FINAL CLOSURE PLAN AND POST-CLOSURE MONITORING AND MAINTENANCE PLAN WASTE MANAGEMENT UNITS II – IV

BONZI SANITATION LANDFILL
STANISLAUS COUNTY, CALIFORNIA

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PROJECT NO. 2012.0023

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LIST OF ACRONYMS

CalRecycle	California Department of Resources Recycling and Recovery
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CIWMB	California Integrated Waste Management Board
CQA	Construction Quality Assurance
DPCD	Stanislaus County Department of Planning and Community Development
FCP	Final Closure Plan
ft^2	Square Foot
GTS	Groundwater Treatment System
LA	Lead Agency
LFG	Landfill Gas
LLDPE	Linear Low Density Polyethylene
MCE	Maximum Credible Earthquake
PGA	Peak Ground Acceleration
PTO	Permit to Operate
PVC	Polyvinyl Chloride
RWQCB	Regional Water Quality Control Board
SCADA	Supervisor Control and Data Acquisition

SJVAPCD	San Joaquin Valley Air Pollution Control District
SWFP	Solid Waste Facilities Permit
TS/MRF	Transfer Station/Materials Recovery Facility
WMU	Waste Management Unit
WDRs	Waste Discharge Requirements
yd^3	Cubic Yards

EXECUTIVE SUMMARY

The following Final Closure Plan and Post-Closure Monitoring and Maintenance Plan (referred to hereinafter as the Final Closure Plan) describes planned final closure and post-closure monitoring and maintenance procedures for Waste Management Units (WMUs) II, III, and a portion of IV at the Bonzi Sanitation Landfill, located in Stanislaus County, California. In addition to meeting the requirements specified in Title 27 of the California Code of Regulations (CCR), the Final Closure Plan addresses comments from the Regional Water Quality Control Board (RWQCB) included in a letter dated May 22, 2006 and from the California Department of Resources Recycling and Recovery (CalRecycle), formerly the California Integrated Waste Management Board (CIWMB) in a letter dated March 29, 2006 regarding a previously prepared Final Closure Plan that was submitted by EBA Engineers in February 2006. Geo-Logic Associates (GLA) has updated the Final Closure Plan based on comments received from the RWQCB and CalRecycle in letters dated June 27, 2013, March 5, 2014, July 24, 2014, November 25, 2014, and December 9, 2014 regarding the previously prepared July 2006 Final Closure Plan submitted by Geomatrix and the October 2014 Final Closure Plan prepared by Geo-Logic Associates.

PURPOSE AND SCOPE OF DOCUMENT

Pursuant to CCR Title 27 requirements, the purpose of this Final Closure Plan is to:

1. Provide an accurate schedule of all actions necessary to close the landfill and to carry out post-closure maintenance.
2. Provide an accurate estimate of the cost of achieving each action listed in the plan.
3. Provide a detailed plan and schedule for the operator to implement upon closure of the landfill.
4. Provide an enforceable list and schedule of actions necessary for providing water quality protection at the landfill during the closure and post-closure maintenance periods.

The following Final Closure Plan has been prepared in accordance with these objectives and includes a detailed description of each item contained in CCR Title 27 §21790(b)(1) through (b)(8); a description of the sequence of closure stages; a cost estimate for closure and post-closure activities; and a demonstration of financial responsibility. The Final Closure Plan also includes an index (Table E-1) that immediately precedes the main body of text and identifies where the information required by CCR Title 27 may be located in the document.

PRINCIPAL CLOSURE COMPONENTS

Principal closure activities described in the following Final Closure Plan include construction of final cover, surface water drainage structures, and completion of a flood protection berm around the landfill. Other environmental control and related systems such as groundwater monitoring wells, landfill gas (LFG) collection wells, and a groundwater treatment system (GTS) are currently in place at the landfill. Closure construction will be performed under the Construction Quality Assurance (CQA) procedures included in the CQA Plan that is appended to this document.

Final Cover and Grading

The final cover proposed for WMUs II - IV includes the following layers (from bottom to top):

- A 2-ft-thick (minimum) compacted intermediate cover (placed in the Fall of 2012);
- A variable thickness compacted foundation layer (to provide a proper grades for layers placed above);
- A low permeability layer consisting of 60-mil linear low density polyethylene (LLDPE) geomembrane;
- A double-sided geocomposite drainage layer on top of the LLDPE along the northern side slope; and
- A 1.5-ft-thick layer of vegetative/protective cover soil.

The landfill is unlined and the low permeability LLDPE layer has an effective permeability that is much lower than the requirement to "attain a hydraulic conductivity of either $1x10^{-6}$ cm/sec (i.e., 1 ft/yr) or less, or equal to the hydraulic conductivity of any bottom liner system or underlying natural geologic materials, whichever is less permeable." The maximum (steepest) final grades proposed for closure are 4:1 (horizontal: vertical) and the top deck of the closed facility will be inclined at a minimum inclination of two percent. Final cover material sources will include interim cover soil that is currently in-place on the landfill and soil from borrow areas adjacent to the landfill. The final surface of the closed facility will be vegetated with a hydroseed mixture of native grasses and forbs that will not require irrigation.

Surface Water Drainage Control

The surface water drainage system for closure was designed based on the 100-year, 24-hour storm event. Storm water control structures to be constructed during closure include a series of perimeter ditches and culverts that will discharge to the existing northern storm water sedimentation basin. The landfill is located within a 100-year flood plain and will be protected from washout or inundation by a perimeter berm.

Groundwater and Landfill Gas Monitoring and Control

Monitoring, control, and treatment systems for groundwater and LFG in WMUs II through IV are currently in place and will continue operating during the closure and post-closure maintenance periods. Modification to the current monitoring and control systems during closure may include vertical extension of LFG extraction wells and horizontal collector trench risers, relocation and installation of additional header system piping and laterals, and relocation/installation of condensate collection dropouts. Similar modifications may also be required for selected groundwater monitoring wells and perimeter LFG monitoring points along the eastern and southern property boundaries as a result of the perimeter access road construction. Two additional landfill gas monitoring probes will be installed prior to closure activities.

Sequence of Closure Construction

The principal tasks to be performed and general sequence of closure stages include:

1. **CEQA Compliance.** The existing Solid Waste Facilities Permit (SWFP) for the landfill references a Negative Declaration that was prepared and certified by the Stanislaus County Department of Environmental Resources and submitted to the State Clearinghouse (State Clearinghouse No. 92012070) on January 23, 1992. It is uncertain whether the Negative Declaration specifically addresses closure of the landfill (the RWQCB is currently trying to locate this document). In the event the current Negative Declaration addresses closure, the project is CEQA compliant. If additional CEQA documentation is required for compliance, it is assumed to include preparation of documents to support certification of a Negative Declaration or Mitigated Negative Declaration for the closure project. Preparation of a new or Supplemental Environmental Impact Report (SEIR) is not anticipated. In the event additional CEQA work is required, it will be performed prior to closure approximately on the schedule described in this Final Closure Plan.

2. **Preparation of Final Construction Documents.** Final construction documents including Drawings, General Conditions, and Technical Specifications are included in this Final Closure Plan. These documents will then be used for bidding and to select a closure construction contractor.

3. **Final Cover Construction.** Final cover construction will include placement of the foundation layer, LLDPE low permeability layer, placement of the geocomposite drainage layer, and placement of the vegetative/protective cover layer. Modifications (if any) to the LFG system and groundwater monitoring wells will be performed concurrently with cover construction. Approximately 2-feet of intermediate cover were placed by Sukut Construction in the Fall of 2012.

4. **Surface Water Drainage and Access Road Construction.** Construction of the surface water drainage system and perimeter access road will be constructed concurrently with the final cover. The hydroseed vegetative surface will be placed following completion of the surface water drainage system and final cover.

5. **Closure Construction Certification.** Following completion of closure activities, a final closure CQA report will be submitted that certifies closure of the parcel in general accordance with the plans and specifications for the project. The report will include as-builts of the geomembrane panel layout.

Construction Quality Assurance

The CQA Plan for closure describes procedures to ensure that materials and procedures used in the construction of the final cover will be tested, installed, and monitored in accordance with the requirements of the final construction documents and the design specifications presented herein. The CQA Plan includes specific testing and acceptance requirements for the different closure components and describes the experience requirements of the contractor, the work crew, and the inspectors that will be associated with the project.

POST-CLOSURE MONITORING AND MAINTENANCE

The goal of post-closure maintenance is to assure that the closed landfill continues to comply with the performance standard to minimize the infiltration of water into the waste, thereby minimizing the production of leachate and gas. To meet this objective, the Post-closure Monitoring and Maintenance Plan describe activities to:

- Maintain the structural integrity and effectiveness of all containment structures, and maintain the final cover as necessary to correct the effects of settlement or other adverse factors;
- Maintain monitoring and control systems and monitor the groundwater, surface water, and the unsaturated zone in accordance with applicable requirements of CCR Title 27, Article l, Subchapter 3, Chapter 3, Subdivision 1 (§20380 et seq.);
- Minimize erosion and related damage of the final cover due to drainage; and
- Protect and maintain surveyed monuments [installed under §20950(d).

COST ESTIMATE AND FINANCIAL ASSURANCE

The closure and post-closure cost estimates were prepared based on the assumption that a third party will be responsible to complete the closure construction activities described in this Final Closure Plan. A demonstration of financial responsibility for closure and post-closure care has been completed in accordance with the requirements of 27 CCR §22205 et seq.

TABLE E-1
CLOSURE/POST CLOSURE REGULATORY MATRIX - CALRECYCLE

CALRECYCLE - CLOSURE/POST-CLOSURE MAINTENANCE PLAN - PRELIMINARY CLOSURE PLANS	CALRECYCLE SECTION NO.	SWRCB SECTION NO.	PLAN SECTION(S)
Cost Analysis and Estimate	21790(b)(1)	21769(b)(2)(A) & (c)(2)(A)	Sect. 4.0 & App. H
Maps	21790(b)(2 & 4)	21769(b)(2)(B) & (c)(2)(D)	Attached Figures & Drawings
Final Treatment Procedures		21769(c)(2)(C)	N/A
Post-Closure Land Uses	21790(b)(5)	21769(c)(2)(H)	Sect. 3.1
Estimate of Required Closure	21790(b)(6)		Sect. 2.1.4
Estimated Closure Date	21790(b)(7)	21769(c)(2)(B)	Sect. 2.1.5
Closure Activities	21790(b)(8)		Sect. 2.2
Site Security and Structure Removal	21790(b)(8)(A)		Sect. 2.2.8
Final Cover and Grading	21790(b)(8)(B)	21090	Sect. 2.2.1 & 2.2.2
Construction Quality Assurance	21790(b)(8)(C)	21090(b)(1)(E)	Sect. 2.4 & App. C
Drainage and Erosion Control	21790(b)(8)(D)	21090(b)(1) and (3)	Sect. 2.2.6, 2.2.7 & App. E
Gas Monitoring	21790(b)(8)(E)	20425(d)(3)	Sect. 2.3.4, 3.3.4 & App J
Leachate Monitoring	21790(b)(8)(F)	21090(c)(2)	N/A
Items Under 21790 (Preliminary Plans)	21800(c)	21090	All Sections
Sequence of Closure Stages With Dates	21800(c)	21769(c)(2)(B)	Sect. 2.7
Schedule for Disbursement	21800(d)		Sect. 5.0
Description of Planned Uses per 21190	21825(b)(1)	21769(c)(2)(H)	Sect. 3.2
Description of Maintenance per 21180	21825(b)(2)		Sect. 3.0
Emergency Response Plans per 21130	21830(b)(1)		N/A
List of Responsible Parties	21830(b)(2)		N/A
Post-Closure Planned Uses per 21190	21830(b)(3)	21769(c)	Sect. 3.2

CALRECYCLE - CLOSURE/POST-CLOSURE MAINTENANCE PLAN - PRELIMINARY CLOSURE PLANS	CALRECYCLE SECTION NO.	SWRCB SECTION NO.	PLAN SECTION(S)
As-built Description of Monitoring and Control Systems, etc.	21830(b)(4)		N/A
Description of Maintenance per 21180	21830(b)(5)		N/A
Operations and Maintenance Plan for Gas Control System	21830(b)(6)		N/A
Plan to Report Results of Monitoring/Control per 21180	21830(b)(7)		N/A
Post-Closure Maintenance Cost Estimates per 21840	21830(b)(8)	21769(c)(2)(A)	Sect. 4.0 & App. H

TABLE 2-2
CLOSURE/POST CLOSURE REGULATORY MATRIX – SWRCB

SWRCB REQUIREMENT	SWRCB CITATION	RELATED CALRECYCLE CITATION	SECTION RANGE(S) FULFILLING SWRCB CITATION
Chapter 3. Criteria for All Waste Management Units, Facilities, and Disposal Sites			
Subchapter 5. Closure and Post-Closure Maintenance ** Article 1. General Standards For All Waste Management Units **			
20950. General Closure and Post-Closure Maintenance Standards Applicable to Waste Management Units (Units) for Solid Waste.	20950	re (f): 21780(a)(3), 21790(b)(1), 21800(c), 21820, 21840	All Sections
Article 2. Closure and Post-Closure Maintenance Standards for Disposal Sites and Landfills 21090. Closure and Post-Closure Maintenance Requirements for Solid Waste Landfills.			
Final cover requirements (general)	21090(a)-(a)(2)	21140, 21790(b)(8)(B), 21800(c)	Sect. 2.2.1
Erosion control layer	21090(a)(3)-(a)(3)(A)3.	21140, 21150, 21790(b)(8)(D), 21800(c)	Sect. 2.2.1 & 2.2.7
Maintenance (& plan for)	21090(a)(4)-(a)(4)(D)		Sect. 3.3
Discharges of liquids to covers (leachate & condensate)	21090(a)(5)(A)		N/A
Discharges of liquids to covers (other liquids)	21090(a)(5)(B)	20800, 21600(b)(8)(D)	N/A

SWRCB REQUIREMENT	SWRCB CITATION	RELATED CALRECYCLE CITATION	SECTION RANGE(S) FULFILLING SWRCB CITATION
Stability analysis	21090(a)(6)	21145, 21790(b)(8)(B)	Sect. 2.2.3 & App. D
Grading requirements (performance standards)	21090(b)-(b)(3)	20650, 21142(a), 21150, 21600(b)(4)(D), 21790(b)(8)(B)	Sect. 2.2.2
General post-closure duties	21090(c)-(c)(5)	re (c)(2): 21150, 21160, 21180, 21790(b)(8)(F) // re (c)(4): 21600(b)(8)(F)	Sect. 3.0 & 3.3
Landfill closure deadline & extension	21090(d)	21110, 21790(b)(8), 21800(c)---N/A	N/A
Final cover survey(s)	21090(e)-(e)(4)	21142(b)	
Optional clean closure	21090(f)-(f)(2)	21810	N/A
21132. Landfill Emergency Response Plan Review.	21132		N/A
21400. Closure Requirements for Surface Impoundments.	21400		N/A
21410. SWRCB - Closure Requirements for Waste Piles.	21410		N/A
Chapter 4. Documentation and Reporting For Regulatory Tiers, Permits, WDRs, and Plans			
Subchapter 4. Development of Closure/Post-Closure Maintenance Plans SWRCB - Closure and Post-Closure Maintenance Plan Requirements.			
Prelim. Cl/P-Cl Plan purpose	21769(b)(1)		N/A
Prelim. Cl/P-Cl Plan contents cost analysis	21769(b)(2)-(b)(2)(B)5.		N/A
Final Cl/P-Cl Plan	21769(c)-(c)(2)(H)3.		All Sections
Chapter 5. Enforcement Article 4. Enforcement by Regional Water Quality Control Board (RWQCB) **			
22190. SWRCB - Mandatory Closure (Cease and Desist Orders).	22190(b)		N/A
Chapter 6. Financial Assurances at Solid Waste Facilities and at Waste Management Units for Solid Waste Subchapter 2. Financial Assurance Requirements Article 1. Financial Assurance for Closure			
22207. SWRCB - Closure Funding Requirements.	22207(a)		Sect. 5.0

SWRCB REQUIREMENT	SWRCB CITATION	RELATED CALRECYCLE CITATION	SECTION RANGE(S) FULFILLING SWRCB CITATION
Article 2. Financial Assurance for Post-closure Maintenance			
SWRCB - Post-Closure Funding Requirements.	22212(a)		Sect. 5.0
Article 4. Financial Assurance Requirements for Corrective Action			
SWRCB - Corrective Action Funding Requirements.	22222		N/A

1.0 INTRODUCTION

Geomatrix and Geo-Logic Associates (GLA) are pleased to present this revised Final Closure Plan and Post-closure Maintenance Plan (Final Closure Plan) for Waste Management Units (WMUs) II through IV at the Bonzi Sanitation Landfill, located in Stanislaus County California. Revisions to the Final Closure Plan were completed to address comments from the Regional Water Quality Control Board (RWQCB) in a letter dated May 22, 2006 and from CalRecycle, formerly the California Integrated Waste Management Board (CIWMB) in a letter dated March 29, 2006 regarding a previous Final Closure Plan for WMUs II though IV prepared by EBA Engineers in February 2006. This revised Final Closure Plan has been prepared in accordance with in the Stipulated Judgment for Injunction, Civil Penalties, and Relief dated December 23, 2005 (Stipulated Judgment), Title 27 of the California Code of Regulations (CCR) and Section 40 of the Code of Federal Regulations (CFR). In addition, GLA has provided updates based on comments received from the RWQCB and CalRecycle in letters dated June 27, 2013, March 5, 2014, and July 24, 2014 regarding the previously prepared July 2006 Final Closure Plan submitted by Geomatrix.

The Bonzi Sanitation Landfill is privately owned and operated by Ma-Ru Holding Company, Inc. and includes four separate WMUs (I, 11, III, and IV) WMU II and the western half of WMU III are Class III disposal modules and WMU IV and the eastern half of WMU III are "unclassified" inert disposal modules. WMU I, which operated as a Class III disposal module and was the initial location of disposal operations at the landfill, was closed in 1998.

In general, the objectives of this Final Closure Plan is to identify and describe the tasks for closing WMUs II through IV in a manner that will protect the public health and safety and the environment. This Final Closure Plan also serves as the basis for developing an estimate of the costs associated with closure of WMUs Il through IV. It should be noted that this Final Closure Plan was developed at the request of the RWQCB to address Compliance Item #20 of the Stipulated Judgment that requires submittal of a final closure plan for WMUs II and III. Although closure of WMU IV is not part of the Stipulated Judgment, Ma-Ru Holding Company, Inc. has elected to incorporate the closure of this WMU into the closure program. As a result, this Final Closure Plan addresses the closure of all three WMUs at the Landfill.

A copy of the Final Closure Plan will be maintained at the landfill throughout active operations, closure, and the post-closure maintenance period. In the event it becomes impractical to maintain a copy at the landfill during the closure or post-closure maintenance period, a copy of the Final Closure Plan will be maintained at an alternate location, as approved by CalRecycle.

1.1 Background

The landfill has been operated as a waste management facility since 1967. The entire facility includes four WMUs, identified herein as WMUs I through IV (Drawing G02). The WMUs are unlined and are not equipped with leachate collection and removal systems. WMU I represents the initial disposal module used for waste placement operations, followed by WMU II, the western half of WMU III, the eastern half of WMU III, and WMU IV. General characteristics of the WMUs include:

- **WMU I:** This Class III module is approximately 36.4 acres in size and was operated from 1967 to 1978. The types of waste deposited in this module include municipal refuse, agricultural wastes, industrial wastes, and construction wastes. The estimated volume of waste placed in WMU I is approximately 2 million cubic yards (yd^3).
- **WMU II:** This Class III module is approximately 17.7 acres in size and was operated from 1978 to 1984. The types of waste deposited in this module include municipal refuse, agricultural wastes, industrial wastes, and construction wastes. The estimated volume of waste placed in WMU II is approximately 750,000 yd^3.
- **WMU III (Western Half):** This Class III module is approximately 10.9 acres in size and was operated from 1984 to 1992. The types of waste deposited in this module include agricultural wastes, industrial wastes, and construction wastes. The estimated volume of waste placed in the western half of WMU III is approximately 262,000 yd^3.
- **WMU III (Eastern Half):** This "unclassified" module is approximately 8.9 acres in size and was operated from 1992 to 1999. The placement of waste in this module represented the operational transition to the acceptance and disposal of inert wastes only, thereby providing the basis for its "unclassified" designation by the RWQCB. The types of waste deposited in this module include industrial and construction wastes. The estimated volume of waste placed in the eastern half of WMU III is approximately 215,000 yd^3.
- **WMU IV:** WMU IV, which is approximately 19.6 acres in size (including the northern stormwater retention basin), has been in operation since 1999 and is currently inactive. Similar to the eastern half of WMU III, WMU IV is an "unclassified" module that has been used for inert wastes only as defined in 27 CCR, §20230. At the time of site preparation, this module was inadvertently over-excavated below the historic high groundwater elevation. As a result, and as mandated by the RWQCB, the over-excavated portion was filled with only concrete, clean earth, and rock to an elevation of 58 feet above mean sea level (MSL). The types of waste used to fill portions above the 58 feet MSL baseline include inert waste defined in 27 CCR, §20230 and other inert wastes specifically permitted under the Landfill's current Solid Waste Facilities Permit (SWFP) (No. 50-AA-003) and Waste Discharge Requirements (WDRs) Order No. 98-093.

As previously noted, WMU I was closed in 1998. The final closure construction activities encompassed the installation of a final cover system that included (in ascending order): a 24-inch thick foundation layer; a 30-mil minimum thickness polyvinyl chloride (PVC) flexible membrane low-hydraulic-conductivity layer; and an 18-inch thick vegetative layer. Improvements to WMU I also included the installation of interior and perimeter drainage facilities.

The landfill is currently inactive. Existing environmental control facilities include active treatment processes for both groundwater and landfill gas (LFG). Other pertinent ancillary facilities associated with the landfill are all located outside the limits of buried refuse and are summarized below (the locations of these facilities are shown on Drawing G02):

- A tipping/processing area Is located within the north-central portion of the site between WMUs I and IV. This area is lined with reinforced concrete and is approximately 102,000 square feet (ft^2) in size. A truck loading dock is located near the northeast corner of the tipping area.
- An equipment maintenance shop located within the southwest portion of the tipping/processing area. This shop consists of a metal building and is approximately 6,400 ft^2 in size.
- A hazardous materials storage container is located at the southwest corner of the equipment maintenance shop. This container is stored beneath the equipment maintenance shop southern canopy.
- An administrative office is located at the western entrance main gate off Hatch Road near the landfill northern property boundary.
- The scalehouse and scale are located northeast of the administrative office.
- A vehicle canopy is located southeast of the administrative office.
- A lunchroom and storage building are located west and adjacent to the administrative office.
- A single-family residence for a landfill employee is located west and adjacent to the lunchroom/storage building.
- A water supply well is located north and adjacent to the single-family residence. The water supply well is inactive.
- A 10,000-gallon above ground water tank is located east of the scalehouse.
- A drop box storage area (approximately 1.3 acres in size) is located north and adjacent to WMU IV.
- A miscellaneous storage area (approximately 7 acres in size) is located in the northeast corner of the property. This area includes two pole bam/canopy structures.
- A groundwater treatment system (GTS) complex and LFG flare station (including two, 3,200-gallon high-density polyethylene [HDPE] condensate storage tanks) is located west of the single-family residence.
- The GTS retention pond (approximately 4.4 acres in size) is located in the southwest corner of the landfill property.

The landfill currently operates under permits issued by the Stanislaus County Department of Planning and Community Development, CalRecycle, RWQCB, and San Joaquin Valley Air

Pollution Control District (SJVAPCD). Copies of the landfill's active permits are included in Appendix A.

1.2 Final Closure Plan Organization

Details of the closure design concepts are presented in Section 2. In general, Section 2 identifies and describes the tasks for closing WMUs II through IV in a manner that will protect the public health and safety and the environment. Section 3 of the Plan describes the post-closure monitoring and maintenance procedures for WMUs II through IV, including operation and maintenance requirements of the LFG system and the GTS. The engineer's cost estimate to implement the closure activities and corresponding fund disbursement schedule are presented in Section 4 and Section 5, respectively. References are included in Section 6 and supporting calculations and documentation are included in the appendices.

2.0 FINAL CLOSURE PLAN

2.1 General Site Information

2.1.1 Location

27 CCR, §21800(c) and §21790(b)(2)

The general location of the landfill is shown on Drawing G01. The landfill is located in the northern one-half of Section 12, Township 4 South; Range 8 East, Mount Diablo Baseline and Meridian, at 2650 West Hatch Road in an unincorporated area of Stanislaus County, California. The site is approximately three miles southwest of Modesto and five miles west of State Highway 99 and comprises Assessor's Parcel Numbers 017-41-36 and 017-41-11. The point of access for the landfill is from Hatch Road, which borders the site to the north.

Site plans showing existing features of the facility, legal property boundaries, on-site structures, entry roads, total permitted acreage of the landfill, and total acreage used for waste disposal are shown on Drawings G01 and G02. As shown on Drawing G02, the entire property encompasses approximately 135 acres, of which approximately 115 acres are permitted for solid waste disposal under the existing SWFP No. 50-AA-003[1]. A copy of the SWFP is enclosed in Appendix A of this Plan. The remaining 20 acres correspond to the GTS retention pond area (13 acres) in the southwest corner of the property and a miscellaneous storage area (approximately 7 acres) located in the northeast corner of the property. Previous ~~and current~~ site operations have encompassed most of the 115-acre permitted area except for a small area

[1] Note that the landfill SWFP and WDRs indicate the facility is located on a 128-acre parcel that is comprised of Assessor's Parcel Numbers 17-41-36 and 17-41-11. This acreage generally corresponds to the permitted area (115 acres) and the GTS retention pond area (13 acres). However, the 128-acre reference does not account for the 7-acre storage area located in the northeast corner of the property, which is technically part of Assessor's Parcel Number 17-41-36. Accordingly, the entire property acreage (135 acres) presented in the previous paragraph reflects the adjusted acreage to account for this omission.

along the northern property boundary that is used for site access and storage, the administrative office, a single-family residence, the GTS complex, and the LFG flare station.

Land use within one mile of the site is primarily agricultural. Those areas within one mile that are not used for agriculture are comprised of open space, residential developments, and commercial use properties. Land within 1,000 feet of the site was originally zoned for Exclusive Agricultural (A-2-10) at the time the landfill's SWFP was granted in 1984. General land uses within 1,000 feet of the landfill property boundary include:

- Lands north of the landfill are used primarily for residential and industrial purposes, the Riverdale Park Tract subdivision is located approximately 100 feet north of the northern Landfill boundary. A transfer station/materials recovery facility (TS/MRF) owned and operated by Waste Management, Inc. is located north-northwest of the landfill. The TS/MRF property includes an old burn dump formerly operated by Modesto Disposal Service, Inc. A Veterans of Foreign Wars (VFW) facility is located east and adjacent to the TS/MRF property. The Tuolumne River borders each of the aforementioned developments and facilities and is located approximately 1,000 to 1,200 feet north of the landfill.
- Lands west of the landfill are mixed agricultural, commercial, and residential uses. An auto wrecking yard and residence is located west and adjacent to the northern part of the landfill's western property boundary.
- Lands south of the landfill are used exclusively for agriculture. These lands include an approximate 153-acre orchard to the south-southeast, a 14.5-acre orchard, and an approximate 140-acre vineyard to the south-southwest that is owned by Ma-Ru Holding Company, Inc. (the landfill owner).
- Lands east of the landfill are used primarily for agriculture although a small market and house are situated on a 0.65-acre parcel located near the northeast corner of the site and are bounded to the west, south, and east by landfill property. A trucking company borders a portion of the landfill near the southeast property corner.

2.1.2 Topographic Map

27 CCR, §21769(c)(2)(D)

Topographic maps of the site are presented in Drawings G02, C01, C02, C03, and C04. Drawing G02 includes a small-scale topographic map of the entire site, whereas Drawings C01 through C04 ~~is~~ are large-scale maps of the areas to be encompassed by the final closure activities (i.e., WMUs II through IV). Information added to the topography on these maps includes:

- Final limits of waste placement in WMUs II through IV;
- Boundaries of WMUs II through IV and associated areas to be encompassed by the final closure operations;

- Projected final contour grades for WMUs II through IV and surrounding areas (maximum elevation of the final cover is 97 feet MSL); and
- Pertinent surface drainage patterns and features.

2.1.3 Proposed Post-Closure Land Uses

27 CCR, §21769(c)(2)(H), §21800(c) and §21790(b)(5)

Post-Closure land use for WMUs II through IV will be non-irrigated open space. The respective WMUs will be vegetated at the time of closure and returned to a natural setting, with the exception of access roads, environmental monitoring and control systems, and drainage structures. A final cover post-closure maintenance program (described in Section 3) will be implemented to maintain the integrity and effectiveness of the final cover throughout the post-closure period.

2.1.4 Estimate of the Maximum Extent Requiring Closure

27 CCR, §21800(c) and §21790(b)(6)

Drawing C02 shows the estimated maximum area requiring closure as part of this Final Closure Plan. As shown on Drawing C02; the proposed closure area is approximately 48 acres and encompasses all of WMUs II and III and the southern portion of WMU IV. Because WMU IV and the eastern half of WMU III are "unclassified" modules that only contain inert wastes, the final cover requirements stipulated in 27 CCR, §21090(a) do not apply to these modules. However, extending the final cover into these areas is proposed as a groundwater quality protection measure and to enhance LFG collection efforts. For the case of WMU IV, the northernmost extent of the final cover will be terminated at the northern perimeter access road (see Drawing C11) at an elevation at or above the 58-foot MSL boundary within the over-excavated area. Additional information regarding closure of the over-excavated area is presented in Subsection 2.2.5.

2.1.5 Closure Date

27 CCR, §21800(c) and §21790(b)(7)

The final receipt of waste for WMU IV was in 2009. An intermediate cover was placed in the Fall of 2012 and it is anticipated that the final cover and ancillary final closure components will happen in year 2015/2016.

2.1.6 Final Treatment Procedures for Waste

27 CCR, §21769(c)(2)(C)

Wastes included in WMUs II through IV include municipal solid waste and inert waste that do not require additional treatment prior to closure. In the event wastes are exposed during closure construction that could affect the final grading plan or the final cover, they will be relocated to other areas within WMUs II through IV and buried beneath the final cover system.

2.2 Final Closure Design Components

Design of the final cover system is presented in Subsection 2.2.1 through 2.2.8.

2.2.1 Final Cover System

27 CCR §21800(c), §21790(b)(8)(B), §21140 and §21090(a)

2.2.1.1 Proposed Final Cover Design

The final cover design for WMUs II through IV will be constructed in accordance with applicable state and federal regulations to minimize infiltration of water into the buried waste, thereby minimizing the production of leachate and LFG. The proposed final cover system is shown in Drawings C10 and C11 includes (from bottom to top):

- An intermediate cover layer consisting of a 24-inch thick layer of soil compacted to at least 90 percent relative compaction in accordance with ASTM D1557. This layer was placed in the Fall of 2012 by Sukut Construction which consisted of approximately 118,200 yd^3 of native soil from the borrow area shown on Drawing C03. In addition, Sukut Construction also excavated approximately 83,581 yd^3 of inert material from the northern stormwater retention basin and place it within the depression areas of WMU II through IV.
- A variable thickness foundation layer consisting of soil compacted to at least 90 percent relative compaction in accordance with ASTM D1557. The thickness of the foundation layer is variable as it is designed to provide a base cover at the design grades for placement of the low hydraulic conductivity layer. In accordance with CCR Title 27 requirements and depending on materials available at the time of closure construction, the foundation layer may also include contaminated soil, incinerator ash, or other waste materials. provided that such materials have appropriate engineering properties to be used for the layer.
- A low hydraulic conductivity layer consisting of a 60-mil thick Linear Low Density Polyethylene (LLDPE) geomembrane liner with a hydraulic conductivity of less than or equal to 2×10^{-11} centimeters per second (cm/sec). Allowable material properties for the LLDPE will be included in the Technical Specifications for the project and are summarized in the CQA Plan (Appendix C).
- A double-sided geocomposite drainage layer placed along the northern sideslope to provide vegetative layer drainage. The geonet composite drainage layer will also serve to protect the liner during placement of the vegetative layer.

- An 18-inch thick layer of vegetative/protective cover soil that will be compacted to a firm consistency, and will be capable of supporting a hydroseed mixture of native grasses and forbs upon completion.

  The proposed seed mixture for closure will be based on local application experience and will include wheat straw, tackifier, and fertilizer. A drought-tolerant annual grass/legume mixture with an effective 12-inch root zone will be used to minimize potential root penetration to the barrier layer. Soil amendments to enhance germination and support the vegetation may also be broadcast prior to hydroseeding.

2.2.1.2 Final Cover Construction

Construction of the final cover will include the following generally sequential steps:

- Existing vegetation on the surface of the intermediate cover will be removed in areas designated to receive final cover.
- The miscellaneous inert waste piles stockpiled in the over-excavated portion of WMU IV have been removed and relocated to areas within WMUs II, III, and IV that required additional fill. The relocated refuse/inert materials was compacted following placement in accordance with the intermediate cover specifications (Geo-Logic, September 2012).
- Following the relocation of refuse/inert materials as described above, 24-inches of intermediate cover soil was placed over WMUs II through IV. The soil fill material was moisture conditioned at the time of placement and compacted to a minimum 90 percent of maximum dry density pursuant to ASTM D1557 test procedures.
- Areas with intermediate cover that can be incorporated into the final cover system will be fine graded by cutting or filling to eliminate rough or low areas. Upon completion of the fine grading operations, the upper 6 inches of the existing intermediate cover layer material will be scarified, moisture conditioned, and compacted to a minimum 90 percent of maximum dry density pursuant to ASTM D1557.
- Additional foundation layer material will be placed, moisture conditioned, and compacted in 6-inch lifts to match final foundation layer design grades.
- Following preparation of the foundation layer surface, the geomembrane will be deployed and the seams will be welded in accordance with the Technical Specifications for the project.
- The protective geocomposite drainage layer will be deployed on top of the completed geomembrane along the northernmost sideslope. The geocomposite panels will be stitched in accordance with the Technical Specifications for the project.
- Vegetative layer soil will be placed over the flexible membrane liner and geocomposite (northernmost sideslope). The need for amendments to support vegetation will be

evaluated by physical and chemical tests in accordance with the Technical Specifications and/or the CQA Plan for the project.

- Following construction, the vegetated layer of the final cover will be seeded, fertilized, and mulched to establish a cover of annual grasses. The grass cover will provide erosion protection for the final cover and protection of the infiltration layer. Other naturally occurring grasses and forbs will probably become established on the final cover with time and will provide additional erosion protection. A drought-tolerant annual grass/legume mixture with an effective 12-inch root zone will be used to minimize potential root penetration to the barrier layer. Unless a roughened condition already exists, the area to be seeded will be roughened by scarifying, disking, harrowing, track walking, or otherwise worked to a depth of 2 to 4 inches.

2.2.1.3 Proposed Final Cover Material Sources

Based on the final cover design and the overall final grades shown on Drawings C01 and C02, approximately 416,500 yd^3 of borrow source material will be required to construct the final cover system and associated appurtenances. The following breakdown summarizes the estimated in-place material requirements for the respective construction components:

- Foundation Layer: 248,800 yd^3
- Vegetative Layer: 113,200 yd^3
- Miscellaneous Engineered Fill: 54,500 yd^3

The source material (about 416,500 yd^3) will be obtained from the south-adjacent property. Of the 140-acres, approximately 18 acres will be utilized for borrow source material, and approximately 20 acres will be maintained for continued GTS discharge under WDR Order No. 90-215[2].

2.2.2 Grading

27 CCR, §21800(c), §21790(b)(8)(B), §21142 and §21090(b)

Regulatory requirements for final grades at closure are included in 27 CCR, §21090(b) and §21142. In accordance with these requirements, the final landfill grades have been designed to minimize ponding, accommodate anticipated future settlement, and reduce run-off velocities to protect the final cover from soil erosion. As shown in Drawing C02, the maximum (steepest) final grades are 4:1 and the flattest portions of the final cover are two percent.

2.2.3 Stability

27 CCR; §21090(a) and §21750(f)(5)

Stability analyses were performed to support design of the proposed final cover system and preparation of this Final Closure Plan. These analyses are described in detail in Appendix D and the results are summarized below. As described Appendix D, site-specific material property data are not currently available to quantify stability safety factors for the landfill. As a result, conservative (low) strength properties were assumed for the analyses. Site-specific tests using actual soil and geosynthetic materials that will be used for construction will be performed prior to closure construction to confirm the results of the analyses described in Appendix D. This testing would be performed immediately before construction as part of the conformance testing for the geomembrane in accordance with the CQA Plan in Appendix C. The results will be summarized in the Final CQA Report for review and submitted to the RWQCB and CalRecycle when completed.

Static stability analyses were based on the infinite slope limit equilibrium procedure summarized in Koerner and Soong (1998). In general, this procedure may be used to calculate a safety factor for a thin veneer of cover soil (1 to 3 feet thick) on a geosynthetic material at a given slope angle and slope length. The Koerner and Soong (1998) method can also incorporate seismic loading and seepage forces. A number of different analytical scenarios were considered to assess the safety factors associated with sliding within different portions of the cover.

The results of the analyses indicate static safety factors greater than 1.5 for all potential failure surfaces under the assumption that the final cover does not become saturated. Seepage analyses (included in Appendix D) suggest that sliding of the vegetative soil layer could occur on the steeper portions of the cover if this layer becomes fully saturated. However, this is a common final cover stability analysis result that does not necessarily indicate an unstable condition because the geocomposite drainage layer is intended to prevent saturation. Additionally, full vegetative soil layer saturation, should it occur, would be a transient condition.

Pseudostatic stability analyses were on a seismic coefficient of 0.15g. For cases where the pseudostatic safety factor was less than 1.5, deformation analyses would typically be performed using the generally accepted procedure described by Makdisi and Seed (1978). As summarized in Appendix D, however, all pseudostatic safety factors were greater than 1.5 and deformation analyses were not necessary.

GLA has performed a review of the cover stability analysis included in Appendix D as the final cover grading has been revised from the previous analysis. The slope that was evaluated in the previous analysis consisted of a maximum 4:1 slope with a maximum length of 75 feet, which is consistent with the northwestern slope of the updated final cover grading plan. Similarly, the proposed final cover section and materials associated with this updated FCPCMP are consistent with those used in the 2006 stability analysis. Therefore, with respect to slope stability of the final cover system, the updated final cover grading plan does not affect the stability of the cover slopes, and the methods, material properties, and results of the 2006 final cover stability analysis remain applicable to the current closure design.

2.2.4 Settlement

27 CCR, §21800(c) and §21790(b)(7)

The final cover contours are designed to conform to the existing fill slopes, accommodate storm water drainage from the landfill surface after settlement, and to minimize erosion of final cover soils. To ensure the integrity of the final cover, a program of periodic observation and maintenance will be instituted as described in Section 3 of this Final Closure Plan.

2.2.5 Survey Monuments

The landfill's existing perimeter groundwater monitoring well network, which includes monitoring wells located outside the waste footprint (Drawing G02), currently act as survey control points for the site. In addition five settlement monuments will be installed as shown on Drawing C02. These settlement monuments will be used throughout the post-closure maintenance period as reference points for future landfill settlement measurements.

2.2.6 Drainage

27 CCR, §21800(c), §21790(b)(8)(D) and §21150

2.2.6.1 Proposed Inundation Protection

According to the Flood Insurance Rate Map for Stanislaus County, California (Community Panel Number 06099C0535E), portions of the site lie within Zone X and Zone AE, 100-year base flood elevations. The base elevation for Zones X and AE are 60 and 70, respectively and are presented on Drawing C04. Both the existing and planned final grades on the eastern, southern, and southwestern portions of the landfill are above the base flood elevations for Zones X and AE. Therefore; no flood protection is required in these areas.

The final grade in the northern portion of the site is below the Zone X base flood elevation. At the northeast corner of the site, the base flood elevation is approximately 64 feet MSL; at the mid-point of the north side of the landfill, the base flood elevation is approximately 63 ft MSL; and at the northwest corner of the site, the base flood elevation is approximately 62 ft MSL. To prevent inundation or washout due to the 100-year flood, a perimeter berm along the north side~~s~~ of the site will be constructed to a level one-foot above the base flood elevations which corresponds to an elevation of 65 MSL. Details of the flood control berm are presented on Drawings C04 and C10.

2.2.6.2 Proposed Drainage System

The drainage control facilities for the final grading plan have been designed to accommodate a 100-year; 24-hour storm event. These facilities include perimeter drainage ditches that will collect and convey storm water run-off from the landfill slopes to the northern stormwater retention basin. The perimeter roadways will also be sloped in the direction of the perimeter drainage ditches to prevent off-site run-off. The only exception is the perimeter road along the north sideslope which does not have a ditch. In this location, the road will slope outwardly to drain directly to the northern stormwater retention basin. As shown on Drawings C01 and C02; the primary storm water retention pond will be located within the over-excavated portion of WMU IV (identified herein as the "northern stormwater retention basin"). Consistent with current operations, the northern stormwater retention basin will also receive storm water run-off from the northern portion of WMU-1 and from the concrete tipping pad. The northern stormwater retention basin, which is designed to retain all storm water on-site for subsequent loss by percolation and evaporation has been sized to accommodate flows associated with a 100-year; 24-hour storm event with one foot (minimum) of freeboard. Details and sections illustrating the drainage facility components are presented in Drawings C10 and C11.

2.2.7 Slope Protection and Erosion Control

27 CCR, §21800(c), §21790(b)(8)(D) and §21150

2.2.7.1 Method of Slope Protection and Erosion Control

The surfaces of WMUs II through IV will be revegetated at the time of closure as summarized above to provide protection against soil loss by water and wind erosion.

2.2.7 2 Soil Loss Analysis

A Universal Soil Loss Equation analysis is presented in Appendix F. The results of this analysis indicates that soil loss will be limited to less than 2 tons per acre per year (the threshold value suggested by the United States Environmental Protection Agency (US EPA) for landfill final covers).

2.2.8 Security

27 CCR, §21800(c), §21790(b)(8)(A) and §21135

Existing security provisions at the site include perimeter fencing that serves as a physical barrier to unauthorized access and gated entrances that are locked during closed hours. These provisions, along with the locking of utility boxes and/or gates enclosing the environmental control systems, will remain in effect throughout the post-closure maintenance period. Additional measures during closure will include the installation of signs and securing points of access to environmental monitoring and control systems and storm water retention ponds in accordance with 27 CCR, §21135. Because the facility has not allowed public disposal or access since 1984, the public notification requirements stipulated in 27 CCR, §21135(a) are not necessary.

2.2.9 Removal of Landfill Structures

27 CCR, §21800(c), §21790(b)(8)(A) and §21137

Structures that will be retained after closure include the existing administrative office, lunchroom/storage building, carport, scale house, scales, 10,000 gallon above ground water tank, and the single-family residence. All other structures (vehicle canopy) will be dismantled, removed from the site, and disposed at the time of closure.

2.3 Existing Monitoring and Control Systems

2.3.1 Locations of Current Monitoring and Control Systems

27 CCR, §21800(c) and §21790(b)(4)

Monitoring and/or control systems for groundwater and LFG in WMUs II through IV are currently in place and will continue operating during the closure and post-closure maintenance periods. These units are not equipped with either leachate or unsaturated zone monitoring or control facilities. The layouts of the respective monitoring and control systems are illustrated on Drawings G02 and G03.

2.3.2 Groundwater Treatment System

In response to Cleanup and Abatement Order 89-185, a groundwater extraction and treatment system was constructed to prevent downgradient migration of contaminants, including volatile organic compounds (VOCs), total dissolved solids (TDS), arsenic, barium, chromium and vanadium. Construction of the system was completed in November 1991.

The three primary components of the system include the extraction well field, the air stripping system, and the detention pond. The extraction well field consists of three groundwater extraction wells (EW-1 through EW-3) located near the northwestern portion of the landfill. Each of the 6-inch diameter extraction wells are equipped with a 3 to 5 horse-power pump designed to operate between 8 and 75 gallons per minute (gpm). Each extraction well is also equipped with a pressure transducer to provide remote sensing/control of the extraction pumps by the air stripping system.

The air stripping system is located on the northwestern portion of the site and consists of an air stripper tower packed with Delta-Pak®, a forced air blower, a transfer pump and miscellaneous control equipment. Although it is not currently operating, the system is also equipped with a pretreatment chemical system designed to mitigate scaling problems associated with the natural hardness of the influent water. The air stripping system is designed to treat up to 225 gpm of water with an influent air flow rate of 7,500 standard cubic feet per second. The height of the air stripper tower was designed to reduce the highest VOC concentration historically found on site by at least 98.2 percent.

The effluent from the air stripper is pumped to the lined detention pond located in the southwest corner of the landfill property. The detention pond encompasses an area of approximately 4.5 acres and is lined with a 60-millimeter high density polyethylene (HDPE) geomembrane liner. The detention pond has been sized to accommodate treatment system effluent volumes and storm volumes from the 100-year return period, 24-hour duration storm event.

2.3.3 Landfill Gas Collection System

The Landfill is currently equipped with a LFG control system. The LFG control system was originally installed in 1999, with subsequent expansions in 2003 and 2005. A site plan showing the general layout of the LFG control system is presented on Drawing G03. The current. system components include a total of eight horizontal collector trenches, 53 perimeter LFG extraction wells (EW1 through EW53), and six interior LFG extraction wells (EW54 through EW59).

The horizontal collector trenches and perimeter LFG extraction wells are connected to a series of header pipes and laterals which convey the collected LFG to the flare station located near the north end of WMU I (Drawing G03). The header pipes (8-inch diameter) and laterals (4-inch diameter) are constructed of HDPE (SDR 17) pipe. The flare station, in turn, consists of a skid mounted packaged flare system that includes the following primary equipment components:

- Two, 15 horsepower pressure blowers;
- Condensate knock-out pot;
- 100 to 700 standard cubic feet per minute, totally-enclosed vertical ground flare; and
- System control panel equipped with a programmable logic controller.

The Landfill is also equipped with a perimeter LFG monitoring network consisting of 39 monitoring points that are located at various locations along the entire Landfill property boundary. Please refer to Drawing G03 for the locations of the respective monitoring points. Both the LFG control system and perimeter LFG monitoring points are currently monitored on a monthly basis (minimum) to ensure safe operation and adequate LFG migration control.

2.3.4 Closure Modifications to Monitoring and Control Systems

27 CCR, §21800(c) and §21790(b)(8)(E and F)

Changes to the current monitoring and control systems during closure will be limited to modifications necessary to accommodate the final closure grades. Typical system modifications would include vertical extension of LFG extraction wells and horizontal collector trench risers, relocation and installation of additional header system piping and laterals, relocation/installation of condensate collection dropouts; raising groundwater monitoring wellheads, and the installation of geosynthetic boots around cover penetrations. A typical penetration detail is shown in Drawing C13. Upon completion of any wellhead modifications to the groundwater monitoring wells; the "top of casing" of each wellhead will be resurveyed and integrated with the existing groundwater monitoring well network datum.

It should be noted that the extension of wellheads and relocation of header system piping will require periodic disconnection of LFG control system components. However, the final closure construction contract will include provisions to stage the modifications in such a manner as to keep portions of the LFG control system operational during the course of construction. Necessary permits and variances will be obtained from the SJVAPCD to perform this work.

Many of the existing LFG monitoring probes are single completion and do not meet 27 CCR §21790(c)(1)(F) requirements, therefore two new LFG probes (8WR and 51N) will be constructed prior to closure activities bringing the total to 41 at the site. The locations of these probes are shown on Drawing G03. In addition, a continuous explosive gas monitoring detection system will be installed prior to closure activities in all enclosed structures (residence, lunchroom/storage building, administrative building, and scalehouse). A detailed description of the LFG monitoring system is presented in the Landfill Gas Monitoring and Control Plan (Appendix J).

2.4 Construction Quality Assurance (CQA)

Appendix C presents the CQA Plan for closure of WMUs II through IV. The CQA Plan provides that materials and procedures used in the construction of the final cover will be tested, installed, and monitored in accordance with the requirements of the final construction documents and the design specifications proposed in the Final Closure Plan. A registered civil engineer or certified engineering geologist who is designated as the CQA officer will be in charge of observing the installation of the work, reviewing the materials for conformance with the specifications and drawings, testing during and following construction, and documentation of construction in conformance with the specifications and drawings.

2.5 Compliance with California Environmental Quality Act

Geo-Logic understands that the RWQCB will act as the LA for CEQA compliance. The RWQCB has determined that the final cover construction is exempt from the provisions of CEQA pursuant to Title 14 CCR Section 15321(a)(2).

2.6 Labor Transition Plan

The Labor Transition Plan was prepared for the landfill and submitted to Stanislaus County, on July 24, 2006. The Labor Transition presents provisions for preferential reemployment and/or assistance to displaced employees of the landfill when the facility is closed. This plan has been prepared to be consistent with Title 27 of the CCR Section 21785 and Section 43501.5 to the

Public Resources Code (PRC). The operator's Labor Transition Plan certification is included in Appendix G.

2.7 Final Closure Construction Schedule

The proposed construction schedule for closure is presented in Table 2-1. The schedule will be updated upon completion of bid processes and prior to execution of the construction contract. The updated schedule will be submitted to the appropriate regulatory agencies for review.

TABLE 2-1 - FINAL CLOSURE CONSTRUCTION SCHEDULE

TASK	DESCRIPTION	DURATION (DAYS)(1,2)	IMPLEMENTATION PERIOD(2)
1	Pre-Construction Activities and Approvals(3)	89	08/31/15 – 11/27/15
2	Construction Bidding and Contract Execution	33	11/30/15 – 01/01/16
3	Contractor Mobilization	17	01/18/16 – 02/03/16
4	Site Preparation(4)	12	02/08/16 – 02/19/16
5	Engineered Fill and Foundation Layer Placement(5)	89	02/22/16 – 5/20/16
6	Final Cover Construction(6)	103	03/21/16 – 07/01/16
7	Final Site Construction(7)	19	06/20/16 – 07/08/16
8	Contractor Demobilization	5	07/11/16 – 07/15/16
9	Final CQA Report and Certification(8)	61	07/18/16 – 09/16/16
10	Final Closure and Post-Closure Maintenance Plan Amendments	89	09/19/16 – 12/16/16

Notes:

(1) Calendar days.

(2) The duration of individual tasks and corresponding implementation periods are estimates. An updated schedule will be submitted upon completion of the bid process and prior to execution of the construction contract.

(3) Includes preparation of construction plans, specifications, regulatory review and approval of the final closure components, and landfill gas system assessment.

(4) Includes clearing and grubbing, structure removal, and intermediate cover layer preparation.

(5) Includes construction of flood control berm, perimeter access road berm, drainage channel berm, and foundation layer.

(6) Includes geomembrane installation, geocomposite installation, vegetative/protective cover placement, toe drain, culverts, rip-rap, landfill gas control system.

(7) Includes installation of settlement monuments, aggregate base placement, and erosion control.

(8) Includes post construction aerial survey.

3.0 POST-CLOSURE MONITORING AND MAINTENANCE PLAN

This Post-closure Monitoring and Maintenance Plan (Post-Closure Plan) has been prepared for WMUs II through IV to meet the requirements set forth in 27 CCR, §21090. The following subsections describe the methods and procedures necessary to maintain, monitor and inspect the closed WMUs II through IV.

3.1 Post-Closure Purpose and Performance Standard

The goal of post-closure monitoring and maintenance is to assure that the closed landfill continues to comply with the performance standard to minimize the infiltration of water into the waste, thereby minimizing the production of leachate and gas. To meet this objective, this Post-Closure Plan describes the activities necessary to meet the following requirements set forth in 27 CCR, §21090(c):

- Maintain the structural integrity and effectiveness of all containment structures, and maintain the final cover as necessary to correct the effects of settlement or other adverse factors;
- Maintain monitoring systems and monitor the groundwater and surface water, and the unsaturated zone in accordance with applicable requirements of Article 1, Subchapter 3, Chapter 3, Subdivision 1 (§20380 et seq.);
- Prevent erosion and related damage of the final cover due to drainage; and
- Protect and maintain surveyed monuments installed under §20950(d).

3.2 Post-Closure Land Use

Post-Closure land use for WMUs II through IV will be non-irrigated open space. The respective WMUs will be vegetated at the time of closure and returned to a natural setting, with the exception of access roads, environmental monitoring and control systems, and drainage structures. A final cover post-closure maintenance program will be instituted to ensure that the WMUs' final cover retains its integrity and effectiveness.

3.3 Methods to be used for Post-Closure Maintenance, Monitoring, and Inspection of Closed Units

A post-closure inspection and maintenance program will be implemented at the site to verify that containment and monitoring facilities retain their integrity throughout the post-closure period. The landfill will be inspected and maintained by the owner or a qualified third party to ensure that all post-closure requirements have been met. The following activities will be included in the inspection and maintenance program:

- The final cover will be inspected for effects of settlement, ponding, erosion, or damage to the low permeability cover system;

- A periodic leak search will be performed to monitor the integrity of the low hydraulic conductivity layer of the final cover;
- Surface water drainage structures and conveyance piping will be inspected for accumulation of sediment and debris, erosion damage, and obstructions;
- The environmental monitoring system components will be inspected to ensure they remain in sound working condition;
- Permanent survey monuments will be visually inspected to ensure they have not been damaged; and
- Fencing and signs around the facility boundary will be inspected.

Details on proposed landfill post-closure inspection, monitoring, and maintenance procedures are described below. Additional inspections will be scheduled after major storms or significant seismic events. Copies of post-closure inspection logs will be maintained at the facility for review by the agencies upon request.

3.3.1 Final Cover Inspections and Periodic Leak Searches

3.3.1.1 Inspections

The final cover areas will be inspected semi-annually (once in the spring and once in the fall) for:

- Differential and general subsidence and surface water ponding;
- Erosion and cracking of the protective soil layer;
- Exposure/damage to the low permeability layer;
- Burrowing animal holes;
- Liquid seeps;
- Areas of distressed vegetation;
- Blocking or obstructions of drainage structures; and
- Slope failures.

Annual monitoring for surface gas will be conducted during one of the semi-annual inspections (27 CCR §21180(a)(2)). Routine inspection and maintenance of the final landfill cover will be performed by personnel trained to notice and repair surface cracking, ponding, or unusual surface conditions. Following completion of the inspections, a report will be prepared that discusses the condition of the cover system. Recommendations for required maintenance and repair will be made as necessary. The report will maintained in the file at the facility and will be available to regulatory personnel upon request.

3.3.1.2 Periodic Leak Surveys

CCR Title 27 §21090(a)(4)(A) requires: a "Periodic Leak Search - a schedule for carrying out periodic monitoring of the integrity of the low-hydraulic-conductivity layer, including a method for effectively identifying and repairing breaches in that layer [for example and where allowed, by temporarily discontinuing active gas extraction and using surface gas probes or inserted soil gas probes to identify locations where landfill gas is emerging]." Pursuant to this requirement, periodic surveys will be: performed by completing a landfill gas monitoring survey using inserted soil gas probes on a grid across the surface of the closed facility. For the purposes of this Post-closure Plan, the periodic surveys will be performed within one year of closure certification and every five years thereafter. Additional surveys will be performed if necessary based on the results of the semi-annual monitoring events or if the facility is subjected to a potentially damaging storm or seismic event. Final cover repairs (if necessary) will be general, as described below.

3.3.2 Final Cover Maintenance

As necessary, based on the inspections and/or the periodic leak surveys, landfill cover maintenance and repair will be performed as soon as practicable. General maintenance and repair procedures could include:

- **Differential and General Subsidence.** Repairs will be completed by removing vegetation in the affected area and opening up the geomembrane (and possibly the geocomposite, if on the side slope) and placing foundation soil to a slightly mounded_grade that will promote surface water runoff and prevent ponding. The geomembrane (and possibly geocomposite, if on the side slope) will be repaired and select soils with properties comparable to those used in the vegetative cover layer will be placed in 12-inch lifts and loosely compacted in place over the geosythetics. The finished surface will be graded to blend into the surrounding cover, be free of tire ruts and depressions, be seeded with a seed mix comparable to the original mix, and be fertilized and mulched.
- **Cover Erosion.** Repair will be performed by placing or grading soil in the voids of the eroded area and compacting the soil. The vegetative cover will be re-seeded following repair.
- **Exposure or Damage to the Geosynthetics.** In the event the final cover geosynthetic materials are exposed or damaged, they will be repaired by a qualified contractor who will expose and remove the damaged area and install a patch. If a patch is installed, seaming will be performed in accordance with CQA requirements. Once the patch has been completed, the vegetative cover will be re-installed and re-seeded.
- **Burrowing Animal Holes.** Repair will be made by tamping select soil into the voids to a minimum depth of 6 inches. If burrows occur in a confined area, the area will be repaired using fill soil to cover the burrow and then recompacted with rubber-tired equipment. Rodent control measures will be implemented if more than an occasional burrow is found.

- **Liquid Seeps.** Any liquid seeps noted will be reported to the RWQCB and measures will be implemented to identify the source of the liquid seep and, if appropriate, prevent discharge to surface waters. These steps could include:

  1. Identify and repair blocked drainage structures, animal burrows, broken leachate lines, or other potential sources of liquid seeps;
  2. Identify and repair depressions or areas of ponded water by placing soil at a grade that will promote surface water runoff; and/or
  3. Contain (via temporary berms or other measures) and collect liquids from the seeps and transport those liquids to the leachate storage facilities.

  A report will be prepared for submittal to the RWQCB that describes the location and duration of the seep(s) and methods taken to protect surface water discharge.

- **Distressed Vegetation.** Repairs will be made by restoring the protective soil layer as necessary, surface hand-seeding, and mulching over the repair area. Repair can also be implemented by applying a pre-seeded erosion mat that is intended to restart growth.

- **Slope Failure.** Significant slope movement will be reported to the RWQCB, LEA, and CalRecycle and an assessment of appropriate corrective measures will be developed following evaluation of the failure. Minor cracking that does not impact the underlying synthetic liner can be repaired by filling cracks with vegetative soil and monitoring the area for additional evidence of movement. Significant slope deformation or failure could require reconstruction of portions of the cover. In this case, possible repair procedures may include: (1) excavation of the affected portion of the cover and regrading of the area; (2) placement of additional foundation layer soil to reestablish grade; (3) reconstruction of the synthetic liner and drainage layer (if installed); (4) reconstruction of the vegetative soil layer; and (5) reseeding of the rebuilt area.

3.3.3 Drainage System Maintenance

Post-closure maintenance of the surface water management system is intended to ensure adequate performance of the system. Maintenance activities will include, as necessary, drainage channel repairs, pumping of detention basins, removal of silt and debris along drainage channels and in detention basins, repair and replacement of erosion and sediment controls (e.g., silt fences, straw bales, riprap), and grading of the final erosion layer.

Surface water drainage features located on the landfill potentially could be affected by differential settlements to varying degrees or by heavy rainstorms. As a result, an initial surface water management system inspection schedule will call for inspection every quarter, and after each major rainstorm for the first 2 years after landfill closure. This initial schedule will allow early identification of settlement-impacted drainage features that may require maintenance or repair. Following the initial schedule, regular inspection and maintenance will be performed at least once a year before each rainy season and after each major storm.

3.3.4 Landfill Gas Monitoring and Control System Maintenance

The LFG monitoring and control system consists of the LFG extraction well field, condensate system, blower flair station and the LFG migration monitoring system. Maintenance activities for each of the systems are described below.

3.3.4.1 LFG Extraction Wellfield

A Landtec GEM-500 or current industry standard device will be used to measure wellhead gas concentrations (methane, carbon dioxide, and oxygen), applied vacuum on both the well and header sides of the wellhead control valve, temperature, and flow. The wellhead control valve will be adjusted, as necessary, to optimize gas quality (maximization of methane concentration and minimization of oxygen), and control off-site gas migration. Wellfield monitoring and adjustments will be performed on a monthly basis, at a minimum and reported quarterly.

The area around each LFG extraction well will be visually inspected. All weeds and debris will be removed from around each well. Soil settlement and the seal around each well will be noted. If settlement has resulted in a break in the seal around the well annulus, the seal will be repaired. Extraction well casings, valves, flexible connectors, and collection piping will be visually inspected for damage and air leaks. Damaged components or leaking valves and fittings will be repaired or replaced, as needed.

3.3.4.2 Condensate System

Condensate sump operation will be monitored on a monthly basis. The sump isolation valve will be exercised. Visual inspection of pipe fittings and valves will be made for signs of leakage. If condensate sumps are not functioning properly, pump performance will be evaluated. If the pumps, the regulators or controls, or air supply or force main lines are damaged or are malfunctioning, they will be repaired or replaced, as needed.

3.3.4.3 Blower/Flare Station.

Operation of the blower and flare system will be performed on a daily basis using a SCADA (or similar) system to minimize the potential down time. Routine inspection and maintenance of mechanical and electrical system components will be performed on a monthly basis, at a minimum, or as recommended by the equipment manufacturers. Work will include inspection and replacement of belts, inspection and lubrication of motor/blower unit bearings, and visual inspections of sensors, control valves, condensate knockouts, sand other system components. The motor/blower alignment will be checked prior to initial startup and every six months thereafter. The motor control panel connections will be checked and tightened on a quarterly basis.

At least biweekly, the propane pilot gas supply level will be checked. The pilot gas solenoid valve will also be inspected. The chart on the flow and temperature chart recorder will be checked and replaced, as necessary. The flame arrestor will be checked and cleaned prior to startup and every quarter thereafter. The thermocouples and pilot igniter will be checked quarterly. On an annual basis, the integrity of the flare flame banks and refractor lining will be inspected. Replacement or repair of system components will be made, as necessary.

The knockout pot sight glass will be checked for leaks. If a noticeable condensate level is noted in the knockout pot sight glass, the blower/flare station will be shut down in order for the knockout pot to be drained.

3.3.4.4 LFG Migration Monitoring System

During the post-closure period, probe monitoring will be performed by qualified personnel in accordance with CCR Title 27 requirements and CalRecycle guidelines. LFG probe monitoring will be performed on a monthly basis and reported quarterly. Gas pressure and methane concentrations will be noted. Gas monitoring will be performed using a combustible gas indicator with a dual range of 0 to 100 percent LEL and 0 to 100 percent by volume.

If monthly monitoring results indicate methane concentrations in the gas probes are less than the LEL, and public health and safety is not threatened, the owner may request approval for a reduced sampling frequency, in accordance with Section 20921 (d) of Title 27. If methane concentrations above the LEL are detected at one or more probe location, the data will be reviewed for accuracy and an evaluation will be made to rule out possible interferences. Such interferences could include the presence of subsurface liquids, or previously unidentified combustible gas sources. If no interferences are noted; the performance of the LFG extraction wells will be made, followed by reevaluation of probe methane concentrations. Should the follow-up results confirm the initial field readings, the LEA and CalRecycle will be notified within five days of the completion of follow-up testing.

3.3.5 Groundwater and Vadose Zone Monitoring System Maintenance

The groundwater monitoring system will be operated, inspected, and maintained throughout the post-closure maintenance period. Groundwater will be monitored according to WDRs and the monitoring and reporting program that may be in force at that time. For the purposes of this Post-Closure Plan, water quality monitoring and reporting during the post-closure period is assumed to be consistent with current WDRs (Appendix A). Adjustments to the number of monitoring points and/or monitoring frequencies may be proposed during the post-closure maintenance period if a review and analysis of data obtained from initial monitoring activities indicate a different number of points or a modified frequency is technically justified. Adjustments to the monitoring program will be made only with approval of the RWQCB.

During the post-closure maintenance period, it may be necessary to decommission, replace, or abandon selected groundwater monitoring wells and or to install new ones. Well abandonment or installation will be in accordance with State of California Department of Water Resources Standards. Abandonment of monitoring wells will generally involve removal of dedicated pumps and controls and over-drilling or pressure grouting of casings. Proposed abandonment procedures will be submitted to the RWQCB, LA, and CalRecycle before the work is undertaken.

3.3.6 Groundwater Extraction and Treatments System

Operation and maintenance of the system will, at a minimum, include weekly collection of system. readings and routine monthly maintenance. Maintenance will include inspect on and replacement of belts, inspection and lubrication of pumps, and visual inspections of sensors, control valves, and other system components. Air stripper packing or granular activated carbon will be replaced as needed based on system performance. The motor control panel connections will be checked and tightened on a quarterly basis. Monthly discharge volumes will be reported to the RWQCB. Samples will be collected and analyzed on a quarterly basis and submitted during quarterly operation and maintenance reports.

3.4 Survey Monument Maintenance

Five survey monuments will be installed on the final cover of WMUs II, III, and IV prior to completion of closure activities. The survey monuments will be protected and maintained throughout the post-closure maintenance period. If damage occurs, repair or replacement will be scheduled and the monuments will be re-surveyed to obtain the horizontal and vertical coordinates.

3.5 Isosettlement Map and Final Cover Surveys

Provisions for measuring and monitoring settlement throughout the post-closure maintenance period include a survey of the landfill within the final limits of waste placement upon completion of closure and every 5 years throughout the post-closure maintenance period. Isosettlement maps will be prepared for the landfill (within the final limits of waste placement) showing the change in elevation from the map produced upon closure and the most recent topographic map. The maps will be produced with a maximum contour interval of 2 feet and a scale of 1 inch equals 100 feet. A record of these surveys and maps will be prepared and submitted to the appropriate regulatory agencies every 5 years throughout the post-closure maintenance period.

4.0 CLOSURE COST ESTIMATES

In accordance with 27 CCR, §21769(c)(2)(A), §21790(b)(1) and §21820, an engineer's cost estimate for the closure expenses associated with WMUs II through IV has been prepared by a

Registered Professional Engineer and is presented in Appendix H. The enclosed estimate is based on the cost, in current 2015 dollars, of hiring a third party to implement the respective scopes of work. As presented in Appendix H, the estimated costs are as follows:

- Closure Cost - $4,206,738;

  Cost includes $15,000 for removal of the vehicle canopy;

  Cost does not include $40,000 for optional removal of scale house, scale, and 10,000 gallon water tank; and

  Cost does not include $25,000 for optional relocation of landfill gas flare and connections;
- Post Closure Maintenance Cost - $9,153,250; and
- Corrective Action Costs for GTS - $4,786,767.

Note that closure and corrective action cost estimates include a 20 percent contingency factor as required by 27 CCR, §21820(a)(4).

Per 27 CCR, §21820(a)(1), the engineer's cost estimate presented herein represents the cost of closing WMUs II through IV at the point in their active life when the extent and manner of operation would make closure the most expensive. As required by 27 CCR, §21820(a)(5 and 6), the closure expenses, post-closure expenses, and corrective action expenses will be updated annually to incorporate any changes to the Plan or at the Landfill that either increase or decrease the cost of closure. Any modifications to these costs will be submitted to CalRecycle for approval.

As required by 27 CCR, Chapter 6, the operator of a disposal facility is responsible for establishing a "demonstration of financial responsibility" to provide funding for site closure costs. Ma-Ru Holding Company, Inc. has established and maintains two trust accounts that will be used exclusively for closure and post-closure maintenance expenses, associated with WMUs II through IV. A copy of a January 25, 2006 letter issued by the CalRecycle acknowledging the establishment of these trust accounts is enclosed in Appendix I.

In addition to the two trust accounts mentioned above, Ma-Ru Holding Company is currently establishing a third trust account that will be used exclusively to fund the corrective action. The establishment of this find was mandated by the RWQCB in Cease and Desist Order R52005-0073 to fund the operation and maintenance of the groundwater extraction and treatment system, currently operating at the landfill.

5.0 FUND DISBURSEMENT FOR CLOSURE

In accordance with 27 CCR, §21800(d), the Table 5-1 presents a detailed schedule for the disbursement of funds for the closure activities. The Post-Closure Maintenance Fund and the Corrective Action Fund will be paid out evenly on an annual basis over thirty years with disbursements of $305,108 and $159,559, respectively. The fund disbursement schedule presented herein has been prepared based on the proposed construction schedule outlined earlier in Subsection 2.7 and costs obtained from the engineer's cost estimate presented in Section 4 and Appendix H. Please note that the fund disbursement costs do not include the 20 percent contingency factor. The fund disbursement schedule will be updated upon completion of bid processes and prior to implementation of construction activities.

TABLE 5-1 FUND DISBURSEMENT SCHEDULE

PAYMENT	TASK	DESCRIPTION	COMPLETION DATE[1]	DISBURSEMENT AMOUNT
I	1	Pre-Construction Activities and Approvals	11/27/15	NA
	2	Construction Bidding and Contract Execution	01/01/16	NA
	3	Contractor Mobilization	02/03/16	$36,751
	4	Site Preparation	02/09/16	$84,579
	5	Engineered Fill and Foundation Layer Placement	02/29/16	$81,688
	----	CQA Inspection / Testing	02/29/16	$44,017
			Payment I Subtotal	**$247,035**
II	5	Engineered Fill and Foundation Layer Placement	03/31/16	$316,543
	6	Final Cover Construction	03/31/16	$193,725
	----	CQA Inspection / Testing	03/31/16	$62,023
			Payment II Subtotal	**$572,291**
III	5	Engineered Fill and Foundation Layer Placement	04/30/16	$306,332
	6	Final Cover Construction	04/30/16	$528,342
	----	CQA Inspection / Testing	04/30/16	$60,023
			Payment III Subtotal	**$894,696**
IV	5	Engineered Fill and Foundation Layer Placement	05/20/16	$204,221
	6	Final Cover Construction	05/31/16	$545,953
	----	CQA Inspection / Testing	05/31/16	$62,023
			Payment IV Subtotal	**$812,198**
V	6	Final Cover Construction	06/30/16	$528,342
	7	Final Site Construction	06/30/16	$143,002
	----	CQA Inspection / Testing	06/30/16	$60,023
			Payment V Subtotal	**$731,367**
VI	6	Final Cover Construction	07/01/16	$17,611
	7	Final Site Construction	07/08/16	$104,002
	8	Contractor Demobilization	07/15/16	$10,809
	9	Final CQA Report and Certification	07/31/016	$9,382
	----	CQA Inspection / Testing	07/08/16	$16,006
			Payment VI Subtotal	**$157,811**
VII	9	Final CQA Report and Certification	08/31/16	$20,775
			Payment VII Subtotal	**$20,775**
VIII	9	Final CQA Report and Certification	09/16/16	$10,723

PAYMENT	TASK	DESCRIPTION	COMPLETION DATE(1)	DISBURSEMENT AMOUNT
	10	Final Closure and Post-Closure Maintenance Plan Amendments	09/30/16	$7,917
			Payment VIII Subtotal	**$18,640**
IX	10	Final Closure and Post-Closure Maintenance Plan Amendments	10/31/16	$20,453
			Payment IX Subtotal	**$20,453**
X	10	Final Closure and Post-Closure Maintenance Plan Amendments	11/30/16	$19,793
			Payment X Subtotal	**$19,793**
XI	10	Final Closure and Post-Closure Maintenance Plan Amendments	12/16/16	$10,556
			Payment XI Subtotal	**$10,556**
			TOTAL	**$3,505,615**

Notes:
(1) The completion date for each task has been estimated.
(2) See Table 2-1 for notes on construction task components

6.0 REFERENCES

Dames & Moore, December 1990, Design Memorandum #5., Final Design of Groundwater Remediation System, Bonzi Sanitation Landfill, Modesto, California, Job No. 15066-008-044; Prepared for Bonzi Sanitation Landfill by Dames & Moore, Sacramento, California.

EBA Wastechnologies, June 1996a, Final Closure Plan, Bonzi Sanitation Landfill, Stanislaus County, CA, EBA Job No. 91-311; Prepared for Bonzi Sanitation Landfill by EBA Wastechnologies, Santa Rosa, California.

EBA Wastechnologies, June 10, 1997, Addendum to Final Closure and Post-closure Maintenance Plans, Bonzi Sanitation Landfill, Stanislaus County, CA, EBA Job No. 91-311; Prepared for Bonzi Sanitation Landfill by EBA Wastechnologies, Santa Rosa, California.

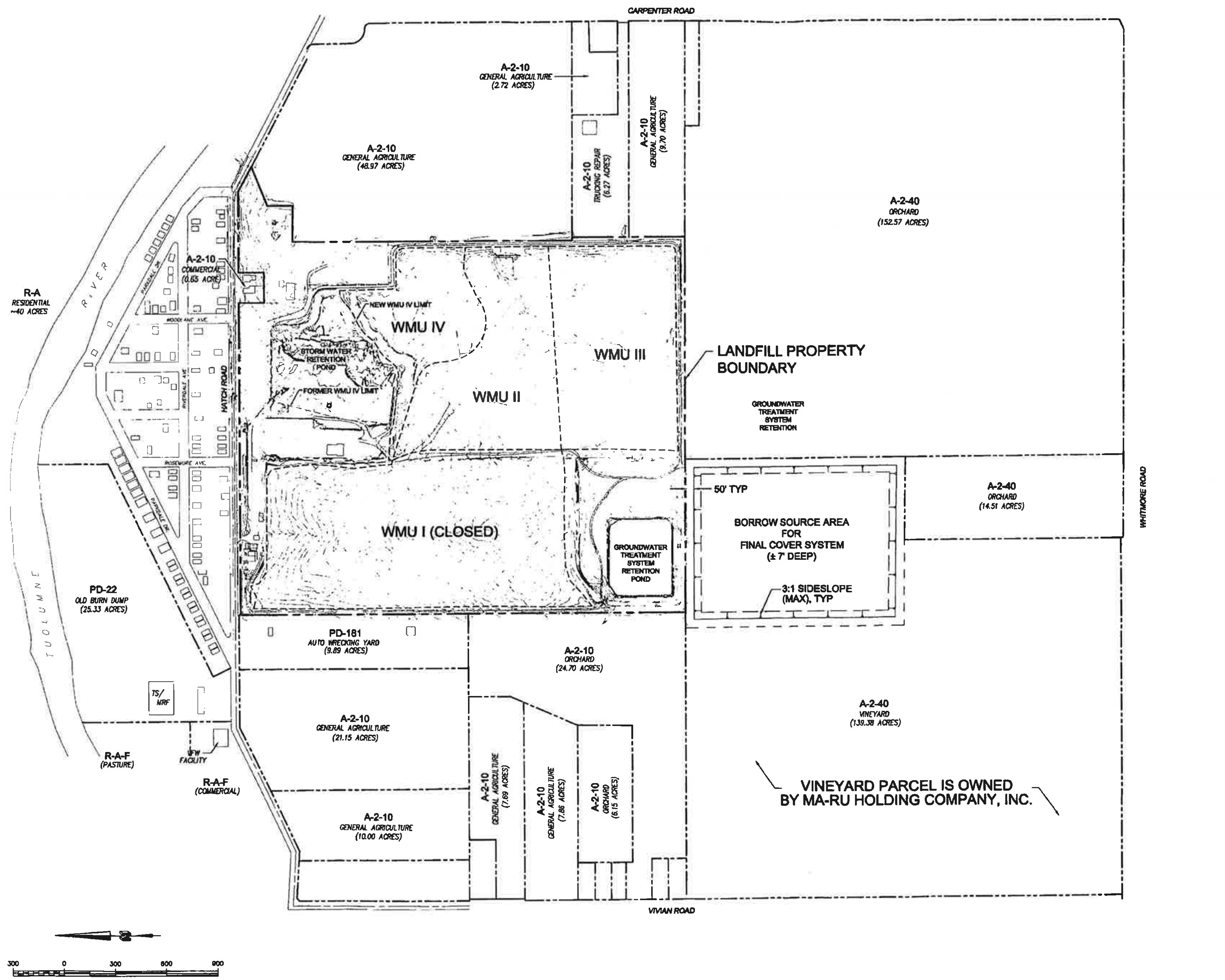
EBA Engineering, February 2006, Joint Technical Document, Bonzi Sanitation Landfill, Stanislaus County, California. EBA Job No. 91-311; Prepared for Ma-Ru Holding Company, Inc. by EBA Engineering, Santa Rosa, California.

EBA Engineering, February 2006b, Final Closure Plan, Bonzi Sanitation Landfill, Stanislaus County, California, EBA Job No. 91-311; Prepared for Ma-Ru Holding Company, Inc. by EBA Engineering, Santa Rosa, California.

Federal Emergency Management Agency, May 7, 2001, Flood Insurance Rate Map, Stanislaus County (Unincorporated Areas); Panel 535 of 1075, Community-Panel Number 06099C0535E.

ITRC, December 2003. Technical and Regulatory Guidance for Design; Installation, and Monitoring of Alternative of Alternative Final Landfill Covers.

FIGURES



LEGEND

— — —	PROPERTY LINE
WMU	WASTE MANAGEMENT UNIT
TS/MRF	TRANSFER STATION/MATERIAL RECOVERY FACILITY
A-2-10	EXCLUSIVE AGRICULTURAL DISTRICT WITH A MINIMUM PARCEL DESIGNATION OF 10 ACRES
R-A	RURAL RESIDENTIAL DISTRICT
R-A-F	RURAL RESIDENTIAL DISTRICT (FLOOD PLAIN)
PD	PLANNED DEVELOPMENT

Source: EBA Engineering, Final Closure Plan for Waste Management Units I-IV (Feb. 2006)

SURROUNDING LAND USE / ZONING MAP
Bonzi Sanitation Landfill
Stanislaus County, California

By: JG	Date: 07/24/06	Project No. 12482.00
Geomatrix		Figure 3

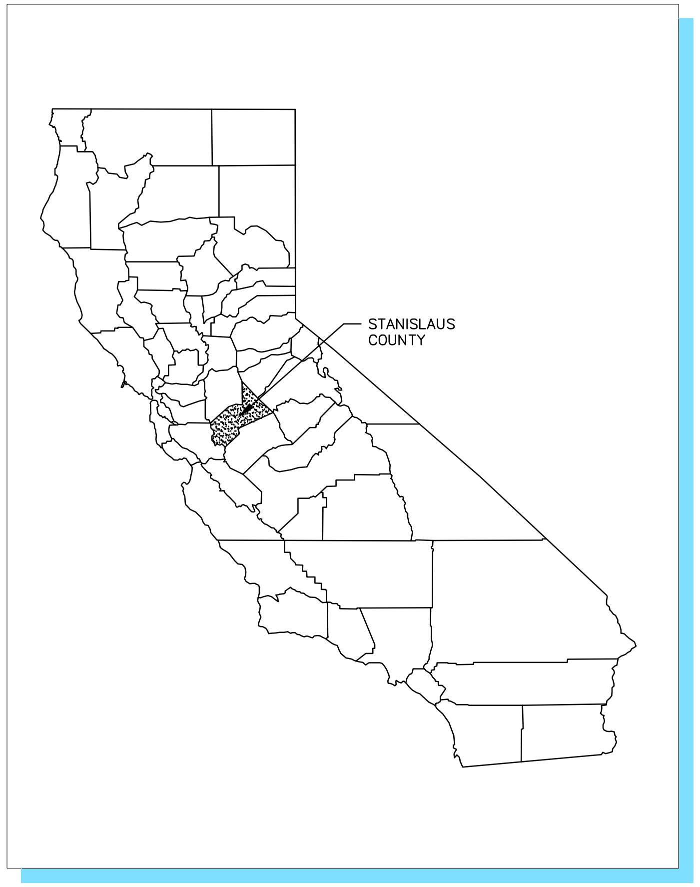
Plot Date: 07/24/06 - 1:19pm, by: jgraul
Drawing Path: S:\12400\12482\12482.001\08_0726_dp\, Drawing Name: fig_03.dwg

DRAWINGS

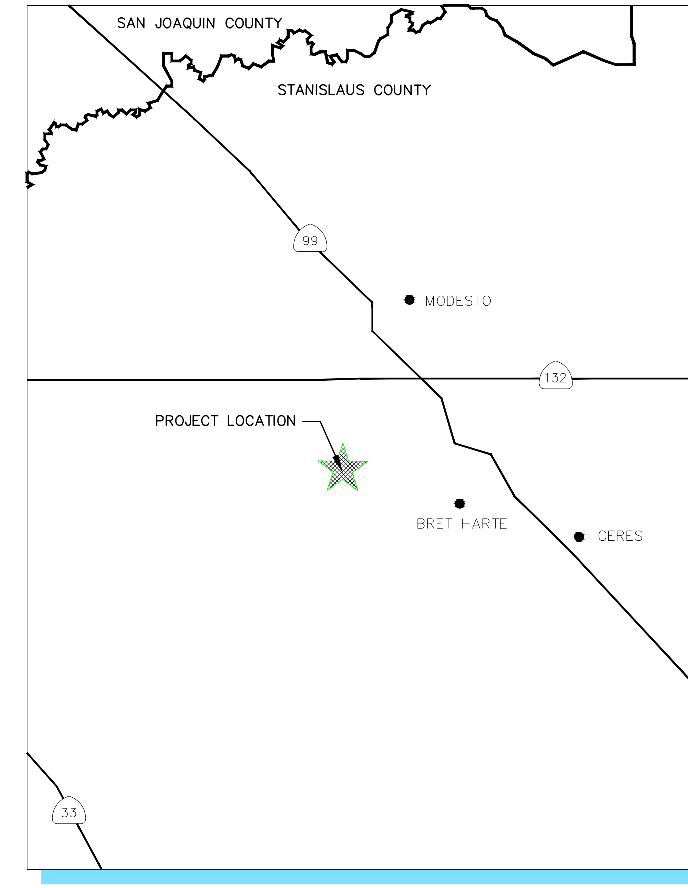
BONZI SANITATION LANDFILL
FINAL
CLOSURE PLAN
MODESTO, CA

PREPARED FOR:

THE MA-RU HOLDING COMPANY, INC.



CALIFORNIA COUNTIES

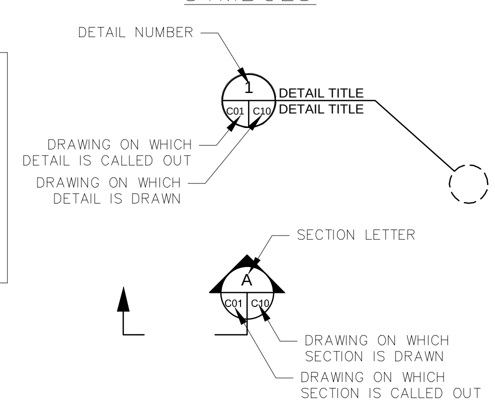


REGIONAL MAP

ABBREVIATIONS

℄	CENTER LINE	MAX	MAXIMUM
ø	DIAMETER	MIN	MINIMUM
E	EASTING	N	NORTHING
EL	ELEVATION	NTS	NOT TO SCALE
FT	FEET	%	PERCENT
GCL	GEOSYNTHETIC CLAY LINER	PCPE	PERFORATED CORRUGATED POLYETHYLENE
HDPE	HIGH DENSITY POLYETHYLENE	TYP	TYPICAL

SYMBOLS



VICINITY MAP

DRAWING INDEX

DRAWING NUMBER	TITLE AND DESCRIPTION	LATEST REVISION NUMBER	LATEST REVISION DATE
GENERAL			
G01	TITLE PAGE	D	02/05/15
G02	EXISTING CONDITIONS & SITE PLAN	C	10/08/14
G03	LANDFILL GAS MONITORING & CONTROL POINTS	C	10/08/14
CIVIL			
C01	ACCESS ROAD AND PERIMETER CHANNEL GRADING PLAN	C	10/08/14
C02	FINAL COVER GRADING PLAN	D	02/05/15
C03	BORROW AREA GRADING PLAN	C	10/08/14
C04	FLOOD CONTROL BERM GRADING PLAN	D	02/05/15
C05–C09	RESERVED		
C10	DETAILS	C	10/08/14
C11	DETAILS	D	02/05/15
C12	DETAILS	C	10/08/14
C13	DETAILS	C	10/08/14
C13–C19	RESERVED		
C20	CROSS SECTIONS	C	10/08/14

NOTES:
1. PIPE BENDS AND GEOSYNTHETICS ARE SHOWN NTS.

REV. NO.	DATE	DESCRIPTION	DRAWN BY	DESIGNED BY	CHECKED BY	APPROVED BY
A	04/22/13	ISSUED FOR REVIEW	HSO/RSB	NC	TVR	NC
B	11/27/13	ISSUED FOR REVIEW	CM	NC/CM	TVR	NC
C	10/08/14	ISSUED FOR REVIEW	WC	NC	NC	NC
D	02/05/15	ISSUED FOR REVIEW	JM	NC	NC	NC

DATE OF ISSUE: 02/09/2015
DESIGNED BY: NC
DRAWN BY: NC/CM
CHECKED BY: TVR
APPROVED BY: NC

Geo-Logic ASSOCIATES

BONZI SANITATION LANDFILL
FINAL
CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA

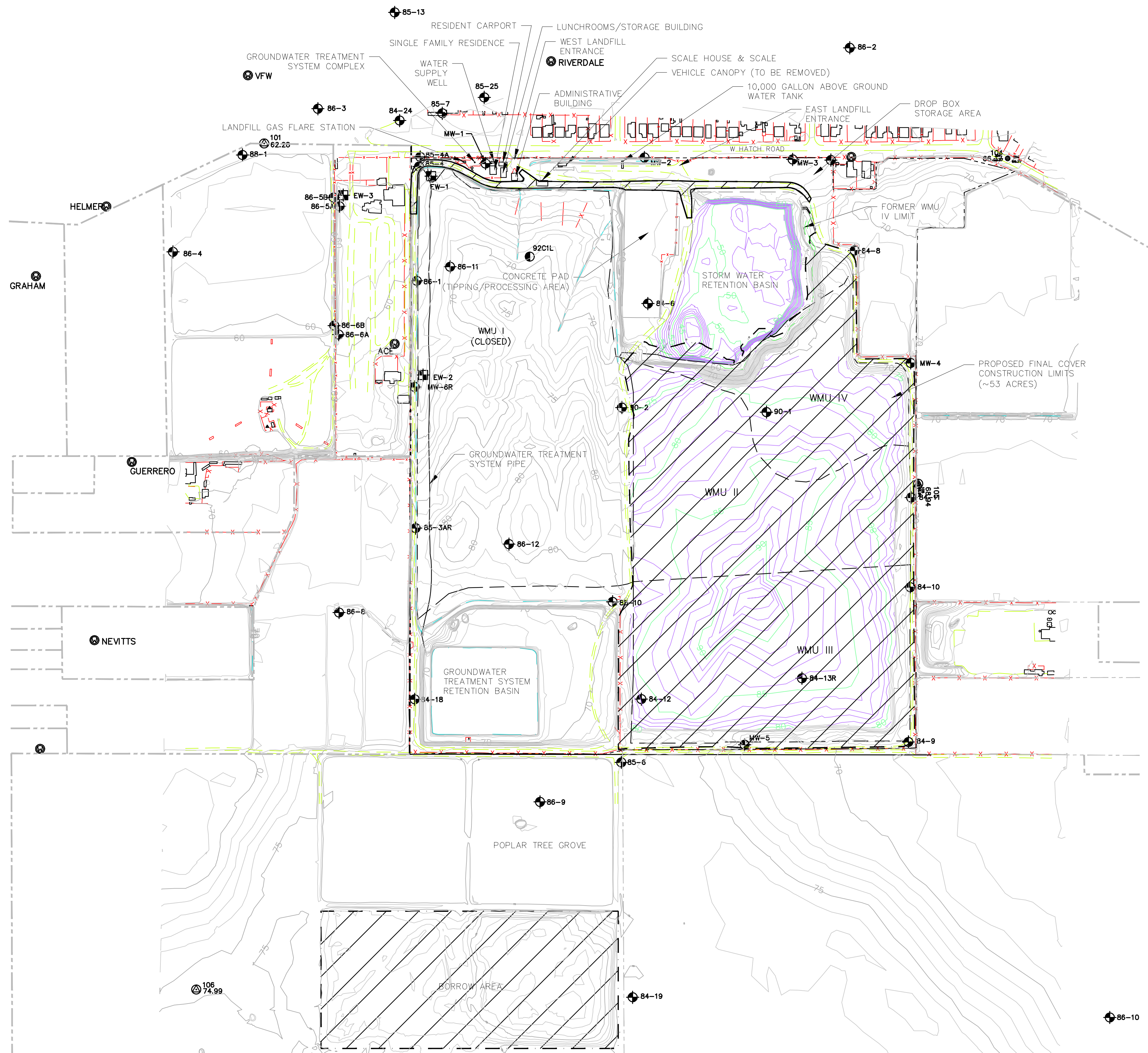
TITLE PAGE

DRAWING NO. G01

PROJECT NO. 2012.0023

ISSUED FOR REVIEW

LOCATION: N:\Bonzi\CAD\Working Drawings\February 2015 Submittal\TITLE.dwg DATE: 2/12/2015 4:48 PM PLOT SCALE = 1:2 PLOTTED BY: JAVIER MENDIVIL



LEGEND

- EXISTING BUILDING
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING 5 FT CONTOUR
- EXISTING 1 FT CONTOUR
- EXISTING 5 FT CONTOUR (3)
- EXISTING 1 FT CONTOUR (3)
- EXISTING DRAINAGE
- EXISTING FENCE
- EXISTING WALL
- PROPERTY BOUNDARY (APPROX.)
- ADJACENT PROPERTY BOUNDARY (APPROX.)
- CONSTRUCTION LIMITS
- WMU LIMITS (APPROX.)
- OLD WMU LIMITS (APPROX.)
- 105 68.94 CONTROL POINT
- EW-1 GROUNDWATER EXTRACTION WELL (APPROX.)
- MW-1 GROUNDWATER MONITORING WELL (APPROX.)
- ACE OFFSITE DOMESTIC WELL (APPROX.)
- 92C1L LEACHATE MONITORING POINT (APPROX.)
- 84-11 OTHER WELL (APPROX.)
- FINAL CLOSURE CONSTRUCTION AREA

APPROXIMATE QUANTITIES

GENERAL SITE INFORMATION

PROPERTY AREA:	135.0 ACRES
PERMITTED AREA:	115.0 ACRES
WMU I AREA:	36.4 ACRES
WMU II AREA:	17.7 ACRES
WMU III AREA:	19.8 ACRES
WMU IV AREA:	19.6 ACRES

MAXIMUM EXTENT OF CLOSURE: 47.6 ACRES

NOTES:

1. EXISTING TOPOGRAPHY BASED ON AERIAL SURVEY PERFORMED BY COOPER AERIAL SURVEYS, CO. ON JUNE 7, 2012.
2. TO PROVIDE ADDITIONAL TOPOGRAPHIC RESOLUTION, ONE FOOT CONTOURS WERE GENERATED BY GEO-LOGIC AND ARE BASED ON THE AERIAL TOPOGRAPHIC MAP BY COOPER AERIAL SURVEYS, CO.
3. EXISTING STORM WATER RETENTION BASIN TOPOGRAPHY PERFORMED BY SUKUT CONSTRUCTION, INC. ON NOVEMBER 16, 2012. EXISTING INTERMEDIATE COVER TOPOGRAPHY RECEIVED FROM SUKUT CONSTRUCTION, INC. ON JANUARY 25, 2013.

REV. NO.	DATE	DESCRIPTION	DRAWN BY	DESIGNED BY	CHECKED BY	APPROVED BY
A	04/22/13	ISSUED FOR REVIEW	HSO/RSB	NC	TVR	NC
B	11/27/13	ISSUED FOR REVIEW	CM	NC/CM	TVR	NC
C	10/08/14	ISSUED FOR REVIEW	WC	NC	NC	NC

DATE OF ISSUE: 02/09/2015
DESIGNED BY: NC
DRAWN BY: WC
CHECKED BY: NC
APPROVED BY: NC

Geo-Logic ASSOCIATES

BONZI SANITATION LANDFILL
FINAL CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA

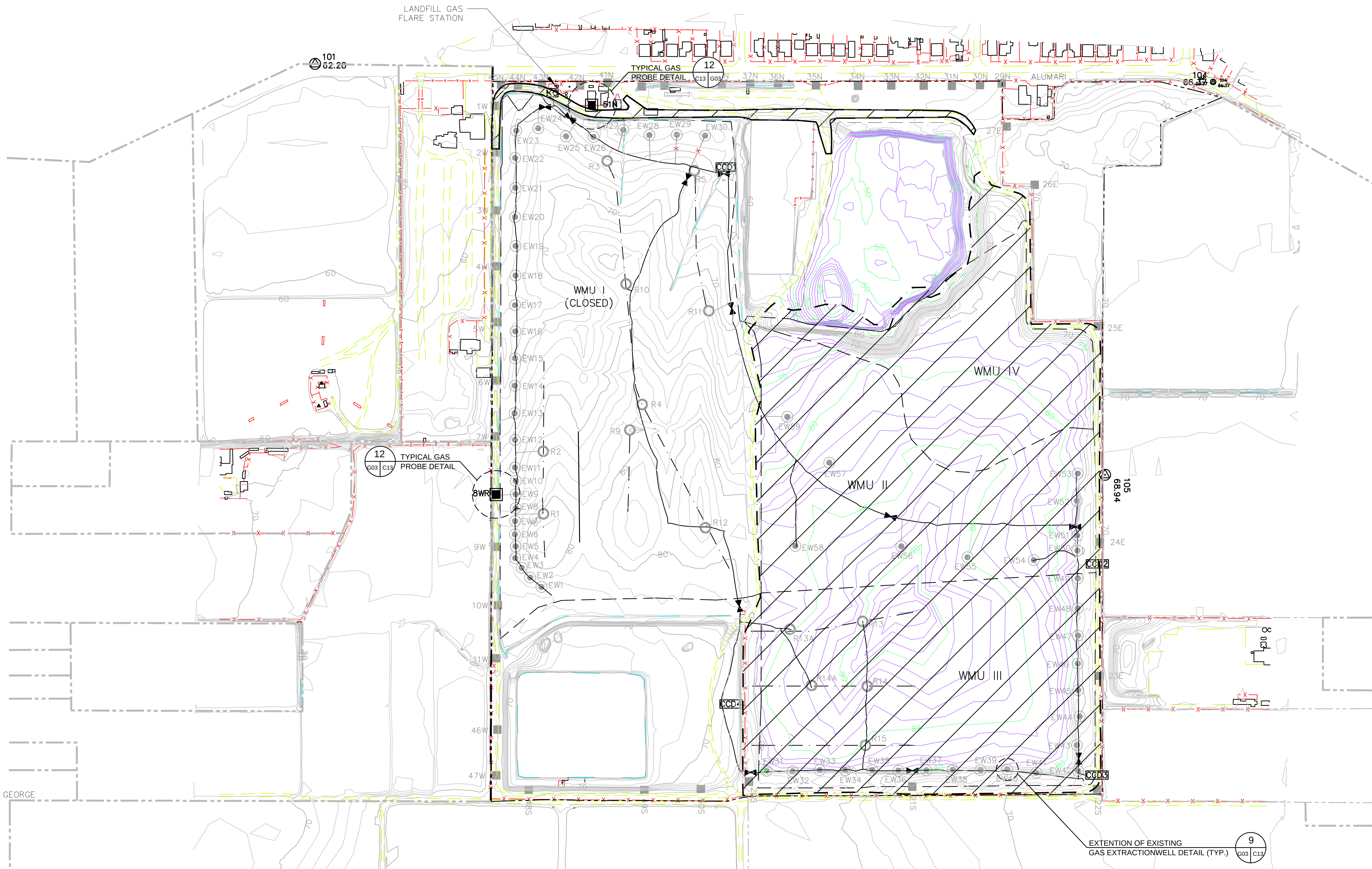
EXISTING CONDITIONS & SITE PLAN

DRAWING NO. G02

PROJECT NO. 2012.0023

LOCATION: N:\Bonzi\CAD\Working Drawings\February 2015 Submittal\DESIGN.dwg DATE: 2/12/2015 4:48 PM PLOT SCALE = 1:2 PLOTTED BY: JAVIER MENDIVIL

ISSUED FOR REVIEW



GRAPHIC SCALE

200' 0' 100' 200' 400' 800'

LEGEND

- EXISTING BUILDING
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- 80 EXISTING 5 FT CONTOUR
- EXISTING 1 FT CONTOUR
- 80 EXISTING 5 FT CONTOUR (3)
- EXISTING 1 FT CONTOUR (3)
- EXISTING DRAINAGE
- EXISTING FENCE
- EXISTING WALL
- PROPERTY BOUNDARY (APPROX.)
- ADJACENT PROPERTY BOUNDARY (APPROX.)
- CONSTRUCTION LIMITS
- WMU LIMITS (APPROX.)
- OLD WMU LIMITS (APPROX.)
- LFG PIPING (APPROX.)
- HORIZONTAL COLLECTION TRENCH (APPROX.)
- 105 68.94 CONTROL POINT
- EW1 VERTICAL LFG EXTRACTION WELL (APPROX.)
- R1 HORIZONTAL COLLECTOR TRENCH RISER (APPROX.)
- 21S PERIMETER LFG MONITORING POINT (APPROX.)
- HEADER VALVE (APPROX.)
- CCD1 CONDENSATE COLLECTION DROPOUT (APPROX.)
- KO CONDENSATE COLLECTION KNOCKOUT (APPROX.)
- FINAL CLOSURE CONSTRUCTION AREA
- 51N PROPOSED PERIMETER LFG MONITORING WELL (APPROX.)

NOTES:

1. EXISTING TOPOGRAPHY BASED ON AERIAL SURVEY PERFORMED BY COOPER AERIAL SURVEYS, CO. ON JUNE 7, 2012.
2. TO PROVIDE ADDITIONAL TOPOGRAPHIC RESOLUTION, ONE FOOT CONTOURS WERE GENERATED BY GEO-LOGIC AND ARE BASED ON THE AERIAL TOPOGRAPHIC MAP BY COOPER AERIAL SURVEYS, CO.
3. EXISTING STORM WATER RETENTION BASIN TOPOGRAPHY PERFORMED BY SUKUT CONSTRUCTION, INC. ON NOVEMBER 16, 2012. EXISTING INTERMEDIATE COVER TOPOGRAPHY RECEIVED FROM SUKUT CONSTRUCTION, INC. ON JANUARY 25, 2013.

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B	11/27/13	ISSUED FOR REVIEW	CM	NC/CM	TVR	NC
C	10/08/14	ISSUED FOR REVIEW	WC	NC	NC	NC

DATE OF ISSUE: 02/09/2015
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Geo-Logic ASSOCIATES

BONZI SANITATION LANDFILL

FINAL CLOSURE PLAN

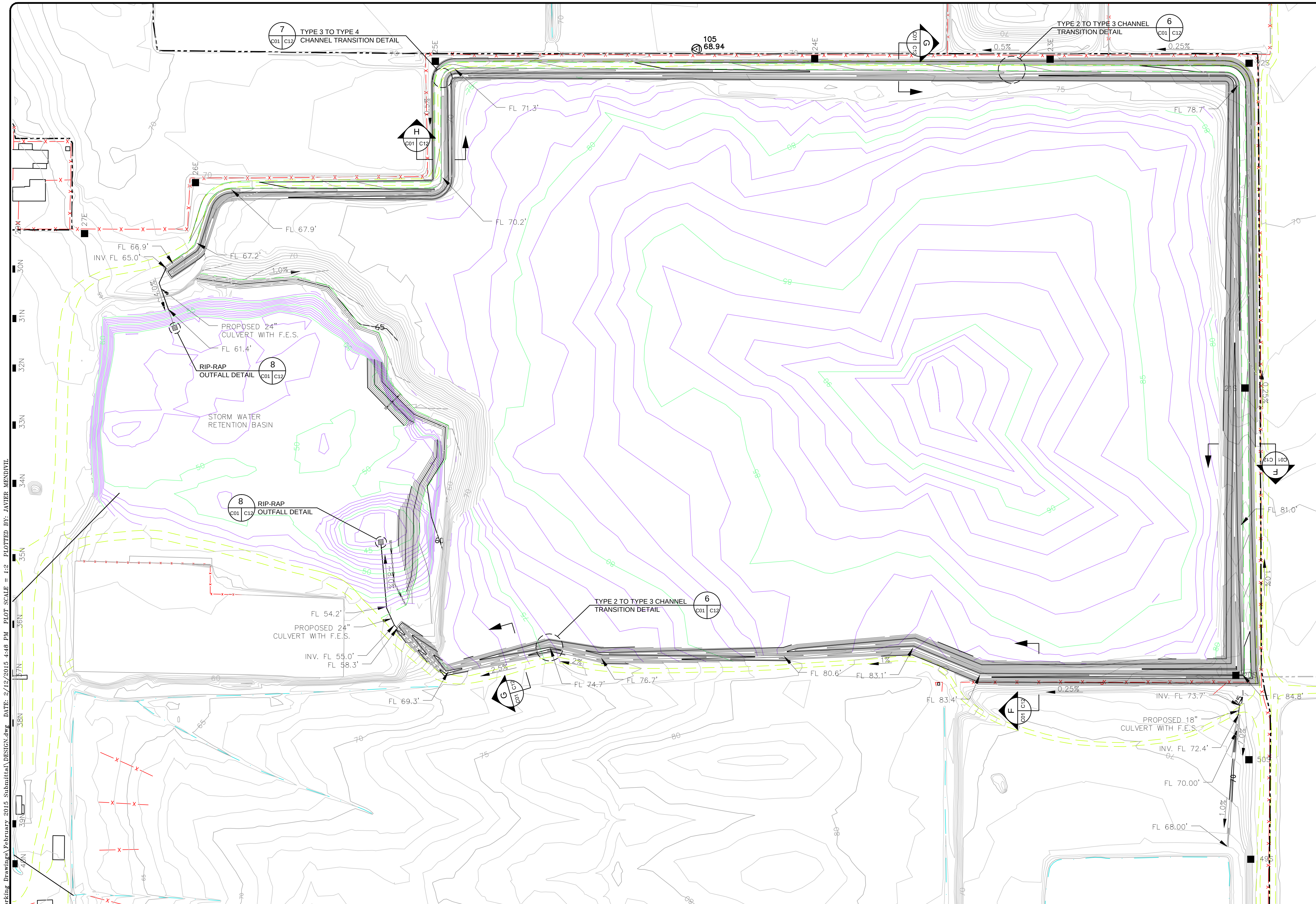
STANISLAUS COUNTY, CALIFORNIA

LANDFILL GAS MONITORING & CONTROL POINTS

DRAWING NO. G03

PROJECT NO. 2012.0023

ISSUED FOR REVIEW



NORTH

GRAPHIC SCALE

100' 0' 50' 100' 200' 400'

LEGEND

- EXISTING 5 FT CONTOUR
- EXISTING 1 FT CONTOUR
- PROPOSED 5 FT PERIMETER BERM CONTOUR
- PROPOSED 1 FT PERIMETER BERM CONTOUR
- EXISTING 5 FT CONTOUR (3)
- EXISTING 1 FT CONTOUR (3)
- PROPOSED ROAD
- EXISTING UNPAVED ROAD
- EXISTING DRAINAGE
- EXISTING FENCE
- PROPERTY BOUNDARY (APPROX.)
- ADJACENT PROPERTY BOUNDARY (APPROX.)
- LIMITS OF INTERMEDIATE COVER FILL
- 105 68.94 CONTROL POINTS
- 21S PERIMETER LFG MONITORING POINT (APPROX) (5)

APPROXIMATE QUANTITIES

SOUTH AND EAST ACCESS ROAD BERM:	5,600 CY
WEST PERIMETER DRAINAGE BERM:	42,600 CY

NOTES:

1. EXISTING TOPOGRAPHY BASED ON AERIAL SURVEY PERFORMED BY COOPER AERIAL SURVEYS, CO. ON JUNE 7, 2012.
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4. LOCALLY DEPRESS CHANNELS AT CULVERT INLETS.
5. LOCATION OF LANDFILL GAS MONITORING PROBES IS APPROXIMATE. LANDFILL GAS MONITORING PROBES LOCATED WITHIN THE CONSTRUCTION AREA SHALL BE EXTENDED AS NECESSARY.

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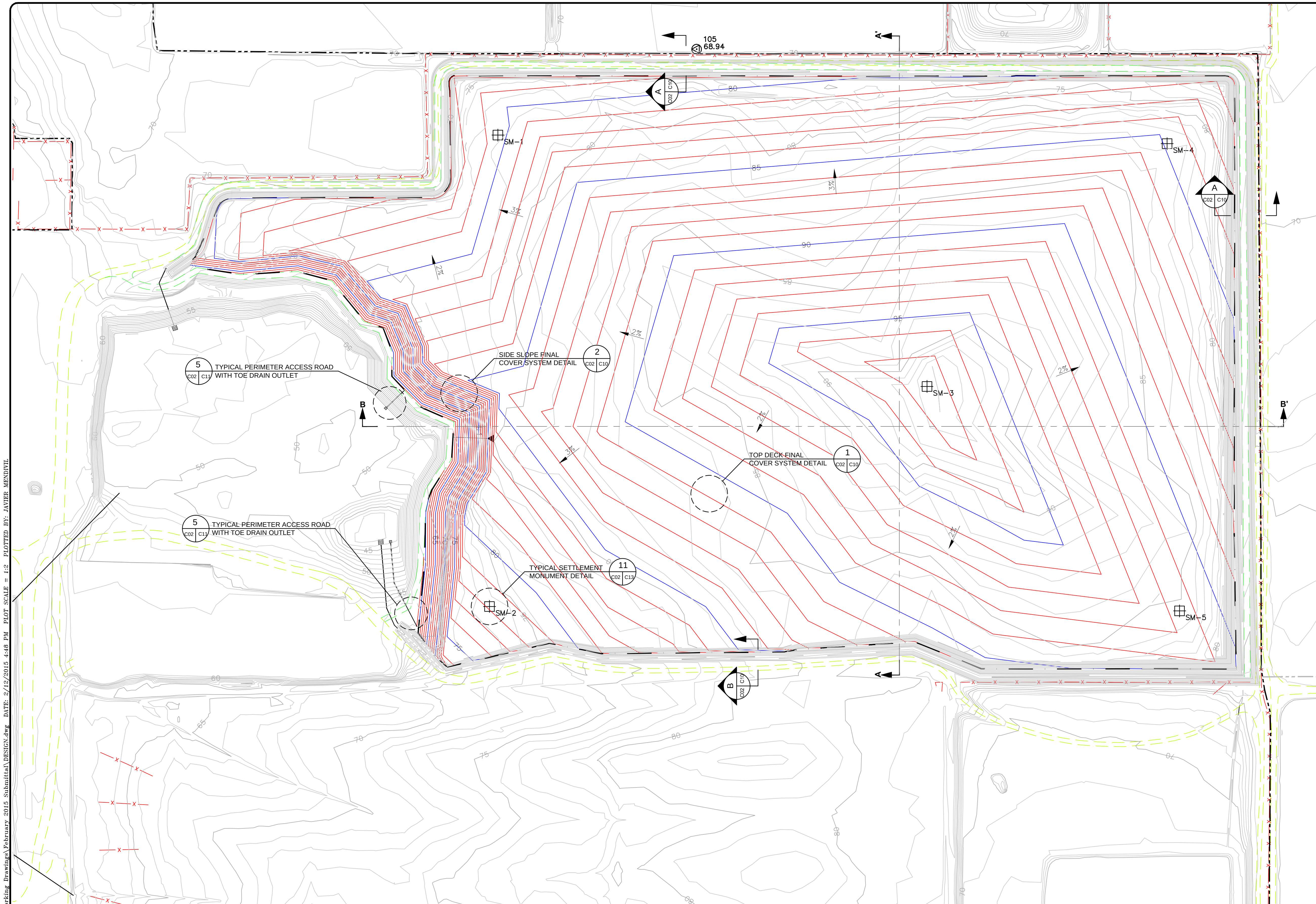
Geo-Logic ASSOCIATES

BONZI SANITATION LANDFILL
FINAL CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA
ACCESS ROAD AND PERIMETER CHANNEL GRADING PLAN

DRAWING NO. C01
PROJECT NO. 2012.0023

ISSUED FOR REVIEW



GRAPHIC SCALE

100' 0' 50' 100' 200' 400'

LEGEND

70	EXISTING 5 FT CONTOUR
	EXISTING 1 FT CONTOUR
70	PROPOSED 5 FT TOP OF FINAL COVER CONTOUR
	PROPOSED 1 FT TOP OF FINAL COVER CONTOUR
	PROPOSED ROAD
	EXISTING UNPAVED ROADS
x	EXISTING FENCE
	PROPERTY BOUNDARY (APPROX.)
	ADJACENT PROPERTY BOUNDARY (APPROX.)
	MAXIMUM FINAL CLOSURE AREA
105 68.94	CONTROL POINTS
SM-1	PROPOSED SETTLEMENT MONUMENT

QUANTITIES

VOLUME OF FOUNDATION LAYER: 248,800 CY

VOLUME OF VEGETATIVE/PROTECTIVE COVER: 113,200 CY

NOTES:

1. EXISTING TOPOGRAPHY BASED ON AERIAL SURVEY PERFORMED BY COOPER AERIAL SURVEYS, CO. ON JUNE 7, 2012.
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C	10/08/14	ISSUED FOR REVIEW	WC	NC	NC	NC
D	02/05/15	ISSUED FOR REVIEW	JM	NC	NC	NC

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Geo-Logic ASSOCIATES

BONZI SANITATION LANDFILL

FINAL CLOSURE PLAN

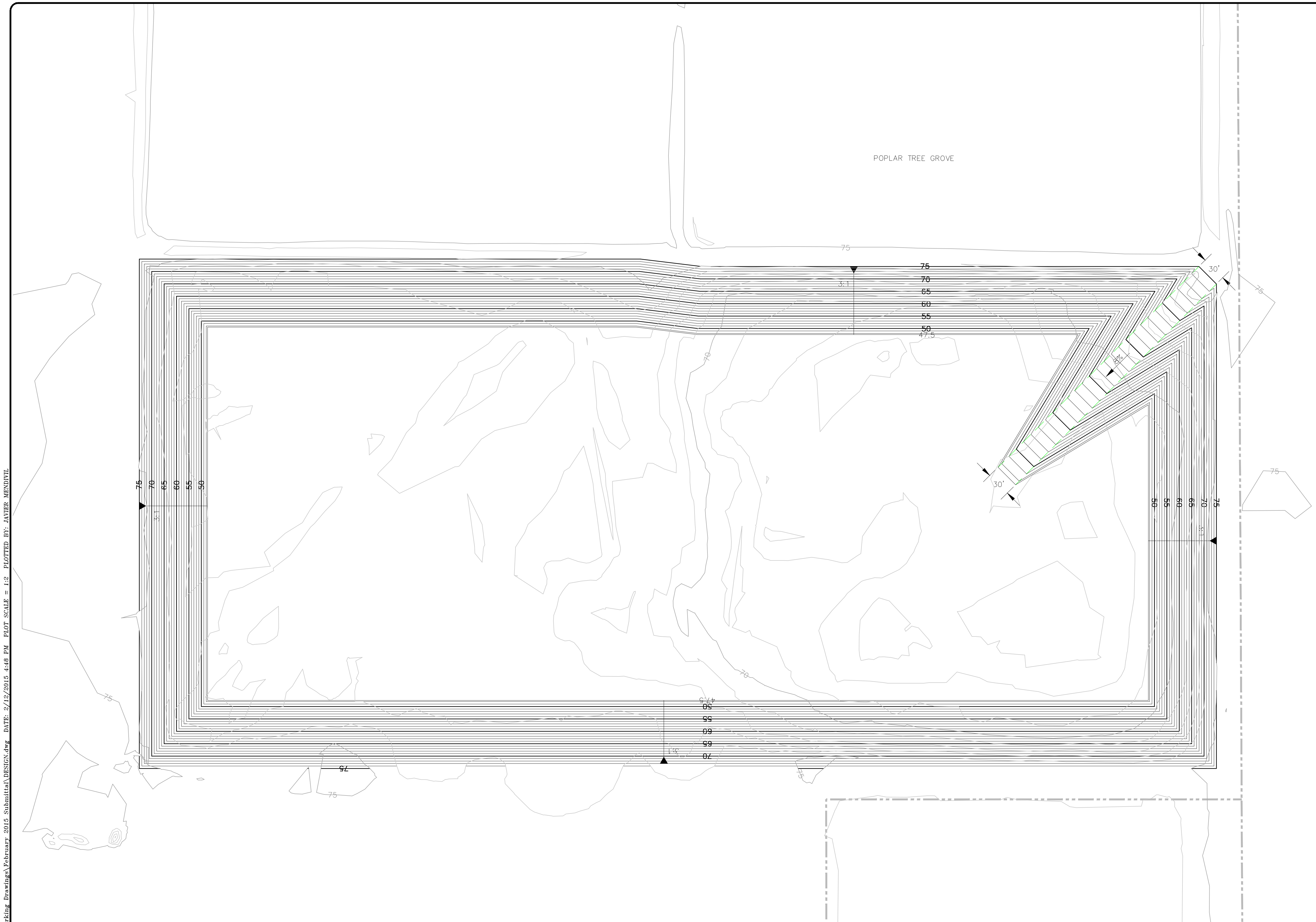
STANISLAUS COUNTY, CALIFORNIA

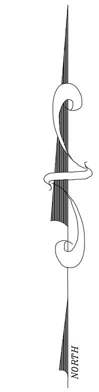
FINAL COVER GRADING PLAN

DRAWING NO. C02

PROJECT NO. 2012.0023

ISSUED FOR REVIEW





GRAPHIC SCALE

60' 0' 30' 60' 120' 240'

LEGEND

80	EXISTING 5 FT CONTOUR
	EXISTING 1 FT CONTOUR
70	GRADING 5 FT CONTOUR
	GRADING 1 FT CONTOUR
	PROPERTY BOUNDARY ADJACENT (APPROX.)

QUANTITIES

TOTAL VOLUME OF BORROW AREA: 537,000 CY

ESTIMATED REMOVED FOR INTERMEDIATE COVER (DURING FALL 2012 CONSTRUCTION): 118,200 CY

NET REMAINING: 418,800 CY

NOTES:
1. EXISTING TOPOGRAPHY BASED ON AERIAL SURVEY PERFORMED BY COOPER AERIAL SURVEYS, CO. ON JUNE 7, 2012.

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Geo-Logic ASSOCIATES

BONZI SANITATION LANDFILL
FINAL CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA
BORROW AREA GRADING PLAN

DRAWING NO. C03
PROJECT NO. 2012.0023

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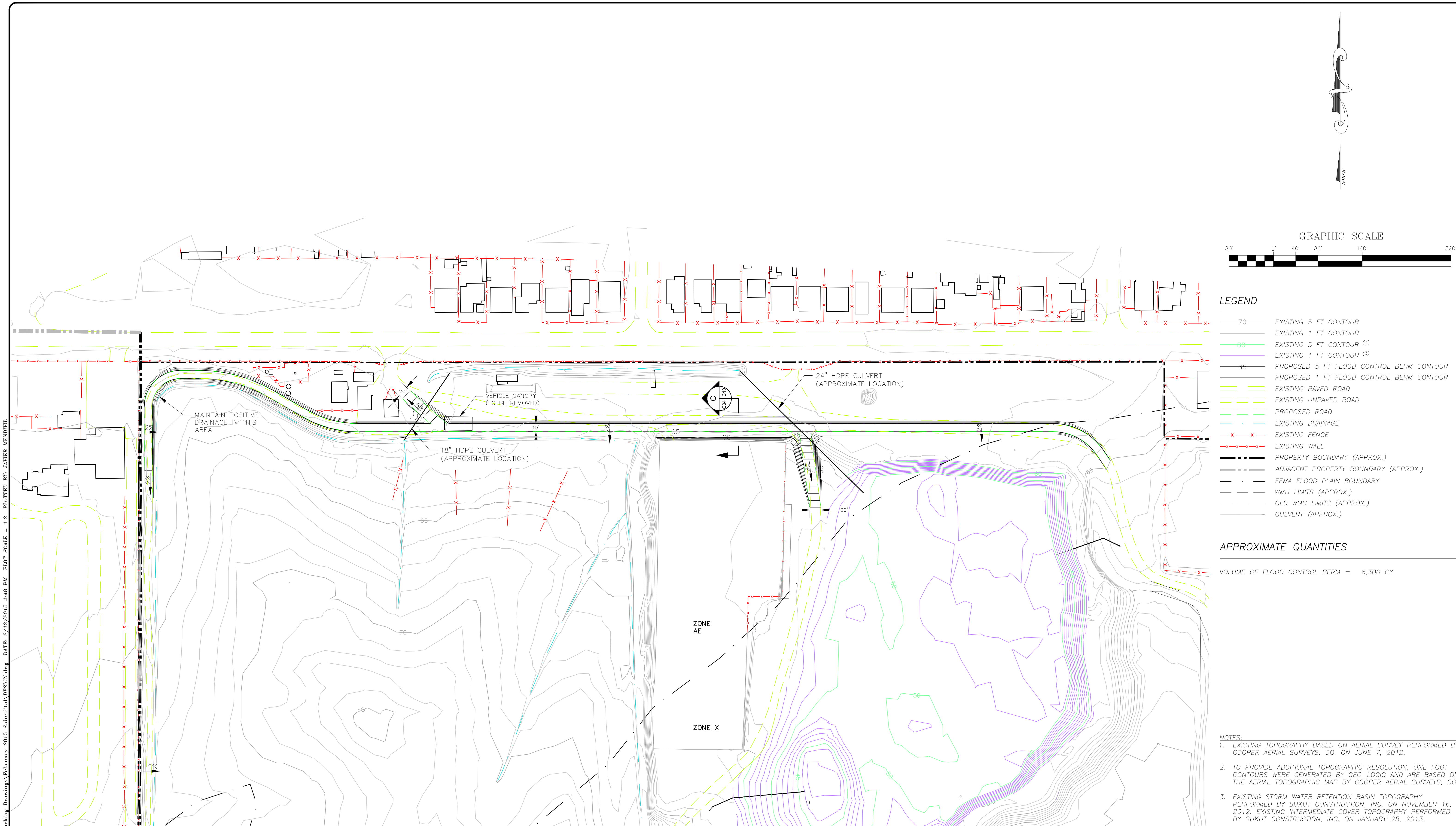

GRAPHIC SCALE

80' 0' 40' 80' 160' 320'

LEGEND

70	EXISTING 5 FT CONTOUR
	EXISTING 1 FT CONTOUR
60	EXISTING 5 FT CONTOUR (3)
	EXISTING 1 FT CONTOUR (3)
65	PROPOSED 5 FT FLOOD CONTROL BERM CONTOUR
	PROPOSED 1 FT FLOOD CONTROL BERM CONTOUR
	EXISTING PAVED ROAD
	EXISTING UNPAVED ROAD
	PROPOSED ROAD
	EXISTING DRAINAGE
x	EXISTING FENCE
	EXISTING WALL
	PROPERTY BOUNDARY (APPROX.)
	ADJACENT PROPERTY BOUNDARY (APPROX.)
	FEMA FLOOD PLAIN BOUNDARY
	WMU LIMITS (APPROX.)
	OLD WMU LIMITS (APPROX.)
	CULVERT (APPROX.)

