Sunnyside Cogeneration Associates

P.O. Box 10, East Carbon, Utah 84520 • (435) 888-4476 • Fax (435) 888-2538

April 5, 2013

Mr. Keith Eagan
Division of Water Quality
195 North 1950 West
Salt Lake City, Utah 84116

Re: Sunnyside Cogeneration Associates (SCA)
Permit Modification, SCA #2 Ash landfill
Ground Water Discharge Permit No. UGW070002

Dear Mr. Eagan:

Enclosed for your review is a copy of the permit modification report, which supports SCA's request for approval to construct and operate the SCA #2 Ash Landfill.

This application is comprised of the following documents:

* Amended Red-lined Ground Water Permit #UGW070002
* Engineering Report
* MW-8 Water Monitoring Data
* Hydrologic Characterization
* Geotechnical Engineering Report
* SCA #1 Ash Landfill Leachate Report(HELP)
* Application for a Dam, Form R-69
* Permit Drawings

Presently SCA is placing ash in the SCA #1 Ash Landfill Phase III, which was permitted on September 18, 1997. It is anticipated that the Phase III disposal area will be completed in 2015. SCA would like to begin construction of the proposed SCA #2 Ash landfill in 2013, and begin utilizing the landfill for ash placement in 2015.

Should you have any questions, comments or concerns regarding the contents of this permit modification report please contact Rusty Netz at(435)888-4476.

Thank You,

Richard Carter
Agent for
Sunnyside Cogeneration Associates

c.c. Rusty Netz
Plant File

STATEMENT OF BASIS

SUNNYSIDE COGENERATION ASSOCIATES
~~COAL~~ ASH LANDFILLS

Renewal of Ground Water Discharge **Permit No. UGW070002**

~~January 2012~~March 2013

A. DESCRIPTION OF FACILITY

The Sunnyside Cogeneration Facility is a coal-fired power plant that produces approximately 51 Mega Watt net of electricity. The primary fuel stock for the plant is ~~waste~~ waste coal ~~refuse~~ material ~~tailings~~ that resulted from the operation of ~~a~~two large underground coal mines which operated for nearly a century. The plant's expected life is 30 years.

Burning the ~~waste~~ waste coal ~~refuse~~ generates approximately 800 to 1000 tons of ash per day. The ash will be trucked to a disposal site SCA #1 Ash Landfill in the NW 1/4, Sec. 12, T. 15 S., R. 13 E., SLBM, or SCA #2 Ash Landfill in the NW ¼ Sec 8 and NE ¼ Sec 7, T. 15S., R. 14 E., SLBM, both approximately one mile from the power plant. The ash generated from the facility is excluded from the definition of solid waste and therefore no solid waste permit is required for ~~this~~ these sites. The SCA #1 site is located along a steeply sloping escarpment that faces south to southeast and terminates in a relatively flat area along Icelander Creek. The SCA #2 site is located at the head of a small side canyon facing the west.

The SCA #1 Ash Landfill is an unlined landfill comprised of three phases on approximately 75 acres. It has been under construction since the early 1990's.

The existing SCA #1 Ash Landfill Phase I ~~Ash Disposal Facility~~ is an unlined disposal landfill. Ash is placed in cells in a terrace-and-bench configuration. Terraces are 20 feet high with a 2 horizontal to 1 vertical faces. Each terrace is set back 15 feet from the previous terrace to form a bench. The existing SCA #1 Ash Landfill Phase 1 ~~Ash Disposal Facility~~ encompasses approximately 15 acres. Phase I is now closed, capped and re-seeded according to approved specifications.

SCA #1 Ash Landfill Phase II ~~Ash Disposal Facility~~ is located immediately west of the Closed SCA #1 Ash Landfill Phase I ~~Ash Disposal Facility~~. Phase II is developed ~~2 cells at a time~~ over a ten-year period, and ~~will~~ encompasses approximately 32 acres of land.

Phase II is nearly complete.

SCA #1 Ash Landfill Phase III ~~Ash Disposal Facility~~ is located immediately west of the Closed SCA #1 Ash Landfill Phase I~~I Ash Disposal Facility~~and east of the Phase II landfill. Phase III is developed ~~2 cells at a time~~ over a fifteen~~ten~~-year period, and will encompass approximately 30 acres.

The SCA#2 Ash Landfill is located approximately one mile to the southeast from the SCA power plant facility and approximately 1.5 miles east of the SCA #1 Ash Landfill. It is proposed to begin construction in 2013 with ash placement in approximately 2015. SCA#2 Ash Landfill will be constructed in a terrace and bench configuration with a footprint of approximately 34 acres, plus surrounding access and drainage facilities. Terraces will be a maximum of 60 feet high with approximately 3 horizontal to 1 vertical faces. Each terrace will be set back 15 feet from the previous terrace to form a bench.

B. SUBSURFACE CONDITIONS

Ground water in the vicinity of the ash landfills is contained in isolated areas of alluvium overlying the relatively impermeable Mancos Shale. The individual areas of alluvium were deposited both from currently active streams such as Icelander Creek, as well as ancient streams and pediment gravels from an earlier cycle of erosion and deposition. Ground water is also contained in weathered Mancos Shale underlying the alluvium. Near the SCA #1 Ash landfill site ground water issues from ancient pediment gravel at Whitmore Springs, and this flow recharges localized aquifers contained in recent alluvium, colluvium and weathered Mancos shale associated with Icelander Creek. The Mancos Shale contains soluble salts, and in a regional sense there is natural degradation of ground water quality as the water moves from its source in the Book Cliffs and comes into contact with the Mancos Shale. There are no spring sources near the SCA #2 Ash Landfill site and it would appear from the high TDS levels observed in MW-8 that even the shallow groundwater there has been affected by the Mancos Shale.

In the summer of 1994 the monitor well ~~farthest~~ downgradient from the SCA #1 Ash landfill, MW-1, exceeded the permit protection level for total dissolved solids (TDS), and has remained above that level since. This rise in TDS was not seen in Whitmore Springs or the other monitor wells at the site. Subsequent investigations showed that the water from the other sampling points associated with SCA #1 Ash Landfill~~for this permit~~ are similar in chemical composition to composition of MW-1. There is also a buried ridge of Mancos Shale under the alluvium that probably causes a separate ground water flow system west of the landfill that is sampled by MW-1. The chemistry of water in MW-1 is consistent with leaching from native materials at the site rather than from leaching from the ash in the landfill, which shows a different composition of all monitoring points.

Because MW-1 is probably not in a location that can directly evaluate impacts from the landfill, the permittee has replaced it with MW-4 adjacent to the existing SCA #1 aAsh ~~l~~Landfill and MW-7 which is adjacent to sediment pond #017~~runoff basin~~. The permittee is encouraged to voluntarily sample MW-1 even though it is not currently a monitor point, in order to build a historical record of water quality in the well. If submitted to DWQ, these analyses shall be entered into the administrative record for this permit.

C. BACKGROUND WATER QUALITY

Background ground water quality is summarized in Tables 1 and 2 of the permit. ~~This~~ Table 1 data represents the average of samples taken from Whitmore Spring from October, 1992 through July, 1995, and is very similar to the average composition of water from monitor wells MW-2 and MW-3. Separate background water quality information and protection levels are established for MW- 1, 2, 3 and 4 [Phase I and III] and MW-7 [Phase II]. TDS is higher in the seeps. Table 2 data represents the average of samples taken from MW-8 from January 2012 through January 2013 in preparation for the SCA #2 Ash Landfill construction to begin.

D. GROUND WATER CLASSIFICATION

Based on available data, ground water at the SCA #1 Ash ~~l~~Landfill site is Class II. SCA #1 Phase II MW-7 is established under Class III, based upon TDS. Groundwater at the SCA #2 Ash Landfill is Class III based upon TDS and Selenium.

E. BEST AVAILABLE TECHNOLOGY

Prevention of ground water pollution will be accomplished through the operation and final closure of the landfills. Ash is placed in 12-inch lifts and compacted. The landfills are ~~is~~ configured into ~~20-foot~~ terraces. A 15-foot bench is constructed at the top of each terrace. Drainage from the terraces is routed to the sedimentation basin at the toe of the landfill. A 16-inch vegetative cover soil has been~~is~~ placed and compacted on top of each terrace and outslopes as it is finished. ~~The final cover material shall have a hydraulic conductivity no greater than 10^{-3} cm/sec.~~ Based on SCA's successful reclamation experience on its other projects and in an effort to improve re-vegetation on the ash landfills, SCA will place a 6 to 8-inch compacted cap plus an 18 to 24-inch native soil cover on the upper terraces of the SCA #1 Ash Landfill Phase III not yet covered. SCA will also apply this reclamation method on the SCA #2 Ash Landfill.

In preparation for the SCA #1 Ash Landfill Phase III, Sand Blanket drains were~~will be~~ installed over two identified seasonal seeps to facilitate drainage and to prevent up take by the ash-fill material. One seep is under the ~~proposed~~ Phase III landfill footprint; the other seep is just out side the ~~proposed~~ footprint. These drains ~~will~~ consist of sand ~~to be~~

placed above the seeps with a bentonite dam at the down gradient end. A screened HDPE~~PEP~~ pipe ~~will be~~ was placed 4" above the bedrock and ~~will~~ serves as the conduit for the seep water. Due to the pozzolanic property of the ash-fill, no synthetic liner will be needed. Any discharge will be diverted to the sediment basin described in the permit.

F. GROUND WATER MONITORING

The ash material does not produce leachate that contains any distinct "tracer" parameters that could be used to evaluate a discharge of leachate from the landfill. Analysis of simulated ash leachate shows no parameters in the leachate that are not also present in the ground water at the site. Protection levels have been established for metals that may be associated with ash leachate.

The primary threat to ground water quality from the SCA #1 Ash ~~l~~Landfill is from salts associated with the ash. Under the Ground Water Protection Regulations, TDS may not rise above 125 percent of background in a Class II ground water. At this site there is the possibility for natural variation in the background to exceed TDS protection levels not caused by the landfill. Therefore, exceedance of TDS protection levels will be a cause for out-of-compliance status unless the permitee makes a satisfactory demonstration to the Executive Secretary shows the rise in TDS is due to circumstances not related to landfill leachate.

For MW-7 the chemistry of water from this well is significantly different from the other monitoring points in this permit, separate background water quality and protection levels have been established based on samples taken from this well.

For MW-8 the chemistry of water from this well is significantly different from the other monitoring points associated with the SCA #1 Ash Landfill. Separate background water quality and protection levels have been established based on samples taken from this well.

G. COMPLIANCE

All wells have been in compliance through out the period of this permit, with the exception of MW-2. December 14, 2005 reported MW-2 exceeded the Permit Conditions for the constituents of lead and TDS. As per item F. above, the permittee has adequately demonstrated that these exceedences were not caused by the facility, but rather by suspected contaminated samples. Monthly split samples reported that these constituents were below the Permit Protection levels.

July 2006, MW-1, MW-2 reported elevated Selenium and TDS and MW-7 reported elevated TDS. As per item F. above the permittee has adequately shown, by means of

comparative analyses, that these constituents are not the result of the Facility, but rather conditions cause by six years of drought. Sulfate is the constituent for causing elevated TDS. All TCLP analyseis have reported non-detect for sulfate and selenium, therefore the facility is not the source. The same is true for selenium. These constituents are likely leaching from the underlying Mancos Shale.

The most recent ash leachate analyses [TCLP] was submitted February 17, 2011~~June 6, 2006~~, and satisfies the Permit Condition for Part I.E.5.d.

G. PERMIT TERM

The revised permit will be subject to renewal in 2017.

STATE OF UTAH
DIVISION OF WATER QUALITY
UTAH WATER QUALITY BOARD
SALT LAKE CITY, UTAH 84114-4870

GROUND WATER DISCHARGE PERMIT

In compliance with the provisions of the Utah Water Quality Act, Title 19, Chapter 5, Utah Code Annotated 1953, as amended, the Act,

SUNNYSIDE COGENERATION ASSOCIATES
P.O. Box ~~10~~139
~~East Carbon~~Sunnyside, Utah 8453~~920~~

is granted an amended ground water discharge permit which supersedes the amended permit issued ~~August 29, 2001~~March 19, 2012 for the operation of the SCA #1 Ash Landfill and the SCA #2 Ash Landfill ~~Ash Disposal Area~~ associated with the Sunnyside Cogeneration Plant located at Sunnyside in Carbon County, Utah.

The SCA #1 Ash Landfill~~Disposal Area~~ is located on a tract of land within the northeast quarter of Section 12 Township 15 South Range 13 East, Salt Lake Base and Meridian. (110° 24~~3~~' W. Long. and 39° 32~~3~~' N. Lat.) The SCA #2 Ash Landfill is located on a tract of land within the NE quarter of Section 7 and NW quarter of Section 8 with additional access routes in Section 6 and the SW quarter of Section 5 Township 15 South Range 14 East, Salt Lake Base and Meridian. (110° 22' W. Long. & 39° 32' N. Lat.)

The permit is based on representations made by the permittee and other information contained in the administrative record. It is the responsibility of the permittee to read and understand all provisions of this permit.

The facilitie~~s~~ shall be constructed and operated in accordance with conditions set forth in the permit and the Utah Ground Water Quality Protection Regulations.

This permit shall become effective on _____.

This permit and the authorization to operate shall expire at midnight, January _____, 2018.

Signed this _____day of _____.

_____
Walter L. Baker, P.E.

Executive Secretary
Utah Water Quality Board

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I. CONSTRUCTION PERMIT

The original and revised Construction Permits are included as Appendix A of this permit.

II. SPECIFIC PERMIT CONDITIONS

A. Ground Water Classification

Monitoring data have shown variable ground water quality across the site. The ground water classification for the alluvial aquifer associated with Icelander Creek and Whitmore Springs in the immediate vicinity of ~~this facility~~the SCA#1 Ash Landfill is Class II Drinking Water Quality Ground Water. Ground water which is contained in or which has come in contact with the Mancos Shale may be Class III, Limited use Ground Water. The ground water classification for the alluvial aquifer associated with upper Icelander Creek in the immediate vicinity of the SCA#2 Ash Landfill has come in contact with the Mancos Shale and is Class III Limited use Ground Water

B. Background Water Quality

Background water quality for the Icelander Creek alluvial aquifer associated with the SCA#1 Ash Landfill has been established from ground water monitoring results from Whitmore Spring. Values represented in Table 1 were derived from 12 samples taken from Whitmore Spring between October, 1992 and July, 1995. Ground water chemistry in Whitmore Springs is very similar to that in wells MW-2 and MW-3 and constitutes background water quality in those wells for the purposes of this permit. ~~Water quality in the new well will be established after examination of data from background sampling of that well.~~

Table 1

Constituent	Mean Background Concentration, mg/l	Standard Deviation
Total Dissolved Solids (TDS)	2415[1]	352[1]
Calcium	112	18
Sodium	298	34
Potassium	7	1
Magnesium	123	17
Chloride	64	9
Sulfate	796	97
Bicarbonate	584	53
Carbonate	1	2

[1] updated 04/10/2004

Background water quality for the upper Icelander Creek alluvial aquifer associated with the SCA#2 Ash Landfill has been established from ground water monitoring results from MW-8. Values represented in Table 2 were derived from 10 samples taken from MW-8 between January 2012 and January 2013.

Table 2

Constituent	Mean Background Concentration, mg/l	Standard Deviation
Total Dissolved Solids (TDS)	10256	346
Calcium	387.2	14.6
Sodium	1392	106
Potassium	18.64	0.8
Magnesium	777.5	22.7
Chloride	238.8	15.4
Sulfate	5662	1223
Bicarbonate	491.8	5.1
Carbonate	ND	ND

C. **Ground Water Protection Levels**

Ground water protection levels for downgradient wells MW-1, MW-2, MW-3 and MW-4 and MW-7 associated with SCA #1 Ash Landfill for this permit are represented in Table ~~3~~2.

Ground water protection levels for downgradient well MW-8 associated with SCA #2 Ash Landfill for this permit are represented in Table 4.

Table ~~3~~2

Constituent	MW- 1 Background Value (mg/l)	MW- 1, 2, 3, 4 Protection Levels (mg/l)	MW-7 Background Value (mg/l)	MW-7 Protection Levels (mg/l)
pH	8.25 units	6.5-8.5 units	7.98 units	6.5-8.5 units
TDS	2415	3018[1]	4290	5363[1]
Arsenic	0.0036	0.0125[2]	0.006	0.025[3]

Barium	0.0767	0.5[2]	0.194	1.0[3]
Cadmium	0.0031	0.0039[1]	<.003	0.0025[3]
Copper	0.0120	0.325[2]	0.018	0.65[3]
Lead	0.0070	0.0088[1]	<.01	0.0075[3]
Selenium	0.0063	0.0125[2]	0.0167	0.025[3]
Silver	0.008	0.025[2]	0.0011	0.05[3]
Zinc	0.0624	1.25[2]	0.037	2.5[3]

1. 1.25 x background concentration for TDS
2. 0.25 x Ground Water Quality Standard for Class II Ground Water
3. 0.5 x Ground Water Quality Standard for Class III Ground Water

Table 4

Constituent	MW- 8 Background Value (mg/l)	MW- 8 Protection Levels (mg/l)
pH	7.16 units	6.1-8.5 units
TDS	10256	12820[1]
Arsenic	0.0086	0.025[3]
Barium	0.012	1.0[3]
Cadmium	ND	0.0025[3]
Copper	ND	0.65[3]
Lead	ND	0.0075[3]
Selenium	0.0573	0.086[4] or 0.0923[5] or 0.0949[6]
Silver	ND	0.05[3]
Zinc	ND	2.5[3]

1. 1.25 x background concentration for TDS
3. 0.5 x Ground Water Quality Standard for Class III Ground Water
4. 1.5 x background concentration for Selenium
5. 2x standard deviation for background concentration for Selenium
6. Highest level detected for background concentration for Selenium

D. **Best Available Technology Standard**

1. Authorized Construction and Operation

a) The ~~Ash Disposal Area~~SCA #1 and SCA#2 Ash Landfills will be operated as a landfill strictly for disposal of ash generated from the burning of ~~waste~~ waste coal ~~refuse~~ obtained from the adjacent ~~waste~~ SCA waste coal ~~refuse~~ pile ~~and tailings impoundment~~ and Star Point waste coal ~~refuse~~ pile, or other similar ~~waste coal~~~~refuse~~ waste coal sources, and other coal based fuels [alternative fuels], limestone reagent added to control SO_2 emissions, and fuel oil or other high BTU coal (supplemental fuel) as limited by the FERC certification dated February 11, 1992, as supplemented by the Notice of Self-Certification of Sunnyside Cogeneration Associates as a Qualifying Small Power Production Facility in Docket No. QF86-556-004 filed April 19, 2000. While being loaded into trucks destined for the landfill, such ash will be conditioned with slurry containing water and water treatment solids. No other material is authorized for disposal by this permit in the Ash Disposal Area. At the present time, the Phase I Ash Disposal Area ~~encompasses an area of approximately 20 acres~~, is now capped and is in post closure. A Construction Permit has been issued which ~~will~~ allows for expansion of the Phase II Ash Disposal area of the landfill ~~of approximately 32 acres~~. A Construction Permit has been issued which allows for construction of the Phase III Ash Landfill between Phases I and II. The total ~~facility~~ SCA#1 Ash Landfill is approximately 75~~52~~ acres. This construction will follow that which was approved in the original Phase I~~20 acre~~ design [see Part I]. A Construction Permit has been issued which will allow for construction of the SCA #2 Ash Landfill of approximately 34 acres plus surrounding access and drainage facilities.

2. Design and Construction

a) *SCA #1 Ash Landfill Phase I ~~Ash~~ Disposal Area* - The existing ash disposal area has been constructed as previously designed and approved and is now closed, capped and re-seeded according to specifications.

b) *SCA #1 Ash Landfill Phase II ~~Ash~~ Disposal Area* - The Ash Disposal Area has been constructed according to drawings dated February 8, 1997. Additional expansion of the landfill will also incorporate referenced

design specification. Prior to ash placement in the expanded area, organic topsoil and vegetation will be removed, where necessary, from the underlying area. Ash will be placed in 12-inch lifts and compacted. Ash will be configured in 20 foot terraces with a maximum outslope of 2 horizontal to 1 vertical. A 15-foot wide bench will be constructed at the top of each terrace. The bench will be sloped to control drainage as shown in drawing 3. Drainage from the toe of each terrace will be routed to the sedimentation basin at the bottom of the disposal area. A sixteen inch vegetative cover soil material will be placed on the top of the final terrace and outslope configuration as each terrace is finished. The final sixteen-inch cover material will have a hydraulic conductivity no greater than 1×10^{-3} cm/sec.

c) *SCA #1* Ash Landfill *Phase III ~~Ash~~ Disposal Area* - The Ash Disposal Area will be constructed according to drawings dated December 23, 2003. Additional expansion of the landfill will also incorporate referenced design specifications. Because of minimal lateral extent of soil and vegetative covering, removal of these materials will not be required and will have no consequences regarding the ash placement in the expanded area. Ash will be placed in 12-inch lifts and compacted. Ash will be configured in 20-foot terraces with a maximum outslope of 2 horizontal to 1 vertical. A 15-foot wide bench will be constructed at the top of each terrace. The bench will be sloped to control drainage as shown in drawing 3. Drainage from the toe of each terrace will be routed to the sedimentation basin at the bottom of the disposal area. A sixteen inch vegetative cover soil material will be placed on the top of the final terrace and outslope configuration as each terrace is finished. The final sixteen inch cover material will have a hydraulic conductivity no greater than 1×10^{-3} cm/sec. ~~The Phase III area will be approximately 30 acres.~~As an alternate option, and based on SCA's successful reclamation experience on its other projects and in an effort to improve re-vegetation on the ash landfills, SCA may choose to reclaim using the proposed cap and reclamation plan for the SCA #2 Ash Landfill on the upper portion of the SCA#1 Phase III Ash Landfill that has not yet been covered. This will include a compacted 6 to 8-inch soil cap (import soil 2" minus with >30% passing the #200 sieve) plus an 18 to 24-inch loose thickness native soil cover with fertilizer, mulch and surface roughening.

d) *SCA #2 Ash Landfill* - The SCA #2 Ash Landfill will be constructed according to drawings dated March 2013 and will follow material placement techniques demonstrated at the SCA #1 Ash Landfill. Because

of minimal lateral extent of soil and vegetative covering, removal of these materials will not be required and will have no consequences regarding the ash placement in the expanded area. Ash will be placed in 12-inch lifts and compacted. Ash will be configured in maximum 60-foot high terraces with a projected outslope of 3 horizontal to 1 vertical (maximum allowed 2H:1V). A 15-foot wide bench will be constructed at the top of each terrace. The bench will be sloped to control drainage as shown in drawing 8. Drainage from the toe of each terrace will be routed through sediment traps and to the sedimentation basin at the bottom of the disposal area. The SCA #2 area will be approximately 34 acres, plus surrounding access and drainage facilities. The cap and reclamation plan will include a compacted 6 to 8-inch soil cap (import soil 2" minus with >30% passing the #200 sieve) plus an 18 to 24-inch loose thickness native soil cover with fertilizer, mulch and surface roughening.

3. Run-on and Run-off Control

Surface water run-on will be controlled by site grading and ditches to direct drainage away from the SCA #1 Ash Landfill Phase I, II, and III ~~Ash~~ Disposal Areas and from the SCA #2 Ash Landfill.

4. Sediment Basins

Storm water and ash-contact run-off is collected in the sediment basins. These basins approved and permitted by the UPDES process for surface discharge to Icelander Creek, and the revised construction permit covers the construction of the new sediment basin.

E. Compliance Monitoring

1. Compliance Monitoring Points

Sunnyside Cogeneration shall operate ground water monitoring points as follows:

a) *SCA#1 Ash Landfill Phase I, II and III ~~Ash~~ Disposal Area* - Existing monitoring wells MW-1, MW-2, MW-3, MW-4, and MW-7 will serve as downgradient monitoring points. Whitmore Spring serves as the upgradient monitoring point. Locations for these are shown in Drawing Y-30D.

b) *SCA #2 Ash Landfill* – Existing monitoring well MW-8 will serve as the down-gradient monitoring point. Due to the uphill cliff topography of the site, no up-gradient monitoring point exists. Location for MW-8 is shown on Drawing 5.

All monitoring wells are constructed in accordance with criteria contained in the EPA RCRA Ground Water Monitoring Technical Enforcement Guidance Document, 1986, OSWER-9950.1 (RCRA TEGD)

2. Future Modification of the Monitoring Well Network

If at any time the Executive Secretary determines the monitoring program to be inadequate, Sunnyside Cogeneration shall submit within 30 days of receipt of written notice from the Executive Secretary a modified monitoring plan that addresses the inadequacies noted by the Executive Secretary.

3. Compliance Monitoring Period

Monitoring shall commence upon issuance of this permit and shall continue at each ash landfill through a ~~30~~ 10 year period following final closure of ~~the ash disposal area~~that ash landfill.

4. Monitoring Frequency

The ground water monitoring wells will be sampled semi-annually while the corresponding ash disposal landfill is open, according to the requirements of Part II.E.5(c).

5. Monitoring Requirements

a) In association with each sampling event, water level measurements shall be made in each monitoring well prior to removal of any water from the well bore. Measurements will be made from a permanent single reference point clearly marked on the top of the well or surface casing. Measurements will be made to the nearest 0.01 foot, and reported as elevation above sea level.

b) Water quality samples will be collected, handled and analyzed in conformance with the Water Quality Sampling Plan that has been approved by the Executive Secretary. Sampling at additional surface water monitor points shall be done according to the Water Quality Sampling Plan.

c) The following analyses shall be performed on all compliance monitoring samples collected:

i) Field Measurements: pH, specific conductance, temperature

ii) Laboratory Analysis:

- Major Ions: (Chloride, Sulfate, Carbonate, Bicarbonate, Sodium, Potassium, Magnesium, and Calcium)
- TDS
- Metals: (As, Ba, Cd, Cu, Pb, Se, Ag, Zn)

d) Ash leachate analysis shall be done every five years beginning with permit issuance in 1992 according to the revised approved Ash Leachate Analysis.

6. Post Closure Monitoring

The permittee shall conduct monitoring after final capping and closure of ~~the~~ each Ash Disposal Area on a semiannual frequency for a period of ~~30~~ 10 years after final closure. Water Quality sampling from the monitoring wells will include the same field and lab analysis contained in Part II .E.5(c).

7. Laboratory Approval

All water quality analyses shall be performed by a laboratory certified by the State of Utah to perform such analysis.

F. **Non-Compliance Status**

1. Probable Out-of-Compliance Status

Other than as provided in paragraph II~~I~~.F.2 below, Sunnyside Cogeneration shall evaluate the results of each round of ground water sampling analytical results to determine any exceedance of the ground water protection levels outlined in Part II Tables 3 or ~~4~~1. Upon determination by Sunnyside Cogeneration that a protection level has been exceeded, at any compliance monitoring well, Sunnyside Cogeneration shall:

a) Immediately re-sample the exceeding monitoring well(s), submit analytical results from the re-sampling, and notify the Executive Secretary of the probable out-of-compliance status within 30 days of initial detection.

b) Implement a monthly frequency of sampling for the ground water monitoring well(s) required by this permit. The monthly frequency shall continue until the Executive Secretary notifies Sunnyside Cogeneration that the permitted monitoring frequency can be resumed.

2. Probable Out-of-Compliance Status for Total Dissolved Solids

In the event total dissolved solids (TDS) exceeds 3,018 mg/l in wells MW-1, MW-2, MW-3, and MW-4; or 5,363 mg/l in well MW-7; or 12,820 mg/l in well MW-8; and no other parameters exceed protection levels, the permittee shall prepare a report on the cause of the exceedance for submission with the next regular monitoring report. This report must show an analysis of major ion chemistry at all monitoring points for the current sampling event and any past data needed to evaluate the cause of the exceedance. If the Exceedence Report fails to identify the probable cause for exceeding the Protection Limits in Tables 3 or ~~4~~2, the analysis shall include Piper and Stiff diagrams for water chemistry of the monitoring points, ash leachate, leachate from naturally occurring materials at the site, and water from the ash runoff basin. Other information, such as trend analysis, may also be presented to support the report's conclusions.

In the event the report does not satisfactorily demonstrate that the TDS exceedence was caused by factors other than that of the landfill, the permittee shall follow the procedures in Parts II.F.1 and 3, as applicable. Based on available information, the Executive Secretary may require changes in the compliance-monitoring plan to better monitor the landfill's effects on ground water.

3. Out-of-Compliance Status due to Exceedence of Permit Limits

Based on the accelerated monitoring results obtained under monthly sampling as listed in Part II.F.1, Sunnyside Cogeneration shall determine in accordance with UAC R317-6-6.16, if an out of compliance situation exists. Upon making this determination Sunnyside Cogeneration shall:

a) Notify the Executive Secretary of the out of compliance status within 24 hours of detection.

b) Submit a Source Assessment and Compliance Schedule to the Executive Secretary within 30 days of detection of the out of compliance status that outlines the following:

i) Steps of action that will assess the extent of the contamination and identify its source.

ii) Measures that will be taken to alleviate contribution of any further contamination to the ground water and prevent any recurrence of the non-compliance.

iii) Actions that will be taken to mitigate and remediate existing contamination from the implicated facility.

c) Implement the Source Assessment and Compliance Schedule within 120 days of approval by the Executive Secretary.

4. Out-of-Compliance Status due to Failure of Best Available Technology

If the permittee determines that an out of compliance situation exists due to failure to maintain best available technology, Sunnyside Cogeneration shall notify the Executive Secretary according to the provisions of this permit.

In the event a compliance action is initiated against the permittee for violation of permit conditions relating to containment technology, the permittee may affirmatively defend against that action by demonstrating the following:

a) The permittee submitted notification according to the provisions of this permit.

b) The failure was not intentional or caused by the permittee's negligence, either in action or failure to act.

c) The permittee has taken adequate measures to meet permit conditions in a timely manner or has submitted to the Executive Secretary, for his approval, an adequate plan and schedule for meeting permit conditions; and

d) The provisions of Utah Code Ann. § 19-5-107 have not been violated.

G. Reporting Requirements

1. Reporting

Water quality sampling results shall be submitted to the Executive Secretary as follows:

Semi-Annual Sampling		Report Due On
1st	(Jan., Feb., March, April, May, June)	July 15
2nd	(July, Aug., Sept., Oct., Nov., Dec.)	January 15

Failure to submit reports within the time frame due shall be deemed as noncompliance and may result in enforcement action.

H. Compliance Schedule

Reports of compliance or noncompliance with, or any progress report on interim and final requirements contained in any compliance schedule of this permit shall be no later than 14 days following each schedule date.

III. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. Representative Sampling

Samples taken in compliance with the monitoring requirements established under Part I shall be representative of the monitored activity.

B. Analytical Procedures

Water sample analysis must be conducted according to test procedures specified under UAC R317-6-6.3.L, unless other test procedures have been specified in this permit.

C. Penalties for Tampering

The Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

D. Reporting of Monitoring Results

Monitoring results obtained during each reporting period specified in the permit, shall be submitted to the Executive Secretary, Utah Division of Water Quality at the following address no later than the 15th day of the month following the completed reporting period:

State of Utah
Division of Water Quality
Department of Environmental Quality
Salt Lake City, Utah 84114-4870
Attention: Ground Water Protection Program

E. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. **Additional Monitoring by the Permittee**

If the permittee monitors any pollutant more frequently than required by this permit, using approved test procedures as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted. Such increased frequency shall also be indicated.

G. **Records Contents**

Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements:
2. The individual(s) who performed the sampling or measurements;
3. The date(s) and time(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and,
6. The results of such analyses.

H. **Retention of Records**

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Executive Secretary at any time.

