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GAS COLLECTION AND CONTROL SYSTEM PLAN FOR SUNRISE MOUNTAIN LANDFILL CLARK COUNTY, NEVADA

Prepared for:

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April 6, 2001
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SCS ENGINEERS

April 5, 2001

Ms. Patricia Bowlin
Environmental Engineer
AIR-4
USEPA Region IX
75 Hawthorne Street
San Francisco, CA 94105

Re: Gas Collection and Control System Design Plan
Sunrise Mountain Landfill
Clark County, Nevada

Dear Ms. Bowlin:

SCS Engineers, on behalf of Republic Services of Southern Nevada (RSSN), hereby provides the Gas Collection and Control System (GCCS) Design Plan required by the Federal Municipal Solid Waste Landfills Emission Guidelines effective January 7, 2000 (in accordance with the Federal Plan schedule).

The GCCS Design Plan was developed based on known current information about the site. When existing conditions of the site are further defined pursuant to ongoing field investigations/evaluations, the GCCS design may be modified.

If you have any questions or comments regarding this submittal, please contact Mr. Alan Gaddy of RSSN at (702) 734-5400.

Sincerely,

Steven C. Lamb, P.E.
Project Manager

Stephen B. Smith, P.E.
Vice President
SCS ENGINEERS

Attachments

cc. Mr. Mason McNinch, Clark County Health District, Air Quality Division
Mr. Steve Wall, USEPA Region 9
Mr. Tom Gardner, RSSN
Mr. Derek Reeve, SCS Engineers

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SECTION 1.0
INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This report was prepared by SCS Engineers (SCS) to fulfill the requirements of the New Source Performance Standards (NSPS), 40 CFR Part 60, Subpart Cc (Emission Guidelines –EG) "Rule", for a Gas Collection and Control System (GCCS) Design Plan (Plan) for the Sunrise Mountain Landfill (Site), in Las Vegas, Nevada. The Site is owned by the Bureau of Land Management (BLM), leased to Clark County, and was formerly operated by Republic Disposal Urban Maintenance Processing Company, Inc. (DUMPCo). The Site is now operated by Republic Services of Southern Nevada (RSSN). The Site is regulated under the NSPS based upon a design capacity exceeding 2.5 million Megagrams {metric tons (Mg) which is approximately 2,750,000 U.S. tons}, and based upon a non-methane organic compounds (NMOC) emission rate calculation that demonstrated an annual NMOC emission rate exceeding 50 Mg per year.

The following GCCS Plan fulfills the requirements set forth in 40 CFR §60.752 and §60.759, as described herein (referred to hereafter as §60.752 and §60.759). The scope of this GCCS Plan is limited to description, documentation, and certification that the GCCS meets the requirements set forth in §60.752 - *Standards for Air Emissions from Municipal Solid Waste Landfills* and §60.759 - *Specifications for Active Collection Systems.*

This GCCS Plan was developed in general accordance with the NSPS and the guidance set forth in the *Enabling Document for the New Source Performance Standards and Emission Guideline for Municipal Solid Waste Landfills* (Enabling Document). As required by the NSPS, the GCCS Plan addresses areas defined as active areas where the first refuse deposited in the area has reached an age of 5 years or more; or areas closed or at final grade where the first refuse deposited in the areas has reached an age of 2 years or more (§60.752(b)(2)(ii)(A)). The last receipt of waste at the Site was prior to October 9, 1993; therefore all waste is over five years old.

1.2 NEW SOURCE PERFORMANCE STANDARDS AND EMISSION GUIDELINES

On March 12, 1996, EPA promulgated New Source Performance Standards (NSPS) and Emissions Guidelines (EG) for existing and new landfills under Section III (b) of the Clean Air Act (CAA). The NSPS and EG are intended to control NMOC emissions. According to the regulation, landfills larger than 2.5 million Mg of waste are required to estimate NMOC emissions in accordance with a three-tiered process. Landfills with NMOC emissions greater than 50 Mg/year will be further required to install a LFG collection system in accordance with the design and operational criteria set forth in the regulation.

NSPS applies to landfill facilities permitted, modified or reconstructed after May 30, 1991. The EG applies to landfills that accepted waste after November 1987, but had no permit modifications (footprint expansion) after May 30, 1991. The Sunrise Mountain Landfill, therefore, falls under the EG, and will be required to meet the compliance schedule associated with the EG, which differs from the NSPS schedule. The EPA promulgated regulations effective January 7, 2000 for EG sites, which include the following milestones:

- Design capacity report and emissions statement (Tier 1) was due 90 days after the effective date (submitted on April 6, 2000).
- Optional Tier 2 emissions statement would be due 180 days after submittal date of Tier 1.
- Optional Tier 3 submittal would be due 12 months after submittal date of Tier 1.
- The GCCS plan showing the proposed LFG collection system design would also be due 12 months after submittal date of the Tier 1 assuming the landfill exceeds the 50 megagrams per year of NMOC emissions.

System construction must be completed 30 months after submittal date of Tier 1, or October 6, 2002. RSSN reserves the right to construct the LFG collection system is a phased-approach pending the outcome of ongoing field investigations/evaluations associated with the Administrative Orders (see below).

1.3 BACKGROUND

The United States Environmental Protection Agency, Region 9 (USEPA) issued an Administrative Order on April 26, 1999 (USEPA Docket No. RCRA-7003-09-99-0005) to several respondents regarding the Sunrise Mountain Landfill Site. The Order was issued by the Administrator of the USEPA, Region 9, under the authority of Section 7003 of the Solid Waste Disposal Act of 1976, commonly referred to as the Resource Conservation and Recovery Act (RCRA).

The Administrative Order (Order) included 24 Findings of Fact, which were ascertained from historical data, site inspection/observation results, and relevant technical information. The Order required the respondents to submit to the USEPA a Landfill Assessment Work Plan. RSSN is the primary respondent and acting as the lead party. The submittal of the Final Landfill Assessment Work Plan (Work Plan) (SCS Engineers, 2001) was the first of six steps required by the USEPA Order. Step 2 of the Order is currently being implemented; Step 2 involves conducting activities cited in the Work Plan and preparing a Landfill Assessment Report. Steps 3 and 4 involve preparing and implementing a Landfill Corrective Measures Plan. Steps 5 and 6 involve closure certification and long-term operation and maintenance of the Site.

Several landfill gas-related issues are addressed in the Work Plan, and will be further defined in Steps 2 through 4. These issues include:

- Landfill gas characterization by surface emissions monitoring and probe installations;
- Evaluation of the landfill's final cover;
- Determination of the actual quantity and location of disposed wastes;

- Possible waste relocation; and
- Evaluation of future storm water control structures.

The resolution of these issues may influence the extent of the GCCS design, and impact the schedule for implementation of the GCCS design. These issues were considered during the development of this GCCS Plan.

1.4 COMPLIANCE SUMMARY TABLE

A summary of the compliance requirements and the project specific conditions is presented in Table 1.1.

TABLE 1.1 REGULATORY COMPLIANCE CHECKLIST
SUNRISE MOUNTAIN LANDFILL

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.752(b)(2)(i) 3745-76-07(B)(2)(a)	Submit a collection and control system design plan prepared by a professional engineer to the Administrator within 1 year of the calculated NMOC emission rate equaling or exceeding 50 Mg per year.	This Plan fulfills requirement.	
§60.752(b)(2)(i)(A) 3745-76-07(B)(2)(a)(i)	The collection and control system as described in this plan shall meet the design requirements of paragraph (b)(2)(ii) of this section.	As presented in this Plan, the proposed system meets the design requirements.	
§60.752(b)(2)(i)(B) 3745-76-07(B)(2)(a)(ii)	The collection and control system design plan shall include any alternatives to the operational standards, test methods, procedures, compliance measures, monitoring, record keeping, or reporting provisions of §60.753 through §60.758 as proposed by the owner or operator.	No alternatives are specified.	
§60.752(b)(2)(i)(C) 3745-76-07(B)(2)(a)(iii)	The collection and control system design plan shall either conform with specifications for active collection systems in §60.759, or include a demonstration to the Administrator's satisfaction of the sufficiency of alternative provisions under §60.759.	As presented in this Plan, the proposed system meets the design requirements, as will be confirmed during future surface emissions testing.	
§60.752(b)(2)(i)(D) 3745-76-07(B)(2)(a)(iv)	The Administrator shall review the information submitted under this section, and either approve it, disapprove it, or request that additional information be submitted. Because of the many site-specific factors involved with LFG system design, alternative systems may be necessary. A wide variety of system designs are possible such as vertical wells, combination horizontal and vertical collection systems, or horizontal trenches only, leachate collection components, and passive systems.	Information required for review is presented within this Plan.	

TABLE 1.1 REGULATORY COMPLIANCE CHECKLIST
SUNRISE MOUNTAIN LANDFILL

Regulatory Reference	Regulatory Requirement	Description of Site-Specific Conditions	Regulatory Review
§60.752(b)(2)(ii) 3745-76-07(B)(2)(b)	Install a collection and control system within 18 months of the submittal of the design plan that effectively captures the gas generated within the landfill.	RSSN will install theGCCS design within 18 months provided future developments associated with the Administrative Order do not hinder an efficient installation	
§60.752(b)(2)(ii)(A)(1) 3745-76-07(B)(2)(b)(i)(a)	An active collection system shall be designed to handle the maximum expected flow rate from the entire area of the landfill that warrants control over the intended use period of the gas control or treatment system equipment.	The proposed system is designed to handle the maximum flow for the GCCS, as estimated from U.S. EPA's landfill gas generation model (LANDGem).	
§60.752(b)(2)(ii)(A)(2) 3745-76-07(B)(2)(b)(i)(b)	The GCCS shall collect gas from each area, cell, or group of cells in the landfill in which the initial solid waste has been placed for a period of 5 years or more if active, or 2 years or more if closed or at final grade.	The proposed system is designed to collect gas from all areas of the landfill that warrant collection. All areas are at final grade pending developments associated with the Administrative Order.	
§60.752(b)(2)(ii)(A)(3) 3745-76-07(B)(2)(b)(i)(c)	The GCCS shall collect gas at a sufficient extraction rate.	Landfill gas will be collected at a sufficient rate, as will be confirmed during future surface emissions monitoring of the landfill. Rates of collection may be modified based upon results of surface emissions monitoring.	
§60.752(b)(2)(ii)(A)(4) 3745-76-07(B)(2)(b)(i)(d)	The GCCS shall be designed to minimize off-site migration of subsurface gas.	The GCCS outlined in this Plan is designed to minimize off-site migration of subsurface gas by reducing gas pressures within the landfill.	
§60.752(b)(2)(iii)(A) 3745-76-07(B)(2)(b)(ii)(c)(i)	All collected gas shall be routed to an open flare designed and operated in accordance with §60.18.	A flare will be designed and operated according to §60.18.	

TABLE 1.1 REGULATORY COMPLIANCE CHECKLIST
SUNRISE MOUNTAIN LANDFILL

§60.752(b)(2)(iii)(B) 3745-76-07(B)(2)(b)(ii)(c)(ii)	All collected gas shall be routed to a control system designed and operated to reduce NMOC by 98 percent weight, or when an enclosed combustion device is used for control, to either reduce NMOC by 98 percent weight or to reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane, at 3 percent oxygen.	The control system will consist of a flare operated to reduce NMOC by 98 percent.	
§60.752(b)(2)(iii)(B) 3745-76-07(B)(2)(b)(ii)(c)(ii)	The reduction efficiency or parts per million by volume shall be established by an initial performance test, required under §60.8, using the test methods specified in §60.754(d).	Initial performance testing will occur following completion of the system.	/
§60.752(b)(2)(iii)(B)(1) 3745-76-07(B)(2)(b)(ii)(c)(i)(a)	If a boiler or process heater is used as a control device, the landfill gas stream shall be introduced into the flame zone.	Not applicable.	
§60.752(b)(2)(iii)(B)(2) 3745-76-07(B)(2)(b)(ii)(c)(i)(b)	The control device shall be operated within the parameter ranges established during the initial or most recent performance test. The operating parameters to be monitored are specified in §60.756.	The flare will be operated within the parameters established during the initial performance testing, as will be presented in the initial Annual Compliance Report.	
3745-76-07(B)(2)(b)(ii)(c)(i)(b)	Route the gas to a treatment system that processes the collected gas for subsequent sale or use. All emissions from any atmospheric vent from the gas treatment system shall be subject to the requirements of paragraph 3745-76-07 (B)(2)(c)(i) or (B)(2)(c)(ii) of this rule.	Not applicable.	
§60.759(a)(1) 3745-76-14(A)(1)	A professional engineer shall certify collection devices within the interior and along the perimeter areas to achieve comprehensive control of surface gas emissions.	Collection devices will provide comprehensive control of surface emissions, as will be confirmed by future surface emissions monitoring.	

TABLE 1.1 REGULATORY COMPLIANCE CHECKLIST
SUNRISE MOUNTAIN LANDFILL

§60.759(a)(1) 3745-76-14(A)(1)	The following issues shall be addressed in the design: depth of refuse, refuse gas generation rates, flow characteristics, cover properties, gas system expandability, leachate management, condensate management, accessibility, compatibility with filling operations, integration with closure end use, air intrusion control, corrosion resistance, fill settlement, and resistance to the refuse decomposition heat.	All applicable issues are addressed within this Plan.	
§60.759(a)(2) 3745-76-14(A)(2)	Gas collection devices shall be installed in sufficient density to address landfill gas migration issues and augmentation of the collection system through use of active or passive systems at the landfill perimeter or exterior.	Gas collection devices will be installed at a sufficient density to facilitate control, as will be confirmed by future surface emissions monitoring.	
§60.759(a)(3) 3745-76-14(A)(3)	Placement of gas collection devices shall control all gas producing areas, except those from asbestos, non-degradable, and non-productive areas of the landfills as delineated below.	Gas will be controlled in all gas-producing areas of the landfill as described in this Plan.	
§60.759(a)(3)(i) 3745-76-14(A)(3)(a)	Segregated areas of asbestos or non-degradable material may be excluded from collection if sufficiently documented.	Segregated areas containing asbestos and non-degradable materials are excluded from the GCCS as documented in this Plan.	
§60.759(a)(3)(ii) 3745-76-14(A)(3)(b)	Any non-productive areas of the landfill may be excluded from control, provided excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill.	The Northeast Canyon area and portions of the Eastern Perimeter area have been excluded from the GCCS for reasons addressed in this Plan.	
3745-76-14(A)(3)(c)	The values for k, L_o, and C_{NMOC} determined in field-testing shall be used, if field-testing has been performed in determining the NMOC emission rate or radii of influence. If field-testing has not been performed, the default values for k, L_o, and C_{NMOC} provided in paragraph (A)(1) of rule 3745-76-09 of the Administrative Code shall be used.	The C_{NMOC} value from AP-42 (595 ppmv as hexane) will be used in calculating emission from the landfill. The AP-42 default values for k and L_o will be used: 0.02 yr^{-1} and 100 m^3/Mg, respectively.	

