STANDARD OPERATING PROCEDURE

SAMPLE DOCUMENTATION AND TRACKING

SUNRISE MOUNTAIN LANDFILL CLARK COUNTY, NEVADA

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Standard Operating Procedure (SOP)

Introduction

This SOP has been developed in accordance with the United States Environmental Protection Agency (EPA) approved Sampling and Analysis Plan (SAP) and the approved Landfill Assessment Work Plan both dated February 29, 2000 for the current and on-going activities at the Sunrise Mountain Landfill in Las Vegas, Nevada. The purpose and scope of this SOP is to develop a standard for the documentation, labeling, Chain of Custody (COC), packaging, and storage of samples obtained from sampling events at the Sunrise Mountain Landfill. This SOP covers the Assessment of the Existing Final Cover Soils, Hydrogeological Exploratory Drilling, Lagoon Exploratory Drilling, Groundwater Sampling, Waste Sampling, and Landfill Gas Characterization. The standards set forth in this document are to be adhered to at all times and for all sampling events. All contractors operating on the Sunrise Mountain Landfill who must perform sampling will be required to fulfill all requirements of this SOP.

Assessment of the Existing Final Cover Soils

Procedure

The existing final cover soils will be assessed by using the test pit/trenching and shallow boring methods as discussed in subtask 3.4.3.3 of the Final Landfill Assessment Work Plan and Sections 1.5 and 1.6.2 of the SAP. Fourteen test pit/trenches will be excavated prior to drilling the shallow borings.

Test Pit/Trench

Test pit/trench numbers will be assigned by the Responsible Person (RP) and will be numbered sequentially starting at the next available number from previous test pit/trench activities. The test pit/trenches will be located by coordinates using the global positioning system (GPS). Coordinates will be recorded on the attached Test Pit/Trench Log.

The test pit/trenches will provide data on the interface between the cover and the waste on a larger scale than the shallow borings are capable of providing. Specifically, observations will be made of the following:

- Variation in depth to the cover/waste interface,
- The degree of trash embedded in the cover material,
- The construction practices used to place the cover,
- The identification of any oversized material (i.e., large stones), and
- Documentation shall include the above observations and the requirements in Section 1.5.3 of the SAP.

The test pit/trench will be logged on the attached Test Pit/Trench Log. Landfill gas monitoring will be conducted in accordance with Section 4.5.3 of the SAP and recorded on the attached Field Log for Landfill Gas Monitoring. The locations of the test pit/trenches will be distributed such that four pits will be excavated on the upper deck of the Top Deck Area, four on the side-slopes (sidewalls) of the Top Deck Area, four on the Lower Southern Flats Area, and two in the Eastern Perimeter Area. Two of the locations on the Top Deck Area will coincide with areas where cracking has been observed in the cover, as defined by the BLM's GIS coordinate data.

Shallow Boring

Undisturbed core archive samples representing the entire depth of the final cover soils will be collected through shallow boring and will be identified with a unique sampling number (this includes the location and borehole number, see below), coordinates from GPS unit, represented sample depth, date and time, sample collector (Refer to Section 1.6.2.2 of the SAP). Each one of the undisturbed core samples will be stored as prescribed below. The shallow boring will be logged on the attached Shallow Boring Log. Cover soil depths will be observed from the core sample collected and verified with a measurement from the borehole. Landfill gas monitoring will be conducted at each shallow boring in accordance with Section 4.5.3 of the SAP and recorded on the attached Field Log for Landfill Gas Monitoring.

Visual observation and logging will consist of the following:

- Identifying and marking the core with a unique sample number
- Date and time of core sample, sample collector
- Visual observation of soil,
- Percent recovery of the core,
- Type of soil,
- Color variation,
- Moisture content,
- Type of waste material encountered,
- Cover soil depths, measured from the core (represented sample depth),
- Cover soil depth, measured from the borehole,
- Survey coordinates from GPS unit, and
- All other documentation required in Section 1.6.2.2 of the SAP will be recorded on the attached Field Log for Geotechnical Sampling and Shallow Boring Observation and/or the Shallow Boring Log.

Samples for geotechnical testing will be taken at ten percent of the shallow boring locations. Special considerations are to be noted on the upper deck of the top deck area and western side of the of the lower southern flats areas as noted in Section 1.6.2.2 of the SAP. Waste samples will also be taken at prescribed locations as described in subtask 3.4.4.5 of the Landfill Assessment Work Plan (see Waste Sampling in this SOP). Shallow borings will be terminated at six inches into waste unless a landfill gas sample probe is to be installed in that location. All abandoned borings will be filled with drill

cuttings to within three feet of the ground surface. A three-foot continuous bentonite column will be placed in the upper three feet to seal the boring. The attached Soil Test Tracking Log will be completed each day to identify the sampling activities. The attached Soil Sample Request Record will be used as the COC for the geotechnical samples sent for laboratory testing. The RP or Assistant Responsible Person (ARP) will check these forms for accuracy and consistency and initial each form. After review and approval, the RP or the ARP will enter the geotechnical sample numbers on the Master Sampling Log, prior to shipping the samples to the laboratory.

A laboratory as specified in Section 7.2 of the SAP will perform the geotechnical tests identified below in Groups 1, 2, 3, and 4. The Sand Cone (ASTM D1556) and Soil Moisture Test (ASTM D2216) will be performed on-site by qualified personnel. Data during the performance of the geotechnical tests conducted on-site (sand cone and soil moisture) will be recorded on the attached Sand Cone/Soil Moisture Record. Final results from the sand cone and soil moisture tests will be recorded on the Soil Test Tracking Record. As the geotechnical testing results come back from the laboratory, the results will be recorded or attached as appropriate to the Soil Test Tracking Log. After the Soil Test Tracking Log is complete (all test data received for each soil sample listed on the Log), the completion date will be entered on the Master Sampling Log.

