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DEPARTMENT OF
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BUREAU OF SANITATION

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DIRECTOR

TRACI J. MINAMIDE
CHIEF OPERATING OFFICER

VAROUJ S. ABKIAN
ADEL H. HAGEKHALIL
ALEXANDER E. HELOU
ASSISTANT DIRECTORS

KHALIL M. GHARIOS, P.E., DIV. MANAGER
1149 SOUTH BROADWAY, 5TH FLOOR
LOS ANGELES, CA 90015
TEL: (213) 485-3002
FAX: (213) 485-2959

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March 13, 2012

California Regional Water Quality Control Board
Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, CA 90013

Attn: WEN YANG, Chief of Landfill Disposal Unit
DOUGLAS CROSS, Engineering Geologist

**LOPEZ CANYON LANDFILL (FILE NO. 69-068, ORDER NO. R4-2004-0176, CI-5636)
CORRECTIVE ACTION COST ESTIMATE FOR KNOWN OR REASONABLY FORESEEABLE
RELEASE TO WATER**

The City of Los Angeles Bureau of Sanitation hereby submits the Lopez Canyon Landfill Corrective Action Cost Estimate for Known or Reasonably Foreseeable Release to Water as directed in the modified WDR received December 6, 2011.

The estimated cost for a leachate release 15 year corrective action is \$1.6 million if the City chooses to use a 3rd party contractor. The leachate release was found to be the highest cost corrective action [the other release scenarios considered were much less costly] for the releases considered most probable.

Should you have any questions concerning this submittal, please contact John Hamilton at (213) 847-2700.

Sincerely,

Khalil M. Gharios, P.E. Division Manager
Solid Resources Processing/Construction Division

Attachments

c: Jonathan Zari, BOS
John Karroum, BOS
David Thompson, LEA



Corrective Action Cost Estimate for Known or Reasonably Foreseeable Release to
Water
For Lopez Canyon Landfill
By
The City of Los Angeles
Bureau of Sanitation
Solid Resource Processing and Construction Division

1. PURPOSE

This Corrective Action Cost Estimate for Known or Reasonably Foreseeable Release to Water for the Lopez Canyon Landfill was prepared to meet the requirements of the Waste Discharge Requirement Permit (WDR) Revised Monitoring and Reporting Program under program (No. CI-5636) issued December 6, 2011 and Title 27 Section 22101(a) of the California Code of Regulations (CCR).

In the revised WDR permit issued to the City of Los Angeles (City) Bureau of Sanitation (Bureau) on December 6, 2011 the California Regional Water Quality Control Board Los Angeles Region directed the City to submit before March 5, 2012 a Corrective Action Cost Estimate for Known or Reasonably Foreseeable Release to water pursuant to Section 22101(a) of the California Code of Regulations, Title 27 (27CCR) [shown below].

22101(a) **Water release corrective action estimate**

The operator shall provide a cost estimate for initiating and completing corrective action for all known or reasonably foreseeable releases from the solid waste landfill to water in accordance with the program required by the SWRCB pursuant to section 20380(b).

This Corrective Action Cost Estimate for Known or Reasonably Foreseeable Release to Water report for Lopez Canyon Landfill meets the WDR and 27CCR requirements.

2. BACKGROUND

2.1. Site Information

The Lopez Canyon Landfill is a 399-acre Class III disposal site (including seven acres leased from the U.S. Forest Service) of which approximately 166 acres were used for refuse disposal. This 166-acre disposal area is divided into four areas known as Disposal Areas A, B, AB+ and C, as shown in the Appendix. The landfill operating permit was not extended, and it ceased to accept refuse after July 1, 1996. The preliminary final grading plan reflects a maximum landfill elevation of 1,770 feet above mean sea level (including five feet of final cover) in accordance with the Conditional Use Permit (CUP) for the landfill, CUP No. 95-0166CU. All closure construction activities at the site are completed except final hydro-seeding of Disposal Area C. The Construction Quality Assurance (CQA) reports were approved by your office on October 31, 2011. A closure certification report together with the final as-built closure cost will be submitted to the RWQCB once the hydro-seeding is completed in early April 2012.