TABLE 1.1 REGULATORY COMPLIANCE CHECKLIST
SUNRISE MOUNTAIN LANDFILL

§60.759(b)(1) 3745-76-14(B)(1)	LFG extraction components shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other non-porous corrosion-resistant material.	The GCCS will be constructed of non-porous, corrosive resistant materials, including PVC or HDPE.	
§60.759(b)(1) 3745-76-14(B)(1)	Dimensions of gas extraction components shall be sufficient to convey projected amounts of gas; withstand installation, static, and settlement forces; and withstand planned overburden or traffic loads.	The GCCS design is sized sufficiently to convey the projected amount of gas for the system. Adequacy of the proposed system will be confirmed during future surface emissions monitoring. The system components are consistent with the "state-of-the-practice" for modern GCCS designs and can withstand the installation and operational stresses placed on the components.	
§60.759(b)(1) 3745-76-14(B)(1)	The collection system shall extend as necessary to comply with the emission and migration standards.	The GCCS will be expanded as necessary to conform to emission standards set forth in the NSPS. Future expansion of the GCCS will be performed in accordance with scheduling requirements set forth in the NSPS or an approved alternative schedule. Adequacy of the proposed system will be confirmed during future surface emissions monitoring.	
§60.759(b)(1) 3745-76-14(B)(1)	Collection devices such as wells and horizontal collectors shall be perforated to allow gas entry without head loss sufficient to impair performance across the intended extent of control.	Collection wells are perforated so as not to increase head loss, in accordance with current "state-of-the-practice" methods.	
§60.759(b)(1) 3745-76-14(B)(1)	Perforations shall be situated with regard to the need to prevent excessive air infiltration.	Perforations typically are at least 10 to 15 feet below existing grade, which is sufficient to control excessive air infiltration.	

TABLE 1.1 REGULATORY COMPLIANCE CHECKLIST
SUNRISE MOUNTAIN LANDFILL

§60.759(b)(2) 3745-76-14(B)(2)	Vertical wells shall be placed so as not to endanger underlying liners and shall address the occurrence of water within the landfill.	This Site does not have a liner.	
§60.759(b)(2) 3745-76-14(B)(2)	Holes and trenches constructed for piped wells and horizontal collectors shall be of sufficient cross-sectional area so as to allow for their proper construction and completion including the centering of pipes and placement of gravel backfill.	Wells will be designed with boreholes of diameter sufficient for proper installation of well casings and backfill materials.	
§60.759(b)(2) 3745-76-14(B)(2)	Collection devices shall be designed so as not to allow indirect short-circuiting of air into the cover or refuse into the collection system or gas into the air.	Wells are designed to prohibit short-circuiting of air into cover or refuse.	
§60.759(b)(2) 3745-76-14(B)(2)	Any gravel used around pipe perforations shall be of sufficient dimension so as not to penetrate or block perforations.	Gravel used for backfill will be of sufficient size to not penetrate or block perforations.	
§60.759(b)(3) 3745-76-14(B)(3)	Collection devices may be connected to the collection header pipes below or above the landfill surface.	Collection devices will be connected above grade to the header system.	
§60.759(b)(3) 3745-76-14(B)(3)	The connector assembly shall include a positive closing throttle valve, any necessary seals and couplings, access couplings, and at least one sampling port.	Wells will incorporate a control valve, sampling ports, seals and couplings, and access points.	
§60.759(b)(3) 3745-76-14(B)(3)	Collection devices shall be constructed of PVC, HDPE, fiberglass, stainless steel, or other non-porous material of suitable thickness.	The system is constructed of "state-of-the-practice" materials, with proven performance in landfills across the United States. The wells and piping shall be constructed of PVC or HDPE.	
§60.759(c) 3745-76-14(C)	The gas mover equipment shall be sized to handle the maximum gas generation flow rate expected over the intended use period of the gas moving equipment.	The proposed gas moving system was designed to handle the maximum flow rate derived from the LANDGem model for the GCCS service area.	

TABLE 1.1 REGULATORY COMPLIANCE CHECKLIST SUNRISE MOUNTAIN LANDFILL

§60.759(c)(1) 3745-76-14(C)(1)	For existing gas collection systems, existing flow data shall be used to project the maximum flow rate. If no flow data exists, procedures delineated in the item below shall be used.	No existing gas collection system is present.	
§60.759(c)(2) 3745-76-14(C)(2)	For new collection systems, the maximum flow rate shall be in accordance with the methods specified in §60.755(a)(1). This value shall be based on use of the modified Scholl Canyon LFG Emissions Model, and may use AP-42 defaults for k and L_0.	The maximum flow for evaluating the existing system was derived from the LANDGem model using AP-42 defaults.	

SECTION 2.0
EXISTING SITE CONDITIONS

2.1 LANDFILL DESCRIPTION

The Site includes the Sunrise Mountain Landfill, which lies on a 720-acre parcel of land that is leased to Clark County by the BLM; and three adjacent areas known as the Northeast Canyon Area, the Eastern Perimeter Area, and the Western Burn Pit Area. The Site is located approximately 3 miles east of Las Vegas, in Clark County, Nevada (Figure 1, Site Location Map, Appendix A), and is situated on the eastern edge of Las Vegas Valley, immediately southeast of Frenchman Mountain. The Site location is also depicted on the title sheet (Drawing 1, Appendix A). Drawing 2, Appendix A, depicts existing conditions at the Site.

According to the Historical Landfill Assessment Report (SCS Engineers, 2001), the Site began to receive municipal solid waste (MSW) in 1951 under management of the Southern Nevada Disposal Service Company. Disposal Urban Maintenance Processing Company, Inc. (DUMPCo) began operating the landfill in 1955 and stopped accepting waste on October 8, 1993.

2.1.1 Waste Quantity And Types

Using the data obtained as part of the Historic Landfill Assessment Report (SCS Engineers, 2001), the total volume of MSW at the Site was estimated. At the beginning of this analysis (in 1952), the daily waste rate was assumed to be 400 tons per day. In years that the daily rate or annual waste rate was not known, the rate was assumed. Refer to Tables 2.1a and 2.1b below for a summary of MSW tonnages.

Table 2.1a
Summary of MSW Tonnages
Using Daily Waste Rates Based on Historical Research

Year	Number of Years	Daily Rate (tons) (1)	Annual Tonnage (tons)	Period Total (tons)	Cumulative Tonnage (tons)
1952-60	9	400	146,000	1,314,000	1,314,000
1961-70	10	730	266,450	2,664,500	3,978,500
1971-80	10	1060	386,900	3,869,000	7,847,500
1981-85	5	1390	507,350	2,536,750	10,384,250
1986	1	1710	**624,000**	624,000	11,008,250
1887	1	2160	788,400	788,400	11,796,650
1988	1	2610	952,650	952,650	12,749,300
1989	1	3060	1,116,900	1,116,900	13,866,200
1990	**1**	**3500**	1,277,500	1,277,500	15,143,700
1991-93	3	3425	**1,250,000**	3,750,000	18,831,700

(1) Bold figures were obtained from historical documents. All others were assumed or extrapolated.

Table 2.1b
Summary of Extrapolated Annual and Cumulative MSW Tonnages

Year	Tons disposed	Cumulative tons
1951	146,000	146,000
1952	146,000	292,000
1953	146,000	438,000
1954	146,000	584,000
1955	146,000	730,000
1956	146,000	876,000
1957	146,000	1,022,000
1958	146,000	1,168,000
1959	146,000	1,314,000
1960	146,000	1,460,000
1961	266,450	1,726,450
1962	266,450	1,992,900
1963	266,450	2,259,350
1964	266,450	2,525,800
1965	266,450	2,792,250
1966	266,450	3,058,700
1967	266,450	3,325,150
1968	266,450	3,591,600
1969	266,450	3,858,050
1970	266,450	4,124,500
1971	386,900	4,511,400
1972	386,900	4,898,300
1973	386,900	5,285,200
1974	386,900	5,672,100
1975	386,900	6,059,000
1976	386,900	6,445,900
1977	386,900	6,832,800
1978	386,900	7,219,700
1979	386,900	7,606,600
1980	386,900	7,993,500
1981	507,350	8,500,850
1982	507,350	9,008,200
1983	507,350	9,515,550
1984	507,350	10,022,900
1985	507,350	10,530,250
1986	624,000	11,154,250
1987	788,400	11,942,650
1988	952,650	12,895,300
1989	1,116,900	14,012,200
1990	1,277,500	15,289,700
1991	1,250,000	16,539,700
1992	1,250,000	17,789,700
1993	1,042,000	18,831,700

Assuming the MSW was compacted at 1,000 pounds per cubic yard, the cumulative volume of 18,831,700 tons equates to 37,787,400 cubic yards of waste.

Based on the documents reviewed and the interviews conducted as part of the Historic Landfill Assessment Report (SCS Engineers, 2001), the waste-in-place at the Site includes the following types:

- Municipal Solid Waste;
- Petroleum Contaminated Soil;
- Asbestos;
- Construction Debris;
- Sewage Sludge;
- Septage Waste;
- Medical Waste; and
- Dead Animals Waste.

2.1.2 Landfill Areas

The Site consists of the 720-acre leased property, the Northeast Canyon Area, the Eastern Perimeter Area, and the Western Burn Pits Area. The Site was further differentiated into twelve distinct regions as shown in Drawing 2, in Appendix A.

Using the information contained in the Historical Landfill Assessment Report (SCS Engineers, 2001), the approximate size and average waste depth for each region was assumed. This data is summarized in Table 2.2.

Table 2.2
Summary of Distinct Site Regions

Region No.	Region Description	Approximate Area (Acres)	Assumed Average Waste Depth (ft)
1	Western Side of Lower Southern Flats	59.7	35
2	Eastern Side of Lower Southern Flats	89.4	35
3	Dead Animals	2.3	25
4	Side Slopes of Top Deck	117.0	105
5	Upper Deck of the Top Deck	73.2	105
6	Asbestos Waste	8.6	20
7	Construction Debris	3.4	15
8	Eastern Perimeter	27.5	28
9	Northeast Canyon	44.4	17

RSSN will evaluate the data obtained during the on-going landfill assessment, and use this data as necessary to develop the final design of the GCCS.

Off-Lease Areas

The Northeast Canyon and Eastern Perimeter Areas are located off the 720-acre lease property. The Northeast Canyon Area consists of approximately 44.4-acres, which contains an estimated waste volume of 1,216,505 cubic yards. Thus, the average depth of waste in the Northeast Canyon Area equals less than 17 feet. The Eastern Perimeter Area consists of approximately 27.5-acres, which contains approximately 1,257,738 cubic yards of waste. Thus, the average depth of waste in the Eastern Perimeter Area equals approximately 28 feet.

2.1.3 Final Cover System

According to the Sunrise Mountain Landfill Closure Plan (Harding Lawson, 1994), an EPA-prescriptive final cover system was constructed over portions of the Site regulated by EPA Subtitle D. Approximately 180 acres of EPA-prescriptive final cover was constructed on the following regions:

- Western Side of Southern Flats.
- Upper Deck of the Top Deck.

The EPA-prescriptive final cover consists of the following layers:

- Infiltration layer consisting of a minimum of 18 inches of low permeability soil (k < 1.0 x 10-5 cm/sec.)
- Erosion soil layer consisting of a minimum of 6 inches of native soil materials.

Prior to installing the infiltration layer, a minimum 12-inch thick structural fill layer was placed over the existing intermediate cover to achieve closure grades.

According to the Historical Landfill Assessment Report (SCS Engineers, 2001), portions of the Site that accepted waste prior to October 9, 1991 were closed in accordance with September 1990 Clark County Health District Regulations Governing Solid Waste Sites & Facilities. These regulations required a final cover of at least 24 inches of earthen material (in addition to the daily cover) to be placed over the entire surface of all completed portions of the landfill.

2.2 LANDFILL GAS MODELING

Preliminary LFG modeling using conservative default values specified in the Initial Design Capacity Report and Tier 1 NMOC Emission Rate Report, (SCS Engineers, 2000) indicated that the Sunrise Mountain Landfill currently emits in excess of 50 Mg/year of NMOCs. According to the guidelines, RSSN may opt to perform Tier 2 and Tier 3 analyses using specific data acquired through field-testing. However, RSSN has decided to implement a LFG control system based on Tier 1 results. The proposed LFG system design will meet the NMOC emissions control system design and operation criteria.

2.3 LANDFILL GAS SURFACE EMISSION MONITORING

Between December 15, 1999 and January 28, 2000, SCS performed surface emissions monitoring of methane (CH_4) concentrations at the Sunrise Mountain Landfill property (720-acre parcel), the Eastern Perimeter Area, the Northeast Canyon Area, and the Western Burn Pit Area. This surface monitoring including 2,078 points at the Site. The purpose of the monitoring was to provide data for LFG characterization and to estimate the level of coverage needed for LFG collection system design. Methane gas concentrations were measured using a Landtech GEM 500 portable flame ionization detector (FID) equipped with a probe extension to allow the measurement of methane concentrations approximately 3 inches above the ground surface.

Thirteen points out of 2,078 possessed elevated methane concentrations of 500 parts per million (ppm) or above during the December 15, 1999 monitoring event. The elevated methane measurements were found in two general areas within the 720-acre leased property: in the east-central portion and in the west-southwest portion. No elevated methane (i.e., at or above 500 ppm) measurements were located in the Eastern Perimeter Area, the Northeast Canyon Area, or the Western Burn Pit Area. On January 28, 2000, only three points were identified above 500 ppm methane. Those three points were re-tested and found to be below 500 ppm methane.

SECTION 3.0
FUTURE SITE DEVELOPMENT

Future developments at the Site may have an impact on the development of a GCCS Plan. These future developments include investigations, characterizations, and remedial actions associated with the Administrative Order and the facility's Work Plan. Requirements of the Work Plan could effect this GCCS Plan for the Site include landfill gas surface emissions monitoring, assessment of the landfill's existing final cover, possible amendments to the final cover, installation of storm water control structures, and possible relocation of waste that is currently outside the 720-acre lease area.