I. **Twenty-four Hour Notice of Noncompliance Reporting**

1. The permittee shall verbally report any noncompliance that may endanger public health or the environment as soon as possible, but no later than twenty-four (24) hours from the time the permittee first became aware of the circumstances. The report shall be made to the Utah Department of Environmental Quality 24 hour number, (801) 536-4123, or to the Division of Water Quality, Ground Water Protection Section at (801) 536-4355, during normal business hours (8:00 am - 5:00 pm Mountain Time).

2. A written submission shall also be provided to the Executive Secretary within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

    a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected; and,

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. Reports shall be submitted to the addresses in Part III D, Reporting of Monitoring Results.

J. **Other Noncompliance Reporting**

Instances of noncompliance not required to be reported within 24 hours, shall be reported at the time that monitoring reports for Part III D are submitted.

K. **Inspection and Entry**

The permittee shall allow the Executive Secretary, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and,

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

IV. COMPLIANCE RESPONSIBILITIES

A. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Executive Secretary of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

B. Penalties for Violations of Permit Conditions

The Act provides that any person who violates a permit condition implementing provisions of the Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions is subject to a fine not exceeding $25,000 per day of violation. Any person convicted under Section 19-5-115(2) of the Act a second time shall be punished by a fine not exceeding $50,000 per day. Nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. Need to Halt or Reduce Activity not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

E. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems that are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

V. GENERAL REQUIREMENTS

A. Planned Changes

The permittee shall give notice to the Executive Secretary as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required when the alteration or addition could significantly change the nature of the facility or increase the quantity of pollutants discharged.

B. Anticipated Noncompliance

The permittee shall give advance notice of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

C. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

D. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a permit renewal or extension. The application should be submitted at least 180 days before the expiration date of this permit.

E. Duty to Provide Information

The permittee shall furnish to the Executive Secretary, within a reasonable time, any information which the Executive Secretary may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Executive Secretary, upon request, copies of records required to be kept by this permit.

F. Other Information

When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Executive Secretary, it shall promptly submit such facts or information.

G. **Signatory Requirements**

All applications, reports or information submitted to the Executive Secretary shall be signed and certified.

1. All permit applications shall be signed as follows:

   a. For a corporation: by a responsible corporate officer;

   b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.

   c. For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Executive Secretary shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the Executive Secretary, and,

   b. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to Authorization. If authorization under Part IV G 2. is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part V.G.2. must be submitted to the Executive Secretary prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. Penalties for Falsification of Reports

The Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

I. Availability of Reports

Except for data determined to be confidential by the permittee, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Executive Secretary. As required by the Act, permit applications, permits, effluent data, and ground water quality data shall not be considered confidential.

J. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

K. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

L. **Transfers**

This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Executive Secretary at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,

3. The Executive Secretary does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

M. **State Laws**

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, penalties established pursuant to any applicable state law or regulation under authority preserved by Section 19-5-117 of the Act.

N. **Reopener Provision**

This permit may be reopened and modified (following proper administrative procedures) to include the appropriate limitations and compliance schedule, if necessary, if one or more of the following events occurs:

1. If new ground water standards are adopted by the Board, the permit may be reopened and modified to extend the terms of the permit or to include pollutants covered by new standards. The permittee may apply for a variance under the conditions outlined in R317-6.4(D)

2. If alternative compliance mechanisms are required.

3. If subsequent ground water monitoring data reveals the background water quality values in Part II Tables 1 & 2 are not accurate.

4. If data collected subsequent to permit issuance indicate that the fresh water reservoir and or the coal runoff basin present risks to ground water quality.

APPENDIX A 1992, 1997, and 2004 CONSTRUCTION PERMITS

Original Construction Permit

Original (1992) Construction Permit

We have completed our review of the plans and specifications for the construction of Sedimentation Basins which will serve the Sunnyside Cogeneration coals storage and ash disposal sites. The plans were received December 16, 1991.

The plans and specifications as submitted, comply with *the Utah Water Quality Rules, (R317, Utah Administrative Code)*. A **Construction Permit** is hereby issued as constituted by this letter, subject to the following conditions:

1. Any revisions or modifications to the approved plans and specifications must be submitted to the Division of Water Quality (the Division) for review and approval, before construction or implementation thereof.

   Construction must not begin until the ground water discharge permit is issued.

2. The approved facilities must not be placed in service unless the division has made a final inspection, and has authorized in writing to place the constructed facilities in service.

3. Sediments shall be removed when sixty percent of the maximum sediment storage volume is reached.

4. The native soil used for construction of the bentonite enriched lining must:

   a. Be free of rocks larger than two inches, debris, organic and other foreign substances, and,
   b. Be predominately silt or clay, i.e. more than 50% passing a No. 200 sieve.

This construction permit will expire on February 18, 1993, unless substantial progress is made in constructing the approved facilities or the plans and specifications have been resubmitted and the construction permit is reissued. This permit does not relieve you in any way of your obligations to comply with other applicable local requirements, or those stated in the permit issued under the *Utah Pollutant Discharge Elimination System*. You may contact Mr. Claron Bjork of Southeastern Utah District Health Dept at 637-3671 for further assistance in this regard.

A set of approved plans and specifications is returned herewith bearing an imprint of our construction permit stamp. The stamped set must be kept available for examination and inspections

to be conducted by the Division, or for resolution of any conflicts or discrepancies that may arise during construction or installments.

Construction Permit, Revised: February, 1997

The plans and specifications as submitted on February 8, 1997 for the SCA #1 Ash Landfill Phase 2 ~~Ash~~ Disposal Facility, comply with *the Utah Water Quality Rules, (R317, Utah Administrative Code).* A **Construction Permit** is hereby issued as constituted by this letter, subject to the following conditions:

1. *Any revisions or modifications to the approved plans and specifications must be submitted to the Division of Water Quality (the Division) for review and approval, before construction or implementation thereof.*

2. *The approved facilities must not be placed in service unless the Division has made a final inspection, and has authorized in writing to place the constructed facilities in service.*

This construction permit will expire on *April 1, 1998*, unless substantial progress is made in constructing the approved facilities or the plans and specifications have been resubmitted and the construction permit is reissued. This permit does not relieve you in any way of your obligations to comply with other applicable local requirements, or those stated in the permit issued under the *Utah Pollutant Discharge Elimination System.*

The project consists of the construction of an ~~first cell of an ultimately four cell~~ ash disposal area which will be approximately 32 acres in size. The project will also include the construction of a haul road from the Phase 1 area, perimeter berms and ditches, a seepage blanket and outlet, an armored ash containment ditch, a lined sedimentation basin and emergency outlet, a cell access road within Cell 1 and the establishment of ~~turf~~ native vegetation on the haul road and sedimentation basin embankments. The seepage blanket will intercept the seep under Cell 1 and discharge it outside of the disposal area. The sedimentation basin will intercept stormwater runoff from the surface of the disposal area for containment or treatment. The basin is designed to totally contain a 10 yr 24 hr storm volume and flow. The liner for the pond will consist of either a synthetic membrane or two, six-inch compacted lifts of clay with a minimum hydraulic permeability of 1×10^{-6} cm/sec. The liner will be covered with an 18-inch thick soil layer. A stone armor layer will form the top layer of the pond lining. Any runoff that exceeds the rate and volume of the design storm will overflow into a 12" dia. line and discharge into the adjacent Icelander Creek, an ephemeral stream.

A set of approved plans and specifications is returned herewith bearing an imprint of our construction permit stamp. The stamped set must be kept available for examination and inspections to be conducted by the Division, or for resolution of any conflicts or discrepancies that may arise during construction or installation.

Construction Permit, Revised: April 2004

The plans and specifications as submitted on December 31, 2004 for the SCA #1 Ash Landfill Phase 3 ~~Ash~~ Disposal Facility, comply with *the Utah Water Quality Rules, (R317, Utah Administrative Code).* A **Construction Permit** is hereby issued as constituted by this letter, subject to the following conditions:

1. *Any revisions or modifications to the approved plans and specifications must be submitted to the Division of Water Quality (the Division) for review and approval, before construction or implementation thereof.*

2. *Sediments shall be removed from the sedimentation basins when sixty percent of the maximum sediment storage volume is reached. The maximum sediment storage volume is that volume of in-basin sediment where the remaining open storage volume in the basin is adequate to totally contain the 10 year, 24 hour storm. The sediments shall be removed from all basins if any one basin' s maximum sediment capacity is 60% full.*

3. *The approved facilities must not be placed in service unless the Division has made a final inspection, and has authorized in writing to place the constructed facilities in service.*

This construction permit will expire on *April 2005*, unless substantial progress is made in constructing the approved facilities or the plans and specifications have been resubmitted and the construction permit is reissued. This permit does not relieve you in any way of your obligations to comply with other applicable local requirements, or those stated in the permit issued under the *Utah Pollutant Discharge Elimination System.*

This construction permit, which covers Phase 3 of the project, consists of the construction of the third cell of the ash disposal area, which will be approximately 30.47 acres in size. Phase 3 will cover the area between the fill areas of Phases 1 and 2. The finished surface terrace and bench construction contours will tie into, and match those of the two existing adjacent phases on either end of the fill area. Terraced slopes, constructed with an approximate 2.5 horizontal to 1 vertical slope, will be approximately 20 ft. high, with 15 ft. wide benches separating each slope. Cover soil will be placed of the finished ash surfaces and vegetation will be established to minimize erosion and percolation of rainfall into the ash. Cover soil will be placed once or twice per year, as seeding, fertilizing, and mulching of the cover soil will be performed once per year.

The project will also include the construction of a piped seepage collection system to collect seepage from ephemeral seeps which underlay the fill area, open drainage collection ditches, a lined

sedimentation basin with emergency outlet, and the establishment of ~~turf~~ native vegetation on the haul road and sedimentation basin embankments. The seepage collection system will intercept the seep under the Phase 3 fill area and discharge it outside of the disposal area to an open drainage collection ditch, which will convey the seepage to a sedimentation basin.

The Phase 3 sedimentation basin is a component of the integrated seepage and runoff control system for all three phases. The Phase 3 sedimentation basin will be approximately 2.75 acre-feet in volume, and will be located below the Phase 3 fill area and between the Phase 1 and 2 sedimentation basins. All project area drainage will be directed to one of the three sedimentation basins or interconnecting drainage ditches. The system is designed to totally contain a 100 yr-24 hr storm with no stored sediment or a 10 yr-24 hr storm volume and flow with a full compliment of stored sediment. The liner for the Phase 3 sedimentation pond will consist of two, six-inch compacted lifts of clay with a maximum hydraulic permeability of 1×10^{-6} cm/sec. The native soil used for the liner must be free of rocks larger than two inches, debris, organic and other foreign substances, and be predominately silt or clay, with more than 50% passing a No. 200 sieve. The liner material will be amended with granular bentonite to achieve this permeability. The liner will be covered with an 18-inch thick soil layer. A stone armor layer will form the top layer of the pond lining. Storm flows will normally decant into a 4" diameter line and be discharged into the downstream drainage ditch going to the Phase 2 sedimentation pond. Any runoff that exceeds the rate and volume of the design storm will be discharged over an open spillway 5.5 ft. above the decant line.

A set of approved plans and specifications is returned herewith bearing an imprint of our construction permit stamp. The stamped set must be kept available for examination and inspections to be conducted by the Division, or for resolution of any conflicts or discrepancies that may arise during construction or installation.

Sunnyside Cogeneration Associates (SCA)

SCA #2 Ash Landfill
Engineering Report

March 2013

Permit Application Report
SCA #2 Ash Landfill
Permit No. UGW070002

Sunnyside Cogeneration Associates
PO Box 159
Sunnyside UT 84539
(435) 888-4476

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List of Appendices

1.0 Introduction

The Sunnyside Cogeneration Associates (SCA) power plant burns waste fuel and provides dozens of jobs, both directly through plant operations, and indirectly through contractor positions and suppliers. SCA supplies electric power to the local power grid and is a major tax contributor to the local area. SCA is part of the overall mining and energy production industry which is an essential part of the local, state and global economy. Continued operation of SCA brings important social and economic benefits to the area. Removal of the waste coal left behind by others through the past decades of mining in the area results in an efficient use of natural resources and reclamation of the existing refuse piles. Operations occur in a manner which protects air quality, surface waters and groundwater in the region. Ash is a byproduct of the SCA power plant and SCA has been disposing of this ash at the SCA #1 Ash Landfill a short distance west of the power plant since plant began operations in the early 1990's.

The Sunnyside Cogeneration Associates #2 Ash Landfill is a new ash landfill to be constructed on private property owned by SCA in an area approximately 1 mile to the south east of the SCA power plant. This report presents descriptions, rationale, analysis, and design computations for the engineering features of the SCA #2 Ash Landfill. This engineering report is part of a permit modification package for the SCA #2 Ash Landfill.

2.0 Executive Summary

The proposed SCA #2 Ash Landfill is located in unincorporated Carbon County (Section 8, Township 14 South, Range 14 East, SLB&M) just south of the city of Sunnyside. Approximate location of the landfill is Latitude 39° 32' 24" North and Longitude 110° 22' 50" West. County zoning for this area allows for this use and Carbon County has granted a Conditional Use Permit for the SCA #2 Ash Landfill.

The proposed SCA #2 Ash Landfill is to be constructed in a small side canyon. This location was selected because it

- has a significant amount of existing disturbed area from a prior land owner,
- does not have regular surface water flows,
- is closer to the power plant and will reduce material haul distances, and
- will reduce the potential for dust near local residences.

Sediment traps and a clay lined sediment pond (#18) are proposed with the SCA #2 Ash Landfill to control storm water runoff from the landfill.

The plan, as submitted herewith, includes capacity for up to 3.6 Million cubic yards of ash material to be placed within a landfill footprint of approximately 34 acres with a maximum material thickness of 170 feet above existing ground (approximately 375 feet from the toe to the top of the landfill). Based on an average of 300,000 cubic yards per year, the landfill could serve for approximately twelve years. If the annual material placement quantity is less, the landfill could serve for a longer time.

Ash will be placed in a terrace-and-bench configuration. Terraces will be a maximum of 60 feet in height with an approximate 3 horizontal to 1 vertical slope above and below each bench. Each terrace will be set back a minimum of 15 feet from the previous terrace to form a bench. The geotechnical engineer's stability calculations for SCA#2 allowed for slopes as steep as 2:1 with terraced benches every 60 feet in elevation. SCA has chosen to build with gentler slopes to maintain a conservative approach and reduce the potential for erosion.

SCA's ash includes a significant percentage of limestone which is added to the combustion process for SO2 control. The SCA ash material has pozzolanic properties and tends to harden over time in the landfill, thus increasing mass stability and reducing the potential for leachate generation.

Initial landfill development consists of constructing a new sediment pond #018, the lower sediment trap #1, lower perimeter ash containment/conveyance ditches, storm water run-on prevention berms, and an access road turnaround for the trucks.

Periodic access roads will be constructed over time as part of landfill development. The upper sediment trap #2 and additional upper access routes will be constructed at a later time as the lower portion of the ash landfill nears that elevation.

Cover soil will be placed on finished ash surfaces and vegetation will be established to minimize erosion and percolation of rainfall into the ash. Cover soil will be placed as often as needed as part of routine reclamation operations. Seeding, fertilizing, and mulching of the cover soil will be performed in the Fall.

3.0 Geotechnical Evaluation

This section presents the results of a geotechnical evaluation completed by Professional Service Industries, Inc. (PSI) in April 2012. The purpose of the geotechnical evaluation was to

- characterize the subsurface profile of the site,
- evaluate the global and local slope stability of the proposed ash landfill,
- evaluate existing groundwater conditions and
- provide geotechnical recommendations regarding erosion control and construction considerations for the proposed ash landfill.

A summary of findings from the geotechnical report is included here. For more information we recommend a review of the full report (See Appendix C).

3.1 Site Description

The SCA #2 Ash Landfill encompasses approximately 34 acres in a small side canyon with existing elevations ranging from approximately 6400 to 6775. The site is underlain by colluvial and alluvial deposits. The surface includes vegetated areas as well as gravel, rock and boulders with steeper areas showing significant rock outcroppings.

3.2 Field Investigation

Two borings were completed at the proposed site. B-1 was completed to approximately 50 feet near the bottom (west) of the proposed fill. A permanent monitor well (MW8) was installed in the borehole to observe groundwater. B-2 was drilled to a depth of 33 ½ feet near the upper east area of the proposed site. Samples and boring characteristics were analyzed from each bore hole.

Four exploratory test pits were excavated to observe the near-surface soil conditions and depth to the bedrock.

PSI conducted Refraction Microtremor (ReMi) testing along three profile line arrays within the proposed site. This testing uses standard seismic refraction equipment. The waves measured were used to assist in differentiating between the overburden soil deposits and underlying bedrock. This assisted in determining approximate depth to bedrock at various locations across the site in between borings and test pits.

3.3 Laboratory Testing

Laboratory tests were completed on samples of soil and the SCA ash material to evaluate physical and engineering properties. Tests included direct shear, unconfined compressive strength, moisture-density relationship, and sieve analysis. A summary of the lab test results is shown on the following table.

Material Description	Water Content (%)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Internal Friction Angle (Φ)	Gradation		
					Gravel (%)	Sand (%)	Silt/Clay (%)
Sandy Silt (ML)	9	-	-	-	13	32	55
Silty sand with gravel (SM)	5-7	-	-	-	26-35	32-38	33-38
Silty gravel with sand (GM) / (GP-GM)	2-5	-	-	-	40-76	15-30	9-31
Bulk combined ash sample from stockpile	-	88	24	32	2	50	48

3.3.1 Strength Tests

Given the cohesive strength developed in the compacted ash due to the pozzolanic properties of the ash, unconfined compressive strength tests were performed on three moisture conditioned cylinder samples. After drying, the samples were broken and the unconfined compressive strength of the ash material was found to be in the range of 5,760 - 6,910 psf. Effective Shear Strengths and Unit Weights of the different soils were determined as follows:

Description of Soil	Unit Weight of Soil, pcf		Effective Shear Strength	
	Moist	Saturated	C' (psf)	ϕ'
Ash	80	85	800	32
Silty gravel with sand (SM) (GM)	120	125	0	34
Gravel with silt, sand and cobbles (GP-GM)	140	145	0	38
Shale bedrock	150	155	25,000	0

3.4 Subsurface Conditions

The subsurface soil and bedrock observed generally consist of alluvial and colluvial materials (silty sands with gravel and silty gravel with sands) underlain by lean clays and sandy silt with cobbles and boulders. The soils are underlain by a relatively impervious layer of shale bedrock. The depth to the shale bedrock varied from approximately 14 to 50 feet below existing grade. Standard Penetration resistance, N-Values, ranged from approximately 32 to greater than 50 blows per foot in the overburden soils and greater than 50 blows per foot in the shale bedrock.

3.5 Groundwater

Groundwater was encountered in boring B-1 at a depth of approximately 20 feet below existing grades. Groundwater was not observed in boring B-2 or the exploratory excavations during the drilling/excavation operations. Groundwater is expected to remain 10 feet or more below the ground surface in the vicinity of the landfill and not anticipated to come into contact with any ash materials. Similarly, the groundwater is expected to remain perched atop the shale bedrock as it moves in a general northeast to southwest direction.

SCA has conducted groundwater sampling and analysis at the monitor well MW-8 set by PSI in boring B-1 (Approximate Latitude 39° 32' 18" North and Longitude 110° 23' 04" West.) This sampling and analysis occurred between January 31, 2012 and January 29, 2013. Results of the analysis are included in Appendix A. These results represent the pre-construction or baseline conditions for groundwater in the area. The analysis shows groundwater high in TDS and many of the Cations and Anions. Generally, these results are common for groundwater conditions in contact with the Mancos Shale formations.

SCA would have preferred to install an up-gradient monitoring well for the purpose of monitoring groundwater conditions prior to reaching the landfill area. However, since this site was selected due to its location at the head of the small side canyon (to reduce the potential for storm water and near surface groundwater) the uphill cliff topography of the site also does not allow for access to an up-gradient location. The lack of groundwater observed in B-2 near the upper portion of the landfill area supports the expectations for little to no groundwater at a higher

elevation. Access routes on the top of the mountain are a considerable distance away from the area and not likely to be representative of the groundwater reaching this area.

Given that the areas above the landfill area were not accessible, SCA would like to request a variance from the traditional up-gradient well or source.

3.6 Stability Analysis

Ash material placement at the SCA #2 Ash Landfill will be accomplished in a similar manner to the SCA #1 ash landfill. Ash will be placed above the existing alluvium/colluvium slopes in lifts, moisture conditioned and compacted. Based on the existing site topography, subsurface evaluation, geophysical study (ReMi), site reconnaissance and other information from available geologic maps, cross sections were developed for use in the slope stability analyses. Various cross section options were evaluated to model long term global stability of the overall landfill design, the intermediate stability during construction and to evaluate the local shorter term stability of the ash benches that will be used throughout the construction phases of the landfill.

The PSI Geotechnical Report (Appendix C) provides substantial detail and explanation of the modeling and calculations performed for various conditions. A summary of the results of these calculations is outlined below:

Global Long Term Stability Analyses (a minimum factor of safety of 1.2 is recommended)

Description	Geotech Cross Section	Method	Factor of Safety
Global Stability block failure mode (static)	E-E	Simplified Janbu	2.9
Global Stability block failure mode (pseudo-static)	E-E	Simplified Janbu	2.4
Global Stability circular failure mode (static)	E-E	Modified Bishop	3.0
Global Stability block circular mode (static)	E-E	Modified Bishop	2.5

Intermediate Stability Analysis (a minimum factor of safety of 1.2 is recommended)

Description	Geotech Cross Section	Method	Factor of Safety
Intermediate Stability block failure mode (static)	Intermediate Section 1	Simplified Janbu	3.5
Intermediate Stability block failure mode (pseudo-static)	Intermediate Section 1	Simplified Janbu	2.7
Intermediate Stability block failure mode (static)	Intermediate Section 2	Simplified Janbu	3.1
Intermediate Stability block failure mode (pseudo-static)	Intermediate Section 2	Simplified Janbu	2.5

Short Term Stability Analysis (Ash benches)

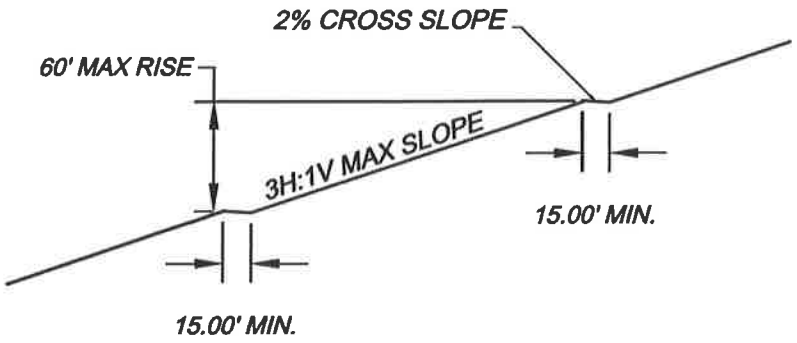
(Minimum factors of safety of 1.5 static and 1.2 pseudo-static conditions are recommended)

Description	Cross Section Slope (Ash Bench)	Bench Height (ft)	Method	Factor of Safety
Short term stability circular failure mode (static)	2H:1V	60	Modified Bishop	2.1
Short term stability circular failure mode (pseudo-static)	2H:1V	60	Modified Bishop	1.8

3.7 Design Parameters

After reviewing the recommendations from the PSI Geotechnical Engineering Report, SCA has determined the following design parameters for the SCA #2 Ash Landfill:

- 3H:1V slope on the face of the landfill
- Benches/Terraces 15 feet wide at a maximum vertical spacing of 60 feet
- Drainage Collection ditches on each bench/terrace with the ditch profile slope generally in the range of 1-2%. Drainage will be directed to perimeter collection ditches, through erosion control BMP's and sediment traps and then into a clay-lined sediment pond.



TYPICAL FILL SECTION

In an effort to be more conservative and provide for a greater factor of safety in the design, SCA is using a design slope of 3H:1V on the face of the landfill instead of the steeper 2H:1V slope that the geotechnical engineer has determined to be allowable. SCA recognizes the variability that may occur in construction and has chosen this gentler slope to provide flexibility and a level of tolerance in the construction conditions. A construction tolerance will allow segments with slopes up to 2.5H:1V without re-grading, but all areas that inadvertently end up steeper than 2H:1V will be re-graded.

SCA also expects that this gentler design slope will give the project a greater stability, reduced risk of erosive conditions and improved conditions for reclamation.

3.8 Settlement Analysis

The placement of ash on the alluvium is likely to cause settlement of the alluvium. The geotechnical analysis of the site indicates that, given the granular nature of the overburden and ash materials, consolidation settlement and secondary compression have been determined to be negligible. Immediate settlement is calculated with the soil behaving as a linear elastic material. Settlement is estimated to be on the order of 6 to 8 inches. Settlement of the material should occur relatively quickly after initial placement. Thus the majority of expected settlement should occur during construction as the ash materials are placed.

The magnitude of expected settlement (even if it was double the estimated amount) is tolerable during construction and operation of the SCA #2 Ash Landfill.

3.9 Summary of Geotechnical Conclusions

The conclusions of the PSI geotechnical evaluation are summarized in the following paragraphs.

Water: While ground water was not observed in Boring B-2 (upper east slope) or in any of the test pits, ground water was observed in Boring B-1 at the lower west end of the site. No surface waters were present at the site or within the near proximity of the site. The granular surface soils (ranging from approximately 14 to 50 feet thick) on top of the relatively impervious shale bedrock will provide an adequately porous layer to convey any ground water that does migrate under the proposed ash landfill. Any migrating ground water is expected to move in a general northeast to southwest direction atop the shale bedrock and at least 10 feet below the ground surface in the vicinity of the landfill and not come into contact with the ash materials.

Leachate Evaluation: PSI recommends placement of a 6-inch thick low permeability soil cap on top of the completed landfill with a native soil cover above that for re-vegetation. Surface water should be controlled to reduce the potential for erosion or ponding and observed erosion conditions should be repaired. Providing these recommendations are followed, PSI anticipates that the risk of water percolating through the ash material and into the groundwater is minimal.

Structural Stability: PSI conducted several structural stability analyses for the proposed landfill in various possible configurations ranging from bench heights of 30 ft. and cross slope section of 1.5H:1V up to a bench height of 60 feet and cross slope section of 2H:1V. All of the configurations modeled indicated short term and long term safety factors greater than the minimums recommended per ASTM E 2277-03 "Standard Guide for Design and Construction of Coal Ash Structural Fills" and also in accordance with the guidelines presented in USACE Manual EM 1110-2-1902 "Slope Stability".

Settlement: PSI recommends that ash materials be placed in maximum 12-inch lifts and with proper compaction; the expected settlement occurring in this landfill will have minimal impact.

Site Suitability: Based on the results and recommendations of their study, PSI is of the opinion that the site of the proposed SCA#2 ash landfill is suitable from a geotechnical engineering perspective.

4.0 Soil Cover Design and Reclamation

SCA has gained successful reclamation experience over the past 20 years and benefitted from the collective experience of the Utah coal mining community. SCA's proposed soil cover is based on this experience and is designed to both minimize water percolation in contact with the ash materials and to promote successful re-vegetation and erosion control. The following principles have influenced this design:

- Precipitation in the area ranges from 10 inches to 20 inches per year
- Evapotranspiration in the area can range from 20 inches to 35 inches per year
- Seeding with a mixture of properly selected species can establish a good vegetative cover to reduce erosion, reduce weeds, maintain natural conditions and extract water from the soil cover layer.
- Mixing a weed free straw or hay mulch along with fertilizer into the upper soil cover layer provides added nutrients in the soil cover without making it immediately available for weed growth.
- Placement of the soil cover in a roughened state can reduce erosion gullies by capturing precipitation in small pockets rather than allowing it to run down the slope. These pockets are also effective at assisting initial vegetation growth.
- A layer of low permeability soil beneath the vegetative soil cover can reduce the potential for soil moisture to come into contact with the ash materials

Given the principles above, SCA proposes the following soil cover design:

- Cap the landfill with a 6 to 8-inch layer import soil material. SCA has developed a practice at the SCA #1 Ash Landfill for placing and compacting this soil cap and will continue to follow this practice on the SCA #2 Ash Landfill. This includes importing clean soil material (2-inch minus with relatively high percent fines). Place and spread this

material across the surface of the slope, moisture condition and compact with a small dozer, making two passes.

- Place a native soil layer for vegetative growth (average 18 to 24-inch loose thickness)
    - The proposed native soil will be tested to confirm appropriate fertilizer and mulch amendments. Given the experience with native soils in this area, it is expected that soil amendments may include something like the following:
        - Spread fertilizer over the soil cover at a rate of up to 200 lb./acre 16-16-8 fertilizer (slow release) or equivalent
        - Depending on the organic content of the native soil, SCA may choose to spread up to 1.5 ton per acre of certified weed free straw mulch.
        - Mix the above noted fertilizer and mulch into the top 12-18 inches of soil utilizing any efficient and effective method (some options include scarifying, plowing, track hoe pocketing, etc.) and
        - Leave the slope surface in a roughened condition to reduce erosion potential (typical 4"-8" deep pockets)
- Seed with reclamation seed mix currently being used on SCA's Sunnyside properties, hydro-seeded with 1.5 tons per acre wood fiber much and tackifier.

5.0 Leachate Potential

Extensive modeling for and evaluation of leachate potential has been prepared in connection with the design of the SCA #1 Ash Landfill located a short distance to the west / north west of this site. (For more information, please refer to Appendix D which includes the modeling reports of the SCA #1 Ash Landfill). The SCA #1 Ash Landfill was designed with a 16" soil cover and no base liner. Surface water is directed around and off of the landfill and contained in lined sedimentation ponds. The different phases of the SCA #1 Ash Landfill have been in operation and / or closure during the past 20 years. Regular monitoring of ground water and surface water in the area confirms the results of the modeling which indicated no significant impacts to ground water were expected.

Given the proposed soil cover for the SCA #2 Ash Landfill described above, the pozzolanic properties and low hydraulic conductivity of the ash, the dry conditions at the selected site, the proposed surface water controls and the proposed lined sediment pond: the proposed design of the SCA #2 Ash Landfill, with no base liner, 6-8 inches of compacted soil cap and 18-24 inches of vegetated native soil cover, will not result in groundwater quality impacts beyond limits established by the State of Utah. The potential for leachate discharge to occur during the active and post-closure phases of the SCA #2 Ash Landfill is negligible.

5.1 Sediment Pond #018 Liner

Sediment Pond #018 will be lined with a low-permeability barrier layer to minimize infiltration of ash-contact runoff which is captured in the pond. The proposed liner design involves either a native clay layer or soil/bentonite mixture.

A native clay material liner would consist of screened import material (2-inch minus), spread and compacted in place. The liner would be 12 inches thick, compacted in two 6-inch lifts to 95% with a resultant hydraulic conductivity less than or equal to $1x10^{-5}$ cm/s.

A soil / bentonite mixture would consist of screened native soil (2-inch minus) and granular bentonite (minus-40 mesh) blended in specific proportions (minimum 6 percent – dry weight basis), moisture conditioned to above-optimum moisture content, and spread and compacted in place. The liner would be 8 inches thick, compacted to 95% with a resultant hydraulic conductivity less than or equal to $1x10^{-5}$ cm/s.

Given the sediment traps proposed up from the Sediment Pond #018, it is expected that the sediment accumulation in #018 will be significantly reduced and regular sediment cleaning will occur more in the sediment traps and less in #018. Nonetheless a 6-inch protective layer of native soils (screened material 2-inch minus) will be placed on top of the liner with detecta tape placed at 3 to 5 foot intervals between the liner and the protective layer.

5.1.1 Proposed Hydraulic Conductivity Testing

Prior to placing the pond liner, construction methods will be reviewed with a geotechnical lab and simulated with the actual material to be used for the liner (either the actual native clay material or the proposed mixture of bentonite/soil). It is proposed that hydraulic conductivity of the liner be determined by preparing two samples using the proposed material and methods and performing falling head conductivity tests in accordance with ASTM D 5084 on the samples. Upon verification that the proposed material and methods will meet permeability requirements, the construction would proceed with field tests to verify compaction.

