perimeter Final Cover Termination	lf	1,120	$	12.00	$	13,440.00	
West Perimeter Final Cover Termination	lf	720	$	12.00	$	8,640.00	
South Perimeter Final Cover Termination	lf	1,200	$	12.00	$	14,400.00	
North and West tie-ins to existing geosynthetic cover	lf	1,000	$	15.00	$	15,000.00	Includes potholing, exposing and cleaning of existing geosynthetic cover material
South tie-in to existing geosynthetic cover	lf	700	$	15.00	$	10,500.00	Same as above
Surface Water Drainage System							
ECM/grass-lined swale	lf	700	$	14.00	$	9,800.00	Install at north finish grade tie-in
Top Deck Diversion Berm with ECM/grass-lined ditch	lf	1,210	$	10.00	$	12,100.00	Install at deck area of landfill
Grass-lined ditch	lf	300	$	12.00	$	3,600.00	Install at northwest perimeter of landfill
Concrete-lined ditch	lf	700	$	20.00	$	14,000.00	Install at toe of slope at south landfill perimeter
Rock-lined downchute	ea	1	$	20,000.00	$	20,000.00	Remove and re-establish existing rock gabion drainage swale and downchute lining
Pipe Downdrain	lf	250	$	100.00	$	25,000.00	Install at sideslope areas
Pipe Crossdrain	lf	100	$	70.00	$	7,000.00	Install across south perimeter access road
Drainage Inlet	ea	2	$	3,000.00	$	6,000.00	Install at south perimeter access road

Table R-19 Cost Estimate Alternative 3A - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
East Adjacent Area							Includes PCB remediation area
Earthwork							
Earthfill	cy	31,640	$	4.50	$	142,380.00	Moisture condition and compact
Import Soil	cy	88,750	$	25.00	$	2,218,750.00	Purchase and deliver soil for foundation layer and vegetative soil cover. Includes fluff factor.
1.0' Foundation Layer	cy	16,200	$	4.50	$	72,900.00	Moisture condition and compact
1.5' Vegetative Soil Cover	cy	26,500	$	4.50	$	119,250.00	Moisture condition and compact
Geosynthetic Subgrade Preparation	sf	474,800	$	0.10	$	47,480.00	Remove rock protrusions and level ground surface prior to geosynthetics placement
Final Grading	ac	9.7	$	2,000.00	$	19,400.00	Track walk prior to hydroseeding
Geosynthetic Final Cap							
60-mil HDPE geomembrane	sf	474,800	$	0.50	$	237,400.00	
Drainage Geocomposite	sf	467,000	$	0.75	$	350,250.00	
Cover Termination	lf	2,260	$	12.00	$	27,120.00	4" perforated HDPE pipe, SDR 11, including pipe fittings, and geotextile wrap
Surface Water Drainage System							
Grass-lined ditch	lf	2,260	$	12.00	$	27,120.00	Install at north and east boundary
Pipe Culvert	lf	50	$	75.00	$	3,750.00	Install across access road
Ditch Outlet	ls	1	$	5,000.00	$	5,000.00	Perimeter ditch outlet to SF Bay
Panhandle Area							
Earthwork							
Earthfill	cy	21,600	$	4.50	$	97,200.00	Moisture condition and compact
Import Soil	cy	44,880	$	25.00	$	1,122,000.00	Purchase and deliver soil for vegetative soil cover. Includes fluff factor.
2.0' Vegetative Soil Cover	cy	31,600	$	4.50	$	142,200.00	Moisture condition and compact
Geosynthetic Subgrade Preparation	sf	424,400	$	0.10	$	42,440.00	Remove rock protrusions and level ground surface prior to geosynthetics placement
Final Grading	ac	9.0	$	2,000.00	$	18,000.00	Track walk prior to hydroseeding

Table R-19 Cost Estimate Alternative 3A - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
Panhandle Area (continued)							
Geosynthetic Cap							
60-mil HDPE geomembrane	sf	424,400	$	0.50	$	212,200.00	
Final Cover Termination (West Boundary)	lf	1,300	$	8.00	$	10,400.00	Geosynthetic cap termination, trench excavation and backfill
North tie-in to existing and new Landfill geosynthetics	lf	450	$	15.00	$	6,750.00	Includes potholing, exposing and cleaning of existing geosynthetic cover material
Surface Water Drainage System							
ECM/grass-lined ditch	lf	1,300	$	14.00	$	18,200.00	Drainage ditch west side of west perimeter access road
Grass-lined ditch	lf	900	$	12.00	$	10,800.00	Drainage ditch east side of west perimeter access road
Pipe Culvert	lf	30	$	75.00	$	2,250.00	West perimeter ditch inlet to freshwater wetland
Drainage ditch outlet	ls	1	$	5,000.00	$	5,000.00	West perimeter ditch outlet to SF Bay
Wetlands Inlet Structures							
Intertidal Wetland #1 Inlet Structure	ls	1	$	213,500.00	$	213,500.00	Install 2-4'x6' RC box culvert and concrete headwall. For details, see Inlet worksheet.
Intertidal Wetland #2 Inlet Structure	ls	1	$	154,100.00	$	154,100.00	Install 1-4'x6' RC box culvert and concrete headwall. For details, see Inlet worksheet.
Freshwater Wetland Outlet Structure	ls	1	$	120,800.00	$	120,800.00	Remove and replace existing outlet structure. For details, see Inlet worksheet.
Wetlands Restoration	ac	2.5	$	69,900.00	$	174,750.00	For details, See Wetlands Restore-Cap Scenario rolled-up worksheet
Shoreline Protection							
Rock Riprap	tons	76,800	$	100.00	$	7,680,000.00	Shoreline protection along the south perimeter of the Landfill and Adjacent Areas.
Earthfill	cy	9,700	$	4.50	$	43,650.00	Soil backing along the southern perimeter of the Landfill and Adjacent Area. Moisture condition and compact.
Import Soil	cy	11,600	$	25.00	$	290,000.00	Purchase and deliver soil for earthfill. Includes fluff factor.
Geosynthetic Subgrade Preparation	sf	199,300	$	0.10	$	19,930.00	Remove rock protrusions and level ground surface prior to geosynthetics placement
60 mil HDPE	sf	199,320	$	0.50	$	99,660.00	Protective cover for soil backing
Cushion Geotextile (12 oz/sy)	sf	199,320	$	0.20	$	39,864.00	Cushion fabric between rock riprap and HDPE protective cover
Geogrid	sf	210,040	$	2.00	$	420,080.00	Soil reinforcement to resist slope failure due to liquefaction during earthquake events

Table R-19 Cost Estimate Alternative 3A - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity	Unit Price	Cost	Remarks
Shoreline Protection (continued)					
Access Road					
Class 2 Aggregate Base	cy	4,000	$ 22.00	$ 88,000.00	12" thick AB. Includes service road for the Landfill and Adjacent Areas.
Revegetation					
Hydroseeding	ac	40.9	$ 2,000.00	$ 81,800.00	Includes Landfill and Adjacent Areas.
Temporary Fence	lf	2,400	$ 24.00	$ 57,600.00	Based on $4/lf per month rental
PCB Area (Southeast Corner of Landfill)					
PCB Impacted Soil Excavation	cy	8,500	$ 20.00	$ 170,000.00	Direct to dump truck from ground excavation
Off-Site Disposal	tons	13,600	$ 303.00	$ 4,120,800.00	Cost includes transportation, disposal, and TSCA tax.
PCB Impacted Groundwater	gal	2,618,000	$ 2.00	$ 5,236,000.00	Assume disposal method by incineration
Dewatering					Includes wetlands excavation at Panhandle Area
Disposal Cost	gal	6,000,000	$ 0.006	$ 36,000.00	
Equipment Rental	mo	4	$ 17,000.00	$ 68,000.00	Based on 4 months equipment rental. Includes settling tanks, filtration system, pumps, and pipeline to sewer manhole
Floating Barrier	ls	1	$ 174,000.00	$ 174,000.00	Floating barrier with skimmer on SF Bay. Includes matl, deployment and operation for 90 days
Decontamination Pad	ea	2	$ 19,000.00	$ 38,000.00	Includes sump pump and discharge pipe to settling tank
Groundwater Monitoring					
Existing Well Abandonment	ls	1	$ 40,360.00	$ 40,360.00	For details, see BKUP GW rolled-up worksheet
New Well Installation	ls	1	$ 46,414.00	$ 46,410.00	Same as above
Landfill Gas (LFG) System - Option 3					
LFG Active System with Flare Unit	ls	1	$ 971,000.00	$ 971,000.00	For details, see BKUP LFG-4A rolled-up worksheet
Leachate Extraction System					Proposed at south perimeter of landfill
Transmission pipeline	lf	2,100	$ 50.00	$ 105,000.00	Along south perimeter to sewer manhole tie-in
Force main tie-in to existing sewer manhole	ls	1	$ 20,000.00	$ 20,000.00	Manhole tie-in near northwest corner of landfill