SECTION 4.0
LANDFILL GAS COLLECTION AND CONTROL SYSTEM

4.1 SYSTEM OBJECTIVES

Consistent with SCS' scope of services, the LFG collection and control system components will be sized to control LFG generated in the existing methane-generating portions of Site. The objectives of the proposed landfill gas collection and control system are as follows:

- Complying with air emissions regulations;
- Controlling odors;
- Maintaining LFG migration control, and
- Maintaining the integrity of the cap.

All of the above objectives rely on efficient collection of LFG generated in the landfill. The collected LFG is routed to combustion equipment. Uncollected LFG emitted to the atmosphere can cause odors, as well as violate new regulations regarding emissions of non-methane organic compounds (NMOC). The presence of a cap greatly reduces the potential for such emissions, but does not reduce the need for LFG collection to control LFG.

4.2 BASIS OF DESIGN

4.2.1 Landfill Gas Generation Modeling

SCS compiled an approximate fill history of the landfill. This information was assimilated and inserted into the EPA's Landfill Gas Generation Model (LANDGem Model) to provide a preliminary assessment of LFG recovery potential at the landfill and to provide a basis for the conceptual LFG collection system design.

Since the landfill ceased receiving municipal solid waste (MSW) in October 1993, LFG (and, thus methane) generation peaked in 1994. Since 1994, LFG generation has decreased and will continue to do so. The LANDGem Model estimates the maximum LFG generation rate at Site to be 5.21 million cubic feet per day (MMcfd), which equates to approximately 3,619 cfm occurring in 1994. The LANDGem estimates that in year 2002, the Site will generate approximately 4.44 MMcfd, or 3,084 cfm.

The maximum collection rate for a GCCS at this Site, assuming 75% collection efficiency, is estimated to be 2,313 cfm in year 2002. For purposes of sizing collection piping, the blower station, and estimating condensate production, SCS used a design flow rate equal to 2,400 cfm. The tabular outputs from the LANDGem Model are included in Appendix B. If additional information is obtained as a result of field investigations and evaluations, the design flow may be adjusted.

4.2.2 GCCS Coverage

According to the *Enabling Document for the New Source Performance Standards and Emission Guideline for Municipal Solid Waste Landfills* (Enabling Document) (§60.759(a)(3)(i) 3745-76-14(A)(3)(a), segregated areas of asbestos or non-degradable material may be excluded from collection if sufficiently documented. In addition, item §60.759(a)(3)(ii) 3745-76-14(A)(3)(b)) states that any non-productive areas of the landfill may be excluded from control, provided excluded areas can be shown to contribute less than 1 percent of the total amount of NMOC emissions from the landfill. SCS has identified areas both within the 720-acre leased area as well as outside it, which fall into one of the two categories.

Land devoted exclusively to asbestos, construction and demolition debris (CDD), medical waste, septic waste (now empty), and soil biotreatment (the soil was remediated and utilized as daily cover) will be excluded from the GCCS. These areas are located within the 720-acre leased area, and occupy approximately 30 acres.

The Northeast Canyon area and portions of the Eastern Perimeter area are believed to contain some of the oldest waste disposed of at the site. Induced polarization (IP), aerial photography, topographic maps, calculations, and test pits demonstrate that waste in the majority of these areas is shallow (~20-30-feet). These areas, illustrated on Drawing 2, are estimated to contain approximately 2.5 million cubic yards (cy) of waste. Assuming a waste density of 1,000 pounds per cubic yard (lb/cy), approximately 1.24 million tons of waste is located in these areas. The LANDGem Model estimated methane and NMOC generation rates in these areas. Assuming the waste in these areas was deposited from 1951-1960, the resulting NMOC generation in 2002 from waste placed in these areas was approximately 4% of the Site's total NMOC generation in 2002.

The Northeast Canyon area and portions of the Eastern Perimeter area are excluded from the GCCS based on the following factors:

- Surface emissions monitoring in the area revealed no detectable concentrations of methane at or above 500 parts per million (ppm).
- NMOC concentrations are close to the 1 percent NSPS exclusion requirement threshold;
- GCCS design in these areas would be premature based on the on going investigations, characterizations, and remedial actions associated with the Administrative Order, and
- Shallow waste depths prohibit effective landfill gas extraction with vertical wells;

Surface emissions monitoring will continue in these areas in accordance with the Administrative Order. If methane emissions in these areas exceed 500 ppm, the expansion of the GCCS design will be evaluated.

4.3 VERTICAL EXTRACTION WELL DEPTH AND SPACING

A total of 70 vertical wells are proposed for the Site as shown on Drawing 4, Appendix A. Vertical extraction wells will be installed up to depths equivalent to 3/4 of the depth of refuse. The actual well depth and spacing may be modified based on field conditions when compared to modeling data. SCS assumes that the effective radius of influence of each extraction well is approximately 2.5 times the well depth (i.e., a well depth of 80 feet would correspond to a radius of influence of 200 feet). This assumption is based on SCS full-scale system operations experience at other landfills. A well schedule containing a list of all 70 proposed extraction wells, their locations, depths, slotted pipe lengths, and theoretical radii of influence is also contained in Drawing 4.

4.4 WELL FIELD PIPE SIZING

The LFG collection piping which delivers the LFG to the blower/flare station or utilization facilities is sized to consider the head losses throughout the piping network to minimize the vacuum requirements of the system. The extraction blower and header piping will be designed to deliver a minimum of 10 inches of water column (in.-w.c.) of vacuum to each extraction wellhead in the LFG collection system. The collection system components will be conservatively sized based on the LFG generation rate. Sample headloss/pipe sizing calculations are contained in Appendix B.

Criteria that will control the sizing of header piping are as follows:

- **Gas Velocity** - Design gas velocities will not exceed 2,400 feet per minute (fpm) for flows concurrent with the slope, and 1,200 fpm for flows against the slope.

- **Unit Head Loss** - Head losses in any given section of piping will be standardized to a 100-foot section which shall not have head losses in excess of one inch of water column.

The header and lateral piping will be constructed of PVC or HDPE, and will be, installed above grade. A minimum slope of 1 percent is specified for piping when LFG flow is concurrent with condensate flow. When LFG flow opposes condensate flow, a minimum 2 percent slope is specified. A three percent slope is planned for piping on the landfill surface.

Since the landfill area in the 720-acre leased area consists of essentially two distinct areas, the Top Deck and the Southern Flats, the GCCS was designed with two main headers linked by a common blower/flare station.

4.5 BLOWER/FLARE STATION

4.5.1 Blower Selection

Blower selection for the GCCS is based on the landfill gas generation model results presented earlier in Section 4.2.1. As a conservative measure when sizing blowers, SCS typically uses the LFG generation rate in lieu of the collection rate to account for the unpredictable nature of LFG production. Since the Site ceased accepting waste in October 1993, the LFG generation in 2002 represents the maximum generation, which the system will need to be capable of handling. Additionally, for purposes of conservative modeling and due to a lack of exact fill data, SCS did not subtract potentially non-productive or inert tonnage from the total MSW used in the LANDGem. In other words, waste volumes from areas excluded from the GCCS, discussed in Section 4.2.2, were not excluded from the modeling analysis. This tactic ensures that the blower and flare will be sized sufficiently to handle gas generation. Thus, the maximum LFG generation rate that the system must control (occurring in 2002) is 3,084 cfm. Assuming a collection efficiency of 75% (based on AP-42), the collection rate equals 2,313 cfm. For purposes of sizing the blower station on a conceptual level, SCS used a maximum design flow rate equal to 3,000 cfm. Blower and flare design calculations are contained in Appendix B.

Two blowers at 1,500 cfm each are specified to operate in parallel for a combined total flow capacity of 3,000 cfm. The use of two blowers offers increased flexibility in LFG control.

SCS anticipates the following specifications for the blower. Actual specifications will be developed during the development of Construction Drawings and Specifications:

- Blowers are industrial grade, centrifugal type to provide a wide range of flows and long-term service. The blowers shall have non-sparking totally enclosed fan cooled (TEFC) motors appropriate for National Electric Code (NEC) Class 1 Division 2 environments. The blowers will not be housed in an enclosed structure; therefore, they are not required to be explosion proof.

- Blower capacity of 1,500 cfm at approximately 60 inches of water column inlet vacuum and 20 inches outlet pressure (vacuum ratings based on similarly sized extraction systems at other landfills).

- 20 to 30 HP TEFC motors wired for 480V, 3-phase service.

- Piping, fittings, and blind flanges to allow for future system modification.

4.5.2 Flare Selection

The LFG collection system at Site will require a flare to control LFG emissions. The flare does not preclude the implementation of a LFG utilization facility and would be necessary if the utilization system were off line. The flare is intended to be a candle-stick type.

4.5.3 Instrumentation/Control System Design

The flare system will be equipped with an automatic control system. When activated, the flare controller automatically will activate the pilot system; upon successful ignition of the pilot, the controller will start the blower and ignite the flare. The pilot will be extinguished following successful ignition of the main flame. If the flame is extinguished, the controller will sense the outage, shut off the LFG supply, and reset/restart the system after a prescribed shutdown time. The system will automatically restart for any number of flameouts unless prevented by equipment malfunctions. Several conditions (primarily equipment malfunctions and temperature extremes) will propagate a system shutdown; these conditions will trip an alarm and will not allow a restart of the system without a manual reset.

- Anticipated flare control equipment will include:
- Flow indicator.
- Thermocouples to indicate stack temperatures for blower shutdown for low or high temperature alarm conditions.
- Chart recorder to record temperature and flow.
- Automatic propane pilot for ignition.
- Interface with blower controls for automatic motor starting following pilot ignition.
- Alarm indicators for high and low temperatures, flame outage, and blower failure.
- A programmable logic controller (PLC) will be specified to receive signals from the devices listed above and communicate with the appropriate equipment (flare, blower, valves, etc.) to perform the necessary function.

4.5.4 Condensate Production and Control

Condensate is formed as the temperature of LFG extracted from the landfill decreases in the collection system piping. Seven condensate traps and two condensate sumps are planned for the GCCS. The actual number of traps and sumps may vary depending on field conditions. Management of LFG condensate at the Sunrise Mountain Landfill will be handled as follows:

- Condensate formed in the lateral piping from the wellhead to the header will drain into the header pipes (except when laterals are at localized low points).
- Condensate formed in the header piping will drain into either a condensate trap (designated CT-# on Drawing 4) or a condensate sump/tank (designated CS-# on Drawing 4). Traps and sump/tanks are designed at low points in the piping system.

Condensate traps are designed to collect condensate from the header system and dispose it back into the landfill. Condensate sump/tanks were designed to collect condensate in areas where traps were not feasible. The sump/tanks will store condensate temporarily prior to proper disposal.

Condensate in header piping can form a blockage in the gas system if it collects in a low point and is not removed from the header system. To maintain positive drainage, a minimum 3 percent slope is specified for collection piping on the landfill surface. Differential settlement under the collection piping is less of a concern in areas off the refuse mounds, so a minimum slope of 1 percent is anticipated for piping located on natural soil when LFG flow is in the direction of condensate flow. On natural ground, when LFG flow opposes condensate flow in the header, a minimum 2 percent slope is anticipated.

The total quantity of condensate collected by the LFG system is expected to be highest during the winter months when the temperature differential of LFG from the wellhead to the flare station is greatest. Condensate collection estimates for winter were calculated (see Appendix B) to be approximately 1,905 gallons per day for both sections of the landfill. This value represents the anticipated maximum daily amount from 2,400 cfm of LFG, which is the anticipated collection rate if an LFG temperature of 120 degrees F at the wellhead and 40 degrees F at the blower is assumed.

SECTION 5
COMPLIANCE REVIEW AND EVALUATION

The purpose of this Section is to describe and document information required to certify compliance of the GCCS with the applicable sections of *40 CFR 60.759 - Specifications for active collection systems*, including:

- §60.759 (a) - Compliance with §60.752 (b) (2) (ii).
- §60.759 (b) - Construction procedures.
- §60.759 (c) - Conveyance of LFG in compliance with §60.752 (b) (2) (iii).

Additionally, portions of *40 CFR 60.755 - Compliance provisions* relevant to GCCS specifications are addressed, including:

- §60.755 (a) (1) - Calculations for maximum expected gas generation flow rate.
- §60.755 (a) (2) - Sufficient density of gas collectors.
- §60.755 (a) (3) - Collection system flow rate sufficiency.
- §60.755 (a) (5) - Identification of excess air infiltration.

The information presented below is applicable to the existing GCCS.

5.1 COMPLIANCE WITH §60.759 (a) (1)

The following report sections address compliance with the applicable sections of §60.759 (a).

5.1.1 Control of Surface Emissions

Surface emissions will be controlled by the collection of LFG utilizing the GCCS and the final cover system at the landfill. Currently the existing cover is controlling surface emissions without the active GCCS for the majority of the Site, as documented in Section 2.3.

5.1.2 Depths of Refuse

The elevation of the landfill bottom, peak elevations, maximum estimated depth of refuse, and estimated average depth of refuse for the entire landfill is provided herein.

5.1.3 Refuse Gas Generation Rates and Flow Characteristics

LFG generation modeling was used to estimate the LFG generation rate for the landfill. The LFG generation rate provided by this method was then used to evaluate the adequacy of the GCCS design. Waste disposal rates used in the model were obtained from the Historical Landfill Assessment Report (SCS Engineers, 2001).

Modeling was performed using the LANDGem Model, with k and L_0 inputs recommended by

EPA's *AP-42* (November 1998) for dry sites. As shown in Appendix B, the model uses a k of 0.02 and L_0 of 100 cubic meters per megagram (m^3/Mg).

As shown in Appendix B, LFG generation peaked in 1994, the year after closure, and has been declining since then. The LFG collection system is designed to handle the maximum LFG flows expected to occur in 2002. Appendix B shows that the landfill is expected to generate 8.10×10^8 cubic feet of methane in 2002, which equates to 3,084 scfm of LFG, assuming a methane content of 50 percent. Assuming a LFG collection efficiency of 75 percent, which, according to AP-42, is typical for most landfills, the estimated average LFG flow from the landfill is about 2,313 scfm. Actual LFG flow will vary based on field conditions encountered.

5.1.4 Landfill Final Cover System

See Section 2.1.3.

5.1.5 Gas System Expandability

As described above, the GCCS has sufficient capability to accommodate collection of up to 2,400 scfm of LFG. The GCCS also has sufficient capacity to accommodate installation of additional wells or other collection methods at the Site, should they be required, based upon surface emissions monitoring.

5.1.6 Condensate Management

For the GCCS, seven (7) condensate traps and two (2) condensate sumps/tanks will collect the condensate, by gravity, from the low points along the GCCS LFG header. The condensate sump/tanks will be emptied manually on a regular basis. The actual number and location of the traps and sumps will determined during the development of Construction Drawings and Specifications based on field conditions at that time.

