KINGSTON FOSSIL PLANT
MONITORING WELLS NSTALLATION
JAN 2005

Hensley, Christopher W.

From: Petty, Harold L.
Sent: Friday, February 04, 2005 8:26 AM
To: Hensley, Christopher W.
Subject: FW: Analyses cross section in Cad

Chris:

Please print out a half size of each of these. Print this e-mail and put all in the notebook/

Thanks,
Lynn

-----Original Message-----
From: TElkady@GeoSyntec.com [mailto:TElkady@GeoSyntec.com]
Sent: Thursday, February 03, 2005 7:01 PM
To: Petty, Harold L.; Daniel.R.Smith@worleyparsons.com; Smith, Amos L; Boggs, J. Markus; Bowers, Larry C; eGreg.McNulty@parsons.com
Cc: GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES; TElkady@GeoSyntec.com
Subject: Analyses cross section in Cad

Dear All:

I hope this email finds you all well.

I am attaching a total of 6 CAD files that define the limits of the analysis cross section and the boundaries of subsurface stratigraphy along the agreed analysis cross sections for different analyses cases.

As we discussed, Case 1 represents the current conditions at the site (for calibration purposes); Case 2 represents conditions that occurred during failure; and Case 3 represents assumed future condition.

For future conditions, it is asssumed that wet disposal of fly ash will continue by raising the dikes in stages until the disposal life of a certain stage is significantly reduced. At this point, it is anticipated that operations at in the dredge cells will switch to dry disposal. Approximate calculations (assuming fly ash disposal rate to be 398,000 cy/year as reported in the Dregde Cells Operation plans) estimated the disposal life to be about 8 to 9 months with top of dike at elevation 902 ft. Given the short disposal life at this stage, it is anticipated that operations in the dredge cells will switch to dry disposal. Therefore, Case 3 (future conditions) cross section assumes wet disposal of fly ash up to elevation 902 ft with water level 2 feet below top of the dike (i.e., 900 ft).

A brief description of the contents of Cad File is as follows:

- File titled "Cell I-case 1&2" defines the boundaries of the subsurface layers along the Cell I cross section drawn with vertical exaggeration.
- File titled "Cell I-case 1&2 to scale" defines the boundaries of subsurface layers along the Cell I cross section drawn with no vertical exaggeration.
- File titled "Cell I-case3" defines the boundaries of the subsurface layers along the Cell I cross section for assumed future conditions.
- File titled " Cell III-Case 1&2" defines the boundaries of the subsurface layers along the Cell III cross section drawn with vertical exaggeration.
- File titled " Cell III-Case 1&2 to scale" defines the boundaries of subsurface layers along the Cell III cross section drawn with no vertical exaggeration.
- File titled "Cell III-case3" defines the boundaries of the subsurface layers along the Cell III cross section for assumed future conditions.

If you have any questions/comments, please let me know.

Tamer

Tamer Y. Elkady, Ph.D.
Senior Staff Engineer
GeoSyntec Consultants
1255 Roberts Blvd NW
Suite 200
kennesaw, GA, 30144-3694
(678)202-9500

Petty, Harold L.

From: Rick Pope [rpope.conetec@verizon.net]
Sent: Wednesday, December 08, 2004 1:53 PM
To: Petty, Harold L.
Subject: Ch values

Len,

Here's the table of values you requested.

If you should have any questions, give Bruce a call.

Thanks

TABLE 1 - SUMMARY OF CPTU SOUNDINGS

Job No.: 04-717
Location: TVA Fossil Fuel Power Plant - Kingston, Tennessee
Client: MACTEC Engineering and Consulting Inc.
Date: March 22, 23, 24, 2004

Date	CPTU Sounding	File Name	Total Depth (ft)	Pore Water Pressure Dissipation Tests (sec)	Dissipation depth (ft)	C_h (cm^2/min)	Est. Water Table Depth (ft)	U-max	T-50 (sec)	Comments
22-Mar-04	CPT-1	717cp001.cor	50.03	1,000	50.03	88.564	27.60	120.00	8.1	ran out of rods, having more shipped in.
23-Mar-04	CPT-10	717cp010.cor	47.41	400	31.66	19.980	2.70	79.07	35.8	
23-Mar-04	CPT-8	717cp008.cor	71.69	475	52.00	229.583	10.02	76.82	3.1	
23-Mar-04	CPT-1A	717cp01a.cor	95.14	1,625	32.32	118.641	28.22	58.75	6.0	redue of CPT-1
					51.35	81.812	28.22	100.24	8.8	
					52.00	96.486	28.22	110.28	7.4	
					68.41	255.305	28.22	58.61	2.8	
					71.69	193.953	28.22	92.12	3.7	
					81.36	119.160	28.22	185.18	82.3	
23-Mar-04	CPT-6	717cp006.cor	87.93	490	48.39	42.706	36.85	110.05	16.8	
					64.80	218.692	36.85	110.33	3.3	
					71.36	174.721	36.85	182.18	4.1	
					74.64	175.375	36.85	172.93	4.1	
					77.92	153.321	36.85	175.75	4.7	
24-Mar-04	CPT-4	717cp004.cor	95.14	2,304	61.84	86.870	25.35	89.26	8.2	
					65.12	121.524	25.35	104.18	5.9	
					71.69	246.170	25.35	63.92	2.9	
					74.97	214.634	25.35	106.81	3.3	
					78.25	172.003	25.35	153.18	4.2	
					80.38	2.974	25.35	217.80	240.8	
24-Mar-04	CPT-11	717cp011.cor	63.98	0			23.42			
24-Mar-04	CPT-9	717cp009.cor	49.38	145	22.47	226.680	6.74	55.24	3.2	
					25.75	114.745	6.74	116.15	6.2	
					29.04	210.577	6.74	90.10	3.4	
24-Mar-04	CPT-12A	717cp12a.cor	61.52	200			20.28			2nd attempt - 1st attempt refusal at 2.6 feet
24-Mar-04	DIKE N	717cp00n.cor	69.06	145	35.43	166.052	11.04	55.24	4.3	
24-Mar-04	DIKE S	717cp00s.cor	67.09	605	35.43	165.432	9.40	58.71	4.3	
					38.71	97.874	9.40	85.55	7.3	
					67.09	8.412	9.40	67.01	85.1	
Totals:		11	758.4	7,389						

FR DRAIN STUDY	ΦI STUDY -MODELING	28FEB	24 FEB / TDEC
PROJ REVIEW MTG		28 FEB	
10% REVIEW	ΦII DESIGN	10 MAR	
50% DCN REVIEW		15 APR	
SWPPP TO TDEC		15 APR	22 APRIL TDEC
100% DCN REVIEW		12 MAY	
ISSUE DCN		01 JUN	
START CONST	ΦIII	01 JUN	
RTO - DREDGE CELL		30SEP	

FR DRAIN STUDY	ΦI STUDY - MODELING	28FEB	24 FEB/TDEC
PROJ REVIEW MTG		28 FEB	
10% REVIEW	ΦII DESIGN	10 MAR	
50% DCN REVIEW		15 APR	
SWPPP TO TDEC		15 APR	22 APR TDEC
100% DCN REVIEW		12 MAY	
ISSUE DCN		01 JUN	
START CONST	ΦIII	01 JUN	
RTO - DREDGE CELL		30 SEP	

KIF Dredge Cell Dike
Summary of Slug/Pump Test Results

Slug Test Results Assuming Bedrock as Lower Aquifer Boundary (Original)

	Screen Interval (ft)			K (cm/s)			
Well	from	to	Media	BR	CBP	Hvorslev	Mean
MW-1	9.6	19.6	ash	1.7E-05	2.4E-05	2.5E-05	2.2E-05
MW-3A	29.6	39.6	ash	3.5E-05	2.4E-05	5.3E-05	3.7E-05
MW-4A	4.0	9.0	FA	5.1E-06	5.0E-06	8.6E-06	6.2E-06
MW-4B	19.0	24.0	BA	1.2E-05	2.4E-06	1.6E-05	1.0E-05
MW-5A	42.5	47.5	FA	3.7E-05	1.3E-05	4.7E-05	3.2E-05
MW-6A	50.0	55.0	BA-FA	1.6E-04	7.3E-05	2.1E-04	1.5E-04
MW-7A	40.0	45.0	BA-FA	2.3E-05	8.5E-06	3.8E-05	2.3E-05
MW-7B	60.0	65.0	BA	1.5E-04	5.1E-05	2.0E-04	1.3E-04
MW-8A	20.0	25.0	BA-FA	6.0E-05	2.2E-05	8.8E-05	5.7E-05
MW-8B	35.0	40.0	FA	1.0E-05	1.0E-05	9.9E-06	1.0E-05
MW-9A	10.0	15.0	FA-fill	1.1E-06	2.9E-05	1.4E-06	1.0E-05
MW-9B	20.0	25.0	BA-FA	1.3E-03	3.2E-04	1.8E-03	1.1E-03

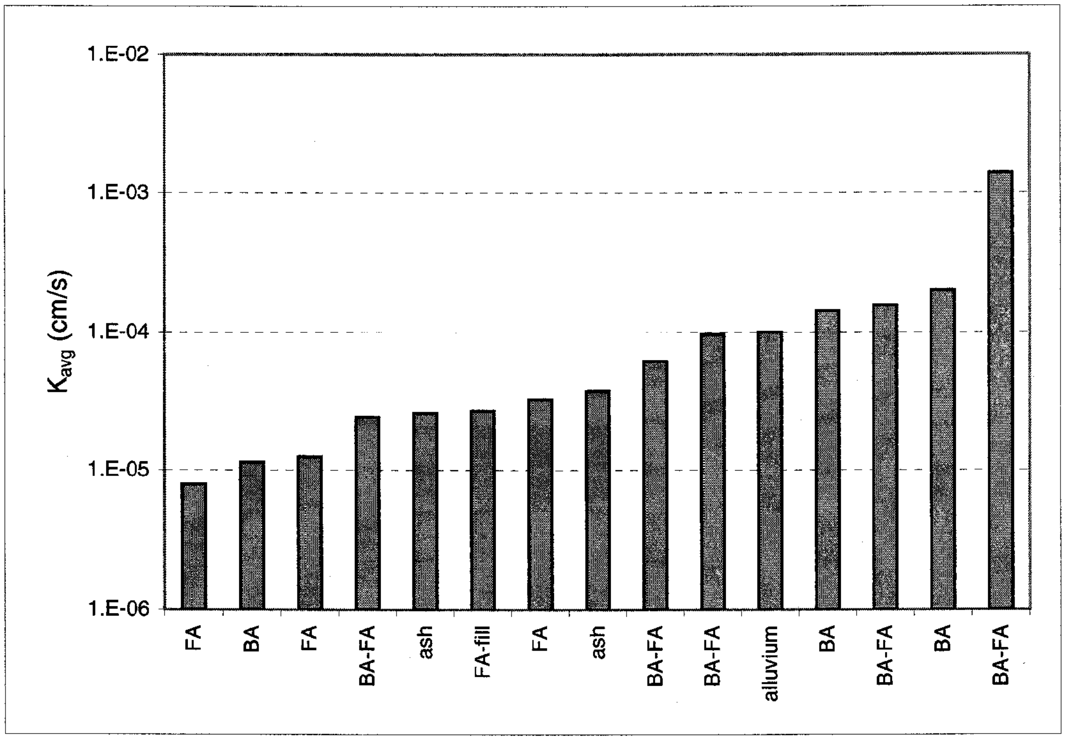
Slug Test Results Assuming Ash-Alluvium Interface as Lower Aquifer Boundary (New)

	Screen Interval (ft)			K (cm/s)				Diff. in
Well	from	to	Media	BR	CBP	Hvorslev	Mean	Means
MW-1	9.6	19.6	ash	1.7E-05	3.5E-05	2.5E-05	2.6E-05	17%
MW-3A	29.6	39.6	ash	3.5E-05	2.4E-05	5.3E-05	3.7E-05	0%
MW-4A	4.0	9.0	FA	5.2E-06	9.9E-06	8.6E-06	7.9E-06	27%
MW-4B	19.0	24.0	BA	1.3E-05	5.3E-06	1.6E-05	1.1E-05	11%
MW-5A	42.5	47.5	FA	3.7E-05	1.3E-05	4.7E-05	3.2E-05	1%
MW-6A	50.0	55.0	BA-FA	1.6E-04	9.9E-05	2.1E-04	1.6E-04	6%
MW-7A	40.0	45.0	BA-FA	2.3E-05	1.2E-05	3.8E-05	2.4E-05	5%
MW-7B	60.0	65.0	BA	1.6E-04	7.2E-05	2.0E-04	1.4E-04	6%
MW-8A	20.0	25.0	BA-FA	6.1E-05	3.6E-05	8.8E-05	6.2E-05	9%
MW-8B	35.0	40.0	FA	1.0E-05	1.7E-05	9.9E-06	1.2E-05	24%
MW-9A	10.0	15.0	FA-fill	1.2E-06	7.8E-05	1.4E-06	2.7E-05	159%
MW-9B	20.0	25.0	BA-FA	1.5E-03	9.4E-04	1.8E-03	1.4E-03	22%

Pump Test Results Assuming Ash-Alluvium Interface as Lower Aquifer Boundary

	Screen Interval (ft)			K (cm/s)		
Well	from	to	Media	CJ	Theis	Mean
MW-3B	29.6	39.6	alluvium	1.3E-04	7.2E-05	1.0E-04
MW-5B	4.0	9.0	BA	3.5E-04	5.4E-05	2.0E-04
MW-6B	19.0	24.0	BA-FA	1.7E-04	1.8E-05	9.6E-05

Correlation of Kavg and Media Type



Well	Screen Interval (ft)		Media	K_{avg} (cm/s)
	from	to		
MW-4A	4.0	9.0	FA	7.9E-06
MW-4B	19.0	24.0	BA	1.1E-05
MW-8B	35.0	40.0	FA	1.2E-05
MW-7A	40.0	45.0	BA-FA	2.4E-05
MW-1	9.6	19.6	ash	2.6E-05
MW-9A	10.0	15.0	FA-fill	2.7E-05
MW-5A	42.5	47.5	FA	3.2E-05
MW-3A	29.6	39.6	ash	3.7E-05
MW-8A	20.0	25.0	BA-FA	6.2E-05
MW-6B	70.0	75.0	BA-FA	9.6E-05
MW-3B	95.0	100.0	alluvium	1.0E-04
MW-7B	60.0	65.0	BA	1.4E-04
MW-6A	50.0	55.0	BA-FA	1.6E-04
MW-5B	62.5	67.5	BA	2.0E-04
MW-9B	20.0	25.0	BA-FA	1.4E-03

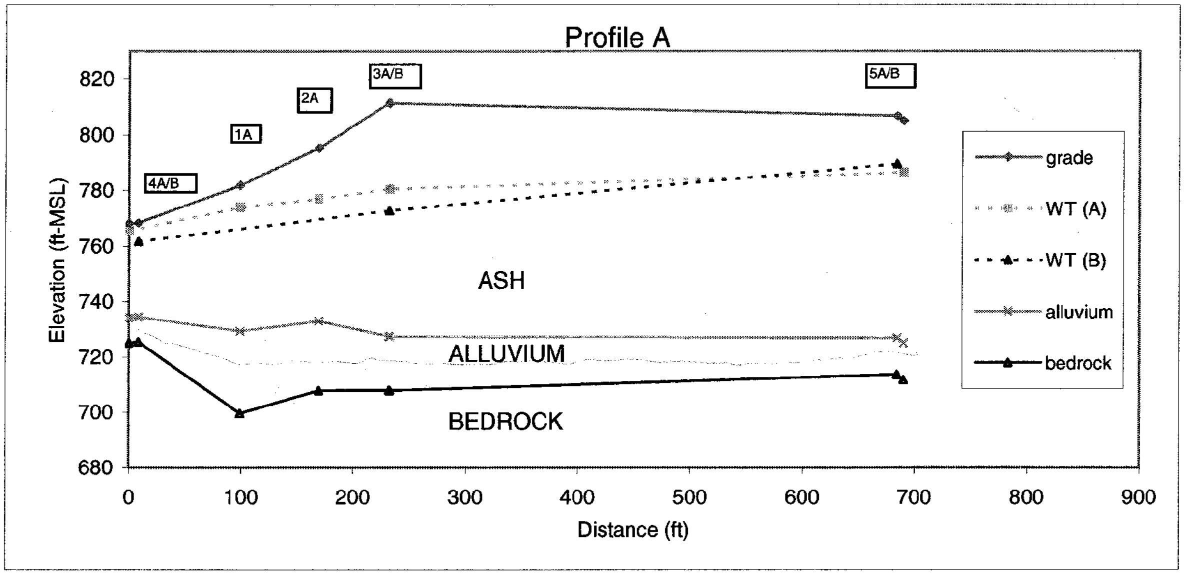
FA - fly ash
BA - bottom ash

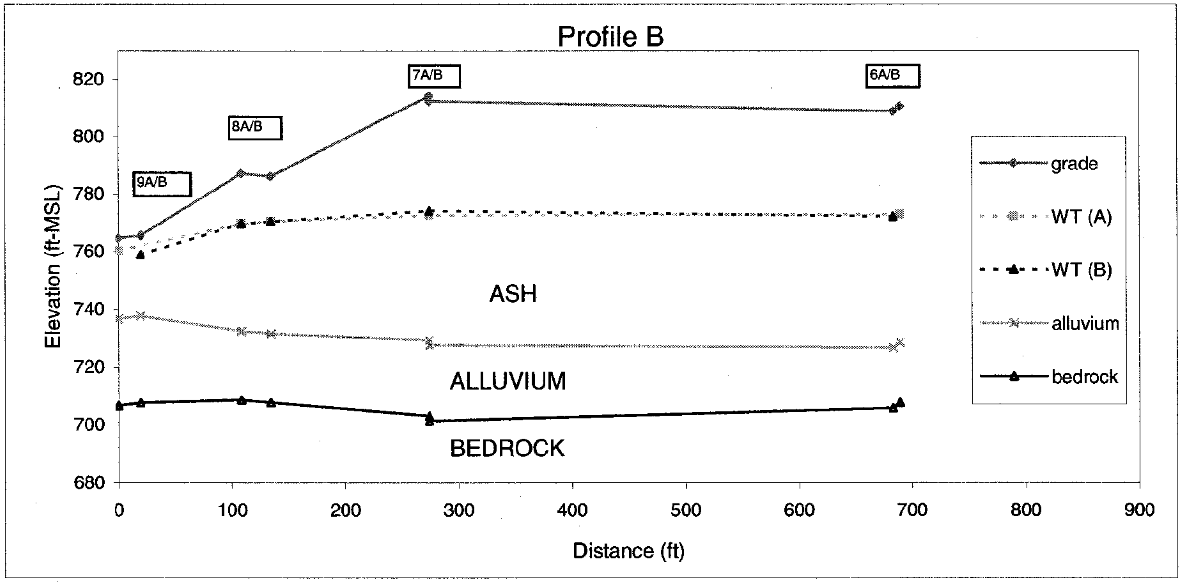
KIF Dredge Cell - Piezometer Information Summary

Well	TOC Elevation (ft-msl)	Grade Elevation (ft-msl)	Stick-up (ft)	TVA Measured Well Depth BTOC(ft)	TVA Measured Well Depth BGS (ft)	MACTEC Reported Well Depth BGS (ft)	Estimated sediment fill up in screen (ft)	TOS depth (ft)	BOS depth (ft)	WT depth BTOC (ft)	WT depth BGS (ft)	1/21/05 WT Elevation (ft-msl)	Depth BGS to alluvium (ft)	Depth BGS to bedrock (ft)	WT to BOS (ft)	Saturated thickness - WT to top alluvium (ft)	Saturated thickness - WT to bedrock (ft)
MW-1	781.87	781.6	0.3	18.3	18.0	20.2	1.6	9.6	19.6	7.8	7.5	774.1	52.5	82.2	12.1	45.0	74.7
MW-2	795.50	795.0	0.5	24.9	24.4	35.2	10.2	24.6	34.6	18.4	17.9	777.1	62.5	87.5	16.7	44.6	69.6
MW-3A	811.45	811.1	0.4	38.1	37.7	40.2	1.9	29.6	39.6	30.9	30.5	780.6	84.0	103.5	9.1	53.5	73.0
MW-3B	811.56	810.7	0.9	103.0	102.1	100.6	-2.1	95.0	100.0	38.7	37.8	772.9	84.0	103.5	62.2	NA	65.7
MW-4A	768.21	766.8	1.4	9.3	7.9	9.6	1.1	4.0	9.0	2.7	1.3	765.6	34.0	43.0	7.8	32.8	41.8
MW-4B	768.49	766.6	1.9	23.7	21.8	24.6	2.2	19.0	24.0	6.7	4.8	761.8	34.0	43.0	19.2	29.2	38.2
MW-5A	805.08	804.1	1.0	51.0	50.0	48.1	-2.5	42.5	47.5	18.6	17.6	786.5	80.0	93.2	29.9	62.4	75.6
MW-5B	806.92	804.4	2.5	69.6	67.1	68.1	0.4	62.5	67.5	17.3	14.8	789.7	80.0	93.2	52.8	65.3	78.5
MW-6A	810.76	808.3	2.5	57.5	55.0	55.6	0.0	50.0	55.0	37.7	35.2	773.0	82.2	103.0	19.8	47.0	67.8
MW-6B	808.89	807.9	1.0	76.0	75.0	75.6	0.0	70.0	75.0	36.6	35.6	772.3	82.2	103.0	39.4	46.6	67.4
MW-7A	814.30	811.7	2.6	47.5	44.9	45.6	0.1	40.0	45.0	40.0	37.4	774.3	85.0	111.2	7.6	47.6	73.8
MW-7B	812.56	811.9	0.7	65.7	65.0	65.6	0.0	60.0	65.0	40.0	39.3	772.6	85.0	111.2	25.7	45.7	71.9
MW-8A	786.26	784.8	1.5	25.1	23.6	25.6	1.4	20.0	25.0	15.7	14.2	770.6	54.7	78.5	10.8	40.5	64.3
MW-8B	787.19	785.7	1.5	43.4	41.9	40.6	-1.9	35.0	40.0	17.4	15.9	769.8	54.7	78.5	24.1	38.8	62.6
MW-9A	764.70	764.7	0.0	15.1	15.1	15.6	-0.1	10.0	15.0	4.2	4.2	760.5	28.0	58.0	10.8	23.8	53.8
MW-9B	765.68	765.1	0.6	25.1	24.5	25.6	0.5	20.0	25.0	6.6	6.0	759.1	28.0	58.0	19.0	22.0	52.0

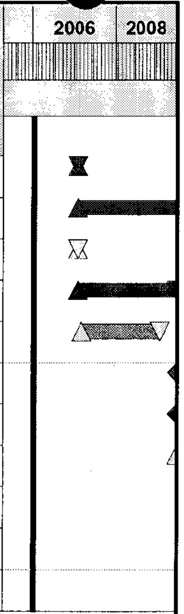
Abbreviations:

TOC - top of casing
BTOC - below top of casing
BGS - below ground surface
TOS - top of screen
BOS - bottom of screen
WT - water table


Profile A


Profile B

P S T A	S E C	Activity ID	Activity Description	Forecast Start	Forecast Finish	Finish Target	Total Float	Resp Engr	Prin Engr	RE	Res ID	Bdgt Mhrs	Frcst Mhrs	Actual Mhrs
Implementation (Phase 3)														
D	30	LDKCK530PA	KIF530 Receive Phase 3 FPEP Approval	06FEB06	06FEB06		0	SMH	HLP	RDP		0.00	0.00	0.00
D	30	LDKCK530PS	KIF530 Phase 3 - Project Support Mhrs (Hammock)	06FEB06	12OCT08		0	SMH	HLP	RDP	TS2PC,	260.00	260.00	0.00
D	35	LDKCK530X1	KIF530 Issue Partner PA	14FEB06	14FEB06		148		HLP	RDP		0.00	0.00	0.00
D	99	LDKCK530NS	KIF530 Implementation Field Support	14FEB06	29JUN08		0		HLP	RDP	FDCE	300.00	300.00	0.00
D	35	LDKCK530PO	Implementation And Construction Period	15MAR06	02FEB08		148		HLP	RDP		0.00	0.00	0.00
D	35	LDKCK530NO	KIF530 DCN KIF-0X-XXX RTO		29JUN08		9		HLP	RDP		0.00	0.00	0.00
D	35	LDKCK530PT	KIF530 Project Turnover		29JUN08		0		HLP	RDP		0.00	0.00	0.00
D	35	LDKCK530ND	KIF530 Closure Process of DCN KIF-0X-XXX	01JUL08	21SEP08		9		HLP	RDP	FDCE	0.00	0.00	0.00
D	T2	LDKCK530RU	ERU ASSEMBLE AND DISTRIBUTE KIF-0X-XXX	22SEP08	23SEP08		7	DLL	DLL	RDP	TS2RU	24.00	24.00	0.00
D	35	LDKCK530NC	KIF530 DCN KIF-0X-XXX Closed		23SEP08		9		HLP	RDP		0.00	0.00	0.00
D	30	LDKCK530PC	KIF530 Verify Benefits & Close Project		12OCT08		0	SMH	HLP	RDP		0.00	0.00	0.00



FR DRAW Civil Supt 01Jun05 30SEP05 150

Prepare PRAW RTO 30SEP05

Close DCN XY FRDR 15DEC05

Start Date	01JAN89	▨ Early Bar	FHEM
Finish Date	02AUG13	■ Progress Bar	Sheet 142 of 172
Data Date	16JAN05	■ Critical Activity	TENNESSEE VALLEY AUTHORITY
Run Date	14JAN05 15:40		Layout 70