Table R-19 Cost Estimate Alternative 3A - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
Excavation and Radiation Screening/Disposal							Includes Adjacent Areas and Shoreline excavation
Pre-Containment LLRW Surface Anomalies Removal							
Pre-Clearing,Grubbing, and Stripping Screening	days	38	$	11,888.00	$	455,460.00	Based on 50'x50' grid at 16 grids per day production rate (~ 613 equivalent grids)
Clearing, Grubbing, Stripping	days	38	$	20,095.00	$	766,260.00	For quantity estimate, depth of stripping is assumed 1'. Number of days based on 1488cy/day production rate, or rad screening rate, whichever is greater
Pre-Excavation Screening	days	108	$	11,888.00	$	1,288,360.00	Based on 50'x50' grid at 16 grids per day production rate (~ 1734 equivalent grids)
Excavation	days	108	$	20,095.00	$	2,177,800.00	Excavation includes soil, waste, concrete rubble after clearing, grubbing, and stripping. Number of days based on 1488cy/day production rate or rad screening rate, whichever is greater
Secondary Radiation Screening	days	102	$	5,616.00	$	573,710.00	Based on 1500cy/day production rate
Soil Confirmation Sampling	ea	836	$	572.00	$	478,000.00	One sample per grid plus 10% QC sample. Analytical incldes TAL and WET testing
Post-Excavation Screening	days	38	$	11,888.00	$	455,460.00	Based on 50'x50' grid at 16 grids per day production rate
Disposal of LLRW	cy	11,350	$	250.00	$	2,837,450.00	10% of clear,grub,stripped materials and 5% of additional excavation
Additional LLRW Anomalies Removal							
Pre-Clearing,Grubbing, and Stripping Screening	days	15	$	11,888.00	$	173,120.00	Based on 50'x50' grid at 16 grids per day production rate (~233 equivalent grids)
Clearing, Grubbing, Stripping	days	15	$	20,095.00	$	301,430.00	For quantity estimate, depth of stripping is assumed 1'. Number of days based on 1488cy/day production rate, or rad screening rate, whichever is greater
Pre-Excavation Screening	days	15	$	11,888.00	$	173,120.00	Based on 50'x50' grid at 16 grids per day production rate (~ 233 equivalent grids)
Excavation	days	15	$	20,095.00	$	292,630.00	Excavation includes soil, waste, concrete rubble after clearing, grubbing, and stripping. Number of days based on 1488 cy/day production rate or rad screening rate, whichever is greater
Secondary Radiation Screening	days	30	$	5,616.00	$	171,210.00	Based on 1500cy/day production rate
Soil Confirmation Sampling	ea	288	$	572.00	$	164,930.00	One sample per grid plus 10% QC sample. Analytical incldes TAL and WET testing
Post-Excavation Screening	days	15	$	11,888.00	$	173,120.00	Based on 50'x50' grid at 16 grids per day production rate
Disposal of LLRW	cy	886	$	250.00	$	221,440.00	10% of clear,grub,stripped materials and 5% of additional excavation
Construction Quality Assurance							
Landfill and Adjacent Areas	days	320	$	3,000.00	$	960,000.00	CQA services for landfill closure and adjacent areas remediation based on 320 working days construction schedule.
LFG well field and flare unit	days	120	$	1,000.00	$	120,000.00	CQA services for gas field and flare unit based on 120 working days construction schedule.

Table R-19 Cost Estimate Alternative 3A - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Subtotal Capital Cost	$	50,330,204.00
20% Contingency	$	10,066,040.80
Total Capital Cost	$	60,396,244.80

Notes:

1. Capital cost is in 2005 dollars.
2. Cost estimates for landfill gas (LFG) control system, groundwater monitoring system, and wetlands restoration were obtained from backup spreadsheets.
3. Assumes infrastructure and building demolition will be completed (by others) prior to final cover installation for Adjacent Area at the east side of the Landfill.
4. Cost for other construction items were obtained from vendor quotes and similar landfill closure and/or remedial projects.

Abbreviations:

AB = aggregate base
ac = acres
CQA = Construction Quality Assurance
cy = cubic yard
ea = each
GCL = geosynthetic clay liner
HDPE = high density polyethylene
H&S = Health and Safety
lf = linear feet
LFG = Landfill Gas
LLRW = Low Level Radioactive Waste
ls = lump sum
mo = months
PCB = polychlorinated biphenyl
RC = reinforced concrete
sf = square feet
SF = San Francisco
SWPPP = Storm Water Pollution Prevention Plan

Table R-20 Cost Estimate Alternative 3A - Operation and Maintenance

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
Final Cover	lump sum (ls)	1	$	69,000.00	$	69,000.00	Repair of final cover due to settlement, slope failure, or erosion
Vegetation	ls	1	$	12,600.00	$	12,600.00	Maintenance of vegetation
LFG System - Option 3A	ls	1	$	262,500.00	$	262,500.00	For details, see BKUP LFG-3A rolled-up worksheet
Stormwater Monitoring	ls	1	$	60,980.00	$	60,980.00	For details, see BKUP SW rolled-up worksheet
LFG Condensate Disposal	ls	1	$	55,800.00	$	55,800.00	Assumes 60 gpd condensate, off-site disposal to Class I facility
Drainage	ls	1	$	5,000.00	$	5,000.00	Maintenance of drainage control system including clearing of materials blocking drainage conveyances.
Site Security	ls	1	$	9,600.00	$	9,600.00	Periodic inspection of point of access to the landfill, and environmental control systems
Emergency Response	ls	1	$	5,000.00	$	5,000.00	Include landfill inspection after major earthquake, storm, or fire that may exceed site design which could require emergency response actions.
Periodic Inspection, Documentation, Reporting and Regulatory Compliance	ls	1	$	18,000.00	$	18,000.00	Includes preparation of iso-settlement maps and 5-year site review
Institutional Control	ls	1	$	36,000.00	$	36,000.00	Includes monitoring, enforcement, and reporting
Subtotal O&M Cost					$	534,480.00	
20% Contingency					$	106,896.00	
Annual Average O&M Cost					$	641,376.00	
30 Year O&M Present Value					$	12,205,099.68	

Table R-21 Cost Estimate Alternative 3A - Landfill Gas (Active System - Automated Flare) Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Item	Description	Quantity	Unit	Unit Price	Cost
Material and Construction					
1	Mobilization	1	LS	$ 6,000.00	$ 6,000.00
2	Gas Extraction Well	41	LS	$ 1,200.00	$ 49,200.00
3	Gas Extraction Well Installation (includes well head, solid pipe, perf. pipe, bentonite, gravel, membrane boot, etc.)[1]	41	LS	$ 5,600.00	$ 229,600.00
4	6" SDR-17 Lateral Pipeline	4,000	LF	$ 2.60	$ 10,400.00
5	6" SDR-17 Lateral Pipeline Installed Underground	4,000	LF	$ 12.60	$ 50,400.00
6	8" SDR-17 Header Pipeline	4,000	LF	$ 4.23	$ 16,920.00
7	8" SDR-17 Header Pipeline Installed Underground	4,000	LF	$ 28.00	$ 112,000.00
8	2" SDR-11 Condensate Pipeline	3,200	LF	$ 0.85	$ 2,720.00
9	2" SDR-11 Condensate Pipeline Installed Underground	3,200	LF	$ 9.80	$ 31,360.00
10	8" Isolation Valve	9	LS	$ 1,600.00	$ 14,400.00
11	8" Check Valve	1	LS	$ 800.00	$ 800.00
12	Wellhead Vaults with bolt down lids	41	LS	$ 350.00	$ 14,350.00
13	Wellhead Vaults with bolt down lids Installation	41	LS	$ 700.00	$ 28,700.00
14	2" SDR-9 Air Pipeline	3,200	LF	$ 0.95	$ 3,040.00
15	2" SDR-9 Air Pipeline Installation	3,200	LF	$ 9.80	$ 31,360.00
16	Air Compressor	1	LS	$ 30,000.00	$ 30,000.00
17	Condensate Sump with pump	4	LS	$ 20,000.00	$ 80,000.00
18	Enclosed Flare and Installation[2]	1	LS	$ 250,000.00	$ 250,000.00
19	Miscellaneous Fittings	1	LS	$ 5,000.00	$ 5,000.00
20	Permitting[5]	1	LS	$ 5,000.00	$ 5,000.00
				Material and Construction Subtotal:	$ 971,000.00
Operations and Maintenance					
21	Enclosed Flare Operations and Maintenance[2, 3, 4]				
	21.1 Routine Site Visits	1	YR	$ 9,800.00	$ 9,800.00
	21.2 Non-routine Site Visits	1	YR	$ 4,200.00	$ 4,200.00
	21.3 Routine Repairs	1	YR	$ 9,800.00	$ 9,800.00
	21.4 Non-routine Repairs	1	YR	$ 4,200.00	$ 4,200.00
	21.5 Materials	1	YR	$ 3,000.00	$ 3,000.00
	21.6 Equipment	1	YR	$ 2,000.00	$ 2,000.00
	21.7 Source Testing and Reporting	1	YR	$ 7,500.00	$ 7,500.00
22	Landfill Gas System Operations and Maintenance[2, 3, 4]				
	22.1 Routine Site Visits	1	YR	$ 49,000.00	$ 49,000.00
	22.2 Non-routine Site Visits	1	YR	$ 21,000.00	$ 21,000.00
	22.3 Routine Repairs	1	YR	$ 42,000.00	$ 42,000.00
	22.4 Non-routine Repairs	1	YR	$ 14,000.00	$ 14,000.00
	22.5 Materials	1	YR	$ 20,000.00	$ 20,000.00
	22.6 Equipment	1	YR	$ 10,000.00	$ 10,000.00
23	Landfill Gas Monitoring[2, 3, 4]				
	23.1 Routine Site Visits	1	YR	$ 21,000.00	$ 21,000.00
	23.2 Non-routine Site Visits	1	YR	$ 7,000.00	$ 7,000.00
	23.3 Routine Repairs	1	YR	$ 21,000.00	$ 21,000.00
	23.4 Non-routine Repairs	1	YR	$ 7,000.00	$ 7,000.00
	23.5 Materials	1	YR	$ 5,000.00	$ 5,000.00
	23.6 Equipment	1	YR	$ 5,000.00	$ 5,000.00
				Annual Operations and Maintenance Subtotal:	$ 262,500.00

Notes:

[1]The depth of wells were assumed to be 12 feet deep.