2.2. Geology

The landfill is located in the foothills of the San Gabriel Mountains on the northeast rim of the San Fernando Valley. The landfill is mainly underlain by bedrock of the Tertiary Towsley Formation. The Towsley formation is composed predominantly of interbedded silt, shale, and sandstone of non-marine origin. Ground-water wells in the Towsley formation do not yield significant quantities of water and yield water of generally poor quantity. For this reason, the Towsley formation is not considered a water bearing formation by the California Department of Water Resources (DWR) [CDMG, 1973]. The northern-most part of the landfill property (not containing waste) is underlain by the Tertiary-Quaternary Saugus Formation. The Saugus formation is composed predominantly of massive sandstone and conglomerate bedrock. The Saugus formation is considered a water bearing interval in that wells in the Saugus formation readily yield useable quantities of good quality water. The bedrock formations beneath the landfill typically dip at an angle of approximately 50 to 65 degrees to the north. Quaternary marine terrace deposits of the Modelo formation are present locally near the southeastern boundary of the property but do not underlie the landfill footprint. The Modelo formation is composed primarily of low permeability shale and siltstone beds. The Modelo formation is not considered water bearing by DWR and may act as a hydraulic barrier between the landfill and the water bearing San Fernando Hydrogeologic Subunit to the south. Quaternary and Holocene alluvial deposits line the drainage channels and canyon bottoms. Talus deposits are present in places along the toes of steep rock outcrops.

2.3. Hydrogeology

The bodies of water that could be potentially affected by the Lopez Canyon Sanitary Landfill include the ground water contained in the aquifer(s) beneath and adjacent to the landfill. The nature of these ground-water aquifer(s) are discussed in the following paragraphs. There are no permanent surface water bodies (e.g. rivers, streams, or lakes) in the immediate vicinity of the landfill, though the Bureau does monitor surface water run-off from the landfill.

The landfill is located adjacent to the surface projection of the San Fernando Hydrogeologic Subunit of the Los Angeles - San Gabriel Hydrogeologic Unit. The ground water contained in the bedrock formation beneath the landfill is hydrogeologically isolated and does not connect to either the San Fernando Hydrogeologic Subunit to the south and west [RWQCB, 1991]. The Towsley formation, the bedrock geologic formation underlying the majority of the waste cells at the landfill, is not considered water bearing [Brown, 1975] as it is capable of producing only limited

quantities of water high in dissolved solids. Thus the water contained in the Towsley formation has few beneficial uses due to both its limited quantities and its poor quality [Brown, 1975].

2.4. Conceptual Hydrogeologic Model

A conceptual hydrogeologic model for the landfill was formulated based on current ground-water elevations, available data regarding the hydrogeologic conditions in the vicinity of the landfill, and general hydrogeologic principles. In this conceptual model, the ground-water flow in the vicinity of the landfill is primarily due to infiltrating rainwater. This infiltrating rainwater follows one of two primary flow paths. In one case, the infiltrating water penetrates the alluvium and flows primarily along the bedrock-alluvium interface toward the canyon bottoms and then along the canyon bottoms toward the canyon mouths. In the second case, the infiltrating water flows within the vadose zone down the dip of relatively high permeability sandstone and conglomerate beds sandwiched between less pervious siltstone and shale beds until either hitting alluvium in the canyons or the ground-water table in the bedrock.

In the first case, the alluvial ground water in Canyons A, B, and C percolates essentially vertically within the alluvium to the alluvium/bedrock interface. After reaching the alluvium/bedrock interface, the ground water then flows primarily along the alluvium/bedrock interface in the canyon bottoms into Lopez and Bartholomaus Canyons. The ground water then flows south towards the San Fernando Subunit of the Upper Los Angeles River Basin (ULARB). The ground-water flow direction is primarily dictated by subsurface geologic structure, by the pre-grading topography in the landfill area, and to some extent influenced by the present topography and surface cover. The disposal areas at the landfill are shown in Appendix 1. Based on the landfill topography before grading, an alluvial ground-water flow divide beneath the topographic divide between Disposal Area C and Disposal Areas A and B was incorporated into the conceptual hydrogeologic model. This ground-water flow divide was assumed to run north-south in the vicinity of Monitoring Well MW95-1. In the conceptual model, alluvial ground water beneath Disposal Area AB+ and Disposal Area C flows towards Lopez Canyon and alluvial ground water beneath Disposal Areas A and B flows towards Bartholomaus Canyon. As the alluvium in Canyons A, B, and C and in Lopez and Bartholomaus Canyons in the immediate vicinity of the landfill is derived from the Towsley formation (which is predominantly composed of claystone and siltstone), the alluvium in these canyons may be assumed to be rich in clay and silt sized particles and to have a low saturated hydraulic conductivity.