5.1.7 Leachate Management

There is no leachate collection system constructed at the landfill.

5.1.8 Accessibility

Access roads provide site access.

5.1.9 Integration with Closure End Use

No end uses currently are proposed for the closed landfill.

5.1.10 Air Intrusion Control

Air intrusion control for the GCCS is provided by installation of the final cover system installed over the entire site. The use of 10 to 15-foot minimum blank sections on the vertical well casings in the interior extraction wells and bentonite plugs at top of casings provide additional control for potential air intrusion. Air intrusion control is also provided by well field tuning to reduce the oxygen and nitrogen content of the collected LFG to a level at or below the regulatory limits of 5 percent oxygen and 20 percent nitrogen. Oxygen and nitrogen levels will be reduced (as necessary) by reducing the vacuum placed on individual wells

5.1.11 Corrosion Resistance

In general, the system components described in Section 4 of this report represent "state-of-the-practice" materials, and have proven to be resistant to corrosion with proper installation, operations, and maintenance in GCCS applications across the United States.

5.1.12 Fill Settlement

Settlement or subsidence of waste fill can affect a GCCS in numerous ways, including:

- Damage or destruction of header and lateral piping systems.
- Blockage of header and lateral piping systems, as a result of condensate collecting in the piping (at locations where the elevation of the top of the pipe drops below the elevation of the bottom of nearby pipe sections due to settlement), thereby blocking the flow of gas.
- Damage, displacement or destruction of well casings, seals, and filter materials, as a result of settlement in the landfill mass adjacent to the well.

Components or features incorporated into the GCCS design to address potential effects of settlement include collection system piping above the landfill surface, and flexible couplings installed in the header pipe.

5.1.13 Resistance to Decomposition Heat

The components incorporated into the GCCS have performed well historically when subjected to the heat of decomposition under normal operating conditions. Typically, the components used in a modern GCCS are resistive to temperatures not exceeding 150°F. The GCCS components which are most susceptible to heat damage include vertical extraction wells. PVC or HDPE well casings will be installed within the refuse mass. PVC and HDPE pipe has proven successful for numerous GCCS applications across the United States. Above grade pipe shall be either PVC or HDPE.

5.2 COMPLIANCE WITH §60.759 (a) (2)

The following section describes compliance with §60.759 (a) (2).

5.2.1 Density of Gas Collection Devices

Surface emissions are currently controlled over a majority of the Site without a GCCS. Based on surface emissions monitoring, only a few extraction wells would be required to control methane surface emissions at the Site. However, 70 wells are included in the GCCS design to collect landfill gas. Installation of these wells may be in a phased-approach based on actual field conditions encountered at the time of installation.

Based upon the criteria used for the evaluation, the GCCS should provide sufficient collection coverage to meet the NSPS surface emissions monitoring requirements. The adequacy of the well density will be confirmed during future surface emissions monitoring, including identifying any areas that may require additional control measures based upon the monitoring results.

5.3 COMPLIANCE WITH §60.759 (a) (3)

5.3.1 Collection Devices Placement

Collection devices will be installed throughout the landfill, as shown on Drawing 4 (Appendix A) with the exception of areas of asbestos or other non-degradable and/or non-productive waste fill.

5.4 COMPLIANCE WITH §60.759 (b) (1), (2), AND (3)

5.4.1 Construction of System Components

As described in previous sections of this report, the GCCS components are constructed of materials suitable for LFG applications.

5.5 COMPLIANCE WITH §60.759 (c) (1), (2)

5.5.1 Landfill Gas Conveyance

The GCCS blower/flare station is designed for a flow rate of 3,000 scfm, which is expected to provide sufficient gas management. The two header pipes are each capable of transporting up to 1,500 scfm of LFG. This collection rate exceeds the projected maximum gas flow rate of 1,200 scfm in each area. Therefore, the header piping system is anticipated to have sufficient capacity to provide LFG collection for the site.

5.6 PLAN FOR SURFACE EMISSION MONITORING

Surface emissions monitoring will be performed as specified herein. These monitoring requirements have been developed in general accordance with the requirements set forth in NSPS. The required date to operate the GCCS is 18 months following the submittal of this GCCS Plan, or October 6, 2002. The first quarterly monitoring event (required by NSPS) will occur within three (3) months of the required operation date of the GCCS Plan, or January 6, 2003. Subsequent monitoring events will be scheduled in accordance with the NSPS Enabling Document. The actual route used for monitoring events will be shown on a field sketch attached to each future Surface Emissions Monitoring Report.

5.7 RECORDKEEPING

No variances to the recordkeeping requirements set forth in 40 CFR §60.757 (f) and (g) are proposed in this Plan. Recordkeeping shall be performed as set forth in the regulations.

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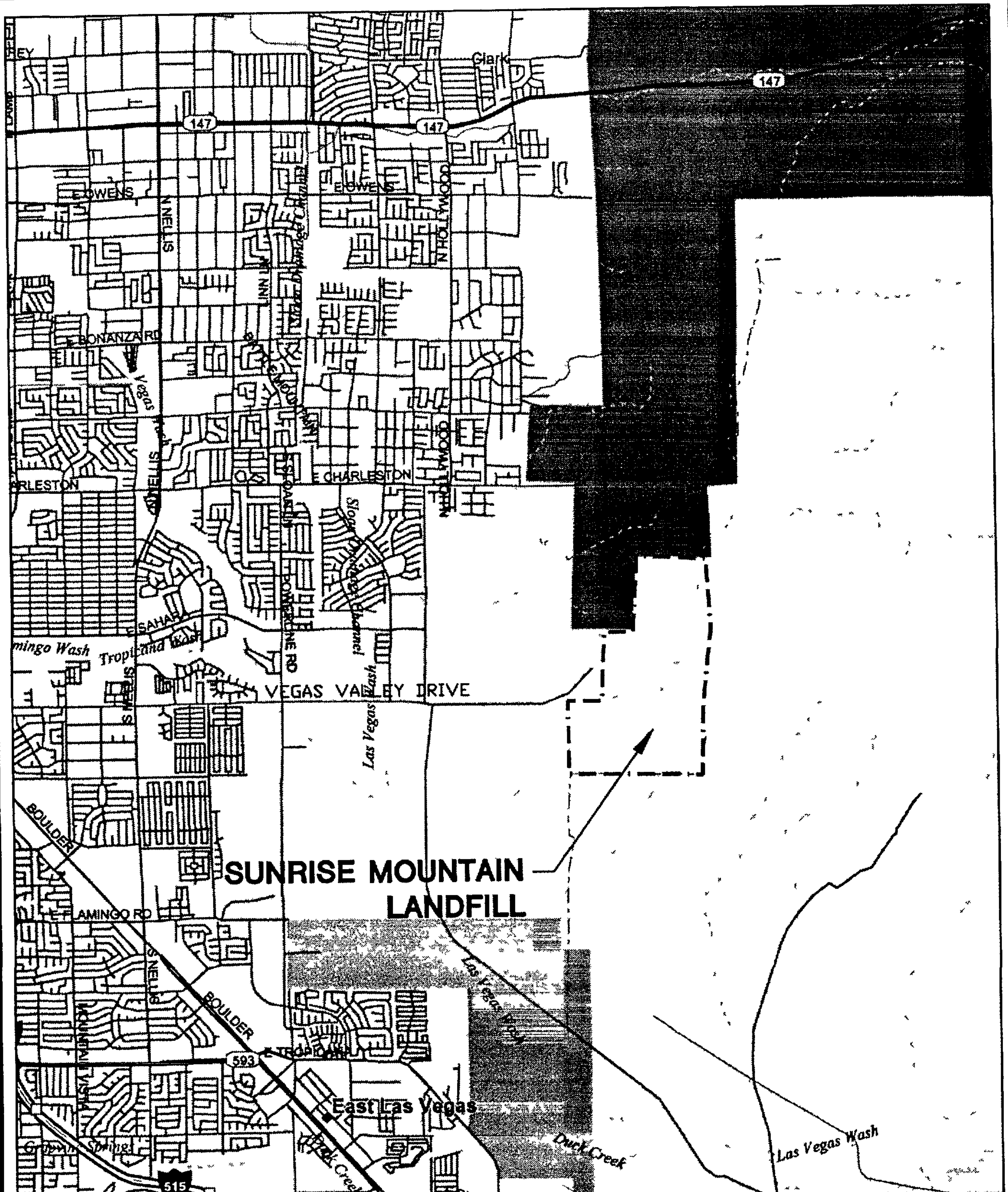
APPENDIX A

FIGURES AND DRAWINGS



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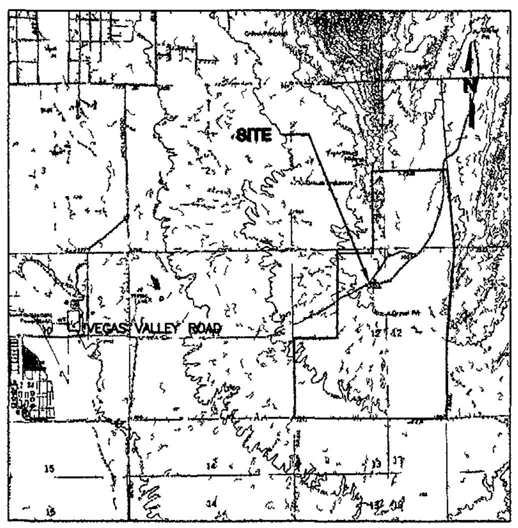
SCALE: NTS	2702 N 44TH ST SUITE 105B PHOENIX, AZ 85008 PH. (602) 840-2596 FAX (602) 224-0572	PROJ NO. 99007.01T17	DWN. BY: TSS	Q/A RVW BY: SBS
FIGURE NO. 1		DSN. BY: TSS	CHK. BY: SCL	APP. BY: SCL

GAS COLLECTION AND CONTROL SYSTEM (GCCS)
DESIGN DRAWINGS
FOR THE
SUNRISE MOUNTAIN LANDFILL
APRIL 6, 2001
CLARK COUNTY, NEVADA

INDEX

LOCATION MAP



STEVEN C. LAMB
14335
4/5/01

NOT FOR CONSTRUCTION

REV / DATE / DESCRIPTION / CK. BY	
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PROJECT TITLE	GAS COLLECTION AND CONTROL PLAN SUNRISE MOUNTAIN LANDFILL
CLIENT	REPUBLIC SERVICES OF SOUTHERN NEVADA 770 EAST SAHARA AVENUE LAS VEGAS, NV 89104 (702) 644-4594
	SCS ENGINEERS STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS 2702 N 44TH ST SUITE 105B PHOENIX, AZ 85008 PH (602) 840-2596 FAX (602) 224-0572
PROJ NO	99007.01-T17
DWN. BY	TSS
Q/A RVW BY	SBS
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DATE	MARCH 2001
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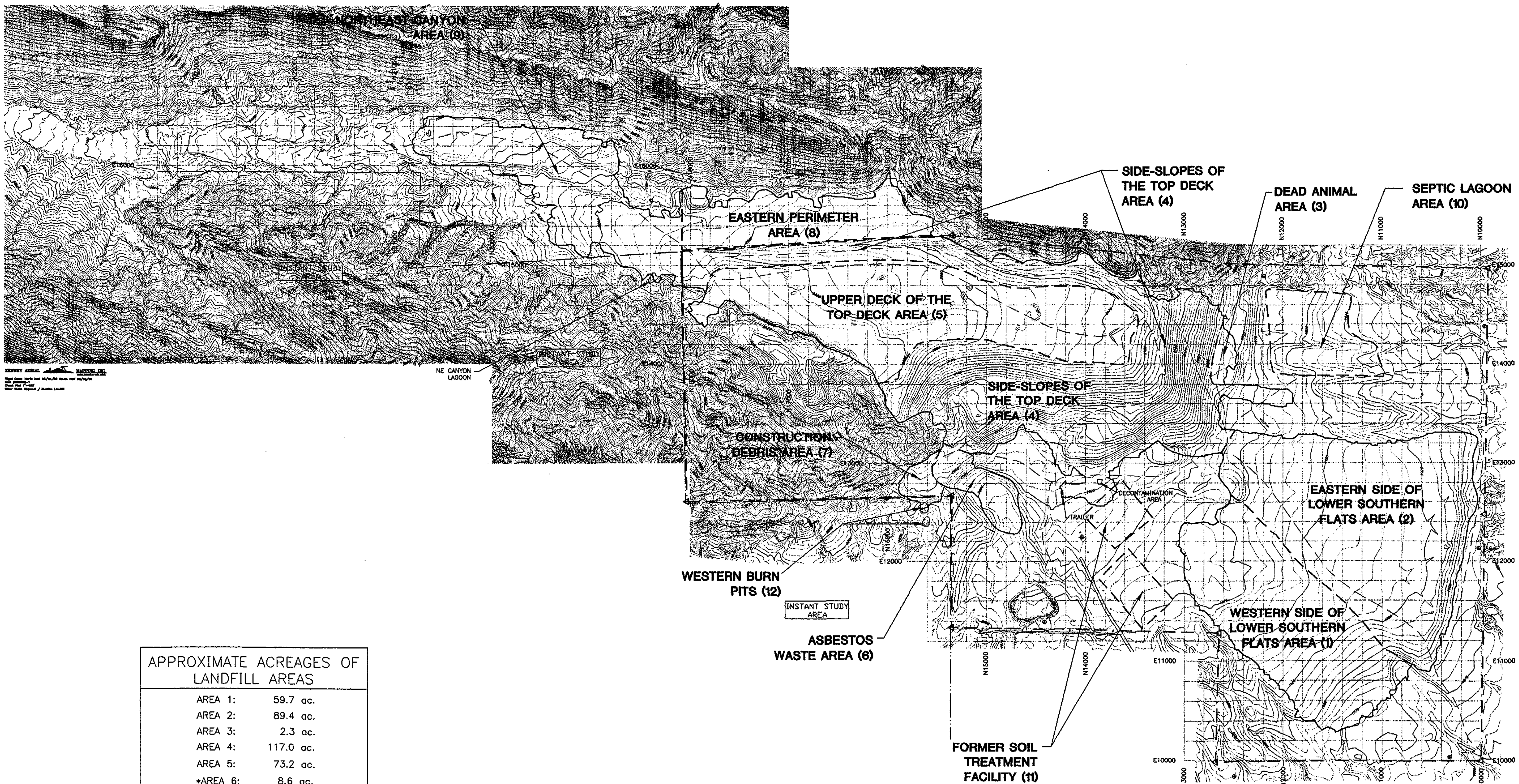
DRAWING NO	1 of 7



APPROXIMATE ACREAGES OF LANDFILL AREAS	
AREA 1:	59.7 ac.
AREA 2:	89.4 ac.
AREA 3:	2.3 ac.
AREA 4:	117.0 ac.
AREA 5:	73.2 ac.
*AREA 6:	8.6 ac.
*AREA 7:	3.4 ac.
*AREA 8:	27.5 ac.
*AREA 9:	44.4 ac.
*AREA 10:	18.3 ac.
*AREA 11:	12.3 ac.
*AREA 12:	0.3 ac.
TOTAL:	456.4 ac.
EXCLUDED AREA [1]:	114.8 ac.
GCCS COVERAGE:	341.6 ac.