[2]Costs were estimated based on EMCON/OWT, Inc.'s and LFG Specialties' industry leading experience and expertise.

[3]Assumes system will be in operation for 30 years (O&M performed 2 times per month first 2 years and 1 time per month thereafter.)

[4]O&M costs for the active system are significantly greater than the passive system, due to the quantity of mechanical fixtures within the system (i.e. valves, blowers, flare, etc.) and piping network.

[5]Permitting costs consists of background work and research toward development of permit applications.

Table R-22 Cost Estimate Alternative 3B - Cap the Landfill and Adjacent Areas, Install Active Gas Collection System, Decommission Northern Gas Control System, Treat Landfill Gas with GAC/KMnO4 Adsorption Unit, and Long-Term Monitoring

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

							Present Value Costs (3% Discount Factor Applied)						
Year	Capital Costs	Annual Inspection and GCCS O&M Cost	Groundwater Monitoring Cost	Periodic Costs	Total Annual Costs	Discount Factor (3%)	Capital Costs	Annual Inspection and GCCS O&M Cost	Groundwater Monitoring Cost	Periodic Costs(1)	Total Present Value Cost (at 3% Discount Factor)	Comments
0	$ 1,272,000	$ -	$ -	$ -	$ 1,272,000	1.0000	$ 1,272,000	$ -	$ -	$ -	$ 1,272,000	Engineering and Regulatory Compliance
1	$ 58,805,045	$ -	$ -	$ -	$ 58,805,045	0.9709	$ 57,092,277	$ -	$ -	$ -	$ 57,092,277	Construction and CQA
2	$ -	$ 716,976	$ 111,594	$ 82,500 (1)	$ 911,070	0.9426	$ -	$ 675,819	$ 105,188	$ 77,764	$ 858,771	Inspection and maintenance, GCCS O&M, groundwater monitoring (quarterly), and stormwater monitoring
3	$ -	$ 716,976	$ 111,594	$ 108,143 (1, 2)	$ 936,713	0.9151	$ -	$ 656,135	$ 102,124	$ 98,966	$ 857,225	Inspection and maintenance, GCCS O&M, groundwater monitoring (quarterly), and stormwater monitoring
4	$ -	$ 716,976	$ 111,594	$ 82,500	$ 911,070	0.8885	$ -	$ 637,024	$ 99,150	$ 73,300	$ 809,474	Inspection and maintenance, GCCS O&M, groundwater monitoring (quarterly), and stormwater monitoring
5	$ -	$ 716,976	$ 111,594	$ 108,143	$ 936,713	0.8626	$ -	$ 618,470	$ 96,262	$ 93,285	$ 808,017	Inspection and maintenance, GCCS O&M, groundwater monitoring (quarterly), and stormwater monitoring
6	$ -	$ 716,976	$ 111,594	$ 124,919 (1, 2, 3)	$ 953,489	0.8375	$ -	$ 600,456	$ 93,458	$ 104,618	$ 798,532	Inspection and maintenance, GCCS O&M, groundwater monitoring (quarterly), and stormwater monitoring
7	$ -	$ 716,976	$ 56,887	$ 9,143 (2)	$ 783,006	0.8131	$ -	$ 582,967	$ 46,254	$ 7,434	$ 636,656	Inspection and maintenance, GCCS O&M, groundwater monitoring (semi-annual), and stormwater monitoring
8	$ -	$ 716,976	$ 56,887	$ -	$ 773,863	0.7894	$ -	$ 565,987	$ 44,907	$ -	$ 610,895	Inspection and maintenance, GCCS O&M, groundwater monitoring (semi-annual), and stormwater monitoring
9	$ -	$ 716,976	$ 56,887	$ 9,143	$ 783,006	0.7664	$ -	$ 549,502	$ 43,599	$ 7,007	$ 600,109	Inspection and maintenance, GCCS O&M, groundwater monitoring (semi-annual), and stormwater monitoring
10	$ -	$ 716,976	$ 56,887	$ -	$ 773,863	0.7441	$ -	$ 533,497	$ 42,329	$ -	$ 575,827	Inspection and maintenance, GCCS O&M, groundwater monitoring (semi-annual), and stormwater monitoring
11	$ -	$ 716,976	$ 56,887	$ 35,062 (2, 3)	$ 808,925	0.7224	$ -	$ 517,959	$ 41,097	$ 25,329	$ 584,384	Inspection and maintenance, GCCS O&M, groundwater monitoring (semi-annual), and stormwater monitoring
12	$ -	$ 716,976	$ 56,887	$ -	$ 773,863	0.7014	$ -	$ 502,873	$ 39,900	$ -	$ 542,772	Inspection and maintenance, GCCS O&M, groundwater monitoring (semi-annual), and stormwater monitoring
13	$ -	$ 716,976	$ 56,887	$ 9,143	$ 783,006	0.6810	$ -	$ 488,226	$ 38,737	$ 6,226	$ 533,189	Inspection and maintenance, GCCS O&M, groundwater monitoring (semi-annual), and stormwater monitoring
14	$ -	$ 716,976	$ 56,887	$ -	$ 773,863	0.6611	$ -	$ 474,006	$ 37,609	$ -	$ 511,615	Inspection and maintenance, GCCS O&M, groundwater monitoring (semi-annual), and stormwater monitoring
15	$ -	$ 716,976	$ 56,887	$ 9,143	$ 783,006	0.6419	$ -	$ 460,200	$ 36,514	$ 5,868	$ 502,582	Inspection and maintenance, GCCS O&M, groundwater monitoring (semi-annual), and stormwater monitoring
16	$ -	$ 716,976	$ 56,887	$ 25,919 (3)	$ 799,782	0.6232	$ -	$ 446,796	$ 35,450	$ 16,152	$ 498,398	Inspection and maintenance, GCCS O&M, groundwater monitoring (semi-annual), and stormwater monitoring
17	$ -	$ 716,976	$ 56,887	$ 9,143	$ 783,006	0.6050	$ -	$ 433,782	$ 34,418	$ 5,532	$ 473,732	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
18	$ -	$ 716,976	$ 56,887	$ -	$ 773,863	0.5874	$ -	$ 421,148	$ 33,415	$ -	$ 454,563	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
19	$ -	$ 716,976	$ 56,887	$ 9,143	$ 783,006	0.5703	$ -	$ 408,881	$ 32,442	$ 5,214	$ 446,537	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
20	$ -	$ 716,976	$ 56,887	$ -	$ 773,863	0.5537	$ -	$ 396,972	$ 31,497	$ -	$ 428,469	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
21	$ -	$ 716,976	$ 56,887	$ 35,062	$ 808,925	0.5375	$ -	$ 385,410	$ 30,580	$ 18,847	$ 434,837	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
22	$ -	$ 716,976	$ 56,887	$ -	$ 773,863	0.5219	$ -	$ 374,184	$ 29,689	$ -	$ 403,873	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
23	$ -	$ 716,976	$ 56,887	$ 9,143	$ 783,006	0.5067	$ -	$ 363,286	$ 28,824	$ 4,633	$ 396,743	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
24	$ -	$ 716,976	$ 56,887	$ -	$ 773,863	0.4919	$ -	$ 352,705	$ 27,985	$ -	$ 380,689	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
25	$ -	$ 716,976	$ 56,887	$ 9,143	$ 783,006	0.4776	$ -	$ 342,432	$ 27,170	$ 4,367	$ 373,968	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
26	$ -	$ 716,976	$ 56,887	$ 25,919	$ 799,782	0.4637	$ -	$ 332,458	$ 26,378	$ 12,018	$ 370,855	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
27	$ -	$ 716,976	$ 56,887	$ 9,143	$ 783,006	0.4502	$ -	$ 322,775	$ 25,610	$ 4,116	$ 352,501	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
28	$ -	$ 716,976	$ 56,887	$ -	$ 773,863	0.4371	$ -	$ 313,374	$ 24,864	$ -	$ 338,238	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
29	$ -	$ 716,976	$ 56,887	$ 9,143	$ 783,006	0.4243	$ -	$ 304,246	$ 24,140	$ 3,880	$ 332,266	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
30	$ -	$ 716,976	$ 56,887	$ -	$ 773,863	0.4120	$ -	$ 295,385	$ 23,437	$ -	$ 318,821	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
31	$ -	$ 716,976	$ 56,887	$ 35,062	$ 808,925	0.4000	$ -	$ 286,781	$ 22,754	$ 14,024	$ 323,560	Inspection and maintenance, GCCS O&M, groundwater monitoring (annual), and stormwater monitoring
TOTALS	$ 60,077,045	$ 21,509,280	$ 1,980,150	$ 754,655	$ 84,321,130		$ 58,364,277	$ 13,643,734	$ 1,325,782	$ 588,580	$ 73,922,372	

Notes:

(1) Wetlands post construction monitoring and maintenance (five years).

