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November 17, 2015

Mr. Pladej Prompungtagorn  
Project Manager  
MSW Permits Section  
Waste Permits Division – MC 124  
Texas Commission on Environmental Quality  
P.O. Box 13087  
Austin, Texas 78711-3087

Re: Pescadito Environmental Resource Center - Webb County  
Municipal Solid Waste (MSW) Permit Application No. 2374  
Permit Application – Second Notice of Deficiency (NOD)  
Tracking Nos. 14669041(19666994); CN603835489/RN106119639

Dear Mr. Prompungtagorn;

CB&I Environmental and Infrastructure, Inc. (CB&I) is in receipt of your letter dated October 19, 2015 transmitting a request for additional information regarding the referenced application. Our submittal is formatted as follows:

Attachment A contains a revised signature page from the Part 1 form and updated page 13 of the Master Table of Contents.

Attachment B contains the original version of the changed pages.

Attachment C contains a redline version of the changed pages. Please be advised that the page numbers listed in the responses below refer to the changed pages and may not match the page numbers on the redline version.

Attachment D contains three (3) copies of the original changed pages found in Attachment B.

We have listed each of your comments below followed by our response in italics.

### **PART III**

#### **Attachment III-B**

1. Section 3.3 indicates that the citizen's convenience center (CCC) will be constructed of reinforced concrete and/or asphalt. In response to the first NOD, a cross-section drawing was provided (Drawing No. III B.1-4) and it indicates that the CCC's floor will be the existing ground. Please make revisions as necessary and/or explain how the existing ground and the

mountable curbs around the CCC facility will prevent groundwater contamination in accordance with 30 TAC §§330.55(b) and 330.63(b)(4).

***Response: Drawing No. III-B.1-4 has been revised to indicate the use of concrete or asphalt at the CCC. Attached is a revised Title Page, Table of Contents and Drawing No. III-B.1-4.***

#### **Attachment III-C – Appendix III-C.1**

2. Section 5.4.5 was revised to indicate that the South Detention Basin (SDB) will be fully constructed and has been designed with excess capacity to safely detain and release the 100-year, 24-hour storm event. Please provide references in this section to the location containing storage capacity and discharge demonstrations or calculations in the permit application.

***Response: Section 5.4.5 in Appendix III-C.1 has been revised to reference the information requested. Attached is a revised Title Page, Table of Contents and page 17.***

#### **Attachment III-D – Appendix III-D.0**

3. Section 2.0 was revised to indicate that leachate, contaminated water and gas condensate will be transported to the pond, the evaporation pond will be emptied or recirculated back into the waste mass and only leachate and gas condensate may be recirculated. Please provide an explanation on how leachate and gas condensate will be separated from the mixed liquid for recirculation.

***Response: Section 2.0 in Attachment III-D has been revised to clarify that only leachate and gas condensate will be recirculated. Attached is a revised Title Page, Table of Contents and page 5.***

#### **Attachment III-E – Appendix E-2 (Comments are provided by Mr. Mamadou Balde, P.G.)**

4. In response to comment #37 of the first NOD, it states that observed free water is “not intended to imply matrix saturated conditions”. Since the term “free water” is used in Appendix B distinctly from other qualifiers like wet soil and moist soil, please clarify the differences or if they have the same meaning. Please include this information and all relevant definitions in the narrative of Appendix III-E-2.

***Response: The term “free water” simply means that water was visibly observed in the recovered, (disturbed) soil samples – either auger-drilling cuttings [e.g., boring B-1] and/or sonic drilling core samples. The source of the water could not be determined because of sample disturbance and could have been influenced by drilling and sampling procedures. The use of the term is not intended to imply matrix saturated***

*conditions or the collection of soil samples from within zone(s) of saturation. The term is used separately and distinctly from other moisture condition terms (i.e., qualifiers) used on boring logs including “moist”, “wet”, and “saturated”, which apply to observed sample matrix conditions. The term free water does not address moisture conditions of the sample matrix. The observed presence of free water was noted on the logs for informational purposes only.*

*The use of the term free water has been clarified in Sections 4.0 and 4.2 of the revised Subsurface Investigation Report (SIR). Additionally, the definition of free water term provided in the Key to Terms and Symbols in Appendix B has been revised to clarify its stated distinction relative to other moisture condition terms.*

5. Regarding the use of geophysical logging to “augment existing site characterization data”, the responses to comments#54 and #55 of the first NOD list the intended purposes for which the downhole geophysical data was acquired; it does not, however, appear to include evidence that the acquired data was actually used to enhance or corroborate other information. Please submit specifically the name of the borehole(s), depth(s), geophysical signature(s) that were used in correlations that appeared to support existing information that was obtained independently.

*Response: Although no regulatory citation was provided requiring this information, we have included a discussion of how the geophysical logs were used in Part III, Attachment III-E. Attached is a revised Title Page, Table of Contents and text of Attachment III-E Geology Report. Due to the number of revisions needed to address comment number 7, the entire III-E text is provided.*

6. The TCEQ’s questions regarding the quality of the GPS survey, including the undetermined and unknown level of accuracy of the survey was addressed by performing an “error analysis”. For the vertical, it was done by comparing positions obtained from the survey to interpolated ground surface elevations from the final 2-ft topographic contour map prepared by Dallas Aerial Survey. The GPS positions for the horizontal were compared to the perimeter benchmarks established by a RPLS from Mejia Engineering Company. The overall conclusion was that the survey is accurate to within 1 meter ground surface resolution.

a. The differences or range of “errors” obtained from the above comparisons do not measure the survey accuracy which is calculated rigorously through a network adjustment, for example by the least square method using redundant baseline observations and control points which are verifiably accurate benchmarks. Please note that the direct comparison of point positions that is presented is not an error analysis and it does not measure the survey accuracy. Please perform an error analysis of the GPS survey, or state clearly in the appropriate sections of

Appendix III-E-2 that this analysis was not conducted, and the survey accuracy was undetermined.

***Response: An "error" analysis following the methodology described by TCEQ in Comment #6a was not performed to evaluate GPS position data. To this end, survey accuracy was not determined by RK as part of the subsurface investigation.***

***In response to Comment #6a issued as part of the second NOD, the project team re-engaged the services of the RPLS (Mejia Engineering Company) to undertake a new ground survey of exploratory boring, piezometer, and test pit locations reported in the SIR as necessary to facilitate an additional comparison. This survey included collection of horizontal position and ground surface elevations (i.e., designated as N/G) at all locations, in addition to the collection of top-of-casing elevation measurements at piezometer sites (i.e., designated as T/P). A table comparing horizontal and vertical position data obtained by the RPLS on 11/6/15 to RK position data was developed and included in the SIR as Table 7. Supporting documentation provided by Mejia Engineering Company for the recent ground survey effort was also added to the SIR as Appendix F.***

***On the basis of this comparison, it is clear that reported geographic position data in the SIR closely matches independently-established horizontal and vertical controls established by a RPLS for the site. Collectively, comparison of RK position data with actual survey information indicates that reported differences are acceptable and that use of position data is adequate for purposes of the subsurface investigation.***

b. Should the above estimated survey accuracy be correct, please explain how an elevation error of up to 1 meter (3.28 feet) may not impact the determination of groundwater flow direction, considering the calculated gradient of 0.7 to 0.8 % (Attachment III-E, Section 4.2.2) or inferred gradient of 2 to 3% (Attachment III-F, Section 3.0). For comparison, please note that according to 30 TAC §330.421(d), the determination of groundwater flow direction in monitoring wells requires an accuracy of 0.01 foot.

***Response: Given the total acreage of the site on the order of 1,100 acres and relative spacing of piezometers typically greater than 1,500 feet, potential errors in reported geographic position data up to 1 meter (3.28 feet) at some locations do not adversely affect the determination of groundwater flow direction, particularly when considering a calculated gradient of 0.2 to 0.3%. All elevation contouring for depth-to-water measurements was based on the critical assumption that piezometers are hydraulically connected across the site. As reported in the SIR, Figures 16 through 19 reflect combined plotting of all water level data regardless of piezometer screen interval for respective gauging events. Figures 20 through 24 provide subsets of contoured***



*piezometer data for “shallow” and “deep” screen-interval piezometers. Review of these figures supports the following:*

- *Water level contouring data consistently shows a relatively smooth surface mimicking surface topography.*
- *Water level contours are relatively parallel.*
- *Regardless of geographic position accuracy, water level contour maps in the SIR show a total piezometric head difference of approximately six to seven meters (20 to 23 feet) across the site.*
- *Because of the ground surface elevation difference across the site, significant changes to the general pattern of plotted water level contour data will not occur even if the accuracy of vertical position data points was to vary on the order of  $\pm 1$  meter ( $\pm 3$ -feet) (i.e., flow direction, gradient, mimicking of surface topography, etc., would not change).*

*On the basis of the recent 11/6/15 survey conducted by Mejia Engineering (an RPLS surveyor), it has been established that vertical position data reported in the SIR agrees with independently-established values to within  $\pm 1$  meter ( $\pm 3$ -feet). Despite the fact that RPLS survey values do not exactly match RK position data, the recent survey information does not alter previous conclusions pertaining to either groundwater gradient or flow direction. Based on our evaluation of the data, the application of RPLS survey results to the piezometric contouring have no significant effect.*

*As to the cited 30 TAC §330.421(d), those regulations apply exclusively to groundwater monitoring wells installed in accordance with Subchapter J requirements. Piezometers were installed throughout the proposed landfill footprint solely to meet applicable requirements for the subsurface investigation as set forth in 30 TAC §330.63(e)(5)(c), which technically does not require piezometers or wells, but the installation of soil borings. Information developed as part of the subsurface investigation and reported in the SIR is sufficient to establish groundwater flow direction and gradient as per 30 TAC §330.63(e)(5)(c) requirements. As an additional consideration, it should be noted that a piezometric elevation coinciding with the ground surface has been assumed for hydrostatic design as set forth in the landfill permit application.*

- c. Please explain the large difference between the gradient values given in Attachment III-E [sic III-E.2], Section 4.2.2 and Attachment III-F, Section 3.0.

*Response: Water level information from various upgradient and downgradient wells taken from different synoptic plots were reviewed and were determined to have a very consistent gradient on the order of 0.2 to 0.3%, which matches the values reported in the Geology Report (Attachment III-E, Section 1). This information has been revised in Section 4.2.2 of the SIR, Appendix III-E.2, and in the Groundwater Monitoring Plan, Attachment III-F, Section 3.*

***Attached is a revised Title Page, Table of Contents and text of Attachment III-F – Groundwater Monitoring Plan and III-E.2 – Subsurface Investigation Report.***

7. The response received does not appear to address questions about identifying the uppermost aquifer in accordance with 30 TAC §330.63(e)(5)(F) and 30 TAC §330.403(e)(1). Please address the following:

a. Attachment III-F, Section 3.0 indicates that the regulatory uppermost aquifer occurs in the zone between the Recent Pleistocene (RP) and the Eocene age Yegua-Jackson (Y-J) group. No stratigraphic or lithologic unit(s) between the RP and Y-P are named or represented as constituting the uppermost aquifer.

Please name and show the interval in the stratigraphic column where the regulatory uppermost aquifer was found or is expected. Please specify its characteristics and estimated thickness.

***Response: Part III, Attachment III-E Geology Report has been revised to address this request. Attached is a revised Title Page, Table of Contents and text of Attachment III-E - Geology Report.***

b. A distinction is made between the site's "regulated uppermost aquifer" and the "recognized uppermost regional aquifer". The former occurs between the RP and the Eocene Y-J group; the latter is reportedly at a depth of more than 600 feet below the site. The response to comment #62 of the first NOD letter and other submitted documentations (Attachment III-E-2, Section 4.2.2) indicate that shallow groundwater which appear to be hydraulically connected to the regulated uppermost aquifer is also present in the sand and silt units of the Y-J. It may therefore be that the "regulated uppermost aquifer" and the "uppermost recognized aquifer" are hydraulically connected under the site. Please document the presence of an aquiclude between the "regulated uppermost aquifer" and "uppermost recognized aquifer" or consider the possibility that the two are hydraulically connected.

***Response: Documentation of an aquiclude between the "regulated uppermost aquifer" and the "uppermost regional aquifer" has been provided in Part III, Attachment III-E Geology Report. Attached is a revised Title Page, Table of Contents and text of Attachment III-E - Geology Report. Additionally, information in Attachment III-F – Groundwater Monitoring Plan has been revised for consistency. Attached is a revised Title Page, Table of Contents and revised text of Attachment III-F – Groundwater Monitoring Plan.***

c. In response to comment #61 of the first NOD letter, it is indicated that by "specific intent", none of the appendices of the Geology Report (Appendices III-E-1, III-E-2, III-E-3, III-E-4) use the term 'uppermost aquifer' or attempt to define it. Since one of the purposes of the Geology Report is to help identify and characterize the uppermost aquifer (30 TAC

§330.63(e)(4)(B)) please explain the technical reason(s) for intently [*sic intentionally*] excluding the term ‘uppermost aquifer’ from all the appendices of the Report.

***Response: An interesting comment. The Geology Report discusses the “uppermost aquifer”. This was clearly indicated in the TCEQ checklist that was provided upon the initial submittal of Parts III and IV. There is no reason or requirement for the appendices to the Geology Report to discuss that item. For instance, it would make little sense for the Geotechnical Data Report (III-E.3) to have that discussion. No revisions necessary.***

d. Please provide a summary description and a graphical representation of what is considered the site’s regulated uppermost aquifer and all hydraulically connected units. The description and/or representation will include factual or anticipated aquifer extent, thickness and depth, to meet the requirements of 30 TAC §330.63(e)(5)(F) and 30 TAC §330.403(e)(1).

***Response: A summary description and graphical representation of the subsurface soils, including the “uppermost aquifer” has been provided in Part III, Attachment III-E - Geology Report. Attached is a revised Title Page, Table of Contents and text of Attachment III-E - Geology Report.***

#### **PART IV**

8. Section 25.4 was revised to indicate that inspections for erosion cover [*sic erosion of cover*] will be conducted once every month and as soon as practicable after the end of a storm event of 2 inches or greater. Please provide a justification for the proposed inspection frequency. Please note that the Stormwater Discharge General Permit (SWDGP) is required for the proposed facility as indicated in Section 1.3 of Part I of the application, in accordance with 30 TAC §305.45(a)(7), and the SWDGP requires that inspections must be conducted at least once every month and within 24 hours after the end of a storm event of 0.5 inches or greater.

***Response: The inspection requirements in Section 25.4 of Part IV have been revised. Attached is a revised Title Page, Table of Contents and page 50.***

#### **OTHER CHANGES**

During a meeting with the TCEQ on October 29, it was suggested that Drawing No. III-F.1-1 located in Appendix III-F.1 should be updated to show the spacing between compliance wells and to label the South Detention Basin. These changes have been made and revised Title Page, Table of Contents and Drawings III-F.1-1 and III-F.1-2 are attached.

Additionally, it has been discovered that Drawings III-D.1-2 and III-D.1-3 in Appendix III-D.1 were not signed when they were revised and submitted in response to the first Technical Notice

of Deficiency. Although no changes have been made, a revised Title Page, Table of Contents and Drawings III-D.1-2 and 3 are attached to include a signature and update the date.

We are also including the geophysical log of DB-1 which was inadvertently left out of previous submittals. It should be placed at the end of Appendix C to Appendix III-E.2 in the section for borings after the geophysical log for B-126.

The information provided in this response has also been sent to the Laredo Public Library and uploaded to the web site at [www.pescaditoerc.com](http://www.pescaditoerc.com).

We trust this information addresses your current concerns; however, should you need additional information, please let us know.

Sincerely,  
CB&I Environmental and Infrastructure, Inc.  
TBPE Firm F-5650



Michael W. Oden, P.E.  
Project Manager

**Attachments**

- A - Part 1 Form Signature Page
- B – Original Replacement pages
- C – Redline/Strikeout version of changed pages
- D – Three copies of changed pages (TCEQ only)

CC: Mr. Carlos Y. Benavides III  
Mr. William W. Thompson  
Mr. Geoffrey S. Connor  
Mr. Richard Klar (without attachments)

**Attachment A**  
**to November 2015 Response Letter**

**Part I Form Signature Page and**  
**Updated Page 13 from Master Table of Contents**

### Signature Page

I, CARLOS Y. BENAVIDES III Manager  
(Site Operator (Permittee/Registrant)'s Authorized Signatory) (Title)

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

Signature: CYBENAVIDES III Date: Nov 16, 2015

~~TO BE COMPLETED BY THE OPERATOR IF THE APPLICATION IS SIGNED BY AN AUTHORIZED REPRESENTATIVE FOR THE OPERATOR~~

~~I, \_\_\_\_\_, hereby designate \_\_\_\_\_  
(Print or Type Operator Name) (Print or Type Representative Name)~~

~~as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a Texas Water Code or Texas Solid Waste Disposal Act permit. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any permit which might be issued based upon this application.~~

~~Printed or Typed Name of Operator or Principal Executive Officer~~

~~Signature~~

SUBSCRIBED AND SWORN to before me by the said Carlos Y. Benavides III

On this 16<sup>th</sup> day of November, 2015

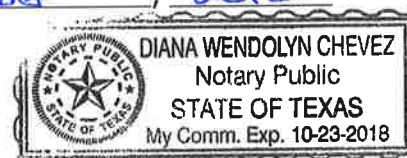
My commission expires on the 23<sup>rd</sup> day of October, 2018

Diana Wendolyn Chavez  
Notary Public in and for

Webb

County, Texas

(Note: Application Must Bear Signature & Seal of Notary Public)



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Pescadito Environmental Resource Center

MSW No. 2374

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**Attachment B**  
**to November 2015 Response Letter**

**Original Replacement Pages**

**Part III, Attachment III-B.1**

**Part III**  
**Attachment III-B**  
**Appendix III-B.1**

**GENERAL FACILITY DESIGN FIGURES**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**

**PESCADITO**  
ENVIRONMENTAL RESOURCE CENTER

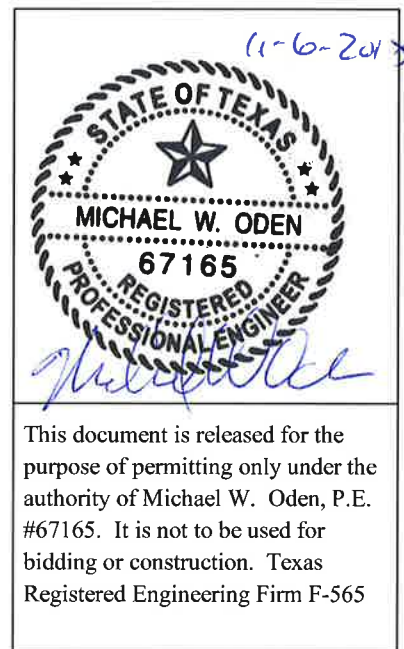
**Initial Submittal March 2015**  
**Revised September 2015**  
**Revised November 2015**

**Prepared for:**  
**Rancho Viejo Waste Management, LLC**  
**1116 Calle del Norte**  
**Laredo, TX 78041**

**Prepared by:**  
**CB&I Environmental and**  
**Infrastructure, Inc.**

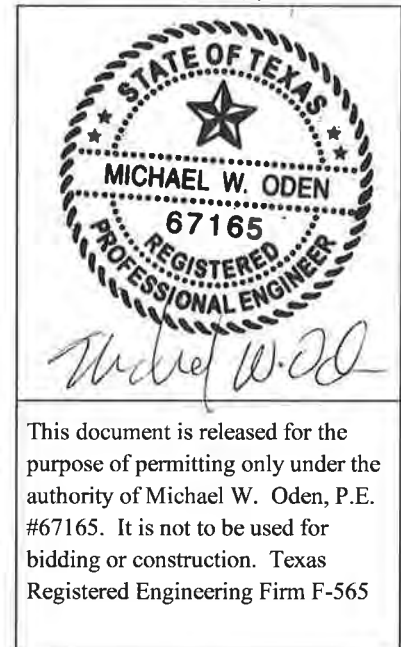


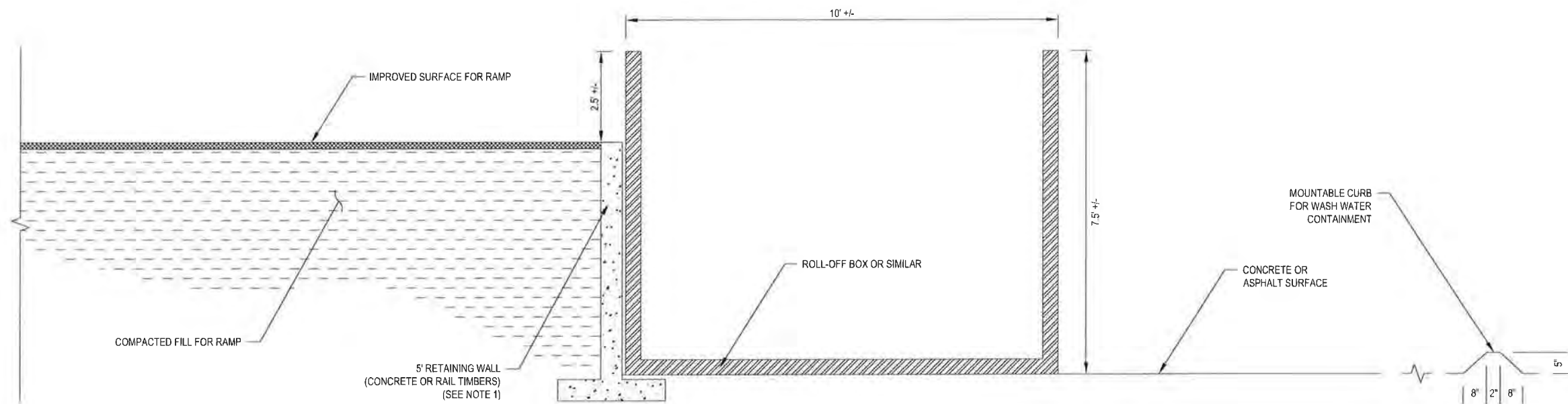
**12005 Ford Rd, Suite 600**  
**Dallas, TX 75234**



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1  
B.1-4

**SECTION A-A'**  
NOT TO SCALE

**NOTES**

1. CONTAINERS MAY BE INITIALLY SET ON EXISTING GROUND ELEVATION WITH NO RETAINING WALL OR COMPACTED FILL RAMP DEPENDING ON USE AND CONVENIENCE TO CUSTOMERS.

T:\140215\Projects\Pescadito\Drawings\B.1-4\B.1-4.dwg, 11/06/2015 10:05:52 AM

REV. NO.	DATE	DESCRIPTION
2	11/2015	NOD 2
1	9/2015	NOD 1



**CB&I Environmental & Infrastructure, Inc.**  
TBPE FIRM F-5650

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THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF PERMITTING UNDER THE AUTHORITY OF MICHAEL W. ODEN, P.E. 67165

11-6-2015

**PESCADITO ENVIRONMENTAL RESOURCE CENTER  
WEBB COUNTY, TEXAS  
MSW 2374**

**CONVENIENCE CENTER DETAILS**

PROJ NO.	148866	DATE:	APRIL 2015
DESIGNED BY:		DRAWING NO.	III
DRAWN BY:	MTE		<b>B.1-4</b>
CHECKED BY:	RDS		
APPROVED BY:	MWO		4 OF 6 SHEETS

## **Part III, Appendix III-C.1**

**Part III**  
**Attachment III-C**  
**Appendix III-C.1**

**FACILITY SURFACE WATER DRAINAGE REPORT NARRATIVE**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**

**PESCADITO**  
ENVIRONMENTAL RESOURCE CENTER

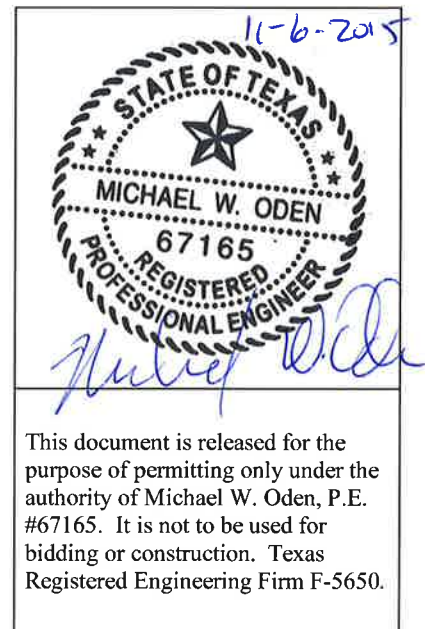
**Initial Submittal March 2015**  
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**Prepared for:**  
**Rancho Viejo Waste Management, LLC**  
**1116 Calle del Norte**  
**Laredo, TX 78041**

**Prepared by:**  
**CB&I Environmental and**  
**Infrastructure, Inc.**



**12005 Ford Rd, Suite 600**  
**Dallas, TX 75234**

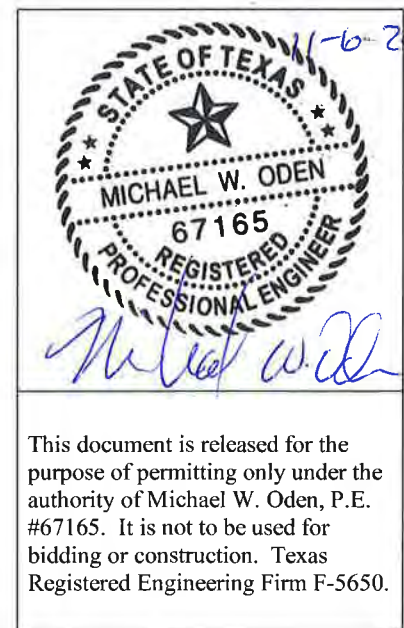


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## Attachments

III-C.1-A      Approved Conditional Letter of Map Revision





#### **5.4.5 South Detention Basin**

The South Detention Basin will be installed along the southern border of the facility to temporarily detain all stormwater that falls on the landfill, perimeter roads, and ancillary facilities. The detention basin receives stormwater through the perimeter ditches. The size of the South Detention Basin has been designed based on a fully developed landfill footprint and will be constructed prior to the time that waste in the first cell developed is placed above existing ground. The basin has been designed with excess capacity to safely detain and release the 100-year, 24-hour and 25-year, 24-hour storm events while maintaining one foot of freeboard above the maximum water level, in accordance with best management practices.

The location of the South Detention Basin is shown in Drawings 5, 6, 11 and 12 of Appendix III-C.2. Profiles and details of the basin are provided on Drawings 11 and 12. See Attachment 10 to Appendix III-C.3 (III-C.3-10) for the detention basin sizing. See Attachment 3.D in Appendix III-C.4 (III-C.4-3.D) for the HydroCAD® Output files for the detention basin capacity calculations. Page 82 in Section I contains information for the 100-year storm and page 82 in Section II for the 25-year storm. Drawings 6, 11 and 12 in Appendix III-C.2 show the location of the basin.

#### **5.4.6 South Detention Basin Discharge**

The South Detention Basin will have two discharge points, located approximately at the southwest and southeast corners of the basin. Each discharge point will contain multiple culvert outlets that will facilitate the controlled release of stormwater. Stormwater will discharge through the culverts to the outside of the basin. Riprap or other erosion control material will be placed at the discharge locations to minimize the potential for erosion and scour. Refer to Drawing 12 of Appendix III-C.2 for details of the proposed outlet structure design.

Discharge from the detention basin will be sent to both the east and the west into Drainage Areas DA-3 and DA-2, respectively. Percentage of the discharge volume from the detention basin to DA-2 and DA-3 has been split to provide discharge rates and volumes consistent with the CLOMR (intermediate conditions). Additional stormwater conveyance features may be installed to direct water directly into the San Juanito Creek tributary system. Please note that the outlet structure design may be changed provided that the revised design provides adequate reinforcement and protection of the outfall and equivalent release rates to the modeled design. Any changes desired will be submitted as a permit modification and approval obtained prior to implementation.

**Part III, Attachment III-D.0**

**Part III  
Attachment III-D**

**WASTE MANAGEMENT UNIT DESIGN**

**Pescadito Environmental Resource Center  
MSW No. 2374  
Webb County, Texas**

**PESCADITO**  
ENVIRONMENTAL RESOURCE CENTER

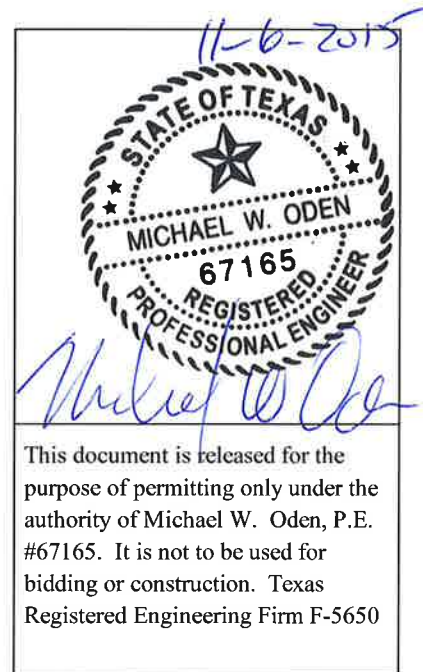
**Initial Submittal March 2015  
Revised September 2015  
Revised November 2015**

**Prepared for:  
Rancho Viejo Waste Management, LLC  
1116 Calle del Norte  
Laredo, TX 78041**

**Prepared by:  
CB&I Environmental and  
Infrastructure, Inc.**



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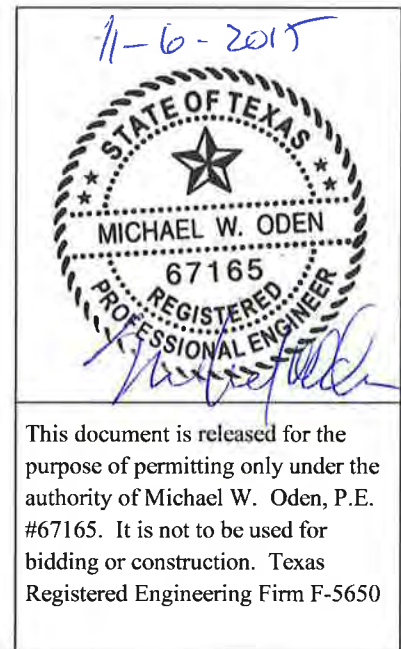


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- III-D.5 – Geotechnical Analyses
- III-D.6 – Leachate and Contaminated Water Plan
- III-D.7 – Liner Quality Control Plan
- III-D.8 – Alternate Final Cover Demonstration
- III-D.9 – Final Cover Quality Control Plan



## **2.0 SURFACE IMPOUNDMENTS**

The PERC facility may utilize an on-site evaporation pond (considered a surface impoundment) for leachate, contaminated water and landfill gas condensate. Detail drawings are provided in Appendix III-B. A minimum of 12-inches of free board will be provided at all times to account for the 25-year, 24-hour rainfall event of 7.5-inches. Leachate, contaminated water and gas condensate will be transported to the pond, or storage tanks, via a force main or hauled via tanker truck. If by force main, the level in the pond will be visually checked prior to activating the pumps to assure the required free board is available. Should there be a need for leachate, contaminated water and gas condensate disposal and the evaporation pond is filled to within 12-inches of the top, alternate disposal methods will be employed such as direct haul off-site to a permitted facility, storage in tanks until the pond is emptied or recirculation back into the waste mass. Only leachate and gas condensate may be re-circulated into the waste. If contaminated water has been combined with leachate or gas condensate, the resulting mixture will not be re-circulated. Use of one or more of the storage tanks to store only leachate and/or gas condensate will prevent the commingling of contaminated water and allow recirculation of these two liquids.

