MUSKOGEE COMMUNITY RECYCLING AND DISPOSAL FACILITY MUSKOGEE COUNTY, OKLAHOMA ODEQ PERMIT NO. 3551020

TIER III PERMIT MODIFICATION LANDFILL EXPANSION VOLUME 2B OF 4

Prepared for

Waste Management of Oklahoma, Inc.

October 2023



Prepared by

Weaver Consultants Group, LLC

CA 3804 PE 06/30/2025 6420 Southwest Boulevard, Suite 206 Fort Worth, Texas 76109 817-735-9770

WCG Project No. 0086-364-11-19

MUSKOGEE COMMUNITY RECYCLING AND DISPOSAL FACILITY MUSKOGEE COUNTY, OKLAHOMA ODEQ PERMIT NO. 3551020

TIER III PERMIT MODIFICATION LANDFILL EXPANSION

VOLUME 2B OF 4

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FOR

MUSKOGEE LANDFILL AND RECYCLING CENTER

MUSKOGEE, OKLAHOMA

Appendices

Prepared For:
WASTE MANAGEMENT OF OKLAHOMA, INC.
MUSKOGEE, OKLAHOMA

Prepared By:
RUST ENVIRONMENT & INFRASTRUCTURE
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RUST E & I PROJECT NO. 86251

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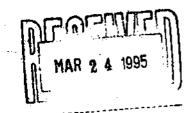
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October, 1994





3551020

PHASE II - HYDROGEOLOGICAL INVESTIGATION FOR MUSKOGEE COMMUNITY LANDFILL AND RECYCLING CENTER MUSKOGEE, OKLAHOMA

APPENDICES

Prepared For: WASTE MANAGEMENT OF OKLAHOMA, INC. MUSKOGEE, OKLAHOMA

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PROJECT NO. 86251.150

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APPENDIX B OIL AND GAS WELL INVENTORY

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Petroleum Information

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(Mail to Corporation Commission, Oblahoma City, Oblahoma) OKLAHOMA CORPORATION COMMISSION

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OIL AND GAS CONSERVATION DEPARTMENT

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	\mathcal{K}	1-1-1	DHIL	LING ST	ARTED	8/19	ip	l, dalli	UNG FINI	_{знер} 8	/29	19 61	Shale		145	177	Shale	Fec	1313	Ŀ
	\mathbf{V}^{-}		DATE	OF I	AST PA	ODUCTIO	ON		СОМР	ETED			Sandy	Lime	177	189	Sand		1316	[;
1-1-1-6	-1-1-	 	WELL	L LOCAT	ED C	4	NE ,	S	соми 1 4 19	80	Nonk a	4 Cauch	Shale		189	222	Sandy Shale		T	;
140	_ - -	160	Line	and	198	0		t Fout o	West Li		********	Posts.	Sand.		222	240	Shale	1	1130.	1:
	~	 - 	Печа	ilon (Re	lative	io sen le	wall f	FRANCK	FLOOR		Southet Touriet	Decilon.	Shale	•	240	320	Sand	İ	1335	l!
Locate i	-+U corre	cup							1.) 0				. Sand	• • •	320	337	Lime		1350	
			- :					. 0.1110	(4 J	F-122	·11-4······		Shale		337	548	Shale	ŀ	1360	Ш
		<u> </u>	7	OIL OR	GAS S.	ANDS OF	ZON	C.S.					Sand		548	565		-1	1373	1
No.	arpo≑		Fre	<u> </u>			-	Неше		TF	tom	To	Shale	<u>.</u> .	565	712	Lime		1379	11
Str	ay		1,21	88 12	65	<u>.</u>		7 4,						Broken	712	720			1 /	1
2 H:5	kogee	:	12	79 13	13								Shale	77.01.011	720	775			1 - 1	i
3						6				_				Broken	775	790	·		i !	i
	Parloret	log Zece	rd II A	•¥				31	tol Becore	1			Shale	TORGIT	790	805		>	1	Ì
Foregil	len	from	.To	No. of	Shote	_	Forme	lon	From	To	Size o	of Short	Lime		805	_	ł	- 1	:	l
				T					 	 	 		Shale			811		ľ	1 1	ı
									†	 -	 		Lime		811	865	FILE	ാി	2	ĺ
									┼		┨╾		Shale		865	872	DC NOT	EFA	COLA	l
			1.7	c	ASING	RECORE)						Sand		872	907	CORSERVA			
	, Aa	ount Sel	1					Amou	ni Pulled	Paci	or Reco	ord .		Black	907	935	ACAGER 14	, , , , , <u>,</u> ,	S (2)	. 1
5.20 W	t. Th	de. Me	ale	Ti.	In.	Fi.	la.	Size	Length		Set		Shale	STACK	935	947	· .		, ,	İ
l_					$\neg \neg$			 	 					Hard	947	960				٠.
42.15			1	358		-	 	 	†	-	_		Shale	naro	960	971		ı		l
		1_						 -	 				Lime		971	994		Ī	i d	
Liner Record:	Ampun	 t.		Kind	- 	٠.	Тор			liona.					994	1005				
					A DAL	ND MUE	DING	-		1100			Shale		1005	1010		ſ		
Amour	nt Set	Sacks	Che	micel	Met	had al.		1	Muddla		Result	<u> </u>	Sand		1010	1025		:		
Sue ft.	In. C	ODOD!	Gal.	Mate		enling	ᄷᆓ	1000	Melho		(See No		Shale		1025	1068				
+ 136	8-1-	50			T								Sand		1068	1075		- 1	. 1	
	1-1-			T-	 		!						Shale		1075	1095				ŀ
Note Wheter											•		Sand	-	1095	1105		- 1	: 1	
Note. What m	atriog w	CE UISQ	10 210	eci sanc	le II ou	ler girkny)4 ¥+1	e pulled	17				Shale		1105	1149	\$	- }		ļ
TE Were 1	bottom h	ale pluge	mand?		<u> </u>				4 .5 . 16				Lime		1149	1156	·		Ī	
		p.cy.	*****				14, 40	oin set d	md results	obtern	+4		Shale		1156	.1159	21			
Retary Tools					rools					Λ.	13	25	Lime		μ159	1168				
		_											Sand ·	•	1168	1175				
Type Rig	et, end Bucy	yrus-	Crie	_28-1	,—		i, cund	ltom		Jeet to		—	Sand		1175	1180			İ	
11111111													<u>Shale</u>		1180	1238		ŀ		
Describe inilia	d 1550 =	halber 4				CTION				umn t	nø		Saηd _{the} ,	undereigned, being	liret duly av	om upon	oals, state that this well to the best of my knowle			
billid	1041; W	uemet D	110W	intondy	TUDING	01 6041	vå ot	ра Биш	ping	այաքի 1			complete o	ccording to the rec	ords of this	office and	to the best of my knowle	age and	co روناويز اوناويز.	1110

24 hroner

Type of Pump it pump is used, describe.

610 Acres

Hail to Corporation Commission, Osignomy City, Osign	OZD GJ
OKLAHOMA CORPORATION COMMISS	101
OU AND GAS CONSERVATION DEPARTMENT	

10/14/61

					<u> </u>	•
	Fermatica	Tep	Bellam	Formation	Top.	'n
	Clay	0	10	Frown Lime-Froker	1254	T
	Shale	10		Lime	1293	
	Sand	85		Shale	1325	l
	Shale	95	115	Lime	1332	١.
	Sand	115	123	Shale & Shells	1335	1
	Shale	125	180	Shale	1343	:
	Sand	100	191	Shale & Shells	1367	:
	Şî:ale	191	297	Shale	1390	j
	Sand	297	315	Lime	1400	1
	Shale	315	390	Shelly Si.ale	1525	1
	Sand :	390	405	Shale	1580	'n
	Shale	405	552.	Lime - Miss.	16Ô0]
	Sand	552	567		!	٠.
	Shale	567	770		1	
	Lime	770	783	1	1	
	Shale	783	837		1	٠.
	Lime - Groken	837	845			
	Shale	845	860	_	J	
	Sand	850	875			
	Lime	875	907		٠ ا	
	Shale	907	917		- 1	. '
	Lime	917	931	1	1	1
	Shale	931	951	'		1
	Lime	951	964			
,	Shale	954	1025	·	- 1	 I
	Line .	1025	1031		. [
	Shale	1031	1045		- 1	
	Lime	1045	1050		- 1	
	Shale	1030	1099		- 1	
		1099	1105			
	Shale	1103	1110	FILE CO	PY	
	Lime	1110	1115	DO NOT REN	ion	,
	Sand - Sad Hole	1115	1134	CONSERVATIO	1,744	L
	Shale	1134	1182	- STOPPING	A DE	P
	Sand	1182	1200			
	Shale	200	1205			
	Sand	205	1210			l
	Sand - Muskojce	210	1240			l
	Shale	1.40	1255	l		l
	I, the undersigned, being fir	at duly a	wem usen	eath, state that this well record .	a true, c	61)

Subscribed and swom to before me this ACAC day of the Co.

COUNTY Nuskogee sec 6 Twp14 N Rog 18 East COMPANY OPERATING RELIE 011 Company OFFICE ADDRESS OX 1631, Huskogee, Oklahoma rann name Warren well no2 DRILLING STARTED 9/15, 1951, DRILLING TINISHED 9/26 151 DATE OF FIRST PRODUCTION COMPLETED WELL LOCATEDS 4 No. 4 SN 4 1770 Horth of Bouth

	OIL (OR GAS SA	NDS OR ZONES		
Haze	From	To'	Name	From	To
ad hole	1115	1134	4 Timperridse	1250	1264
2 Stray	1182	1200	5. /		T-2
i linskovce	1210	1240	•		

Porte	rating Bece	ed U As	7	Shot Bocard							
Formátion	From	Ťο	No. of Shots	Formation	From	To:	Size of Shot				
Scale s	1350	1355	6 .			1	<u> </u>				
Smale	1357	1360	4		T						

CASING RECORD

Amount Set								Amoun	Pulled	Packer Record		
Size	Wt.	Thde.	Mote	Tt.	la.	f).	ln.	Size	Longth	Depth Set	Mote	
5	-			406				6.	40ن			
				1350			†	i				
							T			_		

CEMENTING AND MUDDING Chemical Amount Set Socke Method of Muddlau Results Coment Семенция Method (See Hote) Gel. Make 350 100

Note What method was used to protect sands if autor strings were pulled?_

Kind

OTE Were ballow hale pluge used? If so, state bind, depth set and results obtained

TOOLS USED

Bucyrus-Eric 28 L

INITIAL PRODUCTION TEST Liberide initial lest, whether by New through tubing or cosing or by pumping Pumping

_	
A=c1	Oil Production 12 bbls. Size of choke, Il any Length of test 24 hr. Water
Prea	bble. Gravity of oilType of Pump is pump is used, describe

(Hail to Corporation Commission, Oblahama City, Oblahama)

rwp.

F: =	OKI				ORATIC ISERVATIO				1			
510 Acres		-,-					BECOR	-				
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	Ti	٦ 🛪	MPANY.	OPER	ATING J	eche	OIL	Compa	עתנ			
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⋰⋰ ⋰	╌	- DB	111 1W/2 S	11076	vacren D 12	/27	DB14.1	WE	CIADO.	1/2	6	
-} - () -	╬╼╂╾	⊣ ∷	TE OF F	967 I	RODUCTIO	5, 39. Sei	, DRICL	NG /INA	onld	#. £ *	, J¥ V.	
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	1.60	-	LL LOCA	1000	ر د سالان ساری ا	JL . 14		.W. J.3(ω	North	of Bouth	
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le raie well corre					to see le							
	·,	CH			VELL (Oil,	100		·} , ,	O1]	L		
: 	<u> </u>	•			SANDS OR	20NE	5					
Nume	نحنب	<u>r</u>	roza .T	<u>.</u>	÷	<u>.</u>	Name .		F	rom.	To	
<u>iai Rola.</u>	-		<u>063 1</u>		4		·	<u> </u>				
i lisko ee			150 1		5			<u> </u>				
1 Timerrid			<u> 280 1</u>	<u> 285</u>	. 8				_		<u> </u>	
		ecord II						From	To			
Fermation	From	 -			. <u>—</u>	Format	<u> </u>	Size of Shot				
Misko da Sa Timporcid _i a	127		1318 84 6	30				<u> </u>	<u> </u>	!		
1.0.011.058	12/	0 12	84 6	5	<u> </u>					1_		
	<u> </u>	<u> </u>			RECORD			LJ		Ь.		
	layor	Sal			- RECORD			. 6. 11. 4				
· · · · ·	ıda I	Hake	Ft.	la.	l v	T 1-		1 Pulled		er Re		
	1	7455		18.		In. Size		Length Des		Del	Hate	
·			30	 —		-		.,	 	_	-	
			1335	╂─╴	 	 		-	 —			
				<u> </u>	L	L	<u> </u>	L		Y		
Liner Beroid, Amous	· ·	 -	CEMEN	TING	AND MUD	Top DING		Во	flom			
Amount Set	Sack s	c	hemical	м	athed of	· .	[Muddin		Res	ulte	
Ft to.	Crmts	Gal.	Mate	_ C	etti enting	Amo	ואטי	Method	ا ء	(See Hote)		
	10			$\exists \Box$					$\neg \vdash$			
1333	001											
With What method v	729 UB	ed to p	rolect son	de II	outer etring)4 WOT	pulled	,				
Were bottom t	ole pla	uge wae	<u></u>		o, slate kir	d. den	th set or	d tanulu	obtate			
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S. 17 Tools were us	ed fro	.	Jest to.		Coble to	ob we	te ured	_{[rom_0}		ei te	1335	
				۰	e 28-L	l, and	from		leat to			
Teta firg		ر ق ر ق ر	C/F S	Eri	e 28-L							
<u>-</u> -			אנדמם	PRO	DUCTION	TEST						
Describe immol test, a	whethe	r by Re	throug	h tub	ng ar can	ng ar	pa braidi	olang				

Pumping

30

_bble. Gravity of oil...

 $A(m) \leq a(n) \geq$

Fraduer

THE WELL INDEX CO

			REP. NO.	ノグフ	כי
Formation	Yup	30110B	10125156	149	g den
Clay	(15		ļ — —	
Shale	1:	215	1	Ī.	
Sand	313	330	j	•	
Shale	330	535	1	1	
Sand	535		·	!	
Shale	542				
Lime	615	623	!	! . i	
Shale	623				
Lime - Broken	722				
Shale	730		1	i	
Lime - Broken	776		! ``	!	
Shale	786		i		
Lime	887		l	1	
Shale	895		' ·	ŀ	
Sand `	903		[1	
Sandy Lime	905		í	1	
Shale	914		· ·		
Sandy Lime	940				
Shale		1004	TION	7	- 4
Sand		1009	· · · · · · · · · · · · · · · · · · ·	DEP	
Shale		1025			
Lime		1032			٠,
Shale		1085		ì	;
Sand			_	ľ	
.Shale	1108		<i>£</i>		
Sand		1220	. 5	[
Sand - Broken		1240	() () () () () () () ()	5	
Sandy Shale		1260		}* ~Ψ	F
Sandy Lime	1260			i c	
Brown Lime-Broken	1266	1280			
Sand		1285	S 35 6	- 4 ²	
Brown Lime	1285	1335		ઇ	
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	<u> </u>	{			
			7-1	J-	

I, the undersigned, being fire, duly sworn upon oath, state that this well record is true, correct complete according to the records of this office and to the best of my knowledge and belief.

- ouge of compone

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Mar.

	100	L Walland	1 44 HPU 44 M	
Soil .	0	T	3	201
Clay	! 3	15	62-15	0/1
Shale	15		·	
Sand	190	194	1	
Shale	194	230	i 1	
Sand	230	240	<u> </u>	- 1
Shale	240	310	1	ĺ
Sand	310	327	8,7	1
Shale	327	515		
Sand	515	522		- 1
Shale	522	660	' "'	- 1
Lime	660	665		J
Shale	665	698		- 1
Line	698	715	l '	
Shale .	715	780		. .
Sand	750	785		
Shale	785	812].,
Lime	812	318		
Shale	810	872	DO NOT COPY	.
Sand	872	895	DO NOT REMO	S. [3
Lime	895	910	CONSERVATION	ا تر.
Shale	910	920	1 2 2	JUDY:
Lime - Black	923	932		I.
Shale	932	979		
Lime	979	984		I.,
Shale	984	228	1/2 (2)	· 1
Sand	998	1015	A THE	ľ
Shale	015	1050	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
Sand	1050	1055	1 4 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	19
Sand - Bad Hole Shale	1.55	1077	1 C. Y. O. 1	3'
	1077	1115	CONSTRUCTION OF STREET	
Sand - Stray Sandy Shale	.115	1145		
Shale	1145	1160		
Broken Cand	1160	1165		
Sand	1165	[!
	1130	1195	33	
Lime - Brown	1195	1215	<i>Q</i> .	
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I, the understaned, being that thely swit in upon cloth, clote that the exception according to the rapports of the switch and to the hard of the

and trom leaf to Cable tools were used from U feet to 1.41)
Bucryus-Erie All,

Michal pachuciton rest

TOOLS USED

have. What method has used to protect sands if outer strings were pulled?

in hale plays used?

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E-8-31

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Fo	*		Oil						ERVATIO				•	4	
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11/1	, <u> </u>	1-1	140	-	OFFI	CE AL	DDR	SS	Box	1631	, Mu	skogee	, 0	klal	10ma
1-1-		17	_ _	-	FARH	MAK	(E .	la	rreq			WE	LE: NO	. 7	
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1 1 11			160	_[Line (and .		550	מ	h	. East o	ł West Lis	ne of (Quarte	er Bectle
		\perp		_]	Deva	lion (P	ie iau	٧.	to sea la	vel) D	EARICK	FLOOR	G	ROUN	1D
L	ocale w	rga Lit	Tectly		CHAR	ACTER	or	W	ELL (Oil,	6 6 6	r dryho) -) (-)	Inj	ecti	Lon
						DIL ÓR	GA	5 8	ANDS OF	ZONE	*				
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			Amous	l Set					,2001	<u> </u>	Amen	nt Pulled	Pas	ber P	
Size	Wi		Thda.	Mal	· ·	n.	al	Т	Ft.	ln.	Size	Length	 		
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	F1.	in.	Cene		Gal.	Mak	<u>•</u>	Cer	mening			Method	<u>.</u>	(500	Hote)
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YEA B	2 —	=				15	пс	rı	ıs-Eri	e 28	يلزد				
						DOTIO			WOMON.	***					

.... Type of Pomp is pump is used, describe.

HATION OIL WELL INDEX.C. 1902 Give detailed description and the water, oil or gas. Fermelles Tep Bellow Formetica Iop Soil 0 Clay 2, Shale 15 12 Sandy Shale 125 150 Shale 150 300 300 Sand 315 Shale 315 558 Sand 558 570 Shale 570 740 Bime 740 745 Shale 745 800 Lime 800 810 Shale 810 880 Sand 880 913 Shale 913 922 Lime 922 931 Shale 931 992 996 Sand 992 Shale 996 1012 Lime 1012 1018 Shale 1018 1037

1037

1042

1102

1130

.1170l

1190

1220

1239

1242

1255

1275

1042

1102

1130

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1190

1200

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1290

DO NOT REMOVE CONSERVATION DO I, the underrighted, being that duly sween upon bath complete according to the receive of this office and in the

MAY 3.1 1962

Subscribed and sworn to the fore me title?

Lime

Shale

Shale

Sand

Sand

Sand - Stray

Sand - Broken

Sand - Broken

Limey Sand

Brown Lime

Shale & Shelly Lime 1200

Sand

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\checkmark				OIL	AND	GAS	CON	OTTAVES	N DEP	ARTMEN	T			
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NATIONAL OIL WELL INDEX

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Shale	1240		0,		
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Sand, TR	1251		W.L. Boone		l
Shale	1260	1265	H. P. Sheckelford		1
lole Caving	1265	1275	File		1
	اردسا				

1. the undersigned, being first duly event upon eath, state that this well record is true, correct or complete according to the seconds of this office and to the best of my knowledge and bettel.

W.H. MCPhalliams and title of representative of company

Subscribed and swarn to before me this 8th day of October

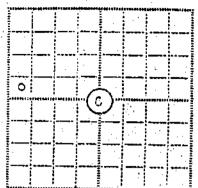
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Formation	Top	Bolloza	}	PEF. NO	Teb	3 dies
Soil	0	2	· · · · · · · · · · · · · · · · · · ·			
Clay	2	4	Sand		1275	1325
Shale	4	125	Shale		P.325	1330
Sand	125	143	Sand Shale	ż	F330	1334
Shale	143	312	Brown 14		1334	1340
Lime	312	330	Iime	me	1340	1360
Shale	330	345	111111111111111111111111111111111111111		1360	1385
Shale Shell	345	415	į.	•	12	٠.
Shale	415	430			1:	١.
Sandy Lime	430	1442	Ì			[]
Shale	442	546			11	i
Lime	546	557			- []	'
Shale	557	620	·		1	ı
Line	620	626			-	
Shale	626	710				ĺ
Lime	710	715				
Sandy Shale	715	745				
Shale	745	795		•		
i.4ma	795	800			1 1	
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and, Str.	1 7	248 '-	ಕ	ð	1 1	
hale	1248 1	275			1 1	
I, the undersigned, being complete according to the a	g first duty . w	of upon	eath, slate that	thus well secon	م رويو وا ه	orrect uni
	erster (). Er (mater and t	Ome pear of an	T LONGINGS	belief.	

Subscribed and awarn to belove me this 11th day of October
My Commission expires 7-16-65

*COMPORATION COMMISSION CIL AND GAS CONSERVATION DEPT CKLAHOMA CITY, OKLAHOMA

The same of the sa



COMPANY T.P. Hellowin SFC. FARM... Rooney /1 LOCATION SUIC SUFFICE COUNTY Linskogee TOTAL DEPTH— 9Ž21 TWP. PRODUCTION— OIL 1 11: ROCK PRESSURE-ELEVATION .---DRILLING COMMENCED. RGE. 8-10-49 DRILLING COMPLETED—

- PRICKOCEE COUNTY

102

This record received by Corporation T. F. McMams Cormission Sept. 15, 1949. Bristow, Oklahoma

OIL OR GAS SAUDS OR MOMES Wainwright sand 8851 to 9221

CLSIMG RECORD 10" - Amount Set 127' 8 5/8" " " 887' " 8371

Cable Tools from 0 to 9221 Tyre Rig: Spudder 💎 Ant. Oil Production:

FORMATION RECORD	TOF	BOTTOM
Soil & clay	ō	20
Shale	20	40
Line	-70	.19
Shale & slate	19	235
Sand	235	245
Shells	215	235
Shale	255	308
Limo	305	310
Shalo	310	505
Line	505	510
Sha) 5	510	5.≩5
Bino	545	550
Shale	550	6.10
Line	640	642
Shale	642	745
Limo	745	750
Shale	750	755
Same	755	765
Shale .	755	820
<u>1</u> 1. 4	620	835
Shale Line	635	850
	ଥଞ୍ଚ	G.30
Shale	ĊÜ	070
Lind	870	885
Sind (011 & 9081)	805	992

TOTAL DEF

T.F.M (Owner)

OTHREELED: 11-17-.9

CORPORATION COMMISSION OIL AND GAS CONSERVATION DEPT OKLAHOMA CITY, OKLAHOMA

Commence of the State of the St

_	ity, oklarioma
ertebere	Muskogce County
	IMARA M. Mara
COMPAN	
o FARM_	
LOCATIO)f.1—
COUNTY	******
TOTAL I	
PRODUC	ESSURE—
ELEVAT	
	G COMMENCED_ 11-20-49 RGE
	3 COMPLETED: 112-27-49
***************************************	18E
	William H.Pine
This record received by the Corporation	Okmulgee, Oklahoma.
Commission Dec. 12,1949.	
	NOTE: All above measurements are taken
NW SW NW OF SEC. 6-14N-18E- 990 North	from Line Wells Logs which are off from
of Louth Line and 275! East of West Line	plus 32 at 750 to minus 71 at 2002.
of quarter section.	· 壁台 · yaa · ji · ji · ji · ji · ji · ji · ji ·
	The shows in the Burgen below 2018 prob.
Completed 11-20-49. OIL	justify drilling out to 2062 T.D. running
	string 55" & cementing above Simpson.
OTI GA GAS SANDS OR ZONES:	Re- run Comma Ray & Neutron & Ferf. off
	same line. If Production is obtained rip
	off pipe above Simpson & produce all
Simpson Dolo. Wtr. 1776 1789	three zones.
Sandy Lime, stain 1970 1982	This well drilled to 2021! By McAdams
	& Wallace, Bristow, and taken over at 2021 by Williams H. Pine.
Sand- Sho oil 2:33 2035	Local by maintains in states
PARFORATING RECORD: No. Shots	FORWARION TOP EDETON
	Clay, yellow 9
Burgen 2031 2038 14 holes	
Eurgen 2011 2018 14 holes	
Burgen 1976 1959 26 holes	
Eurgen 1976 1989 500 Gals.	
	. Jh:: le 250 298
SHOT ::: COmD: Size shot	
	Lime, broken 298 301
Jimpson Jolo, . 1785 1794 17 holes	Lime, broken 298 301 425
######################################	Lime, broken 298 301 Ghale 301 425 Lime 425 437
Jimpson Jolo, . 1785 1794 17 holes Jimpson Dolo. 1785 1794 500 Gall Japanucka 1214 1254 34 holes	Lime, broken 298 301 Gibele 301 425 Lime 425 437
Jimpson Jolo, 1785 1794 17 holes Jimpson Jolo, 1785 1794 500 Gall Japanucka 1214 1254 34 holes	Lime, broken 298 301 425 437 498 501, sho, Gas 498 506
Jimpson Dolo, 1785 1794 17 holes Jimpson Dolo 1785 1794 500 Gall Jimpanucka 1214 1254 34 holes Wapanucka 1239 1244 17 holes Mapanuka 1239 1254 1000 Gall Jimpson Dolo 1785 1794 17 holes	Lime, broken 298 301 425 437 436 437 498 506 506
Jimpson Dolo, 1785 1794 17 holes Jimpson Dolo 1785 1794 500 Gall Jimpanucka 1214 1254 34 holes Wapanucka 1239 1244 17 holes Wapanuka 1739 1254 1000 Gall Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1785 1794 500 gal.	Lime, broken 298 301 425 437 425 437 498 506 510 524 635
Jimpson Dolo, 1785 1794 17 holes Jimpson Dolo 1785 1794 500 Gall Jimpson Dolo 1214 1254 34 holes Japanucka 1239 1244 17 holes Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1785 1794 500 gal Maganucka 1244 1254 34 holes	Lime, brown 298 301 425 437 425 437 496 5and, sho, Gas 498 506 510 524 5361 524 635 645
Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1785 1794 500 Gall Jimpson Dolo 1214 1254 34 holes Jimpson Dolo 1239 1244 17 holes Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1785 1794 500 gal Minjanucka 1244 1254 34 holes Jimpson Dolo 1239 1244 17 holes	Lime, broken 298 301 425 437 425 437 498 506 510 524 635 645 534 645 752
Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1785 1794 500 Gall Mapanucka 1214 1254 34 holes Mapanucka 1239 1244 17 holes Mapanuka 1239 1254 1000 Gal Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1785 1794 500 gal Mapanucka 1244 1254 34 holes Mapanucka 1239 1244 17 holes Mapanucka 1239 1254 1000 gal	Lime, broken 298 301 Lime 301 425 Lime 425 437 Lime 437 498 Sand, sho, Gas 498 506 Sand, wtr. 3 blr./hr. 510 524 Shale 524 635 Lime 635 645 Lime 635 645 Lime 645 752 Lime 645 752 Lime 645 752
Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1785 1794 500 Gall Mapanucka 1214 1254 34 holes Mapanucka 1239 1244 17 holes Mapanuka 1739 1254 1000 Gal Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1786 1794 500 gal Mapanucka 1244 1254 34 holes Mapanucka 1239 1244 17 holes Mapanucka 1239 1254 1000 gal Mapanucka 1239 1254 4000 gal	Lime, broken 298 301 Lime 301 425 Lime 425 437 Lime 427 498 Sand, sho, Gas 498 506 Sand, wtr. 3 blr./hr. 510 524 Shale 524 635 Lime 635 645 Shale 645 752 Shale 645 752 Shale 756 756
Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1785 1794 500 Gall Mapanucka 1214 1254 34 holes Mapanucka 1239 1244 17 holes Mapanuka 1239 1254 1000 Gal Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1785 1794 500 gal Mapanucka 1244 1254 34 holes Mapanucka 1239 1244 17 holes Mapanucka 1239 1254 1000 gal Mapanucka 1239 1254 4000 gal Mapanucka 1239 1254 4000 gal Mapanucka 1239 1254 4000 gal	Lime, broken 298 301 425 437 425 437 498 506 510 524 536 645 752 536 545 645 556 510 524 536 545 556 510 524 536 545 556 510 524 536 516 516 524 535 645 524 535 645 524 536 516 516 516 516 516 516 516 516 516 51
Jimpson Jolo 1785 1794 17 holes Jimpson Dolo 1785 1794 500 Gall Mapanucka 1214 1254 34 holes Mapanucka 1239 1244 17 holes Mapanuka 1739 1254 1000 Gal Jimpson Dolo 1785 1794 17 holes Jimpson Dolo 1786 1794 500 gal Mapanucka 1244 1254 34 holes Vipanucka 1239 1244 17 holes Jipanucka 1239 1254 1000 gal Maranucka 1239 1254 4000 gal	Lime, broken 298 301 425 Lime 301 425 437 498 506 510 524 535 645 645 752 556 516 516 524 535 645 556 645 556 645 556 556 556 556 55

NW SW NW OF SEC. 6-14N-18E Kuskogee County. FARH NAME: Roomey # 2.

