Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant

Documents submitted:
Rail Modification Work Plan Rev 1.

Date Submitted:
01/21/2010

Submitted to whom
Leo Francendese

Concurrence

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EPA [illegible] Date 1/21/10

consulted w/ TDEC

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Rail Modifications Work Plan

1.0 Purpose of Work

This work plan is to install track and switches to improve rail shipments of ash from the TVA Kingston site to Perry County, Alabama and to improve car movement on-site minimizing the number of times Swan Pond Road is blocked.

2.0 Design Components

This project consists of several design components and locations within the Kingston site. All rail work will be constructed to Norfolk Southern Standards. A general discussion of each of the components as follows.

- Construct new rail spur 15A. This rail spur will tie into the north end of the yard and will require the movement and addition of several switches.
- Tie new rail spur 15A and existing rail spur 16 into the south end of the existing rail yard.
- Construct a new rail spur from existing Ash Track 1 into the south end of the existing rail yard.
- Rework several switches to the south end of the rail yard to accommodate the above new construction.
- Rework the existing plant entrance road to tie into the new rail spur from Ash Track 1 to the south end of the rail yard.
- Extend pipes and place fill to accommodate the new rail spur where it crosses the existing Red Water Ditch.
- Construct an access road on the outside of Ash Track 1 to improve the efficiency of placing polymer in the rail cars after loading.
- Rev. 1 Construct a new rail spur (Track # 3) that runs parallel to Ash Track 1.

The above modifications are to relocate the ash rail switches to the south of the existing rail yard and to minimize the blockage of Swan Pond Road. See the attached sketch for location of this work.

3.0 Construction Management

The construction will be accomplished with normal road and rail construction equipment. The rail base, drainage and road work will be accomplished by Civil Projects and the rail work will be accomplished by Queen City Rail.

The construction shall also be accomplished following the normal BMPs as set forth by the Tennessee Department of Conservation Erosion and Sediment Control Manual.

4.0 Schedule

The design portion of this activity began on November 24, 2009. Construction is anticipated to begin no later than December 18, 2009 and be completed by January 31, 2010.

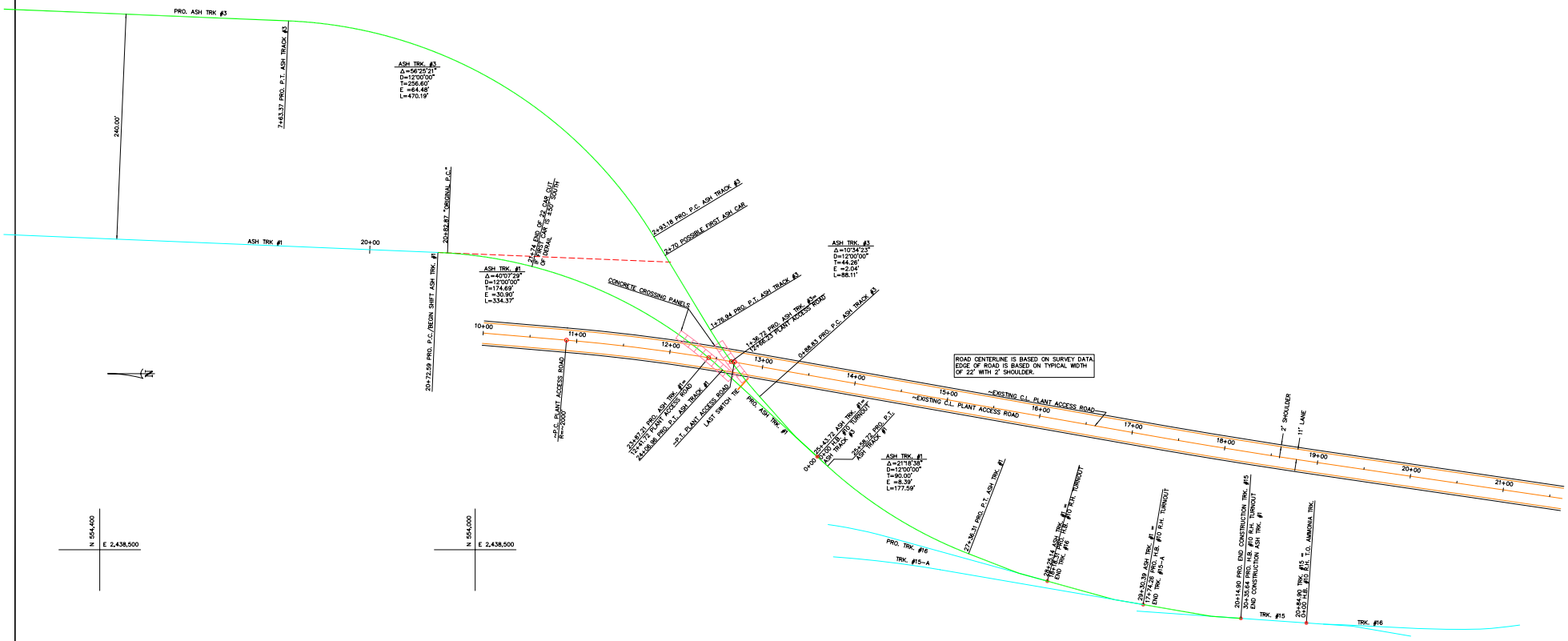
5.0 Waste Management

Used cross-ties and rail will become a waste stream for this project as well as a small amount of material from clearing and grubbing activities and a small amount of demolished asphalt material. These waste streams shall be handled per the site Waste Management Plan.

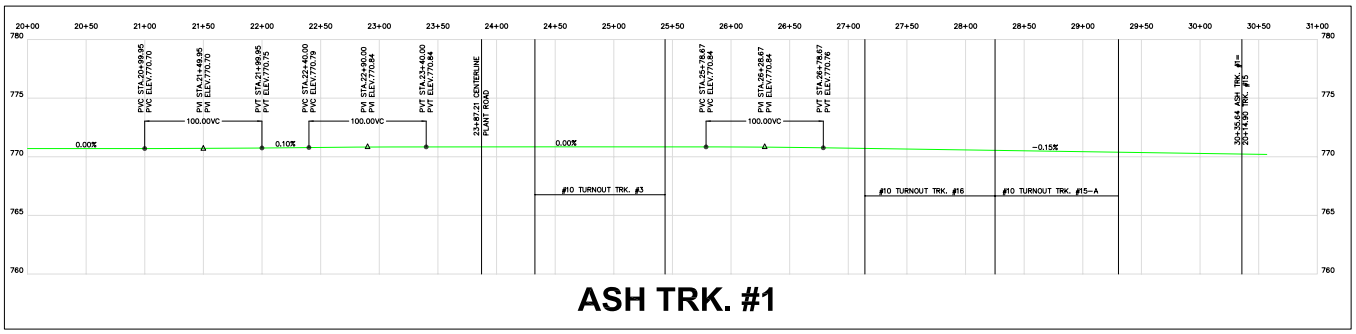
6.0 Health and Safety

All construction activities will be done in accordance with site-wide Health and Safety Plan.