Multiple shallow borings within a 10-foot diameter of the original shallow boring at each location may have to be sampled to obtain adequate sample volume (weight) for geotechnical testing. Samples collected from these multiple shallow borings within the depths and diameter specified in subtask 3.4.3.3 of the Landfill Assessment Work Plan may be composited to obtain the required sample volume (weight) for geotechnical testing. The composited samples may be placed in 5-gallon plastic containers with lids. The geotechnical testing to be performed is as follows:

Group 1 Testing: Soil Classification, consists of 10% of the shallow borings:

- Classifications of Soil for Engineering Purposes (ASTM D2487)
- Particle Size Distribution (ASTM D422-63)
- Atterberg Limits (ASTM D4318)
- Calcium Carbonate Content (ASTM D4373-90)

A minimum of 33 lbs of soil should be obtained for Group 1 laboratory testing.

Group 2 Testing: Compaction, consists of 50% of the Group 1 Tests:

- Standard Proctor (ASTM D698)
- Modified Proctor (ASTM D1557)
- Sand Cone (ASTM D1556) (on-site test)
- Moisture Content (ASTM D2216) (on-site test)

A minimum of 97 lbs of soil should be obtained for Group 2 laboratory testing (includes adequate sample for Group 1 and 2 Testing).

Group 3 Testing: Hydraulic Properties, consists of 50% of the Group 2 Tests:

- Specific Gravity (ASTM D854)
- *Min./Max Density (ASTM D4253)*
- Saturated Hydraulic Conductivity (ASTM D2434)
- Saturated Hydraulic Conductivity (ASTM D5084)
- Moisture Retention Curve (Klute 1986)

A minimum of 172 lbs of soil should be obtained for Group 3 laboratory testing (includes adequate sample for Group 1, 2, 3, and 4 Testing, except Moisture Retention Curve). A minimum of 64 lbs of soil should be obtained for Moisture Retention Curve analysis.

Group 4 Testing: Soil Strength, consists of 50% of the Group 2 Tests:

- Consolidated Drained Triaxial Compression (ASTM D4767)

A minimum of 172 lbs of soil should be obtained for Group 4 laboratory testing (includes adequate sample for Group 1, 2, 3, and 4 Testing).

The weights listed above are based on samples being predominately fine-grained soils with minor aggregate content up to 1-inch in diameter. If the soil is gravelly and/or contains significant quantities of larger aggregate, then the sample collector should consult with the RP to possibly increase the weight of sample collected.

Duplicate samples will also be obtained and tested for the lesser of ten percent of each test grouping or one per day per Section 6.8 of the SAP.

In addition, each shallow boring will be observed by a qualified geologist or engineer and observations will be recorded on the attached Shallow Boring Log and/or Field Log for Geotechnical Sampling and Shallow Boring Observation. At a minimum these observations will include the following:

- Color, type and odor or smell of waste encountered
- Discolored soils
- Depth of soil cover
- Percent recovery of the core
- Type of soil in accordance with USCS
- Moisture conditions
- Oversize and type of rock encountered

Sampling device-cleaning procedures to be performed after each sampling event are outlined in Section 6.2.4 of the SAP.

Sample Identification

Geotechnical sampling for the locations provided in Drawing 4 of the Landfill Assessment Work Plan will be assigned by the RP a permanent location number that will be cross-referenced with the established coordinate system. The sample numbering system established for test pit/trench and shallow boring is as follows:

Test Pit/Trench Identification

Test Pit/Trench	Cross Referenced Location Number
TP-#	Location # assigned by RP

Test pit/trench numbers will be assigned by the Responsible Person (RP) and will be numbered sequentially starting at the next available number from previous test pit/trench activities.

Shallow Boring Identification

Shallow Boring	Cross-Referenced Location Number	Borehole(s)	
SB-	Location Number-(Assigned by RP)	A (X_1-X_2*)	Will always be the first borehole and the undisturbed core sample
		B (0-6)	The first six inches of subsequent drillings and may be a composite sample
		B	All cuttings below the six inch level to the soil/waste interface and may be a composite sample, if applicable
		C	All duplicate composite samples
		D	All waste samples
		E	All duplicate waste samples
		F	Rinseate samples

*X_1-X_2 is the length of the core sample (i.e., 0-4.3 (for example below) or if two cores are required to get through the cover, for instance a 10-foot depth of cover, then 0-5.5 and 5.5-10 would be used for the respective core samples, and so on for three cores, etc.).

For example, if shallow boring number 43 has a cover depth of 4.3 feet, has a 6-inch sample, and requires a geotechnical sample, the core (in clear plastic liner) would be marked SB-43-A (0-4.3), the 6-inch sample (saved in a plastic bag) would be marked SB-43- B (0-6), the geotechnical sample (5-gallon plastic container) would be marked SB-43-B, and the duplicate geotechnical sample (5-gallon plastic container) would be marked SB-43-C. If a resample needs to occur due to a poor recovery for a shallow boring at

location 43 for the undisturbed core sample then the associated sample number shall be: SB-43-AA. All re-sampled shallow borings will repeat the same shallow boring letter assignment until an acceptable sample is obtained as shown in the previous example. If a waste sample were taken from this shallow boring, it would have the designator, SB-43-D, a duplicate waste sample would be designated SB-43-E, and a rinseate sample would be designated SB-43-F (see Waste Sampling section of this SOP).

Area Composite Samples of Top 6-inch Sample

Shallow Boring	Area Cross-Referenced Location
SB-	A-Eastern Perimeter Area B-Eastern Side of the Lower Southern Flats Area C-Western Side of the Lower Southern Flats Area D-Upper Deck of the Top Deck Area E-Side-slopes of the Top Deck Area F-Construction Debris Area G-Septic Lagoon Area H-Dead Animal Area I-Asbestos Area K-Duplicate composite sample[1]

[1] Designator "J" not used as it represents the Western Burn Pit Area, no final cover to evaluate.