6.0 Surface Water Controls

This section presents the analysis and design of the surface water control features for the SCA #2 Ash Landfill. The governing principals behind the surface water controls for this landfill are to collect and divert runoff via terrace ditches to the perimeter collection ditches. This water is detained briefly in sediment traps to slow the flow rate and drop sediments prior to reaching the lined sediment pond #018. Straw bales or other bmp's will be placed periodically in the perimeter collection ditch to further assist in slowing the flow velocity and reducing the potential erosion. SCA has submitted a permit application package to the Utah State Engineer for approval to build Sediment Pond #018 (See Appendix E).

Runoff calculations are based on the concept that the ash terraces will be covered as described above on a periodic basis such that the entire ash landfill is not exposed at the same time. This will allow the re-vegetation efforts to establish a reasonable ground cover and minimize runoff and erosion for the project.

6.1 Existing Surface Water Features

As previously stated, the location for the SCA #2 Ash Landfill was selected in part due to the absence of water sources in the area. This site is not located in a 100 year flood plain and only ephemeral surface water features exist in the near vicinity. The site is located in the upper headwaters area of Icelander Creek. Icelander Creek is normally dry near the site but often has

extended seasonal flows below Whitmore Springs located approximately 1.5 miles to the west / northwest of the site. Water Canyon is located approximately 0.5 miles to the south of the site and typically only sees storm related or snow melt related runoff. Grassy Trail Creek is located approximately 0.8 miles to the north / northwest and usually experiences flow during seasonal runoff conditions and releases from the upstream dam.

6.2 Hydrologic Data

The rainfall point values for the Sunnyside and East Carbon, Utah area were obtained from the NOAA Atlas 14, Volume 1, Version 5. The 24-hour rainfall values used are 1.99 inches for the 10-year event and 2.83 inches for the 100-year event.

Runoff was estimated using the Rational method and hand computations. Assuming Type I antecedent moisture conditions for the site, the runoff coefficient was estimated at 0.65 for exposed ash conditions, 0.25 for surfaces that have been recently covered with soil and roughened, and 0.15 for surfaces that have been re-vegetated in a roughened condition.

The direct tributary drainage area to Sedimentation Pond #018 is approximately 55 acres. The designed sediment traps 1 and 2 together with straw bales and other bmp's will slow the peak flow velocities in the ditches and reduce the sediment load, but overall, the total volume of water delivered to #018 is the same. These sediment traps have been factored into the hydrologic modeling.

Pond and sediment trap design details, watershed boundaries, flow paths, pond connectivity, diversions, ditches, and calculations are shown in the Appendix B to this report and the accompanying drawing package (Appendix F).

Runoff from most areas outside the landfill footprint will generally be diverted away from the sediment pond using diversion berms and ditches on the landfill perimeter.

6.3 Design Assumptions

When the SCA #2 Ash Landfill development is in progress, the tributary drainage area to the sedimentation pond will consist of a combination of existing ground in undeveloped areas, exposed ash on active terraces and benches of the active cell, and cover soil on closed benches. Existing ground in undeveloped areas of the site consists of a coarse alluvium in a relatively dry condition. Runoff from these areas will generally either be diverted away from the landfill or be collected with the landfill runoff and flow to the sediment pond.

Ash surfaces in the active cell tend to be in a somewhat dry condition after exposure to the evaporative conditions typical of the area. Benches in the cell will be sloped inward to prevent runoff from cascading down the terrace faces as an erosion-prevention measure. Runoff from the top of the terrace will drain to perimeter ditches or terraces and be conveyed to the sediment traps and pond. Cover soil on closed portions of the landfill will also tend to be in a relatively dry condition, and will be sloped and roughened as described in the reclamation section above.

As expected, runoff computations indicate that the greatest runoff volume is generated from exposed ash surfaces. In order to produce a conservative pond design volume (on the side of oversizing), the pond was design to contain the runoff volume projected and then the two main sediment traps were added. While it is anticipated that the sediment traps will remain open and drain slowly through the discharge pipe, it is possible to temporarily close the discharge pipe valve and hold the storm water to avoid a discharge from sediment pond #018. The UPDES permit will allow a discharge from #018 as long as the discharge is tested and meets the required water quality standards.

6.4 Hydrologic Modeling Analysis Results

Based upon computations using the Rational method, the 100-year 24-hour event will produce approximately 2.3 acre feet of runoff in a final reclaimed condition. The 10-year 24-hour event will produce between approximately 1.0 and 3.0 acre feet, depending on the condition of the landfill construction at the time of the storm (amount of the landfill constructed, extent of exposed ash surface, sediment traps, etc.). Calculation summaries are included in Appendix B.

Sediment Pond #018 is designed with a capacity of approximately 2.5 acre feet, below the 18" overflow discharge standpipe. Discharge capacity through the standpipe is as much as 13 cfs. While it is possible to envision two major storms occurring in a short time period (with a combined precipitation greater than the design storm), it is expected that there will be no discharge during most years.

Sediment Trap #1 is designed with a capacity of approximately 1.5 acre feet below the 24" overflow discharge standpipe (if constructed in the expanded condition shown on the design drawings). Discharge capacity through the standpipe is as much as 18 cfs, but it is expected that most storms will be smaller than 1.5 acre feet and will therefore simply drain this sediment trap through the 2" drain pipe at flow rates less than 0.3 cfs. Discharge from Sediment Trap #1 will flow directly to Sediment Pond #018.

Sediment Trap #2 is designed with a capacity of approximately 1.8 acre feet below the overflow discharge spillway ditch. Discharge capacity over the spillway can be as much as 15 cfs, but it is expected that most storms will be smaller than 1.8 acre feet and will therefore simply drain this sediment trap through the 2" drain pipe at flow rates less than 0.3 cfs. Discharge from the Sediment Trap #2 drain pipe will flow to a terrace ditch and into the south perimeter collection ditch which will flow to Sediment Trap #1 and then to Sediment Pond #018. If Sediment Trap #2 fills and discharges through the overflow spillway, it will follow ditches on SCA property into SCA's Borrow Area Pond #016 which, if it ever discharges, would end up into Sediment Trap #1 and then Sediment Pond #018.

6.5 Ditch Conveyance and Erosion Control

This section discusses erosion control for runoff control ditches at the SCA #2 Ash Landfill. Ditches flowing across the terraces and around the perimeter of the landfill will not generally be lined. The minimum ditch grade at the landfill is approximately 1 percent—there is little chance that excess ponding will occur in any ditches. The ponding area of the sediment pond #018 will be 100-percent lined, as described above. Ash contact runoff may wet the soil in the ditch invert, but will tend to quickly evaporate in the arid climate rather than infiltrate.

Flow velocities in the terrace ditches will generally be high enough that little sediment deposition will occur. Therefore any ash which may erode from the landfill will be deposited in the sediment traps or the lined sediment pond. Ash and sediment will be routinely excavated from the traps and pond and placed into the active ash cell.

The north and south perimeter ditches are sloped much greater than terrace ditches. They will have periodic bmp's (such as straw bales, silt fences or other check dams) to reduce the risk of serious bed erosion in the ditch. If significant amounts of sediment build up behind the bmp's, maintenance will be required to ensure the continued functionality of the ditch and bmp.

As an alternate to bmp's described above, SCA may determine that it is more efficient to place rock armoring in the ditches to control erosion. Gravel and cobbles obtained from screening cover soil can be placed along the ditch invert. Some fines will initially wash away (to the sedimentation trap), leaving a natural graded armor layer. SCA may also choose to install additional small sediment traps, or other bmp's, at the site to manage flow rates.

7.0 Operation / Maintenance Plan

SCA will operate and maintain the SCA #2 Ash Landfill in accordance with the requirements of the Groundwater Permit.

Closure will include covering and re-vegetation as described above. The SCA #2 Ash Landfill would be considered closed after the soil cover is complete and the landfill has been reseeded.

Post Closure monitoring will occur for 10 years following the point of closure and will include semi-annual inspections to observe the success of re-vegetation, check for erosion problems, and sample the monitoring well MW-8. Maintenance of the site may require attention to re-vegetation or erosion needs. Water monitoring will verify that groundwater conditions are still within protection limits set in the Groundwater Permit. The Post Closure period would be considered complete when ten years following closure have past, re-vegetation efforts have resulted in conditions similar or better than the surrounding area, and surface soils are stabilized (erosion conditions do not present a risk of exposing the ash material).

8.0 Contingency and Corrective Action Plan

SCA will operate and maintain and monitor the SCA #2 Ash Landfill in accordance with the Operation and Maintenance plan described in Section 7.0 throughout the operational, closure and post closure periods.

During these time periods, it is possible that conditions could arise which require corrective action. SCA has developed a plan to address the potential conditions as follows:

- Erosion Gullies – It is possible that erosion gullies could develop on the face of the landfill or in the drainage channels. The likely cause of this condition is from a large storm event or many smaller events over time. Corrective action would be site specific but would focus on controlling surface water runoff, slowing the velocity, redirecting to a stable area and / or filling the gully and re-establishing vegetation.
- Slumping or mass movement of ash or other soil materials – Although the proposed slopes are more conservative than required by the geotechnical engineer, in the event of mass movement, SCA would re-evaluate the stability of the slope in that area and re-grade as necessary to achieve a stable slope.
- Water Quality
    - Surface Water – The state UPDES permit will specify the required quality of surface water discharges from this site. SCA will monitor the UPDES point as required by the permit. In the event that discharges exceed the quality standards, SCA will evaluate and implement the best management practices needed to stay in compliance. Some options may include increased pond or sediment trap capacity; additional ponds, sediment traps or other bmp's; increased re-vegetation efforts to reduced sediment and runoff; etc.
    - Ground Water – SCA will monitor the groundwater quality at MW-8. Given the conditions of the site and the ash material, ground water impacts from the ash landfill are not likely. Nonetheless, if SCA experiences monitoring results that exceed the protection limits, it will take measures to verify the test results, determine the cause of the higher results and implement efforts to reduce potential impacts from the ash landfill (i.e. increased soil cap, additional water diversions, etc.).

APPENDIX A

GROUNDWATER SAMPLING RESULTS

MW-8

Sunnyside Cogeneration Associates Facility

Groundwater Sampling of MW-8
Year 2012-2013

	Field Parameters			Metals(mg/l)							
Sample Date	Temp. (C)	pH (S.U.)	SC (umhos)	Arsenic	Barium	Cadmium	Copper	Lead	Selenium	Silver	Zinc
January 31, 2012	11.5	7.4	8812	0.0094	0.017	ND	ND	ND	0.0949	ND	ND
February 21, 2012	11.3	7.67	8675	0.0076	0.012	ND	ND	ND	0.0777	ND	ND
April 9, 2012	11.8	7.4	9219	0.0075	0.013	ND	ND	ND	0.0551	ND	ND
May 31, 2012	12.4	7.49	9060	0.006	0.011	ND	ND	ND	0.0452	ND	ND
June 25, 2012	13.1	7.46	9545	0.0066	0.01	ND	ND	ND	0.0525	ND	ND
July 25, 2012	12.8	7.26	8675	0.0087	0.009	ND	ND	ND	0.0664	ND	ND
August 30, 2012	12.6	7.17	9290	0.01	0.011	ND	ND	ND	0.0531	ND	ND
October 25, 2012	11	7.31	9433	0.0081	0.011	ND	ND	ND	0.0357	ND	ND
December 5, 2012	12.6	7.22	9466	0.0143	0.012	ND	ND	ND	0.0573	ND	ND
January 29, 2013	11.8	7.26	8983	0.0079	0.01	ND	ND	ND	0.0351	ND	ND
Average	12.09	7.36	9116	0.0086	0.012	ND	ND	ND	0.0573	ND	ND
Standard Deviation	0.67	0.14	308	0.0022	0.0021	ND	ND	ND	0.0175	ND	ND

	Inorganics		Cations(mg/l)					Anions(mg/l)				
Sample Date	TDS (mg/l)	pH (S.U.)	Calcium	Hardness CaCO3	Sodium	Potassium	Magnesium	Chloride	Sulfate	Bicarbonate HCO3	Carbonate CO3	Alkalinity Total
January 31, 2012	9880	7.1	407	4380	1360	20	817	240	5800	484	ND	397
February 21, 2012	10000	7.2	396	4180	1250	18	776	240	5800	488	ND	401
April 9, 2012	9950	7.1	378	4200	1390	18.9	792	220	6000	490	ND	402
May 31, 2012	10200	7.2	403	3680	1360	18.3	808	233	6000	491	ND	403
June 25, 2012	10300	7.2	384	4100	1390	18.8	763	242	6300	491	ND	403
July 25, 2012	9830	7.1	408	3750	1230	16.9	748	240	2020	491	ND	403
August 30, 2012	10800	7.2	377	4100	1480	19.7	766	281	6000	499	ND	409
October 25, 2012	10200	7.2	372	4080	1610	18.2	765	230	6300	503	ND	412
December 5, 2012	10600	7.2	383	4220	1480	19.2	792	230	6200	491	ND	403
January 29, 2013	10800	7.1	364	3990	1370	18.4	748	232	6200	490	ND	402
Average	10256	7.16	387	4068	1392	18.64	778	239	5662	492	ND	404
Standard Deviation	346.5	0.05	14.6	202.6	105.8	0.848	22.7	15.4	1226	5.1	ND	3.96

A "<" sign indicates the value reported was the practical quantitation limit for this sample using the method described. Concentrations of analyte, if present, below this limit. were not quantifiable. These results should be considered non-detect.
ND=NoN-Detect

CHEMTECH-FORD
LABORATORIES

Certificate of Analysis

Lab Sample No.: 1300745-01

Name:	**Sunnyside Cogeneration**	***Sample Date:***	1/29/2013 9:30 AM
Sample Site:	MW-8	***Receipt Date:***	1/30/2013 8:45 AM
Comments:		***Sampler:***	Sunnyside Cogen
Sample Matrix:	Water	***Project:***	GW

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Calculations								
Hardness, Total as CaCO3	3990	1	mg/L	2/6/2013 14:00	PNM	SM 2340 B	471-34-1	
Inorganic								
Alkalinity - Bicarbonate (HCO3)	490	1.0	mg/L	1/31/2013 10:00	RMC	SM 2320 B	71-52-3	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	1/31/2013 10:00	RMC	SM 2320 B	3812-32-6	
Alkalinity - CO2	391	1.0	mg/L	1/31/2013 10:00	RMC	SM 2320 B	124-38-9	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	1/31/2013 10:00	RMC	SM 2320 B	14280-30-9	
Alkalinity - Total (as CaCO3)	402	1.0	mg/L	1/31/2013 10:00	RMC	SM 2320 B	CTFID10279	
Chloride	232	5	mg/L	2/2/2013 7:00	TSM	EPA 300.0	16887-00-6	
pH	7.1	0.1	pH Units	1/30/2013 14:00	RMC	SM 4500 H-B	CTFID10187	SPH
Sulfate	6200	100	mg/L	2/2/2013 7:00	TSM	EPA 300.0	14808-79-8	
Total Dissolved Solids (TDS)	10800	20	mg/L	1/31/2013 14:00	SPH	SM 2540 C	CTFID10226	
Metals								
Arsenic, Total	0.0078	0.0005	mg/L	2/6/2013 0:00	MJB	EPA 200.8	7440-38-2	
Barium, Total	0.010	0.005	mg/L	2/4/2013 11:00	PNM	EPA 200.7	7440-39-3	
Calcium, Total	364	0.2	mg/L	2/4/2013 11:00	PNM	EPA 200.7	7440-43-9	
Cadmium, Total	ND	0.0002	mg/L	2/6/2013 0:00	MJB	EPA 200.8	7440-43-9	
Copper, Total	ND	0.005	mg/L	2/4/2013 11:00	PNM	EPA 200.7	7440-50-8	
Lead, Total	ND	0.0005	mg/L	2/6/2013 0:00	MJB	EPA 200.8	7439-92-1	
Magnesium, Total	748	0.2	mg/L	2/4/2013 11:00	PNM	EPA 200.7	7439-95-4	
Potassium, Total	18.4	0.5	mg/L	2/4/2013 11:00	PNM	EPA 200.7	7440-09-7	
Selenium, Total	0.0351	0.0005	mg/L	2/6/2013 0:00	MJB	EPA 200.8	7782-49-2	
Silver, Total	ND	0.0005	mg/L	2/6/2013 0:00	MJB	EPA 200.8	7440-22-4	
Sodium, Total	1370	0.5	mg/L	2/4/2013 11:00	PNM	EPA 200.7	7440-23-5	
Zinc, Total	ND	0.01	mg/L	2/4/2013 11:00	PNM	EPA 200.7	7440-66-6	

CHEMTECH-FORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY:
ADDRESS: SCA
CITY/STATE/ZIP:
PHONE #: FAX:
CONTACT: Rusty Metz PROJECT: MW-8
EMAIL:

BILLING ADDRESS:
BILLING CITY/STATE/ZIP:
PURCHASE ORDER #:

TURNAROUND REQUIRED:*
*Expedited turnaround subject to additional charge

CHEMTECH-FORD LABORATORIES

___ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX
DW = Drinking Water
WW = Wastewater
W = Water
S = Soil
SO = Solid
SL = Sludge
O = Other

ANALYTICAL TESTS REQUESTED

Bacteriological
R = Routine
I = Investigative
TG = Trigger Source
CO = Confirmation

REPEAT
OR = Original Location
UP = Upstream
DN = Downstream

Lab ID #	SAMPLE IDENTIFICATION	SAMPLE DATE	SAMPLE TIME	Drinking Water FACILITY ID	FIELD: Residual Chlorine	Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. coli only	Repeat (Fail #)	SYSTEM #
D0745-01	1. MW-8	1/29/13	930		See Attached Sheet						
	2.										
	3.										
	4.										
	5.										
	6.										
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	8.										
	9.										
	10.										

Sampled by: [print]
Sampled by: [signature]

ON ICE NOT ON ICE

Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Relinquished by: [signature]	1/29/13 1200 Date/Time	Received by: [signature]	1/30/13 8:45 Date/Time
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time

CHEMTECH-FORD 6100 South Stratler Street (380 West) Murray, UT 84107 Phone: 801-262-7299 FAX: 801-262-7378 www.chemtechford.com

Payment Terms are net 30 days OAC. 1.5% interest charge per month (18% per annum). Client agress to pay collection costs and attorney's fees

TRK# 8201 7946 2594 8940

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

Lab ID #: 00245

Delivery Method: (circle one)

UPS (FedEX) USPS

Walk-In Courier Chemtech

Sample(s) sealed: Yes / (No)

Appropriate container/preserve: (Yes) / No

Temperature 1 C°

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01	A1/2		1					
2		M	944						
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Comments:

Bottle Type	
Plastic	**Glass**
A- Plastic Unpreserved	D- 625 ($Na_2S_2O_3$)
B- Miscellaneous Plastic	G- Glass Unpreserved
C- Cyanide Qt (NaOH)	H- HAAs (NH_4Cl)
F- Sulfide Qt (NaOH/Zn Acetate)	J- 508/515/525 (Na_2SO_3)
M- Metals Pint (HNO_3)	O- Oil & Grease (1:1 HCl)
N- Nutrient Pint (H_2SO_4)	P- Phenols (H_2SO_4)
R- Radiological Gallon (HNO_3)	T- TOC/TOX (H_3PO_4)
S- Sludge Cups/Tubs	U- 531 (MCAA, $Na_2S_2O_3$)
Q- Plastic Bags	V- 524/THMs (Ascorbic Acid)
E- Coliform/Ecoli	W- 8260 (1:1 HCl)
Additional Volumes	X- Vial Unpreserved
Q- quart 1/2pt- half pint	Y- 624/504 ($Na_2S_2O_3$)
P- pint 1/2- half gallon	Z- Miscellaneous Glass

CHEMTECH-FORD
LABORATORIES

Certificate of Analysis

Lab Sample No.: 1200783-02

Name:	**Sunnyside Cogeneration**	***Sample Date:***	1/31/2012 1:00 PM
Sample Site:	MW-8	***Receipt Date:***	2/1/2012 11:00 AM
Comments:		***Sampler:***	Sunnyside Cogen
Sample Matrix:	Wastewater	***Project:***	

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Calculations								
Hardness, Total as CaCO3	4380	1	mg/L	2/15/2012 16:00	MJB	SM 2340 B	471-34-1	
Inorganic								
Alkalinity - Bicarbonate (HCO3)	484	1.0	mg/L	2/13/2012 14:30	TSM	SM 2320 B	71-52-3	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	2/13/2012 14:30	TSM	SM 2320 B	3812-32-6	
Alkalinity - CO2	382	1.0	mg/L	2/13/2012 14:30	TSM	SM 2320 B	124-38-9	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	2/13/2012 14:30	TSM	SM 2320 B	14280-30-9	
Alkalinity - Total (as CaCO3)	397	1.0	mg/L	2/13/2012 14:30	TSM	SM 2320 B	CTFID10279	
Chloride	240	10	mg/L	2/14/2012 12:18	TSM	EPA 300.0	16887-00-6	
pH	7.1	0.1	pH Units	2/1/2012 16:00	JSH	SM 4500 H-B	CTFID10187	SPH
Sulfate	5800	100	mg/L	2/14/2012 12:18	TSM	EPA 300.0	14808-79-8	
Total Dissolved Solids (TDS)	9880	10	mg/L	2/6/2012 9:14	JSH	SM 2540 C	CTFID10226	
Metals								
Arsenic, Total	0.0094	0.0005	mg/L	2/3/2012 15:10	MJB	EPA 200.8	7440-38-2	
Barium, Total	0.017	0.005	mg/L	2/9/2012 16:12	PNM	EPA 200.7	7440-39-3	
Calcium, Total	407	0.2	mg/L	2/9/2012 16:12	PNM	EPA 200.7	7440-43-9	
Cadmium, Total	ND	0.0005	mg/L	2/3/2012 15:10	MJB	EPA 200.8	7440-43-9	
Copper, Total	ND	0.005	mg/L	2/9/2012 16:12	PNM	EPA 200.7	7440-50-8	
Lead, Total	ND	0.0005	mg/L	2/3/2012 15:10	MJB	EPA 200.8	7439-92-1	
Magnesium, Total	817	0.2	mg/L	2/9/2012 16:12	PNM	EPA 200.7	7439-95-4	
Potassium, Total	20.0	0.5	mg/L	2/9/2012 16:12	PNM	EPA 200.7	7440-09-7	
Selenium, Total	0.0949	0.0005	mg/L	2/3/2012 15:10	MJB	EPA 200.8	7782-49-2	
Silver, Total	ND	0.0005	mg/L	2/3/2012 15:10	MJB	EPA 200.8	7440-22-4	
Sodium, Total	1360	0.5	mg/L	2/9/2012 16:12	PNM	EPA 200.7	7440-23-5	
Zinc, Total	ND	0.01	mg/L	2/9/2012 16:12	PNM	EPA 200.7	7440-66-6	

CHEMTECH - FORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY: SCA

ADDRESS:

CITY/STATE/ZIP:

PHONE #: FAX:

CONTACT: Rusty Nett PROJECT:

EMAIL:

BILLING ADDRESS:

BILLING CITY/STATE/ZIP:

PURCHASE ORDER #:

TURNAROUND REQUIRED:*

*Expedited turnaround subject to additional charge

CHEMTECH-FORD LABORATORIES

___ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX
DW = Drinking Water
WW = Wastewater
W = Water
S = Soil
SO = Solid
SL = Sludge
O = Other

ANALYTICAL TESTS REQUESTED

Bacteriological

R = Routine
I = Investigative
TG = Trigger Source
CO = Confirmation

REPEAT
OR = Original Location
UP = Upstream
DN = Downstream

Lab ID #		SAMPLE NAME	SAMPLE DATE	SAMPLE TIME	Drinking Water FACILITY ID	FIELD: Residual Chlorine	Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. coli only	Repeat (Fail #)	SYSTEM #
0783	1.	MW-1	1/31/12	1100								
-01	2.	MW-8	1/31/12	[illegible]								
-02	3.			1300								
	4.											
	5.											
	6.											
	7.											
	8.											
	9.											
	10.											

See Attachment

Sampled by: [print]

Sampled by: [signature]

ON ICE NOT ON ICE

Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
[signature]	1/31/12 1400	Elizabeth Hansen	2/1/12 11:00
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time

TRK# 0201 7980 0731 2082

HEMTECH-FORD
LABORATORIES

Certificate of Analysis

Lab Sample No.: 1201363-01

Name:	**Sunnyside Cogeneration**	***Sample Date:***	2/21/2012 11:00 AM
Sample Site:	MW-8	***Receipt Date:***	2/22/2012 10:00 AM
Comments:		***Sampler:***	Sunnyside Cogen
Sample Matrix:	Wastewater	***Project:***	

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Calculations								
Hardness, Total as CaCO3	4180	1	mg/L	3/6/2012 11:22	DBH	SM 2340 B	471-34-1	
Inorganic								
Alkalinity - Bicarbonate (HCO3)	488	1.0	mg/L	2/26/2012 10:30	TSM	SM 2320 B	71-52-3	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	2/26/2012 10:30	TSM	SM 2320 B	3812-32-6	
Alkalinity - CO2	386	1.0	mg/L	2/26/2012 10:30	TSM	SM 2320 B	124-38-9	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	2/26/2012 10:30	TSM	SM 2320 B	14280-30-9	
Alkalinity - Total (as CaCO3)	401	1.0	mg/L	2/26/2012 10:30	TSM	SM 2320 B	CTFID10279	
Chloride	240	10	mg/L	2/23/2012 10:24	TSM	EPA 300.0	16887-00-6	
pH	7.2	0.1	pH Units	2/22/2012 16:00	JSH	SM 4500 H-B	CTFID10187	SPH
Sulfate	5800	100	mg/L	2/23/2012 10:24	TSM	EPA 300.0	14808-79-8	
Total Dissolved Solids (TDS)	10000	10	mg/L	2/23/2012 13:10	JSH	SM 2540 C	CTFID10226	
Metals								
Arsenic, Total	0.0076	0.0005	mg/L	2/28/2012 16:48	MJB	EPA 200.8	7440-38-2	
Barium, Total	0.012	0.005	mg/L	2/28/2012 18:03	PNM	EPA 200.7	7440-39-3	
Calcium, Total	396	0.2	mg/L	2/28/2012 18:03	PNM	EPA 200.7	7440-43-9	
Cadmium, Total	ND	0.0005	mg/L	2/28/2012 16:48	MJB	EPA 200.8	7440-43-9	
Copper, Total	ND	0.005	mg/L	2/28/2012 18:03	PNM	EPA 200.7	7440-50-8	
Lead, Total	ND	0.0005	mg/L	2/28/2012 16:48	MJB	EPA 200.8	7439-92-1	
Magnesium, Total	776	0.2	mg/L	2/28/2012 18:03	PNM	EPA 200.7	7439-95-4	
Potassium, Total	18.0	0.5	mg/L	2/28/2012 18:03	PNM	EPA 200.7	7440-09-7	
Selenium, Total	0.0772	0.0005	mg/L	2/28/2012 16:48	MJB	EPA 200.8	7782-49-2	
Silver, Total	ND	0.0005	mg/L	2/28/2012 16:48	MJB	EPA 200.8	7440-22-4	
Sodium, Total	1250	0.5	mg/L	2/28/2012 18:03	PNM	EPA 200.7	7440-23-5	
Zinc, Total	ND	0.01	mg/L	2/28/2012 18:03	PNM	EPA 200.7	7440-66-6	

CHEMTECH - FORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY: SCA
ADDRESS:
CITY/STATE/ZIP:
PHONE #: FAX:
CONTACT: Rusty Dtr PROJECT: Ground WTR
EMAIL:

BILLING ADDRESS:
BILLING CITY/STATE/ZIP:
PURCHASE ORDER #:

TURNAROUND REQUIRED:*
*Expedited turnaround subject to additional charge

☐ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX
DW = Drinking Water
WW = Wastewater
W = Water
S = Soil
SO = Solid
SL = Sludge
O = Other

ANALYTICAL TESTS REQUESTED

See Attachment

FIELD: Residual Chlorine

Bacteriological
Total Coliform + E. coli (Present/Absent)
Total Coliform + E. coli (Enumerated)
HPC (Plate Count)
E. coli only
WW: Total Coliform + Fecal Coliform

R = Routine
I = Investigative
TG = Trigger Source
CO = Confirmation

REPEAT
OR = Original Location
UP = Upstream
DN = Downstream

Lab ID #		SAMPLE LOCATION	SAMPLE DATE	SAMPLE TIME	Drinking Water Only: SAMPLE SOURCE CODE	Drinking Water Only: SAMPLE POINT CODE	Repeat (Fail #)	SYSTEM #
1363 01	1.	MW-8	2/21/12	1100				
	2.							
	3.							
	4.							
	5.							
	6.							
	7.							
	8.							
	9.							
	10.							