(2) Groundwater monitoring well replacement (every two years).

(3) Groundwater monitoring well redevelopment (every five years).

Table R-23 Cost Estimate Alternative 3B - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
General							
Mobilization and Demobilization	ls	1	$	1,770,000.00	$	1,770,000.00	Based on 5% of construction cost excluding CQA, Permitting, H&S, and SWPPP implementation costs.
Health and Safety	ls	1	$	50,000.00	$	50,000.00	
Engineering and Regulatory Compliance	ls	1	$	1,060,000.00	$	1,060,000.00	Includes preparation of construction documents, construction certification report, regulatory coordination, and local permits.
Temporary Erosion Control and SWPPP Implementation	ls	1	$	30,000.00	$	30,000.00	
Demolition							
Remove existing drainage structures	ls	1	$	10,000.00	$	10,000.00	Dispose spoils on-site at Landfill IR-01/21.
Remove existing concrete rubble (shoreline protection)	cy	8,500	$	30.00	$	255,000.00	Includes concrete rubble along the southern perimeter of the Landfill and Adjacent Areas. Dispose spoils on-site at Landfill IR 01/21.
Temporary Works							
Sheetpile installation	lf	3,195	$	1,495.00	$	4,776,525.00	Along Landfill and Panhandle shoreline
Dewatering	days	120	$	5,640.00	$	676,800.00	
Air Monitoring							
Ambient Air Monitors	mo	4	$	10,614.00	$	42,456.00	
Portable Ambient Air Analyzer	mo	4	$	1,952.00	$	7,808.00	
Portable Combustible Gas/Oxygen Indicator	mo	4	$	464.00	$	1,856.00	
Landfill IR-01/21							Includes the north, west, and southeast section of Landfill IR 01/21
Earthwork							
Excavated Waste and Debris Consolidation	cy	107,660	$	10.00	$	1,076,600.00	Stripped soils, waste, and concrete rubble excavation along the southerly limit of the Landfill and Adjacent Areas bordering SF Bay minus PCB impacted soil and LLRW. Place excavated material on-site at Landfill IR-01/21.
Earthfill	cy	140	$	4.50	$	630.00	Moisture condition and compact
Import Soil	cy	80,160	$	25.00	$	2,004,000.00	Purchase and deliver soil for foundation layer and vegetative soil cover. Includes fluff factor.
Geosynthetic Cover Subgrade Preparation	sf	395,700	$	0.10	$	39,570.00	Remove rock protrusions and level ground surface prior to geosynthetics placement
2.0' Foundation Layer	cy	29,100	$	4.50	$	130,950.00	Moisture condition and compact
1.5' Vegetative Soil Cover	cy	22,400	$	4.50	$	100,800.00	Moisture condition and compact
Final Grading	ac	22.2	$	2,000.00	$	44,400.00	Track walk prior to hydroseeding

Table R-23 Cost Estimate Alternative 3B - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity	Unit Price	Cost	Remarks
Landfill IR-01/21 (continued)					Includes the north, west, and southeast section of Landfill IR 01/21
Geosynthetic Final Cover					
Geosynthetic Clay Liner (GCL)	sf	405,300	$ 0.60	$ 243,180.00	Includes additional landfill closure area only
60-mil HDPE geomembrane	sf	414,900	$ 0.50	$ 207,450.00	Includes additional landfill closure area only
Drainage Geocomposite	sf	403,500	$ 0.75	$ 302,625.00	Includes additional landfill closure area only
4"perforated HDPE pipe, SDR 11, including pipe fittings, and geotextile wrap	lf	3,440	$ 12.00	$ 41,280.00	
Toe of Slope Gravel Fill	cy	510	$ 25.00	$ 12,750.00	
Gravel Blanket Drain	lf	700	$ 20.00	$ 14,000.00	Blanket drain for leachate extraction and/or protection against head build-up on final cover liner/earthfill
Geosynthetic Termination and Tie-ins					
North Perimeter Final Cover Termination	lf	1,120	$ 12.00	$ 13,440.00	
West Perimeter Final Cover Termination	lf	720	$ 12.00	$ 8,640.00	
South Perimeter Final Cover Termination	lf	1,200	$ 12.00	$ 14,400.00	
North and West tie-ins to existing geosynthetic cover	lf	1,000	$ 15.00	$ 15,000.00	Includes potholing, exposing and cleaning of existing geosynthetic cover material
South tie-in to existing geosynthetic cover	lf	700	$ 15.00	$ 10,500.00	Same as above
Surface Water Drainage System					
ECM/grass-lined swale	lf	700	$ 14.00	$ 9,800.00	Install at north finish grade tie-in
Top Deck Diversion Berm with ECM/grass-lined ditch	lf	1,210	$ 10.00	$ 12,100.00	Install at deck area of landfill
Grass-lined ditch	lf	300	$ 12.00	$ 3,600.00	Install at northwest perimeter of landfill
Concrete-lined ditch	lf	700	$ 20.00	$ 14,000.00	Install at toe of slope at south landfill perimeter
Rock-lined downchute	ea	1	$ 20,000.00	$ 20,000.00	Remove and re-establish existing rock gabion drainage swale and downchute lining
Pipe Downdrain	lf	250	$ 100.00	$ 25,000.00	Install at sideslope areas
Pipe Crossdrain	lf	100	$ 70.00	$ 7,000.00	Install across south perimeter access road
Drainage Inlet	ea	2	$ 3,000.00	$ 6,000.00	Install at south perimeter access road

Table R-23 Cost Estimate Alternative 3B - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
East Adjacent Area							Includes PCB remediation area
Earthwork							
Earthfill	cy	31,640	$	4.50	$	142,380.00	Moisture condition and compact
Import Soil	cy	88,750	$	25.00	$	2,218,750.00	Purchase and deliver soil for foundation layer and vegetative soil cover. Includes fluff factor.
1.0' Foundation Layer	cy	16,200	$	4.50	$	72,900.00	Moisture condition and compact
1.5' Vegetative Soil Cover	cy	26,500	$	4.50	$	119,250.00	Moisture condition and compact
Geosynthetic Subgrade Preparation	sf	474,800	$	0.10	$	47,480.00	Remove rock protrusions and level ground surface prior to geosynthetics placement
Final Grading	ac	9.7	$	2,000.00	$	19,400.00	Track walk prior to hydroseeding
Geosynthetic Final Cap							
60-mil HDPE geomembrane	sf	474,800	$	0.50	$	237,400.00	
Drainage Geocomposite	sf	467,000	$	0.75	$	350,250.00	
Cover Termination	lf	2,260	$	12.00	$	27,120.00	4" perforated HDPE pipe, SDR 11, including pipe fittings, and geotextile wrap
Surface Water Drainage System							
Grass-lined ditch	lf	2,260	$	12.00	$	27,120.00	Install at north and east boundary
Pipe Culvert	lf	50	$	75.00	$	3,750.00	Install across access road
Ditch Outlet	ls	1	$	5,000.00	$	5,000.00	Perimeter ditch outlet to SF Bay
Panhandle Area							
Earthwork							
Earthfill	cy	21,600	$	4.50	$	97,200.00	Moisture condition and compact
Import Soil	cy	44,880	$	25.00	$	1,122,000.00	Purchase and deliver soil for vegetative soil cover. Includes fluff factor.
2.0' Vegetative Soil Cover	cy	31,600	$	4.50	$	142,200.00	Moisture condition and compact
Geosynthetic Subgrade Preparation	sf	424,400	$	0.10	$	42,440.00	Remove rock protrusions and level ground surface prior to geosynthetics placement
Final Grading	ac	9.0	$	2,000.00	$	18,000.00	Track walk prior to hydroseeding

Table R-23 Cost Estimate Alternative 3B - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
Panhandle Area (continued)							
Geosynthetic Cap							
60-mil HDPE geomembrane	sf	424,400	$	0.50	$	212,200.00	
Final Cover Termination (West Boundary)	lf	1,300	$	8.00	$	10,400.00	Geosynthetic cap termination, trench excavation and backfill
North tie-in to existing and new Landfill geosynthetics	lf	450	$	15.00	$	6,750.00	Includes potholing, exposing and cleaning of existing geosynthetic cover material
Surface Water Drainage System							
ECM/grass-lined ditch	lf	1,300	$	14.00	$	18,200.00	Drainage ditch west side of west perimeter access road
Grass-lined ditch	lf	900	$	12.00	$	10,800.00	Drainage ditch east side of west perimeter access road
Pipe Culvert	lf	30	$	75.00	$	2,250.00	West perimeter ditch inlet to freshwater wetland
Drainage ditch outlet	ls	1	$	5,000.00	$	5,000.00	West perimeter ditch outlet to SF Bay
Wetlands Inlet Structures							
Intertidal Wetland #1 Inlet Structure	ls	1	$	213,500.00	$	213,500.00	Install 2-4'x6' RC box culvert and concrete headwall. For details, see Inlet worksheet.
Intertidal Wetland #2 Inlet Structure	ls	1	$	154,100.00	$	154,100.00	Install 1-4'x6' RC box culvert and concrete headwall. For details, see Inlet worksheet.
Freshwater Wetland Outlet Structure	ls	1	$	120,800.00	$	120,800.00	Remove and replace existing outlet structure. For details, see Inlet worksheet.
Wetlands Restoration	ac	2.5	$	69,900.00	$	174,750.00	For details, See Wetlands Restore-Cap Scenario rolled-up worksheet
Shoreline Protection							
Rock Riprap	tons	76,800	$	100.00	$	7,680,000.00	Shoreline protection along the south perimeter of the Landfill and Adjacent Areas.
Earthfill	cy	9,700	$	4.50	$	43,650.00	Soil backing along the southern perimeter of the Landfill and Adjacent Area. Moisture condition and compact.
Import Soil	cy	11,600	$	25.00	$	290,000.00	Purchase and deliver soil for earthfill. Includes fluff factor.
Geosynthetic Subgrade Preparation	sf	199,300	$	0.10	$	19,930.00	Remove rock protrusions and level ground surface prior to geosynthetics placement
60 mil HDPE	sf	199,320	$	0.50	$	99,660.00	Protective cover for soil backing
Cushion Geotextile (12 oz/sy)	sf	199,320	$	0.20	$	39,864.00	Cushion fabric between rock riprap and HDPE protective cover
Geogrid	sf	210,040	$	2.00	$	420,080.00	Soil reinforcement to resist slope failure due to liquefaction during earthquake events