In all areas, except those areas in the upper deck of the Top Deck Area and the Western Side of the Southern Flats Area where the erosion layer is found to be deficient, the top 6-inches of each shallow boring sample will be separated and saved in a plastic bag as identified above in the Shallow Boring Identification. Portions of these individual samples from similar areas (the upper deck, the upper deck slopes, the Eastern Perimeter Area, etc.) will be composited into a 5-gallon plastic container to obtain an area composite sample of the top 6-inches. The composite sample from each area will be analyzed for particle size distribution (ASTM D422-63) and calcium carbonate (ASTM D4373-90) as specified in the Section 3.4.3.3 of the Final Landfill Assessment Work Plan. The composite top 6-inch sample will be representative of the "vegetative or erosion layer" of the final cover system in each area. For example, the composite top 6-inch sample from the upper deck of the Top Deck Area would be identified as SB-D. If a duplicate sample were taken from this area, it would be identified as SB-DK.

Duplicate samples during the Shallow Boring activities are only required when a sample is identified for geotechnical, calcium carbonate analysis, or analytical testing (waste sample). Rinseate samples are only required when a waste sample is obtained during the Shallow Boring activities. Core samples do not require a duplicate, but the Managing Geologist will decide when they are complete based on percent recovery of the core.

The geotechnical sample number will be entered into the Soil Test Tracking Log and the Soil Sample Request Record will be completed. The RP or ARP will check these forms for accuracy and consistency and initial each form. After review and approval, the RP or

ARP will enter the geotechnical sample number on the Master Sampling Log, prior to shipping the samples to the laboratory. The laboratory as specified in Section 7.2 of the SAP will archive in the sample container the amount of sample remaining after the geotechnical testing is completed

The core sample will be placed in a core sample box, labeled as discussed below, and the core sample will be recorded on the attached Core Storage Record. The 6-inch sample (saved in a plastic bag) will be placed in the plastic bag in a core sample box, labeled as discussed below, and the 6-inch sample will be recorded on the attached Core Storage Record. All core storage boxes will be stored on-site in provided storage units.

Sample labels may be written on the core storage box or sample container or may consist of gummed paper or tags. The sample label shall contain the following information written with a permanent ink marker:

- Sample number and identification
- Name of collector
- Date and time of collection
- Place of collection
- Type of Sample
- Analysis to be performed
- Preservatives (if applicable)

Sample Handling

Sampling equipment, container requirements, storage, and sample transportation are all outlined in Section 3.3 of the SAP. Also, refer to Section 6.7 of the SAP for shipping procedures. Sample handling requirements for analytical samples and gas probe samples are discussed in their appropriate sections of this SOP.

Hydrogeological Exploratory Drilling

Ten exploratory borehole locations are identified in subtask 3.4.5.4 of the Final Landfill Assessment Work Plan to obtain data for the geologic and hydrogeologic characterization of the Site. Ten-inch diameter conductor casings have been installed to a depth of 20 to 40 feet beneath ground surface for boreholes No. 1 through No. 6 (Refer to Drawing 5 in the Work Plan). Additional well locations (four, for a total of ten) will be required in addition to these initial exploratory wells following initial characterization. Groundwater samples will be obtained from these wells.

Procedure

A qualified, experienced field geologist will monitor all boreholes and drill-operating procedures as outlined in subtask 3.4.5.5 of the Landfill Assessment Work Plan. Each

borehole will be recorded on the attached Geohydro Boring Log. The minimum required field log observations are as follows:

- Alluvial sediment log (USCS) per ASTM D2488-84

Bedrock core:

- Percent recovery
- Rock quality description (RQD)
- Fracture frequency
- Rock strength
- Rock type
- Mineralogy
- Degree of weathering and cementation
- Bedding features
- Moisture content
- Munsell colors to identify changes in geologic materials/conditions

All samples will be screened on-site for VOC contamination and recorded on the Geohydro Boring Log.

All drill rig and downhole equipment shall be steam cleaned prior to each boring as outlined in Section 6.2 of the SAP.

Landfill gas monitoring will be conducted at each exploratory boring in accordance with Section 4.5.3 of the SAP and recorded on the attached Field Log for Landfill Gas Monitoring.

Continuous Boring (Section 5.2 of the SAP)

1. 8-inch pilot boreholes will be advanced to bedrock (from 20 to 200 feet) below surface to the depth approximated with the CSAMT survey prior to drilling at each of the ten locations. Temporary conductor casing will be used to stabilize near surface materials.
2. A monitoring well will be completed at the bedrock contact and if significant water (yield 2-3 gallons per hour) is not established after a 24 hour period then a new boring will be drilled, cased and grouted to 5 feet below the bedrock contact. Subsequent drilling will occur until the upper most aquifer is located.
3. If a perched water zone has been identified above the uppermost aquifer, the borehole will be advanced to the base of the perched zone and left open for approximately seven days. If the perched zone yields approximately 2-3 gallons per hour at monitoring well will be established at this location.
4. Aquitard's located below the perched zones will not be penetrated and the next pilot boring will be located 100 feet down gradient on a CSAMT line. Provided that no other perched zones are encountered, the base of the second boring will be

advanced to the uppermost aquifer. If another perched zone is encountered then Step 3 is repeated[1].

Refusals will be recorded when drilling and sampling through alluvial sediment (utilizing the split spoon), if rock or highly cemented formations are encountered. If poor recovery is noted then sampling approaches will be modified to suit the conditions (i.e. conventional coring techniques).