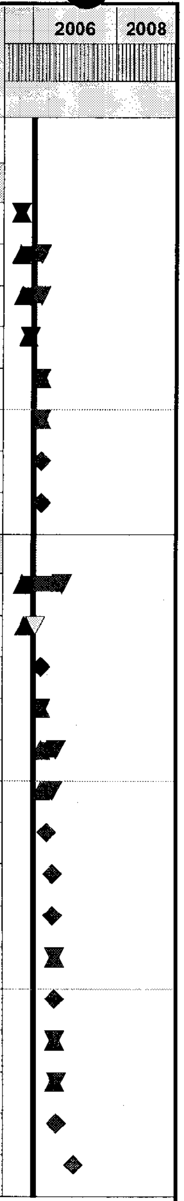
KIF530 DEVELOP FLY ASH/BOTTOM ASH CAPACITY

Preliminary Engg (Phase 1)

PSTA	SEC	Activity ID	Activity Description	Forecast Start	Forecast Finish	Finish Target	Total Float	Resp Engr	Prin Engr	RE	Res ID	Bdgt Mhrs	Frcst Mhrs	Actual Mhrs
A	30	LDKAK530PA	KIF530 Phase 1 - Prelim Engr Approved	22SEP04A	01OCT04A			SMH	SMH	SMH		0.00	0.00	0.00
A	30	LDKAK530PS	KIF530 Ph 1 - Project Support Mhrs Hammock	22SEP04A	31MAR05		-55	SMH	SMH	SMH	FDPE,	260.00	120.00	80.00
A	35	LDKAK530X1	KIF530 Conduct Study (French Drains)	08OCT04A	28 FEB ~~30MAR05~~		-55	MSH	HLP	RDP	FDCEA	120.00	187.00	187.00
A	15	LDKAK530X4	KIF530 Estimators Prep Total Pkg Est (Matrix)	08DEC04A	20DEC04A			CLT	JLH	RDP	TS2CE	40.00	94.00	94.00
A	30	LDKAK530X3	KIF530 Prepare Ph 2 FPEP Pkg (French Drain)	24MAR05*	31MAR05	?	-55	SMH	HLP	RDP		0.00	0.00	0.00
A	30	LDKAK530R0	KIF530 Prelim Engr Proj Review Mtg (French Drn)	23 FEB ~~30MAR05~~	23 FEB ~~20MAR05~~		-54	SMH	HLP	RDP		0.00	0.00	0.00
A	30	LDKAK530PC	Preliminary Engr Complete (French Drain)		28 FEB ~~31MAR05~~	04FEB05	-55	SMH	HLP	RDP		0.00	0.00	0.00
A	30	LDKAK530X5	KIF530 Submit Ph 2 Pkg for Appr'l (French Drain)		31MAR05		0	SMH	HLP	RDP		0.00	0.00	0.00

Final Engineering (Phase 2)

PSTA	SEC	Activity ID	Activity Description	Forecast Start	Forecast Finish	Finish Target	Total Float	Resp Engr	Prin Engr	RE	Res ID	Bdgt Mhrs	Frcst Mhrs	Actual Mhrs
A	35	LDKBK530A2	KIF530 Response To TDEC NODs	08OCT04A	01OCT05		0	MSH	HLP	RDP	FDCE	240.00	240.00	0.00
A	35	LDKBK530A1	KIF530 Develop Decision Matrix	01NOV04A	01FEB05		109	MSH	HLP	RDP	FDCE	80.00	80.00	0.00
A	35	LDKBK530DR	KIF530 10% DCN Design Review (FR Drain)		10 MAR ~~01APR05~~		0	MSH	HLP	RDP		0.00	0.00	0.00
A	30	LDKBK530PA	KIF530 Receive Phase 2 FPEP Approval (Fr Drain)	01~~APR~~05* MAR	01~~APR~~05 MAR		0	SMH	HLP	RDP		0.00	0.00	0.00
A	30	LDKBK530PS	KIF530 Ph 2 - Project Support Mhrs (Hammock)	01APR05	09AUG05		0	SMH	HLP	RDP	FDPE,	272.00	272.00	0.00
A	35	LDKBK530AP	KIF530 Prepare DCN KIF-0X-XXX	02APR05	11JUL05		0	MSH	HLP	RDP	FDCE	100.00	100.00	0.00
A	35	LDKBK530R5	KIF530 50% DCN Design Review		21MAY05		0	HLP	HLP	RDP		0.00	0.00	0.00
A	35	LDKBK530R9	KIF530 100% DCN Design Review		10JUL05		0		HLP	RDP		0.00	0.00	0.00
A	35	LDKBK530M4	KIF530 Award Contract For Long Lead Material		11JUL05		0		HLP	RDP		0.00	0.00	0.00
A	T2	LDKBK530RU	KIF530 ERU ASSEMBLE AND DISTRIBUTE KIF-0X-XXX	18JUL05	19JUL05		0	DLL	DLL	RDP	TS2RU	16.00	16.00	0.00
A	35	LDKBK530NN	KIF530 DCN KIF-0X-XXX Issued		19JUL05		0		HLP	RDP		0.00	0.00	0.00
A	15	LDKBK530X2	Review Const Estimate & Prepare Total Proj Estim	20JUL05	22JUL05		0	JLH	JLH	RDP	TS2CE	24.00	24.00	0.00
A	30	LDKBK530X3	KIF530 Prepare Ph 3 FPEP Pkg	30JUL05	08AUG05		0	SMH	HLP	RDP		0.00	0.00	0.00
A	30	LDKBK530PC	KIF530 Final Engineering Complete		09AUG05		0	SMH	HLP	RDP		0.00	0.00	0.00
A	35	LDKBK530M7	KIF530 LL Matl Delivery		07JAN06		184		HLP	RDP		0.00	0.00	0.00



50% FOR DRAW DES'N RVW 15 APR

Start Date	01JAN89
Finish Date	02AUG13
Data Date	16JAN05
Run Date	14JAN05 15:40

▨ Early Bar
■ Progress Bar
▨ Critical Activity

FHEM
Sheet 141 of 172
TENNESSEE VALLEY AUTHORITY
Layout 70

100% " " " "
ISSUE FOR DRAW DCN XXX 12 MAY 01 JUN 15 JUN

P STA	SEC	Activity ID	Activity Description	Forecast Start	Forecast Finish	Finish Target	Total Float	Resp Engr	Prin Engr	RE	Res ID	Bdgt Mhrs	Frcst Mhrs	Actual Mhrs
KIF531 REPLACE KENNEDY WEIR														
Preliminary Engg (Phase 1)														
A	35	GFKA153101	Replace Kennedy Weir - Parsons Oversite	25OCT04A	02FEB05		-1	MSH	HLP	HLP	FDCE,	40.00	49.00	9.00
A	30	GFKA1531PE	Phase 1 Project Engineer Support	25OCT04A	~~02FEB05~~ 11Feb05		0	SMH	SMH	HLP	FDPE	20.00	20.00	8.00
A	30	GFKA1531PA	FPEP Phase 1 Authorization	29OCT04A				SMH	SMH	HLP		0.00	0.00	0.00
A	11	GFKA1531PC	Phase 1 Project Controls Support	05NOV04A	02FEB05		0	HMS	DJG	HLP	TS2PC,	28.00	28.00	0.00
Final Engineering (Phase 2)														
D	35	GFKB1531PA	FPEP Phase ~~1~~ 2 Authorization 2/3	~~03MAR05~~ 11Feb05	~~03MAR05*~~ 11Feb05	03Mar05	-29	SMH	SMH	HLP		0.00	0.00	0.00
~~D~~	~~35~~	~~GFKB1531CE~~	~~Review Parsons Final Estimate~~	~~08APR05*~~	~~10APR05~~		~~-22~~	~~BLR~~	~~JLH~~	~~HLP~~	~~TS2CE~~	~~24.00~~	~~24.00~~	~~0.00~~
D	~~35~~ 11	GFKB1531PC	Phase 2 Project Controls Support	04MAY05* 11Feb05	29JUL05 31Mar05		-88	JAM	DJG	HLP	TS2PC,	40.00	40.00	0.00
D	~~35~~ 30	GFKB1531PE	Phase 2 Project Engineer Support	04MAY05* 11Feb05	29JUL05 31Mar05		-88	HLP	HLP	HLP	FDPE	40.00	40.00	0.00
D	35	GFKB153101	Replace Kennedy Weir - Parsons Oversite	04MAY05* 11Feb05	31JUL05 31Mar05		-90	HLP	HLP	HLP	FDCE	100.00	~~100.00~~ 0	0.00
Implementation (Phase 3)														
D	35	GFKC1531PA	FPEP Phase 3 Authorization	31JUL05 ~~11Feb05~~	31JUL05*		-90	SMH	SMH	HLP		0.00	0.00	0.00
D	35	GFKC1531PC	Phase 3 Project Controls Support	31JUL05 14Feb05	26DEC05 31Mar05		0	JAM	DJG	HLP	TS2PC,	28.00	28.00	0.00
D	35	GFKC1531PE	Phase 3 Project Engineer Support	31JUL05 14Feb05	26DEC05 31Mar05		0	HLP	HLP	HLP	FDPE	20.00	20.00	0.00
D	35	GFKC153101	Replace Kennedy Weir - Phase ~~3~~ 2 Oversite 2/3	~~01AUG05~~ 14Feb05	~~29NOV05~~ 31Mar05		-90	HLP	HLP	HLP	FDCE	60.00	~~60.00~~ 120	0.00
D	35	GFKC1531PT	Project Turnover		~~26NOV05~~ 31Mar05	29Jul05	-90	HLP	HLP	HLP		0.00	0.00	0.00
D	35	GFKC1531VB	Verify Benefits & Close Project		~~26DEC05~~ 30Jun05	28Oct05	0	HLP	HLP	HLP		0.00	0.00	0.00

31Mar05

2006 2008

Start Date	01JAN89
Finish Date	02AUG13
Data Date	16JAN05
Run Date	14JAN05 15:40

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Early Bar
Progress Bar
Critical Activity

FHEM

Sheet 143 of 172

TENNESSEE VALLEY AUTHORITY

Layout 70

KIF Dredge Cell - Piezometer Information Summary

Well	TOC Elevation (ft-msl)	Grade Elevation (ft-msl)	Stick-up (ft)	TVA Measured Well Depth BTOC(ft)	TVA Measured Well Depth BGS (ft)	MACTEC Reported Well Depth BGS (ft)	Estimated sediment fill up in screen (ft)	TOS depth (ft)	BOS depth (ft)	WT depth BTOC (ft)	WT depth BGS (ft)	1/21/05 WT Elevation (ft-msl)	Depth BGS to alluvium (ft)	Depth BGS to Bedrock (ft)	WT to BOS (ft)	Saturated thickness - WT to top alluvium (ft)	Saturated thickness - WT to bedrock (ft)
MW-1	781.87	781.6	0.3	18.3	18.0	20.2	1.6	9.6	19.6	7.8	7.5	774.1	52.5	82.2	12.1	45.0	74.7
MW-2	795.50	795.0	0.5	24.9	24.4	35.2	-10.2	24.6	34.6	18.4	17.9	777.1	62.5	87.5	16.7	44.6	42.9
MW-3A	811.45	811.1	0.4	38.1	37.7	40.2	1.9	29.6	39.6	30.9	30.5	780.6	84.0	103.5	9.1	53.5	73.0
MW-3B	811.56	810.7	0.9	103.0	102.1	100.6	-2.1	95.0	100.0	38.7	37.8	772.9	84.0	103.5	62.2	NA	65.7
MW-4A	768.21	766.8	1.4	9.3	7.9	9.6	1.1	4.0	9.0	2.7	1.3	765.6	34.0	43.0	7.8	32.8	41.8
MW-4B	768.49	766.6	1.9	23.7	21.8	24.6	2.2	19.0	24.0	6.7	4.8	761.8	34.0	43.0	19.2	29.2	38.2
MW-5A	805.08	804.1	1.0	51.0	50.0	48.1	-2.5	42.5	47.5	18.6	17.6	786.5	80.0	93.2	29.9	62.4	75.6
MW-5B	806.92	804.4	2.5	69.6	67.1	68.1	0.4	62.5	67.5	17.3	14.8	789.7	80.0	93.2	52.8	65.3	78.5
MW-6A	810.76	808.3	2.5	57.5	55.0	55.6	0.0	50.0	55.0	37.7	35.2	773.0	82.2	103.0	19.8	47.0	67.8
MW-6B	808.89	807.9	1.0	76.0	75.0	75.6	0.0	70.0	75.0	36.6	35.6	772.3	82.2	103.0	39.4	46.6	67.4
MW-7A	814.30	811.7	2.6	47.5	44.9	45.6	0.1	40.0	45.0	40.0	37.4	774.3	85.0	111.2	7.6	47.6	73.8
MW-7B	812.56	811.9	0.7	65.7	65.0	65.6	0.0	60.0	65.0	40.0	39.3	772.6	85.0	111.2	25.7	45.7	71.9
MW-8A	786.26	784.8	1.5	25.1	23.6	25.6	1.4	20.0	25.0	15.7	14.2	770.6	54.7	78.5	10.8	40.5	64.3
MW-8B	787.19	785.7	1.5	43.4	41.9	40.6	-1.9	35.0	40.0	17.4	15.9	769.8	54.7	78.5	24.1	38.8	62.6
MW-9A	764.70	764.7	0.0	15.1	15.1	15.6	-0.1	10.0	15.0	4.2	4.2	760.5	28.0	58.0	10.8	23.8	53.8
MW-9B	765.68	765.1	0.6	25.1	24.5	25.6	0.5	20.0	25.0	6.6	6.0	759.1	28.0	58.0	19.0	22.0	52.0

Abbreviations:
TOC - top of casing
BTOC - below top of casing
BGS - below ground surface
TOS - top of screen
BOS - bottom of screen
WT - water table

Petty, Harold L.

From: Petty, Harold L.
Sent: Thursday, January 06, 2005 11:53 AM
To: GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES
Subject: RE: Questions on Kingston Operations

Yes we got it.

Thanks,
Lynn

-----Original Message-----
From: GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES
Sent: Thursday, January 06, 2005 11:33 AM
To: Petty, Harold L.
Subject: RE: Questions on Kingston Operations

Lynn:
Thank you very much – these are very comprehensive answers and help a lot. We have a SEEP model up and running, but are adding additional layers and refinements based on the boring logs and this information.

On a separate note, I did send back a revised outline of the seepage class to Ron yesterday right after our call. Would you mind asking if he got it. I will email it again to you (separate email) to see if we can get it through electronically.

Thanks
Neil

From: Petty, Harold L. [mailto:hlpetty@tva.gov]
Sent: Thursday, January 06, 2005 11:22 AM
To: Neil Davies
Cc: McNulty, Greg; Robert Bachus; Tamer Elkady; Smith, Daniel R.; Purkey, Ronald E.
Subject: Questions on Kingston Operations

Greetings Neil:

To facilitate answering your questions I have copied your previous e-mail and added my answers in ***Bold blue Italics***:

Lynn:

I hope this email finds you fine. We have some questions that would be helpful in effectively constructing and, later on, calibrating the model to be used for the seepage analysis within the Dredge cell. These questions are as follows:

During operations in the Dredge cell, was water allowed to pond freely on top of the Fly ash?. If yes, what is typically the height of the ponding water?. Does ponding extend to the outer dike or is it confined in a mid area within the dredge cell?. ***Water ponds freely to the outer dike (no inner dikes) of each cell. The height of the water above the deposited ash is managed by use of the boards in the outlet structure. Viewed in section from the outlet structure to the dredge discharge point the water is a***

triangle above the ash; approximately three foot deep at the outlet structure to zero feet deep at the discharge point from the dredge line. As ash is dredged into the cell, the bottom of the cell rises with the deposited ash and boards are added periodically to raise the water elevation.

Are the outer dikes constructed around the perimeter of the dredge cells considered a zone of high permeability?. Review of recent design drawings indicate that the outer dikes are supplemented with underdrains most probably to facilitate the drainage of water accumulated behind the dike. Furthermore, previous site investigations have revealed that the hydraulic conductivity is in the 10-6 range. Given all that, it can be inferred that the outer dikes act as a containment dike rather than a zone of high permeability when compared to the disposed fly ash. ***Not exactly.....The underdrains were added to assist the slip circle analysis that was being done. The underdrains were added to lower the phreatic surface in the model for global stability. Also remember that there were no underdrains in the bottom two lifts of the dredge cell for cells I, and III. The outer dikes were constructed by placing alternating layers of bottom and fly ash. The intent during construction was to "blade back" the two layers as they were placed, to obtain a uniform mixture. The CPT data (not from the dissipation tests, but the "relative test results) indicate that there is layering (stratification) of bottom and fly ash, that could create zones of higher hydraulic conductivity within the outer dike itself, as discussed in our meeting.***

In addition, in anticipation for the upcoming seepage workshop, we would like to know what version of SEEP/W does TVA have? as well as if TVA has another program named SLIDE?. In addition, what drafting program does TVA use; AutoCAD or Microstation? ***The version of Seep/w TVA has in hand is 5.12. For drafting we use AutoCAD 2004. We do not have SLIDE. We do have PCSTABL5M, UTEXAS3.***

Thanks,
Lynn

Petty, Harold L.

From: GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES
Sent: Tuesday, January 04, 2005 12:57 PM
To: Petty, Harold L.
Cc: RBachus@GeoSyntec.com; TElkady@GeoSyntec.com
Subject: Questions on Kingston Operations

Follow Up Flag: Follow up
Flag Status: Flagged

Lynn:

I hope this email finds you fine. We have some questions that would be helpful in effectively constructing and, later on, calibrating the model to be used for the seepage analysis within the Dredge cell. These questions are as follows:

During operations in the Dredge cell, was water allowed to pond freely on top of the Fly ash?. If yes, what is typically the height of the ponding water?. Does ponding extend to the outer dike or is it confined in a mid area within the dredge cell?.

Are the outer dikes constructed around the perimeter of the dredge cells considered a zone of high permeability?. Review of recent design drawings indicate that the outer dikes are supplemented with underdrains most probabaly to facilitate the drainage of water accumulated behind the dike. Furthermore, previous site investigations have revealed that the hydraulic conductivity is in the 10-6 range. Given all that, it can be inferred that the outer dikes act as a containment dike rather than a zone of high permeability when compared to the disposed fly ash.

In addition, in anticipation for the upcoming seepage workshop, we would like to know what version of SEEP/W does TVA have? as well as if TVA has another program named SLIDE?. In addition, what drafting program does TVA use; Autocad or Microstation?

We would like to discuss these questions with you during our conference call today @ 1:00 pm.

CONETEC

ConeTec Inc.

Geotechnical and Environmental Site Investigation Contractors

436 Commerce Lane, Unit C, West Berlin, NJ, 08091 • Tel: 856-767-8600 • Fax: 856-767-4008
800-504-1116 • E-mail newjersey@conetec.com • Website www.conetec.com

FAX COVER SHEET

To: ~~B.~~ Len Petty
Company: TVA
Phone:
Fax: 423-751-7094
From: Bruce Miller
Pages: (including cover) 13
Date: 12/8/04
Subject: Consolidation + Permeability Ref.

MESSAGE:

Per our conversation, please find reference literature on above attached. Rick Pope has e-mailed you the revised Table 1

Short course - 1st 4 pages abbreviated

EF SPAIN -
~~Moon &~~
Lunne Robertson & Powell
C P Test in Geotech Practice

Geotechnical Parameters

Hydraulic conductivity (k)

An approximate estimate of soil hydraulic conductivity or coefficient of permeability, *k*, can be made form an estimate of soil behaviour type using the CPT classification charts. Table 4 provides estimates based on the non-normalized chart shown in Figure 2 (Robertson et al., 1986), while Table 5 provides estimates based on the normalized chart shown in Figure 3 (Robertson, 1990). These estimates are approximate at best, but can provide a guide to variations of possible permeability.

Table 4. Estimation of soil permeability (k) from the non-normalized CPT soil behaviour chart by Robertson et al. (1986) shown in Figure 2.

Zone	Soil Behaviour Type (SBT)	Range of permeability k (m/s)
1	Sensitive fine grained	$3x10^{-9}$ to $3x10^{-8}$
2	Organic soils	$1x10^{-8}$ to $1x10^{-6}$
3	Clay	$1x10^{-10}$ to $1x10^{-9}$
4	Silty clay to clay	$1x10^{-9}$ to $1x10^{-8}$
5	Clayey silt to silty clay	$1x10^{-8}$ to $1x10^{-7}$
6	Sandy silt to clayey silt	$1x10^{-7}$ to $1x10^{-6}$
7	Silty sand to sandy silt	$1x10^{-5}$ to $1x10^{-6}$
8	Sand to silty sand	$1x10^{-5}$ to $1x10^{-4}$
9	Sand	$1x10^{-4}$ to $1x10^{-3}$
10	Gravelly sand to dense sand	$1x10^{-3}$ to 1
11	Very still fine-grained soil	$1x10^{-9}$ to $1x10^{-7}$
12	Very stiff sand to clayey sand	$3x10^{-8}$ to $3x10^{-6}$

Baligh and Levadoux (1980) recommended that the horizontal coefficient of permeability can be estimated from the expression:

$$k_h = \left(\frac{\gamma_w}{2.3\,\sigma'_{vo}} \right) RR \ c_h$$

where *RR* is the re-compression ratio in the overconsolidated range. It represents the strain per log cycle of effective stress during recompression and can be determined from laboratory consolidation tests. Baligh and Levadoux recommended that *RR* should range from $0.5x10^{-2}$ to $2x10^{-2}$.

Table 5. Estimation of soil permeability (k) from the normalized CPT soil behaviour chart by Robertson (1990) shown in Figure 3.

Zone	Soil Behaviour Type (SBT)	Range of permeability k (m/s)
1	Sensitive fine grained	$3x10^{-9}$ to $3x10^{-8}$
2	Organic soils	$1x10^{-8}$ to $1x10^{-6}$
3	Clay	$1x10^{-10}$ to $1x10^{-9}$
4	Silt mixtures	$3x10^{-9}$ to $1x10^{-7}$
5	Sand mixtures	$1x10^{-7}$ to $1x10^{-5}$
6	Sands	$1x10^{-5}$ to $1x10^{-3}$
7	Gravelly sands to dense sands	$1x10^{-3}$ to 1
8	Very stiff sand to clayey sand	$1x10^{-8}$ to $1x10^{-6}$
9	Very stiff fine-grained soil	$1x10^{-9}$ to $1x10^{-7}$

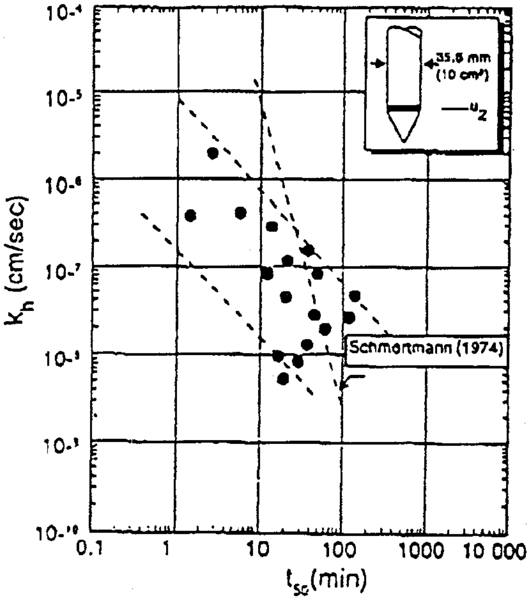


Figure 7. Summary of data for estimating horizontal coefficient of permeability from dissipation tests (after Robertson et al., 1992).

Robertson et al. (1992) presented a summary of available data to estimate the horizontal coefficient of permeability from dissipation tests. This summary is shown in Figure 7. Since the relationship is also a function of the recompression ration (RR) there is a wide variation of + or – one order of magnitude.

Jamiolkowski et al. (1985) suggested a range of possible values of k_h/k_v for soft clays.

Table 6. Range of possible field values of k_h/k_v for soft clays (after Jamiolkowski et al., 1985)

Nature of clay	k_h/k_v
No macrofabric, or only slightly developed macrofabric, essentially homogeneous deposits	1 to 1.5
From fairly well- to well-developed macrofabric, e.g. sedimentary clays with discontinuous lenses and layers of more permeable material	2 to 4
Varved clays and other deposits containing embedded and more or less continuous permeable layers	3 to 15

References

Baligh, M.M. and Levadoux, J.N. 1986. Consolidation after undrained piezocone penetration, II: Interpretation, J. of Geotech. Engineering, ASCE, 112(7): 727-745.

Jamiolkowski, M., Ladd, C.C., Germaine, J.T. and Lancellotta, R. 1985. New developments in field and laboratory testing of soils, State-of-the-art report, Proceedings of the 11th International Conference on Soil Mechanics and Foundation Engineering, San Francisco, 1, 57-153, Balkema.

Robertson, P.K. 1990. Soil classification using the cone penetration test. Canadian Geotechnical Journal, 27 (1): 151-8.

Robertson, P.K., Sully, J.P., Woeller, D.J., Lunne, T., Powell, J.J.M. and Gillespie, D.G. 1992. Estimating coefficient of consolidation from piezocone tests, Canadian Geotechnical J., 29(4): 551-557.

Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J. 1986. Use of piezometer cone data. Proceedings of the ASCE Specialty Conference In Situ '86: Use of In Situ Tests in Geotechnical Engineering, Blacksburg, 1263-80.

Geotechnical Parameters

Consolidation Characteristics

Flow and consolidation characteristics of a soil are normally expressed in terms of the coefficient of consolidation, *c*, and hydraulic conductivity, *k*. They are inter-linked through the formula:

$$c = \frac{k\,M}{\gamma_w}$$

where M is the constrained modulus relevant to the problem (i.e. unloading, reloading, virgin loading).

