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SCS ENGINEERS

July 27, 2012
File No. 01210155.00 / Task 8A

Mr. Luis Rivera
Assistant Executive Officer
California Regional Water Quality Control Board
North Coast Region
5550 Skylane Blvd., Suite A
Santa Rosa, California 95403

Subject: **Amended Joint Technical Document (2nd Revision July 27, 2012), Central Disposal Site, Sonoma County, California**

Dear Mr. Rivera:

On behalf of the Sonoma County Department of Transportation and Public Works (County) and Keller Canyon Landfill Inc., this letter and accompanying documents are submitted by SCS Engineers in support of the County's application for revised Waste Discharge Requirements (WDRs) for the subject landfill site. Enclosed are the following:

- Amended Joint Technical Document (JTD, 2nd Revision) prepared by SCS Engineers and dated July 27, 2012. Four printed hard copies and a computer disc with electronic files of the JTD report text, figures and technical appendices are provided.
- Supporting California Environmental Quality Act (CEQA) documents:
    - Addendum to the Sonoma County Disposal Site Improvement Program, Final Environmental Impact Report (SCH# 1995073068), for the Reopening of the Central Disposal Site, dated May 25, 2012.
    - Notice of Determination for reopening of the Central Disposal Site, dated June 13, 2012.

The County's application for revised WDRs is on file with your office and was confirmed as received on June 2, 2011.

This 2nd Revision of the JTD addresses North Coast Regional Water Quality Control Board (RWQCB) requirements for design of environmental protection features in areas of proposed future waste placement, as outlined in correspondence between the County and your agency dated April 13 and April 20, 2012. An updated water quality sampling and analysis plan is also provided the JTD in response to RWQCB technical comments on earlier submittals. The 2nd Revision of the JTD also incorporates responses to all comments provided by CalRecycle and the

Sonoma County Environmental Health Department based on those agencies' review of the March 2011 and November 2011 JTD submittals.

Revised engineering plans and specification for construction of new waste cells at Landfill 2 within the Central Disposal Site (designated as Phases III and IV), dated July 2012 have been submitted to your office under separate cover. These revised plans and specifications have been prepared in accordance with the siting and design criteria presented in the attached JTD, and reflect your agency's requirements for base liner design and groundwater separation features.

Additional information in support of the WDR application was provided to your office in separate submittals dated June 1, September 30, and December 22, 2011.

With the enclosed and previous submittals, we trust your agency has all necessary information to complete your review of the permit application.

Please contact Ms. Susan Klassen of the County (707-565-2440) or either of the undersigned (925-426-0080) if you have any questions.

Very truly yours,

Ambrose A. McCready, P.E.
Senior Technical Manager/Vice President
SCS ENGINEERS

Joseph J. Miller, P.E.
Project Director / Vice President
SCS ENGINEERS

Copies:
Susan Klassen, Sonoma County Department of Transportation and Public Works
Trish Pisenti, Sonoma County Department of Transportation and Public Works
Lochlin Caffey, Keller Canyon Landfill Company, Inc.
Leslye Choate, Sonoma County Department of Health Services
Nevin Yeates, CalRecycle
Matt St. John, Executive Officer, North Coast RWQCB (cover letter only)
David Leland, Supervising Water Resources Control Engineer, North Coast RWQCB (cover letter only)

SCS ENGINEERS

Amended Joint Technical Document
Central Disposal Site
Sonoma County, California

Prepared for:

Keller Canyon Landfill Company Inc.
901 Bailey Road
Pittsburg, California 94565

Prepared on behalf of:

County of Sonoma Department of Transportation and Public Works

Prepared by:

SCS ENGINEERS
6601 Koll Center Parkway, Suite 140
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(925) 426-0080

March 30, 2011
Revised November 15, 2011
2nd Revision July 27, 2012
File No. 01210155.00

CERTIFICATION

This report entitled "Amended Joint Technical Document, Central Disposal Site, Sonoma County California", 2nd Revision dated July 27, 2012 was prepared under direct supervision of the undersigned in accordance with California Code of Regulations Title 27 Sections 21585 and 21590.

The undersigned hereby certify that the Amended Joint Technical Document submitted herein is to the best of our knowledge true, accurate and complete.

REGISTERED PROFESSIONAL ENGINEER
JOSEPH J. MILLER
C 042598
Exp. 3/31/14
CIVIL
STATE OF CALIFORNIA

July 27, 2012

Date

Joseph J. Miller, P.E., Project Director
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July 27, 2012

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LIST OF ACRONYMS AND ABBREVIATIONS

ADC	Alternative Daily Cover
AQMD	Bay Area Air Quality Management District
CCL	Compacted Clay Liner
CCR	California Code of Regulation
C&DD	Construction and Demolition Debris
CDS	Central Disposal Site
CEQA	California Environmental Quality Act
cfd	cubic feet per day
CFR	Code of Federal Regulations
CHP	California Highway Patrol
CNG	Compressed natural gas
COCs	Constituents of Concern
County	County of Sonoma
CQA	Construction Quality Assurance
CPP	Corrugated Plastic Pipe
CMP	Corrugated Metal Pipe
cu yd	cubic yard
DAF	Dilution Attenuation Factor
EAD	Engineered Alternative Design
EIR	Environmental Impact Report
EMCAP	Environmental Monitoring and Corrective Action Plan
ERP	Emergency Response Plan
FAA	Federal Aviation Administration
FCPMPs	Final Closure and Postclosure Maintenance Plans
ft	Feet
ft^3	Cubic Foot
GCL	Geosynthetic Clay Liner
HDPE	High Density Polyethylene
HELP	Hydrologic Evaluation of Landfill Performance
JTD	Joint Technical Document
LCRS	Leachate Collection and Removal System
LEA	Local Enforcement Agency
LEL	Lower Explosive Limit
LF-1	1971-Permitted Landfill at Central Disposal Site
LF-2	East Canyon Expansion at Central Disposal Site
LFG	Landfill Gas
LFGTE	Landfill Gas-to-Energy
MND	Mitigated Negative Declaration
MRP	Monitoring and Reporting Program
MPE	Maximum Probable Earthquake
msl	Mean Sea Level
MSW	Municipal Solid Waste
MW	Megawatt

LIST OF ACRONYMS AND ABBREVIATIONS (cont'd)

NMOC	Non-Methane Organic Compound
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
PCP	Preliminary Closure Plan
PGF	Power Generation Facility
PHGA	Peak Horizontal Ground Acceleration
POC	Point of Compliance
PPMP	Preliminary Postclosure Maintenance Plan
ppmv	Parts per million by volume
RCRA	Resource Conservation and Recovery Act
RDSI	Report of Disposal Site Information
REA	Rock Extraction Area
RWQCB	California Regional Water Quality Control Board, North Coast Region
SCFM	Standard cubic feet per minute
SWFP	Solid Waste Facility Permit
SWPPP	Storm-Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
tpd	Tons per day
tpd_6	Tons per day, 6-day per week operation
tpy	Tons per year
T/TF	Tipping Facility/Transfer Facility
USEPA	United States Environmental Protection Agency
WDID	Waste Discharge Identification Number
WDRs	Waste Discharge Requirements
WQPS	Water Quality Protection Standards
WMU	Waste Management Unit

1.0 INTRODUCTION

1.1 GENERAL

This Amended Joint Technical Document (JTD) has been prepared in support of regulatory agency requirements for re-permitting the Central Disposal Site (CDS), an existing Class III Municipal Solid Waste (MSW) landfill located in Sonoma County, California. The Central Disposal Site is owned by the Sonoma County Department of Transportation and Public Works (County) and has been in operation since 1971. MSW disposal operations at the Central Disposal Site were temporarily suspended over the period October 2005 through August 2010, during which time the County and other jurisdictions in Sonoma County utilized alternate landfill sites to meet their disposal needs. In September 2010, the County resumed MSW disposal operations within previously-constructed, lined waste management units.

The County proposes to construct new waste cells within the currently-permitted refuse disposal boundary areas, continue MSW filling operations in accordance with all applicable regulatory and permit requirements including the daily tonnage limits specified in the existing Solid Waste Facility Permit (SWFP), and implement partial final closure over approximately 14.4 acres (plan area) over a fill slope known as the "South Face". The South Face is within a discrete waste management unit designated as Landfill 1 (LF-1). The County also proposes to make minor changes to the water quality monitoring program regulated under the existing Waste Discharge Requirements (WDRs). This JTD describes these proposed activities and other items specific to landfill design, operation, environmental monitoring and controls, and post-closure maintenance activities and was prepared as required by Title 27 of the California Code of Regulations (27 CCR).

1.2 PURPOSE AND SCOPE OF AMENDED JOINT TECHNICAL DOCUMENT

The purpose of this JTD is to provide the relevant information required by federal, state and local regulatory agencies with jurisdiction over waste disposal at the CDS.

This JTD has been prepared for submittal to CalRecycle, the California Regional Water Quality Control Board (RWQCB) North Coast Region, and the Sonoma County Department of Health Services, Environmental Health Division acting as the Local Enforcement Agency (LEA). This JTD is specifically intended to provide technical information required under 27 CCR for the RWQCB to issue revised WDRs for the landfill. This document may also be provided to other regulatory agencies in support of landfill permitting.

This version of the JTD, dated July 2012, incorporates responses to all comments provided by CalRecycle and the LEA based on those agencies' review of the March 2011 and November 2011 submittals. A new SWFP was issued by CalRecycle in January, 2012, and is supported by the November 2011 JTD submittal. The County has received CalRecycle and LEA concurrence allowing disposal in new cells within the previously-permitted landfill boundary following issuance of revised WDRs.

This JTD has specifically been prepared to satisfy the requirements contained in 27 CCR §21585, §21590, and §21710 et seq of Division 2 (Solid Waste) of 27 CCR (Environmental

Protection). California is an "approved" state under federal regulation 40 CFR 258 (commonly known as Subtitle D). That is, the state's regulatory program has been found by the United States Environmental Protection Agency (U.S. EPA) to be in conformance with 40 CFR 258. Therefore, satisfying the state regulations contained in 27 CCR automatically meets the federal regulations contained in 40 CFR 258. This version of the JTD, dated July 2012, also addresses RWQCB requirements for design of environmental protection features in areas of proposed future waste placement (Sonoma County, April 13, 2012; RWQCB April 20, 2012).

Provided herein is information on facility ownership, waste management unit classification and siting, waste acceptance classification and management, proposed waste management unit design and construction standards, operating criteria, waste handling provisions, and environmental controls. A Preliminary Closure and Post Closure Maintenance Plan for the final landfill configuration described herein, as required by 27 CCR §21769(b), is included in **Section 9** of this JTD.

A Partial Final Closure and Post Closure Maintenance Plan for the approximate 14.4 acre area within the South Face slope, as required by 27 CCR §21090, has been submitted in a companion document under separate cover (SCS, March 2011). This Partial Final Closure and Post Closure Maintenance Plan and supporting documentation have been determined by CalRecycle to meet the requirements of 27 CCR § 21860 and are considered approvable by that agency (CalRecycle, November 9, 2011). CalRecycle has recommended that this Plan be approved once all other agency conditions for formal approval are met.

As required in 27 CCR § 21590, a JTD Index cross-referencing CalRecycle requirements with the contents of this document are provided in ***Appendix A***. A similar index cross-referencing California State Water Resources Control Board (SWRCB) requirements for the JTD is also provided in ***Appendix A*** as required under 27 CCR §28585 and §20240 et seq. Lastly, a listing of federal Subtitle D siting, design and closure requirements addressed in this JTD is provided in ***Appendix A***. These indices are provided to aid the reviewer in establishing that all applicable requirements for the JTD have been addressed.

Note that there are other non-landfill facilities or operations within the larger County-owned CDS property associated with MSW management. They include a Household Toxics Facility, public MSW transfer station/processing facility (referenced herein as the Transfer/Processing Facility, or T/PF), recyclable materials/re-use drop-off area, clean fuel facility, landfill gas (LFG) to energy facility, and green waste compost operation. These facilities and activities are subject to separate operating permits and are not considered to be part this JTD. References herein to these non-landfill facilities and operations are for information purposes only.

1.3 SITE HISTORY AND CURRENT PERMIT STATUS

1.3.1 Site History

The Central Disposal Site property encompasses 398.5 acres, which includes two landfill areas: the existing LF-1 (also known as the 1971 Permitted Area), and the partially-constructed East Canyon Expansion Unit known as Landfill 2 (LF-2). MSW disposal operations at LF-1 took place over the period 1971 to August 2002. Refuse filling at LF-2 commenced in 2002 and it is the currently-active landfill area. The LF-1 footprint covers approximately 130 acres, approximately 110 acres of which have been filled. The LF-2 Area covers an additional 42.8 acres, approximately 20 acres of which have been constructed. Thus the total area available for disposal is approximately 172.8 acres. To date, approximately 130 acres have been used for MSW disposal.

LF-1 was filled down-canyon, from north to south, and consists of an upper and lower unit. The upper unit is the original 1971 landfill and the location of the current green/wood waste composting operations. The lower canyon of LF-1 was constructed in 1988, and designed with a clay-lined dendritic leachate collection and recovery system (LCRS). These barriers and liquid capture systems were state-of-the practice when installed (Shaw Environmental, 2005). However, LF-1 is considered an unlined, "existing" Class III landfill under current 27 CCR regulatory standards. With the exception of closure, LF-1 is exempt from current liner requirements (RWQCB, 2004). The County must comply with 27 CCR and federal Subtitle D requirements for monitoring and corrective action.

LF-2 was originally designed to have four main phases to complete the cell footprint. Phases I and II have been constructed and are being filled. These cells were constructed with engineered alternative composite base liner systems, which were approved by oversight agencies based on demonstration of performance criteria in current 27 CCR and federal Subtitle D regulations at LF-1.

1.3.2 Permits

The CDS operates under SWFP 49-AA-0001, issued by CalRecycle in January 2012. The SWFP allows waste receipt 6 days per week (Monday-Saturday), and a maximum disposal rate of 2,500 tons per day (tpd). The maximum permitted elevation specified in the SWFP is 565 feet above mean sea level (MSL).

The facility is also subject to WDR No. R1-2004-0040, issued by the RWQCB, for continued operation and corrective action related to contaminant releases first detected in 1995. (The County has since implemented various corrective actions, described in detail herein, to mitigate contaminant releases.) Per the WDRs, the total permitted area for refuse disposal at this time is within the currently-filled approximate 150 acre footprint area.

The CDS is also operated in accordance with the Major Facility Review Permit (Title V Operating Permit) for Facility #A2254, as administered by the Bay Area Air Quality Management District (AQMD). The Title V permit specifies requirements for operation of the landfill, landfill gas (LFG) collection and control system, and various on-site combustion devices with potential to affect air quality.

Various landfill leachate extraction and control systems are in place at the CDS, as described herein. Collected leachate is pumped via a force-main pipeline for discharge to the City of Santa Rosa Waste Water Treatment Plant (Subregional Wastewater Reclamation System). Discharge is in accordance with City of Santa Rosa Industrial Waste Discharge Permit No. SR-IW5202, and Waste Discharge Identification Number (WDID) 1SS011652 issued by the RWQCB.

A compilation of the above and other regulatory approvals for the CDS is provided in **Section 10** of this JTD.

The County proposes to construct new waste cells within the "Rock Extraction Area" (REA) of LF-1 and the unfilled area of LF-2 between LF-1 and LF-2, Phases I and II. Thus the waste footprint will be increased from the aggregate 130 acres to 172.8 acres (plan areas). The current SWFP allows filling over the entire 172.8-acre area contingent on revised WDRs allowing construction of new waste cells within that area.

Agency processes for issuance of new WDRs, including public participation requirements, will be as specified in 27 CCR §21720 and §21730.

2.0 GENERAL SITE INFORMATION

2.1 SITE LOCATION AND LEGAL DESRIPTION

The Central Disposal Site is located at 500 Mecham Road, in Petaluma. The site is bounded by Mecham Road to the east and Hammel Road to the south and is located at latitude 38 degrees, 18 minutes north and longitude 122 degrees, 45 minutes west (GeoSyntec, 2005). A vicinity map is provided in ***Figure 1***. A site location map is provided in ***Figure 2***. The CDS is located on APN-24-080-19, as identified in the Sonoma County Assessor's Map. A legal description of the permitted boundaries is provided in ***Appendix B***.

2.2 FACILITY OWNER/OPERATOR

27 CCR §21600(b)(1)(A)

The Central Disposal Site is owned by the County. The County is also the legal operator of record, as stated in the SWFP, and will continue to act in the capacity of owner/operator. The owner/operator's business address is as follows:

Sonoma County Department of Public Works and Transportation
2300 County Center Drive Suite B-100
Santa Rosa, California 95403
Telephone: 707-565-2231

From 1971 until October, 2005, the County was responsible for day-to-day landfill operations. Disposal operations were temporarily suspended over the period October 2005 through August 2010. Beginning in September, 2010, the County contracted for day-to-day disposal operations with Keller Canyon Landfill Company, Inc., a subsidiary of Republic Services, Inc. The initial term of the operations contract is two years. There are two 1-year extension options.

All MSW deliveries to the County's Mecham Road site, including refuse packer trucks, self-haul vehicles and commercial vehicles are first directed to the Tipping Facility/Transfer Facility. The T/PF lies within the permitted boundary of the CDS, but operates under a separate transfer/processing facility permit issued in January 2012

Waste received at the T/PF is pushed into 20-ton capacity, top-loading transfer trailers and then hauled to the active landfill area of the CDS. The T/PF, although physically separated from the landfill, serves as the tipping floor for the disposal site. There is no public unloading at the active landfill face. Waste is pushed by dozer to the working face, spread in lifts, and compacted using heavy equipment. The waste is covered with a minimum of six inches of compacted soil or approved alternate daily cover (ADC) at the end of each working day or more frequently to assure sound disposal practices.

The maximum combined throughput through the T/PF and landfill (i.e., through the front gate) is 2,500 tpd.

Further details on T/PF operation are provided in **Section 2.7** of this JTD. Additional information on waste handling including refuse unloading, spreading and compacting, inclement weather operations, and daily cover/ADC placement is provided in **Section 7.3** of this JTD. Details on disposal site controls are provided in **Section 8** of this JTD.

For an interim period of five years, during the permitting and construction of new waste cells, the T/PF will perform as both a transfer station and tipping facility and will operate under a temporary SWFP. The purpose of the temporary SWFP is to allow the existing tipping facility to act as a temporary transfer station for the outhaul of MSW from the Mecham Road facility should the County run out of available air space while procuring the required permits to allow for expansion of the existing adjacent landfill. At the end of five years, and on the anniversary of the 5-year permit review (January 2017), the County will surrender the SWFP for the transfer station and the facility will be fully incorporated into the landfill operation.

In the event that landfill and T/PF out-haul activities need to operate concurrently, the maximum site capacity will remain limited to 2,500 tpd with the T/PF activity limited to 1,500 tpd. Concurrent landfill and T/PF operations may only occur with prior LEA approval on a limited basis. Should concurrent operations be necessary on a long-term basis, as determined by the LEA, the County will be required to revise the Solid Waste Facility Permits.

2.3 SITE PLAN

27 CCR §21600(b)(1)(B)

2.3.1 Key Site Features

A site plan showing property boundaries, current topography and limits of fill placement, acreages, buffer areas and other key site features is shown in ***Figure 3***. A version of the same plan, modified to show both existing and proposed landfill MSW disposal units as interpreted by the RWQCB and SWRCB, is provided in ***Figure 3A***. The CDS property encompasses 398.5 acres. Per the conditions of SWFP 49-AA-0001, approximately 172.8 acres (plan area) will be allowed for MSW filling contingent on issuance of revised WDRs. To date, approximately 130 acres (plan area) have been used for MSW disposal. Both the permitted disposal area boundaries and previously filled disposal areas are shown on ***Figure 3*** and ***Figure 3A,*** respectively.

Site elevations range from approximately 220 to 675 ft MSL. Current landfill elevations range from approximately 250 to 540 ft MSL at LF-1, and 250 to 340 ft MSL at LF-2. The maximum permitted landfill elevation specified in the SWFP is 565 ft MSL.

Approximately 11.7 acres of what is known as the Rock Extraction Area lie within the existing permitted disposal area. The location of the REA is shown in ***Figure 3***. Under a lease agreement between the County and Stony Point Rock Quarry Inc., approximately 700,000 cubic yards of rock were removed from this area prior to December 2001. The rock, primarily fractured shale and sandstone, was processed and sold by Stony Point Quarry. Soil excavated from the REA was used for daily and intermediate cover at LF-1. The rock extraction project was considered an independent, stand-alone project from the landfill operations. The REA has not been used for MSW disposal as of this date. The County proposes to construct an engineered base liner and other containment features in the REA and utilize it for future MSW filling, as described herein.

On-site soils excavated during construction of LF-2, Phases I and II were placed in a stockpile area located to the west of LF-1. The location of the soil stockpile is shown in ***Figure 3***. Reportedly, as of October 2010, approximately 590,000 bank cubic yards of excavated soil material were placed in the stockpile area. These soil materials have suitable properties for use as engineered fill or for daily, intermediate and final cover construction.

Areas outside of the permitted fill boundary within the larger County-owned CDS property include other MSW management facilities (operating under separate permits), ancillary facilities including equipment maintenance and the County administrative buildings, or buffer areas. Other MSW management facilities shown on ***Figure 3*** include the public T/PF, the household toxics facility, recyclable materials/re-use drop-off area, clean fuel facility, and LFG to energy (LFGTE) facility. Under a separate lease agreement and permit, a green waste compost facility currently operates on the northern portion of LF-1. Additional information on these ancillary facilities is provided in **Section 2.7** below.

A permanent buffer zone, ranging in plan area width from 220 to 1,500 feet, is located on the northern and eastern sides of the Household Toxics Facility and recycling areas (GeoSyntec, 2005). Trees have been planted in these areas to provide visual screening of the northern part of the CDS property. The remaining areas of the buffer zone remain as native open grassland.

2.3.2 Pre-Disposal Topography

A site plan showing pre-disposal topography is presented in ***Figure 4***. This plan was prepared as part of a previous study using photogrammetric methods based on 1968 aerial photographs of the site (RMC GeoScience, 2002).

2.4 SUMMARY OF PROPOSED SITE DEVELOPMENT AND PARTIAL FINAL CLOSURE

The County proposes to construct new waste cells within the currently-permitted refuse disposal boundaries, continue refuse filling in areas where new base liners will be constructed and over wastes previously placed in LF-1 and LF-2, and implement partial final closure in the South Face area of LF-1. Major elements of the project proposed herein will entail:

- Installation of engineered base liners in previously unfilled floor areas within LF-2. This will be undertaken via two discrete construction phases, designated herein as Phases III and IV (to complement the previously constructed Phase I and II areas of LF-2). An engineered alternative to the Subtitle D / CCR Title 27 prescriptive standards for base liner construction is proposed, in accordance with 27 CCR §20080 and RWQCB requirements. The base liner system will consist of a full double-composite liner configuration with each liner composed of a geomembrane, low-permeability soil layer, and leachate/liquids collection layer.

- Installation of an engineered base liner in the previously unfilled floor of the Rock Extraction Area of LF-1. An engineered alternative to the Subtitle D / CCR Title 27 prescriptive standards is proposed, in accordance with 27 CCR §20080 and RWQCB requirements. The base liner system will consist of a full double-composite liner as described above for LF-2, Phases III-IV.

- Refuse filling in areas where new base liners will be constructed and over wastes previously placed in LF-1 and LF-2. A preferential pathway system is proposed for leachate control where MSW will be placed over existing fill in LF-1.

- Partial final closure of an approximate 14.4-acre plan area within the "South Face" of LF-1. This capital improvement project will be undertaken concurrent with construction of the next new waste cell in LF-2. A Partial Final Closure and Post-Closure Maintenance Plan has been prepared as a companion document to this JTD and has been submitted under separate cover (SCS, 2011).

- Proper abandonment/well destruction of groundwater monitoring wells and piezometers located in the footprint of proposed waste filling activities, and removal of these points from the Monitoring and Reporting Program (MRP) for the CDS. The County also proposes other modifications to the MRP to be more consistent with the statistical methods used to establish Water Quality Protection Standards (WQPS) for groundwater and surface water, as described herein. These modifications are also based on data trends over the last seven years of monitoring under the current MRP.

A site plan showing these landfill development and partial final closure areas is provided in ***Figure 3A*** and ***Figure 5***. All future MSW filling will be within the approximately 172.8-acre waste disposal area as identified in the existing SWFP. Lateral expansion beyond this footprint area is not contemplated at this time. Existing composting operations will be re-located to another location on the CDS property or to another property in advance of future filling in LF-1. At final grades, the maximum fill elevation would be 565 ft MSL, as specified in the SWFP.

Details on base liner and other environmental control system design, and future landfill phasing and grading plans are provided in **Section 5** of this JTD. The preliminary site development plans as proposed herein would provide approximately 9.0 million cubic yards airspace capacity. This remaining capacity estimate is as of May 15, 2012.

2.5 HOURS OF OPERATION

27 CCR §21600(b)(1)(C)

As specified in the existing SWFP (issued January 2012), the CDS is open to receive MSW deliveries Monday through Saturday, 7:00 a.m. until 3:00 p.m. Per the SWFP, County and contractor employees have access to the site to perform related operations work, including cell preparation, daily cover application, and environmental maintenance tasks between the hours of 6:00 a.m. and 6:30 p.m., 7 days per week. The hours of operation by contractors may be extended on an urgent or emergency basis with the approval of the LEA. Rock blasting operations for new cell excavation are allowed between the hours of 4:30 p.m. and 5:30 p.m. on weekdays, excluding holidays.

2.6 SITE SECURITY AND ACCESS

27 CCR §21600(b)(5)(B), §20520 and §20530

The regulations require landfill owner/operators to discourage unauthorized access by persons or vehicles. The CDS has public and non-public access points at Mecham and Hammel Roads, respectively. The gated, main public site entrance is at Mecham Road (***Figures 3*** and ***3A***). From the main entrance, a paved access road leads to the County administrative office and the T/PF entrance. All waste delivery vehicles, including self-haul, packer trucks, roll-offs and commercial vehicles are directed via signs to the T/PF for MSW tipping, recyclable materials or household toxics drop-off via this main access road. The public and all waste delivery vehicles exit the T/PF and the site via the same paved access road.

Currently, access to the CDS active disposal areas is restricted to open top transfer truck/trailers only, which originate from the Central T/PF (see below) or other in-County transfer stations. The general public and commercial vehicles do not have access to active landfill MSW disposal areas.

A gravel surface road provides site access for utility and service vehicles from Hammel Road. A third gated entrance, located on Hammel Road west of the leachate ponds, was constructed in 1998 to provide access to the Rock Extraction Area (then used as a quarry). A fourth entrance on Hammel Road near Mecham Road provides utility and service vehicle access to LF-2.

Easily visible signs placed at the site entrance identify the site name, owner and operator, which materials are and are not accepted, hours of operation, and general health and safety information. This signage is consistent with requirements in 27 CCR §20520. Internal signs direct customers to the appropriate MSW management facilities including the T/PF, recycling areas, household toxics drop-off area, or the green waste compost area.

All public ingress and egress to the T/PF are via the paved access road as described above. Internal haul roads leading to the green waste compost area (which currently overlies an inactive portion of LF-1) have gravel surfacing. Use of paved or gravel roads minimizes the generation of dust and tracking of materials onto Mecham Road and Hammel Road and is consistent with 27 CCR §20540 requirements.

No changes to the above site security, access and traffic and circulation policies are proposed at this time.

2.7 ANCILLARY FACILITIES AND PERMITS

27 CCR §21600(b)(3)(F)

Ancillary facilities related to MSW disposal operations at the CDS include the County administrative office, an equipment maintenance building, surface water sedimentation basins, lined leachate holding ponds, and an LFG flaring station. A plot plan showing these ancillary facilities is provided in ***Figure 3***.

There are other non-landfill facilities or operations within the larger County-owned CDS property associated with MSW management, that currently operate or will operate under separate permits. Brief descriptions of these facilities and operations are as follows.

2.7.1 Transfer/Processing Facility

The T/PF is located on the north side of the main access road, and north of the County administration office (***Figure 3***). In January 2012, the County obtained a separate permit for this facility and adjacent recycling operations as a large-volume transfer/processing facility under the state's tiered solid waste facility permitting program (SWFP No. 49-AA-0404). The T/PF building consists of an approximate 33,900 sq ft steel-frame structure enclosed on three sides. The T/PF is open to the public the same hours as the landfill (the landfill is closed to the public). The maximum combined throughput through the T/PF and landfill is 2,500 tpd.

At the T/PF building, public self-haul vehicles and commercial and franchise hauler collection vehicles are directed to unloading bays and MSW loads are dumped onto a concrete tip floor. Rubber-tired front-end loaders are used to push refuse from the tipping floor into large-volume open-top transfer truck/trailers. The transfer/trailer vehicle access is from the below-grade loading bays. From there, refuse is transferred to the active face of the CDS landfill, or out-hauled to other alternate permitted disposal sites located outside of Sonoma County.

Transfer trailers delivering wastes to the CDS landfill from other County-operated transfer stations (located at Annapolis, Guerneville, Healdsburg and Sonoma) do not have to run through the T/PF building and tip directly at the landfill working face. Records of waste disposal rates at CDS (tons transferred and disposed) are maintained by the County. A certified scale is used to determine tare and net weights of all outbound transfer vehicles, including those destined for the active face of the CDS.

The maximum daily tonnage allowed to be delivered to the working face of the landfill by permit is 2,500 tpd. Additional information on landfill and T/PF concurrent operations is provided in **Section 2.2** of this JTD.

2.7.2 Household Toxics Facility

The Household Toxics Facility collection center is located north of the main access road and east of the T/PF building (***Figure 3***), in the overall T/PF facility improvement area. The Household Toxics Facility is operated by the Sonoma County Waste Management Agency. The facility serves as a drop-off point where the general public and qualified small quantity commercial generators can deliver the hazardous materials. The materials are temporarily stored at the Household Toxics Facility building and then transported to other facilities for recycling, treatment or disposal. The location of the facility makes it convenient for customers to drop off their materials on their way to the T/PF. This reduces the potential for disposal of hazardous materials at the CDS or other out-of-county landfills.

2.7.3 Recycle / Re-Use Area

A public drop-off area for recyclable materials is located adjacent to the T/PF building. It consists of an upper level public tipping area, separated from a lower level by a "Z-wall" retaining structure. Customers drop their recyclable materials into bins on the lower level. The T/PF and recycle area site operator has access to the lower level and replaces the bins when full. The recycling/re-use facility also includes a waste oil recycling building at the southeast corner of the overall T/PF improvement area.

2.7.4 Compost Operations

The Central Compost Site, a green waste composting facility, is operated within a 35-acre area on the northern top deck area of LF-1 (refer to ***Figure 3*** for location). The facility operates under SWFP Permit No. 49-AA-0260 issued by CalRecycle. The Sonoma County Waste Management Agency is the permit holder; the firm Sonoma Compost operates the facility under a lease agreement with the County.

The Central Compost Site is permitted to be open to the public 7 days per week between the hours of 7:00 a.m. and 4:00 p.m. Due to budget constraints, the compost facility has temporarily limited operating hours between 7:00 a.m. and 3:00 p.m., Monday through Saturday. The facility is permitted to receive and process up to 623 tpd of untreated wood debris, yard debris, agricultural waste and food waste. These materials are processed through a horizontal feed grinder to reduce volume, and then placed in windrow-type aerobic compost piles. The windrows are located on a concrete pad. The finished compost product is sold as a soil amendment.

Customers with clean green and wood waste debris enter the facility via the main paved entrance for the CDS, and then proceed to the Compost Site via an internal gravel access road. The permit specifies a traffic limit of 206 vehicles per day.

The Central Compost Site operating permit has specific conditions for material intake, tub grinder operation, stockpile dimensions, and water runoff, odor, vector, noise and litter controls. These conditions are enforced by the RWQCB and LEA as applicable.

The Central Compost Site location overlies landfilled wastes within LF-1. The County proposes to resume MSW filling over this area of LF-1. Existing composting operations will be re-located to another location in advance of future filling in LF-1. Details on proposed fill sequencing are provided in **Section 5.3** of this JTD.

2.7.5 Landfill Gas-to-Energy and Clean Fuel Facilities

A landfill gas collection and control system has been installed at the CDS. The LFG system is operated in accordance with 27 CCR requirements for subsurface combustible gas migration control, Bay Area AQMD regulations and a federal Title V operating permit. The extractionsystem consists of a network of LFG vertical wells and horizontal collectors installed in LF-1 and LF-2 fill areas. Further details on the LFG collection and control system are provided in **Section 5.13** of this JTD.

The gas is collected by vacuum blowers and routed via above- and below-grade piping systems to an 8.0 megawatt (MW) capacity LFGTE plant. The LFGTE plant location is shown in ***Figure 3***. The power plant consists of 10 internal combustion engine-generator sets, rated for a cumulative fuel intake of up to 4 million cubic feet per day (cfd) of LFG. This capacity is equivalent to approximately 2,800 standard cubic feet per minute (scfm). Electric power generated at the LFGTE plant is used to power many of the on-site facilities but the majority of the electricity produced is sold to the Power and Water Resources Pooling Authority, of which Sonoma County is a participant. During engine downtime (for scheduled or unscheduled maintenance), LFG is routed to an enclosed ground flare for thermal gas destruction.

In 2007, the County constructed a pilot-scale compressed natural gas (CNG) fueling facility. This clean fuel facility uses membrane technology to convert LFG to CNG fuel for County-owned transit vehicles. The facility can process up to 100 scfm of LFG. The CNG facility operates as a closed loop system where all by-product gases are re-circulated and thermally destroyed in the LFGTE plant engines or the LFG flare.

2.7.6 Metals Recycling

A metals sorting/baling operation is conducted by a private operator under contract to the County in a designated area on the top deck of LF-1 (see ***Figure 3***). A diesel-powered baler is used to compress large-volume scrap metal items into bales that are then hauled off-site to metal recycling facilities. A grapple-crane integrally mounted to the baler unit feeds scrap materials into the compression chamber. This crane is also used to direct-load bales onto trucks for off-site hauling.

The County proposes to resume MSW filling over this area of LF-1. The metals recycling operation will be re-located to an area just to the west of the REA in advance of filling in LF-1. Prior to re-location, the County will submit plans to the Permit and Resources Management Department showing facility layout and engineering controls to ensure compliance with grading ordinance, municipal separate storm sewer system, and general construction permit requirements.

3.0 WASTE MANAGEMENT UNIT CLASSIFICATION AND SITING

3.1 TOPOGRAPHY

27 CCR §21600(b)(4)(A) and §21750(d)

The CDS property is located in the northern California Coast Ranges, in an area of Sonoma County that is characterized by rolling hills and open range land. A northwest-southeast trending ridge line extends along the eastern and northern portions of the property that separates surface water drainage basins to the north and south. Ground surface elevations along this ridge line range from approximately 545 to 655 feet MSL. Ground surface elevations along the southern CDS property boundary range from about 195 feet to 265 feet MSL (RMC GeoScience, 2002).

Numerous small intermittent south-southwest flowing creeks drain the hills around the property and discharge into Stemple Creek. Stemple Creek is located approximately 1,000 feet south of the CDS southern property.

3.2 FLOODPLAIN AND WETLANDS SITING ANALYSIS

3.2.1 Floodplains

27 CCR §20260(c), §21500(b)(4)(A) and §21750(d), 40 CFR§258.11

In accordance with 27 CCR § 20260(c), Class III landfills must be designed, constructed, operated and maintained to prevent inundation or washout due to floods with a 100-year return period. Similar requirements are embodied in federal Subtitle D regulations (40 CFR Part 258.11(a)).

A map showing the 100 year flood plain and the disposal site location is provided in ***Figure 6.*** The Central Disposal Site is not located within a 100-year floodplain zone. Thus the proposed projects and new MSW units at CDS are consistent with state and federal floodplain siting criteria.

3.2.2 Wetlands

40 CFR§258.12

SWRCB Resolution No. 93-62 (amended July 2005), requires compliance with the floodplain siting requirements specified in 40 CFR §258.12. This requires that new MSW units and lateral expansions shall not be located in wetlands unless certain exemption criteria are demonstrated. The proposed new cell areas in LF-2 and the REA are located in uplands areas of the CDS and are not located in wetlands (Sonoma County, 1997, 1998).

3.3 CLIMATE

27 CCR §21600(b)(4)(A) and §21750(e)

The Sonoma County area is characterized by mild winters and summers, and moderate rainfall. The average annual minimum and maximum temperatures for the region range between 46 and

72 degrees Fahrenheit (California Department of Water Resources, 2011). Other climatologic data for the site is presented below, in accordance with 27 CCR §21750(e) requirements.

3.3.1 Isohyetal Map

A map showing isohyetal contours for the CDS and its surrounding region within and beyond ten miles of the facility perimeter is provided in ***Figure 7.*** The isohyetal map is based on data provided by the Sonoma County Water Agency (2005) and provides contours showing equal annual precipitation amounts. As shown in ***Figure 7***, the site is near the 30-inch annual rainfall contour.

3.3.2 Precipitation

According to the National Weather Service, California/Nevada River Forecast Center, the average annual rainfall for the nearest official rain gauge (Santa Rosa, California) is 31.91 inches per year. Approximately 95% of the storms occur between November and April of each year (RMC Geoscience, 2005).

3.3.3 Design Storm

The 100-year 24-hour precipitation event is 5.77 inches. This was determined based on a review of National Oceanic and Atmospheric Administration (NOAA) precipitation frequency data output for the latitude and longitude at CDS (NOAA, 2011). This value has been utilized for basis of drainage system design for the CDS.

3.3.4 Evapotranspiration

The mean annual evaporation is approximately 43.7 inches (EMCON/OWT, 2005). This value has been used as a basis for estimating liquids infiltration through cover, leachate generation and leachate collection and control system (LCRS) sizing.

3.3.5 Runoff Volume/Pattern

Details on surface water drainage design, including projected volume and pattern of runoff, are provided in **Section 5.11** of this JTD.

3.3.6 Wind Rose

The Central Disposal Site is situated among the ridges and valleys of the northern California Coast Ranges. Wind rose information for the site is presented in ***Appendix C***, based on Bay Area AQMD data for nearby weather stations (GeoSyntec, 2005). The wind rose depicts wind direction, velocity and percentage of time for the indicated direction. As shown, winds in the area blow primarily from northwest to southeast and average 7 miles per hour. It has been reported that the hilly topography and surface heating and cooling up valley, down valley and up slope / down slope flows can produce winds which deviate from typical regional patterns (GeoSyntec, 2005). Facility operations include controls to mitigate dust, litter and landfill odors that can be affected by wind conditions at the CDS. Please refer to **Section 8** of this JTD for details.

3.4 GEOLOGY AND UNDERLYING SOILS

3.4.1 Regional Geology

27 CCR §20240(d), §21600(b)(4)(A) and §21750(f)

The Central Disposal Site is located in the Coast Ranges geomorphologic province. This province is characterized by northwest-trending ridges and valleys that parallel major folds and strike-slip faults. Sonoma County consists of two structural blocks: the Santa Rosa Block and the Sebastopol Block. The Central Disposal Site is located within the eastern margin of the Sebastopol Block, which is bounded to the east by the Tolay fault and to the west by the San Andreas Fault (Woodward-Clyde Consultants, 1997).

The following geologic units (from oldest to youngest) are present in the region: the Franciscan Complex, the Sonoma Volcanics, the Petaluma Formation, the Wilson Grove Formation, and alluvial/colluvial deposits. Each geologic unit is discussed in detail below. A regional geologic map is provided as ***Figure 8***.

3.4.1.1 Franciscan Complex

The Franciscan Complex dates to between Late Jurassic and Late Cretaceous (165 to 65 million years ago). The Franciscan is the basement unit in the region. The unit is characterized as deformed, uplifted, and eroded marine sandstones and shales mixed with chert and mafic igneous rock. This unit formed as an accretionary prism in a subduction zone, which led to the intense folding and faulting, along with a varying degree of low-grade metamorphism. Typically, the Franciscan is relatively impermeable, with most, if not all, groundwater occurring in open fractures.

3.4.1.2 Sonoma Volcanics

The Sonoma Volcanics are Late Miocene to Pliocene in age (7.1 to 5.5 million years old) and consist of basalt, dacite, and andesite flows with interlayered rhyolite and ash flows (Fox, 1983). The Sonoma Volcanics are in erosional contact with the underlying Franciscan. Exposures in the region of this group are somewhat limited, typically occurring as erosional remnants that lie on the Franciscan basement.

3.4.1.3 Petaluma Formation

The Petaluma Formation consists of beds and lenses of poorly consolidated claystone, shale, siltstone, sandstone, and conglomerate with local interbeds of tuff or volcanic ash and diatomite. This geologic unit is located northeast of the Tolay Fault.

3.4.1.4 Wilson Grove Formation

The Wilson Grove Formation is Late Miocene to Pliocene age (11.2 to 1.6 million years old) (Wagner and Bortugno, 1982; Bedrossian, 1981). This formation is a near-shore marine sandstone, that is characterized as consisting of massive sands and minor amounts of gravel and tuff (Fox, 1983). The lower portion of this formation contains an extensive pumaceous tuff layer that is relatively impermeable (Bedrossian, 1981). The total thickness is estimated to be 500 feet (Fox, 1983).