Geophysical tools (prescribed in Section 5.2.3.3 of the SAP) will be utilized to determine the basic physical characteristics of the alluvium and bedrock. The geophysical tools will be used in accordance with the manufacturer's recommendations and a record of the following will be logged (based on the lithologic sample logs and downhole conditions):

- Degree of moisture
- Clay content
- Lithology
- Bedding thickness
- Diameter of the borehole annulus

A 10 to a maximum 14-inch reaming of the 8-inch pilot hole will be initiated after the geophysical logging is completed for installation of the well.

Sample Identification

Hydrogeological boring locations are indicated in Drawing 5 of the Landfill Assessment Work Plan. Core identification labeling has been established for the hydrogeologic core archive and is as follows:

Geohydro Borings

Hydrogeological Boring	Location Number	Borehole & Core Identifier[1]	
GH-	Location Number- (Location 1 to 6 will be based on the existing conductor casing numbers, all others to be assigned by RP)	A (X_1-X_2)[2]	First boring
		B (X_1-X_2) C (X_1-X_2)	Second and third borings if necessary
		D (X_1-X_2)	Fourth boring, if necessary, after consultation with USEPA

[1] If analytical sample is required, the sample ID would indicate the location number, borehole designator, and depth of sample (i.e.,GH-6A-4.5). Depth is top of sample.
[2] X_1-X_2 is the length of the core sample

[1] If on the third boring another perched aquifer is located then the USEPA will be contacted to determine a course of action. Move to next location.

For example, GH-5A (10-12) represents the core sample from the first boring near existing conductor casing 5, from 10 to 12 feet. There are no duplicate sample requirements for the Geohydro Borings.

The core sample will be placed in a core sample box, labeled as discussed below, and the core sample will be recorded on the attached Core Storage Record. All core storage boxes will be stored on-site in provided storage units.

Sample labels may be written on the core storage box or may consist of gummed paper or tags. Sample labels for the core boxes used to store the continuous core samples (2-foot intervals) shall contain the following information written with a permanent ink marker:

- Sample number and identification
- Name of collector
- Date and time of collection
- Type of Sampler used and percent recovery
- Reading from VOC field screening

Sample Handling

Sampling equipment, container requirements, and storage are all outlined in Section 3.3 of the SAP. Also, refer to Section 6.7 of the SAP for shipping procedures.

Lagoon Exploratory Drilling

Four lagoons which BLM identified in their CCJM Reconnaissance Investigation Report of March 18, 1998 will be preliminarily characterized to determine the vertical extent of contamination.

Procedure

A qualified, experienced field geologist will monitor all boreholes and drill-operating procedures as outlined in subtask 3.4.3.4.2 of the Landfill Assessment Work Plan. Each borehole will be recorded on the attached Lagoon Boring Log. All samples will be screened on-site for VOC contamination and recorded on the attached Lagoon Boring Log.

Within each lagoon, two 8-inch boreholes will be drilled. The depths will be based on the geophysical results that will show the depth to the Tertiary contact. If the geophysical survey results indicate that the Tertiary contact is located at a depth of less than 25 feet below ground surface, the boreholes will be completed to the Tertiary contact; otherwise, the boreholes will be completed to a minimum depth of 20 feet below ground surface.

The boreholes will be continuously sampled through the alluvial sediment using a split spoon sampler. The core from each 2-foot split spoon sampling interval will be logged

by the supervising geologist and screened on-site for VOC contamination. The following will be recorded on the Lagoon Boring Log:

- Results of the VOC field screening,
- Description of the sediment lithologies,
- Thickness,
- Percentage of recovered core, and
- Any observed staining.

The core will be stored in core boxes as discussed below for future reference.

A sample will be selected from every other 2-foot split spoon sampling interval for laboratory testing (one sample per 4-foot interval). See additional information in Waste Sampling of this SOP. If the laboratory test results indicate contamination is present in the last 4-foot interval of the boring, an additional 10-feet of drilling and sampling will be required following the same testing procedures. If contamination is found in the last 4-feet of this boring, the process will be repeated until a depth is reached whereby the laboratory testing results indicate that the sediment is clean or until Tertiary contact is reached. Logging, VOC screening, core sampling and storage as discussed above will be performed on any additional drilling.

Sample Identification

Lagoon boring locations are described in subtask 3.4.3.4.2 of the Landfill Assessment Work Plan. Core identification and waste sampling identification has been established for the Lagoon Borings and is as follows:

Lagoon Boring Identification

Lagoon Boring	Cross Referenced Location Number	Boring Identifier[1]	Sample Type[2]	Depth
LB-	Location # (NE Trespass = 1 NE Canyon = 2 East Burn Pit = 3 West Burn Pit = 4)	A - First Boring B - Second Boring (always used)		(#-#)
			C - Duplicate	
			D - Analytical Sample	
			E - Rinseate	

[1] If additional borings are required due to auger refusal, etc., the Boring Identifier will be followed by a sequential number (i.e., A1, A2, or B1, B2, etc.)
[2] Not used for core identification.

For example, the designation LB-3-A (6-8) would represent the depth of 6 to 8 feet in the first boring in the East Burn Pit (core sample), LB-3-AD (6-8) would represent the

analytical sample from the same, LB-3-AC (6-8) would represent the duplicate sample for analytical testing from the same, and LB-3-AE would represent the rinseate sample for analytical testing from the same (see Waste Sampling section of this SOP). Duplicate sampling for analytical testing and rinseate samples will be done the lesser of once every ten samples or once per day. Duplicate samples and rinseate samples during the Lagoon Boring activities are only required when a sample is identified for analytical testing. Core samples do not require a duplicate.

The core sample will be placed in a core sample box, labeled as discussed below, and the core sample will be recorded on the attached Core Storage Record. All core storage boxes will be stored on-site in provided storage units.