The parameters *c* and *k* vary over many orders of magnitude and are some of the most difficult parameters to measure in geotechnical engineering. It is often considered that an accuracy within one order of magnitude is acceptable. Due to soil anisotropy, both *c* and *k* have different values in the horizontal (c_h, k_h) and vertical (c_v, k_v) direction. The relevant design values depend on drainage and loading direction.

Details on how to estimate *k* from CPT soil classification charts are given in another section.

The coefficient of consolidation can be estimated by measuring the dissipation or rate of decay of pore pressure with time after a stop in CPT penetration. Many theoretical solutions have been developed for deriving the coefficient of consolidation from CPT pore pressure dissipation data. These are summarized by Lunne et al. (1997). Torstensson (1977) suggested that the coefficient of consolidation should be interpreted at 50% dissipation, using the following formula:

$$c = \left(\frac{T_{50}}{t_{50}}\right) r_o^{\,2}$$

where:

T_{50} = theoretical time factor

t_{50} = measured time for 50% dissipation = Pore Pressure Dissipat. (PPD)

r_o = penetrometer radius

It is clear from this formula that the dissipation time is inversely proportional to the radius of the probe. Hence, in soils of very low permeability, the time for dissipation can be decreased by using smaller probes.

Robertson et al. (1992) reviewed dissipation data from around the world and compared the results with the leading theoretical solution by Teh and Houlsby (1991), as shown in Figure 8.

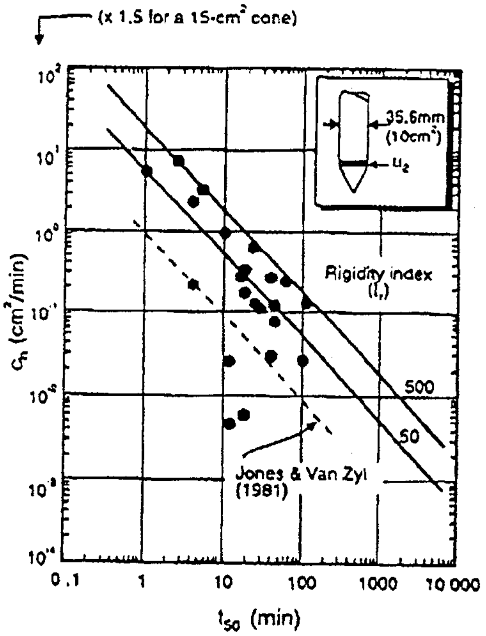


Figure 8. Average laboratory c_h values and CPTU results (after Robertson et al., 1992).

The review showed that the theoretical solution provided reasonable estimates of c_h. The solution shown in Figure 8 applies to pore pressure sensors located just behind the cone tip (i.e. u_2).

The ability to estimate c_h from CPT dissipation results is controlled by soil stress history, sensitivity, anisotropy, rigidity index (relative stiffness), fabric and structure. In overconsolidated soils, the pore pressure behind the cone tip can be low or negative, resulting in dissipation data that can initially rise before a decay to the equilibrium value. In these cases, the pore pressure sensor can be moved to the face of the cone or the t_{50} time can be estimated using the maximum pore pressure as the initial value. Care is required to ensure that the dissipation is continued to the correct equilibrium and not stopped prematurely after the initial rise.

Based on available experience, the CPT dissipation method should provide estimates of c_h to within + or – half an order of magnitude. However, the technique is repeatable and provides an accurate measure of changes in consolidation characteristics within a given soil profile.

An approximate estimate of the coefficient of consolidation in the vertical direction can be obtained using the ratios of permeability in the horizontal and vertical direction given in the section on hydraulic conductivity, since:

$$c_v = c_h \left(\frac{k_v}{k_h} \right)$$

References

Lunne, T., Robertson, P.K., and Powell, J.J.M 1997. Cone penetration testing in geotechnical practice, E & FN Spon Routledge, 352 p, ISBN 0-7514-0393-8.

Robertson, P.K., Sully, J.P., Woeller, D.J., Lunne, T., Powell, J.J.M. and Gillespie, D.G. 1992. Estimating coefficient of consolidation from piezocone tests, Canadian Geotechnical J., 29(4): 551-557.

Torstensson, B.A. 1977. The pore pressure probe, Norsk jord- og fjellteknisk forbund. Fjellsprengningsteknikk – bergmekanikk – geoteknikk, Oslo, Foredrag, 34.1-34.15, Trondheim, Norway, Tapir.

Teh, C.I. and Houlsby, G.T. 1991. An analytical study of the cone penetration test in clay, Geotechnique, 41(1): 17-34.

stress history (OCR). Then, using Figure 5.35, estimate E_u for the relevant shear stress level appropriate to the particular problem. A knowledge of the plasticity index (I_P) would significantly improve the estimate.

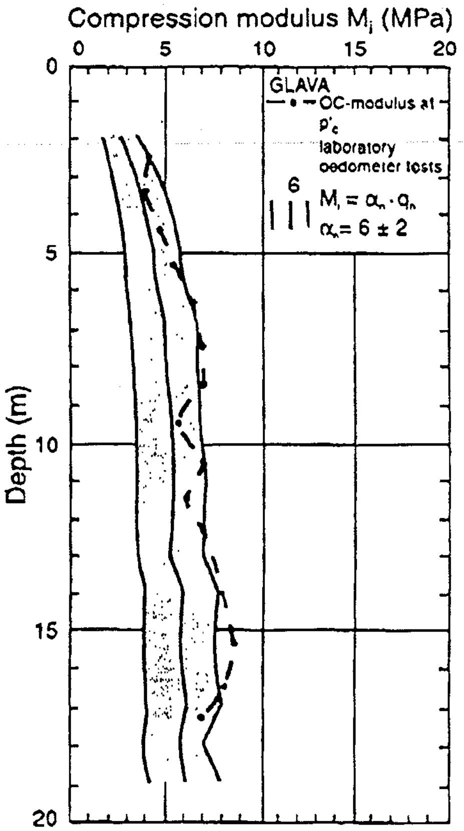


Figure 5.33 Compression modulus M_n for Glava clay (from Senneset *et al.*, 1989).

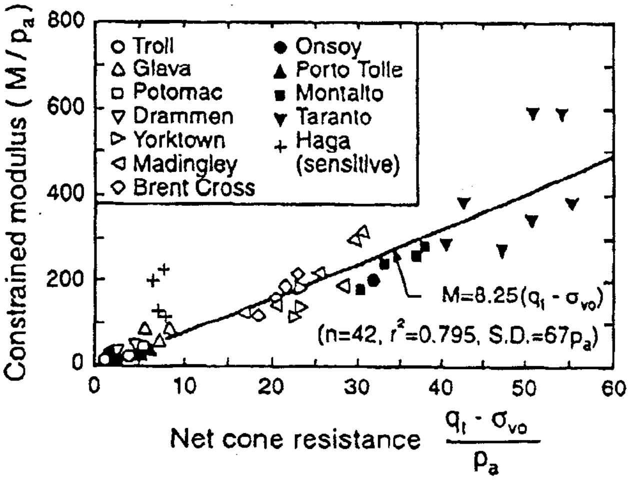


Figure 5.34 General relationship between constrained modulus and net cone resistance (from Kulhawy and Mayne, 1990).

5.4.3.3 Small strain shear modulus

The shear modulus is largest at very low strains and decreases with increasing shear strain. It has generally been found that the initial maximum shear modulus is constant for shear strains less than about 10^{-3}%. This initial, small strain modulus is often denoted G_o.

Mayne and Rix (1993) showed that the small strain shear modulus varied with void ratio (e) and cone penetration resistance (q_t) for a wide range of clays and can be expressed as:

$$G_o = 99.5\,(p_a)^{0.305}\,\frac{(q_t)^{0.695}}{(e_o)^{1.130}} \qquad (5.30)$$

where:

p_a = atmospheric reference stress in the same units as G_o and q_t.

The strong dependence of G_o upon void ratio (e) requires that CPT q_c is only successful as a profiler of G_o if comparison profiles of e_o are known. This is not usually the case. However, elastic theory relates the maximum shear modulus, G_o, to soil density, ρ, and shear wave velocity, V_s, as follows:

$$G_o = \rho \cdot V_s^2 \qquad (5.31)$$

where:

ρ = mass density of the soil $= \gamma/g$

and this supports the recommendation of making direct measurements of *in situ* shear wave velocity using the seismic CPT (see section 7.4).

Based on these observations, Robertson *et al.* (1995) suggested a chart to identify soil type using seismic CPT data, as shown in Figure 5.10. This chart can also be used to estimate G_o based on an estimate of soil type from the basic CPT soil classification charts.

However, care must always be taken when using any of these charts or correlations as it should be remembered that G_o is not independent of the direction of shear (Powell and Butcher, 1991). Butcher and Powell (1995a) showed that the shear wave velocity in clays, and therefore the G_o value deduced, was dependent on the stresses in the directions of propagation and polarization of the shear waves and can vary by up to 300% in heavily overconsolidated clays.

5.4.4 Flow and consolidation characteristics

Flow and consolidation characteristics of soil are normally expressed in terms of the coefficient of consolidation, c, and hydraulic conductivity or permeability, k. They are interlinked through the formula:

$$c = k \cdot \frac{M}{\gamma_w} \qquad (5.32)$$

where M is the constrained modulus relevant to the problem modelled (that is, unloading, reloading, virgin loading).

The parameters c and k vary over many orders of magnitude and are some of the most difficult parameters to measure in geotechnical engineering. It is often considered that an accuracy within one order of magnitude is acceptable. Nevertheless, c and k are parameters that are often essential input in some geotechnical calculations.

Due to soil anisotropy both c and k have different values in the horizontal (c_h, k_h) and vertical (c_v, k_v) direction. The relevant design values depend on drainage and loading direction.

5.4.4.1 Coefficient of consolidation

Rate of consolidation parameters may be assessed from the piezocone test by measuring the dissipation or decay of pore pressure with time after a stop in penetration.

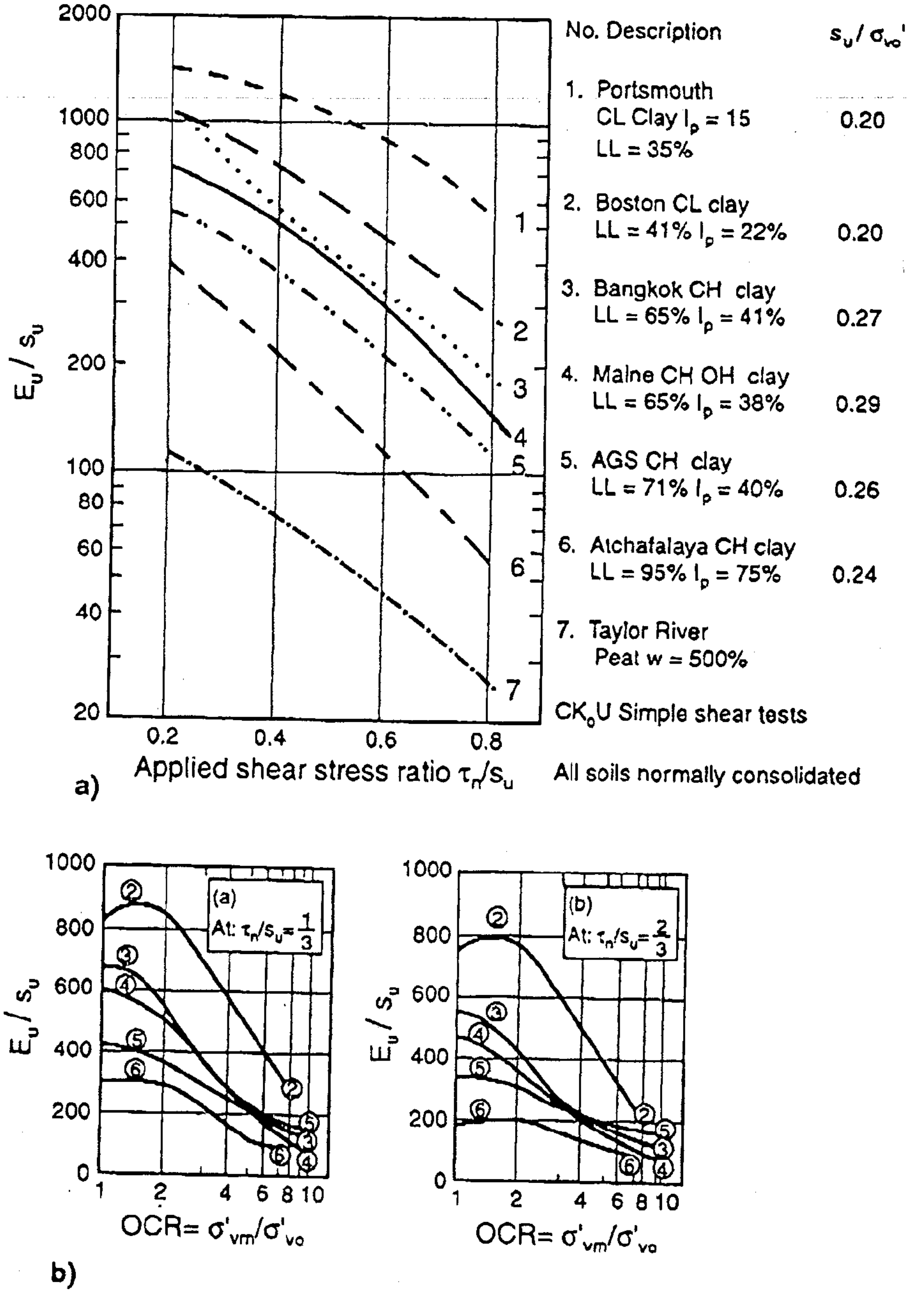


Figure 5.35 Stiffness ratio, E/s_u, as function of I_p (adapted from Ladd *et al.*, 1977).

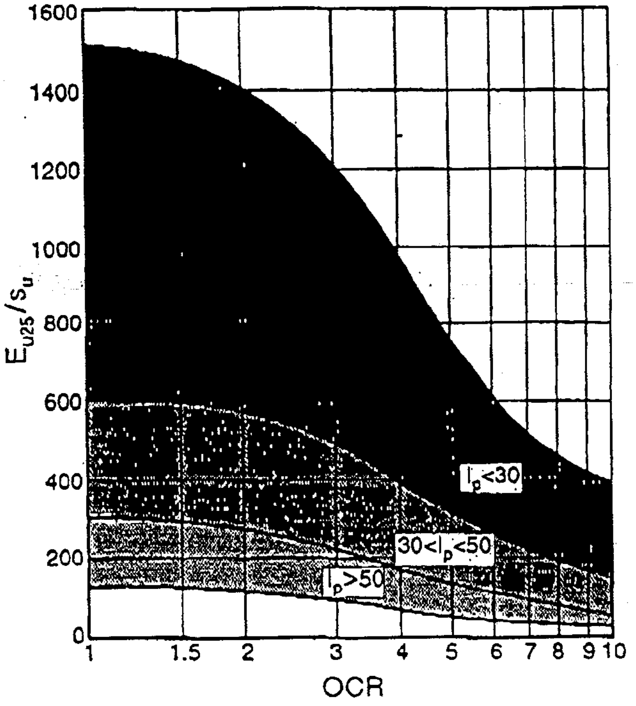


Figure 5.36 Stiffness ratio, E/s_u, as function of OCR (after Duncan and Buchignani, 1976).

Figure 5.37a shows typical dissipation curves for a soft clay (Bothkennar clay) plotted on a logarithmic time scale. The results vary with the filter position. For interpretation it is best to normalize the pore pressure relative to the initial pore pressure at the beginning of dissipation, u_i, and the equilibrium *in situ* pore pressure u_o. The normalized excess pore pressure, U, at time t, is thus expressed as:

$$U = \frac{u_t - u_o}{u_i - u_o} \tag{5.33}$$

where:

u_t = the pore pressure at time t

u_i = initial pore pressure at $t = 0$

u_o = *in situ* pore pressure before penetration.

The results of Figure 5.37a are replotted in normalized form in Figure 5.37b.

Over the last 10 to 15 years, theoretical and semi-empirical solutions have been developed for deriving the coefficient of consolidation from pore pressure dissipation data.

Table 5.9 presents an overview of the main solutions available to calculate the coefficient of consolidation from piezocone dissipation data.

Torstensson (1975, 1977) developed an interpretation model based on cavity expansion theories. Initial pore pressures were computed assuming an elasto-plastic soil model and spherical or cylindrical cavity expansion theory, as shown in Table 5.9. Torstensson then used linear uncoupled one-dimensional consolidation to compute the dissipation of pore pressures.

Torstensson suggested that the coefficient of consolidation should be interpreted at 50% dissipation from the following formula:

$$c = \frac{T_{50}}{t_{50}} \cdot r_o^2 \tag{5.34}$$

where the time factor T_{50} is found from the theoretical solutions, t_{50} is the measured time for 50% dissipation and r_o = penetrometer radius (cylindrical model) or equivalent penetrometer radius for spherical model.

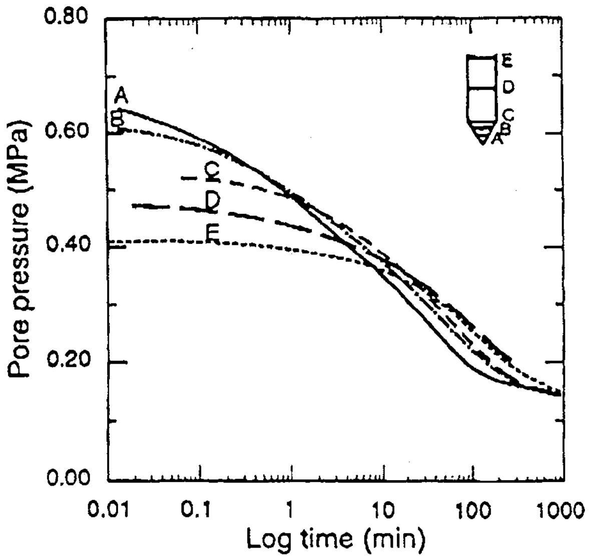


Figure 5.37a Dissipation test results from Bothkennar.

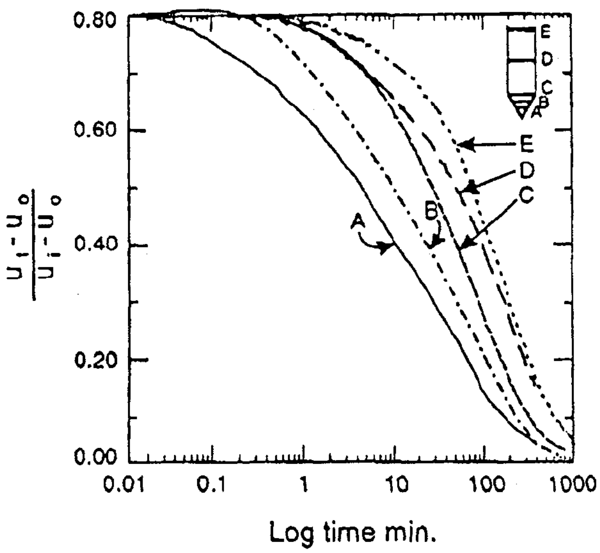


Figure 5.37b Normalized dissipation test data from Bothkennar.

Table 5.9 Available solutions to calculate the coefficient of consolidation from piezocone dissipation tests

Author	Cavity type	Soil model	Initial pore pressure, Δu_i	Consolidation	Remarks
Søderberg (1962)	Cylindrical, radius R	Elastoplastic	$\frac{\Delta u}{\Delta u_i} = \frac{R}{r}$	1-D	Not in use
Torstensson (1975, 1977)	Cylindrical/spherical	Elastoplastic	$\Delta u_i = 2s_u \ln(r_p/r)$ $\Delta u_i = 4s_u \ln(r_p/r)$	1-D	
Randolph & Wroth (1979)	Cylindrical	Elastoplastic	As Torstensson's	1-D	= Equiv. to Torstensson
Battaglio *et al.* (1981)	Cylindrical/spherical	Elastoplastic	Same as Torstensson	1-D	Fits entire curve
Senneset *et al.* (1982)	Cylindrical	Elastoplastic	Same as Torstensson	1-D	= Equiv. to Torstensson
Levadoux & Baligh (1985)	Piezocone model	Non-linear $I_r = 500$	From strain path method	2-D	Most comprehensive work
Gupta & Davidson (1986)	Piezocone model	Elastoplastic	Modified cavity expansion, some dissipation	Linear axisymmetric	
Soarés *et al.* (1987)	Piezocone model	Non-linear	Corrected by visual examination and regression analysis	2-D	
Houlsby and Teh (1988)	Piezocone model	Non-linear I_r varies	Predicted by large strain finite element analysis and strain path method	2-D	Extension of Levadoux and Baligh (1985)

u = pore pressure; s_u = undrained shear strength; r = radial distance; r_p = radius of plastic zone; $I_r = G/s_u$ = rigidity index.

The selection of the appropriate model depends on the location of the porous element. The spherical solution may be most applicable if the filter element is located somewhere on the conical part. If the filter is located somewhere on the cylindrical shaft some distance away from the cone the cylindrical solution will be the most applicable.

A comprehensive study on pore pressure dissipation has been performed by Levadoux and Baligh (1980, 1986) and Baligh and Levadoux (1980, 1986) who proposed an interpretation method after evaluating predictions of dissipation tests in Boston Blue Clay (BBC).

Levadoux and Baligh used the strain path method (Baligh, 1985) to predict the initial pore pressure distribution for normally consolidated Boston Blue Clay with rigidity index, $I_r = 500$. A finite element method was used for the subsequent coupled and uncoupled linear isotropic consolidation analysis.

Some important conclusions from the study of Baligh and Levadoux (1986) were:

1. The simple uncoupled solutions provide reasonably accurate predictions of the dissipation process.
2. Consolidation is taking place predominantly in the recompression mode for dissipation less than 50%.
3. Initial distribution of excess pore pressures around the probe has a significant influence on the dissipation process.
4. Dissipation is predominantly in the horizontal direction.

Houlsby and Teh (1988) proposed an interpretation based on the results of large strain finite element analyses of the penetration pore pressures, and a finite difference analysis of the dissipation pore pressure. They used an approach similar to the Levadoux-Baligh theory but included the effect of varying the rigidity index, I_r $(= G/s_u)$. Houlsby and Teh suggested using a modified dimensionless time factor, T^* given in Table 5.10, defined as follows:

$$T^* = \frac{c_h \cdot t}{r^2 \sqrt{I_r}} \tag{5.35}$$

Table 5.10 Modified time factors T^* from consolidation analysis (from Houlsby and Teh, 1988)

	Location			
Degree of consolidation	Cone (u_1)	Cylindrical extension above cone base (u_2)	Five radii above cone base	Ten radii above cone base
20%	0.014	0.038	0.294	0.378
30%	0.032	0.078	0.503	0.662
40%	0.063	0.142	0.756	0.995
50%	0.118	0.245	1.11	1.458
60%	0.226	0.439	1.65	2.139
70%	0.463	0.804	2.43	3.238
80%	1.04	1.60	4.10	5.24

where:

c_h = coefficient of consolidation in direction perpendicular to cone axis, typically horizontal

r = radius of cone, typically 35.7 mm

I_r = rigidity index, G/s_u.

These solutions are based on elastic plastic soil models and hence the rigidity index represents an equivalent elastic normalized stiffness.

Figure 5.38 shows the values of T^* derived by Houlsby and Teh (1988) and compares them with values by Torstensson (1977) for element locations immediately behind the cone (u_2) and on the face of the cone (u_1). It is interesting to note that the simplified solutions by Torstensson (1977) provide essentially the same values as the more recent and comprehensive solutions by Houlsby and Teh (1988).

Figure 5.39 shows a simplified diagram that can be used to estimate c_h using the Houlsby and Teh (1988) solution.

Robertson *et al.* (1992b) reviewed dissipation data from piezocone tests to predict coefficient of consolidation using Houlsby and Teh's (1988) solutions with reference values from laboratory tests and field observations. The review showed that the Teh and Houlsby solution provided reasonable estimates of c_h. Results were evaluated for pore pressure data from different filter locations and the least scatter was obtained with the pore pressure element location immediately above the cone (u_2). Figure 5.40 shows some of the results presented by Robertson *et al.* (1992b).

Powell and Quatermann (1997) showed that in a soft clay the normalized dissipation curves from different filter positions were very close in shape to those of Teh and Houlsby but displaced relative to each other. Values of c_h deduced using Teh and Houlsby were very similar for filter positions u_1 and u_2 but somewhat lower for u_3.

Teh (1987) also proposed the interpretation of the consolidation data on a root time scale, as the initial section of the plot approximates closely to a straight line.

If the pore pressure dissipation is plotted on a square-root time scale, the gradient of this linear section is m, as shown

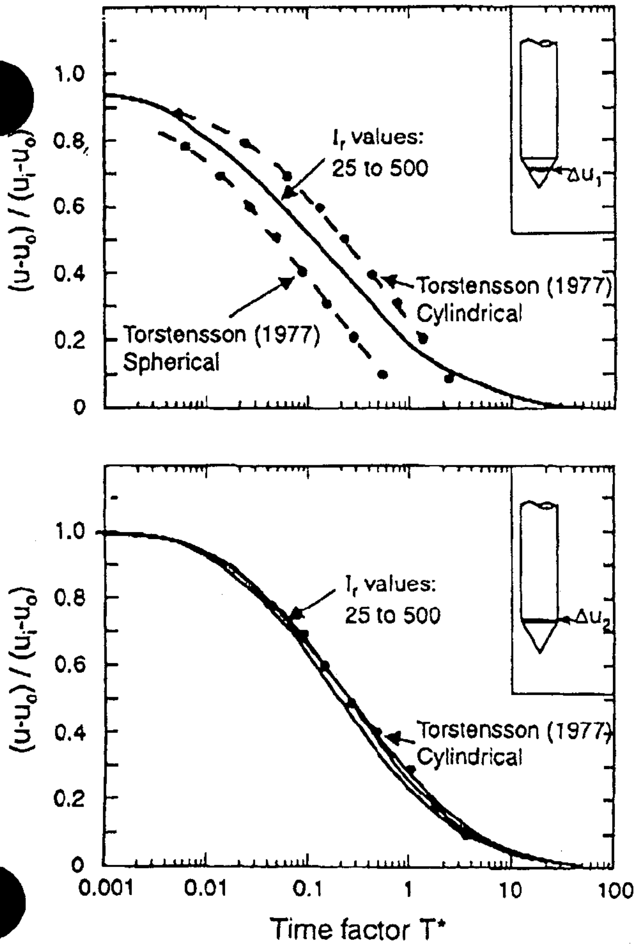


Figure 5.38 Theoretical solution of normalized pore pressure dissipation vs T (after Teh and Houlsby, 1991).