* = EXCLUDED AREAS

LEGEND

- BOUNDARY OF INSTANT STUDY AREA
- APPROXIMATE LEASE BOUNDARY, SUNRISE MOUNTAIN LANDFILL (720-ACRE PARCEL)
- ROADS
- ESTIMATED WASTE LIMIT

N

0 500' 1000' 1500'
SCALE IN FEET
1"=500'

PROFESSIONAL ENGINEER STATE OF NEVADA — STEVEN C. LAMB — CIVIL — No. 14895
4/5/01

NOT FOR CONSTRUCTION

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE: EXISTING SITE CONDITIONS

PROJECT TITLE: GAS COLLECTION AND CONTROL PLAN SUNRISE MOUNTAIN LANDFILL

CLIENT: REPUBLIC SERVICES OF SOUTHERN NEVADA
770 EAST SAHARA AVENUE
LAS VEGAS, NV 89104
(702) 644-4594

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS

CADD FILE: GCCS_DWG2
DATE: MARCH 2001
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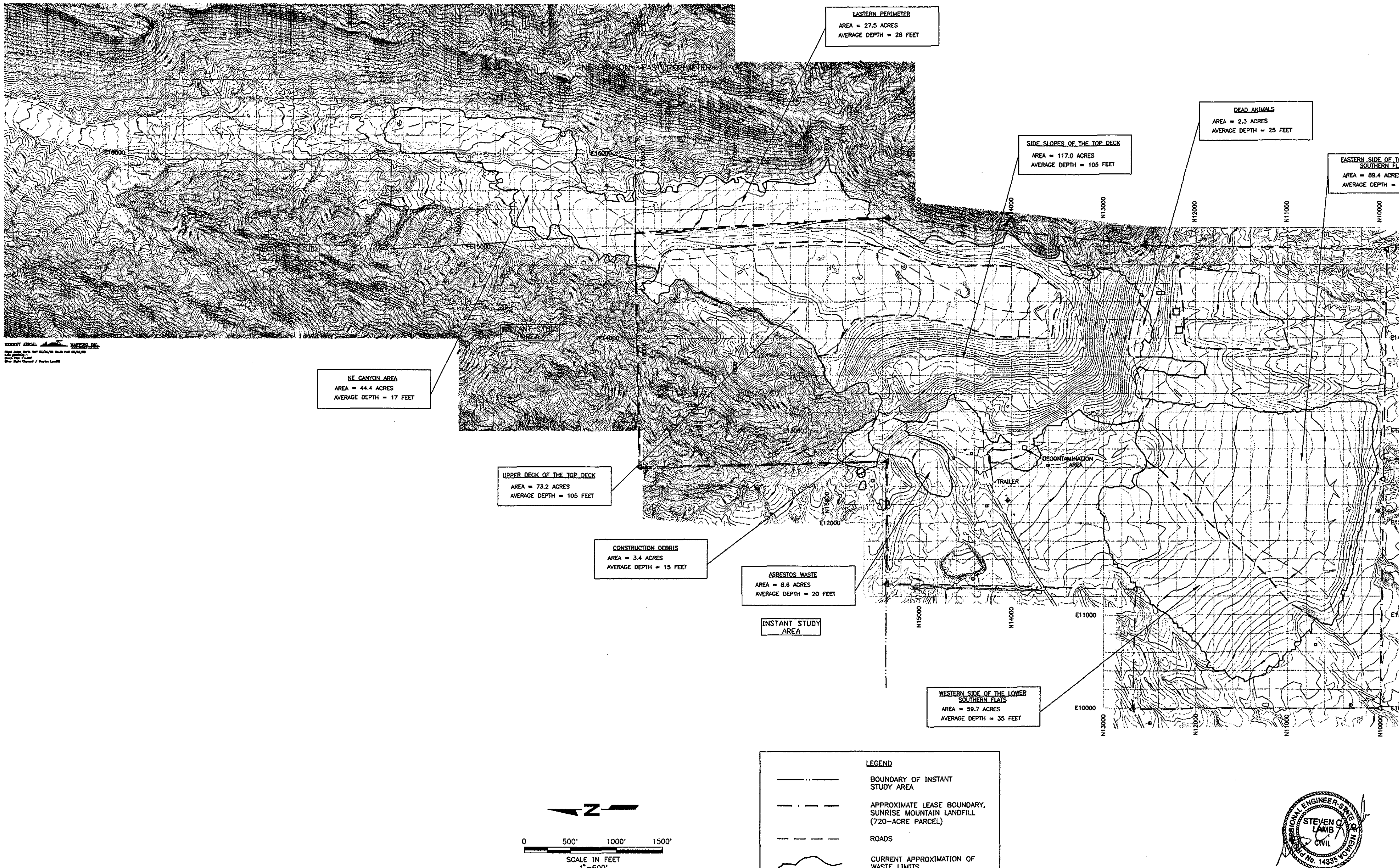

LEGEND

- BOUNDARY OF INSTANT STUDY AREA
- APPROXIMATE LEASE BOUNDARY, SUNRISE MOUNTAIN LANDFILL (720-ACRE PARCEL)
- ROADS
- CURRENT APPROXIMATION OF WASTE LIMITS

STEVEN C. LAMB
CIVIL
No. 14335
PROFESSIONAL ENGINEER STATE OF NEVADA
4/5/01

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REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE: **WASTE AREA MAP**

PROJECT TITLE: **GAS COLLECTION AND CONTROL PLAN SUNRISE MOUNTAIN LANDFILL**

CLIENT: **REPUBLIC SERVICES OF SOUTHERN NEVADA**
770 EAST SAHARA AVENUE
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SCS ENGINEERS
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PROJ. NO. 99007.01-T17 | DWN. BY: TSS | Q/A RVW BY: SBS
DSN. BY: TJS | CHK. BY: DJM | APP. BY: SCL

CADD FILE: GCCS_DWG3

DATE: MARCH 2001

SCALE: AS SHOWN

DRAWING NO. 3 of 7

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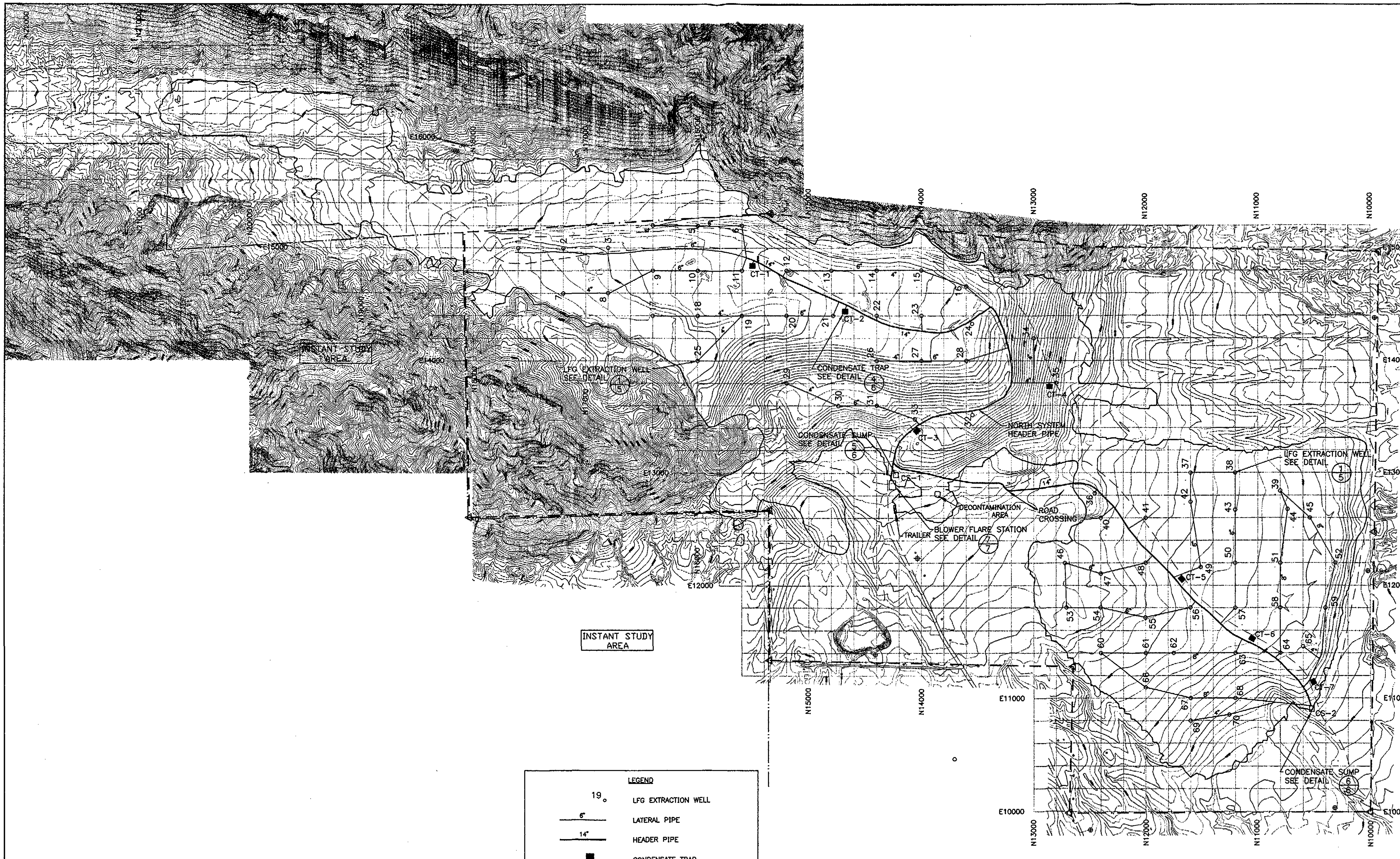

LEGEND

19 o	LFG EXTRACTION WELL
6"	LATERAL PIPE
14"	HEADER PIPE
CT-1	CONDENSATE TRAP
CS-1	CONDENSATE SUMP
	BOUNDARY OF INSTANT STUDY AREA
	APPROXIMATE LEASE BOUNDARY, SUNRISE MOUNTAIN LANDFILL (720-ACRE PARCEL)
	ROADS
	CURRENT APPROXIMATION OF WASTE LIMITS
	EXISTING CONTOUR

N

0 400' 800' 1200'

SCALE IN FEET
1" = 400'

PROFESSIONAL ENGINEER STATE OF NEVADA
STEVEN C. LAMB
CIVIL
No 14335

NOT FOR CONSTRUCTION

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
GCCS DESIGN SITE PLAN

PROJECT TITLE
GAS COLLECTION AND CONTROL PLAN
SUNRISE MOUNTAIN LANDFILL

CLIENT
REPUBLIC SERVICES OF SOUTHERN NEVADA
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PH. (602) 840-2596 FAX (602) 224-0572