Page # 2. William H. Pire:

B5/8" casing Ran Schlumberger Ran 7"

Casing and cemented.

Bailed hole dry & ran Gamma Ray & Neutron

	•	PERFORATING, PLUG BACK, ACIDIZING AND
FORLATION	TOP BOTT	CM HYDRAFRACING RECORD
Sand HFW	996 . 101	3 <u>minor metho recom</u>
Sandy lime	1013 102	PORMATION No. OR Size Results
Sand	1022 .1045	
Shale	1045 105	Birgen 2035 2040 10 holes HF SW
Lime	1059 : 107	Y printer sort soft the worning and
shale	1076 108	
Lime	1082 108	4
phale	1086 111	Tane werra pardding bind 1999, reaking
Lime	1111 112	ISMA_DALIG II II II II IUV'/ SHIP AFF
Shale	1126 118	.
Sand, no sho	1184 120	7 Britari 1989 1985 50 notes w. Dumu
shale	1206 121	TADA TADE DO BETTH COMING
	1215 122	o in
Shale	1222 122	a rane-wells bridging bing E823 ShutOil
Lime	1228 123	
Shale •	1233 223	Z Snown
	1236 124	
	1240 126	
Shale	1265 130	
	1301 ::-131	-
uhale	1316 132	
	1329 133	7
	1339 134	* Wananuaka 1920 7961 1000 Cala
Lime -	1344 143	7
Shale	1439 154	* Wananuaka 1920 1961 1000 Cala
Lime	1544 163	200 1/ Can 2 hhla ast
Shale	1636 179	HOVEO Bridging Plus 70/1 ship see
Hunten Limr	1696 170	-
Shale	1702 175	
Fiola Lime	1750 176	.
Dense	1765 177	l bbl oil/day Eooch 757 759 Hydrafrac
Dolomite	1776 178	
Sandy Dolo.	1789 -179	very little increase
Wilcox wtr. 2 blrs. /hr.	1796 180	5
Green Sandy shale	1805 185	Drilled out plug at 790' & producing from
Sand, hd.	1859 187	
Gr en sandy shale	1874 197	
Sandy lime, stain	1970 198	3
Lime	1983 200	6 017770 00000
Sand	2006 201	S CASING RECORD:
Sand, oil & wtr.	2016 202	10-3/4" 40# 8 Used At.Set
Send Sand, oil & wtr. Sand, So 20332 wtr. 2041		70 N.P.
Lime	2044 205	5 0 3/0" 32#. 8 USEQ 1071 All P
Sandy lime, wtr.	2052 -207	, (" I/# IU USED 2002 N.P.
Sand	2079 208	LIMER RECORD: NONE.
TCTAL DEPTH	208) t
	. 200	CEMENTING AND MUDBING.
801	•	7" Amt.set 20821 cax- cem 300 HO::CO
and the second s		Cemented to abt. 700 ft. top.
•		Cont. Page # 3. Wm.H.Pine

CORPORATION COMMISSION

WELL LOG DIVISION

OKLAHOMA CITY, OKLAHOMA

		· ·				
	17	9	•		Muskoge	· a
			COMPANY-	Tidal Oil Cor	.bun.	SEC.
- [<u> </u>		FARM—	Sallie Sango	NO. ⁸	
. -		; <u> </u>	LOCATION_	_C Sa SE IT		`6
_			COUNTY-	Mrskokee	1.6-	
1			TOTAL DEP		2046*	TWP.
·		 	PRODUCTIO		Tell is pumping	-1
- :-	!!(^)+		ROCK PRESS		water.	14N
			ELEVATION-		9-25-26	
			DRILLING CO		11-19-26	RGE.
-			DRILLING CO	OMPLETED—	11.17-20	183
			•			202
1		301. 1.1				
ia: 🔽	ADDRESS-COR	RESPONDENCE RE	GARDING THIS	WELL TO-	• •	•
	REMARKS:	••			Tidel Oil Co.,	
					30x 2046,	
				<i>i</i>	Tulse, Okla.	
	SE SEASING RI	ECORD of South		•:	A 1	
	Time and boo.	West of East Li	ine.			
	•	•			••	
	10" 24#	291				
	8출" 20분	1351				•
	6 5/8" 17#	1162				
	0)/ 0 I 14F	1100				
	FORMATION	TOP	BOTTOM	FORMATION	TOP	BOTTOM
					· .	
	Clay		. 27	Black shale		1196
	black shale	٠.	28	timber ridg		1218 -
	black shale	egel a	¥5 60	Slight sh	07.	
	gray lime		60	sand		1225
• •	snale		90	black shale		1241
	lime & water		96	brown lime		1250
	shale		127	Erny & brow	n lime	1580
	lime	•	135	brown sinfle		161C
	shale	•	200	gray lime		1630 1644
	brown lime	•	220	black shale brown lime		1685
	dark shale	-	250	orown lime Olack shale		1760
	slate		2 <u>95</u>	brown lime		1785
1,300	brown shale	grand and the	360 420	buttermilk		1830
100	light shale light shale	一人也没有 没有	420 540	limo		2021
	dark shale		600	Wilcox send	3 37 43	2041
	brown lime		£10	Wilcom sand		2046
	light shale	• :	775			
	black shale	- 1885 - C	810	Plummed b	nelt to 1235†	
	brown shelv		290 910	•		
	brown lime		905	Fotal Depth		20461
•	gray lime		935			
	snale		1040	3-3	C-27 G 1	
	sand-bad hole		1063			
	shale		1077			
	ಕ್ಷಚಿತ ತಂಗಾರೆ		1105	•		
	shale		1162			
	Muskosee smil			fair show oil	•	
	·.			·		

1187 - fair show oil

CORPORATION COMMISSION OIL AND GAS CONSURVATION DEPT OKLAHOMA CITY, OKLAHOMA

Muskogee County

TOF.

908

913

BOTTOM

913

927

<u>i</u>			-		
0	<u> </u>	ノ	mala	140000	
		_	 		
			_	_	

	dums Drilling Company	SEC.
1	W NW SW	6
COUNTY_	Muskogce	
TOTAL DEPTH-	12521	TWP.
PRODUCTION—	Dry Hole	
ROCK PRESSURE	• • •	14N
ELEVATION_		
DRILLING COMMENO DRILLING COMPLET	<i>y</i> ₀ , == 0 4/	RGE
DIGILLING COMPLET	ED 12-31-49	1SE

This record received by the Corp ration Commission Jan. 3, 1950.

NW NW SW OF SEC. 6-14N-18E- DRY HOLE

611 or gas sends or zones:

CASING RECORD: NONE.

CEMENTING AND MUDDING: NONE. Cable tools from 0 to T.D.

INITIAL PACDUCTION TEST: NOT GIVEN.

FORDATION Soil a Clay	TOF O	FOTTOM 20
Set Shale		=0
10 3/4"	20	95
Casing @		,,
91: Shale	95	227
Sind	227	237
oh:: <u>l</u> e	237	280
Lime	230	282
Shale	282	383
Line Broken	333	396
Shale	39/	550
Line	550	555
Shale	555	628
Lime	628	630
Shale	630	639
Line	639	641
Shale	641	730
Lime	730	735
ohole (735	795
Lime	795	sci
Shale	801	di 5
Line	S£5	319
Shale	569	670
Sind	870	902
Lime	902	908

Mcndums Drilling Company Box 996 Bethany, Oklahoma.

FOM LATION

Shale

Lime

· ·	71	741
Shale	927	968
Sandy Lime	948	953
Sand small gas	953	967
Shale	967	1014
Sand	1014	1021
Shale	1021	1030
Sand	1030	1048
Shale	1048	1101
Lime	1101	1121
Shale	1121	1152
Line- Brown	1152	1155
Shale	1155	1174
White Lime	1174	1176
Heduced & 1174	, _	,0
Sand	1176	1190
Shale	1190	1205
Sand Timber Hedge	1205	1214
Lime-, brown	1214	1221
Shale	1221	1230
Lime Broken	1230	1243
Shale-T.D.	1243	1252
	* -	

Signed: No Signature

Stenciled: 1-27-50.p.c.

OKLAHOMA CORPORATION COMMISSION OIL AND GAS CONSERVATION DEPARTMENT	live detailed description and thickness water, oil or gas.	SEP 2	1000 NATIONAL OF	L INDEX CO.
WELL RECORD		ַטהו ב	4 1300 REF. NO. 66	プラファ //
COUNTY Miskogen sec. 6 Twild N RGE 18 B	Formation Top	Beitem	Formulies	7.0
COMPANY OPERATINO Tidewater Oil Company	0.13.4.60			
OFFICE ADDRESS P. O. Box 752, Drumright, Okla.	Soil & Clay 0	12	į į	-
FARM HAMM. Muskoges Royalby Unite Ho Tr. 1 No.11	Shale 12	124	ļ	
DRILLING STARTED 5-10- 19 66 DRILLING FINISHED 5-28- 1966	144 J.44	130		
DATE OF FIRST PRODUCTION 8-19-66 COMPLETED 8-1-66	Shale 130	172	,	
WELL LOCATED 1/4 NE 1/4 SW 1/4 1980! North of South	Idme 172	177		
	Shale 177	192		
Line and 1858 h. East of West Line of Quarter Section Elevation (Relative to sea level) DERRICK FLOOR 630-Shound 629-4	Sand 192			
CHARACTER OF WELL IOI nos or derbota Oil Wall	Shale 196			
CHARACTER OF WELL (Oil, gas or dryhole) Oll Well	Sand 320			1
OIL OR GAS SANDS OR ZONES	Shale 326	530	·	
Name From To Name From To	Limey Sand 530			
	Shale 535	565		
	Sandy Shale 565			i
	Shale 610			
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INITIAL PRODUCTION TEST				
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bbls. Growity of oil Type of Pump is pump is used, describe.				
Tubing Pump	Subscribed and sworn to before me !	hia 20. t]		19.65
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	5 5	niar ii Cu Production	bbls. Size of choke, If any	Langue at a con-	21				7	2-11/1	tilla of representati	lrea S	upt
•			y of oilType of Pump s			_+/ GIE!				Hame and	fills of representat	re of com	bqr4
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Formation	Top	Bottom	Farmer	7 · -	7
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			OKAHOMA CORPORATION		
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I, the undersigned, being first duly sworn upon acit, state that this well record is true, correct occomplete occording to the records of this effice and in the best of my Incodedge and being a second seco

Hone and title of ferresentative of company

Subscribed and sworn to before me this 3 day of 8 10. 5.

.ater_Injection_Well

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f, the undersigned, being first duly sworn upon onth, state that this well record is true, correct complete according to the records of this office and to the best of my knowledge and belief

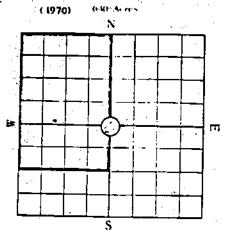
Nome and little of representative of company

NATIONAL OIL WELL INDEX CO.

Subscribed and swom to before me this 14 th day of March ... 19
My Commission expires ... 11-23-69

اح دی ۱ ۱ ۱ ۱	Form 1802A (OIL A	A CORPO	RATION CONTRACTOR DEP	OMMIS: NATHÉRE BECORD	SION	Ca9	•	varir, ed	iled description w or yes. Formetics	2-p	OCT 2	<u> </u>	HAT DICA	HOMA CITY	79
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رير			6331			 	+ 1		_	Shale	1340	1347			
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			-		ion well	_							Com H Illig	al '0	In



PLUGGING RECORD

OKLAHOMA CORPORATION COMMISSION

Oll and Gas Conservation Division Oklohoma City, Oklahema

NOTICE: All questions on this form

)		<i>:</i>		and mailed to I after plugging i	Istrict Office in d	uplicate. Within 15 day
			Company Operar	ing GETT	TY OIL COMP	NIX.
			Office Address	- β. (). 	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	13.35 × 20030
			County Works	Sec.	Two.	Hange 156
			Location in Sect	ion	1/2 Dear 1/2	1600 16
<u> </u>						1 Field Line Stage
Locale Well Car and Outline Le	recity			•	gas or dey)	_
Commenced Plugging	42612	Finish			Total Dep	
Was permission obtained from						
Signature of District Manage	Origii	Monally	Perforation	5: // /:	4 - 165	1
Name of Field Supervisor	16. 14. 15. 15. C	RC			`.	
Name of producing sand 2.						
Show depth and thickness of	all fresh water, of	Land gas format	ions. Oklahoma	Tax Commission	on Assigned Lease	No
SAND OR	ZONE RECORDS			•	CASING RECORE	DS
Formation	Content	From	То	Size	Put In	Pulled Our
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Does the above conform strice						
The Law requires that adjace	nt lease, and land	-owners be notif	fied; give their a	ames with their	addeesens below	
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EMARKS: The place of P	A la contra a			R	E	- 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
EMARKS: Thy plugged?	II aban	doned oil or gas	well, state amoun	r and darriof !	ast production	
	· L		tie.			
lugging Contractor's Namer		<u> </u>	Address	:		
orrespondence regarding this	well should be ad	dressed to	GET.	CY OIL COI	MPANY	
	·			EGX 7520	LAHOMA : 740	
duress				Int Val I La Nation	LANGROUS 740	<u>.3U.,.</u>
is the undersigned, being diffice and to the best of my ki	uly sworn upon oar nowiedge and helie	h, scare that thi	well record is a	ue, correct and	Complete accords	ng in the reports of this
Subscribed and swom to be	face me das the Z	day of	11:24	. N	amari ikidal kaskar cuk erij	presentative of company pr. 1745
Smort School of Spring Service Con-	1. 1. 1.			ر ب	ω , γ , z	→

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(1970) PLUGGING RECORD N OKLAHOMA CORPORATION COMMISSION Oll and Gas Conservation Division Oktohoma City, Oktohoma NOTICE: All questions on this form must be satisfactorily answered and mailed to District Office in duplicate. Within 15 days after plugging is completed. ы Office Address _ Sec. _ Locate Well Correctly and Outline Legae Character of Well (whether oil, gas or dry) _____ 4/_ 4 Commenced Plugging ___ -4-26-72 ____ Total Depth ___ Was permission obtained from the Countrition Commission of its agents before plugging was commenced be-Signature of District Manager π π ur-maily Perforations: 1/14 Name of Field Supervisor L. N. __ Depth top ____/// Show depth and thickness of all fresh water, oil and gas formations. Oklahoma Tax Commission Assigned Lease No. - SAND OR ZONE RECORDS CASING RECORDS **Formation** Content From To Size Put In Pulled Out What Gates 64 155 حنتح 5/1 1677 Describe in detail the manner in which the well was plugged, indicating where the mud fluid was placed and the methods used in introducing into the hole. If cement or other plugs were used, state the character of same and depth placed: I conduce comment and displaced to pico and mut Prosecte circulated concert to scalar Does the above conform strictly to the oil and gas regulations? The Law requires that adjacent lease, and land-owners be notified; give their names with their addresses below: Reguered If he are Il abandoned oil or gas well, state amount and date of last production 1077

the undersigned, being duly sworn upon oath, state that this well record is true, correct and complete acceleding to the records of this we and to the best of my knowledge and belief.

CULATIONA CORPORATION

GETTY OIL COMPANYSSIO

DRUMRICHT OKLAHOMA

P. O. BOX 752

Subscribed and sworn to before me this the Le.

Plugging Contractor's Namer ...

Correspondence regarding this well should be addressed to --

G-NJ Acres (1970) PLUGGING RECORD N OKLAHOMA CORPORATION COMMISSION Oll and Gas Conservation Division Oklahoma City, Oklahoma NOTICE: All questions on this form must be satisfactorily answered and mailed to District Office in duplicate. Within 15 days after plugging is completed. (T) GELLY OIL COMPANY Company Operating PRODUBLY OKLAHOMA - 74030 Office Address 4 S Locale Well Correctly and Outline Lease Character of Well (whether oil, gas or dry) Commenced Plugging Finished Was permission obtained from the Corporation Commission or its agents before plugging was commenced -Signature of District Manager Perforations: D-cassette Name of Field Supervisor 1.10 Name of producing sand'. Waker Depth top __ Show depth and thickness of all fresh water, oil and gas formations. Oklahoma Tax Commission Assigned Lease No. SAND OR ZONE RECORDS CASING RECORDS Formation Content From To Size Put In Pulled Out Describe in detail the manner in which the well was plugged, indicating where the mud fluid was placed and the methods used in introducing into the hole. If cement or other plugs were used, state the character of same and depth placed: CENTEMP. Does the above conform strictly to the oil and gas regulations? The Law requires that adjacent lease, and land-owners be notified; give their names with their addresses below: Ly Will [| I abandoned oil or gas well, state amount and date of last production REMARKS: Why plugged? Plugging Contractor's Name: Address: Correspondence regarding this well should be addressed to GETTY OIL COMPANY P. O. DOX 752 the undersigned, being duly sworn upon bath, state that this well record is true, correct and complete according to the records of this office and to the best of my knowledge and belief.

E-8-51

Name and title of representati

6-RI Acres (1970) PLUGGING RECORD ۸ OKLAHOMA CORPORATION COMMISSION Oll and Gas Conservation Division Oktohomo City, Oklahomu NOTICE: All questions on this form must be satisfactorily answered and mailed to District Office in displicate. Fithin 15 days after plugging is completed. æ GETTY OIL COMPANY Company Operating --- F. O. BOX 752 DRUMRIGHT, OK! AHOMA - 74030 Farm Name to Muskeyer light to Well No. w 22 pield in water Locate Well Correctly and Outline Lease Character of Well (whether oil, gas or dry) day, well Was permission obtained from the Corporation Commission or its agents before plugging was commenced Signature of District Manager Perforations: 124/ Name of Field Supervisor T. H. Dorgessette Name of producing and Defektor Jose on Depth top // 23 Show depth and thickness of all fresh water, oil and gas formations. Oklahoma Tax Commission Assigned Lease No. SAND OR ZONE RECORDS CASING RECORDS Formation Content From Τo Size Put In Pulled Out 1325 371 Describe in detail the manner in which the well was plugged, indicating where the mud fluid was placed and the methods used in introducin: into the hole. If cement or other plugs were used, state the character of same and depth placed: Cleaned out to 320' Cornert was premyed down the 218 public, and circulated to the sureface in the surface casing Closed 2" outlet and squeezed with 50 sacks of con Total convent used was 175 sacts. Cut casing 51 3' below Graved level Does the above conform strictly to the oil and gas regulations? The Law requires that adjacent lease, and land-owners be notified; give their names with right addresses below REMARKS: Why plugged fel heave If shandoned oil or gas well, state amount and date of last production 1) Plugging Contractor's Name: ____ Address: GETTY OIL COMPANY 1915 THE Correspondence regarding this well should be addressed to ₱, TO, TBOX 1752 · -----DRUMRIGHT, OKLAHOMA - 74000

Form No. 1001

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Form.No. 1003 (1970) 640 Acres ١

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PLUGGING RECORD

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OKLAHOMA CORPORATION COMMISSION

Oil and Gas Conservation Division Oktohoma City, Oklahoma

NOTICE: All questions on this form must be satisfactorily answered and mailed to District Office in duplicate. Within 15 days after plugging is completed.

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E-8-53

From No. 1003 ORI Acres PLUGGING RECORD (1970) N OKLAHOMA CORPORATION COMMISSION Oil and Gas Conservation Division Okluhomo City, Oklanismo NOTICE: All questions on this form must be satisfactorily an wore it and mailed to District Office in Jupic, up., 4 (thin 15 days) after plugging as completed. (-_ : Company Operating -Farm Namolle Very Jackeyn the Sout Will Xa. 16 Character of Well tachesher oil (passor disc) Locare Well Coursells and Outline Leader 1330 16. 11. . Loral Depart Commenced Plugging Was permission obtained from the Corporation Commission or its agents before plugging was commenced Perforations: 7218 Signature of District Manager Name of Field Supervisor Fell Dienessette 12/3_ ___ Pottom __ 1273____ ... Depth top . Name of producing sand Detofoto and office Show depth and thickness of all fresh water, oil and gas formations. Oktahona Tax Commission Assigned Lease No. CASING REPORDS SAND OR ZONE RECORDS Pulled Our Size Por In 10 Content Freen Formation 10-14 ے. 1773 1713 1319 Describe in detail the manner in which the well was plugged, indicating where the mud fluid was placed and the methods used in introde into the hole. If coment or other plugs were used, state the character of same and depth placed: d 100 sacks a coment and displaced to 1050 with, 20 bbls of mud and 25 sacks from thebing between carries and surface pipe to the Cinculate Suctored using 60 sacks growners. Cut comes off I holon G.C. Cap Does the above conform strictly to the rul and gas regulations? YES The Law requires that adjacent lease, and land-owners be notified; give their names with their addresses below: REMARKS: Why plugged 2 6000 Habandoned oil or gas well, state amount and date of lasy production Plugging Contractor's Name: _____ carrespondence regarding this well should be able ased to I the undersequed, herrer data twenty upon earth. Suited called and section so be soit me along the ZS

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OKLAHOMA CORPORATION COMMISSION

Oil and Gas Conservation Division Oklohama City, Oklahama

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Form No.: 1003 (NO Acres PLUGGING RECORD (1970) N OKLAHOMA CORPORATION COMMISSION Oil and Gas Consurvation Division Oklahoma City, Oklahoma NOTICE: All questions on this form must be satisfactorily answered and mailed to District Office in duplicate. Within 15 days after plugging is completed. Œ CILLLA ON LAW Company Operating Office Address = County Heart Star Sec. 6 Twp. 14 16 Character of Well (whether oil, gas or dre) / Vent Conf. Locate Well Correctly and Outline 1 ease _____ Total Depth ___ 1-2-71 Commenced Plugging _ Was permission obtained from the Corporation Commussion or its agents before plugging was commenced Signature of District Manager _ ____ Perforations: 1136 - 1168 Name at Field Supervisor John Delegarette 1165 Name of producing sand Deterior Jerrico ____ Depth top _ 1/13 Show depth and thickness of all fresh water, oil and gas formations. Oklahoma Tax Commission Assigned Lease No. CASING RECORDS SAND OR ZONE RECORDS Pulled Out Size Put In Tυ Content From Formation 23 1165 1202 Describe in detail the manner in which the well was plugged, indicating where the mud fluid was placed and the methods used in introca ... into the hole. If cement or other plugs were used, state the character of same and depth placed: Ynessuned to 1200 pri. Yangel 100 sacks of coment and displaced to 1000 will 2 W. City of her and protonated cases, of 250 -252 sacks & coment down ensury and circulated to the sustace Does the above conform strictly to the oil and gas regulations? The Law requires that adjacent lease, and land-owners be notified; give their names with their addresses below: REMARKS: Thy plugged AA have II abandoned oil or gas well, state amount and date of last production -Plugging Contractor's Name: _ Correspondence regarding this well should be addressed to a conthe molerospical being duly swom opon oath, or me that this well reyard extrons entrest arrive and realist boat of me knowledge and bullets.