3.4.1.5 Alluvial/Colluvial Deposits

Quaternary alluvial and colluvial deposits are discontinuously present throughout the region. The alluvial deposits typically consist of layers of silt and clay with isolated lenses of sand and gravel (Huffman and Armstrong, 1980). The alluvial sediments are deposited along streams and creeks, and therefore, parallel those geomorphologic features.

The colluvial deposits form where bedrock is weathered, the sediment is transported down a slope, and accumulates at the base of the slope and in swales. Colluvial deposits can contain clay and silt, but can also contain larger fragmented rock that has eroded from the adjacent slope. Similar to colluvium, landslide deposits are common in the region. Landslide deposits differ in that they are typically larger erosion events that occur during a rapid timeframe. Landslide deposits are also limited to the base of slopes and swales. Site-specific geologic conditions, including landslide potential, are described below.

3.4.2 Site Geology

The Central Disposal Site property is composed of three canyons: the east, central, and west canyons. Refuse filling has been confined to the central and east canyon areas. As is typical for the region, the canyons consist of bedrock canyon walls and alluvial/colluvial valleys. The Franciscan Complex, Wilson Grove Group, Sonoma Volcanics, and alluvium/colluvium are the geologic units present at the site. The Dunham Fault and a small unnamed fault pass through the southwest portion of the site. The locations of the geologic units and features are presented in ***Figure 9***. The geologic features of the site are discussed in more detail below. In addition, geologic features in the Rock Extraction Area and the LF-2 Area are also detailed below.

The Franciscan Complex underlies the fill areas, and is present over the majority of the site. Boring logs from this unit indicate that massively bedded sandstone, shale, and metavolcanic lithologies exist. Boring logs also indicate that the northern portion of the site is underlain by a cemented sandstone and the southern area is underlain by a cemented shale and siltstone. Fractures are abundant in this unit, with open fracture occurring near the surface and filled fractures occurring at deeper depths. The fractures vary in strike between northwest and northeast (GeoSyntec, 2005).

The Wilson Grove Formation is present along the northern and southern portions of the site, but outside of the fill areas. The formation is mapped as poorly consolidated deposits of pebbly, coarse sand, and tuff breccia to a white/tan siltstone with pebbles (EMCON/OWT, 2005).

The Sonoma Volcanics are located in a small area on the western portion of the site. The unit is present between the Dunham and unnamed faults. Wells or exploratory borings have not been installed in this unit, so a more detailed description than the regional description of this unit is not available.

Alluvium and colluvium deposits are currently present south of each fill area and to the east of LF-2. Prior to landfill development, the alluvium and colluvium deposits extended along the central and eastern canyon floors, but were excavated prior to waste placement in LF-1 and LF-2. The soils on site are within the Steibeck-Los Osos association, which consist of the Steinbeck Loam, Los Osos Clay Loam, and Cotati Fine Sandy Loam. These soils are characterized as typically well-drained with low plasticity. Boring logs from the site indicate the alluvium and colluvium deposits are primarily silts and clays with minor sand and gravel content. Furthermore, GeoSyntec (2004) mapped the Rock Extraction Area and found no evidence of the existence of large or deep bedrock landslides. Pre-existing earthflows and colluvium that could have been a landslide source were also removed. Cross-sections from LF-1 and LF-2 are provided as ***Figures 10*** and ***11***, respectively.

3.4.3 LF-2 Area

The LF-2 Area is underlain by the Franciscan Complex. The unit is described as consisting of shales, sandstones, siltstones, and greenstones (GeoSyntec, 2005). The unit is fractured with the fracture strike varying from northeast to northwest. The fractures tend to be open at the surface and filled (mineralized) at depth. Alluvium/colluvium is present south and east of LF-2. The alluvium/colluvium that was formerly present in the floor of LF-2, Phases I and II was removed prior to landfilling.

3.4.4 Rock Extraction Area

The REA is underlain by the Franciscan Complex. The bedrock consists primarily of variable cemented and silicified sandstones and shales (GeoSyntec, 2004). The shale tends to be clayey and is variably sheared (GeoSyntec, 2004). The unit is massively bedded and highly fractured. Fractures are open at the surface, with some of the fractures likely due to the blasting activities that occurred during extraction activities.

3.5 REGIONAL FAULTING AND SEISMICITY

3.5.1 Faults and Earthquake Ground Motions

27CCR §20760(d)

Regional faults include the Tolay Fault, Dunham Fault, Bloomfield Fault, and Americano Fault (***Figure 8***). Of these faults, the Americano, Bloomfield, and Tolay Faults are potentially active, although there is no evidence of Holocene movement (GeoSyntec, 2005).

Other regional active faults further from the site include the Rodgers Creek (5.7 miles from site), San Andreas (15 miles), Maacama (15.5 miles), Hayward (27 miles), West Napa (20 miles), Green Valley (28 miles), and Concord Faults (36 miles). Of these faults, the Rodgers-Healdsburg Fault is the governing seismic event for the site. According to the *Draft Preliminary Report, East Canyon Expansion, Central Landfill* (GeoSyntec, 1995), the Rodgers-Healdsburg Fault is a strike-slip fault; has a moment magnitude of 7.0 Richter scale; estimated capable of producing a maximum probable earthquake (MPE) of 6.75 magnitude; and will produce a Peak Horizontal Ground Acceleration (PGE) of 0.32 g from a MPE.

The Dunham Fault and a minor unnamed fault are present along the southwestern portion of the property. The Dunham Fault has been extensively studied (Cardwell, 1958; Hallenbeck and Associates, 1988; Huntingdon-Herzog and Associates, 1993; Woodward-Clyde Consultants, 1997; and GeoLogic Associates, 2002). The Dunham Fault separates the Franciscan Complex to the northeast from the Wilson Grove Formation to the southwest. The Dunham Fault is characterized as a four-mile long, northwesterly trending normal fault. A trench investigation by

GeoLogic Associates (2002) indicated that movement along this fault has not occurred within the last 11,000 years, and therefore, the fault is considered inactive. The unnamed fault was discovered during a fault investigation by Huntingdon-Herzog and Associates (1993), and was identified as inactive due to the lack of recent movement. In addition, a fault in the East Canyon is identified in the Waste Discharge Requirements (WDRs) Order No. R1-2004-0040 and by Huntingdon-Herzog and Associates (1993). However, during LF-2 Phase I and II construction, no evidence of this fault was identified in the canyon or on the side walls. EMCON/OWT (2005) indicated that the presence of this fault is questionable.

RMC Geoscience reviewed seismic activity data to evaluate whether measurable seismic activity may have occurred within or near the REA or previously identified unnamed fault at the northern end of the CDS property. This assessment was updated using data maintained by the Northern Earthquake Data Center to identify earthquakes with magnitudes greater than 1 that occurred between years 1900 and 2010 within about 5 kilometers of the landfill. The results of this evaluation show no historic seismic activity or micro-seismic activity has been recorded within the landfill boundaries. Results of this study, including mapping of seismic events, are provided in ***Appendix D***.

3.5.2 Conformance with Geologic Siting Criteria

27 CCR §20164 and §20260(e)

3.5.2.1 Fault Location

Per 27 CCR regulations, new Class III landfills or expansions of existing Class II-2 facilities shall not be located on a known Holocene fault. The fault data summarized above and in ***Appendix D*** indicate that no Holocene or active faults are located within 200 feet of the REA or proposed new cell areas in LF-2 (RMC Geoscience, 2011).

3.5.3 Rapid Geologic Change

Per 27 CCR regulations, new Class III landfills can be located within areas of potential rapid geologic change only if the RWQCB finds that the Unit's containment structures are designed, constructed and maintained to preclude failure. Rapid geologic change means the "alteration of the ground surface through actions such as landslides, subsidence, liquefaction and faulting." MSW landfills are also subject to any more stringent unstable area siting requirements referenced in SWRCB Resolution 93-62.

Geologic units in the vicinity of the CDS are described above and in ***Appendix D***. Based on available data, it has been concluded that potential geologic conditions should not affect development of new waste cells in LF-2 and the REA, for the following reasons (RMC Geoscience, 2011):

- Both areas are underlain by bedrock of the Franciscan Formation that consists predominantly of fractured sandstone with lesser amounts of shale. Loose, saturated sand is not present, and as a result, the potential for liquefaction is negligible. Soft, compressible deposits are not present in the proposed expansion areas; therefore, the potential for significant differential settlement of the cell foundation areas is considered very low.

- Under certain conditions, subsidence due to groundwater withdrawal can occur on an area-wide basis. However, significant groundwater extraction in the vicinity of the CDS property is not known to occur and the Franciscan Formation bedrock underlying the site would not be susceptible to this type of subsidence.

- The results of site mapping and observations during varying stages of construction have not indicated the presence of pre-existing landslides, significant shear zones, zones of weakness, or other structural factors that could significantly affect stability of the expansion areas.

- Faulting will not affect the proposed new cell areas for the reasons stated above.

3.6 SURFACE WATER HYDROLOGY

27 CCR §21600(b)(4)(A) and §21750(g)

The Central Disposal Site lies within the Bodega Hydrologic Unit, which is within the Estero San Antonio Hydrologic Area (Woodward Clyde Consultants, 1997). This unit is isolated from the adjacent Santa Rosa and Petaluma Basins by the foothills of the Roblar de la Miseria (GeoSyntec, 1995).

The landfill property is composed of three north-south trending canyons. Typical to the regional topography, each canyon is separated from the adjacent canyon by a ridge. The ridges provide surface water barriers, so that runoff flows from the ridge tops, down the slopes towards the canyon axis, and down topographically along the canyon axis. At the site, prior to waste placement, each canyon drained southward, towards an ephemeral tributary to Stemple Creek. Presently, stormwater that comes in contact with the waste units is directed towards the sedimentation ponds south of LF-1 and LF-2. Surface water in the western canyon that does not come into contact with the waste unit is diverted via berms away from the landfill to diversion ditches and culverts, and then to one of six sediment ponds. In addition, ridges are present along the eastern and northern portions of the property, which serve as surface water divides that hydrologically separate the site from adjacent areas.

Springs and seeps have been well-documented in this region. Typically, springs occur as surface water (precipitation) that infiltrates into the bedrock, is transported along fracture planes, and then is discharged along the canyon walls where the fractures intersect the ground surface. None of the 413 major springs identified in the region are located within a one-mile radius of the site (EMCON/OWT, 2005). However, several minor springs and seeps were documented prior to landfill development along the canyon walls (Terratech, 1970). Terratech (1970) estimated the flow from the springs in the central canyon to range between 0.2 to 0.7 gallons per minute (gpm), and identified the majority of the springs occurred along the eastern wall of the central canyon. Work conducted by Huntingdon-Herzog Associates (1993) estimated the flow rate for the east canyon springs to be between 3 and 25 gpm during April, and less than 0.1 gpm during July. They also estimated flow rates in the west canyon to range between less than 1 gpm to approximately 17 gpm in April to dry conditions in July and August.

A water balance study performed by RMC Geoscience (2005) estimated the groundwater infiltration rate to LF-1. It was concluded that because of the geologic similarity between LF-1 and LF-2, groundwater capture from the underdrain system at LF-2 provided the most reasonable means of estimating groundwater flows from springs at the Central Disposal Site. Based on data for the period September 2002 through February 2005, it was estimated that the site groundwater infiltration rate ranged between 4,000 and 5,000 gallons per acre per month (RMC Geoscience, 2005). Subsequent data provided by the County (2010) for the period July 2005 through June 2010 indicates the infiltration rate averaged 5,400 gallons per acre per month.

Because the site is essentially hydrologically isolated from adjacent areas, and the springs are recharged from precipitation infiltration, the County has installed several control measures to decrease the infiltration rate and to overcome the recharge that does occur. In LF-1, a four to five foot interim cover has been placed to reduce the precipitation infiltration rate. This is demonstrated by the near elimination of leachate seeps along the landfill side slopes (EMCON/OWT, 2005). The County has also installed leachate extraction wells to control water that infiltrates outside of the cover area. These extraction wells pump the groundwater and leachate to the leachate holding ponds south of the fill areas. Further details on leachate and groundwater infiltration controls are provided in **Sections 4.6.2 and 5.2.1** of this JTD.

3.7 GROUNDWATER HYDROLOGY

27 CCR §21600(b)(4)(A)

3.7.1 Groundwater Occurrence

The Franciscan Complex makes up the regional aquifer system at the site. The Wilson Grove Formation, Sonoma Volcanics, and alluvium/colluvium are discontinuously present at the site. Each geologic unit is described below with respect to groundwater occurrence. The on-site monitoring wells and the geologic units monitored are listed in ***Table 1***. Monitoring locations are shown in ***Figure 9***.

3.7.1.1 Franciscan Complex

Due to the variable compositional nature of this unit, hydrogeologic parameters and groundwater quality tend to vary greatly with distance. In general, this unit is characterized by low permeability, low well yields, and variable water levels. Groundwater typically occurs in open fractures. Boring logs from within this unit indicated that the fractures tend to be open at shallow depths and open fractures are rarely observed deeper than 70-80 feet below ground surface (bgs) (GeoSyntec, 2005). Therefore, since this unit is present over much of the site and the open fractures are shallow, groundwater tends to occur at shallow depths with downward vertical groundwater movement inhibited by filled fractures at depth.

Groundwater typically occurs at depths ranging between approximately 0 feet bgs (ground surface) to 75 feet bgs. Most of the groundwater monitoring wells and piezometers at the site are screened within this unit.

Table 1.
Existing Monitoring Well Network
Central Disposal Site Sonoma County, California

Well ID	Designation	Unit Monitored
Landfill-1 Monitoring Wells		
A-2	Point of Compliance	Alluvial
A-3	Point of Compliance	Alluvial
DW-1R	Background	Deep Zone Franciscan
DW-3A/3B	Background	Deep Zone Franciscan
DW-7	Downgradient	Deep Zone Franciscan
F-3	Corrective Action	Franciscan
F-5	Corrective Action	Franciscan
F-8	Corrective Action	Franciscan
F-10	Corrective Action	Franciscan
F-12	Background	Franciscan
F-13	Point of Compliance	Franciscan
F-29	Downgradient	Franciscan
F-2N	Downgradient	Franciscan
F-30	Corrective Action	Franciscan
F-35	Downgradient - LF-1	Franciscan
HA-1	Point of Compliance	Franciscan
HA-2	Point of Compliance	Alluvial
MW-1	Background	Franciscan
MW-3A/3R	Corrective Action	Franciscan
ST1W-1	Point of Compliance	Franciscan
ST1W-2	Point of Compliance	Franciscan
ST1W-3	Point of Compliance	Franciscan
Landfill-2 Monitoring Wells		
A-1	Point of Compliance	Alluvial
A-7	Corrective Action	Alluvial
A-8	Corrective Action	Alluvial
DW-4B	Background	Deep Zone Franciscan
F-11	Point of Compliance	Franciscan
F-14	Background	Franciscan
F-15	Background	Franciscan
F-16	Background	Franciscan
F-17	Point of Compliance	Franciscan
F-18	Point of Compliance	Franciscan
F-19	Point of Compliance	Franciscan
F-31	Corrective Action	Franciscan
F-32	Corrective Action	Franciscan

Table 1.
Existing Monitoring Well Network
Central Disposal Site Sonoma County, California

Well ID	Designation	Unit Monitored
Piezometer Wells		
A-4/5	Piezometer	Alluvial
DW-5	Piezometer	Deep Zone Franciscan
F-22	Piezometer	Franciscan
F-23	Piezometer	Franciscan
F-24	Piezometer	Franciscan
F-25	Piezometer	Franciscan
F-26	Piezometer	Franciscan
F-27	Piezometer	Franciscan
F-28	Piezometer	Franciscan
F-33	Piezometer	Franciscan
F-34	Piezometer	Franciscan
F-37	Piezometer	Franciscan
F-38	Piezometer	Franciscan
F-5	Piezometer	Franciscan
PZ-1	Piezometer	Franciscan
PZ-2	Piezometer	Franciscan
PZ-3/3A	Piezometer	Franciscan
TMW-4	Piezometer	Franciscan
TMW-5	Piezometer	Franciscan
TMW-6	Piezometer	Franciscan
TMW-7	Piezometer	Franciscan
TMW-8	Piezometer	Franciscan
TMW-9	Piezometer	Franciscan
TMW-10	Piezometer	Franciscan
TMW-11	Piezometer	Franciscan
TMW-12	Piezometer	Franciscan
TMW-13	Piezometer	Franciscan
TMW-14	Piezometer	Franciscan
TMW-15	Piezometer	Franciscan
TMW-16	Piezometer	Franciscan
TMW-17	Piezometer	Franciscan
WV-5	Piezometer	Franciscan
WV-6	Piezometer	Franciscan
WV-7	Piezometer	Franciscan
WV-8	Piezometer	Franciscan
WV-9	Piezometer	Franciscan
Other Monitoring Points		
WV-1	Siting Monitoring Well	Franciscan
WV-2	Siting Monitoring Well	Franciscan
WV-3	Siting Monitoring Well	Franciscan
WV-4	Siting Monitoring Well	Franciscan
F-20	Siting Monitoring Well	Franciscan
F-21	Siting Monitoring Well	Franciscan

3.7.1.2 Sonoma Volcanics

No wells are located within the Sonoma Volcanics at the site. Groundwater occurrence within this unit in Sonoma County is reportedly highly variable and unpredictable, with dry holes and variable well yields (EMCON/OWT, 2005).

3.7.1.3 Wilson Grove Formation

Regionally, the Wilson Grove Formation is the principal aquifer unit (Taber, 1987). This unit is reported to have higher permeabilities than the Franciscan. Water derived from this unit is reported to be of excellent quality, and wells are reported to have moderate to high yields (Taber, 1987). Typically, supply wells for domestic and agricultural use in the region are screened within this unit due to its excellent water quality and higher well yields. No wells are screened in this unit at the CDS facility.

3.7.1.4 Alluvium/Colluvium

Due to the variable and discontinuous nature of the alluvium/colluvium, these deposits do not represent a major source of groundwater in the region. Typically, these units have low permeabilities and low well yields, but can be higher where wells are screened within the isolated coarser grained materials (Woodward-Clyde Consultants, 1997). Because the alluvial/colluvial deposits are thin, groundwater occurrence tends to be shallow, typically occurring between 0 feet bgs (ground surface) to 12 feet bgs. Several of the on-site monitoring wells are screened within these deposits.

3.7.1.5 Siting Criteria – Groundwater Occurrence (Waste Separation)

27 CCR §20240(c)

27 CCR §20240(c) and federal Subtitle D regulations require that disposal facilities be sited, designed, constructed and operated to ensure that solid waste will be a minimum of five (5) feet above the highest anticipated elevation of underlying groundwater. The regulations also allow for an engineered alternative, which can be approved provided that the discharger demonstrates: (1) construction of the prescriptive standard is not feasible; and (2) a specific alternative is consistent with the 5-foot separation goal and affords equivalent protection against water quality impairment.

As part of the design effort for this JTD, SCS evaluated the highest recorded groundwater elevation at various points within the proposed new landfill cell footprint areas. This subsurface water data was obtained from piezometers or groundwater monitoring wells installed as part of previous siting investigations or current water quality monitoring programs. Several monitoring wells have been installed in what are now proposed as the footprint areas of Phases 3 and 4 in LF-2 and the REA. Note: all monitoring wells in the proposed landfill footprint areas will be properly abandoned/destroyed as part of project development activities. Separate application for well destructions will be provided by the County as required (refer to **Section 6.1.5.1**).

Groundwater/Waste Separation in LF-2. Existing ground surface elevations in LF-2 proposed for future waste disposal (between existing fill areas LF-1 and LF-2, Phases I and II) range from approximately 280 ft MSL in the southeastern end of the canyon to 350 ft MSL in the northern end of the canyon. Groundwater monitoring wells TMW-4 through TMW-11 and F-3 are located in this area of the East Canyon. Based on monitoring data from these wells, the depth to groundwater in this area varies from about 2 to 25 feet below ground surface and mimics existing surface topography (RMC Geoscience, 2011). Groundwater elevations were recently mapped to range between 220 ft MSL in the southeastern end of the canyon to 340 ft MSL in the northern end, with the gradient from north/northwest to southeast (Pacific GeoScience, 2011).

Proposed base grades in the LF-2, Phase III/IV cell floor area will range from approximately elevation 235 ft MSL at the extreme southern end of the cell to elevation 300 ft MSL in the upper reaches of the floor area (refer to excavation plans described in **Section 5.3** of this JTD). The primary (top) base liner elevations will be approximately 7 feet higher to accommodate construction of an underdrain/groundwater separation system and secondary composite base liner. Proposed excavation depths will range up to 57 feet below existing grades. Proposed excavation grades will be at or below historic high groundwater elevations and an engineered alternative for groundwater separation will be required for new LF-2 cells as allowed by 27CCR §20080. This was the case for Cells I and II in LF-2, where base excavations extended from 210 to 264 ft MSL for cell construction.

The proposed engineered alternative liner system, LCRS layer, and soil operations layer for LF-2, Phases III and IV floor areas will be 12 feet thick. Per RWQCB requirements (RWQCB 2012), the engineered alternative design for LF-2, Phases III and IV will include a groundwater underdrain, plus a 4-foot thick compacted soil foundation layer overlain by a 1-foot thick low permeability soil layer (total 5 foot thick soil lens), placed above excavation grades as a bottom component of the liner system (refer to **Sections 5.6** and **5.7** of this JTD for details). This combination of an underdrain and a soil separation layers is intended to meet the minimum 5-foot separation requirement as interpreted by the RWQCB.

Groundwater/Waste Separation in REA. The REA was previously used as a quarry (for rock and soils) and existing grades at the base of this previous excavation are approximately 400 ft MSL. Other than fine grading to drain the proposed cell floor area and to prepare the floor and sideslope subgrade areas, no further excavation is proposed for new waste cell construction in the REA. Groundwater elevations have been measured near-surface in the REA at existing monitoring wells WV-1 through WV-9, and P-22. The highest recorded groundwater elevation in these wells is approximately 400 ft MSL.

The proposed engineered alternative liner system, LCRS layer and soil operations layer for the new cell floor area in the REA will be 12 feet thick. This base liner system will include a 4-foot thick compacted soil foundation layer and 1-foot thick low permeability soil layer generally placed above existing grades as the bottom component of the liner (refer to **Sections 5.6** and **5.7** of this JTD for proposed liner system details). Thus the separation between the measured high water table and the anticipated elevation of waste (approximately 407 ft MSL) exceeds the minimum of five (5) feet between groundwater and waste.

However, due to the fact that groundwater has been measured near surface at the existing excavation grades (base grades) and to account for capillary rise and potential seasonal seeps or springs that may be expected in the REA excavation side walls, the proposed containment system design will include placement of a capillary break and additional soil layers in the floor and side-slope areas of the REA. The proposed combination of an underdrain and soil separation layers is intended to meet the minimum 5-foot separation requirement as interpreted by the RWQCB (2012).

3.7.2 Groundwater Flow

As indicated above, groundwater primarily occurs in the open fractures of the Franciscan Complex. However, groundwater elevation data and potentiometric surface maps indicate that groundwater flow tends to follow topography, with the overall flow direction to the south-southeast, which is parallel to the axes of the canyons. Groundwater gradients during the First Quarter 2010 monitoring report were approximately 0.13 feet per foot (ft/ft) under LF-1 and 0.08 ft/ft under LF-2 (Pacific Geoscience, 2010).

The vertical groundwater gradient and flow direction was evaluated by EMCON/OWT (2005) using monthly water level data collected through June 2005 from paired wells installed in the LF-1 eastern area (monitoring wells TMW-14 and TMW-15; TMW-14 and TMW-16; TMW-10 and TMW-17; and F-33 and F-34). Those wells evaluated indicated a strong upward gradient is present throughout the year. The upward hydraulic gradient has been estimated to be between 0.06 and 0.2 ft/ft (Huntingdon-Herzog Associates, 1993). The conclusion that the aquifer is under an upward hydraulic gradient is an important finding; this gradient reportedly minimizes downward migration of leachate and potential groundwater contamination from the unlined LF-1 (Shaw, 2005).

Aquifer testing was conducted by Pacific Geoscience in 2005 as part of their Delineation Assessment Report (DAR). Slug tests were performed to estimate hydraulic conductivities in wells screened in the Franciscan Complex. East of LF-1, hydraulic conductivities ranged between $1.95\text{x}10^{-8}$ to $8.38\text{x}10^{-6}$ feet/second, with an average conductivity of $3.15\text{x}10^{-7}$ feet/second. This study found that the bedrock in the ridgeline between LF-1 and LF-2 had a very low conductivity, indicating the limited ability of groundwater to move eastward through the Franciscan bedrock from LF-1. Slug tests performed south of LF-1, near well F-10, indicate hydraulic conductivities range between $1.74\text{x}10^{-8}$ and $2.46\text{x}10^{-4}$ feet/second, with an average conductivity of $3.10\text{x}10^{-6}$ feet/second. Slug test performed near Leachate Pond 1 indicate also indicate a low conductivity, but at a narrower range, between $1.55\text{x}10^{-6}$ and $1.56\text{x}10^{-5}$ feet/second. Slug tests performed within the Rock Extraction area indicate a wide range of conductivity values, ranging between $6.57\text{x}10^{-7}$ and $9.9\text{x}10^{-4}$ feet/second.

3.7.3 Groundwater Quality

The groundwater on-site can be summarized as consisting of a variety of different water types with no trends or correlations to stratigraphic or structural features. Overall, the groundwater on site is generally characterized as bicarbonate-rich, with varying percentages of sodium, calcium, and magnesium. No significant trends in groundwater chemistry are apparent with respect to depth or spatial location, and there is no distinction between groundwater chemistry between shallow and deep monitoring wells.

Comprehensive detection and corrective action water quality monitoring programs are in effect at the Central Disposal Site, in accordance with the facility WDRs. Details on these programs are provided in **Section 6** of this JTD.

3.8 SURROUNDING LAND AND GROUNDWATER USE

3.8.1 Zoning

27 CCR §21750(b)(3)(E)

According to the County of Sonoma, the Central Disposal Site is zoned as “public facilities”, which is the designation given to land utilized by the County. Adjacent parcels to the site are zoned as “land extensive agricultural”, which designates the property for agricultural use. A plot plan showing land uses and zoning for properties within 1,000 feet of the facility boundary is shown in ***Figure 12***.

3.8.2 Land Use

27 CCR §21600(b)(4)(A) and §21750(b)(3)(E)

According to the County of Sonoma General Plan, the site is designated for “Public/Quasi-Public” land uses. Land surrounding the site is designated for agricultural use and is currently used for grazing. Land uses within 1,000 feet of the facility boundary are shown in ***Figure 12***.

Within a one-mile radius of the site, land uses include rural residential and agricultural operations, such as dairy and cattle ranches, and grazing lands (GeoSyntec, 2005). The nearest residential subdivision, Happy Acres, is located approximately 0.5 mile northeast of the site. The next nearest residential subdivisions are located in the City of Cotati, approximately three miles northeast of the site.

The nearest residence (associated with the Gray View Ranch) is approximately 600 feet north of the site. In addition to the Gray View Ranch, the Bloom Ranch is also located north of the site. To the south, residences are located approximately 800 feet from the southern boundary. The Button Ranch is located approximately 0.5 mile west of the site. The Diamond M. Dairy, which includes several residences, is located approximately 500 feet southwest of the site’s boundary. The County owns the property to the east of the site and leases it for grazing purposes.

3.8.3 Groundwater Use

27 CCR §21600(b)(4)(A)

The WDRs (RWQCB, 2004) identify the regional groundwater use as both domestic and agricultural. In the region, groundwater is primarily pumped from wells screened within the Wilson Grove Formation, which is the principal water-bearing unit in the region. Groundwater from this unit is reportedly of excellent quality and wells screened within this unit typically have moderate to high yields. Groundwater supply wells are typically screen within this unit.

The Franciscan Complex and alluvial aquifers, to a lesser degree, are utilized for groundwater purposes. Wells within these units typically have variable yields, and are mostly used for agricultural purposes.

3.8.4 Domestic Well Survey

A domestic well survey was not performed as part of this JTD since the site has been extensively researched. Results from past domestic well surveys are included in this section. Groundwater well locations as identified in previous domestic well surveys are shown in ***Figure 8*** (Woodward-Clyde Consultants, 1997).

South of the landfill and Hammel Road, domestic and agricultural wells are present that range in depths between 11 and 220 feet bgs (Taber, 1987). Based on these depths and location, the wells are likely screened in either alluvium or the Wilson Grove Formation. For the wells where data is available, yields tend to be low, ranging from less than one gallon per minute (gpm) to approximately 58 gpm (Woodward-Clyde Consultants, 1997).

North of the landfill, near Stony Point Road (approximately one mile north), a privately-owned water utility supply well is located that supplies water to some of the residences in the Happy Acres subdivision. The well was drilled in 1957 and is 397 feet deep. The Happy Acres water system includes the deep well, concrete water storage tanks, booster pumps, and a distribution system. The residences not connected to this water supply system have individual groundwater wells.

Two County-owned supply wells are located north of the landfill, near Stony Point Road. Both wells are utilized by the landfill for dust control, fire suppression, domestic uses and for composting process water. The wells are 242 and 302 feet deep, and are capable of supplying 41,000 gallon per day (GPD) during the dry season.

A well near the entrance of the Stony Point Quarry, on Stony Point Road (approximately 1.5 miles from the landfill) supplies water to the quarry. No information is available on the depth of this well, but it reportedly supplies between 3,000 and 5,000 GPD to the quarry.

3.9 AIRPORT SAFETY

27 CCR § 20270(e) and 21600(b)(3)(A)

In accordance with 27 CCR § 20270(e), existing MSW landfill units and lateral expansions located within 10,000 feet of any airport runway used by turbojet aircraft or within 5,000 feet of any airport runway used by only piston-type aircraft must demonstrate that the units are designed and operated so as not to pose a bird hazard to aircraft. Similar requirements are specified in federal Subtitle D regulations (40 CFR Part 258.10(a)).

The Petaluma Airport is located approximately 8.4 miles (44,350 feet) east of the CDS; this is the nearest airport to the landfill. The Central Disposal site and proposed fill development areas within LF-2 and the REA are located greater than 10,000 feet from this airport and thus meet the above siting requirements (GeoSyntec, 2004).

27 CCR §21600(b)(3)(A) requires that the Federal Aviation Administration (FAA) and other appropriate officials be notified if a new MSW unit or lateral expansion will be sited within a 5-mile radius of any airport runway used by turbojet or piston-type aircraft. Future development at the CDS will be within the currently permitted waste boundary as identified in the existing SWFP. Therefore FAA or other agency notification is not required.

3.10 SUMMARY OF SITING AND LOCATION CRITERIA

Information summarized above shows that geologic, hydrogeologic, seismic and other conditions in the areas of proposed new cell construction LF-2 and the REA meet the siting criteria of federal Subtitle D and 27 CCR regulations for MSW landfills, with the exception of the required 5-ft groundwater and waste separation in LF-2. In particular, there are no wetlands and active faults in the proposed new cell areas, these areas are not located within a 100-year floodplain zone or in the vicinity of an airport. Geologic mapping of the REA and LF-2 area indicate no evidence of unstable areas or areas of potential rapid geologic change.

To meet the 5-ft separation requirement in LF-2, an engineered alternative for new cell design, as allowed by the regulations and in response to specific requirements by the RWQCB, will be incorporated into the proposed containment system design. A capillary break/underdrain system and additional soil layers in the base liner system are proposed for this new cell. In addition, to account for potential capillary rise and potential seeps in REA canyon walls and meet RWQCB requirements, an underdrain system and additional soil placement in the base liner system are also proposed for this cell. Agency requirements for groundwater separation in new units are specified in correspondence between the County and RWQCB (Sonoma County, April 13, 2012; RWQCB, April 20, 2012). Details of the proposed engineered alternative underdrain system are provided in **Section 5.6** of this JTD.

4.0 WASTE CLASSIFICATION AND MANAGEMENT

4.1 GENERAL

The Central Disposal Site is operated as a Class III MSW Landfill. This section of the JTD presents background information about the types and quantities of wastes to be accepted at the CDS, and support for the proposed new cell classification per 27 CCR §21750(b). Proposed new WMU designations and cell locations are shown in ***Figure 3A***.

4.2 WASTE TYPES AND VOLUMES

27 CCR §20220 (a, c), §20230, §21600(b)(2)(A) and §21600(b)(7)(C)

4.2.1 Waste Types

The waste types currently permitted and planned to be received at the CDS consist of non-hazardous mixed municipal solid waste from residential, commercial and industrial sources, construction and demolition (C&D) debris, inert waste, agricultural wastes, dead animals and dewatered sludge in accordance with 27 CCR §20220 and 20230. Specific waste materials and types anticipated for disposal at the CDS are described as follows:

- Residential waste: non-hazardous materials generated at residential households or apartments. These materials typical include miscellaneous discarded items such as food waste, paper, rubber, plastic, garden waste, yard trimmings, lumber, metals, glass and ashes not already removed from the waste stream by existing recycling or green waste diversion programs.

- Commercial wastes: non-hazardous discards that originate in businesses, institutional establishments, and the industrial sector. These materials can include paper, food wastes, metal, glass, plastics, ceramics and other items not already removed from the waste stream by existing commercial recycling programs.

- Industrial wastes: non-hazardous solid wastes and semi-solid wastes resulting from industrial processes and manufacturing operations. These materials can include paper, rubber, plastics, metals, ceramics, lumber, glass and other items not already removed from the waste stream by commercial or industrial recycling programs.

- C&D debris: inert and other waste building packaging and rubble resulting from the construction, remodeling, repair, demolition and maintenance of households, commercial buildings, pavements, public works projects and other structures. These wastes may include lumber, metals, asphalt, roofing materials, gypsum, plaster cement, rubber products, roofing shingles, insulation materials (excluding asbestos), rock and earth, not already removed from the waste stream by existing commercial and C&D recycling programs.

- Inert waste: as defined under 27 CCR §20230(a), solid waste that does not contain hazardous waste or soluble pollutants, and significant quantities of decomposable waste.

- Dewatered sludge: this material is accepted at the CDS, provided that the sludge meets the County's pre-disposal testing requirements. The solids content of the sludges received at the CDS ranges between 15 and 20 percent in accordance with 27 CCR §20220(c)(2) and (3) (GeoSyntec, 2005). The sludge is and will continue to only be applied to areas with a leachate collection and removal system (LCRS, i.e. LF-2 and REA).

- Dead animals: Under 27 CCR, this is refers to carcasses or parts of animals that require disposal. At the CDS, dead animal disposal is limited to sheep only, unless an emergency waiver is granted by the LEA.

Metals recycling operations are also performed in designated areas of the CDS. These recycling activities are described **Section 2.7.6** of this JTD.

4.2.2 Waste Volumes

27 CCR §21600(b)(2)(A) requires a description of current average daily tonnage and peak daily waste flows, as well as a five-year projected waste flow.

The County resumed limited MSW filling operations at the CDS in September 2010. Disposal activities are restricted to currently constructed cells – i.e., Phase I and II areas of LF-2, and the "top deck" of LF-1 including the metals recycling area and the north-facing slope above the compost deck area. Based on operating data for the period October 2010 through May 2012, the average daily disposal rate was approximately 475 tpd (6 days per week operation, or tpd_6), and the peak daily flow was approximately 1,100 tpd_6 (Keller Canyon Landfill Inc. / Republic Services, 2010, 2012).

Current waste deliveries to the facility are currently significantly lower than historic averages before disposal operations were temporarily suspended in 2005. Prior to 2005, waste deliveries were as high as 500,000 tons per year. The current daily throughput is intentionally limited because remaining airspace capacity in existing LF-2 Subtitle D cells is limited.

Based on planned waste flow commitments and existing County-wide disposal data, the County anticipates deliveries of approximately 240,000 tons per year to the CDS commencing in year 2013. Waste deliveries would resume at this level following permitting and construction of new waste cells as described herein. This annual disposal rate is equivalent to an average of approximately 770 tpd_6.

Waste disposal rates over the 5-year period 2013 through 2017 are expected to range between 240,000 and 250,000 tpy. This latter rate is equivalent to approximately 800 tpd_6. These anticipated waste volumes are subject to change and are based on several factors including waste flow commitments, economic activity, and recycling efforts.

The current SWFP specifies a permitted maximum tonnage of 2,500 tpd for 6-day per week operation. No change in this current maximum limit is proposed at this time.

4.3 OTHER WASTE REQUIRING SPECIAL HANDLING

Other wastes which will be accepted at the CDS include dead animals, autoclaved medical waste non-hazardous soil containing specified levels of volatile organic compounds (VOCs). Impacted soils are accepted for disposal as outlined in the Major Facility Review Permit (Title V Operating Permit) as administered by the Bay Area AQMD. Briefly, these conditions require that the VOC content of the soils accepted for disposal remain below "contaminated" levels specified in the permit of 50 parts per million by volume (ppmv). VOC concentrations are determined by testing of the materials. These non-contaminated soils may be used as daily or intermediate cover material per the conditions of the permit.

In accordance with Title V Operating Permit, impacted soils received at the CDS which have VOC concentrations in excess of 50 ppmv must be treated, deposited in a final disposal site, or transported off-site for treatment or disposal within specified time frames of receipt.

4.4 HAZARDOUS WASTE

The disposal of hazardous wastes is prohibited at the CDS. A hazardous waste load check program is in effect at the T/PF and materials intercepted are removed by the waste generator or secured in hazardous waste storage lockers for later off-site transport and disposal at a permitted facility. Further details on the hazardous waste load checking program at the T/PF are provided in **Section 8.12** of this JTD.

4.5 WASTE VOLUME AND SITE LIFE PROJECTIONS

27 CCR §21600 (b)(3)(B and C)

Estimates of useable landfill airspace capacity were made using AutoDesk Civil 3D software. Quantity take-off comparisons were made between: (1) existing grades (year 2012); (2) the final grading plan presented herein; and (3) the landfill cell excavation plan for LF-2. Records of wastes disposed over the period September 2010 through May 2012, as reported by the County and the site operator, Keller Canyon Landfill Company, Inc., were used to estimate airspace consumed during that period. Taking into account airspace to be consumed by base liners, preferential path soil layers over existing waste and the final cover system, it is estimated that as of May 15, 2012, approximately 9.0 million cubic yards airspace is available at the CDS under the site development plans proposed herein. Using this volume and a conservative landfill industry airspace utilization factor of 1,200 pounds per cubic yard for in place waste density (waste plus daily cover), approximately 5.4 million tons MSW disposal capacity is available for the fill sequencing and final grading plans as proposed herein. Airspace capacity estimates are provided in ***Table 2.***

Airspace capacity was determined via volumetric take-off comparisons of site topographic surveys from 2007, 2010 (LF-2 area only) and 2012, and proposed excavation and grading plans.

Table 2. Landfill Capacity and Site Life

Cell / Stage	Site Life (Years) 250,000 tpy	500,000 tpy	Net Airspace (CY)
LF-2, Phase III	4.5	2.3	1,876,500
LF-2, Phase IV	3.3	1.6	1,369,500
LF-2, Phase V	4.3	2.2	1,800,000
REA	1.8	0.9	750,000
LF-1	7.7	3.8	3,200,000
Total - Site	**22**	**11**	**8,996,000**

Note: The cell/stage areas above exclude approximate 14.4-acre "South Face" of LF-1 where no future filling is proposed. This area will receive partial final closure.

Based on this projected site airspace capacity, the landfill site life is expected to be exhausted in 22 years for waste placement at the current forecasted rate of 250,000 tpy. Assuming waste disposal rates will be closer to recent historical averages of 500,000 tpy (averaged over the period 2000 – 2004, before disposal operations at CDS were temporarily suspended), site life is expected to be exhausted within 11 years.

The landfill capacity and site life for these varying scenarios is presented in ***Table 2*** and is based on an in-place density of 1,200 pounds per cubic yard. This effective density can be achieved with a waste-to-cover ratio of 4:1 to 5:1. Detailed worksheets with site life calculations are provided in ***Appendix E***.

The site operator reports that its current operational practices result in an in-place waste density of 1,500 pounds per cubic yard (Keller Canyon Landfill Inc., 2012). Maintaining this performance standard over the long term would increase the landfill site life beyond the projections shown in ***Table 2***. We consider our estimate of site life, using a lower in-place waste density, to be conservative for planning purposes.

Projecting the site life is an estimate and is affected by many factors including population and demographic changes, local and regional economic activity affecting waste generation, advances in waste handling and disposal technology, recycling efforts, compaction efforts, settlement, soil cover and alternate daily cover (ADC) use, contractual arrangements for waste deliveries, and future revisions to permit conditions.

The currently-permitted total airspace capacity at the CDS is 32,650,000 cubic yards, based on previous estimates by the County. No change in total airspace capacity is proposed. The remaining airspace capacity estimate above reflects filling to grades as allowed under the current SWFP.

4.6 WASTE DECOMPOSITION PROCESSES AND BY-PRODUCTS

27 CCR §21740(a)(3)

4.6.1 Landfill Gas

Municipal solid waste undergoes natural chemical and biological decomposition processes in a landfill environment. Initially, aerobic bacteria – bacteria that live only in the presence of oxygen - consume oxygen while breaking down organic materials in the buried waste. Anaerobic decomposition processes then take place as available oxygen is depleted. As anaerobic decomposition proceeds, carbon dioxide and some nitrogen and hydrogen are produced. The anaerobic decomposition processes then generate methane as a by-product. Gas production then reaches steady-state conditions, followed by a slow decrease as a result of the complete decomposition of biodegradable materials (i.e., food, yard wastes, paper, etc.). Waste decomposition and LFG generation processes may last for 30 years or more.