APPROXIMATE QUANTITIES

VOLUME OF FLOOD CONTROL BERM = 6,300 CY

NOTES:

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C	10/08/14	ISSUED FOR REVIEW	WC	NC	NC	NC
D	02/05/15	ISSUED FOR REVIEW	JM	NC	NC	NC

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Geo-Logic ASSOCIATES

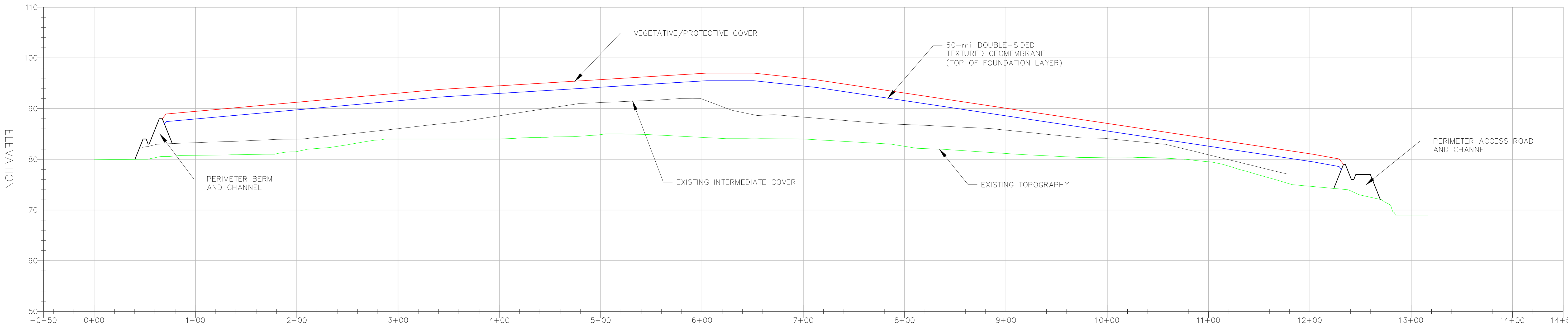
BONZI SANITATION LANDFILL
FINAL CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA

FLOOD CONTROL BERM GRADING PLAN

DRAWING NO. C04

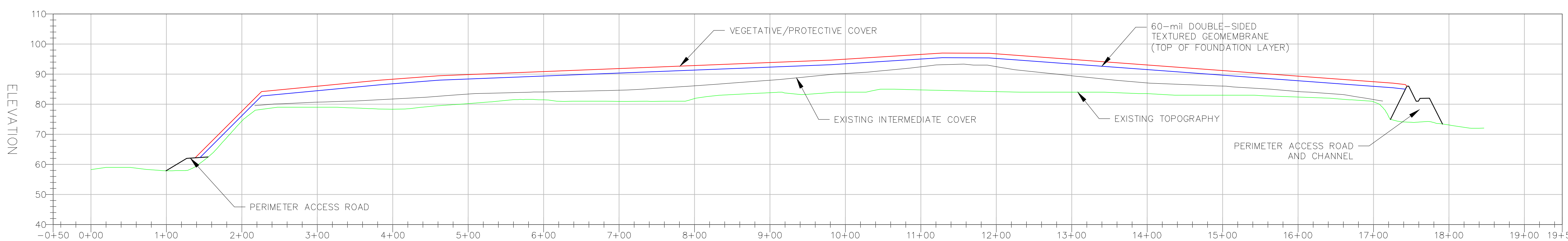
PROJECT NO. 2012.0023

ISSUED FOR REVIEW



SECTION A-A'

HORIZ 1" = 50'
VERT 1" = 10'



SECTION B-B'

HORIZ 1" = 80'
VERT 1" = 40'

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BONZI SANITATION LANDFILL
FINAL
CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA

CROSS SECTIONS

DRAWING NO.
C20
PROJECT NO.
2012.0023

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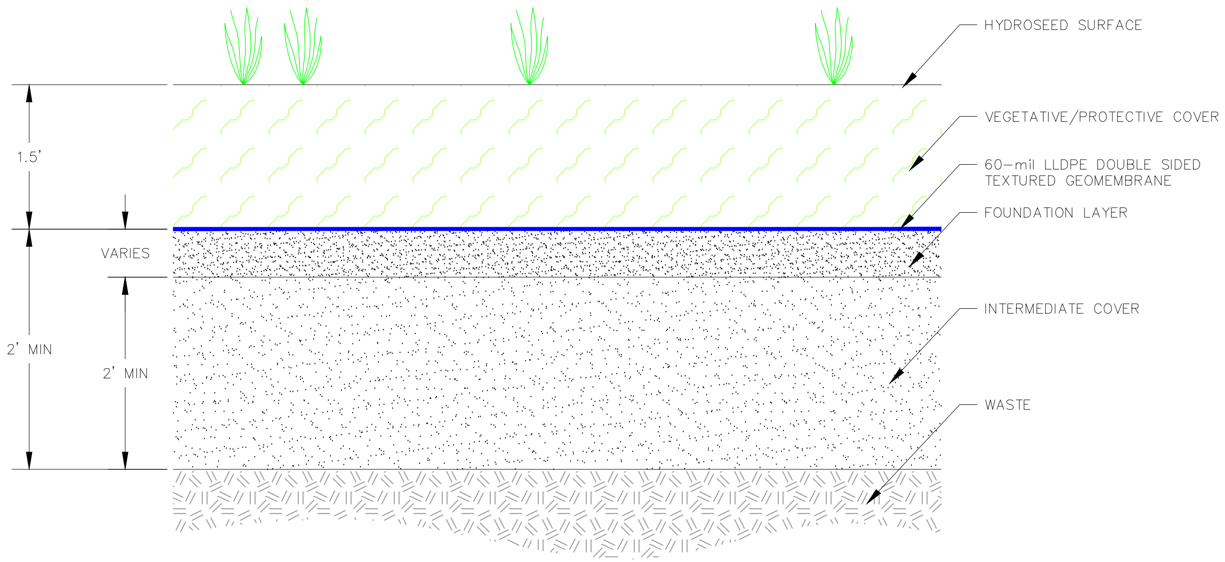
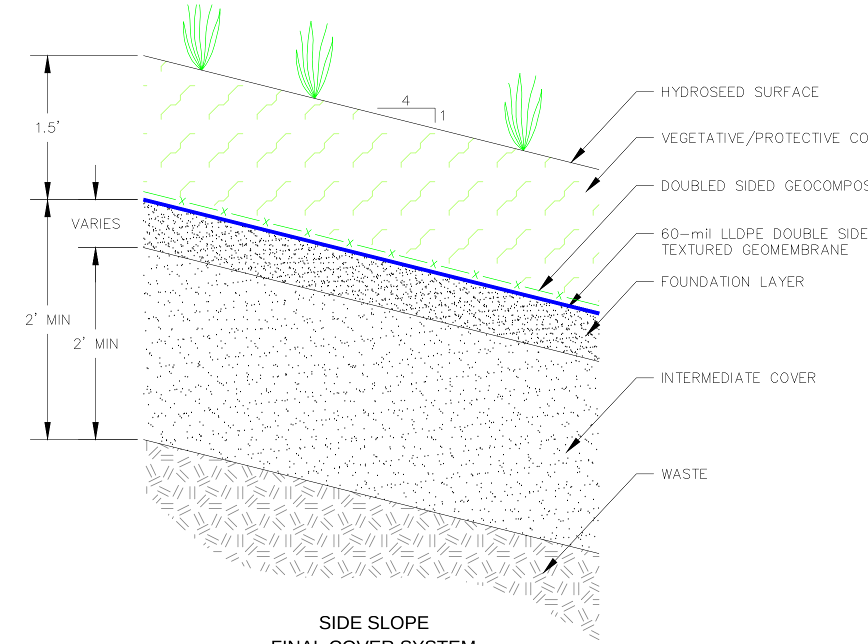


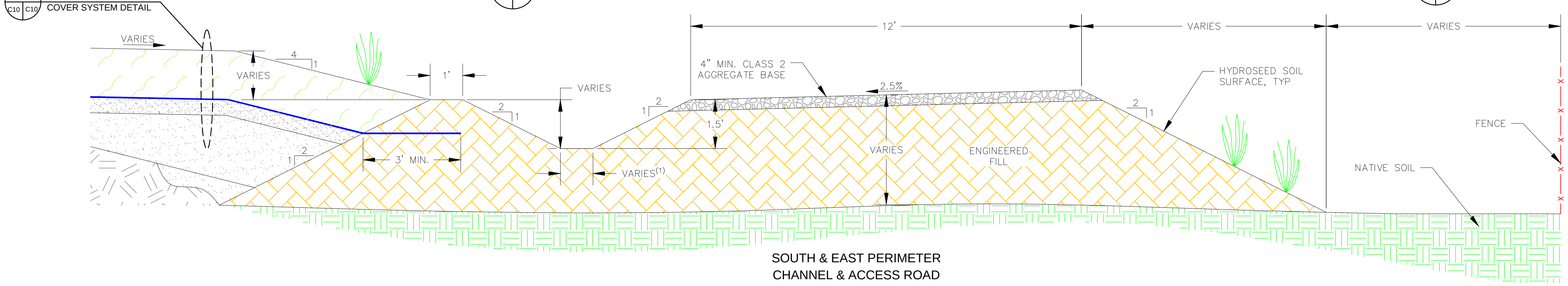
TOP DECK
FINAL COVER SYSTEM

DETAIL 1 (C02 C10)
1" = 1'



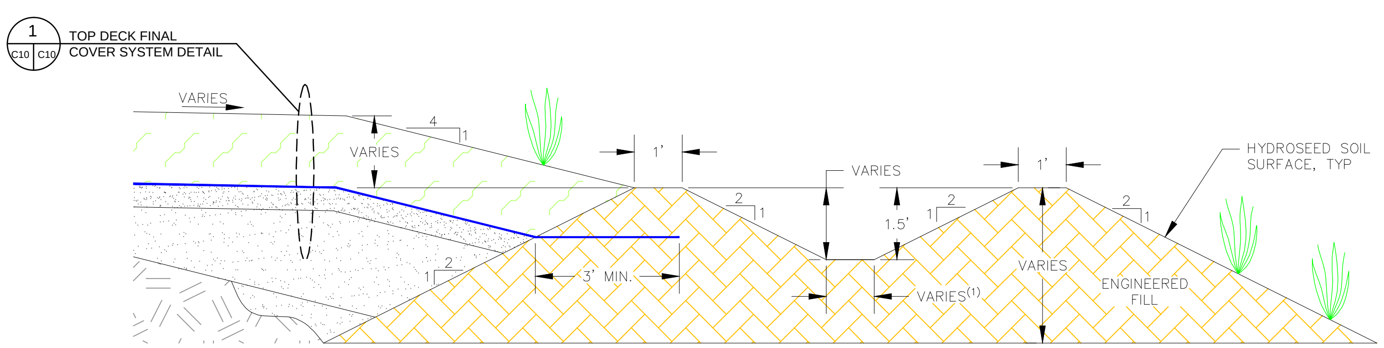
SIDE SLOPE
FINAL COVER SYSTEM

DETAIL 2 (C02 C10)
1" = 1'



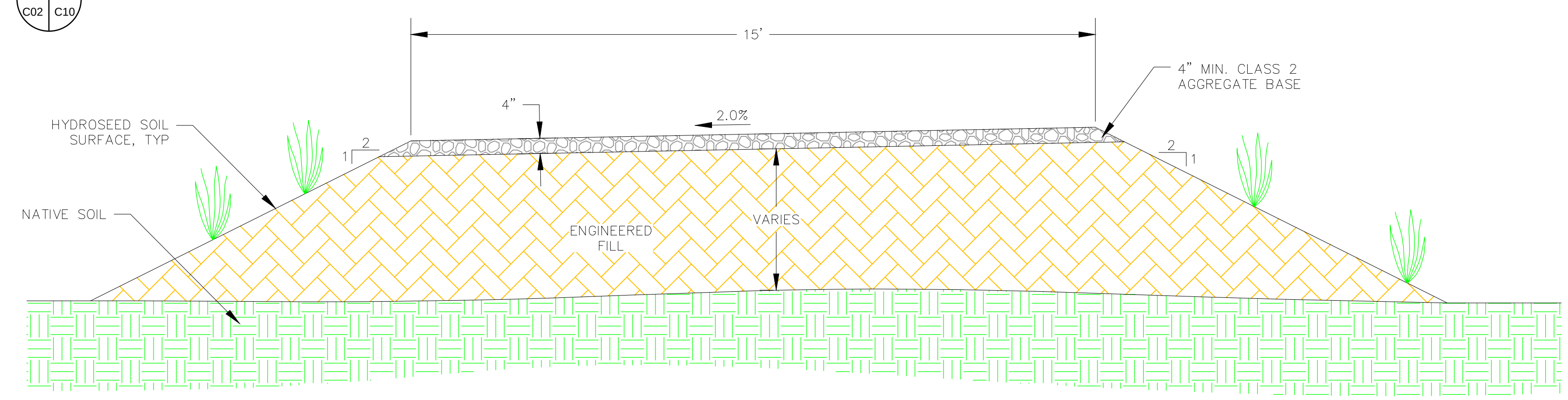
SOUTH & EAST PERIMETER
CHANNEL & ACCESS ROAD

SECTION A (C02 C10)
1" = 2'



WESTERN PERIMETER
CHANNEL

SECTION B (C02 C10)
1" = 2'



TYPICAL FLOOD CONTROL
BERM & ACCESS ROAD

SECTION C (C04 C10)
1" = 2'

NOTES:
1. SEE CHANNEL SECTIONS E, F, AND G ON SHEET C12.

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BONZI SANITATION LANDFILL
FINAL CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA
DETAILS

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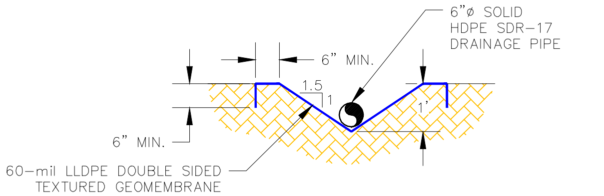
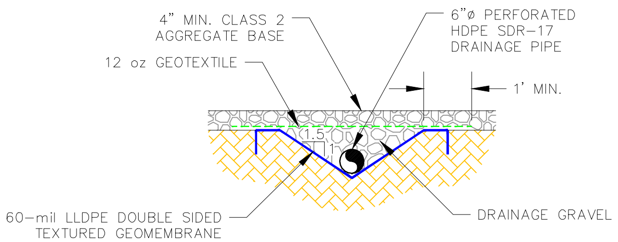


TOE DRAIN OUTLET

DETAIL 3 C11 C11

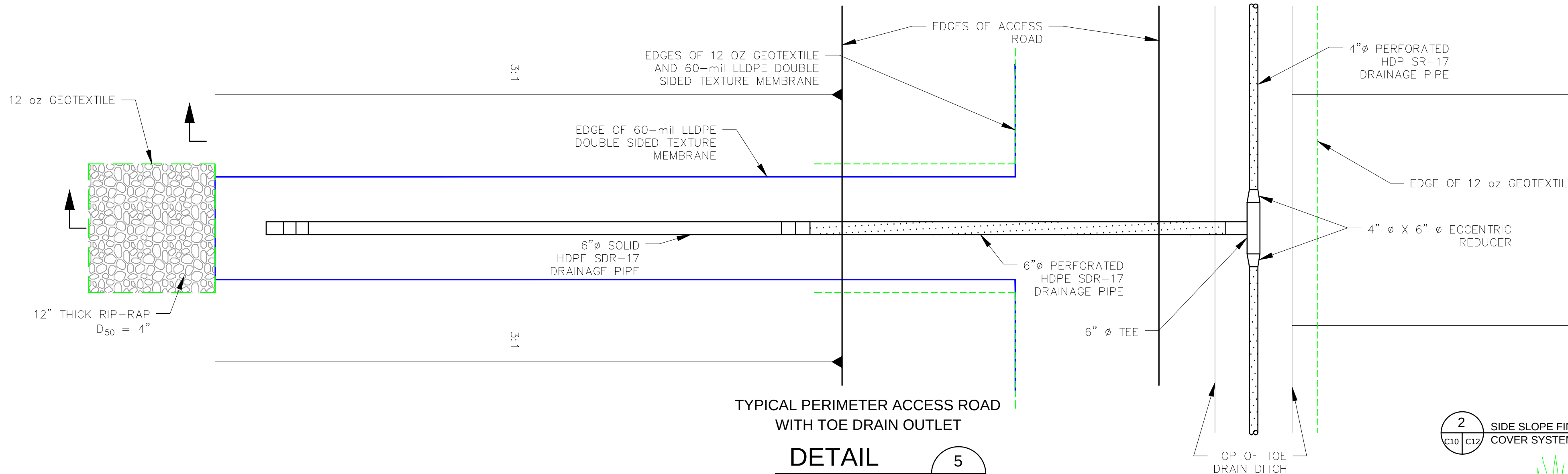
1" = 2'



TOE DRAIN OUTLET

DETAIL 4 C11 C11

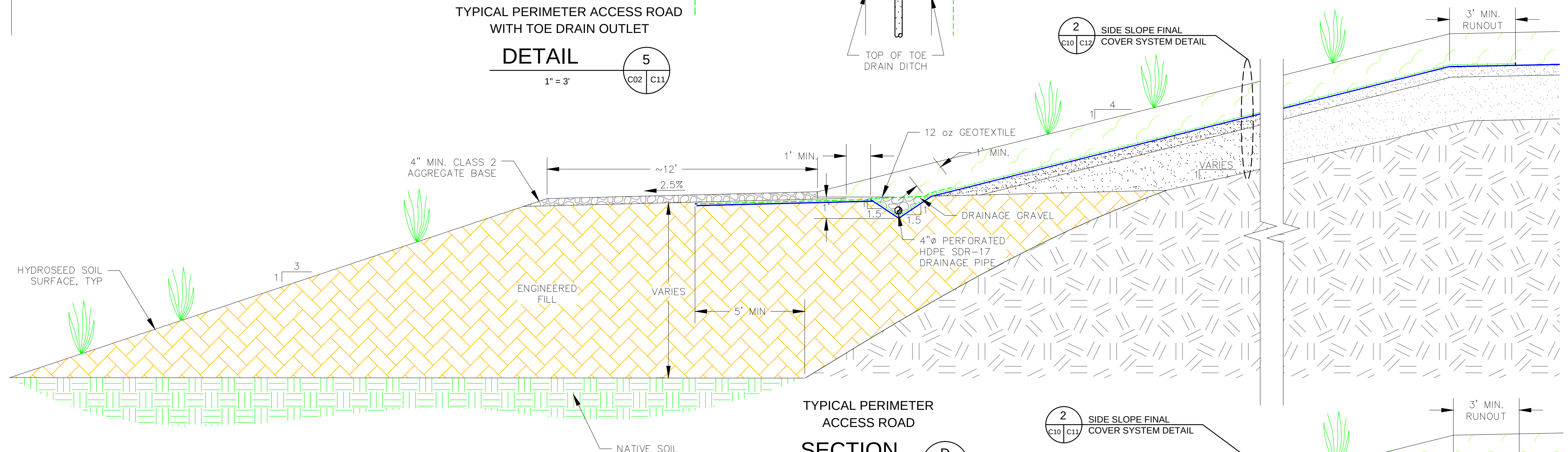
1" = 2'



TYPICAL PERIMETER ACCESS ROAD WITH TOE DRAIN OUTLET

DETAIL 5 C02 C11

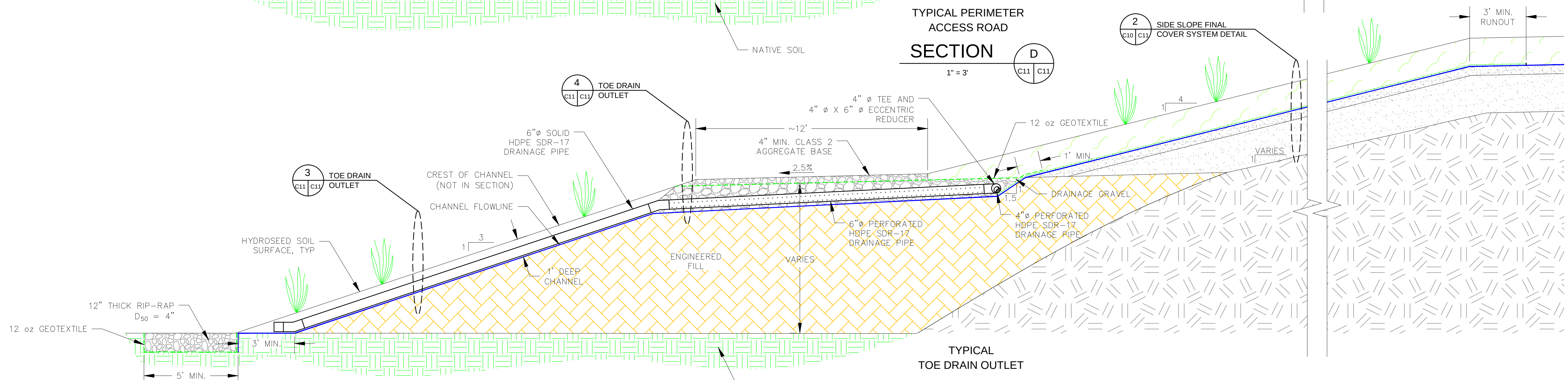
1" = 3'



TYPICAL PERIMETER ACCESS ROAD

SECTION D C11 C11

1" = 3'



TYPICAL TOE DRAIN OUTLET

SECTION E C11 C11

1" = 3'

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D	02/05/15	ISSUED FOR REVIEW	JM	NC	NC	NC

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BONZI SANITATION LANDFILL
FINAL CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA

DETAILS

DRAWING NO. C11

PROJECT NO. 2012.0023

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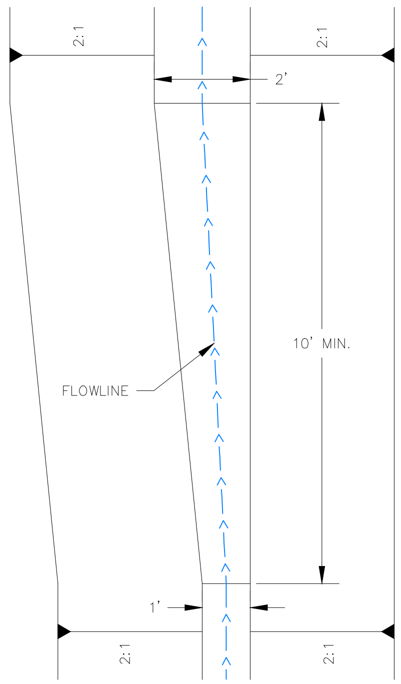
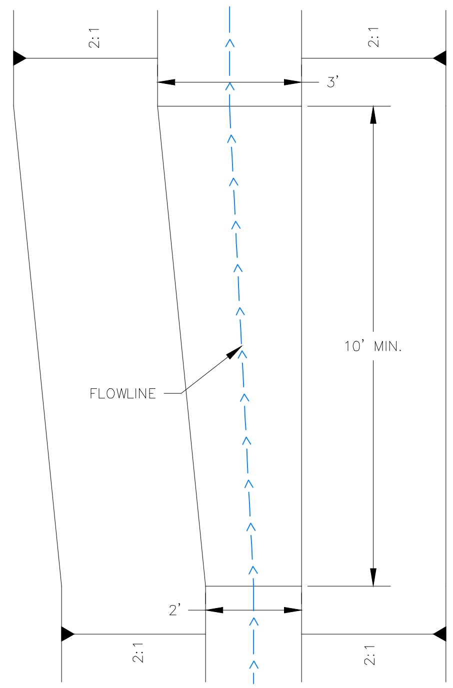


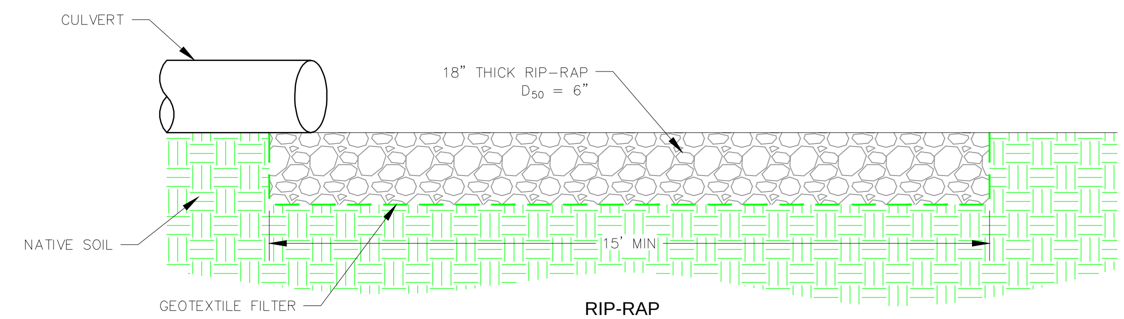
TYPE 2 TO TYPE 3
CHANNEL TRANSITION

DETAIL 6
1" = 2' C01 C12



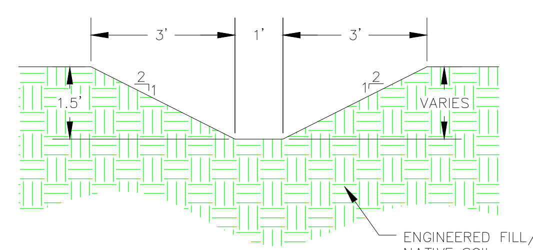
TYPE 3 TO TYPE 4
CHANNEL TRANSITION

DETAIL 7
1" = 2' C01 C12



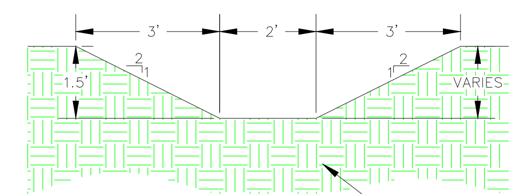
RIP-RAP
OUTFALL

DETAIL 8
1" = 2' C01 C12



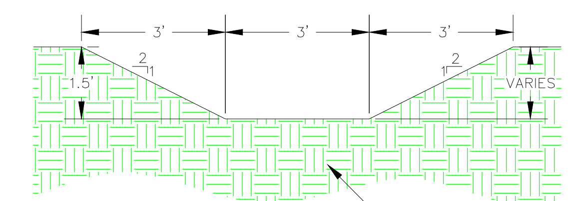
TYPE 2[1]
CHANNEL

SECTION F
1" = 2' C01 C12



TYPE 3[1]
CHANNEL

SECTION G
1" = 2' C01 C12



TYPE 4[1]
CHANNEL

SECTION H
1" = 2' C01 C12

NOTES:
1. CHANNELS SHALL BE GRASS LINED WITH EROSION CONTROL SEED MIXTURE FOR SLOPES UP TO 4% AND SHALL BE ROCK LINED WHEN SLOPE IS GREATER THAN 4%.

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C	10/08/14	ISSUED FOR REVIEW	WC	NC	NC	NC

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BONZI SANITATION LANDFILL
FINAL
CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA

DETAILS

DRAWING NO.
C12

PROJECT NO.
2012.0023

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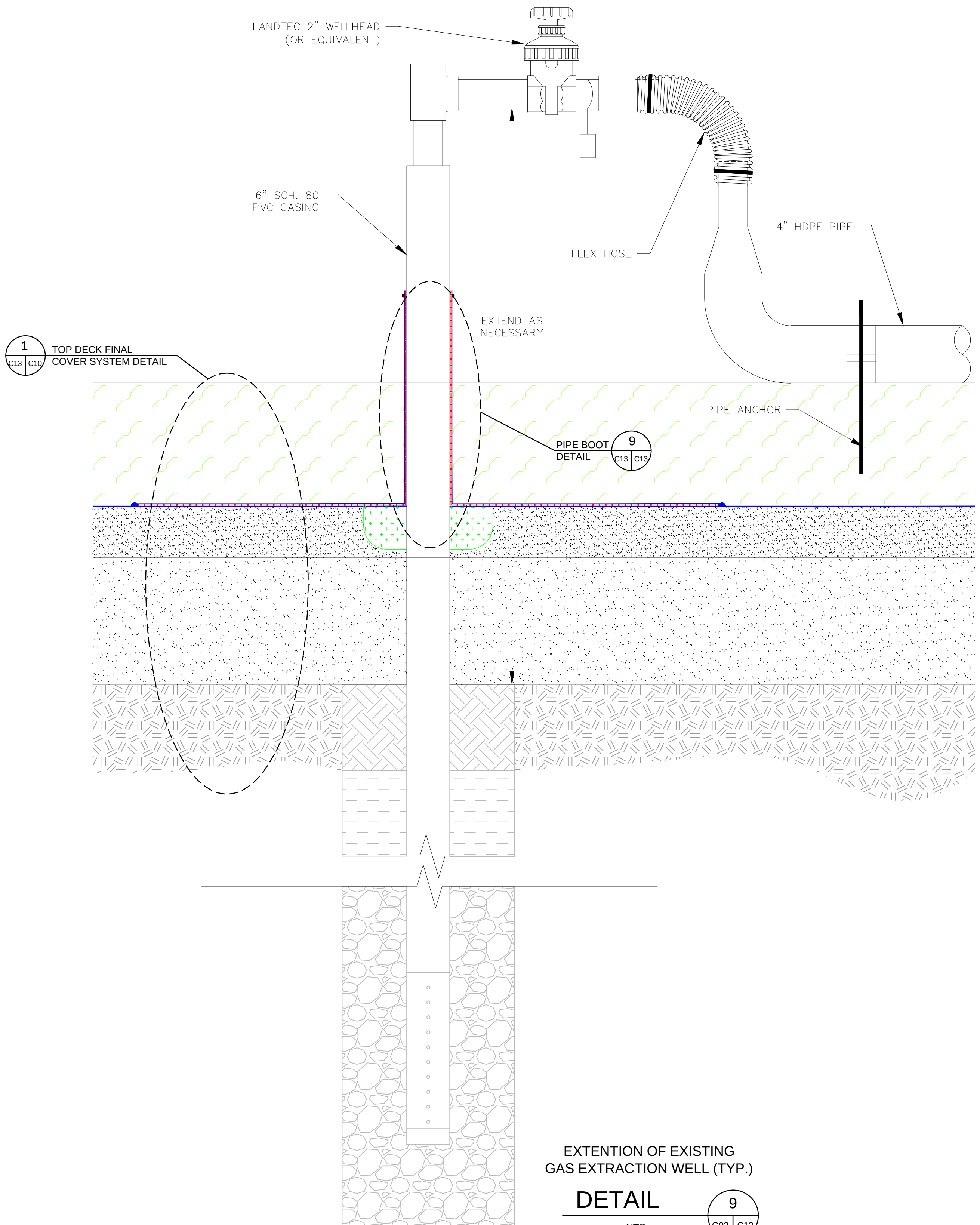
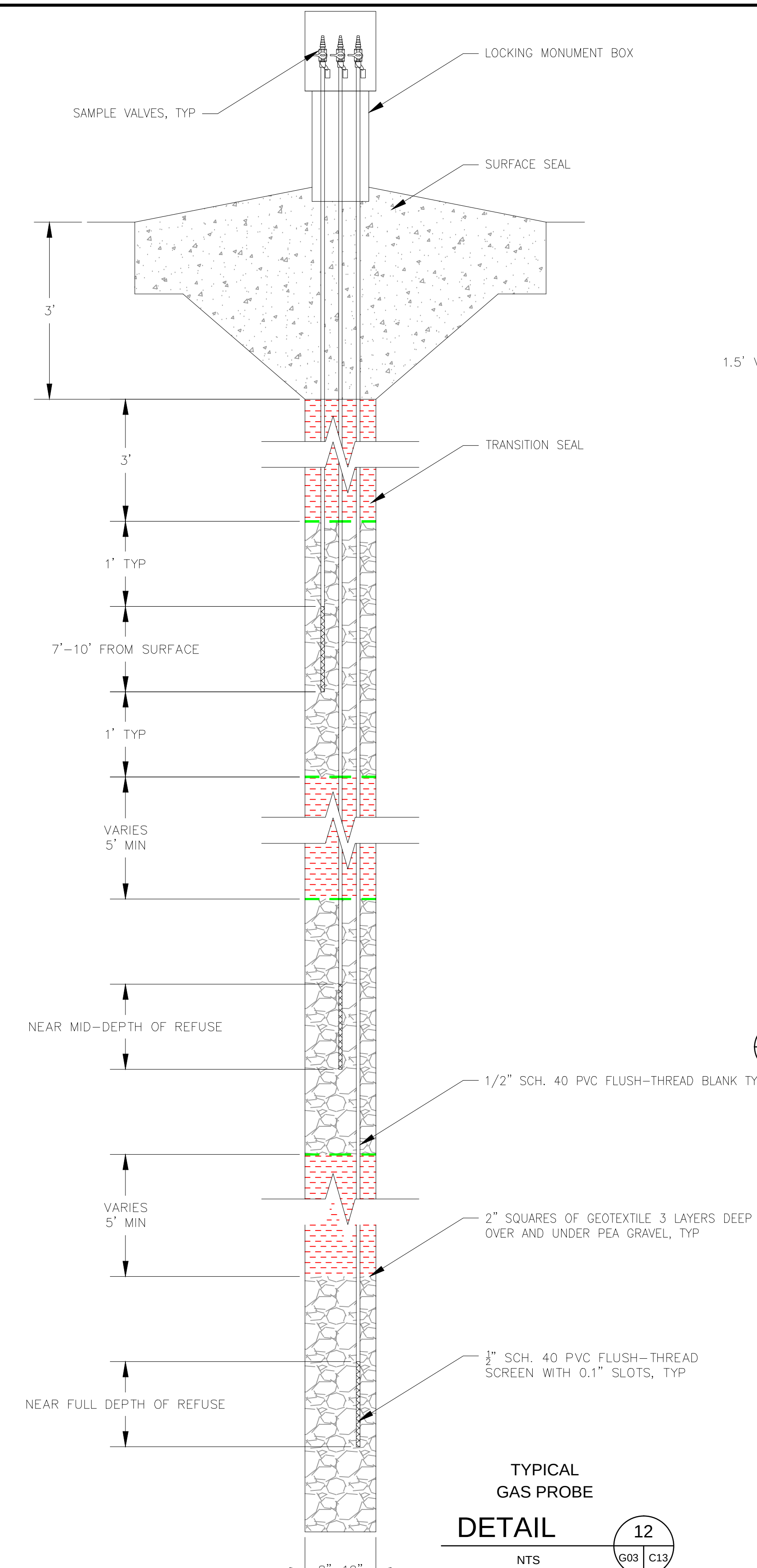


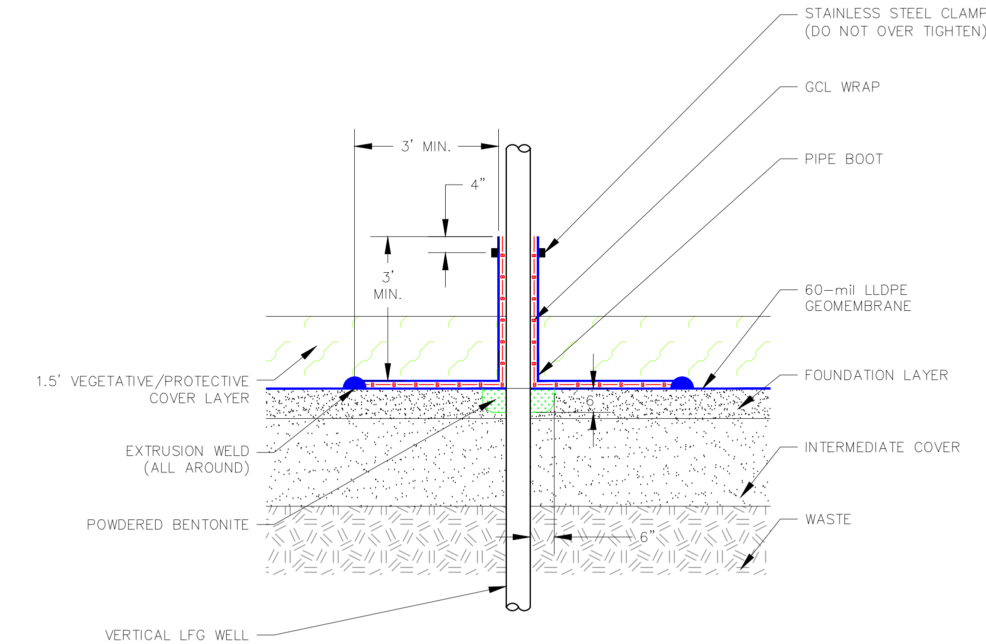
EXTENTION OF EXISTING
GAS EXTRACTION WELL (TYP.)

DETAIL 9 G03 C13
NTS



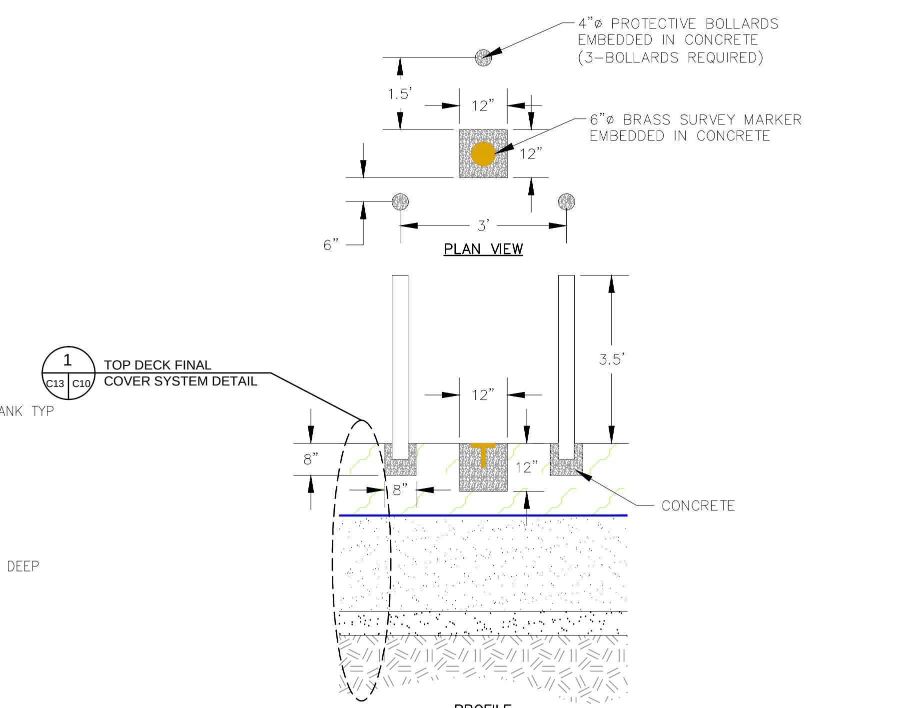
TYPICAL
GAS PROBE

DETAIL 12 G03 C13
NTS



PIPE BOOT

DETAIL 10 C13 C13
1"=2'



TYPICAL
SETTLEMENT MONUMENT

DETAIL 11 C02 C13
1" = 2'

NOTES:
1. TEMPORARILY DISCONNECT EXISTING WELL-HEAD, EXTEND PIPE CASING AS NEEDED, THEN RECONNECT.
2. ACTUAL CASING AND SCREEN LENGTHS FOR INTERMEDIATE AND DEEP ZONE PROBES WILL BE ASSIGNED BY THE GEOLOGIST BASED ON THE CONDITIONS ENCOUNTERED IN THE BORING.

LOCATION: N:\Bonzi\CAD\Working Drawings\February 2015 Submittal\DETAILS.dwg DATE: 2/12/2015 4:48 PM PLOT SCALE = 1:2 PLOTTED BY: JAVIER MENDIVIL

REV. NO.	DATE	DESCRIPTION	DRAWN BY	DESIGNED BY	CHECKED BY	APPROVED BY
A	04/22/13	ISSUED FOR REVEIW	HSO/RSB	NC	TVR	NC
B	11/27/13	ISSUED FOR REVIEW	CM	NC/CM	TVR	NC
C	10/08/14	ISSUED FOR REVIEW	WC	NC	NC	NC

DATE OF ISSUE: 02/09/2015
DESIGNED BY: NC
DRAWN BY: WC
CHECKED BY: NC
APPROVED BY: NC

Geo-Logic ASSOCIATES

BONZI SANITATION LANDFILL
FINAL CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA

DETAILS

DRAWING NO. C13
PROJECT NO. 2012.0023

This drawing has not been published but rather has been prepared by Geo-Logic Associates, Inc. for use by the client named in the title block, solely in respect of the construction operation, and maintenance of the facility named in the title block. Geo-Logic Associates, Inc. shall not be liable for the use of this drawing on any other facility or for any other purpose.

ISSUED FOR REVIEW

APPENDIX A

PERMITS

12-4-8

COUNTY OF STANISLAUS

USE PERMIT

Permit No. 836 Type of Zone: A-1 Date: July 7, 1966

The undersigned is hereby granted a Use Permit in accordance with the provisions of the Stanislaus County Zoning Ordinance No. 335 and any amendments to the same.

NAME and ADDRESS: (a) RUDY BONZI
PRINT OR TYPE NAME OF PERSON OR FIRM
(b) P. O. BOX 1942 (c) Modesto, Calif.
ADDRESS-STREET, NUMBER, ZONE CITY OR TOWN

TYPE of PROPERTY USE: Sanitary land fill

LOCATION of USE: South side of Hatch Rd., east of Vivian Rd.
HOUSE NUMBER- LOCAL NAME OF STREET, ROAD OR HIGHWAY

LEGAL DESCRIPTION: SEE ATTACHED

This permit is granted subject to the following conditions:

(a) That this use be constructed in accordance with plans approved by the Planning Commission and in accordance with other laws and ordinances;
(b) That a Building Permit be obtained from the office of the County Building Department;
(c) That a suitable drainage plan be approved by the County Health Officer, and construction inspected.

CONDITIONS: SEE REVERSE SIDE

Failure to perform any of the stated conditions hereon shall constitute grounds for revocation of this permit.

I, the undersigned, do hereby certify that I have read the above conditions and will comply with same in all respects.

* Rudy Bonzi
SIGNATURE OF AGENT, REPRESENTATIVE OR OWNER

STANISLAUS COUNTY PLANNING COMMISSION

[signature]
SIGNATURE OF OFFICER ISSUING THIS PERMIT

307C-D

CONDITIONS:

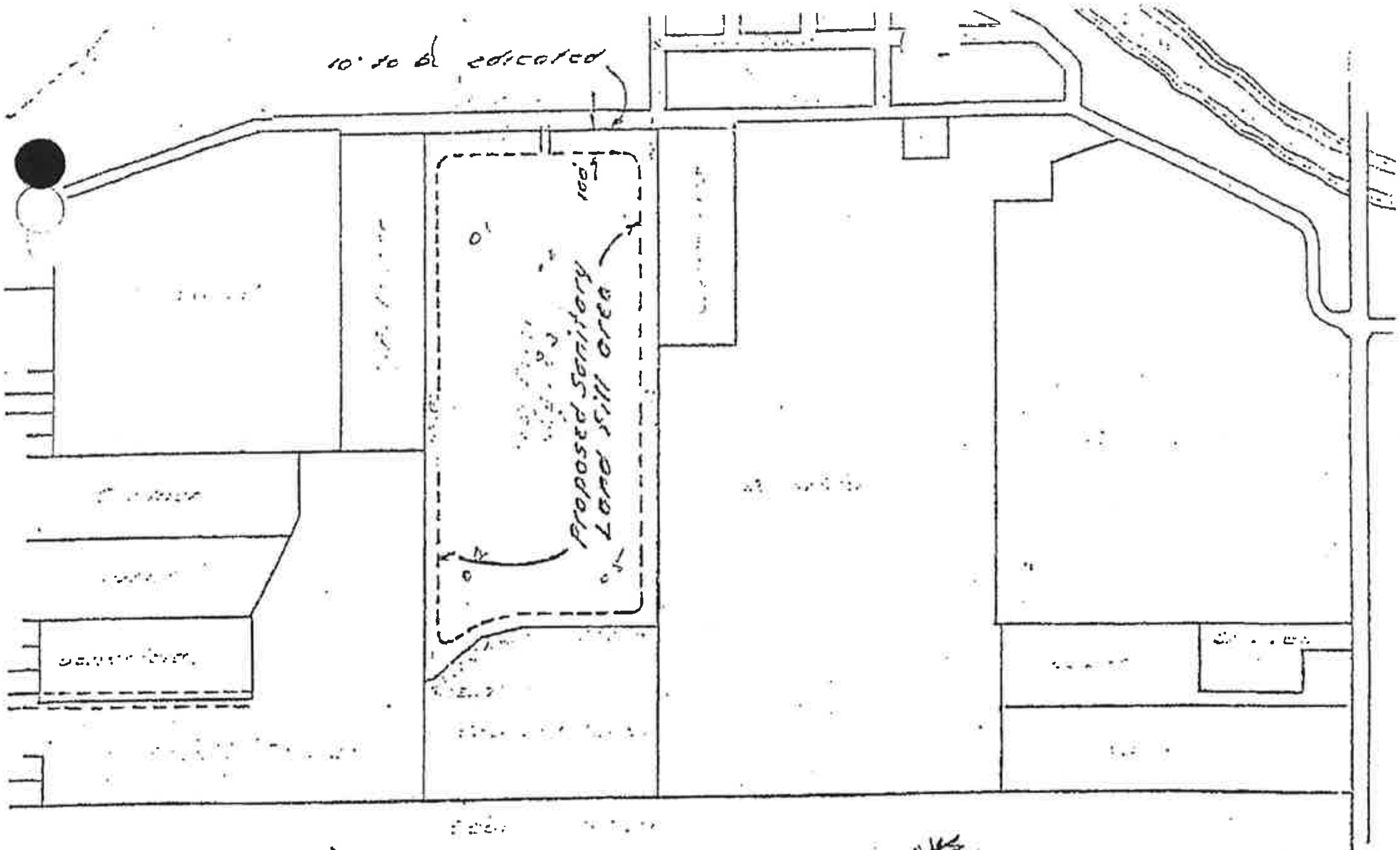
1. The Operation of the sanitary land fill shall comply with all of the terms listed on the attached "Standards, Sanitary Land Fills in Stanislaus County" dated 6-6-66.

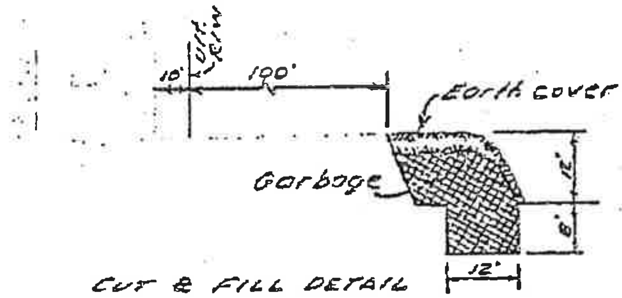
2. The operation and use of the property shall comply with all other ordinances, laws and terms relating to garbage disposal in Stanislaus County and develope the land fill in accordance with the plans and specifications submitted with the application for the use.

3. The owner shall dedicate for road purposes, sufficient right-of-way to make Hatch Road 30 feet wide measured from the existing center line to the south property line.

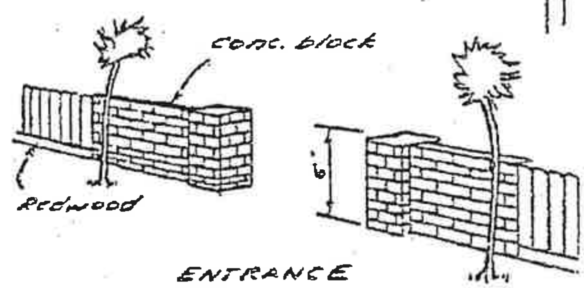
4. Construct the fence and entrance as shown on the applicant's plan.

5. Required dedication for the widening of Hatch Road and the fence construction to be complied with before the site is opened for the applied for use.





CUT & FILL DETAIL
scale: 1" = 30'



ENTRANCE
DETAIL

ZONING USE PERMIT APPLICATION NO. 836

BY RUDY BONZI TO ESTABLISH A SANITARY LAND FILL ON PROPERTY IN AN A-1 AGRICULTURE ZONE.

PARCEL AREA: 41.5 AC.

C

RECEIVED

AUG 18 196_

BOARD OF SUPERVISORS
STANISLAUS COUNTY

TO THE HONORABLE BOARD OF SUPERVISORS
OF STANISLAUS COUNTY, CALIFORNIA:

In Re: Petition to Amendment of Condition of Use Permit -- Use Permit No. 836.

I

Petitioner was granted a Use Permit No. 836 to operate a sanitary land fill known as Bonzi Sanitation Land Fill, W. Hatch Road, Modesto, California, on July 7, 1966.

II

The Sanitary Land fill Standards adopted by the Board of Supervosors of the County of Stanislaus, State of California on July 26, 1966, provided among other things, as follows:

" Item No. 20 -- Salvage

There shall be no salvage separated or stored at a sanitary landfill."

III

Petitioner desire that his Use Permit be modified to permit salvage materials to be separated and to be removed on or before the end of each day before 5 P.M.

IV

Petitioner will have bulk-containers or trucks available during the day in order to load the salvage materials therein immediately and to remove the same before 5 P.M.

V

By permitting the removal of salvageable materials, it will make available more land space for those materials not salvageable and extend the usefullness of available land area.

Granted 8-22

LAW OFFICES
LACOSTE, KELLER & STRAUSS
CARTER-LACOSTE BUILDING
931 10TH STREET
MODESTO, CALIFORNIA

WHEREFORE, petitioner respectfully requests that the Use Permit No. 836 be modified and amended to permit salvage to be separated and removed on or before 5 P.M. daily.

BONZI SANITATION LAND FILL

By Rudy Bonzi
Rudy Bonzi

LAW OFFICES
LACOSTE, KELLER & STRAUSS
CARTER-LACOSTE BUILDING
831 13TH STREET
MODESTO, CALIFORNIA

52, ... 12-4-5

THE BOARD OF SUPERVISORS
OF THE COUNTY OF STANISLAUS
STATE OF CALIFORNIA

IN RE:

Date: August 22, 1967

GRANTING AMENDMENT TO CONDITIONS OF USE PERMIT OF BONZI SANITATION LAND FILL, USE PERMIT NO. 836

WHEREAS, Bonzi Sanitation Land Fill was heretofore granted Use Permit No. 836, subject to terms and conditions; and

WHEREAS, said Petitioner has filed with this Board his Petition to Amend the conditions of said Use Permit,

Upon motion of Supervisor Domecq, seconded by Supervisor Brink, it is ordered by unanimous vote of this Board that Use Permit No. 836 be, and hereby is, amended to include the additional condition to permit salvage materials to be separated and to be removed on or before the end of each day before 5 p.m.

December 16, 1982

TO: PLANNING COMMISSION

FROM: DEPARTMENT OF PLANNING AND COMMUNITY DEVELOPMENT

SUBJECT: ZONING USE PERMIT APPLICATION NO. 836 - Bonzi Landfill - Modify Conditions

The subject use permit was approved by the Board of Supervisors on July 7, 1966. Included in the conditions was a requirement that the operation be conducted in accordance with "standards for sanitary landfills in Stanislaus County." Those standards (which are still in effect) stated that "there shall be no salvage separated or stored at the landfill." In 1967, at the request of the applicant, the Board modified that condition so that the applicant could salvage, but required that salvaged materials to be removed each day before 5 p.m. The applicant, through his attorney, has now asked that this condition be modified.

Conditions and attitudes have changed considerably since 1967, and rather than discouraging salvaging, we now encourage recycling. The County's solid waste plan points out the need for encouraging resource recovery and recycling. The only concerns staff has with modifying the condition is the possible problems created with long-term storage of materials when the operator is waiting for a more favorable price for the materials. We believe that if the recycling activities are conducted as provided by the recommended conditions, they would not be objectional.

Recommendation

Modify existing conditions and add conditions as follows.

Existing Condition No. 1

The operation of the sanitary land fill shall comply with all of the terms listed on the attached "Standards, Sanitary landfills in Stanislaus County" dated 6/6/66, *except that salvage and recycling will be permitted.*

New Conditions 6-10

6. A plan shall be prepared delineating the type of material to be salvaged, the amount, and the location of processing and storage areas.

7. A pest control program shall be implemented with particular emphasis given to control of rats.

8. Salvageables shall be stored over areas previously filled with refuse.

9. Materials recovered at the landfill face shall be stored so as not to interfere with vehicular traffic into and from the landfill nor disturb the

COPY #3

IF NOT USED IN 18 MONTH
THIS PERMIT SHALL BE
VOID Sec. 9-130(b)

S 12 T 4 R 8

USE PERMIT

COUNTY OF STANISLAUS

PERMIT NO. 836 ZONE: A-2 DATE OF APPROVAL: (Amended) December 16, 1982 July 7, 1966

The undersigned is hereby granted a Use Permit in accordance with the provisions of the Ordinance Code of Stanislaus County, Title 9, Chapter 3, and any amendments to the same.

NAME RUDY BONZI ADDRESS 2650 W. Hatch Road

CITY Modesto ZIP: 95351 PHONE: 538-1430

USE: SANITARY LAND FILL.

LOCATION OF PROPERTY: South Side of Hatch Road, East of Vivian Road

ASSESSMENT NO. 17-41-36 ACREAGE: 121.

This permit is granted subject to the conditions (attached/on reverse side).

Failure to perform any of the stated conditions hereon shall constitute grounds for revocation of this permit.

I, the undersigned, do hereby certify that I have read the conditions and will comply with same in all respects.

[signature]
Signature of Agent, Representative or Owner

STANISLAUS COUNTY DEPARTMENT OF PUBLIC WORKS

Ron Chenier
Signature of Officer Issuing Permit

1/20/1983
Date Issued

USE PERMIT NO. 836
(Amended)
Rudy Bonzi
December 16, 1982
CONDITIONS:

MODIFY Condition No. 1

1. The operation of the sanitary land fill shall comply with all of the terms listed on the attached "Standards, Sanitary landfills in Stanislaus County" dated 6-6-66, *except that salvage and recycling will be permitted.*

NEW CONDITIONS:

6. A plan shall be prepared delineating the type of material to be salvaged, the amount, and the location of processing and storage areas.

7. A pest control program shall be implemented with particular emphasis given to control of rats.

8. Storage of salvageables will be permitted over previously filled areas if it can be demonstrated that such storage will not interfere with the grading and maintenance requirements.

9. Materials recovered at the landfill face shall be stored so as not to interfere with vehicular traffic into and from the landfil nor distrub the normal operations of the landfill.

10. Materials imported (concrete, glass, brush, tires) onto the site shall be stored separate from the active working areas of the landdill.

- - - - - - - - - -

SE, NE NW 12-4-8

COUNTY OF STANISLAUS

IF NOT USED IN 18 MONTH
THIS PERMIT SHALL BE
VOID. Sec. 9-130(b)

USE PERMIT

PERMIT NO. 1007 TYPE OF ZONE: A-1 DATE: February 6, 1969

The undersigned is hereby granted a Use Permit in accordance with the provisions of the Stanislaus County Zoning Ordinance No. 335 and any amendments to the same.

1. NAME AND ADDRESS: (a) Rudy Bonzi
PRINT OR TYPE NAME OF PERSON OR FIRM
(b) P. O. Box 1942 (c) Modesto
ADDRESS CITY OR TOWN

2. TYPE OF PROPERTY USE: Erect 40' x 60' storage building for tractors and equipment on site of existing sanitary land fill

3. LOCATION OF USE: 2650 Hatch - S. of Hatch, E. of Vivian Road
HOUSE NUMBER — LOCAL NAME OF STREET, ROAD OR HIGHWAY

4. LEGAL DESCRIPTION: S1 1/4 NE 1/4 of NW 1/4 12-4-8, Beg. 673.40' n. of int. 1/4 cor.; W. 535.27'; SW 443.87'; N. 2143.03'; E. 907.50'

5. This permit is granted subject to the following conditions:
(a) That this use be constructed in accordance with plans approved by the Planning Commission and in accordance with other laws and ordinances;
(b) That a Building Permit, when applicable, be obtained from the office of the County Building Department;
(c) That a suitable sewage disposal system and water supply, if other than public, be approved and inspected by the County Health Officer

Approved as submitted

Failure to perform any of the stated conditions hereon shall constitute grounds for revocation of this permit.

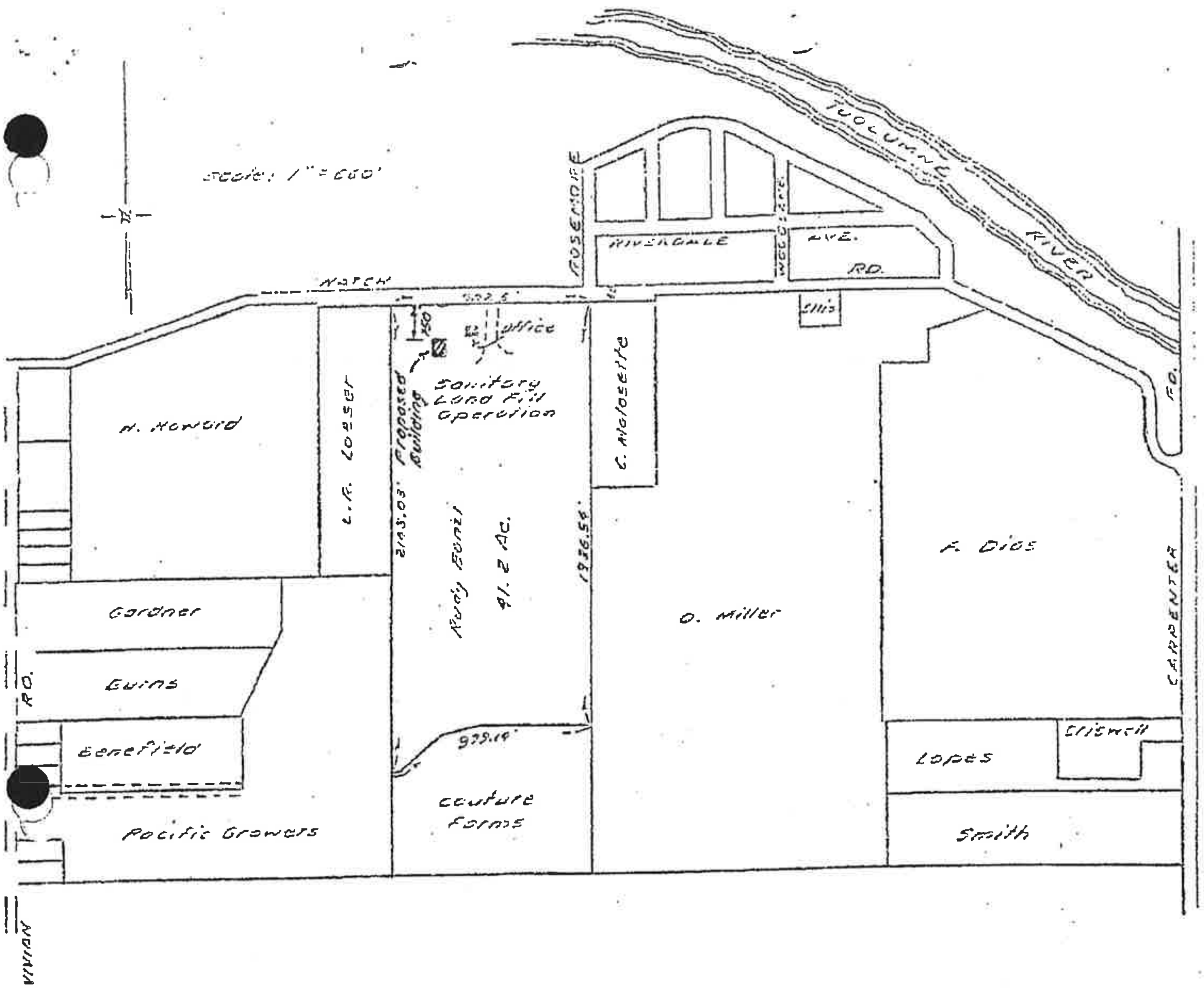
I, the undersigned, do hereby certify that I have read the above conditions and will comply with same in all respects.

Mrs. Mary Bonzi
SIGNATURE OF AGENT, REPRESENTATIVE OR OWNER

STANISLAUS COUNTY PLANNING COMMISSION

Ray W. Irwin
SIGNATURE OF OFFICER ISSUING PERMIT
By Beverly Johnson

3/4/69
DATE GRANTED



ZONING USE PERMIT APPLICATION NO. 1007

By Rudy Borzi to erect a 40'×60 building for storage of tractors and equipment in conjunction with existing sanitary land fill operation.

A-1 Unclassified zone

RECEIVED
OCT - 3 1969
COUNTY OF STANISLAUS
DEPT. OF PUBLIC WORKS

IF NOT USED IN 18 MONTHS THIS PERMIT SHALL BE VOID. Sec. 9-130(B)

COUNTY OF STANISLAUS

USE PERMIT

PERMIT NO. 1052 TYPE OF ZONE: A-1 DATE: October 2, 1969

The undersigned is hereby granted a Use Permit in accordance with the provisions of the Ordinance Code of Stanislaus County, Title 9, Chapter 3, and any amendments to the same.

1. NAME AND ADDRESS: (a) RUDY BONZI
PRINT OR TYPE NAME OF PERSON OR FIRM
(b) 2650 W. Hatch Road (c) Modesto
ADDRESS CITY OR TOWN

2. TYPE OF PROPERTY USE: 2650 W. Hatch Road. Expanding existing sanitary land fill operation onto adjoining property owned by the applicant at 2650 W. Hatch Road

3. LOCATION OF USE:
HOUSE NUMBER — LOCAL NAME OF STREET, ROAD OR HIGHWAY

4. LEGAL DESCRIPTION:
ATTACHED

5. This permit is granted subject to the following conditions:
(a) That this use be constructed in accordance with plans approved by the Planning Commission and in accordance with other laws and ordinances;
(b) That a Building Permit, when applicable, be obtained from the office of the County Building Department;
(c) That a suitable sewage disposal system and water supply, if other than public, be approved and inspected by the County Health Officer.

CONDITIONS: SEE REVERSE SIDE

sion Of
12-3-69
Receives
ers' Nod

n Hatch Road will an doubled in size ner Rudy Bonzi has rom the Stanislaus ning Commission to al land on the east andfill operation.
; approval of the was granted last the commissioners neighbors object to The State Water trol Board also has clearance, planner ; told the commis-
enlargement, on owned by set back 150 road and will by a six-foot high Frontage on the e 619 feet, with the l the 2,637 foot prop- ,320 feet wide.

Failure to perform any of the stated conditions hereon shall constitute grounds for revocation of this permit.

I, the undersigned, do hereby certify that I have read the above conditions and will comply with same in all respects.

Rudy Bonzi
SIGNATURE OF AGENT, REPRESENTATIVE OR OWNER

US COUNTY PLANNING COMMISSION

[signature]
RE OF OFFICER ISSUING PERMIT

10-31-69
DATE GRANTED

CONDITIONS:

1. The . operation of the sanitary land fill shall comply with all of the terms listed on the attached "Standards, Sanitary Land Fills in Stanislaus County", dated 7-26-66.

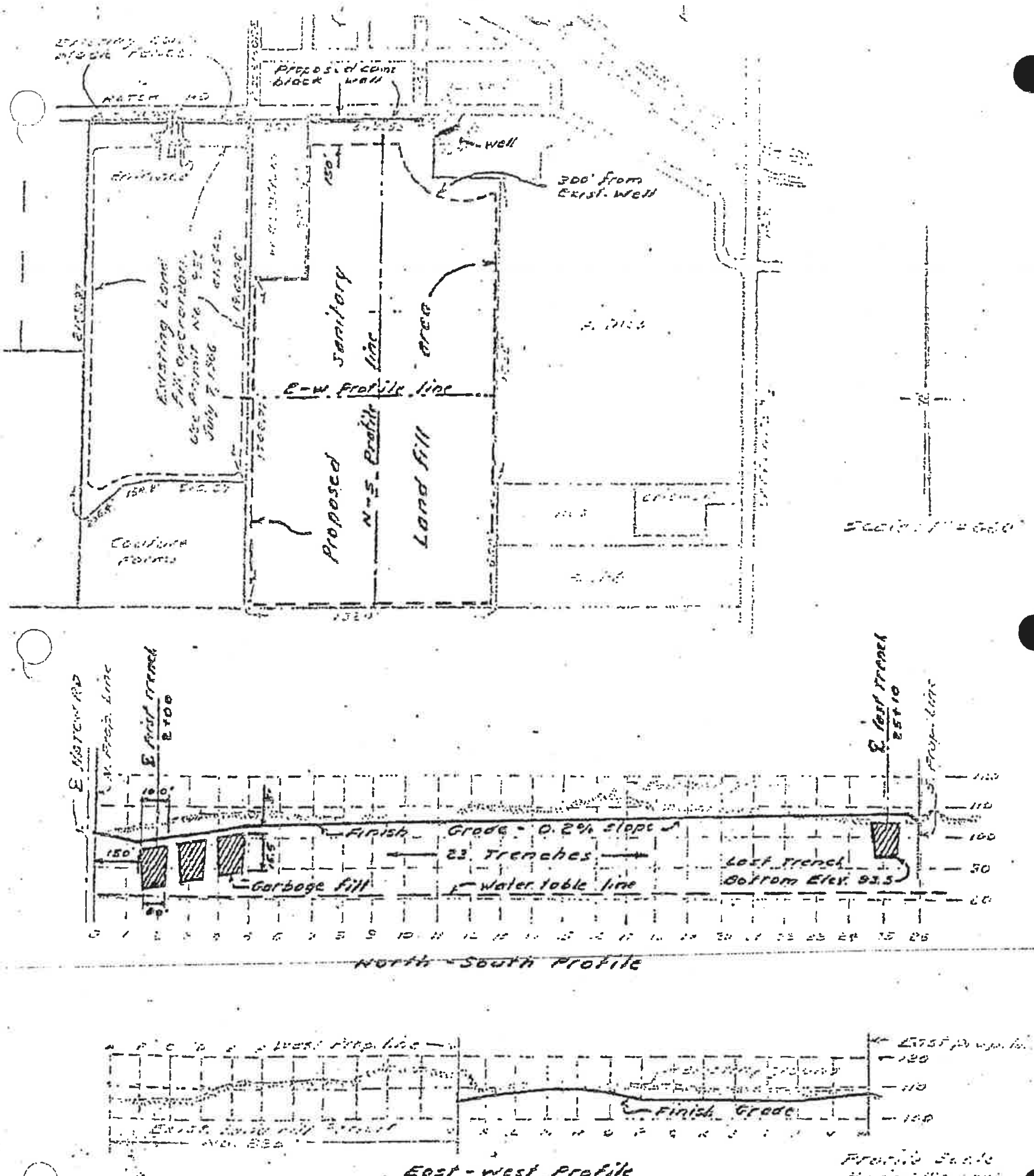
2. The operation and use of the property shall comply with all other ordinances, laws and terms relating to garbage disposal in Stanislaus County and develop the land fill in accordance with the plans and specifications submitted with the application for the use.

3. The owner shall dedicate for road purposes, sufficient right-of-way to make Hatch Road 30 feet wide measured from the existing center line to the ~~south property~~ right of way line

4. That a six foot high fence be constructed along Hatch Road conforming to the same construction and design as the existing fence along the frontage of the existing land fill facility.

5. That the existing entrance at the present site be used for the expansion area with the exception of a temporary opening onto Hatch Road from the new area to provide for occasional heavy truck movement as approved by the Department of Public Works.

6. The required dedication for the widening of Hatch Road and the fence construction to be complied with before the site is opened for the applied for use.



ZONING USE PERMIT APPLICATION No. 1052
By Rudy Bonzi to expand existing sanitary land fill operation on to adjoining property owned by the applicant as shown.

COUNTY OF STANISLAUS

IF NOT USED IN 18 MONTHS THIS PERMIT SHALL BE VOID. Sec. 9-130(b)

USE PERMIT

PERMIT NO. 1676 TYPE OF ZONE: [illegible] DATE: April 2, 1970

The undersigned is hereby granted a Use Permit in accordance with the provisions of the Ordinance Code of Stanislaus County, Title 9, Chapter 3, and any amendments to the same.

1. NAME AND ADDRESS: (a) [illegible]
   PRINT OR TYPE NAME OF PERSON OR FIRM
   (b) P. O. Box 1942
   ADDRESS
   (c) [illegible]
   CITY OR TOWN

2. TYPE OF PROPERTY USE: Erect 60' x 70' bldg. for the storage of trucks and to install two gas pumps for use in conj'n. with sanitary land fill

3. LOCATION OF USE: 2050 [illegible] of [illegible] of Vivian [illegible]
   HOUSE NUMBER — LOCAL NAME OF STREET, ROAD OR HIGHWAY

4. LEGAL DESCRIPTION: [illegible] 1/4 [illegible] 1/4 of [illegible] 1/4 [illegible] [illegible] Int. 1/4 Cor.; W. [illegible]; [illegible]; N. 2143.0[illegible]'; E. [illegible]

5. This permit is granted subject to the following conditions:
   (a) That this use be constructed in accordance with plans approved by the Planning Commission and in accordance with other laws and ordinances;
   (b) That a Building Permit, when applicable, be obtained from the office of the County Building Department;
   (c) That a suitable sewage disposal system and water supply, if other than public, be approved and inspected by the County Health Officer
   d That the proposed gas pumps be located not closer than 50 feet to the south right of way line of [illegible] Road to stay clear of the R-A Zoned area

Failure to perform any of the stated conditions hereon shall constitute grounds for revocation of this permit.

I, the undersigned, do hereby certify that I have read the above conditions and will comply with same in all respects.

[illegible signature]

SIGNATURE OF AGENT, REPRESENTATIVE OR OWNER

STANISLAUS COUNTY PLANNING COMMISSION

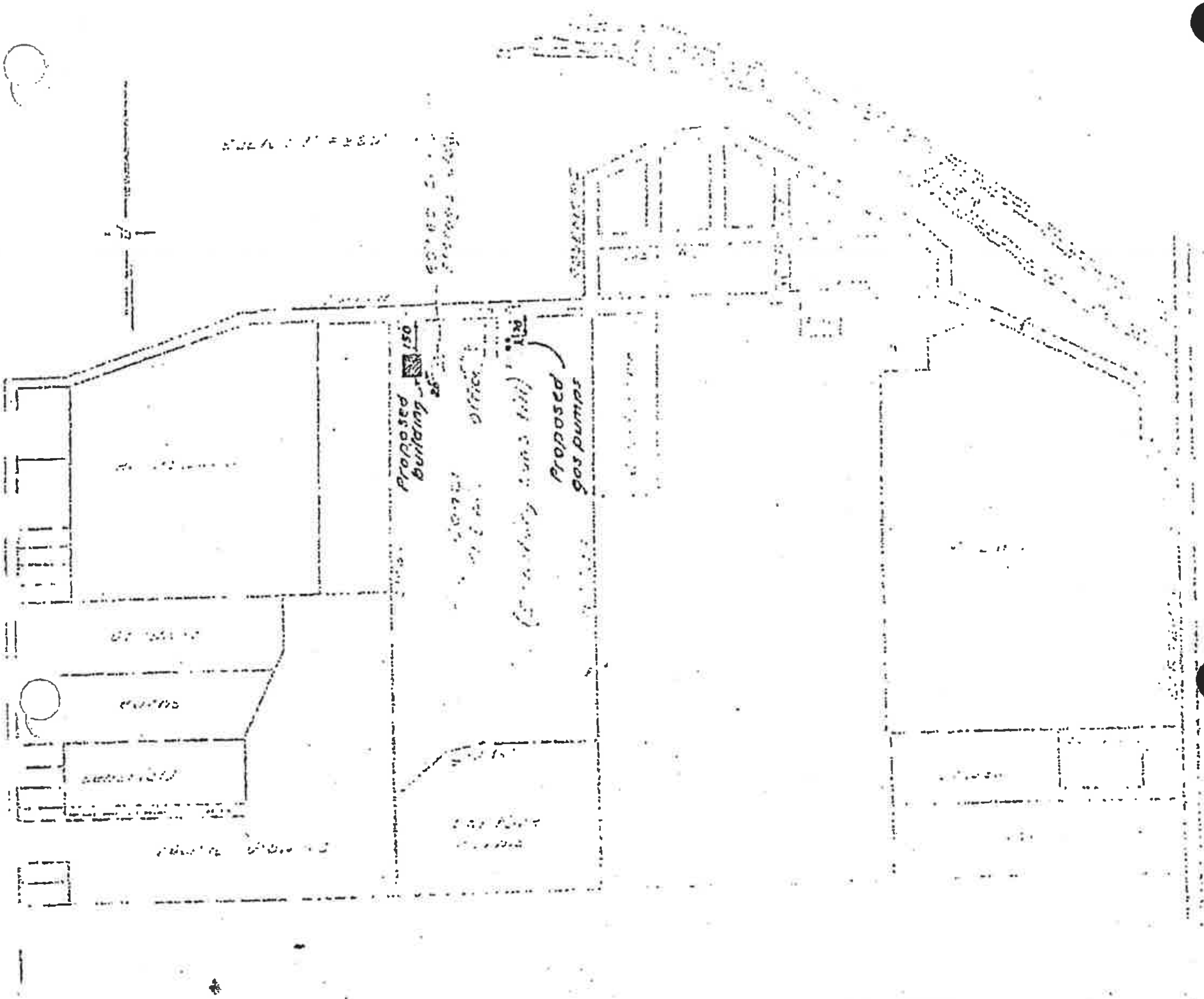
Ray W. [illegible]

SIGNATURE OF OFFICER ISSUING PERMIT

By [illegible]

3/5/71

DATE GRANTED



ZONING USE PERMIT APPLICATION NO. 1076

By Rudy Bonzi to erect a 60' x 70' building for storage of trucks and to install two gas pumps for use in conjunction with existing sanitory land fill operation.

IF NOT USED IN 18 MONTHS THIS PERMIT SHALL BE VOID. Sec. 9-130(b)

COUNTY OF STANISLAUS

USE PERMIT

PERMIT NO. 76-64 TYPE OF ZONE: A-2-10 DATE: June 4, 1976

The undersigned is hereby granted a Use Permit in accordance with the provisions of the Ordinance Code of Stanislaus County, Title 9, Chapter 3, and any amendments to the same.

1. NAME AND ADDRESS: (a) Rudy Ponzi
PRINT OR TYPE NAME OF PERSON OR FIRM

(b) 2650 West Hatch Road (c) Modesto
ADDRESS CITY OR TOWN

2. TYPE OF PROPERTY USE: Expansion of an existing nonconforming sanitary landfill by installing a mobile home for office space and relocate entrance.

3. LOCATION OF USE: south side of Hatch Road, between Carpenter and Vivian Roads (Southwest Modesto area)
HOUSE NUMBER — LOCAL NAME OF STREET, ROAD OR HIGHWAY

4. LEGAL DESCRIPTION: Sec. 12, T. 4, R. 8

5. This permit is granted subject to the following conditions:
   (a) That this use be constructed in accordance with plans approved by the Planning Commission and in accordance with other laws and ordinances;
   (b) That a Building Permit, when applicable, be obtained from the office of the County Building Department;
   (c) That a suitable sewage disposal system and water supply, if other than public, be approved and inspected by the County Health Officer
   (d) Additional expansion to be subject to Planning Commission review and considerati Mobile unit to be located as shown on attached map.
   (e) Applicant to obtain all necessary building permits prior to installing mobile home.
   (f) Mobile unit to be used for office space only.

Failure to perform any of the stated conditions hereon shall constitute grounds for revocation of this permit.

I, the undersigned, do hereby certify that I have read the above conditions and will comply with same in all respects.

SIGNATURE OF AGENT, REPRESENTATIVE OR OWNER

STANISLAUS COUNTY PLANNING COMMISSION

SIGNATURE OF OFFICER ISSUING PERMIT

6-9-76
DATE GRANTED

June 3, 1976

TO: PLANNING COMMISSION

FROM: PLANNING DEPARTMENT

SUBJECT: ZONING USE PERMIT APPLICATION NO. 76-64

I. APPLICATION

A. Applicant:	Rudy Bonzi
B. Owner:	Rudy Bonzi
C. Location of property:	South side of Hatch Road, between Carpenter and Vivian Roads (Southwest Modesto area)
D. Area of property:	121 acres
E. Existing zoning:	A-2-10 (Exclusive Agricultural)
F. Request:	To expand an existing nonconforming sanitary landfill by installing a mobile home for office space and relocate entrance
G. Applicant's statement:	None

II. GENERAL PLAN DESIGNATION

The subject property is designated as "Planned Development" on the Land Use Element of the General Plan.

III. ENVIRONMENTAL REVIEW

Categorically exempt

IV. ANALYSIS

This is a request by Rudy Bonzi to expand an existing nonconforming sanitary landfill by installing a 12 x 37 foot mobile home to be used for a scales office and relocate the main entrance. The mobile unit will be positioned adjacent to a 70 foot scale used in conjunction with the landfill operation. As shown on the attached drawing, the mobile office will be located adjacent to a paved driveway leading into the landfill from Hatch Road. Approval of the application will also result in a relocation of the entrance as shown on the plan. The applicant's property is presently fenced along Hatch Road with a 6 foot high block fence and is landscaped very adequately along the street frontage.

Surrounding land uses consist of a variety of residential, commercial and industrial uses. In reviewing the applicant's plans, staff has no major objection to the placement of the mobile unit on this property. Conditions placed on previous use permits for this landfill operation have been satisfied.

This application is being submitted under provisions of Section 9-126 (nonconforming uses) of the County Zoning Ordinance which provides for such expansion subject to Planning Commission review and consideration.

V. RECOMMENDATION

It is recommended that your Commission take the following actions regarding this application.

A. Establish the following findings:

1. That the proposed application is necessary for the preservation and enjoyment of substantial property rights of the applicant. Based on the fact that the applicant has existed at this site for a number of years and provisions exist to expand subject to Planning Commission approval, Staff feels this finding can be made.

2. That the proposed application will not be detrimental to the health, safety and general welfare of persons residing in the neighborhood. The addition of a mobile unit to be used for office space nor the relocation of the entrance will have an adverse affect on the neighborhood. Adjacent property uses are presently industrial type uses and this addition should in no way affect individuals living or working in the area.

3. That the proposed expansion will not be detrimental or injurious to property and improvements in the neighborhood or to the general welfare of the County. Staff feels this is a logical expansion to the landfill. The mobile unit will be placed well behind the existing 6 foot high block fence and be barely noticeable. For this reason, staff feels that the expansion will not be detrimental or injurious to property in the area.

B. Approve this application for the findings as stated above and subject to the following conditions:

1. Any additional expansion to be subject to Planning Commission review and consideration. Mobile unit to be located as shown on attached map.

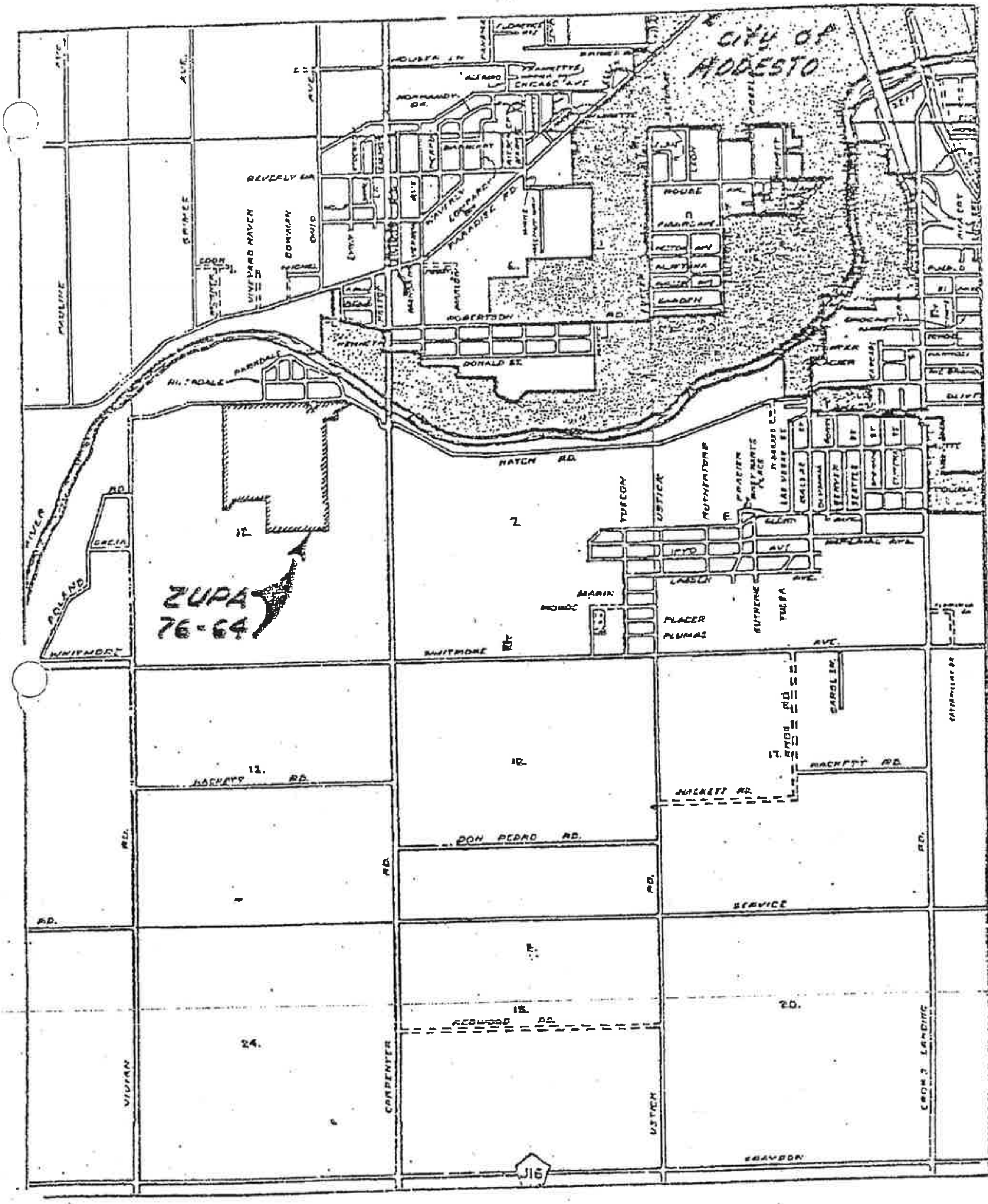
2. Applicant to obtain all necessary building permits prior to installing mobile home.

3. Mobile unit to be used for office space only.

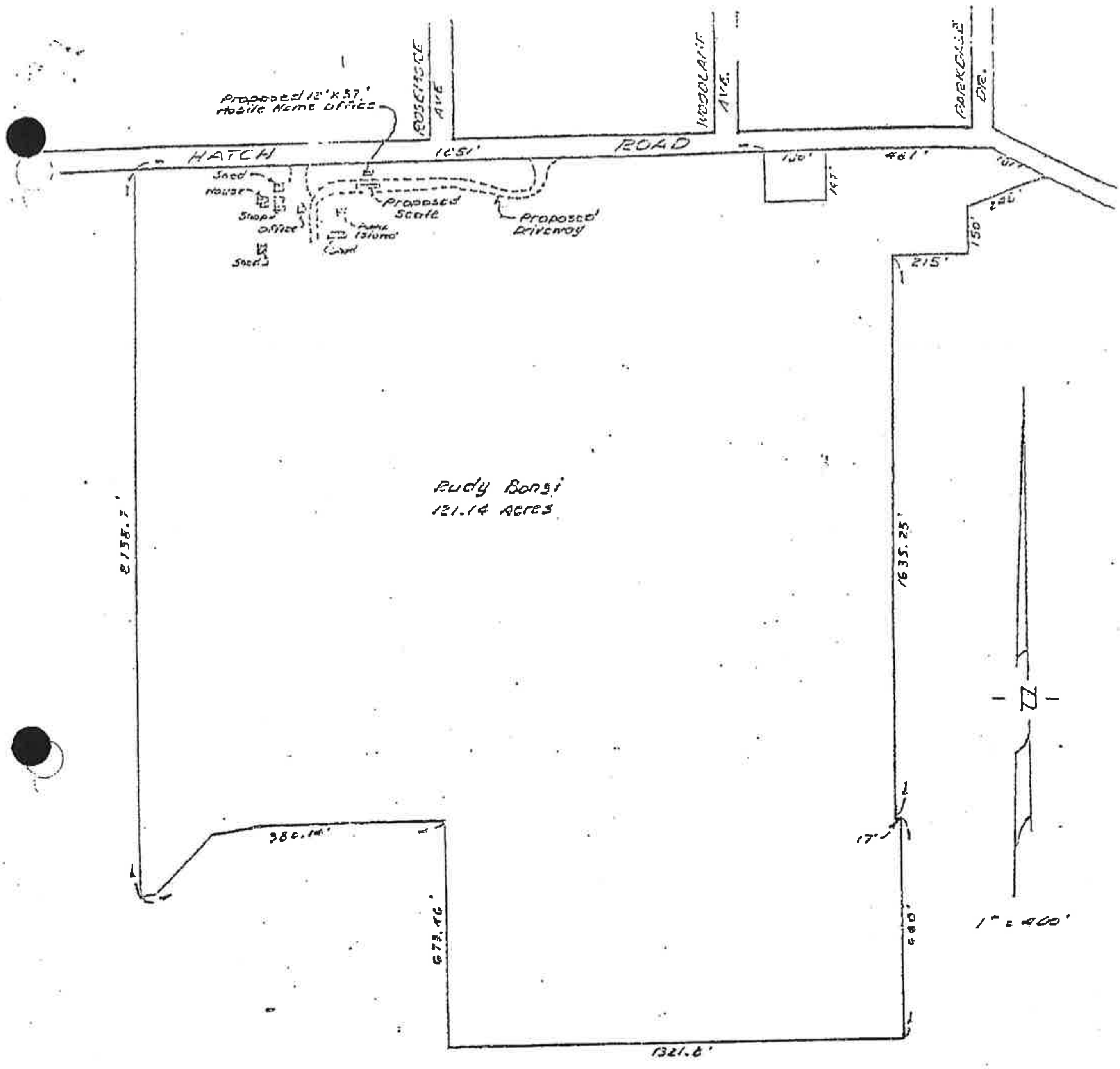
SD:leb

Attachments:

1. Map



VICINITY MAP



ZONING USE PERMIT APPLICATION

NO. 76-69

By Rudy Bonzi to expand an existing nonconforming Sanitary land fill by installing a mobile home for office Space.

ZONE: A-2-10 (Exclusive Agriculture)

Sec. 12-4-8

8, May 76

OPERATING PERMIT FOR FACILITIES
RECEIVING SOLID WASTE

TYPE OF FACILITY	FACILITY/PERMIT NUMBER
LANDFILL	50-AA-0003

NAME AND STREET ADDRESS OF FACILITY	NAME AND MAILING ADDRESS OF OPERATOR
BONZI SANITATION LANDFILL 2650 WEST HATCH ROAD MODESTO, CALIFORNIA 95351	STEVE BONZI BONZI SANITATION LANDFILL 2650 WEST HATCH ROAD MODESTO, CALIFORNIA 95351
PERMITTING ENFORCEMENT AGENCY	**CITY/COUNTY**
STANISLAUS COUNTY DEPARTMENT OF ENVIRONMENTAL RESOURCES	STANISLAUS COUNTY

PERMIT

This permit is granted solely to the operator named above, and is not transferrable.

Upon a change of operator, this permit is subject to revocation.

Upon a significant change in design or operation from that described by the Plan of Operation or the Report of Station or Disposal Site Information, this permit is subject to revocation, suspension, or modification.

This permit does not authorize the operation of any facility contrary to the State Minimum Standards for Solid Waste Handling and Disposal.

This permit cannot be considered as permission to violate existing laws, ordinances, regulations, or statutes of other government agencies.

The attached permit findings, conditions, prohibitions, and requirements are by this reference incorporated herein and made a part of this permit.

APPROVED:	AGENCY ADDRESS
Dennis M. Shuler APPROVING OFFICER DENNIS M. SHULER, PROGRAM MANAGER NAME/TITLE	STANISLAUS COUNTY DEPARTMENT OF ENVIRONMENTAL RESOURCES 1716 MORGAN ROAD MODESTO, CALIFORNIA 95351
SEAL	AGENCY USE/COMMENTS

PERMIT RECEIVED BY CWMB	CWMB CONCURRANCE DATE
MAY 29 1992	JUN 24 1992
PERMIT REVIEW DUE DATE	**PERMIT ISSUED DATE**
July 2, 1997	July 2, 1992

CWMB (Rev. 7/86)

BONZI SANITATION LANDFILL

SOLID WASTE FACILITY PERMIT
NUMBER 50-AA-0003

FINDINGS

1. A. The owner of the landfill is Ma-Ru Holding Company. Ma-Ru Holding Company is a corporation owned by Mary Bonzi and the estate of Rudy Bonzi. The owner of the parcel containing the retention pond used for the groundwater remediation project and stormwater run-off is Mary Bonzi and the estate of Rudy Bonzi. The operator of the landfill is Steve Bonzi.

   B. The facility is located at 2650 West Hatch Road, Modesto, CA, 95351 (APN 017-41-36, and APN 017-41-11) Section 12, Township 4 South, Range 8 East, Mount Diablo Baseline and Meridian in Stanislaus County). A map of the facility can be found as Attachment A to this Permit. Maps with more details are available in the March 1992, Revised Report of Disposal Site Information (RDSI). There are four waste management units (WMUs). WMUs I and II are completely filled, as are WMU III cells a and b. WMU III cell c is currently being filled. WMU III cells d, e, and f, and WMU IV remain to be filled. The site encompasses 128 acres of which 13 acres comprise the site for the groundwater remediation system pond, and 115 acres comprise the existing landfill proper. Approximately 62 net acres have been filled and 35 net acres remain to be filled.

   In the southwestern corner of the landfill is a 13 acre parcel (APN 017-41-11) which contains the pond used for the groundwater remediation project, and which will be used for retention of stormwater run-off from portions of the closed WMUs.

   C. The facility has a scalehouse, a lunchroom, a watchman's residence, a wood chipping and recycling operation on a three acre concrete pad, a 10,000 gallon water storage tank, a pole barn for equipment storage, an office building and a maintenance building. Environmental monitoring and control systems currently in place at the landfill include an extensive network of groundwater monitoring wells, monitoring wells for landfill gases, and a groundwater remediation system (with an air stripping tower). Remaining site capacity as of March 1992, is approximately 570,000 cubic yards. For details of the capacity calculation, consult the Revised RDSI, March 1992, Appendix D.

D. The landfill is currently accepting wastes classified as nonhazardous solid waste or inert wastes using the criteria set forth in the California Code of Regulations Title 23, Division 3, Chapter 15. The site receives nonhazardous wastes such as:

1. Construction/demolition wastes.
2. Industrial wastes.
3. Agricultural wastes.

When WMU III cell c is completed, there will be changes in the types of wastes received. Only inert wastes as defined by the California Regional Water Quality Control Board (CRWQCB) will be accepted for disposal in cells d, e and f. The operator, in consultation with the CRWQCB, developed the following list of waste types which will be received at the landfill and which meet the CRWQCB definition of inerts:

1. Concrete with rebar.
2. Earth.
3. Rock.
4. Asphalt (cured).
5. Mortar.
6. Tile.
7. Stucco.
8. Composition shingles.
9. Brick.
10. Linoleum.
11. Glass.
12. Aluminum window frames.
13. Gypsum board.
14. Scrap rubber products.
15. Electrical wiring.
16. Duct work.
17. PVC pipe.
18. Vitrified clay pipe.
19. Ductile iron, cast iron pipe.
20. Copper tubing.
21. Plaster.
22. Miscellaneous plastics.
23. Stainless steel fixtures.
24. Lumber products (note: 90-95 percent of the lumber products will be salvaged and removed to the on-site wood recycling operation. No treated lumber will be accepted).
25. Porcelain fixtures such as sinks, toilets, tubs.
26. Carpet.

If materials not listed above are inadvertently received, they will be separated at the active face, placed in bins, and removed to an authorized transfer facility or landfill. For further details consult Appendix A of the Revised RDSI, dated March 1992.

Hazardous wastes, liquid wastes, and/or special wastes (asbestos, medical waste, nonhazardous sludges, dead animals, food processing waste and hard-to-handle wastes) will not be accepted at this facility.

E. The permitted tonnage and design capacity is 200 tons of refuse per day. In 1991, the facility received an average of 35 tons per day. In 1991, the peak daily tonnage was 139.8 tons, which was received on September 26, 1991.

A projection of annual tonnage over the next five years is included as Table II, page 3, in the Revised RDSI, dated March 1992. Average annual loading is 30,000 tons.

F. Vehicles enter the facility from Hatch Road. Vehicles are weighed at the scalehouse before proceeding to the active face. At the soil apron above the active face, a windrow is created as the refuse is deposited while the truck is driven forward. The windrow is examined for unacceptable and hazardous wastes, per load checking protocols, and salvageable commodities are manually removed (see Section G of this Permit for a description of salvaging). When the salvage activities are completed, the refuse is mechanically spread from the tipping area onto the active face of the current cell of the area fill. Layers of refuse, two feet or less, are spread with a landfill compactor. The layers are compacted with 3 to 5 passes of the landfill compactor. Wastes are covered daily with a minimum of six inches of cover. After dumping, the vehicles leave the site. Trucks are re-weighed only if the tare weight of the vehicle is not stored in the scalehouse computer. A traffic plan can be found in the Plans section of the revised RDSI dated March 1992.

G. Salvaging consists of manual removal of recoverable materials from construction and demolition debris, and industrial loads, in the tipping area. Materials targeted for removal include, but are not limited to:

1. Paper products.
2. Wood.
3. Metals.
4. Glass.

Other materials may be manually salvaged should markets be developed for these materials. The operator will keep the Local Enforcement Agency (LEA) informed of the salvaging of such other materials.

Metal, glass and paper products are placed in large roll-off bins at the active face. The bins are removed from the active face as needed, but at least weekly.

Wood is diverted to the on-site wood recycling facility. This facility was constructed on a concrete pad on three acres of WMU IV. This facility accepts source separated wood and wood salvaged at the landfill (note: source separated wood is not included in the landfill's 200 tons per day limit because this material is delivered directly to the wood recycling operation through a separate entrance). The wood recycling facility currently chips wood, which is sold as fuel to the biomass incineration industry. Saw dust, produced as a by-product of wood chipping, is sold to the landscaping industry as a soil amendment. Additional details of the wood recycling facility are contained in Appendix B of the Revised RDSI, dated March 1992.

Salvaged and recycled materials will be stored for a period of time and in a manner which will not create health hazards.

As noted above, hazardous wastes are not accepted at this facility. However, if inadvertently received, such wastes will be handled in a manner approved by the LEA and the California Integrated Waste Management Board (CIWMB).

E. Two types of load checking programs will be utilized at Bonzi Sanitation Landfill: the first is the existing hazardous waste exclusion program, and the second is an inert, construction and demolition debris load checking program. The latter will commence with the opening of WMU III cell d. Both programs are described in detail in Appendix A of the Revised RDSI, dated March 1992.

Both of the load checking programs include these elements: employee training, written notification of clients, pre-screening of wastes by drivers, the formation of a waste windrow in the tipping area, manual examination of the loads for hazardous or unacceptable wastes, and protocols for handling such wastes.

Employees are trained to recognize the types of hazardous or special wastes that may be inadvertently included in the loads brought to the facility. Equipment operators and vehicle operators will be given special instructions. All employees will receive regular safety briefings and instructions in protocols for handling unacceptable or hazardous wastes.

A list of emergency contact names and telephone numbers is included as part of the load checking program, and may be found in Appendix A of the Revised RDSI, March 1992.

Incidents of unlawful disposal of hazardous wastes will be reported to the Stanislaus County Department of Environmental Resources (DER), Hazardous Materials Division and/or the Solid Waste Management Division, phone number (209) 525-4150 or 525-4160 (during business hours), or (209) 525-7911 (after business hours). The Fire Department will be called (911), if deemed necessary.

Additional measures may be required upon the request of the LEA or the Board.

I. Anticipated changes in the design or operation of the landfill in the next five years include the following:

1. An increase in tonnage to 200 tons per day.

2. Partial closure of WMUs I, II, and III cells a, b and c, and the installation of approved projects associated with closure, such as a landfill gas control system.

3. Commencing with the opening of WMU III cell d, only inert wastes as defined by CRWQCB will be accepted (see Section D of this Permit).

J. The landfill facility, which is closed to the public, is open up to 24 hours a day, 7 days a week for the receipt, salvaging, and disposal of wastes.

The wood recycling facility is open to the public 6 a.m. to 9 p.m. Monday through Saturday for receipt and shipping of wood waste. The wood chipper may operate between the hours of 7 a.m. and 7 p.m. Hours may be reduced by the operator based on market conditions. The wood recycling facility is closed to the public at least six holidays per year. The wood recycling facility does not operate on Sunday. For further details see the Appendix B of the Revised RDSI, dated March 1992.

The landfill is projected to reach capacity in the year 2017.

2. The following is a list of agencies and documents that condition the design, operation, and use of this facility.

   A. The Revised Report of Disposal Site Information, March 1992.

   B. The California Regional Water Quality Control Board Waste Discharge Requirements (WDR) 89-043, dated March 31, 1989, and WDR 90-215 and Resolution 214, both dated August 10, 1990.

   C. A Negative Declaration (State Clearinghouse #92012070), prepared by DER on January 15, 1992. The State Clearinghouse received for filing the Negative Declaration on January 23, 1992.

   D. The Mitigation, Monitoring and Implementation Schedule, dated January 30, 1992.

   E. Fire safety compliance letter, dated February 11, 1992.

   F. Stanislaus County Department of Planning and Community Development Use Permit No. 836, as amended December 16, 1982; Use Permit 1007, approved October 2, 1969; Use Permit 1076, approved April 2, 1970; and memorandum, dated February 4, 1992.

   G. Final Closure and Postclosure Maintenance Plan (to be approved by the CIWMB, the RWQCB, and the LEA).

   H. A letter explaining the arrangement between the owners and the operator of the facility, in lieu of a lease, Appendix I, Revised RDSI, March 1992.

   I. San Joaquin Valley Unified Air Pollution Control District has issued an Authority to Construct Number 6-118-01 on August 21, 1990, for the groundwater remediation systems's air stripping component.

3. The Stanislaus County Department of Environmental Resources has made the following findings and certifications pursuant to the Public Resources Code, Sections 44010, 50000 and 50000.5:

A. The Bonzi Sanitation Landfill is identified and described in, and conforms with, the April 1986 Solid Waste Management Plan for Stanislaus County.

B. The proposed Solid Waste Facility Permit is consistent with standards adopted by the CIWMB.

C. The Bonzi Sanitation Landfill is consistent with the Stanislaus County General Plan.

4. The design and operation of the Bonzi Sanitation Landfill is in compliance with the State Minimum Standards for Solid Waste Handling and Disposal as determined by the LEA.

5. The Stanislaus County Department of Fire Safety has found that the Bonzi Sanitation Landfill is in conformance with applicable codes.

6. The Stanislaus County Department of Planning and Community Development has found that the landfill is compatible with the surrounding zoning and General Plan for the area.

7. A Negative Declaration (ND) (State Clearinghouse #92012070) was prepared by DER on January 15, 1992. The State Clearinghouse received for filing the ND on January 23, 1992. The ND was approved by DER on March 25, 1992. A Notice of Determination was filed with the State Clearinghouse on March 30, 1992, and the Stanislaus County Clerk on March 26, 1992.

CONDITIONS

REQUIREMENTS

1. This facility shall comply with all State Minimum Standards for Solid Waste Handling and Disposal.

2. This facility shall comply with all federal, state, and local requirements and enactments, including all mitigation measures given in any certified environmental document filed pursuant to the Public Resources Code, Section 21081.6.

3. Additional information concerning the design and operation of this facility shall be furnished upon written request and within the time frame indicated by the LEA.

4. The operator shall maintain a copy of this Permit at the facility. The Permit must be readily available to facility and LEA personnel.

5. The facility operator shall supply the LEA with copies of all correspondence and reports provided to other regulatory agencies which have jurisdiction over the landfill.

PROHIBITIONS

The following are prohibited at this facility:

1. Scavenging.
2. Disposal of dead animals.
3. Disposal of hazardous waste.
4. Open burning and/or disposal of hot ashes.
5. Disposal of septic tank pumpings or sewage sludge.
6. Disposal of medical waste.
7. Disposal of liquid or food processing waste.
8. Disposal of waste quantities which exceed the handling capacity of the facility, or acceptance of any other waste which the facility is not permitted to handle.
9. Standing water on covered fill areas.

SPECIFICATIONS

1. Any change that would cause the design or operation of the facility not to conform to the terms or conditions of the Permit may be considered a significant change and may require a Permit revision. Except for the changes outlined in Findings 1. I. above, all changes must be approved by the LEA and the CIWMB prior to implementation of such changes.

2. This facility has a maximum permitted capacity of 200 tons per operating day and shall not receive more than this amount without first obtaining a revision of this Permit.

3. A change in facility operator will require a new solid waste facilities Permit.

PROVISIONS

This Permit is subject to review by the LEA, and may be suspended, revoked, or modified at any time for sufficient cause after a hearing.

MONITORING AND REPORTING

1. The operator shall provide the LEA with monthly reports, no later than 15 days after the close of the month, which include:

   a. Tons of waste received for disposal, per day and per month.

   b. Tons of salvaged material removed from the waste stream, per category (metals, paper, wood, etc.), per month.

   c. The dates that the facility was cleaned of litter and the approximate volume of litter collected.

   d. Number of vehicles using the landfill per day and per month.

2. Prompt notification shall be given to the LEA, and a record shall be made in the Special Occurrences Log, upon the occurrence of:

   a. Unscheduled shut-down;

   b. Employee injury;

   c. Delivery or attempted delivery of unpermitted or unacceptable waste; or,

   d. Any special occurrences: fires, structural damage, flooding, etc.

   The Special Occurrences Log will be available for review during inspections by, or at the request of, the LEA.

3. The results of the hazardous waste screening program shall be reported to the LEA on a quarterly basis. Such reports shall be submitted within 15 days following the close of each calendar quarter.

4. Information required to be submitted to agencies having jurisdiction over the facility shall also be submitted to the LEA at the frequencies specified by those agencies.

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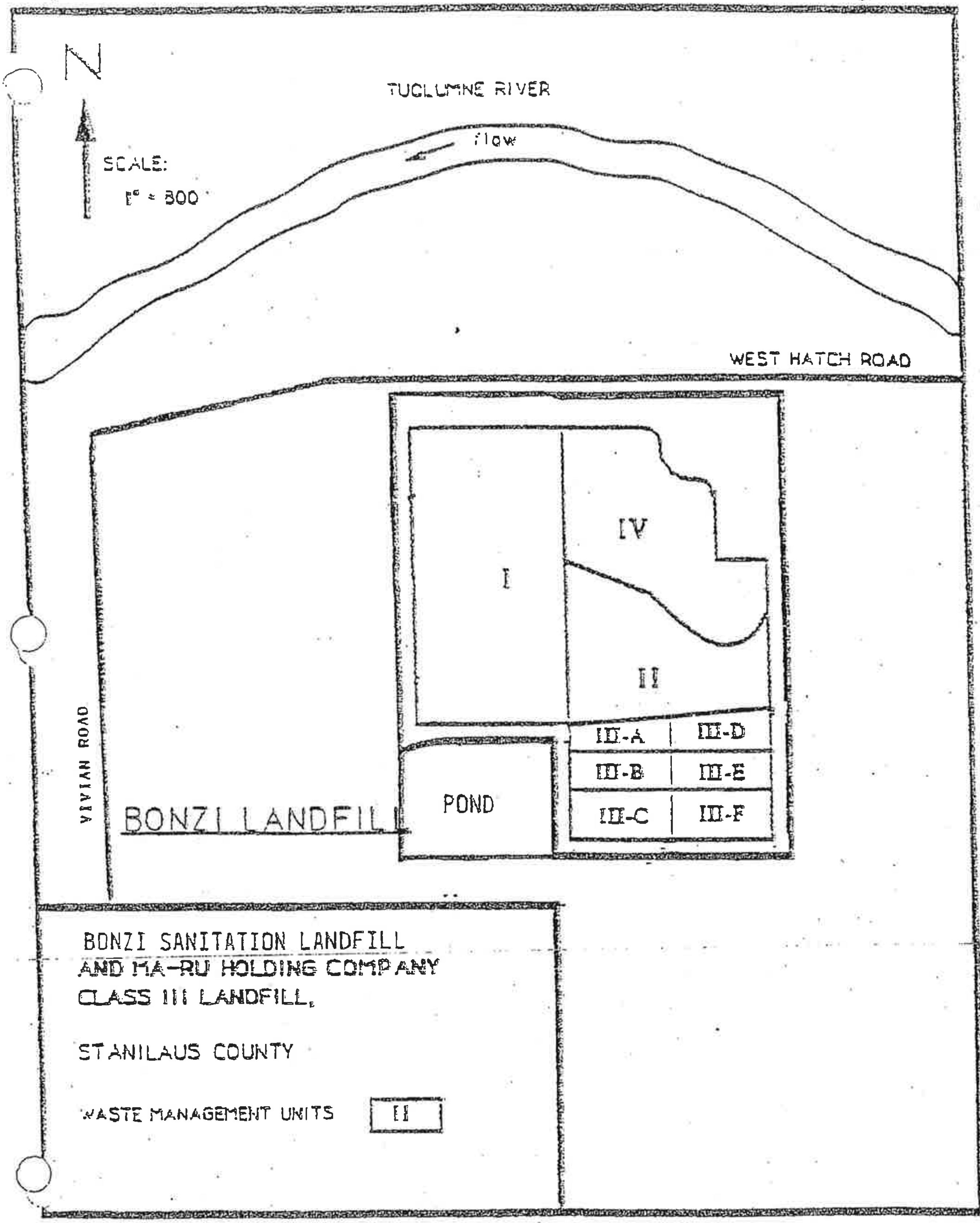
ATTACHMENT A



MITIGATION, MONITORING AND IMPLEMENTATION SCHEDULE
BONZI SANITATION LANDFILL
2650 WEST HATCH ROAD
MODESTO, CA 95351

JANUARY 30, 1992

IMPACT	MITIGATION	MONITORING	MONITORING/TRACKING MECHANISM
1. Air Quality	a. To prevent PM10 emissions clay hauling trucks will be tarped in transit.	LEA	a. Vehicle Inspections.
	b. A water truck will be used to control on-site dust during closure construction.		b. At least monthly facility inspections.
2. Water Quality/ Drainage	Construction of minimum effective slopes for closure per CCR Title 14.	LEA	At least monthly facility inspections.
3. Gas Hazard	Gas monitoring system.	LEA	Quarterly reports from operator.

JAN30.MMI

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. 90-215

WASTE DISCHARGE REQUIREMENTS
FOR
BONZI SANITATION LANDFILL, MA-RU HOLDING COMPANY, INC.
AND
RUDY BONZI AND MARY BONZI
GROUND WATER TREATMENT SYSTEM
STANISLAUS COUNTY

The California Regional Water Quality Control Board, Central Valley Region, (hereafter Board) finds that:

1. Bonzi Sanitation Landfill, Ma-Ru Holding Company, Inc., Rudy Bonzi and Mary Bonzi (hereafter Discharger) submitted a Report of Waste Discharge, dated 26 March 1990, and a site evaluation report, dated 27 November 1989.

2. The Board on 22 September 1989, adopted Cleanup and Abatement Order No. 89-185 requiring implementation of a ground water cleanup plan at the Bonzi Sanitation landfill.

3. A proposed ground water remediation plan was submitted 18 April 1990. The plan includes extraction and pumping of the ground water, air stripping, and irrigation of a nearby grape vineyard with the treated water. Pumping rates will range from 30 gpm to 200 gpm depending on the height and gradient of ground water and the length of time since pumping began.

4. Ground water quality is summarized in Design Memo Number 4 by Dames and Moore, dated 20 April 1990. The ground water under and near the landfill is polluted with volatile organic compounds, metals and salts.

5. Air stripping is proposed to remove volatile organic compounds from the ground water. The proposed air stripping will be done with one tower designed for maximum flow and cycled on and off for lesser flows. Air emissions from the tower will be discharged directly to the atmosphere. Estimated amount of volatile organics to be released is 1.5 ounces (total weight) per day.

6. The retention pond will be lined with 40 mil solar resistant PVC material. It will be sized to contain both treated ground water and storm water runoff from the southwestern portion of the landfill. Winter discharges will take place to maintain freeboard for storm events.

7. The Discharger proposes to discharge between 43,000 and 288,000 gallons per day of treated ground water to augment irrigation water on a vineyard southwest of the landfill site. Irrigation will be done with a drip system and will not create any mists or run off. The property (Assessor's Parcel No(s) 017-042-001) is owned by the Discharger.

8. Ground water containing elevated concentrations of metals and salts constitutes only a fraction of the water being treated. When diluted with other ground water, the metals and salts will not be significantly above background concentrations, so no specific treatment for removal of metals or salt is proposed.

WASTE DISCHARGE REQUIREMENTS
BONZI SANITATION LANDFILL
GROUND WATER TREATMENT SYSTEM
STANISLAUS COUNTY

9. Bonzi Sanitation Landfill and the disposal area is in Section 12, T4S, R8E, MDB&M, with surface water drainage to Tuolumne River, as shown on Attachment A, a part of this Order.

10. The beneficial uses of the Tuolumne River are municipal, industrial, and agricultural supply; recreation; esthetic enjoyment; navigation; ground water recharge; fresh water replenishment; and preservation and enhancement of fish, wildlife, and other aquatic resources.

11. The beneficial uses of the ground water are municipal, industrial, and agricultural supply.

12. The Board has adopted a Water Quality Control Plan, Second Edition, for the San Joaquin River Basin (5C) which contains water quality objectives for all waters of the Basin. These requirements are consistent with that Plan.

13. The Board has adopted a Negative Declaration, based upon an initial study, in accordance with the California Environmental Quality Act, (Public Resources Code Section 21000, et seq.), and the State Guidelines.

The Initial Study describes potential environmental impacts, their significance and mitigation (if any). The conclusion of the study is that the project will not have any significant adverse impacts on the environment. Impacts to the environment will be mitigated sufficiently with proper implementation of the remediation plan. The conclusion is based upon the following findings:

a. The objective of the project is to improve the quality of ground water at and around the site by removing ground water with organic contaminants, treating the water and using it beneficially.

b. Laboratory testing of the treated water will be required to assure safe levels of chemicals being reintroduced to the environment through drip irrigation.

c. The ground water will be extracted via three new wells near and on the landfill property. The ground water will be pumped at rates sufficient to control the direction of ground water flow but will not cause depletion of ground water supplies for the local users.

d. Treatment of ground water will be with an air stripping tower. Volatile organic compounds released to the atmosphere will be no more than 1.5 ounces per day. This quantity is insignificant. Air emissions will be regulated by Stanislaus County.

14. The Board has notified the Discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for this discharge.

15. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

WASTE DISCHARGE REQUIREMENTS
BONZI SANITATION LANDFILL
GROUND WATER TREATMENT SYSTEM
STANISLAUS COUNTY

IT IS HEREBY ORDERED that Bonzi Sanitation Landfill, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, shall comply with the following:

A. Discharge Prohibitions:

1. The direct discharge of wastes to surface waters or surface water drainage courses is prohibited.

2. The by-pass or overflow of untreated or partially treated waste is prohibited.

B. Discharge Specifications:

1. Neither the treatment nor the discharge shall cause a nuisance or condition of pollution as defined by the California Water Code, Section 13050.

2. The discharge shall not cause degradation of any water supply.

3. The discharge shall remain within the designated disposal area at all times.

4. The annual discharge shall not exceed 110 million gallons.

5. Collected screening, sludges, and other solids removed from polluted ground water shall be disposed of in a manner approved by the Executive Officer.

C. Effluent Limitations

1. The 30-day average daily dry weather discharge flow shall not exceed 0.3 million gallons.

2. Discharge of an effluent from the treatment system in excess of the following limits is prohibited:

Constituents	Units	Median	Daily Maximum
Summation of VOCs (EPA Method 601)	µg/l	<0.5	1
Total Dissolved Solids	mg/l	900	1000
Barium	mg/l	0.4	0.8
Chromium	mg/l	0.02	0.05
Arsenic	mg/l	0.01	0.02
Vanadium	mg/l	0.05	0.1

D. Storage Pond specifications:

1. The Discharger shall maintain a retention pond freeboard of no less than one and one half feet (1.5) at all times

E. Provisions:

1. The Discharger may be required to submit technical reports as directed by the Executive Officer.

2. The Discharger shall comply with the attached Monitoring and Reporting Program No. 90-215.

3. The Discharger shall comply with the Standard Provisions and Reporting Requirements, dated 1 July 1990 which are a part of this Order.

4. The Discharger shall report promptly to the Board any material change or proposed change in the character, location, or volume of the discharge.

5. In the event of any change in control or ownership of land or waste discharge facilities presently owned or controlled by the Discharger, the Discharger shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to this office.

6. The Board will review this Order periodically and may revise requirements when necessary.

I, WILLIAM H. CROOKS, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 10 August 1990.

W. S. Johnson for
WILLIAM H. CROOKS, Executive Officer

Ammended 08/10/90

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

MONITORING AND REPORTING PROGRAM NO. 90-215

FOR
BONZI SANITATION LANDFILL, MA-RU HOLDING COMPANY, INC.
AND
RUDY BONZI AND MARY BONZI
GROUND WATER TREATMENT SYSTEM
STANISLAUS COUNTY

Specific sample station locations shall be established under direction of the Board's staff and a description of the stations shall be attached to this Order.

AIR STRIPPER EFFLUENT MONITORING

Constituents	Units	Type of Sample	Sampling Frequency
Total Dissolved Solids	mg/l	Grab	Monthly
Specific Conductivity	μmhos/cm	Grab	Weekly
Standard Minerals	mg/l	Grab	Annually
pH	pH Units	Grab	Weekly
Flow	gallons	Cumulative	Weekly
VOCs (EPA Method 601)	μg/l	Grab	Monthly[1]
Arsenic	mg/l	Grab	Quarterly[2]
Barium	mg/l	Grab	Quarterly[2]
Chromium	mg/l	Grab	Quarterly[2]
Vanadium	mg/l	Grab	Quarterly[2]

1 VOCs will be tested weekly for four weeks to determine effectiveness of treatment.
2 Metals will be tested monthly for three months, thereafter quarterly

POND MONITORING

Constituents	Units	Type of Sample	Sampling Frequency
Freeboard	feet	Grab	Weekly
Flow to irrigation	gallons	Cumulative	Weekly
VOCs (EPA Method 601)	μg/l	Grab	Quarterly[1]
Arsenic	mg/l	Grab	Annually[2]
Barium	mg/l	Grab	Annually[2]
Chromium	mg/l	Grab	Annually[2]
Vanadium	mg/l	Grab	Annually[2]

1 VOCs will be tested monthly for three months to determine effectiveness of treatment.
2 Metals will be tested quarterly for four quarters thereafter annually.

MONITORING AND REPORT... PROGRAM
BONZI SANITATION LANDFILL
GROUND WATER TREATMENT SYSTEM
STANISLAUS COUNTY

GROUND WATER MONITORING

1. Ground water elevations in all three wells will be monitored semiannually. The most central well will be tested semi-annually with EPA Method 601.

REPORTING

In reporting the monitoring data, the Discharger shall arrange the data in tabular form so that the date, the constituents, and the concentrations are readily discernible. The data shall be summarized in such a manner to illustrate clearly the compliance with waste discharge requirements.

Monthly monitoring reports shall be submitted to the Regional Board by the 15th day of the following month.

The results of any monitoring done more frequently than required at the locations specified in the Monitoring and Reporting Program shall be reported to the Boar

Upon written request of the Board, the Discharger shall submit a report to the Board by 30 January of each year. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the Discharger shall discuss the compliance record and the corrective actions taken or planned which may be needed to bring the discharge into full compliance with the waste discharge requirements.

The Discharger shall implement the above monitoring program as of the date of this Order.

W.S. [signature] for
WILLIAM H. CROOKS, Executive Officer

10 August 1990
(Date)

7/17/90/PAM

INFORMATION SHEET

Bonzi Sanitation Landfill, Ma-Ru Holding Company,
Rudy Bonzi and Mary Bonzi, Stanislaus County
Ground Water Treatment System

Bonzi Sanitation Landfill has operated southwest of Modesto (see Site Map, Attachment A) since 1967, accepting municipal and selected industrial wastes. Landfill leachate and occasional inundation of landfilled wastes with rising ground water have polluted the ground water under and near the site with volatile organic chemicals (VOCs), metals and salts. Investigations conducted since 1982 have defined the plumes of pollutants and the hydrogeologic conditions. A ground water remediation system has been designed to extract and treat the polluted water.

The system will consist of a series of three extraction wells which will capture ground water from areas under and near the landfill. The ground water will be pumped to a treatment system compound in the northwestern portion of the landfill consisting of an air stripping tower which will remove volatile organics. The total amount of VOCs released will no more than 1.5 ounces per day. The operation of the air stripping tower will be subject to review by the local air pollution control district.

No salt or metals will be removed by the treatment system. Salt and metals pollution is within a limited area of the site. Mixing of all the extracted ground water will reduce salt and metal concentrations to insignificant levels. Numeric effluent limits for metal constituents have been based upon anticipated levels that will be pumped from the extraction wells.