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APPENDIX C
WATER WELL INVENTORY

WELL RECORDS HANCOCK RD. AND 51ST ST. MUSKOGEE COUNTY

OKLAHOMA WATER RESOURCES BOARD GOO N HARVEY AVE. P.O. 802 150

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Appendix D

APPENDIX D FIELD EXPLORATION PROGRAM

The field exploration program was designed to fill the data gaps necessary to refine a hydrogeologic conceptual model for WMO based on sound engineering and geologic practices, and to meet ODEQ requirements. Based on ODEQ 252:510-11, a minimum of 19 soil borings were required per ODEQ site characterization standards. RUST E&I proposed a total of 30 boreholes to be drilled at the designated locations as shown on Figure 6-1. Fifteen borings were drilled strictly for geotechnical testing, six borings for piezometers and geotechnical testing and nine borings for piezometers. The field exploration program was conducted in September, October, and November of 1993.

The purposes of the field exploration program were to explore the subsurface conditions of Tract A, determine the thickness of any U.S. Drinking Water aquifer underlying the facility, if any, and determine the uppermost saturated zone to be monitored. In addition, soil and rock samples were taken during drilling and tested for physical and engineering properties for landfill design purposes. The information obtained was used to prepare this Phase II final report and a site-specific ground water monitoring plan. The program was based on the assumption that the deepest proposed excavation will be the top of the weathered shale, not taking the depth to ground water into account. A buffer zone 50-feet wide is along the southern and western property boundaries, and 75-feet wide along the northern and eastern boundaries.

The borings were drilled with hollow-stem auger until refusal, then air rotary methods were used. The driller could not obtain core samples in borings B-4, 10, 11, 16, 17, and 18 without drilling with potable water. The core bit turned the soft formation into powder. Excessive ground water from the fractured and weathered bedrock entered the borehole, mixed with the powder, and plugged the core bits. The driller ascertained it was impossible to continue these borings without wet rotary operations. Rust agreed. The borings were logged and sampled using visual classification techniques, paying particular attention to the presence of shallow ground water.

Soil samples for geotechnical analyses were collected from the borings. Lithologic sample logs were made of each borehole and include the following items:

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- Drilling data such as drilling method and type of rig used;
- Description of all soil and rock layers encountered using ASTM 2487 methods including:
 - Name, color, texture, thickness, structure and amount of moisture present in each layer,
 - Approximate soil classifications,
 - Rock classification as defined in the Dictionary of Geological Terms.
 - Secondary features such as slickensides, fossils, fractures, seams, calcite healing, organic debris, ferrous nodules or staining;
 - The depths at which ground water, if any was encountered. Ground water was anticipated to be at or above the top of the weathered bedrock. Typically the rate of drilling exceeded the rate of infiltration of ground water into the borehole. This created a lag period from which ground water was encountered to the time and depth ground water was noted on the sampler or when the sampler penetrated a more permeable zone and water was seen in the sample. Due to the lag period, the depths of the encountered ground water noted on the boring logs may not be accurate. Often times, evidence of ground water was not seen on the sampler or in the sample while drilling with hollow-stem augers. However, once coring operations commenced, damp or wet conditions of the core were noted.
- Stabilized ground water elevations. Typically, since ground water infiltration into the boreholes was so slow, the borehole was completed prior to measuring stabilized ground water. After the boreholes were drilled, 18 to 24 plus hours was considered sufficient time to allow for stabilization. Upon, stabilization, a reading was taken, except for those locations adjacent to piezometers or monitoring wells.

Table D-1 defines the boring/piezometer location number, the topographic elevation where the boring was located, and the depth or zone of all piezometric/geotechnical borings.

When rock conditions were encountered, the rock name, color, bedding, weathering, structure, and any other applicable descriptors were recorded on the field log for each borehole. Percent recovery of the rock core and the Rock Quality Designation (RQD) were calculated for every core. The RQD is a modified core recovery measurement used to characterize the quality of the

rock mass. To calculate RQD, all pieces of a core over six inches in length were added together and divided by the total length of the core run, and expressed as a percentage. Listed below is a table showing the relationship of RQD and rock quality.

	RQD%	Description of Rock Quality
	0 - 25	Very Poor
	25 - 50	Poor
	50 - 75	Fair
	75 - 90	Good
52	90 - 100	Excellent
22		

The detailed logs in the field were recorded on Waste Management forms presented behind this These logs represent conditions and classifications as recorded by the field geologists. Geotechnical laboratory results are presented where applicable, as well as the laboratory classification. In general, the residual soils consisted of silty clays, with the United Soil Classification symbol of "CL."

The boreholes were grouted from the bottom up using a cement-bentonite or bentonite grout to the surface. Rock cores were stored in waxed cardboard boxes, appropriately labelled, and turned over to Waste Management for storage.

TABLE D-1

BOREHOLE DEPTHS

MUSKOGEE COMMUNITY LANDFILL AND RECYCLING CENTER, OKLAHOMA

BORING	30 FEET BELOW DEEPEST PLANNED EXCAVATION' (NGVD)	SURFACE ELEVATION OF BORING, FT	TARGET DEPTH OF BORINGS, FT	ACTUAL DEPTH OF BORING, FT	ACTUAL COMPLETION ELEVATIONS OF BORING, FT (NGVD)
B-1	583	622.9	40	45	577.9
B-2	582	624.5	43	49	575.5
B-3	582	625.5	44	48	577.5
B-4	582	627.9	46	48	579.9
P-1/B-5	586	629.5	44	133 (Zone D)	496.5
P-2/B-6	586	629.7	44	70 (Zone C)	559.7
B-7	586	623³	5,647	. 45	578.0
B-8	587	629.5⁴	43	45	584.5
B-9	588	625.1	37	53	572.1
B-10	588	631.0	43	47	584.0
B-11	589	627.0 ⁴	38	45	582.0
B-12	587	627.9	41	45	582.9
B-13A	587	628³	5,696	20	608
P-4/B13B	587	630.8	44	128 (Zone D)	502.8
P-5/B-14	587	630.5	44	67.5 (Zone C)	563.0
B-15	588	632.5 ⁴	45	45	587.5

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TABLE D-1 (continued)

BORING	30 FEET BELOW DEEPEST PLANNED EXCAVATION ¹ (NGVD)	SURFACE ELEVATION OF BORING, FT	TARGET DEPTH OF BORINGS, FT	ACTUAL DEPTH OF BORING, FT	ACTUAL COMPLETION ELEVATIONS OF BORING, FT (NGVD)
B-16	590	630.5⁴	41	47	583.5
B-17	588	633.4	45	45	588.4
B-18	589	628.9	40	45	583.9
B-19	589	638.6	50	61	577.6
B-20A	589	632.4	43	28.5	603.9
P-8/B-20	589	641.5	53	171.0 (Zone D)	470.5
P-9/B-21	589	642.3	53	85.1 (Zone C)	557.2
P-3	586	629.2	. 43	13.50 (Zone A)	615.7
P-6	587	630.3	43	23 (Zone B)	607.3
P-7	587	630.2	43	8.1 (Zone A)	622.1
P-10	589	641.8	53	25.5 (Zone A)	616.3
P-11	589	627.0	38	21.6 (Zone B)	605.4
P-12	588	627.9	40	22.7 (Zone B)	605.2
P-13	588	625.3	37	19.3 (Zone B)	606.0
P-14	587	629.7	43	24.7 (Zone B)	605.0
P-15	583	624.4	41 .	27.2 (Zone B)	597.2

The deepest planned excavation is defined at the elevation where top of weathered shale is encountered per previous boring data at the site.

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This boring is strictly for a piezometer; no geotechnical testing will be performed.

³ Pit dug to remove saturated surface soils. Estimated elevation.

Boring slightly offset to drill on level ground or other circumstance. Approximate elevation.

	SOIL I	BOREHO	LE L(OG								Ī	
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EVATION EN SAMPLE ECOVERY BYMBOL		AND			E E	Ş	ફ્રેઇ	æž.	₹	2	ا≾ہ		3
BLOWS/ ELE (RECATION) BLOWS/ ELN (RECOVERY)	DESCRIPTI	ION OF MATERIAL			AMPLER AND	CABING TYPE	BLOW9/FOO ON CASING	WATER	LIQUID LAWIT	PLASTIC LIMIT %	SPCIFIC	185	뭂
5			<u> </u>		13	Ö		38	3	옹	88 8	5"	۵
. 1	1	- :				П			Т			\dashv	
	CLAY (CH), tan, homos	geneous struc	ture,		ĺ		I ≓			i I			
- 2	ferrous nodules, fe	errous staini	rug		Į .		∣⊣		l l		ŀ	1	
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5,7,10	1.			:						} }		ı	
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1.6	- interbedded silty	clay @ 14.5 f	feet			$ \ $	╡					- 1	
- 14	•			e e	ł		╡				- }	- 1	
21,26	- H₂O within interbe	dded silty ci	Lay @ I	o teet	,		∃						
- 16 26	ferrous staining, animal detritus	tossitized b	ratir are	u			⊣∃						<u>ب</u>
	annar dettitus				ļ	Н	╛						Se
-18	1					Н	_=			1	- 1		Greg Hassett
22 M	- interbedded shale	with ferrous	staini	ng and		П	∃			1	- 1		60
- 20	weak cementation @						ヨ	`		ļ	ı		ji Pi
. [33,34]	and animal detritu			. ₹-		H	╡				- }		တ
50	41 H) 4				t			1			- 1		
- 22	SHALE, black and gra		, fissi	le,			\exists			1	.		اح
	silt partings, dry						\exists	1					LOGGED BY
-24							\exists				- 1		띭
24,50	- gray @ 25 feet										- 1		8
- 26 ^{[24} , 50]		*/		٠.									2
							. <u>=</u>					1	
28	TOTAL	L DEPIH @27.	feet]			1			1		
· -	BOTT	OM ELEVATION	0 601.	2 feet	1			1			- 1	- }	
	Note: Added fill soi					φ.1	£					1	
	prior to compl	etion of MWU.	IR conc			<u> 1</u>	1						
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			SOIL BO	OREHOL	EL	OG								
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Mus	kogee	Lark	ifill		<u> </u>					1 8	HEET			
usko;	gee, O	klal	noma	SAMPLING MET	00: 24.	-inch	spli	Ĺŧ	SDOOT	s	1	OF	2	
				on five-						\neg		ALL		
			•							1	TART	r T	FN	SH
				WATER LEVEL	18.1	17.3	9.8	32	9.25		TIME	丁	TIN	Æ
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	E27311		9	CASING DEPTH	NA	NA	N/	١	NA	, T	٤/ ــــــــــــــــــــــــــــــــــــ	32 °	11/	52
ARL RIC		75		IRFACE CONDITION	12S	<u> </u>	•							
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	HAMMER				-		•							
	1						10		. 1	1	EST I	RESU	LTS	
	BLOWS/ A IN ON SAMPER (RECOVERY)	ا ر					B.	12	Sg		*			Γ
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TY	§	Ϋ́E	AN DESCRIPTION	-			SAMPLER	CABING TYPE	BLOWS/FOO ON CASING	WATER	LIOUID LIMIT	PLASTIC LIMIT %	뜑	5
DEPTH IN FEET (ELEVATION)	585	~	UESCAFTION	W. WOLEDIAL			<u> </u>	\\	₹ ₀	Į₹ĕ	5	% ₹	SPCIFIC	밁
-		لبيا	<u> </u>				<u> </u>			20	5	42	200	ات
			FILL, silty clay, tan		_									
2			- dark brown @ 2 ft	.•										
			- silty sand intermixed	d with clay	0 3 f	t								
4 1	push			-			I .			1				
	<u> </u>		- silty clay @ 6 ft						l ≓	1			1	1
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	 		- black @ 17 ft											
18							1							1
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	20'		silt partings, ferror	us staining	ı	•			∣≓					
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40			SHALE, blue gray, weat	harad fice	ilo c		┪ .	1						

			SOIL	BOREHOL	<u> LOG</u>							
N	ME AND L	OCAT		DRILLING METH	o: Hollow-	sten	aug	ers,		RING I	10 .	\dashv
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M	uskoge	≥, 0	ndfill klahoma			•	• •		SH		_	
			•		100: 24-inc	n spi	1t	spoon	<u>s </u>	_	<u>x≠2</u> ⊥una	4
				on 5-foot	centers_			 .	ST.	ART	FINISH	\dashv
			•	WATER LEVEL	 	1		T		ME	TIME	-
				TIME				 	∀ 09	:00	10:00)
				DATE	-				19	7f8/	10:00	7
NUM			ELEVATION	CASING DEPTH					<u> </u>	92"	11920	
LL P	iG.			SURFACE CONDITION	VS							
GLE			BEARING .		<u></u>							_
VPU.	HAMMER	TOR	OUE FTLBS	<u> </u>			1					
2	都≅					<u> </u>	l _w	ρā		ST RE	SULTS	\dashv
(ELEVATION)	45	бүмвоц	SAM	PLE NUMBER AND		₹	1	ASB	X	<u> </u>		
Ę	BLOWS/ ABY ON SAMPLER (RECOVERY)	67.k	DESCRIPT	TION OF MATERIAL		SAMPLER AND	CASING TYPE	BLOWS/FOOT ON CASING	鼯	LIGUID LIMET	기왕	<u>.</u>
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		· ·	DRILING METHOL						BOFU	JG NO	<u> </u>	\dashv	tal	
SITE NAME AND			Hollowsten		<u> </u>	-3 m/s	1 T			-3	•	1	ua.	
Muskoge	e La	ndfill	x 7-in 0.D		3, 54	-1110	1 1.0	•	SHEE			ᅥ	팀	
Muskoge	≥, 0	klahoma	SAMPLING METH		-inch	spl	it sp	oons	1	OF	2	<u> </u>	14	
			on 5	-foot						DRILLI			퇴	
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N2721			1	11/19		<u> </u>						!		
DATUM E2730			CASING DEPTH SURFACE CONDITION	n/a _	<u>'s'</u>	٠	L_		11/1	9/42	. 11	./19	792	
	1E 7	BEARING				-,						\dashv		
ANGLE Vertic			Wet and mu	ady				•	·	· _			_ ≝'	
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GLEVATION) GLEVATION) BLOWS/ BLN ON SAMPLER (RECOVERY)	占		C 14 14 16 17			AMPLEA AND BIT	BLOWS/FOOT ON CASING	1 [* *				9	
DEPTH IN FEET (ELEVATION) SLOWS/ A IN ON SAMPLET (RECOVERY)	SYMBOL	· · · -	e Number And			¥ H	BLOWS/FOO ON CASING	_	CONTENT 4	اا	احدا		Ž	
HAN SEE	8	DESCRIPTION	N OF MATERIAL			14	\$ §8		2 8	PLASTIC LIMIT %	SPOFIC GRAVITY	FE 8	뭁	
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14 16 4,5,4 18 20 6,9,1 22 24	—	†					=	‡					Greg Hassett	
18 							=]					Ŧ,	
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20 6,9,1	₽	- Slickensided cleavag	ge planes @ 2	0 feet	•		1 =] [ଔ	Š
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26 5,8, 12		- Soils are slightly m	more consolid	lated @	25 f	eet		∄ [говаер ву	
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			SOIL	BOREHOL	E LO	OG							ŀ	<u>;</u>
TE NAME A	ND LOC	ATIC	N N	ORILING METH	o: Holl	owster	Au;	gers,		BORI		٥.	\exists	
Mh	nskos	zee	Landfill	3k-inch	I.D. x	7-inc	<u>h 0</u>	.D.			<u>B-3</u>		_	
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		_	•	SAMPLING MET			spl	<u>it sp</u>	ons		OF DRILL	: 2	\dashv	
				on 5-foo	ot cent	ers				STAP		FINS	SH	
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ATUM			ELEVATION	CASING DEPTH	N/A				1	09:0 DAT 1/19	<u>/94</u>	11/	19	92
RILL RIG				SURFACE CONDITION	NS									
NGLE			BEARING		Wet a	and Mus	<u>ddy</u>				٠.			١
AMPLE HAM	MER T	ORGI	UE FT.÷L8S											
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(ELEVATION)	A P	ಕ್ಷ	SAA	MPLE NUMBER			AMPLER AND BIT	CABING TYPE BLOWS/FOOT ON CASING		* 1 -				
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CELEVATION) SLOWS/ ALM ON SAMPLER	Œ		Sedent				🔻	₹ ±°		CONTENT *	PLASTIC LIMIT 76	SPCIFIC GRAVITY	뜮	
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7,9	∍,	ł	CLAY (CH)					:	∃			1		
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J-		1	- 1120 WILLIAM I INC.						∄		-	ļ į		
_ 34			- Coal seams, 32 to	35 feet			ĺ	_	∄					
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36 21,	,50	-	SHALE, blue gray, we	eathered, fiss:	ile, dr	у .		-	╡┃			1 1		
21,	, 50							:	31					
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SITE N	HAME	AND	LOCAT	ION:	DRILLING HE			Auger						MBER:		Ì
				nunity Landfill	with 3.25"ID	x 7.25~00	augers.					В-	·1			
21	901 :	S 54	th St	reet W., Muskogee, Ok 86251					(50)				Sheet	1 of 1		1
T.	031	FIU,	lect #	00231	SAMPLING HE 3" del Shelby			1-3000n	(22)	and	-		DRIL	ING		$\ \cdot \ $
					3 Ga Shelb	y 100e 13	• • • • • • • • • • • • • • • • • • • •				\rightarrow	STA		FIN	ISH	H
					NATER LI	EVEL	Г					TD		TI		
					TIME				-			17:3		18:	45	
					DATE		1				\neg	DAT	E	DA	TE	ğ
ATUM:	ft, N	(SL		ELEVATION: 622.85	CAVE DE	PTH						9/27	/93	9/27	/93	A. W. Pool
			Orlu B-	8 1		SURFAC	E CONDITI	ONS: cla	y, fla	ıt, moist	ground	l. Bori	ng rel	ocate	1	₹
NGLE:	Vert	ical		BEARING:		inside p	roperty box	indary								
AMPLE	HAM	MER 1	CORGUE	ftIbs.		N = 2711	99.00 E =	2731378.	00							Ş
					-			1	<u> </u>	NO.		TES	T RES	ULTS		DATILING CONTRACTOR
DEPTH IN FEET	BLOMS/8" ON SAMPLER	¥	ᆾ	ne	SCRIPTION		٠.	##	CASING TYPE	LAB CLASSIFICATION	×	Γ		۔ در	IVE	8
<u>₹</u> ₹	AND A	RECOVERY	SYMBOL		OF SATERIAL			SAMPLER AND BIT	皇	F 35	MATER	LIGUID LIMIT X	PLASTIC LIMIT X	SPECIFIC	(-) 200 SEIVE	2
E E E	吕종	FEC	6	•	AICHIAL			ay.≰	ASI	83	¥ E	EE	픋	E SE	200	≓
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			Halai	Brown SANDY SILT (ML); silty cl	ay interbeds, damp			T	$\overline{\Gamma}$		20.2					ı
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r				Brown SANDY CLAY (CL); damp.	uomo de usanz zrincu	we, son not	14162		1	1	21.8	1		3.14		ı
	TWS		4	Tan & gray CLAY	·			ST				1	ı			
	THE			sandy clay interbed 8 5.0 to 5.2	tt			ST	1]						
	TMS	5						3"		.]						
[- very stiff w/ root structures, s	licknopided cleavage	a clange: his	neku		}			Į.				
	C=3.0	85.		structure 8 8 to 10 ft.	mexengaca escarage	e planes, on	uen y	Is			19.6	ŀ		4.50		
- 10		00,	\mathbb{Z}						NONE							
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	٠		\mathbb{Z}	•					ľ		15.3	41	27			
ļ			\mathcal{L}	- abundant-root structures, sück	ensided cleavage of	anes Ø 13 to	o 14.5 ft			1	15.3	"	- "			
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			\mathbb{Z}	- remnant bedding plane & 18 to	19 ft				-		17.3	52	27			H
	710/14		4	Tananananananananananananananananananan	UNE declarate colo		ont Thin	ss		α -			•			Н
- 20		·	1	Tan severely weathered CLAY-S bedding planes (<0.03 ft), flat b	MALE dry, weak cak edded oxidation in b	edding plan	ies, inin	/	1—	"-	1					H
-				intermixed w/ residual soils Discontinue hollow-stem augering	- resume w/ rotary	operations	P 20 ft		İ	-	1					
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	2801 RUST	S. 5 Pro	4 St	reet v # 86:	V., Mu 251	skog	jee, Ok	SAMPLING M	ETHOD: 5.:	25" OD x	3" ID Core	e Barrel			1	Shee	t i of i	,	1
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						٠.		WATER L	EVEL						Υı	ME	71	MÉ	1
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	l: FL				ELE	VATI	ON: 622.85	CASING C					Ĺ			8/93	9/2	9/93	1 200
	RIG:	Failin	g 150	0					SURFACE	CONDIT	IONS: N	274298	.94, 1	E -	273134	7.58			ŀ
NGLE						• •	ARING: -	· · ·	· ·										18
AMPL	E HAM	MER	TORG	UE: 1	tID3. RES		<u> </u>		<u> </u>	1			$\overline{}$	Т	ī	700	T RES	111 TC	OBTILITIES CONTRACTOR
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2801 S 54th Street W., Muskagee, Ok RUST Project # 88251 BAMPLING METHOD: L5" di and 3" dia. Shelby tube (S WATER LEVEL 4 TIME 1th DATE 9/K CAVE DEPTH 7. DESCRIPTION SAMPLE Vertical BEARING: — SAMPLE WATER TORQUE: ft.—ibs. N = 273305.1 BEARING: — SAMPLE NAMER TORQUE: ft.—ibs. N = 273305.1 ANGLE: Vertical BEARING: — DESCRIPTION OF MATERIAL Tan and brown and gray Q.AY (CH) damp homogeneous structure, ron nocules ro slicken-sided cleavage planes, ron nodules TNS Tan and brown and gray Q.AY (CH) damp homogeneous blocky structur slicken-sided cleavage planes, ron nodules TNS Tan and brown and gray Q.AY (CH) damp homogeneous blocky structur slicken-sided cleavage planes, ron nodules TNS Tan and brown and gray Q.AY (CH) damp homogeneous blocky structur slicken-sided cleavage planes, ron nodules TNS Tan and brown and gray Q.AY (CH) damp homogeneous blocky structur slicken-sided cleavage planes, ron nodules TNS Tan and brown and gray Q.AY (CH) damp homogeneous structure, sicken-sided cleavage planes concentration of son nodules - sandy clay pockets 8 to 5 ft Tan severely weathered CLAY-SNALE: dry, fine grained, well sorted, a colaribitic cleavage planes on centration of son nodules - sandy clay pockets 8 to 5 ft Tan severely weathered CLAY-SNALE: dry, fine grained, well sorted, a colaribitic cleavage planes on centration of son nodules - sandy clay pockets 8 to 5 ft To severely weathered CLAY-SNALE: dry, fine grained, well sorted, a colaribitic cleavage planes well and the residual clay sails - noderate weathering - moderate weathering - moderate weathering - moderate weathering						В-	-3			
RUST Project # 86251 SAMPLING METHOD: L5* di and 3* dia. Shelby tube (S MATER LEVEL 4 TIME 1th DATE 9/R DATE 9/R DATE 1/R DATE 9/R ANGLE: Vertical SEARING: — SAMPLE HANNER TORQUE: ftlbs. N = 273305.1 SAMPLE HANNER TORQUE: ftlbs. N = 273305.1 DESCRIPTION OF NATERIAL Tan and brown and gray (LAY (CI) damp, honogeneous structure, iron nodules rouse in the sicken-sided cleavage planes, ron nodules 1		;								\mathbf{I}
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SAMPLE HAMMER TORQUE: ftibs. N = 273305.1 DESCRIPTION OF MATERIAL Tan and brown and gray QLAY (CH) damp homogeneous structure, iron nodules roundly sincken-sided cleavage planes, iron nodules. TMS Tan CLAY w/ sand (CL) damp, homogeneous structure, stocken-sided cleavage planes, iron nodules. TMS Tan CLAY w/ sand (CL) damp, homogeneous structure, stocken-sided cleavage planes concentration of sron nodules. TMS Tan CLAY w/ sand (CL) damp, homogeneous structure, stocken-sided cleavage planes concentration of sron nodules. TMS Tan Severely weathered CLAY-SHALE; dry, fine grained, well sorted, would cleavage planes w/ origized surfaces (cilo mmi) in nodules; interbedded & interawed w/ residual clay soils. TMS Tan Severely weathering, vertical fractures (0.03ft) w/ oxidized surfaces (cilo mmi) in nodules; interbedded & interawed w/ residual clay soils. TMS Tan Severely weathering. Tan Severely weathering vertical fractures (0.03ft) w/ oxidized surfaces (cilo mmi) in nodules; interbedded & interawed w/ residual clay soils. TMS Tan Severely weathering. TMS Tan Severely weathering vertical fractures (0.03ft) w/ oxidized surfaces (cilo mmi) in nodules; interbedded & interawed w/ residual clay soils. TMS Tan Severely weathering. TMS Tan Severely weathering vertical fractures (0.03ft) w/ oxidized surfaces (cilo mmi) in nodules; interbedded & interawed w/ residual clay soils.	7.0	(CAIS:I		<u>.</u>		9/15	/83	8/15	/93	ŀ
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ROCK BOREHOLE LOG BORING NUMBER: DRILLING METHOD: air-Rotary SITE NAME AND LOCATION: P-1/B-5 Muskogee Community Landfill 2801 S. 54 Street W., Muskogee, Ok RUST Project # 86251 Sheet 1 of 4 SAMPLING METHOD: 3" ID X 5.25" CO DRILLING 10 foot core barrel START FINISH TINE TIME WATER LEVEL TIME 10:45 14:30 DATE DATE DATE CASING DEPTH 10/21/93 10/22/93 DATUM: Ft. MSL ELEVATION: 829.50 ⋠ SURFACE CONDITIONS: DRILL RIG: Badger 1250 ANGLE: 0 BEARING: -DRILLING CONTRACTOR N - 27259138 E = 2731409.77 SAMPLE HAMMER TORQUE: ft.-Ibs. TEST RESULTS CORES CASING TYPE BLOWS/8" ON SAMPLER BLOWS/FT ON CASING DEPTH IN FEE' (ELEVATION) SAMPLER/BI1 PERMEABLITY CM/SEC NO. AND SIZE OF CORE PIECES DEPTH RECOVERY RECOVERY IN FEET SOIL DESCRIPTION SYKBO RUN NO. **ROCK STRUCTURE** 먑 ROCK LITHOLOGY FROH 2 24 RED claystone Red to purple, vertical fracture infilled w/ cement Had gray; horizontal fractures w/ ren oxide staining 0.1 ft apart 15' low angle fractures 0.2 ft apart from 20.8 to 21.4 ft - one 80' fracture 8 25 ft - potentially transmissive zone intilled w/ clay, highly weathered from 25 to 29 ft w/ horizontal to 15' fractures one 80' Gray moderately weathered CLAY-SHALE 23<0 80 0 25 fractures - one 80' fracture Ø 29.2 ft 2>6" 80 18 2 30 Gray unweathered CLAY-SHALE thin bedded, trace fossis, well sorted thin weathered zones w/ clay 8 32.5 - 32.7, 33.7 -34.2, 34.9 - 35.3, 37.8 -38 and 39.4 - 39.8 ft Steel Casing 35 3 8>6" 95 58 G. Hassell 40 CHECKED BY - no transmissive zones O. Smith/G. Hasseti 45 4>6 61 4 69 LOGGEO BY 0. 50 gray SHALEY-LIMESTONE Finely crystalline, strong 5 3>6" 80 27 - 55 calcareous cenent, no