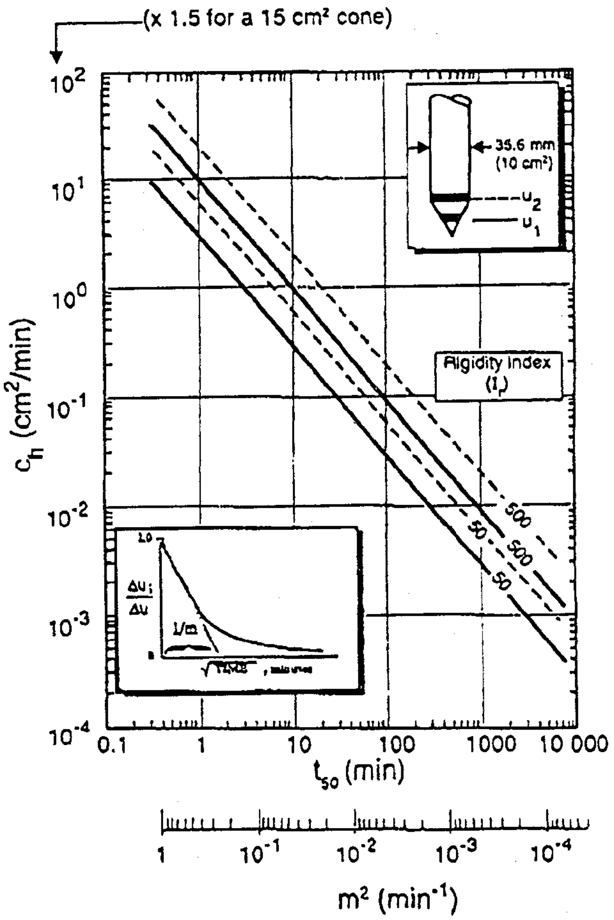


Figure 5.39 Chart for finding c_h from t_{50} (after Robertson *et al.*, 1992b).

M is in Table 5.1.1

on Figure 5.39. Then c_h can be evaluated from the equation:

$$c_h = (m/M)^2 \cdot \sqrt{I_r} \cdot r^2 \qquad (5.36)$$

where: c_h Computed by Eq. 5.34 or 5.35

M = gradient corresponding to the theoretical curve for a given probe geometry and porous element location

m = measured gradient of the initial linear dissipation ($\sqrt{}$(time) units).

Values for M are given in Table 5.11.

The square-root time method is useful for short dissipation tests and/or where initial excess pore pressure (u_i) is uncertain.

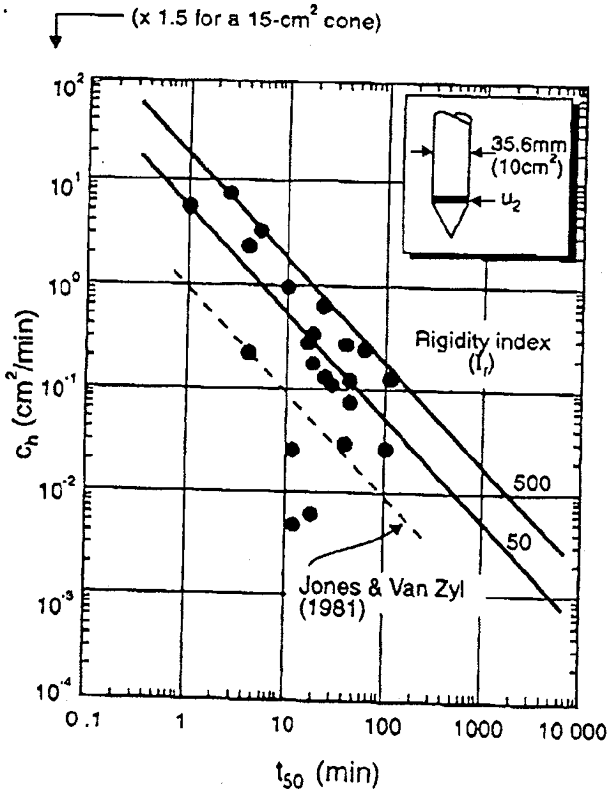


Figure 5.40 Average laboratory c_h values and CPTU results (after Robertson *et al.*, 1992b).

Table 5.11 Gradient of dissipation curve (M), root time plot (from Teh, 1987)

Filter position	Cone (u_1)	Cylindrical extension above cone base (u_2)	Five radii above cone base
Gradient of dissipation curve (M)	1.63	1.15	0.62

As summarized by several authors (for example, Soares *et al.*, 1987; Sandven, 1990; Robertson *et al.*, 1992) the meaning and use of theoretical solutions are complicated by several phenomena including:

1. *Estimation of initial pore pressure distribution.*

Experience has shown that the initial pore pressures around a penetrating cone vary from the cone and along the shaft as illustrated in Figure 5.41. In stiff, heavily overconsolidated clays there is a very large gradient in pore pressure going from the cone to the shaft – where negative pore pressures may be observed. Before pore pressure dissipation starts a local redistribution occurs which may result in an initial increase in pore pressure behind the cone before radial dissipation starts (see Figure 9.26).

Comparison of theoretical analysis with laboratory and field test results shows that to improve the reliability of the prediction of coefficient of consolidation from piezocone tests, it is necessary to define the initial pore water pressure at time $t = 0$.

To better define the correct initial pore pressure value, it is essential to record pore pressures at frequent time intervals, which will be a function of soil type (section 2.3.8), at the beginning of the dissipation test. A linear projection of the square-root time plot can provide a reasonable estimate of u_i.

Powell and Quatermann (1997) showed that in soft clays the use of u_i derived from a square-root time plot significantly improved the repeatability of the normalized dissipation curves.

2. *Effects of soil disturbance due to penetration.*

This effect can create a zone of disturbed soil around the piezocone during penetration which may have lower permeability than the undisturbed soil.

3. *Importance of vertical as well as horizontal dissipation.*

Although it is believed that dissipation is mainly governed by the radial coefficient of consolidation, (e.g. Levadoux and Baligh, 1986) there will be some uncertainties related to the relative importance of c_v and c_h. The importance of this will also depend on soil anisotropy, as discussed below.

4. *Soil anisotropy.*

For most soils the permeability and coefficient of consolidation is higher in the horizontal direction, but this may vary from one soil to another (see below).

Based on the above discussion, the recommended procedure to estimate the coefficient of consolidation is to use dissipation data from the filter location behind the cone (u_2); however, other filter locations may be used even though the data may be somewhat less consistent.

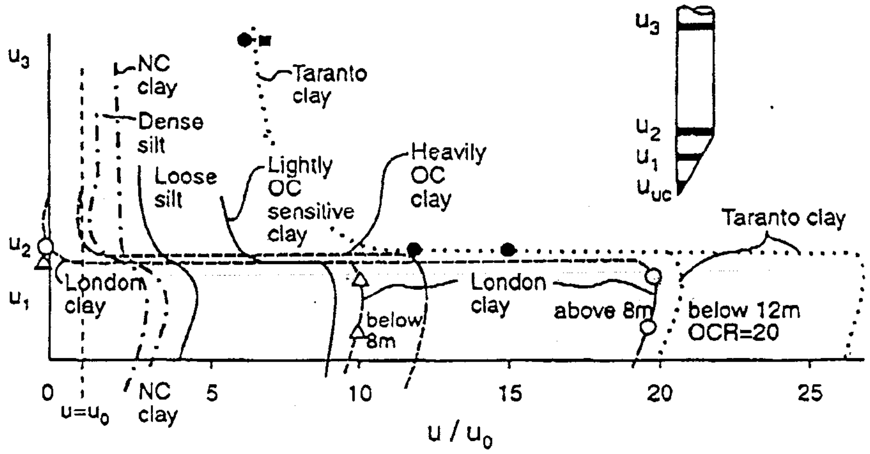


Figure 5.41 Pore pressure distribution in saturated clays (after Sully *et al.*, 1988).

The recommended procedure is as follows:

(a) Plot the early part of the dissipation (less than 10% dissipation) at an enlarged scale, either log or square root time, and evaluate the initial pore pressure, u_i.

(b) Define u_o from available data on ground water level, piezometric readings or data from piezocone tests in adjacent sand layers.

(c) Plot normalized excess pore pressure

$$U = \frac{u_t - u_o}{u_i - u_o} \tag{5.37}$$

versus time (t) on log and/or $\sqrt{t}$ scale.

(d) Define time for 50% dissipation (t_{50}).

(e) Use t_{50} and curves in Figure 5.39 to predict c_h. If no other data are available use an average I_r between the range in Figure 5.39.

(f) If dissipation has not proceeded sufficiently long to define t_{50}, then the slope of the straight line from the first part of u vs $\sqrt{t}$ plot (m) may be used in Figure 5.39 to predict c_v.

Based on available experience, this recommended procedure should provide estimates of c_h to within ± half an order of magnitude. However, the technique is repeatable and provides an accurate measure of the changes in the consolidation characteristics within a given soil profile.

A rough estimate of the coefficient of consolidation in the vertical direction can be obtained using the ratios of permeability in horizontal and vertical direction given in Table 5.12 since:

$$c_v = k_v \cdot \frac{M}{\gamma_w} \tag{5.38}$$

$$c_h = k_h \cdot \frac{M}{\gamma_w} \tag{5.39}$$

If the soil compressibility is assumed isotropic (that is, $m_h = m_v$):

$$c_v = c_h \cdot \frac{k_v}{k_h} \tag{5.40}$$

Due to the uncertainties associated with interpretation of coefficient of consolidation from dissipation test data, the predicted value of c_v can currently only be considered to be representative within one order of magnitude.

5.4.4.2 Coefficient of permeability (hydraulic conductivity)

Baligh and Levadoux (1980) recommended that the horizontal coefficient of permeability can be estimated from the expression:

$$k_h = \frac{\gamma_w}{2.3 \cdot \sigma'_{vo}} \cdot RR \cdot c_h \tag{5.41}$$

where *RR* is the compression ratio in the overconsolidated range. It represents the strain per log cycle of effective stress during recompression and can be determined from laboratory consolidation tests ($0.5 \times 10^{-2} < RR < 2 \times 10^{-2}$ was recommended by Baligh and Levadoux).

Robertson *et al.* (1992a) presented a summary of available data from dissipation tests and laboratory determined k_h values (Figure 5.42). A preliminary relationship proposed by Schmertmann (1974) is also included.

Table 5.12 Range of possible field values of k_h/k_v for soft clays (from Jamiolkowski *et al.*, 1985)

Nature of clay	k_h/k_v
• No macrofabric, or only slightly developed macrofabric, essentially homogeneous deposits	1 to 1.5
• From fairly well- to well-developed macrofabric, e.g. sedimentary clays with discontinuous lenses and layers of more permeable material	2 to 4
• Varved clays and other deposits containing embedded and more or less continuous permeable layers	3 to 15

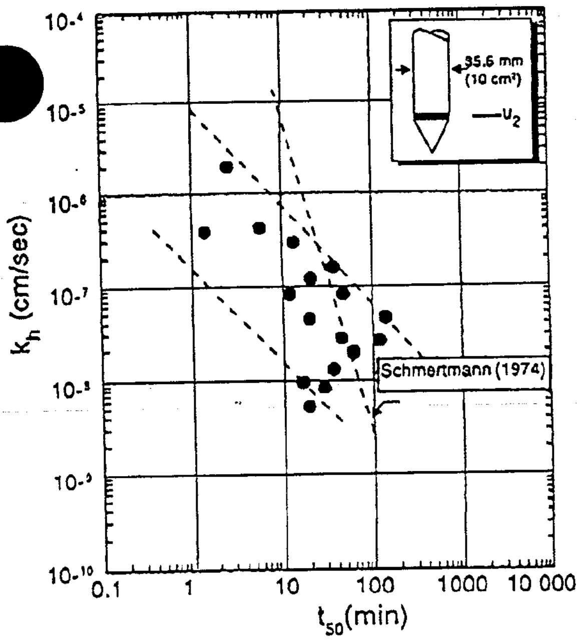


Figure 5.42 Proposed chart for evaluating K_h from t_{50} for 10 cm² piezocones (after Robertson *et al.*, 1992a).

Figure 5.42 can be used as a rough guide to estimate k_h from t_{50}. Jamiolkowski *et al.* (1985) presented Table 5.12 which can be used to estimate k_v from k_h.

Soil permeability can also be estimated as a function of [illegible] types from the CPT classification charts as shown in Tables 5.13a and b.

Estimation of soil permeability from CPT and dissipation data is subject to much uncertainty and should be used as a guide only.

5.5 INTERPRETATION IN COARSE-GRAINED SOILS

Cone penetration testing in coarse-grained soils, such as sandy soils, is generally drained. Under drained conditions there should be no excess pore pressures generated as a result of cone penetration, that is, the *in situ* static pore pressure is measured. An example of a CPTU in sand (McDonalds Farm, BC.) is shown in Figure 5.43.

However, sometimes equipment-related pore pressures may be generated on the cone (u_1) due to high compressive stresses (for example, Bruzzi and Battaglio, 1987; Gillespie, 1990). In very dense fine or silty sands negative pore pressures may be recorded behind the cone (u_2) due to dilatancy effects (Figure 5.44).

In the following sections, fully drained cone penetration is considered, then only measured cone resistance and sleeve friction are used in the interpretation. However, it is important to review the recorded pore pressures to check if the assumption of fully drained conditions is valid.

Most of the interpretation methods described in this section are based on results from large laboratory calibration chamber tests (for instance, Schmertmann, 1975; Veismanis, 1975; Bellotti *et al.*, 1982; Parkin and Lunne, 1982; Baldi *et al.*, 1986; Ghionna and Jamiolkowski, 1992). For completeness, a summary of calibration chamber testing techniques and results is included in Appendix C.

5.5.1 State characteristics

The following sections detail the interpretations related to the parameters that describe soil state and stress history.

5.5.1.1 Relative density (density index)

For cohesionless soils, the density, or more commonly, the relative density or density index, is often used as an intermediate soil parameter.

Table 5.13(a) Estimation of soil permeability (k) from CPT soil behaviour charts. Based on a CPT chart by Robertson *et al.*, 1986 (Figure 5.7)

Zone	Soil behaviour type (SBT)	Range of soil permeability k (m/s)
1	Sensitive fine grained	3×10^{-9} to 3×10^{-8}
2	Organic soils	1×10^{-8} to 1×10^{-6}
3	Clay	1×10^{-10} to 1×10^{-9}
4	Silty clay to clay	1×10^{-9} to 1×10^{-8}
5	Clayey silt to silty clay	1×10^{-8} to 1×10^{-7}
6	Sandy silt to clayey silt	1×10^{-7} to 1×10^{-6}
7	Silty sand to sandy silt	1×10^{-5} to 1×10^{-6}
8	Sand to silty sand	1×10^{-5} to 1×10^{-4}
9	Sand	1×10^{-4} to 1×10^{-3}
10	Gravelly sand to sand	1×10^{-3} to 1
11	*Very stiff fine-grained soil	1×10^{-9} to 1×10^{-7}
12	*Very stiff sand to clayey sand	1×10^{-8} to 1×10^{-6}

*Overconsolidated or cemented

Table 5.13(b) Estimation of soil permeability (k) from CPT soil behaviour charts. Based on normalized CPT chart by Robertson, 1990 (Figure 5.8)

Zone	Soil behaviour type (SBT)	Range of soil permeability k (m/s)
1	Sensitive fine grained	3×10^{-9} to 3×10^{-8}
2	Organic soils	1×10^{-8} to 1×10^{-6}
3	Clay	1×10^{-10} to 1×10^{-9}
4	Silt mixtures	3×10^{-9} to 1×10^{-7}
5	Sand mixtures	1×10^{-7} to 1×10^{-5}
6	Sands	1×10^{-5} to 1×10^{-3}
7	Gravelly sand to sand	1×10^{-3} to 1
8	*Very stiff sand to clayey sand	1×10^{-8} to 1×10^{-6}
9	*Very stiff fine-grained soil	1×10^{-9} to 1×10^{-7}

*Overconsolidated or cemented

MACTEC

January 18, 2005

Mr. Ron Purkey
Tennessee Valley Authority
1101 Market Street, LP-2G
Chattanooga, TN 37402
Phone: (423) 751-4820
Fax: (423) 751-7094

Subject: **Modification to Task Order Proposal for Monitoring Wells Installation**
TVA Kingston Fossil Plant Ash Disposal Area
Kingston, Tennessee
MACTEC Proposal Prop04Knox/399, Revision 1

Dear Mr. Purkey:

MACTEC Engineering and Consulting, Inc., (MACTEC) is pleased to submit this proposal for modification of our original task order proposal for providing geotechnical engineering support for the ash disposal area at the Tennessee Valley Authority (TVA) Kingston Fossil Plant in Kingston, Tennessee. Included in this proposal are the proposed additional services and our cost estimate.

Project Information

We understand that TVA would like MACTEC to provide additional drilling and monitoring well installation at the subject site. The scope of additional work was assigned by Parsons E&C and Geosyntec during a teleconference on January 13, 2005.

Proposed Scope of Additional Services

Based on our understanding of your needs, we will provide the following additional services:

- Drill boring B-3 to refusal including standard penetration test (SPT) at 5-foot depth intervals and at major changes of material type when detectable. The SPT sampling will start at a depth of about 70 feet.

- Install and develop one 2-inch monitoring well at a total depth of 100 feet near the location of boring B-3. The well will be 2-inch I.D., Schedule 40 PVC with double-density, slotted, 0.010-inch screen with a 5-foot screen length.
- Drill boring B-4 at the originally staked location after TVA prepares a working pad at that location.
- Backfill all test borings with a cement-bentonite grout.
- Include the additional field data in our final report for this project.

Assumptions

MACTEC assumes the following:

- All boring/monitoring well locations will be selected and located in the field by TVA or their designees. After completion of drilling, all boring locations will be staked by MACTEC and surveyed by TVA using land surveying techniques. A base map and coordinates of all boring locations will be provided to MACTEC for use in their final report to TVA.
- TVA will furnish a dozer and any necessary stone to provide access for MACTEC's drilling equipment to all boring/monitoring well locations as needed.
- Underground utilities, if any, will be located by others.
- Mitigation of environmental concerns (if any are encountered) is not part of this work.

Cost Estimate

We have estimated the cost to perform the additional services to be approximately $8,120. This projected cost was based on manpower estimates and quantities of work as presented in the attached cost estimate. The actual cost will be based on the units of work performed. Our total cost estimate for this project, including the originally approved $61,000 and the additional cost given above, is $69,120. We request that TAO MAC-0710-00068 be modified to this amount.

Schedule

The additional field services will be performed in conjunction with the original field work. We expect the additional field exploration to last approximately two working days. Preliminary boring logs can be provided at the completion of each boring.

Authorization

We propose to perform the requested services in accordance with the terms and conditions of our existing contract 21705. We understand that, if this proposal is acceptable to you, TVA will authorize this work by issuance of a modified TAO.

Mr. Purkey, we appreciate this opportunity to provide these services to TVA. If you have any questions regarding this proposal, please contact Hussein Benkhayal or Carl Tockstein at (865) 588-8544.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Hussein A. Benkhayal
Senior Professional

Carl D. Tockstein, P.E.
Chief Engineer - Tennessee Operations

HAB/CDT:sjm

Attachment

cc: Mr. Lynn Petty
TVA Chattanooga

MACTEC

TVA

COST ESTIMATE
TVA KINGSTON FP MONITORING WELL INSTALLATION
MACTEC Proposal Prop04Knox/399, Revision 1

Manpower	$2,876.89
Drilling	$5,242.50
Total	$8,119.39

SCHEDULE OF FEES
PERSONNEL CHARGES
TVA KINGSTON FP MONITORING WELL INSTALLATION
MACTEC Proposal Prop04Knox/399, Revision 1

PROFESSIONAL SERVICES

DESCRIPTION	HOURS	RATE	BURDEN	BILLING RATE	COST
Project Administration					
Chief Engineer	0	$48.00	$20.00	$138.72	$0.00
Senior Engineer	0	$25.00	$6.00	$72.25	$0.00
Drilling/Field Coordination					
Senior Engineer	2	$25.00	$47.25	$72.25	$144.50
Project Engineer	0	$23.00	$43.47	$66.47	$0.00
Field Engineering					
Project Engineer	16	$23.00	$43.47	$66.47	$1,063.52
Senior Engineer	0	$25.00	$47.25	$72.25	$0.00
Senior Geologist	16	$29.41	$55.58	$84.99	$1,359.92
Project Geologist	0	$22.50	$42.53	$65.03	$0.00
Data Analysis / Lab Coordination					
Chief Engineer	0	$48.00	$90.72	$138.72	$0.00
Senior Engineer	1	$25.00	$47.25	$72.25	$72.25
Project Engineer	0	$23.00	$43.47	$66.47	$0.00
Senior Geologist	0	$29.41	$55.58	$84.99	$0.00
Report Preparation					
Project Engineer	0	$23.00	$43.47	$66.47	$0.00
Senior Engineer	0	$25.00	$47.25	$72.25	$0.00
Chief Engineer	0	$48.00	$90.72	$138.72	$0.00
Drafter/CADD	2	$15.00	$28.35	$43.35	$86.70
Word Processor	0	$14.00	$26.46	$40.46	$0.00
SUBTOTAL LABOR	37 Hours				$2,726.89

Travel Expenses (Professional)

	Unit Rate	Quantity	Estimated Cost
Expenses (includes transportation to and from site, per diem in accordance with TVA allowances, etc.)	$150.00 Each	1	$150.00

SUBTOTAL TRAVEL EXPENSES	$150.00
SUBTOTAL SUBCONTRACT	$2,876.89

SCHEDULE OF FEES
COST ESTIMATE
TVA KINGSTON FP MONITORING WELL INSTALLATION
MACTEC Proposal Prop04Knox/399, Revision 1

Description	Quantity	Unit	Unit Rate	Subtotal
A. Mobilization and demobilization of drilling, sampling, or support equipment:				
1. #				
6 Truck-mounted drill rig	0	each	$200.00	$0.00
b. ATV-mounted drill rig	0	each	$250.00	$0.00
c. Water truck	0	each	$100.00	$0.00
d. Geoprobe	0	each	$200.00	$0.00
e. Workover rig	0	each	$100.00	$0.00
f. Support truck	0	each	$50.00	$0.00
2. Beyond 25 miles from originating location, add per mile one-way				
a. Truck-mounted drill rig	0	mile	$4.00	$0.00
b. ATV-mounted drill rig	0	mile	$5.00	$0.00
c. Water truck, workover rig, or Geoprobe	0	mile	$2.00	$0.00
d. Support truck	0	mile	$1.00	$0.00
B. Wash Boring in overburden soil, per linear foot				
a. 4 - inch diameter	285	feet	$6.50	$1,852.50
b. 6 - inch diameter	0	feet	$7.50	$0.00
C. Standard penetration test in conjunction with boring, per sample				
1. N < 50	22	each	$20.00	$440.00
2. N > 50	2	each	$25.00	$50.00
F. Grouting (cement) borehole without well, per linear foot:				
1. 6-inch diameter or less, per linear foot	60	feet	$5.50	$330.00
2. 6- to 9-inch diameter, per linear foot	0	feet	$11.00	$0.00
3. 9- to 12-inch diameter, per linear foot	0	feet	$22.00	$0.00
4. Above rates are based on neat line borehole volume, if grout losses occur, additional grouting will be charged at time rate drilling cost plus actual material cost times 1.10.				
G. Type I PVC well construction in pre-drilled borehole, including time and materials, per linear foot:				
1. 1-inch		feet	$10.00	$0.00
2. 2-inch	100	feet	$13.00	$1,300.00
I. Time rate for drill crew and equipment including steam cleaning, packer testing with drill crew, difficult moving, clearing, well development, hauling water, handling IDW, difficult drilling through collapsing or flowing materials, drilling through pavement, rock drilling using a roller cone bit in partially weathered rock only, drilling through boulders or debris, reaming out partially weathered rock corehole, standby, safety orientation, site restoration, packer testing, off-truck drilling, inside work, or time-rate drilling, per hour.				
	0	hours	$150.00	$0.00
J. Equipment charges, per day:				
1. Water truck to support drill rig	0	days	$250.00	$0.00
2. Steam cleaner		days	$75.00	$0.00
3. Generator		days	$50.00	$0.00
9. Grout plant	2	days	$250.00	$500.00
10. ATV drill	2	days	$100.00	$200.00

SCHEDULE OF FEES
COST ESTIMATE
TVA KINGSTON FP MONITORING WELL INSTALLATION
MACTEC Proposal Prop04Knox/399, Revision 1

	Description	Quantity	Unit	Unit Rate	Subtotal
11.	Support truck	2	days	$35.00	$70.00
17	Cellular Telephone	2	days	$50.00	$100.00

V. Overtime charges for drilling at TVA's request during other than 40-hour week or on weekends or holidays, multiply rates by 1.3.