In the second case, some ground water infiltrates through the vadose zone down the dip of pervious strata to the water table. Some of the ground water in the alluvium may also percolate into the underlying bedrock of the canyon bottoms, or during dry periods, ground water may percolate out of the bedrock into the alluvium. In the bedrock, ground-water flows in response to the regional gradient, though it may be influenced to some extent by the bedding orientation and other structural features. In the conceptual hydrogeologic model formulated for the landfill vicinity, the regional ground-water gradient drives flow in the bedrock beneath the landfill in a southerly and westerly direction, from the San Gabriel Mountains into the San Fernando Subunit of the ULARB. The slow recovery of ground water in purged ground-water monitoring wells in both alluvial and bedrock ground-water monitoring wells [personal communication with Haydar Azzouz, GeoSyntec Consultants geologist] indicates that the saturated hydraulic conductivities of the alluvial and bedrock aquifers are low. Because the ground-water elevation in adjacent bedrock and alluvial ground-water monitoring wells are essentially equal, the alluvial and bedrock aquifers are assumed to be interconnected to some extent.

The following general assumptions can be stated based on the hydrogeologic model and site observations discussed above:

- HM-1 The uppermost aquifer beneath the landfill is located in the alluvium. Water in this aquifer flows along the alluvium/bedrock interface down the axes of the various canyons at the site, with some infiltration of ground water between the alluvium and the bedrock aquifers.
- HM-2 Ground-water flow in the bedrock beneath the landfill may be influenced by alluvial flows and structural features, but is generally controlled by the regional gradient and flows in a southerly direction.
- HM-3 The recovery of ground water in ground-water monitoring wells installed in the alluvium and bedrock is very slow, indicating that the hydraulic conductivity of these two aquifers is low. Thus, ground-water velocity is likely to be low in both aquifers.
- HM-4 The depth of water in the alluvium aquifer is a function of the amount of rainfall that has occurred at the landfill in the recent past.

2.5. Seeps and Springs

There are no known springs within a mile of the site. Four seeps were found at the site at various times when the landfill was open between 1975 and 1996. Three are now dry and one is collected and pumped into the Los Angeles sewer system.

Three seeps have been detected in the Disposal Area C. All three seeps were located along the same sandstone conglomerate layer and appear to have originated from the same water source. The Bureau submitted to the RWQCB a notification memo for each of these seeps. All seeps in Disposal Area C were connected to the liner subdrain system to provide drainage under the liner. It is believed that the seeps are now dry because there has been no flow in the sub-drain system since 1996.

One seep was detected in Disposal Area A on July 11, 1994. The seep water is contained in a tank. The seep water in the tank is automatically pumped into the sewer system.

2.6. Surface Water

Surface water exits from the Lopez Landfill in three locations. The locations are South of A-canyon [at the bottom of A-canyon], East of B-Canyon [at the bottom of B-canyon], and South of C-canyon [below C-canyon at the white horse debris basin]. The tributary areas are A-canyon, B-canyon, and [AB+&C]-canyons. The aggregate watershed area with refuse under it is 166 acres then additional area on natural ground.

2.7. Regulatory Background

The Lopez Canyon Landfill operated under Waste Discharge Requirements (WDR) Order No. 91-122 issued by the RWQCB. In August 1992, the Bureau revised the existing WDR and prepared a revised draft WDR to comply with revisions to Article 5, Chapter 15, Division 3, Title 23 (Article 5) of the California Code of Regulations (CCR), which became effective on 1 July 1991 [Law/Crandall, Inc. 1992]. The draft WDR included the development of water quality monitoring and response programs to detect, evaluate, and mitigate the potential release of contaminants from the Lopez Canyon landfill to the ground water, surface water, and the unsaturated (vadose) zone. The final WDR (Order No. 93-062) was approved in 1993 without the corrective financial assurance plans incorporated into the document. In November 2004 Order [No. R4-2004-0176] was approved. This WDR also had language regarding the Release Discovery Response. There was no required Corrective Action Cost Estimate for Known or Reasonably Foreseeable Release to Water in the Document. On September 16, 2010 the Bureau requested the RWQCB to modify the groundwater monitoring

requirements for all closed landfills owned and maintained by the City including Lopez Canyon. The Monitoring and Reporting Program (M&RP) was modified by the RWQCB on December 6, 2011. The following primary elements were added to the M&RP: 1) reduce the monitoring well network from 10 to 5 wells, 2) submission of a Corrective Action Cost Estimate for Known or Reasonably Foreseeable Release to Water, 3) after acceptance of the cost estimate the City will demonstrate that it can perform the Corrective Actions by demonstrating financial assurances according with 27 CCR sections 22220 et. Seq.