SITE	NAME	AND	LOCA	TION:				DRILLING M								BORI	4G NU	MBER:	
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April 1984 /

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lusko 1801 1	gee \$ 54	Commo	munity Landfill Treet W., Muskogee, Ok	air coring								_		
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			bedding w/ oxidized surfaces, ver	LAT-SHALE; dry, lical fractures,no	ven sorreu fossils	Linin	-	-	4	16.8	1		}	
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	: ft. 1	THS C=4.5 C=4.0 72 C=4.0 70	TWS C=4.0 70 C=4.25 100	ELEVATION: 629.5 RIG: Mobil Drill B-61 Vertical BEARING: HAMMER TORGUE: ftibs. BY AND AND AND AND AND AND AND AND AND AND	SAMPLING M 3" da. Shek MATER I TIM DAT CAVE D RIG: Mobil Drill B-61 Vertical BEARING: E HAMMER TORGUE: ftlbs. DESCRIPTION OF MATERIAL Brown SILTY SAND, dry fine grained, wes sorted Tan CLAY (Ct.), dry, homogeneous structure, - vertical sand pockets due to bioturbation - damp.blocky structure, iron nodules C=4.0 70 Tan to gray severely weathered CLAY-SHALE; dry, bedding w/ oxidized surfaces, vertical fractures,no - slicken-sided cleavage planes, iron nodules	SAMPLING METHOD: 3" dia Sheiby tube MATER LEVEL TIME DATE CAVE DEPTH RIG: Mobil Drill B-81 Vertical BEARING: Boring HAMMER TORQUE: ftibs, Grown SILTY SAND, dry fine grained, well sorted Tan CLAY (Ct.), dry, homogeneous structure, - vertical sand pockets due to bioturbation - damp.blocky structure, iron nodules Tan to gray severely weathered CLAY-SHALE; dry, well sorted bedding w/ oxidized surfaces, vertical fractures, no fossils - slicken-sided cleavage planes, iron nodules	SAMPLING METHOD: L5" dia. Soil 3" dia. Sheiby tube. (ST) MATER LEVEL dry TIME 18:08 DATE 9/18/03 CAVE DEPTH Qave 9:12 RIG: Mobil Drill B-61 Vertical BEARING: Boring was slightly E HAMMER TORGUE: ftlbs. DESCRIPTION OF MATERIAL DESCRIPTION OF MATERIAL Tan CLAY (CL), dry, homogeneous structure, - vertical sand pockets due to bioturbation - damp.blocky structure, iron nodules Tan CLAY (CL), dry, homogeneous structure, - vertical sand pockets due to bioturbation - damp.blocky structure, iron nodules Tan to gray severely weathered CLAY-SHALE; dry, well sorted. thin bedding w/ oxidized surfaces, vertical fractures, no fossils Total of the control of	SAMPLING METHOD: L5* dia. Split-spoon 3* dia. Shelby tube. (ST) MATER LEVEL. dry TJME 18:08 DATE 9/18/93 CAVE DEPTH Qave 9:12 t SIG: Mobil Drill B-01 Vertical BEARINS: Boring was slightly offset to ground. N = 272765.17 E- HAMMER TORQUE: ftlbs. ground. N = 272765.17 E- BORING WAS SILTY SAND, dry fine graned, was sorted ST Tan CLAY (CL), dry, homogeneous structure vertical sand pockets due to bioturbation C=4.5 C=4.0 70 Tan to gray severely weathered CLAY-SHALE: dry, well sorted. thin bedding w/ oxidized surfaces, vertical fractures, no fossils ST Tan to gray severely weathered CLAY-SHALE: dry, well sorted. thin bedding w/ oxidized surfaces, vertical fractures, no fossils ST	SAMPLING METHOD: LS* dia. Split-spoon (SS) SAMPLING METHOD: LS* dia. Split-spoon (SS) SAMPLING METHOD: LS* dia. Split-spoon (SS) SAMPLING METHOD: LS* dia. Split-spoon (SS) SAMPLING METHOD: LS* dia. Split-spoon (SS) MATER LEVEL	SAMPLING METHOD: L5* dia. Split-spoon (SS) and 3* dia. Sheby tube. (ST) MATER LEVEL dry TIME 18:08 DATE 0/18/93 CAVE DEPTH Qave 0 12 th SURFACE CONDITIONS: brown soil, approved the conditions of the condition of the condit	SAMPLING METHOD: 15" dia. Spilt-spoon (SS) and 3" dia. Sheiby tube. 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Solit-spoon (SS) and Sheet (ST) DRILL (ST dis. Solit-spoon (SS) and Sheet (ST) DRILL (ST dis. Solit-spoon (SS) and Sheet (ST) START TIME 18:08 0.55 OATE 0/8/93 0.45 OATE 0/8/93 0.45 OATE 0/8/93 0.45 OATE 0/8/93 0.45 CAVE DEPTH dave 0 12 to 0.45 PARTICLE (ST dis. Solit-spoon (SS) and OATE 0/8/93 0.45 OATE 0/8	SAMPLING METHOD: 1.5" dia. Solit-spoon (SS) and Sheetly lube (ST) ORILLING START FIN MATER LEVEL dry TIME 18:08 9.55 it: 11 MSL ELEVATION: 829.5 CAYE DEPTH Quive 812 th 9/18/93 9/18 SURFACE CONDITIONS: brown soil, approximate elevation of 824 Vertical BEARING: Boring was alightly offset to drive on level HAMMER TORQUE: 1tibs. ground. N = 272765.17 € = 2730768.82 THE START FIN DESCRIPTION MATERIAL SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND SOIL AND START FINE THE START FINE TORQUE: 1tibs. ground. N = 272765.17 € = 2730768.82 TEST RESULTS MATERIAL SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND SOIL AND START FINE THE START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND SOIL AND START FINE THE START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND SOIL AND START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND SOIL AND START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND START FINE THE SURFACE CONDITIONS: brown soil, approximate elevation of 824 WE WIND AND START FINE THE SURFACE CONDITIONS: brown soil, approximate to display the surface fine fine fine fine fine fine fine fin

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DEPTH IN FEET (ELEVATION)	BLONS/6* ON SAMPLER	RECOVERY	SYMBOL		SCRIPTION OF			SAMPLER AND BIT	CASING TYPE	LABORATORY CLASSIFICATION	MATER CONTENT X	LIGUIO LIMIT X	PLASTIC LIMIT X	SPECIFIC GRAVITY	(-)200 SEIVE	
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- 10			1	pedding, Iron nodules intermixed &	interpedaed w/ re	skoual clay	2092		-	-						ŀ
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	ř	RUST	Proj	ect #	86251	SAMPLING ME	THOD:	15" Split-s	poon (SS) and	;		. •	Sheet	1 01 1		1
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				∤∕∤	Tan and and gray CLAY w/ sand	(CL),damp w/ moisto	ue pocket	s homo-	 	1	a -	18.3	41	28			
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		c=3.0	75	1//	Tan and gray CLAY (CH),damp.hor cleavage planes iron nodules	rogeneous blocky s	structure,si	icken-sided	72] 	[a.]	19.0		i	5.03		
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				! //	Tan and gray CLAY (CL) moist, lam oxidized bedding surfaces, abundar	mated w/ remnant i nt shell hash (bival	ves & crino	anes, oids) iron		4		16.9	48	30	1		1
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29 RECOVERY	SYMBOL	DESC MA Tan and gray CLAY.damp.homogen	OF TERIAL	N = 2725	34.32 E =		Π	.No.	Ī	750			
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+-		Tan and gray CLAY,damp,homogeni structures, vertical sandy pockets	eous structure. «					_ 5		13	l		<u> </u>
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	4/10/21			remenant bedding planes 8 14 ft ((<0.03 ft), flat bed	ded		ŞŞ							93.9
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	}		FI	\ bedded,interernixed w/ residual cl	ay soils	(<0.03FT) (riat			1					
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_ {	0/22/2		#	and the second s				SS]]	1L8				
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(ELEVATION)	ON SAMPLER	RECOVERY	SYMBOL	_ '	SCRIPTION OF			SAMPLER AND BIT	CASING TYPE	LABORATORY CLASSIFICATION	MATER CONTENT X	유논	PLASTIC LIMIT X	SPECIFIC	(-)200 SEIVE
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J	Husko	gee	Cor	nmunity reet W	y Lar	ndfill		-								<u> </u>	-4/E	1138		
	2801 : RUST	S, 54 Proi	l St iect	reet W # 862	., Mu 251	skog	jee,Ok	SAMPLING M	ETHO	D: 3°-1	n x 5.25'	• OD				1	Sheet	f of 4	1	1
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(ELEVATION)	BLOWS/6* ON SAMPLER	RECOVERY	RUN NO.	NO. AND SIZE OF CORE PIECES	RECOVERY	8	ROCK	OR LITHOLOGY		SYMBOL	HOC	K STRU	TOKE	SAMPLER/BIT	CASING TYPE	BLOWS/FT ON CASING			PERMEABLITY CN/SEC	ı
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weathered triable zones 53

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R	UST	Proj	ect	# 862	251		1	SAMPLING I	4ETH(00: 3*1	D X 5.25" 00				<u> </u>			
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7.	BLOWS/6" ON SAMPLER	RECOVERY	õ	NO. AND SIZE OF CORE PIECES	RECOVERY	₋	SOIL O	ESCRIPTION OR LITHOLOGY	I	SYMBOL	ROCK STRU	CTURE	SAMPLER/BIT	Ş	BLOWS/FT ON CASING	FE	N ET	PERMEABLITY CM/SEC
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ı	Ì		5	1>6"	79	53					ine graned, well	sorted,						
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	2801 : RUST	S. 54 Proj	4 St ject	mmunit reet W # 862	! Mu 251	skog	ee,Ok	SAMPLING ME	THOO:	10	X 5.25" OD		_	5	iheet .	3 of .	•	$\ \ $
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	(; Ft. R]G; F		, IEO	<u> </u>	ELE	VATIO	ON: 630.77	LASING U		E CC		<u> </u>		9/22	83	9/2	5/83	A. N. Pool
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	E HAM	MER 1	FORG	UE: 11	lbs.				N = 274	147.8	83 E = 2730251.18							٥
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13.57 13.52	BLOHS/8* ON SAMPLER	ERY	Γ,	IŽĒ	ΕŖ		SOIL D	ESCRIPTION		<u> </u>		SAMPLER/BIT	CASING TYPE	BLOWS/FT ON CASING	DEI	PTH N ET	ا≒ی	DRILLING CONTRACTOR
E Z	SAM	RECOVERY	RUN NO.	a Sept	RECOVERY	뎙		OR LITHOLOGY	OG PA	<u> </u>	ROCK STRUCTURE	E.	黑	83	_	ET	SE-	<u>Š</u>
DEPTH IN FEET (ELEVATION)	ॾ	35	₽	NO. AND SIZE OF CORE PIECES	2	".			٦			SA	3	-	F. F.	₽	PERMEABLITY CM/SEC	턚
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-			1	- :			Gray Shaler	-LINESTONE		∄∖	calcareous cement, thin beds, rippled to flat to			-				
100									昌	₫∖	gnarly bedded, rip-up clasts of shaley imestone			-				
-									巨		- weathered friable zones 8 97.5 - 98.9]]				
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-		:	"								cement, thin (<0.01) to medium (0.3); flat to ripple							łl
			1 65			A	$S_{\mu} = \mu$, μ .	Set S.		T	nterpedded SHALE,							ssell
_			-								LIMESTONE, SHALE, SANDSTONE sequence B 112.1 (0.02 () thick each)	.				ĺ		10
— 115]					h	TIZ.I (0.02 It thick each) - two coal seams B III.3 to III.32 S III.7 to III.8 (t			+		٠.		Hassell
-		5.								∄ \	- 70' angle fault, offst 0.03 ft 8 ft4.8 to ft5 ft			1				9
-			10	6>6"	97	70				:h	- frieble zones @ 115 - 115.2"			-				Smith/6.
-			1							$ \cdot $	- rop-up classs to 120 ft - 45 fracture 8 ll5.8 to 17.2 ft							0.5
20							LIMESTONE		_/=	尹 <i>/</i>	└ - 70° angle hairline	\mathbf{H}		[]				I≿∂
-							Gray SHALE			国》	fracture 9 187,5 to 118 ft - friable zones 9 118 - \ 118,6'	$\ \cdot\ $						١٠٠
-		,	 	-	\vdash	 				∄ \	SHALE & LIMESTONE rep-up clasts # 20.3 to			-				039901
- 125			11	<u> </u>	<u> -</u>	<u> </u>				∄ ′	vet fine grained well			ן ן				
- 123	1 :		[I	L	1	<u>.</u>				certed year microtio cenent, thin begs, flat bedded - friable zones @	<u> </u>	<u> </u>				<u></u>	ļ