Table R-23 Cost Estimate Alternative 3B - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity	Unit Price	Cost	Remarks
Shoreline Protection (continued)					
Access Road					
Class 2 Aggregate Base	cy	4,000	$ 22.00	$ 88,000.00	12" thick AB. Includes service road for the Landfill and Adjacent Areas.
Revegetation					
Hydroseeding	ac	40.9	$ 2,000.00	$ 81,800.00	Includes Landfill and Adjacent Areas.
Temporary Fence	lf	2,400	$ 24.00	$ 57,600.00	Based on $4/lf per month rental
PCB Area (Southeast Corner of Landfill)					
PCB Impacted Soil Excavation	cy	8,500	$ 20.00	$ 170,000.00	Direct to dump truck from ground excavation
Off-Site Disposal	tons	13,600	$ 303.00	$ 4,120,800.00	Cost includes transportation, disposal, and TSCA tax.
PCB Impacted Groundwater	gal	2,618,000	$ 2.00	$ 5,236,000.00	Assume disposal method by incineration
Dewatering					Includes wetlands excavation at Panhandle Area
Disposal Cost	gal	6,000,000	$ 0.006	$ 36,000.00	
Equipment Rental	mo	4	$ 17,000.00	$ 68,000.00	Based on 4 months equipment rental. Includes settling tanks, filtration system, pumps, and pipeline to sewer manhole
Floating Barrier	ls	1	$ 174,000.00	$ 174,000.00	Floating barrier with skimmer on SF Bay. Includes matl, deployment and operation for 90 days
Decontamination Pad	ea	2	$ 19,000.00	$ 38,000.00	Includes sump pump and discharge pipe to settling tank
Groundwater Monitoring					
Existing Well Abandonment	ls	1	$ 40,360.00	$ 40,360.00	For details, see BKUP GW rolled-up worksheet
New Well Installation	ls	1	$ 46,414.00	$ 46,410.00	Same as above
Landfill Gas (LFG) System - Option 4					
LFG Active System with GAC	ls	1	$ 756,000.00	$ 756,000.00	For details, see BKUP LFG-Option 4 rolled-up worksheet
Leachate Extraction System					Proposed at south perimeter of landfill
Transmission pipeline	lf	2,100	$ 50.00	$ 105,000.00	Along south perimeter to sewer manhole tie-in
Force main tie-in to existing sewer manhole	ls	1	$ 20,000.00	$ 20,000.00	Manhole tie-in near northwest corner of landfill

Table R-23 Cost Estimate Alternative 3B - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
Excavation and Radiation Screening/Disposal							Includes Adjacent Areas and Shoreline excavation
Pre-Containment LLRW Surface Anomalies Removal							
Pre-Clearing,Grubbing, and Stripping Screening	days	38	$	11,888.00	$	455,460.00	Based on 50'x50' grid at 16 grids per day production rate (~ 613 equivalent grids)
Clearing, Grubbing, Stripping	days	38	$	20,095.00	$	766,260.00	For quantity estimate, depth of stripping is assumed 1'. Number of days based on 1488cy/day production rate, or rad screening rate, whichever is greater
Pre-Excavation Screening	days	108	$	11,888.00	$	1,288,360.00	Based on 50'x50' grid at 16 grids per day production rate (~ 1734 equivalent grids)
Excavation	days	108	$	20,095.00	$	2,177,800.00	Excavation includes soil, waste, concrete rubble after clearing, grubbing, and stripping. Number of days based on 1488cy/day production rate or rad screening rate, whichever is greater
Secondary Radiation Screening	days	102	$	5,616.00	$	573,710.00	Based on 1500cy/day production rate
Soil Confirmation Sampling	ea	836	$	572.00	$	478,000.00	One sample per grid plus 10% QC sample. Analytical incldes TAL and WET testing
Post-Excavation Screening	days	38	$	11,888.00	$	455,460.00	Based on 50'x50' grid at 16 grids per day production rate
Disposal of LLRW	cy	11,350	$	250.00	$	2,837,450.00	10% of clear,grub,stripped materials and 5% of additional excavation
Additional LLRW Anomalies Removal							
Pre-Clearing,Grubbing, and Stripping Screening	days	15	$	11,888.00	$	173,120.00	Based on 50'x50' grid at 16 grids per day production rate (~233 equivalent grids)
Clearing, Grubbing, Stripping	days	15	$	20,095.00	$	301,430.00	For quantity estimate, depth of stripping is assumed 1'. Number of days based on 1488cy/day production rate, or rad screening rate, whichever is greater
Pre-Excavation Screening	days	15	$	11,888.00	$	173,120.00	Based on 50'x50' grid at 16 grids per day production rate (~ 233 equivalent grids)
Excavation	days	15	$	20,095.00	$	292,630.00	Excavation includes soil, waste, concrete rubble after clearing, grubbing, and stripping. Number of days based on 1488 cy/day production rate or rad screening rate, whichever is greater
Secondary Radiation Screening	days	30	$	5,616.00	$	171,210.00	Based on 1500cy/day production rate
Soil Confirmation Sampling	ea	288	$	572.00	$	164,930.00	One sample per grid plus 10% QC sample. Analytical incldes TAL and WET testing
Post-Excavation Screening	days	15	$	11,888.00	$	173,120.00	Based on 50'x50' grid at 16 grids per day production rate
Disposal of LLRW	cy	886	$	250.00	$	221,440.00	10% of clear,grub,stripped materials and 5% of additional excavation
Construction Quality Assurance							
Landfill and Adjacent Areas	days	320	$	3,000.00	$	960,000.00	CQA services for landfill closure and adjacent areas remediation based on 320 working days construction schedule.
LFG well field and flare unit	days	90	$	1,000.00	$	90,000.00	CQA services for gas field and flare unit based on 90 working days construction schedule.

Table R-23 Cost Estimate Alternative 3B - Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Subtotal Capital Cost	$	50,064,204.00
20% Contingency	$	10,012,840.80
Total Capital Cost	$	60,077,044.80

Notes:

1. Capital cost is in 2005 dollars.
2. Cost estimates for landfill gas (LFG) control system, groundwater monitoring system, and wetlands restoration were obtained from backup spreadsheets.
3. Assumes infrastructure and building demolition will be completed (by others) prior to final cover installation for Adjacent Area at the east side of the Landfill.
4. Cost for other construction items were obtained from vendor quotes and similar landfill closure and/or remedial projects.

Abbreviations:

AB = aggregate base
ac = acres
CQA = Construction Quality Assurance
cy = cubic yard
ea = each
GCL = geosynthetic clay liner
HDPE = high density polyethylene
H&S = Health and Safety
lf = linear feet
LFG = Landfill Gas
LLRW = Low Level Radioactive Waste
ls = lump sum
mo = months
PCB = polychlorinated biphenyl
RC = reinforced concrete
sf = square feet
SF = San Francisco
SWPPP = Storm Water Pollution Prevention Plan

Table R-24 Cost Estimate Alternative 3B - Operation and Maintenance

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Description	Unit	Quantity		Unit Price		Cost	Remarks
Final Cover	lump sum (ls)	1	$	69,000.00	$	69,000.00	Repair of final cover due to settlement, slope failure, or erosion
Vegetation	ls	1	$	12,600.00	$	12,600.00	Maintenance of vegetation
LFG System - Option 3B	ls	1	$	325,500.00	$	325,500.00	For details, see BKUP LFG-Option 3 rolled-up worksheet
Stormwater Monitoring	ls	1	$	60,980.00	$	60,980.00	For details, see BKUP SW rolled-up worksheet
LFG Condensate Disposal	ls	1	$	55,800.00	$	55,800.00	Assumes 60 gpd condensate, off-site disposal to Class I facility
Drainage	ls	1	$	5,000.00	$	5,000.00	Maintenance of drainage control system including clearing of materials blocking drainage conveyances.
Site Security	ls	1	$	9,600.00	$	9,600.00	Periodic inspection of point of access to the landfill, and environmental control systems
Emergency Response	ls	1	$	5,000.00	$	5,000.00	Include landfill inspection after major earthquake, storm, or fire that may exceed site design which could require emergency response actions.
Periodic Inspection, Documentation, Reporting and Regulatory Compliance	ls	1	$	18,000.00	$	18,000.00	Includes preparation of iso-settlement maps and 5-year site review
Institutional Control and LLRW License	ls	1	$	36,000.00	$	36,000.00	Includes monitoring, enforcement, and reporting
Subtotal O&M Cost					$	597,480.00	
20% Contingency					$	119,496.00	
Annual Average O&M Cost					$	716,976.00	
30 Year O&M Present Value					$	13,643,734.02	