240.00'
7+63.37 PRG. P.T. ASH TRAIL #3
20+72.59 PRG. P.C. /BEGIN SHIFT ASH TRL. #3
20+82.87 "VIRGINIA P.C."
P.C.C. PLANT ACCESS ROAD
20+14.90 PRG. END CONSTRUCTION TRL. #13
20+35.64 PRG. H.B. @D R.H. TURNOUT
END CONSTRUCTION ASH TRL. #1
20+49.95 PRG. END CONSTRUCTION TRL. #12
20+50.16 PRG. END C.R. VIRGINIA TRL.
2' SHOULDER
11' LANE



NOTE:
ASH TRACK #3 CAN REMAIN LEVEL OR BE MODIFIED AS DESIRED TO SUIT FIELD CONDITIONS.



ASH TRK. #1

DESIGN BASED ON 57' CAR LENGTHS

DO NOT SCALE DRAWING FOR DIMENSIONS NOT GIVEN.

0' 50' 100' 150'

THIS IS A FAST-TRACK DESIGN-BUILD PROJECT. THEREFORE THE USER IS CAUTIONED TO LOOK FOR AND REPORT ANY POTENTIAL DISCREPANCIES

LEGEND:
EXISTING TRACK CENTERLINE
PROPOSED TRACK CENTERLINE
TRACK TO BE REMOVED OR RELOCATED
POINT OF SWITCH

ELECTRONIC COPY NOT CERTIFIED

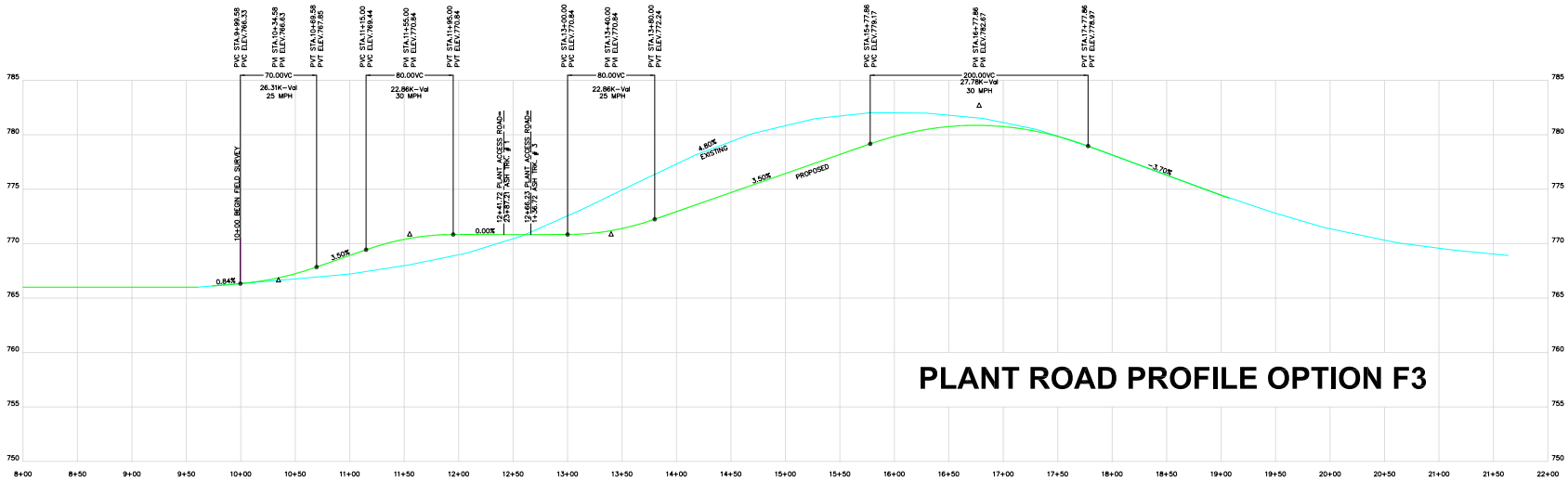
TVA KINGSTON FOSSIL PLANT

REVISION OF ASH TRACK #1 AND
ADDITION OF ASH TRACK #3
RAILROAD CONSTRUCTION PROJECT
NEAR KINGSTON, ROANE COUNTY, TENNESSEE

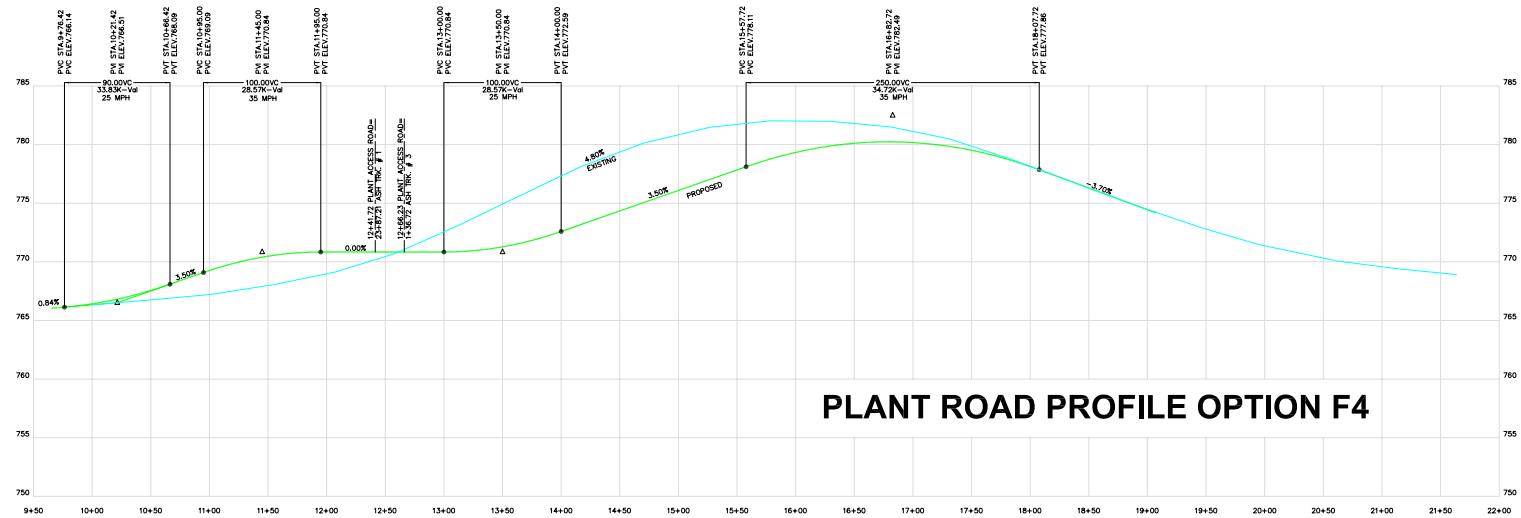
PREPARED BY
J.D. HOFF & ASSOCIATES
ENGINEERING CONSULTANTS
4011 TERRACE VIEW DRIVE
KNOXVILLE, TN 37918
865 687-8812