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SITE P	NAME	AND	LOCA	HOIT					DRILLIN	G HET	HOD:	air-	Rotary	1	- ' '					BORIN				۱
м	usko	gee	Cor	nmunit	y Lar	ndfill		ļ			-								_	P-	4/B	13B		
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DEPTH IN FEET (ELEVATION)	BLOWS/6" ON SAMPLER	RECOVERY	g.	NO. AND SIZE OF CORE PIECES	RECOVERY		só	IL DE	SCRIPTI	ION		SYMBOL	R	OCK.ST	rauct	URE		SAMPLER/BIT	CASING TYPE	BLOWS/FT ON CASING	FF	N ET	ABLITY /SEC	
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CITE	DAME		LOCATI	ONE	DRILLING NE	THOO:	Hollow Stem	Auger				BORI	IG NU	MBER		1
_					with 3.25 10	x 7.25°C	OD augers.					P-	5/B	-14		ı
•	MUSKO 2801 :	ogee S 54	th Str	unity Landfill eet W.	air coring						\Box					ŀ
	Musko	gee	. Oklah	noma	SAMPLING ME	ETHOD:	Split-spoon	(SS) wit	h _				Sheet	1 of 2	!	
					2' drives and	Shelby	tube (ST)						DRIL	LING]
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	4; ft.)			ELEVATION: 030.47	CAVE OF	-	Cave @ 12 1					9/17/	93	9/17	/93	╬
			<u> </u>			+	CE CONDITI			surface	- sand	ly				ŀ
	: Veri			BEARING:		N = 27	4121.25. E =	2730239	37							- }
AMPL	E HAM	MER 1	ORQUE:	ftIbs.		!		 -	т-	- 1	,			70		48
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DEPTH IN FEET (ELEVATION)	BLONS/0. ON SAMPLER	RECOVERY	SYMBOL	DES	CRIPTION OF			SAMPLER AND BIT	CASING TYPE	54 F	NATER CONTENT X	e×	Б×	유논	-)200 SEIVE	٥
	SA		¥	MA	TERIAL				Sign	88.2	A TEN	LIDUIO LIMIT X	PLASTIC LIMIT X	SPECIFIC GRAVITY	g	
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			1 1 81 - 1 - 1					_1			<u></u>	<u> </u>	L	L	L	1
		100		Brown SILTY SAND, dry line grains	ed, well sorted			CME		. 4					İ	
				Too M IV (M) doubersones	tenetura iran nadul			+	4	· -	17.4	50	34	ŀ		İ
				Tan CLAY (CL),dry,homogeneous s	tractinse'nou upon	es,roats				-] "	""				1
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				- remnant vertical fracture or shri	nkage crack infale	d with a b	lack oxidized			-	23.5			2.97		ı
		100		mineral (<0.01 ft) recent bioturbati	ion e a to io it			CNE	ا	-						
- 10			V/λ					""	NONE	-	İ					ı
				•				'		•	18.0					ł
		· · · · ·		Tan severely weathered CLAY-SH	ALE; dry, fine grain	ned, well s	orted Thin	 	1			l .		!		l
•			<u> </u>	bedding w/ oxidized surfaces, rippl w/ oxidized surfaces	le laminated, vertica	al tracture	es (<0.01 (t)	\cdot		-			l			ı
		95	- -	ú.				CNE		4	13.1	35	14			ı
- 15		•••	7.5								1		İ			ı
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			<u>کې ۲</u>						1	7						
			5.5	- thin (<0.0tft) vertical fractures;	intermixed w/ resid	dual clay	soil			1						
20		100	7. T	· · · · · · · · · · · · · · · · · · ·				CME		1	14.3					
- 20			7.5	- claystone and water at 20 and 2	?1 ft.			1								1
			3	- gray at 21.5 ft.						1				-		ı
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- 25			7								,					Ġ
			چ <u>ج</u>	and at 27 to 20 5 to	· -			1		1						à
			<u> </u>	- wet at 27 to 29.5 ft.					1	1	15.4					I OGGED BY
	1	100	5 <u>5</u>	e.				CHE		1		,				දී
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SITE NAME				ORILLING HE			ı Auger	_ 		\dashv	BORIN — P	6 NU 5/B			
Musk	ogee	Com	munity Landfill creet W.	air coring	- 1.45 00	Taßel T	:		•	<u> </u>		J/ D	- 1-4		1
Musk	ogee	. Okla	ahoma	SAMPLING ME	ETHOD: S	plit-speci	n (SS)	eith			5	iheet	2 of 2		l
	Ī.			2' drives and								DRILI	ING		1
			· ·	-					:	-	STA	RT	FIN	ISH	1
				WATER L	EVEL	dry		-			TIM	E	TD	Æ	1
				TIME		18:11					08:	15	09:	40	ļ
				DATE		9/18/93					DAT	E	DA.	ΤE	ŀ
DATUM: ft.	MSL		ELEVATION: 830,47	CAVE DE	PTH C	ave 0 12	t				9/17/	/93	9/17	/93	
DAILL AIG:	Hobil	Oriù B	-81		SURFAC	E CONDIT	TÓNS:	natura	surface	- sand	1y				ŀ
ANGLE: Ver	tical		BEARING:	_	N = 274	121.25, E =	27302	39.37							ŀ
SAMPLE HAP	MER	TORGU	E: ftlbs.		<u> </u>										l
E SEE	_							_ <u>#</u>	<u>⊁</u> ©		TES	TRES	ULTS	ш	
(ELEVATION) (ELEVATION) BLOMS/0* ON SAMPLER	RECOVERY	威	DESC	CRIPTION			SAMPLER	AND BIT	LABORATORY CLASSIFICATION		*ب	ŭ×	유논	(-)200 SEIVE	
SAN SAN	වූ	SYMBOL	, MA	OF. TERIAL			X AK		SIF	WATER	LIGUID LIMIT X	PLASTIC LIMIT X	SPECIFIC	S	I
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	<u> </u>	* \$ <u>*</u>	- wet at 32 to 35.5 ft.				-		4					•	
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		-	Gray unweathered CLAY-SHALE; (dry fine-grained	oaad sartin	o. strena	_		-			ļ			l
		1	clacareous cement, thin beds, flat-	bedded			/ -	- -	-			İ			l
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TE NAME	AND	LOC	TION:				DRILLING HE			Auger (0-37 (t)			4	NG NU		
Musk	ogee	Co	nmunit	v Lai	ndfill	19	air-rotary (3	7- 87 ft		<u>,,</u>				P-	-5/B	14	
2801	S. 54	4 St	reet k	/ Mu	skog	ee, Ok	<u> </u>				<u> </u>			╁	Sheet	100	,
RUST	PFO	ject	# 862	251		· .	SAMPLING ME		foot CI	E continu	ous sample	(0-	-37f	1)			
							10 foot core		5.5		•			ļ	DAIL		
				÷	· .		3" ID X 5.25"			 	, 			ST.	ART	FIN	IISH
							WATER LI				ļ ·			4	ME		ME
							TIME	· ·			!			18:	00	09	:30
					•		DATE				ļl			DA	TE	O.A	TE
TUM: Et.				ELE		DN: 830.47	CASING D							9/2	7/93	9/2	8/93
LL RIG:	Badge	er 125	50			of the control of the		SURFAC	COND	TIONS:							
LE: 0				4.5	BE	ARING: -											
PLE HAM	MER 1	roaio	·	tID\$.		4 3		N = 274	21.25 E	= 273023	9.37		,				
⊋ ⊊		匚	CÓI						1	-	•	₌ا	۳		—		ULTS
BLOWS/6* ON SAMPLER	RECOVERY	إيا	NO. AND SIZE OF CORE PIECES	RECOVERY		SOIL D	ESCRIPTION	널	1.			SAMPLER/BIT	CASING TYPE	BLOWS/FT ON CASING		PTH N	PERMEABLITY CM/SEC
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\neg	Γ	<u> </u>		<u> </u>				-	4	r, line grained.	wat	Ŧ	Ť				$\overline{}$
	1		:		9	Grey unvestiv	ered CLAY-SHALE		−]. so	ried, strong ca nent, thin bed	careous	L]	[]	ł		
						Gray LIMEY-S	SHALE	ji Ji	<u>-</u>	oged		Г		[]	1		
									9 83	roken crumbty 7.5 to 38.1, 38.	5 to 41. &						
1					-				7 io	3 to 42.4 ft - 38.1 ft & damp	6 38'2 fo			-			[
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		2	320	88	34	Gray SILTY C	LAY.	_/ <u>算</u>		rstaline argella trix strong cak ment, nedium b dded, interoed	Ceous Careous	1	Ι.]			
				1 -		Gray SHALEY	-FINES LOWE			ment, meatum b daea, interbed ALE	eds, rappie]			
i .				1					3 \ -	vertical fractu cassite & pyrit	re intilled						
	.				,				<u> </u>	iO.7 to Stift				-		ŀ	ļ
		H	,						ang	ely crystaline, jellaceous mair	ix strong	, d.,					•
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		3	` 5> 8"	100	. 63-	. :			63	3 & 83.7 to 65	4 N						
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ITE NAME	AND	LOCATIO	IN:	DRILLING HE	THOO: H	Iollow Stem	Auger				BORIN		MBER:		1
	_	_		with 3.25"ID x	7.25*0	O augers.					B-	·15			1
2801	S 54	ith Stre	inity Landfill eet W., Muskogee, Ok	air coring		<u></u>						AL			l
RUST	Pro	ject #	86251	SAMPLING ME	THOD:	1.5" dia.Spli	t-spoon	(SS)	and		ı	Sheet	1 0/ 1]
				3" dia Shelby	tube (ST)						DRIL	LING		
•											STA	RT	FIN	ISH	1
				WATER LE	VEL	dry					TIM	Æ	· 71	NE	l
				TIME		18:11					08:	15	09.	40	l
				DATE		9/18/93					DAT	E	DA	TE	LOG M
TUM: ft. F	4SL		ELEVATION: 032.5	CAVE DE		Cave @ 12					9/17/	_	9/17		
ILL AIG: Þ	łobii	Oriii B-01		·	<u> </u>	CE CONDIT					ly, ap	proxim	ate e	evati	1
GLE: Vert	lcat		BEARING:		832.5 1	t. Boring w	as slightl	y off	set to d	r⊯ on					18
APLE HAM	MER	TORQUE:	ftibs.		level gr	round N =	273775.	17, E		57.84					ľ
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(ELEVATION) BLOWS/6* ON SAMPLER	PECOVERY	ಠ	DES	CRIPTION			SAMPLER AND BIT	CASING TYPE	LABORATORY CLASSIFICATION	×	_×	말×	⊵⊵	(-)200 SEIVE	ì
SAS	g	SYMBOL	MA	OF TERIAL			불모	볼	8.2	WATER	LIMIT X	PLASTIC LIMIT X	SPECIFIC GRAVITY	<u> 55</u>	ŀ
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·			Brown SILTY SAND, dry fine grains	ed, well sorted					МL				<u> </u>	92.0	ı
	80	#					ST		1	-				8	ı
			Tan CLAY (CL),dry,homogeneous s	tructure,iron nodule	s,roots				a 7	18.4	54	37	1		l
c=4.5	95	1 //					ŞT			-			}		l
			•						a 1	14.8			8.51		
c=4.5	90						ST		l			1	1		
		1//	Tan and gray CLAY (CL) dry homo	geneaus blacky str	ucture, slici	ken-sided		7	a	18.6		1			l
C=4.25	69		cleavage planes				ST			.1	1				l
			 remnant vertical fracture or shrift mineral (<0.01 ft) recent biotyrbat 	nkage crack intilled ion & 8 to 10 ft	with a dia	ack analzea	51	7	α	19.9			ĺ		
c=4.5	78	Y //					3'	MOKE				1			l
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			Tan severely weathered CLAY-SH, bedding w/ oxidized surfaces, rippl	ALE; dry, fine grain	ed, well so	orted thin]		١	ا			
3:/50-4	5"		A oxigized surfaces	ic idianated, ici neo		J (*0,01) ()	SS]	13.7	43	18			ı
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		4	•								1	ĺ			l
			- thin (<0.0tft) vertical fractures;	intermixed w/ resid	ual clay se	oit		╛			!				l
18/31/50	3"	17.4	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		,	•	ŚS					}			l
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ITE	NAME	AND I	LOCA	TION:			14	DRILLING ME	THOO:	air-Rotary	to 25 ft				BORIN	4G NUI	MBER:	
					. I ar	Afill		wet-rolary (o 45 ft		100	_			B-	-15		
2	801	5. 54	St	reet W	Mu	skog	ee, Ok				• •					Sheet	l of I	
н	USI	Proj	ect	# 862	251 .	. ,		SAMPLING M		5 foot co	' e	· .						
		•						3" ID X 5.25"	. 00							DRILI		
											T	r -			STA		FIN	
				-				WATER L		5.5 10:45	6.1 18:02				TIN	_	70	_
								TIME			9/23/93				10:3		14: DA	
T 164		401			- 1-	V A T 7 C	W6 820 E	CASING D		8/23/63	6,23,63	·			9/22	•	9/22	
	: Ft. /				ELE	VALIC	N: 832.5	CASING		CE CONDI	TIONS: na	tural surf	ace -	- 481		/ 6 3	0/22	703
GLE:		96117	1300			RE	ARING: -		+	est toe of		3011			,			
	HAH	4FR T	ORO	UF: 44	ibs.	, 52.	10114		-		= 273029	7.64						
		-64	J. 166		IES			<u></u>	1.4 - 5.7				T:-		Т	TES	T RES	ULTS
(ELEVATION)	BLOWS/6" ON SAMPLER	Ł		_						_			181	CASING TYPE	E왕	DE	РТИ	_
Z	ZZ	RECOVERY	Ş	NO, AND SIZE OF CORE PIECES	RECOVERY	0	SOIL (DESCRIPTION OR LITHOLOGY		SYMBOL SYMBOL	OCK STRU	CTURE	SAMPLER/BIT	<u>و</u> ا	BLONS/FT ON CASING	FE	N ET	PERMEABLITY CM/SEC
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i					1	Ì.	CLAY-SHALE		1	5 g	ined, vell sorte:	1, weak thin	-					
	-		ı i	25<8"	100	0			5	bec	iding (<0.03 1) ided, angular f 10' to 45' w/) liat actures]			
	- 1								2	Tel sur	aces, intermixe	ed 6]	l		
25									<u> </u>	<u>`</u> ₹\	rbeddded w/ i y sous		ŀ	1	-		;	
	- 1					¥			Σ.	vea	y & 25 fl seve Wered potent	afry		•			<u> </u>	
			2	4>6"	100	80			<u> </u>	- -⊊ 25∶	nsmissive zone 5 ft & 29.4 to :	9.5 11.	-		1			
i	-		•	1.4					5,	Te to t	war fractures 10" (, 0.01 ft);	verlicat		l	1]		
30									<u>-</u>	. ⊂ sec	cture infized w. ondary mineral OL fl)	ization	_			1		
~						•	Gray Unweal	hered CLAY-SHALE		- 488	p, line grained,							
	-		3	S<8"	23	0			-	CES	led, firm quart; sen),thin beddi ided				-			
			J	3/0		,	•		-		MC U				-			
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35	- 1		-				Gray LIMEY-	SHALE	투	5 430	o, fine grained, ted, firm calcar	wed eaus						
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			. 4	4>8"	100	83			<u> </u>	1	ular fractures w/ secondary	30° to			-			
									Ę		eralization							
40									3									
- 1	-				. :		COAL			完	l seam @ 4L7 -	A19 (1]			
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				. ·	DRILLING HE	THOO: H	ollow Stem	Auger				BORIN	ig Mui	4BER:		
_			Comm	·	with 3.25"ID :							B-	16			
	103K0 2801 (211CT	5 54 Pro	th Str	unity Landfill eet W., Muskogee, Ok 86251	SAMPLING ME	TUDO:	EV dia Dal	1	(eet	and	—├		Sheet	1 of 1	•	1
•	1031	FIU	icut #		3" da Shelby			1-3000	(33)	anu	\dashv		ORILI	ING		┨
					5 62 5	1000 10						STA		FIN	ISH	11
				•	HATER LE	VEL	10.9					TIM	€	TI	HE	11
		٠.			TIME		10:10			<u> </u>		15:5	5	17:	15	↓
					DATE		9/18/93					DAT	_	DA		600
	l: ft. h		2411 0 4	ELEVATION: 630.5	CAVE DE		ve @ 11.3 f		ue ni	-urince	- ****	9/17/		9/17		J≥i
	: Vert	_	DrIN 8-6	BEARING:		-	ft. Boring					y, op	, O CAM	ale e	ETG(II	1 '
			ORQUE				ground, N					:				DRILLING CONTRACTOR
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DEPTH IN FEET (ELEVATION)	BLOWS/8" ON SAMPLER	ERY	٦,	DES	SCRIPTION			## ##	CASING TYPE	LABORATORY CLASSIFICATION	>*		٠٠٠	حي	IVE	8
Z Z	SAN	RECOVERY	SYMBOL		OF ATERIAL			SAMPLER AND BIT	울	IF IC	뺼	LIGUID LIMIT K	PLASTIC LIMIT X	CIF.	S	<u> </u>
<u> </u>	ౚ౾	끮	S.					ળ≺	3	LAS	MATER CONTENT X	5 <u>5</u>	53	SPECIFIC GRAVITY	(-)200 SEIVE	붍
				· · · · · · · · · · · · · · · · · · ·				<u> </u>	느	لـقــا	<u> </u>	<u> </u>	·			₁ ¯
	c=4.25	54		Brown and tan CLAY (CH) moist, I	hanageneaus structi	ure, iron nac	tules	ST			19.8					1
	-4.23			- sandy clay pockets (from bioto	urbation) from 2 - 6	fL.		<u> </u>					ĺ			
	c=2.75	80						st					Ì			
	$\vdash \vdash$							-	-	-	21.7	47	32			
	c=2.5	58		ı				ST						٠.		l
	H			- interbedded w/ fossils (crinoid	fronds, bivalves), iro	on staining			┨	4			ļ			
	C≂2.5	79						ST		. 1						
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SITE	NAME	AND	LOCAT	TON:	DRILLING ME				ger			\Box	BORIN		4BER:		1
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	2801	\$ 54	th Si	munity Landfill reet W., Muskogee, Ok # 86251		. (: .								Sheet	1 of 1		1
1	1001	F1 0	jec t'i	F 00201	SAMPLING ME 3" dia. Shelb			W (— \$4	poon (55) a	10	-		DRIL			-
	•	7			3 dia, Shelo	y tube	(517						STAI		FIN	ISH	┨
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ATUP	t: ft.)	4SL		ELEVATION: 033.30	CAVE D	EPTH (Cave © 12.2	n.					9/17/	93	9/17	/93	$\frac{1}{2}$
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DEPTH IN FEET (ELEVATION)	BLOWS/8" ON SAMPLER	RECOVERY	SYMBOL	DES	SCRIPTION OF				SAMPLER AND BIT	CASING TYPE	LABORATORY CLASSIFICATION	E Z	무	2 ×	SPECIFIC GRAVITY	(-)200 SEIVE	
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				Brown and Ian CLAY (CH) damp,	homogeneous struc	ture, roots				T		20.6				_	\mathbf{I}
	c=4.5+			and Carried War					ST ×		1	20.0					ı
				- gray & 2 ft with sand streaks							.]	25.6	55	37			ı
	c=1.5	82			•			l	<u> 51</u>]						ı
	c=15	70			•				ST		Ţ	22.2			3.72		ı
				- slickensided cleavage planes, b	blocky structure & a	ron nodule	s @ 0 ft.	.	· · · · · · · · · · · · · · · · · · ·		4	1					4
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Ē	NUST	Pro	iect	# 882	251	J 3	· -• - ; ·	SAMPLING ME	ETHOD: 9	foot co	re					Shee	t I of	<u> </u>]
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	RIG: F	alling	150	0			ARING: -		SUHFAL	E CONDI	ITTUNS: C	iay							
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(ELEVATION)	BLOWS/6" ON SAMPLER	RECOVERY	•	NO. AND SIZE OF CORE PIECES	RECOVERY		SOIL	ESCRIPTION OR	SYMBO		OCK STRU	CTURE	SAMPLER/BIT	CASING TYPE	BLOMS/FT ON CASING		IN	PERMEABLITY CM/SEC	١
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			ļ		l			red CLAY-SHALE	<u></u>	1 ₩	t zone 0 213 - mogeneous str	iclwe,		l	-	[]			Ì
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			3	2>8"	92	33				<u></u>			4		-	11			l
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F	RUST	Proj	ect 8	16251	SAMPLING ME			lt-sp	100n (SS) .	and						┨
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)/IU 8-1			SURFAC	E CONDIT	IONS	s: clay								┨
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(ELEVATION)	BLOMS/6" ON SAMPLER	RECOVERY	SYMBOL		CRIPTION				SAMPLER AND BIT	CASING TYPE	LABORATORY CLASSIFICATION	MATER CONTENT X	LIMIT X	PLASTIC LIMIT X	SPECIFIC	-)200 SEIVE	ı
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				 no ron nodules, blacky structure to 15 ft 	, slicken-sided cle	avage plane	s from 13	┟	-		α	18.8					i
	C=2.5	65						.	ST		-						I
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	2/50		֚֚֚֚֚֚֚֡֞֟֝֟֟֝֟֟֝֟֓֓֓֓֓֟֟֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓	Tan severely weathered CLAY-SH bedded (<0.03 ft), flat bedded, o	ALE: dry, line grain xidized bedding pla	ied, well sar ines with se	ted, thin condary	-	55		_						I
,	8/50-3	< 1	+ :	mineralization (calcite) discontinue hollowstem augering 8	t8.7, resume w/ reta	ary @ 2011	_ ·-		33		_	}					I
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) 2	801	S. 54	St	reet W	y Lar Mu	skog	ee, Ok		<u> </u>							├─	Sheet	1011		1
F	RUST	Pro,	ect	# 862	251			SAMPLING HE	THOE): CO	ing w/ 5	.25" 00	X 3" 10 c	ore ba	arrel	· · · · ·				ļ
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								DATE	:	9	/23/93	9/23				DAT	E	DA	TE	17
ATUM	: Ft.I	MSL			ELE	VATIO	ON: 628.85	CASING D	EPTH		4L9			<u> </u>		9/23	/93	9/23	/93	
RILL	RIG: F	ailing	150	0	•	<i>C.</i> •			SUA	FACE	CONDIT	IONS:								1
NGLE:							ARING: -	 		070.46	150 F	- 027000								1
AMPLE	HAM	MER I	OKO	UE: ft		4.1			N -	2/240	1.50 €	273026	10.32	_	Т		TES	r RES	UETS	┨
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OEPTH IN FEET (ELEVATION)	LONS/8" SAMPLER	RECOVERY	皇	NO. AND SIZE OF CORE PIECES	RECOVERY			ESCRIPTION OR		SYMBOL	RO	CK STRU	CTURE	SAMPLER/BIT	9	BLOMS/FT ON CASING	FE	N ET	PERMEABLITY CH/SEC	ľ
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25			l							בי בינ	auria	rtical w/ oxid ces ble @ 25 to :								l
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Mustoure Community Lendfill 2801 5-5th Street W., Muskagee, Ok RUST Project # 3825i RUST Project # 3825i Sheet For I Sh	SITE	NAME	AND	LOCAT	ION:		ETHOD: Hollo		uger				BORIN		IBER:		1
Sheby tube (ST) 12 - 24 ft		Muskr	 1000	Comr	nunity Landfill	with 3.25*ID	x 7.25"00 au	gers.					B-	19			
Sheby tube (ST) 12 - 24 ft		2801	S 54	Ith St	reet W., Muskogee, Ok						,			Chnat	1001		1
MATER LEVEL TIME 10,030 13:15 DATE		KUS I	Pro	ject 1	F 80231				us sampi	er O	- 12 ft	_					┨
MATER LEVEL TIME 10:30 1				٠,		Shelby tube	(ST) 12 - 24	ft.		-	·						4
Time						*******		·	- 1		_	\dashv		-			┨
DATE DATE												\dashv		· I			١
SURFACE CONDITIONS: clay											+	\rightarrow		_			┨,
SURFACE CONDITIONS: clay			101		ELEVATION 938 F0			-+	 		+		_	_	_	_	k
NAME Vertical SEARING N = 27/707.818 E = 27/30467.610				Oriu O.	······································	CATE		ONDITIO	NS: clay				10710	93	10710	7 63	ť,
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2/2 100	₩ €	, E	'n	_					g _E ⊢	뿔	FE I	34		Ī		Ä	1
2/2 100	ZZ	SE SE	OVE!	🙀	DES	CRIPTION OF			FLE	말	FIC	SE	목본	DE T	FF	SEI	
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				\langle / \rangle	· · · · · · · · · · · · · · · · · · ·				<u>}</u>	$\mid \cdot \mid$	4						
				द्भा	Gray severely weathered CLAYST	ONE and SHALE]		+						٥
	25			12.51	Discontinue Hollow-stem audenno	at 26'		:	-	Н	-{						Ι,
	25	\vdash							1	: I		1 -	I	1	i I		14
	25				resume with rotary to completion of	eoth					- 1		1		\ I		15
	25				resume with ratary to completion of	Seoth					1						1

SITE	NAME	AND	LOCA	ATION:		·	Tree.	DRILLING HE	THOD: AN	-Rotary		_:			BORI	NG NU	MBER:	;
	Musko	gee	Cor	nmunit	y La	ndfill		·	····						B-	-19		
	2801 RUST	S. 54 Pro	4 St iect	reet w # 882	i., Mu 251	Iskog	ee, Ok	SAMPLING H	THOD						<u> </u>	Sheet	1 of 2	?
			•				• .	3" ID X 5.25"		barrel					1	ORIL	LING	
							•								STA	RT	FIN	IISH
								WATER L	EVEL						TI	4E	TI	ME
		•						TIME				·			09:		_	30
				•			NI 638 50	CASING D	-			1			10/2			TE 3/93
	I: Ft. RIG: I		w 125	50	ELE	YAI II	ON: 638.56	CASING	SURFACE	CONDI	l Tions:	<u>l·</u>			_ IO72.		1072	3/ 93
NGLE					y .	BE	ARING: -								-			
AMPLI	E HAM	MER 1	ORG	UE: ft	Ibs.													
<u> </u>	, .			COF	ES									w		TES	T RES	ULTS
E S	PE S	ERX	_	S ZE	ERY	ļ	SOIL D	ESCRIPTION	g				R/8I	₹	SING	DE	PTH	اِ≍
Ξ¥.	BLONS/8" ON SAMPLER	RECOVERY	RUN NO.	NO. AND SIZE OF CORE PIECES	RECOVERY	5	ROCK	OR LITHOLOGY	SYMBOL	R	OCK STRU	ICTURE	SAMPLER/BIT	CASING TYPE	BLOWS/FT ON CASING	-	IN EET T	PERMEABLITY CM/SEC
DEPTH IN FEE (ELEVATION)	88	. 2	[⊋	O. A.	× .	-	•		"				SAS	3	≣ ∂	FROM	2	
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			_		<u> </u>		Tan weather	O CLAY-SHALE	<u>_</u>	. Wes	fine-grained	Longo	┥.					
							Black CLAY]\ sor	ing: Ihin bed: -bedded: nut	i; Jeraus /	4		-{	}		
				ĺ		ŀ				<u> ۱</u> کو	lures with ox fine grained	Dood						
.										-l\ sori	ing, thin bed; -bedded, into organic clay	L.			1			
)			Ι.		, .					1 \ -c	organic clay par seam P 28				١٦		1	
			י	2>8"	73	50				- it	mestone 8 28	i.8 to 28.9	<u></u>					
				· .			Gray moderal CLAY-SHALE	ely weathered	<u> </u>	7 - C 29.1	nai seams Ø 2 29.7-to 29.8	. 31.0 to /	7]			
				. :					ام ک ا عراج		and 31,8 to 3 fine-grained ing: weak qua				▎▗▏			
35		•	Ι.		l		i e		7-5 E-3	ÇET	ing: weak qua ent, thin bed: le-bedded	rtizitic S: Ilat to			-			١.
		į.	<u></u>		- 47	ļ. <u></u>	Gray LIMEST	ONE, lassifierous	<u> </u>	Fine	lo medium ci	ystalline;	┥		-			
) abu	beds; ripple- idant fossis;	carbonate						
1	l					. : '	COAL	·	2	plai			1		1			
40							GIBY SHALEY	-LIMESTONE	E E	hair	vertical frac ine, this to m	edium beas	1 •		1			
40			2	3>6"	90		• •			cak	y crystaline; areous cener s; frat-bedde	nt: Union]			
										i ipp	e-bedded, ir	ace			4	ļ		
										40.	ay-shale at i	10.6 to			4			
							14								-			
45							Lisa (Established)	gain Aria a										
				10.0			Gray LIMEY-	SHALE	20	Fne	graned, god	d sorting:	_					
	•	- 2	267	.	14.	'	8. 1			lhn bed cen	beds; flat to ded; strong c	rippie. alcareous						
			,		*		Gray SHALEY	-LIMESTONE			ay weathering	at 47 to	1		1			
50	· .	-								Fine	iy crystaline: areous cener	it .						
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	i '' .		1 7	ı .		1. :			1=1-		ssdiferous at	48 to 51.9	1	1	. 1	1	1	1
in the							Gray CLAY W/			<u>ft</u> _	o: line-graine		-1	, ,		1		

				ATION	v Mar	odfill		DRILLING	ETHOO: /	ir-Rotar	У			_	BORIN B-	+G NUF -19	IBER:		
	108X C	S. 5	4 5	reet M	y Lai I., Mu	skog	ee, Ok								 	Sheet	2 of 2	,	
'	1051	Pro	i jec	# 004	201			SAMPLING		. h	-				<u> </u>	DRILL			ł
								3" ID X 5.2	OU COR	Destel		<u> </u>			STA		FIN	ISH	1
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								OA*	rE						DAT	rE	ĐA	TE	ğ
ATU	1: Ft.	MSL			ELE	VAT]	ON: 638.58	CASING	DEPTH						10/23	/93	10/2	3/93	A. M. Pool
RILL	RIG: (gbsE	er 12	50			. •		SURFA	E CONDI	T10NS:								4
NGLE						8 E	ARING: -	<u> </u>											٤
MPL	E HAM	MER	TORG		L-Ibs.		· ·			1			-	1	1 1	T-co		10 TD	1 2
SE	. #	_	\vdash	COf Tw G						.			116	Æ	او_ ا	$\overline{}$	T RES	,	Ž
DEPTH IN FEET (ELEVATION)	BLOWS/6" ON SAMPLER	RECOVERY	RUN NO.	NO. AND SIZE OF CORE PIECES	* RECOVERY	Rad	SOIL ROC	DESCRIPTION OR KLITHOLOGY	o days	R	OCK STRUC	TURE	SAMPLER/BIT	CASING TYPE	BLOWS/FT ON CASING	FROM	ET ET	PERMEABLITY CM/SEC	DRILLING CONTRACTOR
			3	4>6"	90	57	Grav SHAL	EY-LINESTONE		<u></u>			<u>↓ —</u>]	<u> </u>			·	-	
	}						0.5, 0.5.		屋	=1 st	r, finely crysallin ong calcareous c	ement;							l
							0.01705			=1, #	n-beds; rippie-be undent fossis erk rbonate between	l	4	ļ					
] !		4		100	85	Gray LIME Gray CLAY		= =	⊒,	mp; fine-gramed careous cement;	strong ,	┨						
				. :]		wa, co.	3466	<u> </u>	'⊢\ be	ds; ripple-bedded mean lossis, 1-45	t /	"		· -				
			\vdash			·	Total Dept	th at 81 fL	- -	<u>-</u>	icture with pyrite ratals along plane	L	1			}			l
							,			\ Ca	no; fine-grained; rling; strong quar ment, thin beds;	good zitic			ľ †			ŀ	
										\ tia	ment, thin beds; l-bedded				1				ĺ
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SITE	NAME	AND	LOCAT	TION:	DRILLING NE			Auger				BORIN			
	Musko	gee	Com	munity Landfill reet W., Muskogee, Ok	with 3.25°10 :	7.25**0	u augers.					B -	-204	.	
,	2801 : 2051	S 54	ith St	reet W., Muskogee, Ok # 88251	CAMPITAL NE	TUOD	ET dia Cas	1	(00)		— [Sheet	1 of 1	
	,		,		SAMPLING ME 3" dla. Shelby			r_shoon	(33)	31 0	\rightarrow		DRIL	_	
					J GIB. SHEID	, we t	<u> </u>	·				STA		FIN	tsu
					WATER LE		1.8				+	TIM			WE
			٠.	•	TIME		18:17				\dashv	15:2	_	17:	_
					DATE		9/18/93					DAT	-	DA	
ATUR	i: ft. k	(SL		ELEVATION: 832.43	CAVE DE	PTH	22.5'					9/18/	/03	9/18	/93
RILL	RIG: N	lobii	OriH B-	ėl –		SURFA	E CONDIT	IONS: cl	ay						
NGLE	: Vert	Icai		BEARING:				,							
AMPL	E HAM	MER	TORQUI	E: ftibs.		N - 272	215122 E -	273020	3.50	1					
£	ايم	_					•	.	<u>س</u>	LABORATORY CLASSIFICATION		1	T RES	ULTS	
DEPTH IN PEET (ELEVATION)	BLONS/8" ON SAMPLER	RECOVERY	탏	DES	CRIPTION			SAMPLER AND BIT	CASING TYPE	ICA1	MATER CONTENT X	o×	2×	유논	(-)200 SEIVE
1H 1	SEC	5	SYMBOL	MA	OF TERIAL			MA S	SING	SIF	ATE	Civit	PLASTIC LIMIT X	SPECIFIC	8
造	ᄦᇂ	Œ						"	5	LA	T No	25	목글	9.8	¥ .
_	<u> </u>		<u>. </u>	T - 0 111 (0)			· .						<u> </u>	<u>. </u>	<u> </u>
	C≃4.5	85		Tan CLAY (CL), dry, homogeneous	structure, iran nodu	iles		ST.		۳.	14.0				i
	$\vdash \vdash$							·	4	α	18.6	54	37		
	C=4.5	10	$\!$					ST		-		1			
	$\vdash\vdash\vdash$	•	[//]	•				-	-	-	21.5			1.48	
	C=3.0	65	\mathbb{Z}					ST		-				}	
	$\vdash \vdash \vdash$	-		- blocky structure, clayey sand p	ackets due to biotu	rbation 8 i	8-8 ft		1	α-			1		
	C=3.5	65						ST		• -					
			Y/	Tan and gray CLAY (CH) damp, ho	mageneaus, blacky	structure,			7	-	19.6			,	9,
ın	C=4.0	70	\mathbb{Z}	slicken-sided cleavage planes				ST.		1					92.9
10			Y/λ												
	[[\mathbb{Z}				•]					
			\mathbb{Z}^2	- iron nocules @ 13 ft from 13 to 15	ft				_						
	C=3.5	65		THE PERSON OF TH	•			ST	NONE					ĺ	
15		. ***	V/1	•					- J Ø						
				Tan and gray CLAY (CL);damp, res	mant heddiad olao:	PS (<0.03/	't) with	<u></u>		-			;		
";			\mathbb{Z}	oxidized surfaces, vertical fracture surfaces	es (<0.01ft) with st	ained oxidi	zėd							,	
				\$011 dCE3	•	•		<u> </u>	-	-					
	1/24/3		\mathbb{Z}	•				SS	۱ ا						
20		:	M							-					
				- COAL sean W/ H ₂ O & 21 ft						1					
			\mathbb{Z}							1	1				
				 red, gray, and tan CLAY, fracture 23 ft. 	es of 30" to 70" v	ilth oxidize	d surfaces		7	Cr _	19.8				
	8/41/53	l		•				SS		1					
25 ^	<u> </u>		Y //	•					7						
•				<u> </u>]					
			[3]	Tan severely weathered CLAY-5H weak quartzite cement, thin bedding	ALE; damp, fine gra	ined, well s	sorted. ermixed]	.,.				
	[]		7-1	with residual clay soil	3 1 222 101 100			4	\vdash]	17.7				
	1 1		1 1	Total Deoth at 28.5 ft.				'			1.	}			