**Part III, Attachment III-D.1**

**Part III  
Attachment III-D  
Appendix III-D.1**

**SITE LAYOUT FIGURES**

**Pescadito Environmental Resource Center  
MSW No. 2374  
Webb County, Texas**

**PESCADITO**  
ENVIRONMENTAL RESOURCE CENTER

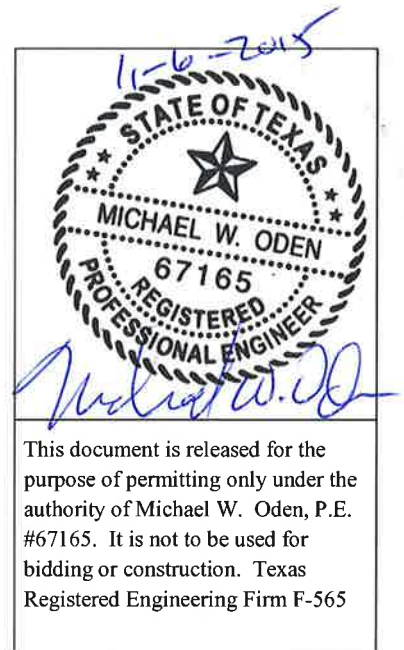
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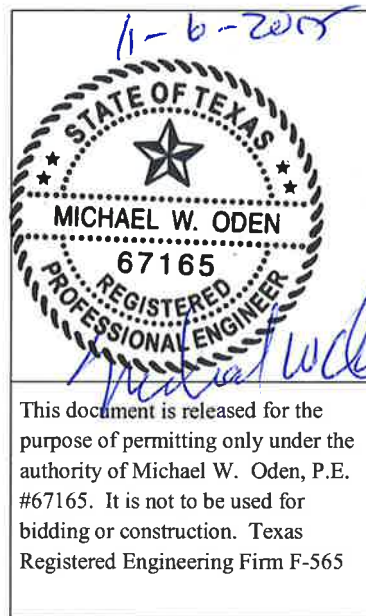


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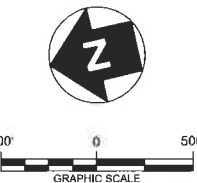


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#### LEGEND

- PERMIT BOUNDARY
- WASTE UNIT BOUNDARY
- DETENTION BASIN
- PERIMETER STORMWATER DITCH
- PERIMETER ACCESS ROAD
- PROPERTY LINE AND FENCE
- FENCE
- 8' HOG FENCE
- CLOMR 100-YEAR FLOODPLAIN

#### NOTES

- EXISTING CONTOURS DEVELOPED FROM SITE AERIAL TOPOGRAPHIC SURVEY BY DALLAS AERIAL SURVEYS ON FEBRUARY 15, 2010.
- BOUNDARY AND IMPROVEMENT SURVEY DEVELOPED BY MEIJA ENGINEERING COMPANY ON AUGUST 15, 2011 AND JUNE 9, 2014.
- FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
- THE NEED FOR FLEXIBILITY TO ACCOMMODATE ADJUSTMENTS AND MODIFICATIONS IS ANTICIPATED CONSIDERING THE SIZE, COMPLEXITY, AND LIFE OF THE PROJECT.
- LIQUID SOLIDIFICATION BASIN MAY BE IN THIS LOCATION OR IN AREAS WHERE WASTE HAS BEEN PLACED. REFER TO DRAWING III-B.1-7 FOR SOLIDIFICATION BASIN DETAIL.
- ALL FACILITIES MAY NOT BE CONSTRUCTED AT THE SAME TIME.
- ENTRANCE FACILITIES TO BE RELOCATED OR WASTE UNITS MODIFIED TO REDUCE AREA AT TIME OF COMPLETING CELLS S-5 TO S-8.
- ALL CELLS ARE DESIGNATED TO RECEIVE CLASS 1 WASTE. EACH CELL HAS A DEDICATED LEACHATE COLLECTION AND REMOVAL SYSTEM.

REV. NO.	DATE	DESCRIPTION
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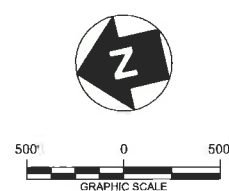
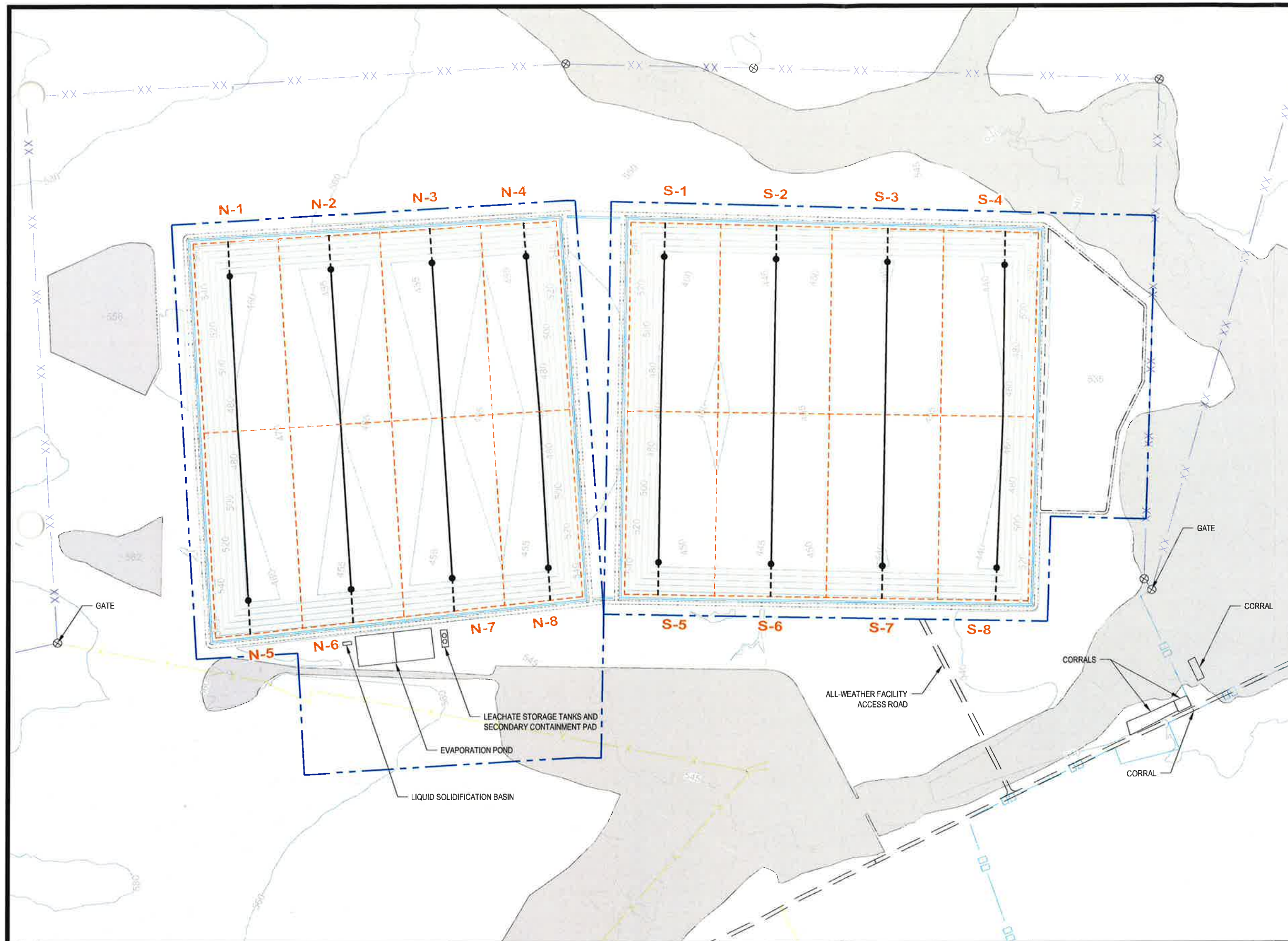
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**PESCADITO ENVIRONMENTAL RESOURCE CENTER  
WEBB COUNTY, TEXAS  
MSW 2374**

**SITE LAYOUT PLAN**

PROJ. NO.:	148866	DATE:	APRIL 2015
DESIGNED BY:	-	DRAWING NO.	III
DRAWN BY:	MTE		D.1-2
CHECKED BY:	RDS		
APPROVED BY:	MWO		2 OF 6 SHEETS





**LEGEND**

- PERMIT BOUNDARY
- WASTE UNIT BOUNDARY
- DETENTION BASIN
- PERIMETER DITCH
- PERIMETER ACCESS ROAD
- PROPERTY LINE AND FENCE
- FENCE
- 8' HOG FENCE
- EXCAVATION ELEVATION
- CLOMR 100-YEAR FLOODPLAIN
- LEACHATE COLLECTION PIPE
- LEACHATE SUMP LOCATION
- LEACHATE SUMP RISER PIPES

**NOTES**

- EXISTING CONTOURS DEVELOPED FROM SITE AERIAL TOPOGRAPHIC SURVEY BY DALLAS AERIAL SURVEYS ON FEBRUARY 15, 2010.
- BOUNDARY AND IMPROVEMENT SURVEY DEVELOPED BY MEIJA ENGINEERING COMPANY ON AUGUST 15, 2011 AND JUNE 9, 2014.
- FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
- THE NEED FOR FLEXIBILITY TO ACCOMMODATE ADJUSTMENTS AND MODIFICATIONS IS ANTICIPATED CONSIDERING THE SIZE, COMPLEXITY, AND LIFE OF THE PROJECT.
- EXCAVATION CONTOURS SHOWN REPRESENT BOTTOM OF THE 3' LINER FOR CLASS I CELLS. CELLS TO RECEIVE ONLY MUNICIPAL SOLID WASTE MAY HAVE 2' LINER.
- SEE SHEET III-D.3-1 FOR TOP OF LINER ELEVATIONS.
- ALL CELLS ARE DESIGNATED TO RECEIVE CLASS 1 WASTE. EACH CELL HAS A DEDICATED LEACHATE COLLECTION AND REMOVAL SYSTEM.

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**MICHAEL W. ODEN**  
REGISTERED PROFESSIONAL ENGINEER

**PESCADITO ENVIRONMENTAL RESOURCE CENTER**  
**WEBB COUNTY, TEXAS**  
**MSW 2374**

**EXCAVATION PLAN**

PROJ. NO.:	148866	DATE:	APRIL 2015
DESIGNED BY:	-	DRAWING NO.	III
DRAWN BY:	MTE		D.1-3
CHECKED BY:	RDS		
APPROVED BY:	MWO		3 OF 6 SHEETS

**Part III, Attachment III-E**

**Part III**  
**Attachment III-E**

**GEOLOGY REPORT**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**

**PESCADITO**  
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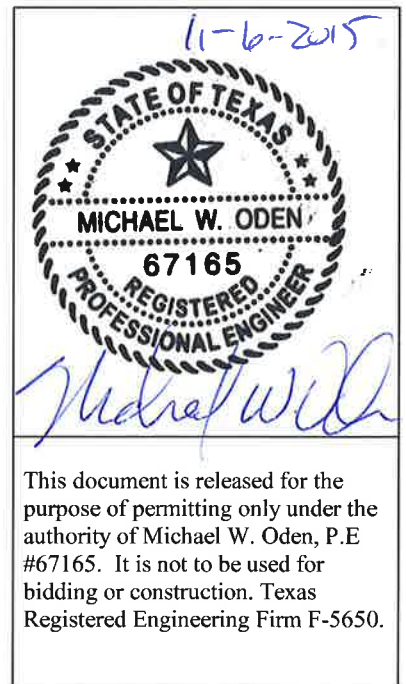
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**Prepared for:**  
**Rancho Viejo Waste Management, LLC**  
**1116 Calle del Norte**  
**Laredo, TX 78041**

**Prepared by:**  
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**Infrastructure, Inc.**

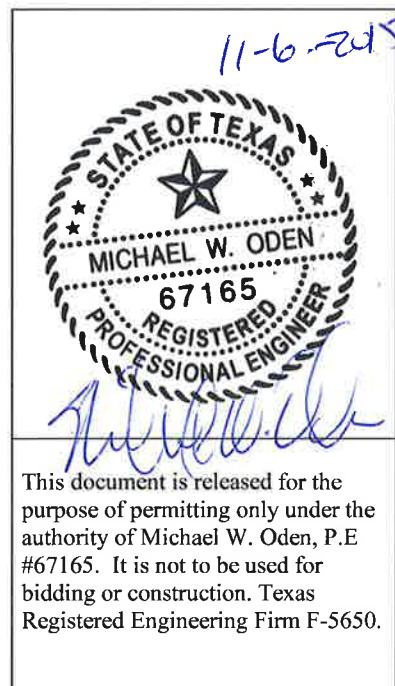


**12005 Ford Rd, Suite 600**  
**Dallas, TX 75234**



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Appendix III-E.4	Summary of Hydrogeologic Testing in Selected Piezometers	
Appendix III-E.5	Supplemental Subsurface Investigation Report – Phase V	





## 1.0 INTRODUCTION

The Pescadito Environmental Resource Center (PERC) is a 953 acre tract of land located in Webb County Texas owned by Rancho Viejo Waste Management LLC (RVWM). It is part of a larger approximately 12,000 acre Yugo Ranch owned by the parent company of RVWM, Rancho Viejo Cattle Company, Ltd. Webb County is located in a semi-arid part of the state with evaporation exceeding rainfall by approximately 40 inches per year. The PERC site is located on a “salt-flat” on the Yugo Ranch that historically has had no significant oil/gas resources and vegetation is quite sparse. See Photo 1 – view to the north from southeast corner of site.

The Geology Report for the Pescadito Environmental Resource Center is provided as a series of documents to meet the specific requirements of 30 TAC §330.63(e) and to provide additional information supporting the facility design and operation. Each of the documents has been prepared by a qualified groundwater scientist or professional engineer.



Photo 1 - Looking North from B-21

A description of the regional geology and hydrogeology and related information is provided in a document entitled *Regional Geology and Hydrogeology* prepared by H. C. Clark, PhD, P.G. A copy of Dr. Clark’s report is included in Appendix III-E.1. This report is submitted to fulfill the requirements of 30 TAC §330.63(e)(1-3).

Site-specific subsurface investigation results and geotechnical data for the site are provided in multiple separate reports appended to this Report. Raba Kistner Environmental, Inc. prepared the *Subsurface Investigation Report* (SIR) included as Appendix III-E.2. Raba-Kistner Consultants, Inc. prepared the *Geotechnical Data Report* (GDR) included as Appendix III-E.3.

Those reports are submitted to fulfill the requirements of 30 TAC §330.63(e)(4)(A-H) and §330.63(e)(5)(A-E) and the requirements of the Soil Boring Plan (SBP) approved by TCEQ on April 11, 2011 (Appendix III-E.2, SIR Appendix A). It should be noted that subsequent to the approval of the SBP and preparation of the SIR and GDR, the permit boundaries were reduced. The revised boundary is enclosed entirely within the original boundary that was used when the SBP was approved. Figure III-E.0-1 within this Appendix shows the two permit boundaries.

Additional information on subsurface conditions has been obtained to support facility design and operation as well as to provide additional hydrogeologic characterization of the subsurface. This information consists of hydraulic testing of previously-installed piezometers to obtain field estimates of horizontal hydraulic conductivity. The information is provided in Summary of Hydrogeologic Testing in Selected Piezometers, prepared by Pierce L. Chandler, Jr., P.E. and is included in Appendix III-E.4.

Further subsurface investigation and testing has been performed to provide information useful for general landfill design as well as to provide additional hydrogeologic characterization of the subsurface. The information is provided in Supplemental Subsurface Investigation Report – Phase V, (SSIR) prepared by Michael W. Oden, P.E. and is included as Appendix III-E.5.

In addition to an extensive literature survey and conventional subsurface investigation techniques, i.e., boring, sampling, and lab testing; borehole geophysical logging was employed at several borings to assist in subsurface characterization. The borehole geophysical logs consisted of gamma, resistivity and caliper logs and are presented in Appendix C to Appendix III-E.2 (III-E.2-C). The borehole geophysical logging was not utilized to reduce the number of borings required in 330.63(e)(4)(B); and as allowed by 330.63(e)(4)(F).

As indicated in Appendix III-E.1 the natural gamma logs were reviewed in an attempt to locate the boundary between the Yegua and Jackson sediments. As no significant increase in background gamma radiation values could be determined from the geophysical logs, as would be expected if Jackson sediments were encountered, the boundary could not be established with geophysics. Subsequent additional investigation determined the boundary to generally be east of the site.

Further the resistivity borehole geophysical logs were used to assist in identifying the more transmissive zones for placement of additional piezometers at the site. There is not much sand in the subsurface (95% clays per the Geotechnical Data Report [III-E.3]), the sands are poorly graded and contain considerable amounts of clay. The transition from clay to sand is gradational. These factors lead to the geophysical logs not showing dramatic differences between the clays and sands and make it difficult to determine a change in the characterization of the subsurface soils.

As an example of the use of the resistivity borehole geophysical logs, look at boring B-124. Piezometers were desired in potentially more transmissive zones along the southern edge of the proposed facility. Upon a review of the boring log for B-124 (III-E.2-B) it was noted that thinly interbedded sandstone layers were found between 100 feet and 113 feet below ground surface (bgs). A review of the resistivity geophysical log (III-E.2-C) showed a slight increase in resistivity (sand is typically more resistive than clay) starting at about 95 feet bgs and ending at approximately 120 feet bgs. Consequently Piezometer B-124 was installed at that location with the screen interval from 110 feet to 113 feet bgs.



## 2.0 HYDROGEOLOGIC SETTING

All information compiled to-date has confirmed the siting evaluation, i.e., a semi-arid area with predominantly low-permeability clay subsurface materials and no shallow groundwater resource. Even deeper, available groundwater resources are slightly used due to water quality and depth considerations.

### 2.1 *Uppermost Recognized Aquifer*

The published documents and area well records summarized in the Regional Geology and Hydrogeology report established that the uppermost recognized aquifer at the facility is the regional Yegua-Jackson Aquifer. This uppermost aquifer is associated with basal Yegua sands located more than 300 feet below the deepest proposed excavation. Flow in the Yegua-Jackson Aquifer is to the east and appears to coincide with the regional dip of the Yegua-Jackson, which is approximately 50 feet to the mile. The Yegua-Jackson Aquifer is recharged from the outcrop miles to the west and northwest. Yegua-Jackson Aquifer water quality in the site area is brackish.

### 2.2 *Aquiclude*

The uppermost Yegua-Jackson Aquifer is under significant confining pressure due to the effective upper confining unit or “aquiclude” provided by hundreds of feet of low permeability Yegua-Jackson clays. The effectiveness of the upper confining unit is demonstrated by conditions at the nearby Ranch Well adjacent to the facility which shows a confining pressure, i.e., a static water level of approximately 220 feet bgs although the water-producing Yegua sands are hundreds of feet lower (see Table 3 in Appendix III-E.1).

The upper confining unit or “aquiclude” to the uppermost Yegua-Jackson Aquifer provides effective environmental protection to the aquifer. In addition to the confining performance demonstrated at the Ranch Well, the properties of the confining unit are well understood from a consensus of published documents and site-specific investigation and testing including a deep boring to 500 feet bgs. These properties include:

- Predominantly clays – less than 10% net sand (Knox, 2007) and less than 5% based on site-specific investigation (SIR, Raba-Kistner, 2015 [III-E.2]).
- Clay vertical hydraulic conductivities (permeabilities) are very low – average Yegua clay  $K_v = 10^{-4}$  ft/day or  $3.5 \times 10^{-8}$  cm/sec and decreasing with depth (Deeds, 2010). Site-specific testing,  $K_v = 10^{-7}$  to  $5 \times 10^{-11}$  cm/sec (SIR, Raba-Kistner, 2015 [III-E.2] and SSIR, CB&I, 2015 [III-E.5]).
- Clays are really dry – moisture levels predominantly 7-8 percentage points below the Plastic Limit, i.e., clays are not saturated (SIR, Raba-Kistner, 2015 [III-E.2] and SSIR, CB&I, 2015 [III-E.5]).
- Clays are highly plastic – Plasticity Indices are generally in the 20 to 60 range (SIR, Raba-Kistner, 2015 [III-E.2] and SSIR, CB&I, 2015 [III-E.5]).

Sands occur as isolated sand units and horizontal interbeds within the general clay matrix of the confining unit. This is consistent with the documented anisotropy of the Yegua-Jackson. To the depths explored by the site-specific investigations, the sand units are thin, isolated and laterally discontinuous (see Figures C-1 to C-10 in Appendix C to Appendix III-E.3 (III-E.3-C) and Figures 2 to 5 in Appendix III-D.2). There are also thin sandy interbeds or partings in the clay matrix. However, site-specific field testing of piezometers installed in these potentially more transmissive sandy intervals indicated low horizontal permeabilities,  $K_h = 3 \times 10^{-5}$  to  $9 \times 10^{-8}$  cm/sec (Summary of Hydrogeologic Testing in Selected Piezometers, PLC 2015 [III-E.4] and SSIR, CB&I, 2015 [III-E.5]).

### **2.3 *Shallow Subsurface Water***

The various site-specific subsurface investigations encountered very limited quantities of very poor quality subsurface water at shallow depth – essentially at the top of the identified upper confining unit or upper “aquiclude” for the uppermost aquifer (basal Yegua sands of the Yegua-Jackson Aquifer). The shallow subsurface water, i.e., perched groundwater, is primarily associated with the relatively continuous contact zone consisting of a very thin layer of coarse-grained sediments occurring at shallow depth at the base of the surficial Recent-Pleistocene soils and above the underlying Eocene-age Yegua-Jackson sediments. The shallow subsurface water appears to be unconfined, i.e., under “water-table” conditions. The shallow subsurface water

associated with the contact zone also appears to be present in the highly weathered and weathered stratum, i.e. Strata II and III as described in the SIR, GDR and SSIR (SIR, Raba-Kistner, 2015 [III-e.2], Summary of Hydrogeologic Testing in Selected Piezometers, PLC 2015 [III-E.4] and SSIR, CB&I, 2015 [III-E.5]). Within the Yegua-Jackson sediments, the shallow subsurface water appears to be located in transmissive secondary structure in the clays and the thin, isolated, shallow sand units. Site-specific piezometer information indicates that some very limited hydraulic communication with the contact zone may exist down to approximately sixty feet bgs. Piezometer readings below the sixty-foot depth show confining pressures, i.e., the deep piezometers indicate higher water levels than shallow piezometers (see Figures 20 to 23 in SIR [Appendix III-E.2]). Regardless of the shallow subsurface water presence, it should be noted that the degree of hydraulic communication that exists in Stratum II and III is comparable to what would be expected in a confining unit or “aquiclude” as commonly defined:

*“Aquiclude - a hydrogeologic unit which, although porous and capable of storing water, does not transmit it at rates sufficient to furnish an appreciable supply for a well or spring (after WMO, 1974). See preferred term confining unit.”* From the U.S. Geologic Survey, **Federal Glossary Of Selected Terms, Subsurface-Water Flow and Solute Transport** (USGS, 1989).

Clays make up over 95% of Strata II and III. Horizontal permeability is in the  $10^{-7}$  cm/sec range and vertical permeability would be even lower due to the anisotropy. It should also be noted that even in Strata II and III, the clays are unsaturated (i.e. very dry with moisture contents predominantly 7-8 percentage points below the Plastic Limit) (SIR, Raba-Kistner, 2015 [III-E.2] and SSIR, CB&I, 2015 [III-E.5]) Note that many of the sand units in the weathered Yegua-Jackson (Strata II and III) are also unsaturated. See Photo 2.



Photo 2 - Clayey Sandstone in B-52 at 10 to 13 feet bgs

Based on information in the *Subsurface Investigation Report*, inferred flow direction for the shallow subsurface water appears to mimic surface drainage patterns, i.e., to the south, with gradients ranging from 0.002 to 0.003. A maximum hydraulic conductivity (horizontal) of  $2.01 \times 10^{-6}$  cm/sec ( $5.7 \times 10^{-3}$  ft/day) is given in the *Geotechnical Data Report*. Using these inputs, and conservatively using an average value for effective porosity for a sandy clay of 7%, a flow velocity of  $5.94 \times 10^{-2}$  to  $8.92 \times 10^{-2}$  ft/year is calculated.

Stratum IV is even more impermeable. Three test results on clay from Stratum IV indicate a vertical permeability (hydraulic conductivity) in the  $10^{-9}$  to  $10^{-11}$  cm/sec range at depth in Stratum IV or the unweathered Yegua-Jackson. A fourth test (PI = 42) result was in the  $10^{-7}$  range; however, testing of that sample was delayed in the laboratory and micro-cracking was observed in the test specimen that could have affected the test result. (see Attachment F to Appendix III-E.5 [III-E.5-F]) SSIR, CB&I, 2015). At the very top of Stratum IV (Test Pit 2), vertical permeability was  $K_v = 1.2 \times 10^{-7}$  cm/sec and horizontal permeability,  $K_H = 8.3 \times 10^{-7}$  to  $5.5 \times 10^{-9}$  cm/sec (see Appendix B to Appendix III-E.3 [III-E.3-B], GDR, Raba-Kistner 2015). As with Strata II and III, Stratum IV clays predominate by over 95% and are not only unsaturated, they are very dry with moisture contents predominantly 7-8 percentage points below the Plastic Limit, i. e., the clays are not saturated (R-K & CBI, 2015). Note that many of the sand units in the unweathered Yegua-Jackson (Strata IV) are also unsaturated (see Photo 3). As you go deeper in Stratum IV, the geologic dip takes greater control in the water flow direction. Even though Stratum IV may contain very limited water, it still functions as an effective confining unit or “aquiclude” to the vertical migration of water.



Photo 3 - Clayey Sandstone in B-58 at 95' bgs

The results of the site investigations demonstrate that: (1) The shallow subsurface water in the contact zone at the base of the Recent-Pleistocene (Strata I) and the hydraulically connected secondary structure in the clays, thin sand units, and/or anisotropic, horizontal, more transmissive bedding characteristics in Strata II and III (highly weathered Y-J and weathered Y-J) down to about 60 feet; and (2) the deeper sand units and anisotropic, more transmissive horizontal bedding characteristics in Strata IV (unweathered Y-J) below 60 feet all the way down to the proposed depth of excavation; together represent the “potential migration pathways” for any release from the proposed landfill. Clearly, 30 TAC §330.63(f)(3) indicates that the contact zone, Strata II and III, and that portion of Stratum IV above the deepest proposed excavation are the logical groundwater monitoring interval for groundwater monitoring wells to ensure detection of any contamination released from a solid waste management unit

The obvious problem at this site is common to many landfills that are constructed in practically impervious clay-rich subsurface materials that would ordinarily be classified as “aquicludes” because of their impermeability characteristics. Such sites typically have some shallow subsurface water depending on season and precipitation. The most logical groundwater monitoring zone in such cases is to monitor the shallow subsurface water and extend the monitoring zone down to the bottom of the deepest proposed excavation. However, the monitored zone will rarely meet the regulatory definition of “aquifer” in 30 TAC §330.3(8).

*“Aquifer--A geological formation, group of formations, or portion of a formation capable of yielding significant quantities of groundwater to wells or springs.”*

Nor will it meet the definition of “uppermost aquifer” in 30 TAC §330.3(168).

*“Uppermost aquifer--The geologic formation nearest the natural ground surface that is an aquifer; includes lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.”*

The shallow subsurface water at this site doesn't meet the regulatory definition of aquifer because it is not capable of “yielding significant quantities of groundwater to wells or springs.” The contact zone, transmissive secondary structure in the clays, thin sand units, and horizontal, more transmissive bedding characteristics represent very little saturated volume since low

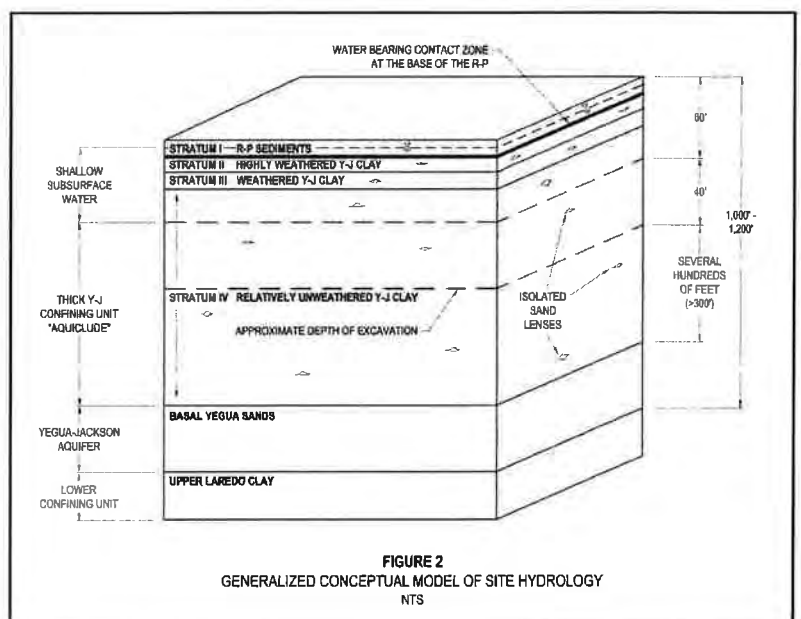
permeability clays make up about 95% of the subsurface. Further, for what limited quantity of water there is, the water quality is very poor – ranging from saline to brine (see SSIR, CBI, 2015). It should be noted that even if there were ample saturated material and good quality water, which the investigations prove there is not, subsurface conditions are so poorly transmissive, that wells cannot yield significant quantities of groundwater. Laboratory and field testing (GDR, Raba-Kistner, 2015 [III-E.3], Summary of Hydrogeologic Testing in Selected Piezometers, PLC 2015 [III-E.4] and SSIR, CB&I, 2015 [III-E.5]) shows that even the more transmissive zones encountered are poorly permeable to practically impervious.