LFG as-generated typically contains 45 to 60 percent methane and 40 to 50 percent carbon dioxide by volume (Eastern Research Group, 2001). LFG also contains nitrogen, oxygen, and trace concentrations of non-methane organic compounds (NMOC).

The rate of waste decomposition and LFG production in a landfill varies according to several factors including organic content of the MSW, moisture content of the waste, moisture pathways through cover and waste, temperature, and degree of compaction.

A comprehensive LFG collection and control system has been installed and is operated at the CDS. The system is designed and operated to control subsurface combustible gas (methane) migration through soils, and NMOC surface emissions that could affect air quality. The system provides added benefit in controlling methane and carbon dioxide emissions; these greenhouse gases (GHG) contribute to global warming. At the CDS, collected LFG is used as fuel to generate power at the on-site LFGTE plant. Further details on the LFG collection and control system are provided in **Section 5.13** of this JTD.

The LFG collection system will be expanded as MSW filling operations proceed at the CDS. As a basis of design, LFG recovery estimates were prepared by SCS based on historic and anticipated waste disposal rates, the expected methane decay rate for the CDS (which is a function of site precipitation), existing and future LFG collection system coverage (or capture efficiency), historic gas deliveries to the LFGTE plant, and other factors. Assumptions and details on LFG recovery estimates are presented in ***Appendix F***.

As shown in ***Appendix F,*** and based on future anticipated waste disposal rates, future LFG recovery at the CDS is expected to range between 2,100 and 2,200 scfm. For comparison, the existing LFGTE plant can accommodate LFG flows up to 2,800 scfm. The existing LFG flare is sized for approximately 1,500 scfm. Thus LFG handling capacity is 4,300 scfm, which exceeds the projected gas recovery rate. (The existing LFGTE plant and flare were installed at a time when waste flow commitments resulted in higher disposal rates and LFG generation than currently experienced or forecast.) Thus sufficient LFG control/destruction capacity is projected for the near- and long-term.

The LFG recovery projections presented herein are based on our engineering judgment as of the date of this report. Because the methane decay and recovery potential values used by SCS for modeling LFG recovery do not provide information on LFG emissions, they should not be used for any regulatory purpose and are not intended for use in response to U.S. EPA regulation and guidance for LFG modeling for Clean Air Act or other local regulatory programs.

4.6.2 Leachate

4.6.2.1 General Mechanisms for Leachate Production

Leachate is defined as liquid that has come into contact with the buried waste. At lined Class III waste management units, leachate is produced primarily as a result of water infiltration through the waste mass. The quantity of leachate generated at a landfill is dependent on several factors, including:

- Initial waste moisture content (as-delivered).
- Amount of surface water infiltration through daily, intermediate or final cover systems.
- Amount of evapotranspiration.
- Waste moisture retention capacity.
- Rate of waste decomposition.

In general, the leachate generation rate at lined waste management units is highest early in the operating life of an individual cell, approaches steady-state condition during the latter stages, and decreases after placement of the final cover system.

As liquid filters through the waste prism, it incorporates soluble components of the waste and cover materials, and also carries various hydrophilic colloidal and other suspended matter. The soluble components usually consist of a variety of alkaline earth and heavy metals, soluble organic compounds such as intermediate or end products of waste decomposition, and a variety of other soluble constituents that may be present in the fill materials. Thus leachate is a mix of soluble organic and inorganic constituents, suspended solids and bacteriological constituents, in an aqueous medium (Golder Associates, 2009).

The site-specific composition of leachate is a function of waste stream components, climate and rainfall, site hydrogeology, cover soils, and waste decomposition processes. The County has implemented a comprehensive groundwater and leachate monitoring program and leachate characteristics at the site are well defined. Refer to **Section 6.1.2.3** of this JTD for further details on leachate monitoring programs.

4.6.2.2 Leachate Presence at LF-1

At the unlined LF-1 area of the CDS, leachate volumes in the waste are also influenced by groundwater infiltration and upwelling. Extensive studies have been performed to assess the presence and mechanisms for leachate generation and migration potential (RMC Geoscience, 2002, 2008; Shaw Environmental Inc. 2005). Key findings applicable to design and operation of future waste disposal cells at the CDS include the following:

- Leachate appears as perched zones within the upper portion of LF-1 and as a continuous zone of saturation in the lower portion of the refuse. A leachate column thickness of up to 100 feet above the cell floor has been measured based on piezometers and leachate well readings in that cell. An extraction system, described below, has created an inward gradient to draw down observed leachate levels in the fill.

- Upwelling groundwater, manifested by springs present in the Central Canyon area, was present prior to LF-1 development.

- Net groundwater flow at LF-1 appears to be from the underlying Franciscan Formation bedrock to the refuse (inward gradient) and the potential for leachate migration from the fill to bedrock is limited.

- Groundwater inflow below has been attributed to the majority of leachate generation in LF-1. The remainder is attributed to storm water infiltration through existing intermediate cover, and to a lesser extent, surface water flow into the LF-1 fill.

- In 2002, the leachate volume in LF-1 fill area was estimated at 140,000,000 to 150,000,000 gallons (RMC Geoscience, 2002). This was done using AutoCAD software to calculate volume between the measured leachate surface(s) in LF-1 and the pre-development landfill surface. Leachate volumes have been reduced since then as a result of ongoing corrective action programs at the CDS as described below.

A site conceptual model was prepared to illustrate these concepts (Shaw Environmental Inc., 2005). In particular, cross-sections of LF-1 were prepared to show schematic mechanisms for groundwater inflow and potential leachate migration. These illustrations are provided in ***Appendix G***. Again, based on this model, the upward groundwater gradient was believed to minimize deeper migration of leachate from the unlined LF-1 into the underlying formation. This is evidenced by results of historic groundwater monitoring, which show only limited evidence of volatile organic compounds (VOCs) and leachate influence in groundwater at wells downgradient of LF-1 (Pacific Geoscience, 2009, 2010, 2011).

Various leachate extraction and control systems are in place to draw down leachate in the LF-1 refuse mass, as part of original cell construction or in response to WDR Order No. R1-2004-0040 for corrective action. Gravity-drain collection systems were installed at the CDS as the site was developed down-canyon in LF-1. These include bottom gravity-drainage systems, perimeter french drains, collector mains, sumps and pump system. Bottom drains include perforated pipe and drain rock placed on clay lined canyon floor are in place. A network of pneumatically operated vertical wells that extract leachate are also used to extract leachate from LF-1. Details on these leachate removal systems are provided in **Section 5.2** of this JTD. Collectively, these systems remove approximately 49,580 gallons of leachate per day from the LF-1 refuse prism (Sonoma County 2010).

A water balance was performed that showed the volume of leachate in LF-1 (leachate storage) was decreasing by approximately 2.0 million gallons per year in response to County extraction efforts (RMC GeoScience, 2008). **Continued operation of these leachate management systems, in particular the leachate extraction system, is critical to long-term environmental management at the Central Disposal Site.** The fill sequencing plans for future waste placement in LF-1 proposed herein have been developed to allow continued leachate and LFG extraction.

4.6.2.3 Leachate Generation Estimates – Proposed New Waste Cells

Leachate quantities for the proposed new cells in LF-2 and the Rock Extraction Area of the CDS were estimated using the Hydrologic Evaluation of Landfill Performance (HELP) model version 3.07. The model was released in November 1997 and was developed by the U.S. EPA under Interagency Agreement No. DW21931425 to the U.S.Army Engineers Waterways Experiment Station. The HELP model predicts the quantities of leachate that will be generated based on climate, soil and landfill design data. This data includes precipitation, temperature, evapotranspiration, landfill profile, soil and waste properties, liner system details and physical properties, and surface water run-off.

Table 3 provides a summary of anticipated average annual leachate generation during site operations. Refer to ***Appendix H*** for complete results of the HELP model analyses. As shown in ***Table 3***, the average volume of leachate expected to be captured in the new LCRS systems in LF-2 and the REA are 121,000 gallons/acre-year for the sideslopes, and 129,700 gallons / acre-year for the cell floors. For the proposed cell design floor and sideslope areas at CDS, these estimated average leachate generation/capture rates correspond to approximately 7,000 gallons per day (gpd) in LF-2 (equivalent to 4.9 gallons per minute, or gpm), and approximately 4,820 gpd (3.3 gpm) in the REA.

Table 3. Summary of Leachate Generation Estimates (Help Model) During Landfill Operation (Active Site)

LF-2/REA Cell Floor 2.5% Slope	Peak Daily Head on Liner [in]	Drainage Layer Permeability "k" [cm/sec]	LCRS Capture Average Annual [gal/ac]
LCRS Layer	0.61	1	129,700
LF-2/REA Cell Wall 3:1 Sideslope	**Peak Daily Head on Liner [in]**	**Drainage Layer Permeability "k" [cm/sec]**	**LCRS Capture Average Annual [gal/ac]**
LCRS Layer	0.014	10	121,000

The peak head on the base liner is estimated at 0.61 inches, which is well below the 12-inch design standard specified in 27 CCR and federal Subtitle D regulations.

The HELP model results were used in evaluating design capacities for the LCRS systems in new cells to be constructed at LF-2, Phases III and IV, and the Rock Extraction Area. The highest volume of leachate would be generated during a 100-year, 24-hour storm event when only one lift is in place. Based on the HELP analyses, the peak leachate generation rate in each cell is estimated to be approximately 3,920 gallons per acre per day, or 54 gpm in LF-2. This value predicted by the model is considered to be conservative for purpose of sizing the LCRS.

For comparison, leachate recovery rates from the existing system in place at LF-2 (Phases I and II) average approximately 5,430 gpd or 3.8 gpm over the period 2002 through 2010. This is based on County data for fiscal years July through June (Sonoma County 2010). This LF-2 leachate capture rate is equivalent to 94,830 gallons per acre per year (existing LF-2 cells are 20.9 acres footprint), which is less than predicted by the HELP model. Thus we consider results of the HELP model to be reasonable.

5.0 LANDFILL DESIGN

The remaining development and operation of the Central Disposal Site has been designed to isolate waste from the surrounding environment, control leachate and landfill gas, divert and manage surface water run-on and run-off, and provide efficient utilization of available disposal capacity (airspace). New lined cells at the CDS proposed for future waste disposal are designed to meet or exceed requirements set forth in 27 CCR, federal Subtitle D regulations as well as existing permit conditions.

This section of the JTD describes the details of the proposed facility design, and how it provides for the surrounding physical setting as required under 27 CCR §21600(b)(4)(A) and §21750(a). It also describes how containment structures will prevent degradation of waters of the state as required by 27 CCR §20310(c) et seq. This section specifically includes information on: existing containment systems; proposed phasing and grading plans; geotechnical evaluations performed; earthfill quantities needed for landfill construction and operation; groundwater infiltration controls; proposed new landfill liner systems; leachate collection and removal system details; surface water drainage and sediment control provisions; existing and proposed environmental monitoring systems; and the construction quality control plan for new cell construction.

All phases of the landfill development will be inspected and documented for quality control and compliance with state and federal regulations. Landfill containment features shall be designed and construction shall be supervised and certified by a registered civil engineer or certified engineering geologist, in accordance with 27 CCR §20310(c) and §21600(b)(4)(B).

5.1 DESIGN OVERVIEW

The County proposes to construct new double composite-lined waste cells within the currently-permitted refuse disposal boundaries in LF-1 and LF-2. Engineered capillary break/underdrain and double composite geomembrane/soil base liners with leak detection capability will be installed in these new cells. The County also proposes to continue refuse filling in areas where base liners will have been constructed and over wastes previously placed in LF-1 and LF-2. New cell construction and waste placement will occur in separate phases over an approximate 11 to 22 year period depending on waste disposal rates.

Landfill development plans have been prepared which show new cell excavation and base grading plans, fill sequencing, final grades and other details on proposed future site development. They are presented in ***Figures 13*** through ***23A***. The primary purpose of the development plans is to provide general design concepts suitable for permitting purposes.

Two new cells will be constructed in LF-2 by excavating existing soils to the proposed design depths to create bottom surfaces that will be double composite-lined to contain the wastes and liquids/gases associated with waste decomposition and consolidation processes. The REA has previously been excavated during quarry operations and a double composite liner system will be placed over these existing grades to allow MSW filling in that area. The proposed liner systems for new cells in LF-2 and the REA exceed the requirements of state and federal regulations for Class II Landfill as defined by 27 CCR §20250 as they consist of double composite liner components with a leak detection capability.

The new cells in LF-2 and the REA will be equipped with capillary break/underdrain systems which provide a break in capillary rise and allow for removal of groundwater below the composite liner systems and thus effectively lower and separate ground water from MSW. Engineered fill soils will be placed over the underdrain system on cell floor areas to provide additional separation between the soil/geocomposite liner systems and groundwater. Leachate and LFG extraction/barrier systems will be installed to prevent gas or liquid contaminant migration from LF-1 into the new underdrain systems.

Construction of new base liners in LF-2 and the REA will complete development of the CDS landfill footprint, within the approximately 172.8-acre waste disposal area as identified in the SWFP. Wastes will then be placed over the entire CDS footprint area, including previously filled areas of LF-1 and LF-2.

In areas where new refuse will be placed over the existing landfill mass, a preferential LCRS pathway layer will be placed. Proposed preferential pathway locations are shown in ***Figure 3A***. In LF-2 and the REA, the preferential pathway will consist of, from bottom to top, a geosynthetic clay liner (GCL), geomembrane and a geocomposite drainage net layer placed over compacted intermediate soil cover. A schematic drawing of the preferential pathway system is provided in ***Figure 19B***. On the compost deck area of LF-1, the preferential pathway will consist of a 1-foot thick layer of soil with a permeability of $1x10^{-6}$ cm/sec (or a GCL if soil permeability requirements cannot be met), a geomembrane, and a 0.5-foot gravel drain layer. Penetrations through the preferential pathway GCL and geomembrane layers for LFG and leachate extraction wells will be needed. The concept that penetration of the preferential pathway will be necessary to maintain the WDR-required leachate extraction has been acknowledged and pre-approved by the RWQCB (RWQCB April 20, 2012).

The preferential pathway layers will be placed over existing fill slopes in LF-1 and the compost deck area in advance of new waste fill. The surface of the compost deck area will be prepared to provide slope for drainage in advance of preferential pathway and waste placement. The preferential pathway systems will act in conjunction with and will be continuous with liners placed under areas where new refuse will be placed over native materials. This preferential pathway system will provide separation between new waste overfilling existing waste, allow continued operation of existing leachate and LFG extraction wells in LF-1, and collect and re-direct leachate from newly-placed wastes to existing LCRS systems in LF-2 and the REA.

The final grading and cover systems are designed to optimize the volume of MSW fill that can be placed over the permitted waste disposal area. The final grades represent the top of the cover layer which is the surface of the landfill that must withstand erosion from wind, precipitation and utility vehicle traffic during the post-closure period. The final cover system over LF-1 includes a high density polyethylene (HDPE) geomembrane and drainage layer which is covered by 18 inches of vegetative soil. The final cover over LF-2 adds a GCL beneath the HDPE geomembrane. These systems are consistent with RWQCB requirements for a final cover at CDS (RWQCB, 2010). At final grades, the maximum fill elevation will be 565 feet MSL, as specified in the existing SWFP.

The County proposes to implement partial final closure of an approximate 14.4-acre plan area within the lower elevations of the South Face of LF-1 (Phase I Partial Final Closure). The existing elevations and slope configurations in this 14.4 acre area are at proposed final grades and no additional refuse placement is contemplated in this area. The partial final closure capital project will take place as soon as practicable following regulatory agency approval of this JTD and accompanying partial final closure plan. It is intended that the partial final closure project be undertaken concurrently with construction of the first new base liner in LF-2.

The design of the new cell layouts and final grades is controlled by the permitted fill area boundaries, existing MSW fill grades and geometry, siting criteria and regulatory requirements for new waste management units and containment systems, slope stability requirements, soil balance to optimize cell excavation and construction/cover needs, rippability of underlying soil materials in LF-2, and the need to provide continued operation of existing leachate and LFG management systems.

5.2 EXISTING CONTAINMENT SYSTEMS

A number of detailed site studies, design evaluations and other reports have been prepared for the Central Disposal site since it was developed in the 1970s. The following descriptions of existing landfill containment systems are adapted from previous work, including that by GeoSyntec (2005), RMC Geoscience (2002), and Shaw Environmental Inc. (2005).

The existing barriers and leachate management systems for LF-1 and LF-2, described below, will remain operational as new waste cells are constructed and refuse filling proceeds at the CDS.

5.2.1 1971 Permitted Area (LF-1)

5.2.1.1 Landfill Development

Prior to site development in 1971, the original topography of the former Central Canyon area (now LF-1) was characterized by a southeasterly-trending valley that formed a south to southeasterly tributary to Stemple Creek. A pre-development topographic map is provided in ***Figure 4***.

Waste placement in LF-1 commenced in 1971. Wastes have been placed over the entire Central Canyon with the exception of the Rock Extraction Area. Site development reportedly progressed by cut-and-fill methods that included excavating the upper several feet of the canyon, compacting the exposed subgrade or locally placing and compacting clay to form a discontinuous base liner, installing a subdrain collector system and barriers, followed by waste placement in sequential layers. As filling progressed, daily and intermediate soil cover was obtained from adjacent on-site slopes. The upper portion of the disposal area (the compost deck, current site of Sonoma Compost operation) was filled during the period 1971 through mid-1988.

Filling then proceeded in the lower canyon, generally south of what is now the compost deck area. Reportedly, the lower portion of the LF-1 was lined with low—permeability soil as the fill progressed down-canyon. The valley bottom was graded at slopes ranging from 7 to 15 percent and lined with clay with a hydraulic conductivity of 1×10^{-6} cm/sec. Dendritic gravel drains were installed in the low-permeability soil layer to direct liquids to a sump at the base of LF-1 (Sonoma County, 2012). The liner was reportedly installed in excess of California regulatory requirements in effect at the time (GeoSyntec, 2005).

5.2.1.2 Leachate Collection Systems

Leachate collection and management systems in the LF-1 area of the CDS include a liquids collection system, a series of subsurface barriers, a lined storage impoundment, and a covered and lined storage impoundment. Principal collection systems include bottom subdrains, perimeter french drains, and vertical extraction wells, described as follows:

- **Subsurface barriers.** Three cutoff barriers were constructed across the original central canyon; one at a mid-level area, and two downgradient from all disposal site operations (refer to the cross-section in ***Figure 10***). The barriers are constructed of compacted clay having a hydraulic conductivity of 1 x 10^{-6} cm/sec or less, and are keyed into the Franciscan Formation. The first barrier was constructed at the separation point between the upper and lower units of LF-1. The remaining two barriers were constructed at the toe of LF-1.

  The two barriers constructed at the toe of LF-1 are referred to as the primary and secondary groundwater barrier systems. These systems were installed to intercept groundwater in the shallow alluvial/colluvial deposits at the southern toe of LF-1 and to prevent offsite migration. In general, both systems were constructed by excavating an interceptor trench across the width (i.e. perpendicular) of the canyon drainage channel. The excavations were reported to extend into competent bedrock. The interceptor trenches were backfilled with compacted clay.

  The primary barrier was constructed in two phases. The initial phase was constructed in 1971 as part of initial development of LF-1. The total depth of the barrier system extended approximately 20 to 25 feet below the channel flow line. The final base and top elevations of the completed barrier were approximately 190 and 215 ft MSL, respectively. The second phase of construction was implemented in 1989 to accommodate expansion of refuse placement operations in the southern footprint of LF-1. This phase involved increasing the height of the barrier to a final grade elevation of approximately 250 ft MSL

  Construction of the secondary barrier was conducted in 1988. The primary purpose of this system was to provide containment protection for Leachate Pond No. 1. The system was intended to provide secondary protection against the possibility of impacted groundwater leaving the site. Excavation for the secondary barrier extended approximately 23 feet below the channel flow line. The final base and top elevations of the completed barrier, at the channel axis, were approximately 187 and 210 ft MSL, respectively.

- **French drains**. Several leachate interceptor drains and/or pits were installed during the course of landfill operations to address leachate seepage at portions of the perimeter of the landfill footprint, at slope benches and other locations. These french drains convey the intercepted leachate by gravity flow to the storage impoundment.

- **Vertical leachate extraction wells**. A network of 92 leachate and dual leachate-gas extraction wells has been installed throughout the LF-1 footprint area. The wells extend into the underlying fill and are equipped with pneumatic pumps for leachate removal. Pump discharge (leachate) is conveyed to on-site leachate ponds via HDPE conveyance lines.

- **Groundwater barrier**. A groundwater barrier system was installed along the southern portion of the property in 1988. This consists of a compacted clay barrier that extends across the entire length of the central canyon drainage channel. The barrier is keyed into competent Franciscan bedrock along its base and eastern flank. The barrier system was installed as a safety precaution to intercept any leachate that may not be intercepted by the other barrier systems (GeoSyntec, 2005).

- **Conveyance line**. An 8-inch diameter HDPE pipe is installed in the perimeter roadway on the eastern side of LF-1. This pipeline conveys collected liquids from the perimeter french drain system described above to the leachate ponds. Note: this conveyance line will be re-routed as part of future site development in LF-2.

In summary, various leachate barriers and collection systems were installed as the LF-1 fill area was developed down-canyon. These have been judged to be state-of-the practice when installed (Shaw Environmental Inc., 2005); however these systems were not installed to present day standards. This is typical of pre-Subtitle D landfill construction. Thus LF-1 is considered an unlined, pre-regulations landfill (RWQCB, 2004). Schematic cross sections of LF-1 illustrating the above barriers and leachate controls are provided in ***Appendix G***.

5.2.2 LF-2 Area

Phases I and II of LF-2 were designed in accordance with the criteria and standards set forth in 40 CFR, Section 258 (federal Subtitle D regulations), 27 CCR Division 2, and RWQCB Order No. 93-83 (September 1993). The design was developed to isolate waste from the surrounding environment, and allow for containment and collection of leachate (GeoSyntec, 2005).

The existing containment systems for LF-2 are configured for excavated floor and side-slope areas, and generally consist of a capillary break/underdrain, composite liner systems, and LCRS. The existing containment systems in LF-2 consist of the following components:

- Cell Floor Areas (bottom to top):
    - Prepared subgrade of excavated native materials or compacted general fill;
    - A 1-foot minimum thickness capillary break/underdrain system, consisting of granular material which provides a positive barrier to capillary rise and allows for removal of groundwater below the composite liner, and thus effectively separates groundwater from refuse;

- Geotextile separator layer
- A 1-foot minimum thickness compacted clay liner (CCL), with a hydraulic conductivity of 1 x 10^{-7} cm/sec or less, which is considered part of the secondary liner in the composite liner system;
- GCL barrier, with a minimum 30-mil HDPE geomembrane backing, also considered part of the secondary liner system;
- 60-mil thick HDPE geomembrane liner, considered a primary liner in the composite system;
- Geotextile cushion layer to protect the HDPE geomembrane from overlying granular materials;
- 1-foot minimum thickness LCRS consisting of a blanket layer of granular material with associated gravity drain collection piping and sump;
- Geotextile filter layer to prevent clogging of the drainage material;
- 24-in minimum thickness soil operations layer.

- Side-Slope Areas (bottom to top):
  - Prepared subgrade of excavated native materials or compacted general fill;
  - Geocomposite (geotextile/geonet/geotextile) capillary break/underdrain layer;
  - GCL barrier, with a minimum 30-mil HDPE geomembrane backing, which is considered the secondary liner in the composite liner system.
  - 60-mil thick HDPE geomembrane liner, considered a primary liner in the composite system.
  - An LCRS consisting of geocomposite (geotextile/geonet), to transmit liquids to the floor area leachate sump;
  - 24-in minimum thickness soil operations layer.

5.2.3 Leachate Storage and Disposal

The County maintains records of leachate removal from the various systems described above at LF-1 and LF-2. Based on data for the period 2000 through 2010, leachate removal rates from LF-1 french drains and sumps averages 28,640 gallons per day (gpd). Liquids removal from extraction wells averages 20,940 gpd. Total leachate removal from LF-1 has averaged 49,580 gpd (equivalent to 34 gpm).

Leachate removal rates from the LF-2 LCRS sumps averages 5,430 gpd (equivalent to 3.8 gpm). Liquids removed from the LF-2 underdrain for the period 2005 through 2010 averaged 3,690 gpd, or 2.6 gpm. These leachate removal totals for LF-1 and LF-2 are based on County data for fiscal years (July through June) for the above period (Sonoma County 2010).

All leachate removed from LF-1 is pumped from the lower sump, flows by gravity from the french drains, or is pumped from the vertical wells to the ground surface where it flows by gravity to the primary lined and covered surface impoundment (Leachate Pond 1, see ***Figure 3***). All liquids removed from the existing LF-2 underdrain and LCRS systems are also piped to the primary lined surface impoundment (Leachate Pond 1). A second lined impoundment (Leachate Pond 2) is available for backup storage when Leachate Pond 1 is near capacity or undergoing maintenance.

The piping and pumping systems at both leachate ponds allow pond contents to be transferred between ponds. The piping systems are equipped with flow metering devices and sampling points; the County routinely monitors the underdrain water and leachate in accordance with existing WDRs (refer to JTD **Section 6.1**).

The leachate ponds have a combined capacity of 4.7 million gallons and were constructed as Class II surface impoundments in accordance with 23 CCR, Chapter 15 requirements, now included in 27 CCR §20365 (GeoSyntec, 2005). Both impoundments are double-lined leachate ponds. Leachate Pond 1 has a steel-frame metal roof over its entire footprint area. Leachate Pond 1 was constructed in 1988 as a soil-based liner system, and was retrofitted in 2001 with an upper synthetic liner system. Leachate Pond 2 has a geosynthetic based liner system. The pond liners were constructed as follows (barrier layers from bottom to top):

- Leachate Pond 1 (capacity 1.8 million gallons):
  - 2-ft thick layer of imported clay with permeability of 1×10^{-8} cm/sec, placed over prepared subgrade.
  - 1- to 1.5-ft thick layer of permeable drain rock.
  - Second 2-ft thick layer of imported clay with permeability of 1×10^{-8} cm/sec.
  - 80-mil textured geomembrane (secondary barrier).
  - 200-mil thick geonet leachate collection and removal layer.
  - 80-mil thick electrically conductive membrane (primary barrier).
- Leachate Pond 2 (capacity 2.9 million gallons):
  - Groundwater underdrain system consisting of a geocomposite drain net, geonet and filter geotextile.
  - Geosynthetic clay liner (GCL) as the secondary containment component.
  - 60-mil thick HDPE secondary geomembrane liner.

- An LCRS (including geonet, sump riser pipe, granular material and cushion geotextile).
- 60-mil thick HDPE primary geomembrane liner.

Collected leachate and underdrain water is pumped from the ponds via force-main pipeline for discharge to the City of Santa Rosa Waste Water Treatment Plant (Subregional Water Reclamation System). Discharge is in accordance with City of Santa Rosa Industrial Waste Discharge Permit No. SR-IW5202. The permit does not specify a daily discharge volume limit. The leachate conveyance system also has a permit under WDID # 1SSO11652 issued by the RWQCB, under general WDR Order No. 2006-0003-DWQ. The County operates the force-main conveyance system under a separate Sewer Management System Plan.

5.3 LANDFILL CONSTRUCTION SEQUENCING AND GRADING PLAN

27 CCR §21600(b)(4)(B and D) and §21090(b) – (b)(3)

Proposed new cell excavation and base grading plans, fill sequencing plans and a final grading plan are shown in ***Figures 13*** through ***17, 17 A*** through ***17 C,*** and ***18***.

5.3.1 Excavation and Base Preparation

5.3.1.1 LF-2

Future development of LF-2 will occupy the general area between LF-1 and existing LF-2, Phase I and II fill. Future cell construction will be subdivided to allow incremental construction of two separate 8- to 10 acre phases (plan areas), referred to as Phases III and IV, respectively. These two phases will be separately constructed generally starting in the north and proceeding southward. This will facilitate short- and long-term storm water and leachate management as the cells are constructed and filled with MSW. Re-configuration of the existing maintenance building equipment ingress/egress locations (or re-location of the building) is recommended prior to Phase IV excavation. The 8-inch diameter leachate conveyance line on the eastern end of LF-1 will be relocated around the perimeter of LF-2 to discharge to the leachate ponds.

Future cells in LF-2 will be designed and constructed to provide a continuous base liner with Phases I and II. The design provides for a second, separate LCRS within LF-2, Phases III and IV. This will complement the separate LCRS components already in place for LF-2 Phases I and II. Base grading for new LF-2 cells has been designed to provide a firm foundation capable of supporting landfill structures, account for separation of wastes from underlying groundwater, and optimize cell capacity and soil excavation quantities.

Excavation, base grading and interim fill plans for LF-2, Phases III and IV are shown in ***Figures 13*** through ***15***, respectively. The drawings show the limits of the excavations, base grading contours, drainage courses, and access roads. Typical cross-sections and details for base liner placement, including tie-ins to the existing base liner in Phases I and II are shown in ***Figures 19*** and ***19A***. Cell excavation, grading and subgrade preparation will provide a firm foundation capable of supporting landfill structures, as required by 27 CCR §20240(d).

Base grades were designed for gravity drainage of flow in the underdrain, leak detection and LCRS layers to main sumps at low points in the southern end of the Phase IV cell. This underdrain would be a gravity-drain system to collect near-surface groundwater from beneath the liners, via a gravel blanket, to drain to a sump as shown in ***Figures 23*** and ***23A***.

During Phase III operation, temporary leachate storage and underdrain storage and piping systems will be required to convey liquids to the leachate ponds. Permanent gravity drain tie-ins to replace the temporary Phase III leachate and underdrain piping will be installed during Phase IV construction. Details on the interim Phase III sump and connection between Phases III and IV are provided in ***Figures 19*** and ***19A***.

An approximate maximum depth of excavation of 57 feet below existing ground surface was used as a design basis. The maximum depth of rippability using standard earth moving equipment is 50 to 60 feet (GeoSyntec, 2005). Blasting of harder rock at depth, and potentially at near surface is expected (Sonoma County 2011).

The landfill cell excavations will be performed using a combination of blasting, as allowed by the current SWFP, and conventional earth moving equipment including dozers and self-loading scrapers. The excavation slopes are a maximum of 2.5:1 with a 15-foot wide bench along the western cell limit to provide maximum 50 vertical feet in elevation for cut slopes. The excavation bench is designed with minimum 2.5 percent slope for drainage.

Specific excavation and base grading activities in LF-2 will include:

- Proper abandonment/destruction of existing LFG, groundwater monitoring wells and piezometers in the excavation footprint (refer to **Section 6.1.5** of this JTD for details).

- Removal and/or re-location of existing site infrastructure, including the former leach field for the administration buildings, and leachate/condensate pipelines (in a trench in the current haul road), and confirmation of removal of the temporary storm water detention pond. Bulk removal of the former sedimentation pond was previously undertaken (Sonoma County, 2011). During construction, confirmation of complete removal of materials unsuitable for base liner foundation will be performed to base grades, controlled by construction quality assurance criteria.

- Clearing and grubbing – removal of materials not suitable for use in construction, including surficial vegetation, debris, temporary stormwater and leachate piping, etc.

- Blasting to remove and loosen hard rock materials. All blasting will be performed in accordance with LEA Conditions (17.l (1–10) as listed in SWFP 49-AA-0001 (CalRecycle, 2012) and in accordance with applicable state and federal regulations.

- Excavation and stockpiling of native soils using earthmoving equipment. The proposed excavations will provide soil required for planned development and operation of the CDS. The excavated soils include materials for the base liner, operations layer, daily and intermediate cover, and final cover foundation and vegetation layers. Excavated soils will be stockpiled in the existing soil stockpile area west of the South Face in LF-1.

- Subgrade preparation. The exposed subgrade will be prepared to provide a firm surface for placement of engineered earthfill and construction of liner systems. Soil materials exposed at subgrade surfaces will be scarified, proof-rolled, moisture conditioned, and compacted. If compaction reveals soft or pumping conditions, the affected area will be excavated and backfilled with engineered fill, with compaction, gradation and density requirements.

- Placement and compaction of engineered earthfill in the upper reaches of the northern and western cell excavation areas. Engineered earthfill placement will be required to achieve the final surface to underlie the base liner system (i.e, to fill low areas to match base excavation grades). Engineered fill is typically placed in 8 to 12-inch thick lifts. The earthfills in LF-2 will be engineered fill with compaction, gradation, and density requirements as specified in the construction documents.

- Surface preparation by fine-grading to the required elevations and grades for the bottom of the double composite liner system shown on the plans. Rough surfaces will be smoothed by removing protruding materials and replacing them with compacted soil. The resulting surface should be relatively smooth and uniform.

- Installation of the underdrain system (refer to **Section 5.6** below).

- Placement and compaction of minimum 4-foot thick compacted soil earthfill over native floor areas above the underdrain. The earthfill, in combination with the low-permeability soil component of the secondary composite liner, will provide for separation between the overlying soil/geocomposite liner systems and groundwater present in the underdrain.

Minor landslide deposits were identified during excavation of LF-2, Phases I and II. Landslide deposits within the Phase III / IV cell excavation areas, if present, will be removed with earthmoving equipment as described above. Mapped or observed landslides present at the margins of cell footprint areas (i.e., just outside the excavation footprint) will be completely removed via over-excavation into underlying competent soil or bedrock materials. Complete mapping of the exposed LF-2 foundation will be performed by a qualified geologist or engineering geologist as part of construction.

Prior to any construction activities, appropriate stormwater drainage controls will be implemented. These measures will include use of temporary ditches, earthen berms and other temporary structures to direct storm water away from erosive surfaces and prevent silt discharge to seasonal drainage channels. Silt fences and straw wattles will be used to trap sediments. Cut surfaces will be hydroseeded with native grasses to prevent erosion. All runoff will be directed to stormwater detention basins to control off-site sediment discharges. In advance of construction work, the County will prepare a Notice of Intent and Construction Storm Water Pollution Prevention Plan with details on the above for agency approval as appropriate.

5.3.1.2 Rock Extraction Area

Previous rock quarry and soil borrow activities have created a large open excavation area abutting LF-1. The current grades in the REA were created by those operations and range from approximately 400 ft MSL at the base to 480 ft MSL at the top of northern and western excavation slopes. The County proposes to install an engineered capillary break/underdrain, soil separation layer, and double composite base liners over native materials with leak detection capability, generally at existing excavation grades. No further mass excavation is proposed; minor grading and engineered earthfill placement will be required to meet design grades.

Proposed base grades for the REA are shown in ***Figure 17***. Wastes will be placed in the REA over the new base liner system and existing LF-1 slopes. A preferential LCRS pathway system, consisting of compacted soils, GCL, geomembrane and a drainage layer, will be placed over existing fill in LF-1 slopes in advance of new waste fill in the REA (the preferential pathway will also be placed in advance of waste placement in LF-2, Phase V and the compost deck). A schematic drawing of the preferential pathway system is provided in ***Figure 19B***. Historic quarry and soil borrow activities in the REA have exposed bedrock over most of the REA, which has since been overlain by a very thin veneer of soil and/or vegetation. Some bedrock exposures are still visible on side slopes of the REA (GeoSyntec, 2004). Placement of engineered soil fill over exposed native surfaces is proposed to protect the overlying base liner components from hard rock surfaces.

Previous studies have indicated that pre-existing earthflows and colluvium were removed by quarry operations. There is no evidence to suggest large or deep bedrock landslides occur within the REA and it is unlikely that earthflows or liquefaction will affect the stability or operation of the landfill in the REA (Geosyntec, 2004; RMC Geoscience 2011).

Past quarry and soil borrow operations also created an approximate 80-foot wide plan view opening in the southern part of the REA, between REA excavation slopes and LF-1 sideslopes. This topographic feature is known as the “narrows” and provides for drainage and vehicle access. An engineered soil embankment (toe berm) will be constructed at the southern end of the REA and will serve as structural fill to provide slope stability for MSW filling.

A previous site investigation indicated a thin lens of debris was placed in the area of the proposed REA toe berm, presumably as part of LF-1 fill activities. Seven test pits were installed; an approximate 1 foot lens of debris was identified in two of those seven test pits at a depth of approximately 5.5 feet below ground surface (under a layer of fill soils). Six soil borings were also installed in the proposed REA toe embankment area. No debris was encountered in any of these borings. The depth to competent bedrock below the toe embankment footprint ranged from 0 feet at the western abutment to approximately 30 ft near the eastern abutment (GeoSyntec, 2005). Removal of debris and fill soils will be required prior to toe embankment placement.

In summary, the REA foundation will consist of bedrock and engineered fill in the floor, northern and western cut slopes and toe berm. Given these conditions described above, specific cell preparation and base grading activities in the REA will include:

- Proper abandonment/destruction of existing LFG, groundwater monitoring wells and piezometers in the REA footprint (refer to **Section 6.1.5** of this JTD for details).

- Clearing and grubbing – removal of surficial soils and vegetation and debris.
- Minor grading to achieve design grades and promote proper drainage for underdrain and LCRS systems, using earthmoving equipment. Where Franciscan Formation sandstone is encountered, which may be extremely difficult to rip, blasting may be required to loosen and remove hard rock material.
- Excavation and removal of the thin lens of fill soil and debris present in the toe embankment area.
- Subgrade and surface preparation, as described above for new LF-2 cells. Refer to ***Figure 17*** for prepared subgrade / base grade elevations.
- Construction of an engineered structural fill toe embankment, approximately 35 feet high in the southern end of the REA. The structural earthfill will be engineered fill with compaction, gradation, and density requirements. The base of the engineered fill will tie extend into competent bedrock on its western abutment, and into bedrock or existing landfill slopes on its eastern abutment.
- Installation of the capillary break/underdrain system (refer to **Section 5.6** below).
- Placement and compaction of minimum 4-foot thick compacted soil earthfill over native floor areas (above the underdrain) and 2-foot thick compacted soil earthfill over sideslopes (over exposed bedrock). Earthfill placement will provide protection for the overlying base liner systems. For the floor area, it will also provide for additional separation between the liner systems and groundwater present in the underdrain. The earthfill in the REA will be engineered fill with compaction, gradation, and density requirements.

5.3.1.3 Compost Deck Area

Future MSW filling in LF-1 will take place in the approximately 35-acre compost deck area. This area was previously used for MSW disposal during the period 1971 through 1988. The compost deck surface is relatively flat, sloping approximately 2 percent from west to east. An intermediate cover system has been placed and based on field investigation, varies in thickness between 4.5 to 8 feet at the locations tested (GeoSyntec, 2008). This area is currently the site of a green waste composting operation known as The Central Compost Site (refer to **Section 2.7.4** of this JTD for a description of compost operations).

Prior to future MSW placement, compost operations will be re-located, the compost deck area will be re-graded and a preferential pathway system will be deployed. A preliminary base grade preparation plan and cross section for the compost deck area are shown in ***Figure 17B***. Specific compost deck site preparation activities will include:

- Removal of existing finished compost product stockpiles, pushwalls and other site infrastructure, including utility/storage buildings and trailers, and electrical, communication and water supply utilities.

- Temporary re-routing of LFG and leachate extraction system piping for site preparation. (Note: existing vertical LFG and leachate extraction wells will remain in service as long as practical. These wells will be incrementally extended as part of future filling operations.)

- Clearing and grubbing – removal of materials not suitable for use in construction, including surficial vegetation, debris, temporary stormwater/drainage piping. Existing concrete/asphalt compost pads may be left in place, pending final grading requirements.

- Re-grading and/or placement of engineered earthfill to promote proper drainage for the preferential pathway system. The area will be re-graded to provide a minimum slope of 3 percent. The prepared subgrade soil thickness will be at least 2 feet. Existing intermediate cover soil thickness will be determined by field investigation for final design purposes.

- Surface preparation by fine-grading to the required elevations and grades for the bottom of the preferential pathway system. Rough surfaces will be smoothed by removing protruding materials and replacing them with compacted soil. The resulting surface should be relatively smooth and uniform.

Analyses were performed to confirm that the proposed minimum 3 percent slope will provide sufficient long-term drainage of the overlying preferential pathway system in light of anticipated MSW loading and settlements. Based on existing and proposed final grades (***Figures 17C*** and ***18***), up to 50 feet of MSW fill will be placed over the compost deck. The analyses entailed: (1) review of information on anticipated settlements for recent and old refuse fill with and without surcharge; 2) calculation of anticipated settlements across the prepared subgrade surface section given our understanding of underlying refuse fill depths and proposed compost deck final grades; and (3) preparation of a cross section showing the resulting compost deck subgrade surface elevations. Results are provided in ***Appendix I***.

Our analysis showed that the prepared subgrade for the preferential pathway will experience relatively uniform settlements over the area. The overall drainage will remain at 3 percent from west to east. In conclusion the surface is expected to maintain positive drainage for the preferential pathway system.

We consider this settlement estimate to be conservative, as wastes in the compost deck area have been in place for 34 years or more, and have likely undergone significant consolidation due to waste decomposition processes and from surcharge due to intermediate cover placement and composting operations.