3. KNOWN OR FORESEEABLE WATER RELEASES

There are three general types of releases [Release Scenario-1 to Release Scenario-3] that were selected as foreseeable at the Lopez Canyon Landfill site:

Release Scenario-1 [Leachate] a subsurface release of leachate from Canyons A, B, AB+, or C. These releases would flow underground in a Southern direction. Detection of a release from the four canyons is very unlikely because historically there has been no detectable impact from the landfill in any of the groundwater wells since 1975 [37 years] when the landfill was opened. This may be because of the adequately sloped drainage areas reduce surface infiltration reducing the generation of leachate in the landfill and the low aquifer hydraulic conductivity lowers the subsurface flow velocity so the leachate is contained within the landfill boundary. The C-canyon is double lined with a geosynthetic liner reducing the potential for a release at that canyon.

Release Scenario-2 [Fuel] a sub-surface release of gasoline or diesel from one of the underground tanks at the fueling station. This release would flow down gradient from the fuel station into the soil on the Southern perimeter of AB+ Canyon. This type of release is also very unlikely because of the early warning leak detection system and tank containment that has been installed at the site.

Release Scenario-3 [Equipment Fluid] a surface release from material spilled onto one or multiple discharge tributaries [stormwater contamination]. There are three discharge locations at the site that collect stormwater from an area of 166 acres. This release scenario is very un-probable because any release would be treated with absorbent, contained and removed from the site so that it wouldn't contaminate the stormwater.

Table 1: Summary of Release Scenarios

Release Scenario	Discharge Area	Probability
1. Leachate	Groundwater	Low
2. Fuel	Groundwater	Low
3. Equipment Fluid	Surface Water	Low

4. CORRECTIVE ACTIONS

The corrective actions for the three (3) foreseeable releases are predicted to be as shown in Table 2.

Table 2: Summary of Corrective Actions

Release Scenario	
1. Leachate	Monitor, extract, and contain leachate using groundwater wells.
2. Fuel	Dig out and dispose of Containment Structure, Tanks, and Contaminated Soil.
3. Equipment Fluid	Contain, remove, and dispose of the contaminated soil.

Release Scenario 1 would be the most complicated and capital intensive of the corrective actions. The area of the release would have to be determined and verified by installation of monitoring wells. Then extraction wells would be installed either underneath the refuse or on the refuse boundary. No treatment would be required since the landfill has access to the City of Los Angeles wastewater collection system. The extraction wells would create a cone of depression in the aquifer that would contain and extract the leachate. During the evaluation and feasibility phases it is estimated that three (3) monitoring wells would be installed to locate the release location. Then during the construction of the extraction wells five (5) wells are predicted to be installed. The leachate abatement network of five (5) groundwater wells would convey groundwater to the sewer through dedicated 2" diameter HDPE pipe. Two of the wells were predicted to be greater than 350' and would require electric power instead of pneumatic operation. The other pneumatic pumps would operate using existing air from the flare station at Lopez Canyon.

Only Release Scenario 1 would require extensive use of a consultant for the Evaluation of the Monitoring and Reporting Program report and the Preliminary Engineering Feasibility report. The other Releases probably wouldn't require a consultant.

For scenario 2 a fuel release, a contractor would be brought in to excavate and remove the structures and contaminated soil. Release Scenario 3 the equipment fluid spilling on the landfill surface would be contained, dug up, and disposed of to keep it out of contact with stormwater runoff.

5. CORRECTIVE ACTION COST ESTIMATE

5.1. Leachate Abatement

Table 3: Leachate Release Corrective Action Cost Estimate

Deliverable	Estimated Cost
1-Evaluation of Monitoring and Reporting Program	\$ 86,086
2-Preliminary Engineering Feasibility Study	\$276,253
3-Capital Cost for Corrective Action Construction (3 rd party)	\$532,258
4-Operation Cost for Corrective Action (3 rd party)	\$692,800
Total Cost	\$1,587,398

The itemized costs are shown in the appendix. These costs are predicted using a 3rd party contractor. The actual event would probably be performed by City crews and significantly lower the items 3 & 4 Capital and Operation costs respectively. The consultant costs would also probably be less, but a very conservative approach was used that probably represents the upper bound of cost for a corrective event.