To meet the regulatory requirements while simultaneously providing an effective groundwater monitoring system, it is proposed that the shallow subsurface water be considered the “regulatory uppermost aquifer” exclusively for complying with the requirements of 30 TAC §330.63(e)(4), 30 TAC §330.63(f)(3), and 30 TAC §330.403(a). The proposed monitoring system fully complies with the above stated rules; regardless the executive director could approve the proposed groundwater monitoring system under 30 TAC §330.403(c).

## 2.4 Summary

The subsurface conditions beneath the site are characterized as follows from the ground surface downward. See Figure 2 for a graphical representation:

- Stratum I is comprised of Recent-Pleistocene deposits with a coarse grained layer of sediments at the base of the Stratum. This zone typically transmits seasonal moisture from surface infiltration
- Strata II, III and IV are predominately Eocene clay deposits of the Yegua-Jackson group and are subdivided as Highly Weathered (II),



Weathered (III) and Relatively Unweathered (IV). These Strata contain 95% clay material that is overly consolidated and 7 to 8 percentage points dry of the plastic limit. Strata II, III and IV clays are practically impervious based on criteria established by Terzaghi and Peck in *Soil Mechanics in Engineering Practice* (1967). Vertical hydraulic conductivities of the clays ranged from approximately  $1 \times 10^{-7}$  cm/sec to less than  $1 \times 10^{-10}$  cm/sec. Isolated sandy intervals in Strata II, III, and IV are also poorly permeable to practically impervious with horizontal hydraulic conductivities ranging from approximately  $1 \times 10^{-5}$  cm/sec to less than  $1 \times 10^{-7}$  cm/sec.

- Strata II, III and IV contain isolated sand lenses that are discontinuous, poorly permeable to practically impervious but may be hydraulically connected to the contact zone to a depth of 60-feet creating a shallow subsurface water bearing zone
- The shallow subsurface water bearing zone has been designated as the “regulated uppermost aquifer” for groundwater monitoring purposes and extends to 60 feet bgs and encompasses Stratum I, II, III and a portion of IV.
- Below 60 feet and to several hundreds of feet (>300 feet below the deepest proposed excavation), Strata IV serves as the effective upper confining unit or aquiclude to the uppermost recognized aquifer beneath the site, i.e., the regional Yegua-Jackson Aquifer
- Below 60 feet, the water in Strata IV is very limited and under confined conditions
- The uppermost recognized aquifer is comprised of the basal sands that occur near the bottom of the Yegua formation and is approximately 400-feet in thickness
- The uppermost recognized aquifer exhibits confining pressures of several hundreds of feet
- The upper Laredo Clays serve as the lower confining unit for the uppermost recognized aquifer, the regional Yegua-Jackson Aquifer (basal sands of the Yegua)

## **Part III, Appendix III-E.2**



**PART III  
ATTACHMENT III-E  
APPENDIX III-E.2**

**SUBSURFACE INVESTIGATION REPORT**

For

**PESCADITO ENVIRONMENTAL RESOURCE CENTER  
TYPE I MUNICIPAL SOLID WASTE MANAGEMENT FACILITY  
LAREDO, WEBB COUNTY, TEXAS  
MSW PERMIT NO. 2374**

Prepared for

**CB&I ENVIRONMENTAL AND INFRASTRUCTURE, INC.  
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On behalf of

**RANCHO VIEJO WASTE MANAGEMENT, LLC  
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Prepared by

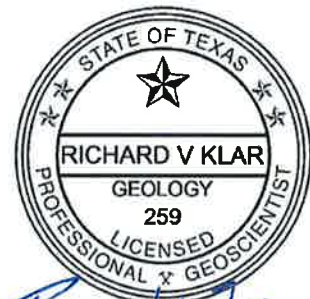


**RABA KISTNER ENVIRONMENTAL, INC.  
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**PROJECT NO. ASF13-140-00**

Initial Submittal February 25, 2015  
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11/16/15



*Richard V. Klar*

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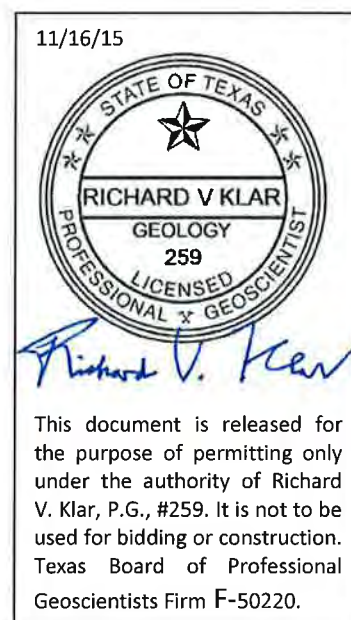




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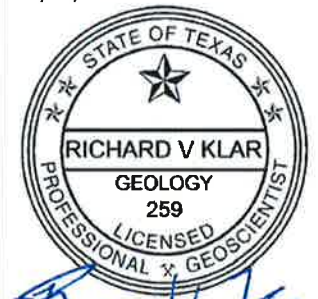
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users efficient access to their National Spatial Reference System. In association with all phases of GPS field data collection, submitted data files were processed with respect to a minimum of three NGS continuously operating reference stations selected by OPUS. The establishment of the well-defined NGS reference framework facilitated necessary correction of GPS field measurements and the final reporting of accurate spatial position data relative to the NGS reference framework. The geographic positions and elevations established for soil borings, piezometers, test pits, and staff gauges installed to evaluate water levels in four existing surface water impoundments are provided in **Table 1 – Soil Boring/Test Pit/Staff Gauge Position Table**.

In all instances, GPS survey data was tied to existing benchmarks established for this project along the perimeter of the proposed landfill permit boundary by a registered professional land surveyor (RPLS). An existing conditions topographic survey for the landfill site was performed by Dallas Aerial Survey (2/15/2010) based on physical benchmarks established along the site perimeter by Mejia Engineering Company (Gilbert L. Cade, III RPLS) using conventional survey methods. A copy of the final exhibit provided by Dallas Aerial Survey (DAS) was provided as a reference to evaluate the consistency of GPS data collected in conjunction with the subsurface investigation pertaining to the positions and ground surface elevations of exploratory borings and test pits. Correspondence provided by DAS attesting to the accuracy of their aerial survey data is provided in **Appendix F**.

Although an error analysis using redundant baseline observations and control points was not performed by **RKEI** to establish absolute survey accuracy as part of the subsurface investigation, the RPLS of record for the project (i.e., Mejia Engineering Company) was engaged in November 2015 to undertake a new ground survey of exploratory boring, piezometer, and test pit locations as necessary to facilitate an additional comparison of geographic position data reported in the SIR. This survey included collection of horizontal position and ground surface elevations at all locations (i.e., designated as T/G in their survey report), in addition to the collection of top-of-casing elevation measurements at piezometer sites (i.e., designated as T/P). A table comparing horizontal and vertical position data obtained by the RPLS on November 6, 2015 to **RKEI** position data was developed and is included herein as **Table 7**. Supporting documentation prepared by Mejia Engineering Company for the recent ground survey effort is provided in **Appendix F**. Comparison of **RKEI** position data with RPLS survey information indicates that position data utilized in the SIR preparation was adequate for purposes of subsurface investigation.

Boring logs containing information specified pursuant to §330.63(e)(4) generated following the completion of all phases of subsurface investigation in addition to a key to terms and symbols are provided in **Appendix B**. As part of the field exploration program, borehole geophysical logs were obtained to complement borehole logging data at the majority of Phase III (open-hole) boring locations. Additionally, geophysical logs were obtained at 7 of the 9 cased piezometers installed as part of the Phase I and II study effort the existing water-supply well located on the adjacent ranch property completed to a depth of about 1,166 feet within the underlying Yegua Aquifer. The location of the water-supply well is provided on **Figure 2**. Geophysical logs for all borehole logging activities are provided in **Appendix C**.

The following sections present a more detailed discussion of subsurface investigation activities and findings.

## **2.1 SOIL BORING PLAN**

The number and depths of borings installed to achieve site characterization objectives was determined in consultation with the TCEQ MSW Waste Permits section as part of the formal regulatory review process. The SBP was formally approved by the TCEQ MSW Waste Permits Section in correspondence dated April 11, 2011 and proposed installation of 27 additional soil borings to depths ranging from 120 to 160 feet below ground surface (bgs), 10 of which would be converted to piezometers, for a combined total of 57 soil borings and 19 piezometers. In addition to the soil borings and piezometers explicitly proposed as part of the Boring Location Plan, borings/piezometers designated as B-11A, B-109A, and B-114A were installed to further evaluate shallow groundwater conditions associated with saturated soil conditions observed at adjacent borings. As further discussed in **Section 2.3.1**, boring DB-1 was





As discussed in more detail in the Geotechnical Data Report for this permit application, subsurface investigation has demonstrated the presence of very stiff to hard, overconsolidated, clayey soils typical of the Yegua-Jackson Group formation from near ground surface to the maximum exploration depths on the order of 120 to 160 feet bgs. Fat clays (CH) and lean clays (CL) represent the predominant soil types observed in all study borings and the test pits. Thinly interbedded layers of clayey sands (CL), poorly graded sands (SP), silts (ML), and elastic silts (MH) were also repeatedly observed within Eocene strata. Typically at depths below about 20 to 40 feet, corresponding to the top of the relatively unweathered Eocene strata (Stratum IV), frequent very thinly interbedded rock strata consisting of fine-grained sandstone, siltstone, and claystone were observed within clay soils.

#### 4.0 GROUNDWATER DATA

Information developed in conjunction with subsurface investigation activities pertaining to the nature and occurrence of shallow groundwater at the site, within the depth interval of exploration in the Yegua-Jackson Group formation (aquifer), is provided herein. To the depths explored as part of this investigation, the obtained groundwater data indicates the following conditions to be present at the site:

- Subsurface water quantity appears to be limited and occurs intermittently, but the flow direction appears to mimic surface drainage patterns to the south.
- Shallow subsurface water present below the plant root zone appears to be very saline.
- Static water levels are relatively shallow throughout the site and generally correspond to the contact between Recent Pleistocene and Eocene strata and/or zones of weathering within uppermost Eocene strata. This contact zone is considered to represent the primary water-bearing zone from a regulatory compliance standpoint, although subsurface water is also present within deeper Eocene strata.
- Matrix saturated conditions within the Eocene strata appear to be associated with thicker silt or sand units and/or secondary structure (i.e., fractures and clay partings) observed in the predominantly clayey soils of the Yegua-Jackson Group formation.
- Because of the high clay content, subsurface strata described in **Section 3.0** would appear to be relatively and/or practically impermeable.

As indicated on boring logs in **Appendix B**, visible or “free” water not associated with matrix-saturated conditions was noted at several locations in conjunction with exploratory drilling and sampling efforts. For purposes of this reporting, the term free water simply means that water was visibly observed in the recovered, (disturbed) soil samples – either auger-drilling cuttings [e.g., boring B-1] and/or sonic drilling core samples. The source of the water could not be determined because of sample disturbance and could have been influenced by drilling and sampling procedures. The use of the term is not intended to imply matrix saturated conditions or the collection of soil samples from within zone(s) of saturation. The term is used separately and distinctly from other moisture condition terms (i.e., qualifiers) used on boring logs including “moist”, “wet”, and “saturated”, which apply to observed sample matrix conditions. The observed presence of free water was noted on the logs for informational purposes only.



The following discussion provides a description of piezometer installation activities and water level measurements, in addition to other pertinent groundwater observations obtained in conjunction with drilling activities, test pit observations and at staff gauges installed at the four surface water impoundments located within the site boundaries.

#### 4.1 PIEZOMETER INSTALLATION

As presented on **Figure 15 – Piezometer/Staff Gauge Location Map**, a total of 19 soil borings installed during the three assessment phases were converted to permanent piezometers constructed in accordance with applicable TCEQ and Texas Department of Licensing and Regulation (TDLR) requirements. Piezometers were generally distributed across the proposed landfill area to allow for good spatial distribution of groundwater monitoring points, but concentrated along the landfill perimeter and inferred downgradient (south) boundary. Piezometers installed during the initial phases of investigation are designated as B-1, B-2, B-6, B-10, B-13, B-18, B-24, B-26, and B-27, whereas piezometers installed following approval of the Soil Boring Plan are designated as B-11A, B-101, B-102, B-106, B-109A, B-114A, B-115, B-118, B-124, and B-126, respectively.

On the basis of preliminary observations during the initial drilling programs, which indicated essentially dry drilling conditions, piezometers were installed and screened to evaluate zones (contiguous depth intervals) where perched lenses of shallow groundwater or apparent groundwater seepage was identified. Observations during drilling predominantly did not indicate matrix saturation conditions, but rather that the occurrence of shallow groundwater throughout the exploration depth interval is limited primarily to zones of weathering along clay partings and fractures. Very thin zones of matrix saturation were observed only in association with isolated sand lenses encountered throughout the SITE. Direct observations made in conjunction with test pit installation (TP-1) indicated first shallow groundwater seepage at the Stratum II/III interface at a depth of about 11 to 11.5 feet bgs. As reported previously, however, groundwater seepage at TP-1 was observed to have dried up overnight, for the most part, and did not result in a significant (measureable) groundwater accumulation in the excavation following the completion of an approximate 24-hr observation period.

In an attempt to evaluate the occurrence of shallow groundwater present in subsurface soil units, piezometers installed during Phase I and II study efforts were screened at several discrete (15 to 20 feet) intervals between 10 to 75 feet relative to existing ground surface. Deeper piezometers installed as part of the Phase III study effort targeted deeper intervals within Stratum IV on the order of about 60 to 84 feet and 80 to 113 feet, respectively. Phase III piezometers designated as B-11A, B-109A, and B-114A, respectively, were installed to further evaluate the presence of shallow groundwater associated with sand/silt or sandstone intervals reported in conjunction with borehole logging efforts, as these may represent zones of localized saturation. As presented on **Figure 15** and depicted on geologic cross sections presented on **Figures 4 through 13**, specific screen depth intervals correlate to the following:

- ~10 to 45 ft well screen: Stratum I/III, Stratum III, and Stratum III/IV
- ~30 to 60 ft well screen: Stratum IV
- ~60 to 84 ft well screen: Stratum IV
- ~80 to 113 ft well screen: Stratum IV

Construction details for all piezometers installed as part of the collective subsurface investigation program are provided on **Table 4 – Summary of Piezometer Construction Details and Screen Elevations**, which includes pertinent monitoring point construction details such as installation date, installation



contractor, total well depths, well screen information, top-of-casing elevations, etc. Well construction diagrams were also prepared to graphically illustrate information summarized on the referenced table and are provided as **Appendix D**. State of Texas Well Reports prepared by the licensed well installation contractors (i.e., Vortex Drilling, Inc., Boart Longyear Drilling Services, and Geoprojects International, Inc.) are provided as **Appendix E**.

Following installation, all piezometers were surged by the installation contractor prior to the acquisition of static depth to water measurements to remove drilling artifacts (i.e., remove fine sediments from filter packs). Very slow recharge rates were generally observed during this process, and it was noted that piezometers at all locations were purged essentially to dryness following the removal of one well volume of water. Typically, water levels did not fully recover following purging activities for periods of 24 to 48 hours. Due to slow recharge conditions, surging activities were conducted over the course of several days at most piezometer locations, irrespective of screen depth interval.

## 4.2 WATER LEVEL MEASUREMENTS

### 4.2.1 Observations During Drilling

On the basis of logging observations made during all phases of exploratory drilling, shallow groundwater, where encountered, was first observed at depths of about 4.5 to 31 feet in open borings, but consistently rose to depths of about 4 to 12 feet after about 24 to 48 hours of observation, irrespective of boring depth, provided that borings were deep enough to penetrate into Stratum III or IV (i.e., generally greater than 10 feet). As reported on soil boring logs in **Appendix B**, the presence of wet soil or matrix saturated conditions was only observed in 10 of the 57 exploratory boring locations installed as part of the collective subsurface assessment effort. Matrix saturated conditions observed during soil boring logging activities are summarized as follows:

- B-5 – (85-95 ft), Laminated sandstone layers (Stratum IV)
- B-6 – (26-31.5 ft), Sandy clay with sandstone lenses (Stratum III)
- B-8 – (46-56 ft), Thinly interbedded sandstone (Stratum IV)
- B-11 – (47-47.5 ft), Silt (Stratum IV)
- B-16 – (27-34 ft), Thinly interbedded siltstone; and (100-104 ft), Sandstone lenses (Stratum IV)
- B-18 – (7-13 ft), Sand with scattered gravel (Stratum I); and (18-26 ft), Sand layers (Stratum III)
- B-19 – (39-50 ft), Scattered sandstone lenses (Stratum IV)
- B-101 – (25 ft), Sand lens (Stratum III)
- B-114 – (10-12 ft), Sand with gravel (Stratum I)
- B-120 – (21.5-23 ft), Sand lens (Stratum III)

As indicated above, discrete zones of matrix saturation were observed at various depth intervals in association with sand or silt deposits, sand lenses, or sandstone/siltstone bedding units. Discrete matrix saturated intervals were observed at relatively shallow depths less than 35-40 feet (i.e., above Stratum IV) at 5 boring locations: B-6, B-18, B-101, B-114, and B-120. It was noted that below 35 to 40 feet bgs, observations during drilling predominantly indicated limited matrix saturation conditions associated with isolated sand lenses and that the occurrence of shallow groundwater throughout the exploration depth interval was limited to these lenses and zones of weathering along clay partings and fractures.



It was noted in conjunction with the field exploration effort that sonic drilling is analogous to driving a pipe into the ground using repeated blows of a hammer. Subsurface materials in front of the pipe are either displaced (forced) into the pipe or outside. In hard materials, the material contacted by the pipe leading edge must be pulverized so that it can be displaced and allow the pipe to advance. Sonic drilling recovers a near-continuous core (sample); however, the drilling/sampling procedure causes disturbance to the sample. As a consequence, the samples are typically unsuitable for geotechnical testing that requires an “undisturbed” sample. In sonic drilling in hard materials, water is used to cool the bit (pipe leading edge), assist in displacement of the pulverized material (cuttings), lubricate the drill casing/sampling barrel (pipe), and stabilize the borehole. Exposure of the pulverized material to water sometimes creates a “paste” or “skin” on the recovered sample. Recovered samples logged as “moist” or “slightly moist” condition were based solely on observations of the sample interior or matrix and not the outer skin condition and/or infrequently observed slight penetration of drilling water in some disturbed samples. As explained in **Section 4.0**, the term “free water” was used separately and distinctly in boring log descriptions to indicate the observed presence of visible water not associated with sample matrix conditions.

#### 4.2.2 Water Levels Measured in Piezometers

Following piezometer installation and the completion of surging activities, static water levels were generally obtained following the completion of all phases of subsurface exploration. A summary of static water level measurements obtained at respective piezometer locations is provided as **Table 5 – Summary of Static Water Level Measurements – Piezometers**. As presented on the referenced table, water levels have generally exhibited a decreasing trend throughout the monitoring period likely associated with persistent drought conditions experienced by the region during 2010 and 2011. On average, water level measurements at individual piezometer locations associated with the most recent gauging event conducted on January 10, 2012 are on the order of 0.5 to 4 feet lower than recorded immediately following piezometer installation. Maximum overall water level declines are noted for older piezometers installed as part of the initial Phase I and II study efforts.

Although the occurrence of shallow groundwater is primarily limited to fractures and horizontal partings within respective stratigraphic units, water level contour maps were generated for the shallow groundwater using a contouring algorithm that assumed homogeneous, isotropic subsurface conditions. Initially, combined maps comprising **Figures 16 through 19** were generated using all available piezometer data for each of the gauging events. In order to evaluate seasonal fluctuations in shallow subsurface water levels, piezometer gauging events were distributed throughout the full duration of the subsurface investigation program as indicated below. Hydraulic interconnection between near-surface and deeper stratigraphic units was a primary assumption for these combined data plots.

- Combined Water Level Contour Map 10/19/10 (**Figure 16**)
- Combined Water Level Contour Map 3/23/11 (**Figure 17**)
- Combined Water Level Contour Map 7/19-20/11 (**Figure 18**)
- Combined Water Level Contour Map 1/10/12 (**Figure 19**)

Based on review of initial plots, it was observed that dissimilar static water levels were present between adjacent piezometers at a number of locations in association with both the 7/19-20/11 and 1/10/12 data plots, primarily in association with piezometers screened at relatively deep intervals (Phase III piezometer screen depths installed between 60 to 113 feet) within Stratum IV. As





presented on **Figures 18 and 19**, these differences in static water level elevations appear to represent the presence of sinks or mounds in an otherwise gently sloping water table surface. In all instances, water level elevations reported for deep piezometers are approximately 1.5 to 4.5 feet greater than at adjacent shallow piezometers and likely represent increased pressure conditions within the deeper Stratum IV interval. These differences are best illustrated by comparison of water level elevations for B-10 to B-106 and B-109A, and B-24 to B-124 and B-126.

To further evaluate shallow groundwater conditions, data presented on **Figures 18 and 19** pertaining to shallow (i.e., 10 to 60 feet) and deep (i.e., 60 to 113 feet) piezometer screen depths were plotted and contoured separately for each well gauging event. These water level contour maps are provided as **Figures 20 and 21** (Shallow Water Level Contour Map with Staff Gauge Data – 7/19-20/11 and Deep Water Level Contour Map – 7/19-20/11, respectively) and **Figures 22 and 23** (Shallow Water Level Contour Map with Staff Gauge Data – 1/10/12 and Deep Water Level Contour Map – 1/10/12, respectively), associated with the 7/19-20/11 and 1/10/12 gauging events, respectively. When considered separately as presented on referenced figures, plotted water level contour data for designated shallow and deep depth intervals generally do not indicate sharp perturbations.

Assuming that sufficient connectivity exists for groundwater flow to occur, groundwater gradients are consistently on the order of 0.002 to 0.003 ft/ft (i.e., 0.2 to 0.3%) to the south-southwest.

#### 4.2.3 Staff Gauge Measurements

At the onset of Phase III study efforts, fixed measurement stations or staff gauges were installed adjacent to four existing (perennial) surface water impoundments as depicted on **Figure 15** to augment/correlate groundwater gauging data obtained at piezometer locations. Staff gauges were designated as SG-1 through SG-4. A summary of water level measurements obtained at respective staff gauge locations from May 2011 through January 2012 is provided as **Table 6 – Summary of Static Water Level Measurements – Staff Gauges**. Review of water level elevations indicates relatively consistent water levels for various gauging events although “dry conditions” were noted for select events at SG-2 and SG-4 locations. It should be noted that dry staff gauge readings do not indicate that the ponds were completely dry, but merely that the installed staff gauges were stranded on dry ground by dropping water levels in the perennial ponds.

Although water levels in surface water impoundments was observed to fluctuate in direct response to rainfall events, water level measurements obtained during dry conditions correspond favorably with groundwater elevations reports at adjacent piezometers. In particular, water level elevations reported at SG-4 were typically measured within 0.5 to 2.5 feet of shallow groundwater levels at the adjacent B-114A piezometer. To better illustrate this, water level measurements from staff gauges were included in water level contour plots provided on **Figures 20 and 22**. Collective piezometer gauging and soil boring logging data suggest a possible relationship between the relatively consistent water levels observed in the surface water impoundments (stock tanks) and the localized occurrences of shallow groundwater observed in proximal soil borings and piezometers.

#### 4.2.4 Observations From Test Pits

Test pit TP-1 was left open for approximately 24 hours following excavation in order to evaluate the nature and occurrence of near-surface shallow groundwater seepage at this location. As indicated



on **Table 3**, slight groundwater seepage was observed in TP-1 during excavation in the north (upgradient) face of the excavation at 7 feet bgs during excavation through the contact between the Recent-Pleistocene (Stratum I), and subsequently observed in the highly weathered Yegua-Jackson (Stratum II) at a depth of approximately 11 to 11.5 feet bgs along a bedding contact within the uppermost, very weathered Yegua-Jackson (Stratum II). However, the observed seepage, for the most part, was observed to have dried up overnight and no accumulation of groundwater was observed in TP-1 throughout the 24-hour observation period. No indication of shallow groundwater seepage or accumulation was observed during excavation of TP-2 to a total depth of 26 feet bgs.



## TABLES



**TABLE 7**

**COMPARISON OF RKEI TO RPLS GEOGRAPHIC POSITION  
DATA**





# COMPARISON OF RKEI TO RPLS GEOGRAPHIC POSITION DATA

Pescadito Environmental Resource Center

Type I MSW Management Facility

Rancho Viejo Waste Management, LLC

MSW Permit No. 2374

							RKEI Leica <sup>(5)</sup>		MEJIA Survey <sup>(3)</sup>		Horizontal Position Difference Between RKEI and MEJIA Survey Data	
Soil Boring Designation	RKEI TOC Elevation <sup>(1,2)</sup> (feet, MSL)	MEJIA TOC Elevation <sup>(2,3)</sup> (feet, MSL)	TOC Elevation Difference between RKEI and MEJIA Survey Data (feet)	RKEI GS Elevation <sup>(1,4)</sup> (feet, MSL)	MEJIA GS Elevation <sup>(3,4)</sup> (feet, MSL)	GS Elevation Difference between RKEI and MEJIA Survey Data (feet)	State Plane (TX-South)		State Plane (TX-South)			
							Easting (feet)	Northing (feet)	Easting (feet)	Northing (feet)	Easting (feet)	Northing (feet)
BORINGS												
B-3	-----	-----	-----	559.91	559.50	0.414	769617.37	17099781.90	769617.370	17099781.90	0.00	0.00
B-4	-----	-----	-----	563.64	563.32	0.321	771861.32	17099452.87	771861.206	17099452.83	0.11	0.04
B-5	-----	-----	-----	559.67	559.07	0.596	773055.27	17099262.05	773054.866	17099262.61	0.41	-0.56
B-7	-----	-----	-----	554.77	554.07	0.702	770959.56	17098228.21	770959.360	17098228.04	0.20	0.17
B-8	-----	-----	-----	561.89	561.54	0.352	773742.49	17098264.15	773742.358	17098263.98	0.14	0.17
B-9	-----	-----	-----	550.18	548.64	1.544	769191.25	17097041.97	769191.250	17097041.97	0.00	0.00
B-11	-----	-----	-----	549.53	548.67	0.859	772244.14	17097105.67	772253.873	17097112.66	-9.73	-6.99
B-12	-----	-----	-----	555.41	554.98	0.429	773509.58	17097017.09	773509.850	17097016.65	-0.27	0.44
B-14	-----	-----	-----	543.80	543.06	0.739	770674.68	17095543.42	770674.829	17095543.76	-0.15	-0.34
B-15	-----	-----	-----	548.17	547.73	0.437	772232.26	17095546.87	772232.643	17095547.22	-0.39	-0.35
B-16	-----	-----	-----	550.48	550.00	0.477	773251.96	17095529.37	773252.216	17095529.48	-0.25	-0.11
B-17	-----	-----	-----	544.79	544.25	0.536	769851.03	17094448.94	769850.984	17094449.03	0.04	-0.09
B-19	-----	-----	-----	539.19	538.63	0.560	770374.96	17093781.59	770374.814	17093781.56	0.15	0.03
B-20	-----	-----	-----	541.39	540.99	0.397	770990.76	17092564.74	770990.705	17092564.82	0.05	-0.08
B-21	-----	-----	-----	544.86	544.57	0.294	772513.69	17092582.70	772513.642	17092582.71	0.05	-0.01
B-22	-----	-----	-----	540.73	539.08	1.649	770284.30	17092386.59	770284.321	17092386.65	-0.02	-0.06
B-23	-----	-----	-----	536.98	536.61	0.374	768704.40	17091612.45	768704.405	17091612.47	-0.01	-0.02
B-25	-----	-----	-----	532.65	532.25	0.403	768963.93	17090102.58	768963.930	17090102.58	0.00	0.00
B-103	-----	-----	-----	553.76	551.95	1.809	770080.87	17098459.53	770080.511	17098458.77	0.36	0.76
B-104	-----	-----	-----	552.11	550.56	1.547	771203.64	17097744.07	771203.410	17097744.06	0.23	0.01
B-105	-----	-----	-----	557.66	556.33	1.325	773253.69	17097884.31	773253.834	17097883.78	-0.15	0.53
B-107	-----	-----	-----	549.53	546.90	2.633	769550.16	17096254.79	769550.160	17096254.79	0.00	0.00
B-108	-----	-----	-----	546.95	544.82	2.129	770630.04	17096284.51	770629.879	17096284.57	0.17	-0.07
B-109	-----	-----	-----	547.60	545.09	2.510	771534.22	17095874.54	771528.282	17095879.12	5.94	-4.58
B-110	-----	-----	-----	553.75	552.22	1.529	772947.96	17096646.60	772947.962	17096646.95	-0.01	-0.35
B-111	-----	-----	-----	544.06	543.16	0.905	769782.25	17095160.03	769782.250	17095160.03	0.00	-0.01
B-112	-----	-----	-----	543.09	540.95	2.143	768814.61	17094097.85	768814.648	17094097.90	-0.04	-0.05
B-113	-----	-----	-----	545.03	542.85	2.176	771418.25	17094770.05	771418.492	17094769.97	-0.24	0.08
B-114	-----	-----	-----	541.87	539.83	2.042	768883.67	17093582.47	768883.643	17093582.47	0.02	0.00
B-116	-----	-----	-----	545.60	543.69	1.907	771580.26	17093363.35	771580.157	17093363.41	0.10	-0.06
B-117	-----	-----	-----	543.68	540.88	2.804	768608.60	17092646.59	768599.927	17092625.01	8.67	21.57
B-119	-----	-----	-----	541.99	539.49	2.502	770637.64	17092055.23	770637.641	17092055.25	0.00	-0.02

PROJECT No. ASF13-140-01





COMPARISON OF RKEI TO RPLS GEOGRAPHIC POSITION DATA

Pescadito Environmental Resource Center

Type I MSW Management Facility

Rancho Viejo Waste Management, LLC

MSW Permit No. 2374

							RKEI Leica <sup>(5)</sup>		MEJIA Survey <sup>(3)</sup>		Horizontal Position Difference Between RKEI and MEJIA Survey Data	
Soil Boring Designation	RKEI TOC Elevation <sup>(1,2)</sup> (feet, MSL)	MEJIA TOC Elevation <sup>(2,3)</sup> (feet, MSL)	TOC Elevation Difference between RKEI and MEJIA Survey Data (feet)	RKEI GS Elevation <sup>(1,4)</sup> (feet, MSL)	MEJIA GS Elevation <sup>(3,4)</sup> (feet, MSL)	GS Elevation Difference between RKEI and MEJIA Survey Data (feet)	State Plane (TX-South)		State Plane (TX-South)			
							Easting (feet)	Northing (feet)	Easting (feet)	Northing (feet)		
B-120	----	----	----	539.92	538.19	1.729	770428.60	17091524.93	770428.624	17091524.98	-0.03	-0.05
B-121	----	----	----	544.09	542.51	1.585	771810.79	17091890.87	771810.790	17091890.91	0.00	-0.04
B-122	----	----	----	543.02	541.65	1.373	771850.19	17091018.37	771850.415	17091018.48	-0.23	-0.11
B-123	----	----	----	535.13	533.85	1.281	769533.57	17091241.54	769533.557	17091241.60	0.01	-0.06
B-125	----	----	----	542.22	541.02	1.202	771215.27	17091270.66	771215.172	17091270.60	0.09	0.06
DB-1	----	----	----	550.60	549.55	1.050	770467.22	17097776.98	770468.900	17097783.45	-1.68	-6.47
		MAXIMUM: ----				MAXIMUM: 2.80				MAXIMUM: 9.73 21.57		
		MINIMUM: ----				MINIMUM: 0.29				MINIMUM: 0.00 0.00		