SCALE:
1"=50' HORZ.
1"=2' VERT.
DATE: JANUARY 16, 2010

JOB #1016
DR. #81-1016-TBD
SHEET 1 of 2
CAD FILE: 1016-31.DWG



PLANT ROAD PROFILE OPTION F3



PLANT ROAD PROFILE OPTION F4

NOTE:
SPEEDS SHOWN ARE BASED ON AASHTO STOPPING SIGHT DISTANCE. OWNER TO DETERMINE SUITABILITY OF VERTICAL CURVES FOR ACCESS BY VEHICLES USING ROADWAY.

DO NOT SCALE DRAWING FOR DIMENSIONS NOT GIVEN.

0' 50' 100' 150'

THIS IS A FAST-TRACK DESIGN-BUILD PROJECT. THEREFORE THE USER IS CAUTIONED TO LOOK FOR AND REPORT ANY POTENTIAL DISCREPANCIES

ELECTRONIC COPY NOT CERTIFIED

TVA KINGSTON FOSSIL PLANT

OPTIONS FOR PLANT ACCESS ROAD PROFILE
RAILROAD CONSTRUCTION PROJECT
NEAR KINGSTON, ROANE COUNTY, TENNESSEE

PREPARED BY
J.D. HOFF & ASSOCIATES
ENGINEERING CONSULTANTS
4011 TERRACE VIEW DRIVE
KNOXVILLE, TN 37918
865 687-8812

SCALE:
1"=50' HORZ.
1"=5' VERT.
DATE: JANUARY 16, 2010

CAD FILE: 1016-31.DWG

JOB #1016
DR. #81-1016-TBD
SHEET 2 of 2

Written by:	Justin Wang	Date:	1/13/2010	Reviewed by:	Jill Simons /Robert Bachus	Date:	1/13/2010

Client:	TVA/Jacobs	Project:	Railroad Foundation Assessment	Project/ Proposal No.:	GR4327	Task No.:	105

COMPUTATION COVER SHEET

Client: **TVA** Project: **Dredge Cells Recovery** Project/ Proposal No.: Task No. **GR4327**

Title of Computations **Railroad Foundation Assessment**

Computations by:	Signature		1/13/2010
	Printed Name	Justin Wang	Date
	Title	Project Engineer	
Assumptions and Procedures Checked by: (peer reviewer)	Signature		1/13/2010
	Printed Name	Jill Simons / Robert C. Bachus	Date
	Title	Project Engineer / Principal	
Computations Checked by:	Signature		1/13/2010
	Printed Name	Jill Simons	Date
	Title	Project Engineer	
Computations back-checked by: (originator)	Signature		1/13/2010
	Printed Name	Justin Wang	Date
	Title	Project Engineer	
Approved by: (pm or designate)	Signature		1/13/2010
	Printed Name	Robert C. Bachus	Date
	Title	Principal	

Approval notes:

Revisions (number and initial all revisions)

No.	Sheet	Date	By	Checked by	Approval

RAILROAD FOUNDATION ASSESSMENT

INTRODUCTION

This "*Railroad Foundation Assessment*" calculation package (Calculation Package) was prepared in support of the installation of a new section of railroad at the Tennessee Valley Authority (TVA) Kingston Fossil Plant (KIF) Ball Field site. The proposed railroad will be located to the east of Track No.1. At the request of Jacobs Engineering (Jacobs), Geosyntec completed the following: (i) calculate the allowable bearing capacity for the shallow foundations anticipated to be used for the proposed construction; and (ii) calculate the total settlement due to the anticipated loading. The purpose of this Calculation Package is to provide the results of these calculations.

PROJECT BACKGROUND

The following project background information is provided by Jacobs. Jacobs and TVA plan to install a new section of railroad to facilitate the transportation of dredged ash. The proposed location of the new railroad is shown in Figure 1. Geosyntec notices that the proposed railroad alignment will intersect the existing instrumentation line.

Based on information provided by Jacobs, there will be a 9-inch thick ballast layer below the railroad ties. The subballast layer, underneath the ballast layer, will be 9-inche thick thick. Jacobs reports that the subballast layer will be placed on the existing demarcation layer and that no ash will exist between the subballast layer and the demarcation layer. The width of the railroad tie will be 8.5 feet. The ballast width, at the top of trapezoidal section, will be 9.5 feet. The width of the subballast section will be 24 feet. The side slope of the ballast and subballast layers will be 2H:1V. Jacobs indicates that the above railroad design meets the Norfolk Southern Railway Company's standards. A cross section of the railroad was prepared by Geosyntec for reference based on information provided by Jacobs and is shown in Figure 2.

The railroad loading information was provided to Geosyntec by Jacobs as follows. The loaded railcar weight is 143 tons per 60 feet length. The locomotive weight is 205 tons and is 75 feet long.

PREVIOUS SITE INVESTIGATION AND FINDINGS

In early 2009, numerous subsurface borings (by Mactec) and CPTu soundings (by Conetec) were advanced in the Ball Field Site. The locations of the borings at the Site is presented in Figure 3. It is noted that Borings B-1, B-12, B-13, B-43, and CPT soundings CPT-9 and CPT-16 were located near the proposed railroad. Based on Geosyntec's review of the above borings and soundings, the subsurface conditions in this area can be summarized as follows (from top to bottom):

- Approximately 8-ft thick unsaturated crust layer of relatively strong fly ash and bottom ash;
- approximately 40-ft thick layer of soft fly ash with local thin zones of bottom ash;
- approximately 20-ft thick layer of relatively soft clayey foundation soils; and
- bedrock.

The groundwater surface is located approximately 8 feet below the ground surface and within or near the base of the unsaturated crust layer. After the completion of the field investigation, a demarcation layer was placed on top of the crust layer. The demarcation layer comprises crushed stone and is used to facilitate vertical drainage of water from the dredged ash that is processed and stored at the Ball Field site.