5.2. Fuel Abatement

For fuel underground storage tank clean-up the Congressional Research Service (CRS) performed a study for the United States congress “Leaking Underground Storage Tanks (USTS) Prevention and Cleanup”, May 18, 2010 [Doc 7-5700]. This study found that the average clean-up for all states in the United States was \$127,000 and the highest 10 state average was \$173,717.

5.3. Equipment Fluid

Any fluid from equipment will be contained and disposed for less than \$20,000.

6. CONCLUSION

The estimated cost range for the most probable corrective actions as outlined is \$20k - \$1.6 million. The maximum cost is established by the highest treatment option which is the landfill leachate abatement corrective action for \$1,587,398.

Table 4: Summary of Corrective Action Cost Estimates

Release Scenario	Cost Estimate for Abatement
1-Leachate Release to Groundwater	\$1,587,398
2-Fuel Tank Release to Soil	\$173,717
3- Equipment Fluid Release to Surface Water	\$20,000

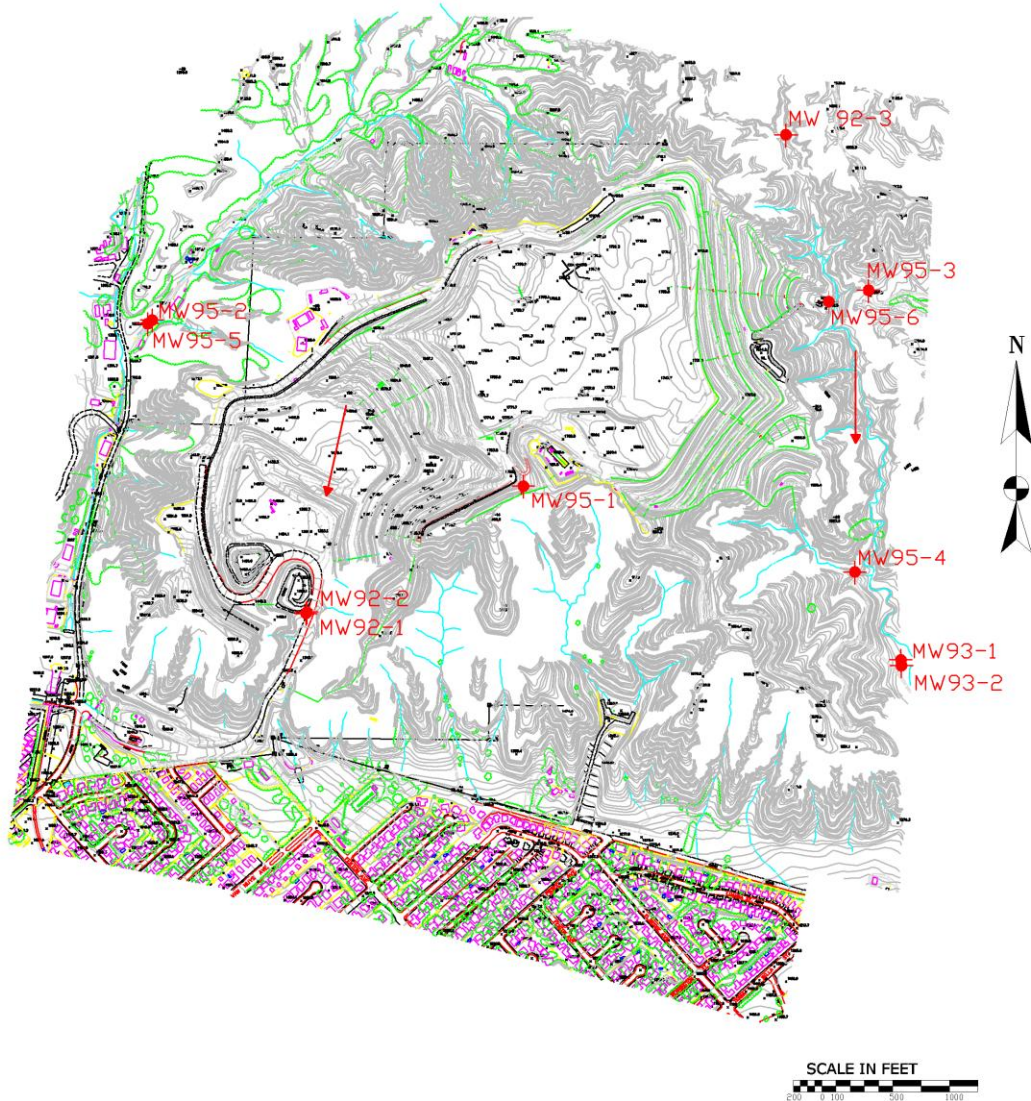


Appendix 1: Site Map



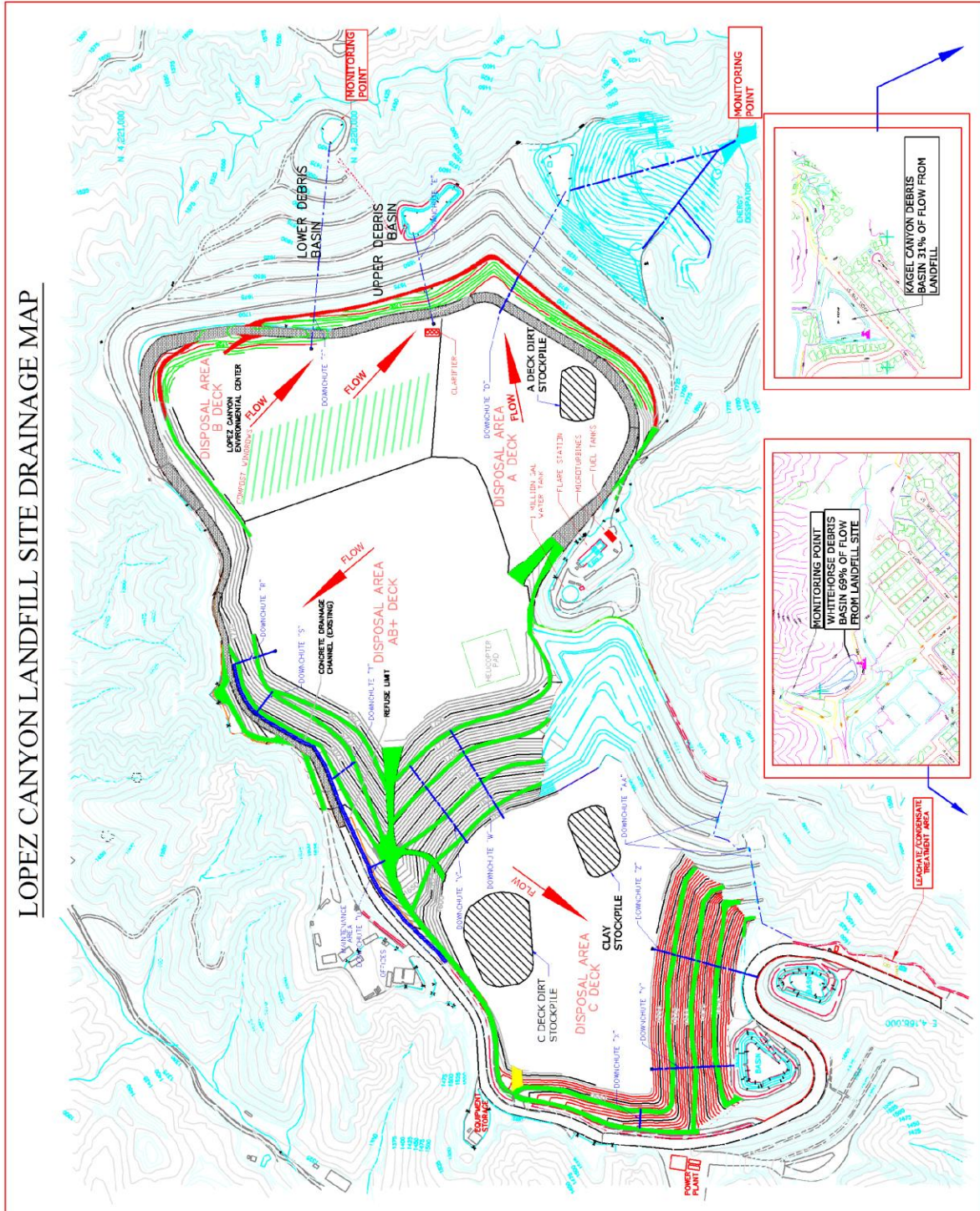


LOPEZ LANDFILL GROUNDWATER WELL LOCATIONS
AND FLOW DIRECTIONS





LOPEZ CANYON LANDFILL SITE DRAINAGE MAP



Appendix 2: Leachate Corrective Action Cost Estimate



Corrective Action Capital and Operation Cost Estimate

TOTAL PROJECT COST				
		\$/hr		
		\$ 120		
	Maintenance			
	Equipment	Operation	Total Annual Cost	
Year				