		--	

W. Crew daily trip charge, to and from site

2	days	$75.00	$150.00

X. Per diem and lodging in accordance with TVA allowances

2	day	$125.00	$250.00

TOTAL COST ESTIMATE **$5,242.50**

Petty, Harold L.

From: Smith, Daniel R on behalf of Smith, Daniel R.
Sent: Wednesday, January 12, 2005 3:15 PM
To: Boggs, J. Markus; GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES; Smith, Amos L; egreg.mcnulty@parsons.com; Benkhayal, Hussein
Cc: Julian, Hank; Petty, Harold L.
Subject: Revised meeting for KIF Seepage - discussion of Holes 8,9, & 4

We need to meet TOMORROW Thursday January 13, 2004 at 11 am. Mactec has completed holes 8&9, and will have completed hole 4 by early tomorrow morning at the latest. They will be ready to drill the wells for these holes starting tomorrow. Please be prepared to discuss basically the same items for these holes as we did yesterday for 5,6 & 7.

<u>We will therefore cancel Friday's meeting.</u> We will set a time for the followup meetings tomorrow.

Mactec needed to move hole # 4 up the slope about 20 ft, due to inaccessibility. From what they described, it will be placed on the existing bench that is at about El 775. Hole 9 went in at the location staked.

Here is the phone no and Meeting ID.
call 423-751-2428 or . Enter Mtg ID 6704 when prompted.

If you have a conflict let me know. Lynn is on the road and this is the best time we could schedule - given an allowance for receiving the faxed information from hole #4. I'm out of the office and can be reached by cell phone.

Daniel R. (Dan) Smith, P.E.
Parsons E & C Phone: (423) 757-8088
33 Chestnut St, Suite 400 Fax: (423) 266-0922
Chattanooga, TN 37932 Cell: (423) 364-1679 Email: Daniel.R.Smith@parsonsec.com
Please note my new email address: Daniel.R.Smith@parsonsec.com

Petty, Harold L.

---

om: GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES
Sent: Tuesday, January 11, 2005 2:17 PM
To: Smith, Daniel R.; Boggs, J. Markus; Julian, Hank; Smith, Amos L; egreg.mcnulty@parsons.com; HABENKHAYAL@mactec.com
Cc: Petty, Harold L.
Subject: RE: Borings at KIF - Piezometer Locations

Boring
s_Jan1105.pdf (149

Gentlemen:
The attached pdf file provides a summary of the borings completed to date and also indicates the agreed upon elevations for piezometers at the locations MW-5, -6, and -7.

The proposed depths are as follows:

MW-5 Location
- 42.5 to 47.5 ft BGS
- 62.5 to 67.5 ft BGS

MW-6 Location
- 70 to 75 ft BGS
- observe water level during drilling; determine depth of upper piezometer based on field observations

W-7 Location
- 60 to 65 ft BGS

Next conference call scheduled for 11am on Friday Jan 14.

Hussein, Dan and Mark - could you please confirm that you have received this email and that the pdf file opens OK.

Thanks
Neil

-----Original Message-----
From: Smith, Daniel R [mailto:Daniel.R.Smith@parsonsec.com]
Sent: Monday, January 10, 2005 12:08 PM
To: Boggs, J Marcus; Neil Davies; Julian, Hank; Smith, Amos; egreg.mcnulty@parsons.com
Cc: Petty, H. L.
Subject: Borings at KIF

<html>
*** WorleyParsons Group Notice ***
"This email is confidential. If you are not the intended recipient, you must not disclose or use the information contained in it. If you have received this email in error, please notify us immediately by return email and delete the email and any attachments. Any personal views/ opinions expressed by the writer may not necessarily reflect the views/ opinions of the company."

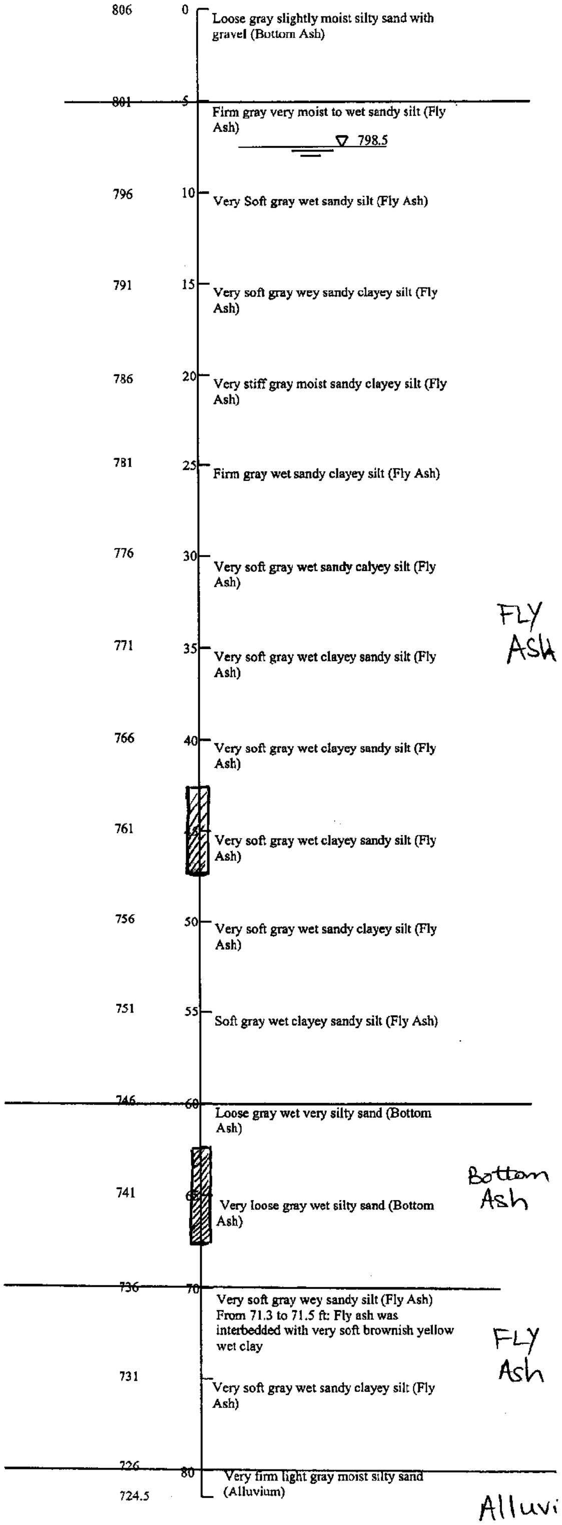
/html>

MW-5

Ground Elevation = 806 ft (estimated from the drawing showing proposed locations of additional borings and peizometers 10W425-26A)

Legend

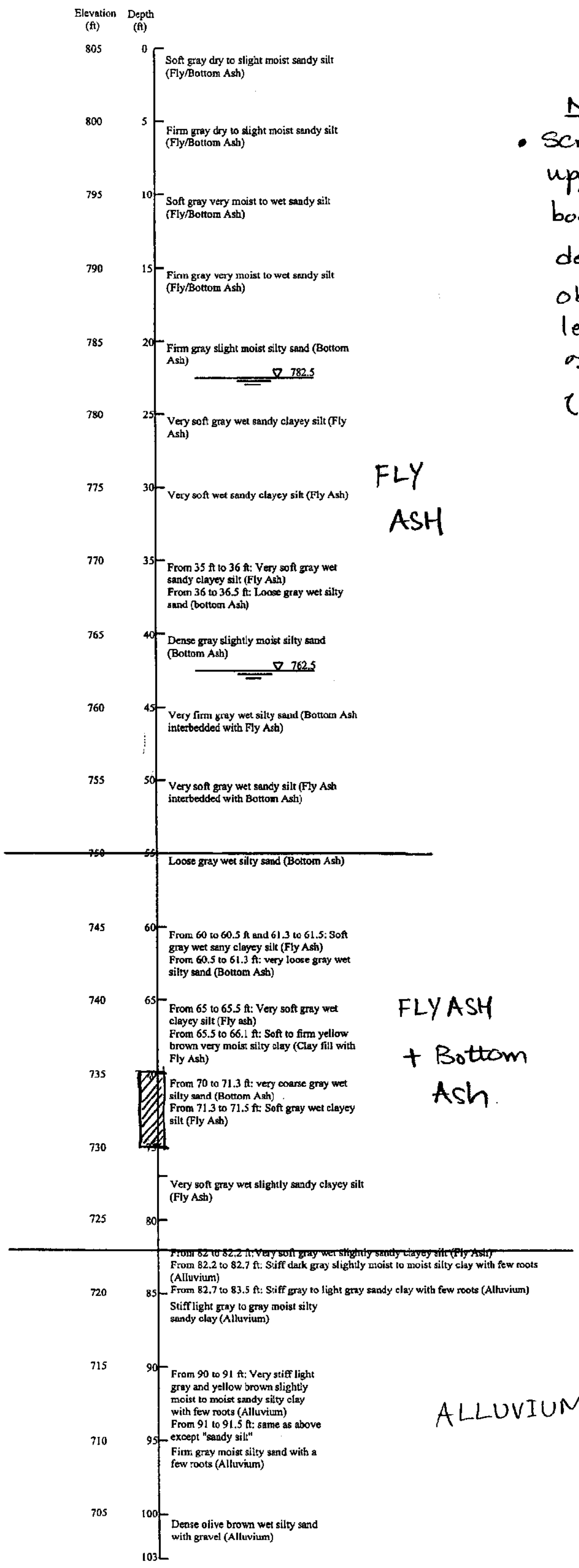
▨ Screen location (agreed during Teleconf on 11Jan2005)



Elevation (ft)	Depth (ft)		
806	0	Loose gray slightly moist silty sand with gravel (Bottom Ash)	
801	5	Firm gray very moist to wet sandy silt (Fly Ash) ▽ 798.5	
796	10	Very Soft gray wet sandy silt (Fly Ash)	
791	15	Very soft gray wey sandy clayey silt (Fly Ash)	
786	20	Very stiff gray moist sandy clayey silt (Fly Ash)	
781	25	Firm gray wet sandy clayey silt (Fly Ash)	
776	30	Very soft gray wet sandy calyey silt (Fly Ash)	FLY Ash
771	35	Very soft gray wet clayey sandy silt (Fly Ash)	
766	40	Very soft gray wet clayey sandy silt (Fly Ash)	
761	45	Very soft gray wet clayey sandy silt (Fly Ash)	
756	50	Very soft gray wet sandy clayey silt (Fly Ash)	
751	55	Soft gray wet clayey sandy silt (Fly Ash)	
746	60	Loose gray wet very silty sand (Bottom Ash)	Bottom Ash
741	65	Very loose gray wet silty sand (Bottom Ash)	
736	70	Very soft gray wey sandy silt (Fly Ash) From 71.3 to 71.5 ft: Fly ash was interbedded with very soft brownish yellow wet clay	FLY Ash
731		Very soft gray wet sandy clayey silt (Fly Ash)	
726	80	Very firm light gray moist silty sand (Alluvium)	Alluvium.
724.5			

MW-6

Ground Elevation = 805 ft (estimated from the drawing showing proposed locations of additional borings and peizometers 10W425-26A)



Elevation (ft)	Depth (ft)	
805	0	Soft gray dry to slight moist sandy silt (Fly/Bottom Ash)
800	5	Firm gray dry to slight moist sandy silt (Fly/Bottom Ash)
795	10	Soft gray very moist to wet sandy silt (Fly/Bottom Ash)
790	15	Firm gray very moist to wet sandy silt (Fly/Bottom Ash)
785	20	Firm gray slight moist silty sand (Bottom Ash) ▽ 782.5
780	25	Very soft gray wet sandy clayey silt (Fly Ash)
775	30	Very soft wet sandy clayey silt (Fly Ash)
770	35	From 35 ft to 36 ft: Very soft gray wet sandy clayey silt (Fly Ash) From 36 to 36.5 ft: Loose gray wet silty sand (bottom Ash)
765	40	Dense gray slightly moist silty sand (Bottom Ash) ▽ 762.5
760	45	Very firm gray wet silty sand (Bottom Ash interbedded with Fly Ash)
755	50	Very soft gray wet sandy silt (Fly Ash interbedded with Bottom Ash)
750	55	Loose gray wet silty sand (Bottom Ash)
745	60	From 60 to 60.5 ft and 61.3 to 61.5: Soft gray wet sany clayey silt (Fly Ash) From 60.5 to 61.3 ft: very loose gray wet silty sand (Bottom Ash)
740	65	From 65 to 65.5 ft: Very soft gray wet clayey silt (Fly ash) From 65.5 to 66.1 ft: Soft to firm yellow brown very moist silty clay (Clay fill with Fly Ash)
735	70	From 70 to 71.3 ft: very coarse gray wet silty sand (Bottom Ash) From 71.3 to 71.5 ft: Soft gray wet clayey silt (Fly Ash)
730	75	
		Very soft gray wet slightly sandy clayey silt (Fly Ash)
725	80	
		From 82 to 82.2 ft: Very soft gray wet slightly sandy clayey silt (Fly Ash) From 82.2 to 82.7 ft: Stiff dark gray slightly moist to moist silty clay with few roots (Alluvium)
720	85	From 82.7 to 83.5 ft: Stiff gray to light gray sandy clay with few roots (Alluvium) Stiff light gray to gray moist silty sandy clay (Alluvium)
715	90	From 90 to 91 ft: Very stiff light gray and yellow brown slightly moist to moist sandy silty clay with few roots (Alluvium) From 91 to 91.5 ft: same as above except "sandy silt"
710	95	Firm gray moist silty sand with a few roots (Alluvium)
705	100	Dense olive brown wet silty sand with gravel (Alluvium)
	103	

FLY ASH

FLY ASH + Bottom Ash.

ALLUVIUM.

Legend

▨ Screen location (agreed during TeleConf 11 Jan 2005)

Note:

- Screen location for the upper 55 ft of the boring logs will be determined based on observation of water level during installation of the lower screen (i.e., 70 to 75 ft bgs)

MW-7

Ground Elevation = 811 ft (estimated from the drawing showing proposed locations of additional borings and peizometers 10W425-26A)

Legend

▨ screen location (agreed during TeleConf on Jan 11, 2005)

Elevation (ft)	Depth (ft)		
811	0	Firm dry gray silty sand (Bottom ash)	
806	5	Dense gray dry to moist silty sand with few coal fragments (Bottom Ash)	
801	10	dense gray dry to moist very silty sand (Bottom Ash)	
796	15	Very dense gray dry to moist very silty sand with rock fragments (Bottom Ash)	OUTER DIKE MATERIAL
791	20	Very dense gray dry to moist very silty sand with rock fragments (Bottom Ash)	
786	25	Firm gray moist to very moist very sandy silt (Fly Ash)	
781	30	▽ 781 Very stiff gray very moist to wet sandy silt (Fly Ash)	
776	35	Very soft gray wet clayey silt (Fly Ash)	
771	40	Very loose gray gravel fragments (Bottom Ash)	
766	45	Very soft gray wet clayey sandy silt (Fly Ash)	
761	50	from 50 to 51.0 ft : Very soft gray wet sandy clayey silt (Fly Ash) from 51.0 to 51.5 ft : Very loose wet gray silty sand (Bottom Ash)	FLY ASH
756	55	Very soft gray wet clayey silt (Fly Ash)	
751	60	▨ From 60 to 60.3 ft:Very soft gray wet clayey silt (Fly Ash) From 60.3 to 61.5 ft:Loose gray wet silty sand (Bottom Ash)	
746	65	From 65 to 66 ft:Loose gray silty wet silty sand (Bottom Ash) From 66 to 66.5 ft: Soft gray wet clayey silt (Fly Ash)	
741	70	Firm gray wet sandy silt (Fly Ash)	
736	75	Very soft gray wet sandy silt (Fly Ash)	
731	80	Very loose gray wet sand (Bottom Ash)	
726	85	From 85 to 86 ft: Very stiff gray moist sandy clayey silt with few roots (Alluvium)	
721	90	Stiff olive brown and gray moist sandy silty clay (Alluvium)	
716	95	From 95 ft 95.5 ft: Loose orange brown moist silty sand (Alluvium) From 95.5 to 96.5 ft: Loose gray very moist to wet clayey silty sand (Alluvium)	ALLUVIUM.
711	100	Firm gray wet silty sand (Alluvium)	
706	105	Dense light olive gray moist to very moist sand with occasional gravel (Alluvium)	
701	110	Dense light olive gray moist sand with gravel (Alluvium)	
	111.2		

Petty, Harold L.

From: Boggs, J. Markus
Sent: Wednesday, January 12, 2005 4:39 PM
To: 'Hussein Benkhayal (hbenkhayal@mactec.com)'
Cc: Petty, Harold L.
Subject: Kingston - well development
Contacts: Hussein Benkhayal

Hussein,
Please let me know when the field crew is ready to begin development of completed piezometers in the dredge cell area. I would like to be present for initial development work in case there are questions or unexpected conditions.
Thanks.
Mark

J. Mark Boggs, Hydrologist
Environmental Engineering Services - East

Tennessee Valley Authority
400 W. Summit Hill Drive
WT 9C-K
Knoxville, TN 37802-1401

Phone: 865-632-6941
Fax: 865-632-8375

Petty, Harold L.

From: GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES
Sent: Thursday, January 13, 2005 11:13 AM
To: Smith, Daniel R.; Boggs, J. Markus; Smith, Amos L; egreg.mcnulty@parsons.com; habenkhayal@mactec.com
Cc: Julian, Hank; Petty, Harold L.
Subject: RE: Revised meeting for KIF Seepage - discussion of Holes 8,9, & 4

Boring Logs

<<0376_001.pdf>>

From: Smith, Daniel R [mailto:Daniel.R.Smith@parsonsec.com]
Sent: Wednesday, January 12, 2005 3:15 PM
To: Boggs, J Marcus; Neil Davies; Smith, Amos; egreg.mcnulty@parsons.com; Benkhayal, Hussein
Cc: Julian, Hank; Petty, H. L.
Subject: Revised meeting for KIF Seepage - discussion of Holes 8,9, & 4

We need to meet TOMORROW Thursday January 13, 2004 at 11 am. Mactec has completed holes 8&9, and will have completed hole 4 by early tomorrow morning at the latest. They will be ready to drill the wells for these holes starting tomorrow. Please be prepared to discuss basically the same items for these holes as we did yesterday for 5,6 & 7.

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Mactec needed to move hole # 4 up the slope about 20 ft, due to inaccessibility. From what they described, it will be placed on the existing bench that is at about El 775. Hole 9 went in at the location staked.

Here is the phone no and Meeting ID.

call 423-751-2428 or . Enter Mtg ID 6704 when prompted.

If you have a conflict let me know. Lynn is on the road and this is the best time we could schedule - given an allowance for receiving the faxed information from hole #4. I'm out of the office and can be reached by cell phone.

Daniel R. (Dan) Smith, P.E.

Parsons E & C Phone: (423) 757-8088

633 Chestnut St, Suite 400 Fax: (423) 266-0922

Chattanooga, TN 37932 Cell: (423) 364-1679 Email: Daniel.R.Smith@parsonsec.com

Please note my new email address: Daniel.R.Smith@parsonsec.com

Petty, Harold L.

From: Bartley, Gregory L.
Sent: Thursday, January 13, 2005 1:55 PM
To: Anderson, Cynthia M; Thacker, Denice R.; Houston, Donald P.; Bowers, Larry C; Johnson, Lindy P.; Hastings, D. Mark; Petty, Harold L.; Purkey, Ronald E.
Cc: Evans, H. Gary; Shattuck, Clinton L.
Subject: RE: Non EDTA Boiler Cleaning Draft Guidance

All, I have only one comment of the draft, and it is that we cannot use frac tanks on the once thru units. Each frac tank holds 20,000 gallons, and we need from 500,000 to 800,000 gallons to collect all the wastes from our once thru units. Some other tank would have to be employed.
Sorry I missed the conf call.

> -----Original Message-----
> **From:** Anderson, Cynthia M
> **Sent:** Thursday, January 13, 2005 8:42 AM
> **To:** Thacker, Denice R.; Houston, Donald P.; Bowers, Larry C; Johnson, Lindy P.; Hastings, D. Mark; Bartley, Gregory L.; Petty, Harold L.; Purkey, Ronald E.
> **Subject:** Non EDTA Boiler Cleaning Draft Guidance
>
> Attached is the draft of the Non-EDTA Boiler Cleaning Waste developed by Environmental Affairs. We will be discussing this guidance along with other issues during our 2:00 PM meeting today.
>
> Thanks,
>
> Cynthia M. Anderson
> Hazardous Waste Specialist
>
> TVA
> 1101 Market Street, LP 5D
> Chattanooga, TN 37402-2801
> Phone: (423) 751-4878
> Fax: (423)751-7011
> cmanderson@tva.gov

Petty, Harold L.

From: GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES
Sent: Thursday, January 13, 2005 1:03 PM
To: Smith, Daniel R.; Boggs, J. Markus; Smith, Amos L; egreg.mcnulty@parsons.com; habenkhayal@mactec.com
Cc: Julian, Hank; Petty, Harold L.; TElkady@GeoSyntec.com
Subject: RE: Revised meeting for KIF Seepage - Summary of Decisions From Jan 13 Call

Based on today's conference call, the following target well elevations were established:

MW-3

- drill down to 70 ft. depth; commence sampling
- drill to refusal or bedrock
- decision to be made on well screen elevation after review of logs

MW-4

- move to location originally established; needs some surface preparation prior to drilling
- drill/sample to bedrock or refusal
- we will probably establish 2 wells at this new location (TBD based on drill logs)

MW-6

- additional well to be established with screen at 50-55 ft BGS

MW-7

- additional well to be established with screen at 40-45 ft BGS

MW-8

- well to be established with screen at 20-25 ft BGS
- well to be established with screen at 35-40 ft BGS

MW-9

- well to be established with screen at 10-15 ft BGS
- well to be established with screen at 20-25 ft BGS

Note Nomenclature:

At each physical location, the pilot boring should be referred to as Bx; well should be labeled as MW-xA and MW-xB where x is the location number.

Thanks

Neil

From: Smith, Daniel R [mailto:Daniel.R.Smith@parsonsec.com]
Sent: Wednesday, January 12, 2005 3:15 PM
To: Boggs, J Marcus; Neil Davies; Smith, Amos; egreg.mcnulty@parsons.com; Benkhayal, Hussein
Cc: Julian, Hank; Petty, H. L.
Subject: Revised meeting for KIF Seepage - discussion of Holes 8,9, & 4

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Daniel R. (Dan) Smith, P.E.

Parsons E & C Phone: (423) 757-8088

633 Chestnut St, Suite 400 Fax: (423) 266-0922

Chattanooga, TN 37932 Cell: (423) 364-1679 Email: Daniel.R.Smith@parsonsec.com

Please note my new email address: Daniel.R.Smith@parsonsec.com

Petty, Harold L.

om: Smith, Daniel R.
ent: Thursday, January 13, 2005 5:58 PM
To: Benkhayal, Hussein; Justice, Todd
Cc: Petty, Harold L.
Subject: KIF Seepage Well Drilling

KIF Seepage Well Drilling

Petty, Harold L.

[illegible]om: Smith, Daniel R on behalf of Smith, Daniel R.
Sent: Thursday, January 13, 2005 5:58 PM
To: Benkhayal, Hussein; Justice, Todd
Cc: Petty, Harold L.
Subject: KIF Seepage Well Drilling

TVA is off Monday, January 17, 2005. IF you have boring logs that need to be sent out on that day ONLY, please fax to me at the number below and I'll take care of distributing to the team. I assume Mactec is working Monday, as we are. If not, then I guess you can disregard this message. We apparently have a 3 pm phone call.

Please call me tomorrow to confirm you got this message. I left Todd an voicemail on his cell phone.

Thanks

Please note new email address: Daniel.R.Smith@parsonsec.com
Daniel R. (Dan) Smith, P.E.
Parsons E & C Phone: (423) 757-8088
633 Chestnut St, Suite 400 Fax: (423) 266-0922
Chattanooga, TN 37450 Cell: (423) 364-1679 Email: Daniel.R.Smith@parsonsec.com

MACTEC

December 16, 2004

Mr. Ron Purkey
Tennessee Valley Authority
1101 Market Street, LP-2G
Chattanooga, TN 37402
Phone: (423) 751-4820
Fax: (423) 751-7094

Subject: **Task Order Proposal for Monitoring Wells Installation**
TVA Kingston Fossil Plant Ash Disposal Area
Kingston, Tennessee
MACTEC Proposal Prop04Knox/399

Dear Mr. Purkey:

MACTEC Engineering and Consulting, Inc., (MACTEC) is pleased to submit this proposal for providing geotechnical engineering support for the ash disposal area at the Tennessee Valley Authority (TVA) Kingston Fossil Plant in Kingston, Tennessee. Included in this proposal are our understanding of the project requirements, our proposed scope of services, our cost estimate, and our schedule.

Project Information

We understand that TVA would like MACTEC to provide drilling, monitoring well installation, laboratory testing, and geotechnical engineering services for evaluations and engineering activities associated with the existing ash disposal area. Our scope of work, cost estimate, and schedule are based on discussions during a teleconference on December 14, 2004, and a revised Scope of Work provided by TVA on December 15, 2004.

Proposed Scope of Services

Based on our understanding of your needs, we will provide the following services:

- Mobilize one All Terrain (ATV) Mounted drill rig and possibly an additional truck-mounted drill rig.

MACTEC Engineering and Consulting, Inc.
1725 Louisville Drive • Knoxville, TN 37921-5904
865-588-8544 • Fax: 865-588-8026

- Drill six test borings including standard penetration test (SPT) at 5-foot depth intervals and at major changes of material type when detectable. The borings will be drilled to refusal (approximate depths range from 70 to 110 feet).

- Backfill all test borings with a cement-bentonite grout.