SUBSURFACE STRATIGRAPHY CONSIDERED FOR ANALYSIS

Based on results from previous site investigations, the subsurface stratigraphy below the subballast layer consists of a crust layer, a soft ash layer, and a clayey foundation material layer. The subsurface profile that is considered in subsequent analyses is illustrated in Figure 2.

RAILROAD LOAD

As mentioned previously, Geosyntec was provided with the railroad loading conditions, the width of the tie, and the thickness of the ballast/subballast material. To calculate the imposed vertical stress at the bottom of the subballast layer, Geosyntec used the method recommended by AREMA [2004]. Assuming that: (i) the loading is spreading at a typical slope of 1H:2V within the ballast/subballast; and (ii) the unit weight of the ballast/subballast material is 120 pcf, the vertical load acting at the base of the subballast (or on the top of the demarcation layer) is

calculated as:

- railcar loading: q = 143x2000/[60x(8.5+1.5*0.5+1.5*0.5)] + 1.5*120 = 657 psf
- locomotive loading: q = 205*2000/[75x(8.5+1.5*0.5+1.5*0.5)] + 1.5*120 = 727 psf

The width of the load on the demarcation layer is 10 ft and it is considered a strip load. The higher loading value of 727 psf is used in the following bearing capacity analysis and settlement analysis.

BEARING CAPACITY ANALYSIS

Material Properties

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Geosyntec relied on information provided in the previous documents [Geosyntec 2009a, 2009b, 2009c], as well as the boring logs from Mactec to select material properties for the bearing capacity analysis, The material properties used in the bearing capacity analysis are summarized in Table 1.

Methodology

The subsurface profile consists of several layers. Therefore, it is necessary to: (i) estimate the imposed stress at the top of each layer; (ii) calculate the allowable bearing capacity for each layer; and (iii) compare the imposed stress to the calculated allowable bearing capacity to verify that each layer provides sufficient bearing resistance. The bearing capacity analysis will be performed using an imposed vertical loading of 727 psf over the demarcation layer.

Calculation of Imposed Vertical Stress

The imposed vertical stress over each layer is calculated by a model recommended by NAVFAC [1986] as shown in Figure 4 for a bearing stratum underlain by multiple layer. This model is used to assess stress dissipation with respect to depth. The results of the imposed vertical stress calculations on each layer in the proposed railroad area are summarized in Table 2.

Calculation of Allowable Bearing Capacity

Bearing capacity of each subsurface layer was calculated using an engineering equation accepted in the geotechnical engineering practice [NAVFAC, 1986]. A summary of the equations and the terminology is provided as follows:

$$q_{ult} = c\,N_c + q\,N_q + 0.5\,\gamma B N_\gamma$$

where:

c = cohesion of each layer;
N_c, N_q, N_γ = bearing capacity factor as a function of frictional strength (see Figure 5);
q = overburden pressure;
γ = the total unit weight of the layer if groundwater table is lower than the bottom of the layer; or the submerged unit weight of the layer if groundwater table is at or higher than the top of the layer; and
B = the width of the imposed vertical stress zone.

Bearing Capacity Analysis Results

Table 3 provides a summary of the bearing capacity analysis results. Allowable bearing pressures for each layer are also presented in Table 3. To obtain allowable bearing capacity, a safety factor of 3 is recommended to be used by NAVFAC [1986]. Table 3 also compares the imposed vertical stress to the allowable bearing capacity indicating that the calculated allowable bearing capacity exceeds the imposed vertical stress for each layer, thus implying the calculated bearing capacity factor of safety is greater than the target value of 3.0.

A conservative estimate of the strength of the foundation materials and a conservative assessment of the imposed loading by the proposed railroad were used in the bearing capacity analyses. Even with these conservative assumptions (to simulate potential worst case conditions), the calculated bearing capacity factor of safety exceeds the target value of 3.0.

SETTLEMENT ANALYSIS

Total Settlement Tolerance

Jacobs suggests that a total settlement of the railroad exceeding 6 inches would be unacceptable. Should excessive settlement occur, a tamper will be used to lift the tracks, re-level the ballast, and then re-install the railroad tracks. Although the total settlement can be addressed by re-leveling the ballast layer, a settlement analysis is performed to estimate the potential total settlement under the imposed loading.

Methodology

Settlement of the ballast, subballast layer, and demarcation layer under the railroad loading are not considered in the settlement analysis. The ballast, subballast layer, and demarcation layer primarily consist of granular materials. Anticipated settlement of these materials is minimal. Similarly, the crust layer appears to be a cemented ash layer that is quite stiff and relatively incompressible. Therefore, Geosyntec believes it is reasonable to exclude the ballast, subballast layer, the demarcation layer, and the crust layer from the subsequent settlement analyses.

Settlements of the relatively soft ash and clay materials were calculated using equations for conventional one-dimensional (1-D) consolidation theory used in geotechnical engineering [Holtz and Kovacs, 1981]. For this project, settlement of the ash and clay is caused by the following mechanisms:

- primary compression of the ash and clay material due to overburden loading (i.e., 9-inch ballast and 9-inch subballast layers) and the railroad loading (i.e., loading from the railcars and the locomotive); and
- secondary compression resulting from the plastic realignment of the fabric (i.e., creep) of soft ash and clay materials under the sustained loading. Based on information provided by Jacobs, the total operation time for the railroad is assumed to not exceed 4 years.

The general forms of the settlement equations are given below:

Primary Settlement

$$S_p = C_{r\varepsilon}\, H \log\left(\frac{\sigma'_{vo} + \Delta\sigma'_v}{\sigma'_{vo}}\right) \qquad \text{for } \sigma'_{vo} + \Delta\sigma'_v \le \sigma'_p$$

$$S_p = C_{r\varepsilon}\, H \log\left(\frac{\sigma'_p}{\sigma'_{vo}}\right) + C_{c\varepsilon}\, H \log\left(\frac{\sigma'_{vo} + \Delta\sigma'_v}{\sigma'_p}\right) \qquad \text{for } \sigma'_{vo} \le \sigma'_p \text{ and } \sigma'_{vo} + \Delta\sigma'_v > \sigma'_p$$

$$S_p = C_{c\varepsilon}\, H \log\left(\frac{\sigma'_{vo} + \Delta\sigma'_v}{\sigma'_{vo}}\right) \qquad \text{for } \sigma'_{vo} \ge \sigma'_p$$

Secondary Settlement

$$S_s = C_{\alpha\varepsilon}\, H \log\left(\frac{t_2}{t_1}\right)$$

Total Settlement

$$S = S_p + S_s$$

Where,

S_p = primary settlement;
S_s = secondary settlement;
S = total settlement;
$C_{c\varepsilon}$ = modified compression index;
$C_{r\varepsilon}$ = modified recompression index;
$C_{\alpha\varepsilon}$ = modified secondary compression index;
H = initial thickness of compressible layer;
σ'_{vo} = initial effective overburden stress;
σ'_p = pre-consolidation pressure;
$\Delta\sigma'_v$ = increase in effective stress due to loading;
t_1 = time for completion of primary compression (assume 1 year in this analysis); and
t_2 = time when settlement due to secondary compression is computed (assume 4 years in this analysis).