Sampled by: [print]
Sampled by: [signature]

ON ICE NOT ON ICE

Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Rusty Dtr	2/21/12 - 1200		
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
			2/22/12 10:00
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time

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FedEx TRK# 0215 8714 9596 8349

WED - 22 FEB A1
PRIORITY OVERNIGHT

CHEMTECH-FORD
LABORATORIES

Certificate of Analysis

Lab Sample No.: 1202919-01

Name:	**Sunnyside Cogeneration**	***Sample Date:***	4/9/2012 10:00 AM
Sample Site:	MW-8	***Receipt Date:***	4/10/2012 10:30 AM
Comments:		***Sampler:***	Sunnyside Cogen
Sample Matrix:	Wastewater	***Project:***	

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Calculations								
Hardness, Total as CaCO3	4200	1	mg/L	4/23/2012 16:31	DBH	SM 2340 B	471-34-1	
Inorganic								
Alkalinity - Bicarbonate (HCO3)	490	1.0	mg/L	4/12/2012 8:00	TSM	SM 2320 B	71-52-3	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	4/12/2012 8:00	TSM	SM 2320 B	3812-32-6	
Alkalinity - CO2	362	1.0	mg/L	4/12/2012 8:00	TSM	SM 2320 B	124-38-9	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	4/12/2012 8:00	TSM	SM 2320 B	14280-30-9	
Alkalinity - Total (as CaCO3)	402	1.0	mg/L	4/12/2012 8:00	TSM	SM 2320 B	CTFID10279	
Chloride	220	10	mg/L	4/11/2012 8:00	TSM	EPA 300.0	16887-00-6	
pH	7.1	0.1	pH Units	4/10/2012 16:00	JSH	EPA 9045C	CTFID10187	SPH
Sulfate	6000	100	mg/L	4/11/2012 8:00	TSM	EPA 300.0	14808-79-8	
Total Dissolved Solids (TDS)	9950	10	mg/L	4/11/2012 11:42	JSH	SM 2540 C	CTFID10226	
Metals								
Arsenic, Total	0.0075	0.0005	mg/L	4/16/2012 14:37	MJB	EPA 200.8	7440-38-2	
Barium, Total	0.013	0.005	mg/L	4/20/2012 14:43	PNM	EPA 200.7	7440-39-3	
Calcium, Total	378	0.2	mg/L	4/20/2012 14:43	PNM	EPA 200.7	7440-43-9	
Cadmium, Total	ND	0.0005	mg/L	4/16/2012 14:37	MJB	EPA 200.8	7440-43-9	
Copper, Total	ND	0.005	mg/L	4/20/2012 14:43	PNM	EPA 200.7	7440-50-8	
Lead, Total	ND	0.0005	mg/L	4/16/2012 14:37	MJB	EPA 200.8	7439-92-1	
Magnesium, Total	792	0.2	mg/L	4/20/2012 14:43	PNM	EPA 200.7	7439-95-4	
Potassium, Total	18.9	0.5	mg/L	4/20/2012 14:43	PNM	EPA 200.7	7440-09-7	
Selenium, Total	0.0551	0.0005	mg/L	4/16/2012 14:37	MJB	EPA 200.8	7782-49-2	
Silver, Total	ND	0.0005	mg/L	4/16/2012 14:37	MJB	EPA 200.8	7440-22-4	
Sodium, Total	1390	0.5	mg/L	4/20/2012 14:43	PNM	EPA 200.7	7440-23-5	
Zinc, Total	ND	0.01	mg/L	4/20/2012 14:43	PNM	EPA 200.7	7440-66-6	

CHEMTECH - FORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY: Sunnyside
ADDRESS:
CITY/STATE/ZIP:
PHONE #: FAX:
CONTACT: Rusty Dutz PROJECT:
EMAIL:

BILLING ADDRESS:
BILLING CITY/STATE/ZIP:
PURCHASE ORDER #:

TURNAROUND REQUIRED:*
*Expedited turnaround subject to additional charge

☐ Mark "X" here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX
DW = Drinking Water
WW = Wastewater
W = Water
S = Soil
SO = Solid
SL = Sludge
O = Other

Bacteriological
R = Routine
I = Investigative
TG = Trigger Source
CO = Confirmation

REPEAT
OR = Original Location
UP = Upstream
DN = Downstream

Lab ID #	SAMPLE LOCATION	SAMPLE DATE	SAMPLE TIME	Drinking Water Only: SAMPLE SOURCE CODE	Drinking Water Only: SAMPLE POINT CODE	ANALYTICAL TESTS REQUESTED	FIELD: Residual Chlorine	Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. coli only	WW: Total Coliform + Fecal Coliform	Repeat (Fail #)	SYSTEM #
2919-01	1. MW-8	4/9/12	1000			See Attachment								
	2.													
	3.													
	4.													
	5.													
	6.													
	7.													
	8.													
	9.													
	10.													
	Sampled by: [print]			Sampled by: [signature]			ON ICE / NOT ON ICE							

Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Rusty Mc	4/9/12 1100		
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
		Abril Arias	4.10.12 10:30
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time

CHEMTECH-FORD 6160 South Stratler Street (360 West) Murray, UT 84107 Phone: 801-262-7299 FAX: 801-262-7378 www.chemtechford.com

CHEMTECH-FORD LABORATORIES

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

Lab ID #: 2919

Delivery Method: (circle one)

(UPS) FedEX USPS

Walk-In Courier Chemtech

Sample(s) sealed: Yes / (No)

Appropriate container/preserve: (Yes) / No

Temperature 16 c°

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01	A1/2	—	1					
2		M	880						
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Comments:

Bottle Type	
Plastic	**Glass**
A- Plastic Unpreserved	D- 625 ($Na_2S_2O_3$)
B- Miscellaneous Plastic	G- Glass Unpreserved
C- Cyanide Qt (NaOH)	H- HAAs (NH_4Cl)
F- Sulfide Qt (NaOH/Zn Acetate)	J- 508/515/525 (Na_2SO_3)
M- Metals Pint (HNO_3)	O- Oil & Grease (1:1 HCl)
N- Nutrient Pint (H_2SO_4)	P- Phenols (H_2SO_4)
R- Radiological Gallon (HNO_3)	T- TOC/TOX (H_3PO_4)
S- Sludge Cups/Tubs	U- 531 (MCAA, $Na_2S_2O_3$)
Q- Plastic Bags	V- 524/THMs (Ascorbic Acid)
E- Collform/Ecoli	W- 8260 (1:1 HCl)
Additional Volumes	X- Vial Unpreserved
Q- quart 1/2pt- half pint	Y- 624/504 ($Na_2S_2O_3$)
P- pint 1/2- half gallon	Z- Miscellaneous Glass

CHEMTECH-FORD
LABORATORIES

Certificate of Analysis

Lab Sample No.: 1204660-01

Name:	**Sunnyside Cogeneration**	***Sample Date:***	5/31/2012 12:05 PM
Sample Site:	MW-8	***Receipt Date:***	6/1/2012 12:25 PM
Comments:		***Sampler:***	Sunnyside Cogen
Sample Matrix:	Water	***Project:***	

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Calculations								
Hardness, Total as CaCO3	368	1	mg/L	6/15/2012 16:12	DBH	SM 2340 B	471-34-1	
Inorganic								
Alkalinity - Bicarbonate (HCO3)	491	1.0	mg/L	6/6/2012 8:00	TSM	SM 2320 B	71-52-3	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	6/6/2012 8:00	TSM	SM 2320 B	3812-32-6	
Alkalinity - CO2	362	1.0	mg/L	6/6/2012 8:00	TSM	SM 2320 B	124-38-9	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	6/6/2012 8:00	TSM	SM 2320 B	14280-30-9	
Alkalinity - Total (as CaCO3)	403	1.0	mg/L	6/6/2012 8:00	TSM	SM 2320 B	CTFID10279	
Chloride	233	5	mg/L	6/2/2012 13:00	TSM	EPA 300.0	16887-00-6	
pH	7.2	0.1	pH Units	6/1/2012 16:00	JSH	EPA 9045C	CTFID10187	SPH
Sulfate	6000	100	mg/L	6/2/2012 13:00	TSM	EPA 300.0	14808-79-8	
Total Dissolved Solids (TDS)	10200	10	mg/L	6/4/2012 13:28	JSH	SM 2540 C	CTFID10226	
Metals								
Arsenic, Total	0.0060	0.0005	mg/L	6/8/2012 12:36	MJB	EPA 200.8	7440-38-2	
Barium, Total	0.011	0.005	mg/L	6/15/2012 22:55	PNM	EPA 200.7	7440-39-3	
Calcium, Total	403	0.2	mg/L	6/15/2012 22:55	PNM	EPA 200.7	7440-43-9	
Cadmium, Total	ND	0.0005	mg/L	6/8/2012 12:36	MJB	EPA 200.8	7440-43-9	
Copper, Total	ND	0.005	mg/L	6/15/2012 22:55	PNM	EPA 200.7	7440-50-8	
Lead, Total	ND	0.0005	mg/L	6/8/2012 12:36	MJB	EPA 200.8	7439-92-1	
Magnesium, Total	808	0.2	mg/L	6/15/2012 22:55	PNM	EPA 200.7	7439-95-4	
Potassium, Total	18.3	0.5	mg/L	6/15/2012 22:55	PNM	EPA 200.7	7440-09-7	
Selenium, Total	0.0452	0.0005	mg/L	6/8/2012 12:36	MJB	EPA 200.8	7782-49-2	
Silver, Total	ND	0.0005	mg/L	6/8/2012 12:36	MJB	EPA 200.8	7440-22-4	
Sodium, Total	1360	50.0	mg/L	6/20/2012 19:41	PNM	EPA 200.7	7440-23-5	
Zinc, Total	ND	0.01	mg/L	6/15/2012 22:55	PNM	EPA 200.7	7440-66-6	

CHEMTECH ORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY: SCA

ADDRESS:

CITY/STATE/ZIP:

PHONE #: FAX:

CONTACT: Rusty Detz PROJECT: MW-8

EMAIL:

BILLING ADDRESS:

BILLING CITY/STATE/ZIP:

PURCHASE ORDER #:

TURNAROUND REQUIRED:*

*Expedited turnaround subject to additional charge

CHEMTECH-FORD LABORATORIES

___ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

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DW = Drinking Water
WW = Wastewater
W = Water
S = Soil
SO = Solid
SL = Sludge
O = Other

ANALYTICAL TESTS REQUESTED

See Enclosed Sheet

Bacteriological
R = Routine
I = Investigative
TG = Trigger Source
CO = Confirmation

REPEAT
OR = Original Location
UP = Upstream
DN = Downstream

Lab ID #		SAMPLE IDENTIFICATION	SAMPLE DATE	SAMPLE TIME	Drinking Water FACILITY ID	FIELD: Residual Chlorine	Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. coli only	Repeat (Fail #)	SYSTEM #
4660 01	1.	MW-8	5/31/12	1205								
	2.											
	3.											
	4.											
	5.											
	6.											
	7.											
	8.											
	9.											
	10.											

Sampled by: [print] | Sampled by: [signature] | ON ICE | NOT ON ICE

Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Rusty Detz	5/31/12 1230	Elizabeth Olsen	6/1/12 12:25
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time

CHEMTECH-FORD 6100 South Stratler Street (380 West) Murray, UT 84107 Phone: 801-262-7299 FAX: 801-262-7378

Payment Terms are net 30 days OAC. 1.5% interest charge per month (18% per annum). Client agress to pay collection costs and

TRK# 7984 5667 5772

0201

MASTER

CHEMTECH-FORD LABORATORIES

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

Lab ID #: 4660

Delivery Method: (circle one)

UPS (FedEX) USPS

Walk-In Courier Chemtech

Sample(s) sealed: Yes (No)

Appropriate container/preserve: (Yes) No

Temperature 8 C°

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01	1 1/2	–	1					
2		M	851						
3									
4									
5									
6									
7									
8									
9									
10									
11									
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20									
21									
22									
23									
24									
25									

Comments:

Bottle Type	
Plastic	**Glass**
A- Plastic Unpreserved	D- 625 ($Na_2S_2O_3$)
B- Miscellaneous Plastic	G- Glass Unpreserved
C- Cyanide Qt (NaOH)	H- HAAs (NH_4Cl)
F- Sulfide Qt (NaOH/Zn Acetate)	J- 508/515/525 (Na_2SO_3)
M- Metals Pint (HNO_3)	O- Oil & Grease (1:1 HCl)
N- Nutrient Pint (H_2SO_4)	P- Phenols (H_2SO_4)
R- Radiological Gallon (HNO_3)	T- TOC/TOX (H_3PO_4)
S- Sludge Cups/Tubs	U- 531 (MCAA, $Na_2S_2O_3$)
Q- Plastic Bags	V- 524/THMs (Ascorbic Acid)
E- Coliform/Ecoli	W- 8260 (1:1 HCl)
Additional Volumes	X- Vial Unpreserved
Q- quart 1/2pt- half pint	Y- 624/504 ($Na_2S_2O_3$)
P- pint 1/2- half gallon	Z- Miscellaneous Glass

HEMTECH-FORD
LABORATORIES

Certificate of Analysis

Lab Sample No.: 1205552-01

Name:	**Sunnyside Cogeneration**	***Sample Date:***	6/25/2012 11:00 AM
Sample Site:	MW-8	***Receipt Date:***	6/26/2012 10:10 AM
Comments:		***Sampler:***	Sunnyside Cogen
Sample Matrix:	Water	***Project:***	GW

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Calculations								
Hardness, Total as CaCO3	4100	1	mg/L	7/11/2012 20:14	DBH	SM 2340 B	471-34-1	
Inorganic								
Alkalinity - Bicarbonate (HCO3)	491	1.0	mg/L	6/26/2012 18:00	TSM	SM 2320 B	71-52-3	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	6/26/2012 18:00	TSM	SM 2320 B	3812-32-6	
Alkalinity - CO2	389	1.0	mg/L	6/26/2012 18:00	TSM	SM 2320 B	124-38-9	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	6/26/2012 18:00	TSM	SM 2320 B	14280-30-9	
Alkalinity - Total (as CaCO3)	403	1.0	mg/L	6/26/2012 18:00	TSM	SM 2320 B	CTFID10279	
Chloride	242	5	mg/L	6/27/2012 16:30	TSM	EPA 300.0	16887-00-6	
pH	7.2	0.1	pH Units	6/26/2012 17:00	JSH	SM 4500 H-B	CTFID10187	SPH
Sulfate	6300	100	mg/L	6/30/2012 7:30	TSM	EPA 300.0	14808-79-8	
Total Dissolved Solids (TDS)	10300	10	mg/L	6/29/2012 14:14	JSH	SM 2540 C	CTFID10226	
Metals								
Arsenic, Total	0.0066	0.0005	mg/L	7/3/2012 17:10	MJB	EPA 200.8	7440-38-2	QM-05
Barium, Total	0.010	0.005	mg/L	7/3/2012 16:45	MJB	EPA 200.7	7440-39-3	
Calcium, Total	384	0.2	mg/L	7/3/2012 16:45	MJB	EPA 200.7	7440-43-9	
Cadmium, Total	ND	0.0005	mg/L	7/3/2012 17:10	MJB	EPA 200.8	7440-43-9	
Copper, Total	ND	0.005	mg/L	7/3/2012 16:45	MJB	EPA 200.7	7440-50-8	
Lead, Total	ND	0.0005	mg/L	7/3/2012 17:10	MJB	EPA 200.8	7439-92-1	
Magnesium, Total	763	0.2	mg/L	7/3/2012 16:45	MJB	EPA 200.7	7439-95-4	
Potassium, Total	18.8	0.5	mg/L	7/3/2012 16:45	MJB	EPA 200.7	7440-09-7	
Selenium, Total	0.0525	0.0005	mg/L	7/3/2012 17:10	MJB	EPA 200.8	7782-49-2	QM-05
Silver, Total	ND	0.0005	mg/L	7/3/2012 17:10	MJB	EPA 200.8	7440-22-4	
Sodium, Total	1390	10.0	mg/L	7/9/2012 16:34	MJB	EPA 200.7	7440-23-5	
Zinc, Total	ND	0.01	mg/L	7/3/2012 16:45	MJB	EPA 200.7	7440-66-6	

6100 South Stratler
Murray, UT 84107
801-262-7299 Office

CHEMTECH-FORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY:

ADDRESS: SCA

CITY/STATE/ZIP:

PHONE #: FAX:

CONTACT: Rusty Nitz PROJECT: Grand Wtr

EMAIL:

BILLING ADDRESS:

BILLING CITY/STATE/ZIP:

PURCHASE ORDER #:

TURNAROUND REQUIRED:*

*Expedited turnaround subject to additional charge

CHEMTECH-FORD LABORATORIES

___ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX
DW = Drinking Water
WW = Wastewater
W = Water
S = Soil
SO = Solid
SL = Sludge
O = Other

ANALYTICAL TESTS REQUESTED

Bacteriological
R = Routine
I = Investigative
TG = Trigger Source
CO = Confirmation

REPEAT
OR = Original Location
UP = Upstream
DN = Downstream

Lab ID #	SAMPLE IDENTIFICATION	SAMPLE DATE	SAMPLE TIME	Drinking Water FACILITY ID	FIELD: Residual Chlorine	Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. coli only	Repeat (Fail #)	SYSTEM #
5552-01	1. MW-8	6/25/12	1100								
	2.										
	3.										
	4.										
	5.										
	6.										
	7.										
	8.										
	9.										
	10.										

See Attachment

Sampled by: [print]

Sampled by: [signature]

ON ICE NOT ON ICE

Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Rusty Nitz	6/25/12 1130	Elizabeth Hansen	6/26/12 10:10
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time

CHEMTECH-FORD LABORATORIES

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

Lab ID #: 5552

Delivery Method: (circle one)

UPS (FedEX) USPS

Walk-In Courier Chemtech

Sample(s) sealed: Yes / (No)

Appropriate container/preserve: (Yes) / No

Temperature 22 C°

Comments:

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01	A 1/2							
2		M	~~SG~~ 900						
3									
4									
5									
6									
7									
8									
9									
10									
11									
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14									
15									
16									
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19									
20									
21									
22									
23									
24									
25									

Bottle Type	
Plastic	**Glass**
A- Plastic Unpreserved	**D-** 625 ($Na_2S_2O_3$)
B- Miscellaneous Plastic	**G-** Glass Unpreserved
C- Cyanide Qt (NaOH)	**H-** HAAs (NH_4Cl)
F- Sulfide Qt (NaOH/Zn Acetate)	**J-** 508/515/525 (Na_2SO_3)
M- Metals Pint (HNO_3)	**O-** Oil & Grease (1:1 HCl)
N- Nutrient Pint (H_2SO_4)	**P-** Phenols (H_2SO_4)
R- Radiological Gallon (HNO_3)	**T-** TOC/TOX (H_3PO_4)
S- Sludge Cups/Tubs	**U-** 531 (MCAA, $Na_2S_2O_3$)
Q- Plastic Bags	**V-** 524/THMs (Ascorbic Acid)
E- Coliform/Ecoli	**W-** 8260 (1:1 HCl)
Additional Volumes	**X-** Vial Unpreserved
Q- quart 1/2pt- half pint	**Y-** 624/504 ($Na_2S_2O_3$)
P- pint 1/2- half gallon	**Z-** Miscellaneous Glass

HEMTECH-FORD
LABORATORIES

Certificate of Analysis

Lab Sample No.: 1206641-01

Name:	**Sunnyside Cogeneration**	***Sample Date:***	7/25/2012 11:00 AM
Sample Site:	MW-8	***Receipt Date:***	7/26/2012 10:25 AM
Comments:		***Sampler:***	Sunnyside Cogen
Sample Matrix:	Water	***Project:***	GW

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Calculations								
Hardness, Total as CaCO3	3750	1	mg/L	8/13/2012 7:45	PNM	SM 2340 B	471-34-1	
Inorganic								
Alkalinity - Bicarbonate (HCO3)	491	1.0	mg/L	7/31/2012 8:00	TSM	SM 2320 B	71-52-3	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	7/31/2012 8:00	TSM	SM 2320 B	3812-32-6	
Alkalinity - CO2	378	1.0	mg/L	7/31/2012 8:00	TSM	SM 2320 B	124-38-9	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	7/31/2012 8:00	TSM	SM 2320 B	14280-30-9	
Alkalinity - Total (as CaCO3)	403	1.0	mg/L	7/31/2012 8:00	TSM	SM 2320 B	CTFID10279	
Chloride	240	10	mg/L	7/26/2012 21:00	TSM	EPA 300.0	16887-00-6	
pH	7.1	0.1	pH Units	7/26/2012 16:30	JSH	SM 4500 H-B	CTFID10187	SPH
Sulfate	2020	50	mg/L	7/26/2012 21:00	TSM	EPA 300.0	14808-79-8	
Total Dissolved Solids (TDS)	9830	10	mg/L	7/30/2012 11:36	JSH	SM 2540 C	CTFID10226	
Metals								
Arsenic, Total	0.0087	0.0005	mg/L	8/3/2012 12:24	MJB	EPA 200.8	7440-38-2	
Barium, Total	0.009	0.005	mg/L	8/9/2012 0:02	PNM	EPA 200.7	7440-39-3	
Calcium, Total	408	0.2	mg/L	8/23/2012 0:02	PNM	EPA 200.7	7440-43-9	
Cadmium, Total	ND	0.0002	mg/L	8/3/2012 12:24	MJB	EPA 200.8	7440-43-9	
Copper, Total	ND	0.005	mg/L	8/9/2012 0:02	PNM	EPA 200.7	7440-50-8	
Lead, Total	ND	0.0005	mg/L	8/3/2012 12:24	MJB	EPA 200.8	7439-92-1	
Magnesium, Total	748	0.2	mg/L	8/23/2012 0:02	PNM	EPA 200.7	7439-95-4	
Potassium, Total	16.9	0.5	mg/L	8/23/2012 0:02	PNM	EPA 200.7	7440-09-7	
Selenium, Total	0.0664	0.0005	mg/L	8/3/2012 12:24	MJB	EPA 200.8	7782-49-2	
Silver, Total	ND	0.0005	mg/L	8/3/2012 12:24	MJB	EPA 200.8	7440-22-4	
Sodium, Total	1230	0.5	mg/L	8/23/2012 0:02	PNM	EPA 200.7	7440-23-5	
Zinc, Total	ND	0.01	mg/L	8/9/2012 0:02	PNM	EPA 200.7	7440-66-6	

CHEMTECH-FORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY: SCA

ADDRESS:

CITY/STATE/ZIP:

PHONE #: FAX:

CONTACT: Rusty Nott PROJECT: Ground Water

EMAIL:

BILLING ADDRESS:

BILLING CITY/STATE/ZIP:

PURCHASE ORDER #:

TURNAROUND REQUIRED:*

*Expedited turnaround subject to additional charge

CHEMTECH-FORD LABORATORIES

___ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX
DW = Drinking Water
WW = Wastewater
W = Water
S = Soil
SO = Solid
SL = Sludge
O = Other

ANALYTICAL TESTS REQUESTED

Bacteriological

R = Routine
I = Investigative
TG = Trigger Source
CO = Confirmation

REPEAT
OR = Original Location
UP = Upstream
DN = Downstream

Lab ID #		SAMPLE IDENTIFICATION	SAMPLE DATE	SAMPLE TIME	Drinking Water FACILITY ID	FIELD: Residual Chlorine	Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. coli only	Repeat (Fail #)	SYSTEM #
60641	1.	MW-8	7/25/12	1100								
-01	2.											
	3.											
	4.											
	5.											
	6.											
	7.											
	8.											
	9.											
	10.											

SCA Attached Sheet

Sampled by: [print]

Sampled by: [signature]

ON ICE NOT ON ICE

Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Rusty	7/25/12 1130		
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
			7/26/12 10:25
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time

CHEMTECH-FORD 6160 South Stratler Street (380 West) Murray, UT 84107 Phone: 801-262-7299 FAX: 801-262-

Payment Terms are net 30 days OAC. 1.5% interest charge per month (18% per annum). Client agress to pay collecti

TRK# 7986 6009 8694

0201

CHEMTECH-FORD LABORATORIES

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

Lab ID #: 6641

Delivery Method: (circle one)

UPS (FedEX) USPS

Walk-In Courier Chemtech

Sample(s) sealed: Yes / (No)

Appropriate container/preserve: (Yes) / No

Temperature 20 C°

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01	A1/2		1					
2		M	909						
3									
4									
5									
6									
7									
8									
9									
10									
11									
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16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Comments:

Bottle Type

Plastic		Glass	
A-	Plastic Unpreserved	D-	625 ($Na_2S_2O_3$)
B-	Miscellaneous Plastic	G-	Glass Unpreserved
C-	Cyanide Qt (NaOH)	H-	HAAs (NH_4Cl)
F-	Sulfide Qt (NaOH/Zn Acetate)	J-	508/515/525 (Na_2SO_3)
M-	Metals Pint (HNO_3)	O-	Oil & Grease (1:1 HCl)
N-	Nutrient Pint (H_2SO_4)	P-	Phenols (H_2SO_4)
R-	Radiological Gallon (HNO_3)	T-	TOC/TOX (H_3PO_4)
S-	Sludge Cups/Tubs	U-	531 (MCAA, $Na_2S_2O_3$)
Q-	Plastic Bags	V-	524/THMs (Ascorbic Acid)
E-	Coliform/Ecoli	W-	8260 (1:1 HCl)
Additional Volumes		X-	Vial Unpreserved
Q- quart	1/2pt- half pint	Y-	624/504 ($Na_2S_2O_3$)
P- pint	1/2- half gallon	Z-	Miscellaneous Glass

CHEMTECH-FORD
LABORATORIES

Certificate of Analysis

Lab Sample No.: 1208080-01

Name: **Sunnyside Cogeneration**
Sample Site: MW-8
Comments:
Sample Matrix: Water

Sample Date: 8/30/2012 11:20 AM
Receipt Date: 8/31/2012 12:00 PM
Sampler: Sunnyside Cogen
Project: GW

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Calculations								
Hardness, Total as CaCO3	4100	1	mg/L	9/21/2012 23:01	DBH	SM 2340 B	471-34-1	
Inorganic								
Alkalinity - Bicarbonate (HCO3)	499	1.0	mg/L	9/2/2012 10:00	TSM	SM 2320 B	71-52-3	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	9/2/2012 10:00	TSM	SM 2320 B	3812-32-6	
Alkalinity - CO2	377	1.0	mg/L	9/2/2012 10:00	TSM	SM 2320 B	124-38-9	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	9/2/2012 10:00	TSM	SM 2320 B	14280-30-9	
Alkalinity - Total (as CaCO3)	409	1.0	mg/L	9/2/2012 10:00	TSM	SM 2320 B	CTFID10279	
Chloride	281	1.0	mg/L	9/14/2012 12:00	BCA	SM 4500 Cl C	16887-00-6	
pH	7.2	0.1	pH Units	8/31/2012 15:20	RMC	SM 4500 H-B	CTFID10187	SPH
Sulfate	6000	2500	mg/L	9/4/2012 11:00	TSM	SM 4500 SO4-E	14808-79-8	
Total Dissolved Solids (TDS)	10800	10	mg/L	9/6/2012 16:15	RMC	SM 2540 C	CTFID10226	
Metals								
Arsenic, Total	0.0100	0.0005	mg/L	9/10/2012 16:50	MJB	EPA 200.8	7440-38-2	
Barium, Total	0.011	0.005	mg/L	9/11/2012 18:48	PNM	EPA 200.7	7440-39-3	
Calcium, Total	377	0.2	mg/L	9/11/2012 18:48	PNM	EPA 200.7	7440-43-9	
Cadmium, Total	ND	0.0002	mg/L	9/10/2012 16:50	MJB	EPA 200.8	7440-43-9	
Copper, Total	ND	0.005	mg/L	9/11/2012 18:48	PNM	EPA 200.7	7440-50-8	
Lead, Total	ND	0.0005	mg/L	9/10/2012 16:50	MJB	EPA 200.8	7439-92-1	
Magnesium, Total	766	0.2	mg/L	9/11/2012 18:48	PNM	EPA 200.7	7439-95-4	
Potassium, Total	19.7	0.5	mg/L	9/11/2012 18:48	PNM	EPA 200.7	7440-09-7	
Selenium, Total	0.0531	0.0005	mg/L	9/10/2012 16:50	MJB	EPA 200.8	7782-49-2	
Silver, Total	ND	0.0005	mg/L	9/10/2012 16:50	MJB	EPA 200.8	7440-22-4	
Sodium, Total	1480	0.5	mg/L	9/11/2012 18:48	PNM	EPA 200.7	7440-23-5	
Zinc, Total	ND	0.01	mg/L	9/11/2012 18:48	PNM	EPA 200.7	7440-66-6	

CHEMTECH FORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY: SCA

ADDRESS:

CITY/STATE/ZIP:

PHONE #: FAX:

CONTACT: Rusty natr PROJECT: MW-8

EMAIL:

BILLING ADDRESS:

BILLING CITY/STATE/ZIP:

PURCHASE ORDER #:

TURNAROUND REQUIRED:*

*Expedited turnaround subject to additional charge

CHEMTECH-FORD LABORATORIES

___ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX
DW = Drinking Water
WW = Wastewater
W = Water
S = Soil
SO = Solid
SL = Sludge
O = Other

ANALYTICAL TESTS REQUESTED

See Enclosed Sheet

Bacteriological
R = Routine
I = Investigative
TG = Trigger Source
CO = Confirmation

REPEAT
OR = Original Location
UP = Upstream
DN = Downstream

Lab ID #	SAMPLE IDENTIFICATION	SAMPLE DATE	SAMPLE TIME	Drinking Water FACILITY ID	FIELD: Residual Chlorine	Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. coli only	Repeat (Fail #)	SYSTEM #
8080 01	1. MW-8	8/30/12	1120								
	2.										
	3.										
	4.										
	5.										
	6.										
	7.										
	8.										
	9.										
	10.										

Sampled by: [print]

Sampled by: [signature]

ON ICE NOT ON ICE

Special Instructions: 7988 6202 6123 - fedex

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Rusty	8/30/12 1230		
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
			8:30:12 12:00
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time

CHEMTECH-FORD
LABORATORIES

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

Lab ID #: 8080

Delivery Method: (circle one)

UPS (FedEX) USPS

Walk-In Courier Chemtech

Sample(s) sealed: Yes (No)

Appropriate container/preserve: (Yes) No

Temperature 15 C°

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01	A½	-	1					
2		M	920						
3									
4									
5									
6									
7									
8									
9									
10									
11									
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15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Comments:

Bottle Type	
Plastic	**Glass**
A- Plastic Unpreserved	D- 625 ($Na_2S_2O_3$)
B- Miscellaneous Plastic	G- Glass Unpreserved
C- Cyanide Qt (NaOH)	H- HAAs (NH_4Cl)
F- Sulfide Qt (NaOH/Zn Acetate)	J- 508/515/525 (Na_2SO_3)
M- Metals Pint (HNO_3)	O- Oil & Grease (1:1 HCl)
N- Nutrient Pint (H_2SO_4)	P- Phenols (H_2SO_4)
R- Radiological Gallon (HNO_3)	T- TOC/TOX (H_3PO_4)
S- Sludge Cups/Tubs	U- 531 (MCAA, $Na_2S_2O_3$)
Q- Plastic Bags	V- 524/THMs (Ascorbic Acid)
E- Coliform/Ecoli	W- 8260 (1:1 HCl)
Additional Volumes	X- Vial Unpreserved
Q- quart 1/2pt- half pint	Y- 624/504 ($Na_2S_2O_3$)
P- pint 1/2- half gallon	Z- Miscellaneous Glass

CHEMTECH-FORD
LABORATORIES

Certificate of Analysis

Lab Sample No.: 1210049-01

Name:	**Sunnyside Cogeneration**	***Sample Date:***	10/25/2012 10:00 AM
Sample Site:	MW-8	***Receipt Date:***	10/26/2012 9:00 AM
Comments:		***Sampler:***	Sunnyside Cogen
Sample Matrix:	Water	***Project:***	GW

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Calculations								
Hardness, Total as CaCO3	4080	1	mg/L	11/13/2012 8:12	MJB	SM 2340 B	471-34-1	
Inorganic								
Alkalinity - Bicarbonate (HCO3)	503	1.0	mg/L	10/28/2012 9:00	TSM	SM 2320 B	71-52-3	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	10/28/2012 9:00	TSM	SM 2320 B	3812-32-6	
Alkalinity - CO2	374	1.0	mg/L	10/28/2012 9:00	TSM	SM 2320 B	124-38-9	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	10/28/2012 9:00	TSM	SM 2320 B	14280-30-9	
Alkalinity - Total (as CaCO3)	412	1.0	mg/L	10/28/2012 9:00	TSM	SM 2320 B	CTFID10279	
Chloride	230	10	mg/L	10/26/2012 12:30	TSM	EPA 300.0	16887-00-6	
pH	7.2	0.1	pH Units	10/26/2012 13:30	RMC	SM 4500 H-B	CTFID10187	SPH
Sulfate	6300	100	mg/L	10/26/2012 12:30	TSM	EPA 300.0	14808-79-8	
Total Dissolved Solids (TDS)	10200	10	mg/L	10/31/2012 11:30	RMC	SM 2540 C	CTFID10226	
Metals								
Arsenic, Total	0.0081	0.0005	mg/L	11/8/2012 18:39	MJB	EPA 200.8	7440-38-2	
Barium, Total	0.011	0.005	mg/L	11/8/2012 14:26	PNM	EPA 200.7	7440-39-3	
Calcium, Total	372	0.2	mg/L	11/8/2012 14:26	PNM	EPA 200.7	7440-43-9	
Cadmium, Total	ND	0.0002	mg/L	11/8/2012 18:39	MJB	EPA 200.8	7440-43-9	
Copper, Total	ND	0.005	mg/L	11/8/2012 14:26	PNM	EPA 200.7	7440-50-8	
Lead, Total	ND	0.0005	mg/L	11/8/2012 18:39	MJB	EPA 200.8	7439-92-1	
Magnesium, Total	765	0.2	mg/L	11/8/2012 14:26	PNM	EPA 200.7	7439-95-4	
Potassium, Total	18.2	0.5	mg/L	11/8/2012 14:26	PNM	EPA 200.7	7440-09-7	
Selenium, Total	0.0357	0.0005	mg/L	11/8/2012 18:39	MJB	EPA 200.8	7782-49-2	
Silver, Total	ND	0.0005	mg/L	11/8/2012 18:39	MJB	EPA 200.8	7440-22-4	
Sodium, Total	1610	10.0	mg/L	11/12/2012 14:57	MJB	EPA 200.7	7440-23-5	
Zinc, Total	ND	0.01	mg/L	11/8/2012 14:26	PNM	EPA 200.7	7440-66-6	

CHEMTECH-FORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY: SCA

ADDRESS:

CITY/STATE/ZIP:

PHONE #: FAX:

CONTACT: Rusty Netz PROJECT: MW-8

EMAIL:

BILLING ADDRESS:

BILLING CITY/STATE/ZIP:

PURCHASE ORDER #:

TURNAROUND REQUIRED:* Normal

*Expedited turnaround subject to additional charge

CHEMTECH-FORD LABORATORIES

___ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX
DW = Drinking Water
WW = Wastewater
W = Water
S = Soil
SO = Solid
SL = Sludge
O = Other

ANALYTICAL TESTS REQUESTED

Bacteriological
R = Routine
I = Investigative
TG = Trigger Source
CO = Confirmation

REPEAT
OR = Original Location
UP = Upstream
DN = Downstream

Lab ID #		SAMPLE IDENTIFICATION	SAMPLE DATE	SAMPLE TIME	Drinking Water FACILITY ID	FIELD: Residual Chlorine	Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. coli only	Repeat (Fail #)	SYSTEM #
10049-01	1.	MW-8	10/25/12	1000								
	2.											
	3.											
	4.											
	5.											
	6.											
	7.											
	8.											
	9.											
	10.											

