

**APPENDIX I**

**EARTHFILL AND MATERIAL QUANTITY ESTIMATES**

**AND SETTLEMENT ESTIMATES**

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June 2012

<b>Landfill No. 2</b>							
<b>Liner System</b>	<b>Acres</b>	<b>SF</b>	<b>Thickness</b>	<b>CY</b>	<b>Tons</b>	<b>CY Onsite</b>	<b>Tons Import</b>
Foundation	NA	NA	Varies	10,000		10,000	
Clay	6	261,400	3	29,000	43,000		43,000
Soil Layer Bottom	6	261,400	4	38,800		38,800	
Underdrain Rock	6	261,400	1	9,700	19,010		19,010
Sand	6	261,400	1	9,700	15,000		15,000
Operations	20	871,200	2	64,500		64,500	
LCRS Rock	6	261,400	1	9,700	19,010		19,010
GCL - 2	15	1,300,000					
HDPE - 2.7	20	2,352,000					
Geocomposite - 2	15	1,300,000					
Geotextile Filter - 3	6	785,000					
Geotextile Cushion - 2	6	523,000					
<b>Preferential LCRS</b>							
Geocomposite	13.5	586,000					
HDPE	13.5	586,000					
GCL	13.5	586,000					
Operations	13.5	586,000	2	43,400		43,400	
<b>Final Cover</b>							
Vegetative	45.8	1,995,000	1.5	110,800		110,800	
Foundation	45.8	1,995,000	1	73,900		73,900	
Geocomposite	45.8	1,995,000					
HDPE	45.8	1,995,000					
GCL	45.8	1,995,000					
<b>Landfill No. 1</b>							
<b>Liner System REA</b>							
Earth Berm	NA	NA	NA	15,000		15,000	
Underdrain Rock	2.3	100,000	1	3,700	7,250		7,250
Sand	2.3	100,000	1	3,700	5,720		5,720
Geotextile Separator - 2	2.3	200,000					
Soil Layer Bottom	2.3	100,000	4	14,800		14,800	
Cushion Layer	11.7	510,000	2	37,780		37,780	
Clay	2.3	100,000	3	11,110	22,000		22,000
Operations	13	566,000	2	42,000		42,000	
Geotextile Filter - 1	2.3	100,000					
LCRS Rock	2.3	100,000	1	3,700	7,250		7,250
Geotextile Cushion - 2	2.3	200,000					
GCL - 2	11.7	1,020,000					
HDPE - 2.7	13	1,529,000					
Geocomposite - 2	11.7	1,020,000					
<b>REA Preferential LCRS</b>							
Geocomposite LCRS	7.4	322,350					
HDPE	7.4	322,350					
GCL	7.4	322,350					
Operations	7.4	322,350					
<b>Compost Preferential LCRS</b>							
LCRS	37.2	1,620,000	0.5	30,000	58,800		58,800
Operations	37.2	1,620,000	2	120,000		120,000	
Geotextile Separators - 2	37.2	3,420,000					
HDPE	37.2	1,620,000					
GCL	37.2	1,620,000					
<b>Final Cover</b>							
Vegetative	135.7	5,911,000	1.5	328,390		328,390	
Foundation	135.7	5,911,000	1	218,930		218,930	
Geocomposite	135.7	5,911,000					
HDPE	135.7	5,911,000					
<b>Daily Soil Cover (10:1)</b>				960,000		960,000	
<b>TOTALS</b>							
Onsite Soil (cy)						2,078,300	
Clay (tons)							65,000
Sand (tons)							20,720
LCRS Rock (tons)							111,320

Note: quantities in final cover include provisions for slope areas. On-site soils include borrow from West Canyon

ATTACHMENT  
GEOSYNTEC 2008 SITE INVESTIGATION

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**Attachment B**

**Excerpts from GeoSyntec Report  
Field Investigation Memorandum  
Central Disposal Site  
County of Sonoma  
June 9, 2008**

**Geosyntec Consultants, Inc.**  
**FIELD INVESTIGATION MEMORANDUM**  
**Central Disposal Site**  
**County of Sonoma**

**TO:** Krzysztof Jesionek (Geosyntec Consultants, Inc.)

**FROM:** Julien Waeber (Geosyntec Consultants, Inc.)

**DATE:** 9 June 2008

**SUBJECT:** Intermediate Cover Evaluation  
Central Disposal Site  
Petaluma, Sonoma County, California

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Geosyntec Consultants, Inc., (Geosyntec) is pleased to present the results of the recent evaluation of the intermediate cover at the Central Disposal Site (CDS) in Petaluma, California. The evaluation included field investigation, sampling and field and laboratory testing of the existing intermediate cover soils.