5.3.2 Fill Sequencing / Grading Plans

27 CCR §21600(b)(4)(C and D)

Proposed fill sequencing plans for future MSW placement at the CDS are provided in ***Figures 13*** through ***17, 17A, 17 C,*** and ***18***. Typical section views and details on tie-ins between LF-2 phases are provided in ***Figures 19*** and ***19A***. In general, the maximum fill height for each phase will be controlled by slope stability considerations, final grades, and the containment system limits for existing and proposed new cells.

Fill sequencing will generally consist of the following steps:

- Excavation and base preparation of new cells areas, as described above.
- Construction of underdrain, soil separation layers and composite base liner systems.
- Construction of interim and permanent landfill access and haul roads.
- Placement and compaction of MSW
- Incremental extension of the soil operations layer in new cells, as required.
- Incremental construction and extension of the preferential pathway system.
- Placement of daily cover or ADC
- Placement of intermediate (i.e., interim) cover.
- Construction of interim and permanent surface water management system features. These features will include drainage ditches and piping, and sedimentation ponds.

At this time it is proposed that filling initially take place over lined Phases III and IV, respectively, in LF-2. The stages of Phase III and IV construction are designed to provide a minimum of 2 years of airspace volume (refuse plus daily cover soils) at a disposal rate of 250,000 tons per year. Forecasted airspace consumption and site life by phase are provided in **Section 4.5** of this JTD. Access to LF-2, Phases III and IV fill areas would be via interim haul road on the western end of those cells, as shown in ***Figures 13*** through ***15***.

Once those cells reach interim grades, LF-2, Phase V filling may then proceed over the eastern slopes of LF-1, and then easterly over the entire lined footprint of LF-2, Phases I-IV. (Alternatively, the County may elect to line and fill the REA or compost deck area in advance of LF-2, Phase V; see below.)

A preferential pathway system will be installed over LF-1 slopes prior to filling LF-2, Phase V. A schematic drawing of the preferential pathway system is provided in ***Figure 19B***. The preferential pathway in this slope area will act in conjunction with the composite liners placed in LF-2, Phases III and IV. Details on tie-ins between the preferential pathway and LF-2 base liners are shown in ***Figure 20***.

Filling of LF-2, Phase V will continue until LF-2 reaches final design grades, as shown in ***Figure 16***. Final grades of the completed LF-2 area will tie-in to those on the South Face of LF-1, where partial final closure will have been completed. The completed waste face slopes at the end of Phase V will be 3:1 H:V (horizontal to vertical) or less. The top deck area would be graded at a minimum 3 percent.

MSW filling will take place in the REA following construction of the earthfill embankment and new base liner in that area. An interim fill plan and sections for filling the REA are provided in ***Figure 17A***. As stated above, lining of the REA would complete development of the entire 172.8-acre waste disposal area footprint as identified in the SWFP. Wastes in the REA would be placed over both the engineered base liner and LF-1 slopes. The preferential LCRS pathway layer is proposed in areas where new waste will be placed in the REA over existing fill slopes in

LF-1. Filling will continue in the REA to interim grades that tie-in with existing on the western end of LF-1, at elevations ranging from approximately 425 to 490 ft MSL.

Access to the REA would be via the existing haul road on the South Face slope of LF-1 that originates on the western end of LF-2 (if filling of the REA occurs before construction of LF-2, Phase V), or via a new access road to be cut through the LF-1 compost area that connects to the existing REA access road.

MSW will also be placed over the compost deck and "top deck" areas of LF-1. Existing compost operations will be re-located to another location on the CDS property, or to another property. An interim fill plan and cross section for the compost deck area are shown in ***Figure 17 C***. In areas where new refuse will be placed over existing landfill mass, a preferential LCRS pathway layer is proposed. The preferential pathway will be constructed over the LF-1 compost deck area and sideslope areas where new waste will be placed over existing fill in LF-1; refer to ***Figure 3A*** for locations. In the compost deck area, existing intermediate cover soils will be re-graded, or engineered fill soils will be placed over existing surfaces to provide a minimum 3 percent slope for the preferential pathway liner system. Refer to **JTD Section 5.3.1.3** for details on compost deck base grade preparation.

Filling over LF-1 will continue until the landfill reaches final design grades, as shown in ***Figure 18***. The maximum height of the landfill will be 565 ft MSL, as specified in the SWFP. The completed waste face slopes at LF-1 will not be steeper than 3:1 H:V. The top deck area of LF-1 would be graded at a minimum 3 percent.

At this time it is envisioned that fill sequencing will proceed sequentially as described above until the site reaches final grades. Depending on various factors including future waste disposal commitments and fill rates, County budget cycles for capital improvements, and the status of lease agreements and contracts for facility operations, the County may elect to alter its fill sequencing schedule. For example, the County may elect to fill over portions of the LF-1 compost deck area in advance of filling in the REA. In addition, the County may elect to line and fill the REA prior to filling LF-2, Phase V. This would allow vehicle access to the REA via existing soil haul roads on the LF-1 South Face slope. In all instances, filling would only take place in new cell areas approved in advance by the regulatory agencies, and would be within the fill area boundaries and height limitations as described herein.

At the appropriate time during refuse filling operations for the various fill sequencing phases, construction activities for the next phase will be started in order to provide uninterrupted landfill operations. For example, construction of LF-2 Phase IV will be completed in advance of Phase III reaching interim grades. The construction of each new cell or specific area in LF-1 where preferential LCRS pathway layers are placed will be in accordance with design plans and specifications approved by the RWQCB and LEA.

5.4 EARTHFILL QUANTITIES

For future landfill development and operation, earthfill is required for a number of onsite uses, which include the following:

- Soil embankments and structural fill at the toe of the REA.
- Earthfill beneath the base liner systems
- Low permeability soil layer in base liner systems
- Sand material for liner component protection and leak detection layers.
- Soil operations layer above base liner systems
- Soil operations layer in preferential pathway system over future LF-1 fill areas
- Access and haul roads
- Daily and intermediate covers for waste
- Final cover system foundation and vegetative layers

AutoDesk Civil 3D software was used to estimate soil excavation volumes and the quantities of earthfill required to construct and operate the facility. Earthfill for site construction will come from several sources. They include the estimated 590,000 cubic yard on-site stockpile placed southwest of LF-1 as part of excavation of LF-2, Phases I and II (***Figure 3***), planned future excavation of LF-2, and imported clay and sand for the low-permeability soil and leak detection components of base liners. The estimated volumes of soil available and required for construction are summarized in ***Table 4***.

Table 4
Site Soil Balance Summary

Item	Soil Available/Needed (Bank Cubic Yards)		
	LF-2	REA / LF-1	Total
Available soils – general fill			
Excavation	800,000	N/A	800,000
Existing stockpile	N/A	590,000	590,000
Sub-total	800,000	590,000	1,390,000
Required soil – general fill			
Earthfill berm/buttress	N/A	15,000	15,000
Liner system - foundation	48,800	14,800	63,600
Liner system – operations layer	64,500	37,800	102,300
Preferential pathway	43,400	120,000	163,400
Cover system - foundation	73,900	218,900	292,800
Cover system - vegetative	110,800	328,400	439,200
Daily cover	520,000	440,000	960,000
Sub-total	861,400	1,174,900	2,036,300
Net Total (Deficit)			(646,300)
Required soil import – low perm	29,000	11,100	40,100
Required import – sand material	9,700	6,600	16,300

On-site soils excavated during construction of LF-2, Phases I and II were placed in a stockpile area located to the west of LF-1. The location of the soil stockpile is shown in ***Figure 3***. Reportedly, as of October 2010, approximately 590,000 bank cubic yards of excavated soil material were placed in the stockpile area. These soil materials have suitable properties for use as engineered fill or for daily, intermediate and final cover construction. This assessment is based on a site investigation that included excavation, logging, sampling and laboratory analyses of stockpiled soils (GeoSyntec 2008). Relevant excerpts of this 2008 investigation are provided in ***Appendix I***.

During facility operation, soils excavated for construction of LF-2, Phases III and IV will be placed on the existing stockpile area (***Figure 3***), and/or on the interim top deck area of LF-2, Phases I and II or in the West Canyon area of the CDS. These temporarily stockpiled materials will later be used for subsequent cell construction, daily and intermediate cover, and preferential pathway construction.

For the entire project, a soil balance of materials needed for general earthfills, daily and intermediate cover, and foundation and vegetation materials for the final cover is projected which is consistent with prudent landfill engineering design. If necessary, other sources could be obtained from offsite which may be associated with disposal or purchase of nearby available soils. Details on soil excavation, earthfill and stockpile volumes by filling stages are provided in ***Appendix I***.

Import of approximately 40,100 bank cubic yards of low-permeability soil will be required for the base liner systems. These materials are available from the nearby Stony Point Quarry. Geotechnical testing at that facility indicates nearly one million tons of soil material with permeability of $1x10^{-7}$ cm/sec is available from that source (Stony Point Quarry, 2010).

Import of approximately 16,300 bank cubic yards of sand material will be required for base liner construction in the floor areas of LF-2, Phases III and IV and the REA. The sand is necessary as a cushioning layer between the secondary geomembrane liner and the overlying low-permeability soil component of the primary composite liner. This cushioning layer is needed to prevent damage to the underlying geomembrane during placement and compaction of the low-permeability soil in the primary geocomposite liner system. The sand layer will also serve as a leak detection layer between the primary and secondary geocomposite liner systems.

This soil balance shows approximately 960,000 bank cu yd would be needed for placement on top of compacted waste at the end of each working day (i.e., daily cover). Cover materials are placed over waste to control vectors, progress of fires, odors, litter, scavenging, and water infiltration. The volume of MSW-to-cover ratio is expected to range from 6:1 to 10:1, based on aerial mapping information provided by the current site operator (Republic Services, 2010). The higher end of the range reflects use of ADC materials in lieu of soils as allowed by the SWFP. Details on daily cover and ADC placement are provided in **Section 7.3.6** of this JTD.

The soil balance shows there will be a net deficit of approximately 646,300 bank cu yd of general fill soil needed during the construction and operation periods. This analysis reflects use of excavation soils in the LF-2 footprint and the existing stockpile west of LF-1 only. The County reports that sufficient quantities of general fill soils are available in the adjacent West

Canyon area of the CDS property. The West Canyon has previously been used as a rock and soil borrow area.

The soil balance estimates in ***Table 4*** are considered preliminary and should be updated as part of final design, and ongoing construction and operation. Our earthwork estimates do not consider shrinkage or swell that may occur during placement and compacting, or other potential uses such as non-landfill related on-site road construction outside the fill footprint.

5.5 GEOTECHNICAL ENGINEERING EVALUATIONS

5.5.1 Regulatory Requirements

27 CCR §20240(d), §20260(d, e) and §20370

27 CCR §20240(d) and §20370 state that Class III Landfills shall be designed to withstand the maximum probable earthquake (MPE) without damage to the foundation or to the structures which control leachate, surface drainage, or erosion, or gas. Specific requirements for the analyses are listed in 27 CCR §21750(f)(5).

5.5.2 Methods of Analysis

A stability analysis was performed by SCS based on the facility design elements and site-specific geologic site conditions presented herein. The following were analyzed: (1) new cell excavation (cut) slopes in the native geologic formations; and (2) final landfill slopes. Our work included:

- Review of previous site investigations, fault studies and seismic hazard assessments, and stability analyses by others.
- Perform analyses to confirm whether design accelerations used in previous stability analyses are suitable for current design, considering the response spectra in the 0.5 to 1.0 second range.
- Obtain soil, sand and geosynthetic material samples for base liner and final cover components as specified in containment system design herein, and submit those samples for laboratory analysis of physical and strength properties and interface testing. Bulk samples of on-site soils to be used in the foundation and low-permeability layers were obtained from on-site stockpiles at the CDS and the nearby Stony Point Quarry by SCS in December 2010. The Stony Point Quarry is a source of low-permeability soils. Geosynthetic material samples were obtained from manufacturers. Bulk samples of sand material were obtained from the Stony Point Quarry and Mark West Quarry (in Healdsburg) in May, 2012. Both quarries are a potential source of sand materials.
- Evaluate and select critical landfill cross sections, using conservative assumptions regarding potential failure surfaces.
- Identify representative one-dimensional columns for evaluation of site seismic response.
- Perform pseudo-static analyses using the computer program PCSTABL5M.
- Perform seismic deformation analyses using methods identified by Bray et al (1998).

5.5.3 Fault Assessment and Design Accelerations

The model input data included seismic information, which is detailed in previous investigations by others (GeoSyntec 2004, 2005, 2008). These seismic design analyses have been based on the MPE occurring on the Healdsburg-Rogers Creek fault. Earthquake induced hazards at the CDS would be dominated by an MPE magnitude 6.75 event with an estimated peak horizontal ground acceleration (PHGA) of 0.32 g.

An analysis to confirm that the above acceleration is suitable for use in the current design, considering the response spectra of 0.5 to 1.0 seconds was performed as part of our work (RMC Geoscience, 2011). Details are provided in ***Appendix D***. This analysis indicates results of the previous seismic hazard assessments are conservative and should be suitable for design of CDS containment features. The PHGA of 0.32 has been used in our evaluation.

Previous hazard evaluations were based on attenuation relationships developed in 1997 that have since been updated. The new relationships are collectively referred to as Next Generation Attenuation (NGA) relationships. In general, use of NGA relationships results in relatively lower PHGAs at most northern California landfill sites (RMC Geoscience, 2011). We therefore consider the use of the PHGA of 0.32 as a basis of stability analyses to be conservative.

5.5.4 Results of Stability Analysis

Methods and results of our stability analysis are provided in ***Appendix J***, and are summarized as follows:

<u>Global Stability</u> The results of the global stability analysis show that the static factor of safety (FS) is greater than 1.5 for the proposed LF-2 and REA base liner and cover systems. Calculated FS values range from 1.50 to 2.68. Based on the proposed final grading and cell excavation base slope configurations, the maximum permanent displacement is estimated to be approximately 5 inches for the base liner and 7 inches for the final cover system.

Based on the final global slope conditions analyzed and the assumptions used in the evaluations, SCS concludes that the final slope section and bottom liner configuration used for the landfill meet the relevant stability standards under both static and seismic conditions. Based on industry design practice and guidelines, up to 12 inches of permanent displacement is considered acceptable for landfill base liners (U.S EPA, 1995).

SCS has reviewed stability criteria used by regulatory agencies during permitting and approval of cell designs for existing landfill expansions throughout California (SCS, 2010). These agencies include CalRecyle and their designated local enforcement agencies and the Central Valley, North Coast, San Francisco, Santa Ana, and Los Angeles RWQCB's. Our survey indicates that permanent seismic displacements for base liners between 6 and 12 inches, with up to 12 inches displacement allowed for final cover systems in some cases. The higher displacement in final cover systems is considered acceptable because resulting damages can be visually identified and repaired.

Previous stability analyses for the CDS predicted displacements of 36 inches in the final cover system for LF-1 (GeoSyntec, 2008). This analysis was based on a slightly different final cover configuration and did not utilize site-specific soils or materials interface test data as was done by SCS. Earlier estimates of final cover displacements were also based on methods described by Makdisi and Seed; SCS utilized methods for estimating displacements that have more recently been utilized in landfill engineering as described by Bray, et al (1998). We understand the earlier estimated cover deformation of up to 12 inches was considered acceptable by the RWQCB and SWRCB consulting geologist, and that the 2008 closure plan for the site was approved (RWQCB, 2010).

Veneer Stability. The final cover system will consist of geosynthetic and soil layers that cover the refuse mass at a maximum slope of 3:1 (horizontal to vertical). The results for the veneer stability analysis show that under static conditions the factor of safety is greater than 1.5. The FS under seepage conditions resulting from the 100-year, 24-hour storm is 1.11. This FS is acceptable for storm conditions.

Based on the slope conditions analyzed for veneer slope stabilities and the assumptions in the evaluations, it is concluded that the veneer slope section analyzed for the final cover design presented herein is considered stable under static, seismic, and seepage conditions. The new cell and proposed containment structures including final cover meet the requirements of 27 CCR §20240(d) and §20370 for settlement and ground motions. Our analyses are also show the landfill containment structures will withstand the maximum horizontal acceleration for the site, as outlined in 40 CFR §258.14(a)

5.6 UNDERDRAIN SYSTEM

27 CCR §20080 and 20240

5.6.1 Regulatory Requirements

27 CCR §20240(c) states that all new landfills shall be sited, designed, constructed and operated to ensure that wastes will be a minimum of 5 feet above the highest anticipated groundwater. 27 CCR §20080(b) allows for an engineered alternative if the discharger demonstrates that: (1) construction of the prescriptive standard is not feasible; and (2) the alternative is consistent with the performance goal addressed by the standard and affords equivalent protection against water quality impairment.

The RWQCB has indicated that the engineered alternative must provide 5 feet of separation between the groundwater underdrain and the lowest geomembrane component of the dual composite liner system (RWQCB April 20, 2012). This requirement is reflected in the engineered alternative proposed herein.

5.6.2 Engineered Alternative – Groundwater Separation

The depth to groundwater in the area proposed for development of LF-2, Phases III and IV varies from about 2 to 25 feet below the existing ground surface. Groundwater occurs at or within several feet of the ground surface at the REA. Due to the shallow groundwater including springs in canyon walls it is anticipated groundwater will be present at or near the base grades in proposed new cell locations. For new cell construction in LF-2, an engineered alterative to the 5-ft separation between groundwater and waste will be required. An engineered alternative for groundwater separation in the REA, while not required by regulation, is proposed as described below and in **Section 3.7.1.5** of this JTD.

Previous mapping during excavation and construction of LF-2, Phases I and II indicated seepage was common on the side walls and the base of the excavation for those cells. The proposed alternative design accounts for this via use of geocomposite drain net materials in excavation slopes; it is physically not possible to provide 5-foot separation in the LF-2 canyon excavation sidewalls. The proposed sideslope barrier thickness, including soil operations layer is 2 feet in LF-2 and 4 feet in the REA. Without a physical drainage mechanism, the liner system in sideslopes would be subject to seeps regardless of thickness. (Seepage in sidewalls in canyon areas is common and expected; engineered alternatives to prevent water intrusion into the waste have been approved at numerous canyon landfills in California).

Figures 13 and ***14*** show the base grade layout for the LF-2 subdrain system. Subdrain section details for LF-2 and the REA area shown in ***Figures 19, 19A, 21 and 22***. In floor areas of the new cells, the system will consist of a 1-ft thick granular rock with permeability equal to or greater than 1.0 cm/sec, placed as a blanket drain over the prepared subgrade. The drain rock layer will be overlain by a geotextile filter fabric. The drain rock layer will be fitted with perforated HDPE pipe that drains to central collection sumps (base areas) at the southern end each cell. The pipes will be designed to withstand the maximum overburden pressure of the landfill.

In floor areas of LF-2 and the REA, a minimum 4-foot thick compacted soil earthfill layer will be placed over the underdrain. Compacted soil materials will be obtained from cell excavations or existing stockpiles. A minimum 1-foot thick layer of low permeability soil (10^{-7} cm/sec) will in turn be placed over the compacted soil earthfill. Collectively, these soil layers will provide 5 feet of physical separation between groundwater in the underdrain and the overlying geomembrane liner in the secondary composite liner system. An illustration of the subdrain and foundation soil layers in relation to the base liner systems is shown in ***Figure 21A***.

In side slope areas where wastes will be placed over native soils, the system will consist of a geocomposite drain layer. Cross sections showing the slope geocomposite drain layer are shown in ***Figures 20*** and ***21***. The outer geotextile layers will prevent fines from entering the drain net. Based on manufacturer’s data, transmissivity of the sideslope drainage system is expected to be 9.7 gallons per minute per lineal foot. The sideslope drainage systems will convey liquids to the floor area subdrain by gravity. This transmissivity accounts for compressive forces of the overlying fill, which will range up to 250 feet over the base liner system (in LF-2).

For Phase III, the collected underdrain water will be routed to a temporary sump at the south end of that cell. Collected liquids will be pumped from the sump and piped to the existing leachate ponds or storm water sedimentation basins. This temporary sump will be removed when Phase III is completed and tied to a permanent underdrain collection system and piping for Phase IV. Details of the Phase III temporary sump system are shown in ***Figures 19*** and ***19A***.

For the completed Phases III and IV base excavation grades, the underdrain trench piping will gravity-drain to a central collection point in the south end of the Phase IV waste cell. The sump will be approximately 15 ft x 20 ft and up to 2-ft deep, and filled with granular rock with a permeability equal to or greater than 1.0 cm/sec. The accumulated liquids will be removed from the sump via a riser pipe and submersible pump system. The discharge piping will be manifolded with control valves to drain to either existing leachate ponds or storm water sedimentation basins. Initially, the water will be treated as leachate; if upon testing it is determined to be suitable for storm water discharge, it will be piped to the stormwater detention basins.

The required drainage capacity of the capillary break/underdrain systems has been evaluated to confirm it will meet or exceed the prescriptive standard for groundwater separation. This drainage capacity was compared with anticipated flow rates at the site. Several site investigations have been performed in an attempt to estimate groundwater seepage rates at the CDS (RMC Geoscience, 2003, Huntingdon-Herzog Associates 1993). In our opinion, the most reliable measurement of groundwater flow rates is from the existing underdrain constructed for LF-2, Phases I and II. In 2005, groundwater inflow in the canyon areas was estimated to range between 4,000 and 5,000 gallons/acre-month (RMC Geoscience, 2005); this was based on then-available monitoring data including underdrain flows at LF-2. Based on data for the period of 2005 through 2010, groundwater flow averaged approximately 5,400 gallons/acre-month for the 20.9-acre existing LF-2 landfill footprint (Sonoma County, 2010). This is equivalent to 2.6 gpm.

For comparison, we estimate the hydraulic capacity of the proposed underdrain/capillary break systems for the new LF-2 cells and REA are both 1,255 gpm. Calculations are provided in ***Appendix K***. **The underdrain design capacity is over two orders of magnitude greater than anticipated groundwater inflows** and in our opinion, the proposed engineered alternative will prevent groundwater from rising to the overlying containment barriers due to capillary forces, and will allow for effective groundwater capture.

5.6.3 Capillary Break / Underdrain Leachate and LFG Barrier

The new cells in LF-2 and the REA will be adjacent to the unlined LF-1 unit. Of concern is potential migration of leachate and LFG from that cell into the adjacent underdrain systems, and impacts to groundwater. The presence of trace concentrations of VOCs in the existing LFG underdrain water have been attributed in part to LFG migration (corrective actions by the County have been effective in mitigating this problem; refer to **Section 6.1.3** of this JTD). Nonetheless additional engineering controls to prevent leachate and LFG migration into the new underdrains are warranted.

A leachate/LFG barrier will be constructed at the interface between existing LF-1 wastes and the new cells in LF-2 and the REA. ***Figures 20*** and ***22*** show the details for the barrier systems in LF-2 and the REA, respectively. The barrier will consist of a trench excavated into native material backfilled with permeable gravel to act as a French drain. Two perforated HDPE pipes, one on top of the other, will be placed in the trench. The lower pipe will collect leachate and the upper pipe will collect LFG. The trench will be lined with an HDPE geomembrane to further prevent migration leachate and LFG toward the LF-2 and REA underdrains. In LF-2 areas where the anticipated depth of LF-1 fill exceeds 10 feet or more below the underdrain elevations, vertical LFG extraction wells may be used. Wells depths will extend to the expected lowest groundwater elevation.

The trenches will be graded to allow leachate to gravity drain. The leachate and LFG collection piping will daylight at the southern end of the respective cells. The piping will tie into existing or new leachate or LFG collection header systems.

The leachate and LFG collection systems in the cut-off barriers are conservatively sized as follows:

- Leachate cut-off barrier (LF-1 at LF-2 and REA interfaces): 450 gpm
- LFG cut-off barrier (LF-1 at LF-2 and REA interfaces): 400 scfm

5.7 COMPOSITE LINER SYSTEMS

27 CCR §20310, §20320, §20360 and §20330

5.7.1 Regulatory Requirements

Federal and state regulations include a prescriptive design and performance standards for MSW landfill base liners. The prescriptive liner design includes a composite liner system consisting of: (1) compacted soil at least 2 feet thick, with a hydraulic conductivity $1x10^{-7}$ cm/sec or less; and an overlying geomembrane component at least 60-mil thick for systems using HDPE materials. The performance criteria specifies that landfills be constructed to ensure that specified contaminant concentrations due to a release to the environment will not be exceeded in the uppermost aquifer at the relevant point of compliance (POC).

The federal performance and prescriptive standards are embodied in 40 CFR §258.40(a)(1) and (b), respectively. State prescriptive design standards are in 27 CCR §20080 (b). State policy with respect to implementation of Subtitle D requirements for MSW landfills are outlined in State Water Resources Control Board (SWRCB) Resolution No. 93-62 (reference: 27 CCR§20330(a)). This policy has been adopted by the state RWQCB in Order No 93-83.

The regulations and state policy allow an alternative design to the prescriptive standard if that design satisfies the performance criteria contained in 40 CFR §258.40(a)(1), where the performance of the alternative composite liner's components (including the LCRS), in combination, equal or exceed the waste containment capability of the prescriptive design. A performance demonstration, typically by comparison of anticipated leakage rates of the prescriptive and alternative designs, is used as a basis for agency approval. 27 CCR §20080 (b) and (c) also allow an engineered alternative liner system via demonstration that the prescriptive standard is unreasonably burdensome or costly, or impractical and will not promote attainment of applicable performance standards.

5.7.2 Engineered Alternative Liner System Description

27 CCR §20080 and §20380(e)

Engineered alternative liner systems are proposed for new cells in LF-2 and the REA as allowed by 27 CCR §20080 and §20380(e) that will meet performance criteria of federal and state regulations. The engineered alternative liner systems are also intended to meet RWQCB conditions of approval as indicated to the County (RWQCB, April 20, 2012). A double composite liner system is proposed.

On the floor areas of LF-2 and the REA, the prescriptive, single-composite liner system is replaced with a double-composite liner with both primary (upper) and secondary (lower) liner components consisting of both low-permeability soil and geomembrane materials. On the side slope areas the 2-foot thick compacted low-permeability soil liner and single geomembrane components are replaced with alternating layers of three geomembrane liners and two GCL liners. The proposed alternative design also includes a high-permeability material leak detection layer placed between the primary and secondary composite soil/geomembrane liner components. ***Figure 21A*** provides an illustrative comparison of the 27 CCR prescriptive liner and the proposed engineered alternative double-composite liner system for landfill floor areas.

5.7.2.1 Liner Components

The alternate liner systems will consist of the following layers from bottom to top (refer to ***Figures 19*** through ***22***):

- LF-2 and REA floor area containment system:
    - Prepared subgrade;
    - Geotextile separator;
    - 1-foot thick capillary break /underdrain system consisting of granular material which provides a positive barrier to capillary rise and allows for removal of groundwater below the composite liner, and thus effectively separates groundwater from refuse;
    - Geotextile separator (8 ounce per square yard);
    - 4-foot thick compacted foundation soil layer to provide physical separation from groundwater;
    - 1-foot thick compacted soil layer with permeability $1x10^{-7}$ cm/sec or less to provide physical separation from groundwater and serve as soil layer in the secondary composite liner;
    - 60-mil thick HDPE geomembrane textured both sides (secondary composite liner component);
    - 1-foot thick sand drainage layer serving as both a secondary liner protection and a leak detection layer;
    - Geotextile separator;
    - 2-foot thick compacted soil layer with permeability $1x10^{-7}$ cm/sec or less (primary composite liner component);

- 60-mil thick textured HDPE geomembrane (primary composite liner component);
- Geotextile cushion (16 ounce per square yard);
- 1-foot thick LCRS granular layer (refer to **Section 5.8** below);
- Geotextile separator; and
- 2-foot thick soil operations layer.

- LF-2 and REA excavation sideslopes (over native soils)
  - Prepared subgrade;
  - Geocomposite drainage layer, that ties into the floor area underdrain system
  - 2-foot thick compacted foundation soil layer to provide additional cushioning for the liner system against the underlying rock surface (REA only)
  - 60-mil thick textured HDPE geomembrane
  - GCL;
  - 60-mil thick textured HDPE geomembrane;
  - GCL;
  - 60-mil thick textured HDPE geomembrane; and
  - Geocomposite LCRS layer; and
  - 2-foot thick soil operations layer

5.7.2.2 Liner Anchor Trench

The design for the liner system anchor trench will include measures to prevent potential LFG migration through the low-permeability drain net component, and into the surrounding native soils. (This problem is common to many early landfill designs subject to federal Subtitle D standards, and was a contributing factor to LFG-related water quality impacts in the underdrain for existing LF-2 cells.)

Figure 23 shows a detail for the liner anchor trench methane barrier to be deployed on native excavation sideslopes in LF-2 and the REA. The ends of the HDPE liner will be wrapped around the geocomposite drain net layer, and welded together with a 40-mil HDPE flap to form an impermeable barrier. This will enhance future LFG capture via future horizontal gas collectors or wells placed in the cell. The anchor trench(es) for LF-2, Phases I and II were retrofitted with a similar system to prevent LFG migration through the LCRS geocomposite. Based on monitoring data (refer to **Section 6**), this has proved to be an effective means of controlling LFG migration into the vadose zone.

5.7.2.3 GCL Component of Liner System

GCLs are a manufactured barrier layer for landfill liners consisting of sodium bentonite encapsulated between two non-woven geotextile fabrics. The geotextile fabrics are needle-punched together and reinforced producing high internal strength under either dry or saturated conditions. SCS recommends this internally reinforced-type GCL be employed for future cell development at CDS. GCLs are approximately ¼-inch thick and supplied in panels of 14.5 feet x 150 feet.

The advantages of a GCL over the prescriptive 2-foot thick soil layer include superior hydraulic conductivity properties, ease of construction versus compacting soil on side-slopes, and higher resistance to differential settlement on slope areas. GCL permeability values vary by manufacturer and range from 1x 10^{-8} cm/sec to 3 x 10^{-9} cm/sec (USEPA, 1997), which exceed the prescriptive soil prescriptive maximum allowable permeability of 1x10^{-7} cm/sec for soil liners.

Use of GCLs in landfill cover systems is commonplace throughout the landfill industry and has been accepted by regulatory agencies throughout California and the United States as an acceptable engineered alternative to clay soil materials. ***Table 5*** provides a list of canyon-type MSW landfills in California where GCLs have been approved for use in liner systems as an alternate to the prescriptive standard. This information has been compiled by SCS from Joint Technical Documents at the CalRecylce office located in the California EPA headquarters in Sacramento. The list is comprised of lined cells at canyon landfills permitted and/or constructed within the last ten years, where the use of GCLs in the floor and on the sideslopes of bottom liner systems has been approved by governing regulatory agencies.

As stated above, 27 CCR §20080 (b) and (c) also require demonstration that the prescriptive standard, when compared to an engineered alternative, is unreasonably burdensome or costly, or impractical and will not promote attainment of applicable performance standards. Based on our experience, there are real-world construction limitations for placement of 2 feet of compacted, low-permeability soils on excavated side slopes as a component of a base liner. In particular, it is extremely difficult and impractical to place and compact a 2-ft thick layer of compacted soils with permeability 10^{-7} cm/sec or less on excavated slopes of 2.5:1 H:V or greater. Use of a GCL on side slopes in lieu of compacted low-permeability soils, extending into cell floors is common practice and provides a contiguous barrier layer. Examples of approved alternate liner installations using GCL are provided in ***Table 5***.

5.7.2.4 Leak Detection Layer

A 1-foot thick sand drainage layer will be installed between the upper (primary) and lower (secondary) soil/HDPE composite liner systems. The drainage layer will follow the contours of the cell excavation and ultimately discharge to separate detection sumps installed below the LCRS sump in the LF-2, Phase IV and REA cells, respectively. Cross-section of the LCRS sump showing the geocomposite leak detection layer are provided in ***Figures 23*** and ***23A***. Access to the leak detection sump will be via a slope riser pipe. The leak detection sump will be monitored with a liquid level indicator to detect a pumpable quantity of liquid, if present.

Table 5. Summary of 2010 Survey of California Canyon Landfills With Approved Alternate Liner (GCL)

				SWFP	WDR	JTD	GCL in Bottom Liner	
Name	Estimated Closure Date	LEA	RWQCB	Permit No. and Issue Date	Order No. and Date Issued	Date	Base	Side slopes
Altamont Landfill & Resource Recovery	2025	Alameda County Environmental Health Department	Central Valley Region	01-AA-0009 August 2005	R5-2002-0119 June 2002	Sept 2009	Yes	Yes
Vasco Road Sanitary Landfill	2022	Alameda County Environmental Health Department	San Francisco Region	01-AA-0010 June 2007	96-041 March 1996	December 2006	No	Yes
Keller Canyon Landfill	2050	Contra Costa County Environmental Health	San Francisco Region	07-AA-0032 December 2009	01-040	May 2008	Yes	Yes
Burbank Landfill Site No. 3	2084	County of Los Angeles Department of Health Services	Los Angeles Region	19-AA-0040 June 1997 (revision pending)	93-062 September 1993	April 2009	Yes	Yes
Chiquita Canyon Sanitary Landfill	2019	County of Los Angeles Department of Health Services	Los Angeles Region	19-AA-0052 October 2009	93-062 September 1993	September 2003	Yes	Yes
Puente Hills Landfill	2013	County of Los Angeles Department of Health Services	Los Angeles Region	19-AA-0053 July 2003 (revision pending)	99-059 Jan 1999	June 2008	Yes	Yes
Sunshine Canyon City/County Landfill	2037	Sunshine Canyon Landfill Jurisdiction	Los Angeles Region	19-AA-2000 July 2008	R4-2007-0023 April 2007	May 2008	No	Yes
Frank R. Bowerman Sanitary Landfill	2053	County of Orange Health Care Agency	Santa Ana Region	30-AB-0360 July 2008	R8-2002-0049	March 2008	Yes	Yes
Badlands Sanitary Landfill	2016	Riverside County Department of Environmental Health	Santa Ana Region	33-AA-0006 November 2005	R8-2002-0085 October 2002	May 2005	Yes	Yes
Lamb Canyon Sanitary Landfill	2023	Riverside County Department of Environmental Health	Santa Ana Region	33-AA-0007 August 2005	R8-2007-0044	January 2009	Yes	Yes
Potrero Hills Landfill	2013	County of Solano	San Francisco Region	48-AA-0075 December 2006	93-072 July 1993	June 2005	No	Yes
Central Disposal Site	2014	Sonoma County Department of Health Services	North Coast Region	49-AA-0005 September 2005	R1-2004-0080 June 2004	May 2005	Yes	Yes
Paso Robles Landfill	2051	Cal Recycle	Central Coast Region	40-AA-001 January 2008	R3-2008-0050 December 2008	August 2007	Yes	Yes

Liquids in the leak detection sump will be removed with a pump via the slope riser. Monitoring of the leak detection system is discussed in **Section 6** of this JTD.

5.7.2.5 Liner Construction Considerations

A two-foot thick low-permeability soil layer will be installed as part of the upper (primary) component of the double-composite liner system. This low-permeability soil layer will be underlain by the sand drainage layer, and lower (secondary) composite liner.

During construction, provisions must be undertaken to ensure that low-permeability soil placement and compaction does not damage the underlying lower (secondary) geomembrane component of the liner system. The sand layer will provide protection of the lower geomembrane and is integral to the design for this purpose. Use of low ground pressure equipment may be necessary during low-permeability soil layer placement above the sand layer. During construction, judgment must be exercised while testing the relative compaction and moisture content of each lift of the low-permeability soil that can practically be compacted over synthetic geomembrane layers. Refer to **Section 5.15** of this JTD for applicable construction quality assurance provisions.

5.8 PREFERENTIAL LCRS PATHWAY LAYER

Proposed fill sequencing plans have been prepared to provide for MSW disposal over the entire permitted CDS footprint area, including previously filled areas of LF-1. Refer to **Section 5.3** above for details. Wastes placed during Phase V of LF-2 filling will abut existing LF-1 slopes. MSW placement in the REA would be over both the engineered base liner and existing LF-1 slopes. MSW will also be placed over the entire compost deck area of LF-1. Existing compost operations will be re-located to another property, or to another location within the CDS property. This will continue until the landfill reaches final design grades, as shown in ***Figure 18***.

A preferential LCRS pathway system, consisting of from bottom to top a GCL, geomembrane and drain net, will be placed over existing slopes and compost deck areas of LF-1 in advance of new waste fill. Preferential pathway locations are shown in ***Figure 3A***. A schematic drawing of the preferential pathway system is provided in ***Figure 19B***. The preferential pathway in LF-1 will act in conjunction with the composite liners placed in LF-2, Phases III and IV and the REA. Details on tie-ins between the preferential pathway and LF-2 and REA base liners are shown in ***Figures 20*** and ***22***. Specific components of the preferential pathway include (bottom to top):

- LF-2 / Sideslope Area Overlying LF-1 Waste (***Figures 19B*** and ***20***):
    - A prepared subgrade of existing intermediate cover in LF-1. Surficial vegetation will be removed, and the exposed subgrade will be compacted to provide a firm surface for placement of overlying materials. Bench road cross-slopes will be reversed to provide positive, downslope drainage and utilities in roadways will be re-located.
    - GCL.
    - 40-mil thick HDPE geomembrane.

  - A geocomposite liquids collection layer which allows for removal of leachate from overlying new fill. The drainage layer will discharge to the LCRS aggregate layer in the new LF-2 lined cells.
  - A 2-foot thick soil operations layer.
- REA / Sideslope Area Overlying LF-1 Waste (***Figure 22***):
  - A prepared subgrade over existing intermediate cover in LF-1. Bench road cross-slopes will be reversed to provide positive, downslope drainage.
  - GCL.
  - 40-mil thick HDPE geomembrane.
  - A geocomposite liquids collection layer which discharges to the LCRS aggregate layer in the new REA lined cell.
  - A 2-foot thick soil operations layer.
- LF-1 Compost Deck Areas:
  - A compacted and prepared subgrade over existing intermediate cover in LF-1 (***Figure 17B***). The subgrade material will be tested and confirmed to be a minimum of 2-feet thick. The compost deck subgrade area will be re-graded to provide a minimum slope of 3 percent prior to preferential pathway LCRS layer placement. This minimum slope will provide for long-term drainage. Refer to **JTD Section 5.3.1.3** for details on compost deck base grade preparation.
  - A 1-foot thick layer of soil with permeability $1x10^{-6}$ cm/sec or less. If this permeability cannot be achieved by re-working existing compost deck soils, a GCL will be deployed instead.
  - 40-mil thick HDPE geomembrane.
  - A gravel liquids collection layer. This will tie into a geocomposite drain net on adjacent sideslopes that do not abut the REA or LF-2, and discharge to an 8-inch, perforated HDPE leachate collection pipe at the slope bottom. Collected leachate will combined with leachate being conveyed away from LF-1 and discharged to the leachate pond.
  - A 2-foot thick soil operations layer.

The preferential LCRS pathway will provide separation between new waste overfilling existing waste and re-direct leachate from newly-placed wastes to existing LCRS systems in LF-1, LF-2 and the REA as described above. In this regard the preferential LCRS pathway will provide for liquids removal in conjunction with and be continuous with liners placed in LF-2 and the REA where new refuse will be placed over native material. The preferential LCRS pathway system is also expected to withstand effects of differential settlement over time.

A critical design element of the proposed preferential LCRS pathway barrier is that it will allow continued operation of existing leachate and LFG extraction wells in LF-1. This is extremely important for long-term environmental management at the CDS. It is anticipated that as fill operations progress to final design grades, new or replacement leachate or LFG extraction wells will need to be installed in the LF-1 footprint. In most cases, new well casings will need to extend through newly placed MSW and into the underlying, existing waste in LF-1 where the level of accumulated leachate is required to be lowered. These borehole penetrations can be sealed with bentonite at the preferential pathway interface to prevent downward liquids migration into the older, underlying fill. This is also the preferred method of sealing during preferential pathway construction. Installation of geomembrane boots around existing well casings during preferential pathway construction is not recommended as the future downward forces due to settlement would damage those casings at depth and render the wells inoperable.

The RWQCB has concurred that new WDRs will allow drilling of vertical wells through the preferential pathway for the extraction of leachate and LFG in the underlying waste mass (RWQCB April 20, 2012). A schematic drawing illustrating extraction well penetrations through the preferential pathway system is provided in ***Figure 19B***.

Note that a preferential pathway system is not proposed on the LF-1 top deck area where the metals recycling operation is currently located (current elevations approximately 520 to 545 ft MSL). The County considers this an interim fill area. MSW will be placed directly on this top deck area following re-location of the metals recycling operation.

5.9 LEACHATE COLLECTION AND REMOVAL SYSTEMS

27 CCR §20230 and §20340

5.9.1 LCRS Description

Base grading plans for Phases III and IV of LF-2 are shown in ***Figures 13*** and ***14***. The LCRS systems consist of a sloping, 1-foot thick aggregate layer and HDPE collection piping on the cell bottom (placed immediately above the primary, or top HDPE liner), which is directed to a single collection sump in each cell. A geotextile filter is placed above the aggregate layer to prevent introduction of soil fines and LCRS clogging. Coarse sand will be placed in the soil operations layer above LCRS piping to further prevent clogging. The sloped side-wall of the cells would be covered with a geocomposite drain net (plastic net with geotextile bonded to both sides). The geocomposite is designed to have a high drainage capacity which allows liquids conveyance. The geocomposite collects and drains leachate that contacts the side walls of the cells and conveys it to the aggregate layer on the bottom.