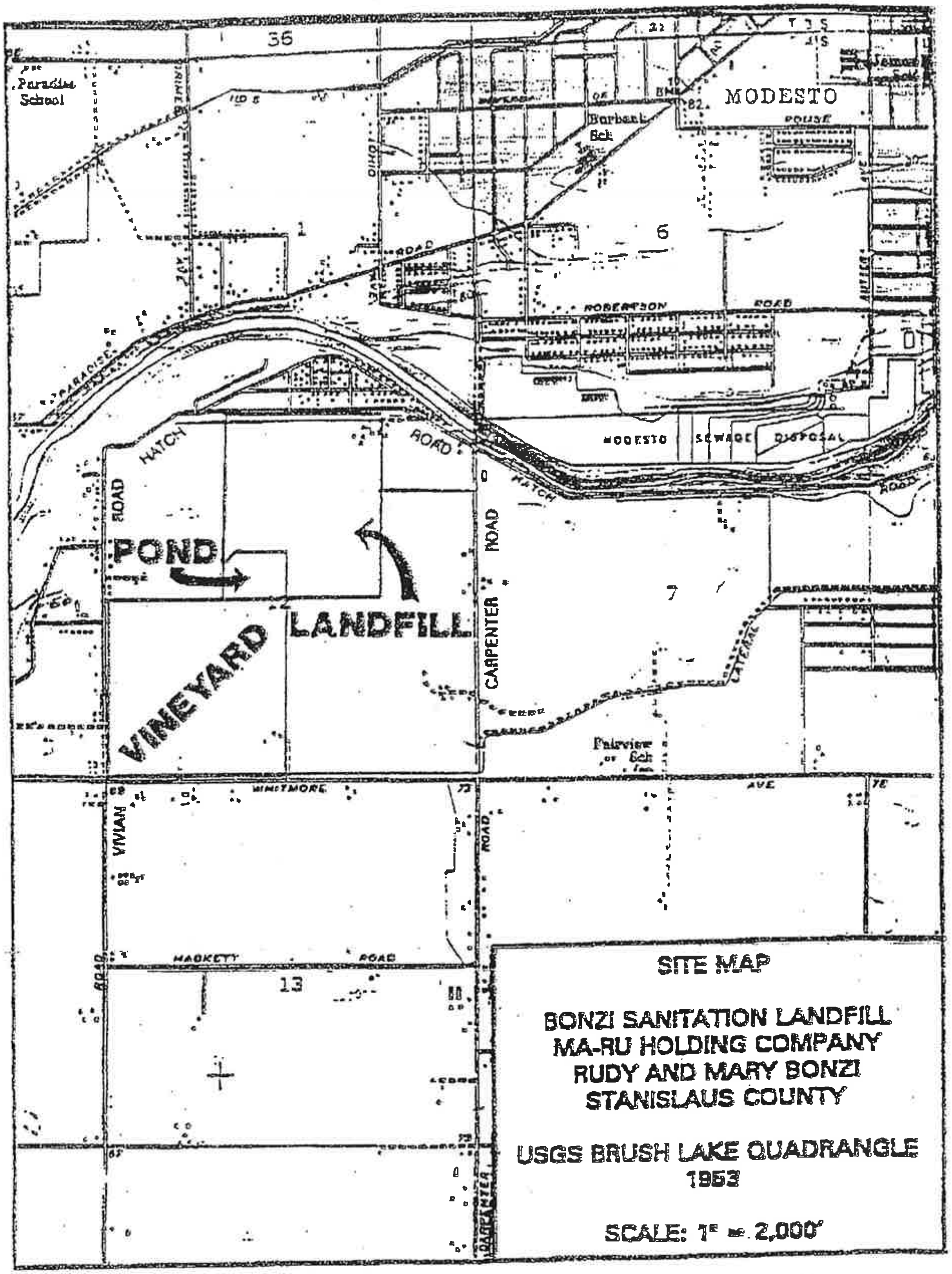
Once the ground water is treated it will be pumped to a lined detention basin, where it will be stored temporarily. A drip irrigation system will deliver treated ground water to nearby vineyards. The irrigation method will minimize infiltration and will eliminate runoff. Ground water extraction and treatment is expected to continue for several years. Treated ground water will be a small fraction of the irrigation water applied to the vineyard, with the rest of the irrigation water supplied from the Turlock Irrigation District system.

The ground water will be pumped at rates sufficient to control the direction of ground water flow, but will only lower the ground water table by a few feet. Therefore, pumping will not cause significant depletion of ground water supplies for the local users.

Occasionally, the air stripping tower will have to be treated with an acid solution to remove scale build-up on the packing material. The solution will be discharged after treatment to the detention pond where it will be diluted with other water and eventually discharged to the vineyard.

The Board adopted a negative declaration on 10 August 1990 based upon the findings of an Initial Study. The conclusion of the study is that the project will not have any significant adverse impacts on the environment.

Attachment A



CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

3443 Routier Road, Suite A
Sacramento, CA 95827-3098
Phone (916) 255-3000
FAX (916) 255-3015

Cal/EPA

Pete Wilson, *Governor*

12 May 1998

CERTIFIED MAIL
Z 684 995 661

MAY 15

Mr. Steve Bonzi
Ma-Ru Holding Company, Inc.
Bonzi Sanitation Landfill, Inc.
2650 West Hatch Road
Modesto, CA 95351

WASTE DISCHARGE REQUIREMENTS ORDER NO. 98-093, MA-RU HOLDING COMPANY, INC. AND BONZI SANITATION LANDFILL, INC., MODESTO, STANISLAUS COUNTY

Our 23 April 1998 *Notice of Adoption of Revised Waste Discharge Requirements for Ma-Ru Holding Company, Inc. and Bonzi Sanitation Landfill, Inc. Parnership* did not include the Waste Discharge Requirement (WDR) Order No. 98-093 which should have been enclosed. We apologize for our error and have enclosed the WDR in this letter.

VICTOR J. IZZO
Senior Engineering Geologist

PAL

Enclosure

cc: Mr. Gordon Dewers, Stanislaus County Department of Environmental Resources, Modesto
Mr. Thomas Skaug, Taber, West Sacramento

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. 98-093

WASTE DISCHARGE REQUIREMENTS
FOR
MA-RU HOLDING COMPANY, INC.
AND
BONZI SANITATION LANDFILL, INC. PARTNERSHIP
BONZI SANITATION LANDFILL
STANISLAUS COUNTY

The California Regional Water Quality Control Board, Central Valley Region, (hereafter Board) finds that:

1. Ma-Ru Holding Company, Inc. owns, and Bonzi Sanitation Landfill, INC. PARTNERSHIP operates, (hereafter Discharger)the Bonzi Sanitation Landfill facility. The facility was previously regulated by Waste Discharge Requirements (WDRs) Order No. 92-155. The Discharger submitted a Final Closure Plan dated June 1997 and a Final Postclosure Maintenance Plan dated June 1997 describing the closure of this facility and requesting approval of an engineered alternative to the prescriptive requirements of landfill cover.

2. The facility is on a 128-acre parcel and is comprised of Assessor's Parcel Numbers 17-41-36 and 17-41-11 approximately 3 miles southwest of Modesto in the northern part of the San Joaquin Valley along the Tuolumne River in section 12, T4S, R8E, MDB&M, as shown in Attachment A. Attachments A through C are incorporated herein and made part of this Order.

3. This facility includes four existing landfills/waste management units (WMUs) for waste disposal and support areas (see Attachment B). The WMUs into which municipal solid wastes, agricultural wastes, industrial wastes, and construction wastes were placed, are described as follows:

   a. WMU I - This landfill, on the west side of the facility, is a 35-acre class III landfill pursuant to California Code of Regulations (CCR), Title 27, Division 2, Subdivision 1, (hereafter Title 27). Wastes were accepted in this area from 1967 to 1978. Approximately two million cubic yards of municipal refuse, agricultural wastes, industrial wastes, and construction wastes were landfilled. This area is currently being capped and closed with a 2-foot minimum compacted soil foundation layer, a barrier layer which consists of a 30-mil minimum thickness PVC flexible geomembrane liner, and an 18-inch vegetative layer. There is no bottom liner or leachate collection and removal system (LCRS).

b. WMU II - This landfill is a class III landfill covering about 18 acres in the central eastern area of the facility. Wastes were accepted from 1978 to 1984. Approximately 750,000 cubic yards of municipal refuse, agricultural wastes, industrial wastes, and construction wastes were landfilled. The landfill is currently being covered with intermediate daily cover and there is no bottom liner and LCRS.

c. WMU III-A, III-B, III-C - These are class III landfills covering about 11 acres in the central southern portion of the facility. Approximately 250,000 cubic yard of agricultural waste, industrial waste, and construction wastes were accepted from 1984 to March 1992. The landfill is currently being covered with intermediate daily cover and there is no bottom liner or LCRS.

d. WMU III-D, III-E, III-F - This is an unclassified landfill covering about 9 acres in the southeastern portion of the facility. "D" through "F" wastes were accepted beginning in March 1992 to the present. Only inert wastes, as defined by Section 20230 of Title 27 were accepted between 1992 and the present. Inert wastes consist of industrial and construction wastes. The landfill is currently being covered with intermediate daily cover and there is no bottom liner or LCRS.

e. WMU IV - This is an unclassified landfill covering 20 acres in the northeastern portion of the facility. This landfill was inadvertently over-excavated during site preparation and is being filled with only concrete, clean earth, and rock to at least 5 feet above historic high groundwater levels. Since January 1998 inert wastes, as defined by Section 20230 of Title 27, have been deposited in this landfill. An estimated 426,000 cubic yards of inert waste will be ultimately deposited into this landfill. There will be no liner or LCRS.

4. Volatile Organic Compounds (VOCs) and elevated inorganic water quality parameters have been found in the groundwater. The presence of VOCs, which do not occur naturally in groundwater, and the elevated inorganic water quality parameters indicate a release of waste to groundwater.

5. Due to the detection of VOCs and elevated concentrations of general water quality parameters, the Board has adopted Cleanup and Abatement Order No. 89-185 and WDRs Order No. 90-215 for groundwater cleanup and corrective action monitoring and remediations.

6. The Corrective Action Monitoring network consists of groundwater monitoring wells immediately downgradient of the landfills. These WDRs include an updated Monitoring and Reporting Program with provisions for a review of the groundwater monitoring network.

7. An engineered alternative for capping of WMU I, as described in the June 1997 Final Closure Plan, consists of the following layers: 2-foot foundation layer with compacted soils, a barrier layer consists of 30-mil minimum thickness PVC flexible geomembrane liner with a 12-ounce cushion geotextile on top (of the geomembrane during the placement of the vegetative layer), and an 18-inch minimum thickness of soil suitable to support vegetative growth overlying the foundation and barrier layers. The Board finds that this engineered alternative is acceptable.

WASTES AND THEIR CLASSIFICATION

8. The Discharger has previously discharged wastes to WMUs I, II, III-A, III-B, and III-C from the following sources:

   a. Municipal Refuse: from the general public
   b. Agricultural Wastes: including brush, tree trimmings, nut shells and husking wastes, rejected fresh fruits, and vegetables
   c. Industrial Wastes: including cans, pallets, waste paper products, off-specification diapers, and off-specification dry processed food products, and
   d. Construction Wastes: including asphalt, concrete, lumber, roofing, fencing , and general demolition debris.

   These wastes are classified as inert, nonhazardous solid waste, or designated waste, using the criteria set forth in Title 27.

9. The Discharger will continue to only discharge inert waste into WMU IV inert wastes, as defined by Section 20230 of Title 27 CCR including, concrete with rebar, earth, rock, asphalt (cured), mortar, tile, stucco, composition shingles, brick, linoleum, glass, aluminum window frames, gypsum board, scrap rubber products, electrical wiring, ductwork, polyvinyl chloride (PVC) pipe, vitrified clay pipe, ductile iron pipe, cast iron pipe, copper tubing, plaster, miscellaneous plastics, stainless steel fixtures, lumber products (no treated lumber), porcelain fixtures such as sinks, toilet, and tubs, and carpet. For the over-excavated portions, about 47 to 57 feet MSL, only concrete, clean earth, rock, cured asphalt, mortar, tile, stucco, brick, glass, and porcelain fixtures such as sinks, toilets and tubs will be discharged. The Discharger shall verify the age of asphalt, composition shingles, and mortar to be more than 10 years old.

DESCRIPTION OF THE SITE

10. Land within 1000 feet of the site is used for housing, open space, and agriculture. Land to the north includes a closed domestic refuse dump and an active transfer and recycling station.

11. The 100-year, 24-hour precipitation event for Modesto is 2.79 inches, as estimated from California Department of Water Resources rainfall depth-duration-frequency data for Modesto.

12. The soils immediately underlying the site consist of fine grained, relatively uniform sands with interbedded discontinuous lenses of silty sands and sandy silts to a depth of 120 feet. Below this depth is a 20 to 40-foot thick hard greenish-gray silty clay aquitard known as the E-Clay or Corcoran Clay. The E-Clay and underlying continental deposits are part of the Tulare Formation. Soil above the E-Clay is permeable with a hydraulic conductivity of approximately 350 ft/day.

13. The closest fault to the site is 20 miles away. The maximum ground acceleration at the site that would be caused by the maximum probable earthquake on this fault is estimated at 0.125 g based on California Department of Conservation, Division of Mines & Geology, Map Sheet 45, May 1987.

14. Surface drainage is to the Tuolumne River which is tributary to the San Joaquin River which flows into the Sacramento-San Joaquin Delta and San Francisco Bay.

15. The beneficial uses of these surface waters are domestic, municipal, agricultural, and industrial supply, groundwater recharge, power generation, recreation, esthetic enjoyment, navigation, fresh water replenishment, and preservation and enhancement of fish, wildlife, and other aquatic resources.

16. The groundwater elevation is generally at 30 feet or more below ground surface. However the highest anticipated groundwater elevation is at a depth of 17 feet below ground surface.

17. The beneficial uses of groundwater are domestic, municipal, agricultural, and industrial supply.

DESIGN, OPERATION, AND CLOSURE OF THE FACILITY

18. Closure of WMU I began in September 1997 and is expected to be completed in Fall 1998 or Spring 1999. A foundation layer with a minimum of 2-foot of compacted soil, a barrier layer consisting of a 30-mil minimum thickness PVC flexible geomembrane liner, and an 18-inch vegetative layer will be used to cap the landfill.

19. WMUs II and III have reached the fill capacity and are no longer receiving additional wastes. The landfills are covered with a minimum of 12 inches of intermediate soil cover. Closure of WMUs II and III will commence following completion of disposal activities in

WMU IV. The Discharger will submit a Final Closure Plan for WMUs II, III, and IV prior to closure of these WMUs.

20. Inert waste intake rate is about 2000 tons per month and continues to be relatively stable from historic calculations. At this intake rate and an assumed waste to soil cover ration of 4:1, WMU IV has about 426,000 cubic-yard capacity and is anticipated to be filled by February 2006.

21. Inert wastes were disposed using the area fill method. Wastes are mechanically spread from the tipping area at the top of the area fill onto the active face with a landfill compactor, and subsequently compacted in layers with repeated passes of the landfill compactor. Wastes are covered with a minimum of 6 inches of daily soil cover.

22. Surface water drainage control for closed Class III WMUs is proposed to be by means of perimeter ditches to intercept run-on from and prevent run-off to adjacent lands. Drainage for the majority of the landfill will convey storm drainage northward to a proposed retention basin in the northeast corner of the landfill. Drainage for the southern sections of WMUs I and III will be diverted to the existing retention basin in the southwest corner of the site used for treated groundwater.

23. Proposed postclosure land use consists of non-irrigated open space. Grazing or other agricultural activities will not be permitted.

GROUNDWATER CLEANUP AND REMEDIATION

24. Groundwater flow velocities are estimated at approximately one foot per day. The river exerts a major influence on the upper aquifer, acting as a discharge boundary during low water and a recharge boundary during high water. Irrigation losses from surrounding agricultural land are another major recharge source. The hydraulic gradient is generally to the north-northwest toward the Tuolumne River. During periods of high river flow, the water table rises in elevation and the hydraulic gradient is to the southwest away from the river in the northern part of the landfill.

25. Groundwater monitoring indicates that groundwater inundates up to as much as four feet of refuse in WMU I and that groundwater beneath WMU I and off-site to the west and northeast are polluted with VOCs.

26. Cleanup and Abatement Order No. 89-185 was adopted by the Board on 22 September 1989. Order No. 89-185 includes requirements for site assessment and construction and operation of a groundwater remediation system. Order No. 89-185 also includes requirements for the Discharger to replace domestic drinking water supplies should the

Bonzi Landfill be determined in a public hearing to be the source of contamination or pollution of the water supplies.

27. WDRs Order No. 90-215 applies to operation of a groundwater remediation system which was brought on-line on 1 November 1991. The extraction system consists of three extraction wells which pump continuously from the uppermost aquifer at a total rate of approximately 30 to 200 gpm. Extracted groundwater is piped to a single tower air stripper treatment system where volatile organic chemicals are removed. Treated groundwater is then piped to a retention pond lined with 60-mil solar resistant HDPE geomembrane. Between 43,000 and 288,000 gallons per day of treated groundwater is proposed to augment drip irrigation water for a vineyard southwest of the landfill site.

28. Air stripping is designed to remove volatile organic compounds from the extracted groundwater. The air stripping is with a single tower designed for maximum flow and cycled on and off for lesser flows. Air emissions from the tower are discharged directly to the atmosphere. Estimated amount of volatile organics released is 1.5 ounces (total weight) per day.

29. The retention pond is lined with 60 mil solar resistant HDPE material. It is sized to contain both treated groundwater and stormwater runoff from the southwestern portion of the landfill. Winter discharges take place to maintain freeboard for storm events.

30. Irrigation of vineyards southwest of the landfill site is done with a drip system and does not create any mists or run off. The property is owned by the Discharger.

31. Groundwater containing elevated concentrations of metals and salts. When diluted with other groundwater, the metals and salts will not be significantly above background concentrations, so no specific treatment for removal of metals or salt is proposed.

32. Recent detections of VOCs in the VFW supply well (see Attachment C) to the northwest of the facility indicate the VOC plume has migrated downgradient since the groundwater extraction system began operation. The Discharger shall propose and submit a work plan to evaluate the effectiveness of the corrective action program.

CEQA AND OTHER CONSIDERATIONS

33. This action to revise WDRs for this facility is exempt from the provisions of the California Environmental Quality Act (Public Resources Code Section 21000 et seq.), in accordance with Title 14, CCR, Section 15301.

34. This Order implements:

  a. the Water Quality Control Plan for the Sacramento River Basin and the San Joaquin River Basin Third edition.

  b. the prescriptive standards and performance goals of Title 27, California Code of Regulations (27 CCR) Division 2, Subdivision 1, effective 18 July 1997, and subsequent revisions.

PROCEDURAL REQUIREMENTS

35. The Board has notified the Discharger, and interested agencies and persons of its intention to revise the WDRs for this facility.

36. In a public hearing, the Board heard and considered all comments pertaining to this facility and discharge.

IT IS HEREBY ORDERED THAT Order No. 92-155 is rescinded and Ma-Ru Holding Company Inc. and Bonzi Sanitation Landfill Inc., and its agents, successors and assignees, in order to meet the provisions of Division 7 of the California Water Code and the regulations adopted thereunder, shall comply with the following:

A. PROHIBITIONS:

  1. The discharge of 'hazardous waste', 'designated waste', and 'non-hazardous waste' at this facility is prohibited. For the purposes of this Order, the term 'hazardous waste', 'designated waste', and 'non-hazardous waste' is as defined in Title 27. Future intake of wastes shall be limited to inert waste as described in Finding No. 9.

  2. The discharge of wastes not classified as inert pursuant to Title 27 to unlined unclassified WMUs is prohibited.

  3. The discharge to the landfill units of liquid or semi–solid waste (i.e., waste containing less than 50 percent solids is prohibited).

  4. The discharge to the landfill units of solid waste containing free liquid or moisture in excess of the wastes' moisture holding capacity is prohibited.

  5. The discharge of solid or liquid waste or leachate to surface waters, surface water drainage courses, or groundwater is prohibited.

6. The discharge of waste other than inert waste to ponded water from any source is prohibited.

7. The discharge of waste within 100 feet of surface waters not related to landfill drainage structures is prohibited.

8. The discharge of wastes which have the potential to reduce or impair the integrity of containment structures or which, if commingled with other wastes in the unit, could produce violent reaction, heat or pressure, fire or explosion, toxic by-products, or reaction products which in turn:

   a. require a higher level of containment than provided by the unit
   b. are 'restricted hazardous wastes', or
   c. impair the integrity of containment structures,

   is prohibited.

B. DISCHARGE SPECIFICATIONS:

General Specifications

1. Wastes shall only be discharged into, and shall be confined to, the landfill waste management unit specifically designed for their containment as shown on Attachment B.

2. WMU IV shall receive only inert waste as defined in section 20230 of Title 27 CCR.

3. The Discharger shall implement load checking procedures necessary to preclude the discharge of 'hazardous waste', 'designated waste' or unauthorized waste at this facility.

4. Prior to the discharge of waste to the waste management unit, all wells within 500 feet of the unit shall have sanitary seals which meet the requirements of the Stanislaus County Department of Environmental Resources or shall be properly destroyed according to Department of Water Resources. A record of the sealing and/or destruction of such wells shall be sent to the Board and to the State Department of Water Resources.

5. Water used for waste management unit maintenance shall be limited to the minimum amount necessary for dust control, construction moisture conditioning, and establishment of vegetation.

6. Waste shall not be discharged below an elevation of 58 feet above mean sea level (MSL). A minimum separation of 5 feet shall be maintained between 'nonhazardous solid waste' as defined in Title 27 and the highest anticipated elevation of groundwater including the capillary fringe. Discharge of 'inert waste' as defined in Title 27 shall be above the highest anticipated groundwater elevation. For unclassified WMU IV, cells which have been excavated only concrete, clean earth, rock, cured asphalt, mortar, tile, stucco, brick, glass, and porcelain fixtures such as sinks, toilets and tubs shall be discharged to areas below the highest anticipated groundwater elevation. The Discharger shall verify the age of asphalt, composition shingles, and mortar to be more than 10 years old. No additional excavation of unclassified WMU cells shall occur below the highest anticipated groundwater elevation.

7. Class III WMUs shall be designed, constructed, and closed in accordance with Title 27 and this Order and approved by Board staff prior to construction and again prior to operation. The plans submitted to the Board for review and approval shall include, but not be limited to, the engineered design plans for the WMU, the construction specifications, construction quality assurance (CQA) plans, and revised water quality monitoring plans. The final construction report shall include, but not be limited to, construction record drawings for the WMU, a CQA report with a written summary of the CQA program and all test results and analyses, and a certification as described in Specification B.22.

WMU Closure Specifications

8. Landfill closure shall be under the direct supervision of a California registered civil engineer or certified engineering geologist.

9. The closed landfill shall be provided with at least two permanent monuments, installed by a licensed land surveyor, from which the location and elevation of all wastes, containment structures, and monitoring facilities can be determined throughout the post–closure maintenance period.

10. At closure, WMU I shall receive a final cover which is designed and constructed to function with minimum maintenance and consists, at a minimum, of a two-foot thick foundation layer (which may contain waste materials) overlain by a 30-mil minimum thickness PVC flexible geomembrane liner as approved by the Board on 16 July

1997. The Discharger shall submit Final Closure Design criteria for WMUs II through IV prior to constructions, as required in General Specifications No. 7 above. Unclassified WMUs shall be covered and graded as appropriate to prevent ponding and erosion.

11. Vegetation shall be planted and maintained over each closed landfill unit. Vegetation shall be selected to require a minimum of irrigation and maintenance and shall have a rooting depth not in excess of the vegetative layer thickness.

12. Closed landfill units shall be graded to at least a three percent (3%) grade and maintained to prevent pounding.

13. Areas with slopes greater than ten percent, surface drainage courses, and areas subject to erosion by wind or water shall be designed and constructed to prevent such erosion.

14. At closure of surface impoundments, all residual wastes, including liquids, slugs, precipitates, settled solids, liner materials, and adjacent natural geologic materials contaminated by wastes, shall be completely removed and discharged to a WMU approved by the Board. If after reasonable attempts to remove contaminated natural geologic materials, the Discharger demonstrates that removal of all remaining contamination is infeasible, the impoundment shall be closed as a landfill pursuant to §21090 of Title 27.

Supervision and Certification of Construction

15. All containment structures shall be designed and constructed under the direct supervision of a California registered civil engineer or a certified engineering geologist and shall be certified by that individual, prior to waste discharge, as meeting applicable prescriptive Title 27 standards and that the landfill and surface impoundment will meet Title 27 performance goals.

Protection from Storm Events

16. Waste management units (WMUs) shall be designed, constructed, and operated to prevent inundation or washout due to floods with a 100–year return period.

17. Precipitation and drainage control systems shall be designed and constructed to accommodate the anticipated volume of precipitation and peak flows from surface runoff under 100–year, 24–hour precipitation conditions.

18. Surface drainage from tributary areas and internal site drainage shall not contact or percolate through wastes.

19. Annually, prior to the anticipated rainy season, but no later than 1 November, any necessary erosion control measures shall be implemented, and any necessary construction, maintenance, or repairs of precipitation and drainage control facilities shall be completed to prevent erosion or flooding of the facility and to prevent surface drainage from contacting or percolating through wastes.

C. PROVISIONS

1. The Discharger shall comply with Standard Provisions and Reporting Requirements, dated August 1997, which are hereby incorporated into this Order. The Standard Provisions and Reporting Requirements contain important provisions and requirements with which the Discharger must comply. A violation of any of the Standard Provisions and Reporting Requirements is a violation of these waste discharge requirements.

2. The Discharger shall comply with Monitoring and Reporting Program No. 98-093, which is attached to and made part of this Order. This compliance includes, but is not limited to, maintenance of waste containment facilities and precipitation and drainage controls, and monitoring groundwater, leachate from waste management units, the vadose zone and surface waters, throughout the active life of waste management units and the postclosure maintenance period. A violation of Monitoring and Reporting Program No. 98-093 is a violation of these waste discharge requirements.

3. The Discharger shall maintain a copy of this Order at the facility and make it available at all times to facility operating personnel, who shall be familiar with its contents, and to regulatory agency personnel.

4. The Discharger shall notify the Board in writing of any proposed change in ownership or responsibility for maintenance or operation of the landfill and the surface impoundment. The Discharger shall also notify the Board of a material change in the character, location, or volume of the waste discharge and of any proposed expansions or closure plans. This notification shall be given 120 days prior to the effective date of the change and shall be accompanied by an amended RWD and any technical documents that are needed to demonstrate continued compliance with these WDRs.

5. The Discharger shall, in a timely manner remove and relocate any wastes discharged at this facility in violation of this Order and of the Water Code.

6. The Discharger shall maintain legible records of the volume and type of each waste discharged to the Class II surface impoundment and the manner and location of discharge. Such records shall be maintained at the facility until the end of the post-closure maintenance period. These records shall be available for review by representatives of the Board and of the State Water Resources Control Board at any time during normal business hours. At the end of the post-closure maintenance period, copies of these records shall be sent to the Regional Board upon request.

7. The Discharger shall immediately notify the Board of any flooding, equipment failure, slope failure, or other change in site conditions which could impair the integrity of waste or leachate containment facilities or precipitation and drainage control structures.

8. The post-closure maintenance period shall continue until the Board determines that remaining wastes in all landfill and surface impoundment will not threaten water quality.

9. The Discharger or persons employed by the Discharger shall comply with all notice and reporting requirements of the State Department of Water Resources with regard to the construction, alteration, destruction, or abandonment of all monitoring wells used for compliance with this Order or with Monitoring and Reporting Program No. 98-093 as required by Sections 13750 through 13755 of the California Water Code.

10. The Discharger shall maintain financial assurances for closure and postclosure maintenance, pursuant to §20950 of Title 27. The Discharger shall submit for approval and maintain financial assurances for initiating corrective action for all known and reasonably foreseeable releases, pursuant to §20380(b) of Title 27. The Discharger shall submit a report every five years starting 1 July 1998 that either validates the viability of the financial assurances mechanism or proposes and substantiates any needed changes.

11. The Discharger shall maintain waste containment facilities and precipitation and drainage controls, and shall continue to monitor groundwater, leachate from the landfill units, the vadose zone, and surface waters per Monitoring and Reporting Program No. 98-093 throughout the post–closure maintenance period.

12. The owner of the waste management facility shall have the continuing responsibility to assure protection of usable waters from discharged wastes and from gases and leachate generated by discharged waste during the active life, closure, and post–closure maintenance period of the landfill and during subsequent use of the property for other purposes.

13. The Discharger shall complete the following tasks in accordance with the time schedule listed below:

TASK	COMPLIANCE DATE
1. Submit a Work Plan to evaluate the effectiveness of the correction action program	27 April 1998
2. Submit Concentration Limits for Constituents of Concerns (COCs)	27 July 1998
3. Submit Final Closure Construction Progress Reports for WMU I	Every 6 months from Plan approval date
4. Complete WMU I Final Closure Construction	In accordance with approved Final closure Plan
5. Submit WMU I Final Construction Report for Closure Pursuant to Specification B.16	Within 3 months after completion of Final Closure construction
6. Begin Closure Construction for WMUs II through IV	Within 6 months after Final Closure Plan approval date

14. In the event of any change in ownership of this waste management facility, the Discharger shall notify the succeeding owner or operator in writing of the existence of this Order. A copy of that notification shall be sent to the Board.

15. The Discharger shall comply with all applicable provisions of Title 27 that are not specifically referred to in this Order.

16. The Board will review this Order periodically and will revise these requirements when necessary.

I, GARY CARLTON, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 17 April 1998.

GARY M. CARLTON, Executive Officer

Attachments

PAL/CSL

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. 98-093

MONITORING AND REPORTING PROGRAM
FOR
MA-RU HOLDING COMPANY, INC. AND
BONZI SANITATION LANDFILL, PARTNERSHIP
BONZI SANITATION LANDFILL
STANISLAUS COUNTY

The Discharger shall maintain water quality monitoring systems that are appropriate for detection monitoring and corrective action and that comply with the provisions of Title 27, California Code of Regulations (CCR), Division 2, Subdivision 1, Chapter 3, Subchapter 3.

Monitoring data indicate a release from waste management unit WMU I, with possible releases from WMU II and III. Specifically, volatile organic carbons (VOCs) were detected downgradient of the landfill. Water quality data for general water quality parameter, Total Dissolved Solids (TDS) and chloride, and several of the metals (barium chromium, and vanadium) also have been detected. Groundwater remediation under Waste Discharge Requirements (WDRs) Order No. 90-215 will serve as part of a correction action under Article 1 of Title 27, Division 2 Subdivision 1, Chapter 3, Subchapter 3.

Compliance with this Monitoring and Reporting Program, and with the companion Standard Provisions and Reporting Requirements, is ordered by WDRs Order No. 98-093. Failure to comply with this Program, or with the Standard Provisions and Reporting Requirements, constitutes non-compliance with the WDRs and with the Water Code, which can result in the imposition of civil monetary liability.

A. REPORTING

The Discharger shall report monitoring data and information as required in this Monitoring and Reporting Program and as required in the Standard Provisions and Reporting Requirements. Reports which do not comply with the required format will be **REJECTED** and the Discharger shall be deemed to be in noncompliance with the WDRs. In reporting the monitoring data required by this program, the Discharger shall arrange the data in tabular form so that the date, the constituents, the concentrations, and the units are readily discernible. The data shall be summarized in such a manner so as to illustrate clearly the compliance with waste discharge requirements or the lack thereof. Historical and current monitoring data shall be graphed at least once annually. Graphs for the same constituent shall be plotted at the same scale to facilitate visual comparison of monitoring data. A short discussion of the monitoring results, including notations of any water quality violations shall precede the tabular summaries.

Field and laboratory tests shall be reported in the quarterly monitoring reports. Method detection limits and practical quantitation limits shall be reported. All peaks shall be reported, including those which cannot be quantified and/or specifically identified. Quarterly, semiannual, and annual monitoring reports shall be submitted to the Board by the **15th day of the month** following the calendar quarter in which the samples were taken or observations made.

The results of any monitoring done more frequently than required at the locations specified herein shall be reported to the Board.

An annual report shall be submitted to the Board by **15 February** of each year containing both tabular and graphical summaries of the monitoring data obtained during the previous year. The Discharger may combine this information with the fourth quarter monitoring report for the facility.

The Discharger shall implement the above monitoring program on the effective date of this Order.

B. REQUIRED MONITORING REPORTS

1. Water Quality Protection Standard Report

The Discharger shall submit, by **27 July 1998**, a Water Quality Protection Standard for the site. The Water Quality Protection Standard, as defined in section 20390 of Title 27, shall consist of constituents of concern, their concentration limits, the point of compliance, and all water quality monitoring points.

Constituents of concern shall include all waste constituents, reaction products, and hazardous constituents that are reasonably expected to be in or derived from waste contained in the landfill. Concentration limits in each medium shall consist of background pursuant to Section 20400 of Title 27. For each monitoring period, the Discharger shall determine whether there is statistically significant evidence of a new release from the ash landfill and whether the WMUs and whether these units are in compliance with the Water Quality Protection Standard using procedures specified in Section 20415 of Title 27.

If the Discharger, through a monitoring program, or the Board finds that there is statistically significant evidence for a *new* release from the landfill for any monitoring parameter or constituent of concern, or significant physical evidence of a release from the landfill the Discharger shall notify the Board or acknowledge the Board's finding in writing within seven days, and shall implement verification procedures within 30 days, pursuant to section 20415(e)(8)(E) of Title 27. Within 90 days, the Discharger shall submit to the Board the results of the resampling and either:

a. A report that demonstrates pursuant to Section 20425 (k) (7) of Title 27 that a source other than the landfill caused the evidence of a release, or that the evidence resulted form an error in sampling, analysis, or evaluation, or from natural variation in groundwater, surface water, or the unsaturated zone; or

b. An amended Report of Waste Discharge for the establishment of an evaluation monitoring program, pursuant to Section 20425 of Title 27, to assess the nature and extent of release from the landfills and to design a corrective action program meeting the requirements of Section 20430 of Title 27. Within 180 days of determining statistically significant evidence of a release, the Discharger shall submit an engineering feasibility study pursuant to Section 20420(k)(6) for corrective action program necessary to meet the requirements of Section 20430 of Title 27.

2. **Detection Monitoring and Corrective Action Report**

The Discharger shall submit reports of the results of detection monitoring and corrective action in accordance with the schedules specified in this Monitoring and Reporting Program.

3. **Annual Monitoring Summary Report**

The Discharger shall submit the Annual Monitoring Summary Report as specified in the Standard Provisions and Reporting Requirements. The progress of the corrective action program shall be analyzed and described in the Annual Monitoring Summary Report.

4. **Constituents-of-Concern (COC) 5 Year Report**

In the absence of a *new* release being indicated, the Discharger shall monitor all Constituents of Concern for all Monitoring Points for each monitored medium for all COCs every fifth year, beginning with calendar year 1999 (the first Reporting Period ends 31 March 1999) with subsequent COC monitoring efforts being carried out every fifth year thereafter alternately in the Summer (Reporting period ends 30 September) and Winter (Reporting Period ends 31 March). The COC Report may be combined with a Detection Monitoring Report or an Annual Summary Report having a Reporting Period that ends at the same time.

5. **Constituents-of-Concern (COC) Leachate Detection Report**

The Discharger shall report to the Board by no later than 15 February of a given year the analytical results of the leachate sample taken the previous Fall, including an identification of all detected COCs that are not on the landfill's COC list. During any year in which a

Spring leachate re-test is performed, the Discharger shall submit a report to the Board, by no later than 31 July of that year, identifying all constituents which must be added to the landfill's COC list as a result of having been detected in both the (previous calendar year's) Fall sample and in the Spring re-test sample.

Standard Observations

Each monitoring report shall include a summary and certification of completion of all Standard Observations for the waste management unit, for the perimeter of the landfill, and for the receiving waters. The Standard observations shall be performed on a weekly basis and shall include those elements as defined in the Standard Provisions and Reporting Requirements.

C. CORRECTIVE ACTION MONITORING PROGRAM

WMUs at the Bonzi Sanitation Landfill disposal facility have released constituents of concern (volatile organic chemicals as analyzed by EPA Methods 601 and 602 and total dissolved solids) to groundwater in violation of the Water Quality Protection Standard. The Discharger is currently implementing a Corrective Action Program (CAP) pursuant to §20385 of Title 27 to achieve compliance with the Water Quality Protection Standards.

In conjunction with the CAP, the Discharger shall implement a water quality monitoring program pursuant to §20430(d) of Title 27 to demonstrate the effectiveness of the CAP. Should the Board or Discharger determine that the CAP is not effective and no longer satisfies §20430 of Title 27, then the Discharger shall submit an amended report of waste discharge to make appropriate changes in the program (§20430(i) and (j) of Title 27).

Corrective action measures may be terminated after the Discharger demonstrates to the satisfaction of the Board that concentrations of constituents of concern are reduced to levels below their respective concentration limits and an approved Detection Monitoring Program is incorporated in the waste discharge requirements (§20430 (f) and (g) of Title 27).

D. REQUIRED MONITORING PROGRAMS

1. General Waste Monitoring

The Discharger shall, on a monthly basis, monitor all wastes discharged to landfill waste management units (WMUs) and report to the Board as follows:

Table I - General Waste Monitoring

Parameters	Units	Frequency
Quantity discharge	Tons, cubic yards	Semi-annually
Type of martial discharged	---	Semi-annually
Source(s) of material discharged	---	Semi-annually
Minimum elevation of discharge	Feet, M.S.L.	Semi-annually
Capacity of landfill unit remaining	Percent	Annually
Summary of Load Checking Program	---	Semi-annually

The Discharger shall also notify the Board within 24 hours of significant incidents including, at a minimum, hazardous material spills and other events specified in Provision C.11 of these waste discharge requirements.

2. **Groundwater Elevation Monitoring**

The groundwater surface elevation (in feet and hundredths, M.S.L.) shall be measured on a quarterly basis and used to determine the velocity and direction of groundwater flow. This information shall be displayed on a water table contour map and/or groundwater flownet for the site and submitted with the quarterly monitoring reports. Groundwater elevations taken prior to purging the well and sampling for Monitoring Parameters shall be used to fulfill the groundwater gradient/direction analyses required. Groundwater elevations for all background and downgradient wells shall be measured within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater gradient and direction. This information shall be included in the quarterly monitoring reports.

3. **Groundwater and Leachate Monitoring**

The following sections outline the detection and corrective action monitoring programs that shall be implemented at the facility to determine compliance with the "Water Quality Protection Standards", state action levels, and to monitor impacts to the groundwater by the waste management units.

a. Detection Monitoring

The detection monitoring system shall consist of the following monitoring and leachate wells.

(1) Background (5 wells): 84-19, 84-20, 84-21, 86-9, 86-10.

(2) Monitoring Points (7 wells): 84-6, 84-13, 84-14, 85-10, 90-1, 90-2.

(3) Compliance Points (10 wells): MW-1, MW-2, MW-3, MW-6R, 84-18, 85-3AR, 85-4, 85-4A, 86-1, P-1.

(4) Leachate (1 well): 92-C1L.

b. Corrective Action Monitoring

The corrective action monitoring system shall consist of the following monitoring wells.

Monitoring Points (19 wells): MW-3, MW-6R, P-1, 85-4A, 85-6, 85-7, 85-10, 85-12, 85-13, 85-25, 86-1, 86-2, 86-3, 86-4, 86-5A, 86-5B, 86-6A, 86-6B, and 88-1.

The monitoring parameters and frequencies for detection and corrective action monitoring are shown below in Tables II and III, respectively.

Table II - Detection Monitoring Program

Parameters	Units	Frequency[1]
Field Parameters		
Temperature	°F	Quarterly
Groundwater Elevation	Ft. & hundredths, MSL	Quarterly
Specific Conductance	µmhos/cm	Quarterly
pH	pH units	Quarterly
Monitoring Parameters		
Total Dissolved Solids	mg/l	Quarterly
Chloride	mg/l	Quarterly
Nitrate (as N)	mg/l	Quarterly
Constituents of Concern		
Arsenic[3]	mg/l	Annually
Barium	mg/l	Annually
Dissolved Iron	mg/l	Annually
Manganese	mg/l	Annually
Nickel	mg/l	Annually
Total Chromium	mg/l	Annually
Vanadium	mg/l	Annually
Volatile Organics[2]	µg/l	Quarterly
Zinc	mg/l	Annually
Expanded List of Constituents of Concern[4]	µg/l or mg/l	Every 5 years

[1] Annual monitoring shall be conducted during the first quarter of each year. The frequency of once every 5 years shall start with sampling in the first quarter of 1999.

[2] EPA Methods 601 and 602, EPA Method 624, EPA Method 8240, or EPA Method 8260 shall be used for analysis of volatile organics. Method detection limits and practical quantitation limits shall be reported. All peaks shall be reported, including those which cannot be quantified and/or specifically identified

[3] Atomic Absorption (AA) shall be used for analysis of Arsenic.

[4] The expanded list of additional constituents of concern shall be based on those constituents specified in Appendices I and II of 40 CFR Part 258 (Subtitle D) that are not already incorporated in the monitoring program. The Discharger may propose, for approval, selected representative monitoring wells for which the additional constituents of concern shall be analyzed.

Table III - Corrective Action Monitoring

Parameters	Units	Frequency
Field Parameters		
Temperature	°F	Quarterly
Groundwater Elevation	Ft. & hundredths, MSL	Quarterly
Specific Conductance	µmhos/cm	Quarterly
pH	pH units	Quarterly
Monitoring Parameters		
Total Dissolved Solids	mg/l	Quarterly
Chloride	mg/l	Quarterly
Nitrate (as N)	mg/l	Quarterly
Constituents of Concern		
Arsenic[3]	mg/l	Annually[1]
Barium	mg/l	Annually
Total Chromium	mg/l	Annually
Vanadium	mg/l	Annually
Volatile Organics[2]	µg/l	Quarterly

[1] Annual monitoring shall be conducted during the first quarter of each year.

[2] EPA Methods 601 and 602, EPA Method 624, EPA Method 8240, or EPA Method 8260 shall be used for analysis of volatile organics. Method detection limits and practical quantitation limits shall be reported. All peaks shall be reported, including those which cannot be quantified and/or specifically identified

[3] Atomic Absorption (AA) shall be used for analysis of Arsenic.

The following offsite water supply wells shall be sampled on an annual basis for volatile organic chemicals, total dissolved solids, and nitrate: Ace Tap, **Helmer**, and **Graham** (See Attachment C). Offsite supply well VFW shall be sampled quarterly for volatile organic compounds, total dissolved solids, and nitrate. If no VOC's are detected in four consecutive quarters, the Discharger can sample and submit VFW offsite well data on an annual basis.

E. WATER QUALITY PROTECTION STANDARD

The Water Quality Protection Standard (Standard) consists of the following elements:

a. Constituents of Concern;
b. Concentration Limits;
c. Monitoring Points;
d. Points of Compliance; and
e. Compliance Period.

Each of these is described as follows:

1. Constituents of Concern

The 'COC' list (list of Constituents of Concern required under 27 CCR 20390) shall include all constituents listed in Tables I, II, and III (above), and the Waste Discharge Requirements No.98-093. The Discharger shall monitor all COCs every five years, or more frequently as required under the corrective action monitoring program.

2. Concentration Limits

The Concentration Limits shall be determined by the Discharger and submitted to the Board by **27 July 1998**. The Concentration Limit for any given Constituent of Concern or Monitoring Parameter in a given monitored medium (i.e., the uppermost aquifer) at a landfill shall be in accordance with Title 27, Section 20400 as follows, and shall be used as the basis of comparison with data from the Monitoring Points in that monitored medium.

3. Monitoring Points

The groundwater monitoring points for detection and corrective action monitoring shall be as listed under D.3., a. and b. above.

4. Points of Compliance

The points of compliance for groundwater are listed in D.3.a.(3) above. The point of compliance for surface water monitoring shall be at the point where surface water flows leave the facility boundary.

5. **Compliance Period**

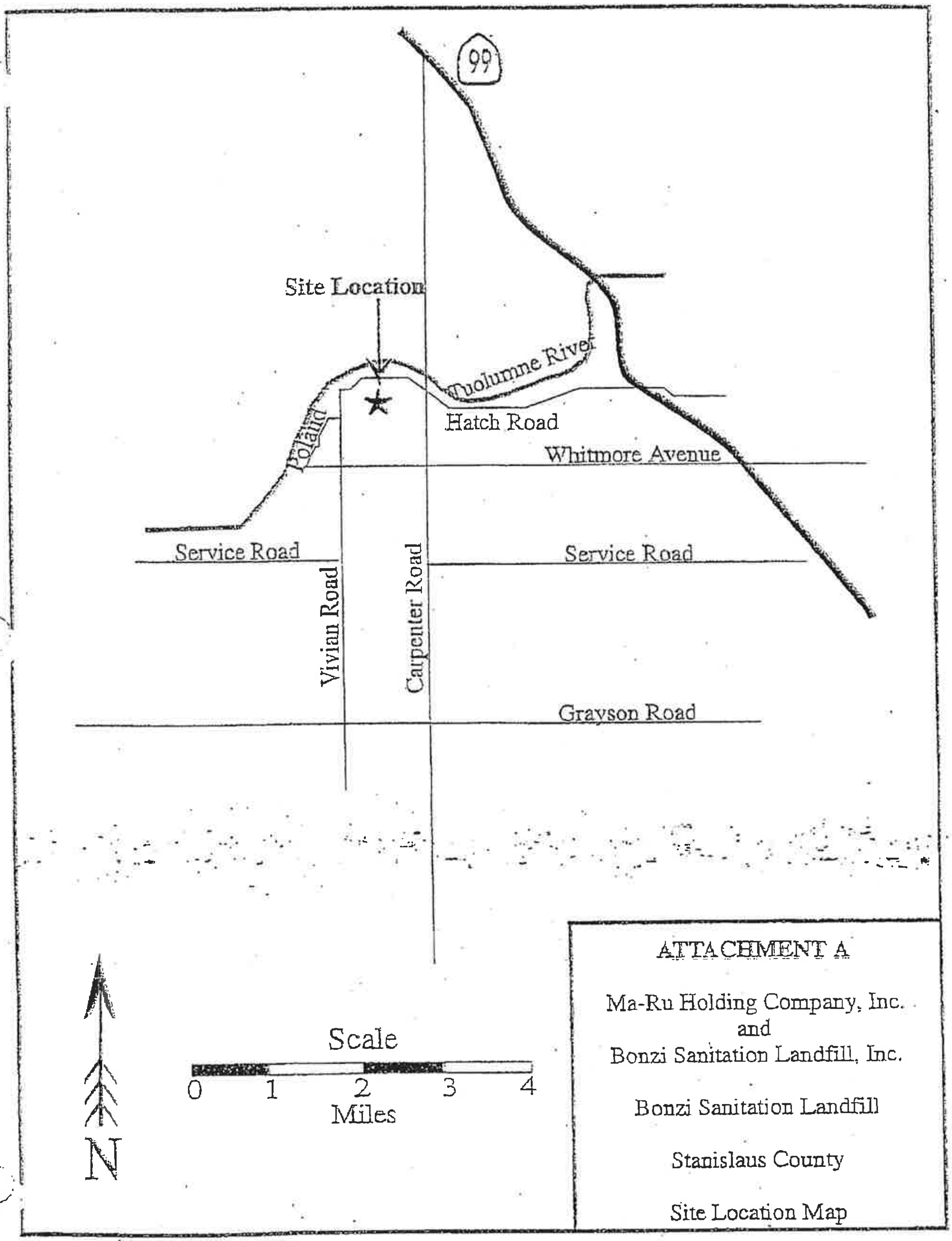
The Compliance Period is the number of years equal to the active life of the landfill plus the closure period. Each time the Standard is exceeded (i.e., a release is discovered), the landfill begins a Compliance Period on the date the Board directs the Discharger to begin an Evaluation Monitoring Program. If the Discharger's Corrective Action Program (CAP) has not achieved compliance with the Standard by the scheduled end of the Compliance Period, the Compliance Period is automatically extended until the landfill has been in continuous compliance for at least three consecutive years.

The Discharger shall implement the above monitoring program on the effective date of this Order.

Ordered by: ______________________
GARY M. CARLTON, Executive Officer

17 April 1998
____
(Date)

Attachments
PAL/CSL



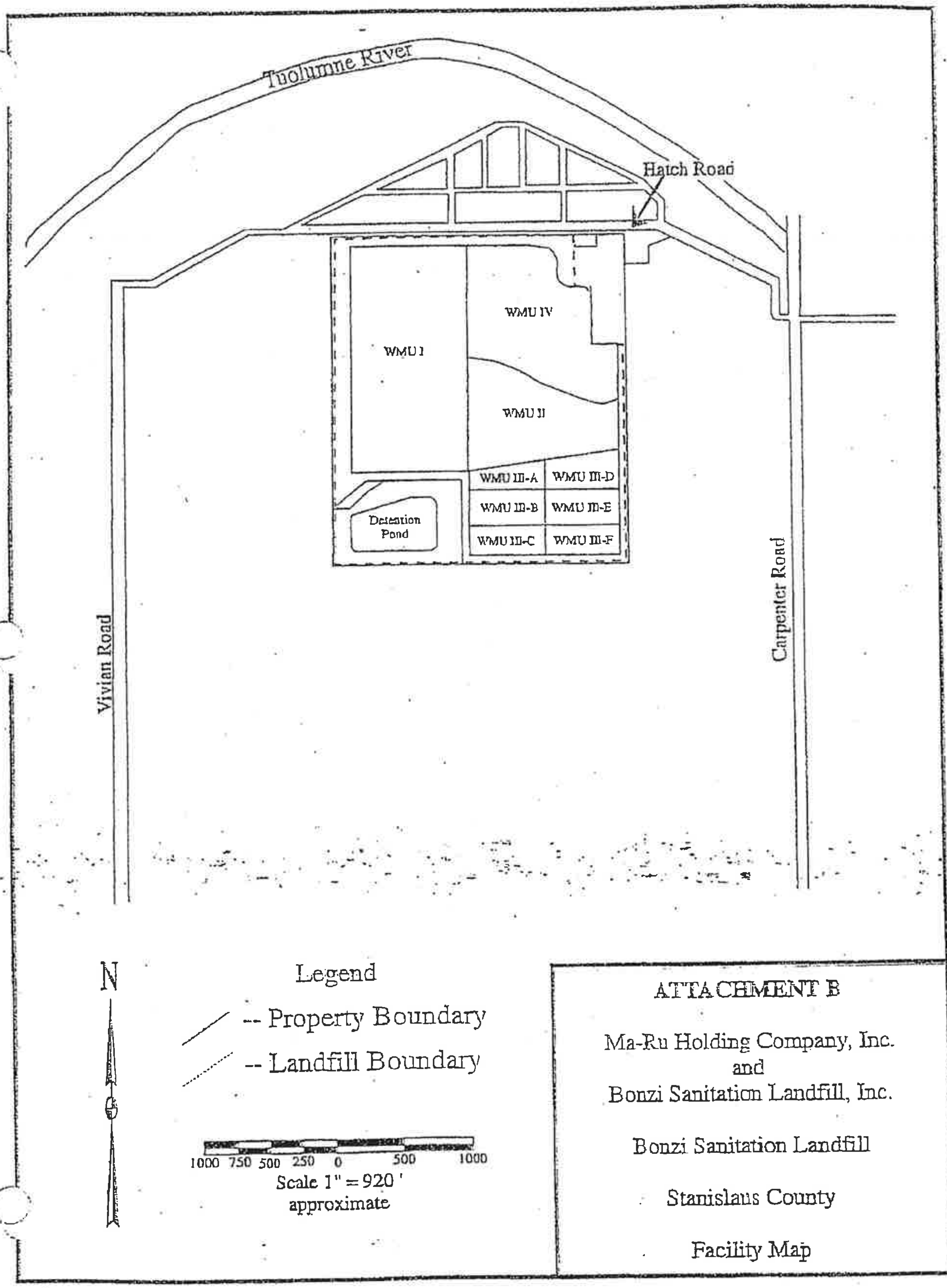
ATTACHMENT A

Ma-Ru Holding Company, Inc.
and
Bonzi Sanitation Landfill, Inc.

Bonzi Sanitation Landfill

Stanislaus County

Site Location Map



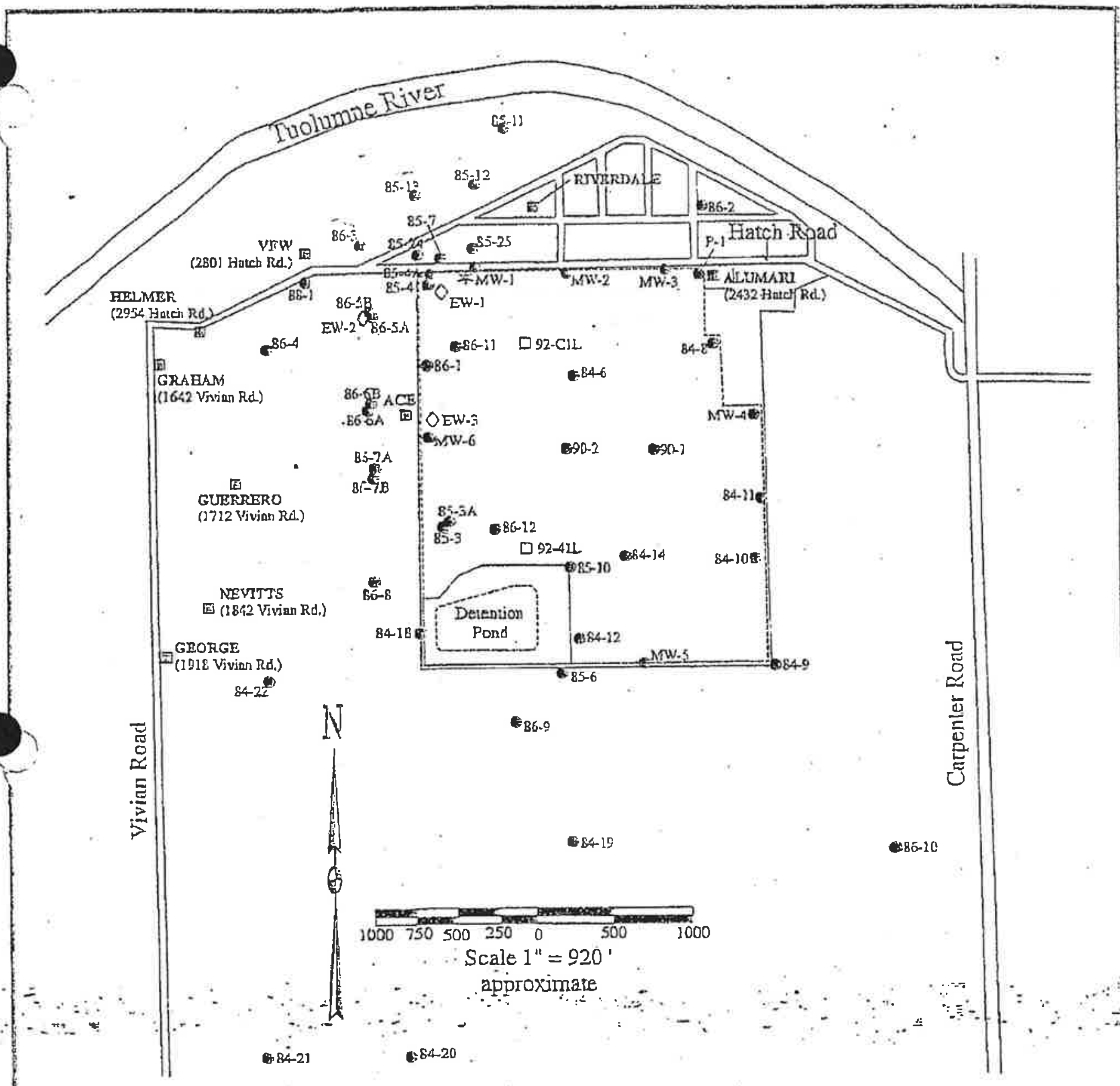
ATTACHMENT B

Ma-Ru Holding Company, Inc.
and
Bonzi Sanitation Landfill, Inc.

Bonzi Sanitation Landfill

Stanislaus County

Facility Map



LEGEND

- Groundwater Monitoring Well
- Extraction Well
- Domestic Source Sampling Location
- Groundwater Treatment Facility
- Leachate Well
- Property Boundary
- Landfill Boundary

ATTACHMENT C

Ma-Ru Holding Company, Inc.
and
Bonzi Sanitation Landfill, Inc.

Bonzi Sanitation Landfill

Stanislaus County

Well Location Map

INFORMATION SHEET

WASTE DISCHARGE REQUIREMENTS
MA-RU HOLDING COMPANY, INC. AND
BONZI SANITATION LANDFILL, PARTNERSHIP
BONZI SANITATION LANDFILL
STANISLAUS COUNTY

The Bonzi Sanitation Landfill is owned by Ma-Ru Holding Company and operated by Bonzi Sanitation Landfill, Inc. The facility is three miles southwest of Modesto, Stanislaus County. Surface drainage is to the Tuolumne River which is approximately 1000 feet north of the facility. Continued discharge of inert waste to unlined unclassified Waste Management Units (WMUs) is proposed in addition to operation as a recycling, salvage, woodchipping, and haul truck maintenance and repair facility.

The facility consists of four unlined landfill areas totaling approximately 100 acres. WMUs I and II are classified as Class III landfills pursuant to California Code of Regulations (CCR), Title 27 Division 2 Subdivision 1 (Title 27). Municipal solids wastes, agricultural wastes, industrial wastes, and construction wastes were placed in WMU I from 1967 to 1978 and in WMU II from 1978 to 1984. WMUs III-A, III-B, and III-C are also Class III landfills pursuant to Title 27. Agricultural wastes, industrial wastes, and construction wastes were placed in these landfills between 1984 and March 1992. WMUs III-D, III-E, and III-F and IV are unclassified landfills. Inert wastes and construction wastes were placed in WMUs III-D, III-E, and III-F from March 1992 to the present. WMU IV was over-excavated during site preparation and will only accept inert wastes.

A Final Closure Plan and Final Postclosure Maintenance Plan were submitted for WMU I. WMU I is being closed with an engineered alternative cap and WMUs II and III will be closed when WMU IV is filled. The engineered alternative consists of the a 2-foot foundation layer with compacted soils, a barrier layer consisting of 30-mil minimum thickness PVC flexible geomembrane liner, and an 18-inch minimum thickness of soil suitable to support vegetative growth overlying the foundation and barrier layers. These updated Waste Discharge Requirements (WDRs) reflect the current status of the facility and specific closure of WMU I.

Volatile Organic Compounds (VOCs) and elevated concentrations of general water quality parameters have been found in the groundwater. The Board has adopted Cleanup and Abatement Order No. 89-185 and WDRs Order No. 90-215 for groundwater cleanup and corrective action monitoring and remediations.

PAL/CSL
17 April 1998

San Joaquin Valley
Air Pollution Control District

Permit to Operate

FACILITY: N-2893

EXPIRATION DATE: 11/30/2006

LEGAL OWNER OR OPERATOR: BONZI SANITATION LANDFILL INC
MAILING ADDRESS: 2650 W. HATCH RD
MODESTO, CA 95358

FACILITY LOCATION: 2650 W. HATCH RD
MODESTO, CA 95358

FACILITY DESCRIPTION: EG LANDFILL

[illegible]e Facility's Permit to Operate may include Facility-wide Requirements as well as requirements that [illegible]pply to specific permit units.

This Permit to Operate remains valid through the permit expiration date listed above, subject to payment of annual permit fees and compliance with permit conditions and all applicable local, state, and federal regulations. This permit is valid only at the location specified above, and becomes void upon any transfer of ownership or location. Any modification of the equipment or operation, as defined in District Rule 2201, will require prior District approval. This permit shall be posted as prescribed in District Rule 2010.

David L. Crow
Executive Director / APCO

Seyed Sadredin
Director of Permit Services

Northern Regional Office • 4230 Kiernan Avenue, Suite 130 • Modesto, CA 95356-9322 • (209) 557-6400 • Fax (209) 557-6475

San Joaquin Valley
Air Pollution Control District

Notice of Revised Permit Format

This may be the first Permit to Operate you have received since the Air Pollution Control District has revised the permit format.

Your Permit to Operate now contains a cover page, permit unit requirements, and a set of facility-wide requirements (if applicable). The permit unit requirements apply only to the specific permit units while the facility-wide requirements apply to every permit unit at your facility.*

Please note that this Permit to Operate supercedes all previous permits for your facility.

If you have any questions, please call our Small Business Assistance Office @ (209) 557-6446.

*Failure to comply with the Permit to Operate may result in enforcement action.

David L. Crow
Executive Director/Air Pollution Control Officer

Northern Region Office
4230 Kiernan Avenue, Suite 130
Modesto, CA 95356-9322
(209) 557-6400 • FAX (209) 557-6475

Central Region Office
1990 East Gettysburg Avenue
Fresno, CA 93726-0244
(559) 230-6000 • FAX (559) 230-6061
www.valleyair.org

Southern Region Office
2700 M Street, Suite 275
Bakersfield, CA 93301-2373
(661) 326-6900 • FAX (661) 326-6985

San Joaquin Valley
Air Pollution Control District

EXPIRATION DATE: 11/30/2006

PERMIT UNIT: N-2893-1-0

EQUIPMENT DESCRIPTION:
GROUNDWATER REMEDIATION PROJECT SERVED BY A PACKED TOWER WITH A WATER FLOW CAPACITY OF 225 GALLONS PER MINUTE AND AN EXHAUST FLOW RATE OF 8100 CUBIC FEET PER MINUTE.

PERMIT UNIT REQUIREMENTS

1. No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]
2. No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]
3. When water is drawn from the extraction wells, the air stripper unit must be in operation. The air stripper must be equipped with an automatic alarm and shut-off system. [District Rule 2201]
4. Records of the emission test results shall be kept. Records shall include the date and time of sample collection, sample concentrations in ppmv, the corresponding VOC emission rate in pounds per day, and the exhaust flow rate in CFM. [District Rule 1070]
5. All records must be retained for a minimum of 2 years, and shall be made available for District inspection upon request. [District Rule 1070]
6. The VOC emissions shall not exceed 1.0 pound in any one day. [District Rule 2201]

These terms and conditions are part of the Facility-wide Permit to Operate.

San Joaquin Valley
Air Pollution Control District

EXPIRATION DATE: 11/30/2006

PERMIT UNIT: N-2893-2-0

EQUIPMENT DESCRIPTION:
LANDFILL GAS COLLECTION SYSTEM WITH A 700 CFM EXTRACTION BLOWER SERVED BY A 22.2 MMBTU/HR VERTICAL GROUND FLARE

PERMIT UNIT REQUIREMENTS

1. The landfill gas collection system shall be operated in accordance with District Rule 4642 (Solid Waste Disposal Sites). [District Rule 4642]
2. The gas collection system shall be designed and operated in such a manner that the surface emissions do not exceed the levels specified in District Rule 4642 (Solid Waste Disposal Sites). [District Rule 4642]
3. Surface emissions testing shall be performed in accordance with District Rule 4642 (Solid Waste Disposal Sites). [District Rule 4642]
4. The NOx emissions shall not exceed 0.06 pounds per MMBtu of heat input. [District Rule 2201]
5. The CO emissions shall not exceed 0.2 pounds per MMBtu of heat input. [District Rule 2201]
6. The VOC emissions shall not exceed 1.6E-03 pounds per MMBtu of heat input. [District Rule 2201]
7. The SOx emissions shall not exceed 1.2E-02 pounds per MMBtu of heat input. [District Rule 2201]
8. The PM10 emissions shall not exceed 0.05 pounds per MMBtu of heat input. [District Rule 2201]
9. The facility shall install and maintain in proper operating condition a gas flow meter with a continuous recording device which measures the amount of landfill gas consumed per day. [District Rule 2201]
10. A daily record of the total heat input to the flare shall be kept on the premises at all times. [District Rule 2201]
11. Records shall be kept in accordance with District Rule 4642 (Solid Waste Disposal Sites). [District Rule 4642]
12. All records shall be retained for a minimum of 5 years, and shall be made available for District inspection upon request. [District Rule 4642]

These terms and conditions are part of the Facility-wide Permit to Operate.

San Joaquin Valley
Air Pollution Control District

PORTABLE EQUIPMENT REGISTRATION

REGISTRATION NO: P-4269-1-0

EXPIRATION DATE: 10/17/2005

LEGAL OWNER OR OPERATOR: BONZI SANITARY LANDFILL, INC
MAILING ADDRESS: 2650 W HATCH ROAD
MODESTO, CA 65358

PRIMARY STORAGE LOCATION: 2650 W HATCH ROAD
MODESTO, CA 65358

EQUIPMENT DESCRIPTION:
NEW 460 HP DURATECH MODEL #512 SERIAL #26011139, DIESEL FIRED IC ENGINE WITH TURBOCHARGER AND INTERCOOLER POWERING A HYDRAULIC DRIVE UNITS, DUST CONTROL UNIT, GRINDING UNIT, AND CONVEYOR BELT

CONDITIONS

1. The sulfur content of the diesel fuel used shall not exceed 0.05% by weight. [District Rule 2280]
2. This engine shall be equipped with a functioning turbocharger and intercooler at all times. [District Rule 2280]
3. Particulate matter emission concentration shall not exceed 0.10 grains per standard dry cubic foot. [District Rule 4201]
4. NOx emissions from this engine shall not exceed 7.2 grams per brake horsepower-hour (500 ppmv @ 15% O2). [District Rule 2280]
5. NOx emissions from new units shall not exceed 100 pounds per day for each project as defined in Section 3.11 of Rule 2280. [District Rule 2280]
6. VOC emissions from new units shall not exceed 100 pounds per day for each project as defined in Section 3.11 of Rule 2280. [District Rule 2280]
7. The unit shall not operate more than 14.3 hours/day or fuel combusted by this engine shall not exceed 348.5 gallon/day. [District Rule 2280]
8. In each participating District as defined in Rule 2280 Section 8.5, this unit shall not operate more than 2857 hours per year. Alternatively, annual fuel consumption shall not exceed 69,686 gallons/year. [District Rule 2280]
9. No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]
10. No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than 3 minutes in any one hour which is as dark or darker than Ringelmann 1 or equivalent to 20% opacity. [District Rule 4101]

CONDITIONS CONTINUE ON NEXT PAGE

This Registration remains valid through the Registration expiration date listed above, subject to payment of the annual registration fees and compliance with the registration conditions and all applicable local, state, and federal regulations. This Registration is valid only within the San Joaquin Valley Unified Air Pollution Control District and the Participating Districts as defined in District Rule 2280, and becomes void upon transfer of ownership of the equipment. Any modification of the equipment or operation will require a new Registration.

David L. Crow
Executive Director / APCO

David Warner
Director of Permit Services

11. Testing to verify compliance with applicable requirements shall be conducted at the expense of the registered owner or operator, at the request of the District, and in accordance with the methodology prescribed by the District. [District Rule 2280]

12. PM10 emissions shall not exceed 150 pounds per day for each project as defined in Section 3.11 of Rule 2280. [District Rule 2280]

13. Except for emergency operations, this unit shall not be operated within 1,000 feet of any K-12 school, unless the public and student notification requirements of the CH&SC Section 42301.6 have been satisfied. [District Rule 4102]

14. If this unit remains in a Participating District for more than 24 hours, the operator shall notify that District within 2 calendar days of the nature and estimated duration of operations, and the name and phone number of a contact person. [District Rule 2280]

15. The actual emissions from this unit, as verified by the record keeping requirements of District Rule 2280, shall not exceed 10 tons per year of any affected pollutant when operated in any Participating District. [District Rule 2280]

16. Daily records of location and date of operation and the type and quantity of fuels consumed shall be maintained by the operator/owner. Daily hours of operation in conjunction with hourly HP or Btu rating may be maintained in lieu of fuel records. [District Rule 2280]

17. This registered equipment shall not remain at any location for longer than six consecutive months, and shall comply with all other residence time restrictions specified in section 3.10.1, 3.10.2, and 3.10.3 of District rule 2280. [Rule 2280, 3.10]

18. This registered equipment shall not be used to replace or supplement any ongoing function of, or utility used at, any facility. [Rule 2280, 3.10.1]

APPENDIX B

SITE LIFE CALCULATIONS

Bonzi Sanitation Landfill - Site Life

The final receipt of waste for WMU IV was in 2009. An intermediate cover was placed in the Fall of 2012 and it is anticipated that the final cover and ancillary final closure components will happen in the Spring/Summer of 2015.

APPENDIX C

FINAL CLOSURE WORKPLAN CONSTRUCTION, QUALITY ASSURANCE PLAN, AND SPECIFICATIONS

FINAL CLOSURE WORKPLAN

FINAL CLOSURE WORKPLAN
BONZI SANITATION LANDFILL

STANISLAUS COUNTY, CALIFORNIA

OCTOBER 2014

PROJECT NO. 2012.0023

PREPARED FOR:

Ma-Ru Holding Company
2650 West Hatch Road
Modesto, California 95670

SUBMITTED TO:

Central Valley Regional Water Quality Control Board
11020 Sun Center Drive #200
Rancho Cordova, California 95670

California Department of Resources Recycling and Recovery (CalRecycle)
1001 I Street
Sacramento, California 95812-4025

PREPARED BY:

Geo-Logic Associates
143E Spring Hill Drive
Grass Valley, California 95945
(530) 272-2448

Geo-Logic ASSOCIATES

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3.0 REFERENCES 6

Geo-Logic Associates (GLA) is pleased to provide this final closure workplan for the Bonzi Sanitation Landfill (BSL) located in Stanislaus County, California. The intent of this workplan and final closure design is to correspond to the approved Final Closure Plan and Post-Closure Monitoring and Maintenance Plan, Waste Management Units II-IV, Bonzi Sanitation Landfill (FCPCMP) prepared by Geomatrix in July 2006 and amended by GLA in October 2014.

1.0 BACKGROUND AND PURPOSE

The BSL is a Class III waste disposal facility located in central Stanislaus County, California and is situated approximately two miles southwest of the city of Modesto in the Central Valley. The BSL is situated just south of the Tuolumne River, with Vivian Road to the west, Whitmore Road to the south and Carpenter Road to the east. Low topographic relief characterizes the landfill and surrounding area. Four Waste Management Units (WMUs) comprise approximately 115 permitted acres of the 135 acre site (Drawing G01). The Landfill began operations in the 1960s at WMU I. The 35-acre WMU I was closed pursuant to California Code of Regulations Title 27 (CCR27) in 1999. The closure included a 2-foot foundation layer, a 30-mil PVC flexible membrane liner (FML), and an 18-inch vegetative layer. WMU II and III accepted waste between 1978 and 1992 and an intermediate cover was placed, though some exposed waste has been observed during subsequent site inspections. The remaining WMU IV was most recently active receiving primarily inert materials until 2009.

In fall 2012, Sukut Construction (Sukut), under contract with CalRecycle, made the first steps to closure by relocating inert material and placing intermediate cover. Inert material that was placed outside of the permitted waste boundary (north of WMU IV) was relocated to low spots within WMU's II, III, and IV. The existing surface of WMUs II, III, and IV along with the relocated inert material was covered with 2 feet of intermediate cover to limit surface water infiltration. During placement of the intermediate cover, extensions and connections of the existing landfill gas collection well headers and system were made as necessary.

The facility overlies shallow (10 to 20 feet deep) groundwater with designated municipal and domestic supply beneficial uses that are being used by adjacent water users from domestic and irrigation and municipal wells down-gradient of the facility. Based on the recognized release to groundwater, primarily volatile organic compounds (VOCs), the site is currently in Corrective Action. A landfill gas (LFG) extraction system and a groundwater pump and treat system (three extraction wells, an air stripper, and lined groundwater retention basin) have been constructed to attempt to address the release. The treated water in the retention basin is discharged for land application to 20-acres of poplar trees on the southwest corner of the site.

This workplan has been prepared to provide a summary the final closure design components to complete the final cover and other improvements at the site. Based on input from the California Department of Resources Recycling and Recovery (CalRecycle) and the Central Valley Regional Water Quality Control Board (RWQCB), the geometry of the final cover and perimeter berm were altered in an attempt to reduce the soils required for fill and to divert all stormwater to the northern retention pond.

2.0 FINAL CLOSURE PLAN

The final closure improvements that were examined as part of this workplan consist of the following main elements:

- Access road and perimeter channel;
- Final cover;
- Flood control berm;
- Borrow area ;
- Erosion control;
- Landfill gas system; and
- Structure removal.

Sukut provided as-built topographic surveys of the inert material/storm water retention basin area and intermediate cover grades. These areas have been combined with the existing June 7, 2012 topographic map prepared by Cooper Aerial Surveys, Co. to provide a base map for the grading plan. Please note that the topographic surveys provided by Sukut were incomplete at the boundaries and do not necessarily tie-in with the existing topographic contours.

2.1 ACCESS ROAD AND PERIMETER CHANNEL

To provide for vehicle access and positive drainage around the site, an access road and perimeter channel shall be constructed as shown on Drawing C01. The access road is designed to be 12-feet wide with a Class 2 aggregate base surface to allow for all weather access. Since the site is relatively flat, the perimeter drainage channels are constructed on a berm of engineered fill (with adjacent access road) to provide positive flow. Soil to construct the access road and perimeter channel berm can be obtained from the borrow area to the south of the site as shown on Drawing C03.

All stormwater is diverted to the northern stormwater retention basin. Perimeter channels are designed as trapezoidal channels that have 2 to 1 (horizontal to vertical) side slopes, are 1.5 feet in depth, and vary in bottom width from 1 foot to 3 feet. Channels with flow line slopes less than 4% are to be grass-lined with the erosion control seed mixture and rock-lined where flow line slopes are greater than 4%. Culvert crossings, sizes, and inverts are also shown on Drawing C01.

2.2 FINAL COVER

The final cover system at the BSL is as follows from bottom to top:

- A 2-foot thick minimum compacted intermediate cover layer (most was placed during fall 2012 construction);
- A variable thickness foundation layer to provide minimum slopes necessary for drainage of subsequent layers;
- A low permeability layer consisting of a 60-mil linear low density polyethylene (LLDPE) geomembrane;
- A double-sided geocomposite drainage layer when slopes are greater than 10% (northern slope); and
- A 1.5-foot thick vegetative/protective cover layer compacted to firm consistency and that is capable of supporting a hydroseed mixture of native grasses.

The maximum (steepest) side slope grades are 4 to 1 (horizontal to vertical) and the minimum (flattest) top deck slope grade is 2% (see Drawing C02). Soils to construct the vegetative/protective cover layer can be obtained from the borrow area to the south of the site as shown on Drawing C03.

2.3 FLOOD CONTROL BERM

According to the Flood Insurance Rate Map (FIRM) for Stanislaus County (Map Number 06099C0535E), portions of the site are within Zones AE and X. To protect the northern (lower elevation) portions of the site, a flood control berm shall be constructed to an elevation of 65-feet with a 15-foot top deck as shown on Drawing C04. The berm shall be constructed of engineered fill compacted as detailed in the specifications. Soils for berm construction are to be obtained from the borrow area to the south of the site as shown on Drawing C03. Class 2 aggregate base shall be placed along the top surface to provide all-weather access.

2.4 BORROW AREA

The borrow area is located to the south of the landfill on the adjacent Whitmore property.

Based on the borrow area grading plan shown on Drawing C03, the total amount of soils available is approximately 537,000 cubic yards. It is estimated that approximately 118,200 cubic yards of material have been removed during construction of the intermediate cover. Therefore, approximately 418,800 cy of soil remains for use in construction of the access road and perimeter channel, the vegetative cover layer, and the flood control berm.

2.5 EROSION CONTROL

Pursuant to the FCPCMP, the final surface of all bare soils (final cover and engineered fill) shall be vegetated with the following hydroseed mix and soil amendments. The top 2 to 4 inches of the surface shall be roughened by scarifying, disking, harrowing, or track walking prior to broadcast of amendments and hydroseed mix.

Seed Mix:

- Poa Scabrella (Pine Bluegrass) ½ lb/acre
- Festuca Idhoensis (Idaho Fescue) 2 lbs/acre
- Blando Brome (Soft Chess) 6 lbs/acre
- Festuca Megalura (Annual Fescue) 3 lbs/acre
- Poa Pretnesis (Kentucky Bluegrass) 2 lbs/acre

Soil Amendments:

- Gypsum 1 ton/acre
- Sulfur 1 ton/acre
- Compost 60 ton/acre
- Fiber Mulch 1,500 lbs/acre

2.6 LANDFILL GAS SYSTEM

As part of final cover construction, portions of the landfill gas system will need to be temporarily taken offline to allow for placement of the final cover components. Well heads may need to be extended to account for the additional vegetative cover thickness and pipe boots will need to be installed at all pipe penetrations through the 60-mil LLDPE liner. Laterals and headers will also need to be removed and reconnected, as necessary during grading operations. Drawing G03 shows the approximate locations of the landfill gas system components with details shown on Drawing C13.

Prior to final closure operations, a field assessment of all landfill gas extraction wells will be made for function and effectiveness. The results of the assessment will be used to generate a final list of landfill gas recommendations to be implemented during final closure and post-closure. At this point, it is assumed that up to 10 landfill gas extraction wells may need to be added to the interior sections of the landfill WMU II, III, and IV. In addition, repairs to the header lines to limit blockage, and installation of some additional condensate sumps may be needed as appropriate. As improvements to the landfill gas system are speculative at this point, no costs for these items have been included in the closure and post-closure estimates. However, specifications for extraction well construction have been included.

Many of the existing LFG monitoring probes are single completion and do not meet 27 CCR §21790(c)(1)(F) requirements, therefore two new LFG probes (8WR and 51N) will be constructed prior to closure activities bringing the total to 41 at the site. The locations of these probes are shown on Drawing G03. In addition, a continuous explosive gas monitoring detection system will be installed prior to closure activities in all enclosed structures (residence, lunchroom/storage building, administrative building, and scalehouse).

2.7 STRUCTURE REMOVAL

As shown on Drawing G02, the following structures are to remain on site:

- Administration office;
- Scale house (optional);
- Scale (optional);
- 10,000 gallon above ground water tank (optional);
- Lunchroom/Storage building;
- Equipment maintenance shop;
- Single family residence;
- Residence carport;
- Groundwater treatment system complex;
- Landfill gas flare station (an optional item is to relocated the flare to the south side);
- Water supply well; and
- Tipping and processing concrete pad.

The only structure to be dismantled, removed, and disposed of is the vehicle canopy. It is assumed that the debris can be disposed of in the landfill prior to placement of the foundation layer in an area which will ensure that a minimum of 2 feet of cover can be placed under the geomembrane liner.

3.0 REFERENCES

Geomatrix Consultants, Inc., 2006, Final Closure and Post Closure Monitoring and Maintenance Plan, Waste Management Units II-IV, Bonzi Sanitation Landfill, Stanislaus County, California.

CONSTRUCTION QUALITY ASSURANCE PLAN

CONSTRUCTION QUALITY ASSURANCE PLAN
FINAL CLOSURE CONSTRUCTION
BONZI SANITATION LANDFILL

STANISLAUS COUNTY, CALIFORNIA

FEBRUARY 2015

PROJECT NO. 2012.0023

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1.0 CONSTRUCTION QUALITY ASSURANCE

1.1 INTRODUCTION AND SCOPE

This plan describes the tasks involved with the construction quality assurance (CQA) for final closure construction at the Bonzi Sanitation Landfill (BSL) located in Stanislaus County, California. This CQA Plan also provides descriptions of portions of the quality control testing program that are to be performed by the Contractor. CQA refers to the duties of a third party CQA Consultant to monitor, inspect, and evaluate materials and workmanship during construction.

The CQA activities document the compliance of the Contractor with the Drawings and Specifications for the construction. For the purposes of this CQA Plan, the term Contractor refers to the company or individual that is responsible for performing the specific work item being examined to complete the excavation and cover construction at the site. This includes but is not limited to the earthwork contractor(s), geosynthetic installer(s), or their subcontractor(s).

The overall goal of this CQA Plan is to assure that proper construction techniques and procedures are used and that the project is built in accordance with the project Construction Drawings and Specifications. The intent is to identify and define problems that may occur during construction and to verify that these problems are corrected before construction is complete. A written final report prepared by the CQA Consultant will be prepared summarizing the construction activities and verifying that the installation was performed in general accordance with the project Construction Drawings and Specifications. Where discrepancies between this document and the Specifications exist, the more stringent requirement shall govern the Contractor.

1.2 DUTIES OF CQA PERSONNEL

It is the duty and responsibility of the CQA Consultant to implement the elements of this CQA Plan in order to ensure that the construction and installation of the cover system at the site is performed in accordance with the Construction Drawings and Specifications and State and Federal Regulations. The CQA personnel shall make every effort to communicate in an efficient and effective manner to the Contractor's representatives on issues concerning testing and observation procedures and results of materials or *in situ* tests performed.

The CQA Consultant is not in a position to direct construction activities, but is encouraged to give advice to the Contractor, its employees, or the Owner on items which may improve the quality or speed progress of the construction. The CQA Consultant and its representatives shall make every effort to furnish test results to the Contractor in a prompt manner. The representatives of the CQA Consultant shall report to the Owner any nonconformance items, which cannot be resolved promptly.

1.3 PERSONNEL QUALIFICATIONS

1.3.1 CQA Officer

The CQA Officer will have formal academic training in civil engineering or a closely related discipline and will be a Registered Civil Engineer or Certified Engineering Geologist registered in the State of California. The CQA Officer will have experience in earthwork construction, landfill design and construction, and geomembrane and solution collection systems installations. The CQA Officer will have practical technical and managerial experience that will allow the CQA Plan to be properly implemented. The CQA Officer must be able to communicate effectively with the Owner and the Contractor so that there will be a clear understanding of construction activities and the CQA Plan.

1.3.2 CQA Monitors

The CQA monitors will work directly for the CQA officer. Each CQA Monitor will have formal training and practical experience in inspecting and testing earthwork construction, geomembrane installations, and solution collection system installations, including conducting and recording inspection activities, preparing daily reports, and performing field testing. In addition, knowledge shall be required of the specific field practices and construction techniques for landfill cover construction and geomembrane installation and all ASTM or other testing standards involving material handling, observation of testing procedures, equipment and reporting procedures.

2.0 MEETINGS

2.1 GENERAL

Throughout the entire construction and installation of the cover system, close communication between all parties involved with the project is essential. In order to coordinate activities between the Owner, California Department of Resources Recycling and Recovery (CalRecycle), CQA Consultant, and Contractor, as well as set up proper lines of authority and reporting, meetings shall be held before and during construction. The type and purpose of meetings to be held for this project are described in this section.

2.2 PRECONSTRUCTION MEETING

A preconstruction meeting shall be held prior to project start-up. The parties that shall attend this meeting are the Owner, ~~CalRecycle,~~ Contractor, and CQA Consultant. In addition, CalRecycle and the RWQCB shall be notified of the meeting and may attend. The purpose of this meeting is to:

1. Review the project Construction Drawings and Specifications
2. Review project tasks and responsibilities
3. Review the project schedule
4. Define lines of communication and authority
5. Establish reporting and documenting procedures
6. Review testing equipment and test methods
7. Establish protocol for submittal of CQA conformance testing data sheets; and
8. Conduct a site inspection to review work areas, lay-down areas, stockpile areas, access roads, and related project issues.

The preconstruction meeting shall be documented by the CQA Consultant and copies shall be provided to all persons present at the meeting including CalRecycle and RWQCB.

2.3 WEEKLY PROGRESS MEETINGS

Progress meetings shall be held periodically throughout construction such as at the beginning or end of each week to review the previous activities or progress, discuss present and future work, and discuss any current or potential construction problems. The progress meetings shall be attended by the Owner, ~~CalRecycle (if necessary), the RWQCB (if necessary),~~ the CQA Officer (if necessary), the CQA Monitor, the Contractor, and subcontractors as necessary. In addition, CalRecycle and the RWQCB shall be notified of the meeting and may attend. The purpose of these meetings shall be to:

1. Review the proposed activities scheduled by the Contractor for the day;
2. Discuss any CQA issues, problems or deficiencies that have arisen during construction;
3. Review the results of any test data from the CQA firm or other testing laboratory;
4. Discuss the Contractor's deployment of personnel and equipment;
5. Review the previous activities including the effectiveness of procedures taken to alleviate any deficiencies.

All progress meetings shall be documented by the Owner’s representative or the CQA Monitor who will transmit minutes to all parties including CalRecycle and the RWQCB. Weekly progress/work summary reports shall be submitted by the first Wednesday following the week documented.

2.4 WORK DEFICIENCY MEETINGS

As needed, meetings shall be held to discuss specific problems or deficiencies that occur during construction that cannot be easily resolved. Work deficiency meetings shall be attended by the CQA Monitor, CQA Officer, the Owner, and the Contractor. In addition, CalRecycle and the RWQCB shall be notified of the meeting and may attend. The purposes of these meetings are to:

1. Identify the nature and extent of the problem;
2. Discuss the means necessary to correct the deficiency or problem; and
3. Provide a solution to the problem and determine how the corrective action shall be implemented.

This meeting shall be documented by the Owner's representative or CQA Monitor on a construction problem and solution data sheet or other suitable form and copies distributed to all parties including CalRecycle and the RWQCB.

3.0 EARTHWORK

3.1 GENERAL

This section outlines the requirements for earthwork operations for the construction of the final closure components at the site. The Contractor shall perform all earthworks as necessary to achieve the grades set forth within the Construction Drawings and Specifications. He shall also purchase (if necessary) and place various aggregate, piping, and miscellaneous materials within the cover system for the project. Earthwork includes, but is not limited to:

1. Excavation from borrow area;
2. Preparing the existing intermediate cover soils;
3. Placement of engineered fill materials;
4. Placement of foundation layer;
5. Preparing the geomembrane subgrade (top of foundation layer);
6. Excavation and backfill of the toe drain trenches and outlets; and
7. Placement of vegetative/protective cover layer.

Specifically excluded from this section are the geomembrane, geocomposite drainage layer, and geotextile installation which are addressed within Sections 4, 5, and 6 of this CQA Plan.

3.2 EXCAVATION AND STOCKPILING

The CQA Monitor shall observe the excavation of the borrow area to ensure that the underlying geologic formations are similar to those anticipated and are suitable for construction of the engineered fill, foundation layer, and final cover layer. The CQA Monitor shall observe slope stability at various stages of excavation, conduct any necessary field measurements to evaluate the slopes for compliance with the project Specifications, and to provide guidance to the Contractor for separation and direction of stockpiling of excavated native materials for use in construction of the engineered fill, foundation layer, and protective soil cover layer.

3.3 PREPARATION OF EXISTING INTERMEDIATE SOIL COVER FOR ENGINEERED FILL AND FOUNDATION LAYER SOIL

Prior to placement of engineered fill or foundation layer soil, the existing intermediate soils shall be inspected by the CQA Monitor and Contractor to ensure that it will provide a firm base for construction of engineered fill and the final cover system. The CQA Monitor shall verify that the Contractor has provided a firm, relatively smooth surface for the engineered fill and foundation layer and that all vegetation has been removed during the clearing and grubbing operations.

Unless otherwise specified by the CQA Officer, the CQA Monitor shall verify conformance by following a method specification for preparation of the existing soils prior to cover placement. The method specification shall consist of observation by proof-rolling the intermediate cover layer with a padfoot compactor or other approved heavy equipment. Any areas observed to be excessively soft should be excavated and reworked or removed and suitable materials placed in accordance with the project density requirements. The CQA Monitor shall perform laboratory tests (compaction curves) and in-place density tests for only the replacement fill materials for the foundation layer to verify compliance with the project Specifications. No other testing is required for the existing materials that are accepted after proof-rolling. Tests in the replacement fill shall be performed at the frequencies described for engineered fill.

The CQA Monitor shall verify that the foundation layer surface is surveyed by the Contractor prior to placement of the final cover layer. At the discretion of the Owner, third party surveying may be performed to verify the Contractor's results.

3.4 ENGINEERED FILL

The CQA Monitor shall verify that the placement of engineered fill for final cover construction is performed by the Contractor with suitable materials to the grades and dimensions required by the Construction Drawings and Specifications. This work also includes the construction of the engineered fill berms and other engineered fills within the construction area. Prior to fill placement, the CQA Monitor shall verify that all preparation activities have been performed by the Contractor and tested in accordance with the appropriate sections of the project Specifications this CQA Plan, including, but not limited to: 1) clearing, grubbing, and stripping; 2) pre-construction borrow source testing; and 3) subgrade preparation.

The pre-construction testing for the engineered fill material shall include a visual examination of the borrow source and sieve analyses performed on <u>each material type observed or one per 10,000 cubic yards</u> whichever results in the greater number of tests.

The CQA Monitor shall observe fill placement and perform the necessary field and laboratory testing to ensure that materials are compacted at the specified moisture content and to the minimum density specified. Tests to be performed and their frequency are provided in Table 1. All other soils or rock materials shall be constructed in accordance with the requirements set forth within the project Specifications or this CQA program.

TABLE 1
ENGINEERED FILL CONSTRUCTION TESTING REQUIREMENTS

TEST	METHOD	MINIMUM FREQUENCY OF TESTING
Sieve Analysis	ASTM D 422	1 per material type or 1 per 10,000 cy (whichever results in the greater number of tests)
Modified Proctor	ASTM D 1557	1 per material type or 1 per 10,000 cy (whichever results in the greater number of tests)
Dry Density & Water Content by Nuclear Method	ASTM D 6938	1 test per 1000 cy
Dry Density (Sand Cone Method or Drive Tube Method)	ASTM D 1556/D 2937	1 test per 20 nuclear tests
Moisture Content by Oven or Microwave	ASTM D 3017 or D 4643	1 test per 10 nuclear tests

3.5 PLACEMENT OF FOUNDATION LAYER

3.5.1 General

A foundation layer shall be constructed as part of the cover system. The CQA firm will ensure that special care is taken by an increased frequency of testing (as needed) and close observation during the foundation layer installation.

3.5.2 Foundation Layer Materials and Placement

The CQA Monitor shall verify that the foundation layer is constructed using soils from the approved borrow area(s) and that the procedure used to process the foundation layer soil prior to placement provides uniform moisture conditioning and breakdown of clods in accordance with the project Specifications. During final cover layer placement the CQA Monitor shall:

1. Observe that the construction activities are not adversely impacting other structures at the site;
2. Monitor lift thickness;
3. Observe the effect of compaction equipment on the intermediate cover layer (pad penetration, pumping, cracking, etc.);
4. Observe placement for material segregation, size of clods, particle size and uniformity of the moisture content;
5. Observe the foundation layer for desiccation cracking; and
6. Observe that repairs, if necessary, are made in accordance with the procedure presented in the Specifications.

In addition to observing material placement, the CQA Monitor shall conduct field and laboratory testing in accordance with the schedule presented in Table 2. Field moisture and density shall be controlled in accordance with the range as provided in the Specifications.

Where field density or moisture contents fail to meet specified values, the CQA Monitor shall verify that the area is reworked or the material removed and replaced (at the Contractor's discretion) under the observation of the CQA Monitor. Retests shall be performed to verify that in-place moisture-density results are within the specified range. The testing frequencies provided in Table 2 can be increased at the discretion of the CQA Monitor. Examples of conditions that may warrant additional tests include but are not limited to:

1. Compactors slip during operation;
2. Excessive pumping or cracking of the fill;
3. Lift thickness is greater than specified;

4. Dirt clogged rollers are used to compact the fill;
5. The compactor is improperly ballasted;
6. Adverse weather;
7. Equipment breakdown;
8. Work conducted in difficult areas; and
9. There is a high frequency of failed tests.

TABLE 2
FOUNDATION LAYER CONSTRUCTION TESTING

TEST	METHOD	FREQUENCY OF TESTING
Sieve Analysis	ASTM D-422	1 per material type or 1 per 5,000 cubic yards (whichever results in the greater number of tests)
Modified Proctor Compaction Curve	ASTM D-1557	1 per material type or 1 per 5,000 cubic yards (whichever results in the greater number of tests)
Dry Density & Moisture Content by Nuclear Method	ASTM D-6938	1 test per 500 cubic yards of fill placed
Dry Density By Sand Cone Method	ASTM D-1556	1 test per 20 nuclear density tests performed adjacent to nuclear density test for correlation
Moisture Content by Oven or Microwave	ASTM D-3017 or D-4643	1 test per 10 nuclear density tests

All perforations of the foundation layer shall be repaired by the CQA Monitor including nuclear density device probe holes, drive tube sample locations, sand-cone holes and grab sample locations. Perforations shall be repaired by backfilling the holes with the approved soil materials.

The CQA Monitor shall verify the surface of the foundation layer is graded as indicated by the project Construction Drawings. The CQA Monitor shall verify that the Contractor has provided for adequate survey control prior to placement and upon completion of the foundation layer. The CQA Monitor shall verify that the proper thickness of soil has been placed as shown at each grid-point. The Contractor's surveying may be checked by a third party surveying team hired by the Owner or CQA firm.

3.6 GEOMEMBRANE SUBGRADE (TOP OF FOUNDATION LAYER)

The subgrade for the finished surface of the foundation layer below the geomembrane shall be inspected by the CQA Monitor and Contractor to ensure that it will provide a firm base for construction of the overlying cover system. The CQA Officer and CQA Monitor will inspect the subgrade for the following:

1. Verify that angular or sharp rocks, rocks larger than the specified diameter, and other debris that could damage the overlying geosynthetic materials are removed from the surface.
2. Verify that the foundation layer is steel drum rolled smooth and is free of irregularities (ridges, protrusions, gouges, etc.), prior to the placement of any geosynthetic material.
3. Verify that the final surface provides continuous and intimate contact with the overlying geomembrane.
4. Verify that any soft or yielding areas of the subgrade (foundation layer) are adequately excavated and replaced with soils in accordance with the Specifications for foundation layer soil materials.
5. Verify that the prepared subgrade (foundation layer) has not desiccated or otherwise deteriorated prior to geomembrane installation.

3.7 FINAL COVER DRAINAGE SYSTEM

3.7.1 General

This section sets forth the requirements for the CQA testing and observation requirements for installing the final cover drainage system components above the geomembrane and below the final vegetative cover soil detailed on the Construction Drawings and Specifications. This work includes the materials for the drainage pipe and drainage gravel. The geotextile and geocomposite for the drainage system are discussed separately in Sections 5 and 6 of this CQA Plan.

The Contractor shall furnish submittals in compliance with this plan and conditions of warranty prior to construction for review by the CQA Officer and CQA Monitor. He shall also prepare and submit a time schedule for installation, including complete testing and acceptance of materials prior to construction.

The Contractor shall provide a copy of the certificate of compliance and the QC certificates for production of each of the materials to be installed as part of the final cover drainage system testing for review by the CQA Monitor and CQA Officer. The CQA Monitor shall verify that the Contractor installs the final cover drainage system materials and equipment in accordance with the Construction Drawings and Specifications. The CQA Monitor shall document the receipt and installation of the drainage pipe and drainage gravel as described in the following sections of this CQA Plan.

3.7.2 Drainage Piping

The Contractor shall provide a copy of the QC certificates and certificate of compliance for production of the drainage piping manufactured for this project prior to construction for review by the CQA Monitor and CQA Officer. Materials shall be delivered to the site only after the CQA Monitor receives and approves the required submittals.

The CQA Monitor shall ensure that the materials were packaged and shipped by appropriate means so that no damage was caused to the materials delivered to the site. Off-loading shall be done in the presence of the CQA Monitor and any damage during off-loading shall be documented by the CQA Monitor and the Contractor. The CQA Monitor shall keep a log of all piping delivered to the site on a log of piping received form.

Damaged materials shall be separated from undamaged materials until proper disposition of material is determined by the CQA Monitor. Final authority on the determination of damage shall be the CQA Monitor. The Earthwork Contractor shall replace damaged or unacceptable material at no cost to the Owner.

The drainage piping shall be stored on a prepared surface approved by the CQA Monitor and shall be protected from puncture, precipitation, dirt, grease, water, mechanical abrasions, ultraviolet light exposure or other damage. The CQA Monitor shall observe that the Contractor uses appropriate handling equipment to load, move or deploy the material to ensure that no damage is caused to the materials during handling of the piping.

No drainage piping shall be placed until the synthetic geomembrane and geocomposite have been installed and approved by the CQA Monitor. When gravel/rock materials are used for the drainage system, the CQA Monitor shall continuously observe placement to ensure that no materials are placed in a manner that could damage the underlying geomembrane. All observed damage shall be recorded by the CQA Monitor and the location clearly marked for scheduled repair.

3.7.3 Drainage Gravel

The Contractor shall provide samples of the drainage gravel material to the CQA Monitor for conformance testing. Samples of the drainage gravel shall be tested in accordance with Table 3, shown below.

TABLE 3

DRAINAGE GRAVEL TESTING

TEST	METHOD	FREQUENCY OF TESTING
Sieve Analysis	ASTM D-422	1 per material type or 1 per 5,000 cubic yards (whichever results in the greater number of tests)
Permeability	ASTM D-2434	1 per material type or 1 per 5,000 cubic yards (whichever results in the greater number of tests)

No drainage gravel material shall be placed until the geomembrane, geocomposite, and drainage pipes have been installed and approved by the CQA Monitor. The CQA Monitor shall continuously observe placement so that no materials are placed over wrinkles in the underlying geomembrane and to ensure that the drainage piping is not damaged. The Contractor shall schedule placement of the drainage gravel material during cooler parts of the day in the event of warm weather in order to avoid placement of drainage materials when the geomembrane is wrinkled. All observed damage shall be recorded by the CQA Monitor and the location clearly marked for scheduled repair.

3.8 VEGETATIVE/PROTECTIVE COVER LAYER

3.8.1 General

A vegetative/protective cover layer shall be constructed as part of the final cover system for the site. Special care will be taken by the Contractor in order to obtain high quality vegetative/protective cover layer material. The CQA firm will ensure that special care is taken by an increased frequency of testing (as needed) and close observation during the vegetative/protective cover layer installation.

3.8.2 Vegetative/Protective Cover Layer Construction

The CQA Monitor shall verify that the vegetative/protective cover layer is constructed using soils from the approved borrow area(s) and that the procedure used to process the final cover layer soil prior to placement provides uniform moisture conditioning and breakdown of clods in accordance with the project Specifications. During final cover layer placement the CQA Monitor shall:

1. Observe that the construction activities are not adversely impacting other structures at the site;
2. Monitor lift thickness;
3. Observe placement for material segregation, size of clods, and particle size; and
4. Observe that repairs, if necessary, are made in accordance with the procedure presented

in the Specifications.

In addition to observing material placement, the CQA Monitor shall conduct field and laboratory testing in accordance with the schedule presented in Table 4. Field moisture and density shall be controlled in accordance with the range as provided in the Specifications.

Where field density or moisture contents fail to meet specified values, the CQA Monitor shall verify that the area is reworked or the material removed and replaced (at the Contractor's discretion) under the observation of the CQA Monitor. Retests shall be performed to verify that in-place moisture-density results are within the specified range. The testing frequencies provided in Table 3 can be increased at the discretion of the CQA Monitor. Examples of conditions that may warrant additional tests include but are not limited to:

Compactors slip during operation;

1. Excessive pumping or cracking of the fill;
2. Lift thickness is greater than specified;
3. Dirt clogged rollers are used to compact the fill;
4. The compactor is improperly ballasted;
5. Adverse weather;
6. Equipment breakdown;
7. Work conducted in difficult areas; and
8. There is a high frequency of failed tests.

TABLE 4
VEGETATIVE/PROTECTIVE COVER CONSTRUCTION TESTING

TEST	METHOD	FREQUENCY OF TESTING
Sieve Analysis	ASTM D-422	1 per material type or 1 per 5,000 cubic yards (whichever results in the greater number of tests)

All perforations of the final cover layer shall be repaired by the CQA Monitor including nuclear density device probe holes, drive tube sample locations, sand-cone holes and grab sample locations. Perforations shall be repaired by backfilling the holes with the approved soil materials.

The CQA Monitor shall verify the surface of the final cover layer is graded as indicated by the project Construction Drawings. The CQA Monitor shall verify that the Contractor has provided for adequate survey control prior to placement and upon completion of the final cover layer.

The CQA Monitor shall verify that the proper thickness of soil cover has been placed as shown at each grid-point. The Contractor's surveying may be checked by a third party surveying team hired by the Owner or CQA firm.

4.0 GEOMEMBRANE QUALITY ASSURANCE

4.1 GENERAL

This section sets forth the requirements for the CQA testing and observation requirements for installing the geomembrane material detailed on the Construction Drawings and Specifications. This work includes the examination of the Manufacturer's and Contractor's QC testing, conformance testing, shipping and handling, deployment, seaming, repairs, and non-destructive and destructive testing of the geomembrane. The CQA Monitor and the CQA Officer shall review the submittals furnished by the Contractor to ensure their compliance with this program and conditions of warranty prior to construction. They shall also review the time schedule for installation submitted by the Contractor prior to construction.

4.2 SHIPPING AND HANDLING

The Contractor shall provide a copy of the QC certificates for production of each geomembrane roll manufactured for this project prior to construction for review by the CQA Monitor and CQA Officer. Materials shall be delivered to the site only after the CQA Monitor receives and approves the required submittals.

The Contractor is responsible for the transportation, off-loading, and storage of the geomembrane. The materials shall be packaged and shipped by appropriate means so that no damage is caused and shall be delivered to the site only after the CQA Monitor receives and approves the required submittals. Off-loading shall be performed in the presence of the CQA Monitor to ensure that any damage during off-loading is properly documented. The CQA Monitor shall keep a log of all geomembrane delivered to the site on the appropriate form for review by the CQA Officer.

The CQA Monitor shall verify that damaged materials are separated from undamaged materials until proper disposition of the material is determined by the Owner or CQA Officer. Final authority on the determination of damage shall be the CQA Monitor.

4.3 GEOMEMBRANE CONFORMANCE TESTING

After production, the geomembrane shall be sampled for conformance testing by a third party geosynthetics laboratory. Sampling shall be performed at the manufacturing plant by the third party geosynthetics laboratory or upon arrival at the site. One geomembrane sample shall be obtained for every 100,000 square feet produced. The CQA Monitor shall identify the roll numbers of the geomembrane which are tested for conformance on the log of geomembrane received form. The samples shall be delivered to the geosynthetics laboratory to determine that the geomembrane properties conform to the requirements given in the Specifications. The CQA Officer shall review all test results and report any non-conformance test results to the Contractor and the CQA Monitor.

Conformance samples shall be collected across the entire width of the roll, but shall not include the first three feet of the roll. The conformance samples shall be three feet wide by the roll width in length. Each sample shall be marked with the Manufacturer's name and product identification, lot number, roll number, and type (LLDPE, 60-mil, double-textured, single-textured, etc.). In event that sampling is necessary at the site, the Contractor shall provide the personnel and equipment to obtain the sample in the presence of the CQA Monitor. No material shall be deployed until passing conformance values are obtained by the CQA Monitor.

The conformance testing shall include the following parameters:

1. Thickness (ASTM D-5994/GRI GM9);
2. Sheet Density (ASTM D-1505);
3. Tensile Properties (ASTM D-6693);
4. Carbon Black (ASTM D-1603);
5. Carbon Dispersion (ASTM D-5596);
6. Asperity Height (ASTM D-7466);
7. Puncture Resistance (ASTM 4833); and
8. Large Scale Direct Shear (ASTM 5321) one per project against geocomposite.

4.4 LLDPE GEOMEMBRANE PLACEMENT

Prior to placing the primary geomembrane panels, the Contractor and CQA Monitor shall observe and verify that the subgrade (foundation layer) has been properly placed and accepted. Once the subgrade (foundation layer) has been approved, deployment of the geomembrane may begin.

The CQA Monitor shall verify that the Contractor's QC Technician has given each panel an identification number that shall be used by all parties. The CQA Monitor shall record the placement of each panel on a geomembrane panel deployment log form to be reviewed by the CQA Officer. The CQA Monitor shall verify that the Contractor has provided sufficient slack in the geomembrane to allow for contraction due to cold temperatures. As the geomembrane panels are deployed in the field, the CQA Monitor shall observe and verify the following:

1. That the subgrade (foundation layer) has not deteriorated between acceptance and panel placement;
2. That any underlying geosynthetics have been repaired and approved as necessary;
3. That the equipment used to transport and deploy the geomembrane does not damage it or the subgrade (foundation layer);
4. That there are no significant defects present in the sheet. Small defects shall be marked, along with the type of repair required (extrudate, patch, etc.);
5. That the sheet is not deployed under adverse weather conditions such as fog, rain, or high winds;
6. That the equipment and deployment methods do not cause excessive wrinkling of the geomembrane and that the sheet is not dragged along a rough surface. If the geomembrane is dragged, the CQA Monitor shall inspect the underside of the material for damage;
7. That personnel do not engage in activities that could damage the geomembrane; and
8. That the Contractor's QC personnel properly record identification information including roll number, panel number, seam number, date, etc.

The CQA Monitor shall record all of the above information in daily reports and log sheets and shall inform all parties of any deviations.

4.5 LLDPE GEOMEMBRANE TEST WELDS

The CQA Monitor shall verify that the Contractor conducts test welds on pieces of scrap geomembrane to verify seam strength prior to field production at the following frequency:

1. At the start of the seaming period;
2. Once every four (4) hours of seaming;
3. Once for every seaming device used;
4. Twice per welding shift; and
5. If the welding machine has been out of service for more than 30 minutes.

The CQA Monitor shall record the shear and peel test results for the test weld coupons on a geomembrane start-up trial weld log form. The Contractor shall not begin welding of field seams unless the CQA Monitor has observed that the trial welds are acceptable. The CQA Monitor shall observe that once a welding technician has been approved on a specific welding apparatus, he does not change machines without first passing a test weld on the new equipment.

4.6 SEAMING OF THE LLDPE GEOMEMBRANE

The CQA Monitor shall observe that the geomembrane is seamed between the ambient temperatures described within the Specifications. The CQA Monitor shall measure and record the temperature 6 inches above the geomembrane surface on an hourly basis. If ambient temperatures are below the project-specified value, then the geomembrane must be preheated prior to seaming. No seaming shall be performed outside of the specified temperature range without written authorization by the CQA Officer. The CQA Monitor shall observe that the geomembrane is not being deployed during precipitation, in the presence of excessive moisture, in areas of ponded water, or in the presence of excessive winds.

The Contractor's QC Technician and the CQA Monitor shall verify that geomembrane seams are oriented parallel to the maximum slope direction and that a seam numbering system compatible with the panel numbering system is used. The CQA Monitor shall observe that the Contractor has taken the following steps prior to seaming the geomembrane:

1. That the geomembrane surface has been cleaned of all foreign material including dirt, dust, debris, moisture, or oil;
2. That a disc grinder has been used perpendicular to seams to remove the oxidation surface in accordance with the project specifications before seaming on extrusion welds;
3. That all areas where the sheet thickness has been significantly reduced from grinding are patched by the Contractor;
4. That any bead grooves are covered with single extrudate;
5. That wrinkles and fishmouths are cut out and the edges overlapped. Where the overlap is less than the project specifications, the area shall be patched;
6. That all seaming takes place over a firm, dry surface;
7. That when the ambient temperature is below the specified value, a hot air device is used for preheating in front of the welder;
8. That the approved type and quantity of welding devices are used on the job;
9. That extrusion welders are purged of heat degraded material prior to use;
10. That for cross or tee seams, the edge of the seam is ground to a smooth incline; and
11. That the seam numbering system and welding procedures agreed upon at the

preconstruction meeting are strictly followed.

The CQA Monitor shall record the above information in his daily reports along with panel placement and seaming log forms to be reviewed by the CQA Officer.

4.7 EXTRUSION WELDING

For extrusion welding, the CQA Monitor shall observe that the welding devices are being purged of heat-degraded extrudate, as necessary, before welding following all work stoppages longer than specified. The CQA Monitor shall verify that all purged extrudate is disposed of off the geomembrane. The CQA Monitor shall verify that no equipment is allowed to begin welding until the test weld, made by that equipment, passes the weld test. All test weld results shall be reviewed and recorded by the CQA Monitor.

4.8 HOT WEDGE (FUSION) WELDING

For hot wedge (fusion) welding, the CQA Monitor shall verify that the welding devices are automated, vehicular mounted, and equipped with gauges giving applicable speed and temperatures. The CQA Monitor shall verify that the speed, temperature, and pressure of the welding device is adjusted appropriately during the test welding conducted prior to seaming of the panels. In the event that field conditions require adjustment to the device, the CQA Monitor shall verify that additional test welds are performed prior to resuming activities. The CQA Monitor shall verify that field test welds for cross seams are conducted at least every 2 hours or as provided in the Specifications.

4.9 NONDESTRUCTIVE TESTING OF GEOMEMBRANE SEAMS

4.9.1 General

Prior to the start of construction, the CQA Monitor and the CQA Officer shall verify that the Contractor has submitted his QC program manual that describes the procedure for nondestructive testing of all field seams. When the seaming begins in the field, the CQA Monitor shall record the results of the geomembrane QC conducted by the Contractor on a geomembrane installer’s field QC log form.

4.9.2 Vacuum Box Testing

For nondestructive seam testing, all extrusion welded field seams shall be tested over their full length using vacuum box test units. The vacuum testing shall be performed by the Contractor's QC Technician under the observation of the CQA Monitor. The CQA Monitor shall verify that the tests are conducted concurrently with the field seaming and that the vacuum box assembly consists of a rigid box with a transparent viewing window and a vacuum gage. The CQA Monitor shall verify that the Contractor's procedure for vacuum testing is as follows:

1. Clean window, gasket surfaces, and check box for leaks;
2. Energize vacuum pump and reduce pressure to the specified value;
3. Place soapy solution on section of seam to be tested;
4. Place box over wetted area and press down;
5. Close bleed valve, open vacuum valve, and ensure that a leak tight seal is created;
6. Examine the length of weld through the viewing window for bubbles for the specified time period;
7. If no bubbles appear, the vacuum valve should be closed, the bleed valve opened, and the box should be moved to the next adjoining area with the specified overlap; and
8. Areas where soap bubbles are detected shall be marked, repaired, and retested.

4.9.3 Air Pressure Testing

If the double hot wedge seaming system is employed, air pressure testing shall be used. The CQA Monitor shall observe that air pressure testing is conducted by the Contractor as follows:

1. Seal both ends of the seam to be tested;
2. Insert a hollow needle or other approved pressure feed device into the tunnel created by the double hot wedge and insert a protective cushion between the air pump and geomembrane;
3. Energize the air pump to the specified pressure, close the valve, and sustain the pressure for the specified time limit;
4. Check the entire seam being tested for indications that it has been fully pressurized. This shall be accomplished by opening the air channel at the opposite end of the seam and observing a loss of pressure;
5. If a loss of pressure exceeds the specified value, or does not stabilize, locate the faulty area and repair; and
6. Remove the approved pressure feed device and seal.

Should a loss of pressure be detected along a seam, the faulty area shall be identified, repaired, and re-tested as provided within the Specifications. If blockage occurs along the seam, the area shall also be identified, repaired and re-tested. The Contractor shall be responsible for all costs associated with the seam repair. The results of both vacuum box and air pressure testing shall be recorded on the seam and panel QC form by the CQA Monitor for review by the CQA Officer.

4.10 DESTRUCTIVE TESTING OF GEOMEMBRANE SEAMS

The location of all destructive tests shall be determined by the CQA Monitor. A minimum of one sample per 500 feet of seam shall be obtained by the Contractor's QC Technician. The Contractor shall repair any suspicious looking welds before release of a seam for destructive sampling. Destructive samples shall be cut by the Contractor as the installation progresses and not at the completion of the project. All destructive samples shall be marked by the Contractor's QC Technician or CQA Monitor with consecutive numbers, the seam number, the date, time, seaming technician, apparatus, and temperature.

Destructive samples shall be cut by the Contractor's QC Technician at locations selected by the CQA Monitor. The CQA Monitor shall:

1. Mark each sample with the seam number, and the adjoining panel numbers;
2. Record the sample location on the geomembrane panel deployment log form and the geomembrane field seaming log form;
3. Record the sample location and reason for taking the sample (random sample, poor welding, etc.); and
4. Record the results of the testing on the appropriate form.

A log of the destructive testing shall be kept by the CQA Monitor with the date, time, location, seaming technician, apparatus, temperature, and pass or fail criteria. The CQA Monitor shall test the geomembrane seams in accordance with ASTM D6392. The CQA Monitor shall verify that the results of the seam testing meet the project specifications. The CQA Monitor shall verify that all destructive sample holes are repaired immediately by the Contractor.

4.11 REPAIRS TO THE GEOMEMBRANE

For final seaming inspection, the CQA Monitor and Contractor shall check the seams and surface of the geomembrane for defects, holes, blisters, undispersed raw materials, or signs of contamination by foreign matter. If dirt inhibits inspections, the Contractor shall brush, blow, or wash the geomembrane surface as required. The CQA Monitor shall decide if cleaning the geomembrane surface and welds is needed to facilitate inspection. Repair areas shall be distinctively marked with a description of the required type of repair.

The CQA Monitor shall verify that all identified holes, tears, blisters, undispersed raw materials, and contamination by foreign matter is patched. The CQA Monitor shall verify that patches are not cut with the repair sheet in contact with the geomembrane and that the patches are extrusion welded to the geomembrane and then vacuum tested. The result of the vacuum test for the repair shall be marked by the Contractor's QC Technician with the date of the test and name of the tester on the sheet. Holes shall be repaired as described in the Specifications. All repair areas shall be recorded on the repair log form by the CQA Monitor.

4.12 GEOMEMBRANE FINAL WALK-THROUGH

The Contractor shall be responsible for maintaining the geomembrane (or portions thereof) until final acceptance by the CQA Monitor. The CQA Monitor shall recommend final acceptance when all seams have passed destructive testing, the Contractor has supplied all documentation, and all field and laboratory testing is complete and satisfactory. Prior to final acceptance, the Contractor, CQA Officer, CQA Monitor, and the Owner shall review the installation of the geomembrane (or portions thereof) for completeness. Any areas that are found to deviate from the intended design, are incomplete, or in need of repair shall be recorded by the CQA Monitor for correction by the Contractor. When all repairs have been completed, the CQA Monitor shall release the geomembrane (or portions thereof) for installation of overlying materials. The Contractor shall retain ownership of the geomembrane throughout the installation of overlying materials as defined within his scope of work and until the project is complete.

5.0 GEOCOMPOSITE

5.1 GENERAL

This section sets forth the requirements for the CQA testing and observation requirements for installing the geocomposite materials detailed on the Construction Drawings and Specifications. This work includes the examination of the Manufacturer's and Contractor’s QC testing, conformance testing, shipping and handling, and deployment, seaming, and repairs of the geocomposite. The CQA Monitor and CQA Officer shall review the submittals furnished by the Contractor to ensure their compliance with this program and conditions of warranty prior to construction. They shall also review the time schedule for installation submitted by the Contractor prior to construction.

5.2 SHIPPING AND HANDLING

The Contractor shall provide a copy of the QC certificates for production of each geocomposite roll manufactured for this project prior to construction for review by the CQA Monitor and CQA Officer. Materials shall be delivered to the site only after the CQA Monitor receives and approves the required submittals. The Manufacturer's QC shall include visual inspection of the geotextile materials for foreign matter and needles. Detection of broken needles at the manufacturing plant shall be accomplished with the use of magnets and continuous metal detectors permanently installed on-line at the factory.

The Contractor is responsible for the transportation, off-loading, and storage of the geocomposite. The materials shall be packaged and shipped by appropriate means so that no damage is caused and shall be delivered to the site only after the CQA Monitor receives and approves the required submittals. Off-loading shall be performed in the presence of the CQA Monitor to ensure that any damage during off-loading is properly documented. The CQA Monitor shall keep a log of all geocomposite delivered to the site on the appropriate form for review by the CQA Officer.

The CQA Monitor shall verify that damaged materials are separated from undamaged materials until proper disposition of the material is determined by the Owner or CQA Officer. Final authority on the determination of damage shall be the CQA Monitor.

5.3 GEOCOMPOSITE CONFORMANCE TESTING

After production, the geocomposite shall be sampled for conformance testing by a third party geosynthetics laboratory. Sampling shall be performed at the manufacturing plant by the third party geosynthetics laboratory or upon arrival at the site. One geocomposite sample shall be obtained for every 100,000 square feet produced. The CQA Monitor shall identify the roll numbers of the geocomposite which are tested for conformance on the log of geocomposite received form. The samples shall be delivered to the geosynthetics laboratory to determine that the geocomposite properties conform to the requirements given in the Specifications. The CQA Officer shall review all test results and report any non-conformance test results to the Contractor and the CQA Monitor.

Conformance samples shall be collected across the entire width of the roll, but shall not include the first three feet of the roll. The conformance samples shall be three feet wide by the roll width in length. Each sample shall be marked with the Manufacturer's name and product identification, lot number, roll number, and type (8 oz. double-sided, single-sided, 250-mil, high flow, etc.). In event that sampling is necessary at the site, the Contractor shall provide the personnel and equipment to obtain the sample in the presence of the CQA Monitor. No material shall be deployed until passing conformance values are obtained by the CQA Monitor.

The conformance testing of the geocomposite shall include the following parameters:

1. Hydraulic Transmissivity (ASTM D4716); and
2. Ply Adhesion (GRI GC7).

5.4 GEOCOMPOSITE INSTALLATION

Prior to geocomposite installation, the CQA Monitor shall observe that all underlying materials have been repaired, tested, and approved in accordance with the Construction Drawings and Specifications. During geocomposite placement, the CQA Monitor shall:

1. Observe the geocomposite as it is deployed and record all defects and disposition of the defects (panel rejected, patch installed, etc.);
2. Observe that equipment used does not damage the geocomposite;
3. Observe that people working on the geocomposite do not engage in activities that could damage it;
4. Observe that the geocomposite is anchored to prevent movement by the wind (the Contractor is responsible for any damage resulting to or from windblown geocomposite);
5. Observe that the seams are overlapped in accordance with the project Specifications;
6. Observe that the Contractor has repaired any holes or tears in the geocomposite; and
7. Observe that the materials and methods used to fasten the panels together meet the Specification requirements.

The CQA monitor shall record all of the above information on log sheets and in daily reports.

6.0 GEOTEXTILE

6.1 GENERAL

This section sets forth the requirements for the CQA testing and observation requirements for installing the geotextile materials detailed on the Construction Drawings and Specifications. This work includes the examination of the Manufacturer's and Contractor's QC testing, conformance testing, shipping and handling, and deployment, seaming, and repairs of the geotextile. The CQA Monitor and CQA Officer shall review the submittals furnished by the Contractor to ensure their compliance with this program and conditions of warranty prior to construction. They shall also review the time schedule for installation submitted by the Contractor prior to construction.