PROJ. NO. 99007.01-T17 | DWN. BY: TSS | Q/A RVW BY: BFJ
DSN. BY: SCL | CHK. BY: DJM | APP. BY: SBS

CADD FILE: GCCS_DWG4
DATE: MARCH 2001
SCALE: AS SHOWN
DRAWING NO. 4 of 7

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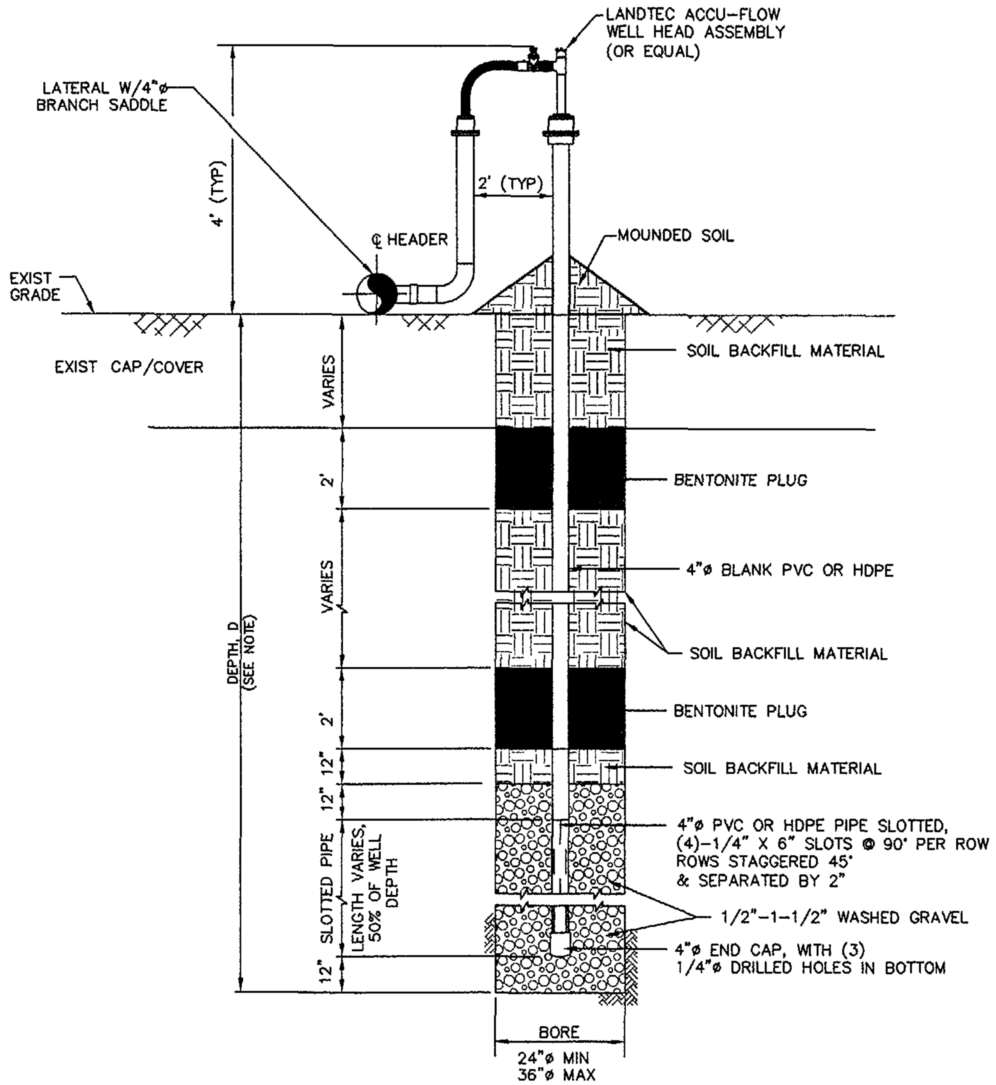
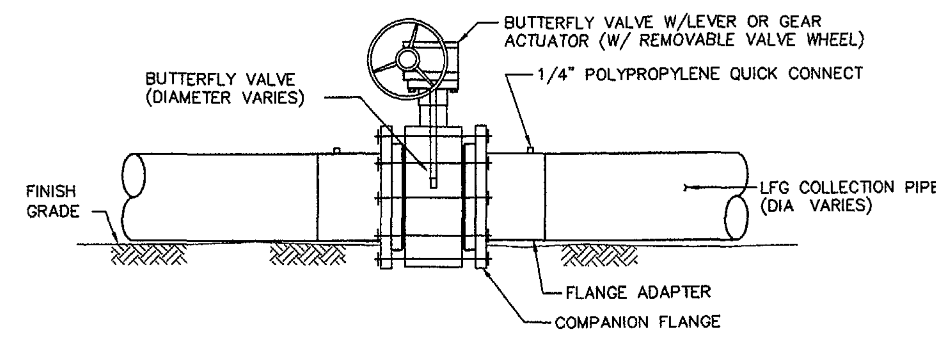
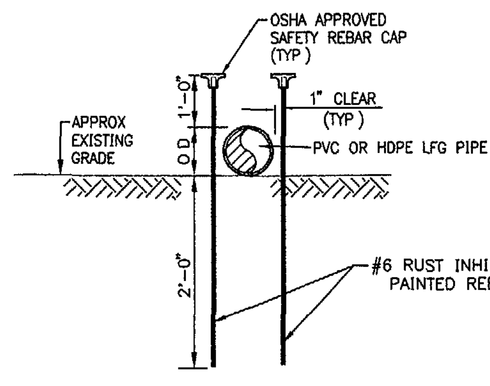
WELL NUMBER	NORTHING (FEET)	EASTING (FEET)
1	17600	15000
2	17200	15000
3	16800	15000
4	16400	15200
5	16000	15200
6	15600	15200
7	17200	14600
8	16800	14600
9	16400	14800
10	16000	14800
11	15600	14800
12	15200	14800
13	14800	14800
14	14400	14800
15	14000	14800
16	13600	14658
17	16400	14400
18	16000	14400
19	15600	14400
20	15200	14400
21	14785	14400
22	14400	14400
23	14000	14400
24	13600	14400
25	16000	14000
26	14400	14000
27	14000	14000
28	13600	14000
29	15200	13800
30	14738	13599
31	14400	13600
32	13600	13600
33	14060	13477
34	13000	14200
35	12800	13800
36	12400	12896
37	11600	13000
38	11200	13000
39	10800	12838
40	12400	12600
41	12000	12600
42	11600	12742
43	11200	12600
44	11800	12600
45	10539	12600
46	12800	12200
47	12400	12200
48	12000	12200
49	11600	12200
50	11200	12200
51	10800	12200
52	10400	12200
53	12800	11800
54	12400	11800
55	12000	11800
56	11600	11800
57	11200	11800
58	10800	11800
59	10400	11800
60	12400	11400
61	12000	11400
62	11752	11400
63	11200	11400
64	10800	11400
65	10600	11400
66	12000	11096
67	11600	11000
68	11200	11000
69	11600	10800
70	11200	10800



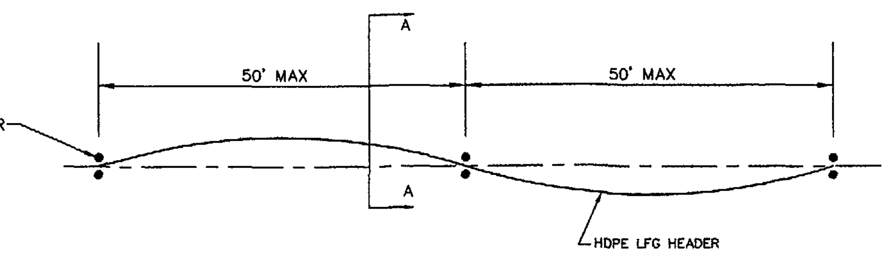
(1/5) TYPICAL EXTRACTION WELL DETAIL
NOT TO SCALE



(2/5) ISOLATION VALVE DETAIL
NOT TO SCALE



SECTION A–A



PLAN

(3/5) ABOVE GROUND HDPE PIPE SNAKING DETAIL
NOT TO SCALE

NOTES

1. BASED ON THE CURRENT WASTE DEPTH INFORMATION THE DEPTH OF WELLS IN THE TOP DECK AREA (LFG WELLS 1–35) WILL RANGE FROM APPROXIMATELY 40 FEET TO 90 FEET DEEP THE DEPTH OF WELLS IN THE SOUTHERN FLATS AREAS (LFG WELLS 36–70) WILL RANGE FROM APPROXIMATELY 25 FEET TO 90 FEET DEEP
2. ACTUAL WELL DEPTHS WILL BE DETERMINED DURING DEVELOPMENT OF CONSTRUCTION DRAWINGS
3. WELL DEPTHS WILL BE APPROXIMATELY 75 PERCENT OF WASTE DEPTH

STEVEN C. LAMB
CIVIL
No. 1433
4/5/01

NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	CK. BY

SHEET TITLE
LANDFILL GAS EXTRACTION WELL DETAILS

PROJECT TITLE
GAS COLLECTION AND CONTROL PLAN SUNRISE MOUNTAIN LANDFILL

CLIENT
REPUBLIC SERVICES OF SOUTHERN NEVADA
770 EAST SAHARA AVENUE
LAS VEGAS, NV 89104
(702) 644-4594

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
2702 N 44TH ST SUITE 105B PHOENIX, AZ 85008
PH (602) 840-2596 FAX (602) 224-0572

PROJ. NO. 99007 01-T17 | DWN. BY TSS | Q/A RVW BY SBS
DSN. BY TJS | CHK. BY DJM | APP BY SCL

CADD FILE GCCS_DWG5
DATE MARCH 2001
SCALE AS SHOWN
DRAWING NO 5 of 7

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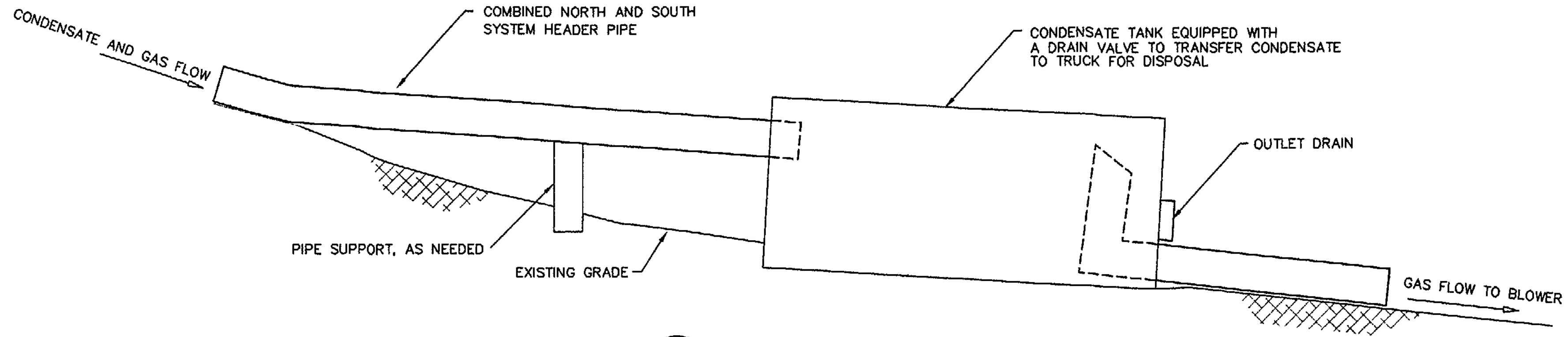
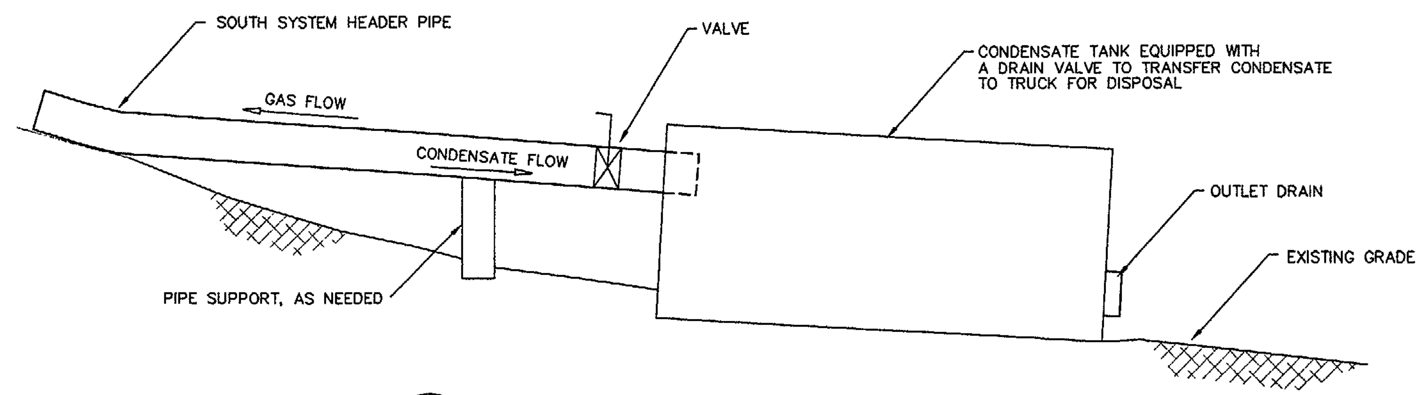


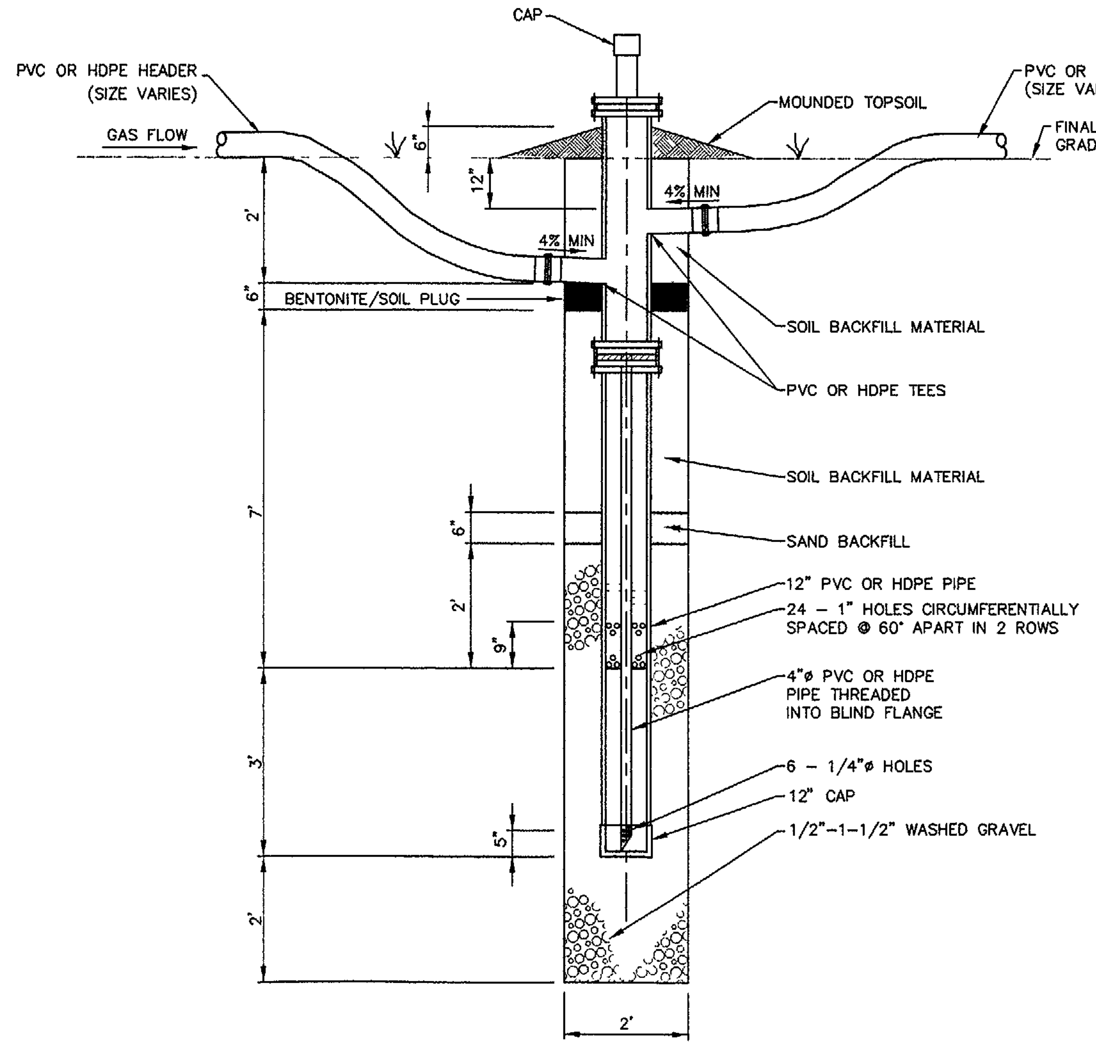
5/6 CONDENSATE SUMP TANK AT BLOWER/FLARE STATION DETAIL
NOT TO SCALE

NOTE: ACTUAL DESIGN TO BE DETERMINED DURING DEVELOPMENT OF CONSTRUCTION DRAWINGS



6/6 CONDENSATE SUMP TANK AT END OF SOUTH SYSTEM DETAIL
NOT TO SCALE

NOTE: ACTUAL DESIGN TO BE DETERMINED DURING DEVELOPMENT OF CONSTRUCTION DRAWINGS



4/6 TYPICAL CONDENSATE TRAP DETAIL
NOT TO SCALE

NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER STATE OF NEVADA STEVEN C. LAMB CIVIL No. 14335 4/5/01