0	532,258	124,800	657,058	Capital Cost
1	5,000	31,200	36,200	Value represents the expected cost for a pump or generator replacement plus Miscellaneous parts
2	5,000	31,200	36,200	Labor is based on half time during the 1st year and one eighth (1/8) time for the remaining years
3	5,000	31,200	36,200	
4	5,000	31,200	36,200	The discount rate, salary and equipment cost increase rate are assumed equal and therefore off-set
5	5,000	31,200	36,200	
6	5,000	31,200	36,200	
7	5,000	31,200	36,200	
8	5,000	31,200	36,200	
9	5,000	31,200	36,200	
10	5,000	31,200	36,200	
11	10,000	31,200	41,200	Two equipment replacements plus miscellaneous parts
12	10,000	31,200	41,200	
13	10,000	31,200	41,200	
14	10,000	31,200	41,200	
15	10,000	31,200	41,200	
NPV		\$	1,225,058	

Capital	\$ 532,258
Operation	\$ 692,800



CAPITAL COST ESTIMATE

									2"	2"	1-1/2"	1-1/2"
						Pump	2" Pipe	1-1/2" pipe	MPTxPE	ELL	MPTxPE	ELL
Pumps	System	Well Depth	GPM	Pump	Motor	Power Cord	Total Cost					
1 SS10-22 (1 hp)	1	460	3-4	\$ 931	\$ 479	\$ 3,240	\$ 4,650	300	300	2	4	2
2 SS07-18 (3/4 hp)	2	365	3-4	\$ 725	\$ 422	\$ 3,240	\$ 4,387	900	900	2	4	2
3 QED AP4+	3	265	3-4				\$ 3,500	1500	1500	2	4	2
4 QED AP4+	4	168	3-4				\$ 3,500	2100	2100	2	4	2
5 QED AP4+	5	70	3-4				\$ 3,500	2700	2700	2	4	2
Quantities							5	7500	7500	10	20	10
Unit Cost								\$ 1.78	\$ 1.26	\$ 36.75	\$ 6.36	\$ 31.98
Total Cost							\$ 19,542	\$ 13,350	\$ 9,450	\$ 368	\$ 127	\$ 320
Sub Total							\$ 43,311					