Table R-25 Cost Estimate Alternative 3B - Landfill Gas (Active System - GAC) Backup

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Item	Description	Quantity	Unit	Unit Price	Cost
Material and Construction					
1	Mobilization	1	LS	$ 6,000.00	$ 6,000.00
2	Gas Extraction Well	41	LS	$ 1,200.00	$ 49,200.00
3	Gas Extraction Well Installation (includes well head, solid pipe, perf. pipe, bentonite, gravel, membrane boot, etc.)[1]	41	LS	$ 5,600.00	$ 229,600.00
4	6" SDR-17 Lateral Pipeline	4,000	LF	$ 2.60	$ 10,400.00
5	6" SDR-17 Lateral Pipeline Installed Underground	4,000	LF	$ 12.60	$ 50,400.00
6	8" SDR-17 Header Pipeline	4,000	LF	$ 4.23	$ 16,920.00
7	8" SDR-17 Header Pipeline Installed Underground	4,000	LF	$ 28.00	$ 112,000.00
8	2" SDR-11 Condensate Pipeline	3,200	LF	$ 0.85	$ 2,720.00
9	2" SDR-11 Condensate Pipeline Installed Underground	3,200	LF	$ 9.80	$ 31,360.00
10	8" Isolation Valve	9	LS	$ 1,600.00	$ 14,400.00
11	8" Check Valve	1	LS	$ 800.00	$ 800.00
12	Wellhead Vaults with bolt down lids	41	LS	$ 350.00	$ 14,350.00
13	Wellhead Vaults with bolt down lids Installation	41	LS	$ 700.00	$ 28,700.00
14	2" SDR-9 Air Pipeline	3,200	LF	$ 0.95	$ 3,040.00
15	2" SDR-9 Air Pipeline Installation	3,200	LF	$ 9.80	$ 31,360.00
16	Air Compressor	1	LS	$ 30,000.00	$ 30,000.00
17	Condensate Sump with pump	4	LS	$ 20,000.00	$ 80,000.00
18	Granular Activated Carbon (GAC) Absorption unit and Installation[2, 3]	1	LS	$ 35,000.00	$ 35,000.00
19	Miscellaneous Fittings	1	LS	$ 5,000.00	$ 5,000.00
20	Permitting[6]	1	LS	$ 5,000.00	$ 5,000.00
				Material and Construction Subtotal:	$ 756,000.00
Operations and Maintenance					
21	GAC Operations and Maintenance [2, 3, 4, 5]				
	21.1 Routine Site Visits	1	YR	$ 21,000.00	$ 21,000.00
	21.2 Non-routine Site Visits	1	YR	$ 7,000.00	$ 7,000.00
	21.3 Routine Repairs	1	YR	$ 21,000.00	$ 21,000.00
	21.4 Non-routine Repairs	1	YR	$ 7,000.00	$ 7,000.00
	21.5 Materials	1	YR	$ 30,000.00	$ 30,000.00
	21.6 Equipment	1	YR	$ 10,000.00	$ 10,000.00
	21.7 Source Testing and Reporting	1	YR	$ 7,500.00	$ 7,500.00
22	Landfill Gas System Operations and Maintenance [3, 4, 5]				
	22.1 Routine Site Visits	1	YR	$ 49,000.00	$ 49,000.00
	22.2 Non-routine Site Visits	1	YR	$ 21,000.00	$ 21,000.00
	22.3 Routine Repairs	1	YR	$ 42,000.00	$ 42,000.00
	22.4 Non-routine Repairs	1	YR	$ 14,000.00	$ 14,000.00
	22.5 Materials	1	YR	$ 20,000.00	$ 20,000.00
	22.6 Equipment	1	YR	$ 10,000.00	$ 10,000.00
23	Landfill Gas Monitoring [3, 4, 5]				
	23.1 Routine Site Visits	1	YR	$ 21,000.00	$ 21,000.00
	23.2 Non-routine Site Visits	1	YR	$ 7,000.00	$ 7,000.00
	23.3 Routine Repairs	1	YR	$ 21,000.00	$ 21,000.00
	23.4 Non-routine Repairs	1	YR	$ 7,000.00	$ 7,000.00
	23.5 Materials	1	YR	$ 5,000.00	$ 5,000.00
	23.6 Equipment	1	YR	$ 5,000.00	$ 5,000.00
				Annual Operations and Maintenance Subtotal:	$325,500.00

Notes:

[1]The depth of wells were assumed to be 12 feet deep.

[2]Four 300lb GAC units (replace two lead vessels every month) and five 55-gal. $KMnO_4$ impregnated zeolite polishers (replace lead vessel every three weeks). A more extensive collection system will increase the volume and size of constituents passing through the system over time; therefore, the order of magnitude of constituents is significantly greater, which would result in a rapid depreciation of carbon over time.

[3]Costs were estimated based on EMCON/OWT, Inc.'s industry leading experience and expertise.

[4]Assumes system will be in operation for 30 years (O&M performed 2 times per month first 2 years and 1 time per month thereafter.) with routine testing for VOC breakthrough of the lead vessel. O&M costs were assumed to be the same as Fort Ord, California.

[5]O&M costs for the active system are significantly greater than the passive system, due to the quantity of mechanical fixtures within the system (i.e. valves, blowers, flare, etc.) and piping network.

[6]Permitting costs consists of background work and research toward development of permit applications.

Table R-26 Cost Estimate Alternative 3 - Stormwater Monitoring

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Summary

Annual Average Cost for Stormwater Monitoring	$60,980.00
Total Per Year	$60,980.00

Stormwater Monitoring

5 locations to sample during the rainy season (October to May)

	Non-Storm Discharge Visual Observations (8 events total, per year)	Monthly Stormwater Visual Observations (6-8 monthly events, 8 months)	Stormwater Sampling Events (2 event per year, 4 samples per event)	Comprehensive Site Compliance Evaluation (1 per year)	Annual Reporting and Revision of the Stormwater Discharge Management Plan (1 per year)	
Labor subtotal	$ 5,120.00	$ 35,840.00	$ 1,280.00	$ 750.00	$ 4,300.00	
Equipment subtotal	$ -	$ -	$ 240.00	$ -	$ -	
Laboratory Analysis Cost	$ -	$ -	$ 5,250.00	$ -	$ -	
Reporting	$ 800.00	$ 5,600.00	$ 200.00	$ -	$ 1,600.00	
Total cost per year	$ 5,920.00	$ 41,440.00	$ 6,970.00	$ 750.00	$ 5,900.00	
30 Year Present Worth Cost[2]						$ 1,829,400.00

Notes:

(1) Assumed 30 years of SMDP implementation

Laboratory Analytical Costs		
Analysis	Cost per sample	
PCBs by EPA Method 8082	$	85.00
SVOCs by U.S. Environmental Protection Agency (EPA) Method 8270C	$	225.00
Total metals by EPA Method 6010/7000	$	125.00
TSS by EPA Method 160.2	$	20.00
Oil and grease by EPA Method 1664 Revision A	$	55.00
Specific conductance by EPA Method 120.1	$	7.50
pH by EPA Method 9040B	$	7.50
Total Laboratory Analysis Cost per Sample	$	525.00

Table R-27 Cost Estimate Alternative 3 - Groundwater Monitoring

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Summary		
30 Year Present Worth Cost for Groundwater Monitoring	$	1,650,125.00
Well Abandonment Prior to Capping	$	30,296.00
Original Well Installation w/ Development	$	46,414.00
30 Year Present Worth Cost for Replacement Well Installation	$	74,667.88
30 Year Present Worth Cost for Well Redevelopment	$	84,669.99
Total Well Work	$	1,886,172.87

Groundwater Monitoring	30 wells to sample (semi annually for 5 years, annually for 25 years)			
		Semi-Annual Cost		Annual Cost
Labor subtotal per event	$	6,160.00	$	6,160.00
Lab subtotal per event	$	34,985.00	$	34,985.00
Interim reporting subtotal per event	$	4,444.00		--
Subtotal - Events plus reports (annual basis)	$	86,734.00	$	41,145.00
Annual report	$	6,261.00	$	6,261.00
Total monitoring costs per year	$	92,995.00	$	47,406.00
Total monitoring cost (for each sampling frequency)	$	464,975.00	$	1,185,150.00
30 Year Present Worth Cost			$	1,650,125.00

Well Abandonment	56 wells, total footage of 1200 ft			
Labor subtotal	$	7,360.00		
Drilling subtotal	$	30,000.00		
Report subtotal	$	3,000.00		
Total Well Abandonment			$	40,360.00

Original Well Installation w/ Development	15 new wells			
Labor subtotal	$	5,580.00		
Drilling subtotal	$	31,135.00		
Surveyor	$	3,500.00		
Utility clearance	$	3,500.00		
Report subtotal	$	2,699.00		
Total Well Installation Cost			$	46,414.00