PIEZOMETERS

B-1	555.61	556.15	-0.54	553.81	552.94	0.870	772273.60	17098253.56	772274.617	17098254.15	-1.02	-0.59			
B-2	547.59	548.09	-0.50	545.89	544.84	1.050	772239.16	17094057.78	772242.526	17094059.16	-3.37	-1.38			
B-6	562.48	561.96	0.52	559.02	558.37	0.650	769305.50	17098158.84	769302.982	17098160.33	2.52	-1.49			
B-10	550.86	550.38	0.48	547.73	547.08	0.650	770748.95	17097018.28	770750.310	17097015.65	-1.36	2.63			
B-11A	553.59	551.83	1.76	549.52	548.55	0.970	772253.72	17097112.80	772254.683	17097100.87	-0.97	11.93			
B-13	548.14	547.73	0.41	544.45	543.84	0.610	768832.69	17095546.84	768829.329	17095544.81	3.36	2.03			
B-18	545.85	545.62	0.23	542.50	542.09	0.410	768574.38	17093341.02	768570.345	17093343.67	4.03	-2.65			
B-24	541.03	540.68	0.35	538.10	537.48	0.620	770548.25	17090922.87	770545.635	17090926.52	2.61	-3.65			
B-26	540.79	540.44	0.35	537.85	537.09	0.760	771762.56	17089884.96	771766.016	17089885.78	-3.46	-0.82			
B-27	538.66	538.35	0.31	535.77	535.06	0.710	770277.21	17089445.54	770276.847	17089448.48	0.37	-2.94			
B-101	557.96	557.96	0.00	552.49	554.88	-2.390	770645.39	17098804.00	770644.480	17098792.85	0.91	11.15			
B-102	559.89	558.35	1.54	556.27	555.25	1.020	772418.12	17098978.96	772417.348	17098974.81	0.77	4.15			
B-106	550.29	551.26	-0.97	548.99	548.18	0.810	770210.77	17097322.93	770210.489	17097316.68	0.28	6.25			
B-109A	549.04	547.99	1.05	546.53	545.09	1.440	771528.37	17095879.27	771532.327	17095868.13	-3.96	11.14			
B-114A	542.62	542.63	-0.01	540.14	540.82	-0.680	768847.93	17093581.97	768853.192	17093576.49	-5.26	5.48			
B-115	543.95	543.60	0.35	541.46	540.65	0.810	770667.66	17093106.68	770667.101	17093097.94	0.55	8.74			
B-118	542.20	542.41	-0.20	538.87	538.68	0.190	768710.47	17092039.35	768712.250	17092026.53	-1.78	12.82			
B-124	539.45	538.28	1.17	536.89	535.08	1.810	770051.61	17090782.39	770053.337	17090772.99	-1.73	9.40			
B-126	540.55	542.39	-1.84	538.03	539.40	-1.370	771233.38	17090513.67	771240.018	17090506.75	-6.64	6.92			
			MAXIMUM:	1.84				MAXIMUM:	2.39				MAXIMUM:	9.73	21.57
			MINIMUM:	0.00				MINIMUM:	0.19				MINIMUM:	0.00	0.00

PROJECT No. ASF13-140-01



COMPARISON OF RKEI TO RPLS GEOGRAPHIC POSITION DATA

Pescadito Environmental Resource Center  
Type I MSW Management Facility  
Rancho Viejo Waste Management, LLC  
MSW Permit No. 2374

							RKEI Leica <sup>(5)</sup>		MEJIA Survey <sup>(3)</sup>		Horizontal Position Difference Between RKEI and MEJIA Survey Data	
Soil Boring Designation	RKEI TOC Elevation <sup>(1,2)</sup> (feet, MSL)	MEJIA TOC Elevation <sup>(2,3)</sup> (feet, MSL)	TOC Elevation Difference between RKEI and MEJIA Survey Data (feet)	RKEI GS Elevation <sup>(1,4)</sup> (feet, MSL)	MEJIA GS Elevation <sup>(3,4)</sup> (feet, MSL)	GS Elevation Difference between RKEI and MEJIA Survey Data (feet)	State Plane (TX-South)		State Plane (TX-South)			
							Easting (feet)	Northing (feet)	Easting (feet)	Northing (feet)	Easting (feet)	Northing (feet)
TEST PITS <sup>(7)</sup>												
TP-1				548.58	544.65	3.930	771245.69	17095607.29	771452.604	17095676.31	-206.91	-69.02
TP-2				549.08	548.45	0.630	772676.36	17095568.06	772628.386	17095564.95	47.97	3.11

- NOTES:**
- 1. Data reported in Site Investigation Report (SIR), prepared by Raba Kistner Environmental, Inc. (RKEI), dated September 18, 2015.
  - 2. TOC = Top of Casing
  - 3. Coordinates provided by Mejia Engineering Company, Gilbert L. Cade III, Registered Professional Land Surveyor (R.P.L.S.) #5060, November 6, 2015.
  - 4. GS = Ground Surface
  - 5. A Leica System 1200 survey grade satellite based global positioning system (GPS) was used for the survey which incorporates satellites managed by the Department of Defense to allow for accurate geographic position measurement worldwide. Raw GPS data were collected using the Leica System 1200 Real Time Kinematic (RTK) rover interfaced with a Leica System 1200 base station. Use of the coupled RTK rover and the stationary base station provided for real time correction of raw GPS observables and generally afforded sub-meter position accuracy.
  - 6. Geographic coordinates are additionally presented in State Plane TX-South Zone 5 in feet.
  - 7. Position data by Mejia at test pits were taken at "representative" locations adjacent to backfilled test pits where there was no ground disturbance. RKEI position data was taken prior to test pit installation.



## **APPENDICES**



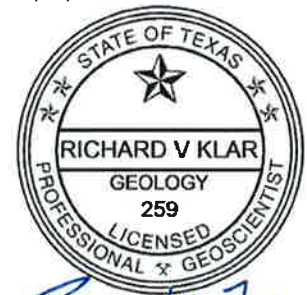


## APPENDIX B

### BORING LOGS AND KEY TO TERMS AND SYMBOLS

(Boring Logs B-1 through B-26, B-11A, B-109A, B-114A,  
B-101 through B-126, and DB-1)

11/16/15



*Richard V. Klar*

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# KEY TO TERMS AND SYMBOLS (CONT'D)

## MOISTURE CONDITION

Dry	- Absence of moisture, completely dry to the touch.
Slightly Moist	- No visible water, but clay soils from sample matrix can be grooved or partially smoothed with a knife.
Moist	- Damp but no visible water, clay soils from sample matrix can be grooved or smoothed with a knife.
Wet	- Visible free water in sample matrix at some locations associated with matrix-saturated conditions.
Saturated	- Visible free water drains easily from sample; sample matrix is typically wet.
Free Water	- Noted observations of visible water in recovered samples. The term is not intended to imply matrix-saturated conditions or the collection of soil sample(s) from within zone(s) of saturation. The term is used separately and distinctly from other moisture condition terms as it does not pertain to sample matrix conditions.

▽ Water level measured in borehole during drilling or within 24-48 hours of completion.

▽ Static water level

## SEDIMENTARY TEXTURE

Texture	Grained Diameter	Particle	Rock Name
*	80 mm	Cobble	Conglomerate
*	5 - 80 mm	Gravel	---
Coarse Grained	2 - 5 mm	---	---
Medium Grained	0.4 - 2 mm	Sand	Sandstone
Fine Grained	0.1 - 0.4 mm	---	---
Very Fine Grained	0.1 mm	Clay, Silt	Shale, Claystone Siltstone

## SOIL STRUCTURE

Bentonitic	- General term applied to clay soils, likely containing montmorillonite (smectite) as an essential mineral, having the ability to swell in water.
Blocky	- Cohesive soil that can be broken into small angular lumps which resist further breakdown.
Calcareous	- Having appreciable quantities of carbonate.
Carbonate	- Having more than 50% carbonate content.
Cemented	- Said of soil particles or clastic sediments that are bound together by cementing agents including colloidal clay, hydrates or iron, or calcium carbonate. Three degrees of cementation are typically reported: weakly-cemented, strongly-cemented, and indurated.
Fissured	- Breaks along definite plane of fracture with little resistance to fracturing.
Flocculated	- Rough surface with the appearance of apparent sand particles, but actually consisting of clay soils (no sand) that are loosely aggregated, with individual clay particles held together tightly in clot-like masses that appear as small lumps, clusters, or granules in soil samples.
Fractured	- General term for any break in soil structure or rock, whether or not it causes displacement, due to mechanical failure by stress including cracks, joints, and faults.
Friable	- Said of a rock or partially indurated soil stratum that crumbles naturally or is easily broken, pulverized, or reduced to powder. Also said of a moist soil consistency that crushes easily under gentle to moderate pressure and coheres when pressed together.
Glauconite	- General name applied to a group of green minerals occurring in soils, generally consisting of hydrous silicates of potassium and iron. It is commonly formed in the sedimentary environment by diagenetic processes (i.e., following deposition of clay soils, etc.).
Indurated	- Hardened by lithification.
Interbedded	- Said of bedding units that lay between or alternate with beds of different character.
Interlayered	- Alternating layers of different soil type.
Intermixed	- Pockets of different soil type and layered or laminated structure is not evident.
Laminated	- Alternating partings or seam of different soil type.
Layer	- Inclusion greater than 3-inches thick extending through the sample.
Lens	- Geologic deposit bounded by converging surfaces, one of which is usually curved, that is generally thick in the middle and thinning out toward the edges.
Mottled	- Said of a soil that is irregularly marked with spots or patches of different color or texture, usually indicating poor aeration or seasonal wetness.
Organic Matter	- Decayed plant root or other organic carbon matter present in surface soils
Parting	- Inclusion less than 1/8-inch thick extending through the sample.
Pocket	- Inclusion of material of different texture that is smaller than the diameter of the sample.
Seam	- Inclusion 1/8-inch to 3-inches thick extending through the sample.
Slickensided	- Having planes of weakness that appear slick and glossy.
Stratified	- Alternating layers of material or color with layers at least 6mm thick.
Weathered	- Said of soil or rocks that are changed in color, texture, composition, firmness, or form with little or no transport of the loosened or altered material resulting from exposure to atmospheric agents at or near the Earth's surface. Most weathering occurs at the surface, but may occur at considerable depths as in well-jointed or fractured rocks or sediments that permit penetration of atmospheric oxygen and/or circulating surface waters.



**APPENDIX C**

**BOREHOLE GEOPHYSICAL LOGS**



## **BORINGS**







Borehole: WELL DB-1

Logs: GAMMA, RESISTIVITY,  
CALIPER

Water Well Logging & Video Recording Services

Geo Cam, Inc. 126 Palo Duro, San Antonio, TX 210-495-9121

Project: RANCHO VIEJO SITE

Date: 06-09-11

Client: RABA-KISTNER CONSULTANTS INC.

County: WEBB

Location:

State: TX

BOREHOLE DATA

Drilling Contractor: BOART LONGYEAR

Driller T.D. (ft) : 501'

Elevation: 530' GPS

Logger T.D. (ft) : 501'

Depth Ref: G.L.

Date Drilled: 06-05-11

BIT RECORD

RUN	BIT SIZE (in)	FROM (ft)	TO (ft)	SIZE/WGT/THK	FROM (ft)	TO (ft)
1	8"	0	130'	NA		
2	7"	130'	258'			
3	6"	258'	TD			

CASING RECORD

Drill Method: SONIC CORE

Weight:

Fluid Level (ft) : 160'

Hole Medium:

Mud Type:

Time Since Circ:

Viscosity:

Rm:

at:

Deg C

Logged by: Robert Becknal

Unit/Truck: 05

Witness: TOMAS CRUZ

LOG TYPE	RUN NO	SPEED (ft/min)	FROM (ft)	TO (ft)	FT./IN.
GAMMA	2	22	500'	1'	20
RESISTIVITY	2	30	595'	5'	20
CALIPER	2	22	486'	5'	20

Comments:

Gamma  
CPS

100

Depth  
1ft:240ft

0

R16

Ohm-m

10

R32

Ohm-m

10

R64

Ohm-m

10

R8

Ohm-m

10

Current

mA

200

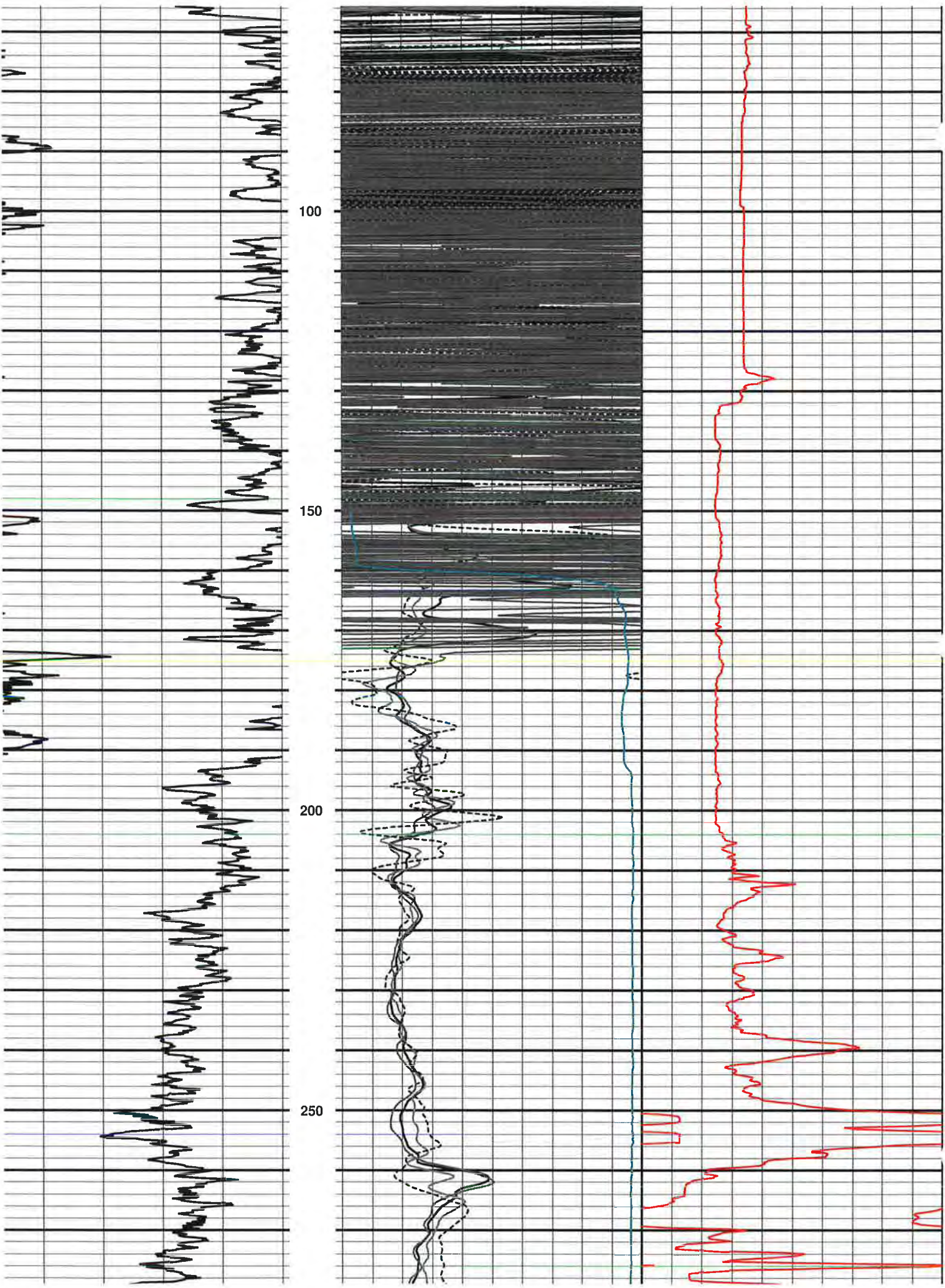
Caliper

In

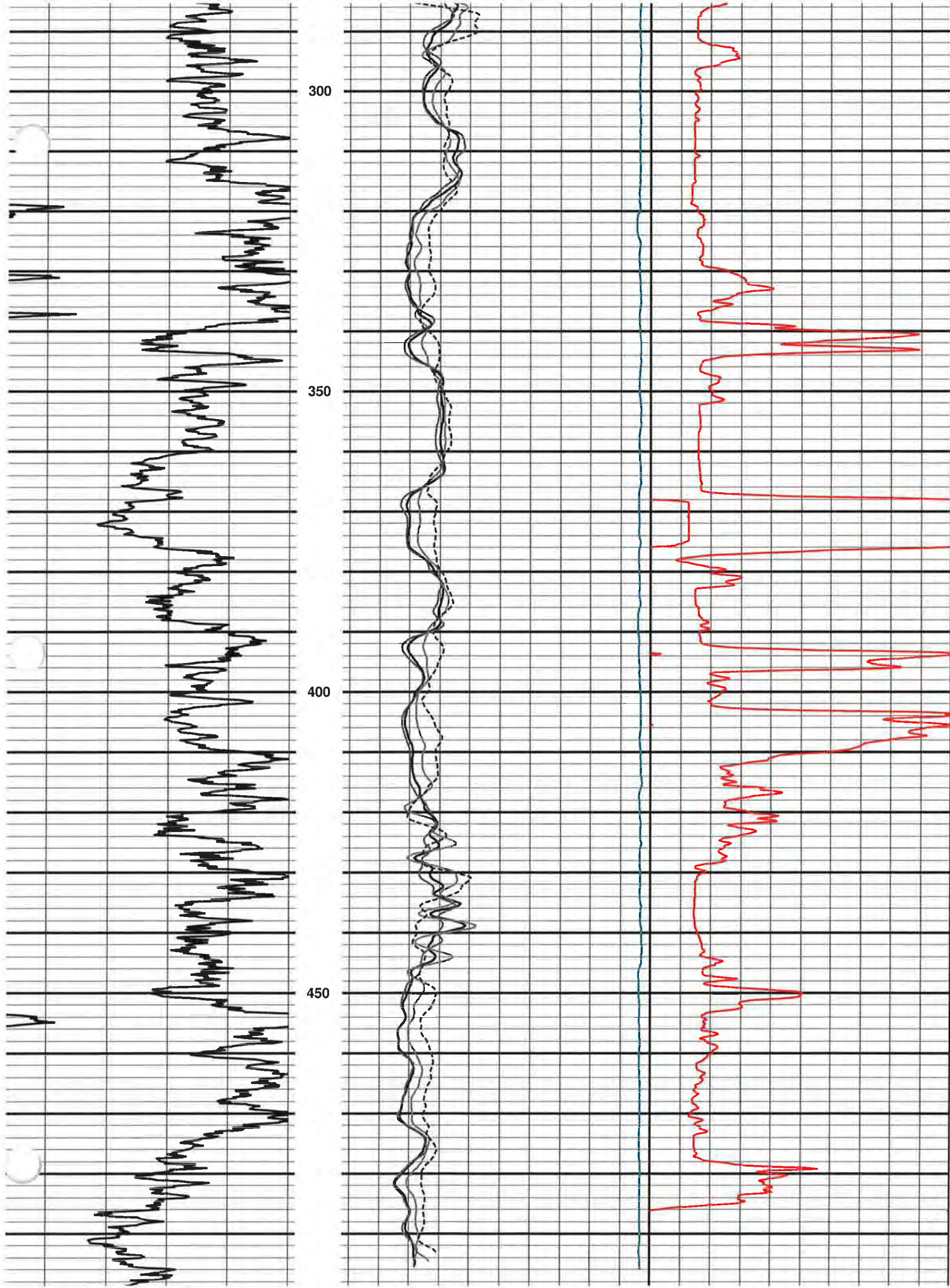
15

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## **APPENDIX F**

### **SUPPORTING DOCUMENTATION FOR INDEPENDENT HORIZONTAL AND VERTICAL POSITION DATA**



**MEJIA ENGINEERING COMPANY**  
**NOVEMBER 6, 2015**





NAME.....MEJIA ENGINEERING COMPANY  
SURVEY DATE..... November 6, 2015  
INSTRUMENT.....GPS TRIMBLE R8-4 GNSS  
INSTRUMENT ACCURACY.....+ - 0.05  
COORDINATE SYSTEM.....NAD 83 STATE PLANE NAD 4205 TEXAS SOUTH  
VERTICAL CONTROL.....NAVD 88  
BENCHMARK.....USGS POINT DESIGNATION 526 TX/WEBB  
BURRITO TANK QUAD. VERTICAL CONTROL 526.28  
SURVEYOR.....GILBERT L.CADE, R.P.L.S. #5060

*J. L. Smith*  
Nov 6, 2015



STATE OF TEXAS  
REGISTERED  
★  
GILBERT L. GADE III  
NO. 5060  
PROFESSIONAL  
LAND SURVEYOR

2018 D	17093343.67	768570.345	542.09 B 18 N/G
2019	17093781.56	770374.814	538.63 B 19
2020	17092564.82	770990.705	540.99 B 20
2021	17092582.71	772513.642	544.57 B 21
2022	17092386.65	770284.321	539.08 B 22
2023	17091612.47	768704.405	536.61 B 23
2024 A	17090922.62	770547.659	540.68 B 24 T/P
2024 B	17090923.02	770548.21	541.2 B 24 T/M
2024 C	17090924.4	770549.461	538.01 B 24 T/C
2024 D	17090926.52	770545.635	537.48 B 24 N/G
2025	17090102.58	768963.93	532.25 B 25
2026 A	17089884.56	771762.345	540.44 B 26 T/P
2026 B	17089884.52	771762.501	540.97 B 26 T/M
2026 C	17089883	771763.432	537.52 B 26 T/C
2026 D	17089885.78	771766.016	537.09 B 26 N/G
2027 A	17089445.02	770277.157	538.35 B 27 T/P
2027 B	17089444.93	770277.068	538.95 B 27 T/M
2027 C	17089443.69	770277.993	535.45 B 27 T/C
2027 D	17089448.48	770276.847	535.06 B 27 N/G
2101 A	17098796.11	770646.552	557.96 B 101 T/P
2101 B	17098796.11	770646.442	558.43 B 101 T/M
2101 C	17098797.98	770647.252	555.44 B 101 T/C
2101 D	17098792.85	770644.48	554.88 B 101 N/G
2102 A	17098971	772418.268	558.35 B 102 T/P
2102 B	17098971.08	772418.007	558.75 B 102 T/M
2102 C	17098968.82	772419.274	555.5 B 102 T/C
2102 D	17098974.81	772417.348	555.25 B 102 N/G
2103	17098458.77	770080.511	551.95 B 103
2104	17097744.06	771203.41	550.56 B 104
2105	17097883.78	773253.834	556.33 B 105
2106 A	17097312.74	770210.686	551.26 B 106 T/P
2106 B	17097312.84	770210.64	551.73 B 106 T/M
2106 C	17097313.5	770208.245	548.44 B 106 T/C
2106 D	17097316.68	770210.489	548.18 B 106 N/G
2107	17096254.79	769550.16	546.9 B 107
2108	17096284.57	770629.879	544.82 B 108
2109 A	17095867.97	771528.243	547.99 B 109 T/P
2109 B	17095867.89	771528.387	548.35 B 109 T/M
2109 C	17095867.89	771526.896	545.53 B 109 T/C

2109 D	17095868.13	771532.327	545.09 B 109 N/G
2109	17095879.12	771528.282	545.3 B 109A
2110	17096646.95	772947.962	552.22 B 110
2111	17095160.03	769782.25	543.16 B 111
2112	17094097.9	768814.648	540.95 B 112
2113	17094769.97	771418.492	542.85 B 113
2114	17093582.47	768883.643	539.83 B 114
2114 A	17093573.71	768852.259	542.63 B 114A T/P
2114 B	17093573.54	768852.271	543.01 B 114A T/M
2114 C	17093573.86	768852.909	541.49 B 114A T/C
2114 D	17093576.49	768853.192	540.82 B 114A N/G
2115 A	17093093.83	770667.852	543.6 B 115 T/P
2115 B	17093094.17	770667.975	544.01 B 115 T/M
2115 C	17093095.8	770666.826	541.11 B 115 T/C
2115 D	17093097.94	770667.101	540.65 B 115 N/G
2116	17093363.41	771580.157	543.69 B 116
2117	17092625.01	768599.927	540.88 B 117
2118 A	17092023.85	768713.83	542.405 B 118 T/P
2118 B	17092023.92	768714.045	542.838 B 118 T/M
2118 C	17092025	768714.789	539.074 B 118 T/C
2118 D	17092026.53	768712.25	538.681 B 118 N/G
2119	17092055.25	770637.641	539.49 B 119
2120	17091524.98	770428.624	538.19 B 120
2121	17091890.91	771810.79	542.51 B 121
2122	17091018.48	771850.415	541.65 B 122
2123	17091241.6	769533.557	533.85 B 123 N/G
2124 A	17090769.47	770054.923	538.28 B 124 T/P
2124 B	17090769.32	770054.801	538.76 B 124 T/M
2124 C	17090770.97	770056.952	535.69 B 124 T/C
2124 D	17090772.99	770053.337	535.08 B 124 N/G
2125	17091270.6	771215.172	541.02 B 125
2126 A	17090506.94	771235.997	542.39 B 126 T/P
2126 B	17090506.63	771236.062	543.49 B 126 T/M
2126 C	17090507.06	771234.565	539.88 B 126 T/C
2126 D	17090506.75	771240.018	539.4 B 126 N/G
	17097783.45	770468.9	549.55 DB-1 N/G
2127	17095676.31	771452.604	544.65 TP 1 N/G
2128	17095564.95	772628.386	548.45 TP 2 N/G



**DALLAS AERIAL SURVEYS, INC.**  
**NOVEMBER 9, 2015**



***DAS, Inc.***

**10220 Forest Lane Dallas, TX 75243  
214-349-2200 Phone 214-349-2193 Fax**



November 9, 2015

CB&I  
Attn: Mr. Michael Oden, PE  
12005 Ford Rd, Suite 600  
Dallas, TX 75234

***RE: 12,000 acres in Webb County***

Dear Mr. Oden:

All mapping meets or exceeds standards of accuracy as designated by National Map Accuracy Standards (NMAS).

For horizontal accuracy, maps on publication scales larger than 1"=1600', not more than 10 percent of the points tested shall be in error by more than 1/30 inch, measured on the publication scale.

For vertical accuracy, as applied to contour maps on all publication scales, shall be such that not more than 10% of the elevations tested shall be in error more than one-half of the contour interval. In checking elevations taken from the map, the apparent vertical error may be decreased by assuming a horizontal displacement within the permissible horizontal error for a map of that scale.

For mapping under dense trees, the vertical accuracy will be plus or minus one contour interval.

Sincerely,

Bill Johnson, CP  
***DAS, Inc.***

**DAS Transmittal**





### **Part III, Appendix III-F**

**Part III**  
**Attachment III-F**

**GROUNDWATER MONITORING PLAN**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**

**PESCADITO**  
ENVIRONMENTAL RESOURCE CENTER

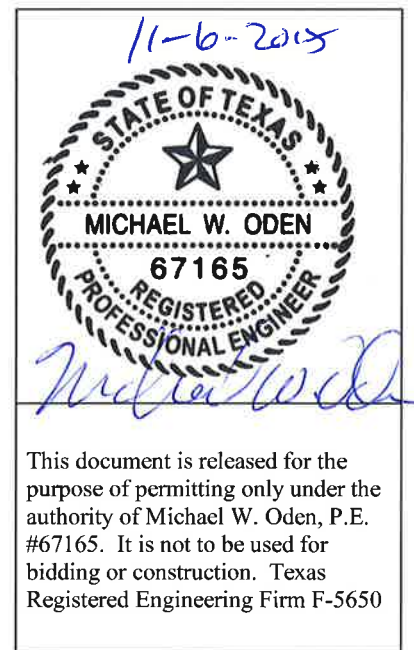
**Initial Submittal March 2015**  
**Revised September 2015**  
**Revised November 2015**

**Prepared for:**  
**Rancho Viejo Waste Management, LLC**  
**1116 Calle del Norte**  
**Laredo, TX 78041**

**Prepared by:**  
**CB&I Environmental and**  
**Infrastructure, Inc.**



**12005 Ford Rd, Suite 600**  
**Dallas, TX 75234**

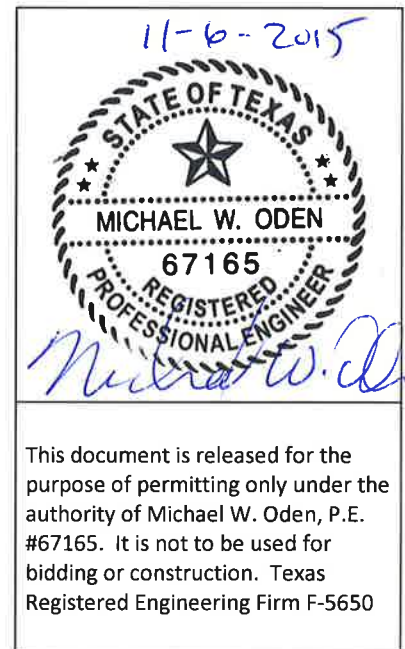


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## **1.0 Introduction 330.63(f)**

This Groundwater Monitoring Program has been prepared for the Pescadito Environmental Resource Center (MSW 2374) in Webb County, Texas in accordance with Subchapter J of 30TAC330. It includes a discussion of the monitoring systems and the sampling and analysis requirements.

The system has been designed based on site specific information and shall be operated and maintained to perform through the life of the Monitoring Program. In order to comply with 30TAC330.403(e)(3), the facility must notify the executive director and any local pollution agency with jurisdiction, if changes in site construction or operation or changes in adjacent property affect or are likely to affect the direction and rate of groundwater flow and the potential for detecting groundwater contamination from the solid waste management units.

## **2.0 Point of Compliance 330.63(f)(1-3)**

Figure III-F.1-1 in Appendix III-F.1 is a topographic map that shows the waste management units, the property boundary and the Point of Compliance (POC) as defined in 30TAC330.3.

This is a “greenfield” site with no previous MSW management units; therefore 330.63(f)(2) is not applicable.