							NUC		EHOL					0000		unë»	
SITE	NAME	AND	LOCA	TION:				DRILLING H	ETHOD: air-	Rotary				1	NG NUI		
	Muska	gee	Cor	nmunity	y Lar	ndfill								P-	-8/B	208	,
	2801	S. 54	4 St	reet W # 882	Mu	skog	ee,Ok	0440 190		ID V 6 05# 0D	·	· ·		-	Sheet	1 of 5	,
. '	וכטר	FIU	iec r	# 002	.Ji			10 foot con		ID X 5.25" OD				 	ORIL	TNG	
								IO 1001 CON	e værrer					STA		FIN	TCH
								WATER	LEVEL		Ť	1		τp		TI	
								TIM				+ :		13:	_	13:	_
								DAT			 	 		DA.	$\overline{}$	DA	
DATUR	t: Ft.	MSL			ELE	VATIO	ON: 64L47	CASING	DEPTH		•	1	•	9/21	/93	8/24	1/93
	RIG: 1		r 125	0		-		<u> </u>	SURFACE	CONDITIONS:	top soll ak	ng roa	ad o	n west	side o	1 LF	
ANGLE	: 0		٠.			BE	ARING: -										
SAMPL	E HAM	MER 1	rorq	JE: ft	Ibs.	. :	·		N - 27215	5.28 E = 27301	85.25						
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TION	BLOMS/6" ON SAMPLER	ERY		IZE SES	ERY		SOIL	ESCRIPTION	절		·_	SAMPLER/BIT	CASING TYPE	BLOMS/FT ON CASING	DE	PTH N ET	Ε̈́
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- 25			 - 	1>6"	18	н -				oxide staining - recovery; core	poor						
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- 25 D ¹			 	1>6"	18	H ·				oxide staining - recovery; core	poor			4			
- 25 10			 I 	1>6*		H -	Seally Rest	nered CLAY-SHALI		oxide staining - recovery; core coal specs. Dark gray to be	poor pieces has			***			
- 25			2	1>6"		11	Severly weak	nered Clay-Shali		oxide staining - recovery; core	roan peces has						

SITE	NAME	ANO I	.OCA	TION:	٠,	7		DRILLING HE	THOO); air-	Rotary				BORIN			
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SITE N	AME	ANO	LOCAT	TON	ORILLING N	ETHOO: H	ollow Stem	Auger			· ·	BORIN	g NUI	IBER:	
					with 3.25"[C) x 7.25°00	augers.					P-	9/B	21	
28	101 S	\$ 54 Pro	th Si	munity Landfill treet W., Muskogee, Ok # 86251	SAMPLING I	METHOD: 6	ME PARTIE	IAUE PAGE	do-		—├	.s	heet	2 of 2	
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AMPLE	HAM	4ER T	ORQU	E: ftlbs.		N = 272	17.180, E =	2730181.	790		_				
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CELEVATION)	ON SAMPLER	RECOVERY	SYMBOL	D	ESCRIPTION OF			SAMPLER AND BIT	CASING TYPE	ZATO	MATER CONTENT &	≘ ×	은≍	FIC	(-)200 SEIVE
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SITE	NAME	AND	LOCA	TION:	.4.			DRILLING M			w			4	NG NUI			
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	2801	S. 54	I St	reet W # 862	Mu	skog	ee, Ok	CAMBI THE N	EZUAA:	·CNI	Continuous sampler			┦	Sheet	1 of 2		
							196 - 196 -	3" ID X 5.25		U.HI				 `	DRILL	ING		ł
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CELEVATION)	BLOMS/6* ON SAMPLER	RECOVERY	RUN NO.	NO. AND SIZE OF CORE PIECES	RECOVERY	EGD.	1 2 7 7 7 7	OR LITHOLOGY	1	SYMBOL	ROCK STRUCTUR		CASING TYPE	BLOWS/FT ON CASING	FE	ĚΤ	PERMEABLITY CM/SEC	֓֡֞֞֞֞֟֞֓֓֓֞֟֓֓֓֓֓֓֓֓֓֓֡֡֞֓֓֓֡
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5				ν.					-	- 4	crystalization 9 63.4 to	.		-				S
		-t							-	-:4	83.5 ft - CLAYSTONE w/ calcite infilled burrows B							I DEGEN BY 6. Hassell
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ŕ	UST	Proj	ect	# 862	51	203		SAMPLING	METHO	D: CME	continuous	sampler					Sheet .	2 01 2	<u>'</u>
								3" 10 X 5.2	5" 00								ORILL	ING	
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					with 3.25"IO	x 7.25*00	augers.					P-	6			
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<u>ء</u> ا	BLONS/6" ON SAMPLER	RECOVERY	SYMBOL		CRIPTION -			SAMPLER	CASING TYPE	LABORATORY CLASSIFICATION	MATER	LIGUID LIMIT X	PLASTIC LIMIT K	SPECIFIC GRAVITY	(-)200 SEIVE	[<u>§</u>
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ŀ			<u> </u>	along bedding planes	mm relect bedui	ty, iron outle	: stam- eig	ļ <u>.</u>	NONE			<u> </u>	i :			1
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-			ا کے ت	- color change to green gray @ 16	ft .	٠.										
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7.1	BLOWS/6* ON SAMPLER	RECOVERY	SYMBOL	DES	CRIPTION	-		- <u> </u>	SAMPLER AND BIT	CASING TYPE	¥2	## ###	₽₩	₽×	SPECIFIC GRAVITY	(-)200 SEIVE
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	- 1		12.1	Severely weathered CLAY-SHALE	thin relect beddir	ng, oxide sta	aining,	_					ŀ			
	1	100		Vertical fracture Tan to gray to brown CLAY-SHAL		_	_	∠ [CHE]					
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	,			with 3.25"ID	x 7.25°0D augers.						-11			
Musk 2801	ogee S 54	i Comi	munity Landfill treet W., Muskogee, Ok # 88251]—				l i
RUS	r Pro	ject :	88251	SAMPLING ME	ETHOD: CHE 5-fo	ot					Sheet	1 of 1]
				Continuous sa	ampier						DRIL	LING.]
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DATUM: ft.			ELEVATION: 626.00	CAVE DE					· · ·	10/10	/93	10/18	/83	×
DRILL RIG:		Drill 8-			SURFACE CONDI	TIONS:	clay							┞┪
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(ELEVATION) BLOWS/6' ON SAMPLER	RECOVERY	SYMBOL	DES Ma	CRIPTION .OF TERIAL		1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	AND BIT	LABORATORY	WATER	CONTENT X	PLASTIC LINIT X	SPECIFIC GRAVITY	3A13S 007(-)	DRILLING CONTRACTOR
	100		Tan & gray CLAY (CH); damp, bloc & staining, slicken-sided cleavage	ky, homogeneous : planes	structure, iran nodules		CME	<u>a</u>	ijĒ	48	32			
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	100		-H ₂ O & 9.5 to 10.5 ft w/ heavily ox	sannt vela hatibi	Claur are well entit	,	CNE		-11]			
- 10	1 .00		E crumbly.	nette ciaj tunes.	G#15 ## ##1, 3011,	- `	- I.	اي	$\exists \bot$	1				
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	1	4	- red CLAYSTONE w/ oxidation 8 t		a assisted and	{			11				ļ	
-	 	F _2\$	Tan severely weathered CLAYSTOI sorting weak calcareous to strong ripple bedded, overconsolidated C	oxidized iron cent	ent, thin beds flat to				1				Ì	ŀ
· ·		F	. rippie bedded, overconsolidated Cl	LAT # 20 to 21.5 ()	L				11			.		
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, 2	801 3	5 54	th SI	munity Landfill treet W., Muskogee, Ok								<u> </u> -			i of i	
R	UST	Pro	ect :	# 86251	SAMPLING ME		ME 5-foo	t								
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					WATER LE	EVE:		•				-	ART DME	+	FJN)	_
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			Orill B-			SURFAC	E CONDIT	IONS: cla	у							
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(ELEVATION)	BLOWS/8" ON SAMPLER	ERY	ଅ	OES	CRIPTION			티	CASING TYPE	LABORATORY CLASSIFICATION		*	ی ا ـ	ا ــد	∡ي	-)200 SE1VE
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-				Tan & gray CLAY (CH) damp, homog		ucture,slicke	en-sided			а] [4	1 2	5		
- 1	- 1	100		cleavage planes, carbonaceous ma	ntena			CME			11			1		
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	1			Tan & gray CLAY w/ sand (CL); da partings, pockets & stringers	mp, homogeneous t	blocky struc	ture, sand] [i	
	- 1	100		parmiga, pocacia a straigera .				CNE] [١		
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İ				Tan & gray CLAY (CH);damp, homog cleavage planes	jeneaus Dlacky stru	ucture, slicke	en-sided				11					
1]			- two heavily oxidized clay zones - slightly overconsolidated clay B	(0.1 & 0.0\$ ft thick 7 to 8 5 tt	() 2 7 to 8.5	ft				11					
0		100		sugnery are ready and according to	7 10 0.0 11.			CME		_	.		ļ			
	i	1 -							NONE	٠.	 		ĺ			
			$\angle 4$	Tan severely weathered CLAY-SH	ALE: dry line main	ad wall ear	od wask		₹.							
				calcareous cement, thin bedds, fla	to ripple bedded.	heavy oxid	ation			٠,	11				ŀ	
			4 4	oxidation (sample is too broken w/	continuous sample	r to note in	equency)	CNE			∤			.	ŀ	
5		100	5	- gray 8 15 ft				CME		-	- 1					
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(ELEVATION)	SAM	RECOVERY	SYMBOL		OF TERIAL			SAMPLER AND BIT	볼	FIF		LIAUTO LIKIT X	PLASTIC LIMIT X	E I	3 SE
(ELI	무용	판	ိ					∛₹	CAS	LAB	CONTENT X	ĭ≛	 ₹ 5	SPECIFIC GRAVITY	(-)200 SEIVE
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		100		Tan & gray CLAY (CL) damp, hono w/ SANDY CLAY, remnant vertical (geneous structure	, bioturbation	infill ed	CME							<u> </u>
		iuu		slickensided cleavage planes, small	iran nadules, root	ls	un,]			ļ		
								ŀ				1	İ		
				Heavily oxidized clay zone P 4.1 to	4 2 ft										
•		80		overconsolidated clay at 8 4.5 ft	72 //			CNE		_					
				• • •						-					
				Tan & gray severely weathered CL	AV-CHALE: dog #	ine orained w			1	4					
			25	sorted weak quartitic cement. The	in beds (<0.01 ft)	, flat to ripple	bedded,			-					
		100	ج ج ج	heavy oxidation, up to 0.01 ft thick frequency)	(sample is too de	sturbed to not	e type &	CME	NONE	}	1				
0		.00		Ti Equetic 3)					£	_	ŀ	l			
	ŀ		- ⁷ -	· · · · · · · · · · · · · · · · · · ·						-					
			2.5	 abundant to vertical to 45° fractions (sample is too disturbed to note from the first content of the		xidation @ 12 to	1 17 ft		1	-					
			5	- H ₂ O P 12 ft	••					-					
ا ،		100	F ₂ F	•				CNE		-					
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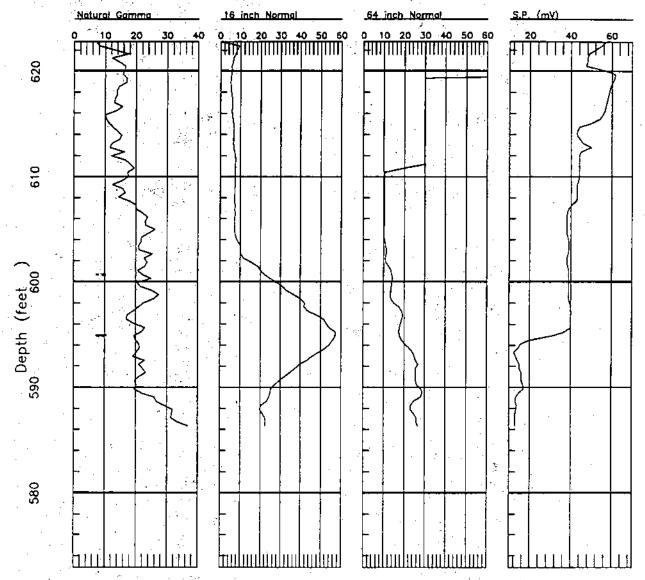
NO DECOMENT OF THE TORK TORK TORK TORK TORK TORK TORK TORK	ELEVATION: 629.72 BEARING: UE: 1tibs.	SAMPLING MATER I TIM DAT CAVE D SCRIPTION OF MATERIAL	SURFACE N = 27376	CONDITIO)NS: cla	y	CLASSIFICATION	MATER CONTENT X	STAI TIM 10:1 DAT 10/19/	Sheet ORILI RT IE IS IF IF IF IF IF IF IF IF	FIN TII 11: DA 10/16	ISH ME 10 TE
BECOVERY SYNBOL	BEARING: BEARING: UE: 1tlbs. DE: Brown SILTY SAND (SN), damp Tan SILTY SAND (SN), damp	WATER I TIM DAT CAVE D SCRIPTION OF MATERIAL	LEVEL IE IE SURFACE N = 27376	95.81 E = :	SAMPLER SAMPLER AND BIT	y .78		CONTENT	STAI TIM 10:1 DAT 10/19/	ORILI RT IE IS TE /93 T RES	FIN TII 11: DA 10/16	IISH ME 10 TE 9/93
SL BECONEUR AND THE STATE OF TH	BEARING: BEARING: UE: ftibs. DE: Brown SILTY SAND (SM), damp Tan SILTY SAND (SM), damp Tan S gray SILTY CLAY (CL) da	WATER I TIM DAT CAVE D SCRIPTION OF MATERIAL	LEVEL IE IE SURFACE N = 27376	95.81 E = :	SAMPLER SAMPLER AND BIT	y .78		CONTENT	TIM 10:1 DAT 10/19/	RT FES	FIN TII th: DA 10/18	ME 10 TE 9/93
BER YORG	BEARING: UE: ftibs. DE: M Brown SILTY SAND (SM), damp Tan SILTY SAND (SM), damp Tan S gray SILTY CLAY (CL) da	CAVE D CAVE D CAVE D CSCRIPTION OF MATERIAL	SURFACE N = 27376	95.81 E = :	SAMPLER AND BIT	.78	CLASSIFICATION	CONTENT	TIM 10:1 DAT 10/19/	IE IS TE /93	TII II: DA 10/16	ME 10 TE 9/93
BER YORG	BEARING: UE: ftibs. DE: M Brown SILTY SAND (SM), damp Tan SILTY SAND (SM), damp Tan S gray SILTY CLAY (CL) da	CAVE D CAVE D CAVE D CSCRIPTION OF MATERIAL	SURFACE N = 27376	95.81 E = :	SAMPLER AND BIT	.78	CLASSIFICATION	CONTENT	10:1 DAT 10/19/	15 FE / 93 T RES	II: DA 10/16	10 TE 9/93
BER YORG	BEARING: UE: ftibs. DE: M Brown SILTY SAND (SM), damp Tan SILTY SAND (SM), damp Tan S gray SILTY CLAY (CL) da	CAVE D CAVE D CSCRIPTION OF MATERIAL	SURFACE N = 27376	95.81 E = :	SAMPLER AND BIT	.78	LABORATORY CLASSIFICATION	CONTENT	0AT 10/19/ TES	T RES	DA 10/16	TE 9/93
BER YORG	BEARING: UE: ftibs. DE: M Brown SILTY SAND (SM), damp Tan SILTY SAND (SM), damp Tan S gray SILTY CLAY (CL) da	CAVE D SCRIPTION OF HATERIAL	SURFACE N = 27379	95.81 E = :	SAMPLER AND BIT	.78	CLASSIFICATION	CONTENT	10/19/ TES	793	10/16	9/93
BER YORG	BEARING: UE: ftibs. DE: M Brown SILTY SAND (SM), damp Tan SILTY SAND (SM), damp Tan S gray SILTY CLAY (CL) da	SCRIPTION OF MATERIAL	SURFACE N = 27376	95.81 E = :	SAMPLER AND BIT	.78	LABGRATORY	CONTENT	TES	T RES	ULTS	
BER TORK	BEARING: UE: ftibs. DE: M Brown SILTY SAND (SM), damp Tan SILTY SAND (SM), damp Tan S gray SILTY CLAY (CL) da	SCRIPTION OF HATERIAL	N = 27376	95.81 E = :	SAMPLER AND BIT	.78	LABORATORY	CONTENT			1	(-)200 SEIVE
RECOVERY SYNBOL	DE: 1t1bs. DE: M Brown SILTY SAND (SM), damp Tan SILTY SAND (SM), damp Tan S gray SILTY CLAY (CL) da	SCRIPTION OF HATERIAL	omogeneous stri		SARPLER AND BIT	П	CLASSIFICATION	CONTENT			1	(-)200 SEIVE
S RECOVERY SYMBOL	Brown SILTY SAND (SM), damp Tan SILTY SAND (SM), damp Tan S gray SILTY CLAY (CL) da	OF HATERIAL	omogeneous stri		SARPLER AND BIT	П	LABORATORY CLASSIFICATION	CONTENT			1	(-)200 SEIVE
100	Brown SILTY SAND (SM), damp Tan SILTY SAND (SN), damp Tan S gray SILTY CLAY (CL) da	OF HATERIAL	omogeneous stru rbation	ucture,	- CHE	CASING TYPE	LABORATORY CLASSIFICATION	CONTENT			1	(-)200 SEIVE
100	Brown SILTY SAND (SM), damp Tan SILTY SAND (SN), damp Tan S gray SILTY CLAY (CL) da	OF HATERIAL	omogeneous stru rbation	ucture,	- CHE	CASING TY	CLASSIFICA	CONTENT	LIGUID LIMIT X	PLASTIC LIMIT X	SPECIFIC	(-)200 SEIV
100	Brown SILTY SAND (SM), damp Tan SILTY SAND (SM), damp Tan & gray SILTY CLAY (CL) da	MATERIAL map, iran nadules, hi	omogeneous stru rbation	ucture,	- CHE	CASIN	CLASSIF		LIGUI	PLAST	SPECIF	(-)200 S
100	Tan SILTY SAND (SM), damp Tan & gray SILTY CLAY (CL) da	anp, iron nadules, hi ional crawfish bidtu	omogeneous stru rbation	ucture,	- CHE	CA	CLAS		75		9.55 8.55)Z(-)
	Tan SILTY SAND (SM), damp Tan & gray SILTY CLAY (CL) da	emp, iron nadules, hi ional crawfish biotu	onogeneous stru rbation	ucture,			-					
	Tan SILTY SAND (SM), damp Tan & gray SILTY CLAY (CL) da	eap, iron nadules, hi ional crawfish biotu	omogeneous stru rbation	ucture,			- - - -	•				
	Tan & gray SILTY CLAY (CL) da	anp, iron nadules, hi ional crawfish biotu	omogeneous stru rbation	ucture,			- - -	`				ļ
100	Tan & gray SILTY CLAY (CL) da occasional sand pockets, occasi	pap, iron nadules, h ional crawfish biatu:	omogeneous stru rbation	ructure,	CNE		-					
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 	I an C gray, severely weathered (CLAY-SHALE: dry	tine grained, we		+	NONE	4			[
1	Tan S gray severely weathered (sorted, weak quartzitic dement, t numerous fractures w/ heavy unio	thin beds (<0.01 ft)	, flat to ripple t	bedded.		🔻	4					
80	inductions tractures wy meany out	00000			CME							
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7,1	 tan & gray & !7 ft - extensive too disturbed to note frequency) 	vertical fracturing heavy oxidation a	ê 17 to 22 ft (s Iona beddina f	sample is Iracture		1	4					
7.5	planes	,				ļļ	1					
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1	 ■ - wel @ 22 ft ■ moderately weathered CLAY-S 	SHALE, gray					1	·				
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	TO ₱ 24.7 ft	,					コ					
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	THE PROPERTY OF THE PARTY.	planes — wet @ 17 to 19 ft	planes — wet @ 17 to 19 ft - wet @ 22 ft - moderately weathered CLAY-SHALE, gray	planes - wet @ 17 to 19 ft - wet @ 22 ft - moderately weathered CLAY-SHALE, gray	planes - wet @ 17 to i9 ft - wet @ 22 ft - moderately weathered CLAY-SHALE, gray	planes - wet @ 17 to i9 ft CNE - wet @ 22 ft - moderately weathered CLAY-SHALE, gray CNE	planes - wet @ 17 to 19 ft CNE - wet @ 22 ft - moderately weathered CLAY-SHALE, gray CNE	Planes - wet @ 17 to 19 ft CNE - wet @ 22 ft - moderately weathered CLAY-SHALE, gray CNE	planes - wet @ 17 to 19 ft CNE - wet @ 22 ft - moderately weathered CLAY-SHALE, gray CNE	planes - wet @ 17 to 19 ft CNE - wet @ 22 ft - moderately weathered CLAY-SHALE, gray CNE	Planes - wet @ 17 to 19 ft CNE - wet @ 22 ft - moderately weathered CLAY-SHALE, gray CNE	Planes - wet @ 17 to 19 ft CNE - wet @ 22 ft - moderately weathered CLAY-SHALE, gray CNE

ITE	NAME	AND	LOCATIO	ON:	DRILLING ME	THOD: Hollow	Stes /	lu ge r		•		BORIN		4BER:		1
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2	801 3	S 54	th Stre	eet W., Muskogee, Ok 88251	SAMPLING ME	יייייייייייייייייייייייייייייייייייייי	S tool o	óstlavou		nolez	┵		Sheet	I of I		1
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	ft. M			ELEVATION: 624.39	CAVE DE							10/27	/93	10/2	7/93	Ŀ
			Drill B-61			SURFACE CO	DNOTTE	INS: clay	<u>' </u>							ŀ
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(ELEVATION)	, E	¥		•				E -	YE	LABORATORY CLASSIFICATION	**	T	· · · · ·		٣	1
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375	BLOMS/8" ON SAMPLER	RECOVERY	S	, MA	TERIAL			AS A	CASING TYPE	SSI	MATER	LIMIT	PLASTIC LIMIT X	SPECIFIC GRAVITY	1-)200 SEIVE	١
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			HE SET	Brown SILTY SAND		-		1		\equiv				_		1
		100	 	Tan & gray SILTY CLAY (CL), hon	ogeneous structure	e, damp, iron nod	les	CME		4						I
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				Tan & gray severely weathered Cl sorted, weak quartitic cement, Th	.AY-SHALE: damp. in beds, flat bedde	line grained, wet ed	l		l i	4						ı
				- broken transmissive zone @ 17 to	17.5 ft					- 4			l			I
			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	- CLAY @ 17.5 to 20 ft						4						1
										4						I
0		100	<u> </u>	- interbedded CLAY @ 20 to 22 ft				CME		. –	1 .					l
- 1			<u> </u>							- 4				٠.		l
ŀ			£ 2	- interbedded COAL w/ CLAY 8 22	.3 to 22.5 ft					4	1					ı
	İ		- 5 -5	- CLAYSTONE @ 22.8 to 23.2 (t - Wet @ 22.8 ft in claystone						4	1					ŀ
	ŀ	100	75	- interbedded clay w/ shale @ 23.	2 to 24.5 ft					4	1					
5	ŀ	100	===	- clay soils @ 24.5 to 25.5 ft - interbedded CLAYSTONE w/ SH/	ALE @ 25.5 to 27 It			CME .		⊣	1 .					K
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APPENDIX E GEOPHYSICAL DATA

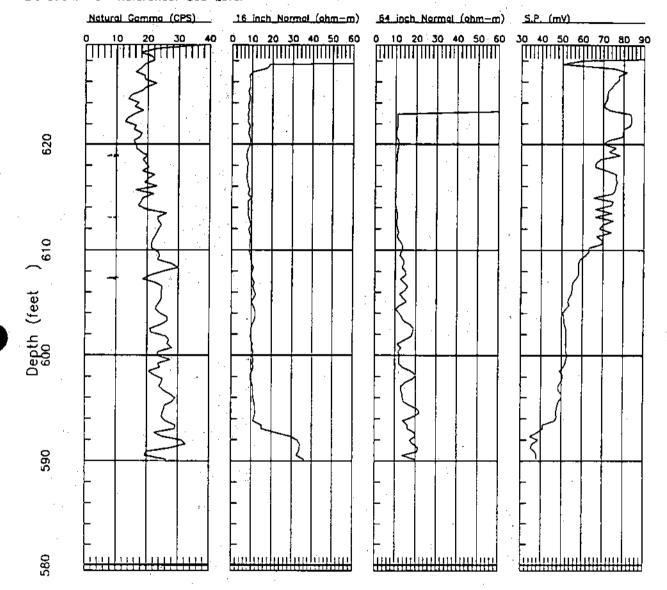
Muskogee\86251dp2.3rd

Well Name: B-1
File Name: EDITA01
Location: Muskogee Community Landfill
Elevation: O Reference: Sea Level

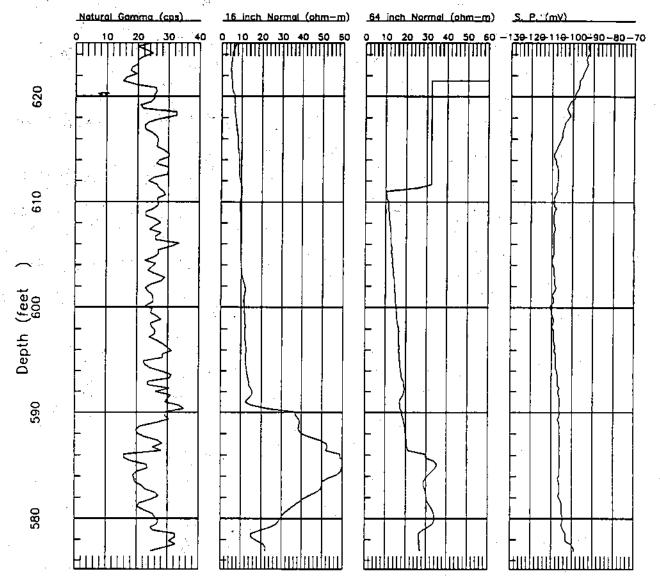


Well Name: B-8 File Name: EDITA208

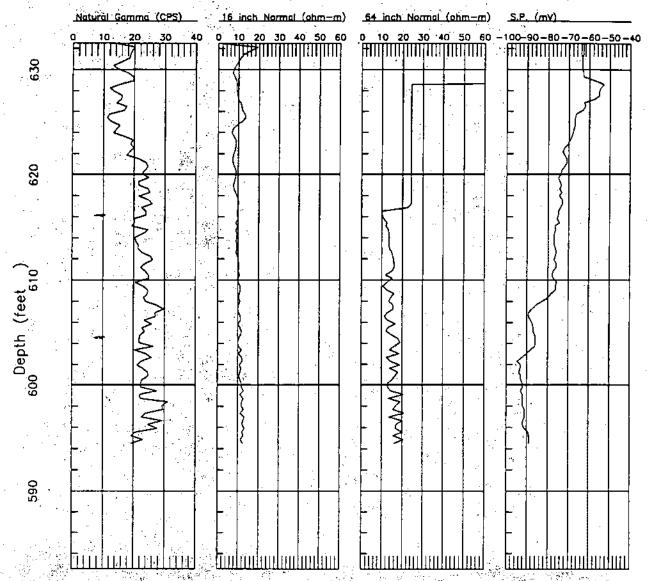
Location: Muskogee Community Landfill Elevation: O Reference: Sea Level