See Attachment

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Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Relinquished by: [signature]	10/25/12 1100	Received by: [signature]	10/26/12 9:00
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
	Date/Time		Date/Time

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TRK# 0201 7939 3011 5558

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

Lab ID #: 100479

Delivery Method: (circle one)

UPS (FedEX) USPS

Walk-In Courier Chemtech

Sample(s) sealed: Yes / (No)

Appropriate container/preserve: (Yes) / No

Temperature 5 C°

Comments:

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01	A'b							
2		M	909						
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Bottle Type

Plastic		Glass	
A-	Plastic Unpreserved	D-	625 ($Na_2S_2O_3$)
B-	Miscellaneous Plastic	G-	Glass Unpreserved
C-	Cyanide Qt (NaOH)	H-	HAAs (NH_4Cl)
F-	Sulfide Qt (NaOH/Zn Acetate)	J-	508/515/525 (Na_2SO_3)
M-	Metals Pint (HNO_3)	O-	Oil & Grease (1:1 HCl)
N-	Nutrient Pint (H_2SO_4)	P-	Phenols (H_2SO_4)
R-	Radiological Gallon (HNO_3)	T-	TOC/TOX (H_3PO_4)
S-	Sludge Cups/Tubs	U-	531 (MCAA, $Na_2S_2O_3$)
Q-	Plastic Bags	V-	524/THMs (Ascorbic Acid)
E-	Coliform/Ecoli	W-	8260 (1:1 HCl)
Additional Volumes		X-	Vial Unpreserved
Q- quart	1/2pt- half pint	Y-	624/504 ($Na_2S_2O_3$)
P- pint	1/2- half gallon	Z-	Miscellaneous Glass

CHEMTECH-FORD LABORATORIES

Certificate of Analysis

Lab Sample No.: 1211323-01

Name: **Sunnyside Cogeneration**
Sample Site: MW-8
Comments:
Sample Matrix: Water

Sample Date: 12/5/2012 11:00 AM
Receipt Date: 12/6/2012 9:15 AM
Sampler: Sunnyside Cogen
Project: GW

Parameter	Sample Result	Minimum Reporting Limit	Units	Analysis Date/Time	Analyst Initials	Analytical Method	CAS No.	Flag
Calculations								
Hardness, Total as CaCO3	4220	1	mg/L	12/26/2012 11:40	PNM	SM 2340 B	471-34-1	
Inorganic								
Alkalinity - Bicarbonate (HCO3)	491	1.0	mg/L	12/7/2012 20:00	TSM	SM 2320 B	71-52-3	
Alkalinity - Carbonate (CO3)	ND	1.0	mg/L	12/7/2012 20:00	TSM	SM 2320 B	3812-32-6	
Alkalinity - CO2	378	1.0	mg/L	12/7/2012 20:00	TSM	SM 2320 B	124-38-9	
Alkalinity - Hydroxide (OH)	ND	1.0	mg/L	12/7/2012 20:00	TSM	SM 2320 B	14280-30-9	
Alkalinity - Total (as CaCO3)	403	1.0	mg/L	12/7/2012 20:00	TSM	SM 2320 B	CTFID10279	
Chloride	230	5	mg/L	12/6/2012 10:30	TSM	EPA 300.0	16887-00-6	
pH	7.2	0.1	pH Units	12/6/2012 17:30	RMC	SM 4500 H-B	CTFID10187	SPH
Sulfate	6200	100	mg/L	12/7/2012 19:00	TSM	EPA 300.0	14808-79-8	
Total Dissolved Solids (TDS)	10600	10	mg/L	12/10/2012 10:00	JSH	SM 2540 C	CTFID10226	
Metals								
Arsenic, Total	0.0143	0.0005	mg/L	12/12/2012 18:03	MJB	EPA 200.8	7440-38-2	
Barium, Total	0.012	0.005	mg/L	12/11/2012 21:56	PNM	EPA 200.7	7440-39-3	
Calcium, Total	383	0.2	mg/L	12/11/2012 21:56	PNM	EPA 200.7	7440-43-9	
Cadmium, Total	ND	0.0002	mg/L	12/12/2012 18:03	MJB	EPA 200.8	7440-43-9	
Copper, Total	ND	0.005	mg/L	12/11/2012 21:56	PNM	EPA 200.7	7440-50-8	
Lead, Total	ND	0.0005	mg/L	12/12/2012 18:03	MJB	EPA 200.8	7439-92-1	
Magnesium, Total	792	0.2	mg/L	12/11/2012 21:56	PNM	EPA 200.7	7439-95-4	
Potassium, Total	19.2	0.5	mg/L	12/11/2012 21:56	PNM	EPA 200.7	7440-09-7	
Selenium, Total	0.0573	0.0005	mg/L	12/12/2012 18:03	MJB	EPA 200.8	7782-49-2	
Silver, Total	ND	0.0005	mg/L	12/12/2012 18:03	MJB	EPA 200.8	7440-22-4	
Sodium, Total	1480	50.0	mg/L	12/13/2012 11:02	PNM	EPA 200.7	7440-23-5	
Zinc, Total	ND	0.01	mg/L	12/11/2012 21:56	PNM	EPA 200.7	7440-66-6	

CHEMTECH-FORD ANALYTICAL LABORATORY

CHAIN OF CUSTODY

COMPANY: SCA

ADDRESS:

CITY/STATE/ZIP:

PHONE #: FAX:

CONTACT: Rusty Netz PROJECT: MW-8

EMAIL:

BILLING ADDRESS:

BILLING CITY/STATE/ZIP:

PURCHASE ORDER #:

TURNAROUND REQUIRED:*

* Expedited turnaround subject to additional charge

CHEMTECH-FORD LABORATORIES

___ Mark 'X' here if you want a copy sent to DEQ Division of Drinking Water.

MATRIX
DW = Drinking Water
WW = Wastewater
W = Water
S = Soil
SO = Solid
SL = Sludge
O = Other

ANALYTICAL TESTS REQUESTED

Bacteriological
R = Routine
I = Investigative
TG = Trigger Source
CO = Confirmation

REPEAT
OR = Original Location
UP = Upstream
DN = Downstream

Lab ID #	SAMPLE IDENTIFICATION	SAMPLE DATE	SAMPLE TIME	Drinking Water FACILITY ID	FIELD: Residual Chlorine	Total Coliform + E. coli (Present/Absent)	Total Coliform + E. coli (Enumerated)	HPC (Plate Count)	E. coli only	Repeat (Fall #)	SYSTEM #
11323-01	1. MW-8	12/5/12	1100								
	2.										
	3.										
	4.										
	5.										
	6.										
	7.										
	8.										
	9.										
	10.										

See Attachment

Sampled by: [print]

Sampled by: [signature]

ON ICE NOT ON ICE

Special Instructions:

Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
Rusty Netz	12/5/12 1200		
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time
		Angelette Gleason	12/6/12 9:15
Relinquished by: [signature]	Date/Time	Received by: [signature]	Date/Time

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Payment Terms are net 30 days OAC. 1.5% interest charge per month (18% per annum). Client agress to pay collection costs and attorn[illegible]

TRK# 7942 2528 3184

0201

CHEMTECH-FORD LABORATORIES

CHEMTECH-FORD LABORATORIES

Sample Receipt Checklist

Lab ID #: 11323

Delivery Method: (circle one)

UPS (FedEX) USPS

Walk-In Courier Chemtech

Sample(s) sealed: Yes / (No)

Appropriate container/preserve: (Yes) / No

Temperature 10 C°

	Lab ID #	Bottle Type	Lot # (preservative)	No. of Subsample(s)	Preserved by client / third party	Preserved in Receiving/Laboratory	Vials submitted with headspace	Sample submitted past hold time	Filtered by client in field
1	01	A 1/2		1					
2		M	932						
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Comments:

Bottle Type			
Plastic		**Glass**	
A-	Plastic Unpreserved	D-	625 ($Na_2S_2O_3$)
B-	Miscellaneous Plastic	G-	Glass Unpreserved
C-	Cyanide Qt (NaOH)	H-	HAAs (NH_4Cl)
F-	Sulfide Qt (NaOH/Zn Acetate)	J-	508/515/525 (Na_2SO_3)
M-	Metals Pint (HNO_3)	O-	Oil & Grease (1:1 HCl)
N-	Nutrient Pint (H_2SO_4)	P-	Phenols (H_2SO_4)
R-	Radiological Gallon (HNO_3)	T-	TOC/TOX (H_3PO_4)
S-	Sludge Cups/Tubs	U-	531 (MCAA, $Na_2S_2O_3$)
Q-	Plastic Bags	V-	524/THMs (Ascorbic Acid)
E-	Coliform/Ecoli	W-	8260 (1:1 HCl)
Additional Volumes		X-	Vial Unpreserved
Q- quart	1/2pt- half pint	Y-	624/504 ($Na_2S_2O_3$)
P- pint	1/2- half gallon	Z-	Miscellaneous Glass

APPENDIX B

HYDROLOGIC CALCULATIONS

SCA#2 Ash Landfill - Sediment Pond and Sediment Traps

Sediment Trap #1 (Lower)

elevation	area	volume	discharge
	acres	acft	cfs
6385	0.035	0	0
6386	0.053	0.04	0
6388	0.133	0.23	0.15
6390	0.204	0.57	0.21
6392	0.281	1.05	0.26
6394	0.364	1.70	7.3
6395	0.413	2.09	18

Discharge thru 2" drain pipe at 6386
Discharge to 24" standpipe at 6393.5

Sediment Trap #2 (Upper)

elevation	area	volume	discharge
	acres	acft	cfs
6635	0.129	0	0
6636	0.153	0.14	0
6638	0.201	0.50	0.11
6640	0.255	0.95	0.18
6642	0.314	1.52	0.23
6644	0.379	2.21	15

Discharge thru 2" drain pipe at 6637
Discharge to Overflow spillway ditch 6643

Sediment Pond #018

elevation	area	volume	discharge
	acres	acft	cfs
6340	0.025	0	0
6344	0.086	0.22	0.15
6348	0.16	0.71	0.26
6352	0.26	1.55	0.33
6355	0.36	2.48	0.38
6357	0.44	3.28	13

Discharge thru 2" drain pipe at 6342
Discharge to 18" standpipe at 6355

Outlet control orifice

$$\text{Area} = \frac{Q}{C*(2*g*h)^{0.5}}$$

Overflow CMP Spillway

$Q = 3.33\ (L-0.2h)*h^{1.5}$

	Solve Flow Rate Q
Q=	15.03 cfs
h=	1 ft
Pipe D	18 in
Weir L	4.7 ft

	Solve for Area	Solve for Flow Rate Q
Q=	30.0 cfs	0.38 cfs
C=	0.6	0.6
h=	13 ft	13 ft
g=	32.2 ft/s^2	32.2 ft/s^2
area=	248.8 in^2	3.1 in^2
d=	17.8 in	2 in

SCA#2 Ash Landfill
Storm Drainage Calculations

Lower Phase condition
(landfill under construction up to elev 6630 with lower terraces reclaimed)

Rational Formula Q = CiA

	Acres	Area (sqft)	Coefficient	C*A (sqft)
Terrace M1 Exposed Ash Surface	11.5	500000	0.65	325000
Terrace L3 Covered and Roughenec	6.3	275000	0.25	68750
Terraces L1 & L2 Revegetated	11.5	500000	0.15	75000

10 Year 24 Hour Storm Analysis **Terrace M1 Exposed Ash Surface**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
60	0.87	0.868	325000	6.48	23508	0.5
120	0.49	0.979	325000	3.65	26515	0.6
180	0.35	1.05	325000	2.61	28438	0.7
720	0.10	1.24	325000	0.77	33583	0.8
1440	0.08	1.99	325000	0.62	53896	1.2

10 Year 24 Hour Storm Analysis **Terrace L3 Covered and Roughened**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
30	1.40	0.701	68750	2.21	4016	0.1
60	0.87	0.868	68750	1.37	4973	0.1
120	0.49	0.979	68750	0.77	5609	0.1
180	0.35	1.05	68750	0.55	6016	0.1
720	0.10	1.24	68750	0.16	7104	0.2
1440	0.08	1.99	68750	0.13	11401	0.3

10 Year 24 Hour Storm Analysis **Terraces L1 & L2 Revegetated**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
30	1.40	0.701	75000	2.41	4381	0.1
60	0.87	0.868	75000	1.49	5425	0.1
120	0.49	0.979	75000	0.84	6119	0.1
180	0.35	1.05	75000	0.60	6563	0.2
720	0.10	1.24	75000	0.18	7750	0.2
1440	0.08	1.99	75000	0.14	12438	0.3

Summary: Terrace under construction is expected to have highest runoff rates at up to 6.5 cfs
Total runoff volume estimated at approximately 1.8 acft plus approximately 0.5 acft from areas up hill from the landfill.
Sediment Trap #1 plus Sediment Pond #018 are adequate to contain the expected runoff under the described condition
Typical Terrace Ditch (2 sqft section) should be adequate with terrace cross slope as contingency
The perimeter collection ditch could experience flows up to 8-10 cfs, depending on conditions

SCA#2 Ash Landfill
Storm Drainage Calculations

Typical Mid level Terrace Drainage

Rational Formula Q = CiA

	Acres	Area (sqft)	Coefficient	C*A (sqft)
Exposed Ash Surface	6.0	260000	0.65	169000
Covered and Roughened	6.0	260000	0.25	65000
Revegetated	6.0	260000	0.15	39000

10 Year 24 Hour Storm Analysis **Exposed Ash Surface Condition**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
30	1.40	0.701	169000	**5.44**	9872	0.2
60	0.87	0.868	169000	3.37	12224	0.3
120	0.49	0.979	169000	1.90	13788	0.3
180	0.35	1.05	169000	1.36	14788	0.3
720	0.10	1.24	169000	0.40	17463	0.4
1440	0.08	1.99	169000	0.32	28026	**0.6**

10 Year 24 Hour Storm Analysis **Covered and Roughened Condition**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
30	1.40	0.701	65000	2.09	3797	0.1
60	0.87	0.868	65000	1.30	4702	0.1
120	0.49	0.979	65000	0.73	5303	0.1
180	0.35	1.05	65000	0.52	5688	0.1
720	0.10	1.24	65000	0.15	6717	0.2
1440	0.08	1.99	65000	0.12	10779	0.2

10 Year 24 Hour Storm Analysis **Revegetated Condition**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
30	1.40	0.701	39000	1.26	2278	0.1
60	0.87	0.868	39000	0.78	2821	0.1
120	0.49	0.979	39000	0.44	3182	0.1
180	0.35	1.05	39000	0.31	3413	0.1
720	0.10	1.24	39000	0.09	4030	0.1
1440	0.08	1.99	39000	0.07	6468	0.1

Summary: Design terrace ditches to pass approximately 5-6 cfs
Typical Terrace Ditch (2 sqft section) should be adequate with terrace cross slope as contingency

SCA#2 Ash Landfill
Storm Drainage Calculations

Upper Phase condition
(landfill under construction up to elev 6775 with lower terraces reclaimed)

Rational Formula Q = CiA

	Acres	Area (sqft)	Coefficient	C*A (sqft)
Terrace U3 Exposed Ash Surface	16.5	720000	0.65	468000
Terrace U2 Covered and Roughened	7.0	307000	0.25	76750
Terraces L1-4, M1-2 & U1 Revegetated	32.1	1400000	0.15	210000

10 Year 24 Hour Storm Analysis **Terrace U3 Exposed Ash Surface**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
60	0.87	0.868	468000	**9.33**	33852	0.8
120	0.49	0.979	468000	5.26	38181	0.9
180	0.35	1.05	468000	3.76	40950	0.9
720	0.10	1.24	468000	1.11	48360	1.1
1440	0.08	1.99	468000	0.89	77610	**1.8**

10 Year 24 Hour Storm Analysis **Terrace U2 Covered and Roughened**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
30	1.40	0.701	76750	2.47	4483	0.1
60	0.87	0.868	76750	**1.53**	5552	0.1
120	0.49	0.979	76750	0.86	6262	0.1
180	0.35	1.05	76750	0.62	6716	0.2
720	0.10	1.24	76750	0.18	7931	0.2
1440	0.08	1.99	76750	0.15	12728	**0.3**

10 Year 24 Hour Storm Analysis **Terraces L1-4, M1-2 & U1 Revegetated**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
30	1.40	0.701	210000	**6.76**	12268	0.3
60	0.87	0.868	210000	4.18	15190	0.3
120	0.49	0.979	210000	2.36	17133	0.4
180	0.35	1.05	210000	1.69	18375	0.4
720	0.10	1.24	210000	0.50	21700	0.5
1440	0.08	1.99	210000	0.40	34825	**0.8**

Summary: Terrace under construction is expected to have highest runoff rates at up to 10 cfs
Upper (north) perimeter ditch should include straw bale check dams to reduce velocity
Sediment Trap #2 would capture all runoff from upper terraces 1-3 and discharge at a slow rate.
Sediment Trap #1 plus Sediment Pond #018 are adequate to treat and control the expected runoff under the described condition (with a total estimated runoff volume estimated at approx 3 acft)
Discharge valves from the two sediment traps may be closed for a time to reduce discharge from #018
South Perimeter collection ditch could experience flows up to 7 cfs with straw bales to reduce velocity

SCA#2 Ash Landfill
Storm Drainage Calculations

Landfill Complete and Revegetated

Rational Formula Q = CiA

	Acres	Area (sqft)	Coefficient	C*A (sqft)
Terraces U1-3 Revegetated flow to Sed Trap 2	25.3	1100000	0.15	165000
Terraces L1-4, M1-2 Revegetated flow to Sed Trap 1	39.2	1707000	0.15	256050

100 Year 24 Hour Storm Analysis **Terraces U1-3 Revegetated flow to Sed Trap 2**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
60	1.64	1.64	165000	6.21	22550	0.5
120	0.93	1.85	165000	3.50	25438	0.6
180	0.63	1.9	165000	2.40	26125	0.6
720	0.17	2.02	165000	0.64	27775	0.6
1440	0.12	2.83	165000	0.45	38913	0.9

100 Year 24 Hour Storm Analysis **Terraces L1-4, M1-2 Revegetated flow to Sed Trap 1**

Interval (min)	Rate (in/hr)	Cumulative Precip (in)	C*A (sqft)	Peak Ditch Flow (cfs)	Storm Volume (cuft)	Storm Volume (acft)
60	1.64	1.64	256050	9.64	34994	0.8
120	0.93	1.85	256050	5.44	39474	0.9
180	0.63	1.9	256050	3.72	40541	0.9
720	0.17	2.02	256050	0.99	43102	1.0
1440	0.12	2.83	256050	0.69	60385	1.4

Summary: Under a fully revegeted condition, relatively little runoff is expected

Sediment Trap #2 would capture all runoff from upper terraces 1-3 and discharge at a slow rate.
Sediment Trap #1 plus Sediment Pond #018 are adequate to treat and control the expected runoff under the described condition

Terrace ditches are expected to experience flows in the range of up to 2-3 cfs
The perimeter collection ditches could experience flows up to 6-10 cfs, depending on conditions

Flows & storm volumes in a 10 year storm are approximately 30% less than the 100 yr storm shown.

NOAA Atlas 14, Volume 1, Version 5

Location name: East Carbon, Utah, US*

Coordinates: 39.5395, -110.3822

Elevation: 6466ft*

* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

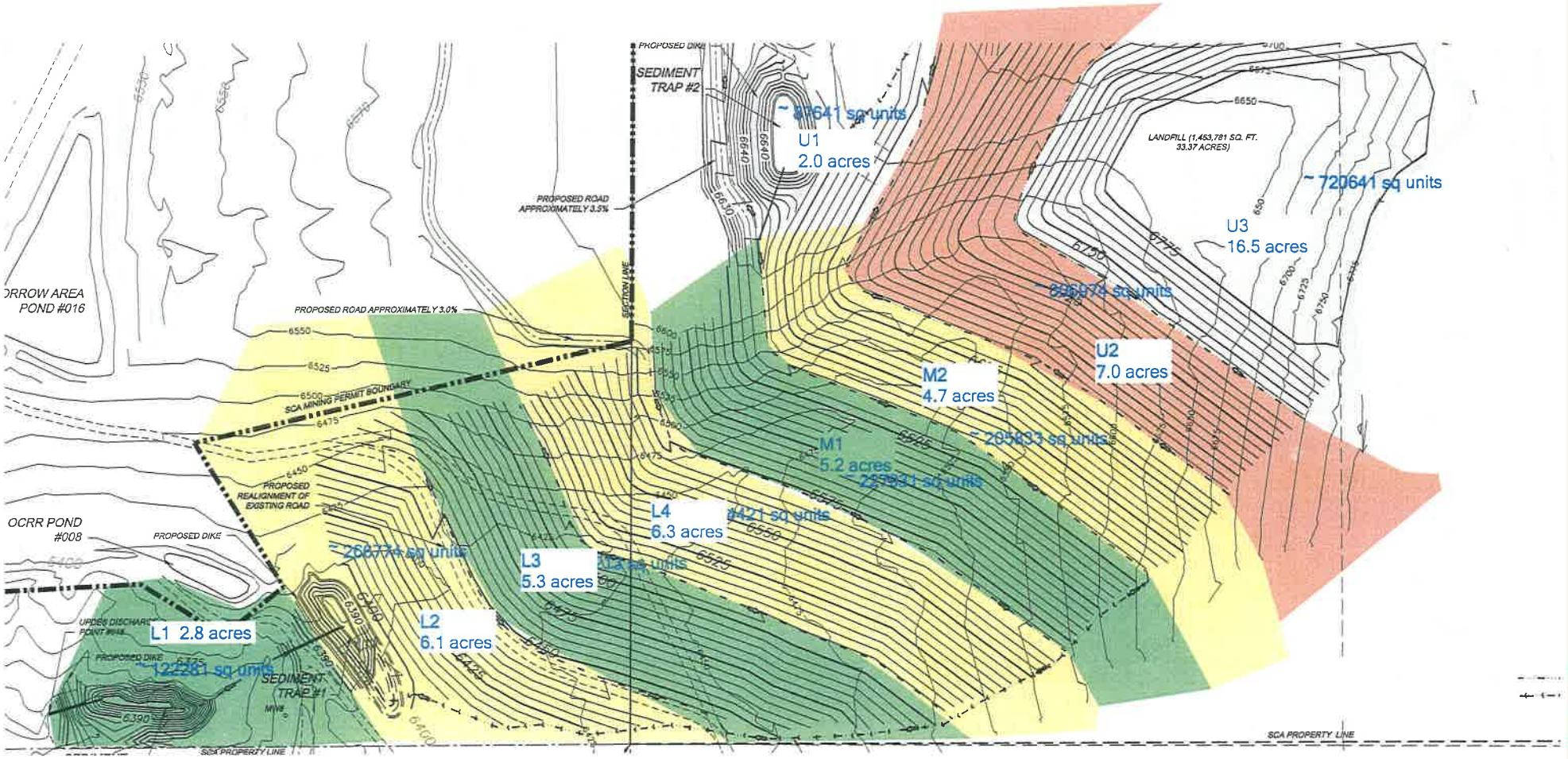
Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
30-min	**0.321** (0.277-0.383)	**0.413** (0.359-0.495)	**0.566** (0.486-0.674)	**0.701** (0.599-0.839)	**0.912** (0.761-1.09)	**1.1** (0.901-1.33)	**1.32** (1.06-1.60)	**1.58** (1.23-1.94)	**1.99** (1.48-2.50)	**2.36** (1.70-3.04)
60-min	**0.398** (0.343-0.473)	**0.511** (0.444-0.612)	**0.7** (0.601-0.834)	**0.868** (0.742-1.04)	**1.13** (0.942-1.35)	**1.36** (1.12-1.64)	**1.64** (1.31-1.98)	**1.95** (1.52-2.40)	**2.46** (1.83-3.09)	**2.93** (2.10-3.76)
2-hr	**0.476** (0.415-0.557)	**0.6** (0.523-0.704)	**0.799** (0.693-0.938)	**0.979** (0.842-1.15)	**1.27** (1.07-1.49)	**1.54** (1.26-1.81)	**1.85** (1.48-2.19)	**2.21** (1.72-2.65)	**2.8** (2.07-3.43)	**3.35** (2.38-4.18)
3-hr	**0.537** (0.474-0.621)	**0.674** (0.593-0.781)	**0.87** (0.764-1.01)	**1.05** (0.915-1.22)	**1.34** (1.14-1.55)	**1.59** (1.33-1.85)	**1.9** (1.56-2.23)	**2.27** (1.81-2.69)	**2.87** (2.20-3.47)	**3.43** (2.53-4.22)
6-hr	**0.683** (0.607-0.776)	**0.847** (0.756-0.965)	**1.06** (0.941-1.20)	**1.24** (1.10-1.41)	**1.51** (1.31-1.72)	**1.74** (1.49-1.99)	**2.02** (1.71-2.34)	**2.37** (1.97-2.77)	**2.96** (2.39-3.52)	**3.51** (2.76-4.24)
12-hr	**0.853** (0.770-0.954)	**1.06** (0.953-1.18)	**1.3** (1.16-1.45)	**1.5** (1.34-1.68)	**1.79** (1.58-2.02)	**2.03** (1.77-2.29)	**2.28** (1.97-2.59)	**2.58** (2.19-2.96)	**3.15** (2.63-3.67)	**3.7** (3.03-4.36)
24-hr	**1.15** (1.06-1.25)	**1.43** (1.32-1.55)	**1.73** (1.61-1.89)	**1.99** (1.83-2.16)	**2.32** (2.12-2.53)	**2.57** (2.35-2.81)	**2.83** (2.56-3.10)	**3.09** (2.77-3.39)	**3.43** (3.03-3.78)	**3.72** (3.23-4.40)


PROPOSED DIKE
SEDIMENT TRAP #2
~ 87641 sq units
U1
2.0 acres
LANDFILL (1,453,781 SQ. FT. 33.37 ACRES)
~ 720641 sq units
U3
16.5 acres
PROPOSED ROAD APPROXIMATELY 3.5%
~ 286974 sq units
U2
7.0 acres
PROPOSED ROAD APPROXIMATELY 3.0%
SCA MINING PERMIT BOUNDARY
M2
4.7 acres
~ 205833 sq units
M1
5.2 acres
~ 225931 sq units
PROPOSED REALIGNMENT OF EXISTING ROAD
L4
6.3 acres
~ 274421 sq units
OCRR POND #008
PROPOSED DIKE
~ 266774 sq units
L3
5.3 acres
~ 232 sq units
L2
6.1 acres
L1 2.8 acres
~ 122281 sq units
SEDIMENT TRAP #1
SCA PROPERTY LINE
SCA PROPERTY LINE

APPENDIX C

GEOTECHNICAL ENGINEERING REPORT

PSI – APRIL 2012

See Plant File for Report

APPENDIX D

SCA ASH LANDFILL #1
LEACHATE MODELING

4.0 Leachate Generation Evaluation

The potential for groundwater quality impacts resulting from leachate generation from the Phase 3 ash disposal facility was evaluated using the Hydrologic Evaluation of Landfill Performance (HELP) model. The HELP model was used to estimate water movement into, through, and out of the Phase 2 and 3 ash cells, assuming that the Phase 3 facility is constructed with no base liner and with 16 inches of cover soil (as is the existing Phase 1 and 2 facilities). HELP model parameters are general in nature, and since the construction of the Phase 3 ash landfill will follow suite with that of Phases 1 and 2 (i.e., same ash, same location, similar slopes and construction practices), the conclusions regarding leachate generation apply.

4.1 Model Data

Climatological, soil property, and facility design data are used as input for the HELP model. Input data used for this evaluation are described below.

4.1.1 Climatological Data

Average monthly precipitation and temperature data recorded during a 39-year period (1950 through 1988) at a Sunnyside climatological center was used to calibrate default data available in the HELP model for Salt Lake City. Solar radiation data was synthetically generated by the HELP model. Default data available in the HELP model for Salt Lake City and latitudinally adjusted for Sunnyside was used for evapotranspiriative data such as the length of the growing season, the evaporative depth zone, average wind speed, and relative humidity.

4.1.2 Ash and Soil Properties

Laboratory testing of ash samples was conducted so that actual test data could be used rather than estimates or default data based upon material type. The laboratory test reports are included in Appendix B.

Cover soil properties are based upon a requirement of the current facility permit that cover soil have an hydraulic conductivity of 1×10^{-3} cm/s or less. The model was run using typical properties for a 10^{-3} cm/s soil. The actual soil which will be used for cover soil at the facility will likely have an hydraulic

conductivity in the range of 10^{-5} to 10^{-6} cm/s. Soils of this type would tend to allow less infiltration and have a higher capacity to retain water which has infiltrated than the assumed soil. The assumed soil properties will therefore tend to produce results which are conservative on the side of overestimating the amount of leachate discharge from the ash cells.

Ash properties as determined by testing are listed below:

Hydraulic Conductivity: 2.1×10^{-5} cm/s
Porosity: 61.3 percent
Field Capacity: 41.1 percent
Wilting Point: 21.6 percent

The assumed cover soil properties are listed below:

Hydraulic Conductivity: 1×10^{-3} cm/s
Porosity: 45.7 percent
Field Capacity: 13.1 percent
Wilting Point: 5.8 percent

4.1.3 Facility Design Data

Modeling assumptions include the following items: the facility will be constructed with no liner; ash will be placed in 20-foot high terraces; the maximum ash thickness will be approximately 100 feet; the top of the facility will be sloped at 3 percent (or less in the case of Phase 3); and a 16-inch thick cover soil layer will be placed over the finished ash surfaces.

4.2 Modeling Scenarios

Three scenarios of the ash disposal facility development were modeled. The first is the case where a cell is being actively filled. The second is the initial post-closurecase where a cell has been filled and covered but is not at equilibrium moisture content. The third is the post-closure period after which the facility has reached an equilibrium moisture content. Each scenario is discussed below.

4.3 Active Ash Disposal Facility

The first scenario modeled is the active disposal facility. In this case, ash is being placed into the active cell on a daily basis, and 20-foot high ash terraces are being developed.

4.3.1 Modeling Assumptions

During the active cell development phase modeled under this scenario, each precipitation event will occur on a recently placed ash surface. However, the HELP model must be run in minimum 1-year increments, which results in a modeled condition where precipitation continuously re-wets the same ash surface. In order to better simulate the active-filling scenario, the HELP model was run for a one-year period on a single 20-foot thick terrace rather than on the actual 3 to 4 terraces which will be developed during each year, and water movement within the terrace was evaluated. Runs were made with both average annual precipitation (13.6 inches) and maximum precipitation (20.0 inches) observed during the 39-year period of record for which rainfall data was available.