Elect Gen							3000					
Wiring							5000					
Total Mat							\$ 51,311					
Well Install							189,600					
Total Mat							\$ 240,911					
Escalation							\$ 48,182.18					
Contingend							\$ 120,455.45					
Total Instal							\$ 409,549					

System Installation [excluding electrical]

Installation Labor		\$/Hr	Hours	\$/person
Technician-1		150	80	\$ 12,000
Technician-2		120	80	\$ 9,600
Technician-3		120	80	\$ 9,600
Technician-4		120	80	\$ 9,600
			Sub Total	\$ 40,800

3rd Party Mark-up and Overhead on Material 20%

3rd Party Mark-up and Overhead Cost \$ 81,910

3rd Party Labor Cost \$ 40,800

Material Cost \$ 409,549

Total Capital Cost \$ 532,258



CONSULTANT COSTS

Evaluation of the Monitoring and Reporting Program

90 Days

	\$/hr	hr	\$
Associate Engineer	173	64	11,121
Project Professional	149	321	47,893
CADD Designer	99	40	3,960
Senior Field Tech	76	80	6,080
Adm Assistant	73	32	2,346
Word Processor	67	40	2,680
Clerical Assistant	52	39	2,006
Laboratory Sub-Contractor	10,000	1	10,000
		Total	86,086

Preliminary Engineering Feasibility Study

180 Days

	\$/hr	hr	\$
Associate Engineer	173	129	22,243
Project Professional	149	643	95,786
CADD Designer	99	40	3,960
Senior Field Tech	76	120	9,120
Adm Assistant	73	64	4,693
Word Processor	67	40	2,680
Clerical Assistant	52	77	4,011
Laboratory Sub-Contractor	20,000	1	20,000
GW Well Installation	37,920	3	113,760
		Total	276,253

Appendix 3: Equipment Specifications