Liquids entering the LCRS preferential pathway system originating from new waste placed over existing fill in LF-1 slopes adjacent to lined LF-2 and REA cells will also be conveyed to the aggregate LCRS collection layer in the base of those cells. Details showing the tie-ins from the slope area preferential pathways to the LCRS systems in LF-2 and the REA are shown in ***Figures 19B, 20*** and ***22***.

Liquids will be removed from the LCRS collection sumps by 24-inch diameter riser pipes equipped with submersible pumps and clean-out access. The piping and pumps will be sized to accommodate anticipated leachate flows as described below. Cleanout risers will be installed at the northern end of the Phase III cell and in the Phase IV LCRS sump to allow later jet-flushing of the main north-south trending LCRS main pipe (refer to ***Figure 13*** for cleanout riser layout).

As with current practices, all liquids removed from the LCRS sumps in the new cells will be piped to the lined surface impoundment (Leachate Pond 1, see ***Figure 3***). A second lined impoundment (Leachate Pond 2) is available for backup storage when Leachate Pond 2 is near capacity or undergoing maintenance. Accumulated liquids will in turn be pumped from the ponds via force-main pipeline for discharge to the City of Santa Rosa Subregional Waste Water Treatment Plant.

In LF-2, fill sequencing will proceed north to south as described above. An interim LCRS sump will be constructed at the southern end of that cell as shown in ***Figures 19*** and ***19A***. During LF-2 Phase III operation, temporary leachate storage and piping systems will be required to convey liquids to the leachate pond. A double-walled polyethylene tank equipped with level controls and HDPE discharge piping will be utilized. Permanent gravity drain tie-ins to the Phase III leachate and underdrain piping will be installed during Phase IV construction.

5.9.2 LCRS Design

LCRS sizing for the proposed new cells in LF-2 and the REA were estimated using the HELP model, version 3.07 (refer to **Section 4.6.2** of this JTD). ***Table 3*** provides a summary of anticipated average annual leachate generation in new lined cells during site operations. Refer to ***Appendix H*** for complete results of the HELP model analyses. As shown in ***Table 3***, the average volume of leachate expected to be captured in the new LCRS systems in LF-2 and the REA, respectively are 129,700 and 121,000 gallons/acre-year for the floor and sideslope area LCRS systems. Based on calculated floor and slope areas for new LF-2 and REA cell areas, these per acre unit flows translate to combined LCRS capture rates of 7,000 gpd for LF-2 (Phases III and IV) and 4,820 gpd for the REA.

The highest volume of leachate would be generated during a 100-year, 24-hour storm event when only one lift is in place. Based on the HELP analyses, the peak daily leachate generation rates for LF-2 and the REA are estimated to be approximately 77,200 and 53,310 gpd, respectively. These capture rates are equivalent to 54 and 37 gpm, respectively. RWQCB Order No. R1-2004-0040 requires that the LCRS system be sized to accommodate twice the anticipated daily flow. Thus the piping systems have been sized to accommodate 155,000 and 105,000 gpd (108 and 73 gpm), respectively, from LF-2 and the REA. These values predicted by the model are considered to be conservative for purpose of sizing the LCRS.

For comparison, leachate recovery rates from the existing system in place at LF-2 (Phases 1 and II) average approximately 5,430 gpd or 3.8 gpm over the period 2002 through 2010. This is based on County data for fiscal years July through June (Sonoma County 2010). This LF-2 leachate capture rate is less than predicted by the HELP model (existing LF-2 cells are 20.9 acres footprint). Thus we consider results of the HELP model to be conservative.

As shown in ***Table 3***, the peak head on the liner in both LF-2 and the REA is estimated at 0.61 inches. This values is well below the 12-inch design standard specified in 27 CCR and federal Subtitle D regulations.

The preferential pathway systems overlying LF-1 slopes will be continuous with liners and leachate collection systems in LF-2, Phases III and IV and the REA. A separate LCRS sump will be provided to capture liquids from the compost deck preferential pathway system. The leachate systems in these cells have been sized to accommodate additional liquids flow(s) from the preferential pathway systems. The HELP model analysis (***Appendix H***) includes inputs to account for the preferential pathway layers.

As a check, SCS estimated peak leachate flows during the landfill expansion project lifetime, including contributions from the preferential pathway systems. The analyses show that peak contributions from the preferential pathway systems would be approximately 21 gpm. Worksheets showing this analysis are provided in ***Appendix H***. The analyses are based on expected liner/LCRS system performance, as determined by HELP modeling. For the preferential pathway areas, we assume the leachate capture rate would be comparable to the adjacent lined cells. This represents a worst-case scenario for purposes of LCRS sizing.

For the peak expected leachate flow, we assume that would happen during the final stages of facility expansion, where only 10 feet of waste has been placed over a 10-acre portion of the compost deck. For this scenario, the LCRS/preferential pathway capture rate was assumed based on HELP model outputs for 10 feet of waste in place.

For the design LCRS flows, 6-inch diameter SDR-11 perforated collection piping will be installed in the floor area LCRS aggregate layers. The properties of this piping, when embedded in the aggregate, will be sufficient to withstand to prevent collapse under the pressures exerted by overlying wastes, cover, and heavy equipment. The waste thickness is expected to range up to 250 ft in LF-2, Phase III and IV, and 150 ft in the REA.

5.9.3 Leachate Force Main Pipeline System Capacity

All liquids removed from the LCRS sumps in the new cells will be piped to the lined surface impoundment (Leachate Pond 1, see ***Figure 3***). A second lined impoundment (Leachate Pond 2) is available for backup storage when Leachate Pond 1 is near capacity or undergoing maintenance. Accumulated liquids will in turn be pumped from the ponds via force-main pipeline for discharge to the City of Santa Rosa Subregional Waste Water Treatment Plant.

An evaluation was performed to confirm that the existing leachate storage and force-main pipeline systems have sufficient capacity to accommodate leachate flows from existing and proposed new LCRS systems. Estimates of expected peak leachate flows during the landfill expansion project lifetime are provided in ***Appendix H***. These estimates include leachate flows from proposed new cells, the preferential pathway systems, and existing LF-1 and LF-2, Phase I/II units. These analyses show that peak leachate flows will be approximately 68 gpm. For comparison, the existing leachate pipeline force-main system is sized for 400 gpm. By this measure, the force-main system capacity is adequate.

A separate analysis was performed by the County in response to a RWQCB request and has been submitted to the agency (Sonoma County, January 2012). It was concluded that the leachate force main system capacity is over 3 times greater than anticipated peak flows under worst-case conditions. (To be conservative, this analysis assumed leachate flows would be double the values predicted by SCS above.) It was also concluded there are 25 days storage capacity in on-site ponds. The County also has a contingency liquids trucking plan in place if needed.

In summary, the existing leachate storage and pipeline infrastructure is appropriately sized for future leachate flows.

5.10 ALTERNATE LINER EQUIVALENCY DEMONSTRATION

27 CCR §20080

The equivalency demonstration for approval of a bottom liner design not conforming to the prescriptive requirements of a composite liner system defined by federal or state regulations consists of two parts. The first part calculates the estimated average annual leachate infiltration rate per acre through the proposed alternative bottom liner system using the HELP model. The second part of the demonstration uses the MULTIMED model to assess the subsurface transport of contaminants in the leachate infiltrating through the bottom liner system and predict the contaminant concentration at the relevant point of compliance (POC) such as a downgradient groundwater monitoring well (USEPA, 1995).

SCS performed comparative analyses using the HELP (version 3.07) and MULTIMED (version 1.50) computer models to demonstrate the equivalency of the proposed alternative double-composite bottom liner systems to the prescriptive bottom liner standards as codified in 40 CFR §258 and 27 CCR §20080 (b).

Please note that the results of HELP and MULTIMED modeling, and in particular, the estimated infiltration and leakage rates presented herein are offered for comparison purposes, to show differences between bottom liner prescriptive standards and engineered alternatives. The model outputs presented herein are not intended to be interpreted as actual liquid volumes that will be released to the environment. The existing comprehensive water quality monitoring program will be modified as necessary as described herein **(Section 6)** to detect potential releases from the disposal facility expansion in accordance with WDRs issued by the RWQCB.

5.10.1 Equivalency Demonstration – HELP Model

SCS used the HELP model to estimate infiltration through the base liner system for both the prescriptive and engineered alternative double-composite liner configurations described herein. A graphic comparison of the prescriptive and proposed engineered alternative base liner system is shown in ***Figure 21 A***. Analyses were performed for liner systems in both excavation side slopes and floor areas of LF-2 and the REA, respectively. The model predicts potential infiltration through the bottom layer of the composite liner systems - for example, through the 2-ft compacted low permeability soil layer in the prescriptive design.

Results of the base liner equivalency HELP model simulations are presented in ***Table 6*** below. Printouts of the revised model simulations, as well as accompanying figures showing cross-sections of the bottom liner configurations corresponding to the prescriptive and engineered alternative model layers are included in ***Appendix H.***

Table 6: HELP Model Simulations – Base Liner Equivalency Demonstration

Bottom Liner System Design Standard	Estimated Average Annual Infiltration Rate Through Liner System Per Acre		
	in/yr	ft³/yr	gal/yr
Engineered Alternative - LF-2 Cell Floor	0.00	0.00	0.00
Prescriptive - LF-2 Cell Floor	1.0×10^{-4}	3.63×10^{-1}	4.86×10^{-2}
Engineered Alternative - REA Cell Floor	0.00	0.00	0.00
Prescriptive - REA Cell Floor	1.0×10^{-4}	3.63×10^{-1}	4.86×10^{-2}

As shown in ***Table 6***, the estimated average annual leakage rate through the proposed engineered alternative double-composite bottom liner system is 0.00 inches (refer to details in ***Appendix H***). In other words, the model predicts that no liquids would infiltrate through the alternative liner system. By this measure alone, the proposed double-composite alternative liner system design for the CDS are superior to the prescriptive standard.

5.10.2 Equivalency Demonstration – MULTIMED

The MULTIMED model was developed by the US EPA and is intended for use in conjunction with a separate leachate source model, such as HELP. Output from the HELP model is used as input in MULTIMED to demonstrate that either a landfill design or the specific hydrogeologic conditions present at a site will prevent contaminant concentrations in groundwater from exceeding the concentrations listed in Table 1 of 40 CFR § 258.40 (USEPA, 1994). In particular, the hydrogeologic computer modeling estimates a Dilution Attenuation Factor (DAF). The DAF is the factor by which the contaminant concentration is expected to decrease between the landfill unit and the POC monitoring location. The DAF for the landfill/aquifer system is expressed as follows:

DAF = initial contaminant concentration / concentration at the POC.

If the DAF is equal to or greater than 100, the US EPA designates the liner design acceptable.

For the equivalency demonstration, MULTIMED is used to predict the contaminant concentration at the downgradient POC and the DAF for both the prescriptive and engineered alternative double-composite base liner systems.

For our analyses, potential infiltration through the cell floor areas, as predicted by the HELP Model, was used as a MULTIMED model input as it represents worst-case conditions (refer to ***Table 7***). The model also uses existing groundwater monitoring wells F-18 and F-2N, which are located downgradient of the LF-2 and REA units and screened in the Franciscan Formation, as the respective POC's. Other MULTIMED model inputs and assumptions used and outputs in the equivalency demonstration for the CDS are presented in ***Appendix L***. (Note that ***Appendix L*** provides for analysis of the prescriptive standard and an earlier version of the engineered alternate liner design (SCS, 2011). This earlier design is no longer applicable; a double-composite liner system is currently proposed.) Results of the MULTIMED analysis simulations are presented in ***Table 7*** below.

Table 7: Results of MULTIMED Model Simulations

Bottom Liner System at 2 Percent Slope		Estimated Infiltration Rate from 2.5% Base into the Subsurface m/yr (in/yr) [(1)]	Estimated Concentration at Point of Compliance mg/L	Dilution Attenuation Factor (DAF)
LF-2	Proposed Double Composite Liner	0.00	N/A	N/A
	Prescriptive Liner	$2.54x10^{-6}$ ($1.0x10^{-4}$)	$1.722x10^{-3}$	580
REA	Proposed Double Composite Liner	0.00	NA	NA
	Prescriptive Liner	$2.54x10^{-6}$ ($1.0x10^{-4}$)	$9.033x10^{-6}$	$1.107x10^{5}$

[1]Corresponding HELP model output value of estimated average annual leakage rate through Primary Composite Liner in in/yr.
Points of compliance: LF-2: well F-17; REA: well F-2N

As shown in ***Table 7,*** and as predicted by the HELP model, no liquids will be released from the engineered alternative double composite alternative liner system. Thus calculation of the estimated concentration at the point of compliance and DAF is not necessary. The DAF corresponding to the MULTIMED model simulations for the prescriptive bottom liner systems are 580 and $1.1x10^5$ for LF-2 and the REA, respectively. These results show that the prescriptive liner system meets minimum EPA performance standards. Because there is no leakage predicted from the engineered alternative double-composite liner system, it can be assumed that the DAF would be far superior to that for the prescriptive liner system, thus indicating that the proposed alternative design meets minimum EPA performance criteria.

These HELP model results demonstrate that the proposed alternative liner systems in LF-2 and the REA will ensure that listed maximum contaminant concentration values will not be exceeded in the uppermost aquifer at the POC from leachate released from the proposed lined areas.

5.10.3 Conclusion – Engineered Alternative Liner Configuration

Based on the HELP model results, SCS concludes that the engineered alternative double-composite liner configurations as proposed herein are consistent with the performance goals of state and federal regulations and per 27 CCR §20080(b)(2)(A) and (B), and afford equivalent or greater protection against water quality impairment than the prescriptive liner systems. We also conclude that the engineered alternative is superior from a construction standpoint; placement and compaction of the prescriptive 2-ft thick low-permeability soil component on excavation slopes is impractical as demonstrated at numerous other landfills throughout California.

A comprehensive construction quality assurance (CQA) program is proposed to ensure proper liner system integrity, and confirm the various components are not damaged during construction. The CQA program includes electronic leak detection testing to identify possible defects after the liner components have been constructed, and allow for subsequent repair of defects if necessary. Please refer to **Section 5.15** for details on the CQA program.

5.11 SURFACE WATER DRAINAGE AND SEDIMENT CONTROL

27 CCR §20365, §21090, §21150, §21710 §21600(b)(8)(F) and §21750

The objectives of the surface-water management system at the CDS are to:

- Control surface water run-off from the landfill.
- Isolate the landfill by diverting surface water run-on from adjacent areas around the landfill footprint.
- Control erosion and sediment transport.
- Limit infiltration, inundation and ponding within the landfill cells.
- Limit erosion and control flows on the landfill surface after intermediate or final cover has been placed.
- Limit erosion, slope failure, washout, and overtopping of the surface water conveyance and sedimentation structures.
- Protect the integrity of landfill post-closure end uses, roads, structures and environmental controls including the LFG and leachate handling systems from storm water damage.
- Prevent exposure of wastes and related safety hazards.

5.11.1 Regulatory Requirements

The design of the surface water system must meet federal, state and county requirements.

Federal requirements for surface water drainage are contained in 40 CFR §258.26 and §258.27. These regulations require design for peak discharges from a 25-year storm event. These regulations also prohibit discharges of pollutants into waters of the United States, including wetlands, that violate standards of the Clean Water Act (including the National Pollutant Discharge Elimination System (NPDES) requirements), or that violate area- or state-wide water quality management plans.

State requirements for precipitation and drainage controls at landfills are contained in 27 CCR §20365, §21090, §21150, §21710 and §21750. These regulations generally require measures be implemented to meet the surface water management objectives stated above. Under 27 CCR, Class III landfills should be designed for a 100-year, 24-hour storm event.

Sonoma County requirements for flood control defined by the Sonoma County Water Agency (SCWA) are contained in that agency's publication "*Flood Control Design Criteria*" (1999).

Criteria for open channels and closed conduits at the CDS are considered minor waterways, which have a drainage area of one square mile or less. These standards generally require design for a 10-year return storm. However, if a secondary or major waterway is placed into a closed conduit, sufficient additional surface routes must be made available for a 100-year design discharge. The County requirements also include provisions for freeboard and channel velocities in open conveyance systems to prevent siltation.

A hydrologic evaluation has been performed for the CDS site to determine the patterns and volumes of runoff that will impact drainage and erosion with the development of LF-2, Phases III and IV, the REA and LF-1 as described herein. This was used as the basis of surface water drainage system sizing.

5.11.2 Hydrologic Evaluation and Water Balance

A hydrologic analysis was performed by SCS for the following features at the CDS site using HydroCAD. All drainage features have been evaluated using the 100 year, 24-hour storm event. ***Appendix M*** contains the analyses performed on the following existing or proposed site features:

- Drainage areas present within the CDS property boundary.
- Ditches, culverts, and channels used to convey storm water runoff within the CDS property boundary.
- Downchutes used to convey channelized runoff within the CDS property boundary.
- Sedimentation ponds/basins.

Note that ***Appendix M*** provides printed summaries of the key elements of the HydroCAD analyses. A computer disc with detailed drainage calculations for each subcatchment area/drainage feature described in ***Appendix M*** has been provided to CalRecycle, the LEA and the RWQCB. These calculations are nearly 200 pages when printed and have been omitted from the appendix for brevity and to conserve resources.

5.11.3 Surface Water Drainage System

The storm water drainage system will include permanent mat-lined drainage ditches (v-ditch and trapezoidal ditches), lateral benches on excavation and fill sideslopes, culverts, cross drains, downchutes and rip-rap for energy dissipation. Runoff will be directed via Type I through III drainage ditches and downchutes. Downchutes will range from 18-to 36-inch diameter and constructed of welded corrugated plastic pipe (CPP). The surface water flow will be directed to existing surface water detention basins. Locations of major drainage courses are shown in ***Figure 25.*** Typical drainage system details are shown in ***Figure 26***.

Based on the HydroCAD analyses and for a 100-yr, 24-hour storm event, peak flow rates in site downchutes are expected to range from 0.43 cubic feet per second (cfs, CMP 2 model output) to 89.9 cfs in CMP 13. Peak flow rates into site sedimentation ponds range from 0.81 cfs in

Sedimentation Pond 8 (SP8 in model output) to 91.97 cfs in Sedimentation Pond 5 (SP5). Refer to the analyses in ***Appendix M***.

During initial construction of new cells and throughout the operational period of the landfill, interim or temporary drainage facilities, including ditches, diversion berms, culverts and bench drains will route storm water run-off to larger ditches. Benches will be constructed as needed to control surface water flows and allow cell access. Runoff from the benches be routed to a series of perimeter ditches. These ditches discharge to a series of detention basins. The basin outflow structures discharge surface water to a tributary of Stemple Creek.

To the extent feasible, the operator will minimize the volume of run-off that cannot be diverted to ditches and perimeter roads. Containment system terminations along the cell floors and between phase boundaries will be used to direct run-on flows away from active cells. However, any surface water that comes into contact with waste at the open face is considered contact water and will be directed into the LCRS.

5.11.4 Erosion and Sediment Control Features

5.11.4.1 Storm Water Best Management Practices (BMPs)

Runoff from the landfill floor areas, side and waste fill slopes will contain sediment, which will need to be intercepted at the source prior to discharge to detention basins. The following erosion control measures will be implemented and maintained during landfill new cell construction, operation, closure and post-closure phases:

- Placement of vegetation on newly-graded slopes. Mulch, consisting of straw or wood fiber, will be applied at the time of seeding.
- Use of benches on sideslopes and waste fill areas, to shorten drainage paths.
- Use of protective lining on interim and final ditches, including grass, rip-rap, and erosion control mats.
- Use of energy dissipaters to reduce flow velocities. These will be installed at the outlets of all conduits. Rip-rap dissipaters are currently installed at all detention pond inlets.
- Use of temporary control measures in active work areas including straw bales, loose straw, erosion mat, and silt fencing.

5.11.4.2 Detention Basins

Surface water runoff within the landfill cell footprints is routed to a series of 5 sedimentation basins. Basin locations are shown in ***Figures 3*** and ***25.*** The basins were designed to slow the peak water flows from the upland areas, and allow soil particles and debris to settle out before the water is released to the downstream drainage. These sedimentation basins are a critical component of the overall surface-water management system.

SCS confirmed the sizes of the detention basins based on the volume of water estimated by HydroCAD. ***Appendix M*** contains the calculation of peak inflow rates into and size of each basin. Our analyses confirm that the existing storm water detention basins are sufficiently sized to handle anticipated peak flows (100 year, 24-hour storm) and allow a minimum of 2 feet of freeboard.

5.11.4.3 Erosion and Soil Loss Calculations

Erosion and Soil Loss calculations were performed for the site using the Universal Soil Loss Equation (USLE) developed by the national Resources Conservation Service. The equation applies to sheet and rill erosion and does not account for soil losses due to gullying. The USLE does not include the effects of soil redeposition.

The erosion and soil loss calculation methods, input assumptions and results are presented in ***Appendix N***. The results show that the amount of soil loss is expected to be 1.45 tons per acre per year which is less than the 2 tons per acre per year recommended by the US EPA.

5.12 INTERIM COVER

27 CCR §21600(b)(6)(C)

Interim cover is placed as part of landfill operations, as completed cells reach interim grades. A minimum of 12 inches of intermediate cover will be placed over refuse areas which will be inactive for periods greater than 180 days. The interim cover material will be taken from existing on-site soil stockpiles. For LF-2, Phase III, interim cover may be obtained from soil stockpiles or the planned Phase IV cell excavation.

5.13 LANDFILL GAS COLLECTION AND CONTROL SYSTEM

27 CCR §21600(b)(4)(E)

5.13.1 Existing LFG Collection and Control System

An LFG collection and control system has been in operation at the CDS since 1987. The LFG system is operated, monitored and maintained in accordance with the following regulatory requirements:

- 27 CCR requirements for subsurface combustible gas migration control and monitoring.
- Major Facility Review Permit (Title V Operating Permit) for Facility #A2254 and Bay Area AQMD Regulation 8, Rule 34 requirements.
- 17 CCR §95464 et seq., known as the AB 32 Landfill Methane Rule. This rule, enforced by the California Air Resources Board (CARB), was adopted in 2010 and provides standards for operation and monitoring of LFG control systems to enhance methane capture. Methane is considered a primary GHG.

- US EPA Greenhouse Gas Reporting Rule, adopted in 2009. This rule requires landfill owners to record and report information annually on waste disposal rates and LFG control device flow metering.

The LFG extraction system at the CDS has regularly undergone various expansions since initial installation in 1987, and currently consists of a network of 136 vertical extraction wells and 20 horizontal gas collectors installed throughout the LF-1 and LF-2 refuse fill areas. Most vertical wells installed in LF-1 are equipped for dual leachate and gas extraction. The LFG is collected by vacuum blowers and routed via above- and below-grade header piping systems to the 8.0 MW capacity, LFG-fueled electric power generation facility. Electric power generated at the LFGTE plant is sold to the local utility. During LFGTE plant engine downtime for scheduled or unscheduled maintenance, LFG is routed to an enclosed ground flare for thermal gas destruction. The LFG collection and control system layout is shown in ***Figure 27***.

The LFGTE plant and flare are sized to handle LFG flows of 2,800 and 1,500 scfm, respectively. The combined capacity is 4,300 scfm. For year 2010, the LFG deliveries to these devices averaged 2,120 scfm. All LFG flow rates above are normalized to 50 percent methane by volume. LFG modeling (**Section 4.6** and ***Appendix F***) shows that within the 20-year expected life cycle of the new flare (installed October 2010), LFG capture will not exceed the combined capacity of the LFGTE plant and flare.

LFG liquid condensate that forms in collection piping flows by gravity to low points (condensate traps) in the main header piping. The condensate in the traps is then conveyed via HDPE piping and discharged at either of the two on-site leachate storage ponds. Condensate produced at the LFGTE plant is also conveyed via leachate piping to the leachate ponds. The condensate is mixed with leachate in the ponds and pumped via force-main for treatment and disposal at the City of Santa Rosa Waste Water Treatment Plant.

5.13.2 Master Plan for LFG Upgrades

5.13.2.1 Design Criteria

The LFG collection system will be expanded sequentially as MSW filling operations proceed at the CDS. Key criteria for system build-out include:

- The system will continue to be operated to maintain compliance with all regulatory and permit requirements affecting subsurface combustible gas migration through soils and NMOC and GHG surface emissions that could affect air quality or global warming. The County is currently assessing the need for LFG control system upgrades in response to the AB 32 Methane Rule.

- Piping and control system upgrades will be sized to accommodate future LFG flows.

- Existing LFG collectors remain operational for as long as practical. Of particular importance is maintenance of LFG vertical extraction wells in the unlined LF-1 fill area. These are important for overall LFG collection and provide benefit in controlling lateral LFG migration into adjacent cell underdrains. This minimizes potential impacts to groundwater.

- Collection system components will be phased in concert with fill sequencing.
- To the extent practical, LFG upgrades do not interfere with day-to-day MSW filling operations. Horizontal gas collectors are preferred in this regard.
- Header piping will be installed in a loop configuration to allow operational flexibility.
- Disruptions to collection system operation will be minimized to enhance power production output.
- Where applicable, dual leachate/gas extraction wells will be used in the top deck area of LF-1.

As a basis of design, LFG recovery estimates were prepared by SCS (refer to **Section 4.6.1** and ***Appendix F***). Our analysis shows that LFG generation peaked in 2005, when waste disposal operations were temporarily suspended at the CDS, and have significantly declined since that time. Based on anticipated waste disposal rates with disposal operations resuming, future LFG recovery at the CDS is expected to range between 2,100 and 2,200 scfm until site closure. The LFGTE plant and flare have a total capacity of 4,300 scfm. Thus LFG treatment facilities at the CDS appear to be sufficient through the projected active life of the landfill, or when the existing flare (installed October 2010) reaches the end of its expected service life in 20 years.

5.13.2.2 System Upgrades

Header Installation. The LFG header system will be sequentially expanded and at final build-out will be a loop configuration. For flows up to 2,000 scfm, 12-inch diameter header is recommended. For flows up to 3,500 scfm, 16-inch diameter header is recommended.

LFG Barrier between LF-1 and New Lined Cells. Leachate and LFG extraction/barrier systems will be installed to prevent gas or liquid contaminant migration from LF-1 into the new underdrain systems. North-south trending collectors will be installed at base grades for new cells in LF-2 and the REA, as described in **Section 5.6.3** and shown in ***Figures 20*** and ***22***, respectively.

LFG Collectors. Horizontal collectors will be installed with advancing lifts in LF-2, the REA and the compost deck area of LF-1. The collectors will be spaced on approximate 200-ft centers, at a vertical distance of approximately 50 feet between refuse lifts. The collectors will generally parallel the east-west alignment of existing collectors. These will be connected to temporary or permanent north-south running laterals on the eastern or western edges of the respective fill areas. When fill elevations reach final grades, vertical LFG extraction wells will be installed throughout the landfill. The wells will be installed to depths terminating 20 feet or more above base liner elevations s in LF-2 and the REA.

Maintain Existing LFG Collectors. Vertical LFG extraction wells (including dual leachate/gas extraction wells) in LF-1 are installed deep within the refuse fill and provide the best means to reduce pressures within the landfill, and prevent the impact of LFG on groundwater. These wells are an important part of the successful groundwater corrective action programs implemented by the County in response to RWQCB requirements. Existing vertical wells will be extended in areas where no more than 30 feet of additional fill will be placed. As fill elevations reach final grades in the top deck area or sideslopes, new or replacement LFG wells will be installed to match original depths. Measures should be taken to seal penetrations through the underlying LCRS preferential pathway system with bentonite seals (refer to **Section 5.8** of this JTD).

Condensate Handling. Condensate will continue to be drained by gravity to existing leachate ponds.

Figure 28 shows a schematic layout for LFG system improvements at final build-out of the CDS. This layout is based on the above criteria and recommendations. All sequential LFG improvement projects undertaken during the landfill operation phases will require submittal of separate Authority to Construct applications and approval by the Bay Area AQMD. System modifications in response to AB 32 requirements will also require CARB approval.

5.14 ANCILLARY FACILITIES

27 CCR §21600(b)(3)(F)

Ancillary facilities related to MSW disposal operations at the CDS include the County administrative office, an equipment maintenance building, surface water sedimentation basins, leachate holding ponds, and an LFG flaring station. A plot plan showing these ancillary facilities is provided in ***Figure 3***. No other ancillary facilities specifically related to ongoing and future landfill disposal operations are planned at this time.

There are other non-landfill facilities or operations within the larger County-owned CDS property associated with MSW management, that currently operate or will operate under separate permits. Descriptions of these facilities and operations are provided in **Section 2.7** of this JTD.

5.15 CONSTRUCTION QUALITY ASSURANCE

27 CCR §21760(a)(1), §21790, §20323 & §20324

Construction of landfill containment features will be carried out in accordance with a CQA plan certified by a registered professional civil engineer or certified engineering geologist. A Preliminary CQA plan has been prepared to document the quality of materials and workmanship for construction of landfill containment structures at the CDS has described herein. This plan has been prepared in accordance with 27 CCR § 21790, §20323 & §20324 and is presented in ***Appendix O.***

Specifically, the appended Preliminary CQA Plan provides guidance for testing and inspection of: (1) the capillary break/underdrain layer, low-permeability compacted soil layer, GCL, geomembrane liner, sand leak detection layer, geocomposite layer, geotextile, LCRS, and operations layer components of new base and sideslope liners; (2) sideslope/compost deck preferential pathway system for areas of future waste placement at LF-1; and (3) foundation layer, geomembrane liner, geocomposite and vegetative layer for partial final closure of the "South Face" area of LF-1.

The Preliminary CQA Plan presented in ***Appendix O*** includes details on the following:

- CQA personnel qualifications, responsibility and lines of authority.
- Inspection, monitoring and testing methods to verify that earthworks and geosynthetic materials construction activities are undertaken in accordance with approved design plans and specifications as approved by the RWQCB, and accepted engineering practice and regulatory requirements. Laboratory and field test requirements are as specified in §20324(C)(2)(e), (f) and (h) as appropriate.
- Laboratory testing requirements for soil and synthetic cover components.
- Record keeping and reporting provisions.
- Procedures for approval/rejection of work, or changes in work.

Please note that the CQA Plan includes provisions for electronic leak detection testing to ensure proper liner construction and integrity. This testing is performed following construction of the composite liner system (i.e., after compacted soil layers, geomembranes, geotextile, soil operations layer, etc. have been placed) and can be used to identify defects in the underlying liner components. This allows for corrective repairs, if necessary, before placement of wastes over the geomembrane liner and soil operations layers. In our view this provides additional assurance to the owner and oversight agencies regarding the liner system integrity.

A Final CQA Plan shall be prepared for each specific landfill capital improvement construction projects undertaken at the facility (for example, Phase III base liner at LF-2, or partial final closure of the "South Face" at LF-1). The Final CQA Plan(s) will be based on final design plans and specifications (bid documents) for each project, and shall be submitted to the oversight agencies for review and approval.

Following each discrete construction project, the work will be documented in separate CQA certification reports in accordance with 27 CCR §20324(c) requirements. The reports will contain daily observation and testing information (daily summary reports), progress photographs, soil and material sampling/test acceptance results (acceptance reports), as-built drawings and surveys, approvals and certification that the work was performed in accordance with the design criteria and approved plans and specifications. The final CQA reports will be signed by a registered civil engineer or certified engineering geologist and submitted to the RWQCB.

6.0 ENVIRONMENTAL MONITORING PROGRAMS

The environmental monitoring programs at the CDS are undertaken to detected releases from the facility that could adversely affect air, water quality, or pose a threat to human health and safety and the environment. These programs monitor groundwater, surface water, leachate, LFG, and the unsaturated zone to meet state regulations and permit conditions.

Descriptions of existing environmental monitoring programs are provided below. Proposed modifications to those programs, along with supporting rationale, are also described.

6.1 WATER QUALITY MONITORING

Water quality monitoring at the CDS is currently performed pursuant to the requirements of Monitoring and Reporting Program No. R1-2004-0040 (MRP) issued by the RWQCB in June 2004. The MRP stipulates monitoring, sampling and reporting requirements for groundwater, surface water, leachate, and landfill gas. A site plan depicting both current and proposed water quality monitoring locations is provided in ***Figure 29***.

6.1.1 Water Quality Protection Standards

27 CCR §20390

27 CCR §2*0390* requires the establishment of Water Quality Protection Standards (WQPS) for each waste management unit. The WQPS consist of a list of constituents of concern (COCs), the concentration limits, points of compliance, and all monitoring points. WQPS have been established using statistical and non-statistical evaluations of water quality monitoring data, and are reported in accordance with requirements of the MRP. Details on the existing and proposed WQPS are discussed in ***Appendix P***, in a proposed Sampling and Analysis Plan for the Central Disposal Site (Pacific GeoScience, February, 2011, modified December 2011 in response to RWQCB comments).

6.1.2 Existing Water Quality Monitoring Programs

27 CCR 20385, §20395, §20415 and §20430

MRP Order No. R-1-2004-0040 specifies detection monitoring programs for groundwater, leachate, surface water and the unsaturated zone, and corrective action programs for groundwater, leachate, LF-2 underdrain discharge and the unsaturated zone.

6.1.2.1 Groundwater Monitoring

Monitoring Points of Compliance. The CDS currently has 21 groundwater wells used for monitoring LF-1 and 13 wells used for monitoring LF-2 (***Figure 29***). The wells are screened in the alluvial, shallow-zone Franciscan formation, or deep-zone Franciscan formations. The wells are designated as detection monitoring wells (background, downgradient, and point of compliance), or corrective action wells according to the MRP. The monitoring well network, well designations, and units monitored are provided in ***Table 1***.

Monitoring Parameters. The detection monitoring wells are monitored quarterly for field parameters (depth to water, pH, temperature, dissolved oxygen, and specific conductance), and sampled for general minerals, total dissolved solids (TDS), nitrogen, and VOCs. Sampling for metals is conducted annually and every five years for designated COC parameters. COCs are as specified in federal Subtitle D, Appendix II and WRCB Resolution 93-62. The corrective action wells are monitored and sampled on a quarterly basis for the parameters described above, and annually for COCs**.** ***Table 8*** lists the monitoring parameters, measurement units, and the frequency of analysis/measurement for the detection and corrective action monitoring wells.

Other monitoring points. There are six groundwater monitoring wells (F-20, F-35, LP-1, WV-1, WV-2, and WV-3) and 40 groundwater and leachate piezometers that were installed as part of previous site investigations. These monitoring points are not listed in the MRP but are voluntarily tested by the County for liquid levels to evaluate site-wide groundwater flow conditions. Locations of these monitoring points are shown in ***Figure 29.***

6.1.2.2 Surface Water Monitoring

A detection monitoring program is in effect for surface water monitoring at the CDS. There are three surface water monitoring locations, designated SW-1, SW-6, and SW-7, that are unnamed tributaries that flow into Stemple Creek, and one background location, designated "Ditch". The surface water locations SW-1, SW-6, and SW-7 are sampled at the property boundary. Surface water monitoring locations are shown in ***Figure 29***.

Surface water monitoring begins with the first surface water runoff in the fall of each year, and continues monthly until surface runoff ceases in the dry season. ***Table 9*** lists monitoring sampling parameters and frequencies. In accordance with the MRP, after each sampling event an intra-sample point assessment is made if a statistically or non-statistically significant increase over the WQPS for each sample has occurred.

6.1.2.3 Leachate Monitoring

Leachate monitoring under MRP Order No. R1-2004-0040 consists of daily measurement of freeboard in the leachate ponds, observations of the presence of liquids in LCRS sumps, and flow measurements of the LF-2 underdrain discharge. Monitoring of field parameters, and sampling for TDS, general minerals, chemical oxygen demand (COD), metals, sulfates and VOCs is performed on a quarterly basis at designated leachate extraction wells/sumps, LCRS sumps, and the two leachate ponds. Samples are collected annually for specified COCs. The County monitors the disposal site surfaces weekly for the presence of seeps. ***Table 10*** lists monitoring sampling parameters and frequencies.

Under the corrective action program, monitoring of leachate drawdown in LF-1, as measured from leachate piezometers, is performed on a monthly basis. Contour maps showing leachate levels are prepared, along with summaries of pumping rates from individual leachate extraction points. Locations of LF-1 leachate extraction wells are shown in ***Figure 30***.

Table 8.
Existing MRP Groundwater Monitoring Parameters
Central Disposal Site Sonoma County, California

Parameter	Units	Frequency
Field Parameters		
pH	pH Units	Quarterly
Specific Conductance	mhos/cm	Quarterly
Temperature	^{o}C	Quarterly
Groundwater Elevation	feet	Quarterly
Dissolved Oxygen	mg/L	Quarterly
Turbidity	Turbidity Units	Quarterly
Monitoring Parameters		
Sodium	mg/L	Quarterly
Magnesium	mg/L	Quarterly
Calcium	mg/L	Quarterly
Iron	mg/L	Quarterly
Speciated Alkalinity	mg/L	Quarterly
Manganese	mg/L	Quarterly
Total Dissolved Solids	mg/L	Quarterly
Chlorides	mg/L	Quarterly
Sulfates	mg/L	Quarterly
Nitrogen Series	mg/L	Quarterly
Fluoride	mg/L	Quarterly
Halogenated VOCs	µg/L	Quarterly
Aromatic VOCs	µg/L	Quarterly
Tritium [1]	mg/L	Quarterly
CAM Metals	mg/L	Annually
Constituents of Concern [2]		
Carbonate	mg/L	Every 5 Years
Bicarbonate Alkalinity	mg/L	Every 5 Years
VOCs (extended list)	µg/L	Every 5 Years
Semi-volatile Organic Compounds	µg/L	Every 5 Years
Organochlorine Pesticides, PCBs	µg/L	Every 5 Years
Chlorophenoxy Herbicides	µg/L	Every 5 Years
Organophosphorus Compounds	µg/L	Every 5 Years
Dissolved Inorganics	mg/L	Every 5 Years

1 - Corrective Action Wells Only

2 - Corrective action wells are sampled annually for COCs

Table 9.
Existing MRP Surface Water Monitoring Parameters
Central Disposal Site Sonoma County, CA

Parameter	Units	Frequency
Field Parameters		
Flow	MGD	Continuous
Dissolved Oxygen	mg/L	Monthly
Hardness (as $CaCO_3$)	mg/L	Monthly
Specific Conductance	Mhos/cm	Monthly
pH	pH Units	Weekly
Temperature	^oC	Weekly
Ammonia	mg/L-grab	Weekly
Unionized Ammonia	mg/L-grab	Weekly
Turbidity	Turbidity Units	Monthly
Total Precipitation	In/Days	Monthly
Monitoring Parameters		
Total Dissolved Solids	mg/L	Monthly
Total Settleable Solids	mg/L	Monthly
Total Suspended Solids	mg/L	Monthly
Ammonia	mg/L	Monthly
Bicarbonate	mg/L	Monthly
Chlorides	mg/L	Quarterly
Sulfides	mg/L	Quarterly
Nitrogen Series	mg/L	Quarterly
Carbonate	mg/L	Quarterly
Chemical Oxygen Demand (COD)	mg/L	Annually
Total Organic Carbon (TOC)	mg/L	Annually
Biological Oxygen Demand (BOD)	mg/L	Annually
Bioassay Test (96 hr)	Percent Survival	Annually
CAM Metals	mg/L	Annually
Constituents of Concern		
Carbonate	mg/L	Every 5 Years
Bicarbonate Alkalinity	mg/L	Every 5 Years
VOCs (extended list)	µg/L	Every 5 Years
Semi-volatile Organic Compounds	µg/L	Every 5 Years
Organochlorine Pesticides, PCBs	µg/L	Every 5 Years
Chlorophenoxy Herbicides	µg/L	Every 5 Years
Organophosphorus Compounds	µg/L	Every 5 Years
Dissolved Inorganics	mg/L	Every 5 Years

Table 10.
Existing MRP Leachate Monitoring Parameters
Central Disposal Site Sonoma County, CA

Parameter	Units	Frequency	Reporting
Field Parameters			
Freeboard in Leachate Ponds	Feet	Daily	Monthly
LCRS - Sumps	Presence of Liquid	Monthly	Monthly
Landfill 2 Underdrain	GPM	Monthly	Monthly
Volume Outhauled	Gallons	Daily	Monthly
Specific Conductance	mhos/cm	Quarterly	Quarterly
pH	pH Units	Quarterly	Quarterly
Monitoring Parameters			
Total Dissolved Solids	mg/L	Quarterly	Quarterly
Chlorides	mg/L	Quarterly	Quarterly
Fluoride	mg/L	Quarterly	Quarterly
COD	mg/L	Quarterly	Quarterly
Sodium	mg/L	Quarterly	Quarterly
Mineral Series	mg/L	Quarterly	Quarterly
Nitrogen Series	mg/L	Quarterly	Quarterly
CAM Metals	mg/L	Quarterly	Quarterly
Sulfates	mg/L	Quarterly	Quarterly
VOCs	µg/L	Quarterly	Quarterly
Constituents of Concern			
Carbonate	mg/L	Annually	Annually
Bicarbonate Alkalinity	mg/L	Annually	Annually
VOCs (extended list)	µg/L	Annually	Annually
Semi-volatile Organic Compounds	µg/L	Annually	Annually
Organochlorine Pesticides, PCBs	µg/L	Annually	Annually
Chlorophenoxy Herbicides	µg/L	Annually	Annually
Organophosphorus Compounds	µg/L	Annually	Annually
Dissolved Inorganics	mg/L	Annually	Annually

6.1.2.4 Unsaturated Zone Monitoring

There are eight LFG monitoring probes installed in soils around the perimeter of LF-2, Phases I and II. The location of the monitoring probes (designated the EC-series) are shown in ***Figure 29***. There are also other Temporary Monitoring Probes in the area between LF-1 and LF-2. Quarterly monitoring for LFG constituents in these probes and the LF-2 underdrain sump riser is performed as part of the corrective action requirements in the MRP.