Sample labels may be written on the core storage box or may consist of gummed paper or tags. Sample labels for the core boxes used to store the continuous core samples (2-foot intervals) shall contain the following information written with a permanent ink marker:

- Sample number and identification
- Name of collector
- Date and time of collection
- Type of Sampler used and percent recovery
- Reading from VOC field screening

See the Waste Sampling section of this SOP for document tracking and labeling requirements for analytical testing.

Sample Handling

Sampling equipment, container requirements, storage, and sample transportation are all outlined in Section 3.3 of the SAP. Also, refer to Section 6.7 of the SAP for shipping procedures. Sample handling requirements for analytical samples are discussed in the Waste Sampling section of this SOP.

Groundwater Sampling

Groundwater sampling requirements are specified in subtask 3.4.5.5.5 of the Landfill Assessment Work Plan.

Procedure

Samples will be collected for laboratory analysis utilizing either a disposable bailer or a decontaminated bladder pump. Samples will be collected in the following order; VOC's, metals, cations and anions general minerals. All bottles for VOC analysis will be filled with zero headspace. Samples will be collected in laboratory-prepared, pre-cleaned and certified bottles, containing appropriate preservatives for the specified analysis, following

the procedures outlined in EPA SW-846. Refer to the Landfill Assessment Work Plan for bottle requirements and sample preservatives.

Sample Identification

Each sample will be designated with a unique number following the table below.

Groundwater Sampling Identification

Sample Location Name	Number	Unique Sample ID#	Boring Identifier	Sample Type[1]
Monitor Well (MW)	1	MW-31	A-First Boring	
Monitor Well (MW)	2	MW-32		
Monitor Well (MW)	3	MW-33	B-Second Boring	
Monitor Well (MW)	4	MW-34		
Monitor Well (MW)	5	MW-35	C-Third Boring	
Monitor Well (MW)	6	MW-36		
Monitor Well (MW)	7	MW-37	D-Fourth Boring	
Monitor Well (MW)	8	MW-38		
Monitor Well (MW)	9	MW-39		E-Duplicates
Monitor Well (MW)	10	MW-40	F-Field Blank	
Monitor Well (MW)	223	MW 253	G-Trip Blank	
Monitor Well (MW)	224	MW 254	H-Rinseate	

[1] Only used for duplicate sample

Taking the location designation number and adding 30 to the numerical value will determine subsequent and or additional sampling locations unique numbers. Each additional sample event will be indicated by adding the number of the sampling round ahead of the unique number, for example, event two for the second boring at the existing conductor casing location 1 would be MW-231-B. If the duplicate sample were taken from this well, the designator would be MW-231-BE. All field blanks, trip blanks, and rinseate samples will be designated with MW-2254-F, G, or H as appropriate for the second sampling round. Refer to Section 6.8 of the SAP for requirements on duplicate sampling, field blanks, trip blanks, and rinseate samples. This unique numbering system will be utilized for sample tracking on all samples that are sent offsite for analysis.

The groundwater sample number will be entered into the Groundwater Sample Report Form and the Chain of Custody will be completed. The RP or ARP will check these forms for accuracy and consistency and initial each form. After review and approval, the RP or ARP will enter the groundwater sample number on the Master Sampling Log, prior to shipping the samples to the laboratory. The laboratory for analyzing groundwater samples is specified in Section 7.4 of the SAP.

As the groundwater testing results come back from the laboratory, the results will be attached to the appropriate Groundwater Sample Report Form. After all the sample results are received for each sample on the respective Groundwater Sample Report Form, the completion date will be entered on the Master Sampling Log

All samples will be labeled using laboratory provided labels with the following information at a minimum:

- Sample number and identification

- Name of collector
- Date and time of collection
- Place of collection
- Type of Sample
- Analysis to be performed
- Preservatives (if applicable)

Groundwater Sampling Report Form

A groundwater sampling report form will be completed for each well that is sampled. This form will include the following information:

- Date and time of sampling
- Site name and project number
- Name of sampler
- Well number
- Total depth of well
- Depth to groundwater
- Purge volume calculation
- PH
- Conductivity
- Temperature
- Purge rate
- Purge start/stop time
- Purge equipment
- Type of sampling equipment
- Analysis required
- Number and size of sample containers
- Sample attributes
- Unique sample number
- Actual sample number
- Duplicate sample information

Sample Handling

Sampling equipment, container requirements, chain of custody procedures, preservation and storage, and sample transportation are all outlined in Section 3.3 of the SAP. Also, refer to Section 6.7 of the SAP for shipping procedures.

Potable Water Sampling

A water sample will be collected from the initial source of potable water used for decontamination of sampling devices. The analysis required is the same as required for groundwater samples. If the source changes, another sample will be obtained.

Sample Identification

Each sample will be designated with a unique number following the table below.

Potable Water Sample Identification

Potable Water	Source Number
PWS-#	Source # assigned by RP

Potable water source numbers will be assigned by the Responsible Person (RP) and will be numbered sequentially starting at the next available number from the previous test.

The potable water source sample number will be entered into the daily Field Log kept by the RP and the Chain of Custody will be completed. The RP or ARP will check these forms for accuracy and consistency and initial each form. After review and approval, the RP or ARP will enter the potable water source sample number on the Master Sampling Log, prior to shipping the samples to the laboratory. The laboratory for analyzing potable water source samples is specified in Section 7.4 of the SAP.

As the potable water source sample results come back from the laboratory, the results will be attached to a copy of the daily Field Log. After all the sample results are received for each sample on the respective daily Field Log, the completion date will be entered on the Master Sampling Log.

Sample labeling and handling requirements for potable water source samples will be the same as specified herein for groundwater samples.