## **2.1 Migration Pathways**

As is more thoroughly discussed in the Geology Report for the facility (Part III, Attachment III-E), soils in the upper 160 feet at the site are predominantly clay, occasionally interbedded with claystone, sandstone and shale. While groundwater may be encountered in thin layers of sandy or silty material within the otherwise highly impermeable clay, this groundwater is essentially not usable due to its very low production potential and poor water quality. The uppermost recognized regional aquifer beneath the site that is capable of producing water in potentially useful quantities is the Yegua-Jackson Aquifer, which is expected to be encountered at least 750 feet below ground surface at the site. Water in this aquifer is poor to very poor in quality, due to concentrations of total dissolved solids, chloride and sulfate that exceed Federal drinking water standards.

Although a leak from a Subtitle D composite liner equipped with a leachate collection system is unlikely, the occasional layers of sandy or silty material at the site represent the most likely pathways for migration. The excavation bottom and leachate collection system are designed to convey any leachate that is generated to a series of sumps. If a leak were to occur, the most likely location would be from the leachate collection sumps in the lowest parts of landfill units.

Any contaminant leaking from the sumps would slowly move laterally for several reasons: (1) the anisotropy of the Yegua-Jackson results in vertical hydraulic conductivities at least an order of magnitude lower than horizontal hydraulic conductivity; and (2) the soil beneath the site gets denser and less permeable with depth. If there were a more transmissive zone in the vicinity of the leak, the most likely pathway for migration would be laterally until intercepting another deeper transmissive zone. The monitoring system has been designed to account for this situation in a location dominated by clay.

Groundwater flow resulting from construction of the facility is not expected to change. Local lenses of groundwater may be removed and some flow may be re-routed around the facility; however the flow direction would still be from the north to the south, mimicking the ground surface.

Based on potentiometric surfaces prepared from data obtained from on-site piezometers installed in the near surface soils at the site (see Appendix III-E.2), the POC is located along the west, south and a portion of the eastern boundary as shown on the figures in Appendix III-F.1.

### **3.0 Groundwater Monitoring Program 330.63(f)(4)**

With respect to the usual regulatory practice, the “uppermost aquifer” is the very limited quantity of shallow subsurface water, i.e., perched groundwater, primarily associated with the relatively continuous contact zone consisting of a very thin layer of coarse-grained sediments occurring at shallow depth at the base of the surficial Recent-Pleistocene (R-P) and above the underlying Eocene-age Yegua-Jackson (Y-J) sediments. The shallow subsurface water appears to be unconfined, i.e., under “water-table” conditions. The shallow subsurface water associated with the contact zone also appears to be present in the highly weathered and weathered Y-J stratum, i.e. Strata II and III. Within the Yegua-Jackson sediments, the shallow subsurface water appears to be located in transmissive secondary structure in the clays and the thin, isolated shallow sand units. It should be noted that the Y-J sediments are typically unsaturated. Site-specific piezometer information indicates that some very limited hydraulic communication with the contact zone may exist down to approximately sixty feet bgs. Below 60-feet at the site, the clays form an aquiclude between the “uppermost aquifer” and the deeper Y-J. Inferred flow direction for the shallow groundwater appears to mimic surface drainage patterns, i.e., to the south with gradients ranging from 0.002 to 0.003.

Note that the designated “uppermost aquifer” does not extend down to the bottom elevations of the proposed excavation. Potential migration pathways below 60 feet bgs would be isolated sand units and anisotropic, more transmissive horizontal bedding characteristics in Strata IV (unweathered Y-J) down to the proposed depth of excavation. It should be noted that the Y-J sediments are typically unsaturated. In the unweathered Y-J, Stratum IV, the regional geologic dip controls potential water flow direction. Even though Stratum IV may contain very limited water, it still functions as an effective confining unit or “aquiclude” to the vertical migration of water from the designated “uppermost aquifer.”

The uppermost recognized aquifer at the facility is the regional Yegua-Jackson Aquifer which is greater than 600-feet beneath the deepest excavation. Flow in the Yegua-Jackson appears to coincide with the regional dip of the Yegua-Jackson to the east at approximately fifty feet per mile.

Per 330.63(f)(3), 330.63(f)(4) and 330.403(e)(1), the groundwater monitoring program has been

designed to detect a possible release from the landfill based on site specific conditions. As detailed above the “uppermost aquifer” for groundwater monitoring purposes is the contact zone at the base of R-P and extending down into the Y-J to a depth of 60 feet bgs. Groundwater flow rate is on the order of 1 to 2 feet per year to the south to southwest and is not affected by seasonal fluctuations based on data presented in Appendix III-E.2. The Y-J beneath the contact zone (Stratum III, III and IV) is predominately clay (95% clay per III-E.3) to great depths. Construction of the landfill may divert water around the facility but the overall direction will remain to the south to southwest. Therefore, no provisions are needed in the monitoring program to account for these

If a release from the landfill were to occur, the highest probability is association with one of the leachate sumps. To ensure earliest possible detection of such a release, the groundwater monitoring system will consist of groundwater monitoring wells which will be installed to, or below, the deepest sump excavation elevation depth nearest the well. To determine monitor well depths, the excavation elevation of the nearest sump to the monitor well location will be used and will assume a 3-foot thick compacted soil liner. Screens will be placed in the lower 10-20-feet of the monitoring well, as shown on Figure III-F.1-2 and the sand filter pack will extend to within 9-feet of the surface.

The Groundwater Monitoring Program for the Pescadito Environmental Resource Center (MSW 2374) has been prepared to meet the requirements of 30TAC330.403. The compliance monitoring wells will be installed along the POC as shown on Figure III-F.1-1. Well spacing will be a maximum of 600-feet and will consist of a minimum of 38 wells. However, in the event that a transmissive sand zone containing perched water is encountered in the sidewall of the excavation within approximately fifty feet of the bottom of the excavation, the next well along the POC boundary will be relocated to that area, with depths determined as outlined above, and the 600-foot spacing will be re-started. That specific groundwater monitoring well will be screened across the transmissive sand zone using the installation detail previously provided. Monitoring well installation will be performed so that there is always a well along the POC a minimum of 600-feet downgradient from the most recent cell constructed.

Note that the POC well locations were selected based on the potential flow direction in the



“uppermost aquifer”, i.e., flow direction to the south and generally mimicking surface topography. However, the POC well locations are also effective for any shift in the flow direction in the deeper (> 60 feet bgs) unweathered Y-J to align with the regional geologic dip. As a consequence, the POC well locations are strategically placed to intercept any potential migration pathways for any release from the landfill.

A total of 7 groundwater monitoring wells will be placed along the northern and portion of the east and west boundaries on an approximately 1200-foot spacing to obtain background or upgradient groundwater quality for comparison to the compliance wells located at the POC.

As each phase of monitoring well installation is completed and prior to placement of waste within 600-feet of newly installed wells, the owner or operator will submit a certification in accordance with 30 TAC §330.401(e) that the facility is in compliance with the groundwater monitoring requirements of §§330.403, 330.405, 330.407, and 330.409.

### **3.1 Monitoring Well Design and Construction**

In accordance with the Monitor Well Construction Specifications found at 30TAC330.421, all monitoring wells will be installed by a licensed Texas driller in accordance with all applicable regulations. The wells will be drilled by a method that will not introduce contaminants into the borehole or casing. A licensed professional geoscientist or engineer who is familiar with the geology of the area will supervise the monitoring well installation and development and will prepare a log of the boring. Monitoring well construction details including proposed screen intervals, well locations and elevations, filter pack and bentonite seal elevations, and surface completion are shown on Figure III-F.1-2. Equivalent alternatives to the construction specifications in 330.421 may be used if prior written approval is obtained from the executive director.

If any fluid is required in the drilling of the monitoring wells, only clean, treated city water will be used and a chemical analysis provided to the executive director along with the installation report. No glue or solvents will be used in the construction of groundwater monitoring wells.

After installation, the monitoring wells will be developed to remove drilling artifacts and open any water-bearing zone for maximum flow. The wells will be developed until all water that was

used or affected during the drilling activities is removed and the field measurements of pH, specific conductance, and temperature are stabilized.

Within 30 days of completion of a monitoring well or any other part of the monitoring system, an installation report will be submitted to TCEQ. The report will include construction and installation details for each well and will be provided on forms available from the commission. The report will include a site map drawn to scale showing the location of all installed monitoring wells to date, the relevant point(s) of compliance, top of casing elevations to the nearest 0.01 foot, tied to the mean sea level (msl), latitude and longitude or landfill grid location of each well, copies of detailed geologic logs including soil sample data, if performed and copies of driller's reports required by other agencies. A registered professional land surveyor will survey the well location and elevation of the top of casing and surface pad.

Any monitoring wells that are damaged and no longer usable will be reported to the executive director for a determination whether to replace or repair the well. In accordance with 30 TAC §305.70, if a compromised well requires replacement a permit modification request will be submitted within 45 days of the discovery.

Plugging and abandonment of monitoring wells will be performed in accordance with 16 TAC §76.702 and §76.1004. No abandonment will be performed without prior written authorization from the executive director.

#### **4.0 Groundwater Sampling and Analysis Plan 330.63(f)(5)**

No hazardous constituents have been identified in the groundwater at the site; therefore a detection monitoring program has been established for the facility. Part III, Appendix III-F.2 - Groundwater Sampling and Analysis Plan (GWSAP) contains the general requirements, sampling procedures and methods, and statistical analysis information required in 30 TAC §330.405(a)-(f).

The GWSAP contains information on the Detection monitoring program as well as Assessment and Corrective Action.

## 5.0 Groundwater Monitoring System Certification

330.403(e)

### General Site Information:

Pescadito Environmental Resource Center

Webb County, Texas

MSW Permit Application No.: 2374

### Qualified Groundwater Scientist Statement

I, Michael W. Oden, am a registered professional engineer in the State of Texas and a qualified groundwater scientist as defined in 30 TAC §330.3. I have reviewed the groundwater monitoring system and supporting data contained in the permit documents. In my professional opinion, the groundwater monitoring system is in compliance with the groundwater monitoring requirements specified in 30 TAC §330.401 through §330.421. This system has been designed specifically for the Pescadito Environmental Resource Center (Permit Application No. MSW No. 2374). The only warranty made by me in connection with this document is that I have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of my profession, practicing in the same or similar locality. No other warranty, expressed or implied, is made or intended.

Firm/Address: CB&I Environmental and Infrastructure, Inc.  
12005 Ford Road; Suite 600  
Dallas, Texas 75234  
TBPE Firm Registration F-5650

Signature: \_\_\_\_\_

*Michael W. Oden*

Date: \_\_\_\_\_

*11-6-2015*



## **Part III, Appendix III-F.1**

**Part III**  
**Attachment III-F**  
**Appendix III-F.1**

**GROUNDWATER MONITORING PLAN FIGURES**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**

**PESCADITO**  
ENVIRONMENTAL RESOURCE CENTER

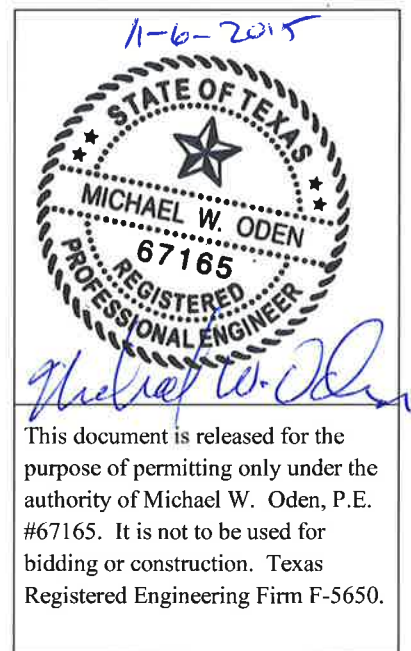
**Initial Submittal March 2015**  
**Revised September 2015**  
**Revised November 2015**

**Prepared for:**  
**Rancho Viejo Waste Management, LLC**  
**1116 Calle del Norte**  
**Laredo, TX 78041**

**Prepared by:**  
**CB&I Environmental and**  
**Infrastructure, Inc.**

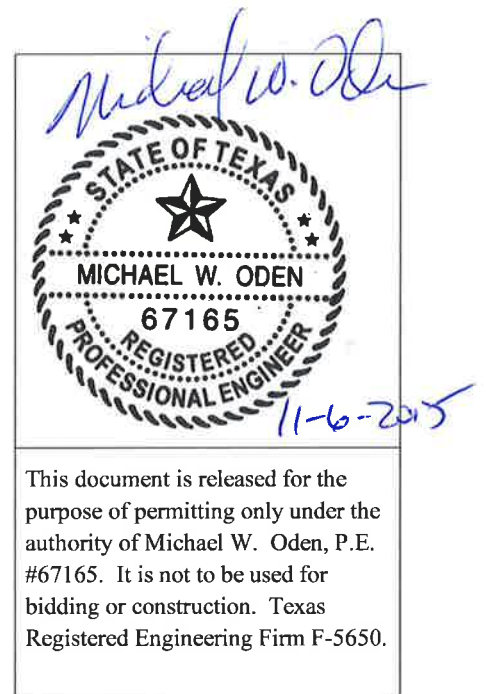


**12005 Ford Rd, Suite 600**  
**Dallas, TX 75234**

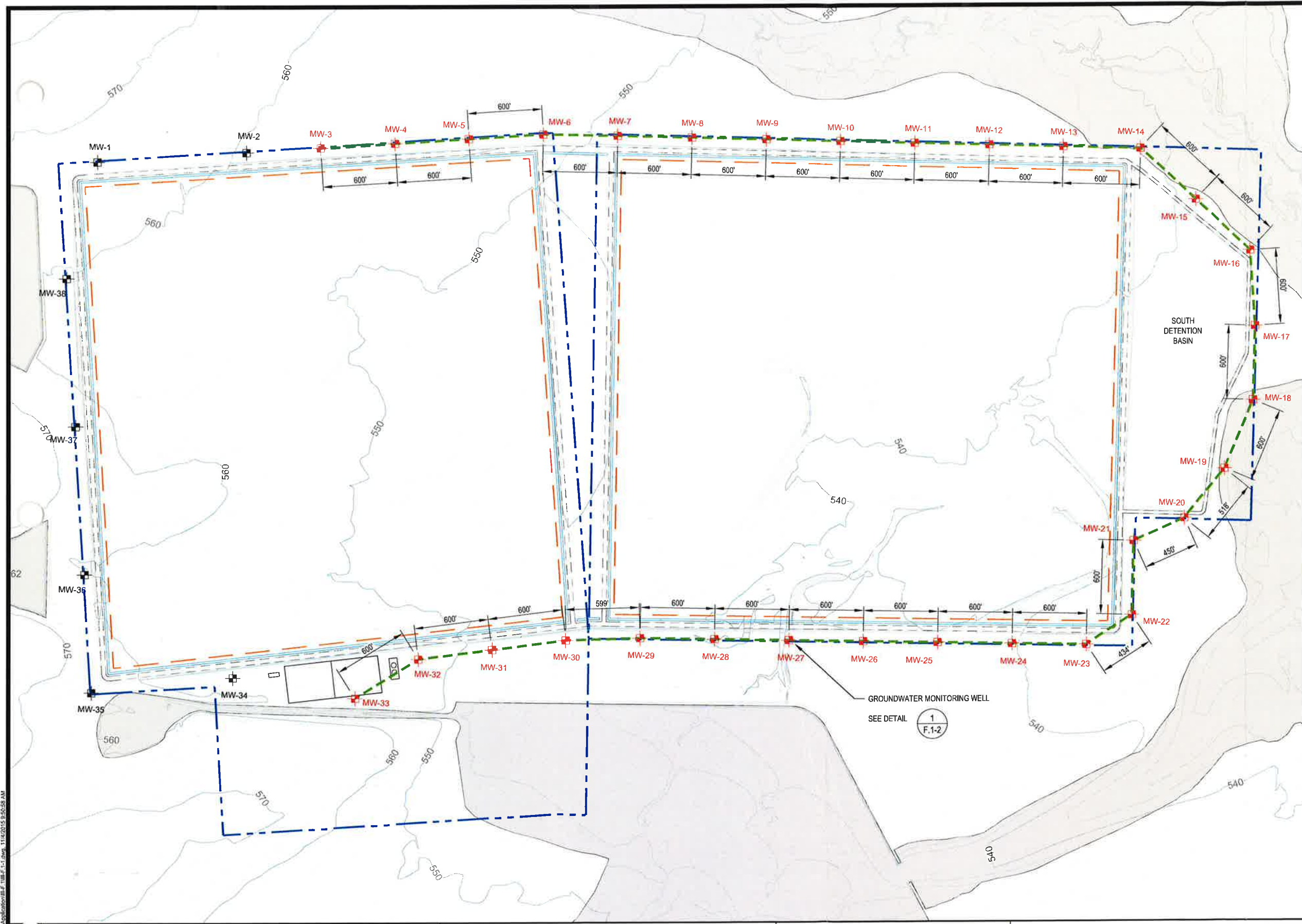


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LEGEND

- PERMIT BOUNDARY
- WASTE UNIT BOUNDARY
- PERIMETER DITCH
- PERIMETER ACCESS ROAD
- MW-1 GROUNDWATER MONITORING WELL (UPGRADIENT)
- MW-10 GROUNDWATER MONITORING WELL (DOWNGRADIENT)
- CLOMR 100-YEAR FLOODPLAIN
- POINT OF COMPLIANCE (P.O.C.)

NOTES

- EXISTING CONTOURS DEVELOPED FROM SITE AERIAL TOPOGRAPHIC SURVEY BY DALLAS AERIAL SURVEYS ON FEBRUARY 15, 2010.
- FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
- THE NEED FOR FLEXIBILITY TO ACCOMMODATE ADJUSTMENTS AND MODIFICATIONS IS ANTICIPATED CONSIDERING THE SIZE, COMPLEXITY, AND LIFE OF THE PROJECT.
- MW-3 TO MW-33 ARE DOWNGRADIENT ALONG P.O.C.
- MW-1, MW-2, AND MW-34 TO MW-38 ARE UPGRADIENT.

T:\MWD\2015\Projects\Pescadito\Drawings\Groundwater\MSW 2374\F.1-1.dwg, 11/16/2015 9:55:38 AM

REV. NO.	DATE	DESCRIPTION
2	11/2015	NOD 2
1	9/2015	NOD 1



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TBPE FIRM F-5650

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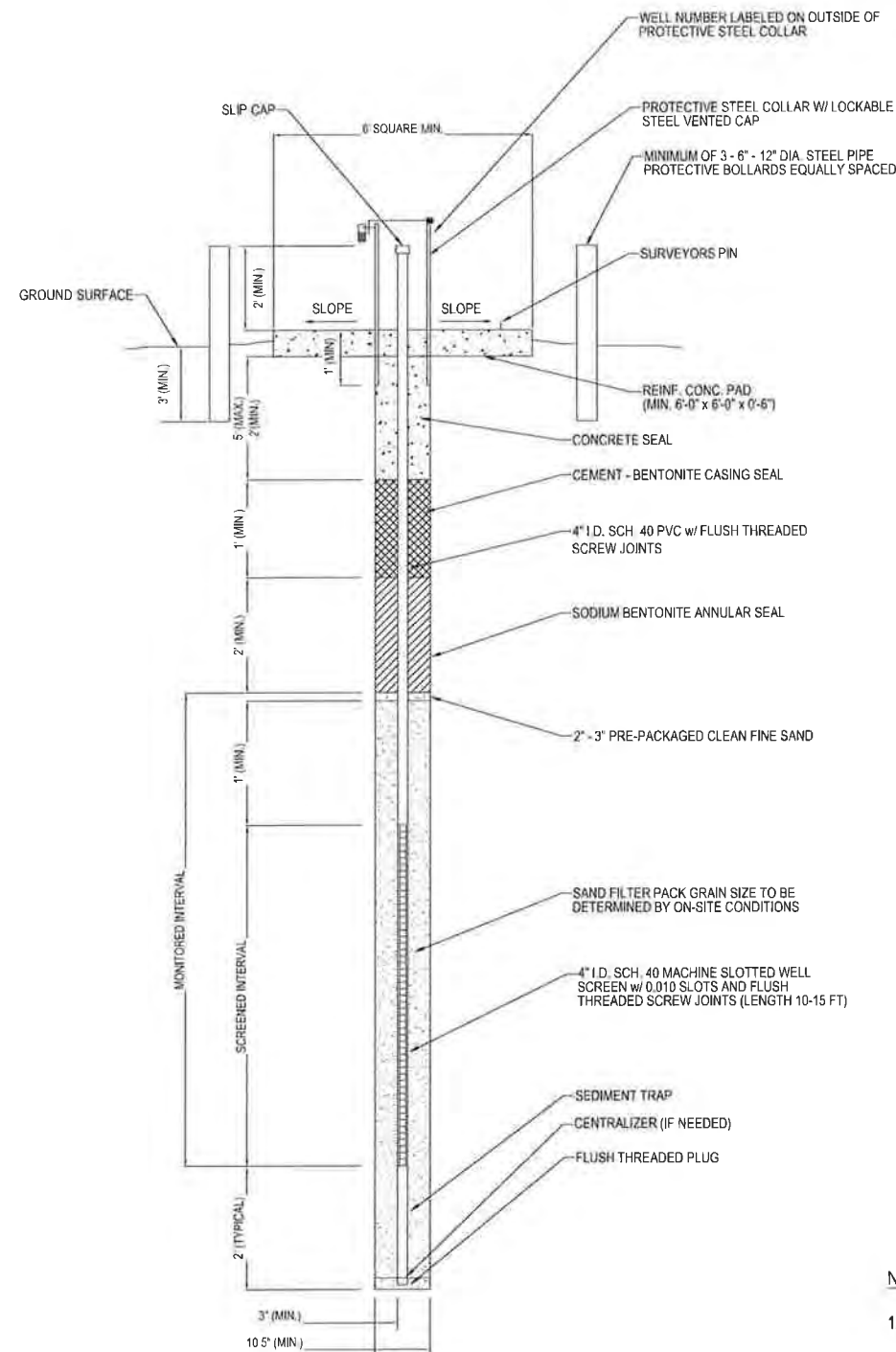
11-6-2015  
THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF PERMITTING UNDER THE AUTHORITY OF MICHAEL W. ODEN, P.E. 97165.  
*Michael W. Oden*

PESCADITO ENVIRONMENTAL RESOURCE CENTER  
WEBB COUNTY, TEXAS  
MSW 2374

GROUNDWATER MONITORING SYSTEM PLAN

PROJ. NO.:	148866	DATE:	APRIL 2015
DESIGNED BY:		DRAWING NO.	III F.1-1
DRAWN BY:	MTE	CHECKED BY:	RDS
APPROVED BY:	MWO		1 OF 2 SHEETS





1  
F.1-2

TYPICAL GROUNDWATER MONITORING WELL

NOT TO SCALE

NOTES:

1. MONITORING WELL INSTALLATION SHALL CONFORM TO METHODS AND MATERIALS DESCRIBED IN APPLICABLE REGULATIONS OF TCEQ.
2. PTFE TAPE OR O-RINGS ON ALL JOINTS.
3. MONITORED INTERVAL TO BE FROM 9' BELOW GROUND SURFACE TO 5' BELOW LINER ELEVATION AT EACH WELL LOCATION.

GROUNDWATER MONITORING WELL SUMMARY TABLE

Well Name	Northing	Easting	Ground Surface Elevation (ft MSL)	Depth to Liner (ft)
MW-1	17098886.69	773881.16	565.91	107.91
MW-2	17097702.31	773688.14	559.21	102.54
MW-3	17097110.12	773591.63	556.43	100.58
MW-4	17096518.07	773494.27	554.75	99.72
MW-5	17095926.02	773396.92	552.54	98.32
MW-6	17095334.01	773299.35	550.91	98.68
MW-7	17094751.01	773153.82	549.51	99.93
MW-8	17094169.73	773005.28	548.77	101.46
MW-9	17093587.87	772856.59	548.00	102.47
MW-10	17093007.29	772707.40	546.58	102.83
MW-11	17092426.17	772558.07	545.54	103.58
MW-12	17091845.05	772408.73	544.09	103.91
MW-13	17091263.93	772259.40	542.59	104.19
MW-14	17090661.89	772104.69	540.67	102.87
MW-15	17090315.17	771600.30	539.35	101.35
MW-16	17089980.45	771102.31	538.01	99.81
MW-17	17090078.66	770498.36	536.84	98.24
MW-18	17090229.27	769917.57	534.01	95.01
MW-19	17090604.86	769395.12	534.50	95.10
MW-20	17090986.53	769111.29	536.55	96.91
MW-21	17091428.42	769025.09	537.64	97.86
MW-22	17091577.75	768443.97	537.68	97.68
MW-23	17091984.47	768293.13	537.94	97.94
MW-24	17092567.11	768436.39	540.44	99.33
MW-25	17093149.76	768579.65	541.99	99.44
MW-26	17093732.41	768722.91	541.54	97.54
MW-27	17094315.05	768866.17	547.36	101.91
MW-28	17094897.70	769009.43	540.00	93.11
MW-29	17095480.34	769152.69	541.99	93.49
MW-30	17096067.47	769269.65	543.99	93.24
MW-31	17096664.67	769327.57	547.69	95.16
MW-32	17097261.87	769385.49	552.73	98.97
MW-33	17097829.62	769191.05	558.02	103.18
MW-34	17098750.56	769569.69	556.70	99.89
MW-35	17099883.71	769707.17	563.37	105.37
MW-36	17099726.98	770651.32	560.31	102.31
MW-37	17099530.46	771835.12	566.08	108.08
MW-38	17099333.94	773018.92	559.58	101.58



CB&I Environmental &  
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P.E. 67185

PESCADITO ENVIRONMENTAL RESOURCE CENTER  
WEBB COUNTY, TEXAS  
MSW 2374

TYPICAL GROUNDWATER MONITORING WELL DETAIL

PROJ NO :	148666	DATE:	APRIL 2015
DESIGNED BY:		DRAWING NO	III
DRAWN BY:	MTE		F.1-2
CHECKED BY:	RDS		
APPROVED BY:	MWO		2 OF 2 SHEETS

## Part IV

## Part IV

### SITE OPERATING PLAN

**Pescadito Environmental Resource Center**

**MSW-2374**

**Webb County, Texas**

# **PESCADITO**

**ENVIRONMENTAL RESOURCE CENTER**

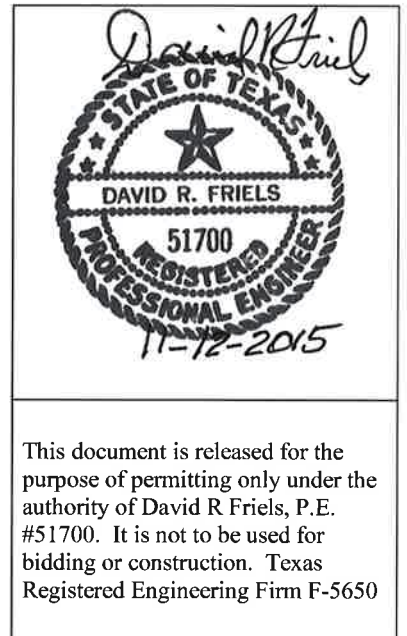
**Initial Submittal March 2015  
Revised September 2015  
Revised November 2015**

**Prepared for:  
Rancho Viejo Waste Management, LLC  
1116 Calle del Norte  
Laredo, TX 78041**

**Prepared by:  
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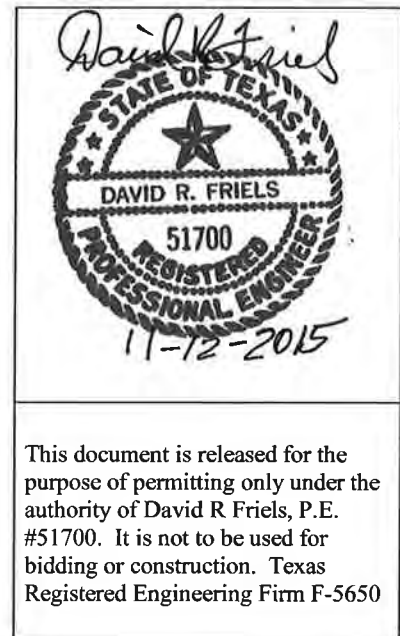
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## **25.4 Erosion of Cover**

Monthly and as soon as practicable after a rainfall event of 0.5 inches or greater, the General Manager or Operations Manager will inspect daily, intermediate, and final cover areas for erosion gullies or washed out areas or other damage. Erosion rills or gullies or wash outs deeper than approximately 4 inches will be repaired as soon as practicable, but not later than five days after detection. The cover inspections, condition noted, and any corrective action will be documented in the cover inspection record. Periodic inspections and restorations will be required during the operational life and for the post-closure maintenance period.

## **25.5 Cover Application Record**

Throughout the landfill operation, a cover application record will be kept on site readily available for inspection by commission representatives and authorized agents or employees of local governments having jurisdiction. For daily, intermediate, and alternate daily cover, the record will specify the date cover was accomplished (no exposed waste), how it was accomplished (soil or ADC type and method of placement), and the last area covered. For final cover, the record will specify the area covered, the date the cover was applied, and the thickness applied that date. Each entry will be certified by the signature of the on-site supervisor that work was accomplished as stated in the record.

**Attachment C**  
**to November 2015 Response Letter**  
**Redline Version of Changed Pages**



**Redline/Strikeout**

**Part III, Attachment III-B.1**

**Part III**  
**Attachment III-B**  
**Appendix III-B.1**

**GENERAL FACILITY DESIGN FIGURES**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**

**PESCADITO**  
ENVIRONMENTAL RESOURCE CENTER

**Initial Submittal March 2015**  
**Revised September 2015**  
**Revised November 2105**

**Prepared for:**  
**Rancho Viejo Waste Management, LLC**  
**1116 Calle del Norte**  
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**Part III, Appendix III-C.1**

**Part III**  
**Attachment III-C**  
**Appendix III-C.1**

**FACILITY SURFACE WATER DRAINAGE REPORT NARRATIVE**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**



**Initial Submittal March 2015**  
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#### 5.4.5 South Detention Basin

The South Detention Basin will be installed along the southern border of the facility to temporarily detain all stormwater that falls on the landfill, perimeter roads, and ancillary facilities. The detention basin receives stormwater through the perimeter ditches. The size of the South Detention Basin has been designed based on a fully developed landfill footprint and will be constructed prior to the time that waste in the first cell developed is placed above existing ground. The basin has been designed with excess capacity to safely detain and release the 100-year, 24-hour and 25-year, 24-hour storm events while maintaining one foot of freeboard above the maximum water level, in accordance with best management practices.

The location of the South Detention Basin is shown in Drawings 5, 6, 11 and 12 of Appendix III-C.2. Profiles and details of the basin are provided on Drawings 11 and 12. See Attachment 10 to Appendix III-C.3 (III-C.3-10) for the detention basin sizing. See Attachment 3.D in Appendix III-C.4 (III-C.4-3.D) for the HydroCAD® Output files for the detention basin capacity calculations. Page 82 in Section I contains information for the 100-year storm and page 82 in Section II for the 25-year storm. Drawings 6, 11 and 12 in Appendix III-C.2 show the location of the basin.