- Install and develop 12 two-inch monitoring wells at depths ranging from 30 to 60 feet as specified by TVA or their designee. The wells will be 2-inch I.D., Schedule 40 PVC with double-density, slotted, 0.010-inch screen with a 5-foot screen length.

- Perform in situ hydraulic conductivity test at 12 monitoring well locations.

- Obtain one complete set of groundwater readings from the newly installed monitoring wells.

- Perform laboratory tests on ash and soil samples consisting of natural moisture content, Atterberg limits, grain size analyses, and specific gravity.

- Prepare a brief report that presents the field and laboratory data.

Assumptions

MACTEC assumes the following:

- All boring/monitoring well locations will be selected and located in the field by TVA or their designees. After completion of drilling, all boring locations will be staked by MACTEC and surveyed by TVA using land surveying techniques. A base map and coordinates of all boring locations will be provided to MACTEC for use in their final report to TVA.

- TVA will furnish a dozer and any necessary stone to provide access for MACTEC's drilling equipment to all boring/monitoring well locations as needed.

- Underground utilities, if any, will be located by others.

- Mitigation of environmental concerns (if any are encountered) is not part of this work.

Cost Estimate

We have estimated the cost to perform the geotechnical exploration services to be approximately $72,440.53. This projected cost was based on manpower estimates and quantities of work as presented in the attached cost estimate. The actual cost will be based on the units of work performed. Our cost estimate includes performing 12 field hydraulic conductivity tests. If these tests are not to be performed by MACTEC, the total estimated cost should be reduced by $11,900, assuming no use or involvement of MACTEC equipment and personnel.

Schedule

Based on our current work load, we can mobilize drilling equipment to the site within a week after receiving your authorization, but not sooner than January 3, 2005. We expect the field exploration to last approximately 10 to 15 working days. Preliminary boring logs can be provided at the completion of each boring. We anticipate laboratory testing to be completed in about two weeks after completion of the field work and the report to be issued approximately one week after completion of the laboratory testing.

Authorization

We propose to perform the requested services in accordance with the terms and conditions of our existing contract 21705. We understand that, if this proposal is acceptable to you, TVA will authorize this work by issuance of a TAO.

Mr. Purkey, we appreciate this opportunity to provide these services to TVA. If you have any questions regarding this proposal, please contact Hussein Benkhayal or Carl Tockstein at (865) 588-8544.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Samuel D. Stone

Hussein A. Benkhayal
Senior Professional

Samuel D. Stone, P.E.
Senior Principal Engineer

HAB/SDS:sjm

Attachment

cc: Mr. Lynn Petty
TVA Chattanooga

MACTEC TVA

COST ESTIMATE TVA KINGSTON FP MONITORING WELL INSTALLATION MACTEC Proposal Prop04Knox/399	
Manpower	$33,750.53
Drilling	$35,440.00
Lab	$3,250.00
Total	$72,440.53

SCHEDULE OF FEES
PERSONNEL CHARGES
TVA KINGSTON FP MONITORING WELL INSTALLATION
MACTEC Proposal Prop04Knox/399

PROFESSIONAL SERVICES

DESCRIPTION	HOURS	RATE	BURDEN	BILLING RATE	COST
Project Administration					
Chief Engineer	8	$48.00	$20.00	$138.72	$1,109.76
Senior Engineer	12	$25.00	$6.00	$72.25	$867.00
Drilling/Field Coordination					
Senior Engineer	16	$25.00	$47.25	$72.25	$1,156.00
Project Engineer	8	$23.00	$43.47	$66.47	$531.76
Field Engineering					
Project Engineer	150	$23.00	$43.47	$66.47	$9,970.50
Senior Engineer	16	$25.00	$47.25	$72.25	$1,156.00
Senior Geologist	60	$29.41	$55.58	$84.99	$5,099.69
Project Geologist	60	$22.50	$42.53	$65.03	$3,901.50
Data Analysis / Lab Coordination					
Chief Engineer	4	$48.00	$90.72	$138.72	$554.88
Senior Engineer	24	$25.00	$47.25	$72.25	$1,734.00
Project Engineer	8	$23.00	$43.47	$66.47	$531.76
Senior Geologist	16	$29.41	$55.58	$84.99	$1,359.92
Report Preparation					
Project Engineer	8	$23.00	$43.47	$66.47	$531.76
Senior Engineer	32	$25.00	$47.25	$72.25	$2,312.00
Chief Engineer	4	$48.00	$90.72	$138.72	$554.88
Drafter/CADD	16	$15.00	$28.35	$43.35	$693.60
Word Processor	12	$14.00	$26.46	$40.46	$485.52
SUBTOTAL LABOR	454 Hours				$32,550.53

Travel Expenses (Professional)

	Unit Rate	Quantity	Estimated Cost
Expenses (includes transportation to and from site, per diem in accordance with TVA allowances, etc.)	$1,200.00 Each	1	$1,200.00
SUBTOTAL TRAVEL EXPENSES			$1,200.00
SUBTOTAL SUBCONTRACT			$33,750.53

SCHEDULE OF FEES
COST ESTIMATE
TVA KINGSTON FP MONITORING WELL INSTALLATION
MACTEC Proposal Prop04Knox/399

Description	Quantity	Unit	Unit Rate	Subtotal
A. Mobilization and demobilization of drilling, sampling, or support equipment:				
1. #				
6 Truck-mounted drill rig	1	each	$200.00	$200.00
b. ATV-mounted drill rig	1	each	$250.00	$250.00
c. Water truck	0	each	$100.00	$0.00
d. Geoprobe	0	each	$200.00	$0.00
e. Workover rig	0	each	$100.00	$0.00
f. Support truck	1	each	$50.00	$50.00
2. Beyond 25 miles from originating location, add per mile one-way				
a. Truck-mounted drill rig	15	mile	$4.00	$60.00
b. ATV-mounted drill rig	15	mile	$5.00	$75.00
c. Water truck, workover rig, or Geoprobe	0	mile	$2.00	$0.00
d. Support truck	15	mile	$1.00	$15.00
B. Wash Boring in overburden soil, per linear foot				
a. 4 - inch diameter	1095	feet	$6.50	$7,117.50
b. 6 - inch diameter	0	feet	$7.50	$0.00
C. Standard penetration test in conjunction with boring, per sample				
1. N < 50	80	each	$20.00	$1,600.00
2. N > 50	13	each	$25.00	$325.00
F. Grouting (cement) borehole without well, per linear foot:				
1. 6-inch diameter or less, per linear foot	555	feet	$5.50	$3,052.50
2. 6- to 9-inch diameter, per linear foot	0	feet	$11.00	$0.00
3. 9- to 12-inch diameter, per linear foot	0	feet	$22.00	$0.00
4. Above rates are based on neat line borehole volume, if grout losses occur, additional grouting will be charged at time rate drilling cost plus actual material cost times 1.10.				
G. Type I PVC well construction in pre-drilled borehole, including time and materials, per linear foot:				
1. 1-inch		feet	$10.00	$0.00
2. 2-inch	540	feet	$13.00	$7,020.00
I. Time rate for drill crew and equipment including steam cleaning, packer testing with drill crew, difficult moving, clearing, well development, hauling water, handling IDW, difficult drilling through collapsing or flowing materials, drilling through pavement, rock drilling using a roller cone bit in partially weathered rock only, drilling through boulders or debris, reaming out partially weathered rock corehole, standby, safety orientation, site restoration, packer testing, off-truck drilling, inside work, or time-rate drilling, per hour.				
	36	hours	$150.00	$5,400.00
J. Equipment charges, per day:				
1. Water truck to support drill rig	0	days	$250.00	$0.00
2. Steam cleaner		days	$75.00	$0.00
3. Generator		days	$50.00	$0.00
9. Grout plant	18	days	$250.00	$4,500.00
10. ATV drill	15	days	$100.00	$1,500.00

SCHEDULE OF FEES
COST ESTIMATE
TVA KINGSTON FP MONITORING WELL INSTALLATION
MACTEC Proposal Prop04Knox/399

	Description	Quantity	Unit	Unit Rate	Subtotal
11.	Support truck	15	days	$35.00	$525.00
17	Cellular Telephone	15	days	$50.00	$750.00

V. Overtime charges for drilling at TVA's request during other than 40-hour week or on weekends or holidays, multiply rates by 1.3.

		--	

W. Crew daily trip charge, to and from site

15	days	$75.00	$1,125.00

X. Per diem and lodging in accordance with TVA allowances

15	day	$125.00	$1,875.00

TOTAL COST ESTIMATE	**$35,440.00**

SCHEDULE OF FEES
LABORATORY TESTING SERVICES
TVA KINGSTON FP MONITORING WELL INSTALLATION
MACTEC Proposal Prop04Knox/399

Description	ASTM	Quantity	Unit	Rate	Subtotal
Natural (Jar) Moisture Content	D-2216	80	per test	$8.00	$640.00
Atterberg Limits	D-4318	8	per test	$65.00	$520.00
Sieve Analysis (wash wo/hydrometer - assumed Spec. Grav.)	D-422	20	per test	$50.00	$1,000.00
Sieve Analysis w/hydrometer (assumed Spec. Grav.)	D-422	8	per test	$110.00	$880.00
Specific Gravity	D-854	6	per test	$35.00	$210.00

TOTAL COST ESTIMATE **$3,250.00**

MACTEC SOIL TEST BORING FIELD REPORT

BORING NO MW-7 PG. 1 OF
RIG TYPE CME 75 HAMMER TYPE Automatic
JOB NO. 3043041063 DRILLER J. WARREN HOURS DRILLING GROUND SURFACE ELEV.
JOB NAME TVA KINGSTON-WELL INSTALL. LOGGED BY T Justice HOURS MOVING DATE: 1/4/05 WEATHER: Cloudy

No.	Depth				SCALE	UD	REC	SOIL CLASSIFICATION	REMARKS
1	0-1.5	2	4	7			1.3	Firm Gray dry SILTY SAND - ASH	
2	5-6.5	6	16	21			1.0	Dense Gray Dry to sl. moist Silty SAND with a few Coal fragments - ASH	
3	10-11.5	10	18	20			1.3	DENSE Gray Dry to sl. moist Very Silty SAND - ASH	
4	15-16.5	15	27	36			1.2	Very Dense Gray Dry to sl. moist Very silty SAND with rock frags - ASH	
5	20-21.5	14	21	32			1.2	SAME AS ABOVE	
6	25-26.5	2	2	5			1.2	Firm Gray moist to v. moist Very SANDY SILT - ASH	
7	30-31.5	9	9	10			1.0	Very Stiff Gray V. moist to wet SANDY SILT - ASH	▽-30'
8	35-36.5	WOH	WOH	2			1.3	Very Soft Gray wet Clayey silt - ASH	
9	40-41.5	WOH	WOH	WOH			0.1	Very loose Gray Gravel Fragments	

+STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES.

BORING TERMINATED:
BORING REFUSAL:
WATER TOB DEPTH @time of drilling ≅30.0FT
WATER 24 HR.: DEPTH
WATER LOSSES
CAVE-IN DEPTHS
CASING: SIZE LENGTH
STANDBY TIME BORING LAYOUT

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER 3 1/4"	0 TO 10 FT
HAND SHOP: W/MUD: W/WATER	TO
ROTARY DRILL: W/MUD: W/WATER HQ CASING	10 TO
DIAMOND CORE	TO
CORE SIZE	TO
UNDISTURBED SAMPLES NO – SIZE –	
BAG SAMPLES NO –	

F1024 8/03

MACTEC **SOIL TEST BORING FIELD REPORT**

BORING NO. MW-7 **PG.** 2 **OF** 3

RIG TYPE CME 75 **HAMMER TYPE** Automatic

JOB NO. 3043041063 **DRILLER** J. WARREN / T. MASON **HOURS DRILLING** ____ **GROUND SURFACE ELEV.** ____

JOB NAME TVA Kingston WELL INSTALL. **LOGGED BY** T. Justin **HOURS MOVING** ____ **DATE:** 1/4/05 1/5/05 **WEATHER:** Cloudy

10	45-46.5	1	WOH	WOH	1.4	Very Soft Gray wet Clayey sandy SILT - ASH (Fly)	
11	50-51.5	1	1	1	1.0	From 50 to 51.0' - SAME AS ABOVE. From 51.0 to 51.5' - Very loose wet Gray Silty SAND - ASH (Bottom)	
12	55-56.5	1	2	WOH	1.4	Very Soft Gray wet Clayey SILT - ASH (Fly)	
13	60-61.5	5	5	5	1.4	From 60 to 60.3 - "SAME AS ABOVE" From 60.3 to 61.5 - LOOSE GRAY WET SILTY SAND - ASH (Bottom)	- END OF SHIFT (1/04/2005)
14	65-66.5	4	2	1	1.1	From 65 to 66.0 - Loose Gray WET SILTY SAND - ASH (Bottom) From 66.0 to 66.5 - Soft GRAY WET CLAYEY SILT - ASH (Fly)	
15	70-71.5	3	4	1	1.4	FIRM Gray WET SANDY SILT - ASH (Fly) From 71.2 to 71.4 OBSERVED Iron-stained interval	
16	75-76.5	3	1	WOH	1.4	Very Soft Gray WET SANDY SILT - ASH (Fly)	
17	80-81.5	3	1	WOH	0.6	Very Loose GRAY WET SAND - ASH (Bottom)	

+STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES.

BORING TERMINATED: 111.2 FT

BORING REFUSAL: 111.2 FT

WATER ~~TOB~~ DEPTH @ time of drilling ≅ 30.0 FT

WATER 24 HR.: DEPTH –

WATER LOSSES –

CAVE-IN DEPTHS –

CASING: SIZE – LENGTH –

STANDBY TIME – BORING LAYOUT –

METHOD OF ADVANCING BORING		DEPTH
POWER AUGER	3 1/4"	0 TO 10 FT
HAND SHOP: W/MUD: W/WATER		TO
ROTARY DRILL: W/MUD: [✓ W/WATER] HQ CASING		10 TO 111.2 FT
DIAMOND CORE		TO
CORE SIZE		TO
UNDISTURBED SAMPLES	NO – SIZE –	
BAG SAMPLES	NO –	

F1024 8/03

MACTEC

SOIL TEST BORING FIELD REPORT

BORING NO. MW-7 PG. 3 OF 3

JOB NO. 3043041063 DRILLER J. WARREN RIG TYPE CME-75 HAMMER TYPE Automatic

JOB NAME TVA KINGSTON WELL INSTALL. LOGGED BY T. Justice HOURS DRILLING ___ GROUND SURFACE ELEV. ___

HOURS MOVING ___ DATE: 1/5/05 WEATHER: Cloudy

SAMPLING No.	Depth	N* 1st 6"	N* 2nd 6"	N* 3rd 6"	SCALE	OR	REC	SOIL CLASSIFICATION	REMARKS
18	85-86.5	6	8	11			1.5	From 85 to 86.0' - Very Stiff GRAY moist Sandy clayey silt with a few roots - Alluvium From 86.0 to 86.5' - SAME AS ABOVE except "Olive Brown"	
19	90-91.5	3	4	6			0.2	STIFF Olive Brown AND GRAY moist Sandy silty clay - Alluvium	
20	95-96.5	6	5	3			1.4	From 95 to 95.5 - Loose ORANGE Brown moist silty SAND - Alluvium From 95.5 to 96.5 - Loose Gray Very moist to wet clayey silty SAND - Alluvium	
21	100-101.5	9	7	9			1.3	Firm LIGHT OLIVE GRAY WET silty SAND - Alluvium	
22	105-106.5	3	11	29			1.5	Dense Light Olive Gray moist to Very moist SAND with ocassional gravel - Alluvium	
23	110-110.5	4	15	18			1.5	Dense Light Olive Gray moist Sand with gravel - Alluvium	
								Fluid-Rotary Refusal @ 111.2 FT	

*STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES.

BORING TERMINATED: 111.2 FT
BORING REFUSAL: 111.2 FT
WATER ~~JOB~~ DEPTH @ time of drilling ≅ 30.0 FT
WATER 24 HR.: DEPTH —
WATER LOSSES —
CAVE-IN DEPTHS —
CASING: SIZE — LENGTH —
STANDBY TIME — BORING LAYOUT —

METHOD OF ADVANCING BORING		DEPTH
POWER AUGER	3 1/4"	0 TO 10 FT
HAND SHOP: W/MUD: W/WATER		TO
ROTARY DRILL: W/MUD: [✓ W/WATER]	HQ CASING	10 TO 111.2 FT
DIAMOND CORE		TO
CORE SIZE		TO
UNDISTURBED SAMPLES	NO — SIZE —	
BAG SAMPLES	NO —	

F1024 8/03

MACTEC **SOIL TEST BORING FIELD REPORT**

BORING NO. MW-7 PG. 2 OF

RIG TYPE CME 75 HAMMER TYPE Automatic

JOB NO. 3043041063 DRILLER J. WARREN/[illegible] HOURS DRILLING GROUND SURFACE ELEV.

JOB NAME TVA Kingston WELL INSTALL. LOGGED BY T. Justice HOURS MOVING DATE: 1/4/05 WEATHER: Cloudy

10	45-46.5	1	WoH	WoH	1.4	Very Soft Gray Wet Clayey Sandy Silt - ASH
11	50-51.5	1	1	1	1.0	From 50 to 51.0' - SAME AS ABOVE. From 51.0 to 51.5' - Very loose wet Gray Silty SAND - ASH
12	55-56.5	1	2	WoH	1.4	Very Soft GRAY Wet Clayey Silt - ASH
13	60-61.5	5	5	5	1.4	From 60 to 60.3 - "SAME AS ABOVE" From 60.3 to 61.5 - LOOSE GRAY WET SILTY SAND - ASH - END OF SHIFT (1/04/2005)
14	65-66.5					
15	70-71.5					
16	75-76.5					
17	80-81.5					

+STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES.

BORING TERMINATED:
BORING REFUSAL:
WATER TOB DEPTH
WATER 24 HR.: DEPTH
WATER LOSSES
CAVE-IN DEPTHS
CASING: SIZE LENGTH
STANDBY TIME BORING LAYOUT

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	TO
HAND SHOP: W/MUD: W/WATER	TO
ROTARY DRILL: W/MUD: W/WATER	TO
DIAMOND CORE	TO
CORE SIZE	TO

UNDISTURBED SAMPLES NO SIZE
BAG SAMPLES NO

F1024 8/03

TVA

Fax Transmittal Form

To:

Neil Davies GeoSyntec Fax number: 678-202-9501	Dan Smith Parsons Fax number: 423-266-0922
Mark Boggs & Hank Julian TVA Fax number: 865-632-8375	Greg McNulty Parsons Fax number: 513-554-6572

From

Lynn Petty
Phone: 423-751-6704
Fax: 423-751-7094
Email: hlpetty@tva.gov

KINGSTON WELL INSTALLATION—2005-DAILY LOGS

Date sent: 1/5/05

Number of pages including cover page: 4

Notes:

FAX COVER SHEET

PAGES: 2 (PLUS COVERSHEET)

DATE: 01/04/2005

TO: LYNN PETTY

fAX #: (423) 751-7094

SUBJECT: TVA KINGSTON WELL INSTALLATION FIELD BORING LOGS.

FROM: TODD JUSTICE (MACTEC)

COMMENTS: DRILLING PROGRESS AND FIELD BORING LOGS PERFORMED ON 01/04/2005.

TVA

Fax Transmittal Form

To:

Neil Davies GeoSyntec Fax number: 678-202-9501	Dan Smith Parsons Fax number: 423-266-0922
Mark Boggs & Hank Julian TVA Fax number: 865-632-8375	Greg McNulty Parsons Fax number: 513-554-6572

From

Lynn Petty
Phone: 423-751-6704
Fax: 423-751-7094
Email: hlpetty@tva.gov

KINGSTON WELL INSTALLATION—2005-DAILY LOGS

Date sent: 1-18-05

Number of pages including cover page: 2

Notes: B-4 (ORIG LOCATION)

MACTEC **SOIL TEST BORING FIELD REPORT**

BORING NO. B-4 **PG.** 1 **OF** 1
RIG TYPE ATV **HAMMER TYPE** MANUAL
JOB NO. 3043041063 **DRILLER** R. BANKS **HOURS DRILLING** ____ **GROUND SURFACE ELEV.** ____
JOB NAME TVA KINGSTON **LOGGED BY** J. Justice **HOURS MOVING** ____ **DATE:** 1/17/05 1/18/05 **WEATHER:** COLD, 20's

B-4

						From 0 to 2.5FT ENCOUNTERED Rip Rap AND CRUSHED STONE BASE AGGREGATE. BEGAN SPOON SAMPLING @ 4.0 FT	Note: Drill Fluid loss @ 12 FT. Installed PVC CASING.
1	4-5.5	3	8	6	0.8	STIFF GRAY Sl. moist clayey sandy silt with a few Coal fragments - Fly ASH	▽ ≅ 6.5'
2	9-10.5	3	1	2	1.4	Soft Gray wet sandy clayey silt with a few root layers - Fly ASH	
3	14-15.5	3	7	12	1.4	Very STIFF RED-BROWN slightly moist silty clay with chert fragments - Fill	
4	19-20.5	10	4	3	1.0	Loose Gray wet clayey silty SAND - BOTTOM ASH	
5	24-25.5	10	8	8	1.0	Firm Gray wet silty SAND with coal fragments - BOTTOM ASH	
6	29-30.5	2	5	2	1.4	Firm Gray wet sandy clayey SILT - Fly ASH	DRILLER NOTED HARD DRILLING @ 32.0 FT
7	34-35.5	12	22	13	1.2	HARD GRAYISH Brown to Olive Brown slightly moist WEATHERED SHALE - RESIDUUM NOTE: ENCOUNTERED GRAVEL with SAND From 34 to 34.1 FT. Possible Alluvial interval located in between FLY ASH AND RESIDUUM	
8	39-40.5	20	26	44	1.5	Very HARD GRAYISH BROWN slightly moist WEATHERED SHALE - RESIDUUM	

+STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES.

BORING TERMINATED: 43.0'
BORING REFUSAL: 43.0'
WATER ~~TOO DEPTH~~ @ time of drilling ≅ 6.5 FT
WATER 24 HR.: DEPTH —
WATER LOSSES SEE NOTE
CAVE-IN DEPTHS —
CASING: SIZE ≅4" **LENGTH** 0 TO 8 FT
STANDBY TIME — **BORING LAYOUT** —

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	___ TO ___
HAND SHOP: W/MUD: W/WATER	___ TO ___
ROTARY DRILL: [✓ W/MUD: W/WATER] 4"ø	0 TO 43.0'
DIAMOND CORE	___ TO ___
CORE SIZE	___ TO ___
UNDISTURBED SAMPLES NO — SIZE —	
BAG SAMPLES NO —	

1024 8/03

TOTAL P.02

MACTEC SOIL TEST BORING FIELD REPORT

BORING NO. B-4 PG. - OF -

RIG TYPE ATV HAMMER TYPE MANUAL

JOB NO. 3043041063 DRILLER R. BANKS HOURS DRILLING ____ GROUND SURFACE ELEV. ____

JOB NAME TVA KINGSTON LOGGED BY J. Justice HOURS MOVING ____ DATE: 1/17/05 1/18/05 WEATHER: COLD, 20'S

B-4

						From 0 to 2.5FT ENCOUNTERED Rip Rap AND CRUSHED STONE BASE AGGREGATE. BEGAN SPOON SAMPLING @ 4.0 FT	Note: Drill Fluid loss at 2 FT. Installed PVC CASING.
1	4-5.5	3	8	6	0.8	STIFF GRAY SL. moist clayey sandy silt with a few coal fragments - Fly ASH	⊻ ≅ 6.5'
2	9-10.5	3	1	2	1.4	Soft Gray WET SANDY clayey silt with a few root layers - Fly ASH	
3	14-15.5	3	7	12	1.4	Very STIFF RED-BROWN slightly moist silty clay with chert fragments - Fill	
4	19-20.5	10	4	3	1.0	Loose Gray WET clayey silty SAND - BOTTOM ASH	
5	24-25.5	10	8	8	1.0	Firm Gray wet silty SAND with coal fragments - BOTTOM ASH	
6	29-30.5	2	5	2	1.4	Firm Gray wet SAndy clayey SILT - Fly ASH	DRILLER NOTED HARD DRILLING @ 32.0 FT
7	34-35.5	12	22	13	1.2	HARD GRAYISH BROWN to Olive Brown slightly moist WEATHERED SHALE - RESIDUUM NOTE: ENCOUNTERED GRAVEL with SAND From 34 to 34.1 FT. Possible Alluvial interval located in between FLY ASH AND RESIDUUM	
8	39-40.5	20	26	44	1.5	Very HARD GRAYISH BROWN slightly moist WEATHERED SHALE - RESIDUUM	

+STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES.

BORING TERMINATED: 43.0'
BORING REFUSAL: 43.0'
WATER ~~TOO DEPTH~~ @ time of drilling ≅ 6.5 FT
WATER 24 HR.: DEPTH —
WATER LOSSES SEE NOTE
CAVE-IN DEPTHS —
CASING: SIZE ≅ 4" LENGTH 0 TO 8 FT
STANDBY TIME — BORING LAYOUT —

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	___ TO ___
HAND SHOP: W/MUD: W/WATER	___ TO ___
ROTARY DRILL: [✓ W/MUD: W/WATER] 4"ø	0 TO 43.0'
DIAMOND CORE	___ TO ___
CORE SIZE	___ TO ___
UNDISTURBED SAMPLES NO — SIZE —	
BAG SAMPLES NO —	

1024 8/03

TOTAL P.02

Petty, Harold L.