4.3.2 Results

4.3.2.1 Average Precipitation

The 13.6 inches of precipitation (average annual amount) which fell on the facility for this modeling scenario was distributed as follows:

Runoff:	1.1 inches
Evaporation:	11.2 inches
Storage:	1.3 inches
Discharge:	0.0 inches

Of the 13.6 inches of precipitation, 1.1 inches ran off from the cell and 12.5 inches infiltrated the ash. Of the 12.5 inches which infiltrated, 11.2 inches subsequently evaporated. The remaining 1.3 inches was stored in pore spaces in the ash fill, which increased the average ash moisture content from 22.0 percent (as-placed moisture content) to 22.6 percent. The final moisture content (22.6 percent) is less than the field capacity of 41.1 percent, and thus no water will drain from the ash. This results in essentially zero leachate discharge. HELP model output is included in Appendix B.

4.3.2.2 Maximum Precipitation

The 20.0 inches of precipitation (peak annual amount) which fell on the facility for this modeling scenario was distributed as follows:

Runoff:	1.3 inches
Evaporation:	15.8 inches
Storage:	2.9 inches
Discharge:	0.0 inches

Of the 20.0 inches of precipitation, 1.3 inches ran off from the cell and 18.7 inches infiltrated the ash. Of the 18.7 inches which infiltrated, 15.8 inches subsequently evaporated. The remaining 2.9 inches was stored in pore spaces in the ash fill, which increased the average ash moisture content from 22.0 percent (as-placed moisture content) to 23.3 percent. The final moisture content (23.3 percent) is less than the field capacity of 41.1 percent, and thus no water will drain from the ash. This results in essentially zero leachate discharge. HELP model output is included in Appendix B.

4.4 Initial Post-Closure Period

The second scenario modeled is the closed facility which has been developed to it÷s full height and on which cover soil has been placed. The physical landfill layout consists of the final bench-and-terrace configuration shown on the permit drawings with an average ash thickness of 50 feet, and 16 inches of cover soil.

4.4.1 Modeling Assumptions

The model run started with an initial ash moisture content equal to the as-placed moisture content of 22 percent, which is representative of the anticipated initial conditions at the time of cell closure.

4.4.2 Results

The HELP model predicts that essentially no leachate discharge will occur from the facility during the 39-year modeling period immediately following cover soil placement. During this time, water which

infiltrates through the evaporative zone increases the moisture content of the underlying ash but is retained in pore spaces and does not percolate further through the ash fill.

Average annual distribution of precipitation over the initial 39-year modeling period is listed below:

Precipitation:	13.6 inches
Runoff:	0.1 inch
Evaporation:	13.3 inches
Storage:	0.2 inch
Discharge:	0.0 inch

Of the average 13.6 inches of precipitation, 0.1 inch ran off from the cell and 13.5 inches infiltrated the ash. Of the 13.5 inches which infiltrated, 13.3 inches subsequently evaporated. The remaining 0.2 inch was stored in pore spaces, increasing the average moisture content of the ash fill. Essentially all water is retained in the ash during this time period, with essentially no leachate discharge. HELP model output is included in Appendix B.

4.5 Equilibrium Post-Closure Phase

The third scenario modeled is the closed facility which has reached an equilibrium moisture content.

4.5.1 Modeling Assumptions

The model run started with an initial ash moisture content approximately equal to the ash field capacity. Based upon the average annual moisture content increase of 0.235 inches per year calculated by the second modeling scenario, it will take about 10 years for each foot of ash thickness to reach a moisture content where leachate discharge could occur. Leachate discharge from the facility could begin to occur where the ash tapers out at the perimeter soon after placement, but approximately 1,000 years will pass before leachate discharge would occur from the thickest (100 feet) zones. These calculations are presented in Appendix B.

4.5.2 Results

The HELP model predicts that leachate discharge will occur after some time period when the moisture content of the ash has increased to field capacity, because at this point water which percolates throughout the evaporative zone increases the moisture content of the underlying zone above field capacity, allowing gravity drainage of the excess moisture through the ash.

Average annual distribution of precipitation over the post-equilibrium modeling period is listed below:

Precipitation:	13.7 inches
Runoff:	0.1 inch
Evaporation:	13.5 inches
Storage:	0.037
Discharge:	0.0034 inch

Of the average 13.6 inches of precipitation, 0.1 inches ran off from the cell and 13.5 inches infiltrated the ash. Of the 13.5 inches which infiltrated, 99.7 percent subsequently evaporated. The remaining 0.3 percent was temporarily stored in pore spaces in the ash fill, which increased the average ash moisture content above field capacity. This excess moisture eventually percolates to the base of the ash fill and discharges as leachate. During the post-equilibrium period, the average annual volume of leachate discharge is estimated to be 3,000 gallons over a 32-acre facility footprint. HELP model output is included in Appendix B.

The impact on groundwater quality of the eventual 3,000-gallons-per-year leachate discharge was evaluated as part of Phase 1 facility permitting. The evaluation estimated the Icelander Creek aquifer flow volume to be approximately 740,000 gallons per year, calculated groundwater impacts resulting from mixing the leachate discharge with the aquifer flow, and concluded that any impacts would be within acceptable limits established by the State of Utah. The data and analysis results from the previous evaluations have been previously submitted as part of the original facility permitting and are included herein as Appendix C.

4.6 Conclusions

The proposed design of the Phase 3 ash disposal facility, with no base liner and 16 inches of cover soil, will not result in groundwater quality impacts beyond limits established by the State of Utah. Essentially no leachate discharge will occur during the active and initial post-closure phases of Phase 3 facility development. Some leachate discharge will occur from the facility when the ash reaches an equilibrium moisture content, but the impact of the leachate discharge will be within established limits.

APPENDIX B-1

Soil Characterization Laboratory; S506
Department of Soil, Water, and Climate
1991 Upper Buford Circle
St. Paul, MN 55108
http://www.soils.agri.umn.edu/facilities/scl/

UNIVERSITY OF MINNESOTA

Jason C. Andrea: (612) 625-6786 • e-mail~ jandrea@soils.umn.edu
Dept. Fax # (612) 625-2208

FAX MEMO
PAGES 1 DATE 6/25 FAX
TO SAL MENDOZA
FROM JASON ANDREA U OF MN
CO.
PH # FAX #

June 24, 1996

Mr. Sal Mendoza
Barr Engineering
8300 Norman Center Dr.
Minneapolis, MN 55437

Dear Mr. Mendoza:

Here are the results of the moisture retention analysis for sample #4404004-jrm (Sunnyside L.F.) which you requested. Moisture retention analysis was carried out using pressure chambers and standard ceramic, porous desorption plates. The percentages shown below indicate the amount of water (found by weight difference) remaining in the soil sample after pressurization. The cost of analyzing two samples at $6.75/samp is $13.50. Please send a check payable to The University of Minnesota to:

Jason Andrea
University of Minnesota
442 Borlaug Hall
1991 Upper Buford Circle
St. Paul, MN 55108

% Moisture Retention = 100 * ((wet weight - oven dry weight)/(oven dry sample weight))

Results:

pressure	*% H_2O*	
1/3 bar (f.c.)	41.08	(field capacity)
15 bar (w.p.)	21.64	(wilting pt)

If you have any questions regarding the laboratory procedures or the results, please give me a call at the above number. Thank you very much.

Sincerely,

Jason Andrea
Jr. Scientist

MOISTURE - DENSITY CURVE

Project SUNNYSIDE LANDFILL - 44/04-004JRM040 Date 6-17-96

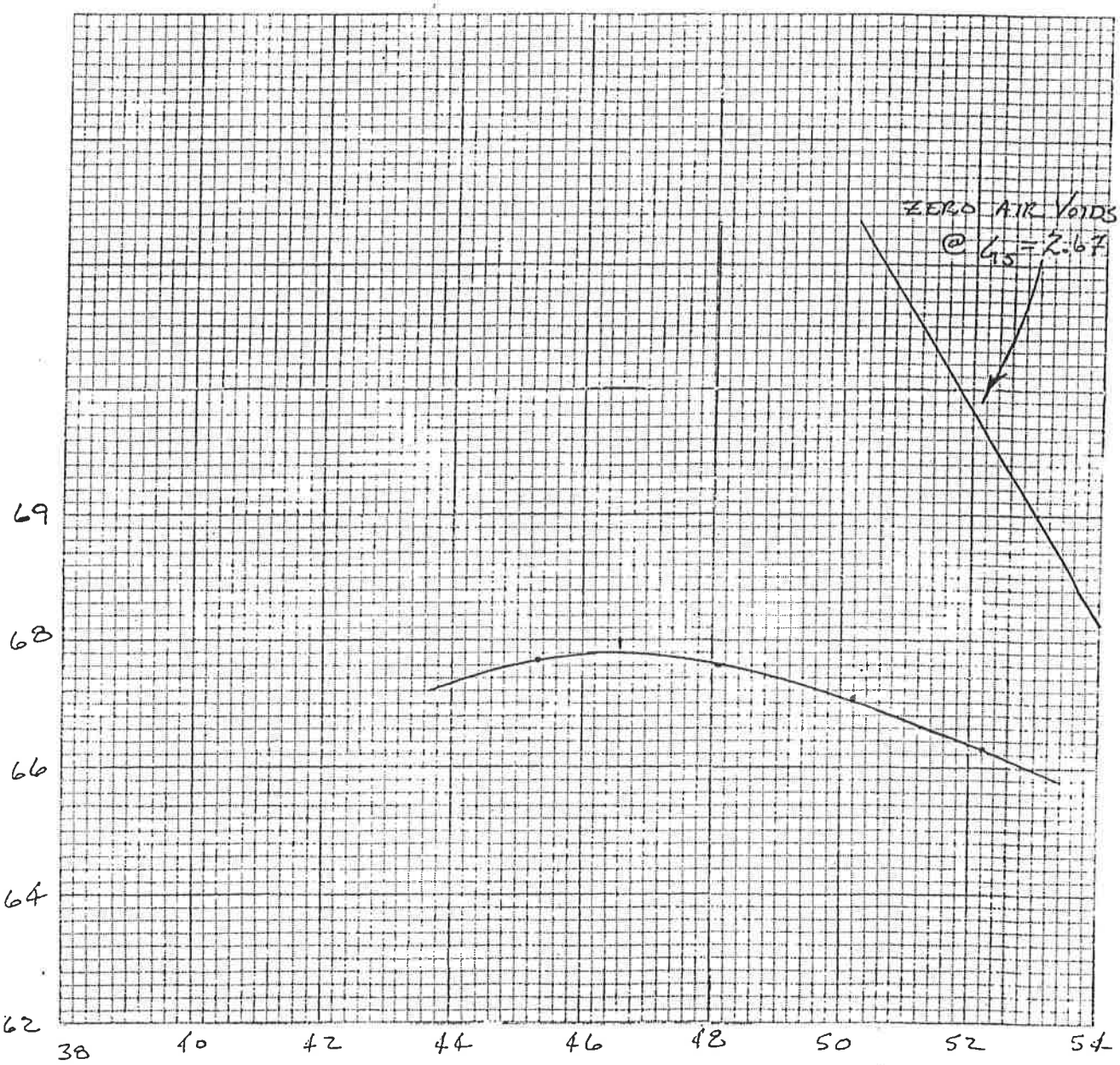
Reported To BARR ENGINEERING COMPANY Job No. 2733

Boring No. _____ Sample No. 1 Depth (ft.) _____ Location _____

Test Method ASTM: D698, METHOD B"

Soil Description ASH, BROWN

Maximum Dry Density 67.8 pcf Optimum Water Content 46.6 %



Permeability Test Data (Compacted Specimens)

Project: SUNNYSIDE LANDFILL - # 44/04-004 JRM 040 Date: 6-19-96

Reported To: BARR ENGINEERING COMPANY Job No.: 2733

Sample No./Designation	1					
Sample Type, Location Elevation or Depth	BAG					
Soil Classification	ASH					
In-Place Water Content (%)	19.1					
Moisture - Density Relation (ASTM: D698)						
Max Dry Density (PCF)	67.8					
Opt. Water Content (%)	46.6					
Atterberg Limits						
Liquid Limit						
Plastic Limit						
Plasticity Index						
Permeability Test						
Specimen No.						
Specimen Height (Inches)	2.99					
Specimen Diameter (Inches)	2.86					
Dry Density (PCF)	64.5					
% of Max. Density	95.1					
Water Content (%)	46.6					
Type of Test (Head)	FALLING					
Max. Head Differential (Ft)	2.3					
Confining Pressure (Effective-PSI)	2.0					
Trial No.	11-15					
Water Temp. (°C)	23					
Co-efficient of Permeability						
K @ 20°C (Cm/Soc)	2.1×10^{-5}					
K @ 20°C (Ft/Min)	4.2×10^{-5}					

APPENDIX B-2

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**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**          HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE           **
**               HELP MODEL VERSION 3.04a  (10 JULY 1995)           **
**               DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                 USAE WATERWAYS EXPERIMENT STATION                **
**          FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************

PRECIPITATION DATA FILE:     C:\scm\4404004\D4X3.D4
TEMPERATURE DATA FILE:       C:\SCM\4404004\D7X3.D7
SOLAR RADIATION DATA FILE:   C:\SCM\4404004\D13X3.D13
EVAPOTRANSPIRATION DATA:     C:\SCM\4404004\D11X3.D11
SOIL AND DESIGN DATA FILE:   C:\SCM\4404004\D10X3.D10
OUTPUT DATA FILE:            C:\SCM\4404004\SUN_X3.OUT

TIME:  14: 2     DATE:   7/ 2/1996

**********************************************************************

     TITLE:  Sunnyside Landfill-Sunnyside, Utah-Average Precipitation(24)