6.2 SHIPPING AND HANDLING

The Contractor shall provide a copy of the QC certificates for production of each geotextile roll manufactured for this project prior to construction for review by the CQA Monitor and CQA

Officer. Materials shall be delivered to the site only after the CQA Monitor receives and approves the required submittals. The Manufacturer's QC shall include visual inspection of the geotextile materials for foreign matter and needles. Detection of broken needles at the manufacturing plant shall be accomplished with the use of magnets and continuous metal detectors permanently installed on-line at the factory.

The Contractor is responsible for the transportation, off-loading, and storage of the geotextile. The materials shall be packaged and shipped by appropriate means so that no damage is caused and shall be delivered to the site only after the CQA Monitor receives and approves the required submittals. Off-loading shall be performed in the presence of the CQA Monitor to ensure that any damage during off-loading is properly documented. The CQA Monitor shall keep a log of all geotextile delivered to the site on the appropriate form for review by the CQA Officer.

The CQA Monitor shall verify that damaged materials are separated from undamaged materials until proper disposition of the material is determined by the Owner or CQA Officer. Final authority on the determination of damage shall be the CQA Monitor.

6.3 GEOTEXTILE CONFORMANCE TESTING

After production, the geotextile shall be sampled for conformance testing by a third party geosynthetics laboratory. Sampling shall be performed at the manufacturing plant by the third party geosynthetics laboratory or upon arrival at the site. <u>One geotextile sample shall be obtained for every 100,000 square feet produced</u>. The CQA Monitor shall identify the roll numbers of the geotextile which are tested for conformance on the log of geotextile received form. The samples shall be delivered to the geosynthetics laboratory to determine that the geotextile properties conform to the requirements given in the Specifications. The CQA Officer shall review all test results and report any non-conformance test results to the Contractor and the CQA Monitor.

Conformance samples shall be collected across the entire width of the roll, but shall not include the first three feet of the roll. The conformance samples shall be three feet wide by the roll width in length. Each sample shall be marked with the Manufacturer's name and product identification, lot number, roll number, and type (8 oz. non-woven, woven, etc.). In the event that sampling is necessary at the site, the Contractor shall provide the personnel and equipment to obtain the sample in the presence of the CQA Monitor. No material shall be deployed until passing conformance values are obtained by the CQA Monitor.

The geosynthetics laboratory shall conduct the following conformance tests on the geotextile:

1. Mass per Unit Area (ASTM D-5261);
2. Grab Tensile (ASTM D-4632);
3. Puncture Resistance (ASTM D-4833);
4. Tear Resistance (ASTM D-4533);
5. Permittivity (ASTM D-4491); and
6. Apparent Opening Size (ASTM D-4751).

6.4 GEOTEXTILE INSTALLATION

The CQA Monitor shall not allow installation of the geotextile wrap until all conformance testing has been completed and adequate results have been obtained. During geotextile placement, the CQA Monitor shall:

1. Observe the geotextile as it is deployed and record all defects and disposition of the defects (panel rejected, patch installed, etc.);
2. Observe that equipment used does not damage the geotextile;
3. Observe that people working on the geotextile do not engage in activities that could damage it;
4. Observe that the geotextiles are anchored to prevent movement by the wind (the Contractor is responsible for any damage resulting to or from windblown geotextiles);
5. Observe that the seams are overlapped in accordance with the project Specifications;
6. Observe that the Geosynthetic Contractor has repaired any holes or tears in the geotextile; and
7. Observe that the thread used to sew the panels together meets the specification requirements.

During installation, the Contractor and CQA Monitor shall inspect the geotextile as it is deployed for the presence of foreign materials and needles. If any needles or other materials which the CQA Monitor feels may be detrimental to the underlying synthetic geomembrane are present within the geotextile, the roll shall be rejected and not used and the Contractor shall replace any rejected material at no additional cost to the Owner. The CQA Monitor shall notify the Contractor of any problem areas and observe and inspect the repair. The CQA Monitor shall record all of the above information on log sheets and in daily reports.

7.0 LANDFILL GAS WELL EXTENSIONS AND PIPING RELOCATION

Prior to construction, the CQA Monitor shall review the material submittals and work plan for the installation of the gas well extensions and relocation of the landfill gas piping system. During construction, the CQA Monitor shall verify that the Contractor installs the extensions and piping in accordance with the Construction Drawings and Specifications. Any testing that is required for the piping by the Contractor shall be observed and recorded by the CQA Monitor. Records of the well extension activities will be kept that include the final as-built conditions (i.e. casing and locking cover elevations, etc.).

8.0 WORK DEFICIENCIES

When deficiencies are discovered, the CQA Monitor shall immediately determine the nature and extent of the problem, notify the Contractor of the problem, and complete the required documentation. The CQA Monitor shall notify the Contractor within a 1/2 hour of discovering any deficiency. If the deficiency will cause significant construction delays or require substantial rework, the CQA Monitor shall notify the Owner and the CQA Officer.

The Contractor shall correct the deficiency to the satisfaction of the CQA Monitor. If the Contractor is unable to correct the problem, the CQA Monitor shall be asked to develop and recommend a solution to the CQA Officer for his approval.

The corrected deficiency shall be retested before additional work is performed by the Contractor. All retests and the steps taken to correct the problem shall be documented by the CQA Monitor on a field construction inspection report and on construction problem and solution data sheet forms.

9.0 DOCUMENTATION

9.1 DAILY RECORDS

At a minimum, daily records shall consist of field notes, a summary of the daily construction activities, associated testing activities, and observation and data sheets. All project records shall be maintained in a well organized project file at the job site and shall be available for review by the CQA Officer, Contractor, the Owner, and jurisdictional agencies at all times. The CQA Officer shall review the reports and field notes prepared by the CQA Monitor and prepare a summary report from the daily records and observation data sheets. The CQA Monitor's daily summary report shall be available to the CQA Officer and the Contractor for review and shall include the following information:

1. Date, project name, and location;
2. Weather data;
3. A description of on-going construction;
4. A summary of test results identified as passing, failing, or in the event of a failed test, retests;
5. Off-site materials received including geosynthetics or drainage materials, plus status of certificates or off-site testing for the materials;
6. A summary of decisions regarding acceptance of the work and/or corrective actions taken; and
7. The signature or initials of the CQA Monitor.

9.2 OBSERVATION AND TEST DATA SHEETS

The CQA Monitor shall prepare observation and data sheets during all phases of construction of the cover system for review by the CQA Officer. Observation and data sheets for this project may include, but would not be limited to the following:

1. Field Construction Inspection and Meeting Reports
2. Nuclear Density/Moisture Data Sheets
3. Field Density Summary
4. Moisture Density Curve Data Sheets
5. Oven Moisture Content
6. Sand Cone Density/Moisture Data Sheets
7. Sieve Analysis Data Sheets
8. Atterberg Limits Data Sheets
9. Acceptance of Prepared Subgrade Forms
10. Geosynthetics Received Log
11. Geotextile Received Log
12. Geotextile Panel Deployment Log
13. Geocomposite Received Log
14. Geocomposite Panel Deployment Log
15. Geomembrane Panel Deployment Log
16. Geomembrane Start-up Trial Weld Log
17. Geomembrane Field Seaming and Nondestructive Testing Log

18. Geomembrane Seam Strength Destructive Test Results
19. Geomembrane Repair Log
20. Photograph Log

Additional observation and data sheets may be required. All entries shall be clear and legible. All documentation should be dated and signed or initialed clearly by the CQA Monitor.

9.3 PROGRESS REPORTS

The CQA Monitor shall prepare progress reports as necessary summarizing the CQA activities for the preceding period. The CQA Officer shall review the daily reports and summaries of observation and data sheets in addition to any progress reports. The CQA Officer shall discuss progress and the results of all testing and CQA observation and documentation with the CQA staff to ensure that the construction is of excellent quality.

9.4 DESIGN CHANGE REPORTS

Design and specification changes may be required during construction. In such cases, the CQA Monitor shall notify the CQA Officer. Design and specification changes shall only be made with written agreement of the Engineer, CQA Consultant and the Owner.

9.5 CONSTRUCTION DIFFICULTY REPORTS

In the event that the Contractor has extreme difficulty in the performance of any specified activities required, a special report shall be prepared to address the problem(s). The Owner, the Contractor, CalRecycle, CQA Monitor, and CQA Officer (if needed) shall meet to discuss any problems encountered and to address the solution. If changes to the Construction Specifications are required, the Engineer, CQA Consultant and the Owner shall be notified and approve any changes in writing.

9.6 FINAL REPORT

At the completion of the project, the CQA Consultant shall prepare a final construction report suitable for presentation to the regulatory agency. Copies of all reports and test results prepared by the CQA Monitor shall be submitted to the CQA Officer for review. Copies of all reports and test results prepared by the CQA Monitor shall be submitted to the CQA Officer for review. Copies of all the documents shall be maintained at the CQA Consultant's office. This report shall verify that the work has been performed in compliance with the Construction Drawings and the Specifications. At a minimum this report shall contain:

1. A summary of all construction activities;
2. A description of significant construction problems and the resolution of these problems;
3. A list of changes (if any) from the Construction Drawings and Specifications and the justification for these changes; and
4. A statement signed and sealed by a Registered Civil Engineer or Certified Engineering Geologist registered in the State of California verifying that the project was constructed in general accordance with the Construction Drawings, Specifications, and CQA Plan.

9.7 RECORD DRAWINGS

A set of record drawings shall be prepared by the Contractor during the course of construction. The record drawings shall accurately locate all construction items including the location of piping and the extent of lining and collection system components, etc. The CQA Consultant shall review the record drawings and provide comment to the Contractor for finalizing. Upon completion of the final record drawings, the Contractor shall forward digital and hard copies of the drawings to the CQA Consultant for inclusion in the final report.

SPECIFICATIONS

DIVISION 0

BIDDING, CONTRACT FORMS, & CONDITIONS

Document 00405

SCHEDULE OF UNIT PRICE WORK

This Document and Table 1, consisting of 2 pages, constitutes a Supplement to the Bid Form. When a Contract is awarded, this Document becomes a supplement to the Construction Contract as Exhibit A. Refer to Section 01025 – Measurement and Payment of Division 1 – General Requirements for descriptions and details on the bid items.

TABLE 1 - BONZI SANITATION LANDFILL – FINAL CLOSURE PLAN
SCHEDULE OF UNIT PRICE WORK

NO.	ITEM	UNIT	QUANTITY	UNIT COST	SUBTOTAL COST
1	Mobilization/Demobilization	LS	1		
2	Structure Removal	LS	1		
3	Clearing and Stripping	AC	70.5		
4	Perimeter Access Road and Drainage Channel Berm	CY	48,200		
5	Flood Control Berm	CY	6,300		
6	Foundation Layer Placement	CY	248,800		
7	Double Sided Geocomposite Drainage Layer	SF	88,251		
8	60-mil LLDPE Double Sided Textured Geomembrane	SF	2,093,649		
9	Vegetative/Protective Cover	CY	113,200		
10	Toe Drain	LF	1,160		
11	24-Inch Diameter Culvert	LF	313		
12	Landfill Gas Control System	LS	1		
13	Erosion Control	LS	1		
14	Settlement Monuments	EA	5		
15	Surveying	LS	1		
	Total				

Notes: 1. Quantities are estimates only for bidding purposes and are based on the "Final Closure Plan" design drawings prepared by Geo-Logic Associates, Inc., October 2014.

DIVISION 1

GENERAL REQUIREMENTS

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SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contract description.

B. Construction water.

C. CONTRACTOR's use of site.

D. Description of work.

E. CONTRACTOR's Work Scope.

1.2 CONTRACT DESCRIPTION

A. Not used.

1.3 CONSTRUCTION WATER

A. Construction water is available from the existing groundwater treatment system retention pond.

1.4 CONTRACTOR'S USE OF SITE

A. The CONTRACTOR should limit activities to the project area, as shown on the Construction Drawings.

1.5 DESCRIPTION OF WORK

A. The work to be performed for this contract includes, but is not necessarily limited to, the construction of a perimeter access road and drainage channel berm, flood control berm, placement of foundation layer, installation of geomembrane liner, geocomposite, placement of a minimum of 1.5-feet of vegetative cover over WMU II, WMU III, and WMU IV. Soil for construction of the perimeter access road and drainage channel berm, flood control berm, foundation layer, and vegetative/protective cover is to be obtained from a borrow area approximately 700-feet south of the landfill. Other components includes landfill gas system adjustments and operations, installation of a toe drain, placement of erosion control material, and installation of settlement monuments.

1.6 CONTRACTOR'S WORK SCOPE

A. CONTRACTOR shall furnish all labor, materials, tools, equipment, supervision, transportation, and installation services required for the following tasks as summarized below, and outlined in the Construction Drawings and Specifications:

1. Mobilization and demobilization of Contractor equipment and labor force.
2. Clearing and stripping vegetation in areas of engineered fill, intermediate cover, and borrow soil area.
3. Excavation, hauling, placement, and compaction of engineered fill to the lines, dimensions, and grades shown on the Construction Drawings.
4. Excavation, hauling, placement, and compaction of foundation layer material to the lines, dimensions, and grades shown on the Construction Drawings.
5. Excavation, hauling, placement, and compaction of vegetative/protective cover layer material to the lines, dimensions, and grades shown on the Construction Drawings.
6. Installation of culverts and drainage channels to the lines, dimension, and grades shown on the Construction Drawings.
7. Extension of landfill gas extraction well heads along with operation and maintenance of the landfill gas extraction system during construction.
8. Installation of erosion control measures on exposed channel and borrow area soils areas.
9. Installation of settlement monuments as detailed in the Construction Drawings.
10. Provide all necessary construction staking to lay out the work and other surveying to compute quantities and prepare as-built drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01019

CONTRACT CONSIDERATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. References and abbreviations of various industry associations, trade associations, societies, organizations, and regulatory agencies, as referenced in the Contract Documents.

1.2 DESCRIPTIONS

A. The Contract Documents contain references to various standard Specifications, codes, practices, and requirements for materials, workmanship, installation inspections, and tests. Which references are published and issued by the organizations, societies, and associations listed below by abbreviation and name. Such references are hereby made a part of the Contract Documents to the extent cited.

B. Any material, method, or procedure specified by reference to the number, symbol, or title of a specific Specification or standard, such as a Commercial Standard, American National Standard, Federal or State Specification, Industry or Government Code, a trade association code or standard, or other similar standard, shall comply with the requirements of the edition in effect on the date of Notice to Proceed.

C. The code, specification, or standard referred to, except as modified in these Specifications, shall have full force and effect as though printed in these Specifications. These Specifications and standards are not furnished to bidders since manufacturers and trades involved are assumed to be familiar with their requirements. The OWNER will furnish, upon request, information as to how copies of the Specifications and standards referred to may be obtained.

1.3 ABBREVIATIONS

A. Whenever in the Contract the following abbreviations are used, their meanings shall be as follows:

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers

ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
GRI	Geosynthetics Research Institute
FS	Federal Specifications
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PPI	Plastic Pipe Institute

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Measurement and payment methods for contract bid items.

1.2 MEASUREMENT OF QUANTITIES

A. Performed according to United States Measures.

B. Based on actual units installed or neat line dimensions of work completed.

1.3 CALCULATION OF QUANTITIES

A. Progress Payment Quantities:

1. CONTRACTOR will compute all quantities of Work performed, or of materials and equipment delivered to the site for progress payment purposes.

2. OWNER/CALRECYCLE may at any time verify quantities calculated by CONTRACTOR.

B. Final Payment Quantities: CONTRACTOR will compute all quantities of Work performed, or of materials and equipment delivered and installed for final payment purposes. OWNER may perform an independent computation of all quantities of work performed, and of materials and equipment installed.

1.4 PAYMENT

A. In accordance with lump sum, unit prices, or force account rates shown on the CONTRACTOR'S final negotiated Bid Schedule.

B. Includes all costs for overhead and profit and for supplying materials, labor, equipment, and tools, necessary to complete the Work in accordance with the Specifications, Construction Drawings, and Contract Conditions.

1.5 VALUES OF UNIT PRICES

A. The number of units and quantities contained in the Bid Schedule are approximate only, and final payment will be made for the actual number of units and quantities incorporated in the work or made necessary to complete the project.

B. In the event that work and materials or equipment are required to be furnished to a greater or lesser extent than is indicated by the Contract Documents, such work and materials or equipment shall be furnished in greater or lesser quantities.

1.6 CHANGES AND EXTRA WORK

A. Changes and extra work will be measured and paid for in accordance with the requirements of this Section.

1.7 REJECTED MATERIALS

A. Quantities of material wasted or disposed in a manner not called for in the Specifications; rejected loads of material, including material rejected after it has been placed by reasons of the failure of CONTRACTOR to conform to the provisions of the Specifications; material not unloaded from the transporting vehicle; material placed outside the limits indicated by the Construction Drawings or established by OWNER; or material remaining on hand after completion of the Work, will not be paid for, and such quantities will not be included in the final total quantities. No compensation will be made for loading, hauling, and disposing of rejected material.

1.8 FORCE ACCOUNT WORK

A. Payment for Force Account work will be determined as follows:

B. Labor.

1. Payment for labor will be based on the Force Account Labor Rate Schedule submitted with the bid.

2. Payment constitutes full compensation for labor including wages, benefits, overhead, and profit for each individual.

C. Equipment.

1. Payment for equipment will be based on the Force Account Equipment Rate Schedule submitted with the bid.

2. Payment constitutes full compensation for supplying equipment and includes all costs for maintenance, fuel, insurance, overhead, profit and

any other costs necessary to provide and operate the equipment. Payment does not include operator labor cost.

D. Materials.

1. Payment for materials will be paid for at CONTRACTOR's invoiced cost plus 10 percent.

2. Payment will be based on invoices from suppliers documenting cost to CONTRACTOR.

3. Where invoices are not available a unit cost must be approved by the OWNER prior to use of the material.

1.9 PAY ITEMS

INTERMEDIATE COVER CONSTRUCTION

1. Mobilization/Demobilization **(Bid Item 1)**

a. Measurement by lump sum (LS), based on mobilizing equipment and labor to perform work and demobilizing from and cleaning the site after all work and testing has been performed and accepted by the OWNER.

b. Payment includes all costs for mobilizing and demobilizing equipment, living expenses, bonds, insurance, office and field overhead, and any other administrative costs necessary to complete the work. Includes work described in Section 01400, 01560, and 01600; as well as all sitework.

2. Structure Removal **(Bid Item 2)**

a. Measured by lump sum (LS), based on removal of the structures as delineated on the Construction Drawings.

b. Payment includes all costs to decommission, disassemble, remove, and dispose of delineated structures. Waste from demolition can be disposed of within the landfill provided that the waste can be covered by a minimum of 2 feet of cover soil under the geomembrane liner.

3. Clearing and Stripping **(Bid Item 3)**

a. Measured by the acre (AC) and will be based on a perimeter survey of the staked construction area as shown on the Construction Drawings.

b. Payment includes all costs to clear, grub, strip, and prepare the subgrade within the engineered fill areas, intermediate cover, and excavation area within the borrow area (construction areas) as described in Section 02110.

4. Perimeter Access Road and Drainage Channel Berm **(Bid Item 4)**

a. Measured by the cubic yard (CY). Measurement will be made by comparing pre-construction topography of the construction area as provided by the OWNER with post-excavation topography conducted by the CONTRACTOR.

b. Payment includes all costs to excavate, haul, process, moisture condition, place, and compact the engineered fill soil material for the perimeter access and drainage channel berm as shown on the Construction Drawings and described in Sections 02221 and 02222. Payment also includes finish grading of perimeter channels including tie-ins to culvert inlet and outlet structures; extending landfill gas monitoring probe casings (as necessary); decommissioning, salvaging and/or removal of existing drainage structures; and purchase, hauling, and placement of aggregate base all-weather surface as shown on the Construction Drawings and described in Sections 02225 and 02230.

5. Flood Control Berm **(Bid Item 5)**

a. Measured by the cubic yard (CY). Measurement will be made by comparing pre-construction topography of the construction area as provided by the OWNER with post-excavation topography conducted by the CONTRACTOR.

b. Payment includes all costs to excavate, haul, process, moisture condition, place, and compact the engineered fill soil material for the flood control berm as shown on the Construction Drawings and described in Sections 02221 and 02222. Payment also includes purchase, hauling, and placement of aggregate base all-weather surface as shown on the Construction Drawings and described in Section 02225.

6. Foundation Layer Placement **(Bid Item 6)**

a. Measured by the cubic yard (CY). Measurement will be made by comparing pre-construction topography of the construction area as provided by the OWNER with post-excavation topography conducted by the CONTRACTOR.

b. Payment includes all costs to excavate, haul, process, moisture condition, place, and compact of the foundation layer material as shown on the Construction Drawings and described in Sections 02221 and 02222. Payment also includes all costs to complete preparation of the foundation layer as subgrade of geomembrane liner consisting of fine grading, smooth drum rolling, and any other activity described in Section 02223.

7. Double Sided Geocomposite Drainage Layer **(Bid Item 7)**

a. Measured by the square foot (SF). Measurement will be based on a perimeter survey of the completed installation. Surveys for measurement quantities will be performed by the CONTRACTOR, however, the OWNER may verify the quantity using a third party surveyor. No adjustment will be made for uneven contours or for overlap at seams or waste material. No measurement will be made for any geocomposite lost due to damage resulting from either the fault or the negligence of the CONTRACTOR.

b. Payment will be by the Square Foot (SF). Includes all costs to furnish and install geocomposite as shown on the Construction Drawings and described in Section 02774.

8. 60-mil LLDPE Double Sided Textured Geomembrane **(Bid Item 8)**

a. Measured by the square foot (SF). Measurement will be based on a perimeter survey of the completed installation. Surveys for measurement quantities will be performed by the CONTRACTOR, however, the OWNER may verify the quantity using a third party surveyor. No adjustment will be made for uneven contours or for overlap at seams or waste material. No measurement will be made for any LLDPE liner lost due to damage resulting from either the fault or the negligence of the CONTRACTOR.

b. Payment will be by the Square Foot (SF). Includes all costs to furnish and install geomembrane as shown on the Construction Drawings and described in Section 02778.

9. Vegetative/Protective Cover **(Bid Item 9)**

a. Measured by the cubic yard (CY). Measurement will be made by comparing pre-construction topography of the construction area as provided by the OWNER with post-excavation topography conducted by the CONTRACTOR.

b. Payment includes all costs to excavate, haul, process, moisture condition, place, and compact the vegetative/protective cover material as shown on the Construction Drawings and described in Sections 02221 and 02229.

10. Toe Drain **(Bid Item 10)**

a. Measurement by the Lineal Foot (LF) of pipe installed complete with drain rock and geotextile filter, based on the field survey.

b. Payment shall be by Lineal Foot (LF). Payment includes all costs to purchase, supply, and install the drainage collection pipe, drainage gravel and outlet structures as shown in the Construction Drawings and described in Section 02710 and Section 02227. Payment shall also include the installation of the geotextile filter/wrap, as shown in the Construction Drawings and described in Section 02771.

11. 24-inch Diameter Culvert **(Bid Item 11)**

a. Measurement by the lineal foot (LF) of culvert will be based on the field survey of the completed culverts as described in Section 02230 and as shown on the Construction Drawings.

b. Payment includes all costs to trench, backfill, and compact and purchase, supply, and install the corrugated metal pipe or HDPE pipe, bedding, and backfill materials for the culverts including inlet and outlet structures and erosion protection as shown on the Construction Drawings and described in Section 02230.

12. Landfill Gas Control System **(Bid Item 12)**

a. Measurement by the lump sum (LS) for operations of the landfill gas control system as shown on the Construction Drawings.

b. Payment includes all costs for temporary shut-downs, operation, well head extensions, pipe penetrations, lateral and header connections, and management of the landfill gas system in order to maintain its function throughout final cover construction. Payment also includes the purchase, supply, and installation of landfill gas piping and valves as necessary to carry out the work as described in Section 02781.

14. Erosion Control **(Bid Item 13)**

a. Measured by Lump Sum (LS).

b. Payment includes all costs to purchase materials, fertilize, process, mulch, seed, and other necessary activities to vegetate (by hydroseeding) exposed soil surfaces after placement of the vegetative cover as described in Section 02936. Payment also includes the costs to purchase materials, transport, and place rip-rap erosion control material, geotextile filter, and any other temporary and permanent erosion control structures as described in Section 02270.

15. Settlement Monuments **(Bid Item 14)**

a. Measured by each (EA).

b. Payment includes all costs to furnish materials and install settlement monuments and protective bollards as shown on the construction drawings and Section 02285.

16. Surveying **(Bid Item 15)**

a. Measured by Lump Sum (LS).

b. Payment includes all costs to perform construction control and slope staking, surveys to complete quantities, surveys to document as-built conditions of the Final Closure Construction, and the preparation of Record Drawings as described in the Specifications.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Acceptance or quality assurance testing by OWNER.

B. Quality control testing by CONTRACTOR.

C. Certificates of compliance.

1.2 SOURCE OF MATERIALS

A. CONTRACTOR must notify OWNER in writing of the sources from which it proposes to obtain material requiring approval, certification, or testing. Such notification must be made as soon as possible after award of Contract but no later than 5 days after receipt of the Notice to Proceed.

1.3 ACCEPTANCE TESTING OR QUALITY ASSURANCE TESTING

A. Acceptance testing is the testing of materials prior to their use in the Work and also any testing deemed necessary by OWNER for acceptance of the completed Work. OWNER will perform acceptance testing of materials and workmanship in accordance with the Contract Documents and reserves the right to perform additional testing at any time to determine conformance with the requirements of the Contract Documents.

B. Acceptance testing by OWNER is not to be considered as a replacement for control testing conducted by CONTRACTOR or a manufacturer producing materials for CONTRACTOR. Acceptance testing will be at the expense of the OWNER.

1.4 QUALITY CONTROL TESTING

A. Quality control testing is the testing of materials prior to their delivery from a manufacturer, or during construction, such as geomembrane liner seam testing, and such other tests as are specified in the various sections of the Specifications to ensure compliance with the Contract Documents. CONTRACTOR must assume full responsibility for quality control testing and give sufficient notice to OWNER to permit it to witness the tests. Quality control testing is at the expense of CONTRACTOR and where specifically required, performed by an independent testing firm.

B. Submit the name, address, and qualifications, together with the scope of proposed services of the proposed testing firm(s) to OWNER for approval at least 5 days prior to the scheduled commencement of any work involving such testing.

C. Within five days after completion of testing performed by or for the CONTRACTOR, submit test results to the OWNER. Identify test reports with the information specified for samples in Section 01300 and additionally, the name and address of the organization performing the test, and the date of the tests.

1.5 CERTIFICATES OF COMPLIANCE

A. CONTRACTOR may use certificates of compliance for certain materials and products in lieu of the specified sampling and testing procedures. Submit certificates required to demonstrate proof of materials compliance with specification requirements. Submit certificates in duplicate with each lot of material delivered to the Work or prior to delivery as required by the Contract. The lots so certified must be clearly identified by the certificate. Certificates must be signed by an authorized representative of the producer or manufacturer, and state that the material complies in all respects with the requirements of the Contract Documents. In the case of multiple shipments, each shipment must be accompanied or preceded by a Certificate of Compliance.

B. The Certificate of Compliance must be accompanied by a certified copy of test results or state that such test results are on file with the producer or manufacturer and must be furnished to OWNER on request. The certificate must give the information specified for samples in Section 01300, the name and address of the organization performing the tests, the date of the tests, and the quantity of material shipped.

C. Materials used on the basis of a Certificate of Compliance may be sampled and tested at any time. The fact that material is used on the basis of a Certificate of Compliance does not relieve CONTRACTOR of responsibility for incorporating material in the Work, which conforms to the requirements of the Contract. Any such material not conforming to such requirements will be subject to rejection, whether in place or not.

D. OWNER reserves the right to refuse to permit the use of certain materials on the basis of a Certificate of Compliance.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01560

TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary controls required during the term of the Contract for the protection of the environment and the health and safety of workers and general public.

B. Furnishing all equipment, materials, tools, accessories, incidentals, and labor, and performing all work for the installation of equipment and construction of facilities, including their maintenance and operation during the term of the Contract.

C. Temporary controls include, but are not limited, to the following:

1. Dust Control
2. Pollution and Erosion Control
3. Traffic and Safety Controls

D. Perform work as specified in this Specification and as required by OWNER. Maintain equipment and accessories in clean, safe and sanitary condition at all times until completion of the Contract.

1.2 DUST CONTROL

A. Provide dust control measures as specified in the Contract. The CONTRACTOR shall obtain a dust control permit from Stanislaus County, if applicable.

B. Dust control consists of transporting water, furnishing required equipment, additives, accessories and incidentals, carrying out proper and efficient measures wherever and as often as necessary to reduce dust nuisance, and to prevent dust originating from construction operations throughout the duration of the Contract, as required by OWNER.

C. Apply water by means of pressure-type distributors or pipelines equipped with a spray system or hoses with nozzles that will insure a uniform application of water.

D. Provide all equipment used for the application of water with a positive means of shut-off.

E. Unless otherwise permitted by OWNER or unless all the water is applied by means of pipelines, provide at least one operations mobile unit with a minimum capacity of 3,500 gallons for applying water at the site during construction.

1.3 POLLUTION AND EROSION CONTROL

A. Erosion Control: Control sediment transport on sloped surfaces. Submit a NOI as required by NPDES regulations. CONTRACTOR shall prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) which complies with all requirements of the applicable stormwater NPDES permit for construction activities.

B. Pollution of Waterways: Perform work using methods that prevent entrance or accidental spillage of solid or liquid matter, contaminants, debris and other objectionable pollutants and wastes into streams, watercourses, flowing or dry, and underground water sources. Such pollutants and wastes will include, but will not be restricted to refuse, earth and earth products, garbage, cement, concrete, sewage effluent, industrial waste, radioactive substances, hazardous chemicals, oil and other petroleum products, aggregate processing tailings, and mineral salts. Dispose of pollutants and wastes in accordance with applicable permit provisions or in a manner acceptable to and approved by the OWNER.

C. Storage and Disposal of Petroleum Products:

1. Petroleum products covered by this section include gasoline, diesel fuel, lubricants, heating oils, and refined and used oil. During project construction, store all petroleum products in such a way as to prevent contamination of all ground and surface waters.

2. Lubricating oil may be brought into the project area in steel drums or other means, as CONTRACTOR elects. Store used lubricating oil in steel drums, or other approved means, and return to the supplier for disposal. Do not burn or otherwise dispose of at the project area.

3. If the total capacity volume of stored petroleum products is greater than 1,320 gallons in total and/or 660 gallons in any single container and these products are stored above ground, CONTRACTOR shall prepare and adhere to a Spill Prevention Control and Countermeasure Plan (SPCC Plan) in accordance with applicable EPA and other state regulations.

D. All chemicals stored on-site must be appropriately labeled as to its content and hazard rating.

1.4 TRAFFIC AND SAFETY CONTROLS

A. Post construction areas and roads with traffic control signs or devices used for protection of workmen, the public and equipment. The signs or devices must conform to the American National Standards Institute, Manual on Uniform Traffic Control Devices for Streets and Highways.

B. Remove signs or traffic control devices as soon as they have served their purpose. It is particularly important to remove any markings on road surfaces, which under conditions of poor visibility could cause a driver to turn off the road or into traffic moving in the opposite direction.

C. Barricades for protection of employees must conform to the portions of the American National Standards Institute, Manual on Uniform Traffic Control Devices for Streets and Highways, relating to barricades.

D. Material Haul on Public Roads: Follow all requirements stated in the permits for using public roads for hauling materials to the site.

E. Provide flag persons, properly equipped with International Orange protective clothing and flags, as necessary, to direct or divert pedestrian or vehicular traffic.

F. Construct and maintain fences, planking, barricades, lights, shoring, and warning signs as required by local authorities, federal and state safety ordinances, and as required to protect OWNER's property from injury or loss, and as necessary for the protection of the public, and provide walks around any obstructions made in a public place for carrying on the Work covered in this Contract. Leave all such protection in place and maintained until removal is authorized.

G. Guard and protect all workers, pedestrians, and the public from excavations, blasting operations, construction equipment, all obstructions, and other dangerous items or areas by means of adequate railings, guard rails, temporary walks, barricades, warning signs, sirens, directional signs, overhead protection, planking, decking, danger lights, etc.

1.5 MAINTENANCE

A. Maintain all temporary controls in good working conditions during the term of the Contract for the safe and efficient transport of equipment and supplies, and for construction of permanent works, as required by the OWNER.

1.6 STATUS AT COMPLETION

A. **Upon completion of the Work, or prior thereto, when so required by the OWNER, remove all temporary controls and restore disturbed areas as required by OWNER.**

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and handling.

C. Storage and protection.

1.2 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

C. Provide interchangeable components of the same manufacturer, for similar components.

1.3 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, and/or damage.

D. Any damaged materials, whether as originally shipped or as a result of handling, shall be replaced at no additional cost to the OWNER and with no extension of contract time.

1.4 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

B. For exterior storage of fabricated products, place aboveground on sloped supports, if in accord with manufacturer's handling instructions.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

H. Any products that become damaged during storage shall be replaced at no additional cost to the OWNER and with no extension of contract time.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

DIVISION 2

SITEWORK

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SECTION 02110

CLEARING AND STRIPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clearing and stripping grass and other organic material from the borrow area, intermediate cover, and areas that will be subgrade for engineered fill, as defined on the Construction Drawings.

B. Stockpiling stripped material.

1.2 RELATED SECTIONS

A. Section 02221 – Excavating and Stockpiling.

B. Section 02222 – Engineered Fill, Foundation Layer, and Backfill.

C. Section 02223 – Subgrade Preparation.

D. Section 02229 – Vegetative/Protective Cover.

PART 2 PRODUCTS

NOT USED.

PART 3 EXECUTION

3.1 PREPARATION

A. Set required lines, levels, contours, and datum by construction staking.

B. Locate, identify, and protect existing phase areas.

C. Notify utility company to locate utilities, if applicable.

D. Provide for dust control.

E. Protect benchmarks, existing structures, and fences from excavation equipment and vehicular traffic.

F. Provide for dewatering as necessary for the work.

G. CONTRACTOR shall note that topography shown on the Construction Drawings may differ from topography at time of construction. The CONTRACTOR shall perform a pre-commencement survey to document site conditions prior to starting work.

3.2 STRIPPING

A. Strip grass, roots, organic soils, and other deleterious materials prior to excavating.

B. Transport and place all materials in the designated stockpile location on the Construction Drawings or as directed by the OWNER, and in accordance with Section 02221.

END OF SECTION

SECTION 02221

EXCAVATING AND STOCKPILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Excavating soil for engineered fill and vegetative/protective cover soils.

B. Excavating to construct stormwater retention basin, and conveyance improvements including ditches and diversion berms.

1.2 RELATED SECTIONS

A. Section 02222 — Engineered Fill and Backfill.

B. Section 02223 – Subgrade Preparation.

C. Section 02229 – Vegetative/Protective Cover.

PART 2 PRODUCTS

2.1 ENGINEERED FILL

A. Soil meeting requirements of Section 02222, Part 2.1.

2.2 VEGETATIVE/PROTECTIVE COVER SOIL

A. Soil meeting requirements of Section 02229, Part 2.1.

2.3 SURPLUS SOILS

A. Remaining soils excavated.

PART 3 EXECUTION

3.1 PREPARATION

A. Set required lines, levels, contours, and datum by construction staking.

B. Locate, identify, and protect existing phase areas.

C. Notify utility company to locate utilities, if applicable.

D. Provide for dust control.

E. Protect benchmarks, existing structures, and fences from excavation equipment and vehicular traffic.

F. Provide for dewatering as necessary for finish excavation and fill placement.

G. CONTRACTOR shall note that topography shown on the Construction Drawings may differ from topography at time of construction. The CONTRACTOR shall perform a pre-commencement survey to document site conditions prior to starting work.

3.2 EXCAVATION

A. Excavate soil and rock as required to the lines, grades, and elevations to construct the landfill, roads, surface waste drainage systems, and other structures as necessary as shown on the Construction Drawings.

B. Machine grade slopes and base to design grades.

C. Grade top perimeter of excavation to prevent surface water from draining into excavation.

D. Notify OWNER of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

E. Correct areas over excavated by placing engineered fill per Section 02222 and as approved by the OWNER.

F. Selectively excavate engineered fill and intermediate cover soil and stockpile near the soil mixing area.

G. Haul unsuitable material, remaining material, surplus soils, to stockpile(s) or location designated by OWNER.

3.3 SOIL STOCKPILING

A. Coordinate selective soil stockpiling with OWNER.

B. Place soil such that maximum slope is 3H:1V, and minimum slope is 5 percent.

C. Placement and mass configuration of soil stockpiles shall be performed at the direction of the OWNER.

D. Provide uniform final graded surface for all soil stockpiles.

3.4 CONSTRUCTION QUALITY ASSURANCE

A. Construction quality assurance (CQA) will be performed in accordance with the construction CQA Plan.

B. The OWNER may perform testing to determine the conformance of the materials with these Construction Specifications and Drawings.

END OF SECTION

SECTION 02222

ENGINEERED FILL, FOUNDATION LAYER, AND BACKFILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Engineered Fill Placement.

B. Foundation Layer Placement.

C. Trench and Other Backfills.

1.2 RELATED SECTIONS

A. Section 02221 – Excavating and Stockpiling.

B. Section 02223 – Subgrade Preparation.

1.3 REFERENCES

A. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soil.

C. ASTM D1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

D. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

E. ASTM D2216 – Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

F. ASTM D2487 – Classification of Soils for Engineering Purposes (Unified Soil Classification System).

G. ASTM D6938 – Standard Test Methods for In-Place Density and Water Content of Soil by Nuclear Methods (Shallow Depth).

PART 2 PRODUCTS

2.1 ENGINEERED FILL

A. Soil obtained from designated borrow area on site, approved by the OWNER and ENGINEER for general fill and bench construction.

B. Free of organic material.

C. Free of frozen material, ice, snow, or excessive moisture.

D. Maximum particle size of 4 inches.

2.3 FOUNDATION LAYER

A. Soil obtained from designated borrow area on site, approved by the OWNER and ENGINEER for general fill and bench construction.

B. Free of organic material.

C. Free of frozen material, ice, snow, or excessive moisture.

D. Maximum particle size of 1 inch.

2.2 TRENCH BACKFILL

A. Select soils obtained from trench excavation or borrow excavation areas and from other areas as directed by the OWNER.

B. Free of organic material.

C. Maximum particle size of 1/2 inch.

PART 3 EXECUTION

3.1 ENGINEERED FILL AND FOUNDATION LAYER PREPARATION

A. Scarify subgrade soils to a 6-inch depth prior to soil placement.

B. Prior to placement of engineered fill, verify that no substantial thickness of loose or uncompacted soil is present in the fill area.

C. Begin engineered fill only when the ENGINEER has accepted the underlying subgrade.

3.2 ENGINEERED FILL PLACEMENT

A. Place engineered fill to the lines and grades shown on the Construction Drawings.

B. Place engineered fill in excavated unsuitable subgrade areas.

C. Place in loose lift thickness not exceeding 8 inches.

D. Compact each lift to a minimum of 90 percent relative compaction at a moisture content adequate to achieve compaction as determined by ASTM D1557. Completed lifts of fill cannot yield under equipment loads.

E. Grade final surface to a vertical tolerance of ± 0.1 foot.

3.3 FOUNDATION LAYER PLACEMENT

A. Place foundation layer to the lines and grades shown on the Construction Drawings.

B. Place in loose lift thickness not exceeding 8 inches.

C. Compact each lift to a minimum of 90 percent relative compaction at a moisture content adequate to achieve compaction as determined by ASTM D1557. Completed lifts of fill cannot yield under equipment loads.

D. Grade final surface to a vertical tolerance of ± 0.1 foot.

3.4 BACKFILL FOR TRENCH

A. Begin only when pipes and other structures have been completed in accordance with the specifications.

B. Place backfill to the lines and grades shown on the Construction Drawings.

C. Place in loose lift thickness not exceeding 12 inches.

D. Compact each lift by wheel rolling with rubber-tired equipment, whacker packer, or using approved compaction equipment.

E. Do not damage installed pipes, utilities, drainage and other structures.

3.5 CONSTRUCTION QUALITY ASSURANCE

A. Constructions quality assurance (CQA) will be performed in accordance with the CQA Plan.

B. The OWNER will determine optimum moisture content and maximum density for all engineered fills and intermediate cover in accordance with ASTM D1557.

C. The OWNER will determine in-place density and moisture content by one or more of the following methods or approved equal: ASTM D1556, ASTM D2216, and ASTM D6938.

D. The OWNER may perform additional testing to determine the conformance of the materials with these Specifications and the Construction Drawings.

E. Frequency of and criteria for testing are included in the CQA Plan.

F. The OWNER may perform sampling and testing of excavated materials as they are stockpiled.

G. The CONTRACTOR shall cooperate fully with the OWNER in performance of sampling and testing. Include costs for assistance in unit or lump sum prices.

3.6 THICKNESS MEASUREMENTS AND VERIFICATIONS

A. The CONTRACTOR shall pothole the vegetative/protective cover at a 100-foot by 100-foot grid in the presence of the CQA Monitor. The additional thickness will apply to half the distance, in all directions, up to the next pothole location.

END OF SECTION

SECTION 02223

SUBGRADE PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Final grading and compaction of finished subgrade in preparation for geomembrane liner placement.

B. Subgrade is defined as the intermediate cover over existing waste and existing soil outside of the waste footprint.

1.2 RELATED SECTIONS

A. Section 02110 – Clearing and Stripping

B. Section 02221 – Excavating and Stockpiling.

C. Section 02222 – Engineered Fill, Foundation Layer, and Backfill.

D. Section 02778 – Geomembrane.

1.3 REFERENCES

A. ASTM D 1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

B. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

C. ASTM D2216 – Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

D. ASTM D2937 – Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.

E. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil by Nuclear Methods (Shallow Depth).

PART 2 PRODUCTS

2.1 SUBGRADE

A. Prior to placement of geomembrane liner, the subgrade surface is prepared in accordance with Section 3.2 and smooth drum rolled to provide a firm smooth surface.

B. Subgrade shall not contain any deleterious materials, debris, organic matter, ice, snow or frozen material.

C. The subgrade soils shall have a maximum particle size of 1 inch at the uppermost surface.

2.2 SOURCE QUALITY CONTROL

A. Perform quality control planning and procedures to assure that deleterious or waste materials are not incorporated into the subgrade soils.

B. Coordinate source quality control program with OWNER.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is complete and in compliance with slopes and dimensions shown on the Construction Drawings and with Paragraph 3.2 of this section.

B. Examine surface to determine whether unsuitable materials are present.

C. Verify surface is free of ponded water.

D. The subgrade surface will be examined and accepted in writing by the OWNER prior to placement of intermediate cover.

3.2 FINISHED GRADING AND COMPACTION OF SUBGRADE

A. In areas with sufficient thickness of subgrade, scarify, moisture condition and recompact the top 6-inch layer of subgrade soils to relative compaction of at least 90% of maximum density at moisture content near optimum as determined by ASTM D1557.

B. Finish subgrade l within a vertical tolerance of ± 0.1 feet of design grade.

C. Fill voids and cracks.

D. After compaction is complete, the ENGINEER and OWNER will accept the subgrade only if and when all criteria of this Section are met or satisfied.

3.3 CONSTRUCTION QUALITY ASSURANCE

A. Construction quality assurance (CQA) will be performed in accordance with the CQA plan.

B. The OWNER may perform additional testing to determine the conformance of the materials with these Construction Specifications and the Drawings.

END OF SECTION

SECTION 02225

AGGREGATE BASE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnishing, placing, grading, and compacting of aggregate base for the access roads.

1.2 RELATED SECTIONS

A. Section 02110 – Clearing and Stripping.

B. Section 02221 – Excavating and Stockpiling.

C. Section 02222 – Engineered Fill, Foundation Layer, and Backfill.

D. Section 02229 – Vegetative/Protective Cover.

1.3 REFERENCES

A. California Department of Transportation (CalTrans) Standard Specifications - July 1999 or more current version.

B. CalTrans Test 202 – Sieve Analysis of Fine and Coarse Aggregates.

C. CalTrans Test 226 – Determination of Moisture Content by Oven Drying.

D. CalTrans Test 231 – Relative Compaction of Treated and Untreated Soils and Aggregates Using the Nuclear Method.

E. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

F. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soil.

G. ASTM D1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

H. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

I. ASTM D2216 – Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

J. ASTM D2487 – Classification of Soils for Engineering Purposes (Unified Soil Classification System).

K. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil by Nuclear Methods (Shallow Depth).

PART 2 PRODUCTS

2.1 AGGREGATE BASE

A. Crushed, screened, clean, sound, and durable rock.

B. Free of organic, oversized, deleterious, or other unsuitable materials.

C. Aggregate may include material processed from reclaimed asphalt concrete, Portland cement concrete, lean concrete base, cement treated base, or a combination of any of these materials. The amount of reclaimed material shall not exceed 50% of the total volume of the aggregate used.

D. Aggregates shall conform to the grading and quality requirements shown in the tables in the CalTrans Standard Specifications Section 26-1.02A for Class 2 Aggregate Base.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrate has been inspected, grades and elevations are correct, and is suitable for aggregate placement.

3.2 PREPARATION

A. Prepare subgrade by scarifying, to a minimum depth of 6 inches, reshaping, and re-compacting to a minimum of 90% of maximum dry density as determined by ASTM D1557.

B. Do not place fill on soft, muddy, or frozen surfaces.

C. Perform all quality control testing for aggregate base in accordance with CalTrans Standard Specifications Sections 26.

3.3 AGGREGATE PLACEMENT

A. Unless otherwise noted, place and compact all materials in general accordance with CalTrans Standard Specifications Section 26.

B. At the time aggregate base is spread (prior to compaction), it shall have a moisture content sufficient to obtain the required compaction. The moisture shall be uniformly distributed throughout the material.

C. Aggregate base shall be delivered to the roadbed as uniform mixtures. Each layer shall be free from pockets of coarse or fine material.

D. Aggregate base material shall be spread and compacted in layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed 6 inches.

E. Aggregate base placed on road approaches and connections, street intersection areas, median strip areas, shoulder areas, and at locations which are inaccessible to the spreading equipment may be spread in one or more layers by any means to obtain the specified results.

F. Aggregate bases, after compaction, shall be watered in conformance with the provisions in CalTrans Standard Specifications Section 17, "Watering".

G. The relative compaction of each layer of compacted aggregate base material shall be not less than 95% as determined by CalTrans Test 231 or ASTM D1557.

H. Aggregate base that does not conform to the above requirements shall be reshaped or reworked, watered, and thoroughly recompacted to conform to the specified requirements, at the CONTRACTOR's expense.

I. Level and contour surfaces to elevations and grades indicated on Construction Drawings.

J. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

K. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

L. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

M. Immediately prior to placing the asphalt, the aggregate base shall conform to the compaction requirement and elevation tolerances specified and shall be free of loose or extraneous material.

3.4 TOLERANCES

A. Flatness: Maximum variation of ½ inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within ½ inch.

C. Variation From Design Elevation: Within 0.1 inch.

3.5 CONSTRUCTION QUALITY ASSURANCE

A. Construction quality assurance (CQA) will be performed in accordance with the CQA plan.

B. The OWNER will determine optimum moisture content and maximum density for all aggregate base in accordance with CalTrans Test 231 or ASTM D1557.

C. The OWNER will determine in-place density and moisture content of the engineered fill by one or more of the following methods or approved equal: CalTrans Test 231, ASTM D1556, ASTM D2216, and ASTM D6938.

D. The OWNER may perform additional testing to determine the conformance of the materials with these Specifications and the Construction Drawings.

E. The CONTRACTOR shall cooperate fully with the OWNER in performance of sampling and testing. Include costs for assistance in unit or lump sum prices.

END OF SECTION

SECTION 02227

DRAINAGE GRAVEL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of drainage gravel for the toe drain collection trench.

B. Description of angular drainage rock for the toe drain collection trench.

C. Work includes furnishing, loading, hauling, and placing the drainage materials.

1.2 RELATED SECTIONS

A. Section 02710 – Polyethylene Pipe.

B. Section 02771 – Geotextile.

C. Section 02774 – Drainage Geocomposite.

D. Section 02778 – Geomembrane.

1.3 REFERENCES

A. ASTM C136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

B. ASTM D2434 - Standard Method for Permeability of Granular Soils (Constant Head).

C. ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

1.4 SUBMITTALS

A. Submit a 50-pound representative sample of the proposed drainage gravel and angular drainage rock material within 10 days after contract award.

PART 2 PRODUCTS

2.1 DRAINAGE GRAVEL

A. Material obtained and imported from off-site.

B. Free of organic or other deleterious material.

C. Having a hydraulic conductivity greater than or equal to 0.5 cm/sec when tested in accordance with ASTM D2434 and placed in accordance with this specification.

D. Material must be hard, durable and not subject to grain crushing.

E. The permeability specification controls over the gradation specification.

F. Material shall be a washed gravel meeting the gradation shown in Table 02227-1.

TABLE 02227-1

DRAINAGE GRAVEL GRADATION

U.S. SIEVE SIZE	PERCENT PASSING
1-inch	100
No. 4	0-30
No. 20	0-5
No. 200	0-2

2.2 ANGULAR DRAINAGE ROCK

A. Clean open-graded angular rock with a maximum particle size of 4 inches with less than 25 percent passing the 2-inch sieve and less than 2% passing the No. 200 sieve,

B. Material obtained and imported from off-site.

C. Free of organic or other deleterious material.

D. Material must be hard, durable and not subject to grain crushing.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that all underlying components such as geosynthetics and collection piping have been installed, tested, and accepted by OWNER in accordance with the Construction Drawings and Specifications.

B. Verify that all necessary pre-construction submittals such as conformance testing of the drainage gravel has been performed prior to placement.

C. Establish lines and grades for placement of the drainage gravel in accordance with the Construction Drawings.

D. Prior to performing the Work, the CONTRACTOR shall mark all landfill gas and monitoring wells, etc. within the limits of the Work with construction stakes and high visibility flagging. The CONTRACTOR shall maintain uninterrupted access to the landfill structures during construction. Any damage caused by the CONTRACTOR shall be repaired by the CONTRACTOR at no expense to the OWNER.

3.2 PLACEMENT

A. Place only when underlying excavations and geosynthetic installations are complete in accordance with the Specifications and accepted by the OWNER.

B. Place to lines and grades shown on the Construction Drawings.

C. Place to the thickness shown on the Construction Drawings.

D. If necessary, place to a minimum thickness of 3 feet over the geomembrane in haul roads or in traffic areas where heavy rubber-tired equipment (scrapers, dump trucks, etc.) will be used during construction.

E. Spread and place materials using a low ground pressure dozer or alternative equipment approved by the ENGINEER.

F. Spread and place materials in a single lift meeting the approximate depth shown on the Construction Drawings.

G. Place without damaging underlying geosynthetics.

H. Place in an uphill or cross-slope direction (not in a downhill direction) to prevent putting tension in the underlying geosynthetics.

I. Place in the cooler part of the day when underlying geosynthetics contain minimal wrinkles.

J. Place in a manner that prevents the development of wrinkles in the underlying geosynthetics in front of the advancing drainage gravel. Remove wrinkles in a manner approved by the ENGINEER.

K. Do not cause underlying geosynthetics to bridge or trampoline at the toes of slopes, benches, across ditch or pipe alignments. If bridging does occur, repair at no additional cost to the OWNER.

L. There are no compaction, wheel rolling, or track walking requirements.

3.3 FIELD QUALITY CONTROL

A. Do not use pointed stakes as grade control devices. Only use devices that will not puncture underlying geosynthetics.

B. Place gravel within a vertical tolerance of +/- 0.1 feet.

C. At the completion of construction, the CONTRACTOR shall provide an as-built survey drawing in digital form to the OWNER that includes the survey point data demonstrating compliance with the Construction Drawings and Specifications.

D. After drainage gravel has been placed, the CONTRACTOR shall protect the drainage materials to prevent inundation from dirt and to prevent damage from other construction activities until the Work is complete and accepted by the OWNER.

3.4 FIELD QUALITY ASSURANCE

A. Sampling and testing of materials to determine material type may be performed by the OWNER at the stockpile, at the material source, or at the place of use in accordance with the CQA Plan.

B. The OWNER will perform gradation tests of materials before and during placement in accordance with ASTM C136.

C. The OWNER will perform permeability tests of materials before and during placement operations in accordance with ASTM D2434.

D. Assist the OWNER as necessary in collecting material samples and conducting tests.

E. OWNER reserves the option of waving gradation specifications if products submitted by CONTRACTOR meet design intent.

END OF SECTION

SECTION 02229

VEGETATIVE/PROTECTIVE COVER LAYER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Processing, moisture conditioning, and placement of the Vegetative/Protective Cover Layer over the geomembrane, drainage geocomposite, and geotextile covering the toe drain.

1.2 RELATED SECTIONS

A. Section 02227 – Drainage Gravel.

B. Section 02710 – Polyethylene Pipe.

C. Section 02771 – Geotextile.

D. Section 02774 – Drainage Geocomposite.

E. Section 02778 – Geomembrane.

1.3 REFERENCES

A. ASTM D422 - Standard Method for Particle-Size Analysis of Fine and Coarse Aggregates.

B. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soil.

C. July 1992 Caltrans Standard Specifications.

1.4 SUBMITTALS

A. CONTRACTOR's surveyor shall prepare and submit for approval a grid layout for the determination of the soil cover thickness over the construction area.

B. CONTRACTOR shall prepare and submit a Workplan for approval to protect, dismantle, salvage and reconstruct the landfill gas collection and flare system such that the system remains operational to the maximum extent possible during construction activities.

PART 2 PRODUCTS

2.1 PROTECTIVE COVER LAYER

A. Soil material obtained from on-site sources or material imported from off-site sources meeting the requirements of this Section.

B. Maximum particle size of 1 inch.

C. Containing no sharp rocks, sticks, or other material that may damage the underlying geosynthetic materials.

D. Containing no ice, snow, or frozen material.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that all underlying components such as geosynthetics, gravel, and collection piping have been installed, tested, surveyed, and accepted by OWNER in accordance with the Construction Drawings and Specifications.

B. Verify that all necessary pre-construction submittals such as conformance testing of the vegetative/protective cover layer materials has been performed prior to placement.

C. Establish lines and grades by field survey for placement of the vegetative/protective cover layer in accordance with the Construction Drawings and this Section.

3.2 PLACEMENT OF PROTECTIVE COVER

A. Excavate from the borrow site or approved stockpile, screen, or otherwise process the protective cover material to the gradation requirements of this Section.

B. Place only when underlying geosynthetic installations are complete in accordance with the Specifications and accepted by the OWNER.

C. On the top deck, place in an uphill or cross-slope direction (not in a downhill direction) to prevent putting tension in the underlying geosynthetics.

D. On the side slopes, place in an uphill direction (not in a downhill or cross-slope direction) to prevent putting tension in the underlying geosynthetics.

E. Place in the cooler part of the day when underlying geosynthetics contain minimal wrinkles that will not fold over as determined by the ENGINEER and when the ambient temperature is no greater than 90°F.

F. Place in a manner that prevents the development of wrinkles in the underlying geosynthetics in front of the advancing vegetative/protective cover layer. Remove wrinkles in a manner approved by the ENGINEER. If folding does occur, repair at no additional cost to the OWNER.

G. Do not cause underlying geosynthetics to bridge or trampoline at the toes of slopes, benches, across ditch or pipe alignments. If bridging does occur, repair at no additional cost to the OWNER.

H. Place to a minimum thickness of 3 feet over the geomembrane in haul roads or in traffic areas where heavy rubber-tired equipment (scrapers, dump trucks, etc.) will be used during construction.

I. Place vegetative/protective cover layer to the thickness, lines and grades shown on the Construction Drawings.

J. Spread and place materials using a low ground pressure dozer or alternative equipment approved by the ENGINEER.

K. Spread and place materials (to the greatest extent possible) in a single lift meeting the minimum depth shown on the Construction Drawings. In no event, shall the lift thickness of the material being spread be less than 1.0-foot.

L. Do not damage underlying geosynthetic materials, drainage gravel, or piping installations.

M. Track-walk the final surface of the vegetative/protective cover at the completion of placement.

3.3 FIELD QUALITY CONTROL

A. Do not use pointed stakes as grade control devices over lined areas. Only use devices that will not puncture underlying geosynthetics.

B. Perform as-built surveys as required to document the vegetative/protective cover layer limits and to measure vegetative/protective cover layer quantities for payment.

C. The CONTRACTOR shall pothole the vegetative/protective cover at a 100-foot by 100-foot grid in the presence of the CQA Monitor. The additional thickness will apply to half the distance, in all directions, up to the next pothole location.

D. At the completion of construction, the CONTRACTOR shall provide an as-built survey drawing in digital form to the OWNER that includes the survey point data and the contoured topography of the finished surface.

3.4 FIELD QUALITY ASSURANCE

A. Sampling and testing of materials to determine material type may be performed by the OWNER at the stockpile, at the material source, or at the place of use in accordance with the CQA Plan.

B. The OWNER may perform gradation tests of materials before and during placement in accordance with ASTM D422.

C. Assist the OWNER as necessary in collecting material samples and conducting tests.

END OF SECTION

SECTION 02230

SURFACE WATER DRAINAGE SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Installation of diversion berms, surface drainage channels, catch basins, culverts, down drains, and associated appurtenances associated with surface water drainage systems at the site as defined on the Construction Drawings.

1.2 RELATED SECTIONS

A. Section 02110 – Clearing and Stripping.

B. Section 02221 – Excavating and Stockpiling.

C. Section 02222 – Engineered Fill, Foundation Layer, and Backfill.

D. Section 02229 – Vegetative/Protective Cover.

PART 2 PRODUCTS

2.1 CORRUGATED METAL PIPE

A. Corrugated metal pipe (CMP) shall be constructed with high quality corrugated galvanized steel pipe specifically designed for the application shown on the Construction Drawings and manufactured in accordance with the SSPWC (Greenbook). The steel shall have a minimum thickness of 14-gauge. All appurtenances for the CMP shall be of the type and size shown on the Construction Drawings.

2.2 REINFORCED CONCRETE PIPE

A. Reinforced concrete pipes (RCP) shall conform to the requirements of AASHTO M170 as per designated class., or Subsection 207-2 of the SSWPC for size, type and D-load

B. Joints shall be the Tongue and Groove type.

2.3 POLYETHYLENE PIPE (PE):

A. Smooth-walled corrugated polyethylene pipe shall conform to requirements of AASHTO Designation M-252 and M-294.

2.4 DROP INLET AND GRATE

A. Drop inlets shall be as shown on drawings or as per OWNER'S requirements.

B. Grate (support structure) for drop inlets shall be constructed of steel or cast iron meeting dimensions shown on the Drawings.

C. The grate openings shall be sized to provide an 80% open area.

2.5 PRECAST CONCRETE MANHOLE, STEPS AND COVER

A. Pre-cast manholes shall be a minimum 48 inches in diameter, of the tongue and groove type and shall be constructed on a reinforced concrete foundation. A minimum 22- inch access opening shall be provided. The bottom section of the manhole shall have a minimum base thickness of six (6) inches to the outside wall of the pipe. All concrete shall be as per Specifications Section 03300. Pre-cast concrete rings shall be constructed using standard forms and shall conform to the latest revision of ASTM Specification C478 except that:

1. Reinforcing steel shall be as required for a Class II "A" wall by the latest revision of ASTM Specification C76.

2. Permissible variations shall be as required by the latest revision of ASTM Specification C76.

B. Manhole steps shall be made of copolymer polypropylene plastic meeting the latest revision of ASTM Specification D4101 and shall have a ½-inch diameter Grade 60 reinforcing rod through its center meeting the latest revision of ASTM Specification A615. Each step shall be 12-inches in width and capable of carrying a load of 1,000 pounds in the center of the step when projected 6-inches from the wall. Each step shall be equipped with non-skid grooves.

C. Cast Manhole Covers: Castings shall be:

1. Neenah HD R-1772-C with solid lid and two (2) pick holes, or equivalent;

2. East Jordan 1022-1 with heavy duty cover, or equivalent.

3. Cast into the cover shall be the word "STORM SEWER" or "STORM DRAIN".

2.6 ENGINEERED FILL AND SOIL BACKFILL

A. Engineered fill and soil backfill materials shall conform to the requirements of engineered fill in accordance with Section 02222.

2.7 BEDDING MATERIAL

A. Bedding material for culverts shall consist of clean sand or gravel with a maximum particle size of ½ inch.

2.8 RIP RAP

A. Rip rap shall conform to the requirements of channel, inlet, and outlet protection in accordance with Section 02270 of these Specifications.

PART 3 EXECUTION

3.1 PREPARATION

A. Set required lines, levels, contours, and datum by construction staking.

B. Notify utility company to locate utilities, if applicable.

C. Provide for dust control.

D. Protect benchmarks, existing structures, and fences from excavation equipment and vehicular traffic.

E. Coordinate construction operations with landfilling operations.

F. Perform clearing and stripping in accordance with Section 02110.

3.2 INSTALLATION OF DRAINAGE STRUCTURES

A. Excavate the drainage channel to the lines, grades, and dimensions shown on the Construction Drawings.

B. Place bedding materials for CMP culverts.

C. Install the CMP culverts and all associated appurtenances by fastening all parts together as shown on the Construction Drawings or as recommended by the supplier.

D. Install reinforced concrete pipes per SSPWC Subsection 306-1.2.

E. Anchor the structures as shown on the Construction Drawings or in accordance with the requirements of the SSPWC (Greenbook).

F. Backfill culverts and drop inlets with compacted engineered fill as shown on the Construction Drawings.

G. CONTRACTOR shall take care as to not damage the structures during installation and compaction. Any damage shall be repaired or the materials replaced (if necessary) by the CONTRACTOR at no additional cost to the OWNER.

END OF SECTION

SECTION 02270

EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. As needed the installation of the following.

1. Silt Fence.
2. Straw Bale Barrier.
3. Rip Rap.

B. Areas to receive erosion and sediment controls shall be as shown on the Construction Drawings and as determined in the field as needed by the OWNER.

C. Areas requiring erosion and sediment control will include the borrow areas, storm water diversion channels, and storm drain outlets.

1.2 RELATED SECTIONS

A. Section 02110 – Clearing, Grubbing, and Stripping.

B. Section 02221 – Excavating and Stockpiling Soil.

C. Section 02222 – Engineered Fill, Foundation Layer, and Backfill.

D. Section 02229 – Vegetative/Protective Cover.

E. Section 02230 – Surface Water Drainage Control.

F. Section 02771 – Geotextile.

1.3 REFERENCES

A. California Department of Transportation (Caltrans) Standard Specifications, Section 66 – Subsurface Drains and Section 72 – Slope Protection.

1.4 REQUIREMENTS

A. Submit an Erosion Control Plan which describes all materials and methods proposed to minimize erosion damage to the working area and to prevent unwanted discharge of sediment laden waters from the project site. The Erosion

Control Plan must be submitted and approved prior to the start of work. The Contractor shall also submit a temporary erosion control plan specifying type and location of the temporary control devices as noted below in Section 02270, 1.6.A.

B. Meet regulatory requirements for construction of this project. Implement erosion control practices and procedures. If the erosion control measures are inadequately maintained, or are found to be inadequate in the field, install additional measures to prevent sediment laden runoff from leaving the site.

1.5 SEQUENCING AND SCHEDULING

A. All erosion control features must be approved by the OWNER before beginning site earthwork.

B. Route runoff from cleared or disturbed areas. Route through temporary sediment traps, straw bale barriers, or silt fences. Place erosion control facilities prior to any earthwork, clearing, and grubbing. It is preferable for construction to progress in an upstream direction starting with downstream erosion control facilities as the first items of construction.

C. Stabilize disturbed ground at the end of each work day. Perform surface roughening immediately upon reaching final grades by uniformly track-walking up and down the slope with a crawler tractor or sheepsfoot roller, leaving a pattern of cleat imprints that parallel the slope contours. Implement permanent soil stabilization and erosion/sedimentation controls upon reaching final grade.

D. Notify the OWNER of any soils showing signs of erosion.

E. Ensure that all waters from any dewatering operations reaching existing water courses meet or exceed the existing quality of the water course.

1.6 PLACEMENT AND REMOVAL OF EROSION CONTROL FACILITIES

A. In the event ongoing construction activities prevent the full installation of all erosion control improvements, the CONTRACTOR shall provide temporary controls as necessary to prevent detrimental runoff from the site during construction of the vegetative/protective cover and the associated drainage facilities. These improvements may include straw waddles, erosion blanket products, sandbags, straw, etc. as approved by the ENGINEER for temporary controls.

B. Remove all temporary control facilities, 30 days after final completion of work or upon approval of OWNER. Dispose of used silt fence and supports, straw bales, and sediment traps. Costs for removal of erosion control features are incidental, and shall be included in lump sum or unit costs.

PART 2 PRODUCTS

2.1 GENERAL

A. Product specifications described below pertain to erosion control facilities shown on the Construction Drawings.

2.2 SILT FENCE

A. Woven geotextile supplied in minimum 3.5 foot widths and meeting the requirements of Table 02270-1.

B. Support Fence: 2-inch by 2-inch by 14-gage wire mesh fencing in 3-foot-wide rolls.

C. Posts: 2-inch by 2-inch by 4.5-foot-long standard (or better) hardwood posts or 4.5-foot-long steel fence posts weighing 1.33 pounds per linear foot.

D. Fasteners: Heavy duty wire staples at least 1-inch-long, tie wires, or hog rings.

E. Gravel Backfill: Caltrans Class 1, Type A.

TABLE 02270-1
WOVEN GEOTEXTILE PROPERTIES

TEST	TEST DESIGNATION	UNIT	REQUIREMENT
Grab Tensile Elongation	D4632	%	50 - 114
Grab Tensile Strength	D4632	lbs	100 min.
Puncture Resistance	D4833	lbs	60 min.
Permitivity	D4491	Sec^{-1}	0.1 - 0.5
Apparent Opening Size	D4751	mm	0.5 - 0.85
Burst Strength	D3786	psi	190 min.

2.3 STRAW BALE BARRIER

A. Bales: Straw bales, minimum size 15-inch x 15-inch x 36-inch.

B. Posts: Per Section 2.02.C.

2.4 RIP RAP

A. Rip rap shall be hard, durable, stone meeting the gradation and/or dimensions shown on the Construction Drawings and meeting the quality requirements of

Caltrans Standard Specifications Section 72-2. CONTRACTOR may use existing oversize material obtained from intermediate cover preparation or from the inert material excavation as approved by the ENGINEER. The breadth and thickness of each piece of rip rap shall be at least one third its length.

PART 3 EXECUTION

3.1 PREPARATION AND APPLICABILITY

A. Construction within environmentally sensitive areas shall be performed in such a manner as to minimize surface disturbance and protect all endangered or protected species of plants and wildlife. In some instances, equipment shall not be permitted in these areas as discussed on the Construction Drawings or as designated by the OWNER.

3.2 SILT FENCE INSTALLATION

A. Drive fence posts a maximum of 18 inches below the soil surface elevation (outside of finish cover system) at a maximum spacing of 6 feet in areas requiring silt fence. The fence line should be at a constant elevation for each continuous length of silt fence.

B. Place wire mesh support fencing and fabric back-to back (fabric on the upslope side) and extend 12 inches into the trench, leaving 24 inches of fencing and fabric above ground level. Fasten filter fabric and wire mesh support fencing to posts using heavy-duty 1 inch wire staples for wood posts, or wire rings for steel posts. At each post, place fasteners at the top of the fence, at ground level, and halfway in between.

C. Join wire support fence ends by overlapping a minimum of 6 inches and connecting the two sections with wire rings in four places. If fabric joints are necessary, cut the wire support fence, sandwich the wire and fabric ends between two wood posts, and bind the posts tightly together.

D. Lengthwise along the top of the silt fence and at ground level, tie fabric to wire support fencing with wire rings at a maximum spacing of 3 feet. Backfill trench with Caltrans Class 1, Type A material.

3.3 STRAW BALE BARRIER CONSTRUCTION

A. Excavate a one bale wide strip of soil 4 inches deep, perpendicular to the flow direction in the channel. Remove all grass and other materials that may allow underflow.

B. Install straw bales end-to-end, with the bindings oriented horizontally around the sides of the bales. Anchor each bale into trench. Push bales together as firmly as possible.

C. Chink the gaps between bales with straw to prevent water from escaping between bales. This must be done carefully to avoid separating the bales. Place and compact excavated soils against the upstream side of the straw bale barrier to a height of 4 inches to prevent piping under bales.

3.4 RIP RAP PLACEMENT

A. The CONTRACTOR shall purchase, transport, and install the rip rap material as per drainage structure (culverts, downdrains, ditches, channels, etc.) as shown on the Construction Drawings.

B. Rip rap shall be placed on top of a filter fabric of non-woven geotextile in accordance with Section 02771.

C. CONTRACTOR shall place rip rap so as to not damage the underlying geotextile. Damage shall be repaired at the CONTRACTOR's expense.

D. Place rip rap in a manner that will produce a reasonably well graded mass of rock with minimum percentage of voids.

E. Place rip rap to its full course thickness in one operation without using chutes or other methods which will cause segregation. Placing rip rap in layers will not be excepted.

3.6 MAINTENANCE

A. General Requirements: Observe the facilities during the first storm following construction to ensure that the facilities are properly located, constructed, and operating as designed. Maintain and repair facilities as needed to ensure that they continue to work as designed.

B. Silt Fence: Check for sagging fences, torn fabric, and signs of erosion and/or sedimentation down slope of the fence. Make repairs as necessary. If the silt fence fails due to storm water runoff inundating the fence, construct additional erosion and sediment control measures to remove sediment from and convey the runoff to downstream drainage facilities. Remove accumulated sediment behind silt fences whenever it reaches approximately one-third the height of the fence.

C. Straw Bale Barrier: Check for undercutting, damaged bales, evidence of erosion or sedimentation between bales, and "end run" erosion at the ends of the barrier.

Make repairs, replace bales, and remove sediment before it reaches approximately one-half the height of the barrier.

D. Rip Rap: Check for undercutting, scour beneath stones, displaced stones, and other evidence of erosion. Make repairs as needed to ensure that material continues to work as designed.

END OF SECTION

SECTION 02285

SETTLEMENT MONUMENTS

PART 1 GENERAL

1.1 SECTION SUMMARY

A. The work to be performed includes the furnishing of all labor, material, transportation, tools, supplies, equipment and appurtenances, and the performance of all work required for installing the settlement monuments in accordance with the Construction Drawings and these Specifications.

1.2 RELATED SECTIONS

A. Section 02936 – Hydroseeding.

B. Section 03300 – Reinforced Concrete.

1.3 SUBMITTALS

A. The CONTRACTOR shall submit to the Engineer for approval the brochures, data sheets, etc. for the materials to be installed prior to purchase and use on the project:

B. Upon completion of the installation, the CONTRACTOR shall provide as-built documentation showing the final survey monument elevations and site coordinates, and other data pertinent to the work performed.

PART 2 PRODUCTS

2.1 GENERAL

A. The CONTRACTOR shall furnish and install all survey markers, concrete encasements, steel posts, footings, and related items as required for completion of the survey monuments as herein specified.

2.2 SURVEY MARKERS

A. The permanent survey markers shall be standard brass caps specifically manufactured for use in survey monument construction. Each cap shall be a minimum of 2 inches in diameter.

2.3 CONCRETE

A. The concrete used for the monuments and footings for the protective posts (bollards) shall be a standard mix, as described in Section 03300.

PART 3 EXECUTION

3.1 GENERAL

A. This portion of the Specifications describes the procedures to be followed for installation of the settlement monuments. The materials and locations shall be as shown on the Construction Drawings and in these Specifications.

3.2 SETTLEMENT MONUMENT

A. Upon completion of the final cover, the CONTRACTOR shall construct a square concrete form to the size shown on the Construction Drawings.

B. The mixed concrete shall be placed in the form and the brass cap set such that the cap is flush with the surface of the concrete.

C. Once the concrete has cured to sufficient hardness, each cap shall be engraved with a cross mark in the center and engraved with a label (identification mark) that differentiates each monument location from the other.

D. Any monument outside of the landfill footprint that is designated as a benchmark shall also be engraved with the monument coordinates (northing, easting, and elevation in feet above mean sea level, amsl) as determined by the final survey.

3.3 FINAL SURVEY

A. Upon completion of the settlement monuments, the CONTRACTOR shall survey and record the coordinates (northing, easting, and elevation amsl) of each brass cap monument. The coordinates of the benchmarks shall also be engraved directly on the brass cap for future reference. The final survey information of the monuments shall be submitted to the Engineer and Owner as described in these Specifications.

END OF SECTION

SECTION 02710

HIGH DENSITY POLYETHYLENE PIPE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install High Density Polyethylene (HDPE) solid pipe, HDPE perforated pipe, and associated pipe fittings for landfill gas collection system per the Construction Drawings. Pipe sizes are shown on the plans.

1.2 RELATED SECTIONS

A. Section 02221 – Excavating and Stockpiling.

B. Section 02222 – Engineered Fill, Foundation Layer, and Backfill.

C. Section 02229 – Vegetative/Protective Cover.

D. Section 02270 – Erosion and Sediment Control.

E. Section 02781 – Polyvinyl Chloride (PVC) Pipe.

F. Section 02783 – Flexible Connections.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
2. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics.
3. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
4. ASTM D790 - Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM D1238 - Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
6. ASTM D1248 - Specification for Polyethylene Plastics Molding and Extrusion Materials.

7. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.

8. ASTM D1525 - Standard Test Method for Vicat Softening Temperature of Plastics.

9. ASTM D1599 - Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings.

10. ASTM D1603 - Standard Test Method for Carbon Black in Olefin Plastics.

11. ASTM D1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

12. ASTM D2122 - Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

13. ASTM D2240 - Standard Test Method for Rubber Property Durometer Hardness.

14. ASTM D2657 - Practice for Heat Joining of Polyolefin Pipe and Fittings.

15. ASTM D2837 - Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

16. ASTM D3035 - Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

17. ASTM D3261 - Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

18. ASTM D3350 - Specification for Polyethylene Plastics Pipe and Fittings Materials.

19. ASTM F1248 - Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.

20. ASTM F714 - Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

21. ASTM F1473 – Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins.

B. National Sanitation Foundation (NSF). NSF Standard Number 14 - Plastics Piping Components and Related Materials.

C. PPI - Plastic Pipe Institute.

D. ANSI - American National Standards Institute.

1.4 SUBMITTALS

A. Submit a MANUFACTURER'S certification of compliance with specified requirements of this Section. Submit catalog cut sheet of pipe and fittings to be supplied prior to commencing work.

B. Provide written certification for qualified HDPE pipe fusion welders.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

A. High density polyethylene (HDPE) manufactured for pipe meeting the following minimum standards.

1. Material Designation: PE 3608 / PE 3408.

2. Cell Classification: 345464 C.

B. All pipe sizes shown on the Construction Drawings and specified in this Section reference nominal diameter, unless otherwise indicated on the Construction Drawings or in this Section. Pipe sizing and workmanship to be in accordance with ASTM F714 and ASTM D3035.

C. Unless otherwise specified on the Construction Drawings, compressed air lines shall be SDR 9, liquid lines shall be SDR 11, and LFG lines shall be SDR 17, HDPE pipe and fittings shall be manufactured from PE 3408 resin. Fittings shall have the same SDR as the pipe to which they are fused. Pipe specifications shall be factory stenciled on the pipe for ease of inspection.

D. Conforming to the minimum requirements of Table 02710-1.

E. Containing no recycled compound except that generated in the Manufacturer's own plant and from resin of the same specification from the same raw material supplier.

F. Resin for pipe and fittings to be listed by both N.S.F. and P.P.I. and manufactured in accordance with ASTM D3350 and ASTM F714.

TABLE 02710-1

POLYETHYLENE PIPE MATERIAL PROPERTIES

PROPERTY	ASTM TEST DESIGNATION	UNIT	REQUIREMENTS
Density	D1505	gm/cm^3	0.955 min.
Melt Index	D1238	gm/10 minutes	0.1 (typ).
Flexural Modulus	D790	psi	110,000 min.
Tensile Strength	D638	psi	3,000 min.
Hydrostatic Design Basis at 73°F (23°C)	D2837	psi	1,600 (typ.)
UV Stabilizer	D1603	% Carbon Black	2% to 3%
Elastic Modulus	D638	psi	110,000 min.
Brittleness Temperature	D746	°F	-103°F (typ.)
PENT	F1473	hours	100 min.
Thermal Expansion Coefficient	D696	in/in/°F	$1x10^{-4}$ max.

G. Homogeneous throughout and free of visible cracks, holes (except where specified or shown), foreign inclusions or other injurious defects. Being uniform in color, capacity, density, and other physical properties.

H. Provide pipe with the following information continuously marked on the pipe or spaced at intervals not exceeding 5 feet.

1. Name and/or trademark of the pipe manufacturer.
2. Nominal pipe size.
3. Standard Dimensional Ratio (SDR).
4. PE 3608 or PE 3408.
5. Manufacturer's Standard Reference.
6. A production code from which the date and place of manufacture can be determined.

2.2 FITTINGS

A. Provide fittings, manufactured from the same class of materials and fully compatible with the HDPE pipe.

B. Provide fittings manufactured in accordance with ASTM D3350 and ASTM D3261. Provide fabricated fittings with pressure ratings matching or exceeding the HDPE pipe.

PART 3 EXECUTION

3.1 PIPE INSTALLATION GENERAL REQUIREMENTS

A. When shipping, delivering, and installing pipe, fittings, and accessories, do so in such manner to ensure a sound, undamaged installation.

B. Provide adequate storage for all materials and equipment delivered to the job site.

C. Handle and store pipe and fittings in accordance with the Manufacturer's recommendations.

3.2 PLACING AND LAYING PIPE

A. On-grade LFG piping shall be graded to a minimum of 1% in the direction of gas flow and 3% against the direction of gas flow. Pipe grades not meeting the minimums as confirmed by as built surveying (by the owner) shall be regraded and resurveyed at the contractor's expense.

B. Provide required maintenance of all such materials and equipment used to handle, place, and lay pipe.

C. Piping installed on side slopes shall have a set of ¾ inch rebar pipe guides with plastic caps (one on each side of the pipe) every 15 feet unless otherwise indicated on plans.

D. For piping installed on decks and other relatively flat areas where necessary to meet minimum pipe grades. Surface grading shall be done and if necessary shall include the supply of clean soil, compaction of soil to 85% relative compaction, and blading with dozer or grader to achieve a 5 foot wide uniform pipe bed. The pipe shall be snaked to allow for up to two linear feet of pipe contraction per 100 feet of pipe. The pipe shall be anchored with earth at least every 50 feet by mounding approximately one cubic yard of earth on over the pipe.

E. Follow the Manufacturer's recommendations when hauling, unloading and stringing the pipe.

F. Take precautions to prevent damage to the pipe.

G. Do not push, pull, or drag pipe and fittings over sharp projections, or drop, or have objects dropped on the pipe and fittings.

H. Inspect for defects before and during installation. Remove any piping showing kinks, buckles, cuts, gouges, or any other damage, which in the opinion of the ENGINEER will affect performance of the pipe.

I. Replace material found to be defective before or after laying with sound material at no additional expense to the OWNER.

J. Remove all dirt, gravel, cobwebs, plastic shavings, and debris before and after placement. The pipe shall be clean prior to acceptance by the OWNER.

K. Carefully lower pipe and accessories into their final resting location and when moving them around the site.

L. Under no circumstances drop or dump materials onto the pipe.

M. Rest the full length of each section of pipe solidly upon the pipe bedding.

N. Take up or relay pipe that has had the grade disturbed while joining or laying the pipe.

3.3 JOINING PIPE

A. Join the HDPE pipe using the thermal butt fusion method or thermal coupling method, in accordance with the procedures established by the pipe MANUFACTURER.

B. Use fusion pressures, temperatures, and cycle times according to pipe MANUFUCTUERER'S recommendations.

C. The ends of the pipes to be joined shall be trimmed, ground, butted flush together and held in place such that the gap does not exceed 1/8 inch after coupling.

D. Only use personnel adequately trained and qualified in the technique involved.

E. Do not perform pipe joining (unless by mechanical means) in water or when conditions are unsuitable for the work.

F. Keep water out of the work area until joining is completed.

G. Secure open ends of pipe and close valves when work is not in progress, so that no water, earth, animals, or other substance will enter the pipe or fittings.

H. Plug, cap or valve off pipe ends left for future connections as shown on the Construction Drawings.

I. Clear and grade fusion welding sites, if necessary, to provide enough space for pipe storage and fusion equipment.

J. Keep the site free of rocks, stumps and debris which could cut, scar, or gouge the pipe.

K. Remove all dirt, gravel, cobwebs, plastic shavings, and debris before and after joining. The pipe shall be clean prior to acceptance by the OWNER.

L. When two pipes of different diameters must be joined, the CONTRACTOR shall join the pipe with an appropriate transition fitting. Transition fittings shall be beveled and reamed, if necessary, to provide a relatively smooth inner surface at the joint.

M. Backfill pipes with the materials (gravel, soil, etc.) shown on the Construction Drawings and in accordance with the appropriate section of these Specifications.

3.4 QUALITY CONTROL

A. For pressurized pipe, all joints shall undergo a pressure test at 5 psig for a minimum of 2 hours, with no more than 0.2 psig pressure drop within that time frame measured on a gauge reading 0 to 10 psig. A soap and water solution (leak detection fluid) must be applied to all joints and the joints inspected for leakage by the formation of bubbles at the point of leakage. All joints and connections shall be visually inspected for leaks after applying the leakage detecting fluid. Any leaks detected must be repaired even if the test meets the set requirements. They shall be identified and re-joined, followed by another pressure test until all joints pass the test. The pressure indicator shall be divided into increments not exceeding 0.2 psi.

B. Pressure tests shall be witnessed by the third party CQA Monitor and certified by the Contractor.

END OF SECTION

SECTION 02771

GEOTEXTILE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnishing and installation of geotextile.

1.2 RELATED SECTIONS

A. Section 02221 – Excavating and Stockpiling.

B. Section 02222 – Engineered Fill, Vegetative/Protective Cover and Backfill.

C. Section 02270 – Erosion and Sediment Control.

1.3 REFERENCES

~~A. GRI GT12(a) - Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials.~~

A. GRI GT13 - Test Methods and Properties for Geotextiles Used as Separation Between Subgrade Soil and Aggregate.

B. ASTM D885 - Methods for Testing Industrial Filament Yarns Made From Man-made Fibers.

C. ASTM D1777 - Method for Measuring Thickness of Textile Materials.

D. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water.

E. ASTM D4491 - Standard Test Method for Water Permeability of Geotextiles by Permittivity.

F. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

G. ASTM D4595 - Standard Test Method for Tensile Properties by the Wide-width Strip Method.

H. ASTM D4632 - Standard Test Method for Breaking Load and Elongation of Geotextiles (grab method).

I. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

I. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

J. ASTM D5216 - Standard Test Method for Mass Per Unit Area (weight) of Woven Fabric.

1.4 DEFINITIONS

A. MANUFACTURER: Responsible for the production of geotextile rolls.

B. INSTALLER: The party responsible for field handling, storing, deploying, repairing, anchoring, and any other aspects of installing the geotextile.

C. Construction Quality Assurance Consultant (CQAC): The party, independent from the manufacturer or installer, responsible for observing and documenting activities related to the quality assurance of the production and installation of the geosynthetic components of the geotextile. Also responsible for issuing a construction monitoring report, and certification sealed by a Registered Professional ENGINEER.

1.5 SUBMITTALS

A. Submit, prior to confirmation of OWNER-CONTRACTOR Agreement, samples and complete description of geotextile fabric proposed for use, that meets or exceeds the requirements of this section. Include certified minimum property values and test methods used to obtain property values. Also include production capacity available and projected delivery dates.

B. Submit, prior to installation, written instructions for storage, handling installation, and seaming of proposed geotextile.

C. Submit, prior to installation, written instructions for repair of geotextile.

D. Submit, prior to delivery, manufacturer's certificates of compliance with specified product requirements. This submittal includes Manufacturer's Quality Control (MQC) testing certificates notarized by responsible party. Include lot, batch, and roll numbers, sampling procedures, test procedures, and test results.(Refer to Part 2.4 of this section).

E. Warranty: Submit to OWNER prior to installation, manufacturers, and installer's written warranty against product and installation defects. Limits of liability must be accepted by the OWNER.

PART 2 PRODUCTS

2.1 GENERAL

A. Product comprised of a nonwoven, needlepunched polypropylene fabric; oriented into a stable network that maintains its structure during handling, placement, and long-term service.

B. Resistant to soil and leachate chemicals.

C. New product made from virgin materials.

2.2 GEOTEXTILE

A. Unless otherwise specified in the Construction Drawings, geotextile used for ~~cushioning and~~ filtration shall conform to the minimum average roll values (MARV), as defined in Table 02771-1.

TABLE 02771-1

GEOTEXTILE PROPERTIES

TEST	ASTM TEST DESIGNATION	UNIT	REQUIREMENT
Mass per Unit Area	D5261	oz/yd^2	>8
Grab Tensile	D4632	lbs	>200
Puncture Resistance	D4833	lbs	>100
Trapezoidal Tear	D4533	lbs	>80
Permittivity	D4491	s^{-1}	>1.2
Apparent Opening Size (AOS)	D4751	mm	0.18 to 0.21
UV Resistance	D4355	%	50@500 hrs

2.3 MANUFACTURER SOURCE QUALITY CONTROL

A. The MANUFACTURER shall sample and test the geotextiles at the frequencies shown in Table 02771-2. Test results shall demonstrate that the material conforms to all requirements in Part 2.2 of this Section, which shall be certified by the MANUFACTURER.

TABLE 02771-2

MANUFACTURER'S QUALITY CONTROL TESTING REQUIREMENTS

TEST	ASTM TEST DESIGNATION	FREQUENCY
Mass per Unit Area	D5261	1/roll
Grab Tensile	D4632	1/50,000 ft^2
Puncture Resistance	D4833	1/50,000 ft^2
Trapezoidal Tear	D4533	1/50,000 ft^2
Permittivity	D4491	1/50,000 ft^2
Apparent Opening Size (AOS)	D4751	1/50,000 ft^2
UV Resistance	D4355	1/250,000 ft^2

B. OWNER will reject rolls for which quality control requirements are not met.

C. Certify the quality of the rolls of geotextile.

D. Provide quality control certificates for each lot and each shift's production. The quality control certificates must include:

1. Roll numbers and identification.
2. Sampling procedures.
3. Results of quality control tests, including a description of test methods used.

2.4 LABELING

A. Mark or tag geotextile rolls with the following information:

1. Manufacturer's name.
2. Product identification.
3. Lot number or date.
4. Roll number.

5. Roll dimensions.

B. Mark special handling requirements on rolls.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to installation of geotextile, examine underlying construction for conformance with specifications.

3.2 PROTECTION

A. When placing soil materials over geotextile ensure the following:

1. No damage to geotextile.

2. No slippage of geotextile on underlying layers.

3. No excessive tensile stresses in the geotextile.

B. Ensure that geotextile filter is covered within 30 days.

3.3 DELIVERY, STORAGE, AND HANDLING

A. Protect geotextile from ultraviolet light exposure, precipitation, inundation, mud, dirt, dust, puncture, cutting, and other damaging or deleterious condition.

B. Ship geotextile in closed trailer.

C. Immediately restore damaged protective covering.

3.4 DEPLOYMENT

A. Follow Manufacturer's recommendations, standards, and guidelines.

B. Roll geotextile down slope keeping the geotextile sheet in sufficient tension to prevent folds and wrinkles.

C. Weight geotextile with sandbags, or equivalent, to ballast during deployment. Leave ballast in place until geotextile is covered with succeeding construction layer.

D. Cut geotextile using approved cutter only. Take care to protect other in-place geosynthetic materials when cutting geotextile.

E. Do not trap excessive dust, stones, or moisture in geotextile that could damage or clog drains or filters, or hamper subsequent seaming.

F. Examine geotextile over entire completed surface to ensure that no potentially harmful foreign objects, such as needles, are present. Remove any foreign objects.

3.5 SEAMS AND OVERLAPS

A. Overlap geotextile as required by the seaming technique and as recommended by Manufacturer prior to seaming.

B. For slopes steeper that 10 percent, sew all seams for geotextiles.

C. All seams shall be either "double prayer" or "single J" seam.

D. Ensure that no soil materials are inadvertently inserted beneath the seams of geotextiles.

E. For slopes less than 10 percent, geotextiles can be either sewn as indicated above, or heat welded.

F. Heat welded seaming shall be performed in a manner that does not damage the underlying geosynthetics and prevents burn-outs in the geotextile. All damaged geosynthetics and burn-outs shall be repaired as provided in these specifications.

G. Sew with polymeric thread having chemical resistance and strength properties equal to or exceeding those of the geotextile.

H. For sewing, use a 401 two-thread chain stitch, or equivalent.

3.6 REPAIRS

A. Repair holes, burn-outs or tears in geotextiles with a patch from the same geotextile material, by sewing or heat welding (as described above) in place with a minimum seam overlap of 12 inches in all directions.

B. Sew the geotextile within 1 inch of the outside edge of the patch materials.

C. If a tear exceeds 50 percent of the roll width, remove and replace the roll.

D. No patches will be allowed within 1 inch of a panel edge.

E. Remove any soil or other material which may have penetrated the torn geotextile.

F. Notify OWNER and CQA Consultant of all repairs.

3.7 QUALITY ASSURANCE

A. Samples of geotextile shall be collected by the CQA Consultant for conformance testing by a third party laboratory in accordance with the CQA Plan.

B. Samples will be taken across the entire width excluding the first 3 feet of the roll unless otherwise approved. Sample size will be 3 feet long by the roll width.

C. The CQA consultant shall observe all repair operations.

3.8 ACCEPTANCE

A. CONTRACTOR retains all responsibility for geotextiles until acceptance by OWNER.

B. OWNER accepts installed geotextiles when all the following have been completed:

1. The installation is complete.

2. Conformance tests verify product requirements.

3. Documentation of installation is complete including the CQA consultant's final report.

4. Verification of the adequacy of all seams and repairs, including associated testing, is complete.

5. Written certification documents have been received by the OWNER.

END OF SECTION

SECTION 02774

DRAINAGE GEOCOMPOSITE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnishing all labor, materials and equipment necessary for installing the Drainage Geocomposite for the site in accordance with the Specifications and the Construction Drawings.

B. Geocomposite described in this section will be geonet with geotextile heat bonded on two sides prior to delivery to the site. This combination, which is pre-fabricated in the plant prior to shipment to the site, is termed as Double-Sided Drainage Geocomposite.

1.2 RELATED SECTIONS

A. Section 02222 - Engineered Fill, Vegetative/Protective Cover and Backfill.

B. Section 02710 - Polyethylene Pipe.

C. Section 02771 - Geotextile.

D. Section 02778 - HDPE Geomembrane.

1.3 REFERENCES

A. GRI GC7 - Standard Guide for the Determination of Adhesion and Bond Strength of Geocomposites.

B. ASTM D792 - Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

C. ASTM D1603 - Standard Test Method for Carbon Black in Olefin Plastics.

D. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

E. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

F. ASTM D4716 - Standard Test Method for Constant Head Hydraulic Transmissivity of Geotextiles and Geotextile Related Products.

G. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

H. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

I. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

J. ASTM D5035 - Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Strip Method).

K. ASTM D5199 - Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.

L. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

1.4 DEFINITIONS

A. Batch: A quantity of resin, usually the capacity of one railcar, used in the fabrication of high density polyethylene (HDPE) geocomposite. A roll number corresponding to the particular quantity of resin used will identify the finished product.

B. Construction Quality Assurance Consultant (CQAC): The party, independent from MANUFACTURER or INSTALLER, that is responsible for observing and documenting activities related to the quality assurance of production and installation of the geosynthetic components of the lining system.

C. Construction Quality Assurance (CQA) Laboratory: The party, independent from the OWNER, MANUFACTURER, Fabricator, and INSTALLER, responsible for conducting tests on samples of geosynthetics obtained at the site.

D. Construction Quality Assurance (CQA) Monitor: The site representative of the CQAC.

E. Fabricator: The party responsible for the fabrication of geocomposite panels constructed from rolls received from the MANUFACTURER.

F. Geocomposite MANUFACTURER: The party responsible for the production of the geocomposite rolls from resin and for the quality control of the resin.

G. Geocomposite Subsurface: The surface on which the geocomposite lies.

H. INSTALLER: The party responsible for field handling, transporting, storing, deploying, seaming, temporarily restraining (against wind), and installing the geocomposite.

1.5 SUBMITTALS

A. Product Data: Submit the following to the OWNER prior to confirmation of OWNER CONTRACTOR Agreement.

1. Resin Data.

   a. Statement of production date or dates.

   b. Certification stating that the geonet resin meets the product requirements (see Paragraph 2.3).

   c. Certification stating that all resin is from the same MANUFACTURER.

   d. Copy of quality control certificates issued by MANUFACTURER.

   e. Test reports from MANUFACTURER.

2. Geocomposite Rolls.

   a. Statement of production date or dates, and MANUFACTURER's certificates for each day's production.

   b. Laboratory test results and certification stating that the geocomposite meets the product requirements of Part 2.

   c. Certification stating that all geocomposite rolls are furnished by one supplier, and that all rolls are manufactured from one resin type obtained from one resin supplier.

   d. Copy of quality control certificates issued by THE MANUFACTURER including designation of test methods used. Also include roll numbers, batch numbers, lot numbers, and roll identification.

   e. Test reports from the MANUFACTURER.

   f. Geocomposite delivery, storage, and handling instructions.

   g. Geocomposite installation instructions.

1.6 QUALIFICATIONS

A. MANUFACTURER/Fabricator/Installation Qualifications

B. INSTALLER: Must have successfully installed a minimum of 1,000,000 square feet of drainage geocomposite with documented references.

1.7 QUALITY ASSURANCE

A. The OWNER will engage and pay for the services of (1) Construction Quality Assurance Consultant (CQAC), and (2) Construction Quality Assurance (CQA) Laboratory for monitoring the quality of the geocomposite.

1.8 DELIVERY, STORAGE, AND HANDLING (MANUFACTURER)

A. General: Conform to the MANUFACTURER's requirements.

B. Delivery.

1. GEOSYNTHETICS CONTRACTOR shall obtain OWNER concurrence that the interface shear testing for the Geomembrane/Geocomposite interface conforms with project requirements prior to shipping geocomposite material to the project site. Deliver materials to the site only after the OWNER accepts the required submittals.

2. Separate damaged rolls from undamaged rolls and store at locations designated by the OWNER until OWNER determines proper disposition of material.

3. OWNER will determine if rolls are considered damaged.

4. Deliver in rolls, do not fold.

C. Storage on Site: (INSTALLER).

1. Store geocomposite rolls in the space allocated by the OWNER.

2. Store geocomposite rolls to protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage.

3. Store geocomposite rolls on prepared surface (not on wooden pallets).

4. Stack geocomposite rolls as per the manufacturer's recommendation.

D. Handling on Site: (INSTALLER).

1. Use appropriate handling equipment to load, move, and deploy geocomposite rolls. Appropriate handling equipment includes cloth chokers and spreader bars for loading, and spreader and roll bars for deployment. Dragging panels on the ground surface will not be permitted.

2. Do not fold geocomposite; folded material will be rejected.

3. CONTRACTOR is responsible for off loading, storage, and transporting material from storage area to installation site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Submit substitutions in accordance with Section 01630, Product Options and Substitutions.

2.2 GEOCOMPOSITE LABELING

A. Provide the following information on the geocomposite roll labels:

1. Length, width, and weight.

2. Name of MANUFACTURER and Fabricator.

3. Directions for unrolling.

4. Product identification; lot number, batch number, and roll number.

2.3 GEONET

A. The resin shall be first quality High Density Polyethylene (HDPE), manufactured specifically for producing geonet for use in drainage systems. Mixing of different resin types, recycled materials, or seconds will not be allowed.

B. The geonet shall meet the requirements as described in Table 02774-1.

2.4 GEOTEXTILE

A. Geotextile used for filtration conforming to the following minimum average roll values (MARV) as defined by the Federal Highway Administration.

B. The geotextile shall meet the requirements as described in Table 02774-1.

2.5 GEOCOMPOSITE

A. Geonet shall be heat bonded to two layers of geotextile, one on each side.

B. No delamination (separation between the geonet and geotextile) greater than 6-square inch area within a 6 foot radius of any point shall be allowed.

C. Unlaminated edge: 12 inch MAXIMUM allowable.

D. The geocomposite shall meet the requirements as described in Table 02774-1.

TABLE 02774-1

GEOCOMPOSITE PROPERTIES

PHYSICAL PROPERTIES	UNITS	ASTM TEST METHOD	REQUIRED VALUE	QUALIFIER
Geonet				
Thickness	mil	D5199	250	Minimum
Tensile Strength	lb/in	D 5035	45	Minimum
Hydraulic Transmissivity	m^2/sec.	D 4716	4×10^{-3}	MARV(1)
Geotextile				
Mass Per Unit Area	oz/yd^2	D 5261	6	MARV
Grab Strength	lbs.	D 4632	160	MARV
Grab Elongation	%	D 4632	50	MARV
Permittivity	sec^{-1}	D 4491	1.6	MARV
Apparent Opening Size (AOS)	mm	D 4751	0.18 to 0.21	Range
Composite				
Ply Adhesion (Minimum)	lb/in	D 7005	0.5	MARV
Ply Adhesion (Average)	lb/in	D 7005	1	MARV
Hydraulic Transmissivity(2)	m^2/sec.	D 4716	8×10^{-4}	MARV

Notes:

1. MARV is statistically defined as mean minus two standard deviations and it is the value exceeded by 97.5% of all the test data.
2. Geocomposite measured at a load of 200 psf and a gradient of 0.5 sandwiched between a bottom layer of 60-mil LLDPE geomembrane and a top layer of sand.

2.6 MANUFACTURER SOURCE QUALITY CONTROL

A. Perform the following quality control tests at the manufacturing plant or other laboratories on geonet, geotextile, and geocomposite products:

TABLE 02774-2

MANUFACTURER'S QUALITY CONTROL TESTING REQUIREMENTS

TEST	TEST DESIGNATION	FREQUENCY (SEE FOOTNOTES)
Geonet		
Thickness	ASTM D5199	(2)
Tensile Strength	ASTM D5035	(2)
Hydraulic Transmissivity	ASTM D4716	(1)
Geotextile		
Mass per Unit Area	ASTM D5261	(2)
Grab Tensile and Elongation	ASTM D4632	(2)
Permittivity	ASTM D4491	(1)
Apparent Opening Size	ASTM D4751	(1)
Geocomposite		
Ply Adhesion	GRI GC7	(2)
Hydraulic Transmissivity	ASTM D4716	(1)

Notes:

(1) One per 500,000 square feet produced or one per resin batch, whichever results in the greatest number of tests.

(2) One per 50,000 square feet produced or one per resin batch, whichever results in the greatest number of tests.

PART 3 EXECUTION

3.1 PREPARATION

A. After the CQA Consultant and the OWNER approve the geocomposite, it shall be placed over the geomembrane as shown on the Drawings.

B. Installation shall be in accordance with the MANUFACTURER's instructions and these Specifications. Where a conflict arises, these Specifications will prevail.

3.2 GEOCOMPOSITE INSTALLATION

A. Deployment.

1. Daily Panel Deployment: Deploy no more panels in one shift than can be secured during that same shift.

2. Do not damage geocomposite by handling, by trafficking, leakage of hydrocarbons, or any other means.

3. Unroll geocomposite panels using methods that will not damage, stretch or crimp geocomposite. Protect underlying surface from damage.

4. Do not allow any vehicular traffic directly on geocomposite.

5. Visually inspect geocomposite for imperfections. Mark faulty or suspect areas for repair.

B. Connections (net) shall be overlapped a minimum of 6 inches along the length and one foot along the width.

C. Connections (net) shall be made using nylon ties secured at 3 foot intervals along the length and 1 foot centers along the width.

D. Edge of geotextile shall be sewn for the entire length of geotextile. No geonet shall be exposed.

E. Defects and Repairs.

1. Examine areas of the geocomposite for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geocomposite must be clean at the time of the examination.

2. Damaged geocomposite shall be removed and repaired according to Part 3.3 of this Section.

3.3 REPAIR PROCEDURES

A. Remove damaged geocomposite and replace with acceptable geocomposite materials if damage cannot be satisfactorily repaired.

B. Repair, removal, and replacement are at CONTRACTOR's expense if the damage results from the CONTRACTOR's, INSTALLER's, or the CONTRACTOR's subcontractor activities.

C. Repair any portion of the geocomposite exhibiting a flaw. Agreement upon the appropriate repair method will be determined between the OWNER's Representative, the CQAC and the INSTALLER. Repair procedures available include:

1. Patching: Used to repair large holes, tears, by overlapping geocomposite 6 inches in all directions and tying.

3.4 QUALITY CONTROL AND CONSTRUCTION QUALITY ASSURANCE

A. MANUFACTURER, Fabricator, INSTALLER, and CONTRACTOR, will participate and conform with all terms and requirements of the Owners construction quality assurance program. The CONTRACTOR is responsible for assuring this participation.

B. Field construction quality control and construction quality assurance (CQA) requirements shall be performed as specified in the CQA Plan.

C. The OWNER may perform additional testing to determine the conformance of the materials with these Specifications and the Construction Drawings.

3.5 GEOCOMPOSITE ACCEPTANCE

A. CONTRACTOR retains all ownership and responsibility for the geocomposite until acceptance by the OWNER.

B. OWNER will accept geocomposite installation when:

1. All required documentation from the MANUFACTURER, FABRICATOR, and INSTALLER has been received and accepted.

2. The installation is finished.

END OF SECTION

SECTION 02778

LLDPE GEOMEMBRANE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section includes furnishing and installing the 60-mil double-side textured black liner low density polyethylene (LLDPE) geomembrane for the moisture barrier and composite liner system in accordance with the Specifications and the Drawings.

1.2 RELATED SECTIONS

A. Section 02221 - Excavating and Stockpiling.

B. Section 02222 – Engineered Fill, Vegetative/Protective Cover and Backfill.

C. Section 02223 – Subgrade Preparation.

D. Section 02227- LCRS Drainage Gravel.

E. Section 02228 - Engineered Fill.

F. Section 02771 - Geotextile.

1.3 REFERENCES

A. GRI-GM11 - Accelerated Weathering of Geomembranes using a Fluorescent UVA Condensation.

B. GRI-GM12 - Standard Specification for Asperity Measurement of Textured Geomembranes using a Depth Gage.

C. GRI-GM13 - Standard Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.

D. ASTM D792 - Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement.

E. ASTM D1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.

F. ASTM D1505 - Standard Test Method for Density of Plastics by the Density Gradient Technique.

G. ASTM D1603 - Standard Test Method for Carbon Black in Olefin Plastics.

H. ASTM D3895 - Standard Test Method for Copper Induced Oxidative Induction Time of Polyolefins by Thermal Analysis.

I. ASTM D4833 - Standard Test Method for Index Puncture of Geotextiles, Geomembranes, and Related Products.

J. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

K. ASTM D5199 - Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.

L. ASTM D5397 - Standard Test Method for Evaluation of Stress Crack of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.

M. ASTM D5596 - Standard Test Method for Microscopic Evaluation of Dispersion of Carbon Black in Polyolefin Geosynthetics.

N. ASTM D5617 - Standard Test Method for Multi-Axial Tension Test for Geosynthetics.

O. ASTM D5885 - Standard Test Method for Oxidation Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry.

P. ASTM D5994 - Standard Test Method for Measuring Core Thickness of Textured Geomembranes.

Q. ASTM D6243 - Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method.

R. ASTM D6392 - Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

S. ASTM D6693 - Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.

1.4 DEFINITIONS

A. Batch: A quantity of resin, usually the capacity of one rail car, used in the manufacture of linear low density polyethylene (LLDPE) geomembrane sheet. A roll number corresponding to the particular lot of resin used will identify the finished sheet.

B. Bridging: The condition when geomembrane becomes suspended over its subgrade due to contraction of the material or poor installation.

C. Construction Quality Assurance Consultant (CQAC): The party, independent from MANUFACTURER or INSTALLER, that is responsible for observing and documenting activities related to the quality assurance of production and installation of the geosynthetic components of the lining system.

D. Construction Quality Assurance (CQA) Laboratory: The party, independent from the OWNER, MANUFACTURER, Fabricator, and INSTALLER, responsible for conducting tests on samples of geosynthetics obtained at the site.

E. Construction Quality Assurance (CQA) Monitor: The site representative of the CQAC.

F. Extrudate: The molten polymer that is emitted from an extruder during seaming using either extrusion fillet or extrusion flat methods. The polymer is initially in the form of a ribbon rod, bead or pellets.

G. Fabricator: The party responsible for the fabrication of geomembrane panels constructed from rolls received from the MANUFACTURER.

H. Geomembrane MANUFACTURER: The party responsible for the production of the geomembrane rolls from resin and for the quality of the resin.

I. Geomembrane: An essentially impermeable membrane used as a solid or liquid barrier. Synonymous term for flexible membrane liner (FML).

J. Geomembrane Subsurface: The soil or geosynthetic surface on which the geomembrane lies.

K. INSTALLER: The party responsible for field handling, transporting, storing, deploying, seaming, temporary restraining (against wind), and installation of the geomembrane.

L. Panel: The unit area of geomembrane that will be seamed in the field. A panel is identified as a roll or portion of a roll without any seams.

1.5 PRE-CONSTRUCTION SUBMITTALS (MANUFACTURER AND INSTALLER)

A. Submit the following to the OWNER, 7 days prior to receiving material at the site.

B. Resin Data. (MANUFACTURER)

1. Statement of production date or dates.

2. Certification stating that the resin meets the product requirements (see Part 2.2).

3. Certification stating that all resin is from the same MANUFACTURER.

4. Copy of quality control certificates issued by MANUFACTURER.

5. Test reports from MANUFACTURER.

C. Geomembrane Roll. (MANUFACTURER)

1. Statement of production date or dates.

2. Laboratory test results and certification stating that the geomembrane meets the product requirements in the CQA Plan.

3. Certification stating that all geomembrane rolls are furnished by one supplier, and that all rolls are manufactured from one resin type obtained from one resin supplier.

4. Copy of the quality control certificates issued by MANUFACTURER.

5. Test reports from the MANUFACTURER.

6. Statement certifying that no reclaimed polymer is added to the resin.

7. Statement listing percentages of processing aids, antioxidants, and other additives other than carbon black added to or in the resin.

8. Geomembrane delivery, storage, and handling instructions.

9. Geomembrane installation instructions.

10. Sample warranties for review.

D. Extrudate Beads and/or Rod. (MANUFACTURER)

1. Statement of the production date or dates.

2. Laboratory certification stating that the extrudate meets the product requirements.

3. Certification stating that one MANUFACTURER manufactures all extrudate and one supplier supplies the resin.

4. Copy of the quality control certificates issued by MANUFACTURER.

5. Test reports from the MANUFACTURER.

6. Certification stating that the extrudate bead or rod resin is the same type, from the same MANUFACTURER and compatible with the resin used to manufacture the geomembrane supplied for this project.

E. Schedules and drawings (INSTALLER).

1. Work schedule: Submit the installation schedule one week prior to installation. Include hours worked per day, per week and per shift. Indicate all weather delays built into schedule.

2. Installation layout drawings: Two weeks prior to installation of the geomembrane, submit drawings showing the panel layout indicating both fabricated (if applicable) and field seams, and details not conforming to the Drawings. Upon acceptance, use these drawings for installation of geomembrane.

F. Qualifications (INSTALLER).

1. Submit, two weeks prior to installation, the name of INSTALLER, and resume of installation supervisor/field ENGINEER to be assigned to the project.

2. Submit, two weeks prior to installation, resume of master seamer(s).

G. Equipment and Personnel: Submit the following two weeks prior to installation: (INSTALLER).

1. Equipment list stating quantity and types.

2. List of personnel to perform field seaming operations.

1.6 SUBMITTALS DURING CONSTRUCTION (INSTALLER)

A. Submit quality control documentation prepared during the installation.

B. Submit daily prior to the start of installation, subgrade acceptance certificate signed by the installation supervisor for each area to be covered by geosynthetics.

1.7 SUBMIT UPON COMPLETION OF THE INSTALLATION (INSTALLER)

A. Certificate stating the liner has been installed in accordance with the Construction Drawings and Specifications.

B. The warranty obtained from the MANUFACTURER/Fabricator and the installation warranty.

C. As built drawings showing location of panels, seams, repairs, patches, and destructive samples, including measurements.

D. Copies of seam test results and statistical analysis of each welder's performance.

1.8 QUALIFICATIONS

A. MANUFACTURER/Fabricator/Installation Firm.

1. GSE, Inc., 19103 Gundle Road, Houston, Texas 77073, (800) 435-2008.

2. AGRU/America, Inc., 600 Rockmead, Suite 300, Kingwood, Texas 77339, (800) 373-2478.

B. INSTALLER: Must have successfully installed a minimum of 10,000,000 square feet of welded polyethylene geomembrane with documented references.

C. Master Welder Qualifications: Must have completed a minimum of 5,000,000 square feet of polyethylene geomembrane seaming work using the type of seaming apparatus proposed for use on this project.

D. Other Seamer's Qualifications: Must have seamed a minimum of 1,000,000 square feet of LLDPE geomembrane.

1.9 QUALITY ASSURANCE

A. The OWNER will engage and pay for the services of (1) Construction Quality Assurance Consultant (CQAC), and (2) Construction Quality Assurance (CQA) Laboratory for monitoring the quality and installation of geomembrane material being installed unless otherwise specified.

1.10 DELIVERY, STORAGE, AND HANDLING (MANUFACTURER)

A. General: Conform to the MANUFACTURER's requirements.

B. Delivery.

1. Deliver materials to the site only after the OWNER accepts required submittals.

2. Separate damaged rolls from undamaged rolls and store at locations designated by the OWNER until OWNER determines proper disposition of material.

3. OWNER will determine the extent of damage to geomembrane.

4. Deliver in rolls, do not fold.

C. Storage on Site: (INSTALLER).

1. Store geomembrane rolls in the space allocated by the OWNER.

2. Store geomembrane rolls to protect from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat or other damage.

3. Store geomembrane rolls on prepared surface (not on wooden pallets).

4. Stack geomembrane no more than three rolls high.

D. Handling on Site: (INSTALLER).

1. Use appropriate handling equipment to load, move, or deploy geomembrane rolls. Appropriate handling equipment includes cloth chokers and spreader bar for loading, spreader, and roll bars for deployment. Dragging panels on ground surface will not be permitted.

2. Do not fold geomembrane material; folded material will be rejected.

3. CONTRACTOR is responsible for off loading, storage, and transporting material from storage area to installation site.

1.11 WARRANTY (MANUFACTURER)

A. Provide MANUFACTURER's warranty for geomembrane material in compliance with provisions of the Conditions of the Contract. Provide a minimum 20 year pro rata warranty for the material against deterioration due to exposure to the elements, either exposed or buried. The warranty for material must cover costs of material replacement and installation; assuming the area is rendered in a clean, dry, unencumbered condition. In the event the area cannot be rendered as such, compensation for defective material will be provided to the OWNER on a pro rata basis for the estimated cost to the OWNER at that time of supplying and installing material to a clean, dry, and unencumbered condition by a third party INSTALLER.

B. Installation: Provide an installation warranty for geomembrane material in compliance with the conditions of the Contract. Provide a minimum of 2 year, non-pro rata warranty for the installation against defects.

PART 2 PRODUCTS (MANUFACTURER)

2.1 PRE-APPROVED MANUFACTURER

A. GSE, Inc., 19103 Gundle Road, Houston, Texas.

B. AGRU/America, Inc., 600 Rockmead, Suite 300, Kingwood, Texas 77339, (800) 373-2478.

2.2 GEOMEMBRANE RESIN

A. Linear Low Density Polyethylene (LLDPE), new, first quality, and manufactured specifically for producing LLDPE geomembrane.

B. Do not mix resin types during manufacturing.

C. Do not use recycled materials or seconds in manufacturing.

D. Meeting the following requirements unless otherwise approved:

TABLE 02778-1

LLDPE RESIN PROPERTIES

TEST	TEST DESIGNATION	REQUIREMENT
Density(1)	ASTM D792 Method A or ASTM D 1505	0.92 to 0.93 g/cm^3

Notes:
1. Measured on resin prior to addition of carbon black. Maximum of 0.939 g/cm^3 with carbon black.

2.3 LINEAR LOW DENSITY POLYETHYLENE (LLDPE) DOUBLE-SIDE TEXTURED GEOMEMBRANES

A. Manufacturing.

1. The resin supplied for the geomembrane will consist of compounded polyethylene specifically produced for geomembrane production and shall not include pipe resin or other resins not formulated for hydraulic containment. No recycled polymers or polymers mixed with other types of resin shall be accepted unless the recycling program has been approved the plant inspected by the ENGINEER.

2. Use only resins and additives produced in the United States, Canada or Western Europe from approved suppliers and manufacturers. All resin, masterbatch, anti-oxidant and other additives, as well as the complete formulation, to be approved by the ENGINEER

3. The base resin is to be pure material with no modifications. Factory blending of resins will only be allowed if the facility has been inspected and approved by the ENGINEER and in which case only when fully automated batching and control systems are used.

4. All resin for each type of geomembrane shall be manufactured by one single MANUFACTURER, and supplied by one single supplier. Each type of additive will also be manufactured and supplied by one single supplier.

5. The additive package, at a minimum, must include: carbon black, antioxidants and a HALS component. Non-slip agents shall not be used. The total combined percentage for all the additives, including carbon black, antioxidants, HALS, and others, shall be less than 3.5% of the geomembrane weight. From this 3.5%, no more than 1% shall correspond to additives other than carbon black.

6. All the additives shall be uniformly dispersed throughout the geomembrane. Additives shall not be extractable under water by leaching. There shall be no visual streaking or variation in additive distribution or dispersion.

7. Do not exceed a combined maximum total of 1 percent by weight of additives other than carbon black or pigment.

8. The geomembrane shall be produced in rolls, and shall be free of holes, bumps, and not dispersed material, cuts, bents, and any other signs of foreign material. Every roll shall be identified with labels that supply information as to the thickness, length, width, roll number, and plant location.

10. The MANUFACTURER shall carry out laboratory tests on the geomembrane's quality control, in the frequency indicated in the CQA Plan.

11. The 60-mil LLDPE double-sided textured geomembrane shall meet the minimum requirements of Table 02778-2.

12. In addition to the requirements of Table 02778-2, the LLDPE geomembrane shall have an interface friction between the

geomembrane and geocomposite that has a minimum post-peak strength of 17 degrees and an adhesion of 50 psf. The interface friction angle shall be measured in accordance with Part 2.7 of these specifications. The geocomposite shall be as per Section 02774 – Drainage Geocomposite.

2.4 EXTRUDATE ROD OR BEAD

A. Meeting the geomembrane MANUFACTURER requirements and using the same base resin as the geomembrane.

B. Made from same resin as the geomembrane.

C. Thoroughly disperse additives throughout rod or bead.

D. Containing 2 to 3 percent carbon black.

E. Free of contamination by moisture or foreign matter.

2.5 WELDING EQUIPMENT FOR INSTALLATION

A. Maintain sufficient operational seaming apparatus to continue work without delay.

B. Use power source capable of providing constant voltage under combined line load.

C. Provide protective lining and splash pad large enough to catch spilled fuel under electric generator, if located on liner.

D. Tensiometers capable of measuring seam strength, calibrated and accurate within 2 pounds.

E. Dies for cutting seam samples.

TABLE 02778-2

PROPERTIES FOR 60 MIL TEXTURED DOUBLE-SIDED LLDPE GEOMEMBRANE[1]

PHYSICAL CHARACTERISTIC	UNITS	ASTM TEST METHOD	REQUIRMENT
Thickness (nominal)	mil	D5994	60 mils minus 10% for any measurement and the average of all measurements for any roll, not less than 60 mils (does not include textured surface)
Density	g/cc	D1505	<0.939
Asperity Height	mil	D7466	20 mils (8 of 10 readings ≥20 mils, and lowest individual reading ≥ 16 mils)
Tensile Strength at Break	lb/in	D6693	>90
Elongation at Break	%	D6693	>250
Tear Resistance	lb	D5884	>33
Puncture Resistance	lb	D4833	>66
Carbon Black Content	%	D4218	2.0-3.0
Carbon Black Dispersion	Category	D5596	9 of 10 different views in Categories 1 or 2, and 1 of 10 in Category 3.
HP-OIT	hours	D7238	≥400
UV Resistance[2]	% retained	GRI-GM 11	Min. Avg. 35% @1600 hrs.

Notes:

1. Requirements for LLDPE -Geocomposite interface strength testing is provided in Part 2.7 of Section 02778 of these specifications.
2. UV resistance is based on percent retained value regardless of the original HP-OIT value.

2.6 MANUFACTURER SOURCE QUALITY CONTROL

A. The Manufacturer shall perform source quality control testing on the geomembrane at the manufacturing plant as indicated on Table 02778-3.

TABLE 02778-3

MANUFACTURING LLDPE GEOMEMBRANE QUALITY CONTROL TESTS

TEST	ASTM TEST METHOD	MINIMUM FREQUENCY
Sheet Thickness	D5994	1 per roll
Asperity Height	D7466	1 per roll
Density	D1505	See Note 2
Tensile Strength at Break	D6693	See Note 1
Elongation at Break	D6693	See Note 1
Tear Resistance	D1004	See Note 1
Puncture Resistance	D4833	See Note 1
Carbon Black Content	D4218	See Note 1
Carbon Black Dispersion	D5596	See Note 1

Notes:
1. One per 50,000 square feet of sheet produced, or one per resin batch, whichever results in the greatest number of tests.
2. One test per resin batch on typical sheet.

B. The objective of the MANUFACTURER's source quality control testing shall be to confirm the MANUFACTURER's published material characteristics and demonstrate the materials compliance with this Specification.

C. The MANUFACTURER shall reject rolls for which quality control requirements are not met.

D. The MANUFACTURER shall certify the quality of all rolls of geomembrane shipped to the site.

E. The CONTRACTOR shall provide the results of the MANUFACTURER's source quality control tests to the CQA Consultant for all rolls of geomembrane shipped to site.