Compression Parameters

Geosyntec relied on information provided in the previous document [Geosyntec 2009c] to select material properties for the stability analyses. The compression parameters used in the settlement analysis are summarized in Table 4.

Pre-consolidation Pressure

Currently, the proposed railroad area is covered by the approximately 2 feet thick demarcation layer and by approximately 5 to 10 feet of dredged ash. Although the dredged ash will be removed as part of the proposed construction activities, it is conservative to assume that the ash and clay will behave as a normally consolidated material. Therefore, the pre-consolidation pressure of the ash and clay is estimated to be the original vertical stress (i.e. prior to the placement of the demarcation layer and the dredged ash) plus the weight of the demarcation layer.

Settlement Analysis Results

The calculated settlement includes primary and secondary settlement of the ash and clay materials that will occur from the beginning of year 1 through the end of year 4. The calculated total settlement is estimated to be approximately 3.4 inches. With regards to this calculated settlement, approximately 2.5 inches would occur in the ash and 0.9 inch will occur in the underlying clay layer. These calculations also indicate that approximately 2.6 inches of this settlement will occur as primary settlement within the first year with the remaining 0.8 inch occurring as secondary settlement over the next 3 years. The results and the calculation table are presented in Table 5.

SUMMARY AND CONCLUSIONS

Jacobs plans to construct a new railroad in the northwestern portion of the Ball Field Site to facilitate the transportation of dredge ash. Prior to advancing the construction of the proposed railroad, Jacobs requested that Geosyntec perform analyses to assess the bearing capacity and settlement of the subsurface in this area. This Calculation Package was prepared to provide the requested analyses. Results of analyses presented in this document indicate the following:

(i) *Bearing Capacity*: The calculated allowable bearing capacity of the subsurface materials is greater than the required bearing capacity calculated based on the railroad loading and railroad size provided by Jacobs. For these analyses, Geosyntec considered potential worst-case foundation loading conditions and representative lower-bound estimates of the strength of the foundation materials [Geosyntec, 2009c]. Based on these results, Geosyntec believes that a bearing capacity failure is not likely to occur under the proposed equipment loading conditions provided by Jacobs.

(ii) *Settlement*: The calculated total vertical settlement is estimated to be approximately 3.4 inches in the anticipated 4 years of operation. The calculated total settlement is less than 6 inches and therefore is considered to be acceptable according to the criteria provided by Jacobs. Jacobs also indicated in the event of excessive total settlement, a tamper will be brought in to lift equipment, re-level the ballast layer, and re-install the railroad tracks.

OTHER CONSIDERATIONS

As mentioned previously, the proposed railroad alignment will intersect the existing instrumentation line. To protect the instrumentation line from damage by the railroad load, Geosyntec recommends that instrumentation line be carefully exposed and then be enclosed with a steel casing prior to constructing the rail road.

REFERENCES

American Railway Engineering and Maintenance-of-Way Association (2004), "Guidelines for Temporary Shoring", October 25, 2004.

Geosyntec Consultants (2009a), "Technical Summary – Proposed Modification Regarding Spacing/Depth of Prefabricated Vertical Drains at Ball Field Temporary Ash Disposal Site", March 17, 2009.

Geosyntec Consultants (2009b), "Slope Stability Analyses for Dike 2", July 31, 2009.

Geosyntec Consultants (2009c), "Rapid Dewatering System and Filter Press System Foundation Assessment", December 16, 2009.

Hammer, D.P., and Blackburn, E.D. (1977), "Design and Construction of Retaining Dikes for Containment of Dredged Material", Technical Report D-77-9, U.S. Army Engineer Water Experiment Station, Vicksburg, Mississippi, August 1977, pp. 93.

Holtz, R.D., and Kovacs, W.D (1981). "An Introduction to Geotechnical Engineering," Prentice-Hall Inc., Englewood Cliffs, N.J., 1981.

Naval Facilities Engineering Command (NAVFAC), "Foundations & Earth Structures", Design Manual 7.02, September 1986, pp. 7.2.130-131.

TABLES

Table 1. Material Properties

Material	Approx. Layer Thickness (ft)	Unit Weight (pcf)	Shear Strength
Demarcation Layer	2	135	c=0, $\phi = 35^o$
Crust Layer	8	120	c=500 psf, $\phi = 25^o$
Soft Ash Layer	40	75	c=0, $\phi = 20^o$
Soft Clay Layer	20	100	c=0, $\phi = 28^o$

Table 2. Calculated Imposed Vertical Stress Over Each Layer

Layer	Layer Top Depth (ft)	Width of Imposed Vertical Stress (ft)	Calculated Imposed Vertical Stress (psf)
Demarcation Layer	0	10	727
Crust Layer	2	12.32	590
Soft Ash Layer	8	19.28	377
Soft Clay Layer	50	68	107

Table 3. Summary of Calculated Bearing Capacity for Each Layer in Filter Press Area

Layer	γ (pcf)	c (psf)	ϕ (°)	D	N_c	N_q	N_γ	q (psf)	B (ft)	q_{ult} (psf)	q_{all} (psf)	Imposed Vertical Stress (psf)	Is Bearing Capacity OK?
Demarcation Layer	135	0	35	0	50	35	40	0	9.5	25,650	**8,550**	**727**	**YES**
Crust Layer	120	500	25	2	21.5	11	7	270	11.82	18,684	**6,228**	**590**	**YES**
Soft Ash Layer	12.6	0	20	10	14	6.5	3	1470	21.1	9,954	**3,318**	**377**	**YES**
Soft Clay Layer	37.6	0	28	50	26.5	16	12	1974	67.5	46,220	**15,407**	**107**	**YES**

Table 4. Compression Parameters

Material	**Modified Compression Index ($C_{c\varepsilon}$)**	**Modified Recompression Index ($C_{r\varepsilon}$)**	**Modified Secondary Compression Index ($C_{\alpha\varepsilon}$)**
Ash	0.042	0.007	0.0022
Clayey Foundation Material	0.087	0.012	0.0022