Well Name: B — 9
File Name: EDTA009
Location: Muskogee Community Landfill
Elevation: 0 Reference: Sea Level

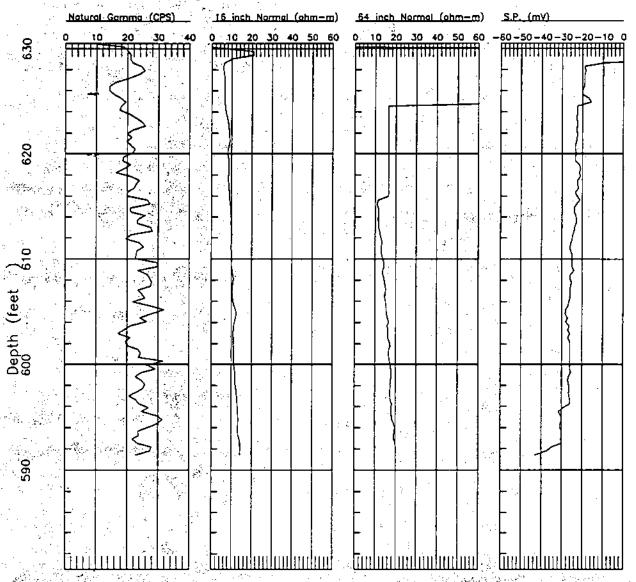


Well Name: b-15 File Name: EDITA215 Location: Muskogee Community Landfill Elevation: O Reference: Sea Level

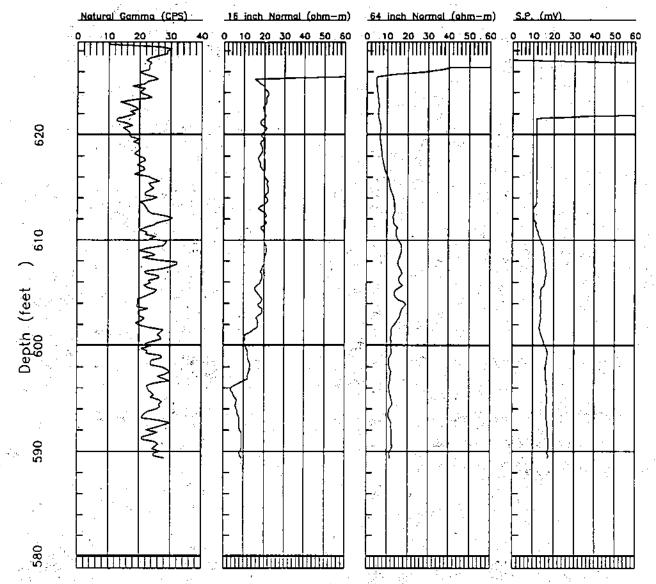


Well Name: B-16

File Name: EDITA216
Location: Muskogee Community Landfill
Elevation: 0 Reference: Sea Level

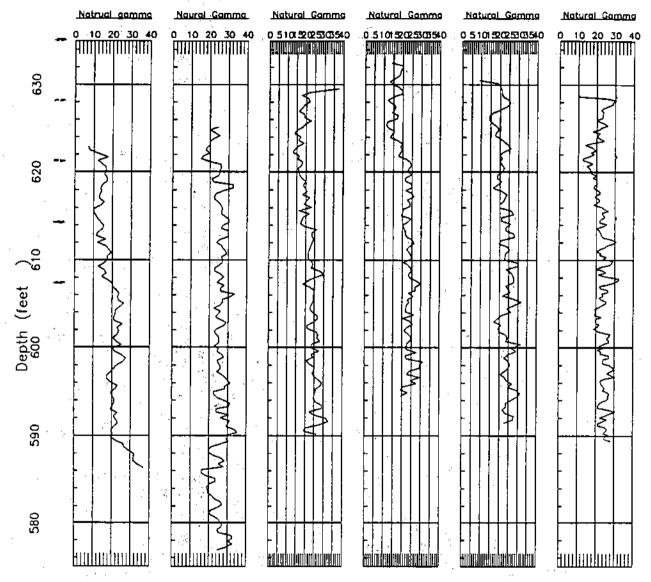


Well Name: B-18 File Name: EDITA218 Location: Muskogee Community Landfill Elevation: O Reference: Sea Level



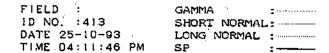
Well Name: Wells: B-1, B-9, B-8, B-15, B-16, B-18 File Name: ALLGAMMA

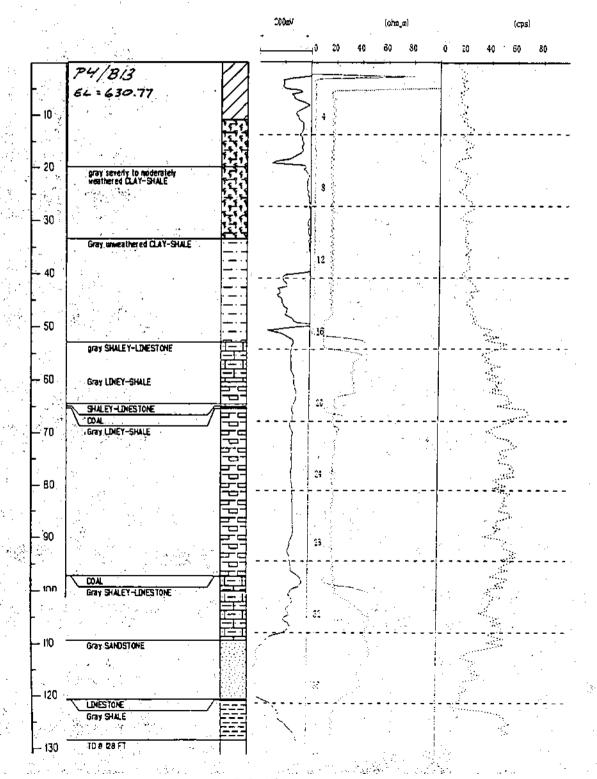
Location: Muskogee Community Landfill Elevation: O Reference: Sea Level



GEOPHYSICAL LOG BORING # <u>8/3 / P4</u> DEPTH (m) <u>38</u>

DRAFT

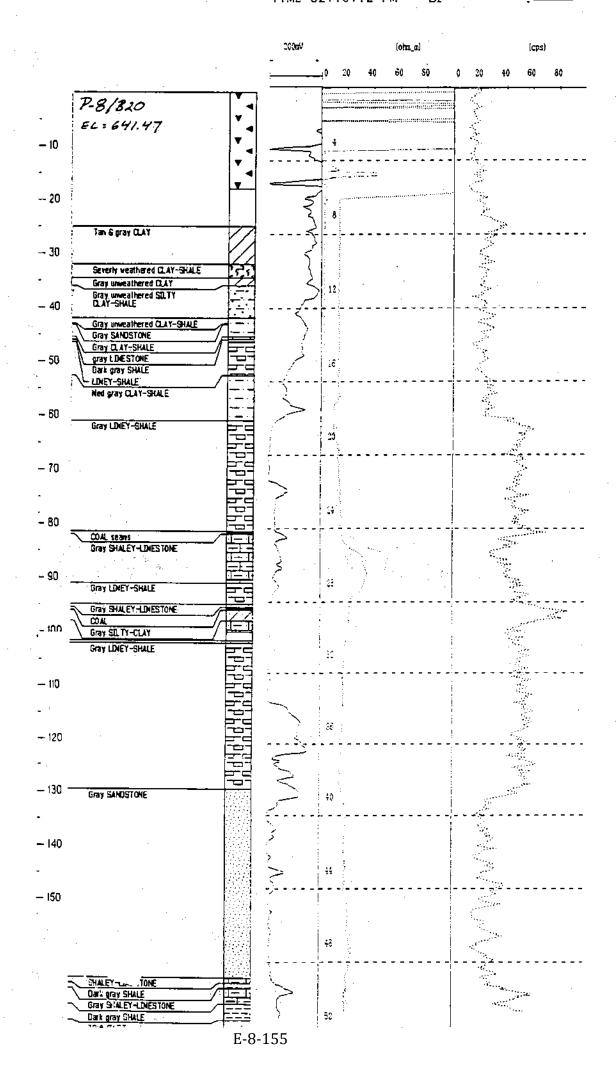




DRAFT

GEOPHYSICAL LOG BORING # 320/RB DEPTH (m) 51.3

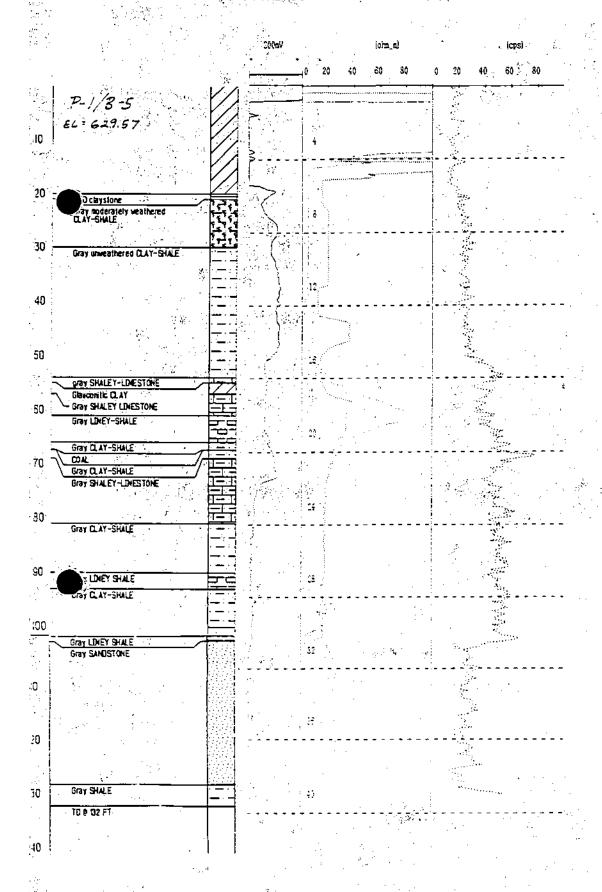
FIELD : ID NO, :620 DATE 24-10-93 TIME 02:19:12 PM

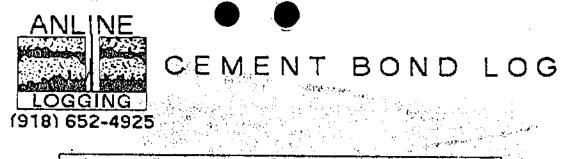


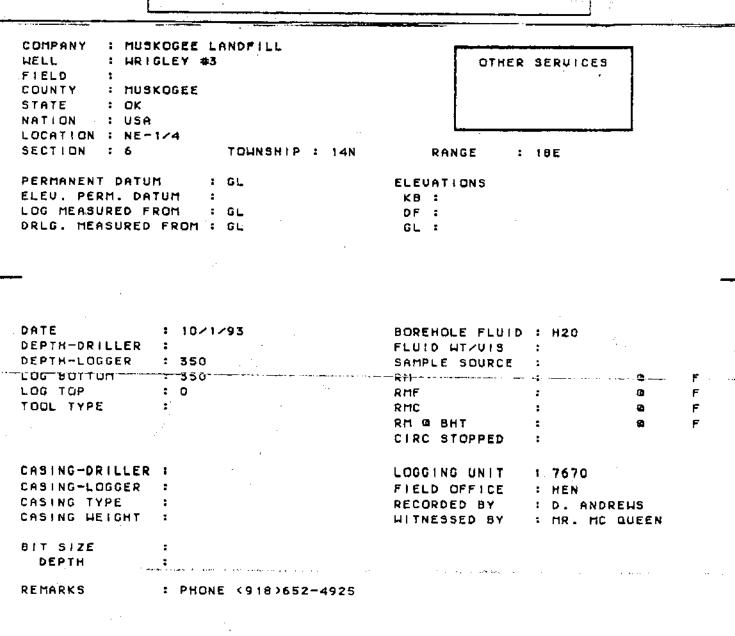
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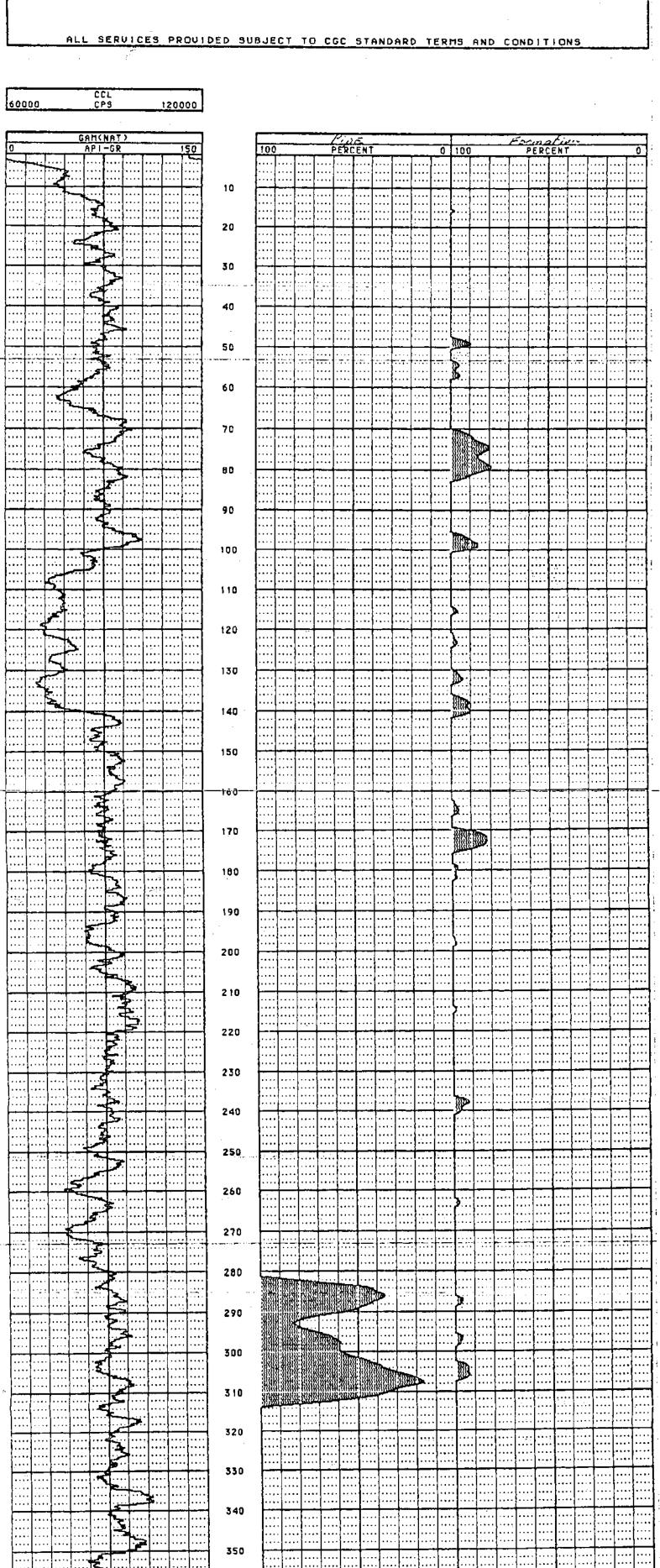
GEOPHYSICAL LOĞ BORING # <u>8-5 / P-/</u> DEPTH (m) <u>39</u>

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Appendix F

APPENDIX F PIEZOMETER INSTALLATION

To address the site-specific hydrogeology, a total of fifteen piezometers were installed. The purpose of the piezometers was to adequately monitor pressure head within individual zones, and determine the potentiometric surface of each zone. The piezometers aided in determining the following information:

- In-situ permeability of geologic units;
- Direction of ground water flow in the uppermost saturated zone, and within the deep saturated zones, if any;
- Rates of ground water flow;
- Maximum high elevation of piezometer surfaces;
- Ground water recharge and discharge areas.

A total of fifteen piezometers were installed which exceeds the ODEQ requirements of at least six piezometers for an 80-acre tract (ODEQ 252-510-11).

A piezometer was installed in each piezometric boring and screened within the specified zones. Three piezometers were set in Zone A, six in Zone B, three in Zone C, and three in Zone D. The actual completion depth of each piezometer was determined in the field after review of the logs and the geophysical logging. The screened interval within each piezometer was based on drilling observations of the permeable zones.

Each piezometer group was clustered together in the same general location. Piezometers P-1, P-2, and P-3 were grouped with monitoring well MW01R in one general location along the eastern buffer zone. Piezometers P-4, P-5, P-6, and P-7 were located in the northwestern corner of the property. Piezometers P-8, P-9, and P-10 were located along the western boundary next to monitoring well MW03R.

The piezometers were constructed of two-inch diameter, flush-threaded, Schedule 40 PVC, with a 0.010-inch slot screen, and a 20/40 washed Colorado silica sand filter pack. The filter pack was installed to approximately two feet above the screen. Bentonite pellets were installed above the filter pack for at least a three-foot seal. When needed, the bentonite pellets were hydrated

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using potable water. A four-inch by four-inch square aluminum or six-inch diameter steel protective casing was set in a four-foot by four-foot concrete pad around the piezometers in the piezometer clusters and P-15. Protective casing and concrete pads were not installed in the piezometers in the center of the landfill(P-11 through P-14).

Piezometers yielding ground water were developed to help restore the natural hydraulic properties of the transmissive unit. The water levels were determined and recorded immediately prior to development. Piezometer P-5 was not developed due to an oversight, but the effect appears to be minimal judging by the hydraulic conductivity of the wells screened in Zone C. Development proceeded using a Waterra® inertial hand pump or QED® development pump until specific conductance, pH, and temperature were stabilized for three consecutive readings.

IN-SITU PERMEABILITY TESTING

Hydraulic conductivity tests were performed for all piezometers. Hydraulic conductivity was evaluated using rising-head slug tests. The tests commenced after development, once the hydraulic properties of the transmissive zone were restored. After development, static water levels were allowed to equilibrate. The following sequence of events occurred during each slug test:

- Determine the static water level.
- 2. Lower the pump into place and remove a known volume (slug) of water from the piezometer. The analysis assumes an instantaneous change in volume when the slug was removed or added. The elapsed time equal to zero was recorded immediately upon cessation of pumping or the addition of water. An electric water-level meter or transducer measured the rise of water within the piezometer.
- Water levels in the piezometer was recorded every 30-seconds for five minutes, then every minute until 15 minutes elapsed. Measurements continued with water levels taken every five minutes until 30 minutes elapsed; whereafter, water levels were taken every 10 minutes until one hour elapsed.

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Successive time-depth measurements proceeded on an hourly or next day basis until
the static water level met 90 percent recovery.

Transmissivity and hydraulic conductivity was evaluated using the appropriate approach for the defined ground water system.

SURVEYING

Prior to the initiation of the exploration program, the proposed locations of all boreholes and piezometers were staked in the field by a professional surveyor licensed in the State of Oklahoma. The actual locations were dependent on accessibility and were adjusted in the field with the permission of the ODEQ and Waste Management.

Upon the installation of all the piezometers, the location of the piezometers and the top of PVC casing protective casing, concrete pad, and/or natural ground was surveyed. The elevations were surveyed to the nearest 0.01 foot using a USGS benchmark or National Geodetic Vertical Datum; the location was given in terms of latitude and longitude of the piezometer at least to the nearest tenth of a second, based on the State of Oklahoma coordinate system. Survey data is given in the back of this appendix.

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		۱		Bemonte Seal: ½-inch bentonite pellet: 23.1 to 26.1 ft	R 20					┨.
L	11				۰۰	20	40	60	80	100
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j				Comments: Centralizers (stainless:	steel)	at 3 fe	et and	1 36 fo	et fr	om
				ground surface. Auger c	uttings	39 to	39.5	feet		
										
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			recovery data, see	permeability G	old.							SUP
	T.D. = 133.0	ft.										

Boring No X-Ref. B-6 SPIEZOMETER CONSTRUCTION SUMMARY Survey Coords E=2731414.180, N=272535.731 Elevation Ground Level (MSL) 629.71 Top of Casing 832.99 Construction Time Log Orilling Summary : Total Depth (ft): 70.0 Start Finish Task Date Time Date Time Borehole Diameter: 5.0" Drilling: Casing Stickup Height: 3.28 ft. 0 - 70Driller: A. W. Pool, Inc. 10/29 1400 10/30 1145 Oklahoma Geaphys.Logging:. Andy Zavasky, Driller Casing: C1. S1 10/30 1205 10/30 1210 Rig: Badger 1250 Muskogee, Bit (s): 3-inch ID x 5-inch OD Core Barrel Filter Placement: 10/30 1210 10/30 1225 Bentonite Seal: 10/30 1300 10/30 1325 Drilling Fluid air Development: 11/02 1550 11/03 1130 ZAME Protective Casing: Anodized Aluminium Well Design & Specifications 20 Basis: Geologic Log 🛛 Geophysical Log 🗍 Casing String (s): C = Casing S = Screen **Hell Development** Developed with QED development pump. Initial water level = 20.08 ft. well volume = 8.54 gallons Volume pumped = 33 gallons Depth (ft) String (a) Elevation (MSL) +3.28 - 59.22 C₁ 632.99 -570.49 570.49 -560.49 59.22 - 69.22 S₁ Stabilization Test Data Spec. Cond. Temp (C) Time ρH 40 Casing: C1 2" ID Sch. 40 PVC, Flush joint 1050 8.31 7070 15.1 1100 8.30 7130 15.3 8.30 7060 15.8 1110 Casing: C2 8.31 7040 16.1 1120 7200 1130 8.33 16.1 Screen: SI 2" ID Sch.40 PVC. 0.10" slots, flush joints 50 Recovery Data Screen: 52 G. Hassett Grout Seal: Econoplug Bentonite grout 2 to 52.0 ft. CHECKED BY 60 Bentonite Seal: Bentonite Pellets 52.0 to 58.0 ft. Smith Filter Pack: 20 - 40 Colorado Silica Sand o 58 to 70 ft. 70 ,8¥

Comments

Drilling equipment was cleaned with hot water/high pressure washer prior to drilling. NOTE: For recovery data, see permeability data.

SUPERVISED BY DATE 10/30/9

T.D. = 70.0 ft.

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				-	·	WELL CONS 00, N=272568.879	Elevation	Ground Lo Top of Ca	evel 620 esing 63	9.22		
				Drilling Summary	•		Constru	ction Tir	Re Log			
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	K IJ	$\mathbb{N} \cap \mathbb{N}$		-	=1			Casing:				
	IXI	IXI I		Rig: Mobile Drill B-6		• 1		C _f , S _f	10/27	0828 0826	10/27	0827 0830
	\mathcal{H}	H	$/\!/$	Bit (s): 3.25-inch IC	x 7.25-inch D	D Hollowstem Auger	·5.0 5.	. '			10/27	20.00
,		M		Orilling Fluid: None				acement: nite Seal:	10/27 10/27	0830 0845	10/27 10/27	0845 0900
		И		Protective Casing	Loodized Alumi	NiDB	Deve	lopment:	Ì			
		H	//	<u> </u>			┨ .					
				Well Design & S	_	_						
				Basis: Geologic Log Casing String (s): C							•	l
٠ ـ ا			$/\!\!A$	casing string (s).	- casing 3	- 36: 66!!	Well Dev	relopmen	it			
- 5	M			Depth	String (s)	Elevation_	Well was	install	ed dry a slow fo	nd not rmation		
			//	+3.05 - 8.15	C ₁	532.27 -621.07	permeabi	lity and	recharg	е.		
	and it			8.15 - 13.15	\$ ₁	621.07 -616.07						
				-		-	CARNIL	-No-To	al Dala			
	<i>7.</i> 50.	13.5		· -		-	Stabulzi	ation Te	st Data			
			$/\lambda$	· · · · · · · · · · · · · · · · · · ·			Time	рH	Spec. (Cond.	Temp	(C)
				Casing: C1 2" 10 Sc	h. 40 PVC, FIU	SU IDIUI				}		
	Ξ		\mathbb{Z}	Casing: C2								
			//	Screen: S1 2" ID Sc	5.40 PVC					ļ		
					ts, flush joints		8	5-1-				
- 10			\mathbb{Z}	Screen: 52			Recove	y Data				
10			$/\!\lambda$	Filter Pack: 20 - 40	Colorado Silic	a Sand		a -		s _o -		
				7 to 13.5	ft.							
	∭≣		\mathbb{Z}	-Grout Seal: Bentonit	e Hole Plug							
	∄≣		$/\!\lambda$	2 to 4.0	ft.							
				Bentonite Seal: Bent	onite Pellets							-
	I ≡		\mathbb{Z}	4 to 7.0								
			4				<u> </u>					<u></u>
J				Comments								

WELL No. P-4 Boring No X-Ref. B-13 PIEZOMETER CONSTRUCTION SUMMARY Survey Coords E=2730251.180, N=274147.832 Elevation Ground Level (MSL) 830.77 Top of Casing 633.71 Construction Time Loa **Drilling Summary** Total Depth (ft): (28.0 Finish Date Time Date Time Task Borehole Dlameter: 5.0" 0 Drilling: Casing Stickup Height: 2.94 ft. 0 - 5010/22 1500 10/22 1630 Driller: A. W. Pool, Inc. 50 ~ 128 10/25 0930 10/25 1600 Andy Zavasky, Driller Geaphys.Lagging: 10/25 1600 10/25 1700 10 Casino: Rig: Badger 1250 10/23 Muskogee, C_1 : 10/23 Bit (s): 3-inch ID x 5-inch 00 Core Barrel **c**₂: 10/26 10/26 0823 0816 S1 2" PVC: 10/26 0815 10/26 0816 20 Drilling Fluid: air 10/26 0830 10/26 0900 Filter Placement: Protective Casing: Steel 0905 Bentonite Seal: 10/26 0900 10/26 Development: 11/07 30 11/06 1200 1445 Well Design & Specifications Basis: Geologic Log 🛛 Geophysical Log 📙 Casing String (s): C = Casing S = Screen Well Development Developed with GEO development pump. Initial water level = 22.5 ft. well volume = 16.29 gallons Volume pumped = 28 gallons Depth (ft) String (s) Elevation (MSL) C₁ +0.0 - 49.0 630,77 -581,77 c2 +2.94 -109.56 633.71 -521.21 109.56 -119.56 521.77 -511.21 5, Stabilization Test Data 60 Spec. Cond. Time ρН Temp (C) Casing: C1 6" ID x 6 5/8" OD 1405 7.46 7900 15.0 7.64 7510 15.1 70 1415 Steel casing 1425 7.67 7840 16.2 Casing: C2 2" ID Sch.40 PVC, Flush Joint 7830 1435 7.71 16 4 1445 7.70 7750 15.7 Screen: St 2" ID Sch.40 PVC, 80 0.10" slots Recovery Data Screen: 52 **n** = So -Grout Seal: Econoplug Bentonite grout 90 0 2 to 100.0 ft. CHECKED BY Bentonite Seal: Bentonite Pellets 100 100 to 108.0 ft. 6. Hassell Filter Pack: 20 - 40 Colorado Silica Sand 110 108 to 128 ft. à SUPERVISED B

Comments

T.D. - 128.0 ft.