2.7 SHEAR STRENGTH TESTING REQUIREMENTS

A. Upon award of the contract, the MANUFACTURER and/or INSTALLER shall provide to the third-party laboratory a minimum 3-foot by the roll width sample of the geomembrane and drainage geocomposite for the project for testing of the interface strength between the overlying geocomposite in contact with the geomembrane for the project.

B. The following interface shall be tested for the project: 60-mil textured LLDPE geomembrane in contact with the drainage geocomposite – both surfaces of the geomembrane shall be tested.

C. Prior to performing the shear testing, the third party laboratory shall sample and test textured geomembrane for asperity height in accordance with this specification, and geocomposite ply adhesion, in accordance with Section 02773.

D. The testing of the interfaces shall be performed by the third party laboratory in general accordance with ASTM D5321 using properly calibrated equipment and shall incorporate the following test requirements unless otherwise approved by the CQA Consultant.

1. Interface strength shall be determined using 3 test specimens tested under 3 normal loads of 100 psf, 300 psf, and 500 psf. These normal loads shall be used for the consolidation loading.
2. The test against the geocomposite material shall be set up with the geomembrane clamped to the upper box and the geocomposite securely clamped in the bottom box of the direct shear apparatus.
3. All specimens shall be tested in a flooded condition.
4. Flooding shall be performed immediately after the placement of the initial consolidating load and shall be maintained throughout the specimen consolidation and testing period.
5. Each specimen shall be sheared at a strain rate of 0.4 inches per minute.
6. The shear load and the shear displacement shall be logged continuously throughout the duration of the test.
7. Each test shall be terminated after 3 inches of displacement. Note if the test was terminated for any cause prior to reaching the 3-inch requirement.

8. At the completion of the test, photograph or otherwise record the location where shearing occurred, and the general conditions of the samples.

9. The results of the test shall be reported in graphical and tabular forms including:

   a. shear force versus shear displacement curves for all normal loads;

   b. peak and post-peak or residual (at 3 inches shear displacement) shear strengths versus normal stress curves;

   c. best-fit straight lines to the shear versus normal stress curves;

   d. actual values of normal stresses along with peak and post-peak shear strengths for each normal load; and

   e. friction angle and adhesion determined from the best fits to peak and post-peak shear strengths versus normal stress curves.

PART 3 EXECUTION (INSTALLER)

3.1 EXAMINATION OF GEOMEMBRANE SUBSURFACE

A. Verify that the liner subgrade has been prepared in accordance with Section 02223 and approved prior to placement of the 60-mil LLDPE geomembrane.

3.2 PREPARATION

A. Repair damage caused to the underlying materials during deployment.

B. Round edges of anchor trenches.

3.3 PERFORM TRIAL SEAM WELDS AS FOLLOWS:

A. Perform trial welds on samples of geomembrane to verify the performance of welding equipment, seaming methods, and conditions.

B. No seaming equipment or welder will be allowed to perform production welds until equipment and welders have successfully completed trial weld.

C. Frequency of trial welds:

   1. Minimum of two trial welds per day per equipment and welder, with one prior to the start of work and one at mid shift.

2. When directed by the CQA Monitor.

3. Every two hours when using a wedge weld to weld across seams.

4. Minimum one trial weld per person per shift.

5. When ambient temperature changes more than 20°F since previous trial weld.

D. Make trial welds in the same surroundings and environmental conditions as the production welds, i.e., in contact with subgrade.

E. Make trial weld sample at least 2 feet long, 3 feet long for double wedge welding machines and 12 inches wide with the seam centered lengthwise.

F. Cut four, one-inch wide test strips randomly selected across the length of the trial weld. Test specimens for peel adhesion and for bonded seam strength (shear) (ASTM D6392).

G. A specimen is considered passing when the following results are achieved. For double wedge welding, both welds must pass in peel and shear.

1. The break is a film tear bond (FTB).

2. The break is ductile.

3. The peel strength is a minimum of 70 percent of the specified sheet strength at yield for wedge welds or flat welds and a minimum of 60 percent of the specified sheet strength at yield for extrusion welds.

4. There is no more than 10 percent separation of the weld. For wedge welds, the width of the weld must be equal to the width of the nip roller.

5. The shear strength is 90 percent of the specified sheet strength at yield for all weld types. Minimum elongation between the grips is 2 inches based on an initial grip separation of 2 inches from the edge of the weld.

H. A trial weld sample is considered passing when all specimens pass peel and shear tests.

I. Repeat the trial weld in its entirety when any of the trial weld samples fail in either peel or shear.

J. When repeated trial welds fail, do not use welding apparatus and welder until deficiencies or conditions are corrected and two consecutive successful trial welds are achieved.

3.4 DEPLOYMENT

A. Ambient Conditions: Give careful consideration to the timing and temperature during deployment. The CQA organization will focus on verifying that (a) there is no bridging or stresses in the geomembrane and (b) there are no wrinkles in the geomembrane that will fold over when covering with soil material. Ideally, deployment, welding, and covering would all occur at the same temperature. In a practical sense the CONTRACTOR should strive to perform these activities within as narrow a temperature range as practical, and avoid these activities during peak hot or cold conditions.

B. Panel Identification: Assign each panel an identifying code number or letter consistent with the CONTRACTOR's submitted panel layout drawing. The coding is subject to approval by the CQA Monitor. The installer is responsible to place the identification code on the installed liner that consists of panel number, roll number, and panel length.

C. Daily Panel Deployment: Deploy no more panels in one shift than can be welded or secured during that same day.

D. Do not deploy in the presence of excessive moisture, precipitation, ponded water, or high winds.

E. Do not damage geomembrane by handling, by trafficking, or leakage of hydrocarbons or any other means.

F. Do not wear damaging shoes or engage in activities that could damage the geomembrane.

G. Unroll geomembrane panels using methods that will not damage, stretch or crimp geomembrane. Protect underlying surface from damage.

H. Use methods that minimize wrinkles and differential wrinkles between adjacent panels.

I. Place ballast on geomembrane to prevent uplift from wind.

J. Use ballast that will not damage geomembrane, such as sandbags or equivalent.

K. Protect the geomembrane in areas of equipment or repeated foot traffic by placing protective cover that is compatible with and will not damage geomembrane.

L. Repair damage to the subgrade or other underlying materials prior to completing deployment of the geomembrane.

M. Do not allow any vehicular traffic directly on unprotected geomembrane.

N. Remove wrinkled or folded material.

O. Visually inspect geomembrane for imperfections. Mark faulty or suspect areas for repair.

P. Install material to account for shrinkage and contraction while avoiding wrinkles. Install material stress-free with no bridging before it is covered. Add material, such as compensation wrinkles at the toe of slopes, as needed to avoid bridging.

Q. Before wrinkles fold over, attempt to push them out. For wrinkles that cannot be pushed out, cut them out and repair cuts prior to burial or at the direction of the OWNER.

3.5 SEAM LAYOUT

A. Orient seams parallel to the line of maximum slope, i.e., orient down not across slopes.

B. Minimize the number of field seams in corners, odd shaped geometric locations, and outside corners.

C. Keep horizontal seams (seams running approximately parallel to slope contours) at least 6 feet away from toe or crest of slopes unless otherwise approved by the OWNER.

D. Use a seam numbering system consistent with panel number system.

E. Shingle panels on all slopes and grades as directed by the OWNER.

3.6 SEAM WELDING PERSONNEL

A. Provide at least one welder (master welder) who has experience welding over 5 million square feet of geomembrane using the same type of welding apparatus in use at site.

B. Qualify personnel performing welding operations by experience and by successfully passing field welding tests performed on site.

C. The master welder will provide direct supervision over other welders.

3.7 SEAM WELDING EQUIPMENT

A. Extrusion welder: equipped with gauges showing temperatures in extruder apparatus at the barrel and nozzle of the extruder. External temperature gauges may measure temperature at nozzle.

B. Hot wedge welder: Automated variable speed vehicular mounted devices equipped with devices adjusting and giving temperatures of the wedges. Pressure controlled by spring, pneumatic, or other system that allows for variation in sheet thickness. Rigid frame fixed position equipment is not acceptable.

C. Maintain adequate quality of welding apparatus in order to avoid delaying the project.

D. Use a power source capable of providing constant voltage under combined line load.

3.8 GENERAL WELDING PROCEDURES

A. Do not commence welding with welding equipment until the trial weld test samples, made by that equipment, passes the test weld.

B. Clean all geomembrane surfaces of grease, moisture, dust, dirt, debris, or other foreign material.

C. Overlap panels a minimum of 3 inches for extrusion welding and 4 inches for hot wedge welding.

D. Do not use solvents or adhesives.

E. Provide adequate material on each weld to allow peel testing of both sides of double wedge welds and extrusion welds.

F. Extend welding to the outside edge of all panels.

G. If required, provide a firm substrate by using a geomembrane rub sheet, a flat board, a conveyor belt, or similar hard surface directly under the weld overlap to achieve firm support.

H. Provide adequate illumination if welding operations are carried out at night.

I. Cut fishmouths or wrinkles along the ridge of the wrinkle in order to achieve a flap overlap. Extrusion weld the cut fishmouths or wrinkles where the overlap is more than 3 inches. When there is less than 3 inches overlap, patch with an oval or round patch extending a minimum of 6 inches beyond the cut in all directions.

3.9 INSTALLATION QUALITY CONTROL

A. Log the following every two hours:

1. Temperature directly on the geomembrane surface being welded.

2. Extrudate temperatures in barrel and at nozzle (extrusion welder).

3. Operating temperature of hot wedge (hot wedge welder) and any pressure adjustments made.

4. Preheat temperature.

5. Speed of hot wedge welder in feet per minute.

B. Weld only when ambient temperature, measured 6 inches above the geomembrane, is between 32°F and 130°F.

C. If the INSTALLER wishes to use methods which may allow seaming at ambient temperatures below 32°F or above 130°F, the INSTALLER shall demonstrate and certify that such methods produce seams which are entirely equivalent to seams produced at ambient temperatures above 32°F and below 130°F, and that the overall quality of the geomembrane is not adversely affected. Then, the temperatures in the above quality assurance procedure shall be modified accordingly.

3.10 DEFECTS AND REPAIRS

A. Examine all welds and non weld areas of the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of the examination.

B. Repair and non-destructively test each suspect location in both weld and non-weld areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

C. Extrusion weld a patch over all "cross" or "tee" welds.

3.11 EXTRUSION TYPE OF WELDING

A. Use procedures to tack bond adjacent panels together that do not damage the geomembrane and allow quality control tests to be performed.

B. Purge welding apparatus of heat degraded extrudate before welding.

C. Bevel the top edges of top geomembrane a minimum of 45° and full thickness of the geomembrane before extrusion welding.

D. Clean seam welding surfaces of oxidation by disc grinder or equivalent not more than 30 minutes before extruding weld. Change grinding discs frequently. Do not use clogged discs.

E. Do not remove more than 4 mils of material when grinding.

F. Grind across, not parallel to, welds.

G. Cover the entire width of grind area with extrudate.

H. When restarting welding, grind ends of all welds that are more than five minutes old.

3.12 HOT WEDGE WELDING

A. Place a smooth insulating plate or fabric beneath hot welding apparatus after usage to not damage the geomembrane.

B. Protect against moisture build up between panels.

C. If welding cross seams, conduct field test welds at least every two hours, otherwise, once prior to start of work and once at midday.

D. Bevel edges of top and bottom panels on cross seams.

E. Do not weld on geomembrane until equipment has passed trial weld test.

F. Extrusion weld a repair patch over all seam intersections as described in Part 3.10.

3.13 FIELD QUALITY CONTROL AND QUALITY ASSURANCE

A. MANUFACTURER, Fabricator, and INSTALLER will participate in and conform with all terms and requirements of the OWNER's quality assurance program. The

CONTRACTOR is responsible for assuring this participation. Quality control and quality assurance requirements are as specified in this paragraph.

3.14 CONFORMANCE TESTING (PERFORMED BY CONSTRUCTION QUALITY ASSURANCE LABORATORY)

A. Allow 3 days for conformance testing following the date material is available to the CQA Laboratory.

B. Perform conformance testing on geomembrane rolls at the frequency described in the CQA Plan.

C. Obtain 3-feet samples across entire roll width not including the first 3 feet of material. Conformance samples should be obtained directly from the MANUFACTURER.

D. Forward samples to Construction Quality Assurance Laboratory.

E. Test samples for conformance with design specifications and guaranteed properties in accordance with the CQA Plan.

3.15 FIELD TESTING (PERFORMED BY INSTALLER)

A. General: Non destructively test all field seams over their full length using a vacuum test unit, air pressure (for double fusion seams only), spark testing, or other approved methods. Perform testing as the seaming progresses and not at the completion of all the field seaming. Complete all required repairs in accordance with this specification.

B. Vacuum Testing Equipment

1. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole, or valve assembly, and a vacuum gauge.

2. A vacuum pump assembly equipped with a pressure control.

3. A rubber pressure/vacuum hose with fittings and connections.

4. A soapy solution and an applicator.

C. Vacuum Box Test Procedures

1. Place the box over the wetted seam area (soapy solution).

2. Ensure that a leak tight seal is created.

3. Energize the vacuum pump and reduce the vacuum box pressure to approximately 10 inches of mercury, i.e., five-psi gauge.

4. Examine the geomembrane through the viewing window for the presence of soap bubbles for a period of not less than ten seconds.

5. All areas where soap bubbles appear shall be marked and repaired in accordance with repair procedures described in this specification.

D. Air pressure testing for seaming processes producing a double seam with an enclosed channel.

1. Equipment, comprised of the following:

a. An air pump (manual or motor driven) equipped with a pressure gauge capable of generating and sustaining a pressure over 40 psi and mounted on a cushion to protect the geomembrane.

b. A rubber hose with fittings and connections.

c. A sharp hollow needle, or other approved pressure feed device.

d. A pressure gauge with an accuracy of plus or minus one psi.

2. Test Procedures.

a. Seal both ends of the welded seam to be tested.

b. Insert needle or other approved pressure feed device into the tunnel created by the weld.

c. Energize the air pump to a minimum pressure of 30 psi or 1/2 psi per mil of liner thickness, whichever is greater, close valve and sustain pressure for at least five minutes.

d. If loss of pressure exceeds three psi (ten mm mercury), or otherwise approved, or does not stabilize, locate faulty area and repair in accordance with repair procedures described in this specification.

e. Puncture opposite end of seam to release air. If blockage is present, locate and test seam on both sides of blockage.

f. Remove needle or other approved pressure feed device and seal the penetration holes.

E. Spark Testing for penetrations or other difficult areas not accessible to vacuum testing.

1. Equipment and Materials.

a. 24 gauge copper wire.

b. Low-amperage electric detector, 20,000 to 30,000 volt, with brush-type electrode capable of causing visible arc up to ¾ inch from copper wire.

2. Procedures.

a. Place copper wire within 1/4 inch of the edge of extrusion seam or clamp seal.

b. Pass electrode over the seam or clamp the area and observe for a spark. If a spark is detected perform a repair.

3.16 LABORATORY DESTRUCTIVE TESTING (PERFORMED BY OWNER AND THE INSTALLER)

A. Location and Frequency of Testing.

1. Collect destructive test samples at a minimum frequency of one test location per 500 feet of seam length.

2. Determine test locations during welding. Locations may be prompted by suspicion of excess crystallinity, contamination, offset welds, or suspected defect. The OWNER will be responsible for choosing the locations. The Monitor will not notify the INSTALLER in advance of selecting locations where weld samples will be taken.

3. The OWNER may increase the test frequency based on marginal results.

B. Sampling Procedures.

1. Cut samples at locations designated by the OWNER as the welding progresses. Verify that laboratory test results have been obtained before the geomembrane is covered by another material.

2. The OWNER will number each sample and mark sample number and location in compliance with the CQA program.

3. Immediately repair all holes in the geomembrane resulting from destructive test sampling. Repair in accordance with repair procedures described in this Section. Test the continuity of the repair in accordance with this Section.

4. Size of Samples: minimum 12 inches wide by 42 inches long with the seam centered lengthwise. Cut a one-inch wide strip from each end of the sample and test these for (shear and peel) in the field. Cut the remaining sample into three parts for distribution as follows:

   a. One portion for the INSTALLER: 12 inches by 12 inches.

   b. One portion for Construction Quality Assurance Laboratory: 12 inches by 18 inches.

   c. One portion to the OWNER for archive storage: minimum 12 inches by 12 inches.

3.17 FIELD TESTING (PERFORMED BY INSTALLER)

A. Test the two, one-inch wide strips specified in Part 3.16, B, by tensiometer for peel and shear, respectively.

B. Both test strips must meet peel and shear requirements for welded seams specified in Part 3.3.

C. If any field test sample fails, follow failed test procedures outlined in this Section.

3.18 LABORATORY TESTING PERFORMED INDEPENDENTLY BY CONSTRUCTION QUALITY ASSURANCE (CQA) LABORATORY

A. Test "seam strength" and "peel adhesion" (ASTM D6392).

B. Minimum acceptable values to be obtained for these tests are specified in Part 3.3.G.

C. Test at least five specimens for each test method. Five of five specimens must meet minimum requirements. None of the peel specimens may peel 100 percent, or the entire sample will be considered as failing.

D. Select specimens alternately by test from the samples (i.e., peel, shear, peel, shear...).

E. Provide test results no more than 48 hours after receiving samples.

F. For double wedge welded samples, test both sides in peel.

3.19 FAILED WELD PROCEDURES

A. Follow these procedures when there is a destructive test failure. Procedures apply when test failure is determined by the Construction Quality Assurance Laboratory, the INSTALLER, or by field tensiometer. Follow one of the following two options:

1. First Option.

   a. Reconstruct or cap strip the seam between any two passing test locations. Cannot extrusion weld flap.

2. Second Option.

   a. Trace the weld at least 10 feet minimum in both directions from the location of the failed test, or to the end of the weld.

   b. Obtain a small sample at both locations for an additional field test.

   c. If these additional test samples pass field tests, then take laboratory samples.

   d. If the laboratory samples pass, then reconstruct the weld or cap between the two test sample locations that bracket the failed test location.

   e. If any sample fails, then repeat the process to establish the zone in which the weld must be reconstructed.

3.20 ACCEPTABLE WELDED SEAMS

A. Bracketed by two locations from which samples have passed destructive tests.

B. For reconstructed seams exceeding 50 feet, a sample taken from within the reconstructed weld passes destructive testing.

C. Whenever a sample fails, provide additional testing for seams that were welded by the same welder and welding apparatus or welded during the same time shift.

3.21 SEAMS THAT CANNOT BE NON-DESTRUCTIVELY TESTED, PERFORM THE FOLLOWING:

A. If the weld is accessible to testing equipment prior to final installation, non-destructively test the weld prior to final installation.

B. If the weld cannot be tested prior to final installation, cap strip the weld. The OWNER and the INSTALLER must observe the welding and cap stripping operations for uniformity and completeness.

3.22 REPAIR PROCEDURES

A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

B. Repair, removal, and replacement are at CONTRACTOR's expense if the damage results from the CONTRACTOR's, the INSTALLER's, or the CONTRACTOR's SUBCONTRACTOR activities.

C. Repair any portion of the geomembrane exhibiting a flaw, or failing a destructive or non-destructive test. Agreement upon the appropriate repair method will be determined between the OWNER'S Representative and the INSTALLER. Do not commence welding on liner until trial weld test sample, made by that equipment and operator, passes trial test. Repair procedures available include:

1. Patching: Used to repair large holes (over 3/8 inch diameter), tears (over 2 inches long), undispersed raw materials, contamination by foreign matter, and to cover cross and tee connections.

2. Abrading and re-welding: Used to repair small sections of seams.

3. Spot welding or seaming: Used to repair small tears (less than 2 inches long), pin holes or other minor, localized flaws.

4. Capping: Used to repair large lengths of failed seams.

5. Removing the seam and replacing with a strip of new material.

D. In addition, satisfy the following procedures:

1. Abrade geomembrane surfaces to be repaired (extrusion welds only) no more than 30 minutes prior to the repair.

2. Clean and dry all surfaces at the time of repair.

3. The OWNER's representative, the CQAC, and the INSTALLER must accept the repair procedures, materials, and techniques in advance of the specific repair.

4. Extend patches or caps at least 6 inches beyond the edge of the defect, and round all corners of material to be patched and the patches to a radius of at least 3 inches.

5. Unless otherwise instructed by the OWNER, cut geomembrane below large caps to avoid water or gas collection between the sheets.

E. Verification of repair:

1. Number and log each patch repair.

2. Non-destructively test each repair using methods specified in Part 3.15 of this Section.

3. Destructive tests may be required at the discretion of the OWNER's Representative.

4. Reconstruct repairs until tests indicate passing results.

3.23 GEOMEMBRANE ACCEPTANCE

A. CONTRACTOR retains all ownership and responsibility for the geomembrane until acceptance by the OWNER.

B. OWNER will accept geomembrane installation when:

1. All required documentation from the MANUFACTURER, Fabricator, and INSTALLER has been received and accepted.

2. The installation is finished.

3. Test reports verifying completion of all field seams and repairs, including associated testing, is in accord with the Section.

4. The OWNER has received written certification documents and drawings.

END OF SECTION

SECTION 02780

LANDFILL GAS WELL HEAD

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Extend Landfill Gas (LFG) well heads and associated pipe fittings and adapters for the extraction and collection of landfill gas in accordance with the Construction Drawings.

1.2 RELATED SECTIONS

A. Section 02221 – Excavating and Stockpiling.

B. Section 02222 – Engineered Fill, Intermediate Cover and Backfill.

C. Section 02270 – Erosion and Sediment Control.

D. Section 02710 - Polyethylene Pipe.

E. Section 02781 – Polyvinyl Chloride (PVC) Pipe.

F. Section 02783 – Flexible Connections.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
2. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics.
3. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
4. ASTM D790 - Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM D1238 - Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
6. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.

7. ASTM D1525 - Standard Test Method for Vicat Softening Temperature of Plastics.

8. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.

9. ASTM D1599 - Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings.

10. ASTM D2240 - Standard Test Method for Rubber Property Durometer Hardness.

11. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

12. ASTM D3017 - Standard Specification for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

13. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

B. National Sanitation Foundation (NSF). NSF Standard Number 14 -Plastics Piping Components and Related Materials.

C. PPI -Plastic Pipe Institute.

D. ANSI -American National Standards Institute.

1.4 SUBMITTALS AND QUALIFICATIONS

A. The CONTRACTOR shall submit to the Project Manager and QA/QC Engineer a list of the equipment and materials proposed to complete this work.

B. Contractor shall submit to the Engineer and the CQA Monitor seven (7) days prior to pipe delivery a letter of certification from the well head manufacturer stating the material and physical properties of the well heads are in accordance with requirements of these Specifications. The certificate shall be signed and sealed by an authorized corporate officer.

C. Provide the Owner for approval:

1. Details of special fittings.

2. Copy of the manufacturer's quality control check of pipe material and production.

3. Certified test records for PVC pipe.

4. Valve type, manufacturer, and model number that contractor proposes for well heads.

PART 2 PRODUCTS

2.1 WELLHEAD ASSEMBLY

A. The wellhead assembly shall be a 2-inch brand new LANDTEC Accu-Flo wellhead assembly, or approved equal, and shall consist of well head piping, flow control gate valve, gas temperature gage, quick-connect gas sampling port, static and impact pressure ports or orifice plate, flex connector, PVC union disconnect, dust cap, and adapter kit. The 2-inch vertical wellhead assemblies shall be Model Nos. AF2V-PV-020-2-G and AF2H-PV-02-2-G respectively.

B. The equipment shall be capable of withstanding the rigors of landfill gas recovery application including internal high vacuum, weathering, gas constituents, and ultraviolet light exposure.

C. The wellhead shall be tight and leakfree and shall be height-adjustable in the field using adapter bushings.

D. The wellhead assembly shall be capable of being used with the LANDTEC GEM-500 and 2000 Monitor.

2.2 MEASUREMENT TUBE

A. The measurement tube shall be Schedule 80 PVC pipe, and shall fit concentrically into the well casing.

B. The measurement tube shall be of sufficient length to allow gas to achieve a uniform velocity profile before being measured.

2.3 IMPACT TUBE

A. The impact tube shall be 316 stainless steel.

B. A stainless steel centralizer shall be installed on the impact tube.

C. The entrance of the impact tube shall be in an area of uniform gas flow.

2.4 TEMPERATURE GAUGE

The temperature gauge shall have a stainless steel probe, watertight dial cover and calibration nut. It shall be connected to the wellhead with a quick-connect fitting.

2.5 QUICK-CONNECT PORTS

The quick-connect ports shall be positive sealing and shall be constructed of polypropylene, stainless steel or chrome plated brass.

2.6 FLOW CONTROL VALVE

A. The slide gate valve provided with the LANDTEC Accu-Flo wellhead assembly shall be manufactured by Valterra, or approved equal, and shall have the following characteristics:

1. 2-inch-diameter SOC connections.
2. Valve body shall be fabricated from PVC.
3. Valve stem shall be stainless steel.
4. Straight through flow design.
5. Replaceable internal components.
6. Seals shall be Buna-N.
7. Paddle shall be Acetal.

2.7 FLEX CONNECTOR

A. The flex connector shall be used to connect the wellhead to the well lateral or extraction header piping.

B. The flex connector shall be PVC-reinforced PVC hose and glued to PVC fittings as shown on the Drawings.

C. The flex hose shall be weather and UV resistant.

2.8 SOLVENT CEMENT

Socket type connections shall only be joined by heavy duty solvent cement furnished by the supplier of the PVC pipe and fittings, and shall conform to ASTM D2564.

2.9 SOLVENT PRIMER

Socket type connections shall be primed with primer meeting ASTM F-656 standards and recommended by the supplier of the PVC pipe and fittings.

PART 3 EXECUTION

3.1 FAMILIARIZATION

A. Prior to implementing any work described in this Section, the CONTRACTOR shall become thoroughly familiar with the site, the site conditions, and all portions of the work falling within this Section and the CQA requirements of the County.

B. Inspection:

1. Prior to implementing any of the work in this Section, the CONTRACTOR shall carefully inspect the installed work and all work performed under other Sections and verify that all work is complete to the point where the installation of this Section may properly commence without adverse impact.

2. If the CONTRACTOR has any concerns regarding the installed work of other Sections, he/she should immediately notify the County in writing within 48 hours of the site visit. Failure to notify the County or continuance with work tasks will be construed as Contractor's acceptance of the related work of all other Sections.

3.2 LANDFILL GAS WELL INSTALLATION

A. For existing wellhead extension work, the exposed casing of each vertical landfill gas well shall be cut to a length of no less than 6 inches and no more than 24 inches, measured along the casing to the finished ground surface.

B. Unless the existing well head is otherwise serviceable, a new gas well head shall be attached to the remaining casing using an adapter fitting, in accordance with the gas well manufacturer's specifications.

C. All well excavations shall be backfilled and compacted to at least 90% of maximum dry density at optimum moisture content per ASTM D1557. The backfill shall be mounded around the new casing to a height of no less than 6 inches above original grade. Clean soil back fill shall be clean silt to silty sand material. Drill cuttings may be used if they meet this specification.

D. The presence of methane requires that all motors be equipped with spark and flame arresters, and that no smoking or open flames be allowed. The CONTRACTOR shall employ an explosion meter, methane monitor, O.V.A., or other approved device for detecting and monitoring methane gas levels during this work. If hazardous conditions develop, safety measures shall be implemented for the site workers, as necessary.

3.3 WASTE DISPOSAL

A. Any waste products encountered during the excavation around the landfill gas wells shall be disposed of within the landfill, prior to the foundation layer placement. A minimum of 2 feet of cover shall be placed over the waste.

B. All materials removed, including used PVC pipe, couplers, etc. shall be loaded and transported offsite to a recycling facility.

3.4 FACILITIES AND OBSTRUCTIONS

A. Facilities and obstructions shown on the Drawings are for information only and do not guarantee their exact locations nor exclude the presence of other obstructions or facilities.

B. The CONTRACTOR shall exercise due care in working and traveling adjacent to existing facilities or obstructions and shall not disturb these facilities or obstructions.

C. In the event facilities or obstructions are disturbed, the CONTRACTOR shall repair or replace them as quickly as possible to the condition existing prior to their disturbance. This repair or replacement will not be a pay item.

D. If desired by the County, the CONTRACTOR shall pay for the repair or replacement work performed by the forces of the County or other appropriate party.

E. If replacement or repair of disturbed facilities or obstructions is not performed after a reasonable period of time, the County may have the necessary work done and deduct the cost of same from payments to the CONTRACTOR.

3.5 PRODUCT PROTECTION

A. The CONTRACTOR shall use all means necessary to protect all prior work, including all materials and completed work of other Sections.

B. In the event of damage, the CONTRACTOR shall immediately make all repairs and replacements necessary, to the approval of the County or QA/QC Engineer at no additional cost to County.

C. At the end of each day, the CONTRACTOR shall verify that the entire work area was left in a state that promotes surface drainage off and away from the area and from finished work.

3.6 CONSTRUCTION QUALITY ASSURANCE (CQA)

A. The CONTRACTOR shall be aware of the CQA activities required by the County and account for these CQA activities in the construction schedule.

END OF SECTION

SECTION 02781

POLYVINYL CHLORIDE (PVC) PIPE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install Polyvinyl Chloride (PVC) pipe and associated pipe fittings for the landfill gas well casings and screens and piping for landfill gas indicated on the Construction Drawings.

1.2 RELATED SECTIONS

A. Section 02221 – Excavating and Stockpiling.

B. Section 02222 – Engineered Fill, Foundation Layer, and Backfill.

C. Section 02229 - Vegetative/Protective Cover

D. Section 02270 – Erosion and Sediment Control.

E. Section 02710 - Polyethylene Pipe.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
2. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics.
3. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
4. ASTM D790 - Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM D1238 - Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
6. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.
7. ASTM D1525 - Standard Test Method for Vicat Softening Temperature of

Plastics.

8. ASTM D1599 - Standard Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings.

9. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds, Class 1245B- for polyvinyl chloride

10. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

11. ASTM D2240 - Standard Test Method for Rubber Property Durometer Hardness.

12. ASTM 2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

13. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fitting

B. American Water Works Association - AWWA Standard C504 – Rubber-seated butterfly valves

C. National Sanitation Foundation (NSF). NSF Standard Number 14 - Plastics Piping Components and Related Materials.

D. PPI - Plastic Pipe Institute.

E. ANSI - American National Standards Institute.

1.4 SUBMITTALS

A. Contractor shall submit to the Engineer and the CQA Monitor seven (7) days prior to pipe delivery a letter of certification from the PVC pipe manufacturer stating the material and physical properties of the pipe are in accordance with requirements of this section. The certificate shall be signed and sealed by an authorized corporate officer.

B. Provide the OWNER for approval:

1. Details of special fittings.

2. Copy of the manufacturer's quality control check of pipe material and production.

3. Certified test records for PVC pipe.

4. Valve type, manufacturer, and model number that contractor proposes for isolation valves.

PART 2 PRODUCTS

2.1 PIPE

A. All Polyvinylchloride (PVC) pipes shall be Schedule 80 for all gas well casings and screens, and Schedule 40 for other pipes unless noted or specified otherwise elsewhere in other sections of the specifications or on the Drawings. PVC pipes shall conform to ASTM D1785, PVC 1120. The rigid unplasticized compound from which PVC pipe, fittings, and appurtances is manufactured shall conform to ASTM D1784, Class 1245B for polyvinyl chloride.

B. All pipe sizes shown on the Construction Drawings and specified in this Section reference nominal diameter, unless otherwise indicated on the Construction Drawings or in this Section.

C. Containing no recycled compound except that generated in the Manufacturer's own plant and from resin of the same specification from the same raw material supplier.

D. Homogeneous throughout and free of visible cracks, holes (except where specified or shown), foreign inclusions or other injurious defects. Being uniform in color, capacity, density, and other physical properties.

E. Provide pipe with the following information continuously marked on the pipe or spaced at intervals not exceeding 5 feet.

1. Name and/or trademark of the pipe manufacturer.

2. Nominal pipe size.

3. Manufacturer's Standard Reference.

4. A production code from which the date and place of manufacture can be determined.

F. Provide solid pipe as shown on the Construction Drawings.

2.2 FITTINGS

A. Schedule 40 fittings shall conform to the requirements of ASTM D2467 for socket type joints and shall have a minimum pressure rating of 100 psig at 73°F. Large diameter fittings may be fabricated provided they conform to the above pressure rating.

2.3 SOLVENT CEMENT

A. Socket type connections shall only be joined by heavy duty solvent cement furnished by the supplier of the PVC pipe and fittings, and shall conform to ASTM D2564.

2.4 SOLVENT PRIMER

A. Socket type connections shall be primed with primer meeting ASTM F656 standards and recommended by the supplier of the PVC pipe and fittings.

2.5 FLANGE GASKETS

A. Neoprene full-face gaskets 1/8 inch-thick of 45 to 60-durometer (shore "A") hardness are required for flanged joints.

2.6 FLANGE BOLTING

A. Bolts, washers, and nuts for making up flanged joints on PVC pipe shall be 316 Stainless Steel.

2.7 BUTTERFLY VALVES

A. Shall conform to AWWA Standard C504 for rubber seated butterfly valves, except the seats shall be mounted securely for complete immobility under all operating conditions.

B. Construction

1. Valve seat shall be mounted on the body only. Mounting on the disk will not be acceptable.

2. Manufacturers: Muessco, Keystone, Flow-Seal, Asahi, Demco or acceptable equivalent.

3. Body of butterfly valve to be of lug design, cast iron, and bolt pattern compatible with 150 lb. ANSI flanges. Lug body shall be drilled for mounting bolts.

4. Disk shall be type 304 or 316 stainless steel.

5. Seats and seals shall be Viton.

6. Shaft shall be type 304 or 316 stainless steel. Either one-piece unit extending completely through the valve disk or stub shaft comprising two separate shafts inserted into valve disk hubs shall be utilized.

C. Manual Operators

1. All valves shall be provided with a manual operator unless otherwise noted on the Drawings or specified. The direction of rotation of the wheel, wrench nut, or lever to open each valve shall be to left (counterclockwise). Each valve body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open and shall be visible to the operator when the valve is in its final position.

2. Operator mounting arrangements and handwheel positions shall be as shown on the Drawings or as directed by the Engineer.

3. Unless otherwise shown on the Drawings or specified herein, above grade 8 inch-diameter and smaller butterfly valves shall have a position locking lever, and below grade valves 8 inch and smaller shall be provided with a square nut type operator. All valves shall be equipped with a visual position indicator.

4. Wrench nuts shall be provided on all buried valves where shown on the Drawings. Not less than two operating keys shall be furnished for operation of the square nut operated valves.

2.8 BACKFILL MATERIALS

A. Soil backfill shall meet the requirements of engineered fill in accordance with Section 02222.

PART 3 EXECUTION

3.1 PIPE INSTALLATION GENERAL REQUIREMENTS

A. When shipping, delivering, and installing pipe, fittings, and accessories, do so in such manner to ensure a sound, undamaged installation.

B. Provide adequate storage for all materials and equipment delivered to the job site.

C. Handle and store pipe and fittings in accordance with the MANUFACTURER's recommendations.

3.2 PLACING AND LAYING PIPE

A. Provide required maintenance of all such materials and equipment used to handle, place, and lay pipe.

B. Follow the MANUFACTURER's recommendations when hauling, unloading and stringing the pipe.

C. Take precautions to prevent damage to the pipe.

D. Do not push, pull, or drag pipe and fittings over sharp projections, or drop, or have objects dropped on the pipe and fittings.

E. Inspect for defects before and during installation. Remove any piping showing kinks, buckles, cuts, gouges, or any other damage, which in the opinion of the ENGINEER will affect performance of the pipe.

F. Replace material found to be defective before or after laying with sound material at no additional expense to the County.

G. Remove all dirt, gravel, cobwebs, plastic shavings, and debris before and after placement. The pipe shall be clean prior to acceptance by the OWNER.

H. Carefully lower pipe and accessories into their final resting location and when moving them around the site. Do not drop the pipe on the geomembrane or other geosynthetic materials.

I. Under no circumstances drop or dump materials onto the pipe.

J. Rest the full length of each section of pipe solidly upon the pipe bedding, geomembrane, or on rub-sheets.

K. Take up or relay pipe that has had the grade disturbed while joining or laying the pipe.

3.3 JOINING PIPE

A. Join the PVC pipe using the appropriate pipe primer and cement, in accordance with the procedures established by the pipe MANUFACTURER.

B. Allow the required dry time according to pipe MANUFACTURER'S recommendations.

C. The ends of the pipes to be joined shall be cut square and burs removed

D. Only use personnel adequately trained and qualified in the technique involved.

E. Do not perform pipe joining in water or when conditions are unsuitable for the work.

F. Keep water out of the work area until joining is completed.

G. Secure open ends of pipe and close valves when work is not in progress, so that no water, earth, animals, or other substance will enter the pipe or fittings.

H. Plug, cap or valve off pipe ends left for future connections as shown on the Construction Drawings.

J. Keep the site free of rocks and debris which could cut, scar, or gouge the pipe.

K. Remove all dirt, gravel, cobwebs, plastic shavings, and debris before and after joining. The pipe shall be clean prior to acceptance by the OWNER.

L. When two pipes of different diameters must be joined, the CONTRACTOR shall join the pipe with an appropriate transition fitting.

M. Backfill pipes with the materials (gravel, soil, etc.) shown on the Construction Drawings and in accordance with the appropriate section of these Specifications.

3.4 PRESSURE TESTING

A. The specified test pressures shall be measured at the horizontal centerline of the lowest point of the piping under test.

B. Each pipeline shall be adequately braced and supported before tests are made.

C. Pipelines that have no valves shall be closed with blind flanges or caps on the ends of the section to be tested.

D. Tests shall be made before the piping has been enclosed in any manner that will prevent inspection during the test.

E. Leakage testing for the LFG extraction system piping shall be performed by pressurizing piping to 2 psig and holding for one hour with no more than 0.5-psig pressure drop within that time frame measured on a gauge reading 0 to 10 psig. A soap and water solution (leak detection fluid) must be applied to all joints and the joints inspected for leakage by the formation of bubbles at the point of leakage. Any leaks detected must be repaired even if the test meets the set requirements. All of these lines, either individually or in common, are to be pressurized to 2 psig. All joints and connections shall be visually inspected for leaks after applying the leakage detecting fluid. Because PVC is shock sensitive and brittle at low temperatures, the CONTRACTOR shall regulate the test pressure such that when pressurizing any PVC pipe with air, the test pressure shall never exceed 2 psig. The CONTRACTOR is cautioned that high test pressures, when using air or gas to pressurize, can shatter a considerable length of PVC pipe and pieces of the pipe can be propelled for long distances.

F. The CONTRACTOR, at his own expense, shall make necessary repairs or replacements in accordance with the Specification. Repairing and testing shall be repeated until the pipeline installation conforms to the specified requirements and is acceptable to the Engineer.

G. After the test has been concluded, the pipeline shall be restored to a condition satisfactory to the Engineer.

H. It is intended that piping, whether tested after installation or not, shall be air-tight and free from leaks. Each leak which is discovered within one year after final acceptance of the work by the County shall be repaired by and at the expense of the CONTRACTOR.

3.5 FLUSHING OF PIPING SYSTEM

A. The piping system shall be flushed of dirt and debris with clean water. The valves at the well heads shall remain closed during the flushing and connection to sumps should be made after flushing is completed.

B. Flush water should not be allowed to spill on final cover soil. Flush water must be maintained and directed to the storm water retention basin.

C. Flushing water must be introduced at the top of slope and forced at a high enough rate to dislodge and rinse any construction debris and remove from entire length of pipe being flushed.

D. Any inert debris, as described in Section 02221, removed from the pipe as part of the flushing shall be contained and transported to the landfill.

3.6 PAINTING AND PROTECTION

A. PVC piping and flex hoses installed above ground shall be protected against the effects of ultra violet (UV) light by the application of a heavily pigmented water-based latex paint formulated for exterior use. The color shall be as determined by the Engineer or Owner.

END OF SECTION

SECTION 02782

LANDFILL GAS MONITORING PROBE INSTALLATION

PART 1 GENERAL

1.1 DESCRIPTION

A. The furnishing of all the products and labor required for the drilling and installation of the landfill gas (LFG) monitoring probes and all other materials as shown on the Construction Drawings and described in these specifications.

1.2 RELATED SECTIONS

A. Section 02107 – Construction Surveying and Stakeout

B. Section 02781 – Polyvinyl Chloride (PVC) Pipe

1.3 DEFINITIONS

A. Landfill Gas Monitoring Probe: A subsurface well utilized for the measurement of soil gas principal constituents and temperature and collection of representative LFG samples in a particular screened depth interval and at a particular location.

B. Construction Quality Assurance (CQA) Monitor: The person responsible for observing and documenting activities related to quality assurance of work outlined in this specification.

1.4 SUBMITTALS

A. Health and Safety Plan (HSP) - Potential physical and chemical hazards will need to be addressed when planning monitoring probe installation. A health and safety plan that addresses known and anticipated field conditions must be prepared prior to field work and be followed during probe installation. The HSP shall include solid waste management, and provisions for personal protective equipment. Contractor shall submit a Health and Safety Plan (HSP) to Owner for review prior to probe construction.

1.5 CONSTRUCTION QUALITY CONTROL (CQC)

A. Borehole drilling and probe construction details will be documented in detail in the field. Field documentation forms will consist of a lithologic borehole log, a probe construction log, and daily field note forms. Deviations from project-specific planning documents will be documented and explained in daily field notes.

B. Field quality control can be maintained through 1) making sure employees are properly trained to conduct the work being implemented, and 2) performing routine field audits to evaluate how well employees are following procedures.

C. Contractor shall be responsible for CQC. Contractor shall either employ or engage and pay for the services of qualified staff or a qualified subcontractor to perform CQC for monitoring and documenting the quality of the monitoring probes in accordance with the Contract Documents.

D. Unless otherwise specified, the Contractor shall complete CQC inspection, sampling, testing or any other action, as considered necessary by the Contractor to ensure that the Work has been completed in accordance with the Contract Documents. Notwithstanding the results of the Contractor's CQC program, compliance of the Work with the Contract Documents shall be defined by the results of the CQA program.

E. Any Work that does not satisfy the requirements of the Contract Documents shall be corrected in accordance with the requirements of the Contract Documents or as directed by the CQA Consultant at the sole expense of the Contractor.

F. The OWNER and the CQA Consultant shall be permitted to review the probe construction methods, completion techniques, and test results at any time.

PART 2 PRODUCTS

2.1 PVC PROBE CASING AND SCREENS

A. The 2-inch Schedule 40 PVC casing and factory slotted screen shall meet the requirements of ASTM Standard F480-06B and the National Sanitation Foundation (NSF) International Standard Number 14-1990, Plastic Piping System Components and Related Materials. Plastic probe casing and liners must be Standard Dimension Ratio (SDR)-rated and conform to the minimum requirements given in Table 2 of the above-referenced ASTM Standard.

2.2 PROBE FILTER PACK

A. Clean pea gravel.

2.3 BENTONITE

A. The bentonite shall be medium chips or 3/8-inch round pellets and/or bentonite slurry.

2.4 PROBE MONUMENT BOX

A. The probe casings shall be protected by a watertight, lockable monument box. The monument box shall be as approved by the OWNER.

2.5 PORTLAND CEMENT

A. Portland Cement shall meet ASTM C150 "Standard Specification for Portland Cement."

PART 3 EXECUTION

3.1 PLANNING

Planning the probe installation work is important to smooth and timely execution, including having the proper quantities of materials. The following aspects will need to be determined when planning a probe installation:

- Borehole drilling method
- Construction materials
- Probe depth
- Screen length
- Probe construction materials
- Location, thickness, and composition of annular seals, and
- Probe completion and protection requirements.

LFG monitoring probe installation and development shall be performed in accordance with applicable State of California well standards and permits for the area of the investigation, and the project-specific planning documents. Drilling methods employed to pilot the borehole for monitoring probe installation are dependent on the physical nature of the subsurface materials (unconsolidated materials and/or consolidated materials) at the site. The drilling contractor shall be a Licensed Water Well Driller, in accordance with local and state requirements, and a qualified drilling contractor for the installation of monitoring probes for environmental investigations.

The borehole diameter must be a minimum of four (4) inches greater than the outside diameter of the probe screen or riser pipe used to construct the probe. This is necessary so that sufficient annular space is available to install filter packs and grout seals. All boreholes will be cleared for UXO, shallow obstructions and utilities prior to initiation of drilling.

3.2 PREPARATION

A. Survey and place construction staking as required for the installation of the monitoring probes.

B. The CONTRACTOR shall review the HSP and conduct daily tailgate safety meetings prior to each day's work activity.

C. The CONTRACTOR shall be responsible for safe handling of all development water, drilling fluids, and drill cuttings in accordance with the Storm Water Pollution Prevention Plan.

3.3 TRANSPORTATION, DELIVERY, HANDLING AND STORAGE

A. Probe Casing:

1. Care shall be taken during transportation of the pipe that it is not cut, kinked, in contact with contaminants, sealed in plastic, or otherwise damaged.

2. Ropes, fabric, rubber-protected slings, straps, or other approved method shall be used when handling casing.

3. Pipe shall be stored in contaminant- free conditions and free of sharp objects which could damage the materials.

3.4 DRILLING METHOD

A. Several drilling methods are available for use in creating a borehole for probe installation. The preferred method in this case is hollow stem auger drilling based on site history.

B. Hollow Stem Auger Methods: Hollow stem auger uses continuous flight hollow stem auger with a bit on the bottom to drill and maintain an open borehole. The continuous flight auger drives the drill cuttings to the surface as drilling progresses. Intact soil samples are collected by pounding a sampler ahead of the auger. The probe casing, filter pack and seal are installed inside the auger.

C. Borehole Logging: Boreholes will be logged using cuttings and samples collected during drilling activities. After drilling has been completed, the field geologist/engineer will measure the total open depth of the borehole with a weighted, calibrated tape measure and document the depth. The CQA Field Geologist will then collaborate with the Supervising Geologist by reviewing lithologic units encountered, water levels, if any, and other logged information to finalize the probe construction details. Boreholes/probe locations should be clearly designated in the field notes using notes and a hand- sketched layout and should include the following information:

1. Measurements of each boring/sample point relative to fixed objects (building, structures, etc.)
2. Boring/sample location with their identification number noted
3. North arrow or other compass directional indicator
4. Other essential site features and/or investigation features (underground storage tanks, piping, above ground tanks, etc.)
5. Measurements of each boring/sample point relative to fixed objects (building, structures, etc.)
6. Boring/sample location with their identification number noted
7. North arrow or other compass directional indicator, and
8. Other essential site features and/or investigation features (underground storage tanks, piping, above ground tanks, etc.).

D. Monitoring Probe Construction Procedures: Monitoring probes will be constructed in accordance with Construction Drawings, and will include at a minimum the following materials.

1. Borehole backfill for overdrilled boreholes prior to probe installation
2. Probe casing and screen
3. Filter pack materials
4. Probe sealing materials (e.g., bentonite pellets, cement, powdered bentonite), and
5. Surface seals and materials for probe surface completion (e.g., concrete, protective steel casing, steel posts, surface boxes, etc.).

E. A discussion of these materials and how they are used is provided in more detail in the following sections.

1. <u>Probe Casing and Screen</u>

The monitoring probe shall consist of factory-sealed commercially available probe screen and casing. Probe screens and casing will be constructed of 2-inch Schedule 40 polyvinyl chloride (PVC) with factory slotted screen. CONTRACTOR shall fabricate the probe casings in accordance with the Construction Drawings and these specifications. The probe casing shall be screened in accordance with the Construction Drawings.

The probe screens shall be permanently joined to the probe casing and shall be centered in the borehole with centralizers. The anticipated length of each screen can be found on the Drawings. Modification can be made in the field, but will be done in consultation with the Supervising Geologist, or their designee such as the CQA Field Geologist.

Screen slot type and size are dependent on the filter pack material and the aquifer formation material. Casing will be connected by flush-threaded or coupled joints and will be completed with a bottom cap. A collection sump may be installed below the screen and will vary in length depending on lithology and project needs. The collection sump and bottom cap will be connected to the probe screen by flush threaded or coupled joints. Plastic casing must have threaded joints and O-ring seals. ***Solvent, glue, or anti-seize compounds must not be used on the joints.***

Casing and screen (probe string) must be clean, free of rust, grease, oil or contaminants and be composed of materials that will not affect the quality of the LFG sample. All casing shall be watertight. The casing shall be plumb and centered in the borehole, be free of any obstructions. The probe string shall be hung in the borehole during installation so that the probe is sufficiently plumbed and straight after completion.

2. Filter Pack

Monitoring probes for LFG will be constructed with filter packs. The filter pack will be the only material in contact with the probe screen. The filter pack will consist of clean pea gravel. The material used for filter pack material shall be sized to match the screen slot size and the surrounding lithology to prevent subsurface materials from penetrating through the filter pack, and preventing the sand or filter pack from entering the probe. The filter pack shall be free of clay, dust, and organic material.

3. Probe Sealing Material

The probes shall have an annular space seal that extends from the top of the filter pack to the surface. The annular sealing material above the filter pack will prevent the migration of fluids from the surface and between aquifers. Sealing material will be chemically compatible with anticipated contaminants. Hydrated bentonite chips or pellets are typically used as an annular seal directly above the filter pack. The annular seal should be a minimum of 3 feet thick unless site-specific requirements dictate otherwise.

Neat Portland cement and/or bentonite grout are typically used as annular fill above the seal. The bentonite-cement grout mixture will consist of a 94-pound sack of Portland cement to 7 gallons of potable water with 2 to 3 percent bentonite by dry weight. Above the sealant material a bentonite grout mixture is often used as an annular fill to complete the probe installation to within 2 feet of the surface. Grouting emplacement needs to be accomplished so that the grout fills the annular space from the bottom to the surface without allowing air pockets to form in the filled zone.

4. Surface Completions Above Grade or Monument Surface Probe Top Casing Completion

With above-grade probe completions, the probe casings shall extend to 3 feet above the ground surface. A locking watertight monument box shall be placed over the top of the casings. The monument box shall be set at least 6 inches deep into a concrete surface seal. A concrete pad should be constructed around the monument box. The pad should be square, approximately 4 feet by 4 feet, sloped away from the monument box, and the top of the pad should be approximately 4 inches off the ground. The monument box will have lockable cap. Protective steel posts will be installed in areas where the probe could be struck by vehicles or heavy equipment. A "V" notch or other permanent mark will be placed at the north edge of the top of the monument box that will be used as the reference point for probe surveying and monitoring.

F. CONTRACTOR shall drill the monitoring probes using the hollow-stem auger drilling method capable of boring to the depths indicated in the Construction Drawings.

G. Drilling shall be performed by the CONTRACTOR only at locations approved by the OWNER or ENGINEER.

H. A steel grate or similar barrier will be placed over the borehole at all times that drilling activities are not taking place. At no time are open borings to be uncovered and/or unattended. No boring shall remain unfinished at the end of the workday.

I. Install initial backfill below the probe casing to the depth indicated on the Construction Drawings.

J. Probe casings shall be set and the annular space backfilled in accordance with the Construction Drawings and these specifications. Probe casings shall be installed immediately after completion of the holes by lifting the casing and lowering the casing into the hole. Install filter pack backfill in the annular space. When the pipe is "supported" by the filter pack in the hole, then the drill rig can be moved to the next location. Probes shall be completely backfilled with the designated amounts and levels of sand and bentonite. If bentonite chips are utilized for a seal the chips shall be allowed to hydrate thoroughly prior to any covering.

K. The CONTRACTOR shall be responsible for any grading, leveling, towing and/or restoration that may be necessary for movement of the drill rig on the site.

L. Monitoring probe Location and Surveying: Monitoring probes will be located by the coordinates shown on the Construction Drawings. Each probe will be surveyed by a Licensed Land Surveyor in the State of California where the probe has been installed and tied to an established local benchmark. The vertical survey will be accurate to 0.01 foot relative to mean sea level. Both the top of casing and ground surface elevation near the probe will be surveyed for vertical control. The "V" notch cut on the north side of each probe casing will be used as the Surveyor's reference mark. For horizontal control, each probe will be tied to an existing site coordinate system and will be surveyed to a horizontal accuracy of 0.1 foot.

3.5 LANDFILL GAS MONITORING PROBE ACCEPTANCE

A. CONTRACTOR retains all ownership and responsibility for the landfill gas monitoring probes until acceptance by the OWNER.

B. OWNER will accept installation when:

1. All required documentation from the MANUFACTURER(s) and INSTALLER has been received and accepted.

2. The installation is finished.

3. Reports verifying completion of all field activities and repairs have been provided in accordance with these Specifications.

4. Written certification documents and drawings have been received by the OWNER.

END OF SECTION

SECTION 02783

FLEXIBLE CONNECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

Furnish and install flexible hoses, clamps, fittings and other items needed for the complete in place installation of the flex hoses and expansion couplings in accordance with this Section.

1. 2 RELATED SECTIONS

A. Section 02221 – Excavating and Stockpiling.

B. Section 02222 – Engineered Fill, Intermediate Cover and Backfill.

C. Section 02270 – Erosion and Sediment Control.

D. Section 02710 - Polyethylene Pipe.

E. Section 02780 – Landfill Gas Well Head.

F. Section 02781 – Polyvinyl Chloride (PVC) Pipe.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics.
2. ASTM D790 - Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
3. ASTM D1238 - Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
4. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique.
5. ASTM D1525 - Standard Test Method for Vicat Softening Temperature of Plastics.
6. ASTM D2122 - Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

7. ASTM D2240 - Standard Test Method for Rubber Property Durometer Hardness.

8. ASTM D2564 – Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

9. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

10. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings

B. National Sanitation Foundation (NSF). NSF Standard Number 14 - Plastics Piping Components and Related Materials.

C. PPI - Plastic Pipe Institute.

D. ANSI - American National Standards Institute.

1.4 SUBMITTALS

A. Contractor shall submit to the Engineer and the CQA Monitor seven (7) days prior to flex hose delivery a letter of certification from the flex hose manufacturer stating the product model and that the material and physical properties of the flex hoses are in accordance with requirements of Section 02783. The certificate shall be signed and sealed by an authorized corporate officer.

B. Provide to Owner for approval:

1. Details of special fittings, clamps, and collars.

2. Copy of the manufacturer's quality control check of hose material and production.

3. Certified test records for Flexible Hose.

4. Flex Hose, manufacturer, and model number that contractor proposes to use for the Expansion couplings and the flexible connections.

PART 2 PRODUCTS

2.1 FLEX HOSES

A. Flex hose size shall be equal to the nominal pipe size they are being installed on and made from a flexible material, and shall be reinforced with stainless Steel (SS) or steel wire. The ends shall be capable of installation on standard IPS size PVC pipe. It shall withstand temperatures from -60° F to 200° F without any adverse effect. It shall be suitable for test pressure of a minimum 2.5 PSIG vacuum. The flexibility for contraction and expansion shall be a minimum of 50 and 20 percent, respectively, of its original size. The hose shall be UV and ozone resistant. The hoses shall be FLXH-060-240T and FLH-040-240T and manufactured by CES-Landtec, Colton, CA or approved equal. The minimum hose length shall be 24 inches.

B. Flexible connections used on the wellhead to lateral or gas extraction header piping shall be reinforced PVC hose, weather and UV resistant, as supplied by LANDTEC with the Accu-Flow wellhead assembly, or approved equal.

C. Flexible hose used on 4-inch-diameter PVC pipe (other than wellhead locations) shall be Kanaflex 101-PS or approved equal. The minimum hose length shall be 24 inches. The hose ends shall be capable of installation on standard IPS size PVC pipe. The flex hose shall be installed with Powerlock clamps.

D. Flexible connectors shall consist of expansion hoses on the main header piping to allow for pipe expansion and contraction, and flexible PVC hose to be installed on the well head piping and lateral to header connections, as detailed on the Drawings.

E. All pipe sizes shown on the Construction Drawings and specified in this Section reference nominal diameter, unless otherwise indicated on the Construction Drawings or in this Section.

F. Flexible hose shall be homogeneous throughout and free of visible cracks, holes (except where specified or shown), foreign inclusions or other injurious defects and shall be uniform in color, capacity, density, and other physical properties.

G. Provide pipe with the following information marked on the pipe.

1. Name and/or trademark of the pipe manufacturer.

2. Nominal pipe size.

3. Manufacturer's Standard Reference.

4. A production code from which the date and place of manufacture can be determined.

2.2 SOLVENT CEMENT

Socket type connections shall only be joined by heavy duty solvent cement furnished by the supplier of the PVC pipe and fittings, and shall conform to ASTM D2564.

2.3 SOLVENT PRIMER

Socket type connections shall be primed with purple primer meeting ASTM F656 standards and recommended by the supplier of the PVC pipe and fittings.

PART 3 EXECUTION

3.1 FLEXIBLE CONNECTIONS INSTALLATION GENERAL REQUIREMENTS

A. When shipping, delivering, and installing pipe, fittings, and accessories, do so in such manner to ensure a sound, undamaged installation.

B. Provide adequate storage for all materials and equipment delivered to the job site.

C. Handle and store pipe and fittings in accordance with the Manufacturer's recommendations.

3.2 INSTALLING FLEXIBLE EXPANSION HOSES

A. Follow the MANUFACTURER's recommendations when unloading the hose.

B. Take precautions to prevent damage to the hose.

C. Do not push, pull, or drag hose over sharp projections, or drop, or allow objects to be dropped on the hose.

D. Inspect for defects before and during installation. Remove any hose showing kinks, buckles, cuts, gouges, or any other damage, which in the opinion of the ENGINEER will affect performance of the hose.

E. Replace material found to be defective before or after laying with sound material at no additional expense to the OWNER.

F. Remove all dirt, gravel, cobwebs, plastic shavings, and debris before and after placement. The pipe shall be clean prior to acceptance by the OWNER.

G. Flex hoses shall be installed at locations as specified on the Drawings.

H. The gap between the PVC pipe ends prior to installation of flex hoses shall be as specified on the Drawings.

I. PVC collars shall be installed on the ends of the header piping prior to installation of the flex hoses and clamping. 2-inch-diameter lateral piping and/or well head flex hose connections do not require collars. Collars shall be installed by the CONTRACTOR to provide additional slip resistance.

J. The flex hose shall be clamped to header or lateral piping with two 304 stainless band clamps as recommended by the hose MANUFACTURER.

K. Flex hoses shall be painted the same as header and lateral piping for aesthetics and to provide additional weather protection.

3.3 FLEX HOSE INSTALLATION

A. Solvent welded joints shall be made in accordance with ASTM D2855. The ends of the plastic hose shall be cut square and smooth, beveled and wiped clean.

B. Primer shall first be applied to the outside of the hose and the inside of the fitting socket with a small paint brush or other approved applicator.

C. After priming, solvent cement shall be applied to the outside of the hose and the inside of the fitting socket with a small paint brush or roller applicator. Solvent shall be applied in such a manner that no material is deposited on the interior surface of the pipe or extruded into the interior of the pipe during joining. The coated surfaces shall be immediately pushed snugly together and the pipe rotated approximately 1/4 turn to insure uniform distribution of the cement. Excess cement on the exterior of the joint shall be wiped clean immediately after assembly.

D. Care shall be exercised in assembling a hose with solvent-welded joints so that stress on previously made joints is avoided. Following joining, the hose shall not be handled prior to the set times specified in ASTM D2855.

END OF SECTION

SECTION 02936

HYDROSEEDING

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Hydroseeding vegetative/protective cover soil layer within the closure area, access road and channel berm sideslopes, flood control berm sideslopes, disturbed ground, and borrow areas. Hydroseeding materials include seed mix, fertilizer, mulch, and tackifier.

1.2 RELATED SECTIONS

A. Section 02221 - Excavation and Stockpiling.

B. Section 02229 – Vegetative/Protective Cover.

C. Section 02270 – Erosion and Sediment Control.

1.3 SUBMITTALS

A. Submit the following 21 days prior to hydroseeding operations.

1. Product data sheet and 1 lb. sample of seed mix.
2. Product data sheet and 1 lb. sample of fertilizer.
3. Product data sheet and 0.5 lb. sample of mulch.
4. Product data sheet for tackifier.
5. Certifications that seed mix is free of noxious seed.

1.4 HYDROSEEDING WINDOW

A. Complete hydroseeding between September 15 and October 15.

PART 2 PRODUCTS

2.1 SEED MIX

A. Table 02936-1

B. Certified free of noxious seed.

2.2 MULCH

A. Degradable green-dyed wood cellulose fiber for hydromulching.

2.3 TACKIFIER

A. Derived natural organic plant sources containing no growth or germination inhibiting material

B. Hydrate in water and readily blend with other slurry materials.

2.4 WATER

A. Obtain from onsite groundwater treatment system retention pond.

2.5 FERTILIZER

A. ESN Fertilizer.

2.6 HYDROSEEDING EQUIPMENT

A. Hydroseeder that utilizes water as carrying agent and maintains continuous agitation of seed mix.

B. Hydroseeder with operating capacity sufficient to agitate, suspend, and mix specified products into a homogeneous slurry.

C. Distribution and discharge lines large enough to prevent clogging.

D. Spray nozzles which provide a uniform distribution of slurry.

E. Alternative application methods other than hydroseeding method described herein may be proposed.

PART 3 EXECUTION

3.1 PREPARATION AND EXAMINATION

A. Notify OWNER 2 days prior to hydroseeding operations.

B. Verify areas to receive hydroseed are graded and the top 2 to 4 inches are roughened by scarifying, disking, harrowing, or track-walked with dozer cleats perpendicular to slope.

C. Verify hydroseed areas are not damaged by construction activity. Correct damaged areas at no additional cost to the OWNER.

D. Coordinate hydroseeding operations with landfill operations.

E. Do not hydroseed when winds affect the distribution of seed application.

F. Do not hydroseed when the ground is frozen, excessively wet, otherwise unsuitable.

3.2 APPLICATION RATES

A. Seed Mix: 13.5 lb/acre in a proportion as shown in Table 02936-1 above.

B. Compost: 60 ton/acre

C. Fiber Mulch: 1,500 lbs/acre

D. Gypsum: 2,000 lbs/acre

E. Sulfur: 2,000 lbs/acre

F. Organic Soil Binder: 130 lbs/acre

3.3 HYDROSEED APPLICATION

A. Achieve uniform visible coat distributed over entire hydromulch-seeding areas in specified proportions.

B. Do not drive hydroseeding equipment on completed areas.

C. Hand seed where hydroseeding is impractical or is inaccessible to equipment.

3.4 CLEANING AND REPAIR

A. Remove access material and waste from site.

B. Repair damaged areas at no additional cost to OWNER.

3.5 WARRANTY AND ACCEPTANCE

A. Completed areas will be inspected after hydroseeding operations. Completed areas will conditionally accepted based on compliance with specified materials, application rates, execution, and maintenance.

B. All completed areas must be guaranteed for one year from the date of conditional acceptance to be in healthy, stable, and flourishing conditions.

C. At the end of the one-year warranty period, OWNER and CONTRACTOR will perform additional inspection of completed areas. Repair and/or replace defective areas noted.

TABLE 02936-1

HYDROSEED MIX

BULK (LB/ACRE)	BOTANIC NAME	COMMON NAME
0.5	Poa Scabrella	Pine Bluegrass
2	Festuca Idahoensis	Idaho Fescue
6	Blando Brome (Bromus Hordeaceus)	Soft Chess
3	Festuca Megalura (Vulpia Myuros)	Annual Fescue
2	Poa Pretensis	Kentucky Bluegrass

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03300

REINFORCED CONCRETE

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Provide prefabricated reinforced concrete or cast-in-place concrete, including formwork and reinforcement, where shown on the Construction Drawings.

1.2 RELATED SECTIONS:

A Section 02222 – Engineered Fill, Foundation Layer, and Backfill.

B. Section 02229 - Vegetative/Protective Cover

B. Section 02230 – Surface Water Drainage Systems.

C. Section 02285 – Settlement Monuments.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A185 - Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
2. ASTM A615 - Specification for Deformed and Pliant Billet - Steel Bars for Concrete Reinforcement.
3. ASTM C33 - Specification for Concrete Aggregates.
4. ASTM C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
5. ASTM C42 - Drilled Cones and Sawed Beams of Concrete.
6. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
7. ASTM C143 - Test Method for Slump of Portland Cement Concrete.
8. ASTM C150 - Specification for Portland Cement.
9. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

B. Caltrans Standard Specification, Section 90 - Portland Cement Concrete.

C. CRSI Manual of Standard Practices.

1.4 DEFINITIONS

A. Construction Quality Assurance (CQA) Laboratory: A laboratory capable of conducting the tests required by this specification. This laboratory shall not be affiliated with the CONTRACTOR.

B. Construction Quality Assurance (CQA) Consultant: The OWNER or the monitoring firm responsible for implementation of the CQA plan.

C. Construction Quality Assurance (CQA) Monitor. Site representative of the CQA Consultant responsible for documenting field observations and tests.

D. Construction Quality Assurance (CQA) Office: The professional representative of the CQA Consultant responsible for implementation of the CQA plan.

E. ENGINEER: The individual or firm responsible for the design and preparation of the project Contract Documents.

F. OWNER: Ma-Ru Holding Company, Inc.

1.5 QUALITY CONTROL/QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the method needed for proper performance of the work of this Section.

B. The OWNER will engage and pay for the services of a CQA Consultant for monitoring the quality and placement of concrete.

C. The CONTRACTOR will engage and pay for the services of an independent testing firm/laboratory for quality control testing of concrete.

D. The CONTRACTOR shall submit the certificate of compliance for concrete mix design within 14 days of its intended use in the Work for review and approval by the OWNER/ENGINEER.

E. Do not commence placement of concrete until required mix designs have been reviewed and approved by the OWNER/ENGINEER.

F. For cast-in-place concrete, three (3) concrete test cylinders will be taken by an independent testing laboratory for every 50 cubic yards of concrete placed or for every day of placement. One of the test cylinders shall be tested at 7 days for 70 percent of design strength and the remaining two shall be tested at 28 days for full design strength.

G. For prefabricated concrete structures, sampling and testing of the concrete shall be performed in accordance with the fabricator's written quality control and quality assurance (QC/QA) program. The QC/QA program shall be submitted to the ENGINEER and OWNER for approval prior to fabrication.

PART 2 PRODUCTS

2.1 FORM WORK

A. Design, erect, support, brace, and maintain formwork so it will safely support vertical and lateral loads which might be applied until such loads can be supported safely by the concrete structure.

B. Construct formwork to the exact sizes, shapes, lines, and dimensions shown on the Construction Drawings, as required to obtain accurate alignment, location, grades, and level and plumb work in the finished structure.

2.2 REINFORCEMENT

A. Comply with the following as minimums:

1. Bars: ASTM A615; grade 60, unless otherwise shown on the Construction Drawings, using deformed bars for number 3 and larger.

B. Fabricate reinforcement to the required shapes and dimensions, within fabrication tolerances stated in the CRSI, "Manual of Standard Practices."

C. Do not use reinforcement having any of the following defects:

1. Bar Lengths, depths, or bends exceeding the specified fabricating tolerances.

2. Bends or kinks not indicated on the Construction Drawings or required for this work.

3. Bars with reduced cross-section due to excessive rust or other causes.

2.3 CONCRETE

A. Comply with the following as minimums:

1. Portland Cement: ASTM C150, Type V, low alkali.

2. Aggregate General:

   a. ASTM C33, uniformly graded and clean.

   b. Do not use aggregate known to cause excessive shrinkage.

3. Coarse Aggregate: Crushed Rock or washed gravel with maximum size of 3/4 inches, and with a minimum size passing the number 4 sieve.

4. Fine Aggregate: Natural washed sand of hard and durable particles varying from fine to particles passing a 3/8-inch screen, of which at least 12 percent shall pass a 50-mesh screen, and no more than 3 percent shall pass the number 200 sieve.

5. Water: Clean and/or reclaimed water from water treatment works.

B. When the 28 day compressive strength of concrete is not shown on the Construction Drawings, provide the following compressive strength as minimum:

1.	Concrete structures	3,500 psi
2.	Chain link fence, gates and posts	2,500 psi

2.4 MORTAR

A. Comply with the following as minimums:

1. Portland Cement: ASTM C150, Type V, low alkali, low shrink.

2. Aggregate: Natural washed sand of hard and durable particles meeting the gradation requirements of ASTM C144 for mortar sand.

3. Water: Clean and/or reclaimed water from water treatment works.

B. Mix design Type M or other mix that provides a minimum 28 day compressive strength of 2,500 psi and is suitable for the construction application shown on the Construction Drawings.

2.5 OTHER MATERIALS

A. Provide other materials, not specifically described, but required for a complete and proper installation, as selected by the CONTRACTOR subject to the approval of the ENGINEER.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Notify the OWNER and the ENGINEER of such conditions and proposed corrective action before correcting unsatisfactory conditions. Do not proceed until unsatisfactory conditions are corrected.

3.2 REINFORCING

A. Comply with the following, as well as the specified standards, for details and methods of reinforcing placement and support.

1. Clean reinforcement and remove loose dust and mill scale, earth and other materials which reduce bond or destroy bond with concrete.

2. Position, support, and secure reinforcement against displacement by forms, construction, and the concrete placement operations.

3. Place reinforcement to obtain the required coverages for concrete protection.

3.3 MIXING CONCRETE

A. Transmit mix the concrete in accordance with provisions of ASTM C94.

B. Mixing Water:

1. At the batch plant, withhold 2-1/2 gallons of water per cubic yard of concrete.

2. Upon arrival at the Site, add all or part of the withheld water (as required for proper slump) before the concrete is discharged from the mixer.

3.4 PLACING CONCRETE

A. Concrete shall be placed in a workmanlike manner in accordance with current industry standards.

B. The concrete shall be vibrated in place and struck level with the flow line of the culvert or channel.

C. The Contractor shall remove any excess materials, so that the concrete does not disrupt the function of nearby structures (for example, obstruct the flow of a culvert).

D. Sufficient time shall be allowed in the schedule for proper curing of the concrete before removing formwork and placement of the backfill materials.

3.5 REPAIRING EXISTING CONCRETE

A. Cracking of existing concrete shall be sealed at the surface to prevent infiltration of flow waters into the subgrade soils.

B. Sealant to be used for repair of existing cracks shall be a polyurethane polymer, epoxy based, or other effective sealant approved by the ENGINEER.

C. Seal shall be pressed flush with channel surface and shall not protrude into channel flow area.

D. Sufficient time shall be allowed for proper curing of sealant prior to activities that may have an effect on repaired cracks.

END OF SECTION

APPENDIX D

FINAL COVER STABILITY ANALYSIS

FINAL COVER STABILITY EVALUATION
BONZI SANITATION LANDFILL
WASTE MANAGEMENT UNITS II - IV
Stanislaus County, California

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July 2006

FINAL COVER STABILITY EVALUATION
BONZI SANITATION LANDFILL
WASTE MANAGEMENT UNITS II - IV
Stanislaus County, California

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BONZI SANITATION LANDFILL
WASTE MANAGEMENT UNITS II - IV
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FINAL COVER STABILITY EVALUATION
BONZI SANITATION LANDFILL
WASTE MANAGEMENT UNITS II - IV
Stanislaus County, California

1.0 INTRODUCTION

The following report was prepared to describe the results of analyses performed to assess the stability of alternative final cover systems proposed for closure of Waste Management Units (WMUs) II, III, and IV of the Bonzi Sanitation Landfill, located in Stanislaus County, California. The alternative final cover systems for these WMUs include (from bottom to top):

- A 2-ft-thick compacted soil foundation layer;
- A low permeability barrier layer that will consist of textured linear, low density polyethylene (LLDPE);[1]
- A geocomposite drainage layer on the side slopes of the area to be closed; and
- A 1.5-ft-thick layer of vegetative soil.

The stability analyses were based on the preliminary Final Grading Plan for the area that is shown in Figure 3-2 and that was prepared by EBA Wastechnologies (EBA). It is understood that the final grading plan for closure may be modified in the future. As described in more detail below, the cover stability analyses were based on infinite slope procedures assuming a maximum 4:1 (horizontal:vertical) final slope. Accordingly, the results of the analyses should be generally applicable for alternative grading plans that do not include relatively steeper slopes.

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[1]Depending on material availability considerations at the time of closure, high density polyethylene (HDPE) or poly vinyl chloride (PVC) may be substituted for the low permeability barrier layer. In this event, the analyses described in this report should be reviewed and modified as necessary to account for potentially different interface shear strengths.

1.1 PURPOSE AND SCOPE OF EVALUATION

The purpose of this evaluation was to evaluate the static and seismic stability of the final cover system as required by California Code of Regulations (CCR) Title 27 §21090(a) and §21750(f)(5). The scope of work performed to meet this objective included:

- Review of existing topographic conditions and topographic conditions planned for the final cover at closure;
- Review of the final cover design;
- Review and selection of seismic parameters for use in stability analyses;
- Evaluation and selection of soil and geosynthetic strength properties for use in stability analyses;
- Static and seismic stability analyses of representative cross sections through the final cover; and
- Preparation of this report.

As described in more detail in the main body of this report, the analyses were based on assumed material properties. Site-specific subsurface exploration and laboratory testing were outside the scope of this evaluation and were not performed. Laboratory testing of representative materials is recommended prior to construction to confirm that the properties used for analysis are applicable to the specific materials that will be used for closure.

1.2 TITLE 27 REQUIREMENTS

CCR Title 27 §21090(a) requires:

> "Final cover slopes shall not be steeper than a horizontal to vertical ratio of one and three quarters to one, and shall have a minimum of one fifteen-foot wide bench for every fifty feet of vertical height. Designs having any slopes steeper than a horizontal to vertical ratio of three to one, or having a geosynthetic component [under §(a)(2)], shall have these aspects of their design specifically supported in the slope stability report required under §21750(f)(5)."

Because the proposed final cover includes a geosynthetic component as the low permeability barrier layer, a slope stability report is required. Information required by CCR Title 27 §21750(f)(5)(c)(1-10) and presented in this report includes:

- **§21750(f)(5)(c)(1).** A review of earthquakes during historic times is presented in Table 2-1. The locations of major active faults within 100 kilometers of the site are identified in Table 2-2 (as shown in this table, there are no Holocene faults within 200 feet of the site).
- **§21750(f)(5)(c)(2).** The location of the critical slope is shown in map view in Figure 3-2.
- **§21750(f)(5)(c)(3).** The location of the critical slope was determined by visual inspection of the site grading and by measurement of slope angles on the map and in cross section.
- **§21750(f)(5)(c)(4).** A profile of the critical slope is shown in Figure 3-3 and the layers that make up the cover system are shown in Figure 3-1.
- **§21750(f)(5)(c)(5).** The engineering properties used in the evaluation of cover stability and the basis for their selection are summarized in Table 3-1 and Appendix A.

- **§21750(f)(5)(c)(6).** The stability evaluations performed for closure of WMUs II - IV were limited to the cover system proposed for closure and the stability of the waste fill and the alluvium underlying the landfill were not considered or included in the analyses.

- **§21750(f)(5)(c)(7).** The maximum horizontal acceleration at the site based on the geometric mean of the attenuation relationships summarized in Tables 2-2a and 2-2b.

- **§21750(f)(5)(c)(8).** Seismic displacement analyses were not required because the pseudostatic safety factor was greater than 1.5 for all conditions that were analyzed.

- **§21750(f)(5)(c)(9).** The seismic peak horizontal ground acceleration was not attenuated (reduced) through the fill material.

- **§21750(f)(5)(c)(10).** The disposal site is founded on stiff alluvium. Loose saturated soils and soft clay are not present. Accordingly, bedrock acceleration was not amplified to account for such conditions. All attenuation relationships that were used for analysis accounted to soil subsurface conditions.

2.0 SITE CONDITIONS

2.1 LOCATION AND FACILITY DESCRIPTION

The Bonzi Sanitation Landfill is located in the northern one-half of Section 12, Township 4 South, Range 8 East, Mount Diablo Baseline and Meridian at 2650 West Hatch Road in an unincorporated area of Stanislaus County. The landfill lies on a gently sloping alluvial plain of the Tuolumne River and ground surface elevations range from about 59 feet MSL to 74 feet MSL across the site. The entire property encompasses about 135 acres, approximately 115 acres of which are permitted for solid waste disposal. The remaining 20 acres of the site are used for a groundwater treatment system retention pond and a storage area. WMUs at the facility are shown in Figure 2-1 and include:

- **WMU I**. This Class III module is approximately 36.4 acres in size and was operated from 1967 to 1978. WMU I was closed in 1998 with a final cover system that included (from bottom to top): a 24-inch-thick foundation layer; a 30-mil-thick PVC low permeability barrier layer; and an 18-inch-thick layer of vegetative soil.

- **WMU II**. This Class III module is approximately 17.7 acres in size and was operated from 1978 to 1984.

- **WMU III (Western Half)**. This Class III module is approximately 10.9 acres in size and was operated from 1984 to 1992.

- **WMU III (Eastern Half)**. The eastern half of WMU III is unclassified and only contains inert industrial and construction wastes. The module is about 8.9 acres in size and operated from 1992 to 1999.

- **WMU IV**. WMU IV is approximately 19.6 acres in size and has been in operation since 1999. This module is unclassified and only accepts inert wastes.

The areas currently proposed for closure encompass about 49 acres and include all of WMUs II and III and the southern portion of WMU IV.

2.2 GEOLOGIC CONDITIONS

The landfill is located within the Great Valley Physiographic Province of California. The upper several hundred feet of geologic formations in the landfill area consist primarily of Pleistocene to Recent unconsolidated alluvium with a heterogeneous complex of clay, silts, sands and gravel. The E-clay or Corcoran Clay, a continuous blue to grey silt/clay layer is characteristic of the local formations, and occurs at a depth of approximately 120 feet below the ground surface.

The surficial geology at the landfill consists of interbedded layers of silty sand and sandy silt to approximately 25 to 50 feet bgs and are underlain by a relatively homogeneous layer of sand. These deposits are presumably underlain by the E-clay. A detailed description of landfill geology and generalized geologic cross-sections are presented in the Hydrogeologic Summary Report (Dames & Moore, 1989) and the Revised Report of Disposal Site Information (Dames & Moore, 1990).

2.3 HYDROGEOLOGIC CONDITIONS

The water-bearing zone beneath the Landfill consists of interbedded alluvial deposits of sands, silty sands and sandy silts overlying the E-Clay. The unconfined aquifer in the Landfill vicinity is estimated to average approximately 70 to 85 feet in thickness, and is presumably underlain by the E-Clay. Groundwater surface elevations at the Landfill are influenced by river-aquifer interactions. The hydraulic conductivity of the shallow water bearing formations underlying the landfill is estimated to range from approximately 7.9×10^{-3} to 2.5×10^{-2} centimeters per second. Detailed descriptions of the landfill hydrogeology are presented in the Site Investigation Report (1987) and Hydrogeologic Summary Report (1989) prepared by Dames & Moore. The predominant groundwater flow direction in the landfill vicinity is strongly influenced by the Tuolumne River and is toward the north-northwest. Groundwater gradients vary in direction and magnitude depending largely on changing river stages. The direction of regional groundwater flow does not appear to be influenced by any cone of depression which may be formed by pumping of a municipal supply well that is located in the Riverdale Park Tract approximately one-eighth of a mile north of the landfill. Groundwater surface elevations have historically ranged from approximately 35 to 50 feet MSL.

2.4 SITE SEISMICITY

2.4.1 Historical Seismicity

The site is located in a relatively aseismic area (compared with other areas of California), although it is located in the vicinity of active faults and has experienced variable levels of ground shaking from earthquakes in the past. Historic earthquakes with magnitudes greater than about 4 that occurred within 100 kilometers of the site are summarized in Table 2-1. As shown in this table, the maximum historic peak horizontal ground acceleration (PHGA) experienced at the site was on the order of 0.12g and was associated with a magnitude 5.8 earthquake about 16 miles from the landfill.

2.4.2 Faulting and Ground Motion

Faults within 100 km of the site are summarized in Tables 2-2a and 2-2b. As indicated in these tables, the closest active fault to the landfill is a segment of the Great Valley fault zone (Segment 7) that is located about 13 miles from the site. The Great Valley fault zone is adjacent to the eastern boundary of the Coast Range Geomorphic Province and consists of a number of discontinuous reverse and blind thrusts that are capable of generating earthquakes of varying magnitudes at different locations. Numerous earthquakes along this boundary have been noted since the magnitude 6.4 1892 Vacaville-Winters earthquake, with the most recent large event along this zone being the 1983 magnitude 6.7 Coalinga earthquake. There are no known Holocene faults within 200 feet of the site.

CCR Title 27 specifies that Class III facilities be designed for the maximum probable earthquake (MPE). According to Title 27, the MPE is:

> "Maximum probable earthquake", or "MPE" (SWRCB), means the maximum earthquake that is likely to occur during a 100 year interval. The term describes a probable occurrence, rather than an assured event that will occur at a specific time;

therefore, the following factors have a bearing upon the derivation of the MPE for a given facility:

(a) the regional seismicity, considering the known past seismic activity;

(b) the fault or faults within a 62 mile (100 kilometer) radius from the facility boundary that may be active within the 100 years following first acceptance of waste;

(c) the type(s) of faults considered;

(d) the seismic recurrence factor for the area described in §(b), above, and for any faults (when known) within that area; and

(e) the mathematic probability analysis (or statistical analysis) of seismic activity associated with the faults included in the area described under §(b), above, including a graphical plot of recurrence information.

Nevertheless, the postulated magnitude of the MPE is superseded by any more powerful seismic event that has occurred within historic time in the area described under §(b), above.

Because there is some uncertainty associated with the MPE, both the MPE and the more conservative maximum credible earthquake (MCE) were considered for this analysis. As summarized in Tables 2-2a and 2-2b, the MCE and MPE moment magnitudes associated with the Segment 7 of the Great Valley fault system are 6.7 and 5.7, respectively (Cao et. al, 2003; Blake, 2000).[2] The PHGAs associated with these events were evaluated based on the geometric mean of four commonly used attenuation relationships (Abrahamson and Silva, 1997; Campbell and Borzongia, 1997; Idriss, 1994; and Sadigh et al., 1997) and were estimated to be on the order of 0.21g for the MCE and 0.12g for the MPE. As summarized in Tables 2-1 and 2-2b, the PHGA associated with the MPE is approximately equal to the maximum estimated PHGA from the historical record.

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[2]Cao et. al (2003) provide information regarding the maximum earthquake (analogous to the MCE) and do not address the MPE. Data for the MPE was obtained from Blake (2000). It should also be noted (as shown in Table 2-2a), relatively larger magnitudes and relatively lower PHGAs are associated with other nearby faults (e.g. the Ortigalita fault and Segment 8 of the Great Valley fault). The potential affect of a relatively larger magnitude earthquake may be addressed as part of a deformation analysis (if necessary).

3.0 COVER STABILITY ANALYSES

3.1 FINAL COVER SECTION

The proposed final cover system for this area of the landfill will include (Figure 3-1):

- A 2-ft-thick soil foundation layer that will be compacted to 90 percent relative compaction in accordance with ASTM D1557 procedures. We understand that soil from an adjacent borrow area will be used for construction of the foundation layer;

- A low permeability barrier layer of textured LLDPE on the side slopes. Smooth LLDPE may be used for the relatively flat top deck of the landfill;;

- A double-sided geocomposite drainage layer (i.e., a geocomposite drainage net that is heat-bonded to non-woven geotextiles on both sides of the net) on the relatively steep (compared to the top deck) side slopes of the area to be closed;

- A 12 oz/yd^2 cushion geotextile on the relatively flat top deck portions of the area to be closed; and

- A 1.5-ft-thick layer of soil that will be placed and compacted and that is capable of supporting vegetation. We understand that the soil for the vegetative layer will be obtained from the same borrow source as the foundation layer. The final cover will not be irrigated during the postclosure period.

3.2 FINAL COVER GRADES AND GEOMETRY

The final grading plan for the closure is shown in Figure 3-2. The location of the cross section selected for analysis is also shown in Figure 3-2 and the cover profile is shown in Figure 3-3. As shown in these figures, the top deck of WMUs II, III, and IV is relatively flat, with overall grades on the order of 2.7 percent to 3 percent. The average side slope for Section A-A' is on the order of

4:1 (horizontal:vertical) with a maximum length of about 75 feet from the crest to the toe of the slope.

3.3 MATERIAL PROPERTIES AND CONDITIONS ASSUMED FOR ANALYSIS

3.3.1 Soil and Geosynthetic Properties

Site-specific test data are not currently available to evaluate material properties for use in stability analyses. As a result, the following properties were assumed for analysis:

- **Foundation Layer Properties**. The foundation layer will be constructed on onsite soils that will be placed and compacted to a minimum of 90 percent relative compaction in accordance with ASTM D1557 procedures. Site data indicate these soils consist primarily of silty fine-grained sand to sandy silt. For the purposes of stability analyses, the foundation layer was assumed to have a strength represented by a friction angle of 25 degrees and a cohesion of 50 lb/ft^2.

- **LLDPE/Foundation Layer Interface Strength**. The interface strength of the foundation layer and the overlying textured LLDPE was assumed based on the test data included in Koerner and Narejo (2005) that suggest a residual friction angle of 25 degrees and an adhesion of about 102 lb/ft^2 for this interface (see Appendix A). For the purposes of analysis, the adhesion value was reduced by 50 percent to 51 lb/ft^2 because the cover analyses are very sensitive to adhesion and the data suggest some uncertainty associated with this parameter.

- **LLDPE/Geocomposite Interface Strength**. The interface strength of the textured LLDPE and the overlying non-woven, needle-punched geotextile component of the geocomposite drainage layer was based on data included in Koerner and Narejo (2005) that suggest a residual friction angle of 17 degrees and an adhesion of about 198 lb/ft^2 (see Appendix A). Similar to above, for the purposes of analysis, the adhesion value was reduced by 50 percent because the data suggest some uncertainty associated with this value.

- **Geocomposite/Vegetative Soil Interface Strength.** The interface strength of the upper geotextile component of the geocomposite drainage layer and the overlying vegetative soil layer was assumed based on data included in Koerner and Narejo (2005) that suggest a residual friction angle of 33 degrees with zero adhesion is representative of the interface between a non-woven, needle-punched geotextile and cohesionless soils. (see Appendix A).

- **Vegetative Soil Layer Properties.** The Final Closure Plan indicates that the vegetative soil layer will be constructed of the site soil as the foundation layer and that the vegetative layer will be compacted. As a result, the strength of this layer was assumed to be the same as the foundation layer.

As indicated above and in Table 3-1, residual (or large displacement) strength properties were assumed for all analysis. Although these assumed properties are judged to be conservative, a laboratory test program is recommended prior to closure construction to confirm that the values assumed for analysis are appropriate.

3.3.2 Groundwater and Seepage Conditions

The final cover will be constructed above groundwater and it is understood that leachate levels are relatively low. As a result, the foundation layer of the final cover should not become saturated from below. It is also likely that the LLDPE barrier layer will prevent saturation of the foundation layer from above. Although a drainage geocomposite is included in the final cover, it is possible that the vegetative soil layer may become saturated for a period of time before it fully drains. Accordingly, analyses were performed to assess the stability of the cover for the assumed transient condition of full vegetative soil layer saturation.

3.4 STABILITY ANALYSIS METHODS

3.4.1 Static Stability Analysis Procedures

Static stability analyses were based on the infinite slope limit equilibrium procedure summarized in Koerner and Soong (1998). In general, this procedure may be used to calculate a safety factor for a thin veneer of cover soil (1 to 3 feet thick) on a geosynthetic material at a given slope angle and slope length. The Koerner and Soong (1998) method can also incorporate seismic loading and seepage forces. A number of different analytical scenarios were considered to assess the safety factors associated with sliding within different portions of the cover.

3.4.2 Seismic Stability Analysis Procedures

Pseudostatic stability analyses were performed using a seismic coefficient of 0.15g. For cases where the pseudostatic safety factor was less than 1.5, deformation analyses would typically be performed using the generally accepted procedure described by Makdisi and Seed (1978). As summarized below, all pseudostatic safety factors were greater than 1.5 and deformation analyses were not necessary.

3.5 RESULTS

The results of the analyses indicate static and pseudostatic safety factors greater than 1.5 for all potential failure surfaces under the assumption that the final cover does not become saturated. Seepage analyses suggest that sliding of the vegetative soil layer could occur on the steeper portions of the cover if this layer becomes fully saturated. However, this is a common final cover stability analysis result that does not necessarily indicate an unstable condition because the geocomposite drainage layer is intended to prevent saturation. Additionally, full vegetative soil layer saturation, should it occur, would be a transient condition.

4.0 DISCUSSION AND RECOMMENDATIONS

The stability analysis results suggest generally acceptable stability of the cover system because:

- The maximum (steepest) final slopes in the area being closed have average inclinations on the order of 4:1 and analyses indicate a minimum static safety factor on the order of 2.7 for this slope;
- Static safety factors were based on residual (large displacement) assumptions regarding soil and geosynthetic interface strengths; and
- Seismic analyses indicate acceptable pseudostatic safety factors.

As indicated previously, there are no site-specific data available regarding site soil type(s) that may be used for cover construction at the landfill and no laboratory testing was performed to assess cover material or cover material interface strengths. Although the assumptions used in this analysis are believed to be conservative, there is no site-specific information available to check or validate the assumed properties that form the basis of the stability calculations. Additionally, the stability of low normal stress systems (such as landfill covers) is highly dependent on the cohesive or adhesive strength of cover interfaces or materials. This could be significant if the cohesive or adhesive strengths of any of the materials used in the Bonzi Landfill cover system are different than that assumed for analysis. To address these uncertainties and to confirm or check the results of the analyses, a laboratory testing program using samples of soils and geosynthetic materials that will be used for construction is essential. Such a test program would include direct shear box testing of an entire section of cover and/or direct shear box testing of specific interfaces or materials.

5.0 LIMITATIONS

The preceding report was prepared by RMC Geoscience under the direction of Richard Mitchell, P.G., C.E.G. The report was peer reviewed by Howard Barlow, P.E., G.E. of Geomatrix Consultants. The conclusions and recommendations of this report are based upon information provided to us regarding the proposed closure project, assumptions regarding final cover material properties, and professional judgement. We have employed accepted geotechnical engineering and engineering geologic procedures and our professional opinions and conclusions are made in accordance with these principles and practices. This standard is in lieu of all warranties, either expressed or implied.

6.0 REFERENCES

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Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER
WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
37.51	121.26	13.8	22.2	9/7/1994	4.1	0.031
37.50	121.30	16.1	25.9	07/15/1866	5.8	0.120
37.42	121.33	20.5	33.1	7/29/1954	4.2	0.020
37.40	121.40	24.4	39.3	04/10/1881	5.9	0.083
37.19	120.95	29.4	47.3	6/18/1975	4.1	0.011
37.69	121.59	30.5	49.1	2/15/1992	4.0	0.009
37.68	121.60	31.0	49.8	5/2/1946	4.6	0.018
37.56	121.66	34.1	54.8	8/24/1980	4.0	0.008
37.57	121.67	34.3	55.2	12/11/1986	4.1	0.009
37.66	121.67	34.6	55.7	6/21/1977	4.4	0.012
37.48	121.69	36.6	58.9	3/31/1986	5.7	0.047
37.43	121.68	37.1	59.8	10/26/1943	4.9	0.019
37.30	121.60	37.4	60.1	8/27/1904	4.6	0.014
37.30	121.60	37.4	60.1	12/11/1901	4.0	0.007
37.68	121.72	37.5	60.3	4/21/1943	4.2	0.009
37.46	121.70	37.6	60.6	2/28/1987	4.0	0.007
37.20	121.50	37.9	60.9	07/06/1899	5.8	0.050
37.43	121.70	38.2	61.5	4/20/1991	4.2	0.008
37.38	121.68	38.4	61.9	9/18/1941	4.0	0.007
37.65	121.75	38.9	62.6	5/1/1943	4.3	0.009
37.76	121.73	39.1	62.9	1/27/1980	5.4	0.031
37.27	121.61	39.1	62.9	6/5/1984	4.2	0.008
37.72	121.75	39.4	63.5	3/10/1991	4.0	0.006
37.33	121.67	39.5	63.6	11/04/1888	4.3	0.009
37.33	121.67	39.5	63.6	01/15/1890	4.3	0.009
37.33	121.67	39.5	63.6	10/12/1887	4.3	0.009
37.33	121.67	39.5	63.6	4/3/1924	4.5	0.011
37.33	121.67	39.5	63.6	02/05/1892	4.3	0.009
37.33	121.67	39.5	63.6	06/28/1891	4.3	0.009
37.33	121.67	39.5	63.6	3/8/1912	4.3	0.009
37.76	121.74	39.6	63.7	3/18/1984	4.3	0.009
37.33	121.68	40.0	64.4	6/22/1949	4.1	0.007
37.17	121.52	40.1	64.6	11/8/1945	4.2	0.008
37.68	121.77	40.2	64.6	4/15/1943	4.1	0.007
37.68	121.77	40.2	64.6	4/15/1943	4.0	0.006
37.31	121.68	40.3	64.9	8/11/1993	4.8	0.015
37.62	121.78	40.4	65.1	4/26/1943	4.1	0.007
37.38	121.72	40.4	65.1	1/15/1981	4.8	0.015
37.34	121.70	40.6	65.3	9/26/1984	4.5	0.011
37.30	121.67	40.6	65.3	6/10/1949	4.6	0.012
37.30	121.67	40.6	65.4	9/3/1986	4.2	0.008
37.81	121.74	40.7	65.5	10/22/1987	4.4	0.010
37.23	121.61	40.8	65.6	9/28/1967	4.9	0.017
37.29	121.67	41.0	65.9	5/3/1984	4.4	0.010
37.36	121.72	41.0	66.0	8/29/1978	4.1	0.007
37.30	121.68	41.0	66.0	5/8/1979	4.8	0.015
37.32	121.70	41.2	66.3	4/24/1984	6.2	0.057
37.90	121.70	41.2	66.3	9/20/1940	4.0	0.006
37.90	121.70	41.2	66.3	9/19/1940	4.0	0.006
37.36	121.72	41.2	66.4	5/21/1996	4.7	0.013
37.28	121.67	41.4	66.7	4/27/1984	4.0	0.006

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
37.48	121.78	41.4	66.7	10/31/1958	4.2	0.007
37.60	121.80	41.5	66.8	6/11/1903	5.5	0.033
37.42	121.76	41.6	66.9	7/1/1990	4.2	0.007
37.26	121.66	41.8	67.3	11/11/1991	4.1	0.006
37.29	121.69	42.0	67.6	12/30/1988	4.3	0.008
37.34	121.73	42.2	67.9	9/26/1984	4.4	0.009
37.50	121.80	42.2	68.0	12/1/1938	4.5	0.010
37.29	121.70	42.3	68.0	8/17/1990	4.0	0.006
37.32	121.73	42.4	68.2	2/8/1988	4.0	0.006
37.12	121.51	42.4	68.3	6/20/1988	4.2	0.007
37.25	121.67	42.5	68.4	7/9/1958	4.1	0.006
37.37	121.76	42.5	68.4	11/10/1988	4.8	0.014
37.46	121.80	42.9	69.0	12/29/1986	4.5	0.010
37.39	121.77	43.0	69.1	6/13/1988	5.4	0.028
37.81	121.79	43.2	69.5	1/24/1980	5.1	0.020
37.10	121.50	43.3	69.6	8/6/1979	5.8	0.043
37.42	121.80	43.3	69.7	4/3/1989	4.7	0.013
37.40	121.79	43.3	69.7	7/9/1989	4.0	0.005
37.33	121.75	43.4	69.8	10/26/1917	4.0	0.005
37.82	121.79	43.4	69.9	1/24/1980	4.0	0.005
37.15	121.58	43.5	69.9	1/19/1987	4.3	0.008
37.14	121.57	43.6	70.2	4/26/1984	4.0	0.005
37.37	121.78	43.7	70.4	9/5/1955	5.5	0.031
37.10	121.51	43.9	70.6	9/13/1995	4.2	0.007
37.84	121.79	43.9	70.7	1/24/1980	4.8	0.014
37.84	121.79	43.9	70.7	1/25/1980	4.4	0.009
37.27	121.72	44.0	70.8	3/24/1959	4.1	0.006
37.13	121.57	44.0	70.9	1/29/1959	4.3	0.008
37.30	121.75	44.4	71.4	3/11/1936	4.3	0.008
37.00	121.30	44.4	71.5	2/4/1942	4.0	0.005
37.83	121.81	44.7	71.9	1/24/1980	5.8	0.042
37.84	121.81	44.9	72.3	1/27/1980	4.1	0.006
37.07	120.58	45.0	72.4	11/1/1954	4.0	0.005
37.63	121.87	45.4	73.0	3/29/1943	4.2	0.006
37.86	121.81	45.4	73.1	1/25/1980	4.6	0.010
37.60	121.88	45.9	73.9	9/24/1936	4.3	0.007
37.25	121.75	46.1	74.2	7/1/1911	6.6	0.063
37.04	121.48	46.2	74.3	6/15/1998	4.0	0.005
37.03	121.46	46.4	74.7	1/16/1993	5.3	0.023
37.00	121.40	46.5	74.8	6/18/1935	4.0	0.005
37.10	121.60	46.7	75.1	03/26/1866	5.4	0.025
38.25	121.32	46.8	75.3	08/04/1850	4.3	0.007
37.30	121.80	46.8	75.3	8/3/1903	5.5	0.028
37.30	121.80	46.8	75.3	01/02/1891	5.5	0.028
37.33	121.82	46.9	75.4	9/2/1927	4.6	0.010
37.01	121.45	47.1	75.8	8/9/1979	4.2	0.006
37.02	121.48	47.3	76.1	3/9/1949	5.2	0.020
37.02	121.48	47.3	76.1	3/14/1949	4.4	0.008
37.50	121.90	47.6	76.7	11/26/1858	6.1	0.046
37.27	121.80	47.8	76.9	8/27/1945	4.5	0.009
37.82	121.88	48.1	77.4	3/17/1962	4.1	0.005

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
37.82	121.88	48.2	77.5	3/17/1963	4.1	0.005
37.00	121.47	48.2	77.6	8/6/1979	4.3	0.007
37.90	121.85	48.5	78.1	11/11/1936	4.3	0.007
37.75	120.17	48.6	78.1	8/12/1918	4.0	0.005
37.00	121.50	49.1	78.9	06/20/1897	6.2	0.048
37.56	121.94	49.3	79.4	3/3/1981	4.4	0.007
38.10	121.70	49.4	79.5	2/14/1909	4.5	0.008
36.98	121.47	49.4	79.5	8/6/1997	4.0	0.004
36.98	121.47	49.4	79.6	12/13/1995	4.1	0.005
36.90	121.20	49.8	80.1	03/06/1882	5.7	0.033
36.98	121.48	49.8	80.2	12/13/1995	4.0	0.004
36.98	121.49	50.0	80.4	1/17/1966	4.1	0.005
37.10	121.70	50.5	81.2	02/26/1864	5.9	0.039
37.79	121.94	50.7	81.5	6/12/1970	4.3	0.006
38.01	121.82	50.7	81.6	9/10/1965	4.9	0.013
37.78	121.94	50.8	81.7	6/12/1970	4.3	0.006
38.00	120.25	50.9	81.9	04/11/1872	5.0	0.014
37.18	121.80	51.1	82.3	4/10/1954	4.1	0.005
37.00	121.57	51.1	82.3	1/9/1928	5.3	0.020
37.00	121.57	51.1	82.3	03/25/1859	5.0	0.014
37.80	121.95	51.3	82.5	6/12/1970	4.1	0.005
37.80	121.95	51.3	82.5	6/12/1970	4.0	0.004
37.84	121.94	51.7	83.2	10/11/1986	4.7	0.010
37.30	121.90	51.7	83.2	10/08/1865	6.3	0.048
37.30	121.90	51.7	83.2	4/4/1905	4.0	0.004
37.30	121.90	51.7	83.2	5/28/1927	5.0	0.014
37.30	121.90	51.7	83.2	4/21/1904	4.0	0.004
37.33	121.92	51.9	83.5	08/30/1873	4.3	0.006
37.33	121.92	51.9	83.5	04/04/1859	4.3	0.006
37.33	121.92	51.9	83.5	6/10/1931	4.0	0.004
37.33	121.92	51.9	83.5	07/23/1885	4.3	0.006
37.33	121.92	51.9	83.5	9/9/1920	4.0	0.004
37.33	121.92	51.9	83.5	08/11/1859	4.3	0.006
37.06	121.69	52.1	83.8	11/16/1964	5.0	0.014
37.00	121.60	52.1	83.8	3/3/1959	4.4	0.007
37.00	121.60	52.1	83.8	9/28/1900	4.0	0.004
36.90	121.38	52.4	84.3	9/30/1950	4.1	0.005
37.60	122.00	52.5	84.5	6/5/1907	4.0	0.004
37.60	122.00	52.5	84.5	07/22/1864	4.7	0.010
37.60	122.00	52.5	84.5	5/16/1933	4.5	0.008
36.93	121.48	52.8	84.9	3/3/1975	4.2	0.005
37.79	121.98	52.8	85.0	8/20/1976	4.0	0.004
37.70	122.00	52.8	85.0	03/05/1864	5.7	0.031
36.92	121.47	53.1	85.5	12/31/1974	4.3	0.006
36.98	121.60	53.2	85.6	3/3/1959	4.0	0.004
36.98	121.60	53.2	85.6	3/2/1959	5.3	0.019
36.90	121.42	53.2	85.7	10/31/1951	4.8	0.011
36.90	121.42	53.2	85.7	10/30/1951	4.0	0.004
36.90	121.42	53.2	85.7	10/30/1951	4.2	0.005
36.92	121.48	53.4	85.9	11/29/1974	4.0	0.004
37.08	121.75	53.4	85.9	5/28/1941	4.5	0.007

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER
WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
38.04	121.86	53.6	86.3	6/22/1989	4.3	0.006
36.96	121.58	53.7	86.4	10/10/1998	4.1	0.004
36.97	121.60	54.0	86.9	7/17/1997	4.1	0.004
36.91	121.48	54.0	86.9	11/28/1974	5.2	0.017
37.80	122.00	54.0	87.0	07/04/1861	5.6	0.027
38.00	121.90	54.1	87.0	05/19/1889	6.0	0.038
37.42	122.00	54.1	87.1	2/11/1930	4.0	0.004
36.88	121.42	54.5	87.7	8/10/1947	4.4	0.006
37.10	121.80	54.5	87.8	09/17/1888	4.5	0.007
37.10	121.80	54.5	87.8	05/24/1865	5.5	0.024
36.90	121.48	54.6	87.9	12/29/1959	4.7	0.009
36.95	121.59	54.6	87.9	1/10/1974	4.4	0.006
37.87	121.99	54.7	88.0	4/7/1990	4.2	0.005
36.82	121.13	54.7	88.1	3/17/1976	4.3	0.006
36.84	121.28	54.8	88.1	4/30/1987	4.1	0.004
37.89	121.98	54.9	88.3	4/28/1990	4.6	0.008
36.95	121.60	54.9	88.4	5/26/1937	4.3	0.006
36.87	121.41	55.0	88.6	3/31/1970	4.5	0.007
36.84	121.30	55.0	88.6	9/2/1998	4.0	0.004
36.98	121.67	55.5	89.4	6/5/1942	4.2	0.005
36.82	121.20	55.6	89.4	9/22/1995	4.3	0.005
37.02	121.73	55.6	89.4	8/18/1982	4.5	0.007
36.92	121.57	55.8	89.8	2/7/1931	4.3	0.005
36.92	121.57	55.8	89.8	5/13/1966	4.5	0.007
36.81	121.20	55.9	90.0	8/28/1994	4.0	0.004
36.82	121.29	56.0	90.1	1/26/1986	4.2	0.005
36.85	121.40	56.0	90.2	7/4/1939	4.0	0.004
37.02	121.75	56.3	90.7	3/21/1968	4.3	0.005
37.06	121.80	56.4	90.7	11/2/1989	4.9	0.011
37.67	122.07	56.4	90.8	12/04/1887	4.3	0.005
37.04	121.78	56.5	90.9	9/7/1967	4.7	0.009
37.13	121.88	56.6	91.1	6/27/1988	5.7	0.029
36.81	121.28	56.7	91.2	1/26/1986	5.5	0.023
37.08	121.83	56.7	91.2	11/25/1919	4.5	0.007
37.08	121.83	56.9	91.5	10/25/1989	5.0	0.012
37.06	121.81	56.9	91.6	10/30/1989	4.1	0.004
36.84	121.41	57.0	91.7	3/22/1997	4.2	0.005
36.99	121.73	57.1	91.9	1/11/1994	4.3	0.005
37.03	121.78	57.1	91.9	10/18/1989	4.2	0.005
36.95	121.67	57.2	92.0	3/16/1953	4.0	0.004
36.82	121.37	57.4	92.4	5/17/1945	4.6	0.008
37.04	121.81	57.4	92.4	10/18/1989	4.8	0.010
37.50	120.00	57.5	92.5	01/22/1857	4.3	0.005
37.50	120.00	57.5	92.5	8/23/1937	4.0	0.004
36.80	121.30	57.5	92.5	2/20/1988	5.3	0.018
37.10	121.87	57.5	92.6	4/25/1981	4.1	0.004
37.23	121.98	57.7	92.8	11/12/1973	4.0	0.004
36.83	121.42	57.7	92.9	10/25/1912	4.0	0.004
36.83	121.42	57.7	92.9	10/17/1922	4.0	0.004
36.83	121.42	57.7	92.9	9/24/1917	4.0	0.004
36.83	121.42	57.7	92.9	12/31/1910	5.0	0.012

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER
WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
36.83	121.42	57.7	92.9	3/11/1911	4.5	0.007
36.83	121.42	57.7	92.9	12/27/1915	4.0	0.004
36.90	121.60	57.8	93.1	4/30/1900	4.5	0.007
36.90	121.60	57.8	93.1	03/30/1883	5.6	0.025
36.90	121.60	57.8	93.1	10/11/1800	5.7	0.028
36.90	121.60	57.8	93.1	04/24/1890	6.0	0.036
36.99	121.75	57.8	93.1	8/6/1984	4.0	0.004
37.60	122.10	57.9	93.3	05/21/1864	5.3	0.017
37.97	122.00	58.0	93.3	5/31/1958	4.1	0.004
38.02	121.97	58.1	93.5	10/27/1955	4.3	0.005
37.00	121.76	58.1	93.5	10/18/1989	4.5	0.007
37.00	121.77	58.1	93.5	6/22/1947	4.7	0.008
37.25	122.00	58.2	93.6	7/19/1925	4.0	0.003
36.92	121.65	58.2	93.6	9/14/1963	4.6	0.007
36.85	121.50	58.2	93.6	8/16/1957	4.3	0.005
37.70	122.10	58.2	93.7	10/21/1868	6.8	0.056
36.78	120.87	58.3	93.8	1/6/1988	4.2	0.004
36.98	121.75	58.4	93.9	10/14/1966	4.2	0.004
36.90	121.62	58.4	94.0	1/1/1949	4.5	0.006
37.00	121.78	58.5	94.1	12/18/1967	5.3	0.017
36.93	121.68	58.6	94.3	4/25/1954	5.3	0.017
37.02	121.80	58.6	94.3	10/18/1989	4.4	0.006
36.93	121.68	58.7	94.5	4/18/1990	4.7	0.008
36.78	121.28	58.8	94.6	8/14/1981	4.2	0.004
36.93	121.69	58.8	94.6	4/18/1990	4.2	0.004
36.96	121.74	58.8	94.6	3/24/1991	4.5	0.006
36.93	121.69	58.8	94.7	10/19/1989	4.5	0.006
36.91	121.65	58.8	94.7	4/18/1990	4.9	0.011
36.91	121.65	58.8	94.7	4/18/1990	4.4	0.006
37.10	121.90	58.8	94.7	04/15/1889	4.8	0.009
37.10	121.90	58.8	94.7	8/8/1916	4.0	0.003
36.92	121.67	58.8	94.7	7/25/1921	4.0	0.003
36.92	121.67	58.8	94.7	12/17/1953	4.2	0.004
36.80	120.70	58.9	94.8	12/5/1937	4.0	0.003
36.92	121.67	58.9	94.9	4/18/1990	5.0	0.012
36.93	121.70	59.0	94.9	4/18/1990	5.2	0.015
36.90	121.64	59.0	95.0	6/18/1980	4.2	0.004
36.91	121.66	59.1	95.0	4/18/1990	4.3	0.005
36.92	121.68	59.1	95.1	4/18/1990	4.2	0.004
36.92	121.68	59.2	95.2	4/18/1990	5.4	0.019
36.88	121.62	59.2	95.3	4/19/1996	4.7	0.008
37.00	121.80	59.2	95.3	1/9/1937	4.3	0.005
36.80	121.40	59.3	95.4	10/18/1908	4.6	0.007
36.80	121.40	59.3	95.4	04/02/1885	5.4	0.019
36.77	121.27	59.3	95.4	4/27/1948	4.4	0.006
36.77	121.27	59.3	95.4	4/27/1948	4.0	0.003
36.90	121.65	59.3	95.5	9/19/1991	4.5	0.006
36.82	121.47	59.4	95.6	5/25/1953	4.0	0.003
36.83	121.50	59.4	95.7	04/18/1865	4.3	0.005
36.93	121.70	59.4	95.7	2/7/1990	4.0	0.003
36.78	120.75	59.5	95.7	4/22/1932	4.0	0.003

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER
WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
37.14	121.95	59.5	95.7	8/8/1989	4.5	0.006
37.72	122.12	59.5	95.7	12/29/1942	4.3	0.005
36.88	121.61	59.5	95.7	4/18/1996	4.4	0.006
36.93	121.71	59.6	95.9	10/18/1989	4.3	0.005
36.87	121.60	59.6	95.9	12/1/1956	4.4	0.006
36.98	121.79	59.7	96.0	10/25/1989	4.0	0.003
37.20	122.00	59.7	96.1	12/30/1934	4.3	0.005
37.20	122.00	59.7	96.1	1/3/1935	4.3	0.005
36.79	121.39	59.7	96.1	10/27/1969	4.6	0.007
36.89	121.64	59.9	96.3	4/7/1990	4.2	0.004
36.85	121.57	60.0	96.5	3/28/1948	4.5	0.006
36.85	121.57	60.0	96.5	3/28/1948	4.6	0.007
36.85	121.57	60.0	96.5	3/28/1948	4.0	0.003
37.13	121.95	60.0	96.5	8/8/1989	5.3	0.017
37.72	122.13	60.0	96.6	12/17/1954	4.5	0.006
36.99	121.81	60.0	96.6	10/19/1989	4.0	0.003
37.73	122.13	60.1	96.7	3/27/1984	4.4	0.005
37.05	121.88	60.1	96.8	10/21/1989	4.6	0.007
37.15	121.97	60.2	96.9	8/8/1989	4.8	0.009
36.80	121.45	60.2	97.0	6/24/1939	5.5	0.021
36.80	121.45	60.2	97.0	3/2/1940	4.0	0.003
36.90	121.68	60.3	97.0	4/22/1954	4.3	0.005
36.98	121.80	60.3	97.1	10/22/1989	4.1	0.004
36.78	121.38	60.3	97.1	12/5/2000	4.0	0.003
36.88	121.65	60.4	97.2	4/22/1990	4.0	0.003
37.00	121.83	60.4	97.2	9/19/1923	4.0	0.003
37.97	122.05	60.4	97.3	10/24/1955	5.4	0.019
36.87	121.63	60.5	97.3	9/14/1963	5.4	0.019
36.91	121.71	60.5	97.4	10/18/1989	4.0	0.003
36.88	121.65	60.5	97.4	10/25/1989	4.1	0.004
36.82	121.52	60.5	97.4	11/23/1950	4.1	0.004
36.78	121.40	60.6	97.5	5/11/1948	4.3	0.005
36.73	121.10	60.6	97.5	11/28/1985	4.9	0.010
37.23	122.04	60.7	97.7	11/7/1989	4.3	0.005
36.88	121.66	60.7	97.7	9/19/1991	4.5	0.006
37.12	121.96	60.7	97.7	10/18/1989	4.2	0.004
37.17	122.00	60.7	97.8	11/9/1914	5.5	0.021
37.16	122.00	60.8	97.8	10/18/1989	4.0	0.003
36.86	121.62	60.8	97.8	1/7/1981	4.5	0.006
37.05	121.90	60.8	97.8	10/26/1989	4.0	0.003
37.19	122.02	60.8	97.8	10/18/1989	4.3	0.005
37.06	121.91	60.8	97.8	10/18/1989	4.1	0.004
37.06	121.91	60.9	98.0	10/21/1989	4.9	0.010
37.04	121.88	60.9	98.0	10/18/1989	7.0	0.060
37.08	121.93	60.9	98.0	11/5/1989	4.2	0.004
36.90	121.70	60.9	98.0	04/30/1899	5.6	0.023
37.09	121.94	61.0	98.1	10/20/1989	4.3	0.005
36.78	121.43	61.1	98.4	1/20/1960	5.0	0.011
36.83	121.57	61.2	98.5	10/18/1800	7.0	0.060
37.06	121.92	61.3	98.6	11/5/1989	4.5	0.006
36.75	121.32	61.3	98.6	4/11/1942	4.0	0.003

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
36.80	121.50	61.3	98.7	11/13/1892	5.6	0.023
36.80	121.50	61.3	98.7	1/9/1930	4.5	0.006
36.80	121.50	61.3	98.7	1/9/1930	4.0	0.003
36.80	121.50	61.3	98.7	1/9/1930	4.5	0.006
36.73	121.20	61.3	98.7	1/7/1945	4.7	0.008
36.92	121.75	61.5	99.0	4/6/1915	4.0	0.003
36.81	121.55	61.5	99.0	10/3/1972	4.1	0.003
36.86	121.64	61.6	99.1	8/5/1990	4.0	0.003
36.77	121.42	61.6	99.1	5/29/1946	4.5	0.006
36.77	121.42	61.6	99.1	7/7/1947	4.3	0.005
37.37	119.96	61.6	99.2	8/10/1975	4.4	0.005
36.86	121.65	61.6	99.2	5/7/1963	4.4	0.005
37.21	122.05	61.7	99.2	12/2/1989	4.0	0.003
36.87	121.67	61.7	99.2	1/4/1961	4.1	0.004
36.81	121.54	61.7	99.2	5/28/1998	4.2	0.004
36.80	121.52	61.8	99.5	11/29/1995	4.4	0.005
36.75	121.37	61.9	99.5	6/16/1995	4.1	0.004
36.80	121.53	61.9	99.6	10/3/1972	4.8	0.008
36.81	121.54	62.0	99.8	8/2/1979	4.0	0.003
37.80	122.15	62.0	99.8	10/22/1952	4.0	0.003
36.98	121.85	62.0	99.9	10/18/1989	4.2	0.004
37.25	122.08	62.2	100.0	6/14/1932	4.5	0.006
36.84	121.63	62.2	100.1	1/27/1981	4.1	0.004
36.79	121.53	62.4	100.4	9/23/1972	4.1	0.004
37.75	122.17	62.5	100.5	10/05/1888	4.3	0.005
37.75	122.17	62.5	100.5	05/18/1893	4.3	0.005
36.75	121.40	62.5	100.6	4/28/1948	4.3	0.005
36.74	121.36	62.5	100.6	6/8/1981	4.3	0.005
36.90	121.75	62.6	100.7	10/25/1935	4.0	0.003
36.75	121.41	62.7	100.9	11/15/1969	4.2	0.004
36.96	121.84	62.7	100.9	10/19/1989	4.6	0.007
37.75	122.18	63.0	101.4	10/13/1952	4.2	0.004
36.96	121.85	63.1	101.6	10/19/1989	4.0	0.003
36.85	121.68	63.1	101.6	7/17/1939	4.5	0.006
37.42	122.17	63.2	101.7	02/00/1888	4.3	0.005
36.79	121.56	63.4	102.0	9/28/1981	4.0	0.003
37.80	122.18	63.4	102.0	5/11/1987	4.3	0.004
36.70	121.20	63.4	102.0	2/17/1937	4.5	0.006
36.76	121.46	63.4	102.1	8/12/1998	5.4	0.018
37.83	122.17	63.5	102.2	8/2/1929	4.0	0.003
36.77	121.52	63.7	102.5	4/13/1980	4.7	0.007
37.50	122.20	63.9	102.8	12/19/1863	4.8	0.008
37.15	122.05	64.0	102.9	10/18/1989	4.3	0.004
37.18	122.08	64.2	103.3	10/20/1989	4.0	0.003
36.90	121.80	64.3	103.5	3/11/1910	5.5	0.020
36.70	121.30	64.4	103.6	9/11/1959	4.0	0.003
36.70	121.30	64.4	103.6	4/9/1961	5.5	0.019
36.70	121.30	64.4	103.6	03/31/1885	5.5	0.019
37.20	122.10	64.6	104.0	02/17/1870	5.8	0.028
37.80	122.20	64.7	104.1	5/29/1946	4.3	0.004
37.80	122.20	64.7	104.1	4/19/1902	4.6	0.006