Waste Sampling

Procedure

Waste samples will be collected with the Geoprobe equipment as described in Section 1.6.2.3 of the SAP. After the interface between the final cover soils and waste has been found using the Geoprobe method (the shallow boring should be about 6 inches into the waste), a split spoon sampler equipped with brass sleeves will be driven into the waste mass. The brass sleeve will be removed from the split spoon sampler, capped, sealed, labeled, and placed in a cooler as specified in the SAP. The waste samples collected will be characterized by analyzing the samples for all the parameters as specified in Section 1.6.2.3 of the SAP.

The waste samples will be collected at the same locations that are designated to have a landfill gas sampling probe installed. An additional two shallow borings within each area specified below will be taken for the purpose of obtaining a waste sample (no landfill gas probe installed). Therefore, there will be a total of seven waste samples collected from the following areas:

- Area A - Eastern Perimeter Area
- Area B - Eastern side of the Lower Southern Flats Area
- Area C - Western side of the Lower Southern Flats Area
- Area D - Upper deck of the Top Deck Area
- Area E - Side-slopes of the Top Deck Area

For Lagoon Borings, a sample will be selected from every other 2-foot split spoon sampling interval for laboratory testing (one sample per 4-foot interval). All samples will be selected from the finer-grained sediment intervals, and if applicable, from intervals where VOCs have been detected and/or staining is present. All selected samples will be laboratory tested for the analytical parameters as specified in Section 1.6.2.3 of the SAP.

Sample Identification

The sample identification system is presented in the Assessment of the Existing Final Cover Soils in this SOP for all waste samples collected from shallow borings. The sample identification system is presented in the Lagoon Exploratory Drilling section of this SOP for all waste samples collected from the Lagoon Borings. Duplicate sampling and rinseate sampling will be done the lesser of every ten samples or once per day.

Duplicate samples during the Shallow Boring activities are only required when a sample is identified for geotechnical, calcium carbonate analysis, or analytical testing (waste sample). Rinseate samples are only required when a waste sample is obtained during the Shallow Boring activities. Core samples do not require a duplicate, but the Managing Geologist will decide when they are complete based on percent recovery of the core.

Duplicate samples and rinseate samples during the Lagoon Boring activities are only required when a sample is identified for analytical testing. Core samples do not require a duplicate.

The unique number from the respective sample identification systems referenced above will be utilized for sample tracking on all samples that are sent to a laboratory for analysis. For the shallow boring waste samples, the waste sample number will be entered into the Field Log for Geotechnical Sampling and Shallow Boring Observation and the Chain of Custody will be completed. For the Lagoon Boring waste samples, the waste sample number will be entered into the Lagoon Boring Log and the Chain of Custody will be completed. The two waste sample types require separate Chain of Custodies. The RP or ARP will check these forms for accuracy and consistency and initial each form. After review and approval, the RP or ARP will enter the waste sample number on

the Master Sampling Log, prior to shipping the samples to the laboratory. The laboratory for chemically analyzing soil and waste is specified in Section 7.1 of the SAP.

As the waste sample testing results come back from the laboratory, the results will be attached to the appropriate Field Log for Geotechnical Sampling and Shallow Boring Observation or the Lagoon Boring Log. After all the sample results are received for each sample on the respective Field Log for Geotechnical Sampling and Shallow Boring Observation or Lagoon Boring Log, the completion date will be entered on the Master Sampling Log

Labels (gummed paper or tags) shall contain the following information:

- Sample number and identification
- Name of collector
- Date and time of collection
- Place of collection
- Type of Sample
- Analysis to be performed
- Preservatives (if applicable)

Sample Handling

Sampling equipment, container requirements, chain of custody procedures, preservation, storage, and sample transportation are all outlined in Section 3.3 of the SAP. Also, refer to Section 6.7 of the SAP for shipping procedures.

Landfill Gas Characterization

Procedure

The purpose of this subtask is to characterize the landfill gas. This characterization will consist of obtaining landfill gas samples from landfill gas sampling probes installed in accordance with methods described in Section 4.6.1 of the SAP. The landfill gas probes will be installed concurrently with the work being performed for the shallow borings with subtask 3.4.3.3 of the Landfill Assessment Work Plan. Landfill gas sampling probes will be installed in groups of five spaced within an area as follows:

- Area A - Eastern Perimeter Area
- Area B - Eastern side of the Lower Southern Flats Area
- Area C - Western side of the Lower Southern Flats Area
- Area D - Upper deck of the Top Deck Area
- Area E - Side-slopes of the Top Deck Area

Sample Identification

Landfill gas characterization samples are specified in subtask 3.4.4.5 of the Landfill Assessment Work Plan. Sample identifiers are as follows:

Landfill Gas Sample Identification

Gas Sampling Probe	Sample Area
GS-	A
	B
	C
	D
	E

For example the gas characterization sample from the upper deck of the Top Deck Area would have the sample identification, GS-D. There are no duplicate samples required for Landfill Gas Characterization samples.

For the gas characterization samples, the waste sample number will be entered into the Field Log for Landfill Gas Monitoring and the Chain of Custody will be completed. The RP or ARP will check these forms for accuracy and consistency and initial each form. After review and approval, the RP or ARP will enter the waste sample number on the Master Sampling Log, prior to shipping the samples to the laboratory. The laboratory for analyzing landfill gas characterization samples is specified in Section 7.3 of the SAP.

As the landfill gas characterization testing results come back from the laboratory, the results will be attached to the appropriate Field Log for Landfill Gas Monitoring. After all the sample results are received for each sample on the respective Field Log for Landfill Gas Monitoring, the completion date will be entered on the Master Sampling Log.