**********************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
            WERE SPECIFIED BY THE USER.


                              LAYER  1
                              --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   0
     THICKNESS                      =     230.00   INCHES
     POROSITY                       =       0.6130 VOL/VOL
     FIELD CAPACITY                 =       0.4108 VOL/VOL
     WILTING POINT                  =       0.2164 VOL/VOL
     INITIAL SOIL WATER CONTENT     =       0.2200 VOL/VOL
     EFFECTIVE SAT. HYD. COND.      =  0.209999998000E-04 CM/SEC
```

22.20	28.40	33.90	38.20	50.30	68.20
69.90	71.00	58.80	45.40	33.60	24.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SALT LAKE CITY UTAH
AND STATION LATITUDE = 39.57 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 24

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/D
PRECIPITATION	0.44	0.58	2.61	1.12	0.66	0.44
	0.27	0.71	3.24	1.18	1.66	0.69
RUNOFF	0.000	0.106	0.576	0.120	0.000	0.00
	0.000	0.000	0.254	0.000	0.000	0.00
EVAPOTRANSPIRATION	0.345	0.222	1.009	1.659	1.057	0.53
	0.499	0.860	2.784	0.968	0.707	0.60
PERCOLATION/LEAKAGE THROUGH LAYER 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.000

****

****

ANNUAL TOTALS FOR YEAR 24

	INCHES	CU. FEET	PERCENT
PRECIPITATION	13.60	49368.004	100.00
RUNOFF	1.056	3833.383	7.76
EVAPOTRANSPIRATION	11.254	40850.516	82.75
PERC./LEAKAGE THROUGH LAYER 1	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	1.290	4684.092	9.49
SOIL WATER AT START OF YEAR	50.600	183677.844	
SOIL WATER AT END OF YEAR	51.785	187980.531	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00

PRECIPITATION	13.60	(0.000)	49368.0	100.00
RUNOFF	1.056	(0.0000)	3833.38	7.765
EVAPOTRANSPIRATION	11.254	(0.0000)	40850.52	82.747
PERCOLATION/LEAKAGE THROUGH LAYER 1	0.00000	(0.00000)	0.000	0.0000
CHANGE IN WATER STORAGE	1.290	(0.0000)	4684.09	9.488

****

****

FINAL WATER STORAGE AT END OF YEAR 24

LAYER	(INCHES)	(VOL/VOL)
1	51.7853	0.2252
SNOW WATER	0.105	

****
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APPENDIX B-3

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*                                                                    *
*                                                                    *
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        *
**                   HELP MODEL VERSION 3.04a  (10 JULY 1995)        *
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY           *
**                     USAE WATERWAYS EXPERIMENT STATION             *
**                FOR USEPA RISK REDUCTION ENGINEERING LABORATORY     *
**                                                                    *
**                                                                    *
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PRECIPITATION DATA FILE: C:\scm\4404004\D4X2.D4
TEMPERATURE DATA FILE: C:\SCM\4404004\D7X2.D7
SOLAR RADIATION DATA FILE: C:\SCM\4404004\D13X2.D13
EVAPOTRANSPIRATION DATA: C:\SCM\4404004\D11X2.D11
SOIL AND DESIGN DATA FILE: C:\SCM\4404004\D10X2-1.D10
OUTPUT DATA FILE: C:\SCM\4404004\SUN_X2-1.OUT

TIME: 13:33 DATE: 7/ 2/1996

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TITLE: Sunnyside Landfill-Sunnyside, Utah-Maximum Precipitation(23)

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE SPECIFIED BY THE USER.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	230.00	INCHES
POROSITY	=	0.6130	VOL/VOL
FIELD CAPACITY	=	0.4108	VOL/VOL
WILTING POINT	=	0.2164	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2200	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.209999998000E-04	CM/SEC

24.50	32.80	37.20	37.20	53.60	62.60
69.30	66.70	60.00	47.30	37.70	29.90

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SALT LAKE CITY UTAH
AND STATION LATITUDE = 39.57 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 23

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/D
PRECIPITATION	1.39	1.48	1.33	1.92	0.83	0.04
	2.78	1.76	2.27	4.17	1.40	0.60
RUNOFF	0.463	0.109	0.008	0.000	0.000	0.00
	0.251	0.000	0.150	0.314	0.000	0.00
EVAPOTRANSPIRATION	0.261	0.662	1.607	2.561	0.899	0.49
	2.158	2.059	1.500	1.919	0.940	0.72
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.00
LAYER 1	0.0000	0.0000	0.0000	0.0000	0.0000	0.00

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ANNUAL TOTALS FOR YEAR 23

	INCHES	CU. FEET	PERCENT
PRECIPITATION	19.97	72491.094	100.00
RUNOFF	1.295	4700.144	6.48
EVAPOTRANSPIRATION	15.786	57302.445	79.05
PERC./LEAKAGE THROUGH LAYER 1	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	2.889	10488.519	14.47
SOIL WATER AT START OF YEAR	50.600	183677.844	
SOIL WATER AT END OF YEAR	53.443	193997.109	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00

PRECIPITATION	19.97	(0.000)	72491.1	100.00
RUNOFF	1.295	(0.0000)	4700.14	6.484
EVAPOTRANSPIRATION	15.786	(0.0000)	57302.45	79.048
PERCOLATION/LEAKAGE THROUGH LAYER 1	0.00000	(0.00000)	0.000	0.000(
CHANGE IN WATER STORAGE	2.889	(0.0000)	10488.52	14.469

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FINAL WATER STORAGE AT END OF YEAR 23

LAYER	(INCHES)	(VOL/VOL)
1	53.4427	0.2324
SNOW WATER	0.047	

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APPENDIX B-4

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** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
** HELP MODEL VERSION 3.04a (10 JULY 1995)
** DEVELOPED BY ENVIRONMENTAL LABORATORY
** USAE WATERWAYS EXPERIMENT STATION
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
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PRECIPITATION DATA FILE: C:\SCM\HELP34A\ssdata4.D4
TEMPERATURE DATA FILE: C:\SCM\HELP34A\ssdata7.D7
SOLAR RADIATION DATA FILE: C:\SCM\HELP34A\ssdata13.D13
EVAPOTRANSPIRATION DATA: C:\SCM\HELP34A\ssdata11.D11
SOIL AND DESIGN DATA FILE: C:\SCM\HELP34A\ss50-22.D10
OUTPUT DATA FILE: C:\SCM\HELP34A\ss50-22.OUT

TIME: 23: 4 DATE: 10/23/1996

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TITLE: Phase 2 Facility: Closed, Initial Moisture Content = 22%

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE SPECIFIED BY THE USER.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	16.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0840	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 2.49 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
0.80	1.00	1.30	1.20	1.30	0.80
1.80	1.40	1.70	1.40	0.80	0.70

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SALT LAKE CITY UTAH

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
24.20	30.20	35.20	43.40	52.70	63.10
70.10	68.10	59.40	48.00	34.90	25.90

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SALT LAKE CITY UTAH
AND STATION LATITUDE = 39.57 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	12.53	45483.914	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	6.172	22404.264	49.26
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	6.358	23079.639	50.74
SOIL WATER AT START OF YEAR	14.544	52794.703	
SOIL WATER AT END OF YEAR	20.827	75601.398	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.075	272.940	0.60
ANNUAL WATER BUDGET BALANCE	0.0000	0.012	0.00

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	16.06	58297.820	100.00
RUNOFF	0.275	996.679	1.71
EVAPOTRANSPIRATION	15.571	56521.230	96.95
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.215	779.876	1.34
SOIL WATER AT START OF YEAR	20.436	74181.461	
SOIL WATER AT END OF YEAR	21.000	76231.797	
SNOW WATER AT START OF YEAR	0.440	1597.040	2.74
SNOW WATER AT END OF YEAR	0.090	326.580	0.56
ANNUAL WATER BUDGET BALANCE	0.0000	0.032	0.00

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	11.37	41273.102	100.00
RUNOFF	0.159	578.092	1.40
EVAPOTRANSPIRATION	11.401	41385.277	100.27
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.190	-690.260	-1.67
SOIL WATER AT START OF YEAR	21.000	76231.797	
SOIL WATER AT END OF YEAR	20.900	75868.117	
SNOW WATER AT START OF YEAR	0.090	326.580	0.79
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.006	0.00

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	9.59	34811.699	100.00
RUNOFF	0.057	208.467	0.60
EVAPOTRANSPIRATION	10.853	39395.820	113.17
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-1.320	-4792.599	-13.77
SOIL WATER AT START OF YEAR	22.619	82107.594	
SOIL WATER AT END OF YEAR	21.524	78132.055	
SNOW WATER AT START OF YEAR	0.271	984.519	2.83
SNOW WATER AT END OF YEAR	0.046	167.460	0.48
ANNUAL WATER BUDGET BALANCE	0.0000	0.011	0.00

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.13	54921.906	100.00
RUNOFF	0.187	677.802	1.23
EVAPOTRANSPIRATION	14.856	53927.551	98.19
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.086	313.867	0.57
SOIL WATER AT START OF YEAR	21.524	78132.055	
SOIL WATER AT END OF YEAR	21.657	78613.375	
SNOW WATER AT START OF YEAR	0.046	167.460	0.30
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0007	2.689	0.00

ANNUAL WATER BUDGET BALANCE	0.0017	6.118	0.01

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ANNUAL TOTALS FOR YEAR 12

	INCHES	CU. FEET	PERCENT
PRECIPITATION	11.29	40982.711	100.00
RUNOFF	0.082	298.825	0.73
EVAPOTRANSPIRATION	10.444	37912.043	92.51
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.764	2771.845	6.76
SOIL WATER AT START OF YEAR	21.654	78603.391	
SOIL WATER AT END OF YEAR	22.353	81141.031	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.065	234.207	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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ANNUAL TOTALS FOR YEAR 13

	INCHES	CU. FEET	PERCENT
PRECIPITATION	9.87	35828.105	100.00
RUNOFF	0.077	278.545	0.78
EVAPOTRANSPIRATION	9.835	35700.953	99.65
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.042	-151.391	-0.42
SOIL WATER AT START OF YEAR	22.353	81141.031	
SOIL WATER AT END OF YEAR	22.333	81070.234	
SNOW WATER AT START OF YEAR	0.065	234.207	0.65

SNOW WATER AT START OF YEAR	0.256	930.714	2.08
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.006	0.00

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ANNUAL TOTALS FOR YEAR 16

	INCHES	CU. FEET	PERCENT
PRECIPITATION	12.83	46572.910	100.00
RUNOFF	0.065	234.953	0.50
EVAPOTRANSPIRATION	13.651	49552.078	106.40
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.885	-3214.136	-6.90
SOIL WATER AT START OF YEAR	22.708	82429.562	
SOIL WATER AT END OF YEAR	21.822	79215.430	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.015	0.00

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ANNUAL TOTALS FOR YEAR 17

	INCHES	CU. FEET	PERCENT
PRECIPITATION	12.16	44140.805	100.00
RUNOFF	0.236	857.859	1.94
EVAPOTRANSPIRATION	11.497	41733.711	94.55
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.427	1549.235	3.51
SOIL WATER AT START OF YEAR	21.822	79215.430	

SOIL WATER AT START OF YEAR	21.928	79598.242	
SOIL WATER AT END OF YEAR	21.297	77309.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.130	471.268	1.69
ANNUAL WATER BUDGET BALANCE	0.0000	-0.005	0.00

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ANNUAL TOTALS FOR YEAR 20

	INCHES	CU. FEET	PERCENT
PRECIPITATION	16.11	58479.309	100.00
RUNOFF	0.102	369.755	0.63
EVAPOTRANSPIRATION	14.545	52796.957	90.28
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	1.463	5312.453	9.08
SOIL WATER AT START OF YEAR	21.297	77309.844	
SOIL WATER AT END OF YEAR	22.606	82060.984	
SNOW WATER AT START OF YEAR	0.130	471.268	0.81
SNOW WATER AT END OF YEAR	0.284	1032.584	1.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.146	0.00

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ANNUAL TOTALS FOR YEAR 21

	INCHES	CU. FEET	PERCENT
PRECIPITATION	14.12	51255.609	100.00
RUNOFF	0.120	434.416	0.85
EVAPOTRANSPIRATION	15.259	55391.445	108.07
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	1.444	5242.100	7.23
SOIL WATER AT START OF YEAR	22.947	83296.492	
SOIL WATER AT END OF YEAR	24.742	89811.852	
SNOW WATER AT START OF YEAR	0.397	1442.510	1.99
SNOW WATER AT END OF YEAR	0.047	169.251	0.23
ANNUAL WATER BUDGET BALANCE	0.0002	0.567	0.00

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ANNUAL TOTALS FOR YEAR 24

	INCHES	CU. FEET	PERCENT
PRECIPITATION	13.60	49368.004	100.00
RUNOFF	0.332	1204.508	2.44
EVAPOTRANSPIRATION	15.023	54535.062	110.47
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-1.755	-6371.558	-12.91
SOIL WATER AT START OF YEAR	24.742	89811.852	
SOIL WATER AT END OF YEAR	22.928	83228.141	
SNOW WATER AT START OF YEAR	0.047	169.251	0.34
SNOW WATER AT END OF YEAR	0.105	381.402	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.009	0.00

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ANNUAL TOTALS FOR YEAR 25

	INCHES	CU. FEET	PERCENT
PRECIPITATION	13.71	49767.316	100.00
RUNOFF	0.316	1147.267	2.31

RUNOFF	0.029	106.411	0.22
EVAPOTRANSPIRATION	14.150	51364.809	107.28
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.989	-3591.511	-7.50
SOIL WATER AT START OF YEAR	23.295	84562.383	
SOIL WATER AT END OF YEAR	22.123	80307.148	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.183	663.724	1.39
ANNUAL WATER BUDGET BALANCE	0.0000	0.003	0.00

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ANNUAL TOTALS FOR YEAR 28

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.37	55793.105	100.00
RUNOFF	0.140	508.063	0.91
EVAPOTRANSPIRATION	11.629	42213.707	75.66
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	3.599	13063.245	23.41
SOIL WATER AT START OF YEAR	22.123	80307.148	
SOIL WATER AT END OF YEAR	25.798	93646.297	
SNOW WATER AT START OF YEAR	0.183	663.724	1.19
SNOW WATER AT END OF YEAR	0.107	387.816	0.70
ANNUAL WATER BUDGET BALANCE	0.0022	8.093	0.01

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ANNUAL TOTALS FOR YEAR 29

	INCHES	CU. FEET	PERCENT

	INCHES	CU. FEET	PERCEN
PRECIPITATION	16.50	59895.016	100.00
RUNOFF	0.189	684.978	1.14
EVAPOTRANSPIRATION	16.320	59240.043	98.91
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.008	-30.021	-0.05
SOIL WATER AT START OF YEAR	21.902	79505.922	
SOIL WATER AT END OF YEAR	21.894	79475.898	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.016	0.00

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ANNUAL TOTALS FOR YEAR 32

	INCHES	CU. FEET	PERCENT
PRECIPITATION	11.92	43269.621	100.00
RUNOFF	0.011	39.381	0.09
EVAPOTRANSPIRATION	11.515	41800.703	96.61
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.394	1429.510	3.30
SOIL WATER AT START OF YEAR	21.894	79475.898	
SOIL WATER AT END OF YEAR	22.288	80905.414	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.025	0.00

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ANNUAL TOTALS FOR YEAR 35

	INCHES	CU. FEET	PERCENT
PRECIPITATION	17.84	64759.215	100.00
RUNOFF	0.050	180.236	0.28
EVAPOTRANSPIRATION	17.948	65151.570	100.61
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.158	-572.588	-0.88
SOIL WATER AT START OF YEAR	23.516	85363.961	
SOIL WATER AT END OF YEAR	23.359	84791.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.006	0.00

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ANNUAL TOTALS FOR YEAR 36

	INCHES	CU. FEET	PERCENT
PRECIPITATION	10.23	37134.910	100.00
RUNOFF	0.266	967.107	2.60
EVAPOTRANSPIRATION	10.788	39158.852	105.45
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.824	-2991.042	-8.05
SOIL WATER AT START OF YEAR	23.359	84791.375	
SOIL WATER AT END OF YEAR	22.535	81800.336	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.008	0.00

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ANNUAL TOTALS FOR YEAR 39

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.66	56845.812	100.00
RUNOFF	0.452	1639.121	2.88
EVAPOTRANSPIRATION	13.851	50279.363	88.45
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	1.352	4908.052	8.63
SOIL WATER AT START OF YEAR	22.362	81173.047	
SOIL WATER AT END OF YEAR	23.568	85553.570	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.145	527.533	0.93
ANNUAL WATER BUDGET BALANCE	0.0053	19.278	0.03

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 39

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.68	0.94	1.37	1.05	1.20	0.89
	1.63	1.40	1.56	1.40	0.84	0.74
STD. DEVIATIONS	0.38	0.42	0.56	0.46	0.59	0.60
	1.10	1.23	1.11	1.00	0.47	0.30
RUNOFF						
TOTALS	0.018	0.040	0.063	0.001	0.000	0.000
	0.001	0.000	0.000	0.000	0.000	0.004
STD. DEVIATIONS	0.054	0.080	0.091	0.003	0.000	0.000
	0.008	0.000	0.000	0.000	0.000	0.012

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 39

	(INCHES)	(CU. FT.)
PRECIPITATION	3.35	12160.500
RUNOFF	0.378	1371.7456
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.000000	0.00000
SNOW WATER	1.31	4756.4434

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2880
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0427

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APPENDIX B-5

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** HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
** HELP MODEL VERSION 3.04a (10 JULY 1995)
** DEVELOPED BY ENVIRONMENTAL LABORATORY
** USAE WATERWAYS EXPERIMENT STATION
** FOR USEPA RISK REDUCTION ENGINEERING LABORATORY
**
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PRECIPITATION DATA FILE: C:\SCM\HELP34A\ssdata4.D4
TEMPERATURE DATA FILE: C:\SCM\HELP34A\ssdata7.D7
SOLAR RADIATION DATA FILE: C:\SCM\HELP34A\ssdata13.D13
EVAPOTRANSPIRATION DATA: C:\SCM\HELP34A\ssdata11.D11
SOIL AND DESIGN DATA FILE: C:\SCM\HELP34A\ssfin50.D10
OUTPUT DATA FILE: C:\SCM\HELP34A\ssfin50.OUT

TIME: 21:49 DATE: 10/23/1996

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TITLE: Phase 2 Facility: Closed, Equilibrium Moisture Content

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NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	16.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0844	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 2.49 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
0.80	1.00	1.30	1.20	1.30	0.80
1.80	1.40	1.70	1.40	0.80	0.70

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SALT LAKE CITY UTAH

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
24.20	30.20	35.20	43.40	52.70	63.10
70.10	68.10	59.40	48.00	34.90	25.90

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR SALT LAKE CITY UTAH
AND STATION LATITUDE = 39.57 DEGREES

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	12.53	45483.914	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	12.491	45343.211	99.69
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.039	140.689	0.31
SOIL WATER AT START OF YEAR	241.685	877316.875	
SOIL WATER AT END OF YEAR	241.724	877457.562	
SNOW WATER AT START OF YEAR	0.075	272.940	0.60
SNOW WATER AT END OF YEAR	0.075	272.940	0.60
ANNUAL WATER BUDGET BALANCE	0.0000	0.014	0.00

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	16.06	58297.820	100.00
RUNOFF	0.280	1017.519	1.75
EVAPOTRANSPIRATION	15.661	56850.742	97.52
PERC./LEAKAGE THROUGH LAYER 2	0.012462	45.236	0.08
CHANGE IN WATER STORAGE	0.106	384.299	0.66
SOIL WATER AT START OF YEAR	241.354	876116.562	
SOIL WATER AT END OF YEAR	241.810	877771.312	
SNOW WATER AT START OF YEAR	0.440	1597.040	2.74
SNOW WATER AT END OF YEAR	0.090	326.580	0.56
ANNUAL WATER BUDGET BALANCE	0.0000	0.022	0.00

ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	11.37	41273.102	100.00
RUNOFF	0.160	580.244	1.41
EVAPOTRANSPIRATION	11.446	41548.848	100.67
PERC./LEAKAGE THROUGH LAYER 2	0.001367	4.963	0.01
CHANGE IN WATER STORAGE	-0.237	-860.977	-2.09
SOIL WATER AT START OF YEAR	241.810	877771.312	
SOIL WATER AT END OF YEAR	241.663	877236.937	
SNOW WATER AT START OF YEAR	0.090	326.580	0.79
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.024	0.00

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	9.59	34811.699	100.00
RUNOFF	0.057	208.460	0.60
EVAPOTRANSPIRATION	10.858	39413.645	113.22
PERC./LEAKAGE THROUGH LAYER 2	0.001425	5.173	0.01
CHANGE IN WATER STORAGE	-1.327	-4815.564	-13.83
SOIL WATER AT START OF YEAR	243.292	883148.687	
SOIL WATER AT END OF YEAR	242.190	879150.187	
SNOW WATER AT START OF YEAR	0.271	984.519	2.83
SNOW WATER AT END OF YEAR	0.046	167.460	0.48
ANNUAL WATER BUDGET BALANCE	0.0000	-0.011	0.00

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.13	54921.906	100.00
RUNOFF	0.187	677.802	1.23
EVAPOTRANSPIRATION	14.895	54070.316	98.45
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.047	171.080	0.31
SOIL WATER AT START OF YEAR	242.190	879150.187	
SOIL WATER AT END OF YEAR	242.283	879488.750	
SNOW WATER AT START OF YEAR	0.046	167.460	0.30
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0007	2.710	0.00

ANNUAL WATER BUDGET BALANCE	0.0017	6.136	0.01

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ANNUAL TOTALS FOR YEAR 12

	INCHES	CU. FEET	PERCENT
PRECIPITATION	11.29	40982.711	100.00
RUNOFF	0.082	298.825	0.73
EVAPOTRANSPIRATION	10.456	37954.637	92.61
PERC./LEAKAGE THROUGH LAYER 2	0.001321	4.794	0.01
CHANGE IN WATER STORAGE	0.751	2724.459	6.65
SOIL WATER AT START OF YEAR	242.222	879266.625	
SOIL WATER AT END OF YEAR	242.908	881756.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.065	234.207	0.57
ANNUAL WATER BUDGET BALANCE	0.0000	-0.005	0.00

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ANNUAL TOTALS FOR YEAR 13

	INCHES	CU. FEET	PERCENT
PRECIPITATION	9.87	35828.105	100.00
RUNOFF	0.077	278.545	0.78
EVAPOTRANSPIRATION	9.858	35783.090	99.87
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	-0.064	-233.520	-0.65
SOIL WATER AT START OF YEAR	242.908	881756.875	
SOIL WATER AT END OF YEAR	242.866	881603.937	
SNOW WATER AT START OF YEAR	0.065	234.207	0.65

SNOW WATER AT START OF YEAR	0.256	930.714	2.08
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.032	0.00

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ANNUAL TOTALS FOR YEAR 16

	INCHES	CU. FEET	PERCENT
PRECIPITATION	12.83	46572.910	100.00
RUNOFF	0.065	234.953	0.50
EVAPOTRANSPIRATION	13.674	49637.066	106.58
PERC./LEAKAGE THROUGH LAYER 2	0.001434	5.204	0.01
CHANGE IN WATER STORAGE	-0.910	-3304.366	-7.10
SOIL WATER AT START OF YEAR	243.184	882759.312	
SOIL WATER AT END OF YEAR	242.274	879454.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.052	0.00

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ANNUAL TOTALS FOR YEAR 17

	INCHES	CU. FEET	PERCENT
PRECIPITATION	12.16	44140.805	100.00
RUNOFF	0.236	857.859	1.94
EVAPOTRANSPIRATION	11.519	41814.004	94.73
PERC./LEAKAGE THROUGH LAYER 2	0.003710	13.467	0.03
CHANGE IN WATER STORAGE	0.401	1455.454	3.30
SOIL WATER AT START OF YEAR	242.274	879454.937	

SOIL WATER AT START OF YEAR	242.321	879624.125	
SOIL WATER AT END OF YEAR	241.670	877262.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.130	471.268	1.69
ANNUAL WATER BUDGET BALANCE	0.0000	0.023	0.00

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ANNUAL TOTALS FOR YEAR 20

	INCHES	CU. FEET	PERCENT
PRECIPITATION	16.11	58479.309	100.00
RUNOFF	0.102	369.715	0.63
EVAPOTRANSPIRATION	14.558	52846.129	90.37
PERC./LEAKAGE THROUGH LAYER 2	0.001380	5.011	0.01
CHANGE IN WATER STORAGE	1.449	5258.337	8.99
SOIL WATER AT START OF YEAR	241.670	877262.062	
SOIL WATER AT END OF YEAR	242.964	881959.125	
SNOW WATER AT START OF YEAR	0.130	471.268	0.81
SNOW WATER AT END OF YEAR	0.284	1032.584	1.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.119	0.00

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ANNUAL TOTALS FOR YEAR 21

	INCHES	CU. FEET	PERCENT
PRECIPITATION	14.12	51255.609	100.00
RUNOFF	0.120	434.416	0.85
EVAPOTRANSPIRATION	15.300	55538.812	108.36
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	1.369	4969.902	6.86
SOIL WATER AT START OF YEAR	243.247	882985.125	
SOIL WATER AT END OF YEAR	244.966	889228.312	
SNOW WATER AT START OF YEAR	0.397	1442.510	1.99
SNOW WATER AT END OF YEAR	0.047	169.251	0.23
ANNUAL WATER BUDGET BALANCE	0.0001	0.544	0.00

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ANNUAL TOTALS FOR YEAR 24

	INCHES	CU. FEET	PERCENT
PRECIPITATION	13.60	49368.004	100.00
RUNOFF	0.332	1204.508	2.44
EVAPOTRANSPIRATION	15.195	55159.395	111.73
PERC./LEAKAGE THROUGH LAYER 2	0.014587	52.951	0.11
CHANGE IN WATER STORAGE	-1.942	-7048.846	-14.28
SOIL WATER AT START OF YEAR	244.966	889228.312	
SOIL WATER AT END OF YEAR	242.966	881967.312	
SNOW WATER AT START OF YEAR	0.047	169.251	0.34
SNOW WATER AT END OF YEAR	0.105	381.402	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.001	0.00

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ANNUAL TOTALS FOR YEAR 25

	INCHES	CU. FEET	PERCENT
PRECIPITATION	13.71	49767.316	100.00
RUNOFF	0.316	1147.267	2.31

RUNOFF	0.029	106.411	0.22
EVAPOTRANSPIRATION	14.169	51434.520	107.42
PERC./LEAKAGE THROUGH LAYER 2	0.006368	23.115	0.05
CHANGE IN WATER STORAGE	-1.015	-3684.344	-7.70
SOIL WATER AT START OF YEAR	243.273	883080.500	
SOIL WATER AT END OF YEAR	242.075	878732.437	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.183	663.724	1.39
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

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ANNUAL TOTALS FOR YEAR 28

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.37	55793.105	100.00
RUNOFF	0.140	508.063	0.91
EVAPOTRANSPIRATION	11.638	42247.703	75.72
PERC./LEAKAGE THROUGH LAYER 2	0.002795	10.145	0.02
CHANGE IN WATER STORAGE	3.587	13019.100	23.33
SOIL WATER AT START OF YEAR	242.075	878732.437	
SOIL WATER AT END OF YEAR	245.738	892027.437	
SNOW WATER AT START OF YEAR	0.183	663.724	1.19
SNOW WATER AT END OF YEAR	0.107	387.816	0.70
ANNUAL WATER BUDGET BALANCE	0.0022	8.094	0.01

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ANNUAL TOTALS FOR YEAR 29

	INCHES	CU. FEET	PERCENT

	INCHES	CU. FEET	PERCENT
PRECIPITATION	16.50	59895.016	100.00
RUNOFF	0.189	684.978	1.14
EVAPOTRANSPIRATION	16.337	59302.391	99.01
PERC./LEAKAGE THROUGH LAYER 2	0.007487	27.176	0.05
CHANGE IN WATER STORAGE	-0.033	-119.530	-0.20
SOIL WATER AT START OF YEAR	241.662	877233.625	
SOIL WATER AT END OF YEAR	241.629	877114.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

ANNUAL TOTALS FOR YEAR 32

	INCHES	CU. FEET	PERCENT
PRECIPITATION	11.92	43269.621	100.00
RUNOFF	0.011	39.381	0.09
EVAPOTRANSPIRATION	11.529	41851.215	96.72
PERC./LEAKAGE THROUGH LAYER 2	0.000000	0.000	0.00
CHANGE IN WATER STORAGE	0.380	1378.975	3.19
SOIL WATER AT START OF YEAR	241.629	877114.062	
SOIL WATER AT END OF YEAR	242.009	878493.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.049	0.00

ANNUAL TOTALS FOR YEAR 35

	INCHES	CU. FEET	PERCENT
PRECIPITATION	17.84	64759.215	100.00
RUNOFF	0.050	180.236	0.28
EVAPOTRANSPIRATION	17.958	65185.871	100.66
PERC./LEAKAGE THROUGH LAYER 2	0.013265	48.151	0.07
CHANGE IN WATER STORAGE	-0.180	-655.035	-1.01
SOIL WATER AT START OF YEAR	243.196	882802.875	
SOIL WATER AT END OF YEAR	243.016	882147.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.010	0.00

ANNUAL TOTALS FOR YEAR 36

	INCHES	CU. FEET	PERCENT
PRECIPITATION	10.23	37134.910	100.00
RUNOFF	0.266	967.107	2.60
EVAPOTRANSPIRATION	10.812	39247.672	105.69
PERC./LEAKAGE THROUGH LAYER 2	0.001375	4.990	0.01
CHANGE IN WATER STORAGE	-0.850	-3084.857	-8.31
SOIL WATER AT START OF YEAR	243.016	882147.812	
SOIL WATER AT END OF YEAR	242.166	879063.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.003	0.00

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ANNUAL TOTALS FOR YEAR 39

	INCHES	CU. FEET	PERCENT
PRECIPITATION	15.66	56845.812	100.00
RUNOFF	0.452	1639.121	2.88
EVAPOTRANSPIRATION	13.933	50577.293	88.97
PERC./LEAKAGE THROUGH LAYER 2	0.001355	4.920	0.01
CHANGE IN WATER STORAGE	1.269	4605.245	8.10
SOIL WATER AT START OF YEAR	241.923	878181.062	
SOIL WATER AT END OF YEAR	243.046	882258.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.145	527.533	0.93
ANNUAL WATER BUDGET BALANCE	0.0053	19.233	0.03

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 39

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	0.68	0.94	1.37	1.05	1.20	0.89
	1.63	1.40	1.56	1.40	0.84	0.74
STD. DEVIATIONS	0.38	0.42	0.56	0.46	0.59	0.60
	1.10	1.23	1.11	1.00	0.47	0.30
RUNOFF						
TOTALS	0.018	0.040	0.064	0.001	0.000	0.000
	0.001	0.000	0.000	0.000	0.000	0.004
STD. DEVIATIONS	0.054	0.080	0.091	0.003	0.000	0.000
	0.008	0.000	0.000	0.000	0.000	0.012

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 39

	(INCHES)	(CU. FT.)
PRECIPITATION	3.35	12160.500
RUNOFF	0.378	1371.7456
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.005697	20.67911
SNOW WATER	1.31	4756.4434

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.2880
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1636

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APPENDIX E

STATE ENGINEER
DAM PERMIT APPLICATION DOCUMENTS
FOR SEDIMENT POND #018

Sunnyside Cogeneration Associates

P.O. Box 10, East Carbon, Utah 84520 • (435) 888-4476 • Fax (435) 888-2538

March 14, 2013

Marc K. Stilson
Division of Water Rights
319 North Carbonville Road
Price, UT 84501

Re: Sunnyside Cogeneration Associates (SCA)
SCA #2 Ash Landfill Sedimentation Basin

Included are the Application for a Dam-Form R-69 and drawings/information regarding the proposed SCA #2 Ash Landfill sedimentation basin.

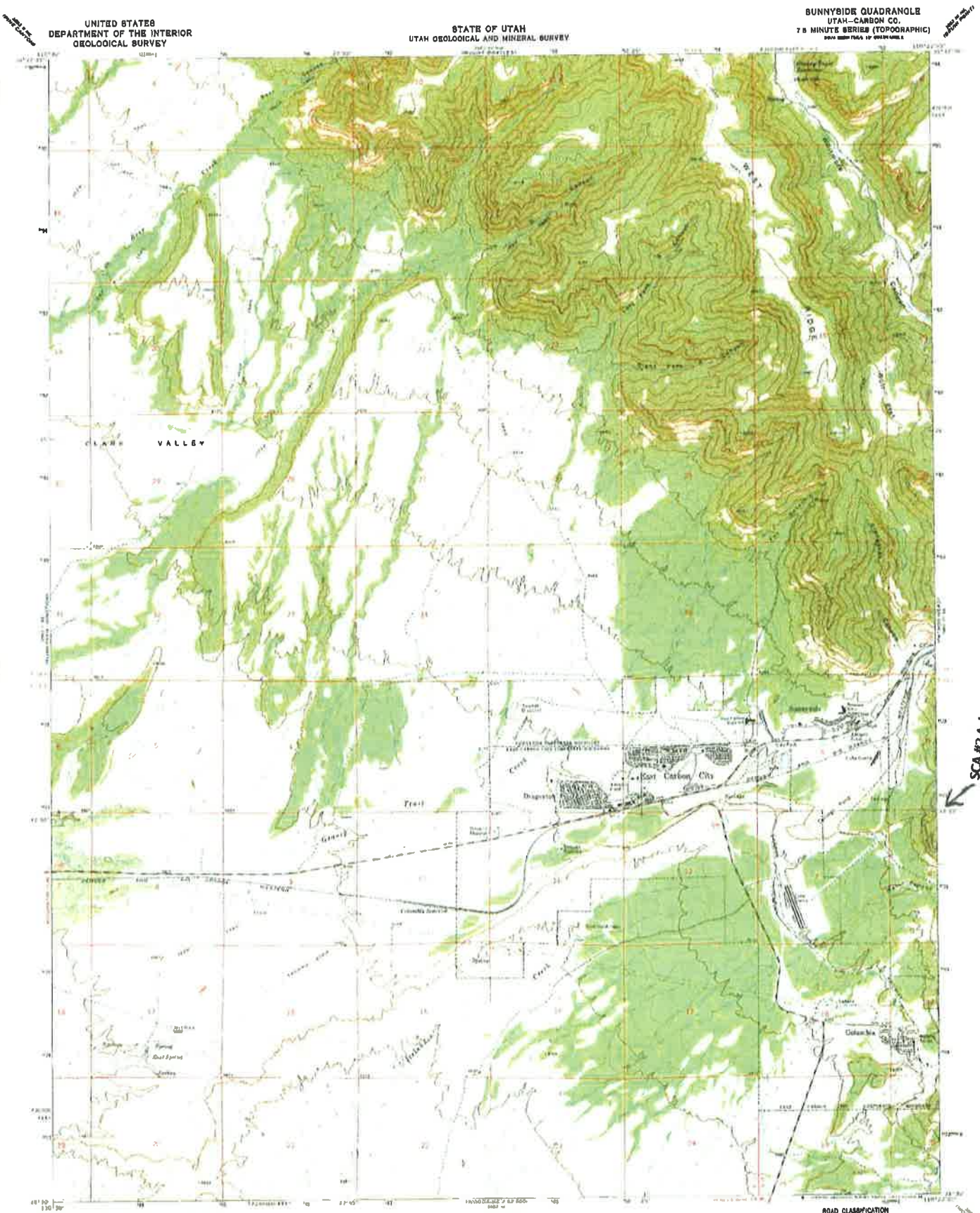
SCA plans to begin construction of the #2 Ash Landfill sedimentation basin in 2013. We are currently in the permitting and development process.

If you have any questions or if further clarification is needed please contact Rusty Netz at (435) 888-4476.

Thank You,

Richard Carter
Agent for
Sunnyside Cogeneration Associates

c.c. Rusty Netz
Plant File


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STATE OF UTAH
UTAH GEOLOGICAL AND MINERAL SURVEY
SUNNYSIDE QUADRANGLE
UTAH—CARBON CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
CLARK VALLEY
East Carbon City
Dragerton
SCA #2 Ash Landfill
Mapped, edited, and published by the Geological Survey
Control by USGS and NOS/NOAA
Topography by photogrammetric methods from aerial photographs taken 1972. Field checked 1972
Projection and 10,000-foot grid ticks: Utah coordinate system, central zone (Lambert conformal conic)
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue
1927 North American datum
SCALE 1:24 000
ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U.S. Route
State Route
SUNNYSIDE, UTAH
N3930—W11032.5/7.5
1972

Form R-69

01/2000

APPLICATION FOR A DAM NOT REQUIRING SUBMISSION OF FORMAL PLANS UNDER SECTION 73-5A-502 STATE OF UTAH

Received / / **Entered** / / **Application No** - -

The following application is submitted pursuant to Section 73-5a-204

1. APPLICANT INFORMATION

Name(s): Sunnyside Cogeneration Associates Telephone: 435-888-4476

Address: PO Box 159

City: Sunnyside State: UT Zip Code: 84539

2. PURPOSE OF RESERVOIR Sediment Pond #018

Stock Pond	Flood Control	Recreation
Irrigation	Debris Basin	Fishery
Regulating Reservoir	Sedimentation X	Wildlife
Diversion Dam	Evaporation X	Tailings

Other (describe)

3. LEGAL LOCATION OF DAM

County Carbon Quarter/Quarter NE ¼ NE ¼ Section 7

Township 14 S Range 14 E Base & Meridian SLB&M

4A. FOR DAMS BUILT ON A NATURAL STREAM OR DRAINAGE

Name of Natural Stream or Drainage Surface area would drain to Icelander Creek

OR Drainage Area above dam <0.25 sqmi (square miles)

Distance below dam to nearest structure occupied by humans Uncertain, greater than 10 (miles)

4B. FOR DAMS BUILT OFF- CHANNEL

Source of Water (ie: well, canal, ditch, etc.)

Capacity of source to reservoir (cubic feet per second)

Distance below dam to nearest structure occupied by humans (miles)

5. DIMENSIONS OF DAM

Height (vertical) 12 feet Length (at top) 125 feet Width (at top) 12 feet

Upstream Slope 3 Horizontal on 1 Vertical

Downstream Slope 2 Horizontal on 1 Vertical

Surface Area at Spillway Crest 0.4 (acres) Capacity at Spillway Crest 2.5 (acre-feet)

Type of Dam (ie: earthfill, concrete, masonry, rockfill, etc.) Earthfill

6. LOW LEVEL OUTLET

Inside diameter of outlet 2 (inches) Total outlet length 95 (feet)

Type of Pipe Galv steel Type of gate or valve 2"

Location of gate or valve (ie: upstream, downstream, center,etc.) Downstream

Outlet capacity with gate open and reservoir at maximum capacity 0.4 (cubic feet per second)

7. SPILLWAY

Crest Length (width of spillway) 1.5 ft dia (feet) Depth (bottom of spillway to top of dam) 15 (feet)

Type of Spillway (ie: earth channel, pipe, concrete, rock channel, Corrugated metal pipe

Spillway capacity with water at top of dam 15 (cubic feet per second)

Control (i.e. gates, flashboards, etc.) 2 ft dia screen / skimmer

8. **WATER RIGHTS**
Describe: _____

9. **COMMENTS**
This small sediment pond is being constructed below the SCA #2 Ash Landfill for the purpose of capturing storm water runoff and protecting water quality in the area. Design and operation of this sediment pond is typical of the area.

10. **PLANS**
The following drawings, including appropriate scales and dimensions, must be attached to the application:

1) A location map, such as a 7.5 minute USGS Quad Map, showing the exact location of the dam
2) A plan view of the dam and reservoir including the location of the spillway, outlet, and channel or supply source.
3) A profile of the dam along the centerline of the dam showing the natural ground, the top of the dam, and the depth to clearing, keyway bottom or cutoff trench.
4) A Cross Section of the dam through the outlet showing the location of the outlet and the types of materials the dam is to be constructed of.
5) Details of the spillway, outlet, drains, gates or valves, or other features of the dam or appurtenant structures.

The undersigned acknowledge they have read the instructions included with this application, and are aware no construction is to begin until this application has been approved by the Utah State Engineer.

3/14/13
Date

Signature

- For Office Use Only -

Water Rights in Order By_____ Date_____
Water Right Numbers if Applicable_____
Regional Engineer's Hazard Rating (High, Moderate, Low)_____
Reviewed by Dam Safety By_____ Date_____
Estimated Breach Flow at Dam_____(cubic feet per second)
Comments_____

Date of Approval

State Engineer or Dam Safety Director

SEDIMENT POND #018

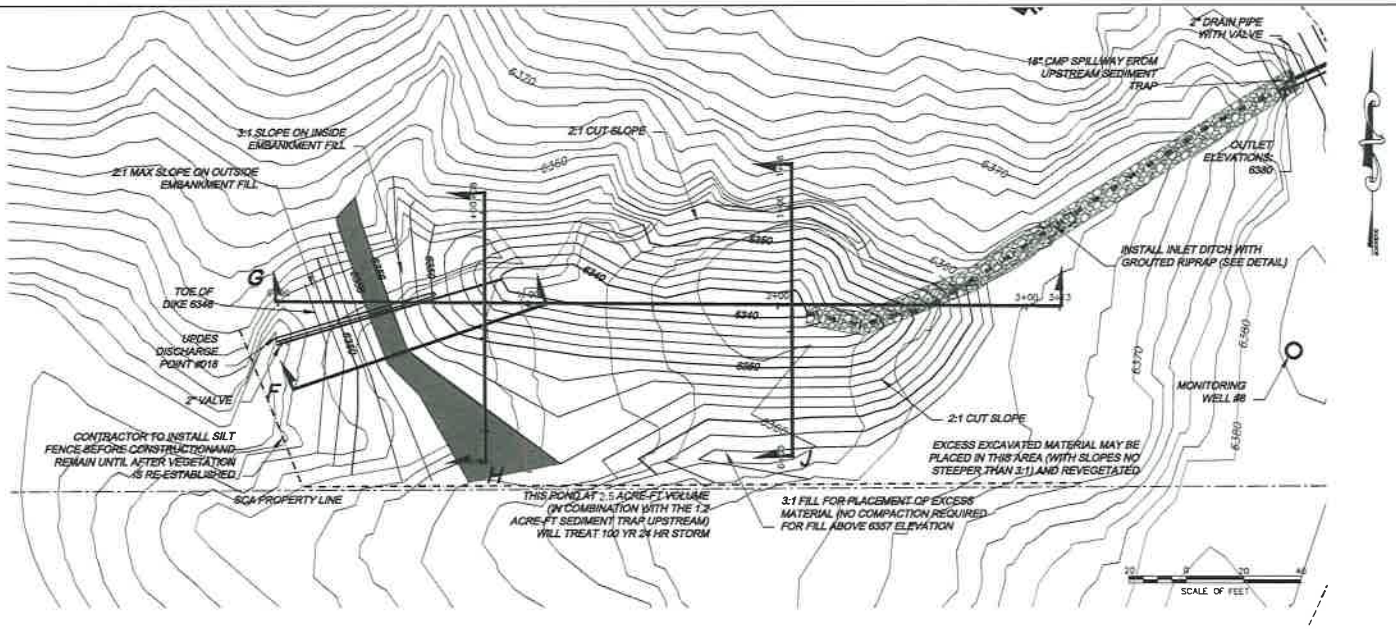
GENERAL

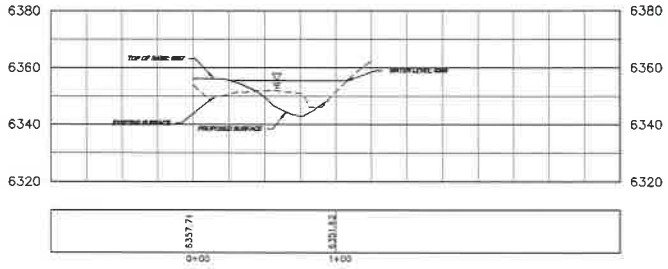
MINIMUM ELEVATION	6327
MAXIMUM ELEVATION	6412
MEAN ELEVATION	6384

EARTHWORK VOLUME

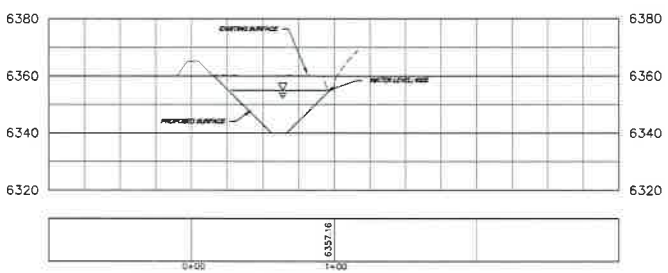
BASE SURFACE	EXISTING LOWER POND
COMPARISON SURFACE	POND 018 ENLARGED1
CUT FACTOR	1.00
FILL FACTOR	1.00
CUT VOLUME (UNADJUSTED)	4950 CU. YD.
FILL VOLUME (UNADJUSTED)	1300 CU. YD.
NET VOLUME (UNADJUSTED)	3650 CU. YD. <CUT>

NOTE: CONTRACTOR TO INSTALL CLAY LINER IN POND TO ELEVATION 6368.0 (SEE DESIGN REPORT FOR LINER SPECIFICATIONS)

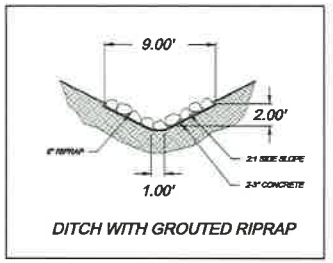




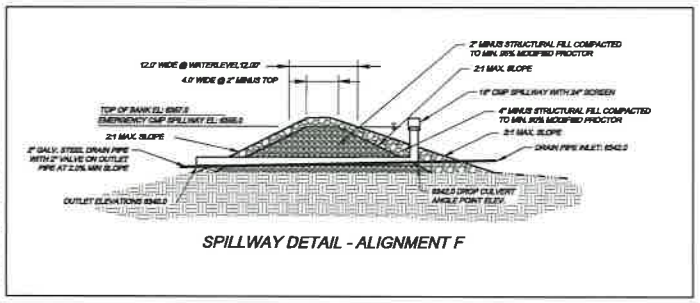
POND ALIGNMENT H SCALE: H 1"=40 V 1"=20



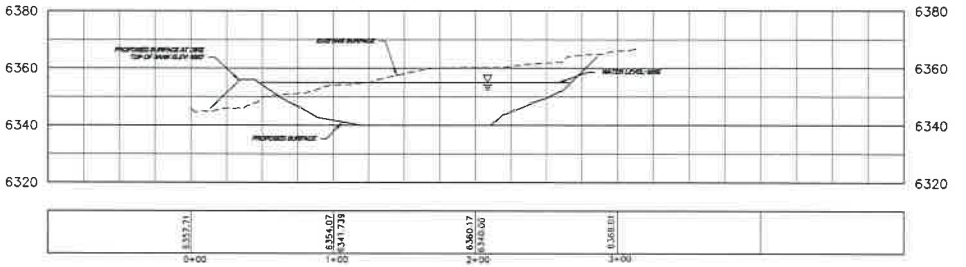
POND ALIGNMENT J SCALE: H 1"=40 V 1"=20



DITCH WITH GROUTED RIPRAP



SPILLWAY DETAIL - ALIGNMENT F



POND ALIGNMENT G SCALE: H 1"=40 V 1"=20

SUNNYSIDE COGENERATION ASSOC.
SCA #2 ASH LANDFILL GROUNDWATER PERMIT SUBMITTAL
SEDIMENT POND #018 DESIGN
Carbon County, Utah

TWIN PEAKS
Engineering & Land Surveying
2264 NORTH 1450 EAST LEHI, UTAH 84043
(801) 450-3311, (801) 439-0700 FAX

ORIG DATE: NOV 2012
PLOT DATE: 19 DECEMBER 2012

SHEET 9 OF 12

1.1 Sediment Pond #018 Liner

Sediment Pond #018 will be lined with a low-permeability barrier layer to minimize infiltration of ash-contact runoff which is captured in the pond. The proposed liner design involves either a native clay layer or soil/bentonite mixture.

A native clay material liner would consist of screened import material (2-inch minus), spread and compacted in place. The liner would be 12 inches thick, compacted in two 6-inch lifts to 95% with a resultant hydraulic conductivity less than or equal to $1x10^{-5}$ cm/s.

A soil / bentonite mixture would consist of screened native soil (2-inch minus) and granular bentonite (minus-40 mesh) blended in specific proportions (minimum 6 percent – dry weight basis), moisture conditioned to above-optimum moisture content, and spread and compacted in place. The liner would be 8 inches thick, compacted to 95% with a resultant hydraulic conductivity less than or equal to $1x10^{-5}$ cm/s.