Written by: **Justin Wang** Date: **1/13/2010** Reviewed by: **Jill Simons /Robert Bachus** Date: **1/13/2010**

Client: **TVA/Jacobs** Project: **Rail Road Foundation Assessment** Project/ Proposal No.: **GR4327** Task No.: **105**

Table 5. Settlement Calculation Table

Layer	z	σ'_0 (psf)	$\Delta\sigma'$ (psf)	σ'_v (psf)	Pc' (psf)	a1	a2	Strain	Layer Thickness (ft)	Primary Settlement (in)	Secondary Settlement (in)
Ash	11	1242.6	377.00	1619.60	1242.6	0.000	0.115	0.005	2	0.12	0.03
Ash	13	1267.8	377.00	1644.80	1267.8	0.000	0.113	0.005	2	0.11	0.03
Ash	15	1293.0	377.00	1670.00	1293.0	0.000	0.111	0.005	2	0.11	0.03
Ash	17	1318.2	377.00	1695.20	1318.2	0.000	0.109	0.005	2	0.11	0.03
Ash	19	1343.4	377.00	1720.40	1343.4	0.000	0.107	0.005	2	0.11	0.03
Ash	21	1368.6	377.00	1745.60	1368.6	0.000	0.106	0.004	2	0.11	0.03
Ash	23	1393.8	377.00	1770.80	1393.8	0.000	0.104	0.004	2	0.10	0.03
Ash	25	1419.0	377.00	1796.00	1419.0	0.000	0.102	0.004	2	0.10	0.03
Ash	27	1444.2	377.00	1821.20	1444.2	0.000	0.101	0.004	2	0.10	0.03
Ash	29	1469.4	377.00	1846.40	1469.4	0.000	0.099	0.004	2	0.10	0.03
Ash	31	1494.6	377.00	1871.60	1494.6	0.000	0.098	0.004	2	0.10	0.03
Ash	33	1519.8	377.00	1896.80	1519.8	0.000	0.096	0.004	2	0.10	0.03
Ash	35	1545.0	377.00	1922.00	1545.0	0.000	0.095	0.004	2	0.10	0.03
Ash	37	1570.2	377.00	1947.20	1570.2	0.000	0.093	0.004	2	0.09	0.03
Ash	39	1595.4	377.00	1972.40	1595.4	0.000	0.092	0.004	2	0.09	0.03
Ash	41	1620.6	377.00	1997.60	1620.6	0.000	0.091	0.004	2	0.09	0.03
Ash	43	1645.8	377.00	2022.80	1645.8	0.000	0.090	0.004	2	0.09	0.03
Ash	45	1671.0	377.00	2048.00	1671.0	0.000	0.088	0.004	2	0.09	0.03
Ash	47	1696.2	377.00	2073.20	1696.2	0.000	0.087	0.004	2	0.09	0.03
Ash	49	1721.4	377.00	2098.40	1721.4	0.000	0.086	0.004	2	0.09	0.03
Clay	51	1771.6	107.00	1878.60	1771.6	0.000	0.025	0.002	2	0.05	0.03
Clay	53	1846.8	107.00	1953.80	1846.8	0.000	0.024	0.002	2	0.05	0.03
Clay	55	1922.0	107.00	2029.00	1922.0	0.000	0.024	0.002	2	0.05	0.03
Clay	57	1997.2	107.00	2104.20	1997.2	0.000	0.023	0.002	2	0.05	0.03
Clay	59	2072.4	107.00	2179.40	2072.4	0.000	0.022	0.002	2	0.05	0.03
Clay	61	2147.6	107.00	2254.60	2147.6	0.000	0.021	0.002	2	0.04	0.03
Clay	63	2222.8	107.00	2329.80	2222.8	0.000	0.020	0.002	2	0.04	0.03
Clay	65	2298.0	107.00	2405.00	2298.0	0.000	0.020	0.002	2	0.04	0.03
Clay	67	2373.2	107.00	2480.20	2373.2	0.000	0.019	0.002	2	0.04	0.03
Clay	69	2448.4	107.00	2555.40	2448.4	0.000	0.019	0.002	2	0.04	0.03
								Total Settlement (Ash):		2.00	0.64
								Total Settlement (Clay):		0.45	0.32

Calculated total settlement in 4 years = 3.4 in

FIGURES

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Client:	TVA/Jacobs	Project:	Rapid Dewatering System and Filter Press System Foundation Assessment	Project/ Proposal No.:	GR4327	Task No.:	105