REV	DATE	DESCRIPTION	CK BY

SHEET TITLE: CONDENSATE MANAGEMENT DETAILS

PROJECT TITLE: GAS COLLECTION AND CONTROL PLAN SUNRISE MOUNTAIN LANDFILL

CLIENT: REPUBLIC SERVICES OF SOUTHERN NEVADA
770 EAST SAHARA AVENUE
LAS VEGAS, NV 89104
(702) 644-4594

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
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PH (602) 840-2596 FAX (602) 224-0072

PROJ. NO. 99007.01-T17 | DSN BY TJS | DWN BY DJM | CHK BY TSS | APP BY SCL | Q/A RVW BY SBS

CADD FILE: GCCS_DWG6
DATE: MARCH 2001
SCALE: AS SHOWN
DRAWING NO: 6 of 7

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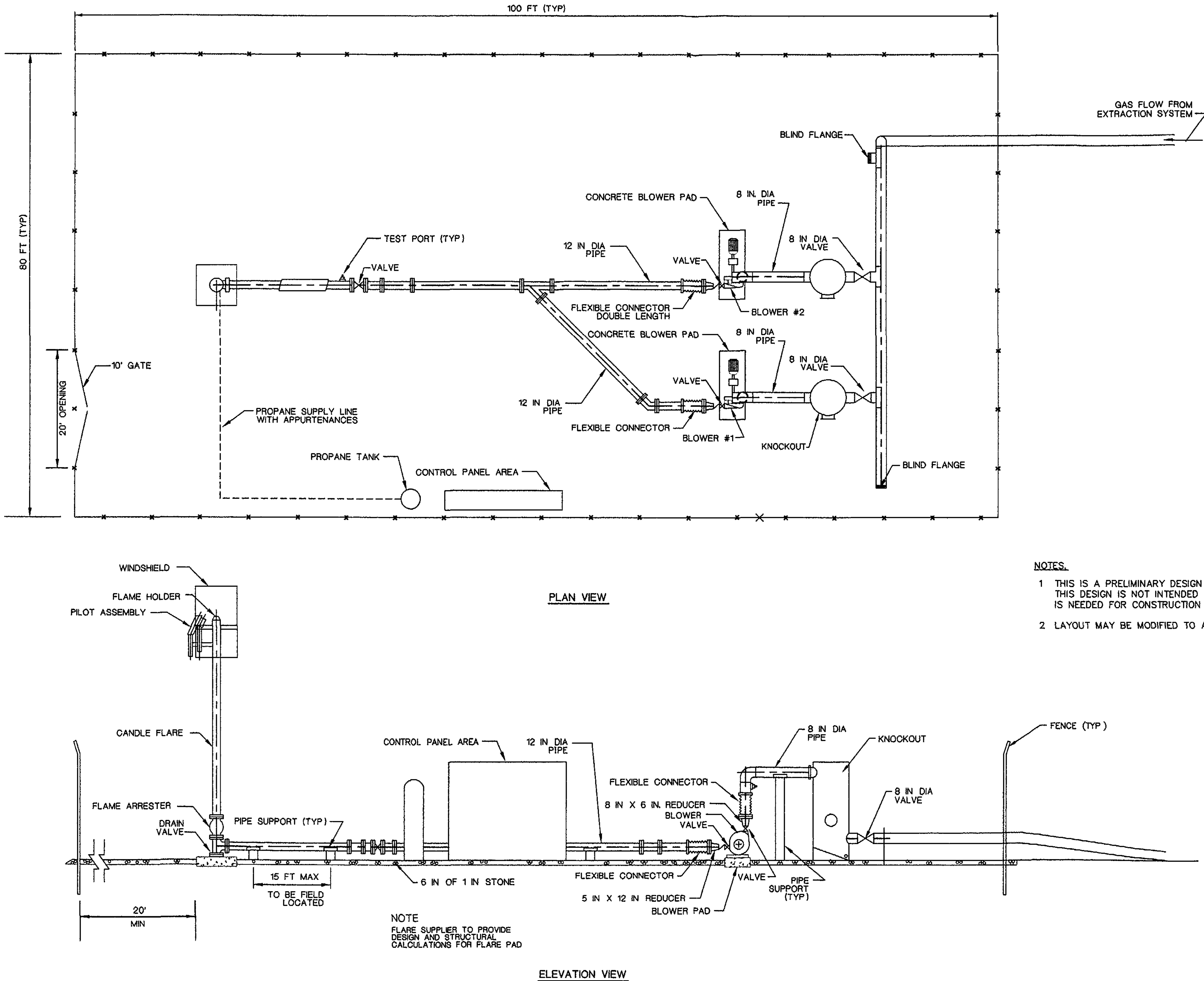

NOTES.

1. THIS IS A PRELIMINARY DESIGN AND IS INTENDED FOR PERMIT PURPOSES ONLY. THIS DESIGN IS NOT INTENDED FOR CONSTRUCTION. A MORE DETAILED DESIGN IS NEEDED FOR CONSTRUCTION
2. LAYOUT MAY BE MODIFIED TO ACCOMODATE FIELD CONDITIONS

NOTES

1. ALL PE PIPE SHALL BE SDR 17
2. ALL PVC PIPE SHALL BE SCHEDULE 80
3. ALL PIPE SIZES SHOWN ARE MINIMUMS

7/7 BLOWER/FLARE STATION DETAIL
NOT TO SCALE

STEVEN C. LAMB, CIVIL, No 14335, PROFESSIONAL ENGINEER, STATE OF NEVADA
4/5/01

NOT FOR CONSTRUCTION

SHEET TITLE: BLOWER FLARE SITE PLAN AND DETAIL
PROJECT TITLE: GAS COLLECTION AND CONTROL PLAN, SUNRISE MOUNTAIN LANDFILL

CLIENT: REPUBLIC SERVICES OF SOUTHERN NEVADA
770 EAST SAHARA AVENUE
LAS VEGAS, NV 89104
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PROJ NO. 99007 01-T17 | DWN BY TSS | Q/A RVW BY SBS
DSN BY TJS | CHK BY DJM | APP BY SCL

CADD FILE: GCCS_DWG7
DATE: MARCH 2001
SCALE: AS SHOWN
DRAWING NO: 7 of 7

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APPENDIX B

CALCULATIONS

TABLE 1. PROJECTED LFG AND NMOC GENERATION RATES
SUNRISE MOUNTAIN LANDFILL, LAS VEGAS, NEVADA

Year	Disposal Rate (tons/yr)	Refuse In-Place (tons)	Disposal Rate (Mg/yr)	Refuse In-Place (Mg)	Methane Generation Rates (m^3/yr)	LFG Generation Rates (cfm)	NMOC Generation Rates (tons/yr)	NMOC Generation Rates (Mg/yr)
1951	146,000	0	132,449	0	0.000E+00	0	0	0
1952	146,000	146,000	132,449	132,449	2.649E+05	36	1	1
1953	146,000	292,000	132,449	264,898	5.246E+05	70	2	2
1954	146,000	438,000	132,449	397,347	7.791E+05	105	4	3
1955	146,000	584,000	132,449	529,796	1.029E+06	138	5	4
1956	146,000	730,000	132,449	662,245	1.273E+06	171	6	5
1957	146,000	876,000	132,449	794,694	1.513E+06	203	7	6
1958	146,000	1,022,000	132,449	927,143	1.748E+06	235	8	7
1959	146,000	1,168,000	132,449	1,059,592	1.978E+06	266	9	8
1960	146,000	1,314,000	132,449	1,192,041	2.204E+06	296	10	9
1961	266,450	1,460,000	241,719	1,324,490	2.425E+06	326	11	10
1962	266,450	1,726,450	241,719	1,566,209	2.860E+06	384	13	12
1963	266,450	1,992,900	241,719	1,807,928	3.287E+06	442	15	14
1964	266,450	2,259,350	241,719	2,049,648	3.706E+06	498	17	16
1965	266,450	2,525,800	241,719	2,291,367	4.116E+06	553	19	18
1966	266,450	2,792,250	241,719	2,533,087	4.518E+06	607	21	19
1967	266,450	3,058,700	241,719	2,774,806	4.912E+06	660	23	21
1968	266,450	3,325,150	241,719	3,016,525	5.298E+06	712	25	23
1969	266,450	3,591,600	241,719	3,258,245	5.676E+06	763	27	24
1970	266,450	3,858,050	241,719	3,499,964	6.047E+06	813	28	26
1971	386,900	4,124,500	350,990	3,741,683	6.411E+06	862	30	27
1972	386,900	4,511,400	350,990	4,092,673	6.986E+06	939	33	30
1973	386,900	4,898,300	350,990	4,443,663	7.550E+06	1,015	36	32
1974	386,900	5,285,200	350,990	4,794,653	8.102E+06	1,089	38	35
1975	386,900	5,672,100	350,990	5,145,643	8.644E+06	1,162	41	37
1976	386,900	6,059,000	350,990	5,496,632	9.175E+06	1,233	43	39
1977	386,900	6,445,900	350,990	5,847,622	9.695E+06	1,303	46	41
1978	386,900	6,832,800	350,990	6,198,612	1.020E+07	1,371	48	44
1979	386,900	7,219,700	350,990	6,549,602	1.070E+07	1,438	50	46
1980	386,900	7,606,600	350,990	6,900,592	1.119E+07	1,504	53	48
1981	507,350	7,993,500	460,260	7,251,581	1.168E+07	1,569	55	50
1982	507,350	8,500,850	460,260	7,711,841	1.236E+07	1,662	58	53
1983	507,350	9,008,200	460,260	8,172,102	1.304E+07	1,752	61	56
1984	507,350	9,515,550	460,260	8,632,362	1.370E+07	1,841	64	58
1985	507,350	10,022,900	460,260	9,092,622	1.435E+07	1,929	67	61
1986	624,000	10,530,250	566,083	9,552,882	1.499E+07	2,014	70	64
1987	788,400	11,154,250	715,224	10,118,965	1.582E+07	2,126	74	68
1988	952,650	11,942,650	864,230	10,834,190	1.694E+07	2,276	80	72
1989	1,116,900	12,895,300	1,013,235	11,698,419	1.833E+07	2,464	86	78
1990	1,277,500	14,012,200	1,158,929	12,711,654	2.000E+07	2,687	94	85
1991	1,250,000	15,289,700	1,133,981	13,870,583	2.192E+07	2,945	103	94
1992	1,250,000	16,539,700	1,133,981	15,004,564	2.375E+07	3,192	112	101
1993	1,042,000	17,789,700	945,287	16,138,545	2.555E+07	3,433	120	109
1994	0	18,831,700	0	17,083,831	2.694E+07	3,619	127	115
1995	0	18,831,700	0	17,083,831	2.640E+07	3,548	124	113
1996	0	18,831,700	0	17,083,831	2.588E+07	3,478	122	110
1997	0	18,831,700	0	17,083,831	2.537E+07	3,409	119	108
1998	0	18,831,700	0	17,083,831	2.486E+07	3,341	117	106
1999	0	18,831,700	0	17,083,831	2.437E+07	3,275	115	104
2000	0	18,831,700	0	17,083,831	2.389E+07	3,210	112	102
2001	0	18,831,700	0	17,083,831	2.342E+07	3,147	110	100
2002	0	18,831,700	0	17,083,831	2.295E+07	3,084	108	98
2003	0	18,831,700	0	17,083,831	2.250E+07	3,023	106	96
2004	0	18,831,700	0	17,083,831	2.205E+07	2,963	104	94
2005	0	18,831,700	0	17,083,831	2.162E+07	2,905	102	92
2006	0	18,831,700	0	17,083,831	2.119E+07	2,847	100	90
2007	0	18,831,700	0	17,083,831	2.077E+07	2,791	98	89
2008	0	18,831,700	0	17,083,831	2.036E+07	2,736	96	87
2009	0	18,831,700	0	17,083,831	1.995E+07	2,681	94	85
2010	0	18,831,700	0	17,083,831	1.956E+07	2,628	92	83
2011	0	18,831,700	0	17,083,831	1.917E+07	2,576	90	82

ESTIMATED NMOC CONCENTRATION IN LFG: 595 ppmv
ASSUMED METHANE CONTENT OF LFG: 50%
SELECTED DECAY RATE CONSTANT: 0.02
SELECTED ULTIMATE METHANE RECOVERY RATE: 3,203.7 ft3/ton
METRIC EQUIVALENT: 100 cu m/Mg

Conversions: **35.314667 cu ft per cu m**
1.1023113 ton per Mg
32.037 cu ft/ton per cu m/Mg

3/14/01

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ENVIRONMENTAL CONSULTANTS

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PHOENIX, AZ 85008-1583
602 840-2596
FAX 602 224-0572

JOB

SHEET NO. OF SCALE

CALCULATED BY DATE

CHECKED BY DATE

CONDENSATE PRODUCTION ANALYSIS

SCS ENGINEERS

ENVIRONMENTAL CONSULTANTS

2702 NORTH 44TH STREET
SUITE 105B
PHOENIX, AZ 85008-1583
602 840-2596
FAX 602 224-0572

JOB SUNRISE MT LANDFILL GCCS

SHEET NO. 1 OF 3 SCALE

CALCULATED BY SCL DATE 4/4/01

CHECKED BY DH DATE 4/5/01

OBJECTIVE

ESTIMATE CONDENSATE PRODUCTION AT SUNRISE MT. LANDFILL

ASSUMPTIONS / GIVENS

- LFG WILL BE 100% SATURATED
- TEMPERATURE OF LFG IN LANDFILL = 100°F
- TEMPERATURE OF LFG IN HEADER = 40°F (at night)
- WEIGHT OF WATER AT 100°F = 19.766 grains / CF (see sheet 3)
- WEIGHT OF WATER AT 40°F = 2.749 grains / CF (see sheet 3)
- 1 lb = 7000 grains

PROCEDURE

WEIGHT OF WATER IN LFG

$$W_{WATER} = 19.766 - 2.749 = 17.017 \text{ grains / CF}$$

$$\text{CONDENSATE PER MMcf} = 17.017 \frac{\text{grains}}{\text{CF}} \times \frac{1 \text{ lb}}{7000 \text{ grains}} \times \frac{1 \text{ gal}}{8.34 \text{ lb}} \times 10^6$$

$$= 291.49 \text{ gal/MMcf}$$

SAY 290 gal/MMcf

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$$Q_{LFG} = 2{,}400 \frac{ft^3}{min} \times 60 \frac{min}{hr} \times \frac{24 hr}{day} = 3{,}456{,}000\ ft^3/day$$

$$= 3.456\ MMcf/day$$

CONDENSATE PRODUCTION: $C = 290 \frac{gal}{MMcf} \times 3.456 \frac{MMcf}{day}$

$$= 1002\ gal/day$$

SIZE CONDENSATE SUMPS

- ASSUME 80% IS COLLECTED BY CONDENSATE TRAPS
- AVAILABE FOR SUMPS = 20% OR 200 gal/day
- ASSUME NORTH SYSTEM SUMP GETS 100 gal/day &
  SOUTH SYSTEM SUMP GETS 100 gal/day

MINIMUM SUMP SIZE SHOULD CONTAIN AT LEAST 1 WEEK'S VOLUME OR 700 gallons.