From: Smith, Daniel R on behalf of Smith, Daniel R.
Sent: Monday, January 17, 2005 1:12 PM
To: GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES; Boggs, J. Markus; Petty, Harold L.; Smith, Amos L; egreg.mcnulty@parsons.com
Subject: Latest sketches for MW installation - TVA KIF Seepage study

Attached are the latest sketches. The pilot borings are not shown, only one well is currently shown for each location. This will be updated later. Neil had previously suggested a numbering approach (see attached email) - this can be incorporated next if everyone agrees.

RE: Revised neeting for KIF Se...
SK10W425-26A.PDF (925 KB)
SK10W425-73A.PDF (464 KB)
SK10W425-73B.PDF (548 KB)

Please note new email address: Daniel.R.Smith@parsonsec.com
Daniel R. (Dan) Smith, P.E.
Parsons E & C
633 Chestnut St, Suite 400
Chattanooga, TN 37450

Phone: (423) 757-8088
Fax: (423) 266-0922
Cell: (423) 364-1679

Email: Daniel.R.Smith@parsonsec.com

2 @ EA HOLE

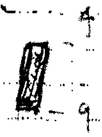
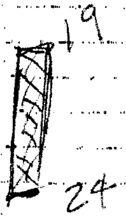
MACTEC **SOIL TEST BORING FIELD REPORT**

BORING NO. D-7 PG. 1 OF 1

RIG TYPE ATV HAMMER TYPE MANUAL

JOB NO. 3043041063 DRILLER R. BANKS HOURS DRILLING ___ GROUND SURFACE ELEV. ___

JOB NAME TVA KINGSTON LOGGED BY J. Justice HOURS MOVING ___ DATE: 1/17/05 1/18/05 WEATHER: COLD, 20'S

	765.0						From 0 to 2.5FT Encountered Rip Rap and Crushed Stone Base Aggregate. Began Spoon Sampling @ 4.0FT	Note: Drill Fluid loss @12FT. Installed PVC Casing.
1	4-5.5	3	8	6		0.8	STIFF GRAY Sl. moist clayey sandy silt with a few coal fragments - Fly ASH	⊻ ≅6.5'
2	9-10.5	3	1	2	 4 9	1.4	Soft Gray wet sandy clayey silt with a few root layers - Fly ASH	
3	14-15.5	3	7	12		1.4	Very STIFF RED-BROWN slightly moist silty clay with chert fragments - Fill	
4	19-20.5	10	4	3	 19 24	1.0	Loose Gray wet clayey silty SAND - Bottom ASH	
5	24-25.5	10	8	8		1.0	Firm Gray wet silty SAND with coal fragments - Bottom ASH	
6	29-30.5	2	5	2		1.4	Firm Gray wet sandy clayey SILT - Fly ASH	DRILLER NOTED HARD DRILLING @ 32.0FT
7	34-35.5	12	22	13		1.2	HARD GRAYISH BROWN to Olive Brown slightly moist WEATHERED SHALE - RESIDUUM	
							NOTE: ENCOUNTERED GRAVEL with SAND From 34 to 34.1FT. Possible Alluvial interval located in between FLY ASH AND RESIDUUM	
8	39-40.5	20	26	44		1.5	Very HARD GRAYISH BROWN slightly moist WEATHERED SHALE - RESIDUUM	

+STANDARD PENETRATION RESISTANCE IS SUM OF BLOWS FOR 2ND 6" AND 3RD 6" TO DRIVE 1-3/8" I.D., 2" O.D. SPLIT BARREL SAMPLER WITH 140 POUND HAMMER FALLING 30 INCHES.

BORING TERMINATED: 43.0'
BORING REFUSAL: 43.0'
WATER ~~TOO DEPTH~~ @ time of drilling ≅ 6.5 FT
WATER 24 HR.: DEPTH —
WATER LOSSES SEE NOTE
CAVE-IN DEPTHS —
CASING: SIZE ≅4" LENGTH 0 TO 8 FT
STANDBY TIME — BORING LAYOUT —

METHOD OF ADVANCING BORING	DEPTH
POWER AUGER	___ TO ___
HAND SHOP: W/MUD: W/WATER	___ TO ___
ROTARY DRILL: [✓ W/MUD: W/WATER] 4" ø	0 TO 43.0'
DIAMOND CORE	___ TO ___
CORE SIZE	___ TO ___
UNDISTURBED SAMPLES NO — SIZE —	
BAG SAMPLES NO —	

1024 8/03

Petty, Harold L.

From: Smith, Daniel R.
Sent: Monday, January 17, 2005 1:12 PM
To: GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES; Boggs, J. Markus; Petty, Harold L.; Smith, Amos L; egreg.mcnulty@parsons.com
Subject: Latest sketches for MW installation - TVA KIF Seepage study

Latest sketches for MW install...

```
<html>
<font face="Arial" style="font-size: 8pt;">*** WorleyParsons Group Notice ***
"This email is confidential. If you are not the intended recipient, you must not disclose
or use the information contained in it. If you have received this email in error, please
notify us immediately by return email and delete the email and any attachments. Any
personal views/ opinions expressed by the writer may not necessarily reflect the views/
opinions of the company."
</font>
</html>
```

MEET

MATT WILLIAMS — SLUC WED - FRI

9 WELLS 2 HRS EA

1:00 PM

10 PEOPLE

LIVEWIRE A

1-31-05

10:00 AM

10:00 - 2PM
PM

x29915

KIF -

[illegible]

①

Petty, Harold L.

From: GEOSYNTEC CONSULTANTS INC Attn: R NEIL DAVIES
Sent: Thursday, January 13, 2005 1:03 PM
To: Smith, Daniel R.; Boggs, J. Markus; Smith, Amos L; egreg.mcnulty@parsons.com; habenkhayal@mactec.com
Cc: Julian, Hank; Petty, Harold L.; TElkady@GeoSyntec.com
Subject: RE: Revised meeting for KIF Seepage - Summary of Decisions From Jan 13 Call

Based on today's conference call, the following target well elevations were established:

MW-3
- drill down to 70 ft. depth; commence sampling
- drill to refusal or bedrock
- decision to be made on well screen elevation after review of logs

MW-4
- move to location originally established; needs some surface preparation prior to drilling
- drill/sample to bedrock or refusal
- we will probably establish 2 wells at this new location (TBD based on drill logs)

MW-6
- additional well to be established with screen at 50-55 ft BGS

MW-7
- additional well to be established with screen at 40-45 ft BGS

MW-8
- well to be established with screen at 20-25 ft BGS
- well to be established with screen at 35-40 ft BGS

MW-9
- well to be established with screen at 10-15 ft BGS
- well to be established with screen at 20-25 ft BGS

Note Nomenclature:
At each physical location, the pilot boring should be referred to as Bx; well should be labeled as MW-xA and MW-xB where x is the location number.

Thanks
Neil

From: Smith, Daniel R [mailto:Daniel.R.Smith@parsonsec.com]
Sent: Wednesday, January 12, 2005 3:15 PM
To: Boggs, J Marcus; Neil Davies; Smith, Amos; egreg.mcnulty@parsons.com; Benkhayal, Hussein
Cc: Julian, Hank; Petty, H. L.
Subject: Revised meeting for KIF Seepage - discussion of Holes 8,9, & 4

We need to meet TOMORROW Thursday January 13, 2004 at 11 am. Mactec has completed holes 8&9, and will have completed hole 4 by early tomorrow morning at the latest. They will be ready to drill the wells for these holes starting tomorrow. Please be prepared to discuss basically the same items for these holes as we did yesterday for 5,6 & 7.

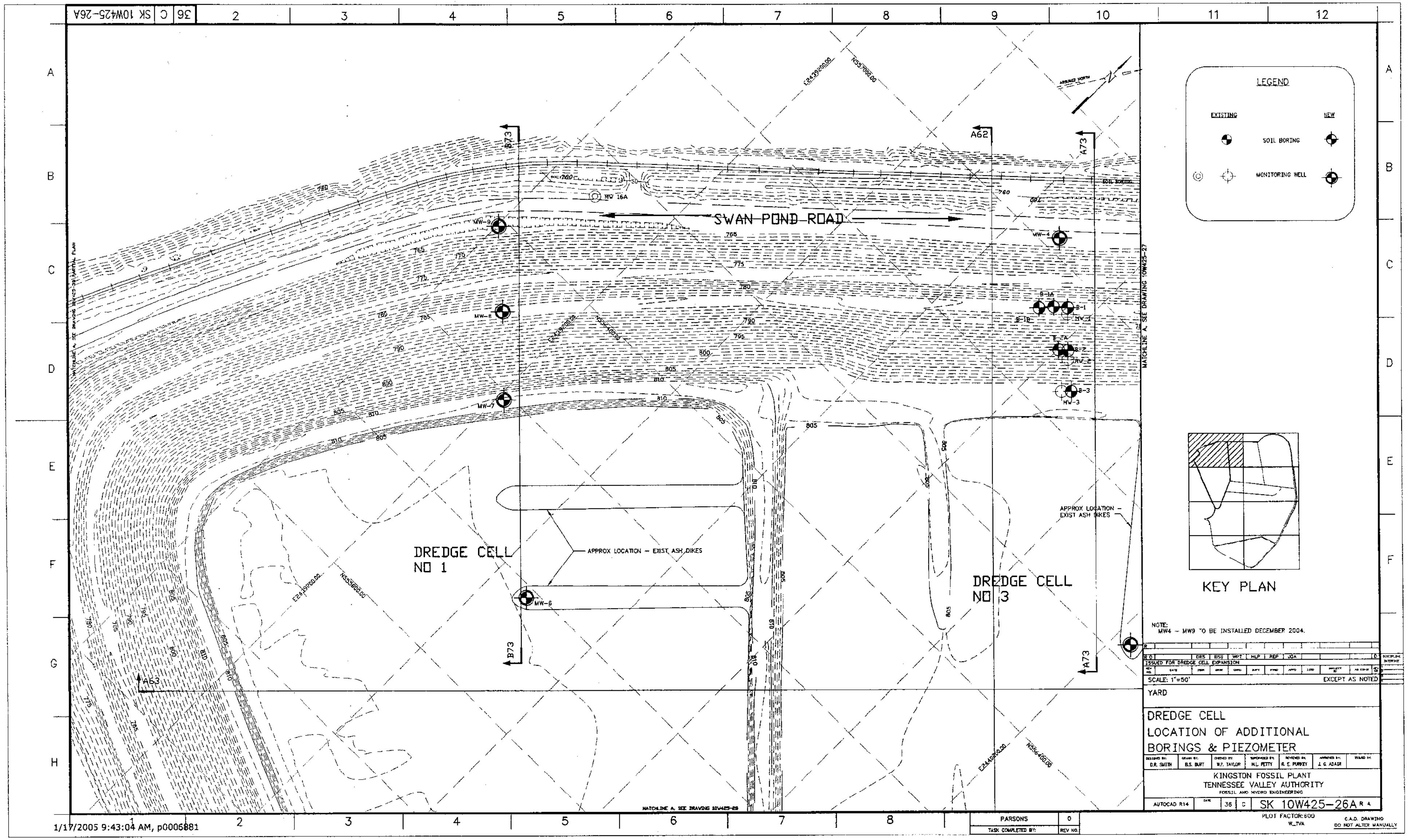
We will therefore cancel Friday's meeting. We will set a time for the followup meetings tomorrow.

Mactec needed to move hole # 4 up the slope about 20 ft, due to inaccessibility. From what they described, it will be placed on the existing bench that is at about El 775. Hole 9 went in at the location staked.

Here is the phone no and Meeting ID.
call 423-751-2428 or . Enter Mtg ID 6704 when prompted.

If you have a conflict let me know. Lynn is on the road and this is the best time we could schedule - given an allowance for receiving the faxed information from hole #4. I'm out of the office and can be reached by cell phone.

Daniel R. (Dan) Smith, P.E.
Parsons E & C Phone: (423) 757-8088
633 Chestnut St, Suite 400 Fax: (423) 266-0922
Chattanooga, TN 37932 Cell: (423) 364-1679 Email: Daniel.R.Smith@parsonsec.com
Please note my new email address: Daniel.R.Smith@parsonsec.com



NOTE:
MW4 – MW9 TO BE INSTALLED DECEMBER 2004.

R 0		DRS	BSB	WPT	HLP	REP	JGA				D
ISSUED FOR DREDGE CELL EXPANSION											

SCALE: 1"=50' EXCEPT AS NOTED

YARD

DREDGE CELL
LOCATION OF ADDITIONAL
BORINGS & PIEZOMETER

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D.R. SMITH	B.S. BURT	W.P. TAYLOR	H.L. PETTY	R. E. PURKEY	J. G. ADAIR	

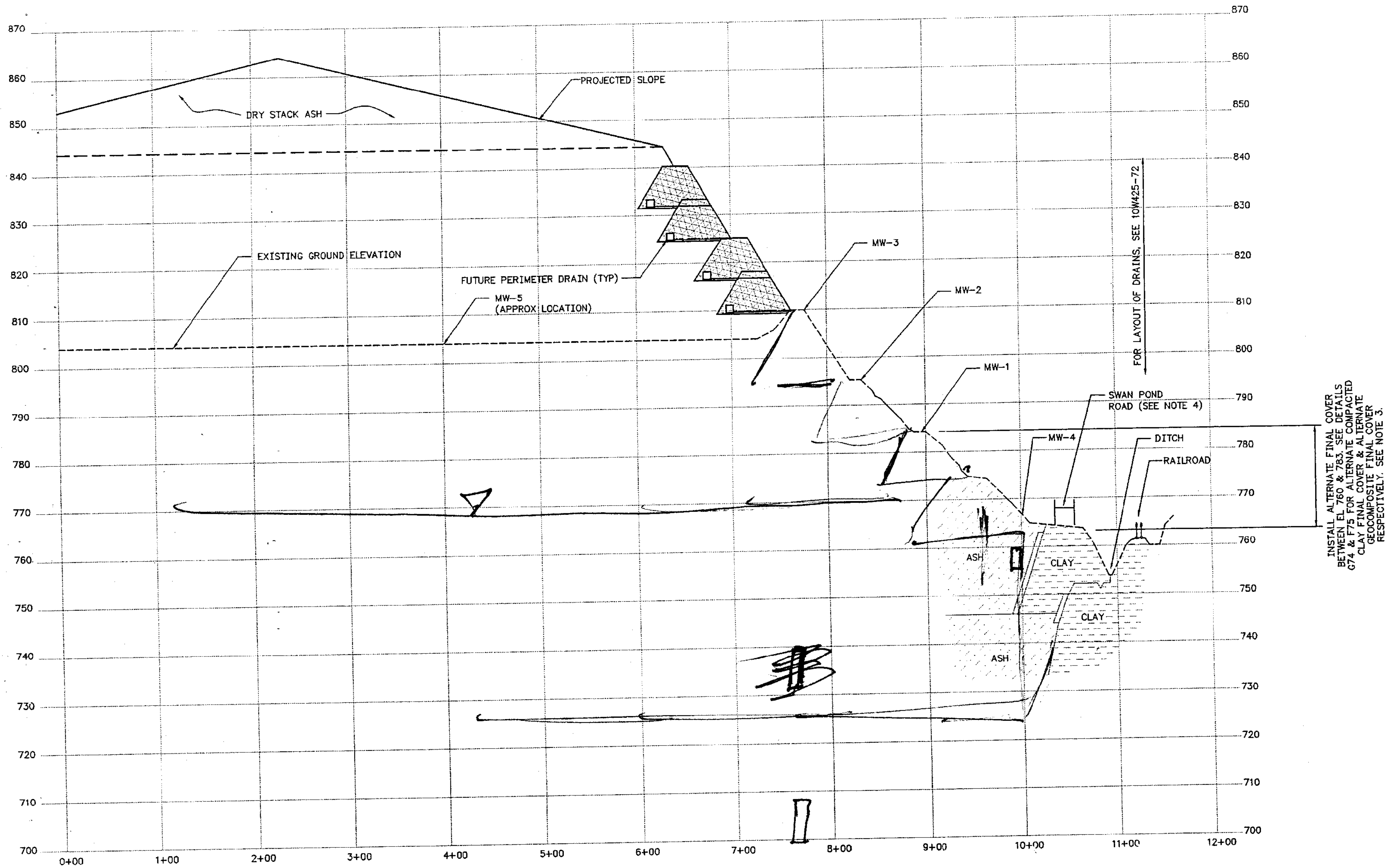
KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14 | DATE | 36 | C | SK 10W425-26A R 4

PLOT FACTOR:600
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

1/17/2005 9:43:04 AM, p0006881



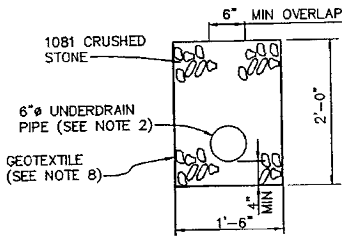
DETAIL A73

SCALE: HORIZONTAL: 1" = 50'
VERTICAL: 1" = 10'

810
-70
740

NOTES:

1. FOR DRAWINGS LIST AND LEGEND SEE 10W425-20
2. FOR GENERAL NOTES SEE 10W425-26
3. BETWEEN EL 760 & 783, STRIP EXISTING 1'-0" SOIL COVER WITHIN THE LIMITS SHOWN ON DRAWINGS 10W425-42 THRU 10W425-45, PRIOR TO INSTALLING FINAL COVER. STOCK PILE SOIL AND REUSE AS RANDOM FILL VEGETATIVE LAYER FOR FINAL COVER.
4. DETAIL DEPICTS SECTION THROUGH EXISTING DREDGE CELLS ADJACENT TO SWAN POND ROAD. BASE ELEVATION OF DREDGE CELL VARIES.
5. UNDERDRAIN AT THIS LOCATION ONLY REQUIRED ALONG DREDGE CELL ADJACENT TO SWAN POND ROAD. SEE DRAWINGS 10W425-42 THRU 10W425-45 FOR LOCATION.
6. LATERAL OUTLET PIPE SHALL BE NON-PERFORATED POLYETHYLENE CORRUGATED TUBING AS MANUFACTURED BY ADVANCED DRAINAGE SYSTEMS, INC., COLUMBUS, OHIO (614) 457-3051 OR EQUAL.
7. LATERAL OUTLET PIPES SHALL BE PLACED EVERY 200 FEET ON CENTER.
8. GEOTEXTILE SHALL BE A WOVEN MONOFILAMENT WITH AN APPARENT OPENING SIZE (AOS) SELECTED BY TVA FES (US STANDARD SIEVE SIZE) WHEN TESTED IN ACCORDANCE WITH ASTM D 4751. THE GEOTEXTILE SHALL BE GEOTEX 104F AS MANUFACTURED BY SYNTHETIC INDUSTRIES OR APPROVED EQUAL.



DETAIL B73

PERIMETER UNDERDRAIN
SCALE: 1" = 1'-0"

R0 ORS BSB WPT HLP REP JGA

ISSUED FOR DREDGE CELL EXPANSION

REV NO. DATE DSGN DRWN CHKD SUPV RVWD APPD ISSD PROJECT AS CONST

SCALE: AS SHOWN EXCEPT AS NOTED

YARD

EXISTING DREDGE CELL
UNDERDRAIN INSTALLATION ON
EXISTING SLOPE EL 760-795

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D.R. SMITH	B.S. BURT	W.P. TAYLOR	H.L. PETTY	R.E. PURKEY	J.G. ADAIR	

KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

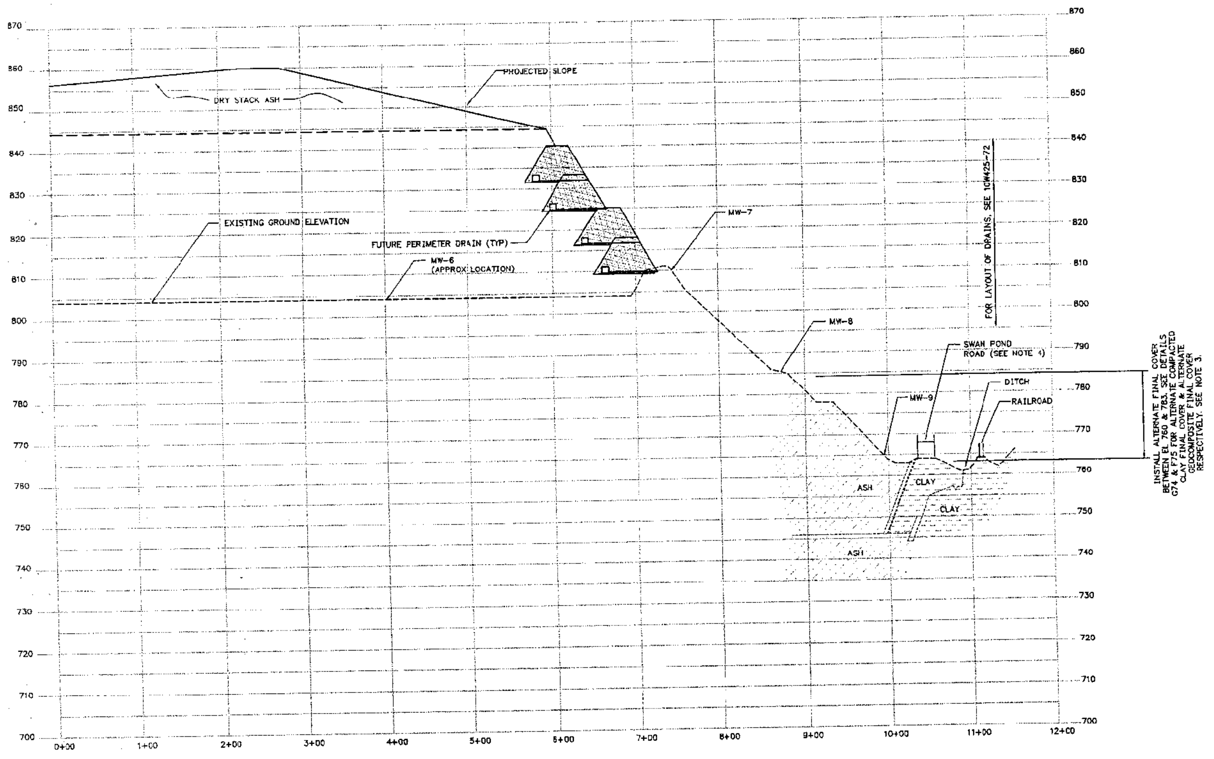
AUTOCAD R14 DATE 36 C SK 10W425-73A R A

PLOT FACTOR:50
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PARSONS 0
TASK COMPLETED BY: REV NO.

36 C SK10W42573B



DETAIL B73
SCALE: HORIZONTAL: 1" = 50'
VERTICAL: 1" = 10'

NOTES:

1. FOR DRAWINGS LIST AND LEGEND SEE 10W425-20
2. FOR GENERAL NOTES SEE 10W425-26
3. BETWEEN EL 760 & 783, STRIP EXISTING 1'-0" SOIL COVER WITHIN THE LIMITS SHOWN ON DRAWINGS 10W425-42 THRU 10W425-45, PRIOR TO INSTALLING FINAL COVER. STOCK PILE SOIL AND REUSE AS RANDOM FILL VEGETATIVE LAYER FOR FINAL COVER.
4. DETAIL DEPICTS SECTION THROUGH EXISTING DREDGE CELLS ADJACENT TO SWAN POND ROAD. BASE ELEVATION OF DREDGE CELL VARIES.
5. UNDERDRAIN AT THIS LOCATION ONLY REQUIRED ALONG DREDGE CELL ADJACENT TO SWAN POND ROAD. SEE DRAWINGS 10W425-42 THRU 10W425-45 FOR LOCATION.
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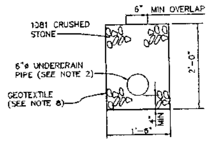

DETAIL B73
PERIMETER UNDERDRAIN
SCALE: 1" = 1'-0"

R O | DRS | BSB | WPT | HLP | REP | JGA | 0
ISSUED FOR DREDGE CELL EXPANSION
SCALE: AS SHOWN EXCEPT AS NOTED
YARD

EXISTING DREDGE CELL
UNDERDRAIN INSTALLATION ON
EXISTING SLOPE EL 760-795

D.R. SMITH | B.S. BURT | W.P. TAYLOR | H.L. PETTY | R.E. PURKEY | J.G. ADAIR

KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14 | 36 | C | SK 10W425-73B R A
PLOT FACTOR:50
W_TVA
C.A.D. DRAWING
DO NOT ALTER MANUALLY

PARSONS
TASK COMPLETED BY:
0
REV NO.

TVA

Fax Transmittal Form

To:

Neil Davies GeoSyntec Fax number: 678-202-9501	Dan Smith Parsons Fax number: 423-266-0922
Mark Boggs & Hank Julian TVA Fax number: 865-632-8375	Greg McNulty Parsons Fax number: 513-554-6572

From

Lynn Petty
Phone: 423-751-6704
Fax: 423-751-7094
Email: hlpetty@tva.gov

KINGSTON WELL INSTALLATION—2005-DAILY LOGS

Date sent: 1-18-05

Number of pages including cover page: 2

Notes: B-4 (ORIG LOCATION)

TVA

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Date sent: 1-18-05

Number of pages including cover page: 2

Notes: B-4 (ORIG LOCATION)

SHEET ____ OF ____

COMPUTED ____ DATE ____

CHECKED ____ DATE ____

~~MATR~~ TAMUR

~~95~~ 400L

~~90-95~~

95 -100

MW-3B

810
\- 85
725

WELLS
4

MW-3A 30-40 FT

810

70-75

13
WELLS

1:00 pm

CALL
@ 1PM

TVA 11030 (WM-7-75)

PARSONS
2443 Crowne Point Drive
Cincinnati, OH 45241
(513) 554-4455 (Phone)
(513) 554-6572 (Fax)

facsimile transmittal

COLLIN

To: H.L. Petty Fax: 423-751-7094

From: Greg McNulty Date: 1-13-04

Re: Failed Email Yesterday Pages: 2

CC: Hank Julian J. Marcus Boggs Amos Smith

☒ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

(770)-475-4984
MIKE MARTIN

TIP

5:30 pm

McNulty, Greg

From: McNulty, Greg
Sent: Wednesday, January 12, 2005 5:02 PM
To: Benkhayal, Hussein
Cc: Julian, Hank; Petty, H. L.; Boggs, J Marcus; Davies, Neil; Smith, Amos; 'Smith, Daniel R'
Subject: Confirmation of D-422 Sieve Analyses with Hydrometer at each Location with 5' Well Screen Interval.