#### 5.4.6 South Detention Basin Discharge

The South Detention Basin will have two discharge points, located approximately at the southwest and southeast corners of the basin. Each discharge point will contain multiple culvert outlets that will facilitate the controlled release of stormwater. Stormwater will discharge through the culverts to the outside of the basin. Riprap or other erosion control material will be placed at the discharge locations to minimize the potential for erosion and scour. Refer to Drawing 12 of Appendix III-C.2 for details of the proposed outlet structure design.

Discharge from the detention basin will be sent to both the east and the west into Drainage Areas DA-3 and DA-2, respectively. Percentage of the discharge volume from the detention basin to DA-2 and DA-3 has been split to provide discharge rates and volumes consistent with the CLOMR (intermediate conditions). Additional stormwater conveyance features may be installed to direct water directly into the San Juanito Creek tributary system. Please note that the outlet structure design may be changed provided that the revised design provides adequate reinforcement and protection of the outfall and equivalent release rates to the modeled design. Any changes desired will be submitted as a permit modification and approval obtained prior to implementation.



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**Part III, Attachment III-D.0**

**Part III**  
**Attachment III-D**

**WASTE MANAGEMENT UNIT DESIGN**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**

**PESCADITO**  
ENVIRONMENTAL RESOURCE CENTER

**Initial Submittal March 2015**  
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**Prepared for:**  
**Rancho Viejo Waste Management, LLC**  
**1116 Calle del Norte**  
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- III-D.2 – Landfill Cross Sections
- III-D.3 – Landfill Design and Details
- III-D.4 – Landfill Operation and Site Life
- III-D.5 – Geotechnical Analyses
- III-D.6 – Leachate and Contaminated Water Plan
- III-D.7 – Liner Quality Control Plan
- III-D.8 – Alternate Final Cover Demonstration
- III-D.9 – Final Cover Quality Control Plan

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## 2.0 SURFACE IMPOUNDMENTS

The PERC facility may utilize an on-site evaporation pond (considered a surface impoundment) for leachate, contaminated water and landfill gas condensate. Detail drawings are provided in Appendix III-B. A minimum of 12-inches of free board will be provided at all times to account for the 25-year, 24-hour rainfall event of 7.5-inches. Leachate, contaminated water and gas condensate will be transported to the pond, or storage tanks, via a force main or hauled via tanker truck. If by force main, the level in the pond will be visually checked prior to activating the pumps to assure the required free board is available. Should there be a need for leachate, contaminated water and gas condensate disposal and the evaporation pond is filled to within 12-inches of the top, alternate disposal methods will be employed such as direct haul off-site to a permitted facility, storage in tanks until the pond is emptied or recirculation back into the waste mass. Only leachate and gas condensate may be re-circulated into the waste. If contaminated water has been combined with leachate or gas condensate, the resulting mixture will not be re-circulated. Use of one or more of the storage tanks to store only leachate and/or gas condensate will prevent the commingling of contaminated water and allow recirculation of these two liquids.

**Redline/Strikeout**

**Part III, Attachment III-D.1**

**No changes were made to Drawings III-D.1-2 or III-D.1-3**

**Part III**  
**Attachment III-D**  
**Appendix III-D.1**

**SITE LAYOUT FIGURES**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**

**PESCADITO**  
ENVIRONMENTAL RESOURCE CENTER

**Initial Submittal March 2015**  
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**Part III, Attachment III-E**



**Part III**  
**Attachment III-E**

**GEOLOGY REPORT**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**

**PESCADITO**  
ENVIRONMENTAL RESOURCE CENTER

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Appendix III-E.2	Subsurface Investigation Report
Appendix III-E.3	Geotechnical Data Report
Appendix III-E.4	Summary of Hydrogeologic Testing in Selected Piezometers
Appendix III-E.5	Supplemental Subsurface Investigation Report – Phase V

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## 1.0 INTRODUCTION

The Pescadito Environmental Resource Center (PERC) is a 953 acre tract of land located in Webb County Texas owned by Rancho Viejo Waste Management LLC (RVWM). It is part of a larger approximately 12,000 acre Yugo Ranch owned by the parent company of RVWM, Rancho Viejo Cattle Company, Ltd. Webb County is located in a semi-arid part of the state with evaporation exceeding rainfall by approximately 40 inches per year. The PERC site is located on a "salt-flat" on the Yugo Ranch that historically has had no significant oil/gas resources and vegetation is quite sparse. See Photo 1 – view to the north from southeast corner of site.

The Geology Report for the Pescadito Environmental Resource Center is provided as a series of documents to meet the specific requirements of 30 TAC §330.63(e) and to provide additional information supporting the facility design and operation. Each of the documents has been prepared by a qualified groundwater scientist or professional engineer.



Photo 1 - Looking North from B-21

A description of the regional geology and hydrogeology and related information is provided in a document entitled Regional Geology and Hydrogeology prepared by H. C. Clark, PhD, P.G. A copy of Dr. Clark's report is included in Appendix III-E.1. This report is submitted to fulfill the requirements of 30 TAC §330.63(e)(1-3).

Site-specific subsurface investigation results and geotechnical data for the site are provided in multiple separate reports appended to this Report. ~~two reports by~~ Raba Kistner Environmental, Inc. ~~prepared the and Raba Kistner Consultants, Inc., respectively. The~~ Subsurface Investigation Report (SIR) ~~is included as~~ in Appendix III-E.2. ~~and Raba Kistner Consultants, Inc. prepared~~

~~respectively. The~~ The Geotechnical Data Report (GDR) ~~is included in as~~ Appendix III-E.3. Those reports are submitted to fulfill the requirements of 30 TAC §330.63(e)(4)(A-H) and §330.63(e)(5)(A-E) and the requirements of the Soil Boring Plan (SBP) approved by TCEQ on April 11, 2011 (Appendix III-E.2, SIR Appendix A). It should be noted that subsequent to the approval of the SBP and preparation of the SIR and GDR, the permit boundaries ~~were~~ reduced. The revised boundary is enclosed entirely within the original boundary that was used when the SBP was approved. Figure III-E.0-1 within this Appendix shows the two permit boundaries.

Additional information on subsurface conditions has been obtained to support facility design and operation as well as to provide additional hydrogeologic characterization of the subsurface. This information consists of hydraulic testing of previously-installed piezometers to obtain field estimates of horizontal hydraulic conductivity. The information is provided in A report, *Summary of Hydrogeologic Testing in Selected Piezometers*, ~~was~~ prepared by Pierce L. Chandler, Jr., P.E. and is included in Appendix III-E.4.

~~Further~~Additional subsurface investigation and testing has been performed to provide information useful for general landfill design as well as to provide additional hydrogeologic characterization of the subsurface. The information is provided in A report, *Supplemental Subsurface Investigation Report – Phase V, (SSIR)* ~~has been~~ prepared by Michael W. Oden, P.E. and is included as~~included in~~ Appendix III-E.5.

In addition to an extensive literature survey and conventional subsurface investigation techniques, i.e., boring, sampling, and lab testing; borehole geophysical logging was employed at several borings to assist in subsurface characterization. The borehole geophysical logs consisted of gamma, resistivity and caliper logs and are presented in Appendix C to Appendix III-E.2 (III-E.2-C). The borehole geophysical logging was not utilized to reduce the number of borings required in 330.63(e)(4)(B); and as allowed by 330.63(e)(4)(F).

As indicated in Appendix III-E.1 the natural gamma logs were reviewed in an attempt to locate the boundary between the Yegua and Jackson sediments. As no significant increase in background gamma radiation values could be determined from the geophysical logs, as would be expected if Jackson sediments were encountered, the boundary could not be established with



geophysics. Subsequent additional investigation determined the boundary to generally be east of the site.

Further the resistivity borehole geophysical logs were used to assist in identifying the more transmissive zones for placement of additional piezometers at the site. There is not much sand in the subsurface (95% clays per the Geotechnical Data Report [III-E.3]), the sands are poorly graded and contain considerable amounts of clay. The transition from clay to sand is gradational. These factors lead to the geophysical logs not showing dramatic differences between the clays and sands and make it difficult to determine a change in the characterization of the subsurface soils.

As an example of the use of the resistivity borehole geophysical logs, look at boring B-124. Piezometers were desired in potentially more transmissive zones along the southern edge of the proposed facility. Upon a review of the boring log for B-124 (III-E.2-B) it was noted that thinly interbedded sandstone layers were found between 100 feet and 113 feet below ground surface (bgs). A review of the resistivity geophysical log (III-E.2-C) showed a slight increase in resistivity (sand is typically more resistive than clay) starting at about 95 feet bgs and ending at approximately 120 feet bgs. Consequently Piezometer B-124 was installed at that location with the screen interval from 110 feet to 113 feet bgs.

## 2.0 HYDROGEOLOGIC SETTING

All information compiled to-date has confirmed the siting evaluation, i.e., a semi-arid area with predominantly low-permeability clay subsurface materials and no shallow groundwater resource. Even deeper, available groundwater resources are slightly used due to water quality and depth considerations.

### 2.1 Uppermost Recognized Aquifer

The published documents and area well records summarized in the *Regional Geology and Hydrogeology* report established that t~~The uppermost regional-recognized~~ aquifer at the facility is the regional Yegua-Jackson Aquifer. This uppermost aquifer is associated with basal Yegua sands located more than 300 feet below the deepest proposed excavation. ~~which is found more than 600 feet beneath the deepest excavation and is isolated from the surface by more than 750 feet of predominantly clays of low permeability.~~ Flow in the Yegua-Jackson Aquifer is to the east and appears to coincide with the regional dip of the Yegua-Jackson, which is approximately 50 feet to the mile. The Yegua-Jackson Aquifer is recharged from the outcrop miles to the west and northwest. Yegua-Jackson Aquifer water quality in the site area is brackish.

### 2.2 Aquiclude

The uppermost Yegua-Jackson Aquifer is under significant confining pressure due to the effective upper confining unit or “aquiclude” provided by hundreds of feet of low permeability Yegua-Jackson clays. The effectiveness of the upper confining unit is demonstrated by conditions at the nearby Ranch Well adjacent to the facility which shows a confining pressure, i.e., a static water level of approximately 220 feet bgs although the water-producing Yegua sands are hundreds of feet lower (see Table 3 in Appendix III-E.1).

The upper confining unit or “aquiclude” to the uppermost Yegua-Jackson Aquifer provides effective environmental protection to the aquifer. In addition to the confining performance demonstrated at the Ranch Well, the properties of the confining unit are well understood from a consensus of published documents and site-specific investigation and testing including a deep boring to 500 feet bgs. These properties include:



- Predominantly clays – less than 10% net sand (Knox, 2007) and less than 5% based on site-specific investigation (SIR, Raba-Kistner, 2015 [III-E.2]).
- Clay vertical hydraulic conductivities (permeabilities) are very low – average Yegua clay  $K_v = 10^{-4}$  ft/day or  $3.5 \times 10^{-8}$  cm/sec and decreasing with depth (Deeds, 2010). Site-specific testing,  $K_v = 10^{-7}$  to  $5 \times 10^{-11}$  cm/sec (SIR, Raba-Kistner, 2015 [III-E.2] and SSIR, CB&I, 2015 [III-E.5]).
- Clays are really dry – moisture levels predominantly 7-8 percentage points below the Plastic Limit, i.e., clays are not saturated (SIR, Raba-Kistner, 2015 [III-E.2] and SSIR, CB&I, 2015 [III-E.5]).
- Clays are highly plastic – Plasticity Indices are generally in the 20 to 60 range (SIR, Raba-Kistner, 2015 [III-E.2] and SSIR, CB&I, 2015 [III-E.5]).

Sands occur as isolated sand units and horizontal interbeds within the general clay matrix of the confining unit. This is consistent with the documented anisotropy of the Yegua-Jackson. To the depths explored by the site-specific investigations, the sand units are thin, isolated and laterally discontinuous (see Figures C-1 to C-10 in Appendix C to Appendix III-E.3 (III-E.3-C) and Figures 2 to 5 in Appendix III-D.2). There are also thin sandy interbeds or partings in the clay matrix. However, site-specific field testing of piezometers installed in these potentially more transmissive sandy intervals indicated low horizontal permeabilities,  $K_h = 3 \times 10^{-5}$  to  $9 \times 10^{-8}$  cm/sec (Summary of Hydrogeologic Testing in Selected Piezometers, PLC 2015 [III-E.4] and SSIR, CB&I, 2015 [III-E.5]).

### 2.3 Shallow Subsurface Water

The various site-specific subsurface investigations encountered very limited quantities of very poor quality subsurface water at shallow depth – essentially at the top of the identified upper confining unit or upper “aquiclude” for the uppermost aquifer (basal Yegua sands of the Yegua-Jackson Aquifer). ~~With respect to 30 TAC §330.63(e)(5)(F) requirements, and the definition in 30 TAC §330.3(168), the referenced reports indicate the regulatory uppermost aquifer is t~~  
The shallow subsurface water, i.e., perched groundwater, is primarily associated with the relatively continuous contact zone consisting of a very thin layer of coarse-grained sediments occurring at shallow depth at the base between of the surficial Recent-Pleistocene soils and above the



underlying Eocene-age Yegua-Jackson ~~group~~ sediments. The shallow subsurface water appears to be unconfined, i.e., under “water-table” conditions. The shallow subsurface water associated with the contact zone also appears to be present in the highly weathered and weathered stratum, i.e. Strata II and III as described in the SIR, GDR and SSIR (SIR, Raba-Kistner, 2015 [III-e.2], Summary of Hydrogeologic Testing in Selected Piezometers, PLC 2015 [III-E.4] and SSIR, CB&I, 2015 [III-E.5]). Within the Yegua-Jackson sediments, the shallow subsurface water appears to be located in transmissive secondary structure in the clays and the thin, isolated, shallow sand units. Site-specific piezometer information indicates that some very limited hydraulic communication with the contact zone may exist down to approximately sixty feet bgs. Piezometer readings below the sixty-foot depth show confining pressures, i.e., the deep piezometers indicate higher water levels than shallow piezometers (see Figures 20 to 23 in SIR [Appendix III-E.2]). Regardless of the shallow subsurface water presence, it should be noted that the degree of hydraulic communication that exists in Stratum II and III is comparable to what would be expected in a confining unit or “aquiclude” as commonly defined:

*“Aquiclude - a hydrogeologic unit which, although porous and capable of storing water, does not transmit it at rates sufficient to furnish an appreciable supply for a well or spring (after WMO, 1974). See preferred term confining unit.” From the U.S. Geologic Survey, **Federal Glossary Of Selected Terms, Subsurface-Water Flow and Solute Transport** (USGS, 1989).*

Clays make up over 95% of Strata II and III. Horizontal permeability is in the  $10^{-7}$  cm/sec range and vertical permeability would be even lower due to the anisotropy. It should also be noted that even in Strata II and III, the clays are unsaturated (i.e. very dry with moisture contents predominantly 7-8 percentage points below the Plastic Limit) (SIR, Raba-Kistner, 2015 [III-E.2] and SSIR, CB&I, 2015 [III-E.5]) Note that many of the sand units in the



Photo 2 - Clayey Sandstone in B-52 at 10 to 13 feet bgs



weathered Yegua-Jackson (Strata II and III) are also unsaturated. See Photo 2.

Based on information in the *Subsurface Investigation Report*, inferred flow direction for the shallow subsurface groundwater appears to mimic surface drainage patterns, i.e., to the south, with gradients ranging from 0.002 to 0.003. A maximum hydraulic conductivity (horizontal) of  $2.01 \times 10^{-6}$  cm/sec ( $5.7 \times 10^{-3}$  ft/day) is given in the *Geotechnical Data Report*. -Using these inputs, and conservatively using an average value for effective porosity for a sandy clay of 7%, a groundwater flow velocity of  $5.94 \times 10^{-2}$  to  $8.92 \times 10^{-2}$  ft/year is calculated.

Stratum IV is even more impermeable. Three test results on clay from Stratum IV indicate a vertical permeability (hydraulic conductivity) in the  $10^{-9}$  to  $10^{-11}$  cm/sec range at depth in Stratum IV or the unweathered Yegua-Jackson. A fourth test (PI = 42) result was in the  $10^{-7}$  range; however, testing of that sample was delayed in the laboratory and micro-cracking was observed in the test specimen that could have affected the test result. (see Attachment F to Appendix III-E.5 [III-E.5-F]) SSIR, CB&I, 2015). At the very top of Stratum IV (Test Pit 2), vertical permeability was  $K_v = 1.2 \times 10^{-7}$  cm/sec and horizontal permeability,  $K_H = 8.3 \times 10^{-7}$  to  $5.5 \times 10^{-9}$  cm/sec (see Appendix B to Appendix III-E.3 [III-E.3-B], GDR, Raba-Kistner 2015). As with Strata II and III, Stratum IV clays predominate by over 95% and are not only unsaturated, they are very dry with moisture contents predominantly 7-8 percentage points below the Plastic Limit, i. e., the clays are not saturated (R-K & CBI, 2015). Note that many of the sand units in the unweathered Yegua-Jackson (Strata IV) are also unsaturated (see Photo 3). As you go deeper in Stratum IV, the geologic dip takes greater control in the water flow direction. Even though Stratum IV may contain very limited water, it still functions as an effective confining unit or “aquiclude” to the vertical migration of water.



**Photo 3 - Clayey Sandstone in B-58 at 95' bgs**



The results of the site investigations demonstrate that: (1) The shallow subsurface water in the contact zone at the base of the Recent-Pleistocene (Strata I) and the hydraulically connected secondary structure in the clays, thin sand units, and/or anisotropic, horizontal, more transmissive bedding characteristics in Strata II and III (highly weathered Y-J and weathered Y-J) down to about 60 feet; **and** (2) the deeper sand units and anisotropic, more transmissive horizontal bedding characteristics in Strata IV (unweathered Y-J) below 60 feet all the way down to the proposed depth of excavation; **together** represent the “potential migration pathways” for any release from the proposed landfill. Clearly, 30 TAC §330.63(f)(3) indicates that the contact zone, Strata II and III, and that portion of Stratum IV above the deepest proposed excavation are the logical groundwater monitoring interval for groundwater monitoring wells to ensure detection of any contamination released from a solid waste management unit

The obvious problem at this site is common to many landfills that are constructed in practically impervious clay-rich subsurface materials that would ordinarily be classified as “aquicludes” because of their impermeability characteristics. Such sites typically have some shallow subsurface water depending on season and precipitation. The most logical groundwater monitoring zone in such cases is to monitor the shallow subsurface water and extend the monitoring zone down to the bottom of the deepest proposed excavation. However, the monitored zone will rarely meet the regulatory definition of “aquifer” in 30 TAC §330.3(8).

*“Aquifer--A geological formation, group of formations, or portion of a formation capable of yielding significant quantities of groundwater to wells or springs.”*

Nor will it meet the definition of “uppermost aquifer” in 30 TAC §330.3(168).

*“Uppermost aquifer--The geologic formation nearest the natural ground surface that is an aquifer; includes lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.”*

The shallow subsurface water at this site doesn't meet the regulatory definition of aquifer because it is not capable of “yielding significant quantities of groundwater to wells or springs.” The contact zone, transmissive secondary structure in the clays, thin sand units, and horizontal, more transmissive bedding characteristics represent very little saturated volume since low

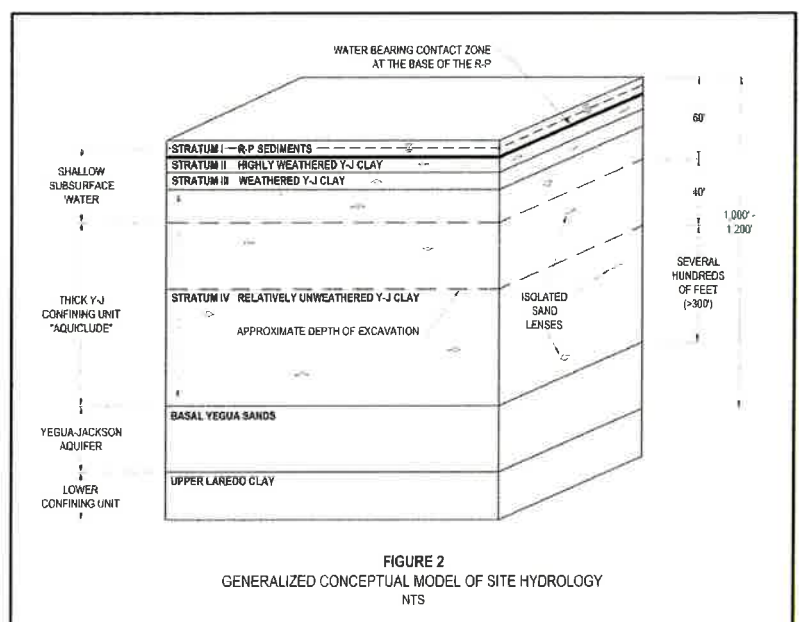
permeability clays make up about 95% of the subsurface. Further, for what limited quantity of water there is, the water quality is very poor – ranging from saline to brine (see SSIR, CBI, 2015). It should be noted that even if there were ample saturated material and good quality water, which the investigations prove there is not, subsurface conditions are so poorly transmissive, that wells cannot yield significant quantities of groundwater. Laboratory and field testing (GDR, Raba-Kistner, 2015 [III-E.3], Summary of Hydrogeologic Testing in Selected Piezometers, PLC 2015 [III-E.4] and SSIR, CB&I, 2015 [III-E.5]) shows that even the more transmissive zones encountered are poorly permeable to practically impervious.

To meet the regulatory requirements while simultaneously providing an effective groundwater monitoring system, it is proposed that the shallow subsurface water be considered the “regulatory uppermost aquifer” exclusively for complying with the requirements of 30 TAC §330.63(e)(4), 30 TAC §330.63(f)(3), and 30 TAC §330.403(a). The proposed monitoring system fully complies with the above stated rules; regardless the executive director could approve the proposed groundwater monitoring system under 30 TAC §330.403(c).

## 2.4 Summary

The subsurface conditions beneath the site are characterized as follows from the ground surface downward. See Figure 2 for a graphical representation:

- Stratum I is comprised of Recent-Pleistocene deposits with a coarse grained layer of sediments at the base of the Stratum. This zone typically transmits seasonal moisture from surface infiltration
- Strata II, III and IV are predominately Eocene clay deposits of the Yegua-Jackson group and are subdivided as Highly Weathered (II),





Weathered (III) and Relatively Unweathered (IV). These Strata contain 95% clay material that is overly consolidated and 7 to 8 percentage points dry of the plastic limit. Strata II, III and IV clays are practically impervious based on criteria established by Terzaghi and Peck in *Soil Mechanics in Engineering Practice* (1967). Vertical hydraulic conductivities of the clays ranged from approximately  $1 \times 10^{-7}$  cm/sec to less than  $1 \times 10^{-10}$  cm/sec. Isolated sandy intervals in Strata II, III, and IV are also poorly permeable to practically impervious with horizontal hydraulic conductivities ranging from approximately  $1 \times 10^{-5}$  cm/sec to less than  $1 \times 10^{-7}$  cm/sec.

- Strata II, III and IV contain isolated sand lenses that are discontinuous, poorly permeable to practically impervious but may be hydraulically connected to the contact zone to a depth of 60-feet creating a shallow subsurface water bearing zone
- The shallow subsurface water bearing zone has been designated as the “regulated uppermost aquifer” for groundwater monitoring purposes and extends to 60 feet bgs and encompasses Stratum I, II, III and a portion of IV.
- Below 60 feet and to several hundreds of feet (>300 feet below the deepest proposed excavation), Strata IV serves as the effective upper confining unit or aquiclude to the uppermost recognized aquifer beneath the site, i.e., the regional Yegua-Jackson Aquifer
- Below 60 feet, the water in Strata IV is very limited and under confined conditions
- The uppermost recognized aquifer is comprised of the basal sands that occur near the bottom of the Yegua formation and is approximately 400-feet in thickness
- The uppermost recognized aquifer exhibits confining pressures of several hundreds of feet
- The upper Laredo Clays serve as the lower confining unit for the uppermost recognized aquifer, the regional Yegua-Jackson Aquifer (basal sands of the Yegua)

**Redline/Strikeout**

**Part III, Appendix III-E.2**

**PART III  
ATTACHMENT III-E  
APPENDIX III-E.2**

**SUBSURFACE INVESTIGATION REPORT**

For

**PESCADITO ENVIRONMENTAL RESOURCE CENTER  
TYPE I MUNICIPAL SOLID WASTE MANAGEMENT FACILITY  
LAREDO, WEBB COUNTY, TEXAS  
MSW PERMIT NO. 2374**

Prepared for

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On behalf of

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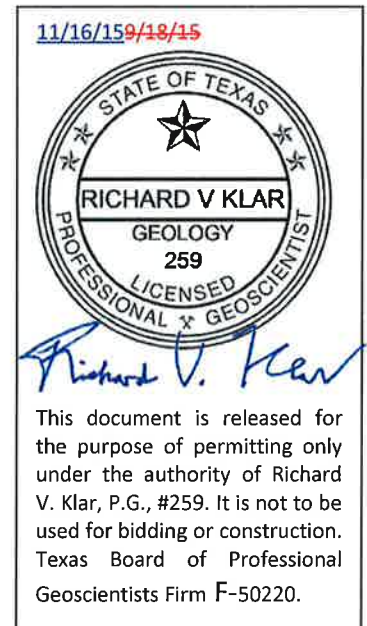
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**PROJECT NO. ASF13-140-00**

Initial Submittal February 25, 2015  
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2<sup>nd</sup> Revision November 16, 2015



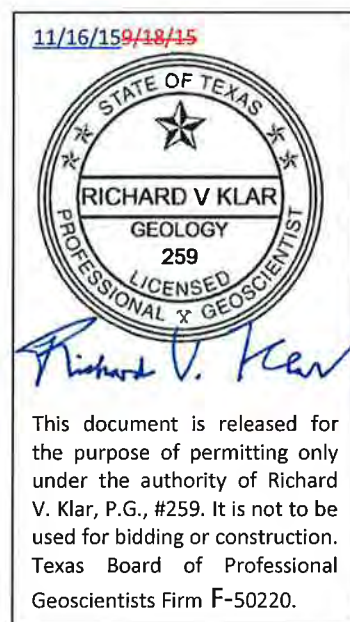


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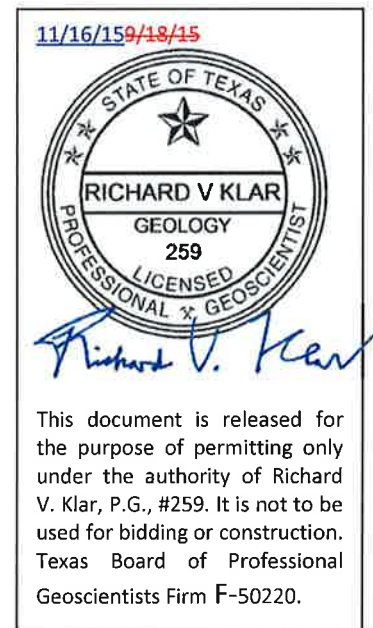
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users efficient access to their National Spatial Reference System. In association with all phases of GPS field data collection, submitted data files were processed with respect to a minimum of three NGS continuously operating reference stations selected by OPUS. The establishment of the well-defined NGS reference framework facilitated necessary correction of GPS field measurements and the final reporting of accurate spatial position data relative to the NGS reference framework. The geographic positions and elevations established for soil borings, piezometers, test pits, and staff gauges installed to evaluate water levels in four existing surface water impoundments are provided in **Table 1 – Soil Boring/Test Pit/Staff Gauge Position Table**.

In all instances, GPS survey data was tied to existing benchmarks established for this project along the perimeter of the proposed landfill permit boundary by a registered professional land surveyor (RPLS). An existing conditions topographic survey for the landfill site was performed by Dallas Aerial Survey (2/15/2010) based on physical benchmarks established along the site perimeter by Mejia Engineering Company (Gilbert L. Cade, III RPLS) using conventional survey methods. A copy of the final exhibit provided by Dallas Aerial Survey ([DAS](#)) was provided as a reference to evaluate the consistency of GPS data collected in conjunction with the subsurface investigation pertaining to the positions and ground surface elevations of exploratory borings and test pits. ~~Correspondence provided by DAS attesting to the accuracy of their aerial survey data is provided in Appendix F. Comparison of GPS data to position and elevation data established independently by the RPLS was conducted and, as demonstrated by this analysis, indicates that reported GPS horizontal and vertical position data is adequate for purposes of the subsurface investigation. When considered with respect to independently established benchmark locations and topographic survey points, GPS data developed as part of the subsurface investigation effort is accurate to within 1 meter ground surface resolution.~~

Although an error analysis using redundant baseline observations and control points was not performed by RKEI to establish absolute survey accuracy as part of the subsurface investigation, the RPLS of record for the project (i.e., Mejia Engineering Company) was engaged in November 2015 to undertake a new ground survey of exploratory boring, piezometer, and test pit locations as necessary to facilitate an additional comparison of geographic position data reported in the SIR. This survey included collection of horizontal position and ground surface elevations at all locations (i.e., designated as T/G in their survey report), in addition to the collection of top-of-casing elevation measurements at piezometer sites (i.e., designated as T/P). A table comparing horizontal and vertical position data obtained by the RPLS on November 6, 2015 to RKEI position data was developed and is included herein as **Table 7**. Supporting documentation prepared by Mejia Engineering Company for the recent ground survey effort is provided in **Appendix F**. Comparison of RKEI position data with RPLS survey information indicates that position data utilized in the SIR preparation was adequate for purposes of subsurface investigation.

Boring logs containing information specified pursuant to §330.63(e)(4) generated following the completion of all phases of subsurface investigation in addition to a key to terms and symbols are provided in **Appendix B**. As part of the field exploration program, borehole geophysical logs were obtained to complement borehole logging data at the majority of Phase III (open-hole) boring locations. Additionally, geophysical logs were obtained at 7 of the 9 cased piezometers installed as part of the Phase I and II study effort the existing water-supply well located on the adjacent ranch property completed to a depth of about 1,166 feet within the underlying Yegua Aquifer. The location of the water-supply well is provided on **Figure 2**. Geophysical logs for all borehole logging activities are provided in **Appendix C**.



- Highly weathered residuum (Stratum II) present along gently sloping upland areas throughout the site are not well developed or laterally continuous owing to dissection by surface drainage features and the associated accumulation of Stratum I alluvial soils. Stratum II is the uppermost, highly weathered portion of underlying Stratum III sediments not always identified in boring logs.
- Stratum III soils were encountered at relatively consistent depth intervals throughout the site indicating a zone of weathering consistently on the order of 20 to 40 feet thick.