## **OBJECTIVE**

The main objective of this investigation was to: (i) evaluate the thickness, type and soil physical properties of the existing intermediate cover of Landfills 1 and 2; (ii) to evaluate the northern extent of waste in Landfill 1; and (iii) to characterize stockpiled soils on site.

## **PREPARATION**

Prior to field activities, Geosyntec developed a Health and Safety Plan (HASP), which included air monitoring for landfill gases (LFG), including methane and organic vapors.

Also, since landfill waste was to be exposed, Geosyntec and the County of Sonoma notified the Enforcement Agency (EA) (Sonoma County Environmental Health Division), California Regional Water Quality Control Board – North Coast Region (CRWQCB) and Bay Area Air Management District (BAAQMD) about the field program. Copies of regulatory agency notifications are included in Attachment 1.

Geosyntec also developed approximately 100 ft x 100 ft (30 m x 30 m) grid systems for both landfills in order to randomly generate a total of approximately 70 test pit locations - 55 in Landfill 1 and 15 in Landfill 2. Based on Geosyntec-developed grid node coordinates, the County surveyor staked the pit locations in the field. Due to encountered physical obstructions, only 62 of the planned 70 test pits were excavated.

## **FIELD INVESTIGATION**

Geosyntec conducted field investigation at the CDS from 24 March 2008 through 28 March 2008. The County of Sonoma provided a backhoe and operator to assist in the investigation. To meet the objectives of this field investigation, Geosyntec:

- observed excavation, logged and sampled test pits within Landfill 1 and Landfill 2;
- observed excavation and logged test pits in areas of inner and outer toe of the visual berm;
- observed excavation, logged and sample existing stockpiled soils located in the south-western area of the CDS; and
- performed laboratory testing on selected soil samples.

Field activities, along with the LFG monitoring data, are documented in Field Daily Reports (Attachment 2). Test pit logs are included in Attachment 3. Attachment 4 includes geotechnical laboratory test reports.

The County provided two track mounted mini-excavators (Takeuchi TB175 and John Deere 135C) and operators for field activities. Figures 1 and 2 present approximate locations of the test pits.

### **Landfill 1 and Landfill 2 Intermediate Cover Evaluation**

Each test pit was excavated to waste, photographed, logged and backfilled. If sufficient soil cover permitted, the test pits were widened and excavated to approximately 6 to 12 in. (150 to 300 mm) above waste and to a maximum depth of 4 ft (1.2 m) below ground surface<sup>1</sup> for nuclear gauge moisture and density testing of the in-place intermediate cover. Soil samples for moisture content and bulk samples for laboratory testing of the different material types encountered were

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<sup>1</sup> The depth of excavation was limited to the maximum OSHA-permitted depth without shoring.

collected at each test pit location. Each test pit was then backfilled and compacted in place using a sheepfoot wheel mounted on a mini-excavator. When encountered, excavated waste was reburied first within the test pit waste zone. Field moisture and density testing was performed using a Troxler 3430 nuclear gauge.

Table 1 summarizes test pit locations and field data, including location coordinates, depth to waste, and field and moisture density data. Test pit logs, including field observation and monitoring data, are included in Attachment 2.

### **Stockpile Evaluation**

A total of 20 test pits were excavated to a depth of approximately 3 ft each (900 mm) at the soil stockpile. At each location, excavated soils were characterized, test pits were photographed and bulk samples of each material type were collected for laboratory testing. Approximate test pit locations are shown on Figure 3.

### **Visual Berm Waste Limit Evaluation**

A total of 5 test pits were excavated along the inner and outer toes of the visual berm at the north end of Landfill 1. Waste was encountered at approximately 7 to 9 ft (2 to 3 m) below ground surface along the south side of the berm, while no waste was encountered along the north side of the berm. Each test pit was logged and photographed and approximate location marked on the field map. Due to large depths of the excavations (see Footnote 1), only two nuclear gauge moisture and density tests were performed within the visual berm test pits. As planned, no samples were collected for testing.