The EC-series and temporary LFG monitoring points were installed to test for LFG in soils as it may affect water quality in the undeveloped canyon east of LF-1 and the LF-2 underdrain. The EC- series wells were initially installed to test for LFG releases from the LF-2 liner anchor trench. The anchor trench was subsequently repaired as part of corrective actions by the County. Results from the last annual COC monitoring indicate that LFG is not contributing to groundwater impacts at the CDS because the constituents detected in the LFG samples are not consistent with the known VOC species in groundwater (Pacific GeoScience, 2010).

6.1.2.5 Reporting

Reports summarizing the above activities are submitted to the RWQCB on a quarterly basis and include data summaries, discussions of monitoring results, and notations of any violations of water quality standards. An annual report is submitted in conjunction with the first quarterly report which summarizes detection and corrective action monitoring data for the previous four quarters, and discussions on compliance with the WDRs and WQPS.

6.1.3 Monitoring History and Corrective Action Status Summary

A release of contaminants from LF-1 was first discovered in 1995, via a detection of VOCs in monitoring well F-10 at the toe of the landfill. The source of the contamination was identified as a leak in the toe-area barrier wall, and the release was confined to the CDS property. Low levels of VOCs were also detected at well F-5 upgradient to LF-1; the source was attributed to LFG (RWQCB, 2004). Subsequent LFG control system operational improvements have since reduced the impacts in well F-5 to below the laboratory detection limit.

An Evaluation Monitoring and Corrective Action Program (EMCAP) was undertaken to address these releases and further investigate potential contaminant sources. Several monitoring wells were installed and various investigations were conducted to evaluate the source and extent of the releases discovered.

Corrective actions implemented by the County as part of the EMCAP have included removal of the original central canyon sedimentation pond (Sedimentation Pond #3) and re-direction of surface water flows around the LF-1 landfill toe; installation of a collection station within the LF-1 leachate barrier wall leak for discharge to the leachate ponds; improvements to the leachate extraction systems (including installation of electrically and pneumatically operated leachate extraction pumps), and upgrades to the LFG collection system.

Extensive studies were subsequently performed to assess the presence and mechanisms for leachate generation and migration potential from LF-1. Key findings are detailed in **Section 4.6.2.2** of this JTD. These studies emphasized the importance of continued draw-down of leachate levels in the LF-1 refuse prism. The remedial measures implemented by the County, including operation of the leachate management systems, have drawn down the leachate volume in LF-1 by approximately 2.0 million gallons per year (RMC Geoscience, 2008). Continued operation of these systems is warranted.

In the area east of LF-1, low level VOCs were detected in wells F-30, F-33, and TMW-14. Subsequent investigations revealed that leachate-impacted water seeped through fill materials beneath the landfill haul road, and caused VOC detections in the monitoring wells. In 2003, the County installed extraction trenches near TMW-14 to intercept the affected groundwater. Pumps were also installed in three rows of LFG wells long the eastern portion of LF-1 to aid in leachate removal. The extracted leachate was pumped to the leachate holding ponds south of LF-1. As a result of these remedial efforts, VOCs decreased in the affected wells.

VOCs were detected in the LF-2 underdrain in 2003. An evaluation monitoring program was undertaken, and the source was attributed to a defect in the liner anchor trench, allowing LFG migration into the underlying groundwater (RWQCB, 2004). A retrofit of the anchor trench was undertaken by the County. Subsequent testing has indicated that LFG-related impacts to the underdrain have essentially been abated as described below.

Detection and corrective action monitoring programs have been ongoing since 2004 as described above. Our review of most recent reports (Pacific GeoScience, 2010), indicates the following trends:

- Groundwater quality data from Point of Compliance wells at LF-1 and LF-2 indicate compliance with 27 CCR and the WDRs.
- No VOCs were detected in groundwater samples at LF-1 or LF-2 during 2009-10 monitoring events, except as follows:
    - Low levels of MTBE have been detected at F-35 (downgradient well at LF-1). Well F-35 is a downgradient interior monitoring point, not a compliance point. Historical data shows the concentrations have been decreasing.
    - Low levels of benzene were detected at DW-4B (upgradient well at LF-2). This result is consistent with previous events.
- No VOCs were detected in corrective action monitoring locations during 2009-10 monitoring events, except as follows:
    - Chlorotoluene and MTBE were detected at well F-10. These constituents have previously been detected at this location. Historical data shows the concentrations have been decreasing.
    - 1,1-dichloroethane was detected at the LF-2 underdrain. This constituent has previously been detected at this location. Historical data shows the concentration has been decreasing, in response to corrective actions by County.

Overall we conclude that the corrective actions undertaken by the County have been effective in mitigating and reducing water quality impacts.

6.1.4 Corrective Action Financial Assurance

27 CCR §20380(b) and *§22222*

Under 27 CCR regulations, owners of Class III MSW landfills must provide financial assurance to assure funds are available to address a known or reasonably foreseeable release to the environment. To comply with this requirement, reasonably foreseeable release scenarios and cost estimates were developed by the County and have been submitted to the RWQCB and CalRecycle. Financial assurance for both the non-water and water releases, respectively, have been prepared and submitted to the oversight agencies (Shaw, September 2011 and April 2012). These submittals are provided in ***Appendix Q***.

The corrective action plan and cost estimates for non-water releases have been accepted by CalRecycle. RWQCB approval for the water and non-water release corrective action plans and cost estimates is pending.

The 27 CCR requirement is to provide financial assurance demonstration for the higher amount of either the water or non-water corrective action plan cost estimates. As shown in ***Appendix Q***, the County has established a pledge of revenue for the water release corrective action scenario.

6.1.5 Proposed Water Quality Sampling and Analysis Plan

27 CCR §20385, §20395, §20400 and *§20415*

The County proposes a modified Sampling and Analysis Plan for the continued monitoring of ground water, surface water, leachate and the unsaturated zone. This plan is proposed in anticipation of new WDRs from the North Coast RWQCB. One reason for the proposed modifications is that proper abandonment/well decommissioning of groundwater monitoring wells and piezometers located in the footprint of proposed waste filling activities will be required, and removal of these monitoring points from the MRP will be necessary.

Other modifications to the current MRP are recommended so that they are more consistent with the statistical methods used to establish the WQPS criteria for groundwater and surface water, or to reflect conclusions based on historic data. They include re-designation, addition or removal of points of compliance, and modifications to sampling frequency and suites of analytical tests. These proposed modifications are based on a thorough evaluation of monitoring data collected since 2004 under the current MRP, plus historic data dating back over one decade (Pacific GeoScience, 2011). The intent is to streamline the programs to continue to provide for earliest possible detection of releases from waste units and thorough evaluation of the effectiveness of corrective action measures while eliminating data redundancy.

Proposed modifications to the current MRP are summarized below. The recommended network of monitoring locations is specific to each of the existing and proposed WMUs, pursuant to RWQCB comments received at a meeting with agency and project stakeholder representatives on November 16, 2011 (Pacific GeoScience, December 2011). Details on the proposed Sampling and Analysis Plan to be considered for a revised MRP, including technical rationale for modifications and proposed measures in response to RWQWCB comments, are provided in ***Appendix P***. The County has and shall maintain water quality monitoring programs that are appropriate for detection monitoring and corrective action, and that comply with Subchapter 3, Chapter 3 Subdivision 1, Division 2 of 27 CCR.

It is understood that under 27 CCR §20380(e), the RWQCB can allow an engineered alternative to prescriptive standards for containment structures proposed herein, should the proposed monitoring programs demonstrate that specified WQPS goals continue to be met.

6.1.5.1 Monitoring Network Modifications

Well and Piezometer Decommissioning. Site development will result in the need to decommission 4 detection monitoring wells (F-29, WV-1, WV-2, and WV-3), 4 corrective action locations (wells F-3, F-8, F-30 and the Trench Riser), 20 piezometers and EC- and TMP-series gas monitoring points. Because site development will occur in phases over several years, the monitoring points slated for decommissioning will be removed from new fill areas approximately 3 to 6 months before each sequential landfill construction project. The water quality monitoring points should be used as piezometers until they are destroyed. The County will submit a work plan for decommissioning of these installations for RWQCB approval prior to the start of field work for each phase of well destruction. The decommissioning plan(s) will be prepared and certified by a California- registered geologist or licensed civil engineer, as required under 27 CCR §20415(e)(1). Proper decommissioning procedures will be employed to ensure that there are no preferential pathways into underlying geologic units beneath new landfill footprint areas.

Detection Monitoring Wells. Proposed modifications are as follows:

- Well F-10, which has been impacted by low levels of MTBE, will become a corrective action well.

- Two new detection monitoring wells will be installed downgradient of proposed new cells in LF-2 (Phases III and IV), specifically to monitor these new units. The locations of these wells, tentatively designated as F-36 and F-40, are shown in ***Figure 29*** and ***Appendix P***.

- Two new detection well installations are recommended to supplement the LF-1 detection monitoring network. The locations of these wells, tentatively designated as F-29R and F-39, are shown in ***Figure 29*** and ***Appendix P***.

- Five background monitoring wells will be used as piezometers and no longer sampled. Intrawell statistical methods are used to evaluate water quality data and comparisons of upgradient (background) versus downgradient monitoring results are no longer necessary.

- Wells DW-3A and DW-3B will be retained as detection monitoring wells for LF-1 and the Compost Area. All other DW-series wells, screened in deep water bearing zones, should be used as piezometers and not sampled. Results of previous investigations have conclusively shown that leachate impacts, if any, would be limited to shallow water bearing zones due to the upwelling forces from Franciscan bedrock.

- The engineered underdrain systems at LF-2, Phases I and II, LF-2, Phases III-IV, and the REA will serve as detection monitoring points for those respective WMUs.

The resulting detection monitoring network would consist of 17 points to monitor water quality in LF-1, 7 points to monitor LF-2, Phases I and II, 8 points to monitor LF-2, Phases III-V, 9 points to monitor the REA, and 18 points to monitor the Compost Area (refer to summary tables and figures in ***Appendix P***). Note that certain wells will serve to monitor more than one WMU.

The locations of proposed new wells F-29R, F-36, F-39 and F-40 may be modified somewhat from those shown in ***Figure 29*** and ***Appendix P*** based on field conditions affected by landfill construction and operational activities. New monitoring wells will be installed at least one year prior to landfill construction to obtain a minimum of 4 quarters of water quality data for statistical analysis. Final design for the new monitoring point will be prepared by a registered geologist or licensed civil engineer, as required under 27 CCR §20415(e)(1). A work plan reflecting this design will be submitted to the RWQCB for approval prior to new well installations. Well drilling, oversight and reporting will be as specified in 27 CCR §20415(e)(2).

Corrective Action Wells. Recommended changes are as follows:

- Corrective action well F-5 should be re-designated as a detection monitoring well for LF-1, and wells MW-3A and MW-3R should be removed from the sampling program and used instead as piezometers that are monitored quarterly. VOCs associated with LFG were first detected in 1997 and 1998. VOC detections since then have been rare – only 3 detections in over 10 years. We conclude that enhanced LFG control system operation by the County has effectively remediated VOC detections.

- Corrective action wells A-7 and F-32 will be removed from the sampling program and re-designated as detection monitoring wells and POC for LF-2, Phases I and II. There have been only rare detections of VOCs in these wells and no anthropogenic VOCs have been detected in annual samples collected from these wells since 2005.

- Corrective action well A-8 will be re-designated as a detection monitoring well and POC for the alluvial aquifer downgradient of LF-2, Phases I and II. There have been only rare detections of VOCs in this well and no anthropogenic VOCs have been detected in annual samples collected from these wells since 2005.

The resulting network of corrective action monitoring points will consist of wells F-10 and F-35, and the LF-2 Phase I and II underdrain.

Point of Compliance Wells. Recommended changes to the POC monitoring well network are proposed in accordance with 27 CCR §20415 requirements as follows:

- Removal of Wells A-3, A-7, F-3 and F-8 for the reasons stated above.

- Well F-19 should be used as a piezometer as it is transgradient to LF-2.

- Compliance well F-2N should become a POC to monitor potential releases from the REA.

- Corrective action wells A-8 and F-32 should become detection monitoring wells. These wells are located downgradient of LF-2, Phases I and II; Well A-8 is located at the property boundary POC and is installed in the uppermost bedrock water-bearing zone.

Based on these recommendations, the resulting network of POC monitoring wells would consist of the following (refer to figures in ***Appendix P***):

- **LF-1**: A-2, F-13, proposed well F-29R, proposed well F-39, HA-1, HA-2, LP-1, ST1W-1, ST1W-2, and ST1W-3.

- **LF-2, Phases I/II:** A-1R, A-7, A-8, F-11, F-31 and F-32.

- **LF-2, Phases III/IV/V**: F-17, F-18, proposed well F-36, proposed well F-40, and ST1W-3.

- **REA**: F-2N, F-13, proposed well F-39, HA-1, HA-2, LP-1.

- **Compost area**: A-2, F-13, proposed well F-29R, proposed well F-39, HA-1, HA-2, LP-1, ST1W-1, ST1W-2, ST1W-3.

Surface Water Monitoring Network. Upstream (background) location "Ditch" should be removed because intra-sampling location statistical analyses are performed to establish the WQPS. Background surface water data is not needed to evaluate potential downstream impacts. Proposed surface water downstream monitoring locations and POC stations are SW-1, SW-6 and SW-7.

Leachate Monitoring Network. The current leachate monitoring network consists of 12 locations, including five (5) LF-1 leachate extraction wells. These five extraction wells should be removed from the monitoring network. Monitoring over the past 7 years (28 events) has provided abundant data on these individual wells. Samples are currently obtained from LCRS sumps and leachate ponds where leachate from each unit is combined. These sump and pond monitoring points provide sufficient, representative data on overall leachate characteristics from LF-1 and LF-2 and the CDS.

New LCRS sumps will be constructed in LF-2 (Phases III and IV) and the REA. These should be added to the monitoring network when constructed.
In summary, the proposed leachate monitoring locations are as follows:

- **LF-1**: LCRS sump

- **LF-2, Phases I/II:** LCRS sump.
- **LF-2, Phases III/IV/V**: New LCRS and leak detection layer sumps.
- **REA**: New LCRS and leak detection layer sumps.

Monitoring Parameters. Recommended changes to the monitoring parameters are:

- Removal of organochloride pesticides, PCBs and select minerals (metals) from the list of annual COCs.
- Addition/removal of various inorganic indicator parameters to the detection monitoring parameters for leachate and groundwater.

Detailed lists of recommended analyses for detection and corrective action monitoring and supporting rationale for these changes are provided in ***Appendix P***. Proposed COCs and concentration limits are based on previous monitoring data at the CDS, as well as 27 CCR §20395 and §20040 requirements.

Reporting and Agency Notifications. No changes to the current reporting schedule, report contents, methods for establishment of Water Quality Protection Standards, notification of release and re-testing, or responding to a release discovery are proposed.

6.2 LANDFILL GAS MONITORING

An LFG monitoring program is undertaken at the CDS in accordance with 27 CCR §20919.5 requirements. The monitoring is performed to ensure that combustible gases generated at the disposal facility are controlled as follows:

- The concentration of methane in air does not exceed 1.25 percent by volume in on-site structures (compost trailer, operator's trailer, and T/PF scale houses). This concentration is equivalent to 25 percent of the lower explosive limit (LEL) for methane gas.
- The concentration of methane gas migrating from the disposal facility does not exceed 5 percent by volume, or 100 percent LEL in soils at the facility boundary.

A network of 16 perimeter LFG monitoring probes has been installed in soils at the CDS facility boundary. The probes reportedly comply with 27 CCR construction standards for landfill perimeter monitoring. These probes are tested on a quarterly basis for subsurface pressures, and methane, carbon dioxide, oxygen concentrations using field instruments. LFG monitoring probe locations are shown in ***Figures 27*** and ***28***.

The interior spaces of the above on-site structures (scale houses, contractor trailers) are tested for combustible gas accumulations on a quarterly basis using field instruments capable of detecting methane gas in the LEL range. Monitoring for combustible gas is also performed in subsurface utility vaults adjacent to the County administrative office on a quarterly basis.

Results of monitoring are submitted to the County LEA and CalRecycle in quarterly reports. Based on monitoring results for 2010, combustible gas levels at all probes and buildings have remained below the regulatory thresholds and the site is in compliance with 27 CCR requirements for combustible gas migration control (Pacific GeoScience, 2010).

The County will continue the current LFG monitoring program while the CDS remains open for MSW disposal, and during the post-closure monitoring period as required by regulation. No changes to the LFG monitoring program are proposed.

7.0 OPERATIONS PLAN

This JTD section describes the personnel requirements, minimum equipment, materials handling, health and safety, and record keeping procedures for the daily MSW disposal operations at the CDS.

7.1 PERSONNEL

Personnel staffing necessary to operate and maintain an active landfill relates to the hours of operation, tonnage received, and maintenance and monitoring requirements. Per the SWFP, the operation at CDS will receive up 2,500 tons per day Monday through Saturday, from 7AM to 3PM. For these conditions, the personnel requirements, training, and supervision structure to meet the Operating Criteria of 27 CCR §21600(b)(5)(G-I) are described below.

7.1.1 Minimum Numbers and Qualifications

27 CCR §21600(b)(5)(G)

The minimum staffing level required for the maximum waste throughput for the daily operations, site maintenance, environmental controls, records, and emergency and health and safety are described in **Table 11**. In addition to these personnel, contracted labor to support landfill operations include surveyors, engineers, geologists, maintenance and construction workers, landscape maintenance labor, welders, mechanics, equipment operators, well drillers, and engineering technicians responsible for leachate and LFG system maintenance.

Table 11. Personnel Requirements

Personnel Description	Number
1 Operations Manager (County)	1
2 Senior Civil Engineer (County)	1
3 Disposal Supervisors	2
4 Lead Equipment Operator (may be contracted)	1
5 Equipment Operators (may be contracted)	4
6 General Labor (may include inmate labor)	2
7 Mechanic, heavy equipment (contract)	1
8 Site Engineer (County)	1
9 Geologist/Environmental Compliance (County)	1
10 Landfill Systems Specialist	1
11 Engineering/Field Technicians (County)	4
12 Health and Safety Officer (County)	1
Total	**20**

7.1.2 Training

27 CCR §21600(b)(5)(H)

All personnel assigned to the operation of CDS will receive onsite training specific to their job function. All personnel will receive training specific to job function and site conditions at CDS. In addition to job training all personnel participate in the Health and Safety Program. This program ensures personnel are well versed in health and safety, hazardous materials recognition, heavy equipment operations, environmental controls, waste handling and disposal procedures and emergency procedures. The Health and Safety program will be consolidated into daily operations and continually administered.

7.1.3 Supervision

27 CCR §21600(b)(5)(I)

The CDS is owned by the County. The County is also the legal operator of record, as stated in the SWFP, and will continue to act in the capacity of owner/operator. The County currently contracts for day-to-day landfill operations with Keller Canyon Landfill Company, Inc., a subsidiary of Republic Services, Inc. The supervisory structure includes roles for both the County and Landfill Operations Contractor personnel and is depicted in the organization chart (see ***Figure 31***) showing personnel title and functional role. The County Division Operations Manager is responsible for all site operations and environmental compliance. A team consisting of the County's Operations Manager, Senior Civil Engineer, and two Disposal Supervisors are responsible for implementing site safety programs. The County has an Operations Manager, Site Engineers, an Operation Supervisor, a Geologist, a Landfill Systems Specialist and Engineering Technicians who manage environmental controls, monitoring, and reporting, and site inspections.

Specific personnel assigned to the supervisory roles are as follows (as of November 2011):

- Sonoma County Division Operation Manager: Trish Pisenti
- Sonoma County Senior Engineer: Alex Sebastian
- Sonoma County Operations Supervisors: Tami Danzart and Bob Simi
- Landfill Operations Contractor: Rick Downey, Keller Canyon Landfill Inc./Republic Services. (The operations contract became effective September 2010. The initial contract term is two years. There are two 1-year extension options.)

The Landfill Operations Manager is responsible for placement and compaction of refuse received for disposal at CDS. Two Disposal Supervisors report to the Landfill Operations Supervisor and are responsible for directing the Equipment Operators in the field. A Mechanic performs equipment maintenance and supports contracted mechanics as necessary. Laborers provide ancillary operations support as necessary. A Supervised Adult Crew, consisting of low-risk inmates with a County Probation Department Supervisor, provides a labor for litter pick-up services and erosion control BMP installation to augment the Contract Operator's staff.

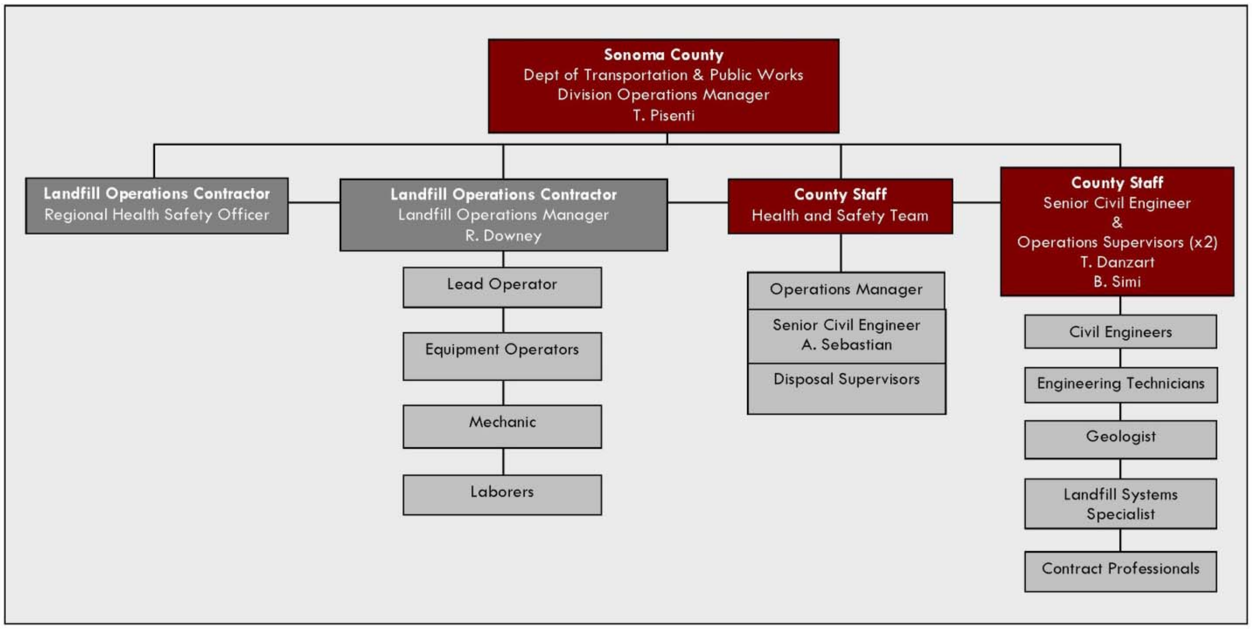

Figure 31. Supervision Organizational Chart (2011)

7.1.4 Safety and Emergency Response

The CDS is owned by the County of Sonoma with oversight by the County's Department of Transportation and Public Works, Integrated Waste Division. The County is also the operator of record. The emergency contacts are shown below (as of July 2012).

Owner /Operator Contact:

County of Sonoma
Department of Transportation and Public Works
Office Phone: (707) 565-2231
Address: 2300 County Center Drive, Suite B-100, Santa Rosa, CA 95403

Deputy Director, Department of Transportation and Public Works
Office Phone: (707) 565-2440
Address: 2300 County Center Drive, Suite B-100, Santa Rosa, CA 95403

Site Engineer, Department of Transportation and Public Works
Office Phone: (707) 565-7949
Address: 500 Mecham Road, Petaluma CA 94952

Regulatory Contacts:

Sonoma County Department of Health Services (LEA)
Office Phone: (707) 565-6560
Address: 475 Aviation Blvd, Suite 220 Santa Rosa, CA 95403

North Coast Regional Water Quality Control Board
Office Phone: (707) 576-2220
Address: 5550 Skylane Blvd, Suite A, Santa Rosa, CA 95403

Fire District Contact:

Rancho Adobe Fire District
Emergency: 911
Business: (707) 795-6011
Address: Station 1
1 East Cotati Avenue, Cotati, CA 94931
(707) 795-5455

Station 2 Headquarters
11000 Main Street, P. O. Box 1029, Penngrove, CA 94951
(707) 795-6011

Alarm Company Contacts:

ADT
Phone: (800) 669-5454
Monitors: Landfill Gas Cogeneration Power Plant

Dean Security/Monitored by Americom Central Stations
Phone: (800) 387-8802
Monitors: All Other Alarms (County Administration Building)

The LEA will be notified if any of the emergency contacts cannot be reached. The emergency contact information is posted at the operations headquarters building, all fee gate buildings, and the equipment operators building, as well as in appropriate emergency response plans, e.g. the County Book of Plans, which includes such documents as the Emergency Response and Evacuation Plan and the Spill Prevention, Containment and Countermeasure Plan (***Appendix R***).

7.2 EQUIPMENT

27 CCR §21600(b)(7)(D)

The equipment necessary to perform the daily operations at a landfill relates to the amount of waste received. The equipment described in this section is the minimum necessary to place and compact 2,500 tons per day, Monday through Saturday. This is the maximum tonnage allowed in the SWFP. For these conditions, the equipment requirements of the Handling Criteria of 27 CCR §21600(b)(7)(D) are described.

The County of Sonoma also owns and is responsible for operation of the adjacent, on-site T/PF which is will be permitted separately from the CDS. Equipment descriptions for the T/PF are documented in the facility operations plan and are not described in this JTD.

7.2.1 Minimum Equipment Requirements

Equipment used at the landfill includes dozers, compactors, scrapers, graders, water trucks, service truck, and pick-up trucks. Track dozers are used to push and spread waste. Steel-wheel compactors are used to compact waste into the landfill. Scrapers are used to excavate, haul and spread soil cover material. Graders are used to maintain soil roadways. Water trucks are used spray water on soil roadways, to minimize dust, and provide fire safety. Service trucks are used by mechanics to maintain heavy equipment. Pick-up trucks are for personnel transportation. The minimum equipment requirements for day-to-day MSW disposal operations at CDS are summarized in ***Table 12***.

Table 12. Minimum Equipment for Waste Disposal Operations

Equipment Description	Quantity
1 Caterpillar Dozer, D-8	1
2 Caterpillar Dozer, D-6 LGP	1
3 Caterpillar Compactor, 826	1
4 Caterpillar Compactor, 836	1
5 Caterpillar Scrapers, 657F	1
6 Caterpillar Grader, 140H	1
7 Water Truck (3,000 gallon)	2
8 Service Truck	1
9 Pickup Truck	1

7.2.2 Standby Equipment

Standby equipment is available onsite and is listed in ***Table 13***. Additional rental equipment is readily available for daily operations or special projects as needed.

Table 13. Standby Equipment

Equipment Description	Quantity
1 Caterpillar Dozer, D-8	1
2 Water Truck, (3,000 gallon)	1
3 Caterpillar Grader, 140H	1

7.2.3 Preventative Maintenance

The landfill heavy equipment is maintained to assure safety, maximize equipment life, and to assure availability during operation hours. A maintenance building is located at the south end of LF-2. Equipment operators perform established daily inspections throughout their work shift.

All equipment receives regular maintenance including lubrication, oil filter changes, and safety inspection by mechanic or mechanics assistant. Repairs to equipment beyond normal maintenance are performed by contract vendors or the equipment manufacturer.

7.3 MATERIALS HANDLING

Procedures to handle the bulk materials are described in this section. Materials received at CDS include soil, alternative daily cover, refuse, and special waste. Handling of materials at CDS is conducted to minimize vectors, and the creation of nuisances associated solid waste disposal. The purpose of these procedures are to protect public health and safety and to meet the Handling Criteria of 27 CCR §21600(b)(7)(B and E) and the Operating Criteria of 27 CCR §21600(b)(5)(J).

7.3.1 Excavation/Soil Stockpiling

On-site soil material excavated during construction of LF-2, Phases I and II is currently stockpiled in the southwestern area of the site (refer to ***Figure 3***). This material is available for use as intermediate or daily cover. Stockpiles are managed so as not to interfere with disposal operations. The stockpile areas are graded to convey run-off into drainage control system. For additional information regarding excavation and stockpiling plans, please refer to **Section 5.3**.

7.3.2 Refuse Unloading Procedures

27 CCR §21600(b)(7)(E)

All MSW deliveries to the CDS, including refuse packer trucks, self-haul vehicles and commercial vehicles are first directed to the separately-permitted, on-site T/PF. Waste received at the T/PF is pushed into 20 ton capacity, top-loading transfer trailers and then hauled to the active landfill area at CDS. There is no public unloading at the active landfill face. Signs are posted along the access road to direct waste delivery vehicles to the T/PF unloading area. Note: Facility operations at the T/PF are permitted separately and are described in detail in the Transfer/Processing Report for the Sonoma County Transfer and Processing Facility, June 2011.

MSW transfer trailers originating from the T/PF are unloaded near the working face at the landfill. The size of the unloading area is determined by the amount of waste received. The operation at CDS is designed to handle up to 2,500 tpd. For this amount of waste, the dimensions of the unloading area are approximately 50 by 200-feet. Operations personnel are present during unloading to identify any hazardous materials not acceptable for disposal at CDS or previously identified and removed at the T/PF (a separate hazardous material load check program is also in effect at the T/PF). Once unloaded, a dozer pushes the waste to the working face for successive spreading and compacting.

7.3.3 Spreading and Compacting

27 CCR §21600(b)(5)(J))

Waste is pushed by a dozer to the working face. The size of the working face is determined by the amount of waste received. The operation at CDS is designed to handle up to 2,500 tons per day, the current SWFP daily limit. For this amount of waste, the dimensions of the working face are up to 200 by 150-feet or if dual working faces are operated, with dimensions approximately 50 by 100 feet. The actual size of the working face will be determined by the Operations Manager based on actual waste throughput. Waste is spread in two-foot lifts where the steel wheeled compactor makes three to five passes. This process consolidates and compacts the refuse as engineered fill. The tipping deck area is graded to prevent ponding and to divert surface drainage water away from the active working face of the landfill. The daily operations are planned according to the fill sequence plans as described in the landfill design section (see **Section 5.3.2**)

7.3.4 Inclement Weather Operations

Inclement weather procedures are necessary to assure site safety and to ensure that disposal operations, an essential public service, are not disrupted. During wet weather, access to the working area can be limited. Construction of a wet-weather deck allows operations to continue safely. Once transfer trucks leave the asphalt roadway, soil roadways and the tipping deck are armored with a 12 to 18-inch lift of compacted aggregate material sloped to maintain minimum 2 percent drainage. The County Site Engineer and Landfill Operations Supervisor will prepare a wet-weather plan based on current fill conditions. Storm runoff is to be diverted away from the active fill. Soil cover material can be stockpiled adjacent to fill operation to avoid haul on soil roadways.

7.3.5 Special Waste Handling Procedures

27 CCR §21600(b)(7)(E), and §21740(a)(1)

The CDS accepts wastes for disposal only, not for treatment or storage. MSW disposal is accomplished by traditional sanitary landfilling methods, and in accordance with current regulations and industry standards. Wastes disposed at CDS Landfill that require special handling include oversized materials, damaged goods, or materials requiring immediate disposal in the presence of an official. For these materials a cavity is excavated in waste to allow immediate coverage.

While the T/PF operation provides waste screening, specific procedures are established should special wastes become encountered at the CDS work face. Operations personnel are trained based on County established procedures for the following specific wastes:

- Contaminated soil
- Special Waste
- Infectious wastes
- Asbestos
- Drained oil filters
- Small animals
- Soils from residential areas
- Dewatered sludge
- Waste suspected of being a hazard.

A household hazardous waste (HHW) exclusion program (load checking program) is in effect at the site. A summary of the program is provided in **Section 8.12** of this JTD.

7.3.6 Daily Cover / Alternate Daily Covers (ADC)

27 CCR §20705 and §21600(b)(6)(B-C)

The purpose of daily cover is to isolate refuse materials from the environment. Daily cover prevents windblown trash, minimizes the escape of odor, prevents excess infiltration of surface, minimizes vectors, prevents water run-off, and prevents fires from occurring in the landfill. Daily cover requirements are described in 27 CCR §28680(a) and §20650. Waste is covered with a minimum of six inches of compacted earthen material or approved alternate daily cover (ADC) at the end of each operating day or more frequently to assure sound disposal practices. The covered surfaces are graded to prevent ponding. Daily cover material is available from on-site stockpile or borrow areas (see **Section 5.4**). Prior to receipt of waste each day, the daily soil cover is recovered and stockpiled near the working area. Removal is limited to clean soil only; waste is not be exposed or removed during this procedure. Recovery of daily cover enhances the long-term performance of the landfill gas and leachate collection systems.

CDS has received approval of the use of ADC. Acceptable ADC materials are tarps, ELC Synthetic Cover (ELC), Shredded Green Waste (SGW), and a spray-on material called Posi-Shell. Demonstrations of the equivalency of these materials have been provided to oversight agencies and are documented in the 2005 JTD (GeoSyntec, 2005).

Currently, tarps are used for daily cover. Tarps are deployed on a daily basis by use of a Tarpomatic, a proprietary automated tarping machine. The County has received LEA approval to utilize tarps as ADC on Saturdays instead of complete soil cover as previously required for Saturdays. The landfill operator and the County propose to continue to use tarps as allowed by permit.

7.3.7 Intermediate Cover

27 CCR §20695, §20070, §20705 and §21600(b)(6)(D)

Intermediate cover requirements and standards are described in 27 CCR §20695, §20700 and §20705. Intermediate cover is a 12-inch layer of compacted soil placed where no additional waste will be deposited within 180 days.

Intermediate covers are planned to be placed according to the fill sequence plans as described in the landfill design section (see **Sections 5.3.2** and **5.12**). Intermediate covers are constructed and maintained in areas that have achieved final grades. Intermediate covers remain until a final cover system is constructed.

Intermediate cover materials have been placed over LF-1. A field investigation to evaluate the characteristics of the intermediate cover at LF-1 was undertaken in 2008. Reportedly, cover thickness varies from 2 to 18 feet across LF-1, and these materials have suitable properties as foundation material for final cover systems (GeoSyntec, 2008).

7.3.8 Cover Soil Availability

27 CCR §21600(b)(6)(A)

Approximately 590,000 cubic yards of soil material suitable for use as daily and intermediate cover is stockpiled in the southeast area of the site (refer to ***Figure 3***). These soils were excavated during construction of LF-2, Phases I and II. Additional materials will be added as cell excavations for LF-2 proceed. A soil balance has been performed and is described in **Section 5.4**. This soil balance shows a net deficit of approximately 646,300 bank cubic yards of general fill material if operations relied solely on use of materials excavated within the permitted landfill footprint area. This additional volume will be needed for cell construction, operation and closure. The County reports that sufficient volumes of general fill soils are available on the CDS property at the adjacent West Canyon area. To minimize excavation from the West Canyon, ADC will continue to be used as daily cover to help preserve onsite soils. Other sources of soil will be investigated if deemed necessary.

7.3.9 Salvaging

27 CCR §21600(b)(7)(B)

The term salvaging as used at the CDS refers to controlled removal of materials from the waste stream for utilization. Salvaging activities are described below. Other terms are also used herein such as recycling or recovery for planned programs to reduce volumes requiring landfill disposal.

Waste is received at the T/PF prior to landfill disposal at CDS. The T/PF is permitted separately from the landfill operations of CDS and is not described in detail in this JTD document. As an incentive for recycling and re-use, the pay booth is located after the public passes through the recycle/re-use area at the T/PF. Although recycling is mandatory, some recoverable materials arrive at the T/PF. Waste is screened for recoverable and recyclable material at the T/PF.

Limited hand separation and diversion of recyclable materials is permitted at the CDS landfill work face. This practice is conducted by CDS personnel. All “last chance” recycling activity is conducted to not interfere with disposal operations. Personnel conducting these operations are required to wear appropriate safety equipment. Materials capable of impairing public health shall not be recovered. Examples of non-salvageable material include drugs, cosmetics, foods, beverages, hazardous chemicals, poisons, medical wastes, syringes, needles, pesticides or as described by 27 CCR §20720.

An area for storing recovered material is located away from the active working face of the landfill operation. The storage of materials will minimize the risk of fire, health and safety hazard, vector harborage, or other hazard or nuisance. Storage time is limited to duration as specified by the LEA. Landfill personnel monitor the storage bins and arrange for their removal.

The term “scavenging” means the uncontrolled and/or unauthorized removal of solid waste material, or recyclable materials by the general public and employees. This is prohibited at the CDS landfill and other on-site facilities.

7.3.9.1 Tires

27 CCR §173500- 17356

The removal of tires from the MSW waste stream is managed at the T/PF. Should tires become encountered in the active waste area, they are removed and placed in debris boxes. Full boxes are removed by a contractor. They are then transferred to a temporary holding facility in Petaluma, California. From there, the tires are shipped to Waste Tire Products in Orland, Glenn County, California. At this facility tires are recycled for use as erosion control. Waste tire storage meets the requirements of Title 14 CCR Division 7 Chapter 3 Article 5.5.

7.3.9.2 Scrap Metal and Reusable Materials

The recovery of scrap metal is managed at the T/PF. Should significant amounts of recyclable scrap metal become encountered at the landfill work face, the landfill operator will coordinate with the County's onsite scrap metal operation to remove these materials for recycling.

7.3.10 Volume Reduction Activities

27 CCR §21600(b)(7)(C)

There are no formal volume reduction activities at the active face of the CDS landfill other than standard refuse placement and compaction practices. Recycling and waste volume activities are undertaken at the adjacent T/PF, Recycle/Re-Use and Compost Operations facilities under separate permits, as described in Section 2.7 of this JTD. The requirements under 27 CCR §21600(b)(7)(C) do not apply to the CDS.

7.4 HEALTH AND SAFETY

Health and safety procedures are instrumental for the landfill disposal operations at CDS. All personnel will commence a Health and Safety Program specific to the site conditions at CDS. The Health and Safety program will be consolidated into daily operations and continually administered. The following subsections contain only the health and safety as required for this document of the Operating Criteria of CCR §21600(b)(5)(C- F).

7.4.1 Sanitary Facilities

27 CCR §21600(b)(5)(C)

A restroom with showers is located at the County's Administration Building. Restroom facilities are also provided at the portable office facility maintained by the operator at the landfill.

7.4.2 Water Supply

Potable water is supplied by bottled drinking water and is available to site personnel. Information on fire suppression infrastructure is provided in **Section 8.4** of this JTD.

7.4.3 Communications

27 CCR §21600(b)(5)(D)

All key operations staff are equipped with portable radios or hand held radios in their vehicles and/or cell phones.

7.4.4 Lighting

27 CCR §21600(b)(5)(E)

In general, landfill operations occur during daylight hours. Portable lighting is available on-site for emergencies or times when necessary.

7.4.5 Safety Equipment

27 CCR §21600(b)(5)(F)

Landfill safety equipment includes fire extinguishers, showers, and eyewash/showers. All landfill operations vehicles and other mobile equipment is equipped with a fire extinguisher. Two showers are available for use onsite at the County's on-site Administration Building.

7.5 RECORD KEEPING

27 CCR §21600(b)(5)(A)

The CDS maintains disposal site records pursuant to federal and state regulations under Title 40 CFR, Part 258 (Subtitle D), CCR §20510 and 20515. Landfill activities related to these requirements are documented and included in the operating record. Approvals, determinations and other requirements authorized by the LEA under are placed in the operating record in accordance with CCR§ 20517, and are maintained at the on-site Administration Building.

7.5.1 Weight Records

All transfer vehicles delivering wastes to the CDS are weighed at the T/PF scalehouse. A computer system is used to record transactions of all waste received. This information is tracked through the County's Refuse Disposal Information Management System. A report of daily tonnage is prepared monthly and kept at the CDS. The filling rate of the site is verified through aerial topographical surveys prepared bi-annually.

7.5.2 Subsurface Conditions

Data and records concerning subsurface conditions are found in the boring logs, geologic and hydrogeologic maps, and various studies. Groundwater information is gathered, as required, under the current monitoring program and is reported to the RWQCB (refer to **Section 6.1.2**).

7.5.3 Special Occurrences

The operator maintains a log of special daily occurrences, which is available at County's on-site Administration Building and is available for review upon request. Occurrences of special interest include landfill fires, landslides, unusual and sudden settlement, earthquakes and resulting damage, property damage, accidents, explosions and discharges of hazardous or other nonpermitted wastes. Designated personnel are responsible for maintaining the log. If any other employee on the site observes a special occurrence, they are required to report it to the operations manager.

7.5.4 Personnel Training Records

Records of personnel training are kept at County's Administration Building.

7.5.5 Notification Records

The operating records are and will continue to be maintained at the County's Administration Building. These records are available during normal business hours for inspection.

7.5.6 Other Records

27 CCR §20510 and 20510

Records pertaining to 27 CCR §20515 and 20510 are kept onsite at the County's Administration Building. These records include inspection records, environmental monitoring, gas monitoring results and any remediation plans, financial assurance documentation, closure and postclosure plans.