As discussed in more detail in the Geotechnical Data Report for this permit application, subsurface investigation has demonstrated the presence of very stiff to hard, overconsolidated, clayey soils typical of the Yegua-Jackson Group formation from near ground surface to the maximum exploration depths on the order of 120 to 160 feet bgs. Fat clays (CH) and lean clays (CL) represent the predominant soil types observed in all study borings and the test pits. Thinly interbedded layers of clayey sands (CL), poorly graded sands (SP), silts (ML), and elastic silts (MH) were also repeatedly observed within Eocene strata. Typically at depths below about 20 to 40 feet, corresponding to the top of the relatively unweathered Eocene strata (Stratum IV), frequent very thinly interbedded rock strata consisting of fine-grained sandstone, siltstone, and claystone were observed within clay soils.

#### 4.0 GROUNDWATER DATA

Information developed in conjunction with subsurface investigation activities pertaining to the nature and occurrence of shallow groundwater at the site, within the depth interval of exploration in the Yegua-Jackson Group formation (aquifer), is provided herein. To the depths explored as part of this investigation, the obtained groundwater data indicates the following conditions to be present at the site:

- Subsurface water quantity appears to be limited and occurs intermittently, but the flow direction appears to mimic surface drainage patterns to the south.
- Shallow subsurface water present below the plant root zone appears to be very saline.
- Static water levels are relatively shallow throughout the site and generally correspond to the contact between Recent Pleistocene and Eocene strata and/or zones of weathering within uppermost Eocene strata. This contact zone is considered to represent the primary water-bearing zone from a regulatory compliance standpoint, although subsurface water is also present within deeper Eocene strata.
- Matrix saturated conditions within the Eocene strata appear to be associated with thicker silt or sand units and/or secondary structure (i.e., fractures and clay partings) observed in the predominantly clayey soils of the Yegua-Jackson Group formation.
- Because of the high clay content, subsurface strata described in **Section 3.0** would appear to be relatively and/or practically impermeable.

As indicated on boring logs in **Appendix B**, visible or “free” water not associated with matrix-saturated conditions was noted at several locations in conjunction with exploratory drilling and sampling efforts.





For purposes of this reporting, the term free water simply means that water was visibly observed in the recovered, (disturbed) soil samples – either auger-drilling cuttings [e.g., boring B-1] and/or sonic drilling core samples. The source of the water could not be determined because of sample disturbance and could have been influenced by drilling and sampling procedures. The use of the term is not intended to imply matrix saturated conditions or the collection of soil samples from within zone(s) of saturation. The term is used separately and distinctly from other moisture condition terms (i.e., qualifiers) used on boring logs including “moist”, “wet”, and “saturated”, which apply to observed sample matrix conditions. The observed presence of free water was noted on the logs for informational purposes only.

The following discussion provides a description of piezometer installation activities and water level measurements, in addition to other pertinent groundwater observations obtained in conjunction with drilling activities, test pit observations and at staff gauges installed at the four surface water impoundments located within the site boundaries.

#### 4.1 PIEZOMETER INSTALLATION

As presented on **Figure 15 – Piezometer/Staff Gauge Location Map**, a total of 19 soil borings installed during the three assessment phases were converted to permanent piezometers constructed in accordance with applicable TCEQ and Texas Department of Licensing and Regulation (TDLR) requirements. Piezometers were generally distributed across the proposed landfill area to allow for good spatial distribution of groundwater monitoring points, but concentrated along the landfill perimeter and inferred downgradient (south) boundary. Piezometers installed during the initial phases of investigation are designated as B-1, B-2, B-6, B-10, B-13, B-18, B-24, B-26, and B-27, whereas piezometers installed following approval of the Soil Boring Plan are designated as B-11A, B-101, B-102, B-106, B-109A, B-114A, B-115, B-118, B-124, and B-126, respectively.

On the basis of preliminary observations during the initial drilling programs, which indicated essentially dry drilling conditions, piezometers were installed and screened to evaluate zones (contiguous depth intervals) where perched lenses of shallow groundwater or apparent groundwater seepage was identified. Observations during drilling predominantly did not indicate matrix saturation conditions, but rather that the occurrence of shallow groundwater throughout the exploration depth interval is limited primarily to zones of weathering along clay partings and fractures. Very thin zones of matrix saturation were observed only in association with isolated sand lenses encountered throughout the SITE. Direct observations made in conjunction with test pit installation (TP-1) indicated first shallow groundwater seepage at the Stratum II/III interface at a depth of about 11 to 11.5 feet bgs. As reported previously, however, groundwater seepage at TP-1 was observed to have dried up overnight, for the most part, and did not result in a significant (measureable) groundwater accumulation in the excavation following the completion of an approximate 24-hr observation period.

In an attempt to evaluate the occurrence of shallow groundwater present in subsurface soil units, piezometers installed during Phase I and II study efforts were screened at several discrete (15 to 20 feet) intervals between 10 to 75 feet relative to existing ground surface. Deeper piezometers installed as part of the Phase III study effort targeted deeper intervals within Stratum IV on the order of about 60 to 84 feet and 80 to 113 feet, respectively. Phase III piezometers designated as B-11A, B-109A, and B-114A, respectively, were installed to further evaluate the presence of shallow groundwater associated with sand/silt or sandstone intervals reported in conjunction with borehole logging efforts, as these may represent zones of localized saturation. As presented on **Figure 15** and depicted on geologic cross sections presented on **Figures 4 through 13**, specific screen depth intervals correlate to the following:





- ~10 to 45 ft well screen: Stratum I/III, Stratum III, and Stratum III/IV
- ~30 to 60 ft well screen: Stratum IV
- ~60 to 84 ft well screen: Stratum IV
- ~80 to 113 ft well screen: Stratum IV

Construction details for all piezometers installed as part of the collective subsurface investigation program are provided on **Table 4 – Summary of Piezometer Construction Details and Screen Elevations**, which includes pertinent monitoring point construction details such as installation date, installation contractor, total well depths, well screen information, top-of-casing elevations, etc. Well construction diagrams were also prepared to graphically illustrate information summarized on the referenced table and are provided as **Appendix D**. State of Texas Well Reports prepared by the licensed well installation contractors (i.e., Vortex Drilling, Inc., Boart Longyear Drilling Services, and Geoprojects International, Inc.) are provided as **Appendix E**.

Following installation, all piezometers were surged by the installation contractor prior to the acquisition of static depth to water measurements to remove drilling artifacts (i.e., remove fine sediments from filter packs). Very slow recharge rates were generally observed during this process, and it was noted that piezometers at all locations were purged essentially to dryness following the removal of one well volume of water. Typically, water levels did not fully recover following purging activities for periods of 24 to 48 hours. Due to slow recharge conditions, surging activities were conducted over the course of several days at most piezometer locations, irrespective of screen depth interval.

## 4.2 WATER LEVEL MEASUREMENTS

### 4.2.1 Observations During Drilling

On the basis of logging observations made during all phases of exploratory drilling, shallow groundwater, where encountered, was first observed at depths of about 4.5 to 31 feet in open borings, but consistently rose to depths of about 4 to 12 feet after about 24 to 48 hours of observation, irrespective of boring depth, provided that borings were deep enough to penetrate into Stratum III or IV (i.e., generally greater than 10 feet). As reported on soil boring logs in **Appendix B**, the presence of wet soil or matrix saturated conditions was only observed in 10 of the 57 exploratory boring locations installed as part of the collective subsurface assessment effort. Matrix saturated conditions observed during soil boring logging activities are summarized as follows:

- B-5 – (85-95 ft), Laminated sandstone layers (Stratum IV)
- B-6 – (26-31.5 ft), Sandy clay with sandstone lenses (Stratum III)
- B-8 – (46-56 ft), Thinly interbedded sandstone (Stratum IV)
- B-11 – (47-47.5 ft), Silt (Stratum IV)
- B-16 – (27-34 ft), Thinly interbedded siltstone; and (100-104 ft), Sandstone lenses (Stratum IV)
- B-18 – (7-13 ft), Sand with scattered gravel (Stratum I); and (18-26 ft), Sand layers (Stratum III)
- B-19 – (39-50 ft), Scattered sandstone lenses (Stratum IV)
- B-101 – (25 ft), Sand lens (Stratum III)
- B-114 – (10-12 ft), Sand with gravel (Stratum I)
- B-120 – (21.5-23 ft), Sand lens (Stratum III)



As indicated above, discrete zones of matrix saturation were observed at various depth intervals in association with sand or silt deposits, sand lenses, or sandstone/siltstone bedding units. Discrete matrix saturated intervals were observed at relatively shallow depths less than 35-40 feet (i.e., above Stratum IV) at 5 boring locations: B-6, B-18, B-101, B-114, and B-120. It was noted that below 35 to 40 feet bgs, observations during drilling predominantly indicated limited matrix saturation conditions associated with isolated sand lenses and that the occurrence of shallow groundwater throughout the exploration depth interval was limited to these lenses and zones of weathering along clay partings and fractures.

It was noted in conjunction with the field exploration effort that sonic drilling is analogous to driving a pipe into the ground using repeated blows of a hammer. Subsurface materials in front of the pipe are either displaced (forced) into the pipe or outside. In hard materials, the material contacted by the pipe leading edge must be pulverized so that it can be displaced and allow the pipe to advance. Sonic drilling recovers a near-continuous core (sample); however, the drilling/sampling procedure causes disturbance to the sample. As a consequence, the samples are typically unsuitable for geotechnical testing that requires an “undisturbed” sample. In sonic drilling in hard materials, water is used to cool the bit (pipe leading edge), assist in displacement of the pulverized material (cuttings), lubricate the drill casing/sampling barrel (pipe), and stabilize the borehole. Exposure of the pulverized material to water sometimes creates a “paste” or “skin” on the recovered sample. Recovered samples logged as “moist” or “slightly moist” condition were based solely on observations of the sample interior or matrix and not the outer skin condition and/or infrequently observed slight penetration of drilling water in some disturbed samples. As explained in Section 4.0, the term “free water” was used separately and distinctly in boring log descriptions to indicate the observed presence of visible water not associated with sample matrix conditions.

#### 4.2.2 Water Levels Measured in Piezometers

Following piezometer installation and the completion of surging activities, static water levels were generally obtained following the completion of all phases of subsurface exploration. A summary of static water level measurements obtained at respective piezometer locations is provided as **Table 5 – Summary of Static Water Level Measurements – Piezometers**. As presented on the referenced table, water levels have generally exhibited a decreasing trend throughout the monitoring period likely associated with persistent drought conditions experienced by the region during 2010 and 2011. On average, water level measurements at individual piezometer locations associated with the most recent gauging event conducted on January 10, 2012 are on the order of 0.5 to 4 feet lower than recorded immediately following piezometer installation. Maximum overall water level declines are noted for older piezometers installed as part of the initial Phase I and II study efforts.

Although the occurrence of shallow groundwater is primarily limited to fractures and horizontal partings within respective stratigraphic units, water level contour maps were generated for the shallow groundwater using a contouring algorithm that assumed homogeneous, isotropic subsurface conditions. Initially, combined maps comprising **Figures 16 through 19** were generated using all available piezometer data for each of the gauging events. In order to evaluate seasonal fluctuations in shallow subsurface water levels, piezometer gauging events were distributed throughout the full duration of the subsurface investigation program as indicated below. Hydraulic interconnection between near-surface and deeper stratigraphic units was a primary assumption for these combined data plots.



- Combined Water Level Contour Map 10/19/10 (**Figure 16**)
- Combined Water Level Contour Map 3/23/11 (**Figure 17**)
- Combined Water Level Contour Map 7/19-20/11 (**Figure 18**)
- Combined Water Level Contour Map 1/10/12 (**Figure 19**)

Based on review of initial plots, it was observed that dissimilar static water levels were present between adjacent piezometers at a number of locations in association with both the 7/19-20/11 and 1/10/12 data plots, primarily in association with piezometers screened at relatively deep intervals (Phase III piezometer screen depths installed between 60 to 113 feet) within Stratum IV. As presented on **Figures 18 and 19**, these differences in static water level elevations appear to represent the presence of sinks or mounds in an otherwise gently sloping water table surface. In all instances, water level elevations reported for deep piezometers are approximately 1.5 to 4.5 feet greater than at adjacent shallow piezometers and likely represent increased pressure conditions within the deeper Stratum IV interval. These differences are best illustrated by comparison of water level elevations for B-10 to B-106 and B-109A, and B-24 to B-124 and B-126.

To further evaluate shallow groundwater conditions, data presented on **Figures 18 and 19** pertaining to shallow (i.e., 10 to 60 feet) and deep (i.e., 60 to 113 feet) piezometer screen depths were plotted and contoured separately for each well gauging event. These water level contour maps are provided as **Figures 20 and 21** (Shallow Water Level Contour Map with Staff Gauge Data – 7/19-20/11 and Deep Water Level Contour Map – 7/19-20/11, respectively) and **Figures 22 and 23** (Shallow Water Level Contour Map with Staff Gauge Data – 1/10/12 and Deep Water Level Contour Map – 1/10/12, respectively), associated with the 7/19-20/11 and 1/10/12 gauging events, respectively. When considered separately as presented on referenced figures, plotted water level contour data for designated shallow and deep depth intervals generally do not indicate sharp perturbations.

Assuming that sufficient connectivity exists for groundwater flow to occur, groundwater gradients are consistently on the order of ~~0.007–0.002~~ to ~~0.008–0.003~~ ft/ft (i.e., 0.2 to 0.3%) to the south-southwest.

#### 4.2.3 Staff Gauge Measurements

At the onset of Phase III study efforts, fixed measurement stations or staff gauges were installed adjacent to four existing (perennial) surface water impoundments as depicted on **Figure 15** to augment/correlate groundwater gauging data obtained at piezometer locations. Staff gauges were designated as SG-1 through SG-4. A summary of water level measurements obtained at respective staff gauge locations from May 2011 through January 2012 is provided as **Table 6 – Summary of Static Water Level Measurements – Staff Gauges**. Review of water level elevations indicates relatively consistent water levels for various gauging events although “dry conditions” were noted for select events at SG-2 and SG-4 locations. It should be noted that dry staff gauge readings do not indicate that the ponds were completely dry, but merely that the installed staff gauges were stranded on dry ground by dropping water levels in the perennial ponds.

Although water levels in surface water impoundments was observed to fluctuate in direct response to rainfall events, water level measurements obtained during dry conditions correspond favorably with groundwater elevations reports at adjacent piezometers. In particular, water level elevations reported at SG-4 were typically measured within 0.5 to 2.5 feet of shallow groundwater levels at the



adjacent B-114A piezometer. To better illustrate this, water level measurements from staff gauges were included in water level contour plots provided on **Figures 20 and 22**. Collective piezometer gauging and soil boring logging data suggest a possible relationship between the relatively consistent water levels observed in the surface water impoundments (stock tanks) and the localized occurrences of shallow groundwater observed in proximal soil borings and piezometers.

#### 4.2.4 Observations From Test Pits

Test pit TP-1 was left open for approximately 24 hours following excavation in order to evaluate the nature and occurrence of near-surface shallow groundwater seepage at this location. As indicated on **Table 3**, slight groundwater seepage was observed in TP-1 during excavation in the north (upgradient) face of the excavation at 7 feet bgs during excavation through the contact between the Recent-Pleistocene (Stratum I), and subsequently observed in the highly weathered Yegua-Jackson (Stratum II) at a depth of approximately 11 to 11.5 feet bgs along a bedding contact within the uppermost, very weathered Yegua-Jackson (Stratum II). However, the observed seepage, for the most part, was observed to have dried up overnight and no accumulation of groundwater was observed in TP-1 throughout the 24-hour observation period. No indication of shallow groundwater seepage or accumulation was observed during excavation of TP-2 to a total depth of 26 feet bgs.





## TABLES



**TABLE 7**

**COMPARISON OF RKEI TO RPLS GEOGRAPHIC POSITION  
DATA**



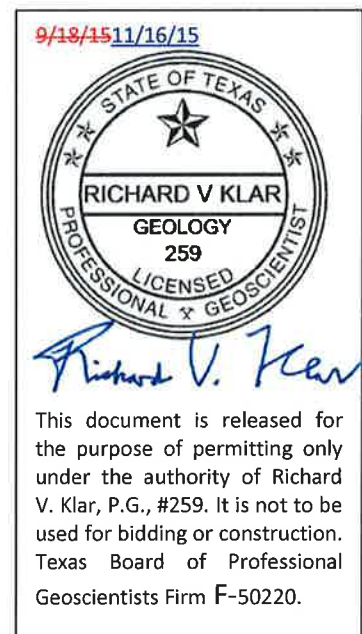
## **APPENDICES**



## APPENDIX B

### BORING LOGS AND KEY TO TERMS AND SYMBOLS

(Boring Logs B-1 through B-26, B-11A, B-109A, B-114A,  
B-101 through B-126, and DB-1)







# KEY TO TERMS AND SYMBOLS (CONT'D)

## MOISTURE CONDITION

Dry	- Absence of moisture, completely dry to the touch.
Slightly Moist	- No visible water, but clay soils from sample matrix can be grooved or partially smoothed with a knife.
Moist	- Damp but no visible water, clay soils from sample matrix can be grooved or smoothed with a knife.
Free Water	- Noted observations of visible water in recovered samples. The term is not intended to imply matrix-saturated conditions or the collection of soil sample(s) from within zone(s) of saturation.
Wet	- Visible free water in sample matrix at some locations associated with matrix-saturated conditions.
Saturated	- Visible free water drains easily from sample; sample matrix is typically wet.

▽ Water level measured in borehole during drilling or within 24-48 hours of completion.

▽ Static water level

Addition to terminology for clarification

## SEDIMENTARY TEXTURE

Texture	Grained Diameter	Particle	Rock Name
*	80 mm	Cobble	Conglomerate
*	5 - 80 mm	Gravel	---
Coarse Grained	2 - 5 mm	---	---
Medium Grained	0.4 - 2 mm	Sand	Sandstone
Fine Grained	0.1 - 0.4 mm	---	---
Very Fine Grained	0.1 mm	Clay, Silt	Shale, Claystone Siltstone

## SOIL STRUCTURE

Bentonitic	- General term applied to clay soils, likely containing montmorillonite (smectite) as an essential mineral, having the ability to swell in water.
Blocky	- Cohesive soil that can be broken into small angular lumps which resist further breakdown.
Calcareous	- Having appreciable quantities of carbonate.
Carbonate	- Having more than 50% carbonate content.
Cemented	- Said of soil particles or clastic sediments that are bound together by cementing agents including colloidal clay, hydrates or iron, or calcium carbonate. Three degrees of cementation are typically reported: weakly-cemented, strongly-cemented, and indurated.
Fissured	- Breaks along definite plane of fracture with little resistance to fracturing.
Flocculated	- Rough surface with the appearance of apparent sand particles, but actually consisting of clay soils (no sand) that are loosely aggregated, with individual clay particles held together tightly in clot-like masses that appear as small lumps, clusters, or granules in soil samples.
Fractured	- General term for any break in soil structure or rock, whether or not it causes displacement, due to mechanical failure by stress including cracks, joints, and faults.
Friable	- Said of a rock or partially indurated soil stratum that crumbles naturally or is easily broken, pulverized, or reduced to powder. Also said of a moist soil consistency that crushes easily under gentle to moderate pressure and coheres when pressed together.
Glaucanite	- General name applied to a group of green minerals occurring in soils, generally consisting of hydrous silicates of potassium and iron. It is commonly formed in the sedimentary environment by diagenetic processes (i.e., following deposition of clay soils, etc.).
Indurated	- Hardened by lithification.
Interbedded	- Said of bedding units that lay between or alternate with beds of different character.
Interlayered	- Alternating layers of different soil type.
Intermixed	- Pockets of different soil type and layered or laminated structure is not evident.
Laminated	- Alternating partings or seam of different soil type.
Layer	- Inclusion greater than 3-inches thick extending through the sample.
Lens	- Geologic deposit bounded by converging surfaces, one of which is usually curved, that is generally thick in the middle and thinning out toward the edges.
Mottled	- Said of a soil that is irregularly marked with spots or patches of different color or texture, usually indicating poor aeration or seasonal wetness.
Organic Matter	- Decayed plant root or other organic carbon matter present in surface soils
Parting	- Inclusion less than 1/8-inch thick extending through the sample.
Pocket	- Inclusion of material of different texture that is smaller than the diameter of the sample.
Seam	- Inclusion 1/8-inch to 3-inches thick extending through the sample.
Slickensided	- Having planes of weakness that appear slick and glossy.
Stratified	- Alternating layers of material or color with layers at least 6mm thick.
Weathered	- Said of soil or rocks that are changed in color, texture, composition, firmness, or form with little or no transport of the loosened or altered material resulting from exposure to atmospheric agents at or near the Earth's surface. Most weathering occurs at the surface, but may occur at considerable depths as in well-jointed or fractured rocks or sediments that permit penetration of atmospheric oxygen and/or circulating surface waters.



**APPENDIX C**

**BOREHOLE GEOPHYSICAL LOGS**





Borehole:

WELL DB-1

Logs:

GAMMA, RESISTIVITY,  
CALIPER

Water Well Logging & Video Recording Services

Geo Cam, Inc. 126 Palo Duro, San Antonio, TX 210-495-9121

Project: RANCHO VIEJO SITE

Date: 06-09-11

Client: RABA-KISTNER CONSULTANTS INC.

County: WEBB

Location:

State: TX

BOREHOLE DATA

Drilling Contractor: BOART LONGYEAR

Driller T.D. (ft) : 501'

Elevation: 530' GPS

Logger T.D. (ft) : 501'

Depth Ref: G.L.

Date Drilled: 06-05-11

BIT RECORD

CASING RECORD

RUN	BIT SIZE (in)	FROM (ft)	TO (ft)	SIZE/WGT/THK	FROM (ft)	TO (ft)
1	8"	0	130'	NA		
2	7"	130'	258'			
3	6"	258'	TD			

Drill Method: SONIC CORE

Weight:

Fluid Level (ft) : 160'

Hole Medium:

Mud Type:

Time Since Circ:

Viscosity:

Rim:

at:

Deg C

GENERAL DATA

Logged by: Robert Becknal

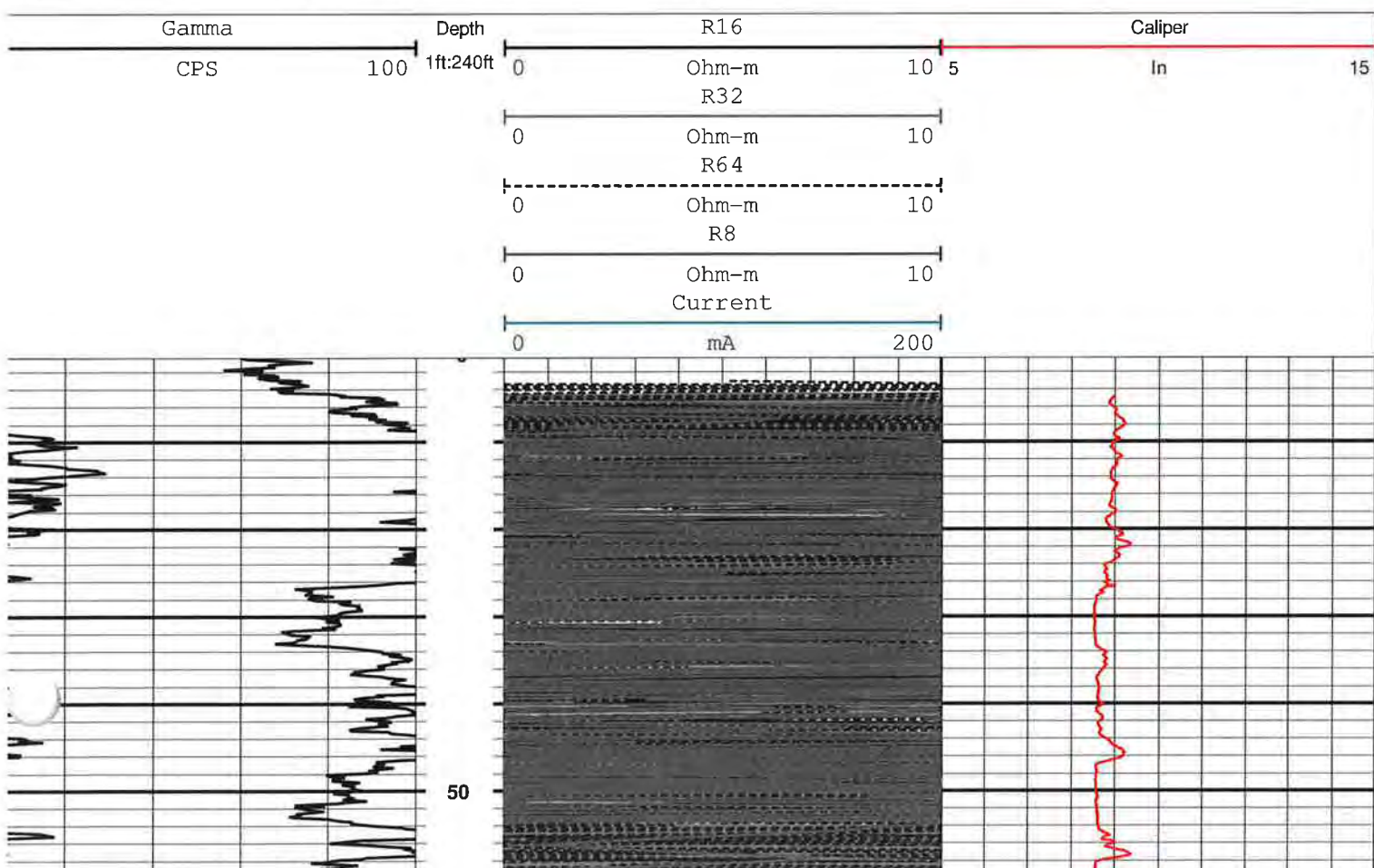
Unit/Truck: 05

Witness: TOMAS CRUZ

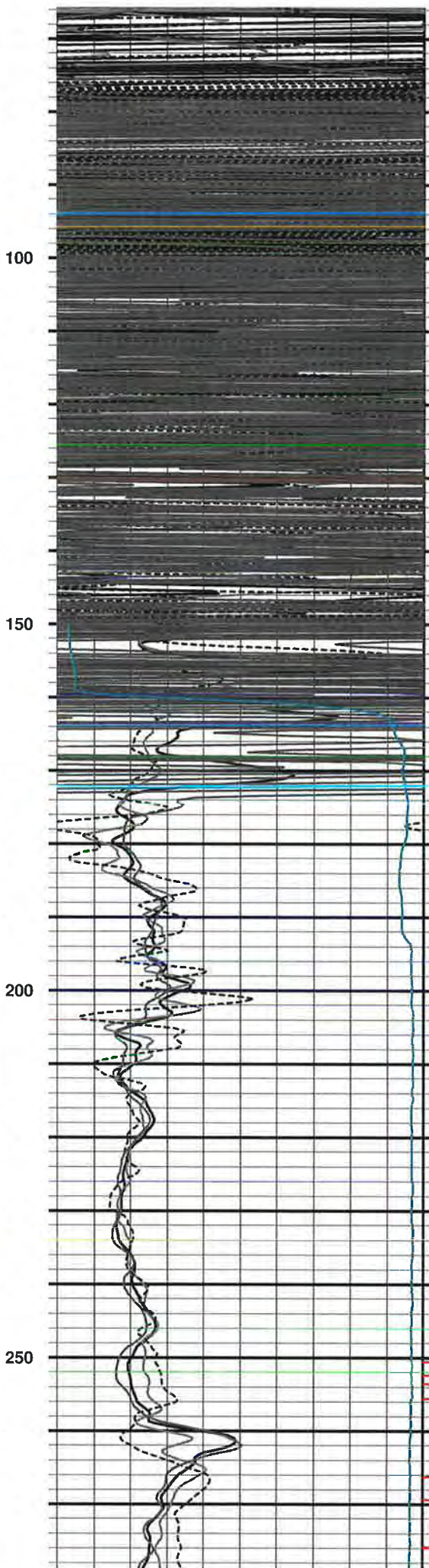
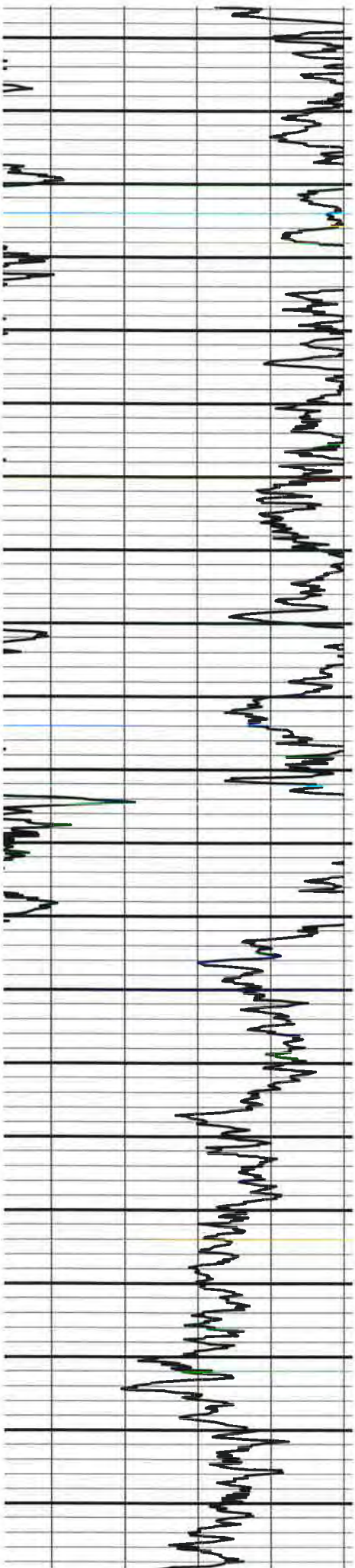
LOG TYPE	RUN NO	SPEED (ft/min)	FROM (ft)	TO (ft)	FT./IN.
GAMMA	2	22	500'	1'	20
RESISTIVITY	2	30	595'	5'	20
CALIPER	2	22	486'	5'	20

Comments:

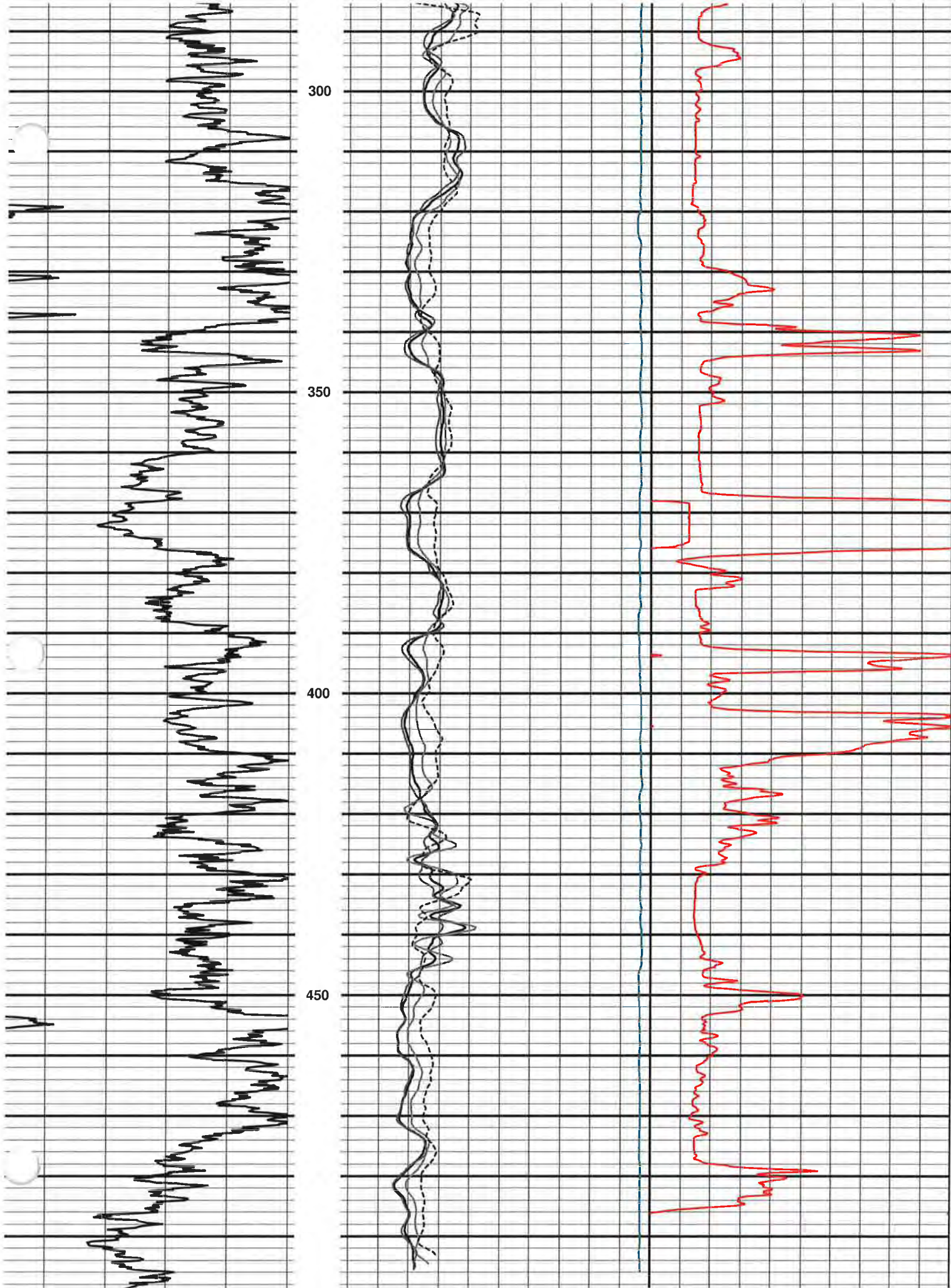
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submittal















## **BORINGS**



## **APPENDIX F**

### **SUPPORTING DOCUMENTATION FOR INDEPENDENT HORIZONTAL AND VERTICAL POSITION DATA**



**MEJIA ENGINEERING COMPANY**  
**NOVEMBER 6, 2015**



**DALLAS AERIAL SURVEYS, INC.**  
**NOVEMBER 9, 2015**





**Redline/Strikeout**

**Part III, Appendix III-F**

**Part III**  
**Attachment III-F**

**GROUNDWATER MONITORING PLAN**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**



**Initial Submittal March 2015**

**Revised September 2015**

**Revised November 2015**

**Prepared for:**  
**Rancho Viejo Waste Management, LLC**  
**1116 Calle del Norte**  
**Laredo, TX 78041**

**Prepared by:**  
**CB&I Environmental and**  
**Infrastructure, Inc.**



**12005 Ford Rd, Suite 600**  
**Dallas, TX 75234**

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## Table of Contents

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Appendix III-F.1 – Figures

Appendix III-F.2 – Groundwater Sampling and Analysis Plan

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## **1.0 Introduction 330.63(f)**

This Groundwater Monitoring Program has been prepared for the Pescadito Environmental Resource Center (MSW 2374) in Webb County, Texas in accordance with Subchapter J of 30TAC330. It includes a discussion of the monitoring systems and the sampling and analysis requirements.