Well Redevelopment Cost	30 wells			
Labor, Drilling, & Report	$	21,599.00		
Well redevelopment will occur every 5 yrs				
Average cost per year	$	4,319.80		
30 Year Present Worth Cost			$	84,669.99

Replacement Well Installation Cost				
One Shallow Well	$	6,994.00		
One Deep Well	$	8,244.00		
Average cost per well			$	7,619.00
Average cost per year assuming 1 well every 2 years			$	3,809.50
30 Year Present Worth Cost				$ 74,667.88

Table R-28 Cost Estimate Alternative 3 - Wetland Monitoring

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Summary		Labor		Expenses		Cost per Acre
Planning	$	23,400.00	$	5,000.00	$	28,400.00
Construction	$	24,500.00	$	17,000.00	$	41,500.00
Total Wetlands Restoration	$	47,900.00	$	22,000.00	$	69,900.00

Planning		Labor		Expenses		Cost per Acre
Initial Site Analysis	$	1,000.00	$	-	$	1,000.00
Conceptual Plan (Including Modeling of Hydrology and Water Infiltration)	$	7,200.00	$	1,000.00	$	8,200.00
Plans & Specifications	$	7,200.00	$	3,000.00	$	10,200.00
Agency permitting & authorizations (not fees)	$	8,000.00	$	1,000.00	$	9,000.00
Total Planning	$	23,400.00	$	5,000.00	$	28,400.00

Construction		Labor		Expenses		Cost per Acre
Site Preparation**		NA		NA	$	-
Soil Amendments and Fertilizers	$	3,000.00	$	3,000.00	$	6,000.00
Culverts & Weirs for Water Flow Management	$	3,000.00	$	1,500.00	$	4,500.00
Construction Supervision (planting supervision)	$	3,000.00	$	-	$	3,000.00
Grazing protection devices/structures	$	8,000.00	$	5,000.00	$	13,000.00
Plant procurement and install	$	7,500.00	$	7,500.00	$	15,000.00
Total Construction	$	24,500.00	$	17,000.00	$	41,500.00

Post Construction		Labor		Expenses		Cost per Acre
Monitoring	$	5,000.00	$	1,500.00	$	6,500.00
Maintenance	$	16,000.00	$	5,000.00	$	21,000.00
Total Post Construction	$	21,000.00	$	6,500.00	$	27,500.00

Notes:

Assumes wetland restoration on capped landfill/solid waste.

Expenses include lab costs, equipment lease, travel, supplies, etc.

NA = not applicable because costs will be included in other construction tasks

**: Assumes all labor and materials for the landfill cap (except for the vegetative cover) are addressed in other remediation tasks

Table R-29 Cost Estimate Alternative 3A - Quantity Take-offs

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Item	Unit	Qty.
New Landfill Area - SE		
Clearing & Grubbing	AC	~
Excavation (waste)	CY	~
Excavation (cover soil)	CY	2,402
Earthfill	CY	140
Final Cover - Vegetative Layer	CY	2,448
Final Cover - Drainage Geocomposite	SF	44,068
Final Cover - 60-mil HDPE	SF	52,487
Final Cover - GCL	SF	44,856
Final Cover - Foundation Layer	CY	2,833
1' Thick Gravel Blanket Length	LF	700
1' Thick Gravel Blanket Volume	CY	1,053
Liner Termination	LF	695
Stormwater Downdrain	LF	~
Stormwater Ditch	LF	~
Stormwater Outlet	LF	~
Geosynthetic Subgrade Preparation	SF	41,544
Access Road Aggregate Base	CY	382
Outfall Reconstruction	LS	1
New Landfill Area - N&W		
Clearing & Grubbing	AC	~
Excavation (cover soil)	CY	5,496
Excavation (existing soil stockpile)	CY	14,500
Diversion Berm Length	LF	838
Diversion Berm Volume	CY	838
Final Cover - Vegetative Layer	CY	19,909
Final Cover - Drainage Geocomposite	SF	359,462
Final Cover - 60-mil HDPE	SF	362,410
Final Cover - GCL	SF	360,422
Final Cover - Foundation Layer	CY	26,233
Liner Termination	LF	1,540
Stormwater Downdrain	LF	258
Stormwater Ditch	LF	937
Stormwater Outlet	LF	~
Geosynthetic Subgrade Preparation	SF	354,142
Access Road Aggregate Base	CY	1,051
East Adjacent Area		
Clearing & Grubbing	AC	~
Excavation (waste)	CY	~
Excavation (cover soil)	CY	2,019
Stripping	CY	~
Earthfill	CY	31,641
Final Cover - Vegetative Layer	CY	26,541
Final Cover - Drainage Geocomposite	SF	466,957
Final Cover - 60-mil HDPE	SF	474,782
Final Cover - GCL	SF	~
Final Cover - Foundation Layer	CY	16,210
1' Thick Gravel Blanket	CY	~
Liner Termination	LF	2,262
Stormwater Downdrain	LF	~
Stormwater Ditch	LF	2,260
Stormwater Outlet	LF	58
Stormwater Outlet Protection	LS	1
Road Crossing Culvert	LF	50
Geosynthetic Subgrade Preparation	SF	474,782
Access Road Aggregate Base	CY	1,122

Table R-29 Cost Estimate Alternative 3A - Quantity Take-offs

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Item	Unit	Qty.
Panhandle Area		
Clearing & Grubbing	AC	~
Excavation (soil)	CY	24,456
Excavation (stripping)	CY	~
Excavation (freshwater wetlands)	CY	7,299
Excavation (Intertidal 1 wetlands)	CY	3,638
Excavation (Intertidal 2 wetlands)	CY	10,550
Compacted Earthfill	CY	21,603
Final Cover - Vegetative Layer	CY	31,621
Final Cover - Drainage Geocomposite	SF	~
Final Cover - 60-mil HDPE	SF	424,447
Final Cover - GCL	SF	~
Final Cover - Foundation Layer	CY	~
Liner Termination	LF	3,016
Stormwater Downdrain	LF	~
Stormwater Ditch	LF	2,289
Stormwater Outlet	LF	~
1 - 6'x4' Box Culvert	LF	100
2 - 6'x4' Box Culvert	LF	110
Geosynthetic Subgrade Preparation	SF	424,447
Access Road Aggregate Base	CY	1,436
Shoreline Protection - South Termination		
Excavation (waste)	CY	8,122
Excavation (PCB impacted soil)	CY	8,488
Concrete Rubble (exist. shoreline protection)	CY	6,472
Earthfill	CY	9,663
Rock Riprap Structure	CY	12,006
Rock Riprap Fillback	CY	3,345
60-mil HDPE	SF	79,703
Geogrid	SF	55,100
Cushion Geotextile Fabric	SF	79,703
Concrete-Lined Drainage Ditch	LF	1,093
Geosynthetic Subgrade Preparation	SF	79,703
Access Road Aggregate Base	CY	~
Shoreline Protection - Panhandle		
Excavation (waste)	CY	~
Excavation (soil)	CY	11,277
Concrete Rubble (exist. shoreline protection)	CY	2,062
Earthfill	CY	~
Rock Riprap Structure	CY	19,274
Rock Riprap Fillback	CY	13,387
60-mil HDPE	SF	119,616
Geogrid	SF	154,936
Cushion Geotextile Fabric	SF	119,616
Concrete-Lined Drainage Ditch	LF	1,660
Geosynthetic Subgrade Preparation	SF	119,616
Access Road Aggregate Base	CY	~

Table R-30 Cost Estimate Alternative 3A - Inlet

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Panhandle - Intertidal Wetland #1 Inlet Structure (2 - 4' x 6' Box Culvert)

Reinforced Concrete Headwall

Item	H or W (ft)	L (ft)	T (ft)	Vol (cy)
Headwall	10	24	1	8.9
Wingwall (2 sides)	8	15	1	8.9
Footing	3	54	1	6.0
Floor	25	15	1	13.9
Cut-off Wall	4	30	1.5	6.7
Subtotal per end				44.3
Total Volume (2 ends)				88.7
Unit Cost ($/cy)				$ 450.00
Cost				$ 39,900.00

Excavation and Backfill

Item	Area (sf)		Unit Price ($/sf)	Cost ($)
Temp. Shoring (steel sheet pile) (drive, extract, salvage)	3750		16	60000
Item	Area (sf)	Vol (cy)	Unit Price ($/cy)	Cost ($)
Foundation Prep	2200	163	50	8100
Item	Gal		($/gal)	($)
Dewatering	277200		0.006	1663.2
Item	Area (sf)	Vol (cy)	Unit Price ($/cy)	Cost ($)
Excavation	176	782.2	20	15644
Backfill (Concrete slurry)	84.0	217.8	120	26133
Cost				$ 111,540.98

Culvert

Item	Barrel	L (ft)	Unit Price ($/lf)	Cost ($)
4' x 6' RC Box Culvert	2	70	443.3	62055
Cost				$ 213,500.00

Panhandle - Intertidal Wetland #2 Inlet Structure (1 - 4' x 6' Box Culvert)