8.0 DISPOSAL SITE CONTROLS

This section describes the Controls Criteria of 27CCR §21600(b)(8)(A-J) and the Public Health Design of 27CCR §21600(b)(7)(A) for the CDS. These controls include measures for public nuisances, fire, leachate, dust, vectors, drainage and erosion, litter, noise, traffic and hazardous waste. Environmental controls for leachate and landfill gas management of the Design Criteria of 27CCR §21600(b)(4)(A)(E) are summarized in this section and further described in **Sections 5.2** and **5.9** of this JTD.

8.1 LEACHATE MANAGEMENT PLAN

27 CCR §21600(b)(8)(C)

This section provides an overview of the subsurface barrier extraction system or LCRS at CDS. The LCRS is described in detail in **Sections 5.2** and **5.9** of this JTD. Environmental monitoring programs for leachate are described in **Section 6.1**. .

8.1.1 Existing Leachate Management Plan

Leachate is managed in accordance with the WDRs, Order No. R1-2004-0040, issued by the RWQCB on July 22, 2004.

There are two waste management unit landfill areas at CDS: LF-1 and LF-2. While LF-1 was partially constructed with a clay liner, it is considered an unlined, pre-regulations landfill. The LCRS system for LF-1 consists of vertical extraction wells, bottom drainage systems, perimeter french drains, collector mains, sump and pump system (refer to JTD **Section 5.2.1** for details). Bottom drains include perforated pipe and drain rock placed on clay lined canyon floor. Three cutoff barriers were constructed for the vertical expansions during development of the canyon fill. Leachate collected in bottom drains is conveyed to collector pipes where leachate is discharged to a sump. Schematic diagrams of containment systems installed as LF-1 was developed are provided in ***Appendix G***. The collected leachate is pumped to the lined surface impoundments (Leachate Pond Nos. 1 and 2, see ***Figure 3***) and then conveyed via a force-main pipeline for discharge to the City of Santa Rosa Waste Water Treatment Plant (Subregional Water Reclamation System). The LCRS at LF-1 also includes a network of 92 pneumatically operated vertical wells that extract leachate to control mounding resulting from the inflow groundwater. Leachate extraction well locations are shown in ***Figure 30***.

LF-2 was constructed in 2002 and has an engineered alternative liner design that provides engineered alternate HDPE and GCL barrier layers. The LCRS consists of a one-foot gravel layer placed over the lined floor area and a geocomposite drain net on the side slopes. Leachate is discharged to a sump where it is then pumped to the surface impoundment and then conveyed via a force-main pipeline for discharge at the City of Santa Rosa Waste Water Treatment Plant.

In addition the LCRS includes a ground-water barrier system along the southern portion of the property. This system, which was constructed in 1988 and consists of a compacted clay barrier keyed into bedrock. The barrier extends across the entire length of the central canyon drainage channel.

Leachate Pond No.1 was originally constructed 1988 with a soil based liner system and was reconstructed with a geosynthetic liner system in 2001. Leachate Pond 1 has 1.8 million gallons capacity. Leachate Pond No.2, which was constructed in 1995, has a geosynthetic based liner system with 2.9 million gallon capacity.

The County maintains records of leachate removal from the various systems described above. Data for the period 2000 through 2010 is summarized below in ***Table 14*** (all values in gallons/day):

Table 14. Historic Leachate Removal Summary

	LF-1 Leachate Extraction Wells	LF-1 French Drains, Sumps	LF-2 LCRS	Total
Fiscal Year:*	2000/01 – 2009/10	2000/01 – 2009/10	2002/03 – 2009/10	N/A
Avg. gal/day:	20,940	28,640	5,430	55,010

* Fiscal year = July 1 – June 30.

8.1.2 Proposed LCRS Management

The LCRS for expansion areas will consist of a combination of a gravel layer the floor areas and a geonet drain layer on the side slopes. The new cells will be graded to convey leachate to low points (sumps) at the south end of the respective cell floors. Liquids from the preferential pathway systems in LF-1 will also be conveyed to new LCRS systems in LF-2, Phases III and IV, and the REA. A separate LCRS sump will be provided for the preferential pathway in the compost deck area. Leachate from these collection points will be pumped from the sumps to the existing surface impoundment ponds for temporary storage. A submersible pump will be used to remove leachate. Leachate collected from the new cell areas will continue to be conveyed from the ponds via force main for discharge at the City of Santa Rosa Waste Water Treatment Plant. City of Santa Rosa Industrial Waste Discharge Permit No. SR-IW5202 cites an average daily disposal flow of 74,000 gallons per day; this volume includes leachate from the CDS and gray water from the adjacent transfer station operations. There are no liquids effluent flow limitations in the City industrial waste discharge permit.

8.1.3 Landfill Gas Condensate Collection

LFG produces condensate within the header pipes of the LFG collection system. Condensate is generated primarily due to the difference between the landfill temperature and ambient temperatures. Condensate is conveyed by gravity through LFG header and lateral piping to condensate traps - low points in the system. At the low points, the condensate is drained into the LCRS, or gravity-drains to the lined surface impoundments (leachate ponds). Condensate is mixed with leachate and is pumped via force main pipeline for discharge to the City of Santa Rosa Waste Water Treatment Plant.

The existing LFG system will be incrementally expanded as fill operations proceed (refer to **Section 5.13** of this JTD). Existing condensate management practices will be continued as the LFG system is expanded with fill operations.

8.2 LANDFILL GAS CONTROL

This section provides an overview of the LFG Control System at CDS. The LFG Control System is described in complete detail in **Section 5.13** of this JTD.

At the CDS, LFG vertical wells and horizontal collector trenches have been installed at both LF-1 and LF-2. These wells and collectors are attached to main header lines and constitute the LFG collection and conveyance system. The collected gas is conveyed to the power generation facility (LFGTE plant) or an enclosed ground flare. The LFGTE plant is sized for an LFG flow of 2,800 scfm and the flare is sized for an LFG flow of 1,500 scfm, for a combined flow of 4,300 scfm. At this time, LF-1 contains 129 vertical wells and 6 horizontal collectors. LF-2 contains 7 vertical wells and 14 horizontal collectors. The current LFG collection rate (2011) is about 2,100 scfm from both LF-1 and LF-2.

The LFG system will be expanded with horizontal collectors for the proposed landfill expansion at CDS. As waste is placed additional vertical wells and horizontal collectors will be installed to control subsurface LFG migration, surface emissions, odors and GHG emissions in accordance with applicable regulatory requirements and permit conditions. In the future, the existing LFG extraction wells at LF-1 and LF-2 will require replacement as refuse filling proceeds in these areas. Details on applicable LFG control regulations/permit conditions and proposed LFG system improvements and operating criteria are provided in **Section 5.13** of this JTD.

8.3 DRAINAGE AND EROSION CONTROL

27 CCR §21600(b)(8)(F) and §20190(c)(4)

This section describes the design criteria and objectives of the drainage and erosion control system at CDS. The existing and proposed permanent stormwater diversion and control facilities at CDS have been designed to accommodate the calculated a 100-year, 24-hour design storm as required by 27 CCR *§*20365. The peak runoff flows are calculated using the rational method based on rainfall intensity, surface conditions, and basin areas. The hydrology analysis for the CDS is located in ***Appendix M***. Stormwater is managed so that ponding of water will not occur on the surface of the landfill. The existing stormwater diversion and control facilities are shown in the Storm Water Pollution Prevention Plan (SWPPP, Sonoma County). The SWPPP contains a Drainage and Erosion Control Plan and is updated annually by the County.

The County has established Site Best Management Practices (BMP’s) for drainage and erosion control in the existing SWPPP. These practices contribute to the control of drainage and erosion and are adapted by the landfill operations. Stormwater runoff for the active operations area is controlled by maintaining a minimum two percent slope on all operation decks and access roads. Maintaining gravity drainage ensures all stormwater runoff is conveyed away from the waste and to stormwater conveyance system. Temporary measures during periods of continued rain include berms and the use of sand bags and other control devices to divert stormwater from the working area by use of berms. As the landfill expands, the collection and conveyance facilities will be expanded.

Regular inspections of the site are conducted throughout the year. Maintenance activities include removing accumulated silt from the sedimentation ponds; cleaning ditches and drainage inlets on the site; stabilization of new ditches as necessary with either grass, erosion control netting or rock; installing litter fences around drainage inlets to protect against stoppage; erosion gullies formed during storm events are promptly filled and re-compacted; seed and straw are placed on all bare slopes prior to the rainy season; construction of straw bale dikes; and other measures as necessary to prevent erosion.

8.4 FIRE CONTROL

27 CCR §21600(b)(8)(B)

The landfill and the onsite facilities are constructed in compliance with local fire prevention regulations, promulgated by the Rancho Adobe Fire District. The operation is conducted to minimize and eliminate any fire hazards resulting from the placement of refuse. In the event of a fire, local fire departments are immediately alerted and site water vehicles are dispatched to the fire area to begin fire control. The County has established fire control procedures for the CDS which are documented in the Fire Prevention Plan. (see ***Appendix R*** for an example of the Fire Prevention Plan). The operator adapts these procedures for fire control. The fire control features and practices for CDS are summarized below:

- Reservoir facilities are located on site consisting of two 100,000 gallon steel storage tanks with four wharf hydrants and eleven standard hydrants located throughout the site. All process water for on-site compost operations (separately permitted), water for landfill dust control and minimum reserve for fire protection can be provided with 200,000 gallons of storage.

- Two 3,000-gallon water trucks with pumping capability are available to help combat fires. In addition, the landfill operations contractor possesses a third 3,000 gallon water truck.

- Maintain active area clear of combustible materials.

- Compact and cover waste in active area.

8.5 DUST CONTROL

27 CCR §21600(b)(8)(D) and §21090(a)(5)

Haul roads are sprayed with water to minimize dust during operational hours, particularly during dry or windy weather. Permanent roads are paved to reduce dust production and swept on a regular basis. A Dust Control Plan (see ***Appendix R***) describes the County's BMPs to reduce dust generation due to industrial activities at the site.

27 CCR §21090(a)(5) provides conditions for application of leachate and LFG condensate to landfill covers for dust control. The County does not currently use leachate or gas condensate for dust control purposes, and does not plan to do so in the future. The County does not apply these liquids to the existing or new MSW units.

8.6 NUISANCE CONTROL

27 CCR §21600(b)(8)(A)

The County and its operator implement various programs to protect surrounding neighbors from potential nuisances. When a complaint is received, designated personnel are promptly dispatched to investigate. The landfill operator works in collaboration with the County in determining the appropriate response.

8.7 VECTOR AND BIRD CONTROL

27 CCR §21600(b)(8)(E)

Vector (insects and rodents) and bird control is achieved through integrated controls at CDS. The landfill operator works collaboratively with the County to prevent vectors and the presence of birds. Measures to minimize the impact of vectors include limiting the working face area, implementation of bird control measures, compaction of refuse, application of daily and intermediate cover (or ADC as appropriate), maintenance of the cover systems, and implementation of drainage BMPs to minimize ponding water.

Bird control measures may include installation of gull wires over the active areas of waste placement and use of bird scare devices. The scare devices may include a combination of bird bombs, bird whistlers, blank 2 caps, scare eye balloons, laser-based repellent devices. The use of loud noise devices was found to be effective (Sonoma County, 2011).

8.8 LITTER CONTROL

27 CCR §21600(b)(8)(G)

Litter control is achieved through combined efforts of the landfill operator and the County. Measures include limiting the working face area, continual compaction of wastes, use of daily and intermediate cover, litter fences, and clean-up crews. Litter is promptly collected and disposed of at the landfill active face. Litter control is a continual part of normal CDS operations. Litter along the litter fences is collected once a day. A vacuum is used for litter pickup on paved roadway surfaces on a regular basis. Approach roads to the site are patrolled by a litter clean-up crew frequently, and the crew is dispatched to specific locations when complaints are received.

This program will be continued as MSW is placed at the CDS as described herein. Litter fences will be constructed at the periphery of the landfill areas to catch litter blowing from the landfill. The County performs litter pick up along Mecham Road and Stony Point Road from West Railroad Avenue to Highway 116 so that these roadsides will be cleaned as necessary when the landfill is open. The County also posts signs on Mecham Road with a phone number to allow citizens to report littering incidents. The California Highway Patrol (CHP) is under contract with the County to add extra patrols to the area and enforce litter and covered load laws.

8.9 NOISE CONTROL

27 CCR §21600(b)(8)(H)

The control of noise from the landfill operation is a function of several factors. The primary noise control measure is the distance between noise source and receiver location. The level of noise is diminished by distance. Diffraction, the bending of sound waves reduces noise levels. Noise control by diffraction is achieved by placing physical barriers between noise source and receiver. Whenever a direct line of sight is broken between the source and receiver, the energy of the sound waves is reduced. Sound waves diffract around the barrier, resulting in decreased noise levels. Thus the primary noise control mechanisms at the CDS are the topography and distance to neighbors. The nearest neighbors to CDS are 500-feet from the southwest boundary and 800-feet from the southern boundary. Noise levels of on-site earthmoving and compaction equipment are controlled by installation and proper maintenance of mufflers.

Noise has not historically been a problem at the CDS site. The County conducts periodic noise measurements to ensure compliance with their general plan standards.

Site operations are conducted in compliance with Cal-OSHA regulations for noise levels. Site personnel are provided with ear plugs or muffs to reduce impacts from continued exposure to on-site noise levels.

8.10 ODOR CONTROL

Odors from the landfill operation can result from the release of LFG into the atmosphere or from exposed refuse prior to the placement of daily cover. The operation at CDS uses a number of measures to control odors. The LFG recovery system provides for control of landfill surface emissions that may be generated by the decomposition of refuse. The captured LFG is combusted in engines at the LFGTE plant or at the back-up flare.

Daily application of cover material or ADC is practiced (see **Section 7.3** of this JTD for further details). More frequent application will occur as necessary to control odors. The soil used in the landfill covers removes the odorous organic compounds through biological and chemical processes, a separate odor reducing mechanism from the LFG collection system. As cracks occur in the cover soil from desiccation or differential settlement, soil is replaced and re-compacted.

8.11 TRAFFIC CONTROL

27 CCR §21600(b)(8)(I)

Traffic control was a design factor in the development of the landfill and facilities at CDS. This is evident by the wide, well-maintained entrance road which provides effective ingress and egress of vehicles. The County has an established Traffic Control Plan which is adapted by the landfill operator. The existing customer access and traffic circulation system at the CDS is summarized in **Section 2.6** of this JTD. CDS is located on the west side of Mecham Road about one and a quarter miles southwest of the Mecham Road/Stony Point Road intersection. Local area roadways include Mecham Road, Stony Point Road, Pepper Road and West Railroad Avenue.

There is no direct public tipping at the active face of the CDS landfill; all waste is received and processed through the County owned T/PF. All vehicles with MSW for disposal are directed through the T/PF facility or the Household Toxics Facility / Recycle Center via the main access road. Vehicles entering CDS include pick-up trucks, automobiles, packer trucks, soil trucks, and roll-off bins. Public self-haul vehicles and commercial collection vehicles are directed to unloading bays where MSW loads are tipped onto a concrete tip floor. Waste is processed and then reloaded into trailers which are located in a below-grade loading bays. From there, refuse is transferred to the active face of the CDS landfill, or out-hauled to other alternate permitted disposal sites located outside of Sonoma County.

Signs and site personnel direct traffic to specific unloading locations at the T/PF. Internal traffic flow is established as described in **Section 2.6** of this JTD.

8.12 LOAD CHECKING PROGRAM

27 CCR §20220 (b)(2) and §21600(b)(8)(J)

All incoming MSW received loads are inspected for hazardous waste at CDS. The hazardous waste screening program is conducted at the T/PF. Hazardous wastes are identified and removed at the TF/FS. The County of Sonoma owns and is responsible for the contracted operation of T/PF. Note: Facility operations at the T/PF are permitted separately and not described in detail in this document.

The County conducts a Load Checking Program per 14 CCR §17409.5 (refer to ***Appendix R***). Hazardous properties include flammable, corrosive, relative, toxic and infectious. Agricultural, common industrial and household products that contain these hazardous properties are not permitted at the CDS. Household hazardous waste is only accepted at the Household Toxics Facility.

While the T/PF provides waste screening, landfill operations personnel are trained to identify hazardous waste. Personnel are trained on the County's established procedures for handling hazardous waste. Should hazardous waste become encountered at the CDS working face, landfill operations personnel will follow the County's established procedures and chain of command, to ensure that any encountered materials are properly removed from the active waste area, handled, stored and arrangements for proper disposal are made. All accumulated hazardous materials are stored at the Household Toxics Facility lockers and removed from the site every 90 days.

Collectively, these HHW exclusion programs ensure, to the extent practical and as required by 27 CCR §20220(b)(2) that MSW landfill units at the CDS receive only those water materials that are approved for discharge.

9.0 PRELIMINARY CLOSURE AND POST-CLOSURE MAINTENANCE PLANS

9.1 PRELIMINARY CLOSURE PLAN

This text section presents a Preliminary Closure Plan (PCP) for the Central Disposal Site, encompassing both the LF-1 and LF-2 areas at final design grades. These combined areas total approximately 172.8 acres plan area. This PCP is based on currently-proposed site development and operation plans for the CDS as described in **Section 5** of this JTD, as well as design concepts previously approved by the RWQCB and other agencies for an earlier final closure plan that assumed no further waste deliveries to the CDS (2008 Final Closure and Postclosure Maintenance Plan (FCPMP) [GeoSyntec, 2008]).

9.1.1 Regulatory and Permit Requirements

27 CCR §20950, §21090, §21769, §21790, and §21800

Preliminary closure plans are to be prepared in accordance with 27 CCR requirements and submitted to the LEA, RWQCB, and CalRecycle. This Preliminary Closure Plan contains all required items pursuant to 27 CCR §21790(b)(1) through (b)(8).

All provisions of this plan are designed toward achievement of the closure performance standards as required by 27 CCR, Division 2, Chapter 3, Subchapter 5, Article 2 and Title 40, §258 (Subtitle D) of the Code of Federal Regulations. Implementation of the improvements described in this PCP will ensure that the CDS is closed in such a manner as to protect the public health, safety and the environment and ensure that adequate resources are available to properly accomplish the preliminary final closure.

In accordance with 27 CCR §21769(b) the purpose of this preliminary closure plan is to provide a reasonable estimate of the maximum expected cost that would be incurred at any time during the unit's projected life for a third part to closure the unit. SWRCB goals and performance standards for final closure are embodied in 27 CCR §20950; they are to minimize the infiltration of water into the waste, and minimize production of leachate and LFG.

9.1.2 Preliminary Closure Description

27 CCR §21790(b)(8)

Final closure plans describe closure activities including an implementation schedule. The following subsection describes proposed final closure activities for the LF-1 and LF-2 areas.

9.1.2.1 Preliminary Final Closure Areas (LF-1 and LF-2)

The areas designated for closure are approximately 172.8 acres (***Figure 18***), encompassing both LF-1 and LF-2. These two areas are currently physically-separate waste management units. Phase I closure will be 14.4 acres of LF-1. Proposed site development will entail installation of new engineered base liners in previously unfilled floor areas of the REA and LF-2 (Phases III/IV), refuse filling in those newly-lined areas and then filling over the 158.4 acre footprint occupied by these two units, LF-1 and LF-2, Phases I/II. A preferential pathway system will be deployed in areas where new refuse will be placed over the existing landfill areas of LF-1. Fill sequencing plans for development of LF-1 and LF-2 are provided in **Section 5** of this JTD. At closure, the various MSW units will be contiguous. This is important with respect to the final cover configurations proposed for these two areas. Regulatory and industry practice is for the cover system of a unit to mirror, or complement, the base liner system.

While LF-1 was constructed with a clay liner, it is considered an unlined, pre-regulations landfill. LF-1 was construction in phases: an upper unlined canyon fill and a lower vertical expansion area, constructed with a clay-lined dendritic LCRS. Elevations of LF-1 will range from 260 to 565 feet above MSL at the completion of fill activities. Phases I through IV of LF-2 were designed in accordance with the criteria and standards set forth in 40 CFR, Section 258 (federal Subtitle D regulations), 27 CCR Division 2, and RWQB Order No. 93-83 (September 1993). The base liner containment systems for LF-2 are configured for excavated floor and side-slope areas, and generally consist of a capillary break/underdrain, composite liner systems, and LCRS. Elevations of LF-2 will range from 260 to 525 feet above MSL at the completion of fill activities. The entire limits of waste, LF-1 and LF-2, have been designated for preliminary final closure as part of this JTD.

9.1.2.2 Location Maps

27 CCR §21790(b)(2) and (4)

In accordance with 27 CCR §21790 (2) and (4), the following site plans and maps are provided in this JTD:

- ***Figure 1*** is a site location map.
- ***Figure 3*** provides a site plan with property boundaries, existing limits of waste placement and permitted disposal area boundaries, and entry roads.
- ***Figure 3A*** provides a site plan with the same information as above, plus locations of the various waste management units as designated by the RWQCB.
- ***Figure 18*** shows a final grading plan with proposed final limits of waste placement.
- ***Figure 12*** provides a site plan with land uses within 1,000 feet of the disposal facility boundary.
- ***Figure 30*** shows existing leachate control system layout.
- ***Figure 27*** shows existing LFG control and monitoring systems layout.

9.1.2.3 Final Cover and Grading

27 CCR §21790(b)(8)(B), §21140, and §21142

This section describes the proposed final grading contours for proposed closure of the CDS. In accordance with 27 CCR §21090(b) and §21142, the final grading will be designed, graded, and maintained to reduce impacts to health and safety to control vectors, fire, odor, litter and LFG migration, prevent ponding, and accommodate anticipated future settlement. Construction will promote lateral run-off of surface water which will minimize the effects of settlement. Access roads will be used to maintain the final cover area and environmental control systems throughout the postclosure maintenance period.

The final grading plan is shown in ***Figure 18***. Final cover system details are provided in ***Figure 24***. The basic design criteria for the final grading configuration shall be in accordance with prudent landfill engineering practices and 27 CCR requirements and includes:

- Perimeter slopes at 3:1 (H:V) or less.
- Minimum 3 percent slope across the top deck areas.
- A minimum slope of 3 percent for drainage channels.
- Installation of 15-ft wide benches at spacing of 50 feet vertical height or less.
- V-ditches/trapezoidal ditches and downdrains installed in benches to reduce run-off velocities and protect the final cover from soil erosion. The drainage ditches will have an overall gradient typically up to three percent in order to convey storm water to the bench down drain inlets and/or perimeter drainage channels.

9.1.2.4 Proposed Final Cover Design

27 CCR §21090 and §21790(b)(8)(B)

Several factors were taken into consideration in determining the cover design for closure at CDS, including the geometry of the existing landfill, proposed fill sequencing plans and tie-ins to existing grades, climatic conditions, potential landfill settlement, available cover materials, erosion protection, vegetative growth, and end use at closure. It was determined that an alternative final cover that surpasses the minimum state and federal requirements (prescriptive standards) would be the most appropriate design for CDS. The proposed cover described below was approved by the RWQCB with recommended modifications (RWQCB, 2010) for a previously-prepared final closure plan (GeoSyntec, 2008). These modifications have been incorporated into the current design.

Slightly different cover systems are proposed for areas that will overlie the LF-1/REA and LF-2 footprints, as per RWQCB requirements. The final cover system profile for the LF-1/REA area will consist of (from bottom to top):

- A minimum 2-ft thick soil foundation layer;
- 60-mil HDPE barrier;

- Geocomposite drainage net; and
- An 18-inch thick soil vegetative layer (erosion resistant layer).

The final cover system profile for the LF-2 area will consist of (from bottom to top):

- A minimum 2-ft thick soil foundation layer;
- Geosynthetic Clay Liner;
- 60-mil HDPE barrier;
- Geocomposite drainage net; and
- An 18-inch thick soil vegetative layer (erosion resistant layer).

The 60-mil thick HDPE geomembrane barrier will eliminate the potential for significant infiltration of moisture into the landfill, and will control and contain LFG. A 60-mil thick geomembrane is proposed in lieu of a 40-mil thick liner to be consistent with RWQCB requirements (2010). An 18-inch thick vegetative layer is proposed for superior long-term barrier protection.

The alternative final cover configuration has been designed to ensure the containment of waste materials, minimize the infiltration of water from rain and provide a vegetative cover of native shrubs and grasses, prevent exposure of people and animals to waste, limit LFG emissions, minimize odor, control fires, and provide pleasant aesthetics.

9.1.2.4.1 Construction Considerations

Foundation Layer. Intermediate cover materials have been placed over LF-1. A field investigation to evaluate the characteristics of the intermediate cover at LF-1 was undertaken in 2008. Reportedly, cover thickness varies from 2 to 18 feet across LF-1, and these materials have suitable properties as foundation material for final cover systems with relative compaction of a minimum of 90 percent (GeoSyntec, 2008).

The existing intermediate cover of a 14.4 acre area on the South Face slope of LF-1 will be incorporated into the foundation layer to provide a minimum thickness of 24 inches. No additional waste will be placed in this area in the future. The top 6 inches of the existing intermediate cover will be stripped to remove surface vegetation, and the exposed subgrade will be prepared to provide a firm surface for placement of overlying materials. The exposed materials will be proof-rolled, scarified and re-compacted as necessary to provide a smooth surface for placement of the 60-mil HDPE barrier. Details on the partial final closure cover transition from the 14.4-acre South Face to future fill areas are provided in ***Figure 24***.

The remainder of the LF-1 and LF-2 areas will be filled to design grades. Upon completion, a 24 inch minimum thickness foundation layer will be constructed. The foundation layer will be properly compacted and proof-rolled as necessary prior to placement of the 60-mil HDPE barrier in the LF-1 area and the geosynthetic clay liner in the LF-2 area. For cost estimating purposes, it is assumed that 1-foot of foundation layer soils will have been placed as intermediate cover prior to closure.

The details on the earthfill quantities and material properties for the foundation layer are presented in **Section 5.4** and ***Appendix I*** of this Amended JTD.

Vegetative Layer (*27 CCR §21090(a)(3)*. An 18-inch thick vegetative soil layer capable of sustaining native grass growth is proposed in both the LF-1 and LF-2 areas in lieu of the minimum 12 inches previously approved by the RWQCB (2010). In our experience, the 18-inch cover provides superior erosion resistance and barrier protection and is more suited for post-closure maintenance activities. An 18-inch thick vegetative layer is more practical and does not require low-ground pressure equipment for normal maintenance activities, LFG well drilling, or other necessary post-closure maintenance.

The details on the earthfill quantities and material properties for the vegetative layer are presented in **Section 5.4** and ***Appendix I*** of this Amended JTD.

9.1.2.5 Infiltration Analysis

An analysis of infiltration was performed using the HELP model (see ***Appendix H***). Estimated infiltration rates for the final cover systems in both LF-1 and LF-2 are 0.32 cubic feet/acre-year (2.4 gal/acre-year). The surface area of the CDS at closure will be 190 acres (slope area). Thus the expected annual infiltration through the final cover will be less than 500 gallons per year, which is negligible.

9.1.2.6 Stability Analyses

27 CCR §21090(a)(6), §21145 and §21750(f)(5)

27 CCR §21145 requires that landfill operators ensure the integrity of final slopes under both static and dynamic conditions to protect public health and safety and prevent damage to postclosure land uses, roads, and LFG and leachate control systems, and prevent exposure to waste. Slope stability analyses shall be conducted and reported pursuant to the requirements of 27 CCR §21090 and §21750(f)(5).

Analyses of global and veneer stability are contained the seismic stability analysis summarized in **Section 5** of this JTD with details shown in ***Appendix J***. The seismic analyses were based on expected ground accelerations associated with the MPE occurring on the Healdsburg-Rogers Fault (0.32 g), and took into account buildup of liquids in the LF-1 waste mass as described herein (up to 100 feet in the LF-1 refuse fill). For critical sections, the results for veneer stability show that under static conditions the factor of safety is in all cases equal to or greater than 1.5 for the proposed cover system and final site configurations. Under seismic conditions, the estimated permanent deformation is 6.7 inches and is determined to fall within the acceptable range of displacement of less than 12 inches (U.S. EPA, 1995). The FS under seepage conditions resulting from a 100-year, 24-hour storm event is 1.11. This FS is acceptable for storm conditions.

We conclude that the veneer slope sections analyzed for the final cover design are considered stable under static, seismic and seepage conditions. The final cover design meets federal and state standards.

9.1.2.7 Settlement Analyses

In general, settlement that occurs in landfills where waste has been compacted in place and covered is due to consolidation and/or anaerobic decomposition. Consolidation is the settlement of waste over time as it becomes dense due to the weight of overlying refuse and cover and anaerobic decomposition of organic components of the waste. Gradual settlement occurs in landfills over a long period of time. The rate and magnitude of settlement varies with many factors including the age, depth, and composition of refuse.

An analysis of waste settlement was performed for LF-1 by GeoSyntec (2008). Secondary settlement due to the self weight of waste was considered in this analysis (i.e. caused by decomposition of the underlying waste during the 30-year post-closure period). Settlements ranging from 0 to 29 feet in the LF-1 area and 4 to 19 feet in the LF-2 area over the 30-year post-closure period are expected.

The analyses indicate that positive drainage of the final cover will be maintained after settlement and that the geosynthetics will be able to accommodate effects of differential settlements. SCS independently confirmed the final grading configuration as proposed herein would maintain positive drainage following settlements. Therefore, the analysis confirmed that the final cover system, including HDPE membrane and GCL components, would perform satisfactorily under anticipated settlements. However, should localized settlement cause areas of ponding on the final cover (typically on top deck areas), these areas will be readily observed and repaired as part of postclosure maintenance.

9.1.2.8 Grading, Drainage and Erosion Control

27 CCR §21090(b)(3), §21750, §21790(b)(8)(D) and §20365

27 CCR, §20365 specifies that waste management units and containment structures shall be designed and constructed to limit, to the greatest extent possible, ponding, infiltration, erosion, slope failure, washout, and overtopping under the 100-year, 24-hour precipitation. The final permanent stormwater diversion and control facilities (see ***Figures 25*** and ***26***) are designed to accommodate a calculated 100-year, 24-hour design storm. Details on drainage of the final cover system at the toe of landfill slopes are provided in ***Figure 24***.

Surface water for the final fill topography will be controlled by channeled ditches, pipelines, drainage benches, debris basins and interim drainage structures. All drainage facilities at CDS have been designed to control peak runoff flows based on rainfall intensity, soil characteristics, land use patterns, acreage, and hydraulic characteristics of the drainage area.

All stormwater conveyance features have been designed and constructed with minimum slopes between two and three percent to prevent ponding, promote lateral runoff, and maintain a positive drainage slope after settlement is complete. The proposed final grading and cover configuration design for the LF-1 and LF-2 areas includes other measures to protect slopes and minimize erosion. They include reduction of run-on water velocity by minimizing the length of final slopes to 50 feet vertical, and installation of benches with drainage structures to trap sediments on slope faces. Rip-rap or geotextile nets will be employed in drainage ditches and at surface water discharge points.

In general, the final cover design will provide for rapid removal of stormwater. Design will assure no excessive velocities will occur, as this would cause erosion of the final cover. Permanent drainage benches and ditches constructed over fill areas will be lined or seeded for a dense vegetation cover to minimize erosion.

In addition to the rapid diversion of water into lined channels and pipes, vegetated side slope final cover would reduce flow velocity on the cover surfaces of the landfill as well as binding the soil to prevent erosion. Covered landfill slopes will be mulched or seeded to promote the growth of natural grasses. The vegetation on slopes will minimize erosion of the landfill cover. Revegetation of completed fill slopes with native grasses via hydroseeding is envisioned.

The soil loss potential on preliminary final landfill slopes was evaluated using the Universal Soil Loss Equation developed by the U.S. Department of Agriculture. The soil loss analysis is provided in ***Appendix N.*** Based on this evaluation, the predicted worst case scenario for soil loss is 1.45 tons/acre-year. Drainage structures and detention basins are appropriately sized to accommodate soil loss for the final landfill configuration at closure.

9.1.2.9 Structure Removal and Decommissioning of Environmental Controls

27 CCR §21790(b)(8)(A) and §21137

Per 27 CCR §21137 site structures not deemed essential for closure construction or postclosure maintenance must be dismantled and removed. There are several non-landfill facilities or operations within the larger County-owned CDS property including the Household Toxics Facility, public T/PF, recyclable materials drop-off center, public scales, County administration building, and LFG power generation facility. These facilities are expected to remain in operation following closure of the CDS landfill. Therefore, at this time, there are no plans for decommissioning any site structures.

At this time, there are no plans to decommission any of the environmental control systems at the CDS at closure or throughout the post-closure maintenance period. If deemed necessary, any decommissioning of boreholes, LFG wells, leachate wells, ground water monitoring wells, or piezometers will be conducted in accordance with the appropriate regulatory agency requirements.

9.1.2.10 Environmental Control and Monitoring Systems

27 CCR §21790(b)(8)(E-F)

The environmental control and monitoring systems for the purpose of this Preliminary Closure Plan include LFG monitoring and control system pursuant to §20920 and the leachate monitoring and control pursuant to §21160. These systems are described in **Sections 5 and 6** of this JTD. At the time of closure, these control systems will include LFG and leachate extraction wells installed in the waste fill (both existing wells and new replacement wells). These wells will remain in operation during and after final closure. During final cover placement, precautions will be taken to ensure that the integrity of extraction wells is not compromised, as described below.

9.1.2.10.1 LFG Monitoring and Control System

27 CCR §20425(d)(3), §20920 and §21790(h)(8)(3)

A surface emission monitoring and control program is in effect at the CDS to fulfill requirements of Bay Area AQMD Regulation 8, Rule 8-34, AB 32 Landfill Methane Rule, and 27 CCR provisions for combustible gas control. These rules require that LFG be collected and properly managed in order to control emissions of NMOCs, odors and greenhouse gases, and to prevent public health and safety hazards. The LFG control and monitoring system is described in **Section 5.13** of this JTD.

The LFG system is expected to be in-place at the time of final closure and will be maintained throughout the postclosure period. During construction of the final cover, LFG well heads, laterals, headers and appurtenances will be protected-in-place or temporarily disconnected during construction. As the final cover system includes a geonet drainage layer, an HDPE liner, and a geosynthetic clay liner in the LF-2 area, the existing LFG wells will be fitted with a prefabricated geomembrane boot which will prevent infiltration through the interface. Construction of the final cover may require portions of the LFG control system to be temporarily disconnected. All construction activities will be made in accordance with the Bay Area AQMD Regulation 8, Rule 8-34 notification and permitting procedures.

9.1.2.10.2 Leachate Control System

27 CCR §21090(c)(2), §21790(b)(8)(F) and §21160

Leachate is managed in accordance with WDR, Order No. R1-2004-0040, issued by the RWQCB on July 22, 2004. Leachate collection and management systems in the LF-1 and LF-2 areas of the CDS currently in operation or expected to be in place at closure include a liquids collection system, a series of subsurface barriers, a lined storage impoundment, and a covered and lined storage impoundment. Principal collection systems include leachate barriers, bottom subdrains, perimeter french drains, and vertical extraction wells. These systems are described in detail in **Section 5.2.1.2** of this JTD.

The LCRS system will be in-place at the time of final closure and will be maintained throughout the closure and postclosure period. LCRS sumps and storage impoundments are outside of the limits of closure work and will not be affected by closure construction. During construction of the final cover at LF-1 and LF-2, all leachate extraction system components will be protected-in-place or temporarily disconnected to allow soil and liner placement as needed. The existing leachate extraction wells in the LF-1 and LF-2 areas will be fitted with a prefabricated geomembrane boot which will prevent infiltration through the interface. This boot will be welded to the HDPE liner.

9.1.2.11 Site Security

27 CCR §21600(b)(8)(A)and §21135

The CDS has provisions in place to discourage unauthorized access by persons or vehicles, including gates and fencing. These provisions are described in **Section 2.6** of this JTD. These provisions will remain in effect during the landfill closure and post-closure periods.

In accordance with 27 CCR §21135, appropriate signs will be placed at the site indicating the intended date of last receipt of waste at the landfill. These signs will be installed not less than 60 days prior to the anticipated last waste deliveries and for a period of not less than 180 days after the last shipment of waste. A notice shall also be placed in local newspapers not less than 30 days prior to the last receipt of waste.

Other solid waste management facilities at the larger County-owned CDS property will remain in operation following closure of the CDS landfill. Existing signs are in place to direct the public to these facilities, and they will remain in place during closure and post-closure.

9.1.3 Surveys and Final Topography

27 CCR §20950(d) and §21090(e)(1)

In order to monitor the future settlement of the landfill, settlement and survey monuments will be installed on the landfill in accordance with 27 CCR §20950 (d). Typical design for these monuments consists of a galvanized pipe, two-inches in diameter and 18 inches in length placed in blocks of concrete, 12 inches in diameter by nine inches in depth. A nail and tag will be placed in the center of each monument for identification. An optional monument design may be utilized, as appropriate.

A minimum of two permanent monuments will be placed in the 172.8 acre area in accordance with 27 CCR§20950(d) to provide both horizontal and vertical control points to allow monitoring of settlement of the final fill contours during the post-closure maintenance period.

An aerial photographic survey of the site will be performed and provided to the RWQCB, LEA and CalRecycle upon completion of closure activities in accordance with 27 CCR §21090(e)(1). The settlement monuments will be surveyed upon completion of all closure construction activities. Additionally, in accordance with 27 CCR, §21090(e)(2) requirements, the County will prepare an iso-settlement map of the entire permitted site every five years throughout the post-closure maintenance period.

9.1.4 Construction Quality Assurance

27 CCR §20323 and §20324, §21600(b)(8)(C) and §21790(b)(8)(C)

Construction of the final cover system will be carried out in accordance with a CQA plan certified by a registered professional civil engineer or certified engineering geologist. The CQA Plan shall specify:

- CQA personnel qualifications, responsibility and lines of authority.

- Inspection, monitoring and testing methods to verify that the final cover system and drainage features is undertaken in accordance with approved design plans and specifications, accepted engineering practice and regulatory requirements.
- Laboratory testing requirements for soil and synthetic cover components.
- Recordkeeping and reporting provisions.

A preliminary CQA Plan is provided in ***Appendix O***. A final CQA Plan will be submitted to the oversight agencies at least 180 days prior to construction of final cover system for the site or any discrete partial final closure projects. The CQA Plan will be approved by the agencies prior to commencement of any closure capping work.

9.1.5 Schedule for Final Closure and Estimated Closure Date

27 CCR *§21790(b)(7)*

This preliminary Final Closure Plan is being proposed for the 172.8 acre area encompassing LF-1 and LF-2 at the CDS. Final closure plans are to be submitted two years prior to the anticipated date of closure; however, this Preliminary Final Closure Plan is being presented as part of the JTD to show anticipated closure activities and associated costs for utilization of the entire 172.8 acre permitted disposal facility.

The County proposed to undertake partial final closure over the approximate 14.4 acre "South Face" area on the lower slope of LF-1, as described in this JTD. This work will commence concurrent with construction of the first new cell in LF-2, and is anticipated to be undertaken in the year 2013 construction season. A stand-alone Partial Final Closure and Post-Closure Maintenance Plan has been prepared as a companion document to this JTD and has been submitted under separate cover (SCS, 2011). This Partial Final Closure and Post-Closure Maintenance Plan has been determined by CalRecycle to meet applicable 27 CCR requirements, and has been considered approvable by that agency.

Final closure of the remaining 158.4 acres will occur within 18 months of the end of waste deliveries. Site life is estimated to range between 11 and 22 years, depending on waste volumes (refer to **Section 4.5** of this JTD for site life projections). The County reserves the right to complete closure activities in stages.

Given the above, the anticipated schedule for final closure is as follows:

- 14.4 acre "South Face" on lower slope of LF-1: year 2013.
- Remaining 158.4 acre permitted area: year 2023.

9.1.6 Maximum Extent of Landfill Requiring Closure

27 CCR §21790(b)(6)

The regulations require an estimate of the maximum extent of the landfill that will require closure at any one time during the active life of the landfill. Given the schedule proposed above, and assuming build-out of new cells as described herein, it is estimated that the maximum extent of the landfill requiring closure will be 158.4 acres plan area.

9.1.7 Record Keeping

Closure construction will be conducted under the supervision of a CQA Officer who will be a registered civil engineer in the State California. The CQA Officer will direct and certify closure reports for submission to CalRecycle, RWQCB, the LEA, and the Sonoma County Recorder's office, in accordance with 27 CCR §21170 and 21880. Reporting will contain, at minimum, the following:

- Description of the closure activities and significant events
- Construction record drawings
- Test results
- Date of closure construction completion
- Description and discussion of all deviations from the approved closure plan
- Topographic map
- Location and telephone number where the closure plan and emergency response plan can be obtained.
- Drawings, specifications, and approved revisions.

The reports will contain a certification that the information presented is accurate to the best of the CQA officer's knowledge, a professional opinion as to whether the closure meets the requirements and intent of the approved closure plan, and associated construction documents.

9.2 PRELIMINARY POST-CLOSURE MAINTENANCE PLAN

This section presents a Preliminary Postclosure Maintenance Plan (PPCMP) for the approximate 172.8 acre area encompassing LF-1 and LF-2, and has been prepared in accordance with applicable requirements of 27 CCR, Chapters 3 and 4, and 40 CFR §258.61. The purpose of this Preliminary PPCMP is to ensure that the environmental control and containment systems in these areas are properly monitored and maintained to minimize impacts to public health and safety and the environment.