## **LABORATORY TESTING AND RESULTS**

Bulk samples collected during the field investigation were selected for geotechnical laboratory testing as follows<sup>2</sup>:

- out of a total of 20 bulk samples collected from the intermediate cover investigation, 10 composite samples were prepared and tested in the laboratory; and
- out of a total of 20 bulk samples collected from the soil stockpile investigation, 10 composite samples were prepared and tested in the laboratory.

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<sup>2</sup> As discussed, no samples were collected from the visual berm.

The following laboratory tests were performed on a total of 20 composite soil samples:

- Atterberg Limits (ASTM D 4318);
- Grain size analysis (ASTM D 1140);
- Maximum Relative Density or compaction curve (ASTM D 1557); and
- Hydraulic conductivity (ASTM D 5084) – stockpile material only.

Table 2 presents a summary of the soil test results. The laboratory test reports are included in Attachment 4.

## CONCLUSIONS

- waste was encountered at depths ranging from 1 to 17.5 ft (0.3 to 5.3 m) in Landfill 1 and from 1 to 13.5 ft (0.3 to 4.1 m) in Landfill 2;
- field density data of the intermediate cover soils indicate generally adequate for a final cover foundation layer relative compaction of a minimum 90%;
- laboratory test results indicate that the intermediate cover and stockpiled soils are adequate materials for use as foundation and vegetative soils;
- air monitoring of each excavation location did not register any methane or organic vapor readings; and
- based on the observation of the visual berm test pits, waste extends approximately to the middle of the berm, i.e., half of the berm is located over the Landfill 1 waste.

**Attachments** Table 1 - Filed Investigation and In-Situ Testing Summary  
Table 2 - Filed and Laboratory Test Result Summary

Figure 1 - Landfill 1 Test Pit Locations

Figure 2 - Landfill 2 Test Pit Locations

Figure 3 - Stockpile Test Pit Locations

Attachment 1 - Regulatory Agency Notifications

Attachment 2 - Field Daily Reports

Attachment 3 - Test Pit Logs

Attachment 4 - Laboratory Test Reports

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ATTACHMENT

COMPOST DECK SETTLEMENT ESTIMATES

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## SCS ENGINEERS

File No. 01210155.00  
June 26, 2012

### MEMORANDUM

TO: Joe Miller  
Ambrose McCready

FROM: Heather Grant

SUBJECT: Compost Deck Area Settlement Analysis – Sonoma

Future MSW filling in LF-1 will take place in the approximately 35-acre compost deck area. Part of compost deck site preparation activities will include re-grading the area to provide a minimum slope of 3 percent in order to proper drainage for the preferential pathway system.

An analysis was performed to confirm that the proposed minimum 3 percent slope will provide sufficient long-term drainage of the overlying preferential pathway system in light of anticipated MSW loading and settlements. Based on existing and proposed final grades, up to 50 feet of MSW fill will be placed over the compost deck. The analyses entailed: (1) review of the literature to obtain data on anticipated settlements for recent and old refuse fill with and without surcharge; 2) calculation of anticipated settlements across the prepared subgrade surface section (attached) given our understanding of the original ground surface, underlying refuse fill depths, and proposed compost deck final grades; and (3) preparation of a cross section showing the resulting compost deck subgrade surface elevations. Anticipated settlements were based on SCS experience with similar landfills and are a reasonable representation of settlement under different conditions. These settlements are assumed as follows:

- Old fill without overburden: 3%;
- Old fill with overburden: 6%;
- New fill: 18%.

Results of this analysis are shown on the attached worksheet and figures.

Our analysis showed that the prepared subgrade for the preferential pathway will experience relatively uniform settlements over the area, ranging up to 7 feet from the preliminary design grades. The resulting surface will maintain grades between 1 and 3 percent, with the lower end of the range above the deeper portion of the original LF-1 canyon fill. The overall drainage will