Additional areas may be added for installation of the landfill gas sampling probes. Gas monitoring results performed under subtask 3.4.4.4 of the shallow borings will be used as the decision criteria for adding additional areas. If more than 25-percent of the shallow borings in an area exceed the 1.25-percent level, a group of five landfill gas probes will be installed in that area. The other areas that would be considered are as follows:

- Area F - Construction Debris Area
- Area G - Septic Lagoon Area
- Area H - Dead Animal Area
- Area I - Asbestos Area
- Area J - Western Burn Pits

Labels (gummed paper or tags) shall contain the following information:

- Sample number and identification
- Name of collector
- Date and time of collection

- Place of collection
- Type of Sample
- Analysis to be performed
- Preservatives (if applicable)

Gas samples will be collected using the procedures in Section 4.6.1 of the SAP.

Sample Handling

Sampling equipment, container requirements, chain of custody procedures, preservation and storage, and sample transportation are all outlined in Section 4.6 of the SAP. Also, refer to Section 6.7 of the SAP for shipping procedures.

Field Quality Assurance Samples

For the purpose of this SOP field QA samples shall include: field blanks, trip blanks, duplicate samples, and rinseate samples.

For groundwater sampling, one field blank shall be collected per sampling round. Field blanks will be obtained by using distilled water that will be transferred into appropriate containers in the field. Field blanks will be handled, labeled, documented and transported in the same manner as the other groundwater samples. The unique sample number for field blanks will be as specified in the Groundwater Sampling section of this SOP.

For groundwater sampling, one set of trip blanks will accompany and will be analyzed for each round of VOC analysis. Trip blanks will consist of VOC sampling containers and should be labeled as specified in the Groundwater Sampling section of this SOP.

For at least one out of every ten samples or once per day, whichever is less; a duplicate sample will be collected. Samples will be obtained, handled, documented and transported in the same manner as the other like samples. The unique sample number for duplicate samples will be as discussed in the appropriate section of this SOP.

For groundwater sampling, a duplicate sample will be obtained during each day of sampling groundwater. The duplicate will be obtained at one of the downgradient groundwater sampling locations to be selected in the field at the time of sampling.

For soil and waste samples, duplicate samples will be collected using the same equipment and type of containers as is used for original sample collection, utilizing the standard procedures already provided herein. Care will be taken to keep the composition of both the original and duplicate samples as similar as possible (i.e., from the same stratigraphic layer, moisture content, appearance, etc.). The duplicate samples will be identified as specified herein and will be submitted to the laboratory to be analyzed for the same parameters and by the same methods, as are the original samples.

If a disposable bailer is used for groundwater sampling, a rinseate sample (consisting of deionized water poured into a new (clean) sample bailer and then into sample containers, will be collected during each daily sampling event and analyzed for VOC's. If a bladder pump is used, a rinseate sample will be collected as specified in Section 5.6.2 of the SAP, during each daily sampling event and analyzed for VOC's. The unique sample number for a rinseate sample will be as discussed in the Groundwater Sampling section of this SOP.

For waste samples including Shallow Boring and Lagoon Boring activities, a rinseate sample (consisting of deionized or distilled water poured over the sampling tool after it has undergone decontamination and been allowed to dry) will be collected in a clean sample jar. A rinseate sample will be collected during each daily sampling event from each type of sampling event (i.e., Lagoon Boring or waste sample from Shallow Boring) and analyzed for VOC's at a minimum. The unique sample number for a rinseate sample will be as discussed in the appropriate section of this SOP.

In addition, at each sample location, one collocated (duplicate) sample may be collected, packaged, labeled, and archived on-site until testing is satisfactorily completed and the Engineering Manager or designee releases the sample(s) for disposal. This shall be done at the option of the Engineering Manager.

Chain of Custody

Sample numbers on all correspondence and documentation including COC's will be consistent with the unique numbering system utilized on the individual sample containers.

COC's must be initialed by the RP prior to departure from the job site. One copy of the COC along with the sample report will be maintained by the RP on the jobsite. A sample is considered within custody if it meets the following criteria:

- If the samples are in a person's actual possession
- In view after being in physical possession
- Sealed so that no one can tamper with the samples after being in physical possession
- In a controlled area with authorized personnel only
- In transit with an approved carrier

The COC form should, at a minimum include:

- Project name and number
- Unique sample number
- Sample location
- Sample matrix
- Sampling date and time

- Preservative
- Analysis method
- Total number of containers
- RP initials
- Signatures and date of the sampler and recipient of the samples

Any errors on the COC should be struck through with a single line and initialed by the person making the correction

Sample Shipment

Samples will be delivered to the laboratory within the specified holding times for the required analysis as outlined in the SAP. Samples will be accompanied by the COC and released to a qualified individual at the laboratory. Samples will be delivered to the laboratory by field sampling personnel or by laboratory personnel only.

Samples will be packaged according to the following guidelines:

- Labeled and sealed samples will be placed in the cooler with ice or equivalent
- A completed COC will be placed inside of the cooler
- Cooler will be closed and latched

Custody seals will be placed on the cooler lid to prevent tampering.

SCS ENGINEERS *Field Log For Landfill Gas Monitoring*

Site Info Project No.

Inspector:	Date:	Temp:
Area Identifier:		
Location No.:	Coordinates: N	E

BORE HOLE GAS MONITORING

Time	Location/Bore No.	CH_4	H_2S	Time	Location/Bore No.	CH_4	H_2S

SECOND LEVEL PROCEDURE FOR HYDROLOGIC BORINGS AND WELLS

Time	Location/Bore No.	CH_4	H_2S	Time	Location/Bore No.	CH_4	H_2S

LANDFILL GAS CHARACTERIZATION SAMPLE

Area Identifier:	Area Identifier:	Area Identifier:	Area Identifier:	Area Identifier:
Sample No.	Sample No.	Sample No.	Sample No.	Sample No.
Probe No.	Probe No.	Probe No.	Probe No.	Probe No.

Inspector's Signature: _____

SCS ENGINEERS *Field Log For Geotechnical Sampling and Shallow Boring Observation*

Site Info Project No.