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
37.80	122.20	64.7	104.1	07/31/1889	5.2	0.013
37.80	122.20	64.7	104.1	3/8/1937	4.5	0.006
37.80	122.20	64.7	104.1	06/10/1836	6.8	0.051
37.33	122.17	64.8	104.3	9/12/1912	4.5	0.006
37.03	121.97	64.8	104.3	4/14/1941	4.0	0.003
37.20	122.11	64.9	104.5	10/18/1989	5.1	0.012
36.68	120.85	65.0	104.6	2/5/1983	4.2	0.004
36.74	121.51	65.3	105.0	3/26/1984	4.0	0.003
37.90	122.18	65.4	105.2	1/8/1977	4.3	0.004
37.90	122.18	65.4	105.2	1/8/1977	4.0	0.003
37.09	122.04	65.5	105.5	12/29/1998	4.0	0.003
36.67	121.22	65.6	105.6	4/16/1932	4.5	0.006
36.76	121.58	65.7	105.8	8/31/1963	4.2	0.004
36.68	121.30	65.7	105.8	4/9/1961	5.6	0.021
36.70	121.40	65.8	105.9	11/22/1909	4.5	0.005
36.67	121.25	65.9	106.0	6/27/1916	4.0	0.003
36.67	121.25	65.9	106.0	8/6/1916	5.5	0.019
36.67	121.25	65.9	106.0	04/01/1857	5.0	0.010
36.68	121.30	66.0	106.2	3/23/1999	4.2	0.004
37.88	122.20	66.1	106.4	3/29/1986	4.0	0.003
38.20	122.00	66.3	106.7	5/21/1902	4.0	0.003
36.85	121.78	66.3	106.8	8/5/1946	4.1	0.003
36.68	121.35	66.6	107.2	12/1/1989	4.4	0.005
37.50	122.25	66.6	107.2	09/14/1850	4.3	0.004
36.67	121.32	66.7	107.3	2/18/1956	4.2	0.004
36.67	121.33	66.7	107.3	1/15/1973	4.1	0.003
36.67	121.33	66.8	107.5	1/8/1932	4.0	0.003
38.30	121.90	66.8	107.5	5/19/1902	5.5	0.019
36.65	121.22	67.0	107.8	1/14/1942	4.2	0.004
37.35	122.22	67.1	107.9	10/31/1957	4.1	0.003
36.65	121.23	67.1	107.9	10/19/1956	4.1	0.003
36.67	121.34	67.2	108.1	9/8/1990	4.0	0.003
38.00	122.17	67.3	108.2	09/24/1860	4.3	0.004
37.00	122.00	67.4	108.5	11/3/1916	4.0	0.003
37.00	122.00	67.4	108.5	2/12/1938	4.5	0.005
37.00	122.00	67.4	108.5	08/31/1868	4.3	0.004
37.00	122.00	67.4	108.5	06/30/1890	5.0	0.010
37.00	122.00	67.4	108.5	7/17/1933	4.3	0.004
37.00	122.00	67.4	108.5	12/11/1919	4.0	0.003
37.00	122.00	67.4	108.5	09/03/1858	4.3	0.004
37.00	122.00	67.4	108.5	11/17/1868	4.3	0.004
37.00	122.00	67.4	108.5	4/23/1934	4.0	0.003
37.00	122.00	67.4	108.5	11/12/1937	4.0	0.003
37.00	122.00	67.4	108.5	12/28/1885	4.3	0.004
37.00	122.00	67.4	108.5	09/02/1893	4.3	0.004
37.00	122.00	67.4	108.5	04/03/1860	4.3	0.004
36.66	121.34	67.6	108.8	9/24/1982	4.0	0.003
36.65	121.27	67.6	108.8	1/18/1999	4.3	0.004
36.68	121.45	67.7	109.0	10/22/1984	4.0	0.003
37.83	122.25	67.8	109.1	10/8/1915	4.5	0.005
36.66	121.36	67.9	109.2	3/6/1980	4.0	0.003

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
37.00	120.07	67.9	109.3	9/12/1928	4.6	0.006
37.85	122.25	68.1	109.6	9/10/1935	5.0	0.010
38.40	121.80	68.5	110.2	04/30/1892	5.5	0.018
36.63	121.25	68.6	110.4	11/3/1945	4.2	0.004
36.64	121.33	68.8	110.7	8/31/1982	4.0	0.003
36.87	121.88	68.8	110.7	11/7/1958	4.3	0.004
37.17	122.17	69.0	111.0	12/28/1914	4.5	0.005
36.62	121.22	69.0	111.1	8/6/1951	4.9	0.009
36.63	121.30	69.1	111.2	8/11/1982	4.6	0.006
36.63	121.27	69.2	111.3	9/4/1972	4.6	0.006
36.72	121.62	69.2	111.3	5/26/1959	4.6	0.006
37.50	122.30	69.3	111.6	02/15/1856	5.5	0.018
36.63	121.36	69.9	112.4	9/14/1965	4.0	0.003
36.60	121.20	70.0	112.7	4/23/1995	5.0	0.009
36.60	121.20	70.2	113.0	3/17/1936	4.0	0.003
36.60	121.20	70.2	113.0	6/11/1948	4.0	0.003
36.68	121.56	70.2	113.0	9/20/1939	4.0	0.003
37.50	122.32	70.4	113.3	2/10/1925	4.0	0.003
36.60	121.23	70.5	113.4	9/28/1957	4.5	0.005
36.59	121.20	70.7	113.8	7/12/1995	4.0	0.003
36.60	120.80	70.9	114.2	7/25/1926	5.0	0.009
37.50	122.33	71.0	114.2	10/1/1915	4.0	0.003
36.58	121.06	71.1	114.4	8/8/1983	4.0	0.003
36.60	121.30	71.1	114.5	11/22/1956	4.2	0.003
36.60	121.30	71.1	114.5	4/8/1942	4.0	0.003
36.58	121.17	71.2	114.5	10/11/1993	4.1	0.003
36.59	121.24	71.2	114.6	8/10/1982	4.5	0.005
37.92	122.29	71.4	114.9	6/26/1994	4.2	0.003
36.58	121.17	71.4	114.9	10/22/1949	4.7	0.006
36.58	121.18	71.5	115.0	7/29/1951	5.0	0.009
36.58	121.22	71.5	115.1	11/7/1987	4.0	0.003
37.90	122.30	71.6	115.2	04/02/1870	5.3	0.013
37.90	122.30	71.6	115.2	12/14/1904	4.0	0.003
37.90	122.30	71.6	115.2	11/18/1888	4.3	0.004
37.90	122.30	71.6	115.2	9/20/1900	4.0	0.003
37.90	122.30	71.6	115.2	12/14/1901	4.0	0.003
36.58	121.18	71.7	115.3	9/27/1995	4.2	0.003
36.58	121.22	71.8	115.5	12/15/1977	4.2	0.003
36.58	121.22	71.8	115.5	10/10/1966	4.1	0.003
37.00	122.10	71.8	115.5	4/29/1908	4.0	0.003
37.00	122.10	71.8	115.5	1/8/1907	4.6	0.006
36.58	121.21	71.8	115.6	2/24/1972	5.1	0.010
36.57	121.09	71.8	115.6	10/13/1980	4.0	0.003
36.60	121.37	72.0	115.9	4/28/1961	4.2	0.003
36.57	121.20	72.1	116.0	10/5/1984	4.0	0.003
36.57	121.21	72.2	116.2	1/14/1986	4.7	0.006
36.58	121.28	72.3	116.3	6/7/1944	4.0	0.003
36.70	121.70	72.5	116.7	3/5/1937	4.5	0.005
37.10	122.20	72.7	117.0	03/26/1884	5.9	0.026
36.56	121.21	72.8	117.2	6/22/1973	4.2	0.003
36.58	121.33	72.8	117.2	6/9/1917	4.0	0.002

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER
WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
36.56	121.18	73.0	117.4	7/26/1988	4.7	0.006
37.27	122.31	73.4	118.2	5/22/1963	4.6	0.005
36.55	121.16	73.4	118.2	5/13/1964	4.0	0.002
36.57	121.33	73.5	118.2	5/31/1986	4.8	0.007
36.67	121.67	73.5	118.3	10/9/1931	4.0	0.002
36.67	121.67	73.5	118.3	8/6/1916	4.0	0.002
36.67	121.67	73.5	118.3	12/28/1924	4.0	0.002
36.58	121.40	73.8	118.7	10/14/1938	4.0	0.002
36.60	121.50	74.1	119.3	10/27/1937	4.5	0.005
37.60	122.40	74.4	119.7	06/01/1838	7.0	0.050
36.53	121.10	74.7	120.2	2/27/1972	4.6	0.005
36.53	121.13	74.7	120.2	11/3/1960	4.1	0.003
36.57	121.42	74.7	120.3	6/22/1954	4.3	0.004
36.57	121.42	74.7	120.3	6/22/1954	4.4	0.004
38.00	122.32	74.8	120.4	9/4/1919	4.6	0.005
38.00	122.32	74.8	120.4	03/22/1864	4.3	0.004
37.80	122.40	75.4	121.4	10/05/1859	5.0	0.009
37.80	122.40	75.4	121.4	05/15/1851	5.0	0.009
37.80	122.40	75.4	121.4	8/11/1902	4.0	0.002
37.58	122.42	75.5	121.5	1/24/1914	4.0	0.002
37.58	122.42	75.5	121.5	1/5/1931	4.0	0.002
38.40	122.00	75.5	121.5	04/19/1892	6.4	0.035
37.67	122.42	75.5	121.5	10/25/1913	4.0	0.002
36.52	121.17	75.6	121.6	3/27/1954	4.4	0.004
37.02	122.20	75.6	121.6	10/24/1926	5.5	0.016
36.51	121.06	75.9	122.2	6/19/1982	4.1	0.003
36.50	121.00	76.6	123.3	6/16/1934	4.0	0.002
36.50	121.00	76.6	123.3	2/10/1946	4.2	0.003
36.50	121.17	76.9	123.8	5/27/1936	4.5	0.004
36.50	121.20	77.1	124.1	9/18/1937	4.0	0.002
37.65	122.45	77.1	124.1	3/22/1957	4.4	0.004
36.53	120.68	77.1	124.1	8/19/1974	4.4	0.004
38.50	121.90	77.2	124.3	04/21/1892	6.2	0.030
37.65	122.46	77.7	125.0	4/28/1979	4.4	0.004
37.65	122.48	78.8	126.7	3/23/1957	4.0	0.002
37.67	122.48	78.8	126.8	3/22/1957	5.3	0.012
38.00	122.40	78.9	127.0	06/30/1893	4.6	0.005
37.70	119.60	79.0	127.1	5/26/1905	4.0	0.002
36.58	121.67	79.1	127.2	3/9/1924	4.0	0.002
36.58	121.67	79.1	127.2	8/25/1923	4.0	0.002
36.58	121.67	79.1	127.2	6/16/1920	4.0	0.002
36.58	121.67	79.1	127.2	10/5/1920	4.0	0.002
36.50	121.40	79.1	127.3	1/6/1931	4.0	0.002
36.75	122.00	79.4	127.8	6/12/1921	4.0	0.002
36.90	122.18	79.5	127.9	7/2/1978	4.2	0.003
37.67	122.50	79.9	128.6	11/23/1852	5.7	0.019
37.70	122.50	80.0	128.8	4/25/1906	4.0	0.002
37.70	122.50	80.0	128.8	6/5/1906	4.0	0.002
37.70	122.50	80.0	128.8	4/18/1906	4.0	0.002
37.70	122.50	80.0	128.8	4/25/1906	5.3	0.012
37.70	122.50	80.0	128.8	06/02/1899	5.4	0.013

Table 2-1

SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER WITHIN 100 KM OF THE SITE

Final Cover Stability Evaluation - Waste Management Units II-IV

Bonzi Sanitation Landfill

Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
37.70	122.50	80.0	128.8	5/18/1906	4.6	0.005
37.70	122.50	80.0	128.8	4/18/1906	4.6	0.005
37.70	122.50	80.0	128.8	5/17/1906	4.6	0.005
37.70	122.50	80.0	128.8	4/18/1906	4.0	0.002
37.70	122.50	80.0	128.8	4/18/1906	4.6	0.005
37.70	122.50	80.0	128.8	4/18/1906	4.0	0.002
37.70	122.50	80.0	128.8	4/18/1906	4.0	0.002
37.70	122.50	80.0	128.8	1/1/1905	4.0	0.002
37.70	122.50	80.0	128.8	4/18/1906	4.0	0.002
37.70	122.50	80.0	128.8	4/18/1906	8.3	0.097
37.70	122.50	80.0	128.8	5/15/1906	4.0	0.002
36.45	121.12	80.2	129.0	10/11/1959	4.1	0.002
37.50	122.50	80.2	129.1	01/02/1856	5.3	0.012
37.75	122.50	80.3	129.3	5/23/1929	4.3	0.003
37.75	122.50	80.3	129.3	03/26/1884	4.3	0.003
37.75	122.50	80.3	129.3	10/10/1883	4.3	0.003
37.75	122.50	80.3	129.3	09/22/1859	4.3	0.003
37.75	122.50	80.3	129.3	06/27/1882	4.3	0.003
37.75	122.50	80.3	129.3	03/28/1888	4.3	0.003
37.75	122.50	80.3	129.3	10/26/1854	4.3	0.003
37.75	122.50	80.3	129.3	02/26/1864	5.0	0.008
37.75	122.50	80.3	129.3	10/20/1857	4.3	0.003
37.75	122.50	80.3	129.3	10/22/1855	4.3	0.003
37.75	122.50	80.3	129.3	02/06/1857	4.3	0.003
37.75	122.50	80.3	129.3	04/26/1865	4.3	0.003
37.75	122.50	80.3	129.3	07/01/1890	4.3	0.003
37.75	122.50	80.3	129.3	04/02/1869	4.3	0.003
37.75	122.50	80.3	129.3	07/05/1857	4.3	0.003
37.75	122.50	80.3	129.3	10/20/1857	4.3	0.003
37.75	122.50	80.3	129.3	03/18/1863	4.3	0.003
37.75	122.50	80.3	129.3	09/13/1858	4.3	0.003
37.75	122.50	80.3	129.3	12/11/1855	5.0	0.008
37.75	122.50	80.3	129.3	06/26/1864	4.3	0.003
37.75	122.50	80.3	129.3	11/13/1851	4.3	0.003
37.75	122.50	80.3	129.3	09/29/1862	4.3	0.003
37.75	122.50	80.3	129.3	10/22/1854	5.0	0.008
37.75	122.50	80.3	129.3	04/17/1860	4.3	0.003
37.75	122.50	80.3	129.3	12/01/1859	4.3	0.003
36.48	121.40	80.5	129.5	10/15/1942	4.3	0.003
38.50	122.00	80.6	129.8	7/30/1904	4.5	0.004
36.50	121.50	80.7	129.8	9/7/1940	4.5	0.004
37.80	122.50	80.8	130.0	06/21/1808	6.3	0.030
37.80	122.50	80.8	130.0	12/3/1905	4.0	0.002
36.58	120.33	80.9	130.1	11/30/1963	4.5	0.004
36.45	121.25	80.9	130.1	9/27/1938	5.0	0.008
36.95	122.26	81.0	130.3	2/15/1927	5.0	0.008
37.70	122.52	81.1	130.5	3/23/1957	4.2	0.003
36.60	121.80	81.3	130.8	4/25/1908	4.5	0.004
36.43	121.05	31.4	131.0	11/17/1969	4.4	0.004
36.42	121.00	82.1	132.2	11/26/1929	4.5	0.004
38.80	121.10	82.3	132.4	5/30/1908	4.0	0.002

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER
WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
36.78	122.12	82.5	132.7	11/15/1947	4.1	0.002
38.25	122.32	82.5	132.8	05/21/1864	4.3	0.003
38.25	122.32	82.5	132.8	1/20/1919	4.0	0.002
38.25	122.32	82.5	132.8	03/08/1865	4.3	0.003
38.25	122.32	82.5	132.8	10/14/1891	4.3	0.003
36.80	122.15	82.7	133.1	3/9/1971	4.6	0.005
36.79	122.14	82.8	133.2	3/8/1971	4.1	0.002
37.61	122.56	83.1	133.7	8/4/1963	4.0	0.002
36.40	121.00	83.5	134.4	04/12/1885	6.2	0.027
37.70	122.57	83.8	134.9	12/11/1958	4.7	0.005
36.80	122.18	84.0	135.1	4/16/1971	4.5	0.004
36.40	121.20	84.0	135.1	9/16/1938	4.0	0.002
36.40	121.20	84.0	135.1	7/22/1961	4.0	0.002
36.50	121.67	84.1	135.3	12/4/1931	4.0	0.002
36.45	121.52	84.3	135.7	11/19/1969	4.2	0.003
36.41	120.79	84.3	135.7	1/12/1990	4.2	0.003
36.50	120.40	84.3	135.7	8/15/1975	4.6	0.004
38.63	121.90	84.5	136.0	9/8/1978	4.2	0.003
38.20	122.40	84.5	136.0	03/31/1898	6.2	0.027
36.43	121.48	85.0	136.7	1/11/1948	4.3	0.003
36.42	120.62	85.3	137.3	4/15/1962	4.7	0.005
38.70	120.30	85.4	137.4	3/5/1946	4.1	0.002
36.42	120.62	85.6	137.7	4/15/1963	4.7	0.005
36.58	121.92	86.0	138.4	08/13/1887	4.3	0.003
36.58	121.92	86.0	138.4	06/14/1891	4.3	0.003
36.58	121.92	86.0	138.4	2/28/1915	4.0	0.002
37.92	122.57	86.2	138.7	1/7/1926	4.0	0.002
38.10	122.50	86.5	139.1	08/27/1855	4.9	0.006
36.35	121.12	87.1	140.1	9/21/1958	4.6	0.004
36.47	120.35	87.4	140.6	8/3/1975	4.0	0.002
36.60	122.00	87.5	140.7	07/03/1841	5.0	0.007
37.90	122.60	87.5	140.7	9/18/1902	4.6	0.004
38.30	122.40	88.0	141.7	10/12/1891	5.5	0.013
36.65	122.10	88.3	142.0	10/22/1926	4.5	0.004
36.46	120.34	88.3	142.0	8/3/1975	4.4	0.003
36.46	120.34	88.3	142.0	8/3/1975	4.9	0.006
37.47	119.41	89.7	144.4	11/18/1981	4.2	0.002
36.62	122.11	90.2	145.1	10/22/1926	4.0	0.002
36.33	120.67	90.7	145.9	7/31/1919	4.0	0.002
38.62	122.13	91.5	147.2	11/30/1949	4.0	0.002
36.30	121.30	91.5	147.3	7/23/1956	4.7	0.004
36.65	122.19	91.6	147.4	8/4/1970	4.7	0.004
38.38	122.41	91.6	147.5	9/3/2000	5.0	0.007
37.91	122.69	92.1	148.3	8/18/1999	4.5	0.003
36.75	119.75	92.5	148.9	08/16/1864	4.3	0.003
38.33	122.50	93.7	150.8	2/25/1919	4.5	0.003
37.00	119.50	94.5	152.1	07/14/1894	4.3	0.002
36.33	121.67	94.9	152.7	10/18/1931	4.0	0.002
36.57	122.17	95.0	152.8	10/22/1926	6.1	0.022
36.30	120.50	95.2	153.2	11/30/1943	4.0	0.002
38.37	119.58	95.3	153.3	4/9/1960	4.0	0.002

Table 2-1
SUMMARY OF HISTORICAL EARTHQUAKES OF MAGNITUDE 4.0 OR GREATER
WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

LOCATION		APPROXIMATE DISTANCE FROM SITE		DATE	EARTHQUAKE MAGNITUDE (M_w)	APPROX. SITE ACCELERATION (g)
North Latitude	West Longitude	miles	km			
38.61	122.25	95.3	153.4	9/17/1973	4.0	0.002
36.32	120.42	95.4	153.5	10/25/1982	4.0	0.002
36.30	120.48	95.5	153.8	8/26/1983	4.0	0.002
37.60	122.80	96.2	154.9	10/25/1934	4.3	0.002
37.60	122.80	96.2	154.9	10/2/1934	4.0	0.002
37.60	122.80	96.2	154.9	10/2/1934	4.0	0.002
36.31	120.40	96.3	155.0	10/25/1982	4.3	0.002
38.22	119.45	96.4	155.1	4/13/1962	5.1	0.007
37.70	119.28	96.4	155.2	6/21/1957	4.6	0.004
38.30	119.50	96.5	155.3	12/19/1919	5.2	0.008
36.30	120.43	96.5	155.4	4/21/1994	4.5	0.003
38.80	120.10	96.8	155.7	8/6/1937	4.5	0.003
38.70	122.17	97.1	156.3	5/8/1969	4.0	0.002
36.29	120.41	97.5	156.9	8/14/1983	4.2	0.002
36.29	120.40	97.6	157.1	8/12/1983	4.0	0.002
36.23	120.65	97.6	157.1	2/5/1947	5.0	0.006
36.29	120.41	97.7	157.2	10/25/1982	5.6	0.013
36.39	121.93	97.8	157.4	2/10/1984	4.3	0.002
36.37	121.91	97.8	157.4	1/23/1984	5.4	0.010
36.37	121.91	98.3	158.2	1/23/1984	4.1	0.002
36.36	121.90	98.3	158.2	1/24/1984	4.0	0.002
38.92	120.33	98.3	158.3	8/31/1912	4.5	0.003
36.20	121.30	98.4	158.3	5/13/1938	4.0	0.002
36.20	121.30	98.4	158.3	5/10/1938	4.0	0.002
36.20	121.30	98.4	158.3	5/10/1938	4.5	0.003
36.36	121.91	98.5	158.5	1/23/1984	5.0	0.006
38.58	122.37	98.5	158.6	12/16/1959	4.1	0.002
36.30	120.31	99.0	159.3	5/3/1983	4.0	0.002
36.25	120.47	99.0	159.3	6/11/1983	5.1	0.007
38.25	122.67	99.1	159.6	08/19/1858	5.0	0.006
38.20	122.70	99.2	159.6	2/9/1900	4.6	0.003
36.28	120.36	99.2	159.6	5/5/1983	4.6	0.003
36.28	120.34	99.6	160.3	5/4/1983	4.3	0.002
36.17	120.92	99.6	160.3	5/23/1936	4.0	0.002
38.62	122.35	99.6	160.3	4/20/1958	4.0	0.002
36.26	120.40	99.6	160.4	7/9/1983	5.3	0.009
36.61	122.35	99.8	160.6	10/22/1926	6.1	0.021
38.60	119.70	99.9	160.8	09/17/1868	5.2	0.008

Notes:
1. Data from Blake (2000) and United States Geological Survey (2006).
2. Approximate site acceleration based on Abrahamson and Silva (1997) attenuation relationship for soil sites.

Table 2-2a
SUMMARY OF ESTIMATED PHGAs ASSOCIATED WITH MAXIMUM EARTHQUAKES ON FAULTS WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

FAULT	DISTANCE		MAXIMUM EARTHQUAKE MAGNITUDE (M_w)	PEAK HORIZONTAL GROUND ACCELERATION (PHGA)				
	miles	km		Abrahamson & Silva (1997)	Campbell & Borzongia (1997)	Idriss (1994)	Sadigh et. al (1997)	Geometric Mean (g)
Great Valley 7	13.0	21.0	6.7	0.200	0.217	0.219	0.219	0.214
Great Valley 8	14.4	23.2	6.6	0.178	0.181	0.194	0.189	0.185
Ortigalita	26.4	42.5	7.1	0.104	0.116	0.119	0.108	0.112
Great Velley 6	28.0	45.0	6.7	0.104	0.083	0.109	0.099	0.098
Greenville	28.3	45.5	6.6	0.080	0.070	0.083	0.071	0.076
Foothills Fault System	30.6	49.2	6.5	0.088	0.054	0.088	0.077	0.075
Calaveras (So. Of Calaveras Res)	35.4	56.9	6.6	0.081	0.055	0.079	0.069	0.070
Calaveras (No. of Calaveras Res)	40.9	65.8	6.2	0.041	0.031	0.040	0.032	0.036
Hayward (Total Length)	43.4	69.9	6.8	0.059	0.048	0.059	0.048	0.053
Hayward (South)	43.4	69.9	7.1	0.068	0.063	0.073	0.060	0.066
Hayward (South)	43.4	69.9	6.7	0.056	0.044	0.055	0.045	0.050
Hayward (SE Extension)	43.6	70.2	6.4	0.048	0.034	0.043	0.035	0.040
Quien Sabe	50.5	81.2	6.4	0.042	0.028	0.036	0.028	0.033
Great Valley 5	50.8	81.8	6.5	0.055	0.031	0.047	0.039	0.042
Monte Vista-Shannon	51.6	83.1	6.7	0.060	0.034	0.055	0.045	0.047
Sargent	53.8	86.6	6.8	0.048	0.037	0.046	0.036	0.041
Concord-Green Valley	54.7	88.0	6.2	0.031	0.021	0.027	0.021	0.025
San Andreas (1906)	57.5	92.6	7.4	0.063	0.057	0.067	0.053	0.060
San Andreas (Santa Cruz Mountains)	57.5	92.6	7	0.051	0.040	0.050	0.039	0.045
San Andreas (Parajo)	57.7	92.8	6.8	0.045	0.034	0.042	0.033	0.038
Great Velley 10	58.2	93.7	6.4	0.045	0.023	0.036	0.030	0.033
San Andreas (Creeping)	60.0	96.5	6.5	0.037	0.024	0.031	0.024	0.029
Zayante-Vergeles	60.2	96.9	7.0	0.049	0.038	0.047	0.036	0.042
Hayward (North)	60.3	97.0	6.4	0.035	0.022	0.028	0.022	0.026
San Andreas (Peninsula)	60.6	97.6	7.1	0.051	0.041	0.051	0.039	0.045

Table 2-2b
SUMMARY OF ESTIMATED PHGAs ASSOCIATED WITH MAXIMUM PROBABLE EARTHQUAKES
ON FAULTS WITHIN 100 KM OF THE SITE
Final Cover Stability Evaluation - Waste Management Units II-IV
Bonzi Sanitation Landfill
Stanislaus County, California

FAULT	DISTANCE		MAXIMUM PROBABLE EARTHQUAKE MAGNITUDE	PEAK HORIZONTAL GROUND ACCELERATION (PHGA)				
	miles	km		Abrahamson & Silva (1997)	Campbell & Borzongia (1997)	Idriss (1994)	Sadigh et. al (1997)	Geometric Mean (g)
Great Valley 7	13.0	21.0	5.7	0.135	0.109	0.114	0.106	0.115
Great Valley 8	14.4	23.2	5.7	0.123	0.095	0.107	0.096	0.105
Ortigalita	26.4	42.5	5.6	0.035	0.032	0.045	0.033	0.036
Great Velley 6	28.0	45.0	5.7	0.062	0.038	0.052	0.043	0.048
Greenville	28.3	45.5	5.9	0.044	0.038	0.051	0.040	0.043
Foothills Fault System	30.6	49.2	5.2	0.034	0.019	0.023	0.025	0.025
Calaveras (So. Of Calaveras Res)	35.4	56.9	5.6	0.044	0.025	0.036	0.029	0.033
Calaveras (No. of Calaveras Res)	40.9	65.8	6.2	0.041	0.031	0.040	0.032	0.036
Hayward (Total Length)	43.4	69.9	6.5	0.051	0.037	0.047	0.038	0.043
Hayward (South)	43.4	69.9	6.7	0.056	0.044	0.055	0.045	0.050
Hayward (South)	43.4	69.9	6.5	0.051	0.037	0.047	0.038	0.043
Hayward (SE Extension)	43.6	70.2	5.9	0.028	0.022	0.029	0.022	0.025
Quien Sabe	50.5	81.2	5.3	0.012	0.010	0.014	0.010	0.011
Great Valley 5	50.8	81.8	5.5	0.026	0.014	0.020	0.016	0.018
Monte Vista-Shannon	51.6	83.1	5.1	0.016	0.009	0.013	0.011	0.012
Sargent	53.8	86.6	6.1	0.028	0.020	0.025	0.020	0.023
Concord-Green Valley	54.7	88.0	6.5	0.041	0.028	0.035	0.028	0.033
San Andreas (1906)	57.5	92.6	7.4	0.063	0.057	0.067	0.053	0.060
San Andreas (Santa Cruz Mountains)	57.5	92.6	6.7	0.043	0.031	0.039	0.030	0.035
San Andreas (Parajo)	57.7	92.8	6.6	0.041	0.028	0.036	0.028	0.033
Great Velley 10	58.2	93.7	5.5	0.022	0.011	0.016	0.013	0.015
San Andreas (Creeping)	60.0	96.5	6.5	0.037	0.024	0.031	0.024	0.029
Zayante-Vergeles	60.2	96.9	4.5	0.003	0.004	0.005	0.004	0.004
Hayward (North)	60.3	97.0	6.5	0.037	0.024	0.031	0.024	0.029
San Andreas (Peninsula)	60.6	97.6	7.0	0.048	0.038	0.047	0.036	0.042

Table 3-1
SUMMARY OF MATERIAL PROPERTIES ASSUMED FOR ANALYSIS
Final Cover Stability Evaluation - Waste Management Units II - IV
Bonzi Sanitation Landfill Landfill
Stanislaus County, California

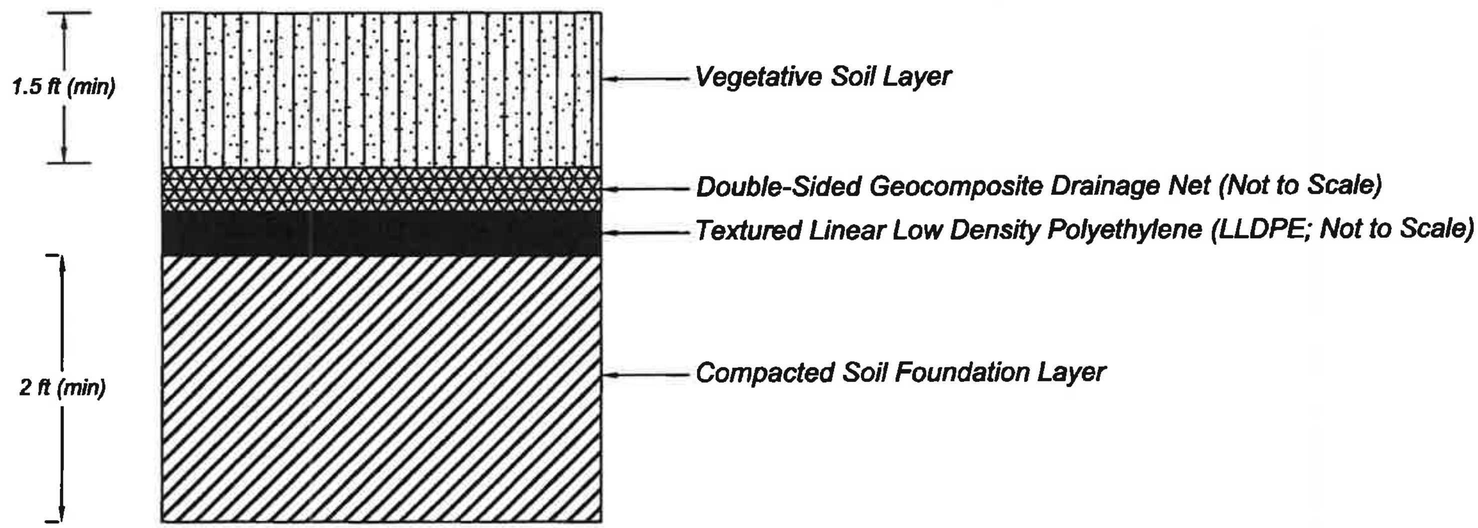
LAYER	ASSUMED PROPERTIES			BASIS FOR ASSUMPTION AND COMMENTS
	Unit Weight (lb/ft^3)	Friction Angle (degrees)	Cohesion or Adhesion Intercept (lb/ft^2)	
Vegetative Layer	120	25	50	Site Specific vegetative layer source not identified. Vegetative soil material assumed to consist primarily of granular soil with limited clay.
Geotextile/Overlying Soil Interface	NA	33	0	Geotextile (upper portion of double-sided geocomposite or cushion geotextile) is nonwoven-needle-punched fabric and assumed to be in full contact with overlying soil that is also assumed to be generally granular in nature. Assumed friction angle based on residual strength data included in Koerner and Narejo (2005; see Appendix A).
Geotextile/Underlying Textured LLDPE Interface	NA	17	100	Geotextile (lower portion of double-sided geocomposite) is nonwoven-needle-punched fabric and assumed to be in full contact with underlying textured LLDPE. Assumed friction angle and adhesion intercept based on residual strength data included in Koerner and Narejo (2005; see Appendix A). Adhesion value reduced 50% to account for limited test data.
Textured LLDPE/Underlying Compacted Foundation Layer Interface	NA	25	51	Textured LLDPE assumed to be in full contact with underlying compacted foundation layer constructed of primarily granular soil. Assumed friction angle and adhesion intercept based on residual strength data included in Koerner and Narejo (2005; see Appendix A). Adhesion value reduced 50% to account for limited test data.
Foundation Layer	125	25	50	Foundation layer assumed to consist of compacted borrow soil. Site specific strength data not available. Material properties assumed based on primarily granular material.

Notes:
1. All soil and geosynthetic properties assumed (no site specific data available or provided for review).
2. Site-specific testing recommended prior to construction to confirm values used for analysis.

Table 3-2
SUMMARY OF STABILITY ANALYSIS RESULTS
Final Cover Stability Evaluation - Waste Management Units II - IV
Bonzi Sanitation Landfill Landfill
Stanislaus County, California

CONDITION OR MATERIAL INTERFACE	STATIC SAFETY FACTOR	PSEUDOSTATIC SAFETY FACTOR	YIELD ACCELERATION (g)	SEISMIC DEFORMATION (cm)
Failure Within Vegetative Soil Layer				
Vegetative Soil	3.1	1.9	NA	NA
Vegetative Soil (Transient Partially Saturated Condition)	1.3	NA	NA	NA
Vegetative Soil (Transient Fully Saturated Condition)	1.0	NA	NA	NA
Failure at Vegetative Soil/Underlying Geotextile Interface				
Geotextile/Overlying Soil Interface	2.7	1.6	NA	NA
Failure at Geosynthetic Textured LLDPE Barrier Layer/Overlying Geonet (Geotextile) Interface				
Textured LLDPE/Geonet (Geotextile) Interface	3.7	3.0	NA	NA
Failure at Geosynthetic Barrier Layer/Underlying Soil Interface				
Textured LLDPE/Underlying Soil Interface	3.2	1.9	NA	NA
Failure Within Foundation Layer Soil				
Foundation Layer Soil	3.2	1.6	NA	NA

NOTES:
1. Safety factors calculated based on procedures described in Koerner and Soong (1998). See Appendix B.
2. All analyses based on assumed material properties. See Table 3-1 and Appendix A.
3. Pseudostatic safety factors based on seismic coefficient of 0.15g. Pseudostatic analyses not performed for transient conditions.
4. Yield acceleration is the seismic coefficient required for a safety factor of 1.0.
5. NA - not analyzed because pseudostatic safety factor greater than 1.5 or transient conditions.



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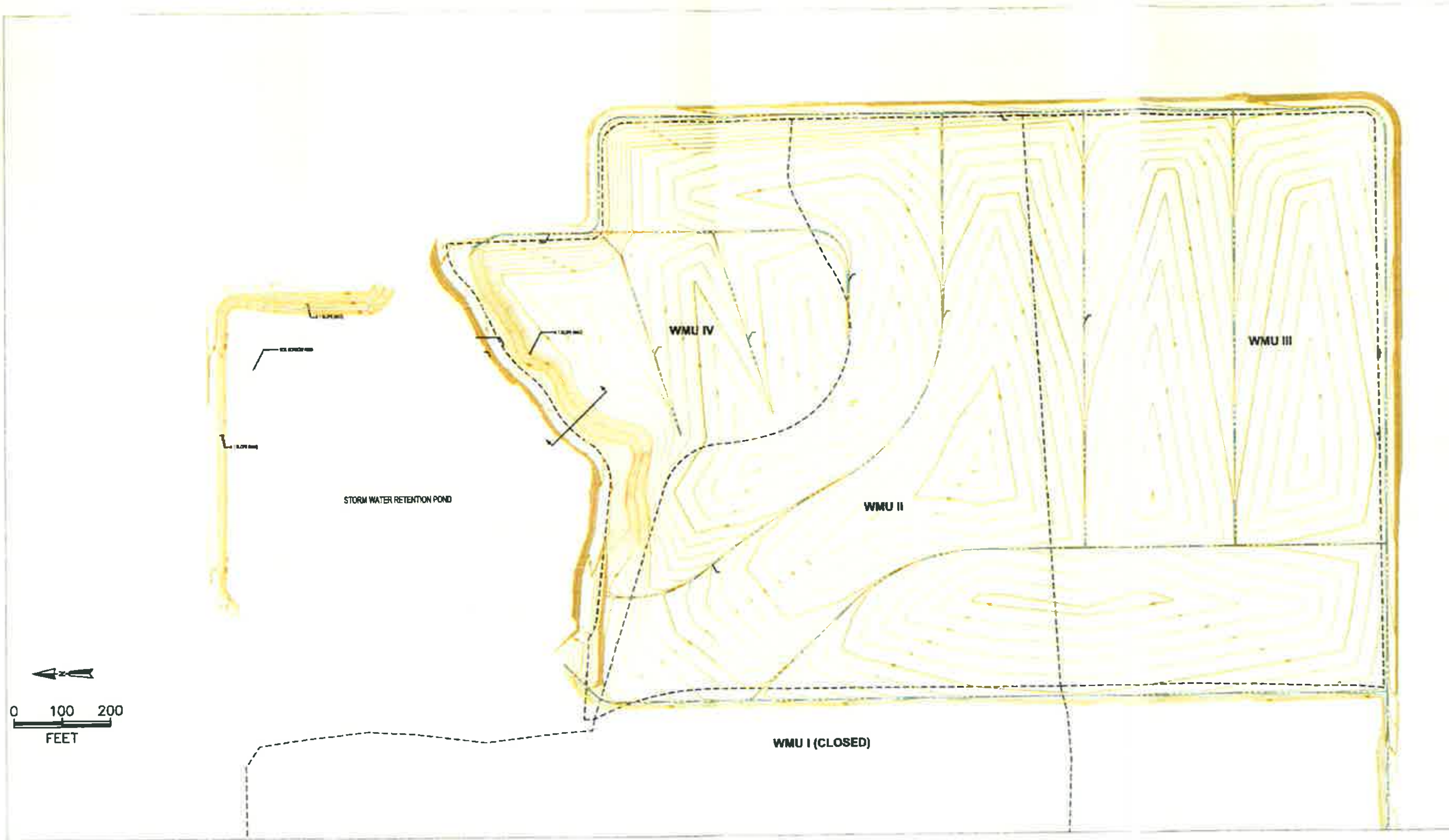
TYPICAL COVER SECTION
Bonzi Sanitation Landfill
Stanislaus County, California

Figure
3-1



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PROPOSED FINAL GRADING PLAN AND LOCATION OF CROSS SECTION
Bonzi Sanitation Landfill - Waste Management Units II - IV
Stanislaus County, California

Figure
3-2

Appendix A
MATERIAL PROPERTY INFORMATION

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Drexel
UNIVERSITY

GRI GEI GII GSI GAI GCI

Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces

by

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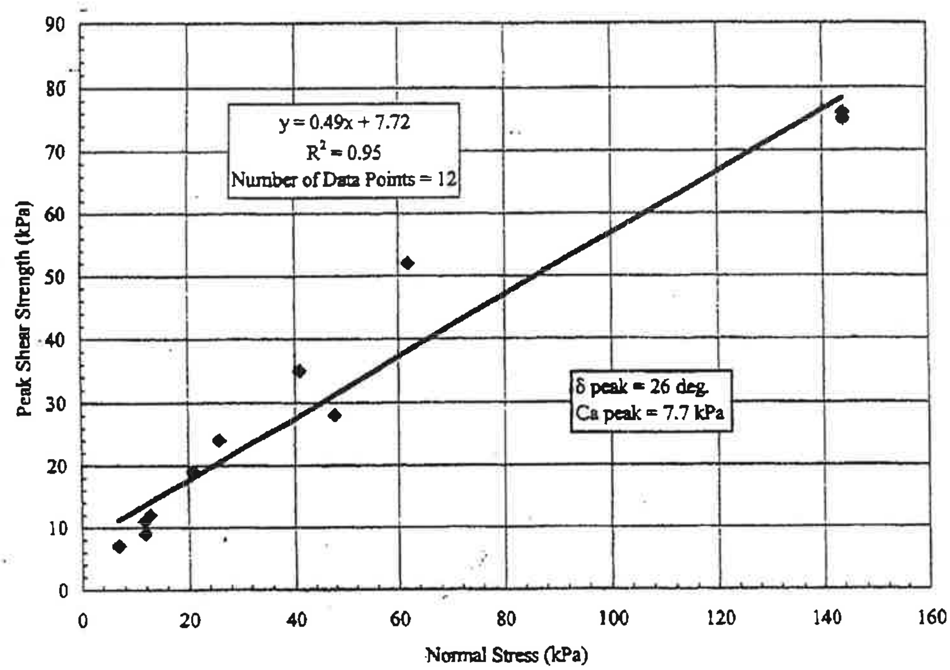
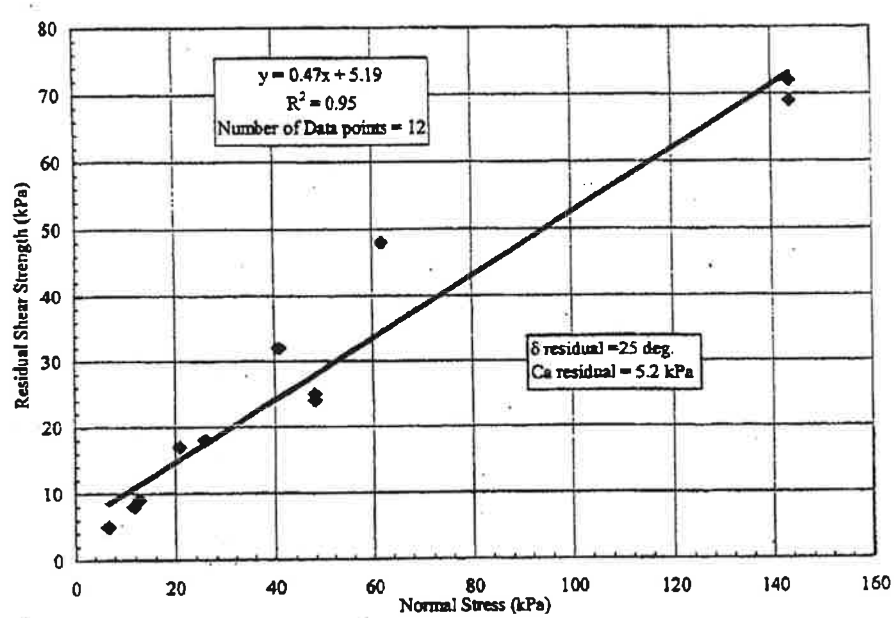
GRI Report #30

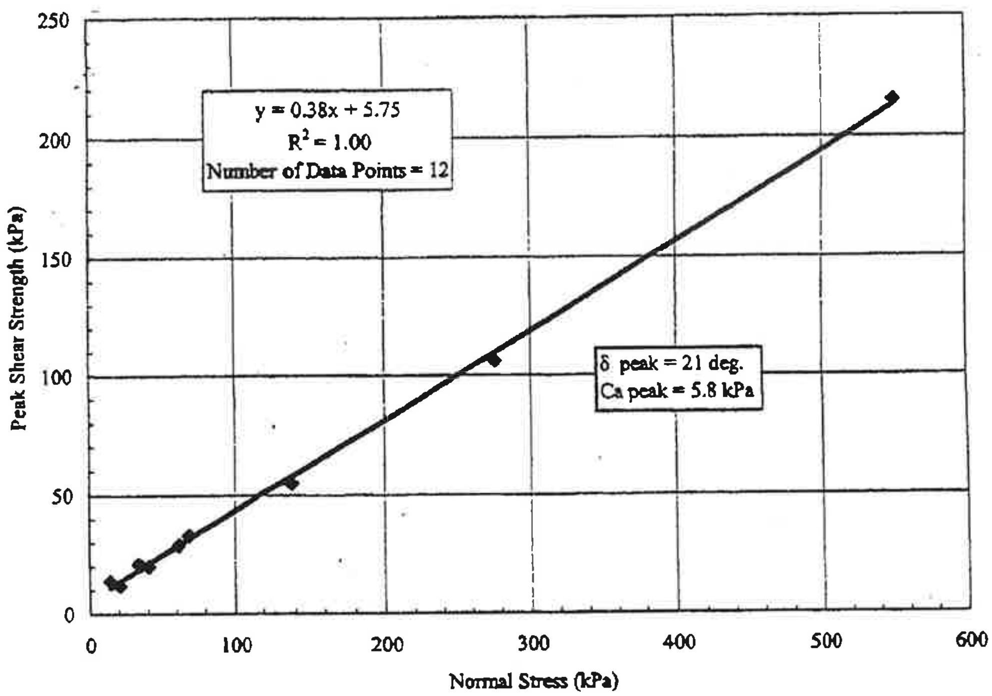
June 14, 2005



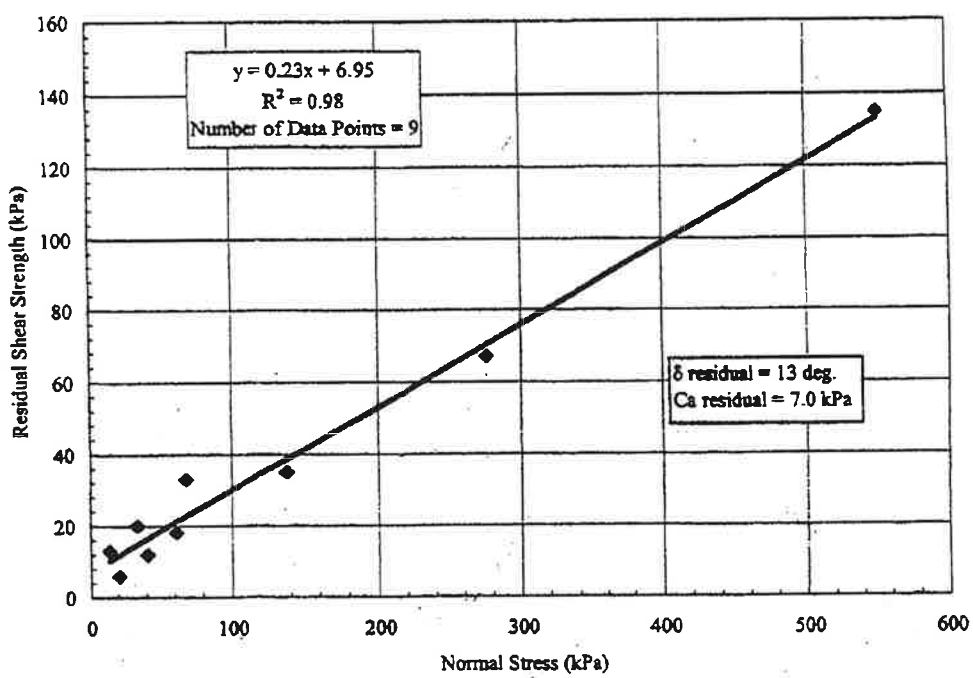
Appendix Figure 4a -Peak Shear Strength; Textured LLDPE against Granular Soil.



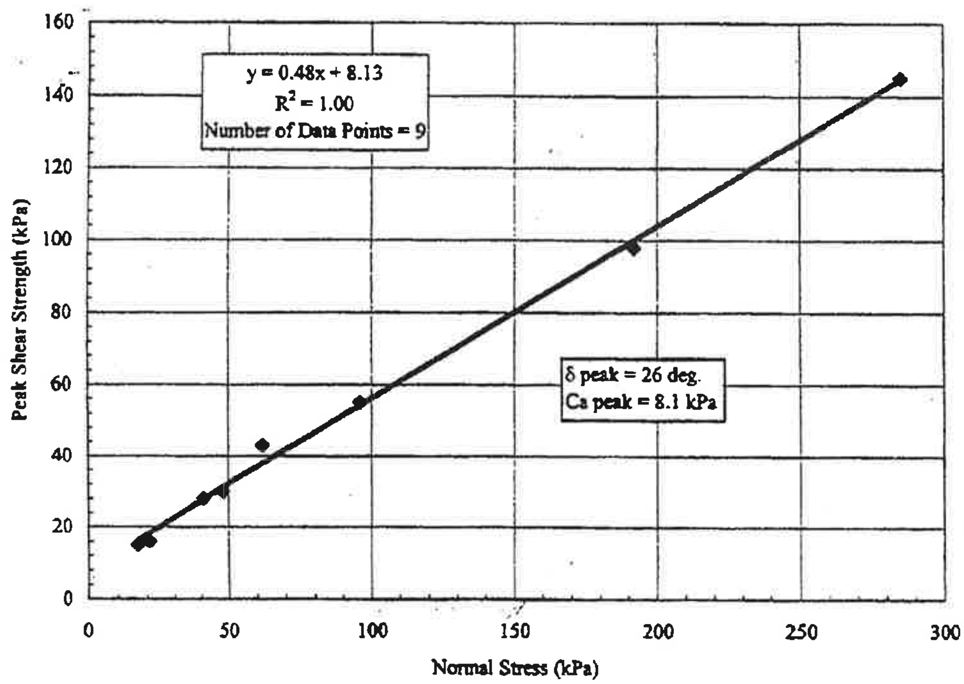
Appendix Figure 4b - Residual Shear Strength; Textured LLDPE against Granular Soil.



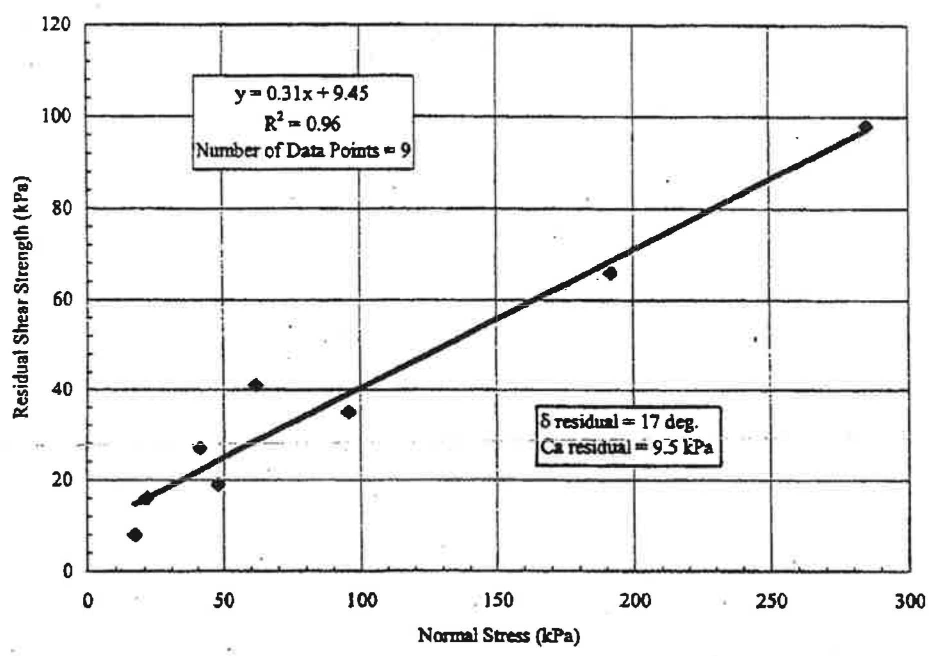
Appendix Figure 4c - Peak Shear Strength; Textured LLDPE against Cohesive Soil.



Appendix Figure 4d - Residual Shear Strength; Textured LLDPE against Cohesive Soil.



Appendix Figure 4e -Peak Shear Strength; Textured LLDPE against NW-NP Geotextile.



Appendix Figure 4f - Residual Shear Strength; Textured LLDPE against NW-NP Geotextile.

Appendix B

SUMMARY OF STABILITY ANALYSIS CALCULATIONS

INFINITE SLOPE STABILITY ANALYSIS - VEGETATIVE SOIL COVER

Static, No Seepage

γ =	120	unit weight of the cover soil (pcf)
h =	1.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	25	friction angle of the cover soil (deg)
Φ =	0.436	friction angle of the cover soil (rad)
δ =	25	interface friction angle between cover soil and geomembrane (deg)
Γ =	0.436	interface friction angle between cover soil and geomembrane (rad)
c_a =	50	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	50	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	12353	Total weight of the active wedge(lb)
W_P =	574	total weight of the passive wedge
N_A =	11984	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
C_a =	3440.767	adhesive force between cover soil of the acctive wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
a =	705	$= (W_A - N_A \cos\beta) \cos\beta$
b =	-2284	$= - [(W_A - N_A \cos\beta) \sin\beta \tan\Phi + (N_A \tan\delta + C_a) \sin\beta \cos\beta + \sin\beta (C + W_P \tan\Phi)]$
c =	248	$= (N_A \tan\delta + C_a) \sin^2\beta \tan\Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{FS = 3.13}$$

INFINITE SLOPE STABILITY ANALYSIS - VEGETATIVE SOIL

Static, Full Seepage

γ_t =	120	total (moist) unit weight of the cover soil (pcf)
γ_{sat} =	125	saturated unit weight of the cover soil
γ_w =	62.4	unit weight of water (pcf)
H =	18.19	vertical height of the slope measured from the toe (ft)
h_w =	1.5	height of water measured perpendicular to slope (ft)
h =	1.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	30	friction angle of the cover soil (deg)
Φ =	0.524	friction angle of the cover soil (rad)
δ =	25	interface friction angle along failure surface (deg)
Γ =	0.436	interface friction angle between cover soil and geomembrane (rad)
c_a =	50	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	50	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	13465	Total weight of the active wedge (lb)
U_n =	6521	resultant of the pore pressures acting on the interwedge surfaces
U_h =	70.2	resultant of the vertical pore pressures acting perpendicular to the slope
U_V =	280.8	resultant of the vertical pore pressures acting on the passive wedge
W_P =	598	total weight of the passive wedge (lb)
N_A =	6559	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
C_a =	3440.767	adhesive force between cover soil of the active wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
a =	3172.33	$= W_A \sin\beta \cos\beta - U_h \cos 2\beta + U_h$
b =	-3597.83	$= - W_A \sin^2\beta \tan\Phi + U_h \sin\beta \cos\beta \tan\Phi - N_A \cos\beta \tan\delta - (W_P - U_V) \tan\Phi$
c =	428	$= N_A \sin\beta \tan\delta \tan\Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

FS =	1.00

INFINITE SLOPE STABILITY ANALYSIS - VEGETATIVE SOIL

Static, Partial Seepage

$\gamma_t =$	120	total (moist) unit weight of the cover soil (pcf)
$\gamma_{sat} =$	125	saturated unit weight of the cover soil
$\gamma_w =$	62.4	unit weight of water (pcf)
$H =$	18.19	vertical height of the slope measured from the toe (ft)
$h_w =$	1	height of water measured perpendicular to slope (ft)
$h =$	1.5	thickness of the cover soil (ft)
$L =$	75	length of slope measured along the geomembrane (ft)
$m =$	4	soil slope ratio beneath the geomembrane (x:1)
$\beta =$	14.0	soil slope angle beneath the geomembrane (deg)
$B =$	0.245	soil slope angle beneath the geomembrane (rad)
$\varphi =$	30	friction angle of the cover soil (deg)
$\Phi =$	0.524	friction angle of the cover soil (rad)
$\delta =$	25	interface friction angle along failure surface (deg)
$\Gamma =$	0.436	interface friction angle between cover soil and geomembrane (rad)
$c_a =$	0	adhesion between cover soil of the active wedge and the geomembrane (psf)
$C =$	0	cohesive force along the failure plane of the passive wedge
$c =$	0	cohesion of the cover soil
$W_A =$	13291	Total weight of the active wedge (lb)
$U_n =$	4412	resultant of the pore pressures acting on the interwedge surfaces
$U_h =$	31.2	resultant of the vertical pore pressures acting perpendicular to the slope
$U_V =$	124.8	resultant of the vertical pore pressures acting on the passive wedge
$W_P =$	584	total weight of the passive wedge (lb)
$N_A =$	8490	effective force normal to the failure plane of the active wedge (lb)
$N_P =$		effective force normal to the failure plane of the passive wedge
$C_a =$	0	adhesive force between cover soil of the active wedge and the geomembrane (kip)
$E_A =$		interwedge force acting on the passive wedge from the active wedge
$E_P =$		interwedge force acting on the passive wedge from the active wedge
$a =$	3129.04	$= W_A \sin\beta \cos\beta - U_h \cos 2\beta + U_h$
$b =$	-4553.10	$= - W_A \sin^2\beta \tan\Phi + U_h \sin\beta \cos\beta \tan\Phi - N_A \cos\beta \tan\delta - (W_P - U_V) \tan\Phi$
$c =$	554	$= N_A \sin\beta \tan\delta \tan\Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{FS = 1.32}$$

INFINITE SLOPE STABILITY ANALYSIS - VEGETATIVE SOIL

Pseudostatic

γ =	120	unit weight of the cover soil (pcf)
h =	1.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	25	friction angle of the cover soil (deg)
Φ =	0.436	friction angle of the cover soil (rad)
δ =	25	interface friction angle between cover soil and geomembrane (deg)
Γ =	0.436	interface friction angle between cover soil and geomembrane (rad)
c_a =	50	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	50	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	12353	Total weight of the active wedge (lb)
W_P =	574	total weight of the passive wedge
N_A =	11984	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
m =		slope ratio (horizontal : vertical)
C_a =	3440.767	adhesive force between cover soil of the active wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
C_S =	0.15	average seismic coefficient
a =	4700.9	$= (C_S W_A + N_A \sin\beta)\cos\beta + CS\, W_P \cos\beta$
b =	-9344.3	$= -[(C_S W_A + N_A \sin\beta)\sin\beta\tan\Phi + (N_A \tan\delta + C_a)\cos^2\beta + (C + W_P \tan\Phi)\cos\beta]$
c =	990.7	$= (N_A \tan\delta + C_a)\cos\beta\sin\beta\tan\Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$\boxed{FS = 1.88}$

INFINITE SLOPE STABILITY ANALYSIS - VEGETATIVE COVER/GEOTEXTILE INTERFACE

Static, No Seepage

γ =	120	unit weight of the cover soil (pcf)
h =	1.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	25	friction angle of the cover soil (deg)
Φ =	0.436	friction angle of the cover soil (rad)
δ =	33	interface friction angle between cover soil and geomembrane (deg)
Γ =	0.576	interface friction angle between cover soil and geomembrane (rad)
c_a =	0	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	0	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	12353	Total weight of the active wedge(lb)
W_P =	574	total weight of the passive wedge
N_A =	11984	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
C_a =	0	adhesive force between cover soil of the acctive wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
a =	705	$= (W_A - N_A \cos \beta) \cos \beta$
b =	-1978	$= - [(W_A - N_A \cos \beta) \sin \beta \tan \Phi + (N_A \tan \delta + C_a) \sin \beta \cos \beta + \sin \beta (C + W_P \tan \Phi)]$
c =	213	$= (N_A \tan \delta + C_a) \sin^2 \beta \tan \Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{FS = 2.69}$$

INFINITE SLOPE STABILITY ANALYSIS - VEGETATIVE SOIL/GEOTEXTILE INTERFACE

Pseudostatic, No Seepage

γ =	120	unit weight of the cover soil (pcf)
h =	1.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	25	friction angle of the cover soil (deg)
Φ =	0.436	friction angle of the cover soil (rad)
δ =	33	interface friction angle between cover soil and geomembrane (deg)
Γ =	0.576	interface friction angle between cover soil and geomembrane (rad)
c_a =	0	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	0	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	12353	Total weight of the active wedge (lb)
W_P =	574	total weight of the passive wedge
N_A =	11984	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
m =		slope ratio (horizontal : vertical)
C_a =	0	adhesive force between cover soil of the active wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
C_S =	0.15	average seismic coefficient
a =	4700.9	$= (C_S W_A + N_A \sin\beta) \cos\beta + CS\, W_P \cos\beta$
b =	-8122.7	$= -[(C_S W_A + N_A \sin\beta) \sin\beta \tan\Phi + (N_A \tan\delta + C_a) \cos^2\beta + (C + W_P \tan\Phi) \cos\beta]$
c =	853.9	$= (N_A \tan\delta + C_a) \cos\beta \sin\beta \tan\Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{FS = 1.62}$$

INFINITE SLOPE STABILITY ANALYSIS - LLDPE/GEOTEXTILE INTERFACE

Static, No Seepage, Textured LLDPE/Geotextile Interface

γ =	120	unit weight of the cover soil (pcf)
h =	1.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	25	friction angle of the cover soil (deg)
Φ =	0.436	friction angle of the cover soil (rad)
δ =	17	interface friction angle between cover soil and geomembrane (deg)
Γ =	0.297	interface friction angle between cover soil and geomembrane (rad)
c_a =	100	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	100	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	12353	Total weight of the active wedge(lb)
W_P =	574	total weight of the passive wedge
N_A =	11984	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
C_a =	6881.534	adhesive force between cover soil of the acctive wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
a =	705	$= (W_A - N_A \cos\beta) \cos\beta$
b =	-2653	$= -[(W_A - N_A \cos\beta) \sin\beta \tan\Phi + (N_A \tan\delta + C_a) \sin\beta \cos\beta + \sin\beta (C + W_P \tan\Phi)]$
c =	289	$= (N_A \tan\delta + C_a) \sin^2\beta \tan\Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{FS = 3.65}$$

INFINITE SLOPE STABILITY ANALYSIS - LLDPE/GEOTEXTILE INTERFACE

Pseudostatic, Textured LLDPE

γ =	120	unit weight of the cover soil (pcf)
h =	1.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	17	friction angle of the cover soil (deg)
Φ =	0.297	friction angle of the cover soil (rad)
δ =	33	interface friction angle between cover soil and geomembrane (deg)
Γ =	0.576	interface friction angle between cover soil and geomembrane (rad)
c_a =	100	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	100	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	12353	Total weight of the active wedge (lb)
W_P =	574	total weight of the passive wedge
N_A =	11984	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
m =		slope ratio (horizontal : vertical)
C_a =	6881.534	adhesive force between cover soil of the active wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
C_S =	0.15	average seismic coefficient
a =	4700.9	$= (C_S W_A + N_A \sin\beta)\cos\beta + CS\, W_P \cos\beta$
b =	-14421.7	$= -[(C_S W_A + N_A \sin\beta)\sin\beta \tan\Phi + (N_A \tan\delta + C_a)\cos^2\beta + (C + W_P \tan\Phi)\cos\beta]$
c =	1054.9	$= (N_A \tan\delta + C_a)\cos\beta \sin\beta \tan\Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{FS = 2.99}$$

INFINITE SLOPE STABILITY ANALYSIS - TEXTURED LLDPE/SOIL INTERFACE

Static, No Seepage

γ =	120	unit weight of the cover soil (pcf)
h =	1.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	25	friction angle of the cover soil (deg)
Φ =	0.436	friction angle of the cover soil (rad)
δ =	25	interface friction angle between cover soil and geomembrane (deg)
Γ =	0.436	interface friction angle between cover soil and geomembrane (rad)
c_a =	51	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	51	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	12353	Total weight of the active wedge(lb)
W_P =	574	total weight of the passive wedge
N_A =	11984	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
C_a =	3509.582	adhesive force between cover soil of the acctive wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
a =	705	$= (W_A - N_A \cos\beta) \cos\beta$
b =	-2300	$= - [(W_A - N_A \cos\beta) \sin\beta \tan\Phi + (N_A \tan\delta + C_a) \sin\beta \cos\beta + \sin\beta (C + W_P \tan\Phi)]$
c =	250	$= (N_A \tan\delta + C_a) \sin^2\beta \tan\Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{FS = 3.15}$$

INFINITE SLOPE STABILITY ANALYSIS - TEXTURED LLDPE/SOIL INTERFACE

Pseudostatic, Textured LLDPE/Soil

γ =	120	unit weight of the cover soil (pcf)
h =	1.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	25	friction angle of the cover soil (deg)
Φ =	0.436	friction angle of the cover soil (rad)
δ =	25	interface friction angle between cover soil and geomembrane (deg)
Γ =	0.436	interface friction angle between cover soil and geomembrane (rad)
c_a =	51	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	51	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	12353	Total weight of the active wedge (lb)
W_P =	574	total weight of the passive wedge
N_A =	11984	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
m =		slope ratio (horizontal : vertical)
C_a =	3509.582	adhesive force between cover soil of the active wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
C_S =	0.15	average seismic coefficient
a =	4700.9	$= (C_S\, W_A + N_A \sin\beta)\cos\beta + CS\, W_P \cos\beta$
b =	-9410.0	$= -[(C_S\, W_A + N_A \sin\beta)\sin\beta\tan\Phi + (N_A \tan\delta + C_a)\cos^2\beta + (C + W_P \tan\Phi)\cos\beta]$
c =	998.2	$= (N_A \tan\delta + C_a)\cos\beta\sin\beta\tan\Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{FS = 1.89}$$

INFINITE SLOPE STABILITY ANALYSIS - FOUNDATION LAYER

Static, No Seepage

γ =	120	unit weight of the cover soil (pcf)
h =	1.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	25	friction angle of the cover soil (deg)
Φ =	0.436	friction angle of the cover soil (rad)
δ =	25	interface friction angle between cover soil and geomembrane (deg)
Γ =	0.436	interface friction angle between cover soil and geomembrane (rad)
c_a =	51	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	51	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	12353	Total weight of the active wedge(lb)
W_P =	574	total weight of the passive wedge
N_A =	11984	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
C_a =	3509.582	adhesive force between cover soil of the acctive wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
a =	705	$= (W_A - N_A \cos \beta) \cos \beta$
b =	-2300	$= - [(W_A - N_A \cos \beta) \sin \beta \tan \Phi + (N_A \tan \delta + C_a) \sin \beta \cos \beta + \sin \beta (C + W_P \tan \Phi)]$
c =	250	$= (N_A \tan \delta + C_a) \sin^2 \beta \tan \Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{FS = 3.15}$$

INFINITE SLOPE STABILITY ANALYSIS - FOUNDATION LAYER

Pseudostatic

γ =	120	unit weight of the cover soil (pcf)
h =	2.5	thickness of the cover soil (ft)
L =	75	length of slope measured along the geomembrane (ft)
m =	4	soil slope ratio beneath the geomembrane (x:1)
β =	14.0	soil slope angle beneath the geomembrane (deg)
B =	0.245	soil slope angle beneath the geomembrane (rad)
φ =	25	friction angle of the cover soil (deg)
Φ =	0.436	friction angle of the cover soil (rad)
δ =	25	interface friction angle between cover soil and geomembrane (deg)
Γ =	0.436	interface friction angle between cover soil and geomembrane (rad)
c_a =	50	adhesion between cover soil of the active wedge and the geomembrane (psf)
C =	50	cohesive force along the failure plane of the passive wedge
c =	50	cohesion of the cover soil
W_A =	19314	Total weight of the active wedge (lb)
W_P =	1594	total weight of the passive wedge
N_A =	18737	effective force normal to the failure plane of the active wedge (lb)
N_P =		effective force normal to the failure plane of the passive wedge
m =		slope ratio (horizontal : vertical)
C_a =	3234.612	adhesive force between cover soil of the active wedge and the geomembrane (kip)
E_A =		interwedge force acting on the passive wedge from the active wedge
E_P =		interwedge force acting on the passive wedge from the active wedge
C_S =	0.15	average seismic coefficient
a =	7451.3	$= (C_S\, W_A + N_A \sin\beta)\cos\beta + CS\, W_P \cos\beta$
b =	-12878.8	$= -[(C_S\, W_A + N_A \sin\beta)\sin\beta\tan\Phi + (N_A \tan\delta + C_a)\cos^2\beta + (C + W_P\tan\Phi)\cos\beta]$
c =	1313.6	$= (N_A \tan\delta + C_a)\cos\beta\sin\beta\tan\Phi$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\boxed{FS = 1.62}$$

APPENDIX E

SURFACE WATER DRAINAGE ANALYSIS AND GROUNDWATER TREATMENT SYSTEM POND SIZING

SURFACE WATER DRAINAGE ANALYSIS

SURFACE WATER DRAINAGE ANALYSIS
BONZI SANITATION LANDFILL
FINAL CLOSURE AND POST-CLOSURE MAINTENANCE PLAN

STANISLAUS COUNTY, CALIFORNIA

FEBRUARY 2015

PROJECT NO. 2012.0023

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1.0 SURFACE WATER DRAINAGE ANALYSIS

The drainage control systems for the Bonzi Sanitation Landfill have been designed to accommodate the anticipated volume of precipitation and resulting run-off generated from the design grades at final closure during the peak 100-year, 24-hour rainfall event. This data was then used for the subsequent design of the drainage control structures around the site. The configuration of the landfill that was analyzed is shown on Figure 1 within this report.

The rainfall data used in the hydrology analysis of the Bonzi Sanitation Landfill was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 rainfall frequency maps. Upon review of the rainfall frequency maps (Figure 2), the peak 2-yr, 24-hr and 100-year, 24-hour storm event was determined to be 1.54 and 3.21 inches, respectively.

The surface water hydrology of the Bonzi Sanitation Landfill was calculated using the WinTR-55 (USDA, 2013) computer program. This program provides a graphical user interface to the TR-55 method developed by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS), 1986.

In general, run-off from the closure of WMU II, III and IV is to be collected by a series of berms, diversion channels, and culverts and directed towards the existing storm water retention pond on the north of the site (one of two existing retention ponds onsite). Run-off from the southern portions of WMU-I (existing closed) is collected by similar methods of conveyance and directed around the unit to the groundwater treatment system pond. While run-off from the norther portion of WMU-1 is directed to a swale along the north wall and then into the existing northern storm water retention pond. The drainage patterns and surface water control systems are shown on Figure 1, Attachment 1.

At closure the top deck surface will have an effective slope of 2.0%. Sheet flow off the top of the landfill will collect downstream where the topdeck transitions (or breaks) to the side slopes and connects to the perimeter channels. All new perimeter channels are grass lined with geometry as shown in Attachment 4.

2.0 PEAK RUN-OFF DETERMINATION

2.1 Description of Method

The TR-20 method embedded in WinTR-55 was used to calculate the peak run-off generated from the design 100-year, 24-hour storm event (USDA, Soil Conservation Service, 1986). This method is widely accepted for determining stormwater run-off for small watersheds and can be used to describe a heterogeneous watershed that is divided into a number of homogeneous sub-watersheds. This method relates rainfall depth, a runoff curve number (CN), time of concentration (T_c), and drainage area to determine the peak run-off from a drainage area.

In calculating the surface hydrology it is conservatively assumed that all the precipitation impacting a particular sub-area is eventually diverted into designed drainage channels. It is also assumed that the design storm event will have a duration that exceeds the time of concentration of overland flow.

Prior to beginning the run-off calculations, various parameters were identified. These parameters are listed below. First, the 100-year, 24-hour and 2 year, 24 hour rainfall depths were determined to be 3.21 inches and 1.54 inches, respectively (Figure 2, Attachment 1). Next, the regional rainfall time distribution for the location of the landfill was classified as being of Type I rainfall (Figure 3, Attachment 1). The landfill drainage area (approximately 102 acres) was divided into 9 sub-areas delineating potential run-off flow paths and concentration points (Figure 1, Attachment 1). Along the anticipated flow path, time of concentration for sheet, shallow-concentrated, and channel flow regimes were then calculated for each sub-area (see Attachment 2). Based on the local soil types it was determined that hydrologic soil group B best represents on site soils. Finally, a run-off curve number (CN) was determined for each sub-area based on the hydrologic soil group, cover type, soil treatment, hydrologic condition, and antecedent run-off condition.

Upon identifying the starting parameters, the WinTR-55 computer program was then used to calculate the peak run-off flow for the 9 sub-areas (see Attachment 2).

2.2 Results of the Analyses

The design 100-year, 24-hour storm event will generate a combined peak discharge of 62.5 cubic feet/second over the entire contributing landfill watershed areas. However, a conservative approach to sizing of the structures was implemented in which the peak discharge for each major run-off concentration point was determined separately. As a result, the sum of the resulting peak discharge amounts do not add up to the overall peak discharge over the entire landfill site. The discrepancy is due to landfill orientation and run-off routing corresponding to differing time of concentrations. The run-off and peak discharge calculations for each point of concentration on the Bonzi Sanitation Landfill are provided in Attachment 3.

3.0 CONTROL STRUCTURE SIZING

3.1 Drainage Channel Sizing

All open channels were sized using the computer program FlowMaster V8i (Bentley 2009). The detailed calculation and report sheets for open channel sizing are provided in Attachment 4.

Collection channels along the perimeter access roads and borrow area will be trapezoidal with the side slopes and bottom width meeting the requirements shown in the Hydraulic Drainage Structure Summary table provided at the front of Attachment 4. To reduce the amount of erosion during peak run-off events, all drainage channels are to be lined with an erosion control vegetation layer except as noted in the Channel Hydraulic Drainage Structure Summary table.

It was assumed that the existing perimeter channels for the closed WMU-1 area were adequately sized during closure of that unit and verification of the sizing was not performed as part of this analysis.

3.2 Culvert Sizing

The channels drain to collection points around the site where the water will be fed into culverts that discharge into the northern stormwater retention basin. The proposed culverts were sized using the computer program CulvertMaster V3.3 (Bentley, 2009). The detailed calculation and report sheets for the culvert sizing are provided in Attachment 5. It was assumed that the existing culverts for the closed WMU-1 area were adequately sized during closure of that unit and verification of the sizing was not performed as part of this analysis.

Rip-rap aprons at the toe of each culvert will dissipate the flows at exit from the downdrains at the tow of the retention pond. Calculations for the rip-rap apron sizing are included in Attachment 6.

3.3 Storm Water Retention Basin

To verify the capacity of the existing storm water retention pond, the pond volume was calculated using the average end area method at 1 foot contour intervals (see Attachment 7). The generated volumes and capacities of the design storm event is shown in the spreadsheets within Attachment 6. The 100-yr 24-hr design storm event would fill the existing storm water retention basin to approximately 8 feet deep, roughly 15% of overall capacity. The maximum water depth of the stormwater retention basin is 14 feet (elevation 57 feet AMSL).

4.0 REFERENCES

Bentley Systems Inc., 2009, CulvertMaster Version 3.3, Watertown, CT.

Bentley Systems Inc., 2009, FlowMaster Version 8i, Watertown, CT.

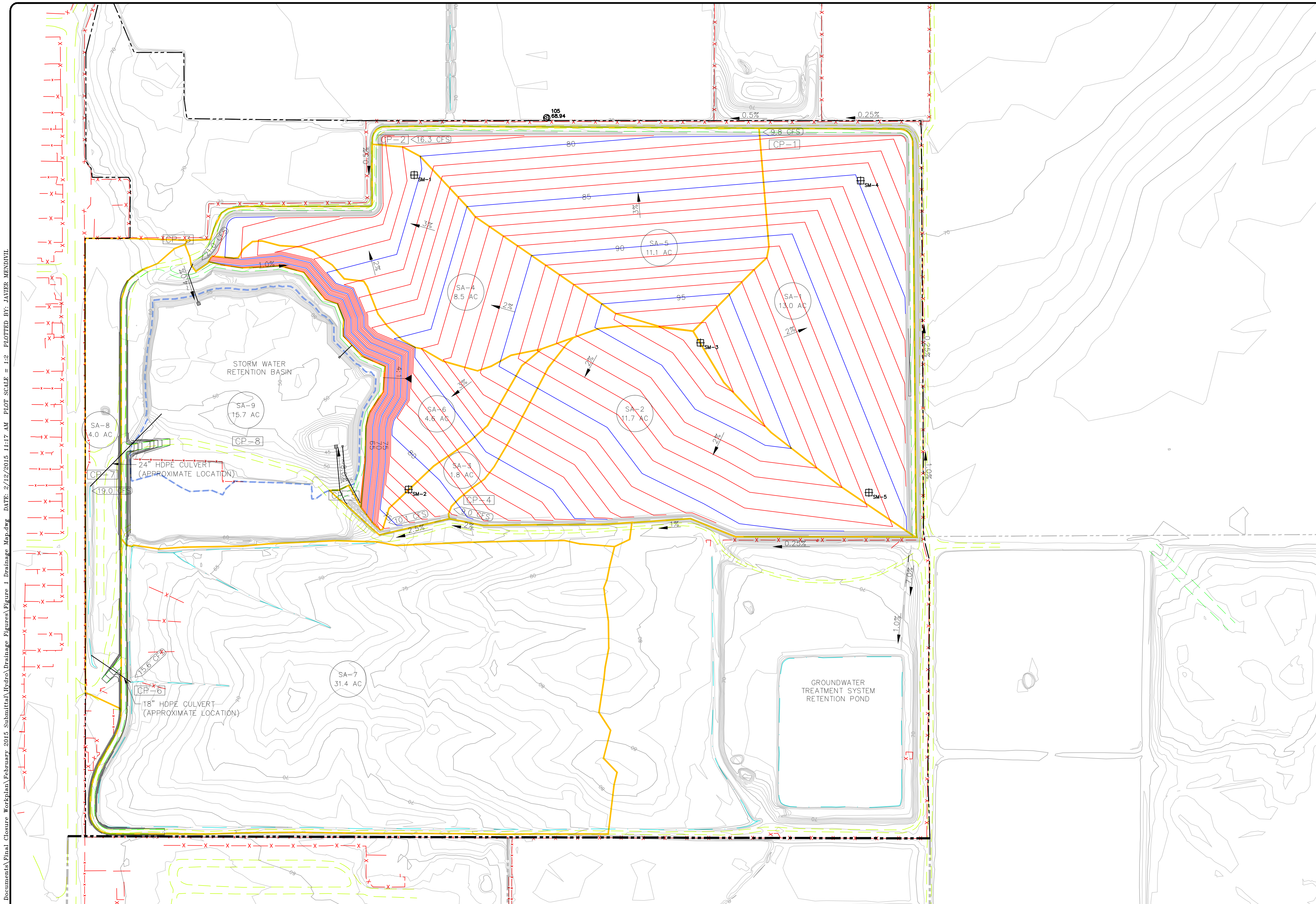
Goldman, Steven J., Jackson, Katherine, and Bursztynsky, Tara A. (1986) "Erosion and Sediment Control Handbook", McGraw-Hill, Inc.

National Oceanic and Atmospheric Association (NOAA), Hydrometeorological Design Studies Center, Precipitation Frequency Data Server, http://hdsc.nws.noaa.gov/hdsc/pfds/.

U.S. Department of Agriculture, Natural Resources Conservation Service, Conservation Engineering Division, WinTR-55, (2013), "WinTR-55 Small Watershed Hydrology Computer Program, Version 1.00.10".

ATTACHMENT 1

DESIGN STORM DATA



GRAPHIC SCALE

150' 0' 75' 150' 300' 600'

LEGEND

- EXISTING 5 FT CONTOUR
- EXISTING 1 FT CONTOUR
- PROPOSED 5 FT TOP OF FINAL COVER CONTOUR
- PROPOSED 1 FT TOP OF FINAL COVER CONTOUR
- PROPOSED ROAD
- EXISTING UNPAVED ROADS
- EXISTING PAVED ROADS
- EXISTING FENCE
- PROPERTY BOUNDARY (APPROX.)
- ADJACENT PROPERTY BOUNDARY (APPROX.)
- HYDROLOGICAL SUB AREA BOUNDARY
- 105 68.94 CONTROL POINTS
- SM-1 PROPOSED SETTLEMENT MONUMENT
- SA-1 2.55 AC HYDROLOGICAL SUB AREA LABEL AND ACREAGE
- CP-56 PROPOSED COLLECTION POINT
- 46 CFS CALCULATED DRAINAGE FLOW (CUBIC FEET PER SECOND)

NOTES:

1. EXISTING TOPOGRAPHY BASED ON AERIAL SURVEY PERFORMED BY COOPER AERIAL SURVEYS, CO. ON JUNE 7, 2012.
2. TO PROVIDE ADDITIONAL TOPOGRAPHIC RESOLUTION, ONE FOOT CONTOURS WERE GENERATED BY GEO-LOGIC AND ARE BASED ON THE AERIAL TOPOGRAPHIC MAP BY COOPER AERIAL SURVEYS, CO.
3. EXISTING STORM WATER RETENTION BASIN TOPOGRAPHY PERFORMED BY SUKUT CONSTRUCTION, INC. ON NOVEMBER 16, 2012. EXISTING INTERMEDIATE COVER TOPOGRAPHY PERFORMED BY SUKUT CONSTRUCTION, INC. ON JANUARY 25, 2013.

LOCATION: N:\Bonzi\Project Documents\Final Closure Workplan\February 2015 Submittal\Hydro\Drainage Figures\Figure 1 Drainage Map.dwg DATE: 2/12/2015 11:17 AM PLOT SCALE = 1:2 PLOTTED BY: JAVIER MENDIVIL

REV. NO.	DATE	DESCRIPTION	DRAWN BY	DESIGNED BY	CHECKED BY	APPROVED BY
A	04/22/13	ISSUED FOR REVIEW	RSB	NC	TVR	NC
B	11/27/13	ISSUED FOR REVIEW	CM	NC/CM	TVR	NC
C	09/24/14	ISSUED FOR REVIEW	RPB	RPB	NC	NC
D	02/10/15	ISSUED FOR REVIEW	JM	NC	NC	NC

DATE OF ISSUE: 02/10/2015
DESIGNED BY: NC
DRAWN BY: JM
CHECKED BY: NC
APPROVED BY: NC

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BONZI SANITATION LANDFILL
FINAL CLOSURE PLAN
STANISLAUS COUNTY, CALIFORNIA
SUB-AREAS

FIGURE NO. 1
PROJECT NO. 2012.0023

ISSUED FOR REVIEW

NOAA Atlas 14, Volume 6, Version 2
Location name: Modesto, California, US*
Latitude: 37.6039°, Longitude: -121.0400°
Elevation: 71 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF tabular | PF graphical | Maps & aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.116 (0.100–0.134)	0.157 (0.136–0.182)	0.228 (0.197–0.266)	0.286 (0.245–0.338)	0.363 (0.298–0.448)	0.421 (0.335–0.533)	0.480 (0.371–0.628)	0.544 (0.405–0.736)	0.632 (0.447–0.902)	0.703 (0.476–1.05)
10-min	0.166 (0.144–0.192)	0.224 (0.195–0.261)	0.327 (0.283–0.382)	0.410 (0.351–0.484)	0.521 (0.427–0.642)	0.603 (0.481–0.764)	0.689 (0.532–0.900)	0.779 (0.581–1.06)	0.906 (0.641–1.29)	1.01 (0.683–1.50)
15-min	0.200 (0.174–0.233)	0.271 (0.235–0.316)	0.395 (0.342–0.462)	0.496 (0.424–0.586)	0.630 (0.516–0.776)	0.729 (0.582–0.924)	0.833 (0.644–1.09)	0.942 (0.703–1.28)	1.10 (0.775–1.56)	1.22 (0.826–1.82)
30-min	0.295 (0.257–0.343)	0.400 (0.347–0.466)	0.583 (0.505–0.682)	0.732 (0.626–0.864)	0.929 (0.761–1.15)	1.08 (0.858–1.36)	1.23 (0.950–1.61)	1.39 (1.04–1.88)	1.62 (1.14–2.31)	1.80 (1.22–2.68)
60-min	0.312 (0.272–0.363)	0.423 (0.367–0.493)	0.617 (0.533–0.721)	0.774 (0.662–0.914)	0.983 (0.805–1.21)	1.14 (0.907–1.44)	1.30 (1.00–1.70)	1.47 (1.10–1.99)	1.71 (1.21–2.44)	1.90 (1.29–2.83)
2-hr	0.520 (0.452–0.604)	0.653 (0.567–0.760)	0.838 (0.725–0.979)	0.998 (0.854–1.18)	1.23 (1.01–1.51)	1.42 (1.13–1.79)	1.62 (1.25–2.11)	1.84 (1.37–2.49)	2.15 (1.52–3.07)	2.41 (1.64–3.60)
3-hr	0.620 (0.539–0.720)	0.760 (0.660–0.885)	0.957 (0.828–1.12)	1.13 (0.965–1.33)	1.38 (1.13–1.70)	1.58 (1.26–2.00)	1.80 (1.39–2.35)	2.04 (1.52–2.76)	2.39 (1.69–3.41)	2.68 (1.82–3.99)
6-hr	0.791 (0.687–0.919)	0.952 (0.826–1.11)	1.18 (1.02–1.37)	1.37 (1.17–1.61)	1.64 (1.35–2.03)	1.87 (1.49–2.37)	2.11 (1.63–2.76)	2.37 (1.77–3.21)	2.74 (1.94–3.91)	3.05 (2.07–4.54)
12-hr	1.00 (0.870–1.16)	1.22 (1.06–1.42)	1.51 (1.30–1.76)	1.75 (1.50–2.06)	2.08 (1.70–2.56)	2.33 (1.86–2.95)	2.59 (2.01–3.39)	2.87 (2.14–3.89)	3.25 (2.30–4.63)	3.54 (2.40–5.28)
24-hr	1.24 (1.15–1.38)	1.54 (1.42–1.71)	1.92 (1.76–2.13)	2.22 (2.03–2.49)	2.62 (2.31–3.03)	2.92 (2.52–3.44)	3.21 (2.72–3.87)	3.51 (2.89–4.35)	3.90 (3.09–5.03)	4.20 (3.22–5.59)
2-day	1.50 (1.38–1.66)	1.86 (1.71–2.06)	2.30 (2.11–2.55)	2.65 (2.41–2.96)	3.10 (2.74–3.58)	3.43 (2.97–4.04)	3.75 (3.18–4.53)	4.08 (3.36–5.05)	4.50 (3.56–5.80)	4.81 (3.69–6.41)
3-day	1.66 (1.53–1.83)	2.04 (1.88–2.26)	2.51 (2.31–2.79)	2.89 (2.63–3.23)	3.37 (2.98–3.89)	3.72 (3.22–4.39)	4.07 (3.44–4.91)	4.41 (3.63–5.46)	4.85 (3.84–6.25)	5.18 (3.96–6.90)
4-day	1.83 (1.69–2.03)	2.25 (2.07–2.50)	2.78 (2.55–3.08)	3.18 (2.90–3.56)	3.71 (3.27–4.28)	4.09 (3.54–4.82)	4.46 (3.78–5.38)	4.83 (3.98–5.99)	5.31 (4.20–6.84)	5.66 (4.34–7.54)
7-day	2.19 (2.02–2.42)	2.69 (2.48–2.98)	3.32 (3.05–3.69)	3.81 (3.47–4.26)	4.44 (3.92–5.12)	4.89 (4.24–5.77)	5.34 (4.52–6.44)	5.78 (4.76–7.16)	6.34 (5.02–8.18)	6.76 (5.18–9.01)
10-day	2.40 (2.21–2.65)	2.96 (2.72–3.27)	3.65 (3.36–4.06)	4.19 (3.82–4.69)	4.88 (4.31–5.64)	5.39 (4.67–6.35)	5.88 (4.97–7.09)	6.36 (5.24–7.88)	6.98 (5.53–9.00)	7.44 (5.70–9.91)
20-day	3.13 (2.88–3.46)	3.88 (3.58–4.30)	4.81 (4.42–5.34)	5.52 (5.03–6.18)	6.43 (5.68–7.43)	7.08 (6.13–8.34)	7.71 (6.52–9.30)	8.32 (6.85–10.3)	9.10 (7.20–11.7)	9.66 (7.40–12.9)
30-day	3.74 (3.45–4.14)	4.66 (4.29–5.16)	5.79 (5.32–6.43)	6.64 (6.05–7.43)	7.72 (6.82–8.92)	8.49 (7.35–10.0)	9.22 (7.80–11.1)	9.93 (8.18–12.3)	10.8 (8.57–14.0)	11.5 (8.79–15.3)
45-day	4.64 (4.28–5.13)	5.82 (5.36–6.44)	7.23 (6.64–8.03)	8.30 (7.56–9.29)	9.62 (8.50–11.1)	10.6 (9.14–12.4)	11.4 (9.68–13.8)	12.3 (10.1–15.2)	13.3 (10.6–17.2)	14.1 (10.8–18.8)
60-day	5.49 (5.06–6.07)	6.91 (6.36–7.65)	8.60 (7.90–9.55)	9.86 (8.99–11.0)	11.4 (10.1–13.2)	12.5 (10.8–14.7)	13.5 (11.5–16.3)	14.5 (11.9–18.0)	15.7 (12.4–20.2)	16.6 (12.7–22.1)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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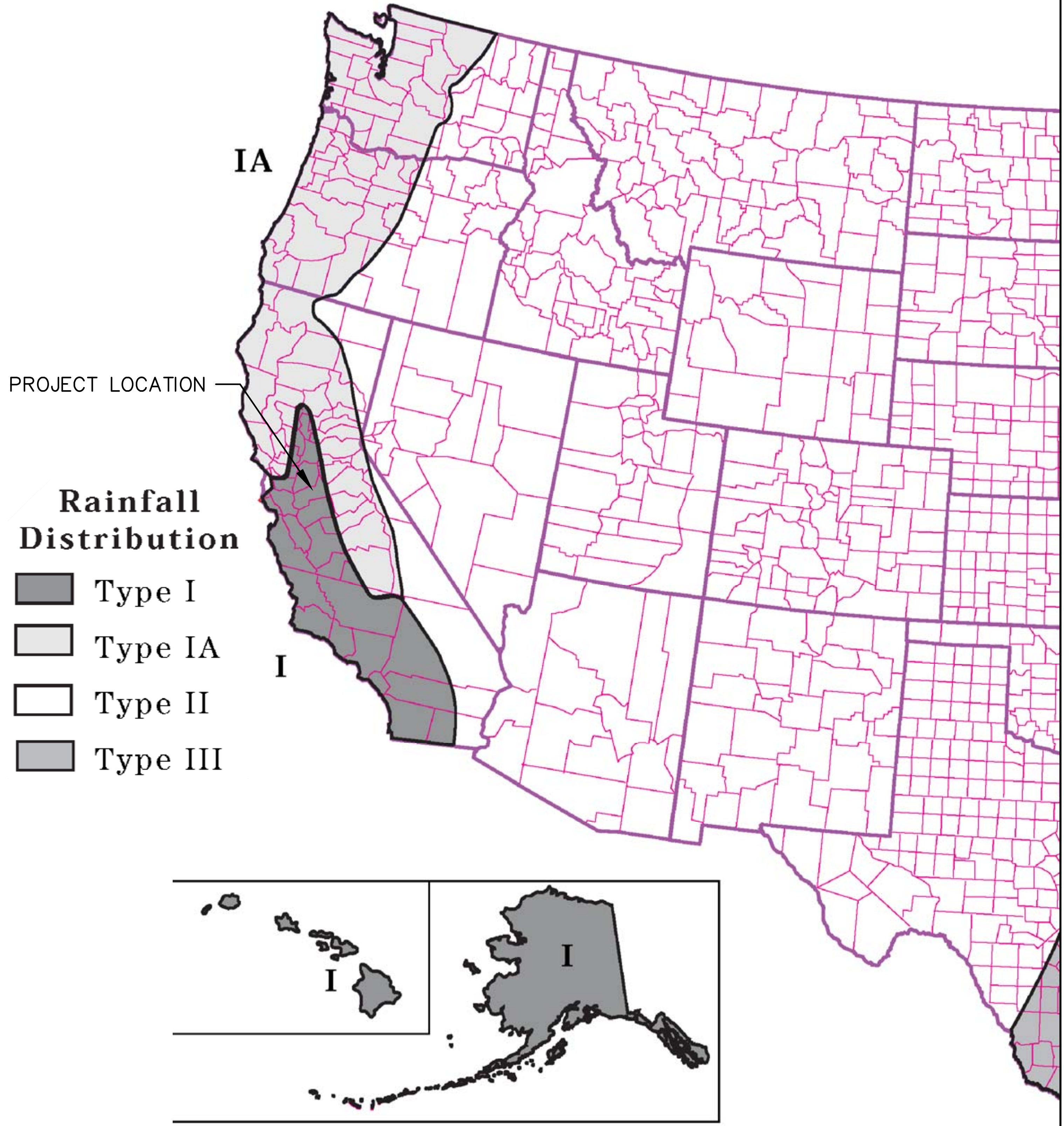
PF graphical

LOCATION: C:\Users\rberquist\Desktop_GLA GV\Bonzi\Hydro\Revision 2014\Hydro Figures 2&3.dwg DATE: 10/1/2014 2:25 PM PLOT SCALE = 1:1 PLOTTED BY: RYAN BERQUIST

DATE OF ISSUE: 10/1/2014 DESIGNED BY: RPB DRAWN BY: RPB CHECKED BY: NC APPROVED BY: NC	Geo-Logic ASSOCIATES	BONZI SANITATION LANDFILL FINAL CLOSURE PLAN STANISLAUS COUNTY, CALIFORNIA **NOAA PRECIPITATION FREQUENCY**	FIGURE NO. **2** PROJECT NO.



DATE OF ISSUE: 10/01/2014 DESIGNED BY: RPB DRAWN BY: RPB CHECKED BY: NC APPROVED BY: NC	Geo-Logic ASSOCIATES	BONZI SANITATION LANDFILL FINAL CLOSURE PLAN STANISLAUS COUNTY, CALIFORNIA **SCS RAINFALL DISTRIBUTION**	FIGURE NO. **3** PROJECT NO. 2013.A023

LOCATION: C:\Users\rberquist\Desktop_GLA GI\Bonzi\Hydro\Revision 2014\Hydro Figure 3.dwg DATE: 10/1/2014 3:05 PM PLOT SCALE = 1:1 PLOTTED BY: RYAN BERQUIST

ATTACHMENT 2

WINTR-55 AND WINTR-20 OUTPUT

WINTR-55 OUTPUT

WinTR-55 Current Data Description

--- Identification Data ---

User: RPB
Project: Bonzi Landfill
SubTitle: Final Closure
State: California
County: Stanislaus
Filename: N:\Bonzi\Project Documents\Final Closure Workplan\February 2015 Submittal\Hydro\TR-55\Drainage.w55

Date: 2/10/2015
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
SA-1		Outlet	13.0	77	0.175
SA-2		Outlet	11.7	77	0.155
SA-3		Outlet	1.8	77	0.325
SA-4		Outlet	8.5	77	0.405
SA-5		Outlet	11.1	77	0.372
SA-6		Outlet	4.6	77	0.292
SA-7		Outlet	31.4	77	0.506
SA-8		Outlet	4.0	77	0.100
SA-9		Outlet	15.7	77	0.325

Total area: 101.80 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
1.54	.0	.0	.0	.0	3.21	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: <standard>

Bonzi Landfill
Final Closure
Stanislaus County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period ANALYSIS: (cfs)	(hr)
SUBAREAS		
SA-1	9.79	10.01
SA-2	9.02	9.98
SA-3	1.11	10.10
SA-4	4.75	10.15
SA-5	6.46	10.13
SA-6	2.97	10.09
SA-7	15.60	10.20
SA-8	3.37	9.93
SA-9	9.72	10.10
OUTLET	55.04	

Bonzi Landfill
Final Closure
Stanislaus County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
SA-1							
CHANNEL	1510					2.600	0.161
CHANNEL	175					3.460	0.014
				Time of Concentration			.175
SA-2							
CHANNEL	1440					2.580	0.155
				Time of Concentration			.155
SA-3							
SHEET	100	0.0200	0.150				0.235
SHALLOW	575	0.0200	0.050				0.070
CHANNEL	215					2.960	0.020
				Time of Concentration			.325
SA-4							
SHEET	100	0.0250	0.150				0.215
SHALLOW	915	0.0250	0.050				0.100
CHANNEL	835					2.570	0.090
				Time of Concentration			0.405
SA-5							
SHEET	100	0.0300	0.150				0.200
SHALLOW	600	0.0300	0.050				0.060
CHANNEL	1200					2.970	0.112
				Time of Concentration			0.372
SA-6							
SHEET	100	0.0200	0.150				0.235
SHALLOW	673	0.0410	0.050				0.057
				Time of Concentration			.292
SA-7							
SHEET	100	0.0200	0.150				0.235
SHALLOW	1128	0.0150	0.050				0.159
CHANNEL	1205					3.000	0.112
				Time of Concentration			.506
SA-8							
SHEET	100	0.0600	0.011				0.019
CHANNEL	515					2.500	0.057

				Time of Concentration	0.1
					========
SA-9					
SHEET	100	0.0230	0.150		0.223
SHALLOW	900	0.0230	0.050		0.102
				Time of Concentration	.325
					========

Bonzi Landfill
Final Closure
Stanislaus County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
SA-1	CN directly entered by user	-	13	77
	Total Area / Weighted Curve Number		13	77
			==	==
SA-2	CN directly entered by user	-	11.7	77
	Total Area / Weighted Curve Number		11.7	77
			====	==
SA-3	CN directly entered by user	-	1.8	77
	Total Area / Weighted Curve Number		1.8	77
			===	==
SA-4	CN directly entered by user	-	8.5	77
	Total Area / Weighted Curve Number		8.5	77
			===	==
SA-5	CN directly entered by user	-	11.1	77
	Total Area / Weighted Curve Number		11.1	77
			====	==
SA-6	CN directly entered by user	-	4.6	77
	Total Area / Weighted Curve Number		4.6	77
			===	==
SA-7	User defined urban (Click button or	B	31.4	77
	Total Area / Weighted Curve Number		31.4	77
			====	==
SA-8	User defined urban (Click button or	B	4	77
	Total Area / Weighted Curve Number		4	77
			=	==
SA-9	User defined urban (Click button or	B	15.7	77
	Total Area / Weighted Curve Number		15.7	77
			====	==

WINTR-20 OUTPUT

Bonzi Landfill
Final Closure

Name of printed page file:
TR20.out

STORM 100-Yr

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA-1	0.020		1.218		10.01	9.79	482.06

Line Start Time (hr)	Flow Values @ time increment of 0.011 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.252	0.05	0.05	0.06	0.06	0.06	0.06	0.07
8.330	0.07	0.07	0.08	0.08	0.08	0.08	0.09
8.407	0.09	0.09	0.10	0.10	0.10	0.11	0.11
8.484	0.12	0.12	0.12	0.13	0.13	0.13	0.14
8.562	0.14	0.15	0.15	0.16	0.16	0.16	0.17
8.639	0.17	0.18	0.18	0.19	0.19	0.20	0.20
8.717	0.21	0.21	0.22	0.22	0.23	0.23	0.24
8.794	0.24	0.25	0.25	0.26	0.26	0.27	0.28
8.871	0.28	0.29	0.29	0.30	0.31	0.31	0.32
8.949	0.32	0.33	0.34	0.34	0.35	0.36	0.36
9.026	0.37	0.38	0.38	0.39	0.40	0.41	0.42
9.103	0.42	0.43	0.44	0.45	0.46	0.47	0.48
9.181	0.49	0.50	0.51	0.52	0.53	0.54	0.55
9.258	0.56	0.57	0.58	0.59	0.60	0.62	0.63
9.335	0.64	0.65	0.67	0.68	0.69	0.70	0.72
9.413	0.73	0.74	0.76	0.77	0.79	0.80	0.81
9.490	0.83	0.84	0.86	0.88	0.90	0.92	0.95
9.568	0.99	1.03	1.08	1.13	1.18	1.23	1.29
9.645	1.36	1.44	1.53	1.63	1.73	1.84	1.96
9.722	2.08	2.21	2.36	2.52	2.71	2.92	3.14
9.800	3.37	3.61	3.87	4.16	4.48	4.86	5.29
9.877	5.77	6.29	6.84	7.38	7.91	8.40	8.83
9.954	9.19	9.46	9.64	9.74	9.79	9.79	9.74
10.032	9.63	9.46	9.22	8.90	8.50	8.07	7.60
10.109	7.13	6.66	6.22	5.80	5.41	5.07	4.78
10.187	4.54	4.33	4.15	3.99	3.86	3.73	3.62
10.264	3.52	3.43	3.35	3.28	3.21	3.15	3.09
10.341	3.04	2.99	2.94	2.89	2.84	2.80	2.75
10.419	2.71	2.67	2.63	2.59	2.55	2.51	2.47
10.496	2.43	2.39	2.36	2.32	2.29	2.26	2.22
10.573	2.19	2.16	2.13	2.11	2.08	2.06	2.03
10.651	2.01	1.99	1.98	1.96	1.94	1.93	1.92
10.728	1.91	1.89	1.88	1.87	1.86	1.85	1.84
10.805	1.83	1.82	1.81	1.80	1.80	1.79	1.78
10.883	1.77	1.76	1.75	1.74	1.73	1.72	1.71
10.960	1.71	1.70	1.69	1.68	1.67	1.66	1.65
11.038	1.64	1.64	1.63	1.62	1.61	1.60	1.60
11.115	1.59	1.58	1.58	1.57	1.57	1.56	1.56
11.192	1.55	1.55	1.55	1.54	1.54	1.54	1.53
11.270	1.53	1.53	1.52	1.52	1.52	1.52	1.51

Bonzi Landfill
Final Closure

Line Start Time (hr)	------------ Flow Values @ time increment of 0.011 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
11.347	1.51	1.51	1.50	1.50	1.50	1.49	1.49
11.424	1.49	1.49	1.48	1.48	1.48	1.47	1.47
11.502	1.47	1.47	1.46	1.46	1.46	1.45	1.45
11.579	1.45	1.44	1.44	1.44	1.44	1.43	1.43
11.657	1.43	1.42	1.42	1.42	1.41	1.41	1.41
11.734	1.41	1.40	1.40	1.40	1.39	1.39	1.39
11.811	1.38	1.38	1.38	1.37	1.37	1.37	1.36
11.889	1.36	1.36	1.35	1.35	1.35	1.34	1.34
11.966	1.34	1.33	1.33	1.33	1.32	1.32	1.32
12.043	1.31	1.31	1.31	1.30	1.30	1.30	1.29
12.121	1.29	1.29	1.29	1.28	1.28	1.28	1.28
12.198	1.27	1.27	1.27	1.27	1.27	1.26	1.26
12.275	1.26	1.26	1.26	1.25	1.25	1.25	1.25
12.353	1.25	1.24	1.24	1.24	1.24	1.24	1.23
12.430	1.23	1.23	1.23	1.23	1.22	1.22	1.22
12.508	1.22	1.21	1.21	1.21	1.21	1.21	1.20
12.585	1.20	1.20	1.20	1.20	1.19	1.19	1.19
12.662	1.19	1.18	1.18	1.18	1.18	1.18	1.17
12.740	1.17	1.17	1.17	1.17	1.16	1.16	1.16
12.817	1.16	1.15	1.15	1.15	1.15	1.15	1.14
12.894	1.14	1.14	1.14	1.13	1.13	1.13	1.13
12.972	1.12	1.12	1.12	1.12	1.12	1.11	1.11
13.049	1.11	1.11	1.10	1.10	1.10	1.10	1.09
13.127	1.09	1.09	1.09	1.09	1.08	1.08	1.08
13.204	1.08	1.07	1.07	1.07	1.07	1.06	1.06
13.281	1.06	1.06	1.05	1.05	1.05	1.05	1.05
13.359	1.04	1.04	1.04	1.04	1.03	1.03	1.03
13.436	1.03	1.02	1.02	1.02	1.02	1.01	1.01
13.513	1.01	1.01	1.00	1.00	1.00	1.00	0.99
13.591	0.99	0.99	0.99	0.98	0.98	0.98	0.98
13.668	0.97	0.97	0.97	0.97	0.96	0.96	0.96
13.745	0.96	0.95	0.95	0.95	0.95	0.94	0.94
13.823	0.94	0.94	0.93	0.93	0.93	0.93	0.92
13.900	0.92	0.92	0.91	0.91	0.91	0.91	0.90
13.978	0.90	0.90	0.90	0.89	0.89	0.89	0.89
14.055	0.88	0.88	0.88	0.88	0.88	0.87	0.87
14.132	0.87	0.87	0.87	0.87	0.87	0.87	0.87
14.210	0.86	0.86	0.86	0.86	0.86	0.86	0.86
14.287	0.86	0.86	0.86	0.86	0.86	0.86	0.86
14.364	0.86	0.86	0.86	0.86	0.86	0.86	0.86
14.442	0.86	0.85	0.85	0.85	0.85	0.85	0.85
14.519	0.85	0.85	0.85	0.85	0.85	0.85	0.85
14.597	0.85	0.85	0.85	0.85	0.85	0.85	0.85
14.674	0.85	0.85	0.85	0.85	0.85	0.85	0.85
14.751	0.85	0.84	0.84	0.84	0.84	0.84	0.84
14.829	0.84	0.84	0.84	0.84	0.84	0.84	0.84
14.906	0.84	0.84	0.84	0.84	0.84	0.84	0.84
14.983	0.84	0.84	0.84	0.84	0.84	0.84	0.84
15.061	0.83	0.83	0.83	0.83	0.83	0.83	0.83
15.138	0.83	0.83	0.83	0.83	0.83	0.83	0.83
15.215	0.83	0.83	0.83	0.83	0.83	0.83	0.83

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.011 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
15.293	0.83	0.83	0.83	0.83	0.82	0.82	0.82
15.370	0.82	0.82	0.82	0.82	0.82	0.82	0.82
15.448	0.82	0.82	0.82	0.82	0.82	0.82	0.82
15.525	0.82	0.82	0.82	0.82	0.82	0.82	0.82
15.602	0.82	0.81	0.81	0.81	0.81	0.81	0.81
15.680	0.81	0.81	0.81	0.81	0.81	0.81	0.81
15.757	0.81	0.81	0.81	0.81	0.81	0.81	0.81
15.834	0.81	0.81	0.81	0.81	0.80	0.80	0.80
15.912	0.80	0.80	0.80	0.80	0.80	0.80	0.80
15.989	0.80	0.80	0.80	0.80	0.80	0.80	0.80
16.067	0.80	0.80	0.80	0.80	0.80	0.80	0.80
16.144	0.79	0.79	0.79	0.79	0.79	0.79	0.79
16.221	0.79	0.79	0.79	0.79	0.79	0.79	0.79
16.299	0.79	0.79	0.79	0.79	0.79	0.79	0.79
16.376	0.79	0.79	0.78	0.78	0.78	0.78	0.78
16.453	0.78	0.78	0.78	0.78	0.78	0.78	0.78
16.531	0.78	0.78	0.78	0.78	0.78	0.78	0.78
16.608	0.78	0.78	0.78	0.77	0.77	0.77	0.77
16.685	0.77	0.77	0.77	0.77	0.77	0.77	0.77
16.763	0.77	0.77	0.77	0.77	0.77	0.77	0.77
16.840	0.77	0.77	0.77	0.77	0.76	0.76	0.76
16.918	0.76	0.76	0.76	0.76	0.76	0.76	0.76
16.995	0.76	0.76	0.76	0.76	0.76	0.76	0.76
17.072	0.76	0.76	0.76	0.76	0.75	0.75	0.75
17.150	0.75	0.75	0.75	0.75	0.75	0.75	0.75
17.227	0.75	0.75	0.75	0.75	0.75	0.75	0.75
17.304	0.75	0.75	0.75	0.75	0.74	0.74	0.74
17.382	0.74	0.74	0.74	0.74	0.74	0.74	0.74
17.459	0.74	0.74	0.74	0.74	0.74	0.74	0.74
17.537	0.74	0.74	0.74	0.73	0.73	0.73	0.73
17.614	0.73	0.73	0.73	0.73	0.73	0.73	0.73
17.691	0.73	0.73	0.73	0.73	0.73	0.73	0.73
17.769	0.73	0.73	0.72	0.72	0.72	0.72	0.72
17.846	0.72	0.72	0.72	0.72	0.72	0.72	0.72
17.923	0.72	0.72	0.72	0.72	0.72	0.72	0.72
18.001	0.72	0.71	0.71	0.71	0.71	0.71	0.71
18.078	0.71	0.71	0.71	0.71	0.71	0.71	0.71
18.155	0.71	0.71	0.71	0.71	0.71	0.71	0.71
18.233	0.70	0.70	0.70	0.70	0.70	0.70	0.70
18.310	0.70	0.70	0.70	0.70	0.70	0.70	0.70
18.388	0.70	0.70	0.70	0.70	0.70	0.69	0.69
18.465	0.69	0.69	0.69	0.69	0.69	0.69	0.69
18.542	0.69	0.69	0.69	0.69	0.69	0.69	0.69
18.620	0.69	0.69	0.69	0.68	0.68	0.68	0.68
18.697	0.68	0.68	0.68	0.68	0.68	0.68	0.68
18.774	0.68	0.68	0.68	0.68	0.68	0.68	0.68
18.852	0.68	0.67	0.67	0.67	0.67	0.67	0.67
18.929	0.67	0.67	0.67	0.67	0.67	0.67	0.67
19.007	0.67	0.67	0.67	0.67	0.67	0.67	0.66
19.084	0.66	0.66	0.66	0.66	0.66	0.66	0.66
19.161	0.66	0.66	0.66	0.66	0.66	0.66	0.66

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.011 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
19.239	0.66	0.66	0.66	0.65	0.65	0.65	0.65
19.316	0.65	0.65	0.65	0.65	0.65	0.65	0.65
19.393	0.65	0.65	0.65	0.65	0.65	0.65	0.65
19.471	0.65	0.64	0.64	0.64	0.64	0.64	0.64
19.548	0.64	0.64	0.64	0.64	0.64	0.64	0.64
19.625	0.64	0.64	0.64	0.64	0.64	0.63	0.63
19.703	0.63	0.63	0.63	0.63	0.63	0.63	0.63
19.780	0.63	0.63	0.63	0.63	0.63	0.63	0.63
19.858	0.63	0.63	0.62	0.62	0.62	0.62	0.62
19.935	0.62	0.62	0.62	0.62	0.62	0.62	0.62
20.012	0.62	0.62	0.62	0.62	0.62	0.61	0.61
20.090	0.61	0.61	0.61	0.61	0.61	0.61	0.61
20.167	0.61	0.61	0.61	0.61	0.61	0.61	0.61
20.244	0.61	0.61	0.60	0.60	0.60	0.60	0.60
20.322	0.60	0.60	0.60	0.60	0.60	0.60	0.60
20.399	0.60	0.60	0.60	0.60	0.60	0.59	0.59
20.477	0.59	0.59	0.59	0.59	0.59	0.59	0.59
20.554	0.59	0.59	0.59	0.59	0.59	0.59	0.59
20.631	0.59	0.59	0.58	0.58	0.58	0.58	0.58
20.709	0.58	0.58	0.58	0.58	0.58	0.58	0.58
20.786	0.58	0.58	0.58	0.58	0.58	0.57	0.57
20.863	0.57	0.57	0.57	0.57	0.57	0.57	0.57
20.941	0.57	0.57	0.57	0.57	0.57	0.57	0.57
21.018	0.57	0.56	0.56	0.56	0.56	0.56	0.56
21.095	0.56	0.56	0.56	0.56	0.56	0.56	0.56
21.173	0.56	0.56	0.56	0.56	0.55	0.55	0.55
21.250	0.55	0.55	0.55	0.55	0.55	0.55	0.55
21.328	0.55	0.55	0.55	0.55	0.55	0.55	0.55
21.405	0.54	0.54	0.54	0.54	0.54	0.54	0.54
21.482	0.54	0.54	0.54	0.54	0.54	0.54	0.54
21.560	0.54	0.54	0.53	0.53	0.53	0.53	0.53
21.637	0.53	0.53	0.53	0.53	0.53	0.53	0.53
21.714	0.53	0.53	0.53	0.53	0.53	0.52	0.52
21.792	0.52	0.52	0.52	0.52	0.52	0.52	0.52
21.869	0.52	0.52	0.52	0.52	0.52	0.52	0.52
21.947	0.52	0.51	0.51	0.51	0.51	0.51	0.51
22.024	0.51	0.51	0.51	0.51	0.51	0.51	0.51
22.101	0.51	0.51	0.51	0.50	0.50	0.50	0.50
22.179	0.50	0.50	0.50	0.50	0.50	0.50	0.50
22.256	0.50	0.50	0.50	0.50	0.50	0.49	0.49
22.333	0.49	0.49	0.49	0.49	0.49	0.49	0.49
22.411	0.49	0.49	0.49	0.49	0.49	0.49	0.49
22.488	0.49	0.48	0.48	0.48	0.48	0.48	0.48
22.565	0.48	0.48	0.48	0.48	0.48	0.48	0.48
22.643	0.48	0.48	0.48	0.47	0.47	0.47	0.47
22.720	0.47	0.47	0.47	0.47	0.47	0.47	0.47
22.798	0.47	0.47	0.47	0.47	0.47	0.46	0.46
22.875	0.46	0.46	0.46	0.46	0.46	0.46	0.46
22.952	0.46	0.46	0.46	0.46	0.46	0.46	0.46
23.030	0.45	0.45	0.45	0.45	0.45	0.45	0.45
23.107	0.45	0.45	0.45	0.45	0.45	0.45	0.45

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.011 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
23.184	0.45	0.45	0.44	0.44	0.44	0.44	0.44
23.262	0.44	0.44	0.44	0.44	0.44	0.44	0.44
23.339	0.44	0.44	0.44	0.44	0.43	0.43	0.43
23.417	0.43	0.43	0.43	0.43	0.43	0.43	0.43
23.494	0.43	0.43	0.43	0.43	0.43	0.43	0.42
23.571	0.42	0.42	0.42	0.42	0.42	0.42	0.42
23.649	0.42	0.42	0.42	0.42	0.42	0.42	0.42
23.726	0.42	0.41	0.41	0.41	0.41	0.41	0.41
23.803	0.41	0.41	0.41	0.41	0.41	0.41	0.41
23.881	0.41	0.41	0.40	0.40	0.40	0.40	0.40
23.958	0.40	0.40	0.40	0.40	0.40	0.40	0.39
24.035	0.39	0.38	0.36	0.34	0.31	0.29	0.26
24.113	0.23	0.20	0.17	0.15	0.12	0.10	0.09
24.190	0.07	0.06	0.05				

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
SA-2	0.018		1.218		9.98	9.02	493.46

Line Start Time (hr)	Flow Values @ time increment of 0.010 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.259	0.05	0.05	0.05	0.06	0.06	0.06	0.06
8.328	0.07	0.07	0.07	0.07	0.08	0.08	0.08
8.396	0.08	0.09	0.09	0.09	0.09	0.10	0.10
8.465	0.10	0.11	0.11	0.11	0.11	0.12	0.12
8.533	0.12	0.13	0.13	0.13	0.14	0.14	0.14
8.602	0.15	0.15	0.15	0.16	0.16	0.17	0.17
8.670	0.17	0.18	0.18	0.18	0.19	0.19	0.20
8.739	0.20	0.20	0.21	0.21	0.22	0.22	0.23
8.807	0.23	0.24	0.24	0.24	0.25	0.25	0.26
8.876	0.26	0.27	0.27	0.28	0.28	0.29	0.29
8.945	0.30	0.30	0.31	0.31	0.32	0.32	0.33
9.013	0.33	0.34	0.35	0.35	0.36	0.36	0.37
9.082	0.38	0.38	0.39	0.40	0.40	0.41	0.42
9.150	0.42	0.43	0.44	0.45	0.46	0.46	0.47
9.219	0.48	0.49	0.50	0.51	0.52	0.52	0.53
9.287	0.54	0.55	0.56	0.57	0.58	0.59	0.60
9.356	0.61	0.62	0.63	0.64	0.65	0.67	0.68
9.424	0.69	0.70	0.71	0.72	0.73	0.74	0.76
9.493	0.77	0.78	0.79	0.81	0.83	0.85	0.87
9.561	0.91	0.94	0.98	1.02	1.07	1.11	1.16
9.630	1.21	1.26	1.33	1.40	1.49	1.58	1.67
9.698	1.76	1.86	1.96	2.07	2.19	2.32	2.48
9.767	2.65	2.83	3.02	3.22	3.42	3.64	3.87
9.835	4.13	4.43	4.77	5.16	5.59	6.05	6.52
9.904	6.99	7.45	7.87	8.24	8.55	8.78	8.92
9.972	9.00	9.02	9.01	8.98	8.91	8.82	8.68

Bonzi Landfill
Final Closure

Line Start Time (hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	------------ Flow Values @ time increment of 0.010 hr ------------						
10.041	8.50	8.25	7.94	7.58	7.17	6.74	6.31
10.109	5.89	5.50	5.13	4.80	4.51	4.26	4.05
10.178	3.87	3.72	3.58	3.46	3.36	3.27	3.19
10.247	3.11	3.05	2.98	2.93	2.87	2.82	2.78
10.315	2.74	2.70	2.66	2.63	2.59	2.56	2.52
10.384	2.49	2.46	2.42	2.39	2.36	2.34	2.31
10.452	2.28	2.25	2.22	2.18	2.15	2.12	2.09
10.521	2.07	2.04	2.02	1.99	1.97	1.94	1.92
10.589	1.90	1.87	1.85	1.83	1.82	1.80	1.79
10.658	1.77	1.76	1.75	1.73	1.72	1.72	1.71
10.726	1.70	1.69	1.68	1.67	1.67	1.66	1.65
10.795	1.64	1.64	1.63	1.62	1.61	1.61	1.60
10.863	1.59	1.59	1.58	1.57	1.56	1.56	1.55
10.932	1.54	1.54	1.53	1.52	1.52	1.51	1.50
11.000	1.49	1.49	1.48	1.47	1.47	1.46	1.45
11.069	1.45	1.44	1.44	1.43	1.43	1.42	1.42
11.137	1.41	1.41	1.40	1.40	1.40	1.39	1.39
11.206	1.39	1.39	1.38	1.38	1.38	1.38	1.37
11.274	1.37	1.37	1.37	1.36	1.36	1.36	1.36
11.343	1.36	1.35	1.35	1.35	1.35	1.34	1.34
11.411	1.34	1.34	1.34	1.33	1.33	1.33	1.33
11.480	1.32	1.32	1.32	1.32	1.31	1.31	1.31
11.549	1.31	1.31	1.30	1.30	1.30	1.29	1.29
11.617	1.29	1.29	1.29	1.28	1.28	1.28	1.28
11.686	1.27	1.27	1.27	1.27	1.26	1.26	1.26
11.754	1.26	1.25	1.25	1.25	1.24	1.24	1.24
11.823	1.24	1.23	1.23	1.23	1.23	1.22	1.22
11.891	1.22	1.22	1.21	1.21	1.21	1.21	1.20
11.960	1.20	1.20	1.19	1.19	1.19	1.19	1.18
12.028	1.18	1.18	1.18	1.17	1.17	1.17	1.17
12.097	1.16	1.16	1.16	1.16	1.16	1.15	1.15
12.165	1.15	1.15	1.15	1.14	1.14	1.14	1.14
12.234	1.14	1.14	1.14	1.13	1.13	1.13	1.13
12.302	1.13	1.12	1.12	1.12	1.12	1.12	1.12
12.371	1.12	1.11	1.11	1.11	1.11	1.11	1.11
12.439	1.10	1.10	1.10	1.10	1.10	1.10	1.09
12.508	1.09	1.09	1.09	1.09	1.09	1.08	1.08
12.576	1.08	1.08	1.08	1.08	1.07	1.07	1.07
12.645	1.07	1.07	1.07	1.06	1.06	1.06	1.06
12.713	1.06	1.05	1.05	1.05	1.05	1.05	1.05
12.782	1.04	1.04	1.04	1.04	1.04	1.04	1.03
12.851	1.03	1.03	1.03	1.03	1.02	1.02	1.02
12.919	1.02	1.02	1.02	1.01	1.01	1.01	1.01
12.988	1.01	1.00	1.00	1.00	1.00	1.00	1.00
13.056	0.99	0.99	0.99	0.99	0.99	0.98	0.98
13.125	0.98	0.98	0.98	0.98	0.97	0.97	0.97
13.193	0.97	0.97	0.96	0.96	0.96	0.96	0.96
13.262	0.95	0.95	0.95	0.95	0.95	0.94	0.94
13.330	0.94	0.94	0.94	0.94	0.93	0.93	0.93
13.399	0.93	0.93	0.92	0.92	0.92	0.92	0.92
13.467	0.91	0.91	0.91	0.91	0.91	0.90	0.90