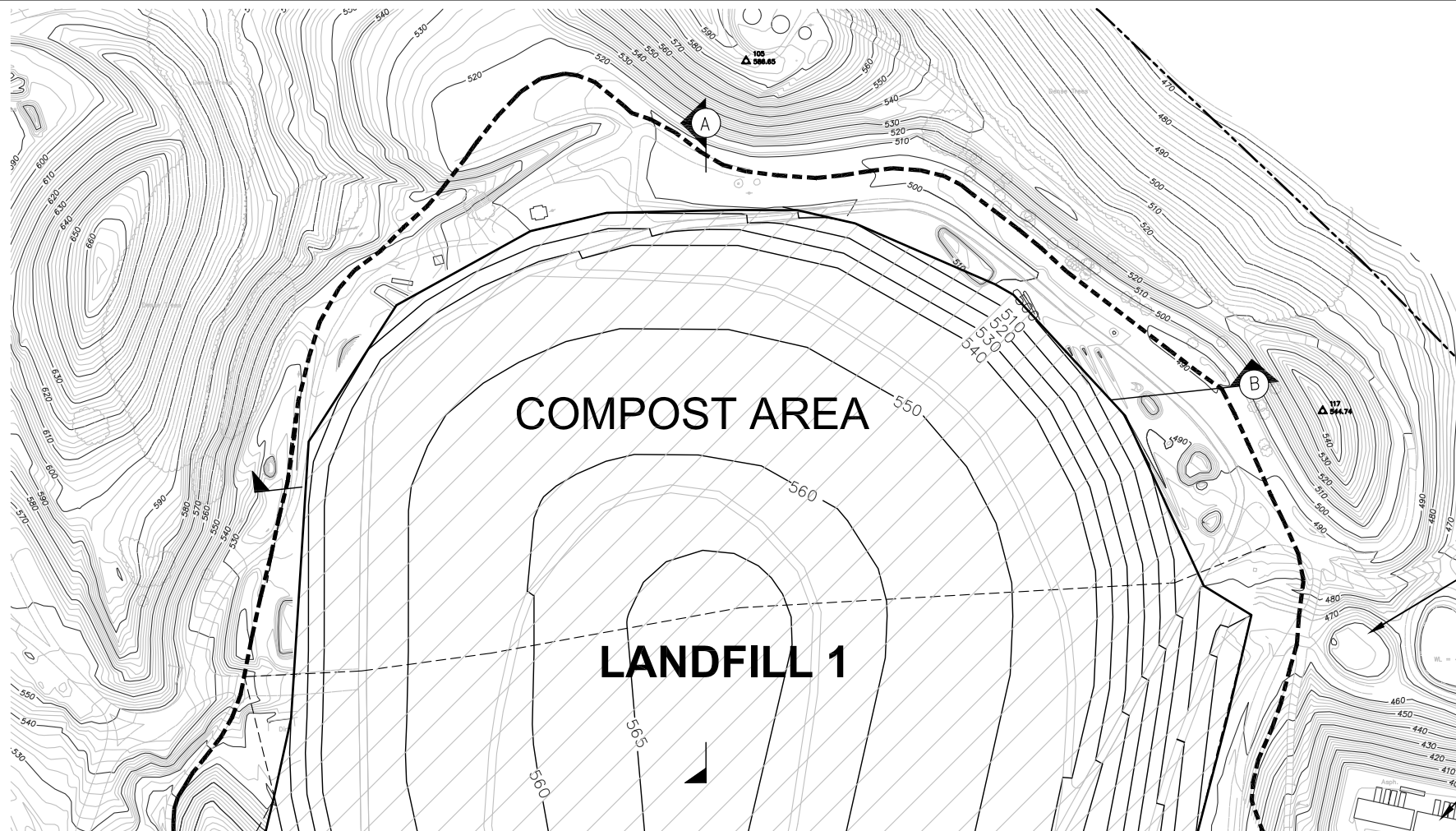
remain at 3 percent from west to east. Thus the surface is expected to maintain positive drainage for the preferential pathway system.

This settlement estimate is considered to be conservative, as wastes in the compost deck area have been in place for 34 years or more, and have likely undergone significant consolidation due to waste decomposition processes and from surcharge due to intermediate cover placement and past composting operations. Further, it was assumed that the maximum settlement would generally follow the original ground topographic surface. However, it is unlikely that the bottom contours of LF-1 were filled without cut/fill and re-grading to create a more uniform subgrade. Based on these facts and assumptions, this analysis is likely a conservative one.