Given the sediment traps proposed up from the Sediment Pond #018, it is expected that the sediment accumulation in #018 will be significantly reduced and regular sediment cleaning will occur more in the sediment traps and less in #018. Nonetheless a 6-inch protective layer of native soils (screened material 2-inch minus) will be placed on top of the liner with detecta tape placed at 3 to 5 foot intervals between the liner and the protective layer.

1.1.1 Proposed Hydraulic Conductivity Testing

Prior to placing the pond liner, construction methods will be reviewed with a geotechnical lab and simulated with the actual material to be used for the liner (either the actual native clay material or the proposed mixture of bentonite/soil). It is proposed that hydraulic conductivity of the liner be determined by preparing two samples using the proposed material and methods and performing falling head conductivity tests in accordance with ASTM D 5084 on the samples. Upon verification that the proposed material and methods will meet permeability requirements, the construction would proceed with field tests to verify compaction.

APPENDIX F

DESIGN DRAWINGS

TWIN PEAKS 2013

Water Quality Sampling and Analysis Plan & Ash Leachate Analysis Plan

SCA #1 Phase I, II, III and SCA #2
Ash Disposal Facilities
Permit No. UGW070002
Sunnyside, Utah

Sunnyside Cogeneration Associates

Revision Date:

May 2013

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1.0 INTRODUCTION

1.1 OBJECTIVE

This water quality sampling plan is designed for the monitoring of groundwater quality in accordance with groundwater discharge (GWD) permit No. UGW070002 at the proposed Ash Landfill Expansion Facility.

1.2 SITE BACKROUND AND DESCRIPTION

The Sunnyside Cogeneration Plant is a coal refuse fired electrical power plant located in Sunnyside, Utah (Figure 1) which has been in operation since 1993. The plant utilizes coarse refuge from two refuse piles as its primary fuel source. Ash currently generated at the power plant is transported and disposed of at the existing Ash Landfill Facility located southwest of the plant. Placement of ash began in May, 1993, in Phase I of the SCA #1 Ash Landfill.

2.0 WATER QUALITY SAMPLING

Water quality sampling is required under the GWD permit. Background water quality sampling was conducted for the present Ash Landfill Facility. The sampling parameters, limits, and reporting procedures from the prior water quality sampling plan will be adopted for this plan.

2.1 SURFACE WATER SAMPLING

In accordance with the existing Water Quality Sampling Plan, two surface water sampling points are presently monitored. These locations include Whitmore Springs and the Fresh Water Reservoir.

2.2 GROUND WATER SAMPLING

In accordance with the ground water permit, groundwater down gradient of the Ash Landfill Facility is to be monitored for possible impacts due to ash landfill operations. The Division of Water Quality ground water classification for the aquifer in the vicinity of the current ash landfill is a Class II ground water (TDS 1,000 to 3,000 mg/L). Ground water in the vicinity of the proposed ash landfill expansion area ranges in TDS from 2,510 to 7,180 milligrams per liter

(Maxim, 1996). The ground water in the vicinity of the proposed landfill would likely be classified as a Class III ground water.

2.2.1 Existing Monitoring Wells

Presently there are five ground water monitoring wells associated with the existing Ash Landfill Facility. The wells are sampled for the parameters listed in the ground water discharge permit. Descriptions of the wells are presented below:

Monitoring well MW-1 (formerly A-1) was installed in November 1990. It was sampled periodically up to September, 1992. From September 1992 to September 1993 it was sampled monthly. From October 1993 to 2001 it was sampled on quarterly sampling schedule. From 2001 to present it has been on a semi-annual sampling schedule. MW-1 is now associated with the Phase III expansion.

Monitoring well MW-2 was installed September 1992. From September 1992 to September 1993 it was sampled monthly. From October 1993 to 2001 it was sampled on quarterly sampling schedule. From 2001 to present it has been on a semi-annual sampling schedule.

Monitoring well MW-3 was installed September 1992. From September 1992 to September 1993 it was sampled monthly. From October 1993 to 2001 it was sampled on quarterly sampling schedule. From 2001 to present it has been on a semi-annual sampling schedule.

Monitoring well MW-4 was installed in July 1996 as an alternative monitoring point to MW-1. It was sampled on a sampling schedule of 8 events to be completed in one year (to establish background values) to be followed by quarterly sampling. MW-4 was installed between MW-1 and MW-2. From 2001 to present it has been on a semi-annual sampling schedule.

Monitoring well MW-7 was installed in July 1997 as part of the Phase II expansion. It was sampled on a sampling schedule of 8 events to be completed in one year (to establish background values) to be followed by quarterly sampling. MW-7 was installed at the toe of the new sedimentation pond 017. From 2001 to present it has been on a semi-annual sampling schedule.

Monitoring well MW-8 was installed in December 2011 as part of the SCA #2 Ash Landfill. It was sampled on a sampling schedule of 8 events to be completed in one year (to establish background values) to be followed by semi-annual sampling. MW-8 was installed at the toe of the SCA #2 Landfill.

3.0 SAMPLING AND ANALYSIS

All surface water and ground water sampling associated with the Ash Landfill Expansion will conform to procedures and schedules as outlined in SCA's Ground Water Permit.

All aspects of sampling and analysis under the GWD permit will conform to MAIN's Standard Quality Assurance/Quality (QA/QC) Control Plan. This plan is included as Appendix B. A brief summary of QA/QC protocol is presented below.

A field blank (rinsate blank) and a field duplicate will be collected for every 20 environmental samples collected. Groundwater to be analyzed for dissolved metals will be filtered and preserved with nitric acid. Surface water samples to be analyzed for dissolved metals will not be filtered. They will be preserved with nitric acid. All samples will be dispensed into appropriate, laboratory –supplied bottles and stored in coolers on ice until received by the analytical laboratory. Appropriate chain of custody procedures and documentation will be followed.

4.0 REPORTING

The water quality sampling results will be submitted in a report to the Division of Water Quality on the following schedule as outlined in the Ground Water Discharge Permit No. UGW070002.

Semi-annually		Report Due On
1st	January, February, March, April, May, June	July 15
2nd	July, August, September, October, November, December	January 15

5.0 REFERENCES

Barr Engineering, 1996, Engineering report phase 2 ash disposal facility, Permit No. UGW07002, Sunnyside, Utah: Consultant Report, 26 p., tables, figures and appendices.

C.T. Main, 1990, Groundwater discharge permit application, Sunnyside Cogeneration Associates, Sunnyside, Utah: Revision I, six sections with figures and tables.

C.T. Main, 1990, Sampling and analysis plan for background groundwater quality determination, Sunnyside Cogeneration Associates, Sunnyside, Utah: four sections with appendices, figures, tables, and drawings.

Huntingdon Chen Northern Inc. (Maxim), August 1992, Revised Water Quality Sampling Plan for Ground Water Discharge Permit No. UGW070002, Sunnyside Cogeneration Plant,

Sunnyside, Utah: Project No. 5-137-91, 5 pages tables, figures, appendices, and drawings.

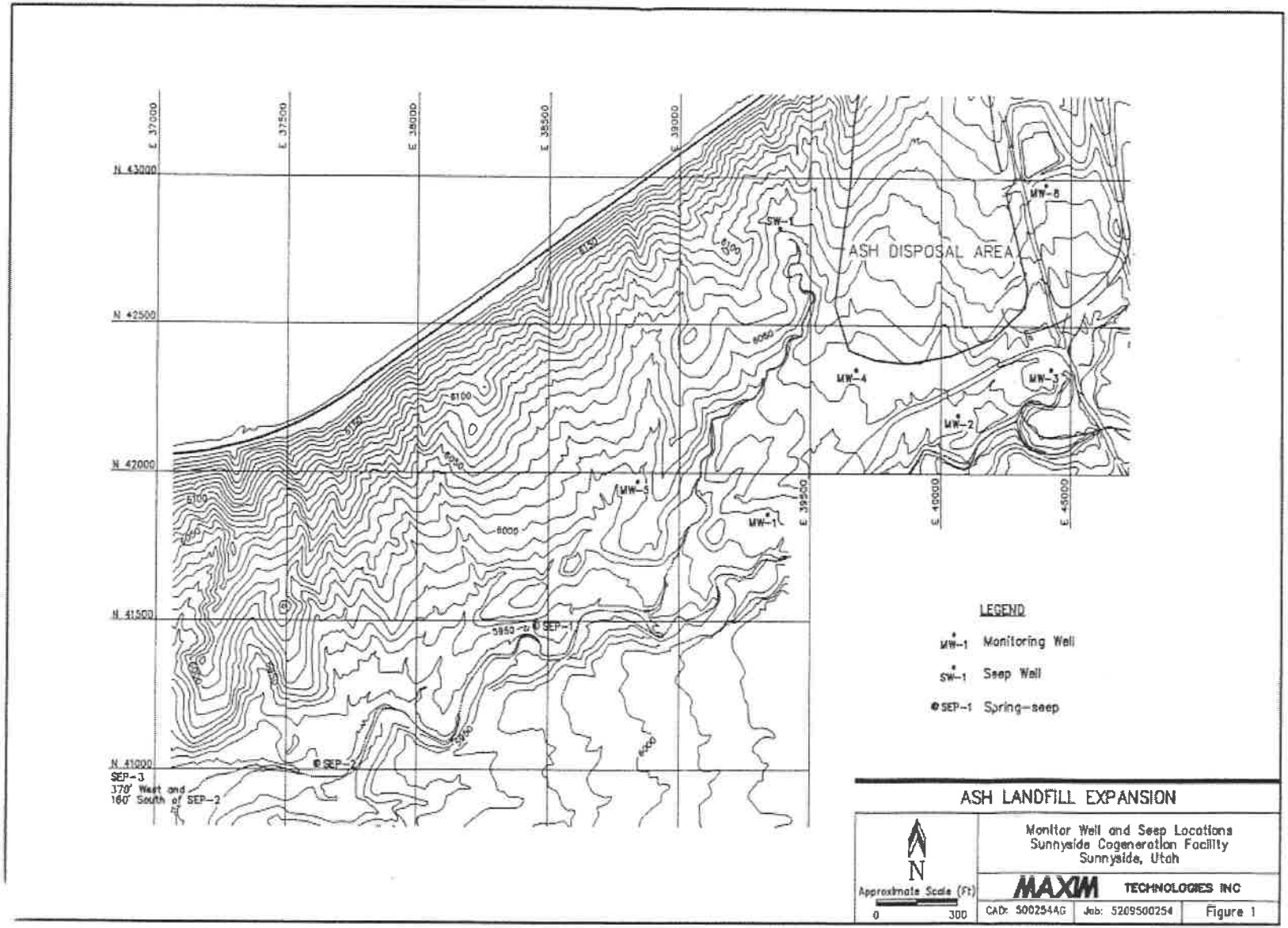
Maxim Technologies Inc., 1996, Hydrologic characterization Sunnyside ash landfill expansion, Sunnyside Ash Landfill, Sunnyside Cogeneration Facility, Sunnyside, Utah: Project No. 520950054, 17 pages, figures, tables, and appendices.

SUNNYSIDE COGENERATION ASSOCIATES
ASH LANDFILL FACILITY
Ground Water Discharge Permit # UGW070002 Compliance Sampling

MONITORING LOCATIONS

Whitmore Springs
Freshwater Reservoir
Well MW-1
Well MW-2
Well MW-3
Well MW-4
Well MW-7
Well MW-8

PARAMETERS	BOTTLE AND PRESERVATION REQUIREMENTS
Field Parameters	
Temp	
pH	Non-applicable
SC	
Analytical Parameters	
Metals-	
Arsenic	
Barium	
Cadmium	1 X 1000ml, poly, filtered at wells
Copper	unfiltered at surface water locations,
Lead	all preserved with HNO3, cool.
Selenium	
Silver	
Zinc	
Inorganics	
TDS	1 X 1000ml, poly, unfiltered, raw, cool.
pH	
Cations and Anions	
Calcium	
Hardness (CaCO3)	
Sodium	
Potassium	
Magnesium	1 X 1000ml, poly, unfiltered, raw, cool.
Chloride	
Sulfate	
Bicarbonate (HCO3)	
Carbonate (CO3)	
Alkalinity (CaCO3)	


E 37000
E 37500
E 38000
E 38500
E 39000
E 39500
E 40000
E 45000
N 43000
N 42500
N 42000
N 41500
N 41000
ASH DISPOSAL AREA
MW-8
SW-1
MW-4
MW-3
MW-2
MW-5
MW-1
SEP-1
SEP-2
SEP-3
370' West and
160' South of SEP-2
LEGEND
MW-1 Monitoring Well
SW-1 Seep Well
SEP-1 Spring-seep
ASH LANDFILL EXPANSION
N
Approximate Scale (Ft)
0
300
Monitor Well and Seep Locations
Sunnyside Cogeneration Facility
Sunnyside, Utah
MAXIM TECHNOLOGIES INC
CAD: 500254AG
Job: 5209500254
Figure 1

DATA COLLECTION QUALITY ASSURANCE/ QUALITY CONTROL PROGRAM

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1.0 INTRODUCTION

The collection of representative environmental data is neither a straightforward nor easily accomplished task. Measurements are subject to a wide variety of instrument, spatial, and temporal variables. A representative sample of the material from which it is collected must represent accurately the spatial, temporal, physical, and chemical qualities of the material. Standard operating procedures help to minimize those errors which would result in the collection of invalid data or non-representative samples. This is very important as field data collection is the primary basis upon which site investigations, assessments, and remedial actions are based.

There are four basic factors which affect the quality of sampling data. These include:
1) selection of the sample collection site; 2) method of sample collection; 3) sample preparation, preservation, and storage methods; and 4) sample analysis.

Samples must be representative of the media from which they were extracted, and maintain their integrity and/or constituents between the time of sampling and the time of analysis. Field measurement devices and procedures also must follow set procedures to obtain precise and accurate readings at representative locations.

This document presents MAIN's SOP for the collection of precise, accurate, and representative field data.

2.0 PRESAMPLING ACTIVITIES

2.1 COMMUNICATION WITH LABORATORY

Communication with laboratory personnel responsible for analysis of the samples prior to sample collection cannot be overemphasized. Lab personnel can be an important source of information and materials if they understand the specifics of the sampling program. Interaction with lab personnel usually improves program efficiency, and the accuracy and completeness of the results. Procedures and analyses being used should be established. Laboratory staff can often provide guidance and suggestions concerning particular problem areas that may develop. Laboratory staff should also understand the chain-of-custody, QA/QC, and labeling procedures that are employed throughout the investigation. Written instructions should be obtained from the laboratory for any non-routine procedures pertaining to sample preparation, preservation, and storage.

2.2 CONTAINER PREPARATION

It is important to use proper sample containers and preservation techniques to minimize the alteration of the sample chemistry between the field and the laboratory. Sample containers will be prepared by the laboratory. Proper preservation will be performed, the jars labeled, and the chain-of-custody initiated prior to any sampling shipment. Container types and preservatives are

shown in Table 1, reprinted from EPA SW-846. Methods of container preparation, sample preservation, sample storage, packing and shipping are discussed in Sections 4 and 5.

2.3 QUALITY CONTROL SAMPLES

Three types of quality control samples will be submitted to the chemical laboratory for analyses.

1) Field Blank – To determine the effect of sample handling procedures and the environment on the sample, a field blank will be collected for every 20 environmental samples collected. The water used must be free of the analytes to be tested for. The "blank" water will be poured into the sampling device, then handled as an environmental sample: poured into bottles, preserved, shipped, and analyzed. The field blank must be collected after the sampling device has been decontaminated, but prior to collection of the next environmental sample. The source of the water utilized to generate the field blank will be noted.

2) FIELD DUPLICATE – A field duplicate is defined as two samples collected simultaneously at sampling location. Duplicate samples will have a sample number different from the original. Both the "false" and "true" sample numbers will be recorded. On the chain-of-custody forms, the "false" sample number will be used for the duplicate sample. One duplicate sample will be collected for every 20 environmental samples.

3.0 COLLECTION OF ENVIRONMENTAL SAMPLES

3.1 GROUNDWATER SAMPLING

Prior to the start of sampling operations, information will be obtained in order to improve the efficiency cost effectiveness of the sampling program. The specifics of the well construction, including the diameter of the well, the depth of the casting, the depth to the screened portion of the well, the total length of the screen, and the material used in the construction of the well and screen will be reviewed. The well diameter is important since it helps determine sampling equipment and procedures. The majority of wells used only for monitoring have two-inch outside diameter. However, in many cases where groundwater recovery was used to remediate a contamination problem, wells with either four, six, or eight-inch outside diameter well casings may have been used. It is also important to know the accessibility to the wells, which may affect the selection of the sampling equipment and transport of the equipment to the well. Prior to sampling, all well locations will be marked on a site map, the order in which the wells will be sampled will be determined, and specific equipment requirements will be developed.

A general checklist of equipment need to sample groundwater monitoring wells follows:

1) Sample collection equipment (bailers, pumps).
2) Reagents for sample preservation provided by the laboratory (see Section 4.3).
3) Appropriate sample containers provided by the laboratory (see Section 4.4).

4) Meters, probes, and standards for desired on site measurements (see Section 4.5).
5) Appropriate field and trip blanks, and water.
6) Appropriate field duplicate sample containers.
7) Forms, labels, and tags (see Section 5.1).
8) Monitoring well keys – many monitoring wells have locking caps, and keys are necessary to gain access. In addition, some sites are secured or have a guard on duty, in which case keys and/or permission are necessary.
9) Tools to assist in well access – these may include screw drivers, hammers, chisels, pipe, wrenches, chain, or a propane torch. All or any of these may be necessary for moving steel security caps on well which have not been opened recently.
10) Electronic water level indicator/graduated depth sounder – these are necessary to determine the static water level and the total depth of the well.
11) Pocket calculator – this is used to determine the number of well volumes to be evacuated from a well prior to sampling.
12) Log book and indelible ink marker. This is used to record field information.

The measurement of the well volume and water level will be conducted in the following fashion.

1) Measure inside diameter of the well.

2) In areas with possible non-aqueous phase floating compounds, the procedure outlined in in Section 3.6 will be followed to measure the potential layer thickness prior to purging.

3) Measure the static water level from the top of the well pipe (not the protective casing) to within 0.01 ft., using an electronic well probe.

4) Determine the total depth of the well from either the well installation logs or direct measurement using an electronic well probe. All measurements are taken from the top of the well casing pipe.

5) Calculate the number of linear feet of static water standing in the well (difference between static water level and total depth of the well).

6) Calculate the static volume using the following table.

Casing Diameter (inches)	Volume per 100 Feet Casing (cf)	Volume per 100 Feet Casing (gal)
1.0	.5	4
1.5	1.2	9
2.0	2.2	16
3.0	4.9	37
4.0	8.7	65
5.0	13.6	102
6.0	19.6	147

7) Rinse the probe and cord thoroughly with distilled water and methanol after each use to avoid possible cross contamination from other wells.

8) Remove at least three well volumes of groundwater prior to sample collection. In most cases, removal of three well volumes results in the collection of a representative groundwater sample not influenced by stagnant water remaining in the well casing. In cases where it is suspected that the removal of three well volumes may result in either under-evacuation or over-evacuation of a particular well, continuously monitor the pH, specific conductance, and temperature while removing 10 well volumes from the well. It is recommended that this experiment be conducted several days before the actual collection of samples.

9) The pumping mechanism used to purge or evacuate the well is dependent upon the equipment available and the accessibility of the well. A variety of pumps may be used, including hand-operated or motor driven suction pumps, peristaltic pumps, and compressed gas or battery driven pumps. In some cases, had bailing is the best method. The pumping method depends on the accessibility of the well, depth to water, and well diameter. If the pump being used does not have a flow meter, a graduated plastic pail can be used to measure the total discharge volume. If a pump that could alter the sample characteristics has been used to purge the well, the hose and rope should be removed from the pump and then decontaminated or stored in an appropriately labeled container, if each hose or rope is to be dedicated to the particular well. The pump used for evacuation should be dismantled and decontaminated. Dedicating equipment to each well is the preferred method.

10) Certain wells are slow to recharge, and it may be necessary to return several hours or even a day later in order to collect a sample. An alternative sampling method for which recharging slowly is to pump the well dry and collect the sample as water returns into the casing. Either method is acceptable and depends upon the analysis to be conducted, well accessibility, and the cost effectiveness.

The following procedure is recommended for obtaining groundwater samples from monitoring wells:

1) Various types of equipment may be used to purge a monitoring well. A bailer is recommended to be used to collect the sample. Although other equipment may be used if it does not affect the water sample's analytes of interest. The bailer can be made of Teflon, PVC (no glued joints), or stainless steel. The use of 3/8" braided nylon rope or fish line is recommended for lowering and raising the bailer.

2) To sample the water, slowly lower the bailer down the well until it is submerged, and then pull it out to the surface. Fill the sample bottles directly from the bailer to reduce the probability of cross-contamination and loss of volatile organic compounds. To avoid contamination of the rope, do not allow the rope to contact the ground; either hold it in hand or lay it on a sheet of plastic laid on the ground.

Groundwater chemistry is such that exposure of groundwater samples to atmospheric conditions can result in substantial alteration of the sample's chemical characteristics. To avoid these changes and to maintain sample representativeness, it is imperative that immediately upon collection, the samples be prepared, preserved, and stored in such a manner as to prevent any changes in sample chemistry from occurring. Refer to subsequent subsections of this document for sample preparation, preservation, storage, and in-field measurements procedures.

3.2 SURFACE WATER SAMPLING

The equipment needed for surface water sampling is usually minimal. In many instances, the sample container will serve as the sampling device. However, when analyzing dissolved metals, the sample must be transferred from the sampling device into a filtration apparatus for filtration prior to sample presentation and storage. A recommended list of surface water sampling equipment and accessories is as follows:

1) Materials for sample preparation (see Section 4.2).
2) Reagents for sample preservation (see Section 4.3).
3) Appropriate sample containers (see Section 4.4).
4) Meters, probes, and standard for desired on-site measurements (see Section 4.5).
5) Appropriate field and trip blanks. The type and number of blanks should be established with the laboratory conducting the analysis.
6) Forms, labels, and tags (see Section 5.4).
7) Sampling devices – These may include a Kemmerer bottle, the sample containers, or a telescoping aluminum pole with an attached clamp and beaker. Due to problems which may result from the inaccessible nature of many surface sampling locations, field personnel are encouraged to draw upon their own experience and creativity in the design of an appropriate sampling device. All devices must be approved by the Project Manager prior to use.
8) Decontamination supplies – These will be used for decontaminating all equipment that comes into contact with the sample (see Section 4.1).
9) Log book and indelible ink marker – This is for recording field information.

Most surface water samples are taken as grab samples. Typically, surface water sampling involves immersing the sample container into the water body. The following suggestions are made to help ensure that the samples obtained are truly representative of the water body being sampled.

1) Generally, the most representative samples and obtained at mid-channel at one-half of the stream depth in a well-mixed stream.
2) Stagnated areas of pools, streams, or rivers may contain zones of pollutant concentration, depending upon the physical and chemical properties of the contaminants and the position of these stagnated waters relative to the sources of contamination.
3) Ordinarily sampling should be conducted beginning at the suspected zones of lowest contamination to the zones of highest contamination.
4) Excessive agitation of the water, which results in the loss of volatile constituents, should

be avoided.

5) A water sample from the surface should not be taken unless sampling specifically for a non-aqueous phase layer floating on the water. Instead, the sample container should be inverted, lowered to the approximate depth, then held at about a 45 degree angle with the mouth of the bottle facing upstream.

Generally, surface water samples are much more stable than groundwater samples. Surface waters, especially from streams under turbulent flow conditions, tend to be in equilibrium with atmospheric conditions, and therefore will not undergo significant changes in water chemistry after collection. However, it is best to appropriately preserve and store the samples, and to take field measurements immediately after sample collection as described in Sections 3.3, 4.1, 4.2, and 4.3 of this document.

3.3 NON-AQUEOUS PHASE LAYER SAMPLING

If a non-aqueous phase layer (NAPL) is present on the surface of the water in a groundwater monitoring well, the thickness of the NAPL will be measured and a sample of it collected, if necessary.

The NAPL thickness will be measured using one of two techniques. A battery operated device that measures NAPL thickness such as an ORS Interface Probe, will be used first if the thickness is unknown. The sensing probe is lowered slowly down the well until it senses liquid. The depth is recorded. The probe is lowered further down the well until it senses water. Then the probe is moved above and below the NAPL water interface 3 to 4 times to get an accurate interface depth reading, which is recorded.

If the NAPL is less than ¼ inch, a surface sampler will be used to measure the NAPL thickness. The sampler, similar to ORS Surface Samplers, is slowly lowered through the NAPL then brought to the surface for measurement and observation. A surface sampler can be used to also sample the NAPL for chemical analysis.

3.4 FIELD MEASUREMENTS

Whether or not in-field measurements are conducted will depend upon the types of material being sampled, the geochemical environment in which the samples exist, and the desired end use of the collected data. For groundwater samples in particular, it is advisable to take in-field measurements of pH, specific conductance, and temperature. All of these parameters are susceptible to change upon contact with atmospheric conditions. As such, if analyzed in the lab, he values for these parameters may not be representative of the true subsurface environment. Since surface waters, especially those from streams and creeks with turbulent flow, are actually at equilibrium with atmospheric conditions, in-field measurements of these parameters for stream samples is not as critical, but should be conducted regardless.

3.5 SPLIT SAMPLES

Split samples will be provided to the Utah Bureau of Groundwater Pollution Control at their request.

4.0 POST SAMPLE COLLECTION PROCEDURES

After a sample has been collected, it may need to be composited, filtered, preserved, and stored. The sampling equipment must also be decontaminated. Procedures for these operations are described in the following sections.

4.1 COMPOSITING

In cases where composite samples are collected, it may sometimes be desirable to combine and split the samples in the field to ensure a representative aliquot. Another option for water samples is a laboratory composite for separately collected grab samples.

4.2 FIELD FILTRATION

Samples of water that will be analyzed for dissolved metals will be filtered in the field through a 0.45 micron filter. Filtration equipment consists of pump (either peristaltic or hand-operated) silicone tubing, and a filter cartridge similar to a QEDFF-8100 Standard Quick Filter or FF-8200 High Capacity Quick Filter.

The water sample to be filtered will be placed in a bottle containing no acid. It is then drawn through the filter and tubing and collected into another bottle. The filtered water is then preserved appropriately.

4.3 SAMPLE PRESERVATION

Sample preservation should be performed in the field immediately after sample collection and preparation. In many cases where pH control or additions of reagents are required, separate bottles and chemical preservatives may be supplied in the laboratory. In other cases the reagents or preservatives may be placed in the sample bottle prior to delivery to the site. Samples collected for organic and inorganic parameters are preserved by storing at 4^{o} C, using natural ice.

Concentrated acids, bases, and other chemicals used to preserve samples cannot be shipped by air. They should be shipped, before sampling begins, to the site or a location near, preferably the site, by ground transportation if the site is not local to the consultant's office.

4.4 SAMPLE STORAGE

Samples should be stored in a container nonreactive with the sample or any parameter that is being analyzed for. Generally, containers are made of plastic, glass, or Teflon. In general, samples collected for metals and general water quality parameters are stored in plastic bottles.

Samples collected for organic analysis are routinely placed in glass bottles. Soil samples are generally places in glass jars with Teflon or plastic lid liners. Table 1 details the required containers, preservation techniques, and holding times as required by EPA SW-846.

In most cases, bottles will be supplies by the laboratory conducting the analyses. It will be the responsibility of the sampler to inform the laboratory staff exactly which analyses will be conducted so the lab can supply the proper amount of appropriate bottles. The filled sample bottles must be stored in a cooler with ice.

4.5 EQUIPMENT AND MATERIAL DECONTAMINATION

All equipment and material used for the collection, preparation, preservation, and storage of environmental and hazardous substance samples must be cleaned prior to its use and after each subsequent use. Unless the equipment and materials being used are disposable, dedicated to the sampling location, or of sufficient number so as not to be reused during any one sampling trip, decontamination must be conducted in the field.

The equipment needed for cleaning or decontamination is dependent upon the materials and equipment to be cleaned. If relatively small items are to be cleaned in the field, several small buckets and small containers of reagents or wash liquids are adequate. However, if major items Such as large pumps are to be decontaminated, it may be necessary to transport large wash basins and larger volumes of washing solutions. The following is a generalized equipment list to be used during decontamination and cleaning.

1) Detergent, such as Alconox.
2) Potable water.
3) Deionized and/or distilled water.
4) Hexane, to remove petroleum products.
5) Storage vessels to transport large volumes of water to the site. Plastic carboys that have 5 to 15 gallon capacity and are made with a spigot near the bottom of the tank are recommended. Enough water to handle the needs for the entire day must be supplied. Containers of various sizes are used depending on the sampling program.
6) Methanol.
7) Buckets for washing and rinsing equipment.
8) Paper towels and Chem wipes to remove excess soil or petroleum products before the equipment is decontaminated.

The following procedure will be used to decontaminate the sampling equipment:

1) Rinse with hexane to remove tar or oil, if present.
2) Wash with a detergent and tap water.
3) Rinse with tap water.
4) Rinse with high-purity methanol.
5) Rinse well with distilled and/or deionized water.
6) Use equipment immediately or wrap in aluminum foil for temporary storage.

5.0 SAMPLE PACKAGING, SHIPPING, AND CHAIN-OF-CUSTODY PROCEDURES

Once the samples have been collected, prepared, preserved, and appropriately stored, they must be packaged and shipped. In addition, from the time of sample collection until analyses have been completed, chain-of-custody procedures must be followed to ensure the proper handling of the samples. This section outlines procedures for the packing and shipping of environmental samples and general chain-of-custody procedures.

5.1 PACKAGING AND SHIPPING PROCEDURES FOR ENVIRONMENTAL SAMPLES

All sample containers must be placed in a sturdy, insulated shipping container. A metal or plastic picnic cooler is recommended. The following is an outline of the procedures to be followed.

1) Using fiberglass tape, secure the drain plug at the bottom of the cooler to ensure that water from sample container breakage or ice melt does not leak from the cooler.
2) Line the bottom of the cooler with a layer of cushioning absorbent material such as vermiculite.
3) Pack sample bottles in the cooler. Check screw caps for tightness and mark sample volume level on the outside of large containers.
4) Use pieces of carved-out plastic foam to keep large glass containers in place and to prevent breakage.
5) Pack small containers, such as 40 milliliter vials, in small plastic sandwich bags. When shipping these with large containers, it is necessary to prevent larger containers from shifting, which might break the smaller containers.
6) Pack cushioning material, such as vermiculite or bubble pack, between sample containers.
7) Pack absorbent material around plastic bottles in case of breakage or leaks.
8) Pack ice, sealed in plastic bags, on top of the samples in the cooler when the samples must be kept cold.
9) Seal the chain-of-custody form in a plastic bag and attach it to the inside of the cooler lid.
10) Close the lid of the cooler; be sure it is tightly fastened.
11) Use fiberglass tape to seal the container between the lid and the cooler. Wrap the tape vertically around the cooler, two wraps each on the long and short dimensions.
12) Attach the following information to the outside of the cooler: name and address of the receiving laboratory with return address, arrows indicating "This End Up" on all four sides, and "This End Up" label on the top of the lid.
13) Use additional labels such as "Fragile" or "Liquid in Glass" when necessary.
14) When the cooler is not equipped with a padlock, apply a signed custody seal and place it between the lid and body of the cooler.

Samples package in this way can be shipped by commercial air cargo transporter. Staff should be prepared to open and re-seal the cooler for inspection when required. Be aware that some commercial carriers have limits as to the number of pounds per item that can be shipped. Inform the laboratory of the containers' Bill of Lading numbers.

5.2 CHAIN-OF-CUSTODY PROCEDURES

Each sample must be labeled using waterproof ink and sealed immediately after it is collected. Labels should be filled out before collection to minimize handling of sample container. Figure 1 is an example of a sample label.

Labels and tags must be firmly affixed to the sample containers. Be sure that the container is dry enough for a gummed label to be securely attached. Tags attached by string are acceptable when gummed labels are not applicable.

Sampling information will be recorded in the field on the Sampling Record form as shown in Figure 2.

Written chain-of-custody procedures must be available and followed whenever samples are collected, transferred, stored, analyzed, or destroyed. The primary objective of these procedures is to create accurate written records that can be used to trace the possession and handling of the sample from the moment of its collection through analysis.

A sample is defined as being in someone's "custody" if:

1) it is in one's actual possession, or
2) it is one's view, after being in one's physical possession, or
3) it is in one's physical possessions and then locked up so that no one can tamper with it, or
4) it is kept in a secured area, restricted to authorized personnel only.

The number of persons involved in collecting and handling samples will be kept at a minimum.

The chain-of-custody record will be completed at the time each sample is collected. (Figure 3).

One member of the sampling team will be appointed Field Custodian. The samples and forms are turned over to the Field Custodian by the team members who collected the samples at the end of each day.

When transferring the samples, the transferee must sign and record the date and time on the chain-of-custody record. Custody transfers made to the Field Custodian should account for each sample, although samples may be transferred as a group. Every person who takes custody must fill in the appropriate section of the chain-of-custody record. To minimize the custody records, the number of custodians in the chain-of-possession should be minimized.

The Field Custodian is responsible for properly packaging and dispatching samples to the appropriate laboratory. This responsibility includes filling out, dating, and signing the appropriate portion of the chain-of-custody record.

All packages sent to the laboratory should be accompanied by the chain-of-custody record and other pertinent forms. A copy of these forms should be retained by the originating office (either carbon copy or photocopy). Mailed packages can be registered with return receipt requested. For packages sent by common carrier, receipts should be retained as part of the permanent chain-of-custody documentation.