The system has been designed based on site specific information and shall be operated and maintained to perform through the life of the Monitoring Program. In order to comply with 30TAC330.403(e)(3), the facility must notify the executive director and any local pollution agency with jurisdiction, if changes in site construction or operation or changes in adjacent property affect or are likely to affect the direction and rate of groundwater flow and the potential for detecting groundwater contamination from the solid waste management units.

## **2.0 Point of Compliance 330.63(f)(1-3)**

Figure III-F.1-1 in Appendix III-F.1 is a topographic map that shows the waste management units, the property boundary and the Point of Compliance (POC) as defined in 30TAC330.3.

This is a “greenfield” site with no previous MSW management units; therefore 330.63(f)(2) is not applicable.

## **2.1 Migration Pathways**

As is more thoroughly discussed in the Geology Report for the facility (Part III, Attachment III-E), soils in the upper 160 feet at the site are predominantly clay, occasionally interbedded with claystone, sandstone and shale. While groundwater may be encountered in thin layers of sandy or silty material within the otherwise highly impermeable clay, this groundwater is essentially not usable due to its very low production potential and poor water quality. The uppermost recognized regional aquifer beneath the site that is capable of producing water in potentially useful quantities is the Yegua-Jackson Aquifer, which is expected to be encountered at least 750 feet below ground surface at the site. Water in this aquifer is poor to very poor in quality, due to concentrations of total dissolved solids, chloride and sulfate that exceed Federal drinking water standards.

Although a leak from a Subtitle D composite liner equipped with a leachate collection system is unlikely, the occasional layers of sandy or silty material at the site represent the most likely pathways for migration. The excavation bottom and leachate collection system are designed to convey any leachate that is generated to a series of sumps. If a leak were to occur, the most likely location would be from the leachate collection sumps in the lowest parts of landfill units.

Any contaminant leaking from the sumps would slowly move laterally for several reasons: (1) the anisotropy of the Yegua-Jackson results in vertical hydraulic conductivities at least an order of magnitude lower than horizontal hydraulic conductivity; and (2) the soil beneath the site gets denser and less permeable with depth. If there were a more transmissive zone in the vicinity of the leak, the most likely pathway for migration would be laterally until intercepting another deeper transmissive zone. The monitoring system has been designed to account for this situation in a location dominated by clay.

Groundwater flow resulting from construction of the facility is not expected to change. Local lenses of groundwater may be removed and some flow may be re-routed around the facility; however the flow direction would still be from the north to the south, mimicking the ground surface.

Based on potentiometric surfaces prepared from data obtained from on-site piezometers installed in the near surface soils at the site (see Appendix III-E.2), the POC is located along the west, south and a portion of the eastern boundary as shown on the figures in Appendix III-F.1.

### 3.0 Groundwater Monitoring Program 330.63(f)(4)

With respect to the usual regulatory ~~practice~~definition, the “uppermost aquifer” is the very limited quantity of shallow subsurface water, i.e., perched groundwater, primarily associated with ~~occurring in~~ the relatively continuous contact zone consisting of a very thin layer of coarse-grained sediments occurring at shallow depth at the base of the surficial ~~between the~~ Recent-Pleistocene (R-P) and above the underlying Eocene-age Yegua-Jackson (Y-J) sediments. The shallow subsurface water appears to be unconfined, i.e., under “water-table” conditions. The shallow subsurface water associated with the contact zone also appears to be present in the highly weathered and weathered Y-J stratum, i.e. Strata II and III. Within the Yegua-Jackson sediments, the shallow subsurface water appears to be located in transmissive secondary structure in the clays and the thin, isolated shallow sand units. It should be noted that the Y-J sediments are typically unsaturated. Site-specific piezometer information indicates that some very limited hydraulic communication with the contact zone may exist down to approximately sixty feet bgs. ~~Very limited amounts of groundwater were also encountered in several of the isolated, discontinuous sand/silt units deeper in the section.~~ Below 60-feet at the site, the clays form an aquiclude between the “uppermost aquifer” and the deeper Y-J. Inferred flow direction for the shallow groundwater appears to mimic surface drainage patterns, i.e., to the south with gradients ranging from 0.002 to 0.003.

Note that the designated “uppermost aquifer” does not extend down to the bottom elevations of the proposed excavation. Potential migration pathways below 60 feet bgs would be isolated sand units and anisotropic, more transmissive horizontal bedding characteristics in Strata IV (unweathered Y-J) down to the proposed depth of excavation. It should be noted that the Y-J sediments are typically unsaturated. In the unweathered Y-J, Stratum IV, the regional geologic dip controls potential water flow direction. Even though Stratum IV may contain very limited water, it still functions as an effective confining unit or “aquiclude” to the vertical migration of water from the designated “uppermost aquifer.”

The uppermost recognized ~~regional~~-aquifer at the facility is the regional Yegua-Jackson Aquifer which is greater than 600-feet beneath the deepest excavation. Flow in the Yegua-Jackson appears to coincide with the regional dip of the Yegua-Jackson to the east at approximately fifty feet per mile.



Per ~~3330.63(f)(34)~~, 330.63(f)(4) and 330.403(e)(1), the groundwater monitoring program has been designed to detect a possible release from the landfill based on site specific conditions. As detailed above ~~Since~~ the “uppermost aquifer” for groundwater monitoring purposes is the contact zone at the base of ~~between the~~ R-P and extending down into the Y-J ~~and to a depth of 60 feet~~ about 10 feet bgs. ~~below ground surface, aquifer thickness has no effect on the design of the system.~~ Groundwater flow rate is on the order of 1 to 2 feet per year to the south to southwest and is not affected by seasonal fluctuations based on data presented in Appendix III-E.2. The Y-J beneath the contact zone (Stratum III, III and IV) is predominately clay (95% clay per III-E.3) to great depths. Construction of the landfill may divert water around the facility but the overall direction will remain to the south to southwest. Therefore, no provisions are needed in the monitoring program to account for these

If a release from the landfill were to occur, the highest probability is association with one of the leachate sumps. To ensure earliest possible detection of such a release, the groundwater monitoring system will consist of groundwater monitoring wells which will be installed to, or below, the deepest sump excavation elevation depth nearest the well. To determine monitor well depths, the excavation elevation of the nearest sump to the monitor well location will be used and will assume a 3-foot thick compacted soil liner. Screens will be placed in the lower 10-20-feet of the monitoring well, as shown on Figure III-F.1-2 and the sand filter pack will extend to within 9-feet of the ~~surface.~~

The Groundwater Monitoring Program for the Pescadito Environmental Resource Center (MSW 2374) has been prepared to meet the requirements of 30TAC330.403. The compliance monitoring wells will be installed along the POC as shown on Figure III-F.1-1. Well spacing will be a maximum of 600-feet and will consist of a minimum of 38 wells. However, in the event that a transmissive sand zone containing perched water is encountered in the sidewall of the excavation within approximately fifty feet of the bottom of the excavation, the next well along the POC boundary will be relocated to that area, with depths determined as outlined above, and the 600-foot spacing will be re-started. That specific groundwater monitoring well will be screened across the transmissive sand zone using the installation detail previously provided. Monitoring well installation will be performed so that there is always a well along the POC a minimum of 600-feet downgradient from the most recent cell constructed.

Note that the POC well locations were selected based on the potential flow direction in the “uppermost aquifer”, i.e., flow direction to the south and generally mimicking surface topography. However, the POC well locations are also effective for any shift in the flow direction in the deeper (> 60 feet bgs) unweathered Y-J to align with the regional geologic dip. As a consequence, the POC well locations are strategically placed to intercept any potential migration pathways for any release from the landfill.

A total of 7 groundwater monitoring wells will be placed along the northern and portion of the east and west boundaries on an approximately 1200-foot spacing to obtain background or upgradient groundwater quality for comparison to the compliance wells located at the POC.

As each phase of monitoring well installation is completed and prior to placement of waste within 600-feet of newly installed wells, the owner or operator will submit a certification in accordance with 30 TAC §330.401(e) that the facility is in compliance with the groundwater monitoring requirements of §§330.403, 330.405, 330.407, and 330.409.

### **3.1 Monitoring Well Design and Construction**

In accordance with the Monitor Well Construction Specifications found at 30TAC330.421, all monitoring wells will be installed by a licensed Texas driller in accordance with all applicable regulations. The wells will be drilled by a method that will not introduce contaminants into the borehole or casing. A licensed professional geoscientist or engineer who is familiar with the geology of the area will supervise the monitoring well installation and development and will prepare a log of the boring. Monitoring well construction details including proposed screen intervals, well locations and elevations, filter pack and bentonite seal elevations, and surface completion are shown on Figure III-F.1-2. Equivalent alternatives to the construction specifications in 330.421 may be used if prior written approval is obtained from the executive director.

If any fluid is required in the drilling of the monitoring wells, only clean, treated city water will be used and a chemical analysis provided to the executive director along with the installation report. No glue or solvents will be used in the construction of groundwater monitoring wells.

After installation, the monitoring wells will be developed to remove drilling artifacts and open

any water-bearing zone for maximum flow. The wells will be developed until all water that was used or affected during the drilling activities is removed and the field measurements of pH, specific conductance, and temperature are stabilized.

Within 30 days of completion of a monitoring well or any other part of the monitoring system, an installation report will be submitted to TCEQ. The report will include construction and installation details for each well and will be provided on forms available from the commission. The report will include a site map drawn to scale showing the location of all installed monitoring wells to date, the relevant point(s) of compliance, top of casing elevations to the nearest 0.01 foot, tied to the mean sea level (msl), latitude and longitude or landfill grid location of each well, copies of detailed geologic logs including soil sample data, if performed and copies of driller's reports required by other agencies. A registered professional land surveyor will survey the well location and elevation of the top of casing and surface pad.

Any monitoring wells that are damaged and no longer usable will be reported to the executive director for a determination whether to replace or repair the well. In accordance with 30 TAC §305.70, if a compromised well requires replacement a permit modification request will be submitted within 45 days of the discovery.

Plugging and abandonment of monitoring wells will be performed in accordance with 16 TAC §76.702 and §76.1004. No abandonment will be performed without prior written authorization from the executive director.

#### **4.0 Groundwater Sampling and Analysis Plan 330.63(f)(5)**

No hazardous constituents have been identified in the groundwater at the site; therefore a detection monitoring program has been established for the facility. Part III, Appendix III-F.2 - Groundwater Sampling and Analysis Plan (GWSAP) contains the general requirements, sampling procedures and methods, and statistical analysis information required in 30 TAC §330.405(a)-(f).

The GWSAP contains information on the Detection monitoring program as well as Assessment and Corrective Action.

## 5.0 Groundwater Monitoring System Certification 330.403(e)

### General Site Information:

Pescadito Environmental Resource Center  
Webb County, Texas  
MSW Permit Application No.: 2374

### Qualified Groundwater Scientist Statement

I, Michael W. Oden, am a registered professional engineer in the State of Texas and a qualified groundwater scientist as defined in 30 TAC §330.3. I have reviewed the groundwater monitoring system and supporting data contained in the permit documents. In my professional opinion, the groundwater monitoring system is in compliance with the groundwater monitoring requirements specified in 30 TAC §330.401 through §330.421. This system has been designed specifically for the Pescadito Environmental Resource Center (Permit Application No. MSW No. 2374). The only warranty made by me in connection with this document is that I have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of my profession, practicing in the same or similar locality. No other warranty, expressed or implied, is made or intended.

Firm/Address: CB&I Environmental and Infrastructure, Inc.  
12005 Ford Road; Suite 600  
Dallas, Texas 75234  
TBPE Firm Registration F-5650

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

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**Part III, Appendix III-F.1**

**Part III**  
**Attachment III-F**  
**Appendix III-F.1**

**GROUNDWATER MONITORING PLAN FIGURES**

**Pescadito Environmental Resource Center**  
**MSW No. 2374**  
**Webb County, Texas**



**Initial Submittal March 2015**  
**Revised September 2015**  
**Revised November 2015**

**Prepared for:**  
**Rancho Viejo Waste Management, LLC**  
**1116 Calle del Norte**  
**Laredo, TX 78041**

**Prepared by:**  
**CB&I Environmental and**  
**Infrastructure, Inc.**



**12005 Ford Rd, Suite 600**  
**Dallas, TX 75234**

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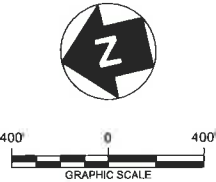
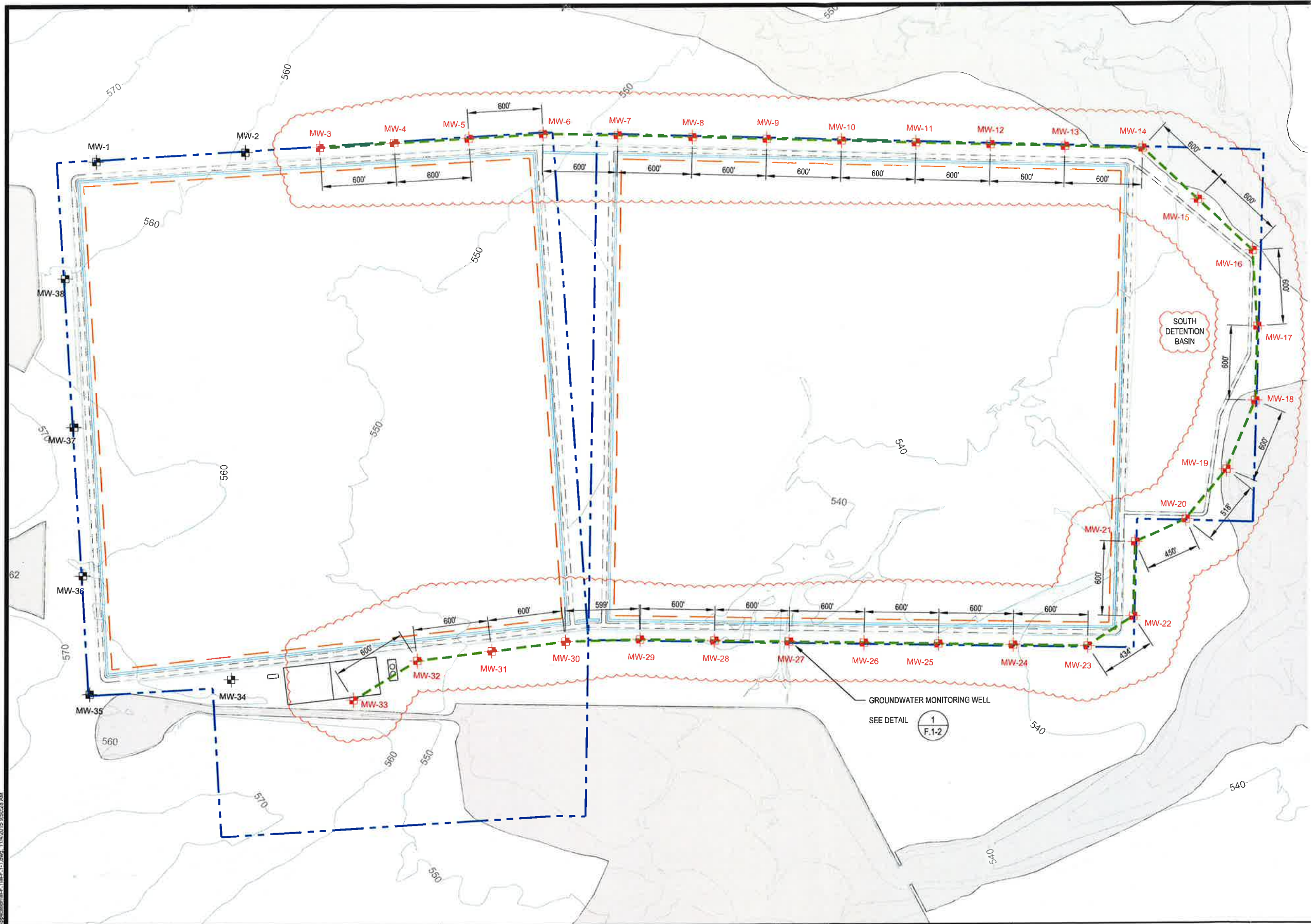
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LEGEND

- PERMIT BOUNDARY
- WASTE UNIT BOUNDARY
- PERIMETER DITCH
- PERIMETER ACCESS ROAD
- MW-1 GROUNDWATER MONITORING WELL (UPGRADIENT)
- MW-10 GROUNDWATER MONITORING WELL (DOWNGRADIENT)
- CLOMR 100-YEAR FLOODPLAIN
- POINT OF COMPLIANCE (P.O.C.)

NOTES

- 1. EXISTING CONTOURS DEVELOPED FROM SITE AERIAL TOPOGRAPHIC SURVEY BY DALLAS AERIAL SURVEYS ON FEBRUARY 15, 2010.
- 2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
- 3. THE NEED FOR FLEXIBILITY TO ACCOMMODATE ADJUSTMENTS AND MODIFICATIONS IS ANTICIPATED CONSIDERING THE SIZE, COMPLEXITY, AND LIFE OF THE PROJECT.
- 4. MW-3 TO MW-33 ARE DOWNGRADIENT ALONG P.O.C.
- 5. MW-1, MW-2, AND MW-34 TO MW-38 ARE UPGRADIENT.

REV. NO.	DATE	DESCRIPTION
2	11/2015	NOD 2
1	9/2015	NOD 1



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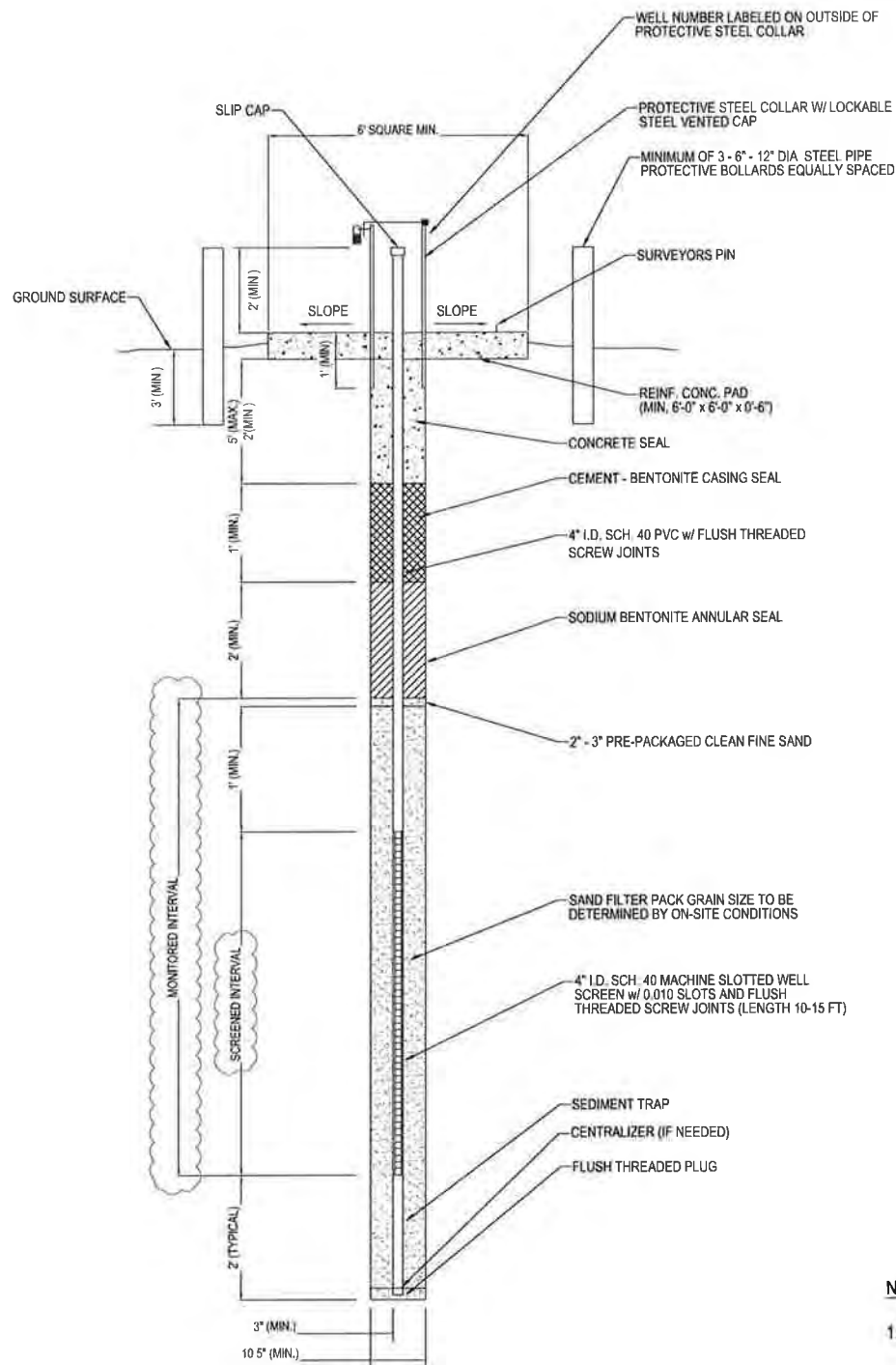


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PESCADITO ENVIRONMENTAL RESOURCE CENTER  
WEBB COUNTY, TEXAS  
MSW 2374

GROUNDWATER MONITORING SYSTEM PLAN

PROJ. NO.:	148866	DATE:	APRIL 2015
DESIGNED BY:	-	DRAWING NO.	III
DRAWN BY:	MTE		F.1-1
CHECKED BY:	RDS		
APPROVED BY:	MWO		1 OF 2 SHEETS



NOTES:

1. MONITORING WELL INSTALLATION SHALL CONFORM TO METHODS AND MATERIALS DESCRIBED IN APPLICABLE REGULATIONS OF TCEQ.
2. PTFE TAPE OR O-RINGS ON ALL JOINTS.
3. MONITORED INTERVAL TO BE FROM 9' BELOW GROUND SURFACE TO 5' BELOW LINER ELEVATION AT EACH WELL LOCATION.

GROUNDWATER MONITORING WELL SUMMARY TABLE

Well Name	Northing	Easting	Ground Surface Elevation (ft MSL)	Depth to Liner (ft)
MW-1	17098886.69	773881.16	585.91	107.91
MW-2	17097702.31	773688.14	559.21	102.54
MW-3	17097110.12	773591.63	556.43	100.58
MW-4	17096518.07	773494.27	554.75	99.72
MW-5	17095926.02	773396.92	552.54	98.32
MW-6	17095334.01	773299.35	550.91	98.68
MW-7	17094751.01	773153.82	549.51	99.93
MW-8	17094169.73	773005.28	548.77	101.46
MW-9	17093587.87	772856.59	548.00	102.47
MW-10	17093007.29	772707.40	546.58	102.83
MW-11	17092426.17	772558.07	545.54	103.58
MW-12	17091845.05	772408.73	544.09	103.91
MW-13	17091263.93	772259.40	542.59	104.19
MW-14	17090661.89	772104.69	540.87	102.87
MW-15	17090315.17	771600.30	539.35	101.35
MW-16	17089980.45	771102.31	538.01	99.81
MW-17	17090078.66	770498.36	536.84	98.24
MW-18	17090229.27	769917.57	534.01	95.01
MW-19	17090604.86	769395.12	534.50	95.10
MW-20	17090986.53	769111.29	536.55	96.91
MW-21	17091428.42	769025.09	537.64	97.86
MW-22	17091577.75	768443.97	537.68	97.68
MW-23	17091984.47	768293.13	537.94	97.94
MW-24	17092567.11	768436.39	540.44	99.33
MW-25	17093149.76	768579.65	541.99	99.44
MW-26	17093732.41	768722.91	541.54	97.54
MW-27	17094315.05	768866.17	547.36	101.91
MW-28	17094897.70	769009.43	540.00	93.11
MW-29	17095480.34	769152.69	541.99	93.49
MW-30	17096067.47	769269.65	543.99	93.24
MW-31	17096664.67	769327.57	547.69	95.16
MW-32	17097261.87	769385.49	552.73	98.97
MW-33	17097829.62	769191.05	558.02	103.18
MW-34	17098750.56	769569.69	556.70	99.89
MW-35	17099883.71	769707.17	563.37	105.37
MW-36	17099726.98	770651.32	560.31	102.31
MW-37	17099530.46	771835.12	566.08	108.08
MW-38	17099333.94	773018.92	559.58	101.58

1  
F.1-2

TYPICAL GROUNDWATER MONITORING WELL

NOT TO SCALE



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TBPE FIRM F-5650

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P.E. 67165

PESCADITO ENVIRONMENTAL RESOURCE CENTER  
WEBB COUNTY, TEXAS  
MSW 2374

TYPICAL GROUNDWATER MONITORING WELL DETAIL

PROJ. NO.:	148866	DATE:	APRIL 2015
DESIGNED BY:	-	DRAWING NO	III
DRAWN BY:	MTE		F.1-2
CHECKED BY:	RDS		
APPROVED BY:	MWO		2 OF 2 SHEETS

**Redline/Strikeout**

**Part IV**

## **Part IV**

### **SITE OPERATING PLAN**

**Pescadito Environmental Resource Center**

**MSW-2374**

**Webb County, Texas**



**Initial Submittal March 2015**

**Revised September 2015**

**Revised November 2015**

**Prepared for:**

**Rancho Viejo Waste Management, LLC**

**1116 Calle del Norte**

**Laredo, TX 78041**

**Prepared by:**

**CB&I Environmental and**

**Infrastructure, Inc.**



**12005 Ford Rd, Suite 600**

**Dallas, TX 75234**

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## 25.4 Erosion of Cover

Monthly and as soon as practicable after a ~~significant~~ rainfall events of 0.5 (~~2~~-inches or greater), the General Manager or Operations Manager will inspect daily, intermediate, and final cover areas for erosion gullies or washed out areas or other damage. Erosion rills or gullies or wash outs deeper than approximately 4 inches will be repaired as soon as practicable, but not later than five days after detection. The cover inspections, condition noted, and any corrective action will be documented in the cover inspection record. Periodic inspections and restorations will be required during the operational life and for the post-closure maintenance period.

## 25.5 Cover Application Record

Throughout the landfill operation, a cover application record will be kept on site readily available for inspection by commission representatives and authorized agents or employees of local governments having jurisdiction. For daily, intermediate, and alternate daily cover, the record will specify the date cover was accomplished (no exposed waste), how it was accomplished (soil or ADC type and method of placement), and the last area covered. For final cover, the record will specify the area covered, the date the cover was applied, and the thickness applied that date. Each entry will be certified by the signature of the on-site supervisor that work was accomplished as stated in the record.

**Attachment D**  
**to November 2015 Response Letter**

**Three copies of Changed Pages (TCEQ Only)**