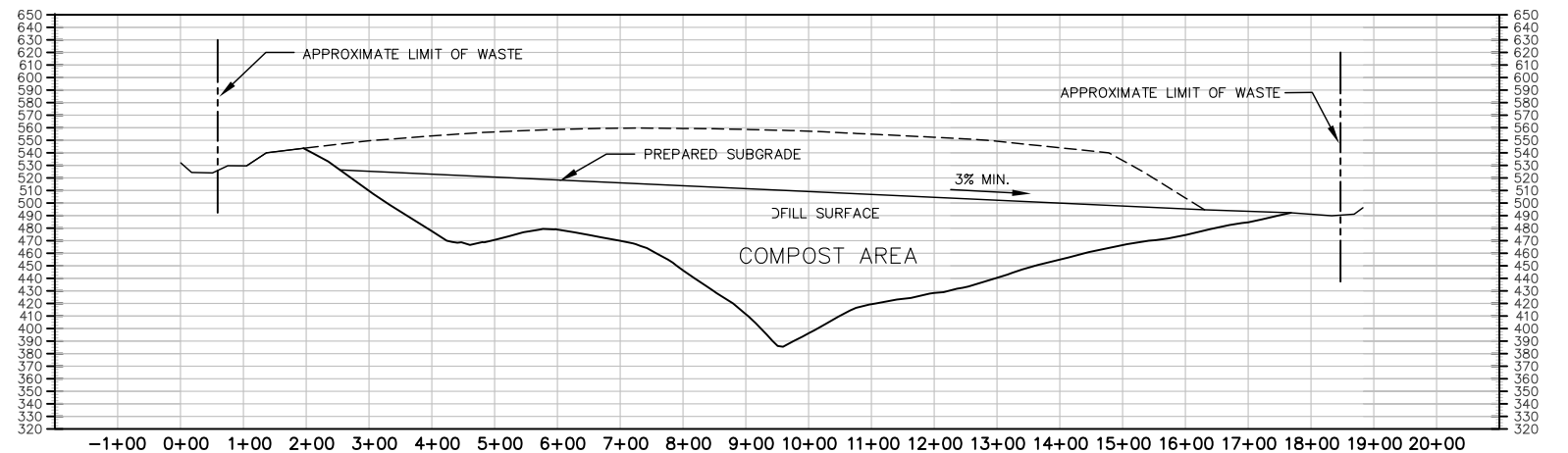
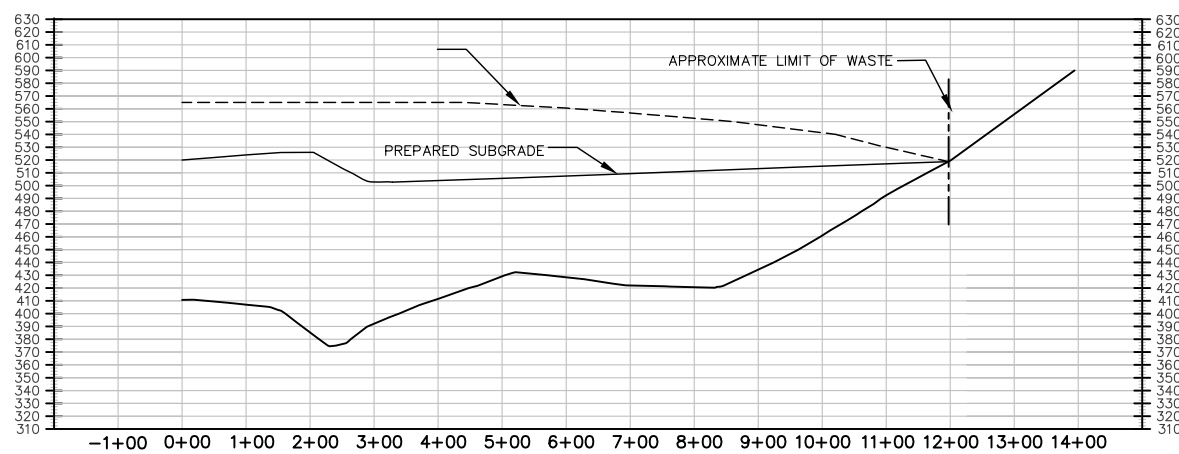
**Section B, 3% Slope Prepared Subgrade**