Inspector:	Date:	Temp:
Area Identifier:		
Location No.:	Coordinates: N	E

BORING OBSERVATIONS (use separate sheet for each shallow boring)

Time:	Bore No.:	Bore Coordinates: N		E
Bore Method:		Sampling Device:		
Present at Location:				
Undisturbed Core Sample:	Yes / No	Total Depth:	Recovery:	% (Less than ___% , resample)

SOIL:

Soil Type (USCS):	Cover thickness (actual):
Soil Discoloration:	Moisture Condition:
Type & Oversize Rock Encountered:	

WASTE:

Waste Type:	Color:	Odor:
Waste Sample: Yes / No Constituents	Sample No.:	Analysis: TCLP

OTHER:

Gas Probe Installed? Yes / No	Three Foot Continuous Bentonite Column Placed? Yes / No

GEOTECHNICAL ANALYSIS

Sample No.	Analysis to be Performed	Laboratory

COMMENTS:

Note 1: On the upper deck of top deck and the western side of the lower southern flats area –Visually compare the top six inches of erosion layer soil to identify if it is different with the remainder of the sample. Comment on deficiencies. Any areas found deficient, use ground surface to soil waste interface for geotechnical testing.

Note 2: Any area where the top six inches of erosion layer (except for areas noted above) is less than six inches of soil, the top six inches of soil is to be separated and saved in a plastic bag with the appropriate label and archived for later use. Use the remaining depth (six inches to soil waste interface) for geotechnical testing.

Note 3: Multiple borings at test locations shall not exceed a 10 foot sampling diameter

Inspector's Signature: _____

SCS ENGINEERS *Sand Cone/Moisture Content Test Record*

Project: _____ Soil Type: _____

Project No._____ Nuclear Gauge Test No.: _____

Date:_____ Proctor Value (D):_____ lbs/ft^3

Tested by: _____ ☐Standard ASTM D698 ☐Mod. ASTM D1557

Location No.:_____ Optimum Moisture Content: _____

Sample				Volume			
1	Weight of Sample:	g	lbs	5	Weight of Jar and Sand:	g	lbs
2	Weight of Container:	g	lbs	6	Weight of Jar and Sand After Test Completion:	g	lbs
1-2	Weight of Sample (a): lbs	g		7	Weight of Sand in Funnel: (Constant for any given sand)	g	lbs
	Moisture			5-6-7	Weight of Sand in Hole (d):	g	lbs
3	Wet Weight of Sample:	g	lbs		Weight per Cubic Foot Sand (e):	g	lbs
4	Dry Weight of Sample (b):	g	lbs		Sand Type:		
3-4	Weight of Water (c):	g	lbs				

Calculation	Sand Cone Calculation	Nuclear Density Meter Values
Moisture Content = c / b x 100%	(f) _____ %	_____ %
Volume= d / e	(g) _____ ft^3	_____ %
Wet Density = a / g	(h) _____ ft^3	_____ %
Dry Density = h / (1 + (f / 100))	(i) _____ ft^3	_____ %
Compaction = i / d x 100	_____ %	_____ %

Reviewed by:	Pass/Fail:	Date:

Inspector's Signature: _____

SCS ENGINEERS

Soil Test Tracking Log

Project Name/Client: _____

Project Location: _____

Project Number: _____

		Test Results*				
Sample No.						
Bore No.						
Coordinates	N					
	E					
Laboratory Used						
Date Sampled						Lab / Comment
Date Delivered						
Class. Of Soil for Eng. Purposes		☐	☐	☐	☐	
ASTM D2487						
Particle Size Distribution		☐	☐	☐	☐	
ASTM D422-63						
Atterberg Limits	PI	☐	☐	☐	☐	
ASTM D4318	PL					
	LL					
Calcium Carb. Content		☐	☐	☐	☐	
ASTM D4373-90						
Standard Proctor		☐	☐	☐	☐	
ASTM D698						
Sand Cone		☐	☐	☐	☐	
ASTM D 1556						
Modified Proctor		☐	☐	☐	☐	
ASTM D1557						
Moisture Content		☐	☐	☐	☐	
ASTM D2216						
Specific Gravity		☐	☐	☐	☐	
ASTM D854						
Min./Max Density		☐	☐	☐	☐	
ASTM D4253						
Saturated Hydraulic Conductivity		☐	☐	☐	☐	
ASTM D2434						
Saturated Hydraulic Conductivity		☐	☐	☐	☐	
ASTM D5084						
Moisture Retention Curve		☐	☐	☐	☐	
Klute 1986						
Consol. Drained Triaxial Compress.		☐	☐	☐	☐	
ASTM D4767						

*Check Box to Indicate Test Requested

SCS ENGINEERS

Soil Sample Request Record

Project Name/Client _____ Project No _____ Date Sent _____

Project Location _____ Shipped Via _____ Date Received _____

Sampled By _____ Lab Contact _____ Shipping Bill No _____

		Analysis Required														
Sample No	Description	Class Of Soil for Eng Purposes ASTM D2487	Particle Size Distribution* ASTM D422-63	Atterberg Limits ASTM D4318	Calcium Carb Content ASTM D4373-90	Standard Proctor ASTM D698	Modified Proctor ASTM D1557	Specific Gravity ASTM D854	Min /Max Density ASTM D4253	Saturated Hydraulic Conductivity ASTM D2434	Saturated Hydraulic Conductivity ASTM D5084	Moisture Retention Curve Klute 1986	Consol Drained Triaxial Compression ASTM D4767		Special Instructions

Fax Results to _____ Attn _____ Other Instructions

Hard Copy Results to. _____

E-mail Results to _____

Need Results by _____

*Sample to be re-mixed and used for testing Calcuim Carbonate Conten