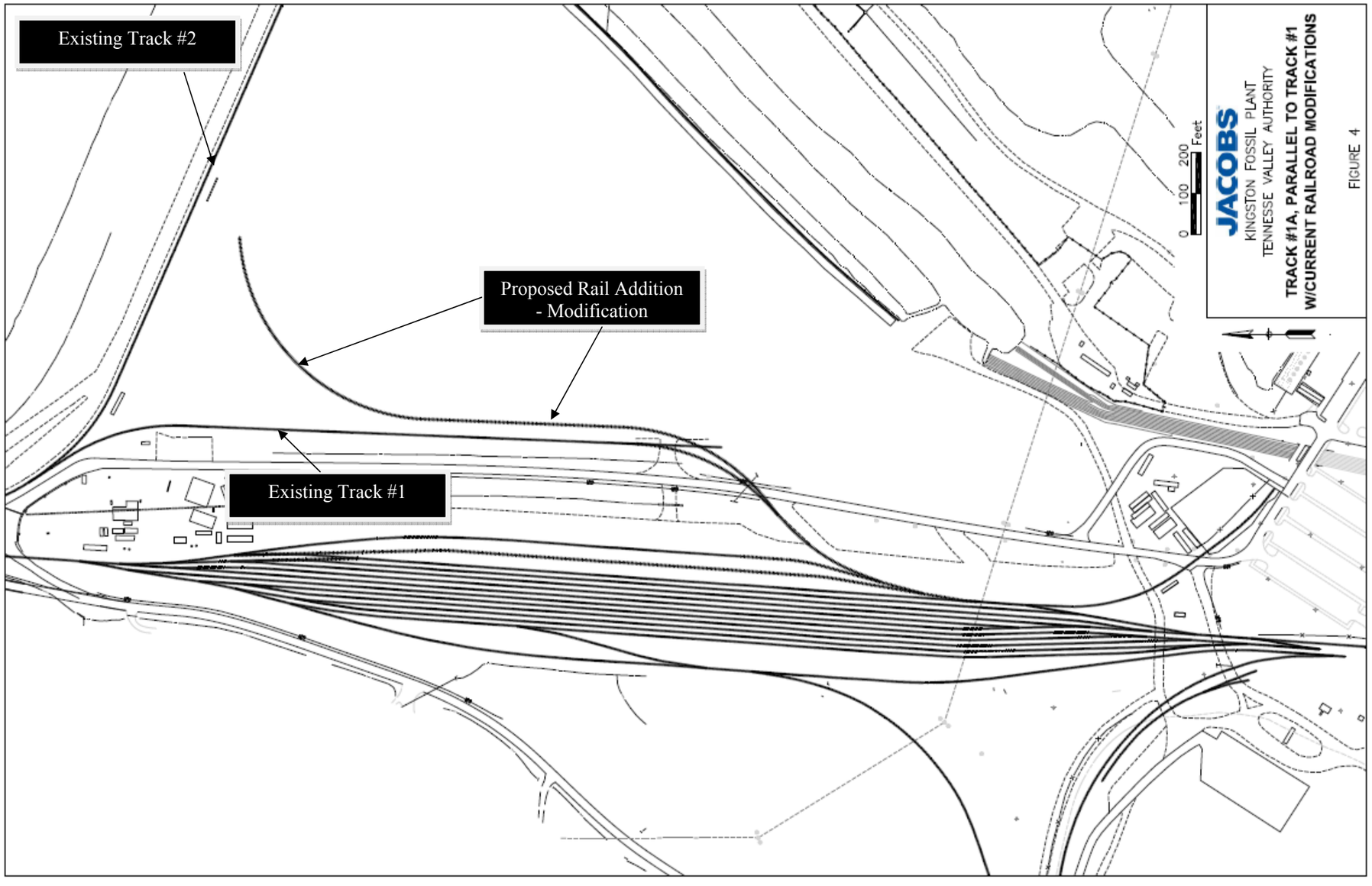

Figure 1. Proposed Railroad Location Plan (Prepared by Jacobs)

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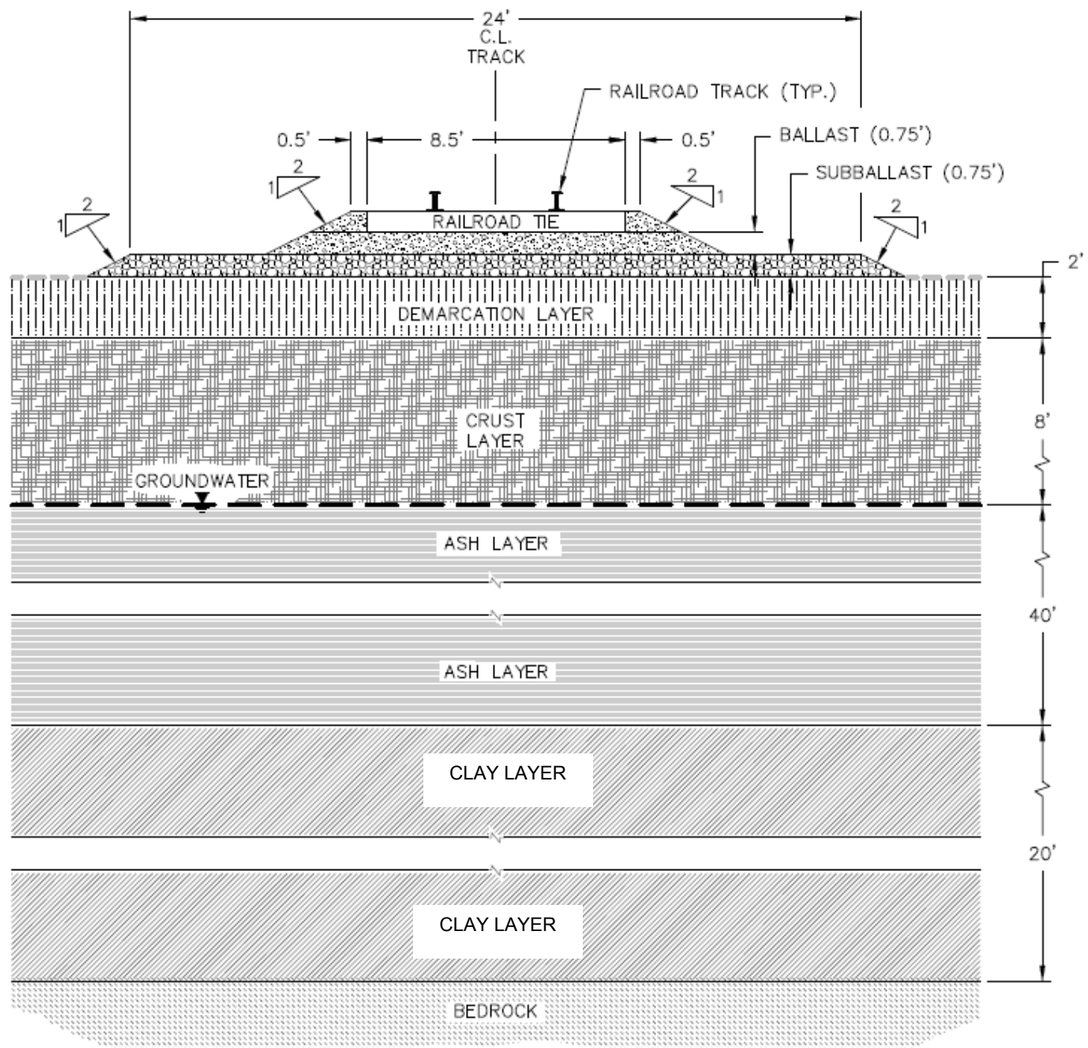

Figure 2. Typical Cross Section (Based on information provided by Jacobs)

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Client:	TVA/Jacobs	Project:	Rapid Dewatering System and Filter Press System Foundation Assessment	Project/ Proposal No.:	GR4327	Task No.:	105