Station	Original Subgrade Elevation (1971 Pre-Fill)	H <sub>1</sub> (Prepared Subgrade 3%)	H <sub>2</sub> (New MSW)	H <sub>1</sub> Settlement (No Overburden)	H <sub>1</sub> Settlement (With Overburden)	H <sub>2</sub> Settlement	Final Elevation, H <sub>1</sub>	Final Elevation, H <sub>2</sub>
2+00	542.50		543.85			0.24		543.61
3+00	509.84	525.24	549.94		0.92	4.45	524.32	545.49
4+00	477.66	522.94	553.41		2.72	5.48	520.22	547.93
5+00	470.66	520.63	556.30		3.00	6.42	517.63	549.88
6+00	478.87	518.33	558.61		2.37	7.25	515.96	551.36
7+00	469.92	516.02	559.62		2.77	7.85	513.25	551.77
8+00	446.43	513.72	559.39		4.04	8.22	509.68	551.17
9+00	411.43	511.41	558.60		6.00	8.49	505.41	550.11
10+00	396.25	509.14	557.27		6.77	8.66	502.37	548.61
11+00	419.38	506.80	554.83		5.25	8.65	501.55	546.18
12+00	428.41	504.49	552.38		4.56	8.62	499.93	543.76
13+00	440.42	502.19	549.18		3.71	8.46	498.48	540.72
14+00	454.95	499.88	544.02		2.70	7.95	497.18	536.07
15+00	466.48	497.57	533.90		1.87	6.54	495.70	527.36
16+00	474.55	495.27	504.03		1.24	1.58	494.03	502.45
17+00	484.57	493.41		0.27			493.14	

Note: Old fill without overburden settlement = 3%  
 Old fill with overburden settlement = 6%  
 New fill = 18%



PLAN VIEW



**SCS ENGINEERS**

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PROJ. NO. 01210155.00

DWN. BY: ATV

ACAD FILE: FIGURE 17C

DSN. BY: ATV

CHK. BY: AAM

APP. BY: JJM

COUNTY OF SONOMA, DEPTMENT OF  
TRANSPORTATION AND PUBLIC WORKS  
PETALUMA, CALIFORNIA

SHEET TITLE:

COMPOST DECK INTERIM FILL PLAN AND SECTIONS

PROJECT TITLE:

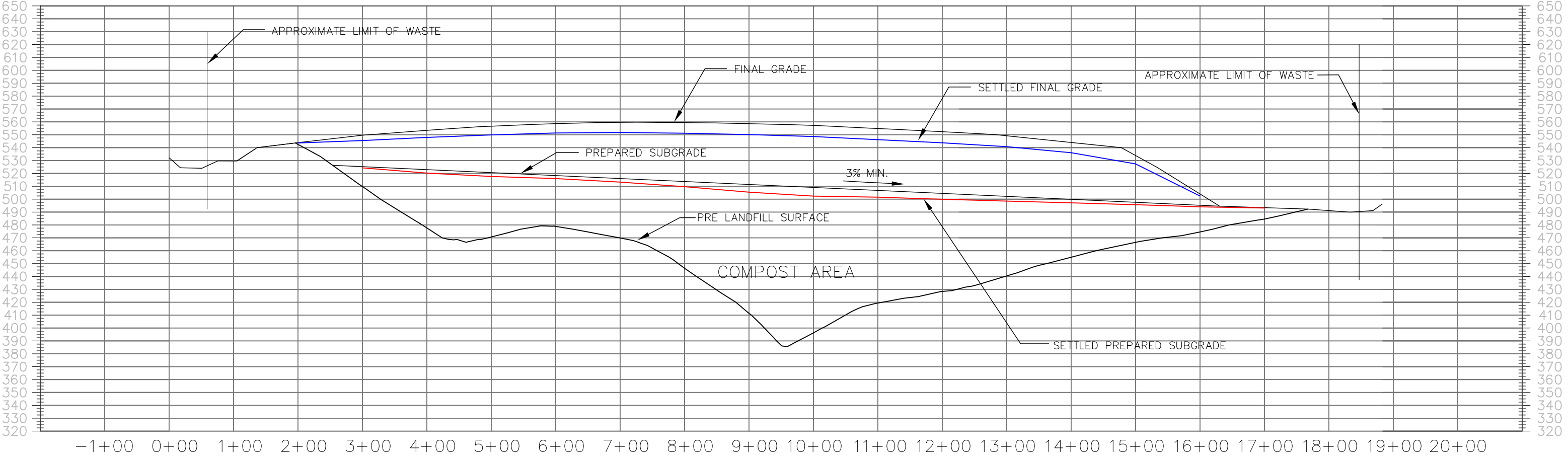
RJTD SONOMA COUNTY CENTRAL DISPOSAL SITE  
SONOMA COUNTY, CALIFORNIA

DATE: 6/29/12

SCALE: AS SHOWN

FIGURE:

17C



SECTION B