Reinforced Concrete Headwall

Item	H or W (ft)	L (ft)	T (ft)	Vol (cy)
Headwall	10	14	1	5.2
Wingwall (2 sides)	8	15	1	8.9
Footing	3	44	1	4.9
Floor	15	15	1	8.3
Cut-off Wall	4	20	1.5	3.0
Subtotal per end				30.3
Total Volume (2 ends)				60.5
Unit Cost ($/cy)				$ 450.00
Cost				$ 27,233.33

Table R-30 Cost Estimate Alternative 3A - Inlet

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Panhandle - Intertidal Wetland #2 Inlet Structure (1 - 4' x 6' Box Culvert) - continued

Excavation and Backfill

Item	Area (sf)		Unit Price ($/sf)	Cost ($)
Temp. Shoring (steel sheet pile) (drive, extract, salvage)	3750		16	60000
Item	**Area (sf)**	**Vol (cy)**	**Unit Price ($/cy)**	**Cost ($)**
Foundation Prep	1400	104	50	5200
Item	**Gal**		**($/gal)**	**($)**
Dewatering	176400		0.006	1058.4
Item	**Area (sf)**	**Vol (cy)**	**Unit Price ($/cy)**	**Cost ($)**
Excavation	112	497.8	20	9956
Backfill (Concrete Slurry)	63.0	163.3	120	19600
Cost				$ 95,813.96

Culvert

Item	Barrel	L (ft)	Unit Price ($/lf)	Cost ($)
4' x 6' RC Box Culvert	1	70	443.3	31028
Cost				$ 154,100.00

Panhandle - Freshwater Wetkand Outlet Structure

Reinforced Concrete Headwall

	H or W (ft)	L (ft)	T (ft)	Vol (cy)	
Headwall	10	8	1	3.0	
Wingwall (2 sides)	8	15	1	8.9	
Footing	3	38	1	4.2	
Floor	15	15	1	8.3	
Cut-off Wall	4	14	1.5	2.1	
Subtotal per end				26.5	
Total Volume (2 ends)				53.0	
Unit Cost ($/cy)				$	450.00
Cost				$	23,833.33

Excavation and Backfill

Item	Area (sf)		Unit Price ($/sf)	Cost ($)
Temp. Shoring (steel sheet pile) (drive, extract, salvage)	3750		16	60000
Item	**Area (sf)**	**Vol (cy)**	**Unit Price ($/cy)**	**Cost ($)**
Foundation Prep	1000	74	50	3700
Item	**Gal**		**($/gal)**	**($)**
Dewatering	126000		0.006	756

Table R-30 Cost Estimate Alternative 3A - Inlet

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Excavation and Backfill (continued)

Item	Area (sf)	Vol (cy)	Unit Price ($/cy)	Cost ($)
Excavation	70	311.1	20	6222
Backfill (Concrete Slurry)	27.9	93.1	120	11173
Backfill (Class 2 AB)	35.0	116.7	25	2917
Cost				$ 84,767.45

Pipe Culvert

Item	Barrel	L (ft)	Unit Price ($/Ea)	Cost ($)
24" RCP	1	90	50.0	4500
24" Flap Gate	1		4700	4700
Cost				$ 9,200.00

Structure Removal

Item	Qty	Unit Price ($/cy)	Cost ($)
Exist. Outlet Structure (place in Landfill)	1	3000	3000
Cost			$ 120,800.00

Table R-31 Cost Estimate Alternative 3A - LLRW Screening, Handling, and Disposal

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Item		Unit	Qty.	Remarks
Pre-Containment LLRW Surface Anomalies Removal				
New Cap Areas				
LF Area		AC	8.71	Includes NW and SE LF areas
East Adjacent Area		AC	9.42	Includes PCB removal area
Panhandle Area		AC	7.64	
	Sub-Total	AC	25.77	
Shoreline Protection		AC	5.66	Includes LF south perimeter and panhandle area
Fill over existing LF cap		AC	2.35	East adjacent area
Gap West of Panhandle		AC	1.07	Area west of panhandle cap area
Area disturbed - West		AC	0.32	Disturbed area west of E-2 boundary
	Total		35.17	Parcel E-2 planned area of grading for containment prep.
Cleared, Grubbed and Stripped Materials				Within remediation area only
Area		AC	35.17	Equals total disturbed area
In-situ volume		CY	56,740	Assume 1 ft of total area
Adjusted volume		CY	73,762	In-situ volume adjusted for 30% fluff factor
LLRW to be disposed off-site		CY	7,376	Assume 10% of adjusted volume
Soil, Waste and Concrete Rubble Excavation for Subgrade Preparation				
Existing Soil Cover		CY	3,887	Existing soil cover at NW area of the Landfill minus stripped volume
Existing Soil Stockpile		CY	9,660	Temporary stockpiled soil at NW area of the existing landfill to be used for final cover minus stripped volume
Existing LF with Geosynthetic Cap and Soil Cover		CY	3,251	Includes remaining 6" vegetative layer over the geosynthetic cap
Waste Excavation		CY	8,122	LF south perimeter
Concrete Rubble		CY	8,534	LF south perimeter and panhandle
East Adjacent Area		CY	2,019	
Panhandle Area		CY	18,325	Panhandle excavation minus stripped volume
Shoreline Area		CY	5,743	Shoreline (panhandle) excavation minus stripped volume
Wetlands Inlet/Outlet Structures		CY	1,591	Includes intertidal and freshwater inlet/outlet structures

Table R-31 Cost Estimate Alternative 3A - LLRW Screening, Handling, and Disposal

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Item	Unit	Qty.	Remarks
Soil, Waste and Concrete Rubble Excavation for Subgrade Preparation (continued)			
In-situ volume	CY	61,132	Total excavation inside grading area
Adjusted volume	CY	79,472	In-situ volume adjusted for 30% fluff factor
LLRW to be disposed off-site	CY	3,974	Assume 5% of adjusted volume
Pre-Clearing,Grubbing, and Stripping Screening	days	38	Based on 50'x50' grid at 16 grids per day production rate (~ 613 equivalent grids)
Clearing, Grubbing, Stripping	days	38	For qto estimate, depth of stripping is assumed 1'. Number of days based on 1488cy/day production rate
Pre-Excavation Screening	days	108	Based on 50'x50' grid at 16 grids per day production rate (~ 1734 equivalent grids)
Excavation	days	108	Excavation includes soil, waste, concrete rubble after the clearing, grubbing, and stripping. Number of days based on pre-excavation screening rate
Secondary Radiation Screening	days	102	Based on 1500cy/day production rate
Soil Confirmation Sampling	ea	836	One sample per grid plus 10% QC sample.
Post-Excavation Screening	days	38	Based on 50'x50' grid at 16 grids per day production rate
Disposal of LLRW	CY	11,350	10% of clear,grub,stripped materials and 5% of additional excavated materials

Table R-31 Cost Estimate Alternative 3A - LLRW Screening, Handling, and Disposal

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Item	Unit	Qty.	Remarks
Additional LLRW Anomalies Removal			
Existing LF capped area	AC	9.67	Remaining area of existing LF with cap and vegetative soil cover
Shoreline to E-2 Boundary	AC	1.94	Gap between shoreline protection to E-2 boundary
Gap North of Landfill	AC	0.51	Area between new LF limit and E-2 boundary
Gap West of Landfill	AC	1.00	Area between new LF limit and E-2 boundary
Gap East of Adjacent Area	AC	0.24	Area east and north of Adjacent Area to E-2 boundary
Total		13.36	Area outside containment area
Cleared, Grubbed and Stripped Materials			Within addt'l removal area only
Area	AC	13.36	Equals total disturbed area
In-situ volume	CY	21,550	Assume 1 ft of total area
Adjusted volume	CY	28,020	In-situ volume adjusted for 30% fluff factor
LLRW to be disposed off-site	CY	2,802	Assumes 10% of adjusted volume
Additional Excavation - After Clearing,Grubbing and Stripping			
Existing LF Capped Area	AC	9.67	Remaining area of existing LF with cap and vegetative soil cover
Gap Areas	AC	3.61	Gap areas
In-situ volume	CY	13,620	Depth of additional cut: 0.5 ft for remaining LF capped area; 1.0 ft for gap areas
Adjusted volume	CY	17,710	In-situ volume adjusted for 30% fluff factor
LLRW to be disposed off-site	CY	886	Assumes 5% of adjusted volume
Pre-Clearing,Grubbing, and Stripping Screening	days	15	Based on 50'x50' grid at 16 grids per day production rate (~ 233 equivalent grids)
Clearing, Grubbing, Stripping	days	15	For qto estimate, depth of stripping is assumed 1'. Number of days based on 1488cy/day production rate
Pre-Excavation Screening	days	15	Based on 50'x50' grid at 16 grids per day production rate (~ 233 equivalent grids)

Table R-31 Cost Estimate Alternative 3A - LLRW Screening, Handling, and Disposal

Hunters Point Shipyard Parcel E-2, Remedial Investigation/Feasibility Study

Item	Unit	Qty.	Remarks
Excavation	days	15	Additional excavation after the area is cleared, grubbed, and stripped. Number of days based on pre-excavation screening rate
Secondary Radiation Screening	days	30	Based on 1500cy/day production rate
Soil Confirmation Sampling	ea	288	One sample per grid plus 10% QC sample.
Post-Excavation Screening	days	15	Based on 50'x50' grid at 16 grids per day production rate
Disposal of LLRW	CY	886	10% of clear,grub,stripped materials and 5% of additional excavation