Benkhayal,

Hello, as discussed yesterday in our 1 pm teleconference, this email confirms the use of the ASTM D-422 sieve analyses with hydrometer tests on soil samples taken from from each location interval where we plan to installed six 5-foot well screens. These six tests will leave two ASTM D422 sieve analyses with hydrometer tests to be performed at other locations. The group could probably discuss the location for these and other tests in tomorrow's 11:00 am conference call.

Greg McNulty PhD, PE, PG

PARSONS
2443 Crowne Point Drive
Cincinnati, Ohio 45241-5407
Cinci Office 513 552-7052
Fax 513 554-6572
Cell Personal 513 304-9099
egreg.mcnulty@parsons.com

TVA

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From

Lynn Petty
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Fax: 423-751-7094
Email: hlpetty@tva.gov

KINGSTON WELL INSTALLATION—2005-DAILY LOGS

Date sent:____________________

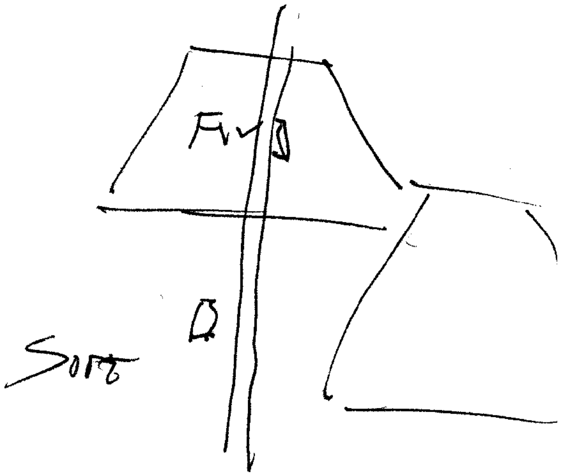
Number of pages including cover page:__________

Notes:

MW-4

Ground Elevation = 765 ft (estimated from
the drawing showing proposed locations of
additional borings and peizometers
10W425-26A)

	Elevation (ft)	Depth (ft)	
775	~~765~~	0	From 0 to 0.3 ft: Very stiff to hard orange brown, moist silty clay with chert fragments (Fill) From 0.3 to 1.5 ft: Dense gray, slight moist silty sand (Bottom ash)
	760	5	Firm gray very moist to wet silty sand (Bottom Ash)
767.5			▽ 757.5
	755	10	Stiff gray wet sandy silt (Fly Ash)
	750	15	Firm gray wet sandy silt (Fly Ash)
	745	20	Firm, gray wet clayey sandy silt (Fly Ash)
750	740	25	Very loose gray wet silty sand (Bottom Ash)
745	~~735~~	30	Loose gray wet silty sand (Bottom Ash)
740	~~730~~	35	Very soft gray wet sandy clayey silt (Fly Ash)
735	~~725~~	40	Very soft, gray wet sandy clayey silt (Fly Ash)
730	~~720~~	45	From 44 to 44.5 ft:Very soft, gray wet sandy clayey silt (Fly Ash) From 44.5 to 45.5 ft: Firm grayish brown moist slightly clay with few roots (Alluvium)
725	~~715~~	50	Loose gray moist silty sand with few roots (Alluvium)
720	~~710~~	55	Firm gray moist sandy clayey silt with few roots
715	~~705~~	60	Very loose gray very moist clayey silty sand (Alluvium)
710	~~700~~	65	Dense gray moist to very moist silty sand (Alluvium)
	695	70	Very Dense gray moist silty sand (Alluvium)
	695	73	



MW-8

Ground Elevation = 785.5 ft (estimated from the drawing showing proposed locations of additional borings and peizometers 10W425-26A)

Elevation (ft)	Depth (ft)	
785.5	0	??
780.5	5	From 4.0 to 4.8 ft: Dark brown gray, very dense, silty fine sand to gravel-sized (Bottom Ash) From 4.5 to 5.5 ft: Very hard, med to dark gray silt sized, slightly moist (Fly Ash)
775.5	10	Hard, meduim gray , silt to very fine sand-sized, slightly moist (Fly Ash)
770.5	15	Soft Meduim to dark gray silt to very coarse sand-sized (with occassional gravel) (Fly Ash) ▽ 768
765.5	20	Firm, meduim to dark gray silt sized (Fly Ash) with some gravel-sized Bottom Ash ??? wet
760.5	25	firm, silt to very fine sand-sized, wet (Fly Ash)
755.5	30	Very soft, meduim to dark gray, silt-sized, wet (Fly Ash)
750.5	35	Firm, meduimgray to black, fine to meduim sand-sized, silty (Fly Ash) with alternating light and dark horizontal layers
745.5	40	Soft, silt-sized to fine sand-sized ?????? (Fly Ash). wet, meduim gray
740.5	45	Stiff, meduim gray to black silt sized with 20% fine sand sized material (Fly Ash) wet
735.5	50	Very soft , meduim to dark gray with occassional balck, fine sand sized horizontal layers, silt sized (Fly Ash), wet
730.5	55	From 54 to 54.7 ft: very soft, meduim gray, silt sized, (Fly Ash) wet From 54.7 to 55.5 ft: Meduim gray to meduim brownish gray with occasional organic matter and rootlets, slightlyclayey silt, slightly moist (Alluvium)
725.5	60	Firm, light to meduim gray with occassional yellowish brown ??? slightly claye, sandy silt, slightly moist (Alluvium)
720.5	65	Stiff, ???, light yellowish gray and brownish yellow, slightly clayey, very sandy, fine to meduim sand, silt, slightly moist (Alluvium)
715.5	70	Soft. light gray, very sandy, fine to meduim sand, silt, wet (Alluvium)
710.5	75	Firm, light gray to light brown gray, very slightly fine to meduim Sand, wet (Alluvium)

3:00 PM
MONDAY

MW-9

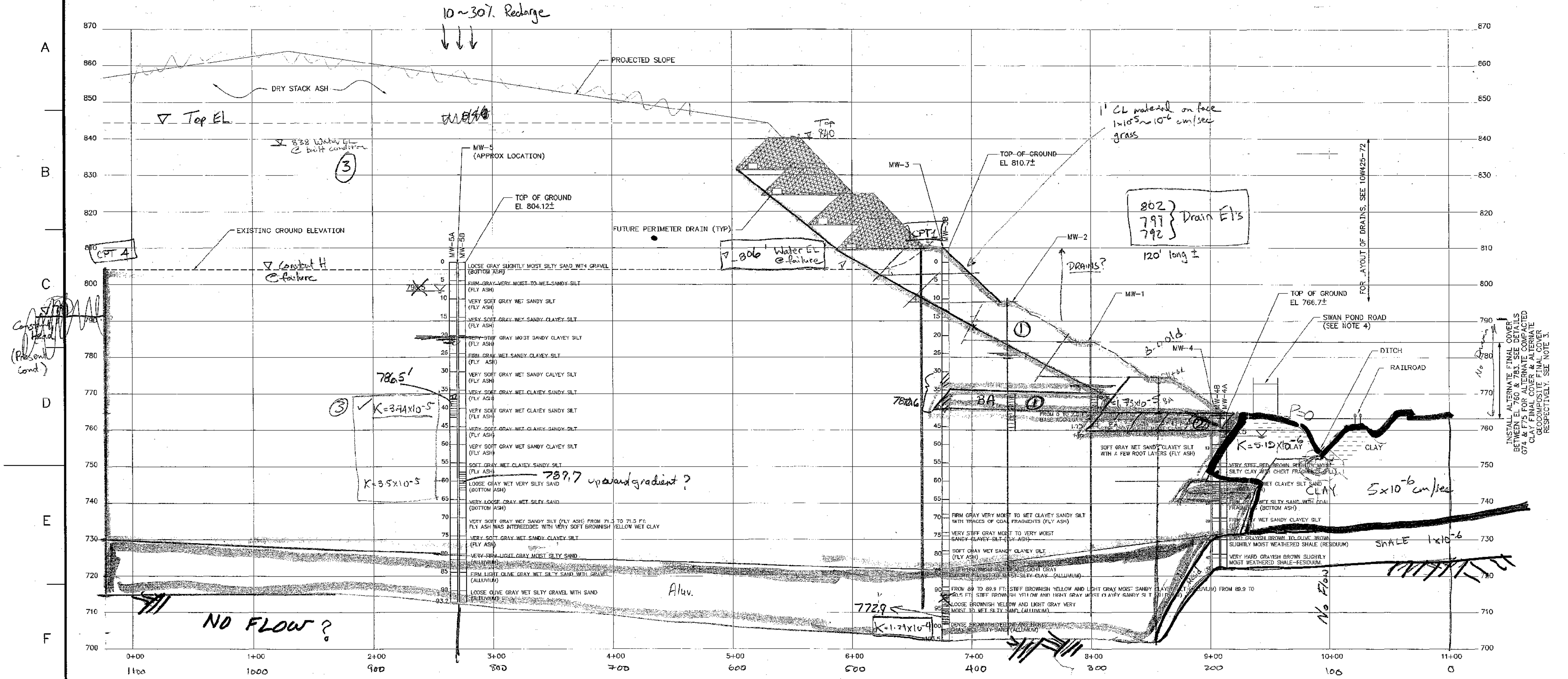
Ground Elevation = 766 ft (estimated from the drawing showing proposed locations of additional borings and peizometers 10W425-26A)

Elevation (ft)	Depth (ft)	
766	0	From 0 to 0.70 ft: very stiff redish brown, silty clay slightly moist From 0.7 to 1.5 ft: very stiff med to dark gray sandy silt-sized (Fly Ash), with occasional gravel -sized material slightly moist
761	5	Firm, medium to very dark gray, silt sized to very fine sand sized (Fly Ash) wet
		▽ 759
756	10	Very Stiff, medium to very dark gray silt to fine sand-sized (Fly Ash). Bottom 0.2' contains angular fragments of gravel brown limestone, wet
751	15	From 14.0 to 14.7 ft: Very hard, dark redish brown cherty silty clay slightly moist 14.7 to 15.5 ft: Very hard, dark gray to black silt to coarse sand-sized Fly Ash, with some fine to medium limestone gravel, wet
746	20	Firm, dark gray to black, fine to very coarse sand-sized (Bottom Ash) with some gravel to pebble sized fragments, wet
741	25	Soft, dark gray, silt-sized (Fly Ash), wet
736	30	Soft, dark brownish gray, slightly clayey sandy silt with occassional gravel weathered shale and other little fragments (Alluvium) wet
731	35	Soft , gray and yellowish brown slightly clayey sandy silt, with gravel sized fragments throughout. recovery low. moist (Alluvium)
726	40	Firm, brownish gray, slightly clayey, very sandy (finre to medium) silt, wet (Alluvium)
721	45	Soft, meduim brownish gray, slightly clayey, very sandy (fine to meduim) silt, wet (Alluvium)
716	50	Very loose, brownish gray, very silty, fine to medium sand, (Alluvium) wet
711	55	Loose, Medium to dark gray to medium brownish gray, very silty Sand, very moist to wet (Alluvium)

KIF Dredge Cell - Piezometer Information Summary

Well	TOC Elevation (ft-msl)	Grade Elevation (ft-msl)	Stick-up (ft)	TVA Measured Well Depth BTOC(ft)	TVA Measured Well Depth BGS (ft)	MACTEC Reported Well Depth BGS (ft)	Estimated sediment fill up in screen (ft)	TOS depth (ft)	BOS depth (ft)	WT depth BTOC (ft)	WT depth BGS (ft)	1/21/05 WT Elevation (ft-msl)	Depth BGS to alluvium (ft)	Depth BGS to Bedrock (ft)	WT to BOS (ft)	Saturated thickness - WT to top alluvium (ft)	Saturated thickness - WT to bedrock (ft)
MW-1	781.87	781.6	0.3	18.3	18.0	20.2	1.6	9.6	19.6	7.8	7.5	774.1	52.5	82.2	12.1	45.0	74.7
MW-2	795.50	795.0	0.5	24.9	24.4	35.2	-10.2	24.6	34.6	18.4	17.9	777.1	62.5	87.5	16.7	44.6	42.9
MW-3A	811.45	811.1	0.4	38.1	37.7	40.2	1.9	29.6	39.6	30.9	30.5	780.6	84.0	103.5	9.1	53.5	73.0
MW-3B	811.56	810.7	0.9	103.0	102.1	100.6	-2.1	95.0	100.0	38.7	37.8	772.9	84.0	103.5	62.2	NA	65.7
MW-4A	768.21	766.8	1.4	9.3	7.9	9.6	1.1	4.0	9.0	2.7	1.3	765.6	34.0	43.0	7.8	32.8	41.8
MW-4B	768.49	766.6	1.9	23.7	21.8	24.6	2.2	19.0	24.0	6.7	4.8	761.8	34.0	43.0	19.2	29.2	38.2
MW-5A	805.08	804.1	1.0	51.0	50.0	48.1	-2.5	42.5	47.5	18.6	17.6	786.5	80.0	93.2	29.9	62.4	75.6
MW-5B	806.92	804.4	2.5	69.6	67.1	68.1	0.4	62.5	67.5	17.3	14.8	789.7	80.0	93.2	52.8	65.3	78.5
MW-6A	810.76	808.3	2.5	57.5	55.0	55.6	0.0	50.0	55.0	37.7	35.2	773.0	82.2	103.0	19.8	47.0	67.8
MW-6B	808.89	807.9	1.0	76.0	75.0	75.6	0.0	70.0	75.0	36.6	35.6	772.3	82.2	103.0	39.4	46.6	67.4
MW-7A	814.30	811.7	2.6	47.5	44.9	45.6	0.1	40.0	45.0	40.0	37.4	774.3	85.0	111.2	7.6	47.6	73.8
MW-7B	812.56	811.9	0.7	65.7	65.0	65.6	0.0	60.0	65.0	40.0	39.3	772.6	85.0	111.2	25.7	45.7	71.9
MW-8A	786.26	784.8	1.5	25.1	23.6	25.6	1.4	20.0	25.0	15.7	14.2	770.6	54.7	78.5	10.8	40.5	64.3
MW-8B	787.19	785.7	1.5	43.4	41.9	40.6	-1.9	35.0	40.0	17.4	15.9	769.8	54.7	78.5	24.1	38.8	62.6
MW-9A	764.70	764.7	0.0	15.1	15.1	15.6	-0.1	10.0	15.0	4.2	4.2	760.5	28.0	58.0	10.8	23.8	53.8
MW-9B	765.68	765.1	0.6	25.1	24.5	25.6	0.5	20.0	25.0	6.6	6.0	759.1	28.0	58.0	19.0	22.0	52.0

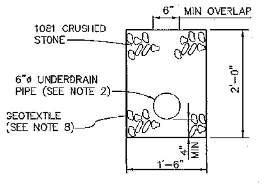
Abbreviations:
TOC - top of casing
BTOC - below top of casing
BGS - below ground surface
TOS - top of screen
BOS - bottom of screen
WT - water table



BL

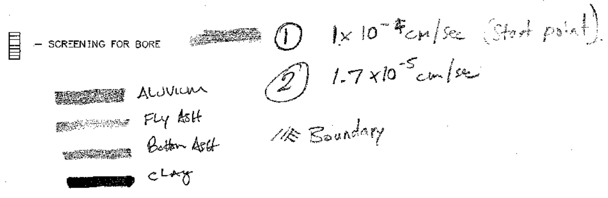
DETAIL A73

SCALE: HORIZONTAL: 1" = 30'
VERTICAL: 1" = 10'



DETAIL B73

PERIMETER UNDERDRAIN
SCALE: 1" – 1'-0"



CELL III

NOTES:

1. FOR DRAWINGS LIST AND LEGEND SEE 10W425-20
2. FOR GENERAL NOTES SEE 10W425-26
3. BETWEEN EL 760 & 783, STRIP EXISTING 1'-0" SOIL COVER WITHIN THE LIMITS SHOWN ON DRAWINGS 10W425-42 THRU 10W425-45, PRIOR TO INSTALLING FINAL COVER. STOCK PILE SOIL AND REUSE AS RANDOM FILL VEGETATIVE LAYER FOR FINAL COVER.
4. DETAIL DEPICTS SECTION THROUGH EXISTING DREDGE CELLS ADJACENT TO SWAN POND ROAD. BASE ELEVATION OF DREDGE CELL VARIES.
5. UNDERDRAIN AT THIS LOCATION ONLY REQUIRED ALONG DREDGE CELL ADJACENT TO SWAN POND ROAD. SEE DRAWINGS 10W425-42 THRU 10W425-45 FOR LOCATION.
6. LATERAL OUTLET PIPE SHALL BE NON-PERFORATED POLYETHYLENE CORRUGATED TUBING AS MANUFACTURED BY ADVANCED DRAINAGE SYSTEMS, INC., COLUMBUS, OHIO (614) 457-3051 OR EQUAL.
7. LATERAL OUTLET PIPES SHALL BE PLACED EVERY 200 FEET ON CENTER.
8. GEOTEXTILE SHALL BE A WOVEN MONOFILAMENT WITH AN APPARENT OPENING SIZE (AOS) SELECTED BY TVA FES (US STANDARD SIEVE SIZE) WHEN TESTED IN ACCORDANCE WITH ASTM D 4751. THE GEOTEXTILE SHALL BE GEOTEX 104F AS MANUFACTURED BY SYNTHETIC INDUSTRIES OR APPROVED EQUAL.

REV NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R 0 ISSUED FOR DREDGE CELL EXPANSION		DRS	BSB	WPT	HLP	REP	JGA				D

DISCIPLINE INTERFACE

SCALE: AS SHOWN EXCEPT AS NOTED

YARD

EXISTING DREDGE CELL
UNDERDRAIN INSTALLATION ON
EXISTING SLOPE EL 760–795

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D.R. SMITH	B.S. BURT	W.P. TAYLOR	H.L. PETTY	R.F. PURKEY	J.G. ADAIR	

KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14 | DATE | 36 | C | SK 10W425–73A R A

PLOT FACTOR:50
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PARSONS | 0
TASK COMPLETED BY: | REV NO.

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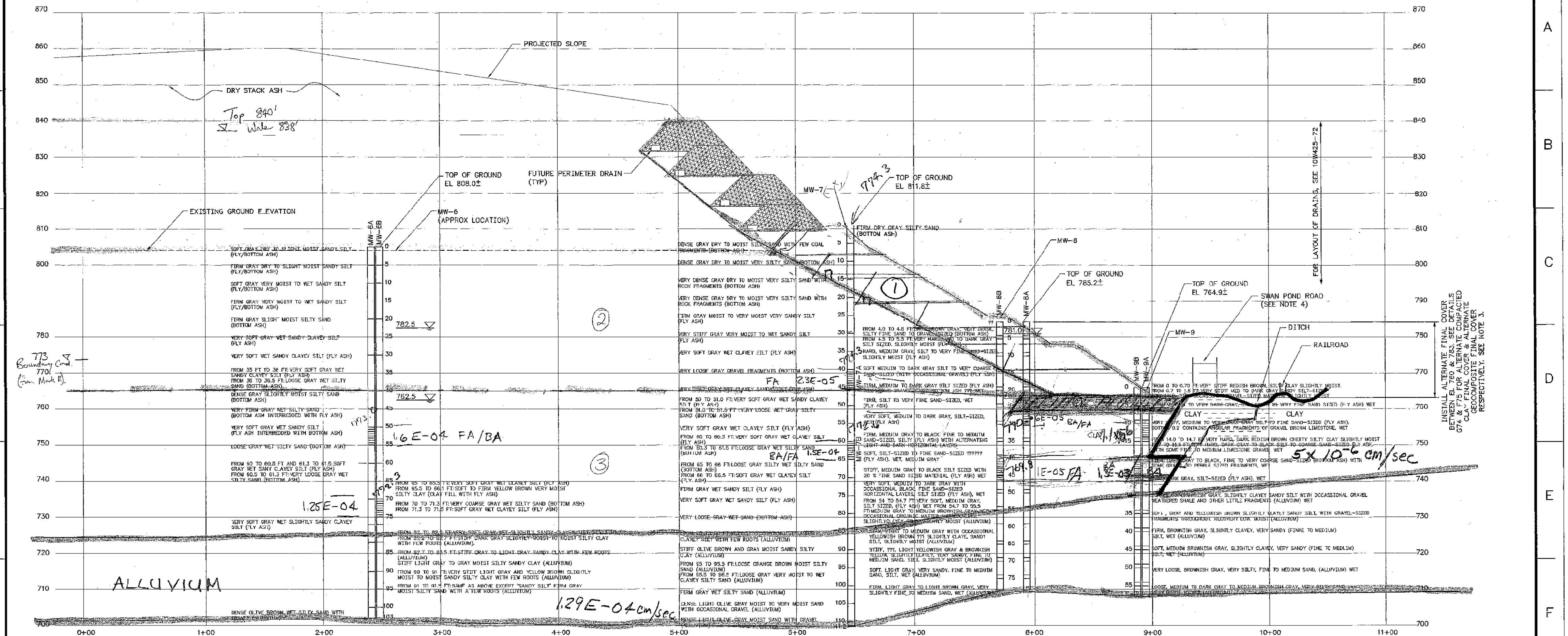
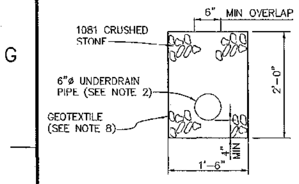


DETAIL B73

SCALE: HORIZONTAL: 1" = 30'
VERTICAL: 1" = 10'



DETAIL B73

PERIMETER UNDERDRAIN
SCALE: 1" = 1'-0"

▥ – SCREENING FOR BORE

CELL I

① 1×10^{-4} cm/sec

② 2.3×10^{-5}

③ 1.4×10^{-4}

④ 1.7×10^{-5} (see 73A)

NOTES:

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REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R											
R 0	ISSUED FOR DREDGE CELL EXPANSION	DRS	BSB	WPT	HLP	REP	JGA				D

SCALE: AS SHOWN EXCEPT AS NOTED

YARD

EXISTING DREDGE CELL UNDERDRAIN INSTALLATION ON EXISTING SLOPE EL 760-795

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
D.R. SMITH	B.S. BURT	W.P. TAYLOR	H.L. PETTY	R.E. PURKEY	J.G. ADAIR	

KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14 DATE 36 C SK 10W425-73B R A

PARSONS	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:50
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

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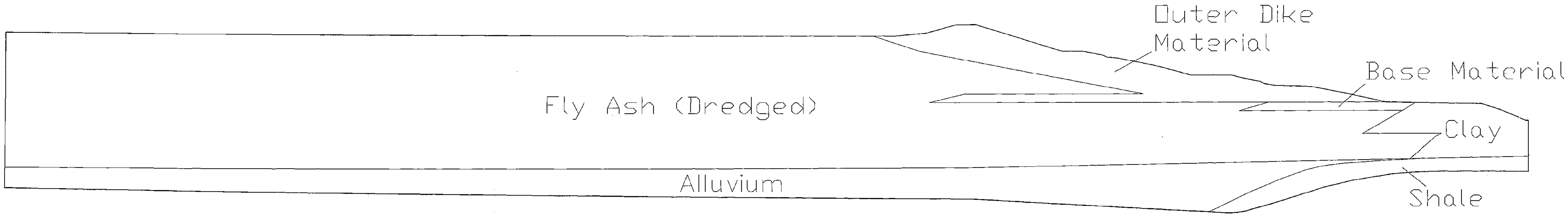
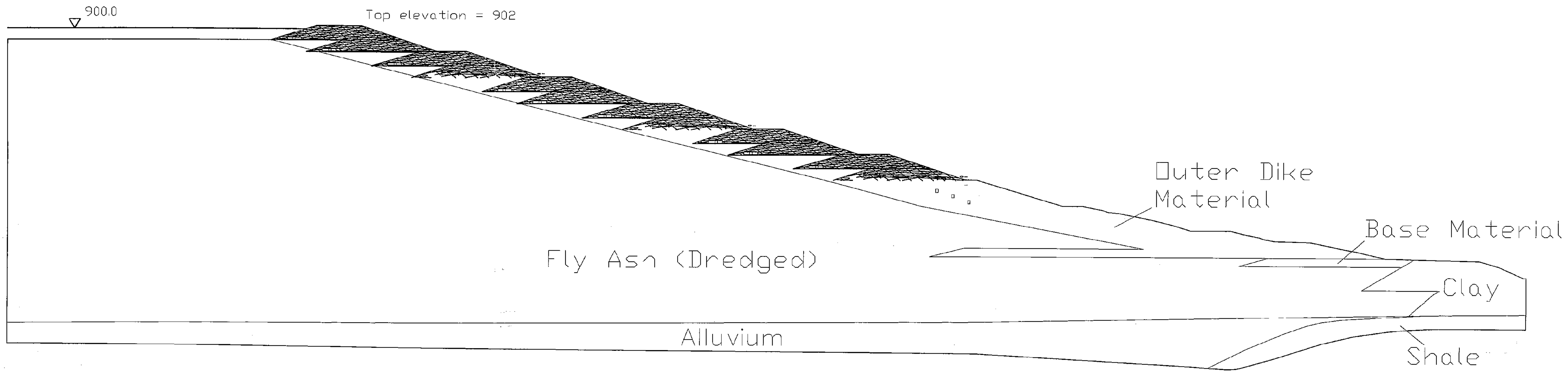


SECTION A73 - CELL III



SECTION A73 - CELL III