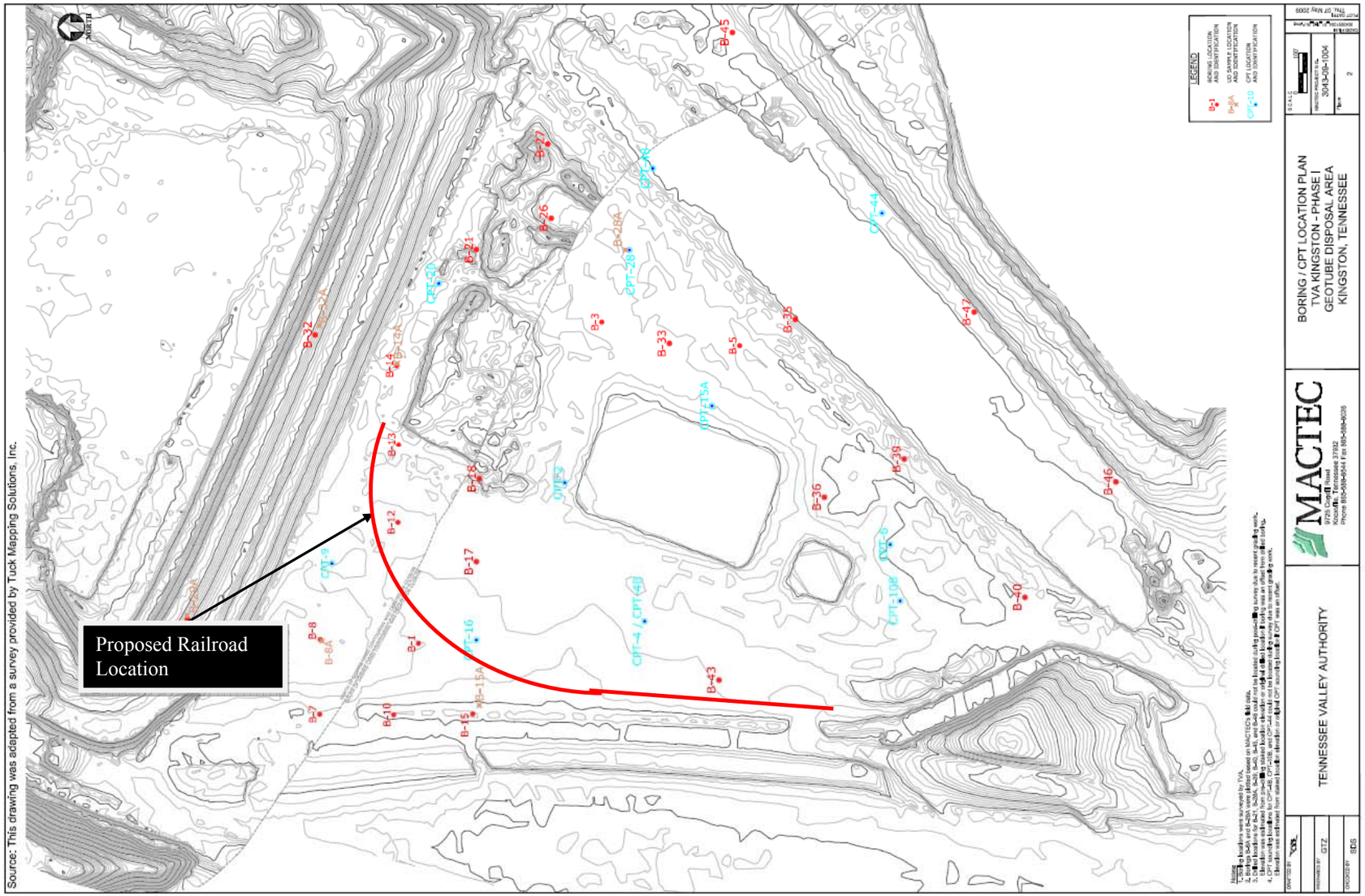
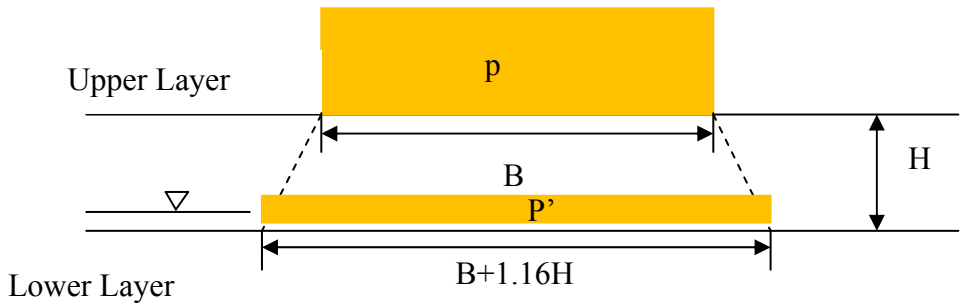


Figure 3. Location of Existing Borings and Proposed Railroad Location



p = applied stress on ground surface
L = length of foundation
(B+1.16H) (L+1.16H)= imposed vertical stress area over lower layer
p' = p*B*H / (B+1.16H)(L+1.16H) = imposed vertical stress over the lower layer

Figure 4. Imposed Vertical Stress Calculation Model [NAVFAC, 1986]

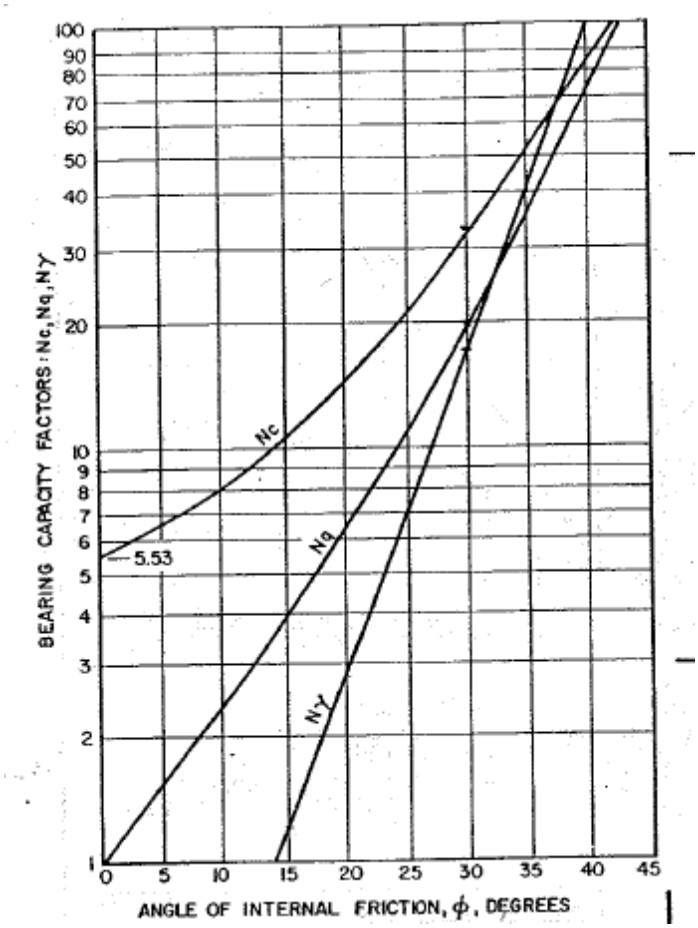


Figure 5. Bearing Capacity Factors [NAVFAC, 1986]