3/3

SEAMLESS-STEEL STEAM, AIR, GAS,

:ation A53-33)

...verse area, sq in.		Length of pipe, ft per sq ft		Length of pipe containing 1 cu ft
...nal	Metal	External surface	Internal surface	
0.057	[illegible].072	5.451	[illegible].199	2,523.773
0.104	[illegible]	7.073	[illegible]0.453	1,383.753
0.151	[illegible]	5.688	7.748	754.380
0.304	[illegible]	4.547	6.141	473.000
0.532	[illegible]	2.637	4.635	270.034
0.864	0.494	2.90[illegible]	3.641	166.618
1.495	0.669	[illegible]	2.760	96.275
2.058	0.799	[illegible]	2.372	70.733
3.358	1.075	[illegible]	1.847	42.913
4.788	1.704	[illegible]	1.347	30.077
7.393	2.228	1.091	1.245	19.479
[illegible]	2.580	0.954	1.076	14.365
[illegible].730	3.174	0.848	0.948	11.312
[illegible].088	4.300	0.686	[illegible].780	7.198
[illegible].851	5.5[illegible]	0.576	0.625	4.984
[illegible]1.181	7.[illegible]	0.443	0.4[illegible]	2.815
[illegible]0.027	[illegible]	0.442	0.47[illegible]	2.070
[illegible].038	[illegible]	0.388	0.38[illegible]	1.828
[illegible].097	[illegible].579	0.299	0.318	1.273
[illegible]	[illegible].082	0.272	0.288	1.044
[illegible].485	17.230	0.254	0.268	0.903
[illegible].454	18.400	0.238	0.250	0.780
[illegible].470	20.584	0.224	0.235	0.697
[illegible]	22.603	0.212	0.222	0.621
[illegible]	25.173	0.191	0.199	0.498

TABLE 10.36. WEIGHT OF WATER VAPOR IN ONE CUBIC FOOT OF AIR AT VARIOUS TEMPERATURES AND PERCENTAGES OF SATURATION

Temperature, deg F	Per cent saturation									
	10	20	30	40	50	60	70	80	90	100
	Weight, grains									
−10	0.028	0.057	0.086	0.114	0.142	[illegible]	0.200	0.228	0.256	0.285
0	0.048	0.096	0.144	0.192	0.240	[illegible]	0.337	0.385	0.433	0.481
10	0.078	0.155	0.233	0.210	0.388	[illegible]	0.543	0.621	0.698	0.776
20	0.124	0.247	0.370	0.494	0.618	[illegible]	0.864	0.988	1.112	1.235
30	0.194	0.387	0.580	0.774	0.968	[illegible]	1.354	1.548	1.742	1.935
32	0.211	0.422	0.634	0.845	1.056	[illegible]	1.479	1.690	1.902	2.113
35	0.237	0.473	0.710	0.947	1.183	[illegible]	1.656	1.893	2.129	2.366
40	0.285	0.570	0.855	1.140	1.424	[illegible]	1.994	2.279	2.564	2.749
45	0.341	0.683	1.024	1.366	1.707	[illegible]	2.390	2.731	3.073	3.414
50	0.408	0.815	1.223	1.630	2.038	[illegible]	2.853	3.261	3.668	4.076
55	0.485	0.970	1.455	1.940	2.424	[illegible]	3.394	3.879	4.364	4.849
60	0.574	1.149	1.724	2.298	2.872	[illegible]	4.022	4.596	5.170	5.745
62	0.614	1.228	1.843	2.457	3.071	[illegible]	4.299	4.914	5.528	6.142
64	0.656	1.313	1.969	2.625	3.282	[illegible]	4.594	5.250	5.907	6.563
66	0.701	1.402	2.103	2.804	3.504	[illegible]	4.906	5.607	6.208	7.009
68	0.748	1.496	2.244	2.992	3.740	[illegible]	5.236	5.974	7.732	7.480
70	0.798	1.596	2.394	3.192	3.990	[illegible]	5.586	6.384	7.182	7.980
72	0.851	1.702	2.552	3.403	4.254	[illegible]	5.956	6.806	7.657	8.508
74	0.907	1.813	2.720	3.626	4.553	[illegible]	6.346	7.523	8.159	9.066
76	0.966	1.931	2.896	3.862	4.828	[illegible]	6.758	7.724	8.690	9.655
78	1.028	2.055	3.083	4.111	5.138	[illegible]	7.194	8.222	9.249	10.277
80	1.093	2.187	3.280	4.374	5.467	[illegible]	7.654	8.747	9.841	10.934
82	1.163	2.325	3.488	4.650	5.813	[illegible]	8.138	9.301	10.463	11.626
84	1.236	2.471	3.707	4.942	6.178	[illegible]	8.649	9.885	11.120	12.356
86	1.313	2.625	3.938	5.251	6.564	[illegible]	9.189	10.502	11.814	13.127
88	1.394	2.787	4.181	5.575	6.968	[illegible]	9.576	11.150	12.543	13.937
90	1.479	2.958	4.437	5.916	7.395	[illegible]	10.353	11.832	13.311	14.790
92	1.569	3.138	4.707	7.276	7.844	[illegible]	10.982	12.551	13.120	14.790
94	1.663	3.327	4.990	6.654	8.317	[illegible]	11.644	13.307	14.971	15.689
96	1.763	3.525	5.288	7.050	8.813	[illegible]	12.338	14.101	15.863	17.626
98	1.867	3.734	5.601	7.468	9.336	[illegible]	13.070	14.937	16.804	18.671
100	1.977	3.953	5.930	7.906	9.883	[illegible]	13.836	15.813	17.789	19.766

To STEVE LAMB

FROM SHASHI

LB.

SCS ENGINEERS

ENVIRONMENTAL CONSULTANTS

2702 NORTH 44TH STREET
SUITE 105B
PHOENIX, AZ 85008-1583
602 840-2596
FAX 602 224-0572

JOB ______

SHEET NO. ______ OF ______ SCALE ______

CALCULATED BY ______ DATE ______

CHECKED BY ______ DATE ______

LFG BLOWER SIZE

ANALYSIS

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JOB 10900701
SHEET NO. 1 OF 2 SCALE
CALCULATED BY TJS DATE 3/14/2001
CHECKED BY DM DATE 4/5/2001

SUNRISE MOUNTAIN LANDFILL, LAS VEGAS, NEVADA

BLOWER SIZING:

MAXIMUM LFG GENERATION RATE (IN 2002) = 3,084 cfm

SIZE BLOWERS TO HANDLE 75% OF MAX. LFG GEN. (ASSUMING 75% COLLECTION:
(0.75)(3084 cfm) = 2400 cfm

INSTALL 2 BLOWERS AT 1500 CFM EACH

ASSUME HEADLOSS REQUIREMENTS OF 50"-W.C. (ACTUAL HEADLOSS REQUIREMENTS WILL BE CALCULATED DURING FINAL DESIGN AS PIPE SIZES ARE FINALIZED).

BTU LOADING ON LFG FLARE

REQ'D: COMPARE EXPECTED LFG/BTU FLOWS TO DETERMINE FLARE CAPACITY DESIGN

GIVEN: ASSUMED 50% CH4
PEAK GENERATED LFG FLOW = 4.44 MMcfd
LET LFG @ 50% METHANE = 500 Btu
TYPICAL FLARE TURNDOWN RATIO OF 5:1

SOL'N: MAX. FLARE CAP. REQ'D
$(0.75) \times 4.44 \times 10^6$ FT^3/D ≅ 2400 cfm, however, size for full generation to match blowers
3084 cfm × 60 MIN/HR × 50 FT^3 CH4/100 FT^3 LFG × 1000 Btu/FT^3 CH4 = 92.5 MMBtu/HR.

MAX. FLARE CAP. REQ'D = 92.5 MMBtu/HR

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JOB 10 9900701
SHEET NO. 2 OF 2 SCALE
CALCULATED BY TJS DATE 3/14/01
CHECKED BY DM DATE 4/5/2001

FLARE CAP CON'T'D

IF TYPICAL TURNDOWN RATIO OF 5:1, THEN

$\frac{92.5}{5}$ = 18.5 MMBtu/HR → TRANSFORM TO CFM LFG USING LOW HEAT VALUE

18.5×10^6 Btu/HR × 1 FT³ CH4/1000 Btu × 100 FT³ LFG/45 FT³ CH4 × 1 HR/60 MIN = 685 CFM LFG (COLLECTED)

∴ FLARE DESIGNED TO HANDLE 92.5 MMBtu/HR AND WITHSTAND A TURNDOWN RATIO OF 5:1 MAY STILL OPERATE AT LFG FLOW (45% CH4) OF 685 CFM.

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JOB ____

SHEET NO. ____ OF ____ SCALE ____

CALCULATED BY ____ DATE ____

CHECKED BY ____ DATE ____

PIPE SIZING

ANALYSIS

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JOB: SUNRISE GCCS PLAN
 SCALE
CALCULATED BY: SCL DATE: 4/3/01
CHECKED BY: QM DATE: 4/5/01

OBJECTIVE

DETERMINE PIPE SIZE FOR HEADER
AND LATERAL PIPES

PROCEDURE

USE MUELLER EQ (SEE ATTACHED PRINTOUTS)

GIVENS / ASSUMPTIONS

BLOWER VACUUM AT INLET = 50" W.C (MINIMUM)

VACUUM AT LAST WELL HEAD AT LEAST 10" W.C

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JOB
SHEET NO. 2 OF 6 SCALE
CALCULATED BY SCL DATE 4/3/01
CHECKED BY DM DATE 4/5/01

NORTH SYSTEM

Header Pipe (assume takes ½ of overall blower capacity)

L = 4200
Q = 1500 scfm = 90,000 scfh

Starting Pressure at blower = 50" w.c
IF D = 14", ending pressure is 44.14" w.c

Lateral (wells 7-11)

L = 1900'
Q = 5 wells @ 35 cfm/well = 175 scfm = 10,500 scfh

Starting pressure @ 44"
If D = 4", ending pressure is 20" w.c. > 10" w.c

∴ USE 14" FOR Header Pipe

USE 4" FOR LATERALS (MAY SIZE UP TO 6")

ACTUAL SIZE OF PIPE TO BE DETERMINED DURING FINAL DESIGN

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CALCULATED BY SCL DATE 4/3/01
CHECKED BY DU DATE 4/5/01

SOUTH SYSTEM

Header Pipe (assume this header takes other half of blower capacity)

L = 4200'
Q = 90,000 scfh

Starting pressure = 50" WC
IF D = 14" ending pressure = 44" WC

Laterals

Typical lateral has 6-8 wells, Use 8 wells

Q = 8 * 35 cfm/well = 280 scfm = 16,800 scfh
L = 2000' +/-
Starting pressure at 44" W.C.
if D = 6", ending pressure at 35" W.C > 10" W.C.

∴ USE 14" FOR Header Pipe

USE 6" FOR LATERALS, USE 4" FOR SINGLE WELL LATERALS

ACTUAL SIZE OF PIPE TO BE DETERMINED DURING FINAL DESIGN

LOW PRESSURE MUELLER

4/6

Chevron Plexco®

(708) 350-3700

(630 Area Code After 7/96)

$$Qh = \frac{2971\ d^{2.725}}{Sg^{0.425}} \left[\frac{h1 - h2}{L} \right]^{0.575}$$

EQUATION 41, PAGE 22

The information contained herein cannot be guaranteed because the conditions of use are beyond our control. This document should not be substituted for the judgement of a professional engineer in determining the suitability of any pipe for a given project as the methodology herein may not accurately represent the site conditions or be inclusive of all parameters that must be considered. The user of this information assumes all risk associated with its use.

ENTER THE KNOWN VALUES IN THE BOXES BELOW.

Qh = Flow Rate =	90000	scfh
Sg = Specific Gravity =	1	
h1 = Inlet Pressure =	50	in H20
h2 = Outlet Pressure =	44.14	in H20
L = PLEXCO Pipe Length =	4200	ft
d = Inside Diameter =	14	in

NOTE: PRESSURES ARE IN INCHES OF WATER

LOW PRESSURE MUELLER

Chevron Plexco®

(708) 350-3700

(630 Area Code After 7/96)

$$Qh = \frac{2971\, d^{2.725}}{Sg^{0.425}} \left[\frac{h1 - h2}{L} \right]^{0.575}$$

EQUATION 41, PAGE 22

The information contained herein cannot be guaranteed because the conditions of use are beyond our control. This document should not be substituted for the judgement of a professional engineer in determining the suitability of any pipe for a given project as the methodology herein may not accurately represent the site conditions or be inclusive of all parameters that must be considered. The user of this information assumes all risk associated with its use.

ENTER THE KNOWN VALUES IN THE BOXES BELOW.

Qh = Flow Rate =	10500	scfh
Sg = Specific Gravity =	1	
h1 = Inlet Pressure =	44	in H20
h2 = Outlet Pressure =	20.06	in H20
L = PLEXCO Pipe Length =	1900	ft
d = Inside Diameter =	4	in

NOTE: PRESSURES ARE IN INCHES OF WATER

PLEXCALC - Version 1.11

5/6

6/6

LOW PRESSURE MUELLER

Chevron Plexco®

(708) 350-3700

(630 Area Code After 7/96)

$$Qh = \frac{2971\, d^{2.725}}{Sg^{0.425}} \left[\frac{h1 - h2}{L} \right]^{0.575}$$

EQUATION 41, PAGE 22

ENTER THE KNOWN VALUES IN THE BOXES BELOW.

Qh = Flow Rate =	16800	scfh
Sg = Specific Gravity =	1	
h1 = Inlet Pressure =	44	in H2O
h2 = Outlet Pressure =	35.65	in H2O
L = PLEXCO Pipe Length =	2000	ft
d = Inside Diameter =	6	in

NOTE: PRESSURES ARE IN INCHES OF WATER