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.010 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
13.536	0.90	0.90	0.90	0.89	0.89	0.89	0.89
13.604	0.89	0.88	0.88	0.88	0.88	0.88	0.87
13.673	0.87	0.87	0.87	0.87	0.86	0.86	0.86
13.741	0.86	0.86	0.85	0.85	0.85	0.85	0.85
13.810	0.84	0.84	0.84	0.84	0.84	0.83	0.83
13.878	0.83	0.83	0.83	0.82	0.82	0.82	0.82
13.947	0.82	0.81	0.81	0.81	0.81	0.80	0.80
14.015	0.80	0.80	0.80	0.80	0.79	0.79	0.79
14.084	0.79	0.79	0.79	0.78	0.78	0.78	0.78
14.153	0.78	0.78	0.78	0.78	0.78	0.78	0.78
14.221	0.78	0.78	0.78	0.78	0.77	0.77	0.77
14.290	0.77	0.77	0.77	0.77	0.77	0.77	0.77
14.358	0.77	0.77	0.77	0.77	0.77	0.77	0.77
14.427	0.77	0.77	0.77	0.77	0.77	0.77	0.77
14.495	0.77	0.77	0.77	0.77	0.77	0.77	0.77
14.564	0.77	0.77	0.76	0.76	0.76	0.76	0.76
14.632	0.76	0.76	0.76	0.76	0.76	0.76	0.76
14.701	0.76	0.76	0.76	0.76	0.76	0.76	0.76
14.769	0.76	0.76	0.76	0.76	0.76	0.76	0.76
14.838	0.76	0.76	0.76	0.76	0.76	0.76	0.76
14.906	0.76	0.76	0.75	0.75	0.75	0.75	0.75
14.975	0.75	0.75	0.75	0.75	0.75	0.75	0.75
15.043	0.75	0.75	0.75	0.75	0.75	0.75	0.75
15.112	0.75	0.75	0.75	0.75	0.75	0.75	0.75
15.180	0.75	0.75	0.75	0.75	0.75	0.75	0.75
15.249	0.74	0.74	0.74	0.74	0.74	0.74	0.74
15.317	0.74	0.74	0.74	0.74	0.74	0.74	0.74
15.386	0.74	0.74	0.74	0.74	0.74	0.74	0.74
15.455	0.74	0.74	0.74	0.74	0.74	0.74	0.74
15.523	0.74	0.74	0.74	0.74	0.73	0.73	0.73
15.592	0.73	0.73	0.73	0.73	0.73	0.73	0.73
15.660	0.73	0.73	0.73	0.73	0.73	0.73	0.73
15.729	0.73	0.73	0.73	0.73	0.73	0.73	0.73
15.797	0.73	0.73	0.73	0.73	0.73	0.73	0.72
15.866	0.72	0.72	0.72	0.72	0.72	0.72	0.72
15.934	0.72	0.72	0.72	0.72	0.72	0.72	0.72
16.003	0.72	0.72	0.72	0.72	0.72	0.72	0.72
16.071	0.72	0.72	0.72	0.72	0.72	0.72	0.72
16.140	0.71	0.71	0.71	0.71	0.71	0.71	0.71
16.208	0.71	0.71	0.71	0.71	0.71	0.71	0.71
16.277	0.71	0.71	0.71	0.71	0.71	0.71	0.71
16.345	0.71	0.71	0.71	0.71	0.71	0.71	0.71
16.414	0.71	0.70	0.70	0.70	0.70	0.70	0.70
16.482	0.70	0.70	0.70	0.70	0.70	0.70	0.70
16.551	0.70	0.70	0.70	0.70	0.70	0.70	0.70
16.619	0.70	0.70	0.70	0.70	0.70	0.70	0.70
16.688	0.69	0.69	0.69	0.69	0.69	0.69	0.69
16.757	0.69	0.69	0.69	0.69	0.69	0.69	0.69
16.825	0.69	0.69	0.69	0.69	0.69	0.69	0.69
16.894	0.69	0.69	0.69	0.69	0.69	0.69	0.69
16.962	0.68	0.68	0.68	0.68	0.68	0.68	0.68

Bonzi Landfill
Final Closure

Line Start Time (hr)	------------ Flow Values @ time increment of 0.010 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
17.031	0.68	0.68	0.68	0.68	0.68	0.68	0.68
17.099	0.68	0.68	0.68	0.68	0.68	0.68	0.68
17.168	0.68	0.68	0.68	0.68	0.68	0.67	0.67
17.236	0.67	0.67	0.67	0.67	0.67	0.67	0.67
17.305	0.67	0.67	0.67	0.67	0.67	0.67	0.67
17.373	0.67	0.67	0.67	0.67	0.67	0.67	0.67
17.442	0.67	0.67	0.67	0.66	0.66	0.66	0.66
17.510	0.66	0.66	0.66	0.66	0.66	0.66	0.66
17.579	0.66	0.66	0.66	0.66	0.66	0.66	0.66
17.647	0.66	0.66	0.66	0.66	0.66	0.66	0.66
17.716	0.65	0.65	0.65	0.65	0.65	0.65	0.65
17.784	0.65	0.65	0.65	0.65	0.65	0.65	0.65
17.853	0.65	0.65	0.65	0.65	0.65	0.65	0.65
17.921	0.65	0.65	0.65	0.65	0.65	0.64	0.64
17.990	0.64	0.64	0.64	0.64	0.64	0.64	0.64
18.059	0.64	0.64	0.64	0.64	0.64	0.64	0.64
18.127	0.64	0.64	0.64	0.64	0.64	0.64	0.64
18.196	0.64	0.63	0.63	0.63	0.63	0.63	0.63
18.264	0.63	0.63	0.63	0.63	0.63	0.63	0.63
18.333	0.63	0.63	0.63	0.63	0.63	0.63	0.63
18.401	0.63	0.63	0.63	0.63	0.62	0.62	0.62
18.470	0.62	0.62	0.62	0.62	0.62	0.62	0.62
18.538	0.62	0.62	0.62	0.62	0.62	0.62	0.62
18.607	0.62	0.62	0.62	0.62	0.62	0.62	0.62
18.675	0.61	0.61	0.61	0.61	0.61	0.61	0.61
18.744	0.61	0.61	0.61	0.61	0.61	0.61	0.61
18.812	0.61	0.61	0.61	0.61	0.61	0.61	0.61
18.881	0.61	0.61	0.61	0.60	0.60	0.60	0.60
18.949	0.60	0.60	0.60	0.60	0.60	0.60	0.60
19.018	0.60	0.60	0.60	0.60	0.60	0.60	0.60
19.086	0.60	0.60	0.60	0.60	0.60	0.59	0.59
19.155	0.59	0.59	0.59	0.59	0.59	0.59	0.59
19.223	0.59	0.59	0.59	0.59	0.59	0.59	0.59
19.292	0.59	0.59	0.59	0.59	0.59	0.59	0.59
19.361	0.58	0.58	0.58	0.58	0.58	0.58	0.58
19.429	0.58	0.58	0.58	0.58	0.58	0.58	0.58
19.498	0.58	0.58	0.58	0.58	0.58	0.58	0.58
19.566	0.58	0.58	0.57	0.57	0.57	0.57	0.57
19.635	0.57	0.57	0.57	0.57	0.57	0.57	0.57
19.703	0.57	0.57	0.57	0.57	0.57	0.57	0.57
19.772	0.57	0.57	0.57	0.56	0.56	0.56	0.56
19.840	0.56	0.56	0.56	0.56	0.56	0.56	0.56
19.909	0.56	0.56	0.56	0.56	0.56	0.56	0.56
19.977	0.56	0.56	0.56	0.56	0.56	0.55	0.55
20.046	0.55	0.55	0.55	0.55	0.55	0.55	0.55
20.114	0.55	0.55	0.55	0.55	0.55	0.55	0.55
20.183	0.55	0.55	0.55	0.55	0.55	0.55	0.54
20.251	0.54	0.54	0.54	0.54	0.54	0.54	0.54
20.320	0.54	0.54	0.54	0.54	0.54	0.54	0.54
20.388	0.54	0.54	0.54	0.54	0.54	0.54	0.54
20.457	0.53	0.53	0.53	0.53	0.53	0.53	0.53

Line Start Time (hr)	Flow Values @ time increment of 0.010 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
20.525	0.53	0.53	0.53	0.53	0.53	0.53	0.53
20.594	0.53	0.53	0.53	0.53	0.53	0.53	0.53
20.663	0.52	0.52	0.52	0.52	0.52	0.52	0.52
20.731	0.52	0.52	0.52	0.52	0.52	0.52	0.52
20.800	0.52	0.52	0.52	0.52	0.52	0.52	0.52
20.868	0.52	0.51	0.51	0.51	0.51	0.51	0.51
20.937	0.51	0.51	0.51	0.51	0.51	0.51	0.51
21.005	0.51	0.51	0.51	0.51	0.51	0.51	0.51
21.074	0.51	0.50	0.50	0.50	0.50	0.50	0.50
21.142	0.50	0.50	0.50	0.50	0.50	0.50	0.50
21.211	0.50	0.50	0.50	0.50	0.50	0.50	0.50
21.279	0.50	0.49	0.49	0.49	0.49	0.49	0.49
21.348	0.49	0.49	0.49	0.49	0.49	0.49	0.49
21.416	0.49	0.49	0.49	0.49	0.49	0.49	0.49
21.485	0.49	0.48	0.48	0.48	0.48	0.48	0.48
21.553	0.48	0.48	0.48	0.48	0.48	0.48	0.48
21.622	0.48	0.48	0.48	0.48	0.48	0.48	0.48
21.690	0.48	0.47	0.47	0.47	0.47	0.47	0.47
21.759	0.47	0.47	0.47	0.47	0.47	0.47	0.47
21.827	0.47	0.47	0.47	0.47	0.47	0.47	0.47
21.896	0.47	0.46	0.46	0.46	0.46	0.46	0.46
21.965	0.46	0.46	0.46	0.46	0.46	0.46	0.46
22.033	0.46	0.46	0.46	0.46	0.46	0.46	0.46
22.102	0.46	0.45	0.45	0.45	0.45	0.45	0.45
22.170	0.45	0.45	0.45	0.45	0.45	0.45	0.45
22.239	0.45	0.45	0.45	0.45	0.45	0.45	0.45
22.307	0.44	0.44	0.44	0.44	0.44	0.44	0.44
22.376	0.44	0.44	0.44	0.44	0.44	0.44	0.44
22.444	0.44	0.44	0.44	0.44	0.44	0.44	0.44
22.513	0.43	0.43	0.43	0.43	0.43	0.43	0.43
22.581	0.43	0.43	0.43	0.43	0.43	0.43	0.43
22.650	0.43	0.43	0.43	0.43	0.43	0.43	0.42
22.718	0.42	0.42	0.42	0.42	0.42	0.42	0.42
22.787	0.42	0.42	0.42	0.42	0.42	0.42	0.42
22.855	0.42	0.42	0.42	0.42	0.42	0.41	0.41
22.924	0.41	0.41	0.41	0.41	0.41	0.41	0.41
22.992	0.41	0.41	0.41	0.41	0.41	0.41	0.41
23.061	0.41	0.41	0.41	0.41	0.40	0.40	0.40
23.129	0.40	0.40	0.40	0.40	0.40	0.40	0.40
23.198	0.40	0.40	0.40	0.40	0.40	0.40	0.40
23.267	0.40	0.40	0.40	0.39	0.39	0.39	0.39
23.335	0.39	0.39	0.39	0.39	0.39	0.39	0.39
23.404	0.39	0.39	0.39	0.39	0.39	0.39	0.39
23.472	0.39	0.39	0.38	0.38	0.38	0.38	0.38
23.541	0.38	0.38	0.38	0.38	0.38	0.38	0.38
23.609	0.38	0.38	0.38	0.38	0.38	0.38	0.38
23.678	0.38	0.37	0.37	0.37	0.37	0.37	0.37
23.746	0.37	0.37	0.37	0.37	0.37	0.37	0.37
23.815	0.37	0.37	0.37	0.37	0.37	0.37	0.37
23.883	0.36	0.36	0.36	0.36	0.36	0.36	0.36
23.952	0.36	0.36	0.36	0.36	0.36	0.36	0.36

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.010 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
24.020	0.35	0.35	0.34	0.33	0.31	0.29	0.26
24.089	0.23	0.21	0.18	0.16	0.13	0.11	0.10
24.157	0.08	0.07	0.06				

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
SA-3	0.003		1.204		10.10	1.11	396.43

Line Start Time (hr)	Flow Values @ time increment of 0.021 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
9.133	0.05	0.05	0.05	0.06	0.06	0.06	0.06
9.277	0.07	0.07	0.07	0.07	0.08	0.08	0.08
9.421	0.09	0.09	0.09	0.09	0.10	0.10	0.11
9.564	0.11	0.11	0.12	0.13	0.14	0.15	0.16
9.708	0.17	0.19	0.21	0.24	0.26	0.30	0.33
9.852	0.38	0.43	0.50	0.57	0.65	0.74	0.82
9.995	0.90	0.97	1.03	1.08	1.10	1.11	1.10
10.139	1.07	1.03	0.98	0.92	0.86	0.81	0.76
10.283	0.71	0.66	0.62	0.59	0.56	0.53	0.51
10.427	0.49	0.47	0.45	0.44	0.42	0.41	0.39
10.570	0.38	0.37	0.36	0.34	0.33	0.33	0.32
10.714	0.31	0.30	0.29	0.29	0.28	0.28	0.27
10.858	0.27	0.27	0.26	0.26	0.26	0.25	0.25
11.001	0.25	0.24	0.24	0.24	0.24	0.23	0.23
11.145	0.23	0.23	0.23	0.22	0.22	0.22	0.22
11.289	0.22	0.22	0.22	0.21	0.21	0.21	0.21
11.432	0.21	0.21	0.21	0.21	0.21	0.21	0.21
11.576	0.21	0.20	0.20	0.20	0.20	0.20	0.20
11.720	0.20	0.20	0.20	0.20	0.20	0.20	0.19
11.863	0.19	0.19	0.19	0.19	0.19	0.19	0.19
12.007	0.19	0.19	0.19	0.19	0.18	0.18	0.18
12.151	0.18	0.18	0.18	0.18	0.18	0.18	0.18
12.294	0.18	0.18	0.18	0.18	0.17	0.17	0.17
12.438	0.17	0.17	0.17	0.17	0.17	0.17	0.17
12.582	0.17	0.17	0.17	0.17	0.17	0.17	0.17
12.725	0.17	0.17	0.16	0.16	0.16	0.16	0.16
12.869	0.16	0.16	0.16	0.16	0.16	0.16	0.16
13.013	0.16	0.16	0.16	0.16	0.16	0.15	0.15
13.157	0.15	0.15	0.15	0.15	0.15	0.15	0.15
13.300	0.15	0.15	0.15	0.15	0.15	0.15	0.15
13.444	0.15	0.14	0.14	0.14	0.14	0.14	0.14
13.588	0.14	0.14	0.14	0.14	0.14	0.14	0.14
13.731	0.14	0.14	0.14	0.13	0.13	0.13	0.13
13.875	0.13	0.13	0.13	0.13	0.13	0.13	0.13
14.019	0.13	0.13	0.13	0.13	0.12	0.12	0.12
14.162	0.12	0.12	0.12	0.12	0.12	0.12	0.12
14.306	0.12	0.12	0.12	0.12	0.12	0.12	0.12

Line Start Time (hr)	------------ Flow Values @ time increment of 0.021 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
14.450	0.12	0.12	0.12	0.12	0.12	0.12	0.12
14.593	0.12	0.12	0.12	0.12	0.12	0.12	0.12
14.737	0.12	0.12	0.12	0.12	0.12	0.12	0.12
14.881	0.12	0.12	0.12	0.12	0.12	0.12	0.12
15.024	0.12	0.12	0.12	0.12	0.12	0.12	0.12
15.168	0.12	0.12	0.12	0.12	0.12	0.12	0.11
15.312	0.11	0.11	0.11	0.11	0.11	0.11	0.11
15.455	0.11	0.11	0.11	0.11	0.11	0.11	0.11
15.599	0.11	0.11	0.11	0.11	0.11	0.11	0.11
15.743	0.11	0.11	0.11	0.11	0.11	0.11	0.11
15.887	0.11	0.11	0.11	0.11	0.11	0.11	0.11
16.030	0.11	0.11	0.11	0.11	0.11	0.11	0.11
16.174	0.11	0.11	0.11	0.11	0.11	0.11	0.11
16.318	0.11	0.11	0.11	0.11	0.11	0.11	0.11
16.461	0.11	0.11	0.11	0.11	0.11	0.11	0.11
16.605	0.11	0.11	0.11	0.11	0.11	0.11	0.11
16.749	0.11	0.11	0.11	0.11	0.11	0.11	0.11
16.892	0.11	0.11	0.11	0.11	0.11	0.11	0.11
17.036	0.11	0.11	0.11	0.11	0.11	0.10	0.10
17.180	0.10	0.10	0.10	0.10	0.10	0.10	0.10
17.323	0.10	0.10	0.10	0.10	0.10	0.10	0.10
17.467	0.10	0.10	0.10	0.10	0.10	0.10	0.10
17.611	0.10	0.10	0.10	0.10	0.10	0.10	0.10
17.754	0.10	0.10	0.10	0.10	0.10	0.10	0.10
17.898	0.10	0.10	0.10	0.10	0.10	0.10	0.10
18.042	0.10	0.10	0.10	0.10	0.10	0.10	0.10
18.185	0.10	0.10	0.10	0.10	0.10	0.10	0.10
18.329	0.10	0.10	0.10	0.10	0.10	0.10	0.10
18.473	0.10	0.10	0.10	0.10	0.10	0.10	0.10
18.617	0.10	0.10	0.10	0.10	0.10	0.10	0.09
18.760	0.09	0.09	0.09	0.09	0.09	0.09	0.09
18.904	0.09	0.09	0.09	0.09	0.09	0.09	0.09
19.048	0.09	0.09	0.09	0.09	0.09	0.09	0.09
19.191	0.09	0.09	0.09	0.09	0.09	0.09	0.09
19.335	0.09	0.09	0.09	0.09	0.09	0.09	0.09
19.479	0.09	0.09	0.09	0.09	0.09	0.09	0.09
19.622	0.09	0.09	0.09	0.09	0.09	0.09	0.09
19.766	0.09	0.09	0.09	0.09	0.09	0.09	0.09
19.910	0.09	0.09	0.09	0.09	0.09	0.09	0.09
20.053	0.09	0.09	0.09	0.09	0.09	0.09	0.09
20.197	0.08	0.08	0.08	0.08	0.08	0.08	0.08
20.341	0.08	0.08	0.08	0.08	0.08	0.08	0.08
20.484	0.08	0.08	0.08	0.08	0.08	0.08	0.08
20.628	0.08	0.08	0.08	0.08	0.08	0.08	0.08
20.772	0.08	0.08	0.08	0.08	0.08	0.08	0.08
20.915	0.08	0.08	0.08	0.08	0.08	0.08	0.08
21.059	0.08	0.08	0.08	0.08	0.08	0.08	0.08
21.203	0.08	0.08	0.08	0.08	0.08	0.08	0.08
21.347	0.08	0.08	0.08	0.08	0.08	0.08	0.08
21.490	0.08	0.08	0.08	0.08	0.07	0.07	0.07
21.634	0.07	0.07	0.07	0.07	0.07	0.07	0.07

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.021 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
21.778	0.07	0.07	0.07	0.07	0.07	0.07	0.07
21.921	0.07	0.07	0.07	0.07	0.07	0.07	0.07
22.065	0.07	0.07	0.07	0.07	0.07	0.07	0.07
22.209	0.07	0.07	0.07	0.07	0.07	0.07	0.07
22.352	0.07	0.07	0.07	0.07	0.07	0.07	0.07
22.496	0.07	0.07	0.07	0.07	0.07	0.07	0.07
22.640	0.07	0.07	0.07	0.07	0.07	0.07	0.07
22.783	0.07	0.07	0.07	0.07	0.07	0.06	0.06
22.927	0.06	0.06	0.06	0.06	0.06	0.06	0.06
23.071	0.06	0.06	0.06	0.06	0.06	0.06	0.06
23.214	0.06	0.06	0.06	0.06	0.06	0.06	0.06
23.358	0.06	0.06	0.06	0.06	0.06	0.06	0.06
23.502	0.06	0.06	0.06	0.06	0.06	0.06	0.06
23.645	0.06	0.06	0.06	0.06	0.06	0.06	0.06
23.789	0.06	0.06	0.06	0.06	0.06	0.06	0.06
23.933	0.06	0.06	0.06	0.06	0.06	0.06	0.05
24.077	0.05	0.05					

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA-4	0.013		1.217		10.15	4.75	357.48

Line Start Time (hr)	Flow Values @ time increment of 0.026 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.515	0.05	0.05	0.06	0.06	0.07	0.07	0.08
8.694	0.09	0.09	0.10	0.10	0.11	0.12	0.12
8.873	0.13	0.14	0.15	0.15	0.16	0.17	0.18
9.053	0.19	0.20	0.21	0.22	0.23	0.24	0.25
9.232	0.26	0.27	0.29	0.30	0.31	0.33	0.34
9.411	0.36	0.37	0.39	0.41	0.43	0.45	0.47
9.590	0.50	0.52	0.56	0.61	0.66	0.72	0.81
9.769	0.91	1.03	1.18	1.36	1.59	1.87	2.19
9.948	2.56	2.96	3.37	3.77	4.12	4.41	4.62
10.127	4.73	4.75	4.67	4.53	4.33	4.09	3.85
10.306	3.60	3.37	3.16	2.96	2.79	2.64	2.50
10.485	2.38	2.27	2.17	2.07	1.98	1.90	1.83
10.664	1.75	1.69	1.63	1.57	1.52	1.48	1.44
10.843	1.40	1.37	1.34	1.31	1.28	1.26	1.24
11.022	1.22	1.20	1.18	1.16	1.14	1.13	1.11
11.201	1.10	1.08	1.07	1.06	1.05	1.04	1.04
11.380	1.03	1.02	1.01	1.01	1.00	1.00	0.99
11.559	0.99	0.98	0.98	0.97	0.97	0.96	0.96
11.738	0.95	0.95	0.94	0.94	0.93	0.93	0.92
11.917	0.92	0.91	0.91	0.90	0.90	0.89	0.89
12.096	0.88	0.88	0.87	0.87	0.86	0.86	0.86
12.275	0.85	0.85	0.84	0.84	0.84	0.83	0.83
12.455	0.83	0.82	0.82	0.82	0.81	0.81	0.81

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.026 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
12.634	0.80	0.80	0.80	0.79	0.79	0.79	0.78
12.813	0.78	0.78	0.77	0.77	0.77	0.76	0.76
12.992	0.76	0.75	0.75	0.75	0.74	0.74	0.74
13.171	0.73	0.73	0.73	0.72	0.72	0.72	0.71
13.350	0.71	0.70	0.70	0.70	0.69	0.69	0.69
13.529	0.68	0.68	0.68	0.67	0.67	0.66	0.66
13.708	0.66	0.65	0.65	0.65	0.64	0.64	0.63
13.887	0.63	0.63	0.62	0.62	0.62	0.61	0.61
14.066	0.60	0.60	0.60	0.59	0.59	0.59	0.58
14.245	0.58	0.58	0.58	0.57	0.57	0.57	0.57
14.424	0.57	0.57	0.57	0.56	0.56	0.56	0.56
14.603	0.56	0.56	0.56	0.56	0.56	0.56	0.56
14.782	0.56	0.56	0.55	0.55	0.55	0.55	0.55
14.961	0.55	0.55	0.55	0.55	0.55	0.55	0.55
15.140	0.55	0.55	0.55	0.55	0.55	0.55	0.54
15.319	0.54	0.54	0.54	0.54	0.54	0.54	0.54
15.498	0.54	0.54	0.54	0.54	0.54	0.54	0.54
15.677	0.54	0.53	0.53	0.53	0.53	0.53	0.53
15.857	0.53	0.53	0.53	0.53	0.53	0.53	0.53
16.036	0.53	0.53	0.53	0.52	0.52	0.52	0.52
16.215	0.52	0.52	0.52	0.52	0.52	0.52	0.52
16.394	0.52	0.52	0.52	0.52	0.52	0.51	0.51
16.573	0.51	0.51	0.51	0.51	0.51	0.51	0.51
16.752	0.51	0.51	0.51	0.51	0.51	0.50	0.50
16.931	0.50	0.50	0.50	0.50	0.50	0.50	0.50
17.110	0.50	0.50	0.50	0.50	0.50	0.50	0.49
17.289	0.49	0.49	0.49	0.49	0.49	0.49	0.49
17.468	0.49	0.49	0.49	0.49	0.49	0.48	0.48
17.647	0.48	0.48	0.48	0.48	0.48	0.48	0.48
17.826	0.48	0.48	0.48	0.48	0.48	0.47	0.47
18.005	0.47	0.47	0.47	0.47	0.47	0.47	0.47
18.184	0.47	0.47	0.47	0.47	0.46	0.46	0.46
18.363	0.46	0.46	0.46	0.46	0.46	0.46	0.46
18.542	0.46	0.46	0.46	0.45	0.45	0.45	0.45
18.721	0.45	0.45	0.45	0.45	0.45	0.45	0.45
18.900	0.45	0.44	0.44	0.44	0.44	0.44	0.44
19.079	0.44	0.44	0.44	0.44	0.44	0.44	0.44
19.259	0.43	0.43	0.43	0.43	0.43	0.43	0.43
19.438	0.43	0.43	0.43	0.43	0.43	0.42	0.42
19.617	0.42	0.42	0.42	0.42	0.42	0.42	0.42
19.796	0.42	0.42	0.42	0.41	0.41	0.41	0.41
19.975	0.41	0.41	0.41	0.41	0.41	0.41	0.41
20.154	0.41	0.40	0.40	0.40	0.40	0.40	0.40
20.333	0.40	0.40	0.40	0.40	0.40	0.39	0.39
20.512	0.39	0.39	0.39	0.39	0.39	0.39	0.39
20.691	0.39	0.39	0.39	0.38	0.38	0.38	0.38
20.870	0.38	0.38	0.38	0.38	0.38	0.38	0.38
21.049	0.37	0.37	0.37	0.37	0.37	0.37	0.37
21.228	0.37	0.37	0.37	0.37	0.36	0.36	0.36
21.407	0.36	0.36	0.36	0.36	0.36	0.36	0.36
21.586	0.36	0.36	0.35	0.35	0.35	0.35	0.35

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.026 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
21.765	0.35	0.35	0.35	0.35	0.35	0.35	0.34
21.944	0.34	0.34	0.34	0.34	0.34	0.34	0.34
22.123	0.34	0.34	0.34	0.33	0.33	0.33	0.33
22.302	0.33	0.33	0.33	0.33	0.33	0.33	0.32
22.481	0.32	0.32	0.32	0.32	0.32	0.32	0.32
22.661	0.32	0.32	0.32	0.31	0.31	0.31	0.31
22.840	0.31	0.31	0.31	0.31	0.31	0.31	0.31
23.019	0.30	0.30	0.30	0.30	0.30	0.30	0.30
23.198	0.30	0.30	0.30	0.29	0.29	0.29	0.29
23.377	0.29	0.29	0.29	0.29	0.29	0.29	0.29
23.556	0.28	0.28	0.28	0.28	0.28	0.28	0.28
23.735	0.28	0.28	0.28	0.27	0.27	0.27	0.27
23.914	0.27	0.27	0.27	0.27	0.27	0.26	0.26
24.093	0.25	0.25	0.23	0.22	0.20	0.18	0.16
24.272	0.14	0.12	0.11	0.09	0.08	0.06	0.05

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA-5	0.017		1.218		10.13	6.46	372.71

Line Start Time (hr)	Flow Values @ time increment of 0.023 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.434	0.05	0.06	0.06	0.07	0.07	0.08	0.08
8.598	0.09	0.10	0.10	0.11	0.12	0.13	0.13
8.762	0.14	0.15	0.16	0.17	0.17	0.18	0.19
8.927	0.20	0.21	0.22	0.23	0.24	0.25	0.26
9.091	0.28	0.29	0.30	0.31	0.33	0.34	0.35
9.256	0.37	0.39	0.40	0.42	0.44	0.46	0.48
9.420	0.50	0.52	0.54	0.56	0.58	0.61	0.64
9.585	0.67	0.70	0.75	0.80	0.87	0.95	1.04
9.749	1.16	1.31	1.47	1.68	1.93	2.23	2.59
9.914	3.01	3.48	4.00	4.54	5.06	5.54	5.93
10.078	6.22	6.40	6.46	6.40	6.23	5.98	5.67
10.243	5.34	5.01	4.69	4.38	4.10	3.85	3.64
10.407	3.45	3.28	3.13	2.99	2.86	2.74	2.63
10.572	2.52	2.43	2.34	2.25	2.17	2.10	2.04
10.736	1.98	1.92	1.87	1.83	1.79	1.75	1.71
10.900	1.68	1.65	1.63	1.60	1.58	1.55	1.53
11.065	1.51	1.49	1.47	1.45	1.44	1.42	1.41
11.229	1.39	1.38	1.37	1.36	1.35	1.34	1.33
11.394	1.33	1.32	1.31	1.30	1.30	1.29	1.29
11.558	1.28	1.27	1.27	1.26	1.26	1.25	1.25
11.723	1.24	1.23	1.23	1.22	1.22	1.21	1.21
11.887	1.20	1.19	1.19	1.18	1.18	1.17	1.16
12.052	1.16	1.15	1.15	1.14	1.13	1.13	1.12
12.216	1.12	1.11	1.11	1.10	1.10	1.09	1.09
12.381	1.09	1.08	1.08	1.07	1.07	1.07	1.06

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.023 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
12.545	1.06	1.05	1.05	1.05	1.04	1.04	1.03
12.710	1.03	1.03	1.02	1.02	1.02	1.01	1.01
12.874	1.00	1.00	1.00	0.99	0.99	0.98	0.98
13.038	0.98	0.97	0.97	0.96	0.96	0.95	0.95
13.203	0.95	0.94	0.94	0.93	0.93	0.93	0.92
13.367	0.92	0.91	0.91	0.90	0.90	0.90	0.89
13.532	0.89	0.88	0.88	0.87	0.87	0.86	0.86
13.696	0.86	0.85	0.85	0.84	0.84	0.83	0.83
13.861	0.82	0.82	0.81	0.81	0.81	0.80	0.80
14.025	0.79	0.79	0.78	0.78	0.77	0.77	0.77
14.190	0.76	0.76	0.75	0.75	0.75	0.75	0.74
14.354	0.74	0.74	0.74	0.74	0.74	0.74	0.74
14.519	0.73	0.73	0.73	0.73	0.73	0.73	0.73
14.683	0.73	0.73	0.73	0.73	0.73	0.72	0.72
14.848	0.72	0.72	0.72	0.72	0.72	0.72	0.72
15.012	0.72	0.72	0.72	0.72	0.72	0.72	0.71
15.176	0.71	0.71	0.71	0.71	0.71	0.71	0.71
15.341	0.71	0.71	0.71	0.71	0.71	0.71	0.70
15.505	0.70	0.70	0.70	0.70	0.70	0.70	0.70
15.670	0.70	0.70	0.70	0.70	0.70	0.70	0.69
15.834	0.69	0.69	0.69	0.69	0.69	0.69	0.69
15.999	0.69	0.69	0.69	0.69	0.69	0.68	0.68
16.163	0.68	0.68	0.68	0.68	0.68	0.68	0.68
16.328	0.68	0.68	0.68	0.68	0.67	0.67	0.67
16.492	0.67	0.67	0.67	0.67	0.67	0.67	0.67
16.657	0.67	0.67	0.66	0.66	0.66	0.66	0.66
16.821	0.66	0.66	0.66	0.66	0.66	0.66	0.66
16.986	0.65	0.65	0.65	0.65	0.65	0.65	0.65
17.150	0.65	0.65	0.65	0.65	0.65	0.64	0.64
17.315	0.64	0.64	0.64	0.64	0.64	0.64	0.64
17.479	0.64	0.64	0.63	0.63	0.63	0.63	0.63
17.643	0.63	0.63	0.63	0.63	0.63	0.63	0.63
17.808	0.62	0.62	0.62	0.62	0.62	0.62	0.62
17.972	0.62	0.62	0.62	0.62	0.61	0.61	0.61
18.137	0.61	0.61	0.61	0.61	0.61	0.61	0.61
18.301	0.61	0.60	0.60	0.60	0.60	0.60	0.60
18.466	0.60	0.60	0.60	0.60	0.59	0.59	0.59
18.630	0.59	0.59	0.59	0.59	0.59	0.59	0.59
18.795	0.59	0.58	0.58	0.58	0.58	0.58	0.58
18.959	0.58	0.58	0.58	0.58	0.57	0.57	0.57
19.124	0.57	0.57	0.57	0.57	0.57	0.57	0.57
19.288	0.56	0.56	0.56	0.56	0.56	0.56	0.56
19.453	0.56	0.56	0.56	0.56	0.55	0.55	0.55
19.617	0.55	0.55	0.55	0.55	0.55	0.55	0.55
19.781	0.54	0.54	0.54	0.54	0.54	0.54	0.54
19.946	0.54	0.54	0.53	0.53	0.53	0.53	0.53
20.110	0.53	0.53	0.53	0.53	0.53	0.52	0.52
20.275	0.52	0.52	0.52	0.52	0.52	0.52	0.52
20.439	0.52	0.51	0.51	0.51	0.51	0.51	0.51
20.604	0.51	0.51	0.51	0.50	0.50	0.50	0.50
20.768	0.50	0.50	0.50	0.50	0.50	0.50	0.49

Bonzi Landfill
Final Closure

Line Start Time (hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	------------ Flow Values @ time increment of 0.023 hr ------------						
20.933	0.49	0.49	0.49	0.49	0.49	0.49	0.49
21.097	0.49	0.48	0.48	0.48	0.48	0.48	0.48
21.262	0.48	0.48	0.48	0.48	0.47	0.47	0.47
21.426	0.47	0.47	0.47	0.47	0.47	0.47	0.46
21.591	0.46	0.46	0.46	0.46	0.46	0.46	0.46
21.755	0.46	0.45	0.45	0.45	0.45	0.45	0.45
21.919	0.45	0.45	0.45	0.44	0.44	0.44	0.44
22.084	0.44	0.44	0.44	0.44	0.44	0.43	0.43
22.248	0.43	0.43	0.43	0.43	0.43	0.43	0.43
22.413	0.43	0.42	0.42	0.42	0.42	0.42	0.42
22.577	0.42	0.42	0.41	0.41	0.41	0.41	0.41
22.742	0.41	0.41	0.41	0.41	0.40	0.40	0.40
22.906	0.40	0.40	0.40	0.40	0.40	0.40	0.39
23.071	0.39	0.39	0.39	0.39	0.39	0.39	0.39
23.235	0.39	0.38	0.38	0.38	0.38	0.38	0.38
23.400	0.38	0.38	0.38	0.37	0.37	0.37	0.37
23.564	0.37	0.37	0.37	0.37	0.37	0.36	0.36
23.729	0.36	0.36	0.36	0.36	0.36	0.36	0.35
23.893	0.35	0.35	0.35	0.35	0.35	0.35	0.34
24.058	0.34	0.33	0.32	0.31	0.29	0.27	0.24
24.222	0.22	0.19	0.16	0.14	0.12	0.10	0.09
24.386	0.07	0.06	0.05				

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA-6	0.007		1.215		10.09	2.97	413.74

Line Start Time (hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	------------ Flow Values @ time increment of 0.018 hr ------------						
8.647	0.05	0.05	0.06	0.06	0.06	0.06	0.07
8.777	0.07	0.07	0.07	0.08	0.08	0.08	0.09
8.906	0.09	0.09	0.10	0.10	0.10	0.11	0.11
9.035	0.11	0.12	0.12	0.13	0.13	0.13	0.14
9.164	0.14	0.15	0.15	0.16	0.16	0.17	0.18
9.293	0.18	0.19	0.19	0.20	0.21	0.21	0.22
9.422	0.23	0.23	0.24	0.25	0.26	0.27	0.27
9.551	0.28	0.30	0.31	0.33	0.34	0.37	0.39
9.680	0.42	0.46	0.50	0.55	0.61	0.67	0.75
9.809	0.83	0.93	1.05	1.18	1.34	1.52	1.72
9.938	1.93	2.15	2.36	2.55	2.71	2.84	2.92
10.068	2.97	2.97	2.93	2.84	2.72	2.58	2.42
10.197	2.27	2.13	1.99	1.85	1.74	1.63	1.55
10.326	1.47	1.40	1.34	1.29	1.24	1.19	1.15
10.455	1.11	1.08	1.04	1.01	0.98	0.95	0.93
10.584	0.90	0.87	0.85	0.83	0.81	0.79	0.77
10.713	0.76	0.74	0.73	0.72	0.71	0.70	0.69
10.842	0.68	0.67	0.66	0.66	0.65	0.64	0.64

Line Start Time (hr)	------------ Flow Values @ time increment of 0.018 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
10.971	0.63	0.62	0.62	0.61	0.61	0.60	0.60
11.100	0.59	0.59	0.58	0.58	0.57	0.57	0.57
11.229	0.56	0.56	0.56	0.55	0.55	0.55	0.55
11.358	0.54	0.54	0.54	0.54	0.54	0.53	0.53
11.488	0.53	0.53	0.53	0.53	0.52	0.52	0.52
11.617	0.52	0.52	0.51	0.51	0.51	0.51	0.51
11.746	0.51	0.50	0.50	0.50	0.50	0.50	0.49
11.875	0.49	0.49	0.49	0.49	0.48	0.48	0.48
12.004	0.48	0.48	0.47	0.47	0.47	0.47	0.47
12.133	0.47	0.46	0.46	0.46	0.46	0.46	0.46
12.262	0.45	0.45	0.45	0.45	0.45	0.45	0.45
12.391	0.44	0.44	0.44	0.44	0.44	0.44	0.44
12.520	0.44	0.43	0.43	0.43	0.43	0.43	0.43
12.649	0.43	0.43	0.42	0.42	0.42	0.42	0.42
12.779	0.42	0.42	0.42	0.41	0.41	0.41	0.41
12.908	0.41	0.41	0.41	0.41	0.40	0.40	0.40
13.037	0.40	0.40	0.40	0.40	0.39	0.39	0.39
13.166	0.39	0.39	0.39	0.39	0.39	0.38	0.38
13.295	0.38	0.38	0.38	0.38	0.38	0.37	0.37
13.424	0.37	0.37	0.37	0.37	0.37	0.36	0.36
13.553	0.36	0.36	0.36	0.36	0.36	0.35	0.35
13.682	0.35	0.35	0.35	0.35	0.34	0.34	0.34
13.811	0.34	0.34	0.34	0.34	0.33	0.33	0.33
13.940	0.33	0.33	0.33	0.33	0.32	0.32	0.32
14.069	0.32	0.32	0.32	0.32	0.31	0.31	0.31
14.199	0.31	0.31	0.31	0.31	0.31	0.31	0.31
14.328	0.31	0.31	0.31	0.31	0.30	0.30	0.30
14.457	0.30	0.30	0.30	0.30	0.30	0.30	0.30
14.586	0.30	0.30	0.30	0.30	0.30	0.30	0.30
14.715	0.30	0.30	0.30	0.30	0.30	0.30	0.30
14.844	0.30	0.30	0.30	0.30	0.30	0.30	0.30
14.973	0.30	0.30	0.30	0.30	0.30	0.30	0.30
15.102	0.30	0.30	0.30	0.30	0.30	0.29	0.29
15.231	0.29	0.29	0.29	0.29	0.29	0.29	0.29
15.360	0.29	0.29	0.29	0.29	0.29	0.29	0.29
15.490	0.29	0.29	0.29	0.29	0.29	0.29	0.29
15.619	0.29	0.29	0.29	0.29	0.29	0.29	0.29
15.748	0.29	0.29	0.29	0.29	0.29	0.29	0.29
15.877	0.29	0.29	0.29	0.29	0.29	0.28	0.28
16.006	0.28	0.28	0.28	0.28	0.28	0.28	0.28
16.135	0.28	0.28	0.28	0.28	0.28	0.28	0.28
16.264	0.28	0.28	0.28	0.28	0.28	0.28	0.28
16.393	0.28	0.28	0.28	0.28	0.28	0.28	0.28
16.522	0.28	0.28	0.28	0.28	0.28	0.28	0.28
16.651	0.28	0.28	0.27	0.27	0.27	0.27	0.27
16.780	0.27	0.27	0.27	0.27	0.27	0.27	0.27
16.910	0.27	0.27	0.27	0.27	0.27	0.27	0.27
17.039	0.27	0.27	0.27	0.27	0.27	0.27	0.27
17.168	0.27	0.27	0.27	0.27	0.27	0.27	0.27
17.297	0.27	0.27	0.27	0.26	0.26	0.26	0.26
17.426	0.26	0.26	0.26	0.26	0.26	0.26	0.26

Bonzi Landfill
Final Closure

Line Start Time (hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	------------ Flow Values @ time increment of 0.018 hr ------------						
17.555	0.26	0.26	0.26	0.26	0.26	0.26	0.26
17.684	0.26	0.26	0.26	0.26	0.26	0.26	0.26
17.813	0.26	0.26	0.26	0.26	0.26	0.26	0.26
17.942	0.26	0.26	0.26	0.25	0.25	0.25	0.25
18.071	0.25	0.25	0.25	0.25	0.25	0.25	0.25
18.200	0.25	0.25	0.25	0.25	0.25	0.25	0.25
18.330	0.25	0.25	0.25	0.25	0.25	0.25	0.25
18.459	0.25	0.25	0.25	0.25	0.25	0.25	0.25
18.588	0.25	0.24	0.24	0.24	0.24	0.24	0.24
18.717	0.24	0.24	0.24	0.24	0.24	0.24	0.24
18.846	0.24	0.24	0.24	0.24	0.24	0.24	0.24
18.975	0.24	0.24	0.24	0.24	0.24	0.24	0.24
19.104	0.24	0.24	0.24	0.24	0.24	0.23	0.23
19.233	0.23	0.23	0.23	0.23	0.23	0.23	0.23
19.362	0.23	0.23	0.23	0.23	0.23	0.23	0.23
19.491	0.23	0.23	0.23	0.23	0.23	0.23	0.23
19.621	0.23	0.23	0.23	0.23	0.23	0.23	0.23
19.750	0.23	0.22	0.22	0.22	0.22	0.22	0.22
19.879	0.22	0.22	0.22	0.22	0.22	0.22	0.22
20.008	0.22	0.22	0.22	0.22	0.22	0.22	0.22
20.137	0.22	0.22	0.22	0.22	0.22	0.22	0.22
20.266	0.22	0.22	0.22	0.21	0.21	0.21	0.21
20.395	0.21	0.21	0.21	0.21	0.21	0.21	0.21
20.524	0.21	0.21	0.21	0.21	0.21	0.21	0.21
20.653	0.21	0.21	0.21	0.21	0.21	0.21	0.21
20.782	0.21	0.21	0.21	0.21	0.20	0.20	0.20
20.911	0.20	0.20	0.20	0.20	0.20	0.20	0.20
21.041	0.20	0.20	0.20	0.20	0.20	0.20	0.20
21.170	0.20	0.20	0.20	0.20	0.20	0.20	0.20
21.299	0.20	0.20	0.20	0.20	0.20	0.19	0.19
21.428	0.19	0.19	0.19	0.19	0.19	0.19	0.19
21.557	0.19	0.19	0.19	0.19	0.19	0.19	0.19
21.686	0.19	0.19	0.19	0.19	0.19	0.19	0.19
21.815	0.19	0.19	0.19	0.19	0.19	0.18	0.18
21.944	0.18	0.18	0.18	0.18	0.18	0.18	0.18
22.073	0.18	0.18	0.18	0.18	0.18	0.18	0.18
22.202	0.18	0.18	0.18	0.18	0.18	0.18	0.18
22.332	0.18	0.18	0.18	0.18	0.18	0.17	0.17
22.461	0.17	0.17	0.17	0.17	0.17	0.17	0.17
22.590	0.17	0.17	0.17	0.17	0.17	0.17	0.17
22.719	0.17	0.17	0.17	0.17	0.17	0.17	0.17
22.848	0.17	0.17	0.17	0.17	0.16	0.16	0.16
22.977	0.16	0.16	0.16	0.16	0.16	0.16	0.16
23.106	0.16	0.16	0.16	0.16	0.16	0.16	0.16
23.235	0.16	0.16	0.16	0.16	0.16	0.16	0.16
23.364	0.16	0.16	0.16	0.15	0.15	0.15	0.15
23.493	0.15	0.15	0.15	0.15	0.15	0.15	0.15
23.622	0.15	0.15	0.15	0.15	0.15	0.15	0.15
23.752	0.15	0.15	0.15	0.15	0.15	0.15	0.15
23.881	0.15	0.15	0.14	0.14	0.14	0.14	0.14
24.010	0.14	0.14	0.14	0.14	0.13	0.13	0.12

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.018 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
24.139	0.11	0.10	0.09	0.08	0.07	0.06	

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA-7	0.049		1.219		10.20	15.60	318.06

Line Start Time (hr)	Flow Values @ time increment of 0.032 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.310	0.06	0.07	0.08	0.09	0.11	0.12	0.14
8.534	0.16	0.18	0.20	0.22	0.24	0.26	0.29
8.758	0.31	0.34	0.37	0.40	0.43	0.46	0.49
8.982	0.53	0.56	0.60	0.64	0.68	0.72	0.76
9.205	0.81	0.86	0.91	0.96	1.02	1.08	1.14
9.429	1.21	1.28	1.36	1.43	1.52	1.62	1.73
9.653	1.86	2.04	2.25	2.52	2.87	3.32	3.90
9.876	4.65	5.60	6.73	8.04	9.50	11.02	12.44
10.100	13.68	14.66	15.32	15.60	15.56	15.24	14.70
10.324	14.01	13.22	12.41	11.63	10.89	10.21	9.62
10.548	9.09	8.61	8.16	7.76	7.37	7.02	6.70
10.771	6.41	6.14	5.90	5.69	5.49	5.32	5.16
10.995	5.02	4.89	4.77	4.66	4.55	4.46	4.37
11.219	4.29	4.21	4.14	4.07	4.01	3.96	3.91
11.442	3.86	3.82	3.78	3.75	3.72	3.69	3.66
11.666	3.64	3.61	3.59	3.56	3.54	3.52	3.49
11.890	3.47	3.45	3.42	3.40	3.38	3.35	3.33
12.113	3.31	3.29	3.26	3.24	3.22	3.20	3.18
12.337	3.16	3.14	3.12	3.11	3.09	3.07	3.06
12.561	3.04	3.02	3.01	2.99	2.98	2.96	2.95
12.785	2.93	2.92	2.90	2.89	2.87	2.86	2.84
13.008	2.83	2.81	2.79	2.78	2.76	2.75	2.73
13.232	2.72	2.70	2.68	2.67	2.65	2.63	2.62
13.456	2.60	2.59	2.57	2.55	2.54	2.52	2.50
13.679	2.48	2.47	2.45	2.43	2.42	2.40	2.38
13.903	2.36	2.35	2.33	2.31	2.29	2.28	2.26
14.127	2.24	2.22	2.21	2.19	2.18	2.17	2.15
14.351	2.14	2.13	2.12	2.12	2.11	2.10	2.10
14.574	2.09	2.09	2.08	2.08	2.07	2.07	2.07
14.798	2.06	2.06	2.06	2.05	2.05	2.05	2.04
15.022	2.04	2.04	2.04	2.03	2.03	2.03	2.02
15.245	2.02	2.02	2.02	2.01	2.01	2.01	2.01
15.469	2.00	2.00	2.00	2.00	1.99	1.99	1.99
15.693	1.98	1.98	1.98	1.98	1.97	1.97	1.97
15.916	1.96	1.96	1.96	1.96	1.95	1.95	1.95
16.140	1.94	1.94	1.94	1.94	1.93	1.93	1.93
16.364	1.92	1.92	1.92	1.91	1.91	1.91	1.90
16.588	1.90	1.90	1.90	1.89	1.89	1.89	1.88
16.811	1.88	1.88	1.87	1.87	1.87	1.86	1.86

Line Start Time (hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	------------ Flow Values @ time increment of 0.032 hr ------------						
17.035	1.86	1.85	1.85	1.85	1.84	1.84	1.84
17.259	1.84	1.83	1.83	1.83	1.82	1.82	1.82
17.482	1.81	1.81	1.81	1.80	1.80	1.80	1.79
17.706	1.79	1.78	1.78	1.78	1.77	1.77	1.77
17.930	1.76	1.76	1.76	1.75	1.75	1.75	1.74
18.153	1.74	1.74	1.73	1.73	1.73	1.72	1.72
18.377	1.72	1.71	1.71	1.70	1.70	1.70	1.69
18.601	1.69	1.69	1.68	1.68	1.68	1.67	1.67
18.825	1.66	1.66	1.66	1.65	1.65	1.65	1.64
19.048	1.64	1.63	1.63	1.63	1.62	1.62	1.62
19.272	1.61	1.61	1.61	1.60	1.60	1.59	1.59
19.496	1.59	1.58	1.58	1.57	1.57	1.57	1.56
19.719	1.56	1.56	1.55	1.55	1.54	1.54	1.54
19.943	1.53	1.53	1.52	1.52	1.52	1.51	1.51
20.167	1.50	1.50	1.50	1.49	1.49	1.49	1.48
20.391	1.48	1.47	1.47	1.47	1.46	1.46	1.45
20.614	1.45	1.45	1.44	1.44	1.43	1.43	1.43
20.838	1.42	1.42	1.41	1.41	1.41	1.40	1.40
21.062	1.39	1.39	1.38	1.38	1.38	1.37	1.37
21.285	1.36	1.36	1.36	1.35	1.35	1.34	1.34
21.509	1.34	1.33	1.33	1.32	1.32	1.31	1.31
21.733	1.31	1.30	1.30	1.29	1.29	1.29	1.28
21.956	1.28	1.27	1.27	1.26	1.26	1.26	1.25
22.180	1.25	1.24	1.24	1.23	1.23	1.23	1.22
22.404	1.22	1.21	1.21	1.20	1.20	1.20	1.19
22.628	1.19	1.18	1.18	1.17	1.17	1.17	1.16
22.851	1.16	1.15	1.15	1.14	1.14	1.14	1.13
23.075	1.13	1.12	1.12	1.11	1.11	1.11	1.10
23.299	1.10	1.09	1.09	1.08	1.08	1.08	1.07
23.522	1.07	1.06	1.06	1.05	1.05	1.04	1.04
23.746	1.04	1.03	1.03	1.02	1.02	1.01	1.01
23.970	1.00	1.00	0.99	0.98	0.96	0.94	0.90
24.194	0.85	0.78	0.72	0.64	0.57	0.50	0.43
24.417	0.37	0.31	0.26	0.22	0.19	0.16	0.13
24.641	0.11	0.10	0.08	0.07	0.06	0.05	

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA-8	0.006		1.215		9.93	3.37	539.03

Line Start Time (hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	------------ Flow Values @ time increment of 0.006 hr ------------						
8.563	0.05	0.05	0.05	0.05	0.05	0.05	0.06
8.608	0.06	0.06	0.06	0.06	0.06	0.06	0.06
8.652	0.06	0.06	0.06	0.07	0.07	0.07	0.07
8.696	0.07	0.07	0.07	0.07	0.07	0.07	0.07
8.740	0.07	0.08	0.08	0.08	0.08	0.08	0.08

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.006 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.784	0.08	0.08	0.08	0.08	0.09	0.09	0.09
8.829	0.09	0.09	0.09	0.09	0.09	0.09	0.10
8.873	0.10	0.10	0.10	0.10	0.10	0.10	0.10
8.917	0.10	0.11	0.11	0.11	0.11	0.11	0.11
8.961	0.11	0.11	0.12	0.12	0.12	0.12	0.12
9.005	0.12	0.12	0.12	0.12	0.13	0.13	0.13
9.050	0.13	0.13	0.13	0.14	0.14	0.14	0.14
9.094	0.14	0.14	0.14	0.15	0.15	0.15	0.15
9.138	0.15	0.15	0.16	0.16	0.16	0.16	0.16
9.182	0.17	0.17	0.17	0.17	0.17	0.18	0.18
9.227	0.18	0.18	0.18	0.19	0.19	0.19	0.19
9.271	0.19	0.20	0.20	0.20	0.20	0.21	0.21
9.315	0.21	0.21	0.21	0.22	0.22	0.22	0.22
9.359	0.23	0.23	0.23	0.23	0.24	0.24	0.24
9.403	0.24	0.25	0.25	0.25	0.25	0.25	0.26
9.448	0.26	0.26	0.27	0.27	0.27	0.27	0.28
9.492	0.28	0.28	0.29	0.29	0.29	0.30	0.30
9.536	0.31	0.32	0.33	0.35	0.36	0.37	0.38
9.580	0.40	0.41	0.42	0.43	0.44	0.45	0.46
9.624	0.47	0.48	0.50	0.53	0.55	0.58	0.61
9.669	0.64	0.66	0.69	0.71	0.73	0.75	0.77
9.713	0.79	0.82	0.84	0.88	0.92	0.97	1.02
9.757	1.08	1.14	1.19	1.25	1.30	1.35	1.40
9.801	1.44	1.48	1.53	1.58	1.65	1.73	1.83
9.845	1.95	2.08	2.22	2.36	2.50	2.63	2.76
9.890	2.88	2.99	3.09	3.18	3.25	3.31	3.35
9.934	3.37	3.37	3.35	3.31	3.27	3.23	3.18
9.978	3.14	3.10	3.07	3.04	3.02	3.00	2.97
10.022	2.93	2.87	2.78	2.67	2.54	2.40	2.25
10.067	2.11	1.97	1.83	1.71	1.61	1.52	1.44
10.111	1.38	1.33	1.28	1.24	1.20	1.17	1.14
10.155	1.11	1.09	1.07	1.05	1.03	1.02	1.01
10.199	1.00	0.99	0.98	0.98	0.97	0.96	0.96
10.243	0.95	0.94	0.93	0.92	0.91	0.90	0.90
10.288	0.89	0.88	0.88	0.88	0.87	0.87	0.87
10.332	0.86	0.85	0.85	0.84	0.83	0.82	0.81
10.376	0.80	0.80	0.79	0.79	0.78	0.78	0.77
10.420	0.77	0.77	0.76	0.75	0.75	0.74	0.73
10.464	0.72	0.71	0.70	0.69	0.69	0.68	0.68
10.509	0.67	0.67	0.67	0.66	0.66	0.65	0.65
10.553	0.64	0.64	0.63	0.62	0.62	0.61	0.61
10.597	0.61	0.60	0.60	0.60	0.60	0.60	0.59
10.641	0.59	0.59	0.59	0.58	0.58	0.58	0.58
10.685	0.58	0.57	0.57	0.57	0.57	0.57	0.57
10.730	0.57	0.57	0.56	0.56	0.56	0.56	0.56
10.774	0.55	0.55	0.55	0.55	0.55	0.55	0.55
10.818	0.55	0.55	0.54	0.54	0.54	0.54	0.54
10.862	0.53	0.53	0.53	0.53	0.53	0.53	0.52
10.907	0.52	0.52	0.52	0.52	0.52	0.52	0.52
10.951	0.51	0.51	0.51	0.51	0.50	0.50	0.50
10.995	0.50	0.50	0.50	0.50	0.50	0.50	0.49

Line Start Time (hr)	------------ Flow Values @ time increment of 0.006 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
11.039	0.49	0.49	0.49	0.49	0.49	0.49	0.48
11.083	0.48	0.48	0.48	0.48	0.48	0.48	0.48
11.128	0.48	0.48	0.48	0.48	0.48	0.47	0.47
11.172	0.47	0.47	0.47	0.47	0.47	0.47	0.47
11.216	0.47	0.47	0.47	0.47	0.47	0.47	0.47
11.260	0.47	0.47	0.46	0.46	0.46	0.46	0.46
11.304	0.46	0.46	0.46	0.46	0.46	0.46	0.46
11.349	0.46	0.46	0.46	0.46	0.46	0.46	0.46
11.393	0.46	0.46	0.45	0.45	0.45	0.45	0.45
11.437	0.45	0.45	0.45	0.45	0.45	0.45	0.45
11.481	0.45	0.45	0.45	0.45	0.45	0.45	0.45
11.525	0.45	0.45	0.44	0.44	0.44	0.44	0.44
11.570	0.44	0.44	0.44	0.44	0.44	0.44	0.44
11.614	0.44	0.44	0.44	0.44	0.44	0.44	0.43
11.658	0.43	0.43	0.43	0.43	0.43	0.43	0.43
11.702	0.43	0.43	0.43	0.43	0.43	0.43	0.43
11.747	0.43	0.43	0.42	0.42	0.42	0.42	0.42
11.791	0.42	0.42	0.42	0.42	0.42	0.42	0.42
11.835	0.42	0.42	0.42	0.42	0.42	0.41	0.41
11.879	0.41	0.41	0.41	0.41	0.41	0.41	0.41
11.923	0.41	0.41	0.41	0.41	0.41	0.41	0.41
11.968	0.41	0.40	0.40	0.40	0.40	0.40	0.40
12.012	0.40	0.40	0.40	0.40	0.40	0.40	0.40
12.056	0.40	0.40	0.40	0.40	0.40	0.39	0.39
12.100	0.39	0.39	0.39	0.39	0.39	0.39	0.39
12.144	0.39	0.39	0.39	0.39	0.39	0.39	0.39
12.189	0.39	0.39	0.39	0.39	0.39	0.39	0.39
12.233	0.39	0.39	0.39	0.39	0.39	0.38	0.38
12.277	0.38	0.38	0.38	0.38	0.38	0.38	0.38
12.321	0.38	0.38	0.38	0.38	0.38	0.38	0.38
12.365	0.38	0.38	0.38	0.38	0.38	0.38	0.38
12.410	0.38	0.38	0.38	0.38	0.38	0.38	0.37
12.454	0.37	0.37	0.37	0.37	0.37	0.37	0.37
12.498	0.37	0.37	0.37	0.37	0.37	0.37	0.37
12.542	0.37	0.37	0.37	0.37	0.37	0.37	0.37
12.587	0.37	0.37	0.37	0.37	0.36	0.36	0.36
12.631	0.36	0.36	0.36	0.36	0.36	0.36	0.36
12.675	0.36	0.36	0.36	0.36	0.36	0.36	0.36
12.719	0.36	0.36	0.36	0.36	0.36	0.36	0.36
12.763	0.36	0.35	0.35	0.35	0.35	0.35	0.35
12.808	0.35	0.35	0.35	0.35	0.35	0.35	0.35
12.852	0.35	0.35	0.35	0.35	0.35	0.35	0.35
12.896	0.35	0.35	0.35	0.35	0.35	0.35	0.35
12.940	0.34	0.34	0.34	0.34	0.34	0.34	0.34
12.984	0.34	0.34	0.34	0.34	0.34	0.34	0.34
13.029	0.34	0.34	0.34	0.34	0.34	0.34	0.34
13.073	0.34	0.34	0.33	0.33	0.33	0.33	0.33
13.117	0.33	0.33	0.33	0.33	0.33	0.33	0.33
13.161	0.33	0.33	0.33	0.33	0.33	0.33	0.33
13.205	0.33	0.33	0.33	0.33	0.33	0.33	0.33
13.250	0.32	0.32	0.32	0.32	0.32	0.32	0.32

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.006 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
13.294	0.32	0.32	0.32	0.32	0.32	0.32	0.32
13.338	0.32	0.32	0.32	0.32	0.32	0.32	0.32
13.382	0.31	0.31	0.31	0.31	0.31	0.31	0.31
13.427	0.31	0.31	0.31	0.31	0.31	0.31	0.31
13.471	0.31	0.31	0.31	0.31	0.31	0.31	0.31
13.515	0.31	0.31	0.31	0.31	0.30	0.30	0.30
13.559	0.30	0.30	0.30	0.30	0.30	0.30	0.30
13.603	0.30	0.30	0.30	0.30	0.30	0.30	0.30
13.648	0.30	0.30	0.30	0.30	0.29	0.29	0.29
13.692	0.29	0.29	0.29	0.29	0.29	0.29	0.29
13.736	0.29	0.29	0.29	0.29	0.29	0.29	0.29
13.780	0.29	0.29	0.29	0.29	0.29	0.29	0.29
13.824	0.28	0.28	0.28	0.28	0.28	0.28	0.28
13.869	0.28	0.28	0.28	0.28	0.28	0.28	0.28
13.913	0.28	0.28	0.28	0.28	0.28	0.28	0.28
13.957	0.27	0.27	0.27	0.27	0.27	0.27	0.27
14.001	0.27	0.27	0.27	0.27	0.27	0.27	0.27
14.045	0.27	0.27	0.27	0.27	0.27	0.27	0.27
14.090	0.27	0.27	0.27	0.27	0.27	0.27	0.27
14.134	0.27	0.27	0.27	0.27	0.27	0.27	0.27
14.178	0.27	0.26	0.26	0.26	0.26	0.26	0.26
14.222	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.267	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.311	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.355	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.399	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.443	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.488	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.532	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.576	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.620	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.664	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.709	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.753	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.797	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.841	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.885	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.930	0.26	0.26	0.26	0.26	0.26	0.26	0.26
14.974	0.26	0.26	0.26	0.26	0.26	0.26	0.26
15.018	0.26	0.26	0.26	0.26	0.26	0.26	0.26
15.062	0.26	0.26	0.26	0.26	0.26	0.26	0.26
15.107	0.26	0.26	0.26	0.26	0.26	0.26	0.26
15.151	0.26	0.26	0.26	0.25	0.25	0.25	0.25
15.195	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.239	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.283	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.328	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.372	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.416	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.460	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.504	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Line Start Time (hr)	Flow Values @ time increment of 0.006 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
15.549	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.593	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.637	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.681	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.725	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.770	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.814	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.858	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.902	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.947	0.25	0.25	0.25	0.25	0.25	0.25	0.25
15.991	0.25	0.25	0.25	0.25	0.25	0.25	0.25
16.035	0.25	0.25	0.25	0.24	0.24	0.24	0.24
16.079	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.123	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.168	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.212	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.256	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.300	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.344	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.389	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.433	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.477	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.521	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.565	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.610	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.654	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.698	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.742	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.787	0.24	0.24	0.24	0.24	0.24	0.24	0.24
16.831	0.24	0.24	0.24	0.24	0.23	0.23	0.23
16.875	0.23	0.23	0.23	0.23	0.23	0.23	0.23
16.919	0.23	0.23	0.23	0.23	0.23	0.23	0.23
16.963	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.008	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.052	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.096	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.140	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.184	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.229	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.273	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.317	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.361	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.405	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.450	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.494	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.538	0.23	0.23	0.23	0.23	0.23	0.23	0.23
17.582	0.23	0.22	0.22	0.22	0.22	0.22	0.22
17.627	0.22	0.22	0.22	0.22	0.22	0.22	0.22
17.671	0.22	0.22	0.22	0.22	0.22	0.22	0.22
17.715	0.22	0.22	0.22	0.22	0.22	0.22	0.22
17.759	0.22	0.22	0.22	0.22	0.22	0.22	0.22

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.006 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
17.803	0.22	0.22	0.22	0.22	0.22	0.22	0.22
17.848	0.22	0.22	0.22	0.22	0.22	0.22	0.22
17.892	0.22	0.22	0.22	0.22	0.22	0.22	0.22
17.936	0.22	0.22	0.22	0.22	0.22	0.22	0.22
17.980	0.22	0.22	0.22	0.22	0.22	0.22	0.22
18.024	0.22	0.22	0.22	0.22	0.22	0.22	0.22
18.069	0.22	0.22	0.22	0.22	0.22	0.22	0.22
18.113	0.22	0.22	0.22	0.22	0.22	0.22	0.22
18.157	0.22	0.22	0.22	0.22	0.22	0.22	0.22
18.201	0.22	0.22	0.22	0.22	0.22	0.22	0.22
18.245	0.22	0.22	0.22	0.22	0.22	0.22	0.22
18.290	0.22	0.22	0.21	0.21	0.21	0.21	0.21
18.334	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.378	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.422	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.467	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.511	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.555	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.599	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.643	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.688	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.732	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.776	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.820	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.864	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.909	0.21	0.21	0.21	0.21	0.21	0.21	0.21
18.953	0.21	0.21	0.21	0.21	0.20	0.20	0.20
18.997	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.041	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.085	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.130	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.174	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.218	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.262	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.307	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.351	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.395	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.439	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.483	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.528	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.572	0.20	0.20	0.20	0.20	0.20	0.20	0.20
19.616	0.20	0.20	0.20	0.20	0.20	0.19	0.19
19.660	0.19	0.19	0.19	0.19	0.19	0.19	0.19
19.704	0.19	0.19	0.19	0.19	0.19	0.19	0.19
19.749	0.19	0.19	0.19	0.19	0.19	0.19	0.19
19.793	0.19	0.19	0.19	0.19	0.19	0.19	0.19
19.837	0.19	0.19	0.19	0.19	0.19	0.19	0.19
19.881	0.19	0.19	0.19	0.19	0.19	0.19	0.19
19.925	0.19	0.19	0.19	0.19	0.19	0.19	0.19
19.970	0.19	0.19	0.19	0.19	0.19	0.19	0.19
20.014	0.19	0.19	0.19	0.19	0.19	0.19	0.19

Bonzi Landfill
Final Closure

Line Start Time (hr)	------------ Flow Values @ time increment of 0.006 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
20.058	0.19	0.19	0.19	0.19	0.19	0.19	0.19
20.102	0.19	0.19	0.19	0.19	0.19	0.19	0.19
20.147	0.19	0.19	0.19	0.19	0.19	0.19	0.19
20.191	0.19	0.19	0.19	0.19	0.19	0.19	0.19
20.235	0.19	0.19	0.19	0.19	0.19	0.19	0.18
20.279	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.323	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.368	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.412	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.456	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.500	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.544	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.589	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.633	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.677	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.721	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.765	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.810	0.18	0.18	0.18	0.18	0.18	0.18	0.18
20.854	0.18	0.18	0.18	0.18	0.18	0.18	0.17
20.898	0.17	0.17	0.17	0.17	0.17	0.17	0.17
20.942	0.17	0.17	0.17	0.17	0.17	0.17	0.17
20.987	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.031	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.075	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.119	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.163	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.208	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.252	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.296	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.340	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.384	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.429	0.17	0.17	0.17	0.17	0.17	0.17	0.17
21.473	0.17	0.17	0.17	0.17	0.16	0.16	0.16
21.517	0.16	0.16	0.16	0.16	0.16	0.16	0.16
21.561	0.16	0.16	0.16	0.16	0.16	0.16	0.16
21.605	0.16	0.16	0.16	0.16	0.16	0.16	0.16
21.650	0.16	0.16	0.16	0.16	0.16	0.16	0.16
21.694	0.16	0.16	0.16	0.16	0.16	0.16	0.16
21.738	0.16	0.16	0.16	0.16	0.16	0.16	0.16
21.782	0.16	0.16	0.16	0.16	0.16	0.16	0.16
21.827	0.16	0.16	0.16	0.16	0.16	0.16	0.16
21.871	0.16	0.16	0.16	0.16	0.16	0.16	0.16
21.915	0.16	0.16	0.16	0.16	0.16	0.16	0.16
21.959	0.16	0.16	0.16	0.16	0.16	0.16	0.16
22.003	0.16	0.16	0.16	0.16	0.16	0.16	0.16
22.048	0.16	0.16	0.16	0.16	0.16	0.16	0.16
22.092	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.136	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.180	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.224	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.269	0.15	0.15	0.15	0.15	0.15	0.15	0.15

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.006 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
22.313	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.357	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.401	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.445	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.490	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.534	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.578	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.622	0.15	0.15	0.15	0.15	0.15	0.15	0.15
22.667	0.15	0.15	0.14	0.14	0.14	0.14	0.14
22.711	0.14	0.14	0.14	0.14	0.14	0.14	0.14
22.755	0.14	0.14	0.14	0.14	0.14	0.14	0.14
22.799	0.14	0.14	0.14	0.14	0.14	0.14	0.14
22.843	0.14	0.14	0.14	0.14	0.14	0.14	0.14
22.888	0.14	0.14	0.14	0.14	0.14	0.14	0.14
22.932	0.14	0.14	0.14	0.14	0.14	0.14	0.14
22.976	0.14	0.14	0.14	0.14	0.14	0.14	0.14
23.020	0.14	0.14	0.14	0.14	0.14	0.14	0.14
23.064	0.14	0.14	0.14	0.14	0.14	0.14	0.14
23.109	0.14	0.14	0.14	0.14	0.14	0.14	0.14
23.153	0.14	0.14	0.14	0.14	0.14	0.14	0.14
23.197	0.14	0.14	0.14	0.14	0.14	0.14	0.14
23.241	0.14	0.14	0.14	0.13	0.13	0.13	0.13
23.285	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.330	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.374	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.418	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.462	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.507	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.551	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.595	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.639	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.683	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.728	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.772	0.13	0.13	0.13	0.13	0.13	0.13	0.13
23.816	0.13	0.13	0.12	0.12	0.12	0.12	0.12
23.860	0.12	0.12	0.12	0.12	0.12	0.12	0.12
23.904	0.12	0.12	0.12	0.12	0.12	0.12	0.12
23.949	0.12	0.12	0.12	0.12	0.12	0.12	0.12
23.993	0.12	0.12	0.12	0.12	0.12	0.12	0.11
24.037	0.11	0.10	0.09	0.08	0.07	0.06	0.06

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA-9	0.025		1.218		10.10	9.72	396.43

Line Start Time (hr)	------------ Flow Values @ time increment of 0.021 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.312	0.05	0.06	0.06	0.07	0.07	0.08	0.08
8.456	0.09	0.10	0.10	0.11	0.12	0.13	0.13
8.600	0.14	0.15	0.16	0.17	0.18	0.19	0.20
8.743	0.21	0.22	0.23	0.24	0.25	0.26	0.27
8.887	0.28	0.29	0.31	0.32	0.33	0.34	0.36
9.031	0.37	0.39	0.40	0.41	0.43	0.45	0.46
9.174	0.48	0.50	0.52	0.53	0.55	0.58	0.60
9.318	0.62	0.64	0.67	0.69	0.72	0.74	0.77
9.462	0.80	0.82	0.85	0.88	0.92	0.96	1.00
9.605	1.05	1.12	1.19	1.28	1.39	1.52	1.67
9.749	1.85	2.06	2.30	2.58	2.92	3.32	3.80
9.893	4.35	4.98	5.68	6.42	7.16	7.88	8.51
10.037	9.03	9.41	9.64	9.72	9.63	9.37	9.00
10.180	8.54	8.05	7.55	7.06	6.60	6.17	5.78
10.324	5.44	5.15	4.90	4.67	4.47	4.28	4.11
10.468	3.95	3.80	3.67	3.54	3.42	3.31	3.20
10.611	3.10	3.01	2.92	2.84	2.76	2.69	2.63
10.755	2.57	2.52	2.47	2.43	2.39	2.35	2.32
10.899	2.29	2.26	2.23	2.20	2.18	2.15	2.13
11.042	2.11	2.09	2.06	2.04	2.02	2.01	1.99
11.186	1.97	1.96	1.94	1.93	1.92	1.90	1.89
11.330	1.88	1.87	1.86	1.86	1.85	1.84	1.83
11.473	1.83	1.82	1.81	1.80	1.80	1.79	1.78
11.617	1.78	1.77	1.76	1.76	1.75	1.74	1.73
11.761	1.73	1.72	1.71	1.71	1.70	1.69	1.69
11.904	1.68	1.67	1.66	1.66	1.65	1.64	1.63
12.048	1.63	1.62	1.61	1.60	1.60	1.59	1.58
12.192	1.58	1.57	1.57	1.56	1.55	1.55	1.54
12.335	1.54	1.53	1.53	1.52	1.52	1.51	1.51
12.479	1.50	1.50	1.49	1.49	1.48	1.48	1.47
12.623	1.47	1.47	1.46	1.46	1.45	1.45	1.44
12.767	1.44	1.43	1.43	1.42	1.42	1.41	1.41
12.910	1.40	1.40	1.39	1.39	1.38	1.38	1.37
13.054	1.37	1.36	1.36	1.35	1.35	1.34	1.34
13.198	1.33	1.33	1.32	1.32	1.31	1.31	1.30
13.341	1.29	1.29	1.28	1.28	1.27	1.27	1.26
13.485	1.26	1.25	1.25	1.24	1.23	1.23	1.22
13.629	1.22	1.21	1.21	1.20	1.20	1.19	1.18
13.772	1.18	1.17	1.17	1.16	1.16	1.15	1.15
13.916	1.14	1.13	1.13	1.12	1.12	1.11	1.11
14.060	1.10	1.09	1.09	1.08	1.08	1.07	1.07
14.203	1.07	1.06	1.06	1.06	1.05	1.05	1.05
14.347	1.05	1.05	1.04	1.04	1.04	1.04	1.04
14.491	1.04	1.04	1.03	1.03	1.03	1.03	1.03
14.634	1.03	1.03	1.03	1.03	1.03	1.03	1.03
14.778	1.02	1.02	1.02	1.02	1.02	1.02	1.02
14.922	1.02	1.02	1.02	1.02	1.02	1.01	1.01
15.065	1.01	1.01	1.01	1.01	1.01	1.01	1.01
15.209	1.01	1.01	1.01	1.00	1.00	1.00	1.00
15.353	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15.497	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.021 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
15.640	0.99	0.99	0.99	0.99	0.98	0.98	0.98
15.784	0.98	0.98	0.98	0.98	0.98	0.98	0.98
15.928	0.98	0.97	0.97	0.97	0.97	0.97	0.97
16.071	0.97	0.97	0.97	0.97	0.96	0.96	0.96
16.215	0.96	0.96	0.96	0.96	0.96	0.96	0.96
16.359	0.96	0.95	0.95	0.95	0.95	0.95	0.95
16.502	0.95	0.95	0.95	0.95	0.94	0.94	0.94
16.646	0.94	0.94	0.94	0.94	0.94	0.94	0.94
16.790	0.93	0.93	0.93	0.93	0.93	0.93	0.93
16.933	0.93	0.93	0.92	0.92	0.92	0.92	0.92
17.077	0.92	0.92	0.92	0.92	0.92	0.91	0.91
17.221	0.91	0.91	0.91	0.91	0.91	0.91	0.91
17.364	0.90	0.90	0.90	0.90	0.90	0.90	0.90
17.508	0.90	0.90	0.89	0.89	0.89	0.89	0.89
17.652	0.89	0.89	0.89	0.89	0.89	0.88	0.88
17.795	0.88	0.88	0.88	0.88	0.88	0.88	0.88
17.939	0.87	0.87	0.87	0.87	0.87	0.87	0.87
18.083	0.87	0.86	0.86	0.86	0.86	0.86	0.86
18.227	0.86	0.86	0.86	0.85	0.85	0.85	0.85
18.370	0.85	0.85	0.85	0.85	0.85	0.84	0.84
18.514	0.84	0.84	0.84	0.84	0.84	0.84	0.83
18.658	0.83	0.83	0.83	0.83	0.83	0.83	0.83
18.801	0.83	0.82	0.82	0.82	0.82	0.82	0.82
18.945	0.82	0.82	0.81	0.81	0.81	0.81	0.81
19.089	0.81	0.81	0.81	0.81	0.80	0.80	0.80
19.232	0.80	0.80	0.80	0.80	0.80	0.79	0.79
19.376	0.79	0.79	0.79	0.79	0.79	0.79	0.78
19.520	0.78	0.78	0.78	0.78	0.78	0.78	0.78
19.663	0.77	0.77	0.77	0.77	0.77	0.77	0.77
19.807	0.77	0.76	0.76	0.76	0.76	0.76	0.76
19.951	0.76	0.76	0.75	0.75	0.75	0.75	0.75
20.094	0.75	0.75	0.75	0.74	0.74	0.74	0.74
20.238	0.74	0.74	0.74	0.74	0.73	0.73	0.73
20.382	0.73	0.73	0.73	0.73	0.73	0.72	0.72
20.525	0.72	0.72	0.72	0.72	0.72	0.71	0.71
20.669	0.71	0.71	0.71	0.71	0.71	0.71	0.70
20.813	0.70	0.70	0.70	0.70	0.70	0.70	0.70
20.957	0.69	0.69	0.69	0.69	0.69	0.69	0.69
21.100	0.68	0.68	0.68	0.68	0.68	0.68	0.68
21.244	0.68	0.67	0.67	0.67	0.67	0.67	0.67
21.388	0.67	0.67	0.66	0.66	0.66	0.66	0.66
21.531	0.66	0.66	0.65	0.65	0.65	0.65	0.65
21.675	0.65	0.65	0.64	0.64	0.64	0.64	0.64
21.819	0.64	0.64	0.64	0.63	0.63	0.63	0.63
21.962	0.63	0.63	0.63	0.62	0.62	0.62	0.62
22.106	0.62	0.62	0.62	0.62	0.61	0.61	0.61
22.250	0.61	0.61	0.61	0.61	0.60	0.60	0.60
22.393	0.60	0.60	0.60	0.60	0.59	0.59	0.59
22.537	0.59	0.59	0.59	0.59	0.58	0.58	0.58
22.681	0.58	0.58	0.58	0.58	0.58	0.57	0.57
22.824	0.57	0.57	0.57	0.57	0.57	0.56	0.56

Line Start Time (hr)	------------ Flow Values @ time increment of 0.021 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
22.968	0.56	0.56	0.56	0.56	0.56	0.55	0.55
23.112	0.55	0.55	0.55	0.55	0.55	0.54	0.54
23.255	0.54	0.54	0.54	0.54	0.54	0.53	0.53
23.399	0.53	0.53	0.53	0.53	0.53	0.52	0.52
23.543	0.52	0.52	0.52	0.52	0.52	0.51	0.51
23.687	0.51	0.51	0.51	0.51	0.51	0.50	0.50
23.830	0.50	0.50	0.50	0.50	0.50	0.50	0.49
23.974	0.49	0.49	0.49	0.48	0.48	0.47	0.45
24.118	0.43	0.40	0.37	0.33	0.29	0.26	0.22
24.261	0.19	0.16	0.14	0.12	0.10	0.08	0.07
24.405	0.06	0.05					

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	------------ Peak Flow ------------ Elevation (ft)	Time (hr)	Rate (cfs)	Rate (csm)
OUTLET	0.159		1.218		10.06	55.04	346.04

Line Start Time (hr)	------------ Flow Values @ time increment of 0.006 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
8.260	0.10	0.11	0.11	0.11	0.13	0.14	0.17
8.304	0.20	0.23	0.24	0.25	0.26	0.26	0.27
8.349	0.28	0.28	0.29	0.30	0.31	0.31	0.32
8.393	0.33	0.34	0.35	0.36	0.38	0.40	0.42
8.437	0.44	0.45	0.46	0.47	0.48	0.49	0.50
8.481	0.51	0.53	0.54	0.57	0.59	0.61	0.63
8.525	0.64	0.65	0.67	0.68	0.69	0.71	0.77
8.570	0.79	0.80	0.81	0.83	0.84	0.86	0.87
8.614	0.89	0.90	0.92	0.95	0.98	1.01	1.04
8.658	1.05	1.07	1.09	1.11	1.12	1.14	1.16
8.702	1.18	1.20	1.21	1.23	1.25	1.27	1.29
8.747	1.31	1.33	1.35	1.37	1.39	1.41	1.43
8.791	1.45	1.47	1.49	1.51	1.53	1.55	1.57
8.835	1.59	1.62	1.64	1.66	1.68	1.70	1.73
8.879	1.75	1.77	1.80	1.82	1.84	1.86	1.89
8.923	1.91	1.93	1.96	1.98	2.01	2.03	2.06
8.968	2.08	2.11	2.13	2.16	2.18	2.21	2.23
9.012	2.26	2.29	2.31	2.34	2.37	2.39	2.42
9.056	2.45	2.48	2.51	2.54	2.57	2.60	2.62
9.100	2.65	2.68	2.72	2.76	2.81	2.85	2.89
9.144	2.92	2.96	2.99	3.03	3.06	3.10	3.13
9.189	3.17	3.21	3.24	3.28	3.32	3.35	3.39
9.233	3.43	3.47	3.51	3.55	3.59	3.63	3.67
9.277	3.72	3.76	3.80	3.84	3.89	3.93	3.97
9.321	4.02	4.06	4.11	4.16	4.20	4.25	4.30
9.365	4.35	4.39	4.44	4.49	4.54	4.59	4.64
9.410	4.69	4.74	4.79	4.85	4.90	4.95	5.00
9.454	5.06	5.11	5.17	5.22	5.28	5.34	5.39
9.498	5.45	5.51	5.57	5.63	5.70	5.77	5.85

Line Start Time (hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	Flow Values @ time increment of 0.006 hr						
9.542	5.93	6.02	6.12	6.22	6.33	6.44	6.56
9.587	6.68	6.80	6.93	7.06	7.19	7.34	7.49
9.631	7.65	7.83	8.02	8.22	8.44	8.67	8.91
9.675	9.16	9.42	9.68	9.96	10.24	10.52	10.83
9.719	11.14	11.48	11.85	12.24	12.65	13.09	13.56
9.763	14.07	14.58	15.12	15.68	16.25	16.84	17.44
9.808	18.06	18.72	19.43	20.18	20.99	21.86	22.78
9.852	23.82	24.92	26.05	27.25	28.51	29.81	31.14
9.896	32.50	33.87	35.24	36.60	37.97	39.29	40.58
9.940	41.81	42.99	44.13	45.17	46.16	47.11	48.02
9.984	48.90	49.75	50.55	51.33	52.06	52.75	53.35
10.029	53.87	54.31	54.64	54.85	54.99	55.04	54.97
10.073	54.86	54.68	54.41	54.13	53.85	53.45	53.04
10.117	52.64	52.21	51.76	51.28	50.79	50.28	49.79
10.161	49.29	48.78	48.26	47.75	47.23	46.73	46.22
10.205	45.68	45.14	44.62	44.11	43.57	43.02	42.48
10.250	41.95	41.42	40.88	40.35	39.81	39.29	38.77
10.294	38.27	37.76	37.26	36.77	36.30	35.82	35.35
10.338	34.89	34.42	33.98	33.53	33.09	32.67	32.25
10.382	31.83	31.43	31.04	30.66	30.29	29.92	29.56
10.427	29.21	28.86	28.52	28.17	27.84	27.51	27.19
10.471	26.87	26.56	26.25	25.96	25.67	25.39	25.11
10.515	24.85	24.58	24.33	24.08	23.83	23.58	23.34
10.559	23.10	22.87	22.64	22.41	22.19	21.97	21.77
10.603	21.56	21.35	21.16	20.97	20.78	20.59	20.41
10.648	20.23	20.06	19.89	19.72	19.55	19.39	19.24
10.692	19.09	18.94	18.79	18.65	18.51	18.38	18.25
10.736	18.12	17.99	17.87	17.75	17.63	17.51	17.39
10.780	17.28	17.17	17.07	16.96	16.86	16.76	16.66
10.824	16.57	16.47	16.38	16.29	16.20	16.12	16.03
10.869	15.95	15.86	15.78	15.70	15.62	15.55	15.47
10.913	15.40	15.33	15.26	15.19	15.12	15.05	14.99
10.957	14.92	14.85	14.79	14.73	14.66	14.60	14.54
11.001	14.48	14.42	14.36	14.31	14.25	14.20	14.14
11.045	14.09	14.03	13.98	13.93	13.88	13.83	13.78
11.090	13.73	13.68	13.63	13.59	13.54	13.50	13.45
11.134	13.41	13.37	13.33	13.29	13.25	13.21	13.17
11.178	13.13	13.09	13.06	13.02	12.99	12.96	12.92
11.222	12.89	12.86	12.83	12.80	12.77	12.74	12.71
11.267	12.68	12.65	12.62	12.60	12.57	12.54	12.52
11.311	12.49	12.47	12.44	12.42	12.40	12.37	12.35
11.355	12.33	12.30	12.28	12.26	12.23	12.21	12.19
11.399	12.17	12.15	12.13	12.11	12.09	12.07	12.05
11.443	12.04	12.02	12.00	11.98	11.96	11.94	11.92
11.488	11.91	11.89	11.87	11.86	11.84	11.82	11.81
11.532	11.79	11.77	11.76	11.74	11.73	11.71	11.69
11.576	11.68	11.66	11.65	11.63	11.62	11.60	11.59
11.620	11.57	11.56	11.54	11.53	11.51	11.50	11.48
11.664	11.47	11.45	11.44	11.42	11.41	11.39	11.38
11.709	11.37	11.35	11.34	11.32	11.31	11.29	11.28
11.753	11.26	11.25	11.24	11.22	11.21	11.19	11.18

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.006 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
11.797	11.16	11.15	11.13	11.12	11.11	11.09	11.08
11.841	11.06	11.05	11.03	11.02	11.00	10.99	10.97
11.885	10.96	10.94	10.93	10.91	10.90	10.89	10.87
11.930	10.86	10.84	10.83	10.81	10.80	10.78	10.77
11.974	10.75	10.74	10.72	10.71	10.69	10.68	10.66
12.018	10.65	10.64	10.62	10.61	10.59	10.58	10.56
12.062	10.55	10.53	10.52	10.50	10.49	10.48	10.46
12.107	10.45	10.44	10.42	10.41	10.40	10.38	10.37
12.151	10.36	10.34	10.33	10.32	10.30	10.29	10.28
12.195	10.26	10.25	10.24	10.23	10.22	10.21	10.19
12.239	10.18	10.17	10.16	10.15	10.13	10.12	10.11
12.283	10.10	10.09	10.08	10.07	10.06	10.05	10.04
12.328	10.02	10.01	10.00	9.99	9.98	9.97	9.96
12.372	9.95	9.94	9.93	9.92	9.91	9.90	9.89
12.416	9.88	9.87	9.86	9.85	9.84	9.83	9.82
12.460	9.81	9.80	9.79	9.78	9.77	9.76	9.75
12.504	9.74	9.73	9.72	9.71	9.70	9.69	9.68
12.549	9.67	9.66	9.65	9.64	9.63	9.62	9.61
12.593	9.60	9.59	9.58	9.57	9.57	9.56	9.55
12.637	9.54	9.53	9.52	9.51	9.50	9.49	9.48
12.681	9.47	9.46	9.45	9.44	9.43	9.42	9.41
12.725	9.40	9.39	9.38	9.37	9.36	9.35	9.34
12.770	9.33	9.32	9.31	9.30	9.29	9.28	9.27
12.814	9.26	9.25	9.25	9.24	9.23	9.22	9.21
12.858	9.20	9.19	9.18	9.17	9.16	9.15	9.14
12.902	9.13	9.12	9.11	9.10	9.09	9.08	9.07
12.947	9.06	9.05	9.04	9.03	9.02	9.01	9.00
12.991	8.99	8.98	8.97	8.96	8.95	8.94	8.93
13.035	8.92	8.91	8.90	8.89	8.88	8.87	8.86
13.079	8.85	8.83	8.82	8.81	8.80	8.79	8.78
13.123	8.77	8.76	8.75	8.74	8.73	8.72	8.71
13.168	8.70	8.69	8.68	8.67	8.66	8.65	8.64
13.212	8.63	8.62	8.61	8.60	8.59	8.58	8.57
13.256	8.56	8.55	8.54	8.53	8.51	8.50	8.49
13.300	8.48	8.47	8.46	8.45	8.44	8.43	8.42
13.344	8.41	8.40	8.39	8.38	8.37	8.36	8.35
13.389	8.33	8.32	8.31	8.30	8.29	8.28	8.27
13.433	8.26	8.25	8.24	8.23	8.22	8.21	8.20
13.477	8.18	8.17	8.16	8.15	8.14	8.13	8.12
13.521	8.11	8.10	8.09	8.08	8.07	8.06	8.04
13.565	8.03	8.02	8.01	8.00	7.99	7.98	7.97
13.610	7.96	7.95	7.94	7.92	7.91	7.90	7.89
13.654	7.88	7.87	7.86	7.85	7.83	7.82	7.81
13.698	7.80	7.79	7.78	7.77	7.76	7.75	7.74
13.742	7.72	7.71	7.70	7.69	7.68	7.67	7.66
13.787	7.65	7.63	7.62	7.61	7.60	7.59	7.58
13.831	7.57	7.56	7.55	7.53	7.52	7.51	7.50
13.875	7.49	7.48	7.46	7.45	7.44	7.43	7.42
13.919	7.41	7.40	7.39	7.37	7.36	7.35	7.34
13.963	7.33	7.32	7.30	7.29	7.28	7.27	7.26
14.008	7.25	7.24	7.23	7.21	7.20	7.19	7.18

Bonzi Landfill
Final Closure

Line Start Time (hr)	Flow Values @ time increment of 0.006 hr (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
14.052	7.17	7.16	7.15	7.14	7.13	7.12	7.11
14.096	7.10	7.09	7.08	7.07	7.06	7.05	7.04
14.140	7.03	7.02	7.01	7.01	7.00	6.99	6.98
14.184	6.97	6.97	6.96	6.95	6.94	6.94	6.93
14.229	6.92	6.92	6.91	6.91	6.90	6.89	6.89
14.273	6.88	6.88	6.87	6.87	6.86	6.86	6.85
14.317	6.85	6.84	6.84	6.83	6.83	6.82	6.82
14.361	6.82	6.81	6.81	6.80	6.80	6.80	6.79
14.405	6.79	6.79	6.78	6.78	6.78	6.77	6.77
14.450	6.77	6.76	6.76	6.76	6.75	6.75	6.75
14.494	6.75	6.74	6.74	6.74	6.74	6.73	6.73
14.538	6.73	6.73	6.72	6.72	6.72	6.72	6.71
14.582	6.71	6.71	6.71	6.71	6.70	6.70	6.70
14.627	6.70	6.69	6.69	6.69	6.69	6.69	6.68
14.671	6.68	6.68	6.68	6.68	6.67	6.67	6.67
14.715	6.67	6.67	6.66	6.66	6.66	6.66	6.66
14.759	6.66	6.65	6.65	6.65	6.65	6.65	6.64
14.803	6.64	6.64	6.64	6.64	6.64	6.63	6.63
14.848	6.63	6.63	6.63	6.62	6.62	6.62	6.62
14.892	6.62	6.62	6.61	6.61	6.61	6.61	6.61
14.936	6.61	6.60	6.60	6.60	6.60	6.60	6.60
14.980	6.59	6.59	6.59	6.59	6.59	6.59	6.58
15.024	6.58	6.58	6.58	6.58	6.57	6.57	6.57
15.069	6.57	6.57	6.57	6.56	6.56	6.56	6.56
15.113	6.56	6.56	6.55	6.55	6.55	6.55	6.55
15.157	6.55	6.54	6.54	6.54	6.54	6.54	6.54
15.201	6.53	6.53	6.53	6.53	6.53	6.53	6.52
15.245	6.52	6.52	6.52	6.52	6.51	6.51	6.51
15.290	6.51	6.51	6.51	6.50	6.50	6.50	6.50
15.334	6.50	6.50	6.49	6.49	6.49	6.49	6.49
15.378	6.48	6.48	6.48	6.48	6.48	6.48	6.47
15.422	6.47	6.47	6.47	6.47	6.47	6.46	6.46
15.467	6.46	6.46	6.46	6.46	6.45	6.45	6.45
15.511	6.45	6.45	6.44	6.44	6.44	6.44	6.44
15.555	6.44	6.43	6.43	6.43	6.43	6.43	6.42
15.599	6.42	6.42	6.42	6.42	6.42	6.41	6.41
15.643	6.41	6.41	6.41	6.41	6.40	6.40	6.40
15.688	6.40	6.40	6.39	6.39	6.39	6.39	6.39
15.732	6.39	6.38	6.38	6.38	6.38	6.38	6.37
15.776	6.37	6.37	6.37	6.37	6.36	6.36	6.36
15.820	6.36	6.36	6.36	6.35	6.35	6.35	6.35
15.864	6.35	6.34	6.34	6.34	6.34	6.34	6.34
15.909	6.33	6.33	6.33	6.33	6.33	6.32	6.32
15.953	6.32	6.32	6.32	6.31	6.31	6.31	6.31
15.997	6.31	6.31	6.30	6.30	6.30	6.30	6.30
16.041	6.29	6.29	6.29	6.29	6.29	6.28	6.28
16.085	6.28	6.28	6.28	6.28	6.27	6.27	6.27
16.130	6.27	6.27	6.26	6.26	6.26	6.26	6.26
16.174	6.25	6.25	6.25	6.25	6.25	6.24	6.24
16.218	6.24	6.24	6.24	6.23	6.23	6.23	6.23
16.262	6.23	6.23	6.22	6.22	6.22	6.22	6.22

Line Start Time (hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	Flow Values @ time increment of 0.006 hr						
16.307	6.21	6.21	6.21	6.21	6.21	6.20	6.20
16.351	6.20	6.20	6.20	6.19	6.19	6.19	6.19
16.395	6.19	6.18	6.18	6.18	6.18	6.18	6.17
16.439	6.17	6.17	6.17	6.17	6.16	6.16	6.16
16.483	6.16	6.16	6.15	6.15	6.15	6.15	6.15
16.528	6.14	6.14	6.14	6.14	6.14	6.13	6.13
16.572	6.13	6.13	6.13	6.12	6.12	6.12	6.12
16.616	6.12	6.11	6.11	6.11	6.11	6.11	6.10
16.660	6.10	6.10	6.10	6.10	6.09	6.09	6.09
16.704	6.09	6.09	6.08	6.08	6.08	6.08	6.08
16.749	6.07	6.07	6.07	6.07	6.07	6.06	6.06
16.793	6.06	6.06	6.06	6.05	6.05	6.05	6.05
16.837	6.05	6.04	6.04	6.04	6.04	6.04	6.03
16.881	6.03	6.03	6.03	6.03	6.02	6.02	6.02
16.925	6.02	6.02	6.01	6.01	6.01	6.01	6.00
16.970	6.00	6.00	6.00	6.00	5.99	5.99	5.99
17.014	5.99	5.99	5.98	5.98	5.98	5.98	5.98
17.058	5.97	5.97	5.97	5.97	5.96	5.96	5.96
17.102	5.96	5.96	5.95	5.95	5.95	5.95	5.95
17.147	5.94	5.94	5.94	5.94	5.94	5.93	5.93
17.191	5.93	5.93	5.93	5.92	5.92	5.92	5.92
17.235	5.91	5.91	5.91	5.91	5.91	5.90	5.90
17.279	5.90	5.90	5.90	5.89	5.89	5.89	5.89
17.323	5.88	5.88	5.88	5.88	5.88	5.87	5.87
17.368	5.87	5.87	5.87	5.86	5.86	5.86	5.86
17.412	5.85	5.85	5.85	5.85	5.85	5.84	5.84
17.456	5.84	5.84	5.84	5.83	5.83	5.83	5.83
17.500	5.82	5.82	5.82	5.82	5.82	5.81	5.81
17.544	5.81	5.81	5.81	5.80	5.80	5.80	5.80
17.589	5.79	5.79	5.79	5.79	5.79	5.78	5.78
17.633	5.78	5.78	5.77	5.77	5.77	5.77	5.77
17.677	5.76	5.76	5.76	5.76	5.75	5.75	5.75
17.721	5.75	5.75	5.74	5.74	5.74	5.74	5.73
17.765	5.73	5.73	5.73	5.73	5.72	5.72	5.72
17.810	5.72	5.72	5.71	5.71	5.71	5.71	5.70
17.854	5.70	5.70	5.70	5.69	5.69	5.69	5.69
17.898	5.69	5.68	5.68	5.68	5.68	5.68	5.67
17.942	5.67	5.67	5.67	5.66	5.66	5.66	5.66
17.987	5.65	5.65	5.65	5.65	5.65	5.64	5.64
18.031	5.64	5.64	5.63	5.63	5.63	5.63	5.63
18.075	5.62	5.62	5.62	5.62	5.61	5.61	5.61
18.119	5.61	5.61	5.60	5.60	5.60	5.60	5.59
18.163	5.59	5.59	5.59	5.58	5.58	5.58	5.58
18.208	5.58	5.57	5.57	5.57	5.57	5.56	5.56
18.252	5.56	5.56	5.56	5.55	5.55	5.55	5.55
18.296	5.54	5.54	5.54	5.54	5.53	5.53	5.53
18.340	5.53	5.53	5.52	5.52	5.52	5.52	5.51
18.384	5.51	5.51	5.51	5.50	5.50	5.50	5.50
18.429	5.50	5.49	5.49	5.49	5.49	5.48	5.48
18.473	5.48	5.48	5.47	5.47	5.47	5.47	5.47
18.517	5.46	5.46	5.46	5.46	5.45	5.45	5.45

Line Start Time (hr)	------------ Flow Values @ time increment of 0.006 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
18.561	5.45	5.44	5.44	5.44	5.44	5.43	5.43
18.605	5.43	5.43	5.43	5.42	5.42	5.42	5.42
18.650	5.41	5.41	5.41	5.41	5.40	5.40	5.40
18.694	5.40	5.40	5.39	5.39	5.39	5.39	5.38
18.738	5.38	5.38	5.38	5.37	5.37	5.37	5.37
18.782	5.36	5.36	5.36	5.36	5.36	5.35	5.35
18.827	5.35	5.35	5.34	5.34	5.34	5.34	5.33
18.871	5.33	5.33	5.33	5.32	5.32	5.32	5.32
18.915	5.31	5.31	5.31	5.31	5.31	5.30	5.30
18.959	5.30	5.30	5.29	5.29	5.29	5.29	5.28
19.003	5.28	5.28	5.28	5.27	5.27	5.27	5.27
19.048	5.26	5.26	5.26	5.26	5.26	5.25	5.25
19.092	5.25	5.25	5.24	5.24	5.24	5.24	5.23
19.136	5.23	5.23	5.23	5.22	5.22	5.22	5.22
19.180	5.21	5.21	5.21	5.21	5.20	5.20	5.20
19.224	5.20	5.20	5.19	5.19	5.19	5.19	5.18
19.269	5.18	5.18	5.18	5.17	5.17	5.17	5.17
19.313	5.16	5.16	5.16	5.16	5.15	5.15	5.15
19.357	5.15	5.14	5.14	5.14	5.14	5.13	5.13
19.401	5.13	5.13	5.12	5.12	5.12	5.12	5.11
19.445	5.11	5.11	5.11	5.11	5.10	5.10	5.10
19.490	5.10	5.09	5.09	5.09	5.09	5.08	5.08
19.534	5.08	5.08	5.07	5.07	5.07	5.07	5.06
19.578	5.06	5.06	5.06	5.05	5.05	5.05	5.05
19.622	5.04	5.04	5.04	5.04	5.03	5.03	5.03
19.667	5.03	5.02	5.02	5.02	5.02	5.01	5.01
19.711	5.01	5.01	5.00	5.00	5.00	5.00	4.99
19.755	4.99	4.99	4.99	4.98	4.98	4.98	4.98
19.799	4.97	4.97	4.97	4.97	4.96	4.96	4.96
19.843	4.96	4.95	4.95	4.95	4.95	4.94	4.94
19.888	4.94	4.94	4.93	4.93	4.93	4.93	4.92
19.932	4.92	4.92	4.92	4.91	4.91	4.91	4.91
19.976	4.90	4.90	4.90	4.90	4.89	4.89	4.89
20.020	4.89	4.88	4.88	4.88	4.88	4.87	4.87
20.064	4.87	4.87	4.86	4.86	4.86	4.86	4.85
20.109	4.85	4.85	4.85	4.84	4.84	4.84	4.84
20.153	4.83	4.83	4.83	4.83	4.82	4.82	4.82
20.197	4.82	4.81	4.81	4.81	4.81	4.80	4.80
20.241	4.80	4.80	4.79	4.79	4.79	4.79	4.78
20.285	4.78	4.78	4.78	4.77	4.77	4.77	4.77
20.330	4.76	4.76	4.76	4.76	4.75	4.75	4.75
20.374	4.74	4.74	4.74	4.74	4.73	4.73	4.73
20.418	4.73	4.72	4.72	4.72	4.72	4.71	4.71
20.462	4.71	4.71	4.70	4.70	4.70	4.70	4.69
20.507	4.69	4.69	4.69	4.68	4.68	4.68	4.68
20.551	4.67	4.67	4.67	4.67	4.66	4.66	4.66
20.595	4.65	4.65	4.65	4.65	4.64	4.64	4.64
20.639	4.64	4.63	4.63	4.63	4.63	4.62	4.62
20.683	4.62	4.62	4.61	4.61	4.61	4.61	4.60
20.728	4.60	4.60	4.60	4.59	4.59	4.59	4.59
20.772	4.58	4.58	4.58	4.57	4.57	4.57	4.57

Bonzi Landfill
Final Closure

Line Start Time (hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
	------------ Flow Values @ time increment of 0.006 hr ------------						
20.816	4.56	4.56	4.56	4.56	4.55	4.55	4.55
20.860	4.55	4.54	4.54	4.54	4.54	4.53	4.53
20.904	4.53	4.53	4.52	4.52	4.52	4.52	4.51
20.949	4.51	4.51	4.50	4.50	4.50	4.50	4.49
20.993	4.49	4.49	4.49	4.48	4.48	4.48	4.48
21.037	4.47	4.47	4.47	4.47	4.46	4.46	4.46
21.081	4.45	4.45	4.45	4.45	4.44	4.44	4.44
21.125	4.44	4.43	4.43	4.43	4.43	4.42	4.42
21.170	4.42	4.42	4.41	4.41	4.41	4.40	4.40
21.214	4.40	4.40	4.39	4.39	4.39	4.39	4.38
21.258	4.38	4.38	4.38	4.37	4.37	4.37	4.36
21.302	4.36	4.36	4.36	4.35	4.35	4.35	4.35
21.347	4.34	4.34	4.34	4.34	4.33	4.33	4.33
21.391	4.33	4.32	4.32	4.32	4.31	4.31	4.31
21.435	4.31	4.30	4.30	4.30	4.30	4.29	4.29
21.479	4.29	4.29	4.28	4.28	4.28	4.27	4.27
21.523	4.27	4.27	4.26	4.26	4.26	4.26	4.25
21.568	4.25	4.25	4.25	4.24	4.24	4.24	4.23
21.612	4.23	4.23	4.23	4.22	4.22	4.22	4.22
21.656	4.21	4.21	4.21	4.21	4.20	4.20	4.20
21.700	4.19	4.19	4.19	4.19	4.18	4.18	4.18
21.744	4.18	4.17	4.17	4.17	4.17	4.16	4.16
21.789	4.16	4.15	4.15	4.15	4.15	4.14	4.14
21.833	4.14	4.14	4.13	4.13	4.13	4.12	4.12
21.877	4.12	4.12	4.11	4.11	4.11	4.11	4.10
21.921	4.10	4.10	4.10	4.09	4.09	4.09	4.08
21.965	4.08	4.08	4.08	4.07	4.07	4.07	4.07
22.010	4.06	4.06	4.06	4.05	4.05	4.05	4.05
22.054	4.04	4.04	4.04	4.04	4.03	4.03	4.03
22.098	4.02	4.02	4.02	4.02	4.01	4.01	4.01
22.142	4.01	4.00	4.00	4.00	3.99	3.99	3.99
22.187	3.99	3.98	3.98	3.98	3.98	3.97	3.97
22.231	3.97	3.96	3.96	3.96	3.96	3.95	3.95
22.275	3.95	3.95	3.94	3.94	3.94	3.93	3.93
22.319	3.93	3.93	3.92	3.92	3.92	3.92	3.91
22.363	3.91	3.91	3.90	3.90	3.90	3.90	3.89
22.408	3.89	3.89	3.89	3.88	3.88	3.88	3.87
22.452	3.87	3.87	3.87	3.86	3.86	3.86	3.86
22.496	3.85	3.85	3.85	3.84	3.84	3.84	3.84
22.540	3.83	3.83	3.83	3.83	3.82	3.82	3.82
22.584	3.81	3.81	3.81	3.81	3.80	3.80	3.80
22.629	3.79	3.79	3.79	3.79	3.78	3.78	3.78
22.673	3.78	3.77	3.77	3.77	3.76	3.76	3.76
22.717	3.76	3.75	3.75	3.75	3.75	3.74	3.74
22.761	3.74	3.73	3.73	3.73	3.73	3.72	3.72
22.805	3.72	3.71	3.71	3.71	3.71	3.70	3.70
22.850	3.70	3.70	3.69	3.69	3.69	3.68	3.68
22.894	3.68	3.68	3.67	3.67	3.67	3.66	3.66
22.938	3.66	3.66	3.65	3.65	3.65	3.65	3.64
22.982	3.64	3.64	3.63	3.63	3.63	3.63	3.62
23.027	3.62	3.62	3.61	3.61	3.61	3.61	3.60

Bonzi Landfill
Final Closure

Line Start Time (hr)	------------ Flow Values @ time increment of 0.006 hr ------------ (cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
23.071	3.60	3.60	3.59	3.59	3.59	3.59	3.58
23.115	3.58	3.58	3.58	3.57	3.57	3.57	3.56
23.159	3.56	3.56	3.56	3.55	3.55	3.55	3.54
23.203	3.54	3.54	3.54	3.53	3.53	3.53	3.53
23.248	3.52	3.52	3.52	3.51	3.51	3.51	3.51
23.292	3.50	3.50	3.50	3.49	3.49	3.49	3.49
23.336	3.48	3.48	3.48	3.47	3.47	3.47	3.47
23.380	3.46	3.46	3.46	3.46	3.45	3.45	3.45
23.424	3.44	3.44	3.44	3.44	3.43	3.43	3.43
23.469	3.42	3.42	3.42	3.42	3.41	3.41	3.41
23.513	3.40	3.40	3.40	3.40	3.39	3.39	3.39
23.557	3.38	3.38	3.38	3.38	3.37	3.37	3.37
23.601	3.36	3.36	3.36	3.36	3.35	3.35	3.35
23.645	3.35	3.34	3.34	3.34	3.33	3.33	3.33
23.690	3.33	3.32	3.32	3.32	3.31	3.31	3.31
23.734	3.31	3.30	3.30	3.30	3.29	3.29	3.29
23.778	3.29	3.28	3.28	3.28	3.27	3.27	3.27
23.822	3.27	3.26	3.26	3.26	3.25	3.25	3.25
23.867	3.25	3.24	3.24	3.24	3.23	3.23	3.23
23.911	3.23	3.22	3.22	3.22	3.21	3.21	3.21
23.955	3.21	3.20	3.20	3.20	3.19	3.19	3.19
23.999	3.19	3.18	3.17	3.16	3.15	3.14	3.11
24.043	3.09	3.05	3.02	2.97	2.93	2.88	2.82
24.088	2.73	2.68	2.62	2.57	2.49	2.41	2.36
24.132	2.30	2.24	2.19	2.14	2.08	2.03	1.98
24.176	1.93	1.88	1.82	1.75	1.69	1.65	1.61
24.220	1.54	1.48	1.44	1.40	1.36	1.29	1.24
24.264	1.20	1.17	1.13	1.10	1.07	1.03	1.00
24.309	0.97	0.94	0.91	0.88	0.85	0.82	0.80
24.353	0.77	0.74	0.72	0.69	0.67	0.65	0.62
24.397	0.60	0.58	0.56	0.54	0.52	0.50	0.49
24.441	0.47	0.38	0.34	0.30	0.28	0.27	0.26
24.485	0.26	0.25	0.24	0.23	0.22	0.22	0.21
24.530	0.20	0.20	0.19	0.18	0.18	0.17	0.17
24.574	0.16	0.16	0.15	0.15	0.14	0.14	0.13
24.618	0.13	0.13	0.12	0.12	0.11	0.11	0.11
24.662	0.10	0.10	0.10	0.09	0.09	0.09	0.08
24.707	0.08	0.08	0.08	0.07	0.07	0.07	0.07
24.751	0.07	0.06	0.06	0.06	0.06	0.06	0.05
24.795	0.05						

ATTACHMENT 3

PEAK DISCHARGE ROUTING CALCULATIONS

Project Name: Bonzi Landfill
Client: Bonzi Sanitation Landfill
Job No.: 2012.0023
Date: 9/23/2014, Revised 2/10/2015
Calculated By: RPB/NC

	100-yr 24-hr Storm Event Subarea Contribution to Total Flow (cfs)								
	SA-1	**SA-2**	**SA-3**	**SA-4**	**SA-5**	**SA-6**	**SA-7**	**SA-8**	**SA-8**
Subarea Contribution to Total Flow (cfs)	9.79	9.02	1.11	4.75	6.46	2.97	15.60	3.37	9.72
Time of Peak (hrs)	10.01	9.98	10.01	10.15	10.13	10.09	10.20	9.93	10.10

	SA-1	TOTAL
CP-1	9.79	9.79

	CP-1	SA-5	TOTAL
CP-2	9.79	6.46	16.25

	CP-2	SA-4	TOTAL
CP-3	16.25	4.75	21.00

	SA-2	TOTAL
CP-4	9.02	9.02

	CP-4	SA-3	TOTAL
CP-5	9.02	1.11	10.13

	SA-7	TOTAL
CP-6	15.60	15.60

	CP-6	SA-8	TOTAL
CP-7	15.60	3.37	18.97

	CP-3	C9-5	CP-7	SA-6	SA-8	TOTAL
CP-8	21.00	10.13	18.97	2.97	9.72	62.79

ATTACHMENT 4

CHANNEL SIZING

Project Bonzi Sanitation Landfill - Final Closure Plan
Client: Ma-Ru Holdings Company, Inc.
Job No.: 2012.0023
Calc'd By: NC
Date: 10/1/2014

DRAINAGE CHANNEL SUMMARY

Areas Contributing to Flow	Peak Flow (cfs)	Design Channel Size				Calculated Channel Parameters		Freeboard (ft)	Factor of Safety (cfs/cfs)	Channel Type	Channel Lining
		Side Slopes (z:1)	Flowline Slope (ft/ft)	Bottom Width (ft)	Depth (ft)	Normal Depth (ft)	Peak Discharge (cfs)				
SA-1	9.8	2.0	0.0025	1.0	1.5	1.35	12.6	0.15	1.3	2	Grass
SA-1 / SA-5	16.3	2.0	0.0050	2.0	1.5	1.26	23.8	0.24	1.5	3	Grass
SA-5 / SA-4	21.0	2.0	0.0050	3.0	1.5	1.26	30.0	0.24	1.4	4	Grass
SA-2	9.0	2.0	0.0100	1.0	1.5	0.96	25.2	0.54	2.8	2	Grass
SA-2 / SA-3	10.1	2.0	0.0250	2.0	1.5	0.66	53.2	0.84	5.3	3	Grass

Channel at SA-1 - Type 2 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00250	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	1.00	ft
Discharge	9.80	ft³/s

Results

Normal Depth	1.35	ft
Flow Area	4.98	ft²
Wetted Perimeter	7.03	ft
Hydraulic Radius	0.71	ft
Top Width	6.39	ft
Critical Depth	0.87	ft
Critical Slope	0.01821	ft/ft
Velocity	1.97	ft/s
Velocity Head	0.06	ft
Specific Energy	1.41	ft
Froude Number	0.39	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.35	ft
Critical Depth	0.87	ft
Channel Slope	0.00250	ft/ft
Critical Slope	0.01821	ft/ft

Channel at SA-2 - Type 2 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	1.00	ft
Discharge	9.00	ft^3/s

Results

Normal Depth	0.96	ft
Flow Area	2.78	ft^2
Wetted Perimeter	5.27	ft
Hydraulic Radius	0.53	ft
Top Width	4.82	ft
Critical Depth	0.83	ft
Critical Slope	0.01840	ft/ft
Velocity	3.24	ft/s
Velocity Head	0.16	ft
Specific Energy	1.12	ft
Froude Number	0.75	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.96	ft
Critical Depth	0.83	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01840	ft/ft

Type 2 Channel - Peak Discharge (0.25% Slope)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00250	ft/ft
Normal Depth	1.50	ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	1.00	ft

Results

Discharge	12.57	ft^3/s
Flow Area	6.00	ft^2
Wetted Perimeter	7.71	ft
Hydraulic Radius	0.78	ft
Top Width	7.00	ft
Critical Depth	0.98	ft
Critical Slope	0.01764	ft/ft
Velocity	2.10	ft/s
Velocity Head	0.07	ft
Specific Energy	1.57	ft
Froude Number	0.40	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	0.98	ft
Channel Slope	0.00250	ft/ft
Critical Slope	0.01764	ft/ft

Type 2 Channel - Peak Discharge (1.0% Slope)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01000	ft/ft
Normal Depth	1.50	ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	1.00	ft

Results

Discharge	25.15	ft^3/s
Flow Area	6.00	ft^2
Wetted Perimeter	7.71	ft
Hydraulic Radius	0.78	ft
Top Width	7.00	ft
Critical Depth	1.35	ft
Critical Slope	0.01616	ft/ft
Velocity	4.19	ft/s
Velocity Head	0.27	ft
Specific Energy	1.77	ft
Froude Number	0.80	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.35	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01616	ft/ft

Channel at SA-3 - Type 3 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.02500	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	10.10	ft³/s

Results

Normal Depth	0.66	ft
Flow Area	2.21	ft²
Wetted Perimeter	4.97	ft
Hydraulic Radius	0.45	ft
Top Width	4.66	ft
Critical Depth	0.72	ft
Critical Slope	0.01796	ft/ft
Velocity	4.56	ft/s
Velocity Head	0.32	ft
Specific Energy	0.99	ft
Froude Number	1.17	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.66	ft
Critical Depth	0.72	ft
Channel Slope	0.02500	ft/ft
Critical Slope	0.01796	ft/ft

Channel at SA-5 - Type 3 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	16.30	ft³/s

Results

Normal Depth	1.26	ft
Flow Area	5.67	ft²
Wetted Perimeter	7.62	ft
Hydraulic Radius	0.74	ft
Top Width	7.02	ft
Critical Depth	0.94	ft
Critical Slope	0.01688	ft/ft
Velocity	2.88	ft/s
Velocity Head	0.13	ft
Specific Energy	1.38	ft
Froude Number	0.56	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.26	ft
Critical Depth	0.94	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01688	ft/ft

Type 3 Channel - Peak Discharge (0.5% Slope)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	ft/ft
Normal Depth	1.50	ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft

Results

Discharge	23.78	ft³/s
Flow Area	7.50	ft²
Wetted Perimeter	8.71	ft
Hydraulic Radius	0.86	ft
Top Width	8.00	ft
Critical Depth	1.14	ft
Critical Slope	0.01609	ft/ft
Velocity	3.17	ft/s
Velocity Head	0.16	ft
Specific Energy	1.66	ft
Froude Number	0.58	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.14	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01609	ft/ft

Type 3 Channel - Peak Discharge (2.5% Slope)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.02500	ft/ft
Normal Depth	1.50	ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft

Results

Discharge	53.17	ft³/s
Flow Area	7.50	ft²
Wetted Perimeter	8.71	ft
Hydraulic Radius	0.86	ft
Top Width	8.00	ft
Critical Depth	1.70	ft
Critical Slope	0.01453	ft/ft
Velocity	7.09	ft/s
Velocity Head	0.78	ft
Specific Energy	2.28	ft
Froude Number	1.29	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.70	ft
Channel Slope	0.02500	ft/ft
Critical Slope	0.01453	ft/ft

Channel at SA-4 - Type 4 Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	21.00	ft³/s

Results

Normal Depth	1.26	ft
Flow Area	6.93	ft²
Wetted Perimeter	8.62	ft
Hydraulic Radius	0.80	ft
Top Width	8.03	ft
Critical Depth	0.93	ft
Critical Slope	0.01629	ft/ft
Velocity	3.03	ft/s
Velocity Head	0.14	ft
Specific Energy	1.40	ft
Froude Number	0.57	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.26	ft
Critical Depth	0.93	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01629	ft/ft

Type 4 Channel - Peak Discharge (0.5% Slope)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	ft/ft
Normal Depth	1.50	ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	3.00	ft

Results

Discharge	29.97	ft^3/s
Flow Area	9.00	ft^2
Wetted Perimeter	9.71	ft
Hydraulic Radius	0.93	ft
Top Width	9.00	ft
Critical Depth	1.13	ft
Critical Slope	0.01554	ft/ft
Velocity	3.33	ft/s
Velocity Head	0.17	ft
Specific Energy	1.67	ft
Froude Number	0.59	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.13	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01554	ft/ft

ATTACHMENT 5

CULVERT SIZING

Culvert Calculator Report
Culvert at SA-3/CP-5

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	57.00	ft	Headwater Depth/Height	0.92	
Computed Headwater Eleva	56.84	ft	Discharge	10.10	cfs
Inlet Control HW Elev.	56.68	ft	Tailwater Elevation	55.00	ft
Outlet Control HW Elev.	56.84	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	55.00	ft	Downstream Invert	54.20	ft
Length	40.00	ft	Constructed Slope	0.020000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.80	ft
Slope Type	Steep		Normal Depth	0.74	ft
Flow Regime	Supercritical		Critical Depth	1.14	ft
Velocity Downstream	8.62	ft/s	Critical Slope	0.004448	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	56.84	ft	Upstream Velocity Head	0.47	ft
Ke	0.50		Entrance Loss	0.23	ft

Inlet Control Properties					
Inlet Control HW Elev.	56.68	ft	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall		Area Full	3.1	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Calculator Report
Culvert at SA-4/CP-3

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	68.40	ft	Headwater Depth/Height	1.54	
Computed Headwater Eleva	68.08	ft	Discharge	21.00	cfs
Inlet Control HW Elev.	68.08	ft	Tailwater Elevation	62.30	ft
Outlet Control HW Elev.	67.99	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	65.00	ft	Downstream Invert	61.40	ft
Length	91.00	ft	Constructed Slope	0.039560	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.97	ft
Slope Type	Steep		Normal Depth	0.92	ft
Flow Regime	Supercritical		Critical Depth	1.64	ft
Velocity Downstream	13.98	ft/s	Critical Slope	0.007322	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	67.99	ft	Upstream Velocity Head	0.90	ft
Ke	0.50		Entrance Loss	0.45	ft

Inlet Control Properties					
Inlet Control HW Elev.	68.08	ft	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	3.1	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

ATTACHMENT 6

RIP-RAP SIZING

Project Name: *Bonzi Landfill*
Client: *Bonzi Sanitation Landfill*
Job No.: *2012.0023*
Date: *09/23/2014*
Calculated By: *RPB*

RIP-RAP APRON SIZING[1]								
Channel Section	Channel or Pipe Outlet Width (feet)	Discharge (cfs)	Median Stone Diameter (d_{50}, inches)	Max Stone Diameter (inches)	Required Rip-Rap Thickness (inches)	Minimum Length of Apron (feet)	Minimum Width at Outlet (feet)	Minimum Width at Apron End (feet)
Eastern Outlet to Retention (CP-3)	2.0	21.0	6.0	9.0	13.5	12.0	6.0	14.0
Western Outlet to Retention (CP-5)	2.0	10.1	6.0	9.0	13.5	12.0	6.0	14.0

Notes:
1) Rip-rap apron sized using Figure 7.45 or Figure 7.46 in the "Erosion and Sediment Control Handbook".