Post-closure maintenance activities for the preliminary final closure of the LF-1 and LF-2 areas will consist of: LFG monitoring and maintenance, groundwater monitoring and maintenance, final cover inspection and maintenance, settlement monitoring and maintenance, access road maintenance, surface water drainage control system monitoring and maintenance, and site security inspection and maintenance. These activities are currently performed under the active operation of the landfill, and will continue as such until the entire site commences the thirty-year postclosure care period. The SWRCB performance goal for post-closure maintenance, per 27 CCR §20950(A)(2), is to assure that the closed landfill is maintained in such a way to minimize water infiltration into the waste and minimize the production of leachate and gas. The post-closure activities described in this section are intended to meet this performance goal.

As required under 27 CCR §21769(c), this Preliminary PCMP provides a basis for estimating costs for a third party to maintain monitoring and inspect the closed landfill area.

9.2.1 Regulatory and Permit Requirements

All provisions of this plan are designed to meet the federal and state post-closure maintenance requirements. Federal requirements for final post-closure maintenance plans are specified in Title 40, §258 (Subtitle D) of the Code of Federal Regulations (CFR). State requirements for post-closure maintenance plans and activities are specified in 27 CCR §21769(b), §21825 (b)(1) and §21180, respectively.

9.2.2 Post-Closure Maintenance Period

27 CCR §20380(c) – (c)(2) and §21180(a)

The CDS shall be maintained and monitored for a period not less than thirty years. Any areas where final cover is placed prior to the closure of the entire landfill shall be maintained in accordance with the approved post-closure maintenance plan, but the thirty year postclosure monitoring period shall not commence until closure of the entire landfill is complete.

9.2.3 Inspection and Maintenance

27 CCR §21090(c), §21180, §21769(b) and §21825(b)(2)

This section describes the inspection and maintenance procedures and methods to be implemented following closure of the LF-1, REA and LF-2 areas. These procedures will be used for the final cover, surface water management system, leachate management system, LFG management system, and water quality monitoring systems.

General postclosure duties throughout the postclosure maintenance period are described in 27 CCR §21090(c) and other regulations cited above. The operator shall perform the inspection and maintenance activities to assure the structural integrity and effectiveness of all containment structures of the closed unit. Specifically, the operator shall continue to operate the LCRS as long as leachate is generated and detected, maintain the monitoring systems and monitor the ground water, surface water, and the unsaturated zone, prevent erosion and related damage of the final cover due to drainage, and protect and maintain surveyed monuments.

The LF-1, REA and LF-2 areas at the CDS will be periodically inspected, maintained and repaired, as necessary. Inspection of the closed areas of the CDS will be performed to ensure that all postclosure requirements have been met.

9.2.3.1 Final Cover and Grading

27 CCR §21090(a)(4) and §21769(c)(2)(H)

The purpose of the completed final cover is to minimize stormwater infiltration into and through the closed landfill, minimize the venting of gas generated in the facility, isolate the buried wastes from the surface, promote drainage, minimize erosion or abrasion of the cover, and accommodate settlement and subsidence so that cover integrity is maintained.

The primary purpose of the final cover maintenance procedures is to maintain the integrity of the completed final cover over the long-term and to provide maintenance, scheduling and documentation so that materials and maintenance practices are consistent with the final cover design specifications. Quarterly visual inspections of the final cover will include identification of erosion and settlement problems. A County Site Engineer, or as designated by the County, will be responsible for documenting the location and extent of any repairs.

9.2.4 Inspection Procedures

All personnel with access to the site will be trained to identify any surface cracking, ponding or unusual surface conditions and report those observations to the Landfill Operations Supervisor or County Site Engineer who will record the information in the site logbook at the time it is observed. At minimum, inspections of the cover will be made on a quarterly basis by walking a grid of the closed area to visually observe the following:

- Evidence of erosion.
- Areas where vegetation has died off.
- Visible depressions.
- Ponded water.
- Evidence of odor.
- Exposed refuse.
- Evidence of cracks.
- Differential settlement and subsidence.
- Slope failure.
- Leachate seeps.
- Areas where underlying layers of the cover are exposed.
- Areas damaged by equipment operation.

In addition to routine inspections conducted on a quarterly basis, the site will be inspected following any major storm event, seismic event or natural disaster for improper operation and resultant effects on the surrounding final cover. County personnel or a qualified contractor will perform a detailed visual inspection by grid walking the site on a quarterly basis. A formal report of findings will be presented to the Site Engineer.

9.2.5 Final Cover Maintenance Procedures

The proposed cover designed for closure of the LF-1 area at CDS consists of (from bottom to top): 24-inch thick foundation layer, 60-mil HDPE barrier, geocomposite drainage net, and 18-inch thick vegetative layer. The proposed cover designed for preliminary final closure of the LF-2 area at CDS consists of (from bottom to top): 24-inch thick foundation layer, geosynthetic clay liner, 60-mil HDLE barrier, geocomposite drainage net, and 18-inch thick vegetative layer. All final cover repair and/or reconstruction activities shall be conducted in a manner to maintain the integrity of the as-built final cover system. Repair of fill materials should be performed in the eighteen-inch vegetative or lower layers as necessary with the procedures utilized during the original final cover construction. Typical issues requiring maintenance or repair are listed below with the recommend repair methods presented in the following subsections:

- Elective penetration through the final cover (and if necessary, preferential pathway system) associated with installation or maintenance of LFG or leachate extraction components.

- Settlement related ponding or drainage interruptions that interfere with the conveyance of discharge of surface waters from the closed landfill surface.
- Surface erosion associated with intense rains.
- Local slumping on slopes resulting from intense rainfall.
- Vertical and near vertical cracking of cover soils as a result of landfill settlement.

Final cover repair activities will be conducted and documented as specified in the CQA Plan, provided in ***Appendix O***. A registered engineer or certified engineering geologist will inspect and certify repairs to the final cover.

9.2.5.1 Elective Penetrations – Extraction Wells

Elective penetration of the final cover associated with installation or maintenance of gas and/or leachate monitoring system components should be avoided whenever possible. If intrusion into or through the cover cannot be avoided, the cover sections should be reconstructed to the original design geometry. All earth work should be completed in accordance with the procedures contained in the specifications for final closure, which would be similar to those in the CQA Plan (***Appendix O***). As the final cover system includes a geocomposite drainage layer, an HDPE liner, and a GCL barrier in the LF-2 area, any penetrations through the liners will be fitted with a prefabricated geomembrane boot which will prevent infiltration through the interface.

All final cover repair and/or reconstruction activities shall be conducted in a manner directed to maintain the integrity of the as-built final cover system. Repair of soil fill materials should be performed in six to eight-inch lifts consistent with construction procedures from the original final cover construction.

For removal of the final cover for the purpose of elective intrusion, the geocomposite drainage material, geomembrane, and GCL, where present, shall be cut to dimensions exceeding those of the excavation by at least 12-inches. The edges of the cut geosynthetics shall be temporarily protected using plywood sheets or other appropriate materials (e.g., scrap geomembrane) during the excavation. Once the excavation and repair of the foundation layer has been completed, new pieces of geosynthetics shall be used to replace the cut out area. The geosynthetic material and installation shall conform to the requirements of the final cover construction specifications and drawings. The geomembrane shall be fitted with prefabricated boots where penetrations are required (e.g., for LFG or leachate extraction wells). The boots shall be approved by the final cover performance officer or his designated representative. Repairs of the geomembrane shall be subjected to CQA testing in accordance with the CQA Plan for construction of the final cover.

Excavation of the final cover should be initiated only after receiving approval from a County Site Engineer, and appropriate regulatory agencies as needed, and should be conducted under the full-time observation of the Site Engineer or County designee.

9.2.5.2 Ponding, Drainage Interruptions and Surface Erosion

Low spots, ponding, surface erosion, or other settlement features, which could interfere with the function and integrity of the geocomposite drainage layer, geomembrane, and GCL barrier layers will be repaired as needed.

Areas of the top deck where sags and ponding due to non-uniform displacement of the geosynthetics are identified as adversely affecting sheet flow drainage will be repaired by excavating the vegetative layer to the geocomposite drainage material, cutting and removing the geosynthetics and rebuilding grades by placing additional foundation soil. Once the grades have been re- established, new pieces of geosynthetics shall be used to replace the cut out area. Reconstruction materials and practices will be consistent with those utilized during final cover system construction.

9.2.5.3 Vegetation

§21090(a)(5)(B)

Maintaining sufficient vegetation over the surface of the landfill is an integral component in maintaining adequate erosion protection. The vegetative cover will support non-irrigated native grasses. Per 27 CCR §21090(a)(5)(B), the county will moderate the use of water for other uses such as dust control, or for initial establishment of vegetation following seeding.

9.2.5.3.1 Vegetation Inspection Procedures

The vegetation will be inspected for landfill surface coverage and stress indications. The causes of these irregularities or deficiencies shall be ascertained at the time of environmental monitoring wherever possible. Landscaping monitoring parameters also include soil quality control, rodent control, and a reseeding program, if necessary. Corrective action will be taken to remedy observed deficiencies. Inspections of the vegetative (erosion control) layer will be conducted in conjunction with the final cover inspections discussed in **Section 9.2.4**. A County Site Engineer or designee shall be responsible for documenting and monitoring the following procedures:

1. Personnel or contractors with access to the site will be trained to observe any landfill surface cracking, liquid ponding, or unusual landfill surface conditions and to report to the County Site Engineer immediately.

2. The vegetative layer of the landfill will be visually inspected by a County representative trained in inspection procedures and a report of findings will be prepared.

3. The vegetative layer of the landfill will be visually inspected by a County representative trained in inspection procedures following unusual events such as landfill fires and a report of findings will be prepared following any such unusual event.

4. The landscaping and temporary irrigation system (if used) will be inspected for landfill surface coverage and stress indications, such as stunted growth, discolorations, and dead or dying plant material. The causes of these irregularities shall be ascertained at the time

of environmental monitoring whenever possible. Landscaping monitoring and maintenance parameters also include weed control, reseeding, fire control, and rodent control.

5. The temporary irrigation system (if required) shall be monitored routinely to facilitate efficiency and proper operation of equipment. Temporary irrigation system inspections shall include checks of the sprinkler or bubbler heads, irrigation lateral and main lines, control valves, pressure relief valves, pressure regulating valves, air relief valves, and pumps. The operation of the irrigation control station will be monitored as well.

9.2.5.3.2 Vegetation Maintenance and Repair Procedures

Maintenance of the vegetative layer, the landscaping, and the temporary irrigation system will be conducted by Sonoma County or qualified contractor personnel. Maintenance efforts are expected to be greatest during the vegetation establishment period and are projected to lessen thereafter. The inspection schedule after the establishment period is expected to decrease accordingly.

It is anticipated that the 18-inches thick vegetative (erosion control) layer will require periodic maintenance throughout the postclosure maintenance period. The conditions that may contribute to the need for maintenance of the vegetative layer correspond to those outlined for final cover maintenance and include the following:

1. Elective intrusion into or through the vegetative erosion associated with maintenance of the LFG control system or leachate extraction system.

2. Sags related to settlement which may interfere with the controlled runoff of surface waters from the closed landfill surface.

3. Surface erosion as a result of high runoff velocities associated with intense rains or a malfunctioning temporary irrigation system.

4. Vertical cracking of the vegetative layer as a result of landfill differential settlement.

5. Local surficial slumping on slopes resulting from intense seasonal rainfall, a malfunctioning temporary irrigation system, or seismic loading.

Repairs to the vegetative layer will be performed in a manner consistent with the original vegetative layer construction procedures. Clean fill, taken from an existing on-site soil stockpile, will be placed in loose lifts of 6 to 8-inches in thickness to re-establish grades to appropriate elevations, as necessary.

9.2.5.4 Drainage and Erosion Control Structures

Postclosure maintenance of the surface-water management system is intended to ensure adequate performance of the system. Therefore, the inspection and maintenance programs for the surface-water management system will continue to be implemented until and throughout the postclosure maintenance period. The inspection and maintenance programs outlined below provide a comprehensive set of procedures to monitor and maintain the integrity of the drainage control structures as necessary until and during the postclosure maintenance period.

Control of runoff, erosion and sediment will be accomplished through the use of drainage ditches, channels and culverts, temporary diversion dikes, straw bale barriers, temporary and permanent seeding, and sediment ponds. Flow from the developed areas and adjacent properties will be intercepted by the channels and routed to the sediment ponds. The ponds will act as combination storm-water management basins. The channels may be subject to siltation and must be periodically maintained. Erosion will be controlled through use of temporary and permanent seeding of landfill slopes.

9.2.5.4.1 Drainage and Erosion Inspection Procedures

Bench Channels. The benches will be constructed 15-feet wide to allow vehicle access. The existing vertical alignment will remain at approximately 50-foot intervals. The benches/access roadways will be graded inward at approximately two percent to collect and convey stormwater along inner swales. The drainage swales will have an overall gradient generally between two and three percent in order to convey storm water to the bench down drain inlets and/or perimeter drainage channels.

Inspection of the bench drains and bench channels will be required during the rainy season after each major storm. Benches will also be inspected during the summer, and necessary repairs will be made prior to the next rainy season. Bench inspections will include checking for erosion ruts, settlement cracks, and proper grading to verify the integrity of the bench channels and culverts.

Culverts. The use of culverts will be used to convey stormwater at CDS. Typically, the culverts will be comprised of corrugated plastic pipe (CPP). The culvert system serves two functions: (i) it conveys surface-water runoff from the top deck drains; and (ii) collects and conveys runoff from the bench drains.

A visual inspection of each culvert will be conducted to identify any of the following deficiencies: joint separation; invert failure; structural failure; perforations; and presence of silt and/or debris.

An inspection report should include a detailed description and approximate location of deficiencies. Corrective measures taken to remedy each deficiency shall also be described in the inspection report.

Downdrains. The downdrains convey storm flow from the top deck and bench drains into a perimeter drainage channel. The storm drains traversing down the surface of the landfill slopes will be comprised of lined ditches, including articulated concrete blocks (ACB) and/or HDPE piping networks. These downdrains are constructed on the exterior face of the finished slopes. An inlet apron will be constructed of concrete around each inlet to serve as a non-erodible approach for deck and bench runoff.

A visual inspection of each downdrain will be conducted to identify any of the following deficiencies: joint separation; invert failure; structural failure; and presence of silt and/or debris.

An inspection report shall be prepared following each inspection giving a detailed description and approximate location of deficiencies. Corrective measures taken to remedy each deficiency shall also be described in the inspection report.

Perimeter Channels. Drainage structures along the perimeter of the landfill will consist of mat-lined or reinforced concrete v-ditch or trapezoidal channels. A visual inspection of each perimeter channel will be conducted to identify any of the following deficiencies: joint separation; invert failure; structural failure; and presence of silt and/or debris.

An inspection report shall be prepared following each inspection giving a detailed description and approximate location of deficiencies. Corrective measures taken to remedy each deficiency shall also be described in the inspection report.

9.2.5.4.2 Drainage and Erosion Maintenance Procedures

Bench maintenance will consist of erosion control along the toe of the slope and re-grading of areas, which have been subjected to differential settlement. Re-grading will control ponding and help maintain drainage into the inlet structures. A grader, dozer, and compactor will be utilized to grade the benches, repair erosion ruts, and maintain the integrity and compaction of the final cover system. In areas where landfill settlement affects the bench grades, additional vegetative layer soil cover material will be placed and compacted to reestablish positive drainage, as needed.

Maintenance activities will include, as necessary, drainage channel and downchute repairs, pumping of sedimentation ponds, removal of silt and debris along drainage channels and in sedimentation ponds, repair and replacement of erosion and sediment controls (e.g., silt fences, straw bales, riprap), and grading of the final cover erosion layer.

Typical culvert, downdrain and perimeter channel corrective measures for deficiencies include the following:

1) For joint separation: use wider CSP band couplers with mastic or pumped grout; and attach patches with self-drilling/self-tapping screws or welds.

2) For invert failure: replace piping; and rotate pipe 180 degrees and patch as required.

3) For structural failure: reinstall pipe anchor supports; and replace section of drain.

4) For clogging by silt/debris: use vacuum pumps to remove debris; or use a water-jet spray to force debris out of the drain; or for smaller amounts of debris, use a bucket line; or use a fire hose to flush out debris.

Access to the buried section of the culvert under each bench can be gained through the removable inlet grate. Mirrors can then be lowered into this section and, with sufficient lighting, a visual inspection can be conducted. The pipe fittings at the upper end of the exposed portion of each culvert can also be removed for inspection and cleaning.

Small amounts of silt and debris may be removed by buckets or fire hose flushing. Extensive clogging may require either vacuum pump or water-jet spray. A vacuum pump may be used to remove sediment from pipes and can be mounted on a vehicle. A vacuum pump system can remove stones, leaves, litter, and sediment deposits.

A water-jet spray can be used to clear debris from the culvert system. Water-jet equipment is usually mounted on a self-contained vehicle with a high-pressure pump and a 200-300 gallon water supply. A 3-inch flexible hose line with a metal nozzle that directs jets of water out in front is used to loosen debris in pipes or trenches. The nozzle can also emit umbrella-like jets of water at a reverse angle, which propels the nozzle forward as well as blasting debris backward. As the hose line is reeled in, the jetting action forces the debris downstream where it is removed by the vacuum pump equipment. The typical length of hose is approximately 200-feet

Access roads for maintenance will be provided on the decks to reduce interference with any surface flows. It is important that maintenance vehicles utilize access roads and benches whenever possible to reduce surface rutting that could interfere with normal drainage patterns.

For open channels and sedimentation ponds, the following corrective measures can be taken for deficiencies identified during the inspection:

1) For cracking: construction of expansion/control joints; and placement of sealants such as epoxy resins, asphaltic material, thermoplastics or silicones.

2) For settlement: grouting injection; or removal of modular concrete blocks; and/or completion of replacement with subgrade work.

9.2.5.5 LCRS

27 CCR §21160(c and d)

During the closure/postclosure maintenance period, the owner/operator shall ensure that leachate collection and control is managed to prevent public contact and controls vector, nuisance, and odors. Both the quantity and quality of leachate shall be monitored as proposed and described in **Section 6.1.5** of this JTD.

The leachate management system at the CDS consists of HDPE pipes, transfer pumps designed to transfer leachate from leachate collection sumps, and two (2) leachate evaporation/storage ponds located at the CDS southern property boundary. LCRS side-slope risers and sump pumps will be operated, inspected, maintained, and tested regularly as long as there appears to be a potential for liquid flow into the LCRS sumps.

Monitoring after preliminary closure of the LF-1 and LF-2 areas will depend on conditions encountered during the postclosure period. In general leachate production generally decreases with time after a final cover has been installed. However that amount of time for the moisture content to stabilize and for actual decreases in leachate production to occur is unknown at this time. Any leachate generated during the postclosure maintenance period will be conveyed to on-site leachate evaporation/storage ponds (Leachate Pond Nos. 1 and 2, see ***Figure 3***), and then conveyed via a force-main pipeline for discharge at the City of Santa Rosa Waste Water Treatment Plant.

For the purposes of this Preliminary PCMP, it is assumed that the frequency of monitoring and testing to be performed will continue as described in the current monitoring and reporting programs as described in **Section 6.1.5** of this JTD.

9.2.5.6 LCRS Inspection Procedures

A visual inspection of the LF-1 LCRS extraction wells, collector mains, sump and pump system and pipeline lift stations will be made by qualified County personnel or contracted maintenance crews. If repairs to the system are required, the necessary personnel will be notified. The focus of the inspections will be on the LCRS pumping equipment and leachate evaporation/detention ponds.

The following items will be included in the visual inspection:

1) Motor/pump electrical control panel for tripped breakers.
2) Compressors for proper operation.
3) Float switch for proper calibration.
4) Leachate piping for evidence of any pipe leakage.
5) Valve inspection for damage and leak.
6) Leachate storage ponds and secondary containment systems for integrity and any evidence of leakage or damage.
7) Discharge piping for clogging or buildup of particulate matter on pipe walls.
8) Sump riser pipe for excessive debris buildup.

9.2.5.7 LCRS Maintenance Procedures

Based on the results of the inspection activities, repairs and/or replacement of components of the LCRS will be made as necessary. Identified worn or malfunctioning elements of the LF-1 leacahate extraction wells will be repaired or replaced, as appropriate. The repairs will be performed by qualified County personnel or as designated.

The County maintains spare LCRS pumps and routinely removes the operating pump, replaces it with a fully serviced pump and sends the one removed to the manufacturer for service. This practice will be continued during the post-closure maintenance period.

Pumps that do not function properly will be repaired or replaced. If a sediment buildup occurs at the base of the risers, the risers will be flushed. Provisions are included in the LCRS design to allow flushing of accumulated sediment within the LCRS sumps. The LCRS system will be tested to demonstrate proper operation on an annual basis.

On an annual basis, leachate ponds LP-1 and LP-2 are cleaned of sediment, visually inspected and repaired as needed. This practice will be continued during the post-closure maintenance period. If solids are present in the ponds, they will be removed and dried and disposed of as appropriate depending on chemical test results.

9.2.5.8 Groundwater Monitoring System

27 CCR §20380(a)

For the purposes of this Preliminary PCMP, it is assumed that the frequency of groundwater monitoring and testing will continue as described in **Section 6** of this JTD and in accordance with WDRs issued by the RWQCB. As currently required, for each monitoring point, it will be determined whether there is statistically significant evidence of a release from the landfill for any monitoring parameter. If there is statistically significant evidence of a release, an evaluation monitoring and corrective action program will be implemented.

The existing groundwater monitoring wells have been designed to ease operation and facilitate minimal maintenance during and after landfilling operations. Additional wells, if needed to evaluate potential releases, will be designed to meet these same criteria. Wells may be equipped with dedicated purging and sampling equipment.

9.2.5.8.1 Groundwater Monitoring Well Inspection Procedures

The groundwater monitoring network will be inspected each time groundwater samples are collected from the wells. The sampling technician will inspect well caps, casings, and protective post-structures for signs of damage or deterioration and missing padlocks.

9.2.5.8.2 Maintenance Procedures

Depending upon the extent of deterioration or damage, the monitoring well will be either repaired or replaced as soon as practical after detecting the problem. Damaged or inoperative caps and locks will be replaced as required. Other repairs, including possible well abandonment and redrilling, will be conducted in accordance with regulatory standards.

9.2.5.9 LFG Control and Monitoring Systems

27 CCR §21160(a) and 40 CFR § 258.61(a)(4)

Federal and state regulations specify that LFG control and monitoring systems be operated and maintained during the thirty-year postclosure maintenance care period. It is assumed that the current LFG monitoring and maintenance procedures will remain in effect. The corresponding inspection and maintenance program includes maintenance requirements for pipe breakage due to landfill settlement and pipe blockage due to the formation of gas condensate, as well as management of the LFG condensate.

9.2.5.9.1 LFG Extraction System

The schematic LFG extraction system for the CDS at closure is presented in ***Figure 26***. It is composed of the gas extraction wells and associated piping. The system will be inspected and maintained until and throughout the thirty-year postclosure period or as long as gas continues to be detected at levels requiring control.

The LFG management system will be inspected with a focus on well head assemblies, pipeline couplings, connections, pipeline leaks (which may be indicated by a gas odor, hissing sounds, elevated gas concentrations in surface air samples or elevated oxygen readings in the collection system), pipeline breakage, cracking, abnormalities, or deformations. Regular inspections of the blower/flare station mechanical and electrical system components will also be performed to ensure adequate and safe operation.

The LFG collection system maintenance procedures will include provisions for minimizing the probability of elevated subsurface temperatures. These elevated subsurface temperatures are caused by LFG combustion, which may result from excessive oxygen intake. The abundance of oxygen usually occurs from the application of excess vacuum to a portion of the LFG collection system. The elevated subsurface temperatures can jeopardize the integrity of the LFG collection system, create unpredictable LFG generation rates, and cause rapid and/or uneven refuse settlement. In addition, monitoring data will be reviewed for suction losses, which may indicate collection system leaks, and for combustion efficiency. Based on the results of the inspections, repairs and/or replacement of components of the active LFG extraction system can be made as necessary.

9.2.5.9.2 LFG Extraction System Maintenance Procedures

Maintenance procedures for elevated subsurface temperatures pertain to surface emissions monitoring and preventing air intrusion into the subsurface. Placement of a final cover system with an HDPE liner component greatly reduces the ability of oxygen intrusion to occur. Well head monitoring of the LFG temperature and composition serves as an indicator of elevated subsurface temperatures. Well head readings with methane contents below 40 percent (by volume), temperatures at or above the 120 to 130°F range, or oxygen contents greater than 4 to 5 percent indicate possible excessive oxygen intrusion and elevated subsurface temperatures.

Routine inspection and maintenance of the LFG extraction system will include adjustment to valves, testing of well pressures, checking for gas leakage at the well head, and checking the integrity of well penetrations through the final cover. Surface repairs will be conducted in accordance with the final cover repair procedures given in **Section 9.2.3** of this JTD. Gas well head flows can be reduced or completely shut off by valve adjustments to reduce oxygen intrusion and therefore lower subsurface temperatures.

Cracked, broken, or malfunctioning portions of the LFG collection system will be repaired upon detection in accordance with industry standards. LFG well repairs are dependent on the nature and extent of damages to the LFG collection system and may include removal and replacement of solid-wall sections of polyethylene (PE) pipe, soil backfill, bentonite grout, and/or geomembrane boots. If it is determined that LFG wells are damaged beyond repair, they will be abandoned and/or re-drilled. Repairs to the LFG headers may include removal and replacement of damaged header pipe. These repair activities will be conducted in compliance with applicable Bay Area AQMD and CalRecycle regulations.

9.2.5.9.3 LFG Monitoring System Inspection Procedures

The LFG monitoring system consists of a network of probes installed in native soils at the CDS property boundary (***Figure 27***). It is assumed this monitoring network will remain in place during the post-closure period. Visual inspections of the LFG monitoring probes will be conducted until and during the postclosure maintenance period with attention to broken probes, end caps, sampling ports and valve boxes.

LFG monitoring until and during the postclosure maintenance period will consist of testing the perimeter gas monitoring probes on a quarterly basis. During the postclosure period, probes that show "zero" combustible gas readings for 1 year will then be monitored on an annual basis.

All monitoring probes and on-site structures will be sampled for methane. The results of LFG monitoring will be submitted to the LEA and the CalRecycle within 90 days of sampling unless compliance levels are exceeded. If compliance levels required by 27CCR §17783(a) are exceeded, immediate steps will be taken to protect public health and safety and the environment and written notification of the LEA and CalRecycle will be made within five days.

All surface emission monitoring and component leak monitoring shall be conducted in accordance with Bay Area AQMD and AB32 Landfill Methane Rule regulations, and the applicable provisions of the Title V operating permit.

9.2.5.9.4 LFG Monitoring System Maintenance Procedures

Repairs will be conducted upon detection. Monitoring probes may be re-drilled if they have sustained excessive damage. Repairs will be conducted in accordance with industry standards.

Data from surface monitoring and perimeter gas monitoring probes will be used to adjust the active LFG extraction system to meet standards presented in 27 CCR and Regulation 8, Rule 34 of the Bay Area AQMD. The flare station will be stack tested and adjusted or modified to meet applicable Bay Area AQMD standards.

9.2.5.9.5 LFG Condensate Inspection and Maintenance Procedures

The LFG condensate management system components including condensate sumps, piping and air compressors, will be inspected monthly, in conjunction with the monthly inspections of the LFG collection system. Gas condensate piping will be visually inspected for leaks or breakage, and condensate pumps will be checked for proper operation. Detection of odor and evidence of condensate or minor spills are indicators of the malfunctioning of the LFG condensate management system.

Maintenance and repairs to the LFG condensate management system will be made upon detection. The continuous operation of the LFG collection system and the condensate system is a Bay Area AQMD operating permit requirement. Cracked, broken, or malfunctioning portions of the LFG condensate management system will be repaired in accordance with industry standards.

9.2.6 Five-Year Iso-Settlement Map

27 CCR §21090(e)

Once the entire site is closed, a photogrammetric survey of the site will be made. Using this survey, a base topographic map will be produced at a scale of 1-inch to 200-feet (i.e., 1: 2400) and at a maximum contour interval of 2-feet. Subsequently, an aerial photographic survey will be completed every five years throughout the thirty-year postclosure maintenance period. These updates will be used to allow analysis of the changes in elevation between consecutive aerial surveys of the landfill. The iso-settlement maps will be submitted to the CalRecycle, RWQCB, and the LEA.

9.2.7 Post-Closure Contacts

27 CCR §21830(b)(2)

As the CDS will remain active after the completion of the partial final closure activities of the southern face of LF-1, the safety and emergency contacts of **Section 7.1.4** of this JTD will be used for the post-closure contacts for this area.

9.3 POST-CLOSURE USE

27 CCR §21790(b)(5)

The closed landfill at the CDS will be maintained as non-irrigated open space. However, if during the postclosure period the County identifies alternative postclosure land use for the landfill, it will propose it to the regulatory agencies for approval.

Bench roads will remain in use for access to leachate and LFG extraction wells on the slope and top deck areas. The roadways will be properly inspected and maintained as described above to ensure against damage to the underlying barrier systems.

Other non-landfill facilities within the larger County-owned CDS property associated with MSW management will remain operational during the post closure period, under separate permits. These facilities include the T/PF, Household Toxics Facility, Recycle/Re-Use Area, and LFGTE plant.

9.4 EMERGENCY RESPONSE PLAN

27 CCR §21830(1), §21130(a) and §21132

An Emergency Response Plan (ERP) is a document that identifies occurrences beyond site design that may endanger public health or the environment and the procedures to minimize these hazards. The ERP for the entire CDS property, referred to as the Book of Plans by the County, is provided in ***Appendix R***. This County Book of Plans document includes several separate elements: a Business Plan, Contingency Plan, Dust Control Plan, Emergency Response and Evacuation Plan, Fire Prevention Plan, Respiratory Protection Plan, Load Checking Plan and a Spill Prevention, Containment and Countermeasure Plan. The current Book of Plans will be in effect during the closure and postclosure maintenance periods at the CDS.

Per §21132, the emergency response plan, provided as the County's Book of Plans, has previously been submitted to the LEA and RWQCB for review (GeoSyntec, 2008). The attached plan in ***Appendix R*** contains recent updates to the County's Load Checking and Spill Prevention, Containment and Countermeasure Plans. Future updates to the Book of Plans will be provided to the RWQCB, LEA and CalRecycle as appropriate.

9.5 CHANGE OF OWNERSHIP

27 CCR §21200

If a change in ownership occurs prior to or during the postclosure maintenance period, the County will notify the new owner concerning the existence of the conditions, regulatory standards and requirements relating to postclosure maintenance of the CDS, and signed agreements that are in place to assure continuous compliance. The owner will notify the LEA the change in title within thirty days and shall provide the name, firm, mailing address, and telephone number of the new owner.

Per 27 CCR §21630(a), owners and/or operators of a facility who plan to sell, encumber, transfer or convey the ownership or operation of the facility or land to a new owner or operator, or who plan to change their address shall notify the LEA and CalRecycle 45 days prior to the anticipated transfer.

9.6 PRELIMINARY CLOSURE AND POST CLOSURE COST ESTIMATES AND FINANCIAL ASSURANCE

9.6.1 Closure Cost Estimates

27CCR §20950(f), §21790(b)(1), §21815, §21820(a), §22207 and 40 CFR §258.71(a)

Cost estimates were prepared for the final closure of the entire 172.8 acre permitted area in accordance with the above-cited federal and state regulations. These regulations require an estimate, in current dollars of the cost of hiring a third party to close the landfill in accordance with the submitted closure plan.

These estimates for have been prepared under the oversight of a licensed civil engineer and are summarized in ***Table 15*** below. The cost estimates reflect current landfill industry unit costs, use of prevailing wage labor rates, and SCS's best engineering judgment based on our understanding of site conditions.

Table 15. Preliminary Closure Cost Estimate

Item	Estimated Cost ($2011)
Pre-Field Activities	$290,000
Final Grading and Cover Placement	$18,366,200
CQA – Soil and Liner Placement	$2,280,000
Revegetation – Hydroseeding	$570,000
LFG Monitoring and Control System	$425,000
Leachate Control	$215,000
Final Drainage	$1,165,000
Documentation	$225,000
Sub-Total	$23,536,200
20% Contingency	$4,707,000
Total	**$28,243,200**

Details on the closure capital cost estimate, including worksheets and key underlying assumptions are provided in ***Appendix S***. Cost estimates include design, materials, equipment, labor, administration and quality assurance for the closure work. A contingency amount is provided as required by regulation. Note: the estimates shown in ***Table 15*** are based on the assumption that closure will be implemented in two mobilizations, foundation soils and vegetative cover soils will be obtained from existing stockpiles or on-site borrow sources, and that existing environmental controls such as the LFG extraction/monitoring system, LCRS system, groundwater monitoring wells and other environmental control features as described herein are already in place and will not require significant upgrades.

The capital cost estimates shown in ***Table 15*** and ***Appendix S*** have been reviewed and approved by CalRecycle (CalRecycle, November 2011). The County has subsequently submitted information to CalRecycle adjusting the fund balance for inflation. The current closure estimate is approximately $28,836,300 ($2012). Worksheets with the annual inflation factor adjustment are provided in ***Appendix S***.

9.6.2 Post-Closure Costs

27CCR §21840 and 40 CFR §258.72

Federal and State regulations require written costs of hiring a third party to perform postclosure maintenance of the entire landfill.

Pursuant to 27 CCR §21180(a), any areas where final cover is placed prior to the closure of the entire landfill shall be maintained in accordance with the approved postclosure maintenance plan, but the thirty years monitoring period shall not commence until closure of the entire landfill is complete.

For purposes of this Preliminary PCMP, inspection, monitoring and maintenance expenses for the entire 172.8 acre permitted area were estimated in accordance applicable requirements above. The estimates reflect costs in current dollars for hiring a third party to inspect, monitor, and maintain the closed landfill and environmental control features. These estimates are summarized in ***Table 16*** below and reflect current landfill industry unit costs, our understanding of site conditions, and our best engineering judgment.

Table 16. Preliminary Post-Closure Monitoring and Maintenance Cost Estimate

Item	Estimated Cost, $/Year ($2011)
Final Cover Maintenance	$127,500
Drainage System Maintenance	$18,900
Leachate Collection	$376,900
LFG System Operation and Maintenance	$139,600
Final Grading Maintenance	$8,000
Groundwater Monitoring	$124,000
Site Security	$10,000
Sub-Total Annual Cost	$804,900
Total 30-Year Cost	**$24,147,000**

Details on the inspection, monitoring and maintenance expenses for the landfill post-closure period including worksheets and key underlying assumptions are provided in ***Appendix S.***

Note: the estimates shown in ***Table 16*** are based on the assumption that procedures and funding for maintenance of existing environmental control systems (LCRS and LFG control system) are already in place as part of active landfill operations, will not change appreciably as part of preliminary final closure. The same assumption applies to water quality, air, and LFG monitoring programs which will continue to be performed in accordance with existing or updated permit conditions and as part of site operations.

The preliminary postclosure monitoring maintenance cost estimates shown in ***Table 16*** and ***Appendix S*** have been reviewed and approved by CalRecycle (CalRecycle, November 2011). The County has subsequently submitted information to CalRecycle adjusting the fund balance for inflation. The current postclosure maintenance estimate is approximately $24,655,000 ($2012). Worksheets with the annual inflation factor adjustment are provided in ***Appendix S***.

9.6.3 Financial Assurance Mechanism

27 CCR §22210 and §22212

Federal and state regulations require that the owner demonstrate the availability of financial resources to conduct closure and postclosure maintenance activities. Financial responsibility is essential for providing long-term assurance that the site will be closed and maintained during the thirty-year postclosure period in a manner that protects public health and safety, and the environment from pollution due to disposal of solid waste at the CDS. As the thirty year monitoring period shall not commence until closure of the entire landfill is complete, the partial final closure of the "South Face" lower slope area of LF-1 will need to continue to assure financial resources.

The mechanism for financial assurance being used by the County is an Enterprise Fund and Pledge of Revenue. Future payments will be made in accordance with 27 CCR §22225. Appropriate documentation will be submitted by the County of Sonoma to regulatory agencies, as appropriate, under separate cover.

10.0 COMPILATION OF APPROVALS

In accordance with requirements of 27 CCR §21790(b)(9), provided below in ***Table 17*** is a list of all approvals having jurisdiction over CDS landfill operations.

Table 17. Compilation of Approvals

Approval	Agency	Permit No. (Date)
Solid Waste Facility Permit	CalRecycle and LEA	49-AA-0001 (January 2012)
Land Use	Sonoma County Permit and Resource Management Agency	N/A
Waste Discharge Requirements (Landfill)	North Coast RWQCB	R1-2004-0040 (June 2004)
Monitoring and Reporting Program	North Coast RWQCB	R1-2004-0040 (June 2004)
RWQCB Resolution	North Coast RWQCB	R1-2005-0003 (January 2005)
Waste Discharge Requirements (Leachate Pipeline)	North Coast RWQCB	2006-0003-DWQ (2006)
Major Facility Review Permit (Title V Permit)	Bay Area AQMD	Facility #A2254 (April 2008)
Permit to Operate (issued annually)	Bay Area AQMD	Plant #2254 (Exp. June 1, 2013)
Wastewater Discharge Permit	City of Santa Rosa	SR-IW5202 (August 2007)

11.0 REQUIREMENTS FOR JTD/RDSI AMENDMENTS

11.1 CEQA INFORMATION

27 CCR §21570(f)(3)(4)

The existing SWFP #49-AA-0001 provides a listing of the following California Environmental Quality Act (CEQA) documents that describe and/or restrict operation of the CDS:

- An Environmental Impact Report (EIR) was filed with the State Clearinghouse (SCH #1995073068) and certified by the Sonoma County Board of Supervisors on December 15, 1998.
- A Notice of Determination was filed with the State Clearinghouse on December 15, 1998. A Technical Addendum, dated April 13, 2005 found that changes to the SWFP (issued 2005) do not require the preparation of a subsequent EIR or Mitigated Negative Declaration (MND).

A MND was filed with the State Clearninghouse (SCH #2003062080) and certified by the Sonoma County Board of Supervisors on August 5, 2003. The MND describes and supports the design and operation authorized by issuance of the 2004 revised SWFP.

The current SWFP allows filling over the entire permitted disposal area comprising 172.8 acres, contingent on revised WDRs allowing construction of new waste cells within that area. Except for the partial final closure of the 14.4-acre plan area within the South Face of LF-1, all future MSW filling proposed in this JTD will be within the approximately 172.8-acre permitted waste disposal area as identified in the existing SWFP.

An addendum to Sonoma County Central Disposal Site Improvement Program Final EIR (SCH # 1995073068) for the Reopening of the Central Disposal Site was issued in May 2012 (Sonoma County, 2012). This document is specific to the proposed site improvements (design and construction standards), operating criteria, waste handling provisions, and environmental controls, as described in this JTD. A Notice of Determination was filed on June 13, 2012.

The County proposes to initiate partial final closure of the approximately 14.4-acre area of the South Face of LF-1 as described herein. Pursuant to Section 23A-11 of the Sonoma County Code, this partial final closure project has been determined to be categorically exempt from CEQA (Sonoma County 2011). A Notice of Categorical Exemption was posted on May 31, 2011.

11.2 COMPLETE CLOSURE/POSTCLOSURE MAINTENANCE PLAN

27 CCR §21570(f)(6)

Under 27 CCR §21570(f)(6), owner/operators of MSW Landfills have the option of submitting the preliminary closure and postclosure maintenance plan with the JTD for concurrent review by the agencies. The Preliminary Closure and Postclosure Maintenance Plans are submitted herein and included in **Section 9** of this JTD.

11.3 CONFORMANCE FINDING INFORMATION

27 CCR §21570(f)(5)

The Central Disposal Site is identified on page 6-2 in the Sonoma County Integrated Waste Management Plan, which was approved by CalRecycle on July 30, 1996. The location of the CDS is identified in the Sonoma County Countywide Siting Element, dated October 2003, prepared pursuant to Public Resources Code Section 50001(a).

11.4 OPERATING LIABILITY INSURANCE

27 CCR §21570(f)(7 and 8) and §22215

A copy of the most recently submitted detailed written estimate identifying to cover the cost of corrective actions addressing a known or reasonably foreseeable release is provided in ***Appendix Q***.

27 CCR §22215 requires that operators of disposal facilities demonstrate adequate financial ability to compensate third parties for bodily injury and property damage caused by facility operation prior to closure. The County of Sonoma is self-insured for general liability covering bodily injury and property damage and maintains a self-insured retention to meet coverage limits required by the regulations. Supporting documentation is provided in ***Appendix T***.

11.5 LAND USE AND/OR CONDITIONAL USE PERMIT INSURANCE

27 CCR §21570(f)(7 and 8)

According to the County of Sonoma, the Central Disposal Site is zoned as “public facilities”, which is the designation given to land utilized by the County. The County is exempt from zoning requirements and a conditional use permit is not required per Sonoma County Permit and Resource Management Department (Sonoma County, 2011). The CDS has been used as a solid waste facility since 1971. Documentation of the designated use is provided in the project EIR referenced above (SCH #95073068) and the existing SWFP.

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