Sources:

Goldman, Steven J., Jackson, Katherine, and Bursztynsky, Tara A. (1986) “Erosion and Sediment Control Handbook”, McGraw-Hill, Inc. pp 5.1 – 5.33.

ATTACHMENT 7

STORM WATER RETENTION BASIN SIZING

Project Name: Bonzi Landfill
Client: Bonzi Sanitation Landfill
Job No.: 2012.0023
Date: 9/23/2014, Revised 2/10/2015
Calculated By: RPB/NC

	100-yr 24-hr Storm Event Subarea Contribution to Total Volume (in)								
	SA-1	**SA-2**	**SA-3**	**SA-4**	**SA-5**	**SA-6**	**SA-7**	**SA-8**	**SA-9**
Subarea Contribution to Runoff Depth (in)	1.218	1.218	1.204	1.217	1.218	1.215	1.219	1.215	1.218
Drainage Area (ac)	13.0	11.7	1.8	8.5	11.1	4.6	31.4	4.0	15.7
Runoff Volume (CF)	57,477	51,730	7,867	37,551	49,077	20,288	138,944	17,642	69,415

	Total Volumes (CF)
100-yr 24-hr	449,990

Project Name: Bonzi Landfill
Client: Bonzi Sanitation Landfill
Job No.: 2012.0023
Date: 9/23/2014, Revised 2/10/2015
Calculated By: RPB/NC

STORM WATER RETENTION POND VOLUME
(By Average End Area Method)

Pond Depth (ft)	Contour Elevation (ft)	Plan Area (sq ft)	Average Area (sq ft)	Contour Interval (ft)	Volume (cu ft)	Cumulative Volume (cu ft)	Cumulative Volume (ac-ft)
14	57	381701	366,094	1.0	366,094	2,371,643	54.445
13	56	350487	345,403	1.0	345,403	2,005,549	46.041
12	55	340319	334,944	1.0	334,944	1,660,146	38.112
11	54	329569	313,259	1.0	313,259	1,325,202	30.422
10	53	296949	287,644	1.0	287,644	1,011,944	23.231
9	52	278340	269,850	1.0	269,850	724,299	16.628
8	51	261361	249,905	1.0	249,905	454,449	10.433
7	50	238449	130,349	1.0	130,349	204,544	4.696
6	49	22249	20,571	1.0	20,571	74,195	1.703
5	48	18892	16,750	1.0	16,750	53,624	1.231
4	47	14607	13,222	1.0	13,222	36,875	0.847
3	46	11837	10,566	1.0	10,566	23,653	0.543
2	45	9295	8,129	1.0	8,129	13,087	0.300
1	44	6963	4,958	1.0	4,958	4,958	0.114
0	43	2952	--	--	--	--	--

~8 ft depth reached from a single 100 yr 24 hr storm event generating 449,990 CF of runoff

GROUNDWATER TREATMENT SYSTEM POND SIZING

Table 4

Water Balance Analysis - Groundwater Treatment System Retention Pond

2650 West Hatch Road

Stanislaus County, California

Month	Input				Output			Totals		
	Precipitation (inches)	Direct Rainfall (cubic feet)	WMU Run-Off (cubic feet)	GTS Discharge (cubic feet)	Pan Evaporation (inches)	Actual Evaporation (cubic feet)	Vineyard Irrigation (cubic feet)	Volume of Water in Pond (cubic feet)	Depth of Water in Pond (feet)	Freeboard (feet)
Initial	-	-	-	-	-	-	-	-	0	9.13
October	0.57	16,278	8,139	745,989	5.16	48,762	718,502	0	0	9.13
November	1.50	42,838	21,419	721,925	2.44	23,058	577,540	142,746	1.26	7.87
December	1.97	56,260	28,130	745,989	1.54	14,553	577,540	324,772	2.86	6.27
January[1]	5.33	152,216	76,108	745,989	1.38	13,041	577,540	556,288	4.91	4.22
February	2.14	61,115	30,557	673,797	2.08	19,656	577,540	663,446	5.85	3.28
March	1.62	46,265	23,132	745,989	4.61	43,565	577,540	811,463	7.16	1.97
April	1.21	34,556	17,278	721,925	6.65	62,843	577,540	910,283	8.03	1.10
May	0.29	8,282	4,141	745,989	8.98	84,861	866,310	709,242	6.25	2.88
June	0.07	1,999	1,000	721,925	10.6	100,170	1,155,080	176,917	1.56	7.57
July	0.06	1,714	857	745,989	10.9	103,005	1,139,935	0	0	9.13
August	0.08	2,285	1,142	745,989	9.06	85,617	663,358	0	0	9.13
September	0.17	4,855	2,427	721,925	7.4	69,930	658,340	0	0	9.13

Retention Pond Capacity

- Design Volume: 1,620,000 $feet^3$
- Sediment Load Volume: 125,000 $feet^3$
- Adjusted Volume: 1,495,000 $feet^3$
- Groundwater Treatment Sy: 113,400 square feet

Precipitation Data from Table 2, June 1996 Final Closure Plan (EBA, 1996)
Run-off Calculation = Precipitation*Runoff Area*0.5
Run-off Area = 7.87

Pan Evaporation Rate from Table 3, June 1996 Final Closure Plan (EBA, 1996)

Average precipitation value derived from Modesto weather station as reported by Western Regional Climate Center.
Average evaporation value derived from Fresno weather station as reported by California Department of Water Resources.

1. 100-year 24-hour storm event (3-inches) added to mean monthly precipitation.

APPENDIX F

SOIL LOSS ANALYSIS

APPENDIX F

SOIL LOSS ANALYSIS
BONZI SANITATION LANDFILL
FINAL CLOSURE WMU'S II-IV

I. INTRODUCTION

The final cover for Waste Management Units (WMUs) II through IV are designed to minimize soil erosion. Based on soil and climatologic conditions of the site, a seed mix and planting technique will be implemented in order to establish a vegetative cover, which is adapted to site conditions and requires minimal maintenance. In addition to establishing vegetative cover, slopes must be designed to limit soil erosion losses to acceptable rates.

II. PREDICTING SOIL LOSS

This analysis employs the Universal Soil Loss Equation (USLE) to verify the adequacy of the final cover design and stabilization criteria of the selected vegetation. The soil loss analysis was performed in order to determine soil loss from the landfill cap during the 2-year, 6-hour precipitation event in order to compare results with U.S. EPA guidelines established at a maximum of 2.0 tons per acre for this particular precipitation event (U.S. EPA, 1982). In order to minimize potential future maintenance requirements, this quantity was set as the maximum allowable rate of erosion for the final cover.

The USLE predicts soil loss due to water induced sheet and rill erosion from the final cover in accordance with Title 27 of the California Code of Regulations (27CCR), §21150, and incorporates the following factors:

- Rainfall-erosivity factor;
- Land use factor;
- Soil erodibility factor; and
- Factor accounting for the length and steepness of the final cover slopes.

The USLE provides average soil loss as the product of five factors and was designed to calculate average soil loss due to rainfall runoff episodes on agricultural lands. The USLE estimates sheet and rill erosion from initial mobilization, and does not account for soil losses due to gullying. The USLE does not consider the effects of soil re-deposition. The Universal Soil Loss Equation is defined as follows:

$$A = RKLSCP$$

Where:

A = The computed soil loss per unit area - Expressed in the units selected for K and the period selected for R. For this analysis, K and R were selected such that A is computed in tons per acre per year.

R = The rainfall and runoff factor - R is the number of rainfall erosion index units.

K = The soil erodibility factor - K is the soil loss rate per erosion index unit for a specified soil as measured on a unit plot, which is defined as a 72.6-foot length of uniform 9 percent slope in clean tilled continuous fallow.

LS = The length-slope factor - LS is the ratio of soil loss per unit area from a given site to that from a unit plot having a 9 percent slope and 72.6-foot length.

C = The cover and management factor - C is the ratio of soil loss from an area with specified cover and management to that from an identical area in tilled continuous fallow.

P = The support practice factor - P is the ratio of soil loss with a farming support practice like contouring, strip cropping, or terracing to that with straight-row farming up and down the slope. Often, C and P will be combined into one factor (CP).

The values and sources for the specific terms of the USLE are presented below:

Determination of A - The product of the five factors representative of the site was computed and evaluated using Table F-1 for the first year after closure and Table F-2 for subsequent years during the postclosure period.

Determination of R - The R value is based on the relationship presented in the *R-Zone* equation. Based on Figure 5.3 (Goldman et al., 1986), the landfill is within R-Zone I.

Based on Figure 5.5 (Goldman et al., 1986), the R-Zone I equation is:

$$R = 16.55\ D^{2.2}$$

Where: D = The precipitation depth for the 2-year return period, 6-hour duration precipitation event.

The 2-year, 6-hour precipitation depth for the site is 0.86 inches (DWR, 1982).

Accordingly:

$$R = 16.55\ D^{2.2}$$
$$R = 16.55\ (0.86)^{2.2}$$
$$R = 11.88$$

Determination of K - The value of K was estimated based on particle size distribution of the silty, sandy soils which are predominant over the landfill site and throughout the proposed borrow areas. Assuming that the vegetative soil layer will be derived from these on-site soils, a K value of 0.30 was estimated for a silty sand using Figure 5.6 (Goldman et al., 1986).

Determination of C - The value for C may be expected to vary during the period of closure construction, initiation of erosion control measures, and establishment of final cover vegetation. Following seeding, the C value is estimated at 0.40 for the first three months. Following initial establishment of cover vegetation, the C value will further decrease to 0.05 for the following eight months of the first year. For purposes of this analysis, a weighted C value of 0.11 was used for the first year after completion of closure activities. For the remainder of the postclosure period, the C value will further decrease to 0.02, which assumes a grassy cover will be established which covers 95% of the entire area (Gray and Leiser, 1982).

Determination of P - Since no erosion control practices are anticipated, a P value of 1.0 (SCS, 1985) was chosen, and represents a conservative USLE parameter value.

Determination of LS - The value of the length-slope factor (Goldman et al., 1986) was calculated from the equation:

$$LS = (L/72.6)^m \, [(430x^2 + 30x + 0.43)/6.613]$$

where L is slope length in feet, x is the sine of the slope angle, and m is 0.3, 0.4, or 0.5 for slopes less than 4 percent, slopes at 4 percent, and slopes greater than 4 percent, respectively.

III. RESULTS

Calculations and results of the soil loss analysis are presented in Tables F-1 and F-2. Soil loss from the closure of WMUs II through IV is estimated to be 0.22 tons per acre for the first year and 0.04 tons per acre for subsequent years during the postclosure maintenance period for the 2-year, 6-hour storm. Both of these estimates are less than the U.S. EPA guideline of 2.0 tons per acre using the parameters described in this analysis. Actual soil loss may be less as this does not account for soil deposition on concave slopes and within channels.

REFERENCES

Goldman, S.J., Jackson, K., and Bursytynsky, T.A., 1986; Erosion and Sediment Control Handbook, McGraw-Hill Book Co., New York.

Gray, D.H., and Leiser, A.T., 1982, Biotechnical Slope Protection and Erosion Control, Van Nostrand Reinhold Co., New York.

Department of Water Resources (DWR), Division of Planning. Rainfall Depth-Duration-Frequency for California, 1986; Revised November 1982; Long Duration-Frequency microfiche updated April 1983; Short Duration-Frequency microfiche updated August 1986.

United States Department of Agriculture, Soil Conservation Service, 1982, Plant Materials for Use on Surface-Mined Lands in Arid and Semiarid Regions.

United States Department of Agriculture, Soil Conservation Service (SCS), 1985, Guides for Erosion and Sediment Control in California. Revised February 1985.

United States Environmental Protection Agency (U.S. EPA), 1982, Draft Guidance Document: Landfill Design, Liner System, and Final Cover, July 1982.

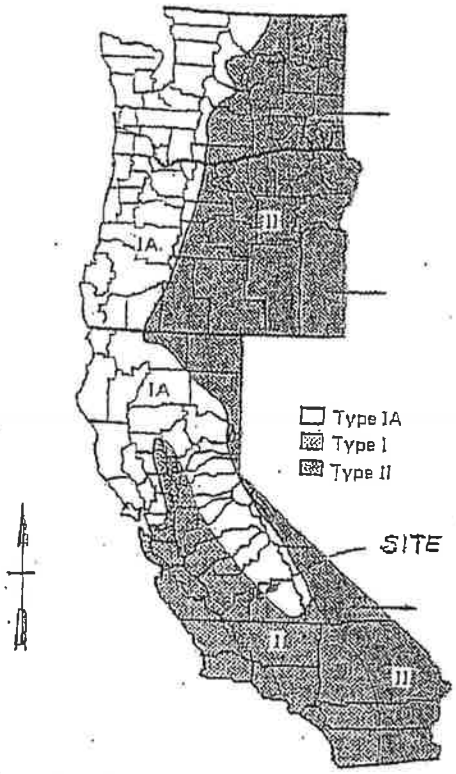


Fig. 5.3 Distribution of storm types in the western United States. (4) Type II storms occur in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming also.

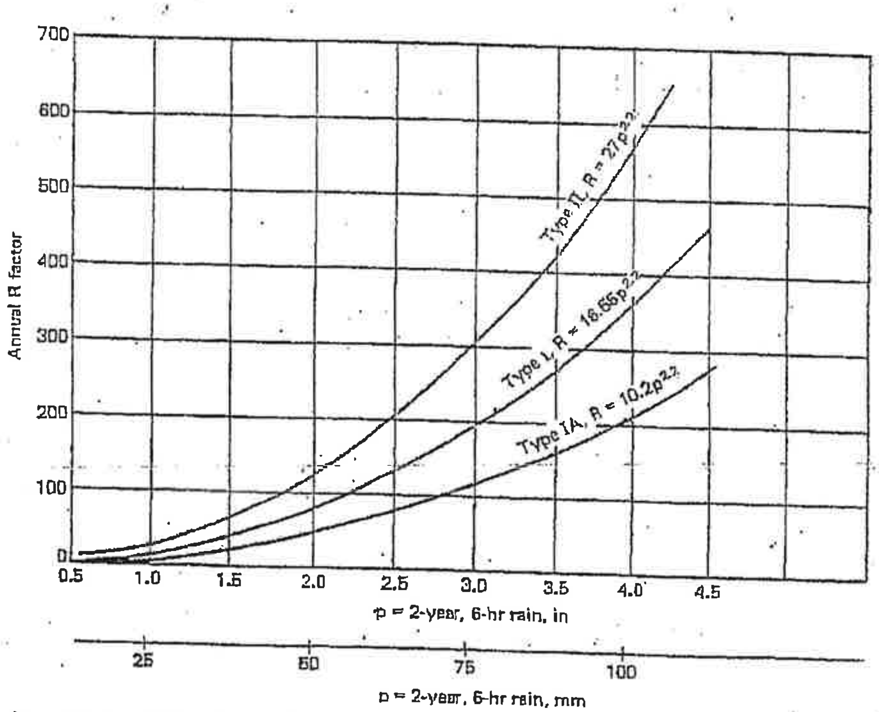


Fig. 5.5 Relations between average annual erosion index and 2-year, 6-hr rainfall in California. (14)

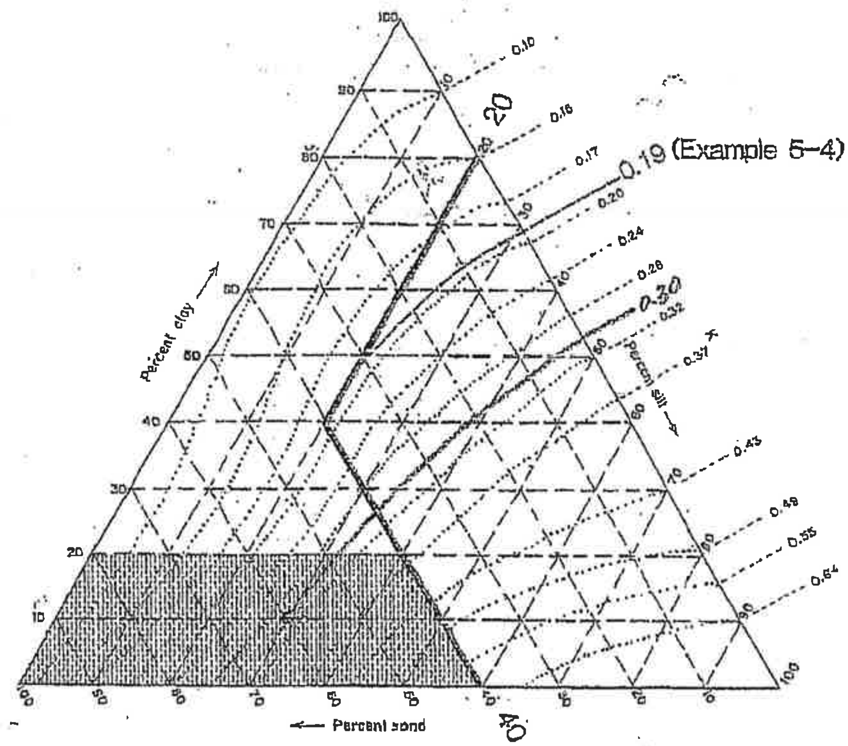


Fig. 5.6 Triangular nomograph for estimating K value. (6) See Table 5.3 for adjustments to K value under certain conditions.

TABLE F1

SOIL LOSS ANALYSIS

FINAL CLOSURE BONZI SANTIATION LANDFIL

Watershed	Area (acres)	Slope	Length (feet)	(1) m for LS	LS Factor	K Factor	Annual Soil Loss (Tons)
A	2.6	0.03	200	0.3	0.35	0.30	0.36
B	2.0	0.03	120	0.3	0.30	0.30	0.24
C	0.5	0.03	120	0.3	0.30	0.30	0.06
D	0.9	0.03	100	0.3	0.29	0.30	0.10
E	2.5	0.03	150	0.3	0.32	0.30	0.32
F	0.9	0.03	110	0.3	0.29	0.30	0.10
G	5.7	0.03	160	0.3	0.33	0.30	0.73
H	0.6	0.03	70	0.3	0.26	0.30	0.06
I	6.1	0.03	160	0.3	0.33	0.30	0.79
J	0.9	0.03	120	0.3	0.30	0.30	0.11
K	2.9	0.03	120	0.3	0.30	0.30	0.33
L	2.3	0.07	160	0.3	0.80	0.30	0.72
M	0.7	0.03	100	0.3	0.29	0.30	0.08
N	0.9	0.07	100	0.3	0.70	0.30	0.25
O	2.4	0.03	110	0.3	0.29	0.30	0.28
P	2.8	0.03	180	0.3	0.34	0.30	0.37
Q	2.0	0.03	200	0.3	0.35	0.30	0.28
R	3.3	0.03	110	0.3	0.29	0.30	0.38
S	0.4	0.03	120	0.3	0.30	0.30	0.05
T	2.1	0.03	100	0.3	0.29	0.30	0.24
U	0.5	0.03	60	0.3	0.25	0.30	0.05
V	1.8	0.03	120	0.3	0.30	0.30	0.21
W	1.8	0.03	100	0.3	0.29	0.30	0.20
X	1.3	0.03	100	0.3	0.29	0.30	0.15
Y	1.2	0.25	100	0.5	5.86	0.30	2.75
Z	0.9	0.25	80	0.5	5.24	0.30	1.85
AA	0.4	0.10	80	0.3	1.19	0.30	0.19
BB	1.5	0.03	140	0.3	0.32	0.30	0.19

Totals: 51.80 Acres

11.4 Tons

0.22 Tons/AC

(1) for S<=3%, m=0.3; S=4%, m=0.4; S>=4%, m=0.5

CP factor = **0.110**

Assumes trackwalked up and down slope

2-year, 6-hour precipitation = **0.86** in.

R (type I) Factor = **11.88** ($R=16.55D^{2.2}$, Goldman et al., 1986)

TABLE F-2

SOIL LOSS ANALYSIS

FINAL CLOSURE BONZI SANITATION LANDFILL

Watershed	Area (acres)	Slope	Length (feet)	(1) m for LS	LS Factor	K Factor	Annual Soil Loss (Tons)
A	2.6	0.03	200	0.5	0.43	0.30	0.08
B	2.0	0.03	120	0.5	0.33	0.30	0.05
C	0.5	0.03	120	0.5	0.33	0.30	0.01
D	0.9	0.03	100	0.5	0.30	0.30	0.02
E	2.5	0.03	150	0.5	0.37	0.30	0.07
F	0.9	0.03	110	0.5	0.32	0.30	0.02
G	5.7	0.03	160	0.5	0.39	0.30	0.16
H	0.6	0.03	70	0.5	0.25	0.30	0.01
I	6.1	0.03	160	0.5	0.39	0.30	0.17
J	0.9	0.03	120	0.5	0.33	0.30	0.02
K	2.8	0.03	120	0.5	0.33	0.30	0.07
L	2.3	0.07	160	0.5	0.94	0.30	0.15
M	0.7	0.03	100	0.5	0.30	0.30	0.02
N	0.9	0.07	100	0.5	0.74	0.30	0.05
O	2.4	0.03	110	0.5	0.32	0.30	0.05
P	2.8	0.03	180	0.5	0.41	0.30	0.08
Q	2.0	0.03	200	0.5	0.43	0.30	0.06
R	3.3	0.03	110	0.5	0.32	0.30	0.08
S	0.4	0.03	120	0.5	0.33	0.30	0.01
T	2.1	0.03	100	0.5	0.30	0.30	0.05
U	0.5	0.03	60	0.5	0.24	0.30	0.01
V	1.8	0.03	120	0.5	0.33	0.30	0.04
W	1.8	0.03	100	0.5	0.30	0.30	0.04
X	1.3	0.03	100	0.5	0.30	0.30	0.03
Y	1.2	0.25	100	0.5	5.86	0.30	0.50
Z	0.9	0.25	80	0.5	5.24	0.30	0.34
AA	0.4	0.10	80	0.5	1.22	0.30	0.03
BB	1.5	0.03	140	0.5	0.36	0.30	0.04

Totals: 51.80 Acres — 2.2 Tons

0.04 Tons/AC

(1) for S<=3%, m=0.3; S=4%, m=0.4; S>=4%, m=0.5

CP factor = **0.020**

Assumes trackwalked up and down slope and established vegetation (Goldman et al., 1986)

2-year, 6-hour precipitation = **0.86** in.

R (type I) Factor = **11.88** ($R=16.55D^{2.2}$, Goldman et al., 1986)

APPENDIX G

LABOR TRANSITION PLAN CERTIFICATION

BONZI SANITARY LAND FILL

2650 W. Hatch Road • Modesto, California 95358
Telephone: (209) 538-1431 • Fax: (209) 538-1825

CERTIFICATION

LABOR TRANSITION PLAN

The undersigned certifies as follows:

1. I am the operator[1] of the Bonzi Sanitation Landfill, Inc. I have filed or caused to be filed a *Labor Transition Plan* pursuant to Section 43501.5(a) of the Public Resources Code with the Enforcement Agency for said landfill.

2. The *Labor Transition Plan* includes:

   a. Provisions that ensure, subject to any requirements already established pursuant to a collective bargaining agreement(s), where possible for full-time employees preferential reemployment and transfer rights of displaced employees to comparable available employment with the Bonzi Sanitation Landfill or Ma-Ru Holding Company for a period of no less than one year following closure of the solid waste facility. "Comparable employment" means the same or a substantially similar job classification at equal or greater wage and benefit levels in the same geographic region of the state.

   b. Provisions to provide displaced employees assistance in finding comparable employment with other employers.

   c. Provisions to ensure compliance with all applicable provisions of Chapter 4 (commencing with Section 1400) of Part 4 of Division 2 of the Labor Code.

3. The provisions of paragraph 2 above will be implemented subject to any requirements already established under a collective bargaining agreement(s).

I certify under penalty of perjury that the above information is true and accurate.

Signature: ______ Date: 07/31/06

General Manager

Signature: Jim Bonzi Date: 7/31/06

Operator

[1] Pursuant to Title 27, California Code of Regulations, Section 20164, "operator" is the landowner or other person legally responsible to the State for, among other things, obtaining a solid waste facilities permit for the site, operating the solid waste facility, closing the facility and maintaining it during the postclosure period.

APPENDIX H

FINAL CLOSURE, POST CLOSURE MAINTENANCE, AND GROUNDWATER TREATMENT SYSTEM COST ESTIMATE

FINAL CLOSURE COST ESTIMATE

DETAILED FINAL CLOSURE COST ESTIMATE
FINAL COVER
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
1	**FINAL COVER**				
1A	**Mobilization/Demobilization**				
	Components: Equipment transport, permits, construction trailer setup, H&S Plan and SWPPP, project management, and administration.				
	Heavy Equipment Transport	ea	$ 2,000.00	10	$ 20,000.00
	Office Trailer	ls	$ 4,000.00	1	$ 4,000.00
	Utilities	monthly	$ 250.00	6	$ 1,500.00
	SWPPP and Health and Safety Reports	ls	$ 5,000.00	1	$ 5,000.00
	Project Management and Administration	hr	$ 175.00	60	$ 10,500.00
	Engineering Technician	hr	$ 100.00	48	$ 4,800.00
	Administrative Assistance	hr	$ 55.00	32	$ 1,760.00
	Subtotal - Mobilization/Demobilization				$ 47,560.00
1B	**Rework Existing Intermediate Cover**				
	Components: Very minor stripping of vegetation in areas of engineered fill, borrow area, and intermediate cover, ~70.5 acres. Surveying and setting grade stakes for the final cover, moisture conditioning and recompacting top 1.0 ft. of intermediate cover.				
	Grade Staking Surveying	ls	$ 15,000.00	1	$ 15,000.00
	Dozer w/ Operator	hr	$ 268.04	80	$ 21,443.20
	Water Truck w/ Operator	hr	$ 125.44	80	$ 10,035.20
	Compactor w/ Operator	hr	$ 226.13	80	$ 18,090.40
	Grade Checker	hr	$ 62.63	80	$ 5,010.40
	Subtotal - Rework Existing Intermediate Cover				$ 69,579.20

DETAILED FINAL CLOSURE COST ESTIMATE
FINAL COVER, Cont.
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
1C	**Foundation Layer Placement**				
	Components: Surveying and setting grade stakes for the foundation layer, excavate and haul 248,800 cy from borrow/stockpile area, mixing, placing, spreading and track-walking varying thickness foundation layer.				
	Grade Staking Surveying	ls	$ 10,000.00	1	$ 10,000.00
	Water Truck w/ Operator	hr	$ 125.44	630	$ 79,027.20
	Dozer w/ Operator	hr	$ 268.04	630	$ 168,865.20
	Scraper w/ Operator	hr	$ 289.74	630	$ 182,536.20
	Padfoot Compactor w/ Operator	hr	$ 226.13	630	$ 142,461.90
	Motor Grader w/ Operator	hr	$ 163.40	630	$ 102,942.00
	Grade Checker	hr	$ 62.63	630	$ 39,456.90
	Subtotal - Foundation Layer Placement				$ 725,289.40
1D	**Low Hydraulic Conductivity Layer**				
	Components: Transport and placement of 60-mil LLDPE geomembrane, anchor trench excavation and backfill.				
	Geomembrane Material and Hauling	sf	$ 0.50	2,102,849	$ 1,051,424.50
	Foreman	hr	$ 66.81	400	$ 26,724.00
	Laborers	hr	$ 47.27	2400	$ 113,448.00
	Wheel Loader or Backhoe, w/ Operator	hr	$ 111.42	400	$ 44,568.00
	Subtotal - Low Hydraulic Conductivity Layer				$ 1,236,164.50

DETAILED FINAL CLOSURE COST ESTIMATE
FINAL COVER, Cont.
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
1E	**Geocomposite Drainage Layer**				
	Components: Transport and placement of geocomposite drainage layer on slopes greater than 10%.				
	Slope area is ~2.0 Acres.				
	Geocomposite Material and Hauling	sf	$ 0.55	88,251	$ 48,538.05
	Foreman	hr	$ 66.81	48	$ 3,206.88
	Laborers	hr	$ 47.27	192	$ 9,075.84
	Wheel Loader or Backhoe w/ Operator	hr	$ 152.07	48	$ 7,299.36
	Subtotal - Geocomposite Drainage Layer				$ 68,120.13
1F	**Perimeter Access Road, Drainage, and Flood Control Berm**				
	Components: Surveying and setting grade stakes for the construction of the perimeter access road				
	berm, drainage channel berm, and flood control berm, excavate and haul 54,500 cy from the borrow				
	area, mixing, moisture conditioning, placing, and compacting soils for berm construction.				
	Assumes that the v-notch and trapezoidal channels will be graded as part of berm construction.				
	Grade Staking Surveying	ls	$ 20,000.00	1	$ 20,000.00
	Water Truck w/ Operator	hr	$ 125.44	144	$ 18,063.36
	Dozer w/ Operator	hr	$ 268.04	144	$ 38,597.76
	Scraper w/ Operator	hr	$ 289.74	144	$ 41,722.56
	Padfoot Compactor w/ Operator	hr	$ 226.13	144	$ 32,562.72
	Motor Grader w/ Operator	hr	$ 163.40	144	$ 23,529.60
	Grade Checker	hr	$ 62.63	144	$ 9,018.72
	Subtotal - Permiter Access Road, Drainage, and Flood Control Berm				$ 183,494.72

DETAILED FINAL CLOSURE COST ESTIMATE
FINAL COVER, Cont.
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
1G	**Vegetative Cover**				
	Components: Surveying and setting grade stakes for the vegetative cover, excavate and haul 113,200 cy from borrow area, mixing, placing, spreading, moisture conditioning, compacting, and track-walking 18 in. thick vegetative cover.				
	Grade Staking Surveying	ls	$ 18,000.00	1	$ 18,000.00
	Water Truck w/ Operator	hr	$ 125.44	296	$ 37,130.24
	Dozer w/ Operator	hr	$ 268.04	296	$ 79,339.84
	Scraper w/ Operator	hr	$ 289.74	296	$ 85,763.04
	Padfoot Compactor w/ Operator	hr	$ 226.13	296	$ 66,934.48
	Motor Grader w/ Operator	hr	$ 163.40	296	$ 48,366.40
	Grade Checker	hr	$ 62.63	296	$ 18,538.48
	Subtotal - Vegetative Cover				$ 354,072.48

DETAILED FINAL CLOSURE COST ESTIMATE
FINAL COVER, Cont.
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
1H	**Access Road Aggregate Base**				
	Components: Hauling and placement of locally sourced aggregate base (AB). Assumes earthwork is included in earthwork construction of final cover.				
	Class II AB	ton	$ 30.00	2400	$ 72,000.00
	Water Truck w/ Operator	hr	$ 125.44	40	$ 5,017.60
	Wheel Loader w/ Operator	hr	$ 152.07	40	$ 6,082.80
	Steel Drum Roller w/ Operator	hr	$ 131.78	40	$ 5,271.20
	Motor Grader w/ Operator	hr	$ 163.40	40	$ 6,536.00
	Grade Checker	hr	$ 62.63	40	$ 2,505.20
	Subtotal - Access Road Aggregate Base				$ 97,412.80
1I	**Settlement Survey Monuments**				
	Components: Installation of permanent survey monuments.				
	Steel Caps	LS	$ 200.00	5	$ 1,000.00
	Sac-crete	LS	$ 100.00	5	$ 500.00
	Painted Steel Bollard	LS	$ 100.00	15	$ 1,500.00
	Laborers	hr	$ 47.27	24	$ 1,134.48
	Subtotal - Settlement Survey Monuments				$ 4,134.48

DETAILED FINAL CLOSURE COST ESTIMATE
FINAL COVER, Cont. AND LEACHATE CONTROL SYSTEM
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
1J	**Final CQA Monitoring and Reporting**				
	Components: Monitoring, inspection, onsite and offsite laboratory testing, report, and certification.				
	Project Manager/Supervising Engineer	hr	$ 225.00	96	$ 21,600.00
	CQA Engineer	hr	$ 130.00	240	$ 31,200.00
	CQA Monitor	hr	$ 90.00	1800	$ 162,000.00
	Autocad Technician	hr	$ 90.00	96	$ 8,640.00
	Clerk	hr	$ 55.00	48	$ 2,640.00
	Travel and Per Diem	ls	$ 30,000	1	$ 30,000.00
	Offsite/Field Laboratory and Misc Expenses	ls	$ 80,915	1	$ 80,915.00
	Subtotal - Final CQA Monitoring and Reporting				$ 336,995.00
1K	**Post Construction Aerial Survey**				
	Components: Aerial photogrametry/survey.				
	Set Ground Control	ls	$ 2,000.00	1	$ 2,000.00
	Aerial Mapping	ls	$ 6,000.00	1	$ 6,000.00
	Subtotal - Post Construction Aerial Surveying				$ 8,000.00
2	**LEACHATE CONTROL SYSTEM**				
	No cost for additional LCRS controls is included. It is assumed that the required LCRS controls will be sufficient at closure. Any replacement of controls will most likely occur during post-closure.				
	Subtotal - Leachate Control System	N/A	N/A	N/A	N/A

DETAILED FINAL CLOSURE COST ESTIMATE
LANDFILL GAS CONTROL AND MONITORING AND GROUNDWATER MONITORING
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
3	**LANDFILL GAS CONTROL AND MONITORING**				
3A	**Landfill Gas Control System**				
	Components: Includes costs for disconnect, extension, and reconnecting landfill gas piping and wells. It is assumed that the required number of landfill gas wells and associated appurtenances will be in in place prior to closure with the exception of a new SCADA system.				
	Extend Wells	ea	$ 300.00	59	$ 17,700.00
	Disconnect / Reconnect Piping	ea	$ 500.00	59	$ 29,500.00
	Project Manager/Senior Engineer	hr	$ 175.00	8	$ 1,400.00
	Project Engineer	hr	$ 135.00	56	$ 7,560.00
	Staff Engineer	hr	$ 90.00	16	$ 1,440.00
	Miscelleneous Expenses	ls	$ 250.00	1	$ 250.00
	Travel and Per Diem	ls	$ 2,000	1	$ 2,000.00
	SCADA System Components and Phone/Internet Hookup	ls	$ 6,000.00	1	$ 6,000.00
	Subtotal - Landfill Gas Control System				$ 65,850.00
3B	**Landfill Gas Migration Monitoring System**				
	No cost for additional wells is included. It is assumed that the required number of wells will be in place at time of closure. Any well replacement will most likely occur during post-closure.				
	Subtotal - Landfill Gas Migration Monitoring System	N/A	N/A	N/A	N/A
4	**GROUNDWATER MONITORING**				
	No cost for additional wells is included. It is assumed that the required number of existing wells will be sufficient at closure. Any well replacement will most likely occur during post-closure.				
	Subtotal - Groundwater Monitoring	N/A	N/A	N/A	N/A

DETAILED FINAL CLOSURE COST ESTIMATE
DRAINAGE CONTROL AND SITE SECURITY
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
5	**DRAINAGE CONTROL**				
	Components: Installation of culverts, rip rap, and toe drain. It is assumed that the grading for the v-notch and trapezoidal channels will be completed with the perimeter berm construction Includes culverts, rip rap, geotextile filter, drainage gravel, and HDPE drainage pipe.				
	HDPE Drainage Pipe	lf	$ 25.00	1,160	$ 29,000.00
	Geotextile	sf	$ 0.25	15,000	$ 3,750.00
	Drainage Gravel	cy	$ 50.00	54	$ 2,700.00
	Rip Rap (Import)	cy	$ 50.00	25	$ 1,250.00
	Culverts	lf	$ 60.00	320	$ 19,200.00
	Wheel Loader or Backhoe w/ Operator	hr	$ 152.07	80	$ 12,165.60
	Grade Checker	hr	$ 62.63	80	$ 5,010.40
	Foreman	hr	$ 66.81	80	$ 5,344.80
	Laborers	hr	$ 47.27	240	$ 11,344.80
	Subtotal - Drainage Control				$ 89,765.60
6	**SITE SECURITY**				
	A fence will be in place around the landfill property and will be replaced/repaired as necessary during the operational life of the landfill, therefore, there will be no cost during closure for this work task.	N/A	N/A	N/A	N/A

DETAILED FINAL CLOSURE COST ESTIMATE
EROSION CONTROL AND STRUCTURE REMOVAL AND DECOMMISSIONING
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
7	**EROSION CONTROL**				
	Components: Seeding of surface with native plant species and application of soil amendments and fiber mulch applied at 1,500 lbs/acre. Assumes gypsum (1 ton/acre), sulfur (1 ton/acre) and compost (60 ton/acre) will be applied as soil amendments. Assumes no irrigation is installed.				
	Soil amendments	acre	$ 200.00	71	$ 14,200.00
	Seeding with Native Plant Species	acre	$ 1,000.00	71	$ 71,000.00
	Mulch	acre	$ 400.00	71	$ 28,400.00
	Wheel Loader or Backhoe w/ Operator	hr	$ 111.42	80	$ 8,913.60
	Water Truck w/ Operator	hr	$ 125.44	80	$ 10,035.20
	Foreman	hr	$ 66.81	80	$ 5,344.80
	Laborers	hr	$ 47.27	160	$ 7,563.20
	Subtotal - Erosion Layer				$ 145,456.80
8	**STRUCTURE REMOVAL AND DECOMMISSIONING**				
	Structure Removal and Decommissioning				
	Components: Removal of the vehicle canopy.				
	Structure Removal	ls	$ 15,000.00	1	$ 15,000.00
	Subtotal - Structure Removal and Decommissioning				$ 15,000.00

DETAILED FINAL CLOSURE COST ESTIMATE
FINAL CLOSURE AND POST-CLOSURE MAINTENACE PLAN
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

9	**FINAL CLOSURE AND POST-CLOSURE MAINTENANCE PLAN**				
	Components: Preparation of FCPCMP by a California registered/licensed engineer, responding to agency comments.				
	Project Manager/Senior Engineer	hr	$ 175.00	96	$ 16,800.00
	Design Engineer	hr	$ 135.00	160	$ 21,600.00
	Autocad	hr	$ 90.00	200	$ 18,000.00
	Clerical	hr	$ 55.00	24	$ 1,320.00
	Miscelleneous Expenses	ls	$ 1,000.00	1	$ 1,000.00
	Subtotal - Final Closure and Post-Closure Maintenance Plan				$ 58,720.00

DETAILED FINAL CLOSURE COST ESTIMATE
SUMMARY
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Total Cost	
1	**FINAL COVER**	$	3,130,822.71
2	**LEACHATE CONTROL SYSTEM**[1]	$	-
3	**LANDFILL GAS CONTROL AND MONITORING**	$	65,850.00
4	**GROUNDWATER MONITORING**[2]	$	-
5	**DRAINAGE CONTROL**	$	89,765.60
6	**SITE SECURITY**[3]	$	-
7	**EROSION CONTROL**	$	145,456.80
8	**STRUCTURE REMOVAL AND DECOMMISSIONING**	$	15,000.00
9	**FINAL CLOSURE AND POST-CLOSURE MAINTENANCE PLAN**	$	58,720.00
SUBTOTAL		$	3,505,615.11
CONTINGENCY @20%		$	701,123.02
TOTAL CLOSURE COST		**$**	**4,206,738.13**

Notes:

1 There will be no additional cost for leachate control installation since the landfill is unlined and no system currently exists.

2 There will be no additional cost for groundwater monitoring since all required monitoring wells will be in place prior to closure.

3 A fence is currently in place around the landfill property prior to closure and will be replaced/repaired as necessary during the operational life of the landfill, therefore, there will be no cost during closure for this work task.

DETAILED FINAL CLOSURE COST ESTIMATE
HOURLY RATES
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Consulting Engineer's Rates	Rates ($/hr)
Principal	225.00
Project Manager/Senior Engineer	175.00
Design/Project Engineer	135.00
CQA Engineer	130.00
CQA Monitor	90.00
Geologist/Hydrogeologist	135.00
Field Technician	100.00
Autocad Technician/Staff Engineer	90.00
Clerical	55.00

Labor and Equipment Rates Used for Construction [1]	Rates ($/hr)		
	Equipment	Labor	Total
Laborer	-	47.27	47.27
Grade Checker	-	62.63	62.63
Foreman	-	66.81	66.81
D8 Dozer	204.08	63.96	268.04
D4 Dozer	55.26	62.63	117.89
Scraper	225.78	63.96	289.74
Wheel Loader	88.11	63.96	152.07
Padfoot Compactor	162.17	63.96	226.13
Motor Grader	99.44	63.96	163.40
Backhoe	48.79	62.63	111.42
Water Truck	72.07	53.37	125.44
5 Axle Belly Dump Truck	90.57	53.72	144.29
Steel Drum Roller	67.82	63.96	131.78
Auger (Driller)	159.30	61.42	220.72

Note:

1 Labor: General Prevailing Wages Determination by the Director of Industrial Relations, State of California, August 22, 2014, Northern California Area.
Equipment: State of California Department of Transportation (Caltrans) Labor Surcharge and Equipment Rental Rates, Effective April 1, 2014 to March 31, 2015.

POST CLOSURE MAINTENANCE COST ESTIMATE

DETAILED POST-CLOSURE MAINTENANCE COST ESTIMATE
VEGETATIVE AND EROSION CONTROL LAYER AND LEACHATE CONTROL AND MONITORING
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
1	**FINAL COVER REPAIR**				
	Components: Erosion layer repairs will consist primarily of repairs due to weather and repairs associated with settlement of the final cover. Assumes that repairs are performed in a one acre area per year. Includes removal of erosion layer material, backfill and replacement of removed erosion layer material, and re-seeding. Includes settlement monument repair and rodent/vector control.				
	Geomembrane Repair	sf	$ 1.00	43,560	$ 43,560.00
	Backhoe w/ Operator	hrs	$ 111.42	40	$ 4,456.80
	Laborer	hrs	$ 47.27	80	$ 3,781.60
	Subtotal - Final Cover Repairs				**$ 51,798.40**
2	**LEACHATE CONTROL AND MONITORING**				
	There is no LCRS in place at the Bonzi Sanitation Landfill.	N/A	N/A	N/A	$ -
	Annual Cost, X/10				**$ -**

DETAILED POST-CLOSURE MAINTENANCE COST ESTIMATE
GROUNDWATER AND GAS MONITORING AND CONTROL
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
3	**GROUNDWATER AND GAS MONITORING AND CONTROL**				
3A	**Groundwater Monitoring**				
	Components: Quarterly groundwater monitoring and reporting.				
	Quarterly Groundwater Monitoring (Sampling, Laboratory Analysis and Reporting)	ls	$ 25,000.00	1	$ 25,000.00
	Annual Cost, X4				**$ 100,000.00**
3B	**Landfill Gas Probe and Surface Monitoring**				
	Components: Monthly landfill gas probe monitoring and quarterly reporting.				
	Sampling, Laboratory Analysis, and Reporting	ls	$ 2,000.00	1	$ 2,000.00
	Annual Cost, X12				**$ 24,000.00**
3C	**Groundwater Monitoring Well Repairs**				
	Component: Well repairs, including replacement of the protective steel covers every 10 years on all groundwater monitoring and extraction wells.				
	Steel Covers	ea	$ 225.00	40	$ 9,000.00
	Locks	ea	$ 25.00	40	$ 1,000.00
	Misc. Supplies (i.e. cement, paint, etc.)	ea	$ 50.00	40	$ 2,000.00
	Field Technician	hr	$ 100.00	300	$ 30,000.00
	Subtotal - Groundwater Well Maintenance (10 Year)				$ 42,000.00
	Annual Cost, X/10				**$ 4,200.00**
3D	**Groundwater Monitoring Well and Extraction System Replacement**				
	Component: One time monitoring well replacement every 15 years.				
	Field Technician	hr	$ 100.00	400	$ 40,000.00
	Engineer	hr	$ 135.00	400	$ 54,000.00
	Drill Rig w/Operator	hr	$ 220.72	400	$ 88,288.00
	Laborer	hr	$ 47.27	400	$ 18,908.00
	Permits, Supplies	ls	$ 2,500.00	40	$ 100,000.00
	Subtotal - Groundwater Monitoring Well Replacement (15 Year)				$ 301,196.00
	Annual Cost, X/15				**$ 20,079.73**

DETAILED POST-CLOSURE MAINTENANCE COST ESTIMATE
GROUNDWATER AND GAS MONITORING AND CONTROL, Cont.
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
3E	**Landfill Gas Operation and Maintenance**				
	Component: Operation and maintenance of well field, blower, flare, and SCADA system, plus utilities.				
	Assumes 275 kWh per day of electricity at $0.13/kWh and $50/month phone/internet cost.				
	Operation and Maintenance	ls	$ 15,000.00	1	$ 15,000.00
	Annual Utilities	ls	$ 13,098.75	1	$ 13,098.75
	Engineering and Reporting	ls	$ 5,000.00	1	$ 5,000.00
	Subtotal - Landfill Gas Operation and Maintenance				**$ 33,098.75**
3F	**Landfill Gas Monitoring Probe Repairs**				
	Component: Well repairs, including replacement of the protective steel covers every 10 years on				
	on the 14 actively monitored gas probes.				
	Steel Covers	ea	$ 225.00	14	$ 3,150.00
	locks.	ea	$ 25.00	14	$ 350.00
	Misc. Supplies (i.e. cement, paint, etc.)	ea	$ 50.00	14	$ 700.00
	Project Engineer	hr	$ 135.00	16	$ 2,160.00
	Field Technician	hr	$ 100.00	72	$ 7,200.00
	Subtotal - Landfill Gas Monitoring Probe Repairs (10 Year)				$ 13,560.00
	Annual Cost, 1/10				**$ 1,356.00**

DETAILED POST-CLOSURE MAINTENANCE COST ESTIMATE
GROUNDWATER AND GAS MONITORING AND CONTROL, Cont.
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
3G	**Landfill Gas Monitoring Probe Replacement**				
	Component: One time probe replacement every 15 years for the 14 probes actively monitored.				
	Field Technician	hr	$ 100.00	200	$ 20,000.00
	Engineer	hr	$ 135.00	200	$ 27,000.00
	Drill Rig w/Operator	hr	$ 220.72	200	$ 44,144.00
	Laborer	hr	$ 47.27	200	$ 9,454.00
	Permits, Supplies	ls	$ 2,500.00	14	$ 35,000.00
	Subtotal - Landfill Gas Monitoring Probe Replacement (15 Year)				$ 135,598.00
	Annual Cost, X/15				**$ 9,039.87**
3H	**Landfill Gas Collection System Replacement**				
	Components: Replace 59 extraction well,s pipe, blower and flare once per closure period of 30 years.				
	Replace Wells	ea	$ 12,000.00	59	$ 708,000.00
	Replace Piping	ls	$100,000.00	1	$ 100,000.00
	Replace Blower and Flare	ls	$150,000.00	1	$ 150,000.00
	Subtotal - Landfill Gas Collection System Replacement (30 Year)				$ 958,000.00
	Annual Cost, X/30				**$ 31,933.33**

DETAILED POST-CLOSURE MAINTENANCE COST ESTIMATE
DRAINAGE CONTROL
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
4	**DRAINAGE CONTROL**				
4A	**Inspection, Monitoring, and Reporting**				
	Components: Quarterly inspection, NPDES monitoring and reporting.				
	Project Engineer	hr	$ 135.00	24	$ 3,240.00
	Engineering Technician	hr	$ 100.00	32	$ 3,200.00
	Subtotal - Inspection, Monitoring, and Reporting				**$ 6,440.00**
4B	**Maintenance**				
	Components: Cleaning will consist of sediment removal in ditches every year and minor erosion repairs.				
	Backhoe w/ Operator	hr	$ 111.42	50	$ 5,571.00
	Laborer	hr	$ 47.27	100	$ 4,727.00
	Subtotal - Maintenance				**$ 10,298.00**
4C	**Replacement and Repair of Drainage Facilities**				
	Components: Replacement of drainage systems. Assume 25% of culverts, lined channels, and inlet/outlet structures need to be replaced every 5 years.				
	HDPE Drainage Pipe	lf	$ 25.00	290	$ 7,250.00
	Rip Rap (Import)	cy	$ 50.00	6	$ 312.50
	Wheel Loader or Backhoe w/ Operator	hr	$ 152.07	20	$ 3,041.40
	Grade Checker	hr	$ 62.63	20	$ 1,252.60
	Foreman	hr	$ 66.81	20	$ 1,336.20
	Laborers	hr	$ 47.27	60	$ 2,836.20
	Subtotal - Replacement and Repair of Drainage Facilities				$ 16,028.90
	Annual Cost, X/5				**$ 3,205.78**

DETAILED POST-CLOSURE MAINTENANCE COST ESTIMATE
SECURITY, INSPECTION, AND OTHER COSTS
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
5	**SECURITY**				
	Components: Fencing repair and replacement. Assume 100 feet of fence need to be replaced every year.				
	Labor	hr	$ 47.27	24	$ 1,134.48
	Material and Miscellaneous	lf	$ 15.00	100	$ 1,500.00
	Subtotal - Security				**$ 2,634.48**
6	**INSPECTION**				
	Component: Routine inspection.				
	Engineering Technician	hr	$ 100.00	32	$ 3,200.00
	Expenses	ls	$ 1,000.00	1	$ 1,000.00
	Subtotal - Inspection				**$ 4,200.00**
7	**OTHER COSTS**				
	5-Year Settlement Surveys				
	Components: Aerial survey, settlement evaluation, technical report. Replacement of 5 monuments on landfill every five years.				
	Project Engineer	hr	$ 135.00	24	$ 3,240.00
	Autocad Technician	hr	$ 90.00	32	$ 2,880.00
	Aerial Topographic Survey	ls	$ 8,000.00	1	$ 8,000.00
	Subtotal - 5-Year Settlement Surveys				$ 14,120.00
	Annual Cost, X/5				**$ 2,824.00**

DETAILED POST-CLOSURE MAINTENANCE COST ESTIMATE
SUMMARY
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Total Cost	
1	**VEGETATIVE AND EROSION CONTROL LAYER**	$	51,798.40
2	**LEACHATE MANAGEMENT**	$	-
3	**GROUNDWATER AND GAS MONITORING AND CONTROL**[1]	$	223,707.68
4	**DRAINAGE CONTROL**	$	19,943.78
5	**SECURITY**	$	2,634.48
6	**INSPECTION**	$	4,200.00
7	**OTHER COSTS**	$	2,824.00
TOTAL ANNUAL POST-CLOSURE COST		**$**	**305,108.34**
30 YEAR POST-CLOSURE MAINTENANCE COST		**$**	**9,153,250.30**

Note:

1 Includes groundwater, gas monitoring, O&M of gas collection system, repairs and replacement.

GROUNDWATER TREATMENT SYSTEM CORRECTIVE ACTION COST ESTIMATE

DETAILED CORRECTIVE ACTION COST ESTIMATE
GROUNDWATER TREATMENT SYSTEM
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Units	Unit Price	Quantity	Total Cost
1	**GROUNDWATER TREATMENT SYSTEM**				
1A	**Operation and Maintenance**				
	Components: Weekly (1 hour) readings and monthly (4 hours) maintenance of treatment system (including storage pond, drip irrigation and effluent lines) and 3 groundwater extraction wells. Semiannual acid scrub of air stripper tower. Assume treatmentsystem (air stripper, extraction land wells and application transfer pump) use 475 kWh per day of electricity at $0.13/kWh. Replacement of air stripper packing material ($25,000) and effluent pump and blower ($15,000) every 10 years.				
	Semiannual Acid Scrub	ea	$ 7,000.00	2	$ 14,000.00
	Extraction Well Redevelopment	ea	$ 6,000.00	3	$ 18,000.00
	Annual Utilities	ls	$ 22,538.75	1	$ 22,538.75
	Packing Material for Air Stripper (once per 10 years)	ls	$ 25,000.00	1	$ 25,000.00
	Materials for Drip Irrigation and Effluent Line Repairs	ls	$ 1,500.00	1	$ 1,500.00
	Replace effluent pump & blower(once per 10 years)	ls	$ 15,000.00	1	$ 15,000.00
	Project Management and Administration	hr	$ 175.00	24	$ 4,200.00
	Engineering Technician	hr	$ 100.00	100	$ 10,000.00
	Laborer	hr	$ 47.27	100	$ 4,727.00
	Subtotal - Operation and Maintenance				**$ 114,965.75**
1B	**System Monitoring**				
	Components: Monthly system monitoring and reporting. Assumes monthly reporting for routine groundwater treatment system maintenance.				
	Monthly Maintenance/Corrective Action Report	ea	$ 1,200.00	12	$ 14,400.00
	Monthly Monitoring (Sampling, Laboratory Analysis and Report)	ls	$ 300.00	12	$ 3,600.00
	Subtotal - System Monitoring				**$ 18,000.00**

DETAILED CORRECTIVE ACTION COST ESTIMATE
SUMMARY
BONZI SANITATION LANDFILL - STANISLAUS COUNTY

Item	Description	Total Cost	
1	**GROUNDWATER TREATMENT SYSTEM**	$	132,965.75
TOTAL ANNUAL POST-CLOSURE CORRECTIVE ACTION COST		**$**	**132,965.75**
SUBTOTAL 30 YEAR POST-CLOSURE CORRECTIVE ACTION COST		**$**	**3,988,972.50**
20% CONTINGENCY		**$**	**797,794.50**
TOTAL 30 YEAR POST-CLOSURE CORRECTIVE ACTION COST		**$**	**4,786,767.00**

LABOR AND EQUIPMENT RATES

State of California - Director of Industrial Relations
General Prevailing Wage Rate Determination
Issue Date: August 22, 2014

Craft	Determination	Locality	Page	Group	Hourly Rate	Notes
Laborer	NC-23-102-1-2014-3	Northern California	49	3	$47.27	General Labor
Foreman	NC-23-63-1-2014-1A	Northern California	40A	1	$66.81	Senior Operator
Operating Engineer	NC-23-63-1-2014-1A	Northern California	40A	4	$62.63	Backhoe Operator
Operating Engineer	NC-23-63-1-2014-1A	Northern California	40A	4	$62.63	Dozer Operator - D4
Operating Engineer	NC-23-63-1-2014-1A	Northern California	40A	4	$62.63	Grade Checker
Operating Engineer	NC-23-63-1-2014-1A	Northern California	40A	5	$61.42	Drilling Machine Operator
Operating Engineer	NC-23-63-1-2014-1A	Northern California	40A	3	$63.96	Dozer/Compactor/Scraper/Wheel Loader Operator
Teamster	NC-23-261-1-2014-1	Northern California	55	3	$53.37	Water Truck Driver
Teamster	NC-23-261-1-2014-1	Northern California	55	4	$53.72	Truck Driver

State of California - Department of Transportation (CalTrans)
Labor Surcharge and Equipment Rental Rates
April 1, 2014 to March 31, 2015

Equipment Type	Manufacturer	Model	Code	Page	Hourly Rate
Dozer	Caterpillar	D4H	2670	30	$55.26
Dozer	Caterpillar	D8R	4870	30	$204.08
Scraper	Caterpillar	623F	1703	29	$225.78
Wheel Loader	Caterpillar	928G	2070G	17	$88.11
Padfoot Compactor	Caterpillar	815F	2320	24	$162.17
Motor Grader	Caterpillar	140H	3265	6	$99.44
Backhoe	Caterpillar	416D	1861D4	17	$48.79
Water Truck	Any	3 Axle	3AXL	34	$72.07
Steel Drum Roller	Dynapac	CP27	3520	24	$67.82
Auger (Driller)	Watson	2000	6012	4	$159.30
Dump Truck	Any	5 Axle	5AXL	34	$90.57

APPENDIX I

FINANCIAL ASSURANCE DOCUMENTATION

California Integrated Waste Management Board

Rosario Marin, Chair
1001 I Street • Sacramento, California 95814 • (916) 341-6000
Mailing Address: P. O. Box 4025, Sacramento, CA 95812-4025
www.ciwmb.ca.gov

Alan C. Lloyd, Ph.D
Secretary for Environmental Protection

Arnold Schwarzenegger
Governor

Mr. Howard Hold
California Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114

January 25, 2006

Subject: Review of the Financial Assurance Demonstrations for the Bonzi Sanitary Landfill, Facility No. 50-AA-0003

Dear Mr. Hold:

The Financial Assurances Section (FAS) of the California Integrated Waste Management Board (CIWMB) completed a review of the financial assurance demonstrations for the Bonzi Sanitary Landfill (Bonzi Landfill) at your request. As you are aware, FAS is responsible for reviewing and approving financial assurance demonstrations for acceptability and adequacy in providing assurances to the State of California of landfill owners' and operators' abilities to close and to provide postclosure maintenance, corrective action and coverage for operating liability exposures for solid waste landfills.

The Bonzi Landfill management has chosen to provide two trust accounts to the CIWMB for the assurance of closure and postclosure funding. The combination of the two trust funds (the Funds), meets the requirements of Title 27, California Code of Regulations (the Regulations), Division 2, Subdivision 1, Chapter 6, Subchapter 3, Article 2, section 22240. The combination of which is monitored to determine compliance with the financial assurance demonstration requirements mandated by California statute for closure and postclosure maintenance cost demonstrations.

On or about July 7, 2005, the CIWMB received a report from EBA Engineering on behalf of Steve Bonzi, Operations Manager of Ma-Ru Holding Co., owner and operator of the Bonzi Landfill. This report contained updates to the capacity filled from 2001 to the current deposit calculation requirement and the associated remaining permitted capacity of the landfill. Section ~~22225 of the Regulations specifies the calculation methods utilized to determine the adequacy of~~ the funding level of the Funds. After these updates to the capacities filled and the remaining capacity at the facility, the required minimum balance of the landfill closure trust account was \$3,606,606 (minimum balance after the May 2005 required deposit). The actual balance of the two landfill closure trust accounts as of July 12, 2005, was \$3,658,688. Therefore based on the reported fund balances and the capacity information submitted by EBA Engineering, the closure and postclosure maintenance funds are currently funded at an adequate amount as required by

Title 27, California Code of Regulations, section 22225, and no additional funds need to be deposited into the accounts prior to the installment due on the next anniversary, May 1, 2006.

The end-of-year balance for the combination of funds totaled $3,668,560, as of December 31, 2005. The total of the closure and postclosure estimates, as inflated to year 2005 dollars, as reported to the CIWMB is $6,245,479.

The CIWMB does not have evidence of a financial assurance demonstration dedicated to the corrective action activities at this facility. If the RWQCB has an approved plan for remediation of known exposures at the facility, the CIWMB can pursue the operator to obtain a financial demonstration as required under section 22221 of the Regulations, or the RWQCB can take direct action against the operator for this demonstration. If the costs of any known corrective action are within the postclosure maintenance activities, and identified in such a postclosure maintenance plan, then the costs are assured through the financial assurance demonstration currently accepted by the CIWMB.

The operator is also required to demonstrate financial responsibility for operating liability claims. The operator has submitted a Certificate of Liability Insurance for the facility, but the required CIWMB Certification of Insurance form CIWMB 107 is not utilized as required by section 22251 of the Regulations. As such, the insurance coverage demonstration is not acceptable.

Due to the dynamic nature of the financial assurance demonstrations, the results of this review are only valid for 30 days. If you have any questions regarding this review, please call me.

If you have questions regarding the financial assurance demonstrations or the insurance requirement, please contact me at (916) 341-6343 or rcastle@ciwmb.ca.gov.

Sincerely,

Richard E. Castle
Research Program Specialist
Financial Assurances Section

cc: Mr. Steve Bonzi, Bonzi Sanitary Landfill
Mr. Mike Delmanowski, C.E.G., C.Hg., EBA Engineering
Mr. David Otsubo, Enforcement Assistance Section, CIWMB

APPENDIX J

LANDFILL GAS MONITORING AND CONTROL PLAN

LANDFILL GAS MONITORING AND CONTROL PLAN
BONZI SANITATION LANDFILL

STANISLAUS COUNTY, CALIFORNIA

OCTOBER 2014

PROJECT NO. 2012.0023

PREPARED FOR:

Ma-Ru Holding Company
2650 West Hatch Road
Modesto, California 95670

SUBMITTED TO:

Central Valley Regional Water Quality Control Board
11020 Sun Center Drive #200
Rancho Cordova, California 95670

California Department of Resources Recycling and Recovery (CalRecycle)
1001 I Street
Sacramento, California 95812-4025

PREPARED BY:

Geo-Logic Associates
143E Spring Hill Drive
Grass Valley, California 95945
(530) 272-2448

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2.1 Landfill Facility 1
2.2 On-Site Structures 1
2.3 Geology 2
2.4 Hydrogeology 2
2.5 Surrounding Land Use 3
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3.2 Monitoring Probe Network 4
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4.0 LFG MONITORING PROGRAM 4
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4.2 On-Site Structure Monitoring 5
4.3 LFG Collection System Leak Monitoring 5
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FIGURES

Figure 1 Vicinity Map
Figure 2 Existing Landfill Gas Monitoring System
Figure 3 Landfill Gas Probe Detail

ATTACHMENTS

Attachment 1 LFG Monitoring Well Summary Table and Typical LFG Well Detail
Attachment 2 Example Field Monitoring Forms

1.0 INTRODUCTION

This Landfill Gas (LFG) Monitoring and Control Plan (Plan) was prepared by Geo-Logic Associates, Inc. (GLA) on behalf of Ma-Ru Holding Company and Bonzi Sanitation Landfill, Inc. (BSL). This Plan primarily reflects the proposed LFG monitoring and control facilities following final closure of the BSL. Monitoring and reporting of the existing landfill gas probe system has been performed by Del-Tech Geotechnical Support Services (Del-Tech) pursuant to the requirements in California Code of Regulations Title 27 (CCR27), Section 20934. The Plan is monitored and enforced by the California Department of Resources Recycling and Recovery (CalRecycle).

2.0 SITE DESCRIPTION

2.1 LANDFILL FACILITY

The BSL is a Class III waste disposal facility located in central Stanislaus County, California and is situated approximately two miles southwest of the city of Modesto in the Central Valley. BSL is situated just south of the Tuolumne River at 2650 West Hatch Road, with Vivian Road to the west, Whitmore Road to the south and Carpenter Road to the east (Figure 1). Low topographic relief characterizes the landfill and surrounding area. Four Waste Management Units (WMU's) comprise approximately 115 permitted acres of the 128 acre site (Figure 2).

The Landfill began operations in the 1960s at WMU I. The 35-acre WMU I was closed pursuant to CCR27 in 1999. The closure included a two-foot foundation layer, a 30-mil PVC flexible membrane liner (FML), and an 18-inch vegetative layer. WMU II and III accepted waste between 1978 and 1992 and have been covered with intermediate cover, while WMU IV received primarily inert materials until 2009. Waste was consolidated on the north end of WMU IV and two feet of interim cover was place on WMUs II through IV by State contractors in Fall 2012. A Final Closure Work Plan is currently being prepared for WMUs II through IV.

2.2 ON-SITE STRUCTURES

There are currently two on-site structures at the BSL, an on-property residential home and a landfill office building. Both structures are monitored pursuant to the requirements in CCR27, Sections 20931 and 20934.

2.3 GEOLOGY

The BSL is located within the Great Valley geomorphic province of California. The Great Valley is an elongated asymmetrical structural trough bonded on the east by the Sierra Nevada Mountains and on the west by the Coastal Range. The Great Valley consists of nearly 8000 feet of marine and terrestrial sediments. Locally the upper several hundred feet consist primarily of Pleistocene age formational units and unconsolidated alluvium consisting of interbedded clays, silts, sands, and gravels. As presented in the Hydrogeologic Summary Report (Dames & Moore, 1989) and the Revised Report of Disposal Site Information (Dames & Moore, 1990), sediments underlying the BSL consist of interbedded sandy silts to silty sands to 25 to 50 feet below ground surface (bgs), underlain by a relatively homogenous layer of sand overlying the Corcoran Clay, a regionally-continuous blue to grey silt/clay layer, at a depth of approximately 120 feet bgs.

Major active (Holocene) faults and fault zones in the vicinity of the BSL include the following:

- The Ortigalita fault zone, located approximately 27 miles southwest of the BSL; and
- The Greenville fault zone, located approximately 28 miles west of the BSL.

Both of the above faults have been designated as Alquist-Priolo Special Studies Zones. Portions of these faults and fault zones are of considerable length and have been characterized by the California Division of Mines and Geology as major Late Quaternary fault zones.

Late Quaternary faults and fault zones in the vicinity of the BSL include the following:

- The Bear Mountain fault zone, approximately 33 miles northeast of the BSL;
- The concealed Stockton fault, approximately 25 miles north of the BSL; and
- An unnamed concealed fault, located approximately ten miles west of the BSL.

None of these faults and fault zones are considered to be active by the California Division of Mines and Geology, and locally, no faults have been identified as traversing the BSL.

2.4 HYDROGEOLOGY

The uppermost water-bearing zone beneath the BSL consists of interbedded sands, silty sands, and sandy silts overlying the Corcoran Clay which acts as an aquitard. The unconfined aquifer is estimated to be approximately 70 to 85 feet thick and groundwater surface elevations have historically ranged from approximately 35 to 50 feet MSL. With the exception of seasonal variations created by flow in the nearby Tuolumne River during some winters, which may cause groundwater elevations to increase beneath the landfill, groundwater generally flows to the north-northwest with a hydraulic gradient ranging from approximately 0.001 ft/ft to 0.003 ft/ft. The hydraulic conductivity of the unconfined water-bearing zone underlying the site is estimated to range from approximately 7.9 x 10-3 to 2.5 x 10-2 centimeters per second. Detailed descriptions of the hydrogeology are presented in the Site Investigation Report (1987) and Hydrogeologic Summary Report (1989) prepared by Dames & Moore.

2.5 SURROUNDING LAND USE

Land use within one mile of the BSL is primarily agricultural. Those areas within one mile that are not used for agriculture are comprised of open space, residential developments, and commercial use properties. Land within 1,000 feet of the BSL was originally zoned for Exclusive Agricultural at the time the Landfill's Solid Waste Facilities Permit was granted in 1984. A general description of the surrounding land use within 1,000 feet of the BSL property boundary is as follows:

Lands north of the BSL are used primarily for residential and industrial purposes. The Riverdale Park Tract subdivision is immediately north of the northern BSL boundary (i.e., approximately 100 feet). Also to the north-northwest is the former transfer station/materials recovery facility (TS/MRF) owned and operated by Waste Management, Inc. Included on the TS/MRF property is an old burn dump formerly operated by Modesto Disposal Service, Inc. A Veterans of Foreign Wars (VFW) facility is located east and adjacent to the TS/MRF property (i.e., northwest of the BSL). The Tuolumne River, which borders each of the aforementioned developments/facilities to the north, is located approximately 1,000 to 1,200 feet north of the Landfill. Lands west of the BSL are presently comprised of mixed agricultural, commercial, and residential uses. An auto wrecking yard and residence is located adjacent to the northwest property boundary.

3.0 LFG CONTROL AND MONITORING FACILITIES

3.1 GAS COLLECTION AND CONTROL SYSTEM (GCCS)

The BSL is currently equipped with a LFG control system in WMUs I through III and is operated as a mechanism to comply with LFG control requirements stipulated in CCR27, Sections 20919. A Site plan showing the existing LFG control system is presented on Figure 2 which includes a total of eight (8) horizontal collector trenches, fifty three (53) perimeter LFG extraction wells (EW1 through EW53), and six (6) interior LFG extraction wells (EW54 through EW59).

The horizontal collector trenches and perimeter LFG extraction wells are connected to a series of header pipes and laterals which convey the collected LFG to the flare station with a capacity of 100 to 700 standard cubic feet per minute. The header pipes (8-inch diameter) and laterals

(4-inch diameter) are constructed of HDPE (SDR 17) pipe. The flare station, in turn, consists of a skid-mounted packaged flare system. Also located at the flare station, but detached from the skid system, are two (2) 3,200-gallon HDPE condensate storage tanks. In addition, there are four (4) condensate collection dropout points within the well-field header system.

3.2 MONITORING PROBE NETWORK

The existing LFG perimeter monitoring network consists of thirty nine (39) monitoring wells that are located at various locations along the entire Landfill property boundary (Figure 2). Two additional LFG monitoring wells will be added to the network prior to closure activities, bringing the total number of probes to 41. Each monitoring point consists of either single-, double-, or triple-nested monitoring probes completed at variable depths that were based on the estimated depth of waste and depth to groundwater. A table summarizing the LFG probe details along with a typical probe detail is presented Attachment 1.

In addition to the aforementioned monitoring/control provisions, pertinent on-site structures are equipped with continuous methane monitoring systems. These structures include the administrative office and a single-family residence.

3.3 GCCS EVALUATION AND IMPROVEMENTS

GC Environmental, Inc. (GCE) prepared an assessment of the existing LFG collection and control system at the BSL (GCE, 2010). The scope of the assessment was to review the existing landfill flare system design and current state of operation, to review the LFG collection system design and operation, to identify improvements needed to operate the systems reliability, and to provide estimated repair and annual operations and maintenance costs. As part of the final closure, BSL will make improvements to the GCCS based on recommendations provided by GCE and the Final Closure design.

4.0 LFG MONITORING PROGRAM

4.1 LFG PROBE MONITORING

In accordance with current monitoring protocols approved by CalRecyle, 12 multi-depth monitoring probes (1W, 5W, 9W, 21S, 23E, 26E, 29N, 32N, 36N, 38N, 41N, and 44N) are monitored monthly and reported quarterly for methane, carbon dioxide, and oxygen using a Landtec GEM 2000 field gas analyzer or similar field gas analyzer. Two additional probes (8WR and 51N) are being added to the monitoring system prior closure bringing the total number of probes that will be monitored to 14. During the 30-year postclosure maintenance period, the

LFG monitoring systems may be modified to reflect changes to adjacent or on-site land uses. Future LFG monitoring results may also require modifications of the LFG monitoring system.

The gas analyzer is calibrated at least daily for methane, carbon dioxide, and oxygen. Prior to purging, the barometric pressure, atmospheric temperature, general weather conditions, probe pressures, and the initial methane value are recorded. Then, each probe is purged until all gas levels have stabilized for 30 seconds prior to logging the gas concentrations. After the gas levels have stabilized the gas levels (methane, carbon dioxide, oxygen, and balance gas) are manually recorded in percent volume on field sheets and electronically logged into instrument memory for future downloading. The results are reported to CalRecycle within fifteen (15) days of monitoring. Contents of the report are listed in Section 5.

4.2 ON-SITE STRUCTURE MONITORING

In accordance with CCR Title 27, Section 20937(a)(1), methane monitors are also installed in all onsite structures to protect public health and safety and the environment. A warning light and audible alarm is activated when a methane concentration at 20 percent of the lower explosive limit (LEL) is detected. In the event the alarm is activated, protocols are in place to ventilate the structure and alleviate the threat of explosion. In addition, on-site structures are also monitored monthly and reported quarterly using a calibrated field gas analyzer. The onsite structures are listed on the Explosive Gas Monitoring Field Data Sheet within Attachment 2. Field readings are manually recorded on field sheets and the results reported to the CalRecyle within fifteen (15) days of monitoring. Contents of the report are listed in Section 5.

4.3 LFG COLLECTION SYSTEM LEAK MONITORING

The LFG collection system is monitored quarterly for leaks using a calibrated field gas analyzer. The LFG collection system is monitored for leaks paying particular attention to areas known to be under positive pressure such as LFG blower seals and flare station piping, or any areas emitting odors. The results will be reported to the LEA within fifteen (15) days of monitoring. Contents of the report are listed in Section 5.

5.0 ROUTINE REPORTING

All routine quarterly reports contain the following information at a minimum. Typical field forms are provided in Attachment 2.

<u>General:</u>

- Beginning and ending times and dates;

- Landfill gas monitoring equipment make and model used;
- Description of the general monitoring methods used;
- Ambient temperature, weather conditions, barometric pressure at start time, and direction of barometric change (rising/falling); and
- Technician(s) name(s).

Monitoring Probes:

- Times and barometric pressure of each reading; and
- Methane, carbon dioxide, oxygen, and balance gas (sum of all other gases) concentration and pressure in each of the probes after purging.

On-Site Building/Structure Monitoring:

- Beginning and ending times; and
- List of routine monitoring points with maximum combustible gas concentration at each point.

6.0 NON-ROUTINE REPORTING

When the results of landfill gas monitoring indicate concentrations of methane or trace gases in excess of the compliance requirements specified in §20921(a), the operator takes the following actions:

(1) Immediately:

- Take steps necessary to protect public health and safety and the environment and notify CalRecyle.

(2) Within seven days of detection of excessive landfill gas concentrations:

- Verify validity of results by reviewing the following:

  (i) probe readings;

  (ii) possible liquid interference;

  (iii) control probe influence; and

  (iv) barometric pressure effects.

- Place in the operating record a description of and submit a letter to the CalRecyle that describes:

  (i) the levels of methane and trace gas detected;

(ii) a brief description of the nature and extent of the problem based on information currently available;

(iii) the steps the operator has taken to protect public health and safety and the environment; and

(iv) a brief description of any further corrective actions that the operator or others need to take to adequately protect public health and safety and the environment prior to the implementation of the remediation plan described in subdivision (3) below.

(3) Within 60 days of detection, implement a remediation plan (approved by CalRecyle) and place a copy of the plan in the operating record. A copy of the plan and notification that the plan has been implemented will be sent CalRecycle for their records.

7.0 EQUIPMENT OPERATION AND MAINTENANCE

To provide for the safe, efficient operation of the landfill gas control system, the operator or its representative has implemented a maintenance program as follows:

- A site-specific operations and maintenance (O&M) manual shall be maintained and currently kept in the control panel of the future landfill flare. The O&M manual will be kept current to reflect any expansion or modifications to the gas control system.
- The operations and maintenance manual provides for periodic inspections and servicing of gas control equipment.
- Operations and maintenance is recorded and the records are retained by the Operator or its representative.

8.0 CONSTRUCTION QUALITY ASSURANCE/QUALITY CONTROL

The operator or its representative will be responsible for providing inspections, as needed, to ensure the integrity of the system. Prior to any construction, the designer will obtain and review all applicable test reports, shop drawings, and manufacturer's certificates to verify that all equipment used or to be used in the gas control system has been manufactured in accordance with industry standards.

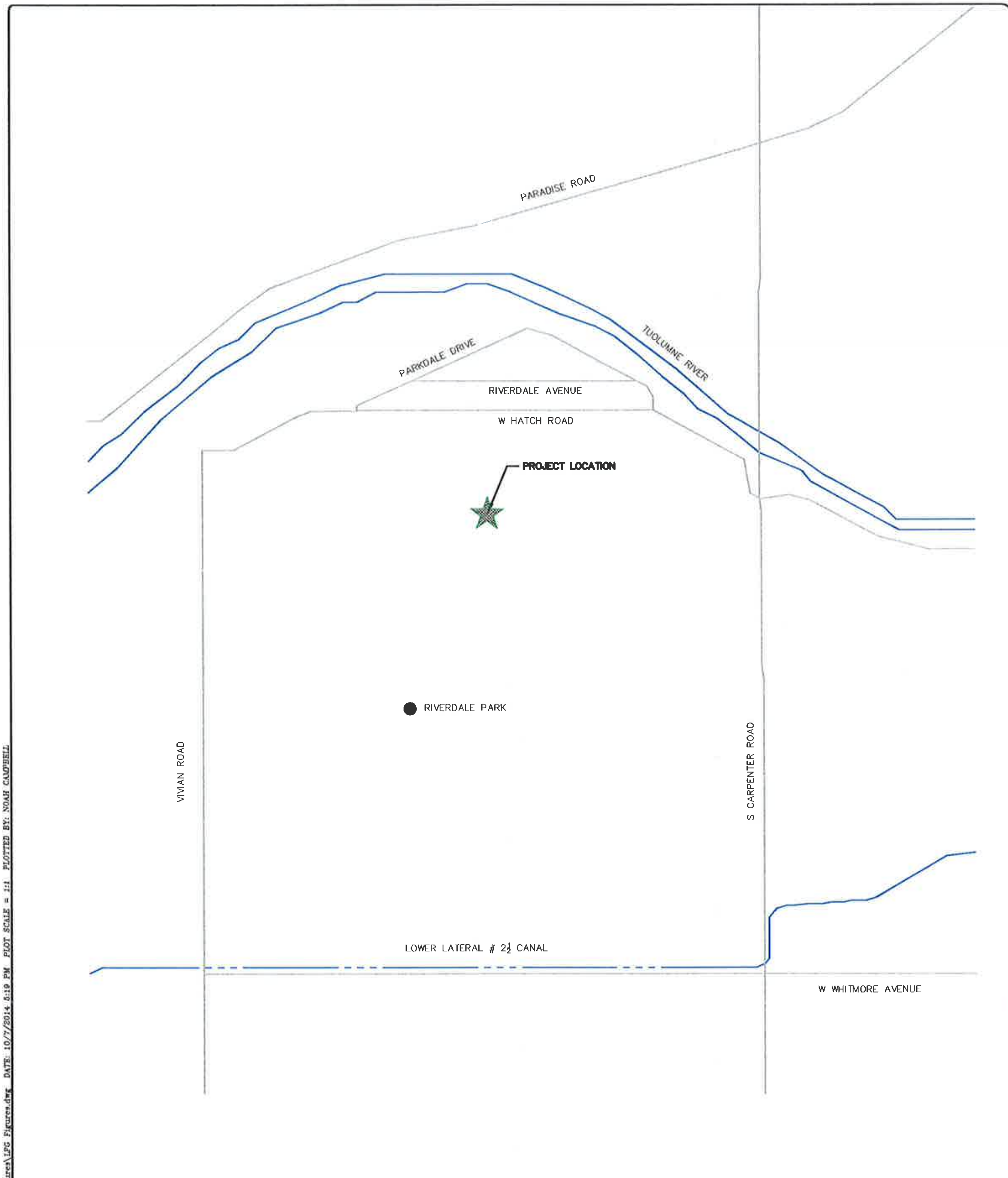
9.0 CERTIFICATION

The landfill gas monitoring network described in this document was designed in accordance with applicable sections of Title 27 of the California Code of Regulations, and all statements and descriptions contained herein are accurate to best of my knowledge.

REGISTERED PROFESSIONAL ENGINEER
NOAH CAMPBELL
C 64963
EXP. 6/30/15
CIVIL
STATE OF CALIFORNIA

Noah Campbell, P.E.
License Number C64963

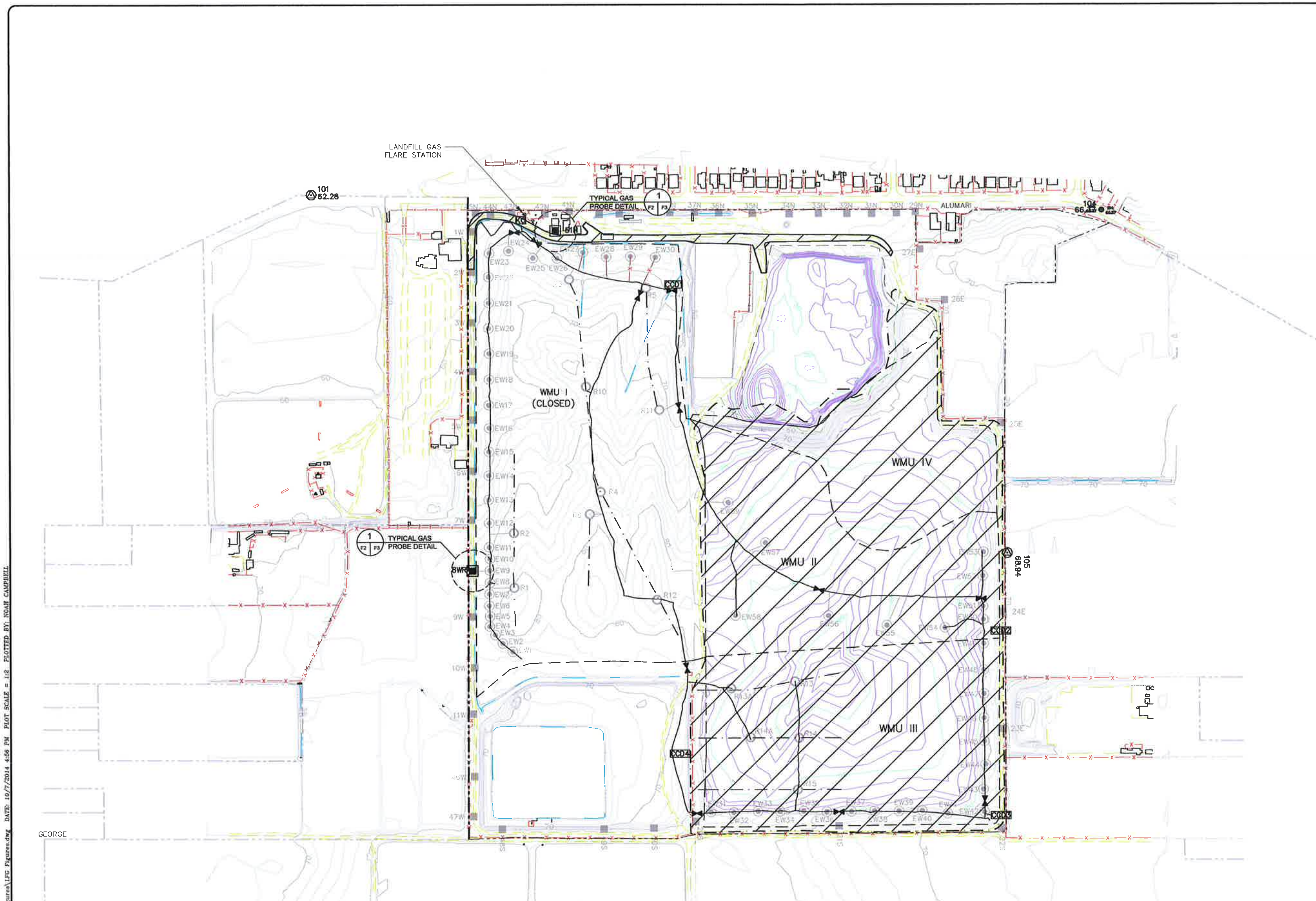
FIGURES



LOCATION: N:\Bonzi\CAD\Figures\LFG Figures.dwg DATE: 10/7/2014 5:19 PM PLOT SCALE = 1:1 PLOTTED BY: NOAH CAMPBELL

DATE OF ISSUE: 10/03/2014 DESIGNED BY: NC/CM DRAWN BY: WC CHECKED BY: TVR APPROVED BY: NC	Geo-Logic ASSOCIATES	BONZI SANITATION LANDFILL LANDFILL GAS MONITORING AND CONTROL PLAN STANISLAUS COUNTY, CA **VICINITY MAP**	FIGURE NO. 1 PROJECT NO. 2012.0023

ISSUED FOR REVIEW



GRAPHIC SCALE

200' 0' 100' 200' 400' 800'

LEGEND

- EXISTING BUILDING
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING 5 FT CONTOUR
- EXISTING 1 FT CONTOUR
- EXISTING 5 FT CONTOUR[3]
- EXISTING 1 FT CONTOUR[3]
- EXISTING DRAINAGE
- EXISTING FENCE
- EXISTING WALL
- PROPERTY BOUNDARY (APPROX.)
- ADJACENT PROPERTY BOUNDARY (APPROX.)
- CONSTRUCTION LIMITS
- WMU LIMITS (APPROX.)
- OLD WMU LIMITS (APPROX.)
- LFG PIPING (APPROX.)
- HORIZONTAL COLLECTION TRENCH (APPROX.)
- 105 68.94 CONTROL POINT
- EW1 VERTICAL LFG EXTRACTION WELL (APPROX.)
- R1 HORIZONTAL COLLECTOR TRENCH RISER (APPROX.)
- 21S PERIMETER LFG MONITORING POINT (APPROX.)
- HEADER VALVE (APPROX.)
- CCD1 CONDENSATE COLLECTION DROPOUT (APPROX.)
- KO CONDENSATE COLLECTION KNOCKOUT (APPROX.)
- FINAL CLOSURE CONSTRUCTION AREA
- 51N PROPOSED PERIMETER LFG MONITORING WELL (APPROX.)

NOTES:

1. EXISTING TOPOGRAPHY BASED ON AERIAL SURVEY PERFORMED BY COOPER AERIAL SURVEYS, CO. ON JUNE 7, 2012.
2. TO PROVIDE ADDITIONAL TOPOGRAPHIC RESOLUTION, ONE FOOT CONTOURS WERE GENERATED BY GEO-LOGIC AND ARE BASED ON THE AERIAL TOPOGRAPHIC MAP BY COOPER AERIAL SURVEYS, CO.
3. EXISTING STORM WATER RETENTION POND TOPOGRAPHY PERFORMED BY SUKUT CONSTRUCTION, INC. ON NOVEMBER 16, 2012. EXISTING INTERMEDIATE COVER TOPOGRAPHY RECEIVED FROM SUKUT CONSTRUCTION, INC. ON JANUARY 25, 2013.

LOCATION: N:\Bonzi\CAD\Figures\LFG Figures.dwg DATE: 10/7/2014 4:56 PM PLOT SCALE = 1:2 PLOTTED BY: NOAH CAMPBELL

REV. NO.	DATE	DESCRIPTION	DRAWN BY	DESIGNED BY	CHECKED BY	APPROVED BY
A	11/22/13	ISSUED FOR REVIEW	CM	NC/CM	TVR	NC
B	10/03/14	ISSUED FOR REVIEW	WC	NC	TVR	NC

DATE OF ISSUE: 10/03/2014
DESIGNED BY: NC
DRAWN BY: WC
CHECKED BY: TVR
APPROVED BY: NC

Geo-Logic ASSOCIATES

BONZI SANITATION LANDFILL
LANDFILL GAS MONITORING AND CONTROL PLAN
STANISLAUS COUNTY, CALIFORNIA
EXISTING LANDFILL GAS MONITORING SYSTEM

FIGURE NO. 2

PROJECT NO. 2012.0023

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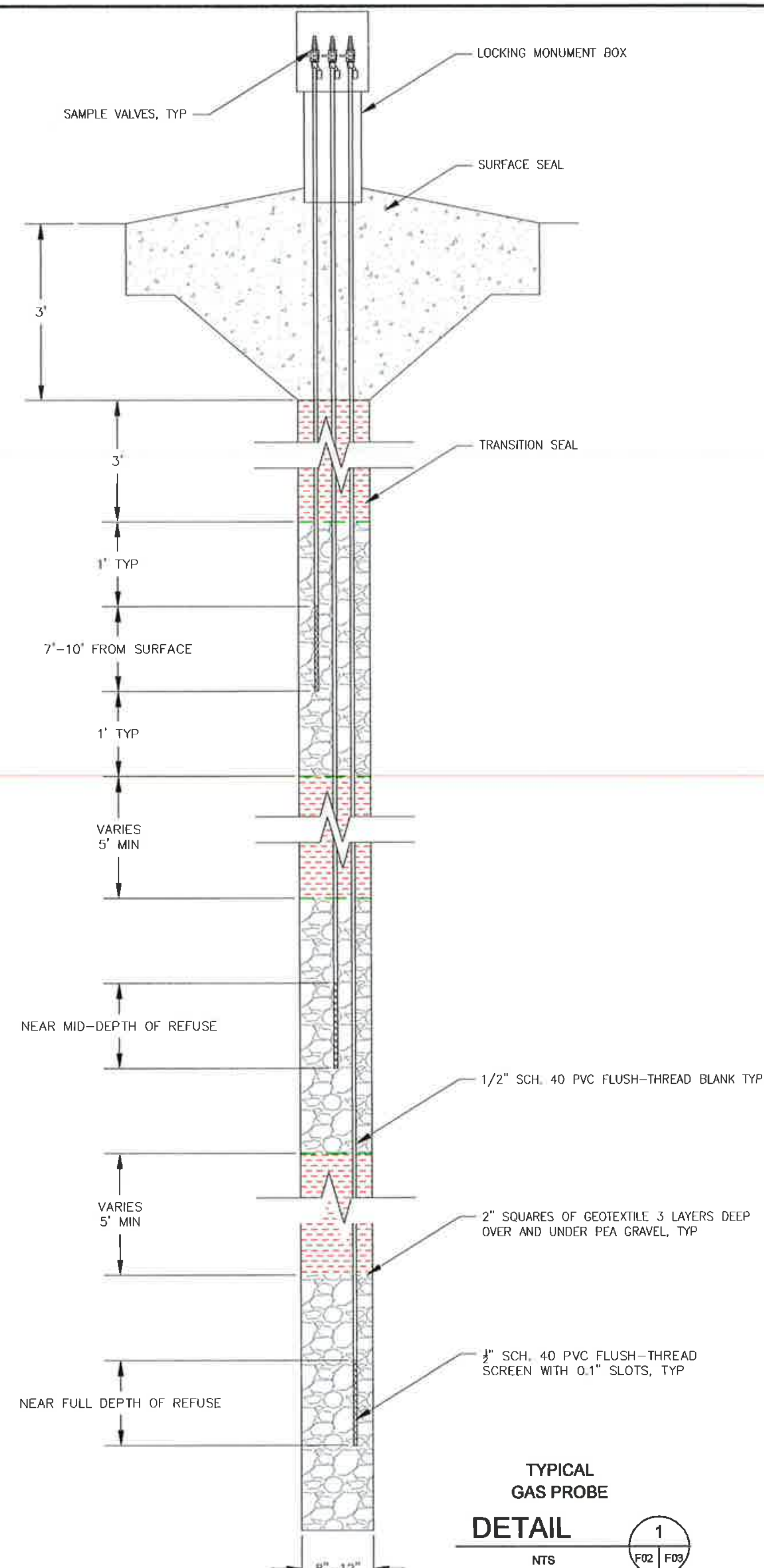


TYPICAL
GAS PROBE
DETAIL
NTS
1
F02 | F03

NOTE:
1. ACTUAL CASING AND SCREEN LENGTHS FOR INTERMEDIATE AND DEEP ZONE PROBES WILL BE ASSIGNED BY THE GEOLOGIST BASED ON THE CONDITIONS ENCOUNTERED IN THE BORING.

REV. NO.	DATE	DESCRIPTION	DRAWN BY	DESIGNED BY	CHECKED BY	APPROVED BY
A	11/22/13	ISSUED FOR REVIEW	CM	NC/CM	TVR	NC
B	10/03/14	ISSUED FOR REVIEW	WC	NC	TVR	NC

DATE OF ISSUE: 10/03/2014
DESIGNED BY: NC
DRAWN BY: WC
CHECKED BY: TVR
APPROVED BY: NC

Geo-Logic ASSOCIATES

BONZI SANITATION LANDFILL
LANDFILL GAS MONITORING AND CONTROL PLAN
STANISLAUS COUNTY, CALIFORNIA
LADFILL GAS PROBE DETAIL

FIGURE NO. 3
PROJECT NO. 2012.0023

ISSUED FOR REVIEW

LOCATION: N:\Bonzi\CAD\Figures\LFG Figures.dwg DATE: 10/7/2014 4:56 PM PLOT SCALE = 1:2 PLOTTED BY: NOAH CAMPBELL

ATTACHMENT 1

LFG MONITORING WELL SUMMARY TABLE
AND TYPICAL LFG WELL DETAIL

Table 1

Bonzi Sanitation Landfill - Title 27 Landfill Gas Probe Schedule

Probe ID	Est. GW Elev. (ft)	Est. Depth to GW (ft)	Grade Elevation (ft)	Shallow			Intermediate(2)			Deep(2)			Boring Depth (ft)
				Casing (ft)	Screen (ft)	Total (ft)	Casing (ft)	Screen (ft)	Total (ft)	Casing (ft)	Screen (ft)	Total (ft)	
8WR	37.5	37	74.5	7	3	10	19	4	23	31	4	35	36
51N	39.8	22	61.8	7	3	10	14	6	20	--	--	--	21
												Drilling Total (ft)	57

Notes:

1) The schedule assumes probe placement to the estimated depth to groundwater.
2) Actual casing/screen lengths for intermediate and deep zone probes will be assigned by the geologist based on conditions encountered in the boring.

Table 2
Landfill Gas Monitoring Well Details
Bonzi Sanitation Landfill
Stanislaus County, California

Well ID	Probe ID	Ground Surface Elevation (ft msl)	Elevation of the Base of waste at the Bonzi Landfill (ft msl)	Perforated Interval Elevation (ft msl)	Perforated interval depth (ft bgs)	Probe depth (ft bgs)	Seal Thickness (ft) *	Comments	Approximate Distance from Previously Listed Well (ft)	Latitude	Longitude
1W	1W (a)	64	35	57 - 52	7 - 12	12	7	Only two probe depths required because well is less than 30 feet deep.	165 (from 45N)	37.60899417	-121.0425888
	1W (b)	64	35	44 - 39	20 - 25	24.5	8			37.60899417	-121.0425888
2W	2W (a)	64	35	57 - 52	7 - 12	12	7	Only two probe depths required because well is less than 30 feet deep.	170	37.60854122	-121.0425855
	2W (b)	64	35	44 - 39	20 - 25	25	5			37.60854122	-121.0425855
3W	3W (a)	64	35	58 - 53	6 - 11	11	6	Only two probe depths required because well is less than 30 feet deep.	200	37.60799195	-121.0425815
	3W (b)	64	35	42 - 37	22 - 27	27	11			37.60799195	-121.0425815
4W	4W (a)	64	35	59 - 54	5 - 10	10	5	Only two probe depths required because well is less than 30 feet deep.	200	37.60744248	-121.0425775
	4W (b)	64	35	45 - 40	19 - 24	24	5			37.60744248	-121.0425775
5W	5W (a)	64	35	--	--	--	--	Borings logs not available.	200	37.60689075	-121.0425657
6W	6W (a)	65	35	--	--	--	--	Borings logs not available.	200	37.60634328	-121.042571
7W	7W (a)	69	35	--	--	--	--	Borings logs not available.	200	37.60580303	-121.0425764
9W	9W (a)	73	35	--	--	--	--	Borings logs not available.	410	37.60469214	-121.0425467
10W	10W (a)	73	35	--	--	--	--	Borings logs not available.	200	37.60413924	-121.042555
46W	46W (a)	74	35	68 - 63	6 - 11	11	5		240	37.60293889	-121.04246523
	46W (b)	74	35	58 - 53	16 - 21	21	4			37.60293889	-121.04246523
	46W (c)	74	35	49 - 44	25 - 30	30	3			37.60293889	-121.04246523

Table 2
Landfill Gas Monitoring Well Details
Bonzi Sanitation Landfill
Stanislaus County, California

Well ID	Probe ID	Ground Surface Elevation (ft msl)	Elevation of the Base of waste at the Bonzi Landfill (ft msl)	Perforated Interval Elevation (ft msl)	Perforated interval depth (ft bgs)	Probe depth (ft bgs)	Seal Thickness (ft) *	Comments	Approximate Distance from Previously Listed Well (ft)	Latitude	Longitude
47W	47W (a)	74	35	67 - 62	7 - 12	11.5	4		170	37.60248032	-121.04246189
	47W (b)	74	35	59 - 54	15 - 20	20	3			37.60248032	-121.04246189
	47W (c)	74	35	47 - 42	27 - 32	32	3			37.60248032	-121.04246189
48S	48S (a)	73	35	68 - 63	5 - 10	10	5		135	37.60230504	-121.04211775
	48S (b)	73	35	55 - 50	18 - 23	23	3			37.60230504	-121.04211775
	48S (c)	73	35	44 - 39	29 - 34	34	4			37.60230504	-121.04211775
49S	49S (a)	73	35	68 - 63	5 - 10	9.5	4		415	37.60232242	-121.04071154
	49S (b)	73	35	58 - 53	15 - 20	20	3			37.60232242	-121.04071154
	49S (c)	73	35	45 - 40	28 - 33	32.5	3			37.60232242	-121.04071154
50S	50S (a)	73	35	67 - 62	6 - 11	10.5	5		205	37.60234882	-121.04001811
	50S (b)	73	35	59 - 54	14 - 19	19	3			37.60234882	-121.04001811
	50S (c)	73	35	46 - 41	27 - 32	31.5	3			37.60234882	-121.04001811
20S	20S (a)	75	35	70 - 65	5 - 10	10	5		180	37.60244342	-121.0394164
	20S (b)	75	35	60 - 55	15 - 20	20	5			37.60244342	-121.0394164
	20S (c)	75	35	45 - 40	30 - 35	35	5			37.60244342	-121.0394164
21S	21S (a)	68	35	64 - 59	4 - 9	9	4		680	37.60236244	-121.0371168
	21S (b)	68	35	54 - 49	14 - 19	19	5			37.60236244	-121.0371168
	21S (c)	68	35	44 - 39	24 - 29	29	5			37.60236244	-121.0371168
22S	22S (a)	68	35	63 - 58	5 - 10	10	5	Only two probe depths required because well is less than 30 feet deep.	620	37.60239028	-121.0350116
	22S (b)	68	35	48 - 43	20 - 25	25	5			37.60239028	-121.0350116

Table 2
Landfill Gas Monitoring Well Details
Bonzi Sanitation Landfill
Stanislaus County, California

Well ID	Probe ID	Ground Surface Elevation (ft msl)	Elevation of the Base of waste at the Bonzi Landfill (ft msl)	Perforated Interval Elevation (ft msl)	Perforated interval depth (ft bgs)	Probe depth (ft bgs)	Seal Thickness (ft) *	Comments	Approximate Distance from Previously Listed Well (ft)	Latitude	Longitude
23E	23E (a)	70	35	66 - 61	4 - 9	9	5		400	37.60347149	-121.0349679
	23E (b)	70	35	56 - 51	14 - 19	19	5			37.60347149	-121.0349679
	23E (c)	70	35	46 - 41	24 - 29	29	5			37.60347149	-121.0349679
24E	24E (a)	69	35	62 - 57	7 - 12	12	7	Only two probe depth required because well is less than 30 feet deep.	490	37.60479643	-121.0349854
	24E (b)	69	35	44 - 39	25 - 30	28.5	5			37.60479643	-121.0349854
25E	25E (a)	67	35	60 - 55	7 - 12	12	7	Only two probe depth required because well is less than 30 feet deep.	800	37.60696645	-121.0350173
	25E (b)	67	35	45 - 40	22 - 27	27	10			37.60696645	-121.0350173
26E	26E (a)	65	35	60 - 55	5 - 10	10	5		560	37.6083851	-121.0359432
	26E (b)	65	35	50 - 45	15 - 20	20	5			37.6083851	-121.0359432
	26E (c)	65	35	40 - 35	25 - 30	30	5			37.6083851	-121.0359432
27E	27E (a)	65	35	60 - 55	5 - 10	10	5		215	37.60880518	-121.0362174
	27E (b)	65	35	50 - 45	15 - 20	20	5			37.60880518	-121.0362174
	27E (c)	65	35	40 - 35	25 - 30	30	5			37.60880518	-121.0362174
29N	29N (a)	60	35	54 - 49	6 - 11	11	6	Only two probe depths required because well is less than 30 feet deep.	245	37.60932959	-121.0363683
	29N (b)	60	35	40 - 35	20 - 25	25	9			37.60932959	-121.0363683
30N	30N (a)	60	35	55 - 50	5 - 10	10	5	Only two probe depths required because well is less than 30 feet deep.	115	37.60930818	-121.0366518
	30N (b)	60	35	40 - 35	20 - 25	25	10			37.60930818	-121.0366518

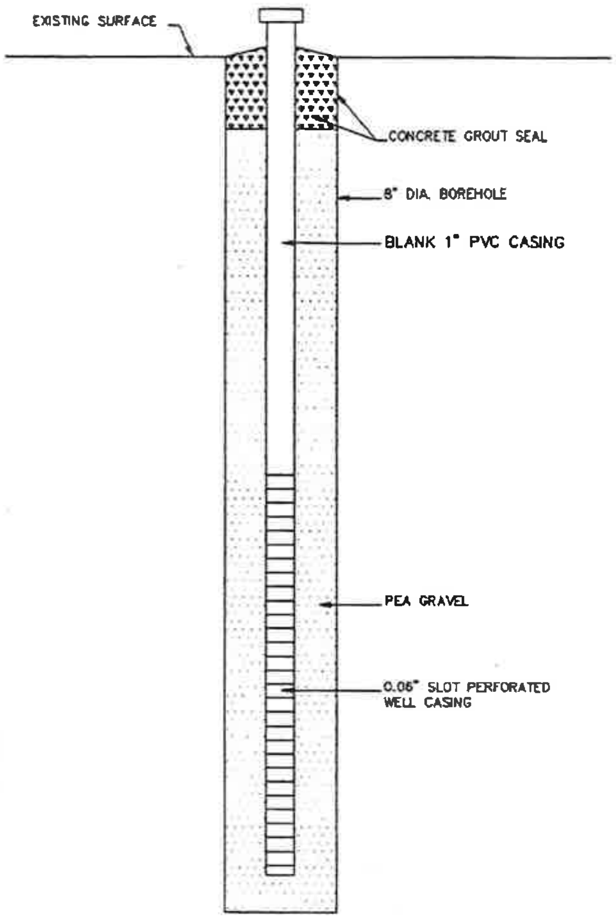
Table 2
Landfill Gas Monitoring Well Details
Bonzi Sanitation Landfill
Stanislaus County, California

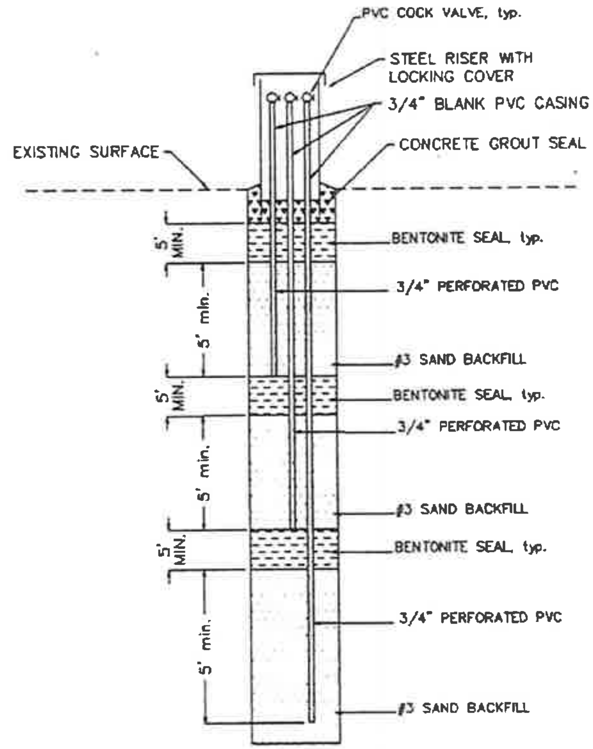
Well ID	Probe ID	Ground Surface Elevation (ft msl)	Elevation of the Base of waste at the Bonzi Landfill (ft msl)	Perforated Interval Elevation (ft msl)	Perforated interval depth (ft bgs)	Probe depth (ft bgs)	Seal Thickness (ft) *	Comments	Approximate Distance from Previously Listed Well (ft)	Latitude	Longitude
31N	31N (a)	60	35	53 - 48	7 - 12	12	7	Only two probe depths required because well is less than 30 feet deep.	100	37.60930663	-121.03699210
	31N (b)	60	35	43 - 38	17 - 22	22	5			37.60930663	-121.0369921
32N	32N (a)	60	35	55 - 50	5 - 10	9.8	5	Only two probe depths required because well is less than 30 feet deep.	100	37.60930504	-121.0373393
	32N (b)	60	35	43 - 38	17 - 22	22	5			37.60930504	-121.0373393
33N	33N (a)	60	35	55 - 50	5 - 10	10	5	Only two probe depths required because well is less than 30 feet deep.	110	37.60930333	-121.0377146
	33N (b)	60	35	45 - 40	15 - 20	20	5			37.60930333	-121.0377146
34N	34N (a)	60	35	53 - 48	7 - 12	12	7	Only two probe depths required because well is less than 30 feet deep.	125	37.60930141	-121.0381339
	34N (b)	60	35	43 - 38	17 - 22	22	5			37.60930141	-121.0381339
35N	35N (a)	60	35	55 - 50	5 - 10	10	5	Only two probe depths required because well is less than 30 feet deep.	140	37.60930690	-121.03875529
	35N (b)	60	35	42 - 37	18 - 23	23	5			37.60930690	-121.03875529
36N	36N (a)	60	35	52 - 47	8 - 13	12.5	8	Only two probe depths required because well is less than 30 feet deep.	150	37.60930520	-121.03912610
	36N (b)	60	35	42 - 37	18 - 23	23	5			37.60930520	-121.03912610
37N	37N (a)	60	35	54 - 49	6 - 11	11	6	Only two probe depths required because well is less than 30 feet deep.	100	37.60930362	-121.03947132
	37N (b)	60	35	44 - 39	16 - 21	21	5			37.60930362	-121.03947132

Table 2
Landfill Gas Monitoring Well Details
Bonzi Sanitation Landfill
Stanislaus County, California

Well ID	Probe ID	Ground Surface Elevation (ft msl)	Elevation of the Base of waste at the Bonzi Landfill (ft msl)	Perforated Interval Elevation (ft msl)	Perforated interval depth (ft bgs)	Probe depth (ft bgs)	Seal Thickness (ft) *	Comments	Approximate Distance from Previously Listed Well (ft)	Latitude	Longitude
38N	38N (a)	60	35	55 - 50	5 - 10	10	5	Only two probe depths required because well is less than 30 feet deep.	100	37.60930204	-121.03981654
	38N (b)	60	35	45 - 40	15 - 20	20	5			37.60930204	-121.03981654
39N	39N (a)	60	35	--	--	--	--	Borings logs not available.	190	37.60944611	-121.04046786
40N	40N (a)	60	35	--	--	--	--	Borings logs not available.	100	37.60944456	-121.04080465
41N	41N (a)	60	35	--	--	--	--	Borings logs not available.	120	37.60944950	-121.04121390
42N	42N (a)	60	35	--	--	--	--	Borings logs not available.	100	37.60944113	-121.04154961
43N	43N (a)	60	35	--	--	--	--	Borings logs not available.	120	37.60943573	-121.04196630
44N	44N (a)	60	35	--	--	--	--	Borings logs not available.	97	37.60944103	-121.04229459
45N	45N (a)	60	35	--	--	--	--	Borings logs not available.	68	37.60943663	-121.04252659

Notes
(a) = Probe located at Shallow depth
(b) = Probe located at Intermediate depth
(c) = Probe located at Deep depth
*Seal thickness includes the bentonite chips and cement slurry or equivalent
-- = Not Available, boring logs are not available for monitoring wells installed by Beta Associates in 1982.





Source: EBA
Not to Scale

TYPICAL LANDFILL GAS MONITORING WELL
Bonzi Sanitation Landfill
Modesto, California

By: EM	Date: 02/05/09	Project No. 12482.002
AMEC Geomatrix		Figure 4

ATTACHMENT 2

EXAMPLE FIELD MONITORING FORMS

CALIBRATION PROCEDURE AND BACKGROUND REPORT

LANDFILL NAME: ____

INSTRUMENT MAKE:__________ MODEL: ______________ S/N: ______________

Calibration Procedure

1. Allow instrument to zero itself while introducing zero air.
2. Introduce calibration gas into the probe.
   Stabilized reading = _________ ppm
3. Adjust meter settings to read 500 ppm

Background Determination Procedure

1. Upwind Background Reading (highest in 30 seconds): ppm (1)
2. Downwind Reading (highest in 30 seconds): ppm (2)
   Calculate Background Value:

$$\frac{(1) + (2)}{2}$$

Background = _______ ppm

PERFORMED BY: ________________________TIME:____________________

DATE:______________________

CALIBRATION PRECISION RECORD

LANDFILL NAME: ____

MONITORING DATE: ____________________ PERFORMED BY: ____________________________

EXPIRATION DATE: ____________________ (3-mos.) TIME: ________________________

INSTRUMENT MAKE: ____________________ MODEL: ______________ S/N ______________

CALIBRATION GAS STANDARD: __________ ppm CH_4 (STD)

MEASUREMENT #1:

Meter Reading for Zero Air: __________ ppm (1)

Meter Reading for Calibration Gas: __________ ppm (2)

MEASUREMENT #2:

Meter Reading for Zero Air: __________ ppm (3)

Meter Reading for Calibration Gas: __________ ppm (4)

MEASUREMENT #3:

Meter Reading for Zero Air: __________ ppm (5)

Meter Reading for Calibration Gas: __________ ppm (6)

CALIBRATION PRECISION:

$$\frac{[STD-(2)]+[STD-(4)+[STD-(5)}{3} \times \frac{1}{500} \times \frac{100}{1}$$

= ____________________ % (result must be less than 10%)

DAILY GEM CALIBRATION LOG

DATE: ______________________________

SITE: ______________________________

TECHNICIAN: ______________________________

GEM S/N: ______________________________

GEM TYPE: ______________________________

ARRIVAL TIME: ______________________________

DEPARTURE TIME: ______________________________

Calibration No. 1

TIME: ________________ TEMP: ________________

LOT # 50% CH_4/35% CO_2 / Balance Gas: ________________

(Probes Only) LOT # 15% CH_4/15% CO_2 / Balance Gas: ________________

LOT # 4% O_2 / Balance Gas: ________________

Calibration No. 2

TIME: ________________ TEMP: ________________

LOT # 50% CH_4/35% CO_2 / Balance Gas: ________________

(Probes Only) LOT # 15% CH_4/15% CO_2 / Balance Gas: ________________

LOT # 4% O_2 / Balance Gas: ________________

Calibration No. 3

TIME: ________________ TEMP: ________________

LOT # 50% CH_4/35% CO_2 / Balance Gas: ________________

(Probes Only) LOT # 15% CH_4/15% CO_2 / Balance Gas: ________________

LOT # 4% O_2 / Balance Gas: ________________

DEL-TECH GEOTECHNICAL SUPPORT, INC.
(209) 847-8757 (OFFICE) • (209) 847-7744 (FAX) • deltech1@pacbell.net (Email)

LANDFILL PERIMETER GAS MONITORING - FIELD LOG SHEET
BONZI LANDFILL / MODESTO, CA.

LOCATION	DATE	TIME	CH4 %	CO2 %	O2 %	N2 %	Temp deg F	VAC. / PRES IN-WATER	WELL DEPTH FT./ IN.	COMMENTS	SAMPLE TECH.
1WS									12.0		
1WD									24.5		
5W											
9W											
21SS									9.0		
21SM									19.0		
21SD									29.0		
23ES									9.0		
23EM									19.0		
23ED									29.0		
26ES									10.0		
26EM									20.0		
26ED									30.0		
29NS									11.0		
29ND									25.0		
36NS									12.5		
36ND									23.0		
38NS									10.0		
38ND									20.0		
41N									22.5		
44N											
ONSITE HOME											
OFFSITE HOME											
INFLUENT											
EFFLUENT											

Flare Station Measurements				Ambient Conditions			
Intake Vacuum		Stack temp.		Weather		Temp. (F)	Pressure
Exhaust Pressure		Flow rate (cfm)					
Inventory	Paper	Red Pens		Blue Pens	Baking Soda	Other	
Sample Tech.							

NOTES: Measurements were taken while the flare was ON line or OFF-line

MONTHLY CHECKLIST

LOCATION:		PERSONNEL:	
DATE:		TIME:	
1	CHANGE AIR COMPRESSOR OIL		
2	CHECK AIR COMPRESSOR AIR FILTERS		
3	CHECK AIR COMPRESSOR DRIVE BELT TENSION AND WEAR		
4	CHECK BFS PRESSURE GAUGES		
5	CHECK BFS TEMPERATURE GAUGES		
6	ROTATE/BUMP ALL NON-OPERATING BLOWERS (IF APPLICABLE)		
7	CHECK CHART RECORDER PAPER & CHANGE AS REQUIRED		
8	CHECK ABOVE GROUND PIPING FOR SETTLEMENT (IF APPLICABLE)		
9	SURFACE EMISSIONS: CHECK PIPING IN BFS FOR LEAKS		
10	CALIBRATE GAS SENSOR MODULES		
COMMENTS:			
REVIEWED BY:		DATE:	

SURFACE EMISSIONS EXCEEDANCE
REMEDIATION NOTIFICATION AND CONTROL

SITE: ______________________ DATE: ______________________

RECORD NO.	LOCATION:	DATE IDENTIFIED:
EXCEEDANCE VALUE (ppmv):		INSPECTOR:
INSPECTOR COMMENTS:		

LANDFILL OPERATIONS NOTIFICATION NO. 1				
NAME	INITIALS	DATE	TIME	ORGANIZATION

REMEDIATION RESPONSE NO. 1			
DATE:	TIME:	NAME:	INITIALS:
DESCRIPTION:			

10-DAY RECHECK				
DATE	TIME	VALUE (ppmv)	NAME	INITIALS

LANDFILL OPERATIONS NOTIFICATION NO. 2				
NAME	INITIALS	DATE	TIME	ORGANIZATION

REMEDIATION RESPONSE NO. 2			
DATE:	TIME:	NAME:	INITIALS:
DESCRIPTION:			

10-DAY RECHECK				
DATE	TIME	VALUE (ppmv)	NAME	INITIALS

LANDFILL OPERATIONS NOTIFICATION NO. 3				
NAME	INITIALS	DATE	TIME	ORGANIZATION

1 MONTH RECHECK				
DATE	TIME	VALUE (ppmv)	NAME	INITIALS

INSTRUMENT RESPONSE TIME RECORD

LANDFILL NAME: ____

MONITORING DATE: ____________________ TIME: ____________________

INSTRUMENT MAKE: _______________ MODEL: _____________ S/N: ____________

MEASUREMENT #1:

Stabilized Reading Using Calibration Gas: __________ ppm

90% of the Stabilized Reading: _________ ppm

Time to Reach 90% of Stabilized reading After switching from Zero Air to Calibration Gas _________ seconds (1)

MEASUREMENT #2:

Stabilized Reading Using Calibration Gas: __________ ppm

90% of the Stabilized Reading: _________ ppm

Time to Reach 90% of Stabilized reading After switching from Zero Air to Calibration Gas _________ seconds (2)

MEASUREMENT #3:

Stabilized Reading Using Calibration Gas: __________ ppm

90% of the Stabilized Reading: _________ ppm

Time to Reach 90% of Stabilized reading After switching from Zero Air to Calibration Gas _________ seconds (3)

CALCULATE RESPONSE TIME:

$$\frac{(1) + (2) + (3)}{3} = \_\_\_\_\_\_\_$$ SECONDS (MUST BE LESS THAN 30 SECONDS)

PERFORMED BY: ____

APPENDIX K

DESIGN CALCULATIONS

Geo-Logic ASSOCIATES

143E Spring Hill Drive
Grass Valley, CA 95945
530.272.2448
www.geo-logic.com

Job No. 2012.0023 Job Name: Bonzi LF Closure
Sheet No. 1 of 3
Calculated By: TVR Date: 11/25/13
Checked By: Date:
Scale: NA

Bonzi Landfill Closure - Toe Drain Outlet

$q_{Geoc.} = K_{veg} \times L_h$ where $K_{veg} = 1 \times 10^{-5}$ cm/sec; and $L_h = 25$ m.

$= \frac{1 \times 10^{-5} \text{cm/sec}}{100 \text{ cm/m}} \times 25 \text{ m} = 0.00008 \text{ m}^2/\text{sec} = \text{m}^3/\text{sec/meter}$

$Q_{pipe} = q_{geoc.} \times L_{ToeDrain} = L = \frac{Q_{pipe}}{q_{geoc.}} \div FS$

Where: Q_{pipe} = per Flowmaster for 4 inch ϕ HDPE dropping 1' across road (ie. 1' in 20' or 5%) = $Q_4 = 0.0131$ m³/sec

FS = 2,

$L_{Toe Drain} = \frac{\frac{0.0131 \text{ m}^3/\text{sec}}{0.00008 \text{ m}^2/\text{sec/m}}}{2} = 82 \text{ m} = 268 \text{ feet}$

$\boxed{\text{use 250 feet}}$

For 6" pipe ⇒ $Q_6 = 0.0385$

$L_6 = \frac{\frac{0.0385}{0.00008}}{2} = 240 \text{ m} = 789 \text{ feet}$

$\boxed{\text{use 750 feet}}$

standard

4-inch Outlet Pipe
Worksheet for Circular Channel

Project Description	
Project File	untitled.fm2
Worksheet	Toe Drain Outflow
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.012	
Channel Slope	0.050000	ft/ft
Diameter	4.00	in

Results		
Depth	4.0	in
Discharge	0.0131	m^3/s
Flow Area	0.09	ft^2
Wetted Perimeter	1.05	ft
Top Width	0.00	ft
Critical Depth	0.33	ft
Percent Full	100.00	
Critical Slope	0.044553	ft/ft
Velocity	5.28	ft/s
Velocity Head	0.43	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	0.50	cfs
Full Flow Capacity	0.46	cfs
Full Flow Slope	0.050000	ft/ft

6-inch Outlet Pipe
Worksheet for Circular Channel

Project Description	
Project File	untitled.fm2
Worksheet	Toe Drain Outflow
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data		
Mannings Coefficient	0.012	
Channel Slope	0.050000	ft/ft
Diameter	6.00	in

Results		
Depth	6.0	in
Discharge	0.0385	m^3/s
Flow Area	0.20	ft^2
Wetted Perimeter	1.57	ft
Top Width	0.00	ft
Critical Depth	0.49	ft
Percent Full	100.00	
Critical Slope	0.045058	ft/ft
Velocity	6.92	ft/s
Velocity Head	0.74	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	1.46	cfs
Full Flow Capacity	1.36	cfs
Full Flow Slope	0.050000	ft/ft