Drilling equipment was cleaned with hot water/high pressure washer prior to drilling. NOTE: For recovery data, see permeability data.

WELL No. P-5 Boring No X-Ref. 8-14 PIEZOMETER CONSTRUCTION SUMMARY Survey Coords E=2730239.370, N=274121.253 Elevation Ground Level (MSL) 630.47 Top of Casing 833.32 Construction Time Log **Orlling Summary** Start Finish Total Depth (ft): 67.5 Date Time Cate Time Tesk Muskogee Community Landfill Borehole Diameter: 5.0" Drilling : Casing Stickup Height: 2.85 ft. 0 - 6710/27 1500 10/28 0930 Driller: A. W. Pool, Inc. Geophys.Lagging: Andy Zavasky, Driller Casing: 10/28 0955 C₁, S₁ 10/28 0945 Rig: Badger 1250 Bit (s): 3-inch IO x 5-inch 00 Core Barret 10/28 0955 10/28 1034 Filter Placement: tO Bentonite Seal: 10/28 1035 10/28 1110 Drilling Fluid: air 11/11 1800 Development: 11/11 1730 Protective Casing: Anodized Aluminium Weil Design & Specifications Basis: Geologic Log 🛛 Geophysical Log 🗍 Casing String (s): C = Casing S = Screen Well Development Developed with Waterra hand pump. Initial water level = 15.37 ft. well volume = 8.90 gallons Volume pumped = 5 gallons Elevation (MSL) Depth (ft) String (s) 633.32 -578.00 +2.85 - 52.47 C, 52.47 - 67.47 S₁ 578.00 -563.00 Stabilization Test Data no data Spec. Cond. Temp (C) Casing: C1 2" ID Sch. 40 PVC, Flush joint Casing: C2 Screen: S1 2" ID Sch.40 PVC, 0.10" slots **Recovery Data** Screen: S2 G. Hassett s, -Grout Seal: Econoplug Bentonite grout 2 to 41.0 ft. 50 Ä CHECKED Bentonite Seal: Bentonite Pellets 41.0 to 49.0 ft. Filter Pack: 20 - 40 Colorado Silica Sand - 60 49 to 67.50 ft. ď SUPERVISED BY DATE 10/28/93 Conments Drilling equipment was cleaned with hot water/high pressure washer prior to drilling. NOTE: For recovery data, see permeability data. T.D. = 67.5 ft.

WELL No. P-6 Boring No X-Ref. 8-6 PIEZOMETER CONSTRUCTION SUMMARY Survey Coords E=2730241.030, N=274148.580 Elevation Ground Level (MSL) 630.29 Top of Casing 633.94 Construction Time Log Drilling Summary Total Depth (ft): 23.0 Finish Task ' Date T1me Date Time Borehole Dlameter: 7.25" Casing Stickup Height: 3.85 ft. Drilling: Driller: A. W. Pool, Inc. 0 - 2310/25 1320 10/26 1406 Nuskogee Communit Nuskogee, Oklahoma Geophys.Logging: Andy Zavasky, Ordler Casing: C1, S1 10/26 1410 10/26 1420 Rig: Mobile 8-61 Bit (s): 3.25-inch ID x 7.25-inch OD Hollow Stem Auger Fifter Placement: 10/26 1420 10/26 1454 1520 Bentonite Seal: 10/26 1456 10/26 Drilling Fluid: none Development: 11/06 1000 11/07 1630 Protective Casing: Anodized Aluminium SITE NAME LOCATION. 5 Well Design & Specifications Basis: Geologic Log A Geophysical Log Casing String (s): C = Casing S = Screen Well Development String (a) Elevation (MSL) Developed with Waterra hand pump. Initial water level = 10.92 ft. well volume = 2.30 gallons Volume pumped = 14.5 gallons Depth (ft) +3.65 - 12.97 C₁ 633.94 -617.32 12.97 - 22.97 617.32 -607.32 Stabilization Test Data Spec. Cand. Temp (C) οН Time Casing: Ct 2" ID Sch. 40 PVC, Flush joint 1550 7.55 4820 14.8 1600 7.53 4810 14.4 1610 7.54 4740 14.4 Casing: C2 1620 7.58 4680 14.2 4800 14.5 1630 7.54 15 Screen: \$1.2" ID Sch.40 PVC. 0.10" slots, flush joint **Recovery Data** Screen: 52 G. Hassell $\mathbf{G} =$ Sa = Grout Seal: Econopiug Bentonite grout 2 to 8.5 ft. CHECKED BY Bentonite Seal: Bentonite Pellets - 6.5 to 11.0 ft. 20 Spice Filter Pack: 20 - 40 Colorado Silica Sand ö 11 to 23 ft. SUPERVISED BY DATE 10/26/93 Comments Orilling equipment was cleaned with hot water/high pressure washer prior to drilling. NOTE: For recovery data, see permeability data. T.D. = 23.0 ft.

				Borin	WELL g No X	No. <u> </u>			
	PI Survey Coords _		TER CONS	TRUCT	FION Ground Le	SUMN evel (MSI	(ARY		
				T	Top of Ca		33.70		
	Drilling Summary			Constru	ction Tir	ne Log			
	Total Depth (ft): 8.	-		7,	ısk	Sta : Date	ort • Time	Fin Date	ish Time
	Borehole Diameter: Casing Stickup Held			{ 	Drilling :	3333		5010	721-5
IXI IXI k	Driller: A. W. Pool, In				0 - 13.5	10/29	1500	10/29	1515
	Andy Zavasky, Drille	er .		Geophys	Logging; Casing:			i	
	Rig: Mobile Drill B-8				Casing.	10/29	1530	10/29	1531
	/ l -) Hollowstem Augers		S ₁	10/29	1528	10/29	1529
		:		Filter Pla	acement: :	10/29	1535	10/29	1540
	Orilling Fluid: None		•		ite Seal:	10/29	1545	10/29	1550
	Protective Casing: A	nodized Alumio	ieim.	Deve	elopment:		1		
	Protective casing.	MOGIZED AMMINI				i		İ	
	Well Design & S	ecifications	3	!					
	Basis: Geologic Log	Geophysic.	al Log 🗌			<u> </u>			
	Casing String (s): C	= Casing S =	Screen	Well Dev	relopmen	t			
	Depth (ft)	String (s)	Elevation (MSL)	 Well was	install	ed dry			
	+3.47 - 5.01	C ₁	633.70 -625.22			,			
	5.01 - 8.01	s _i	625.22 -622.22						
	/ / -		_ :	1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
	/ -		-	Stabilla	ation Te:	et Data			
			-	Steome	auon je.				
				Time	рН	Spec. C	Cond.	Temp	(C)
	Casing: C1 2" ID Sc	h. 40 PVC, Flus	sh joint				[
	:Casing: C2								
			• .						
	Screen: S1 2" ID Sc					. • •	.!		
	0.10" slo	is	•	Recover	y Data				
	Screen: S2								
	Grout Seal: Bentonit	e Hole Plug			a -		s _o -		
	0.5 to 1.0	l ft							
	Bentonite Seal: Bent	anita Palinte							
	1 to 4.0								
		:* '	_						
	Filter Pack: 20 - 40 4 to 8.10		Sand						
	4 10 8.10	T . ,							
				1					
	Comments	•							
	Drilling equipment wa		hot water/high pres	sure washer	prior to d	rilling.			
		*,	. •						
. T.D. = 8.10 ft.	<u> </u>	2,7							

Boring No X-Ref. B-20 PIEZOMETER CONSTRUCTION SUMMARY Survey Coords E=2730185.250, N=272155.268 Elevation Ground Level (MSL) 841.47 Top of Casing 634.82 Construction Time Log **Drilling Summary** Finish Total Depth (ft): 171.0 Task Date Time Oate Time Borehole Diameter: 5.0" Drilling HSA: Casing Stickup Height: 3.15 ft. 0 - 62 10/21 1315 10/21 1600 Driller: A. W. Pool, Inc. 50 - 133 10/23 1230 10/24 1335 Andy Zavasky, Oriller 10/24 1330 10/24 1500 Geophys.Logging: Casing: Rig: Badger 1250 10/23 1610 1710 C_1 : Bit (a): 3-inch ID x 5-inch 00 Core Barret c_2 : 10/24 1525 10/23 1535 S1 2" PVC: 10/24 1515 10/24 1525 Orilling Fluid: air 30 Filter Placement: 10/24 1535 10/24 1600 Protective Casing: Steet Bentonite Seat: 10/24 1600 10/24 1605 40 Development: 11/06 1000 11/06 1630 Well Design & Specifications Basis: Geologic Loo Geophysical Log 50 Casing String (s): C = Casing S = Screen Well Development 60 Oeveloped with GED development pump. Initial water level = 34.75 ft. well volume = 21.43 gallons Volume pumped = 86 gallons Elevation (MSL) Depth (ft) String (a) 641.47 -580.47 +0.0 - 61.0 C₁ +3.15 - 128.7 Ç2 644.62 -512.77 512.77 -477.77 128.7 - 163.7 51 Stabilization Test Data Spec. Cond. Temp (C) Time ρН 90 18050 13.5 Casing: C1 8" ID x 8 5/8" 00 1455 7.36 1515 7.38 16840 15.8 Steel casing 15.8 t6560 1530 7.27 100 Casing: C2 2" ID-Sch.40 PVC riser, flush Joint 15.6 1545 7.26 17110 1600 7 29 17170 15.7 Screen: S1 2" ID Sch.40 PVC. 110 0.10" slots, flush joints **Recovery Data** Screen: S2 120 So -Grout Seal: Econoplug Bentonite grout ď 2 to 112 ft. 130 Bentonite Seal: Bentonite Pellets 140

112 to 124 ft.

Filter Pack: 20 - 40 Colorado Silica Sand 124 to 171 ft.

Comments -

150

160

T.D: = 17LO ft.

Orilling equipment was cleaned with hot water/high pressure washer prior to drilling. NOTE: For recovery data, see permeability data.

CHECKED BY

WELL No. P-9 Boring No X-Ref. B-21 PIEZOMETER CONSTRUCTION SUMMARY Survey Coords E=2730(81,790, N=272)(7,160 Elevation Ground Level (MSL) 842.32 Top of Casing 845.57 Construction Time Log Drilling Summary Finish Total Depth (ft): 85.1 Task Date Tine Date Time Borehole Diameter: 5.0" Drilling: Casing Stickup Height: 3.25 ft. 0 - 85.1 10/28 10/29 0930 1425 Driller: A. W. Pool, Inc. Muskogee, Oklahoma Geophys.Logging: Andy Zavasky, Driller Casino: 10/29 0940 10/29 0945 C_I, S_I Rig: Badger 1250 Bit (s): 3-inch ID x 5-inch OD Core Barrel Filter Placement: 10/29 0945 10/29 1015 Sentonite Seat: 10/29 1015 10/29 1130 Drilling Fluid air Development: 11/03 1600 11/05 1050 SITE NAME Protective Casing: Anodized Aluminium Well Design & Specifications Basis: Geologic Log 🛛 Geophysical Log 🗌 Casing String (s): C = Casing S = Screen Well Development Developed with GED development pump. Initial water level = 22.75 ft. well valume = 10.64 gallons volume pumped = 46 gallons Depth (ft) String (s) Elevation (MSL) +3.25 - 75.08 645.57 -567.24 C₁ 75.08 - 85.08 S67.24 -557.24 **S**₁ Stabilization Test Data Time Spec. Cond. Temp (C) Casing: C1 2" ID Sch. 40 PVC, Flush joint 0950 9.03 5370 13.1 1010 8.27 5150 12.1 1030 8.53 4910 13.9 50 Casing: C2 4950 1050 8.51 13 8 Screen: St 2" ID Sch.40 PVC, 0.10" slots, flush joints Recovery Data CHECKED BY 6. Hassett Screen: \$2 60 n + So -Grout Seal: Econoplug Bentonite grout 2 to 58.0 ft. Bentonite Seal: Bentonite Pellets 58 to 65.0 ft. -70 Filter Pack: 20 - 40 Colorado Silica Sand 65 to 85.1 ft. Ö 80 Comments Drilling equipment was cleaned with hot water/high pressure washer prior to drilling. NCTE: For recovery data, see permeability data. NOTE 2: 1 bag (sand) added initially plus 1/2 bag; the tape measure came up to 65 ft. hole was apparently sloughing off. Hole was drilled over two days; Ist day cored 0-67; next morning hole had sloughed to 11 below the surface. T.D. = 85.1 ft.

WELL No. P-10 Boring No X-Ref. _ PIEZOMETER CONSTRUCTION SUMMARY Survey Coards E=2730184,580, N=272134,047 Elevation Ground Level (MSL) 841.83 Top of Casing 645.27 **Drilling Summary** Construction Time Log Total Depth (ft): 25.5 Finish Time Oate Time Task Date Borehole Diameter: 7.25" Casing Stickup Height: 3.44 ft. Drilling: 0 - 25.51645 10/26 1550 10/26 Oriller; A. W. Pool, Inc. Muskogee, Oklahoma Geophys.Logging: Andy Zavasky, Orilier Casing: C1. S1 10/26 1645 10/25 1650 Rig: Mobile Drill B-61 Bit (s): 3.25-inch ID x 7.25-inch OD Hollowstem Auger Filter Placement: 10/25 1650 10/26 1700 Bentonite Seal: 10/26 1700 10/26 1705 Orilling Fluid: None Development: Protective Casing: Anodized Aluminium Well Design & Specifications Basis: Geologic Log 🛛 Geophysical Log 🗍 Casing String (s): C = Casing S = Screen Well Development Depth (ft) String (s) Elevation (MSL) Well was installed dry and not developed due to slow formation permeability and recharge. C 1, 645.27 -619.08 +3.44 - 22.75 22.75 - 25.25 619.08 -616.58 St Stabilization Test Data Spec. Cond. Temp (C) рH Time Casing: C1 2" IO Sch. 40 PVC, Flush joint Casing: C2 20 Screen: St 2" IO Sch.40 PVC. 0.10" stats, flush joint **Recovery Data** CHECKED BY 6. Hassett Screen: S2 G = S. -Grout Seal: Econoplug Bentonite Grout 2 to 18.0 ft. 25 Bentonite Seal: Bentonite Pellets 18 to 21.5 ft. D. Smith Filter Pack: 20 - 40 Colorado Silica Sand 30 21.5 to 25.5 ft. Comments Drilling equipment was cleaned with hot water/high pressure washer prior to drilling. Zone A piezometer drilled on top of road, which was constructed with fill from 0-18.5 ft. only small portion of natural clay available to set screen. T.D. • 25.5 ft.

		;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;	DIEZOMETED CONST	Boring N		ef	P-11		
		•. •	PIEZOMETER CONST	Elevation Grou		l (MS	L}_020.9		
			Drilling Summery	Construction	on Time	Log			
			Total Depth (ft): 21.8	V 1-		Sta Date	ert Tiae	Fin Date	ish Time
			Borehole Diameter: 7.25" Casing Stickup Height: 2.58 ft. Driller: A. W. Pool, Inc. Andy Zavasky, Driller	0 - Geophys.Log	lling : - 21.8 1 Iging:	0/18	0,800	10/18	0835 0842 0841 0915
			Rig: Mobile Orill B-51 Bit (s): 3.25-inch ID x 7.25-inch OD Hollow Stem Auger		51 1	0/18	0941 0840	10/18	0842 0841
			Drilling Fluid: none Protective Casing: none	Filter Placem Bentonite S Developm	Seal: 1	0/18 0/19 1/02	0845 1205 1158	10/18 10/19 11/05	0915 1210 1325
			Well Design & Specifications Basis: Geologic Log ☑ Geophysical Log ☐ Casing String (s): C = Casing S = Screen Depth (ft) String (s) Elevation (MSL) +2.58 - 11.51 C1 629.57 - 615.48 11.53 - 21.53 S1 615.48 - 605.48 - -	Well Developed winitial wat well volume pump	rith Wate er level	l = 5	.44 ft.	p.	
5	1 1' 1		Casing: C1 2" ID Sch. 40 PVC, Flush joint	1100 B. 1125 7.		Data Spec. (292 283 297	0	Темр 15. 15. 16.	1 9
0		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Screen: SI 2" ID Sch.40 PVC, 0.10" slots, flush joint Screen: S2		.55 .10 Data	287 290	0	16. 15.	
		LIVE W	Grout Seal: Cement bentonite grout O to 5.0 ft. Bentonite Seal: Bentonite Pellets 5 to 9.0 ft.	G =			s _o =		
5			Filter Pack: 20 – 40 Colorado Silica Sand 9 to 21.6 ft.				· 1, .		!
) .	. = 21.6 f		Comments Drilling equipment was cleaned with hot water/high pres recovery data, see permeability data.	sure washer prid	or to drilli	ng. NC	OTE: For		

			DIEZONETED CONS	Boring No			,	
			PIEZOMETER CONS					
 	_	7.	Survey Coords <u>E=2730775.860, N=272907.0</u> 74		Level_(MS Casing _6		92	 -
4.				μ				
.	ŀ		Drilling Summary	Construction	lime Log			
			Total Depth (ft): 22.7			ert	_	ish
	\vdash		Borehole Diameter: 7.25"	Task	Date	Time	Date	Time
			Casing Stickup Height: 2.69 ft. Oriller: A. W. Pool, Inc.	Drilling 0 - 21.0		1050	10/17	1130
			Andy Zavasky, Driller	Geophys.Logging	:			
\mathcal{U}	\mathcal{M}			Casing				
1/2			Rig: Mobile Drill B-61	C	1. 1.	1132	10/17	1135
\mathcal{U}	\mathcal{A}		Bit.(s): 3.25-inch ID x 7.25-inch OD Hollow Stem Auger	l [.]	'		***	
	\mathcal{L}		Drilling Fluid: none	Filter Placement		1137	10/17	1210
K	\mathcal{L}			Bentonite Sea: Development	I	1230	10/17	1245 1721
\mathcal{A}			Protective Casing: none	Development.	.	1000	***	
	\mathcal{A}		Mali Davida G Canadida Mana					
			Well Design & Specifications			İ		
2		1	Basis: Geologic Log Geophysical Log	ļ	1	'	1 !	
			Casing String (s): C = Casing S = Screen	Well Developm	ent			
	3		Depth (ft) String (s) Elevation (MSL)	Daveloped with	Waterra h	and num	n.	
			+2.69 - 12.58 C ₁ 629.57 -615.34	Oevelaped with Initial water well volume = Valume pumped	level = 7 2.81 gallo	7.01 ft. Ins	-5.	
			12.58 - 22.58 S ₁ 615.34 -605.34	Valume pumped	= 17.4 gal	llans		
			- -	·				
			- -	Stabilization T	oot Data			
			- -	Stabilization	est pata			
	╛	F , 7		Time pH	Spec.	Cond.	Temp	(C)
			Casing: Ct 2" 10 Sch. 40 PVC, Flush joint	1440 6.54	>990		17.	
1				1458 6.73 1510 6.52	>990 >990		17. 17.	
			Casing: C2	1525 6.65	>990	100	16	7
1 3			Screen: 51 2" ID Sch.40 PVC,	. [
3			0.10" slots, flush joint					
		254	Screen: S2	Recovery Dat	3			
] =		2-3	· · · · · · · · · · · · · · · · · · ·	a -		s _o =		
		F 4	Grout Seal: Cement bentonite grout O to 6.5 ft.					
=		₹ 5						
_ [Bentonite Seal: Bentonite Pellets					
		F- 4	6.5 to 10.0 ft.	•				
]// Ξ		7.5						
]		4	Filter Spale 20 40 Calarada Silina Spad					
		54	Filter Pack: 20 - 40 Colorado Silica Sand 10 to 22.7 ft.					
		<u> </u>						
<u> </u>		2.2						
	٠.		Comments					

		WELL Boring No X	No. <u>P</u> -Ref	-13 P-13		
	PIEZOMETER CONS				·	
	Survey Coords _E=2730184.580, N=272134.047	•				
		Top of Ca			<u> </u>	
	Orilling Summery	Construction Tie	ne i oa			 ,
			_			
	Total Depth (ft): 19.3 Borehole Diameter: 7.25"	Task	Sta Date	Time	Fin Date	15N Time
7 70	Casing Stickup Height: 3.58 ft.	Orilling :]			
1 HH	Driller: A. W. Pool, Inc.	0 - 19.3	10/17	1500	10/17	1540
	Andy Zavasky, Driller	Geophys,Lagging:				
1	1	Casing: C ₁	10/17	1546	10/17	1548
1 K/K/	Rig: Mobile Orill 8-81	l si	10/17	1545	10/17	1546
7 HZ	Bit (9): 3.25-inch ID x 7.25-inch OD Hollow Stem Auger		i			
	Drilling Fluid: nane	Filter Placement:	10/17	1550 1635	10/17	1630 1640
		Bentonite Seal: Development:	11/02	1620	11/04	1708
	Protective Casing: none	2010,011	******			
	Well Design & Specifications					
					.	
	Basis: Geologic Log Geophysical Log Casing String (s): C = Casing S = Screen	-	• •			
	Lasing String (s): C = Casing S = Screen	Well Developmen	it			
	Depth (ft) String (s) Elevation (MSL)	Developed with W	áterra h	and bum	o .	
	+3.58 - 9.12 C ₁ 628.91 -616.21	Developed with W Initial water le well volume = 2. Volume pumped =	vel = 5 83 gallo	.30 ft. ns		
	9.12 - 19.12 S ₁ 616.21 -606.21	Yolume pumped =	43.9 gal	lons		
	_					
	_ . -				·-··-	
	· ·	Stabilization Te	st Data			
	1 1	Time pH	Spec. C	ond.	Temp	(C)
	Casing: C1 2" ID Sch. 40 PVC, Flush joint	7.41	2660	- 1	20.	8
		7.35	2500 2370	1	19. 18.	
	Casing: C2	7.34 7.32	2460		17.	
		1708 7.27	2500	•	16.	7
	Screen: Si 2" ID Sch.40 PVC. 0.10" slots, flush joint	<u> </u>		1		
	Screen; 52	Recovery Data				
				· _		
	Graut Seal: Cement bentonite grout	Q =		s _o -		
	0 to 3.0 ft.					
	Bentonite Seal: Bentonite Pellets			~		
	3 to 7.0 ft.					
						·
	Filter Pack: 20 - 40 Colorada Silica Sand					
	7 to 19.3 ft.					
	· ·					
	Commonte	,				
	Comments					
2세 크 12 개 (55 2)	 Drilling equipment was cleaned with hot water/high pres recovery data, see permeability data. 	sure washer prior to o	trilling. NO	TE: For		

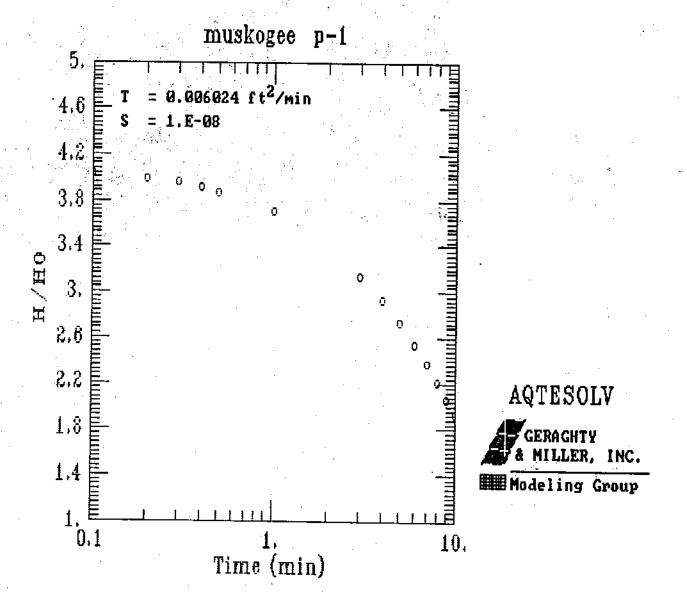
	PIEZOMETER CONS: Survey Coords <u>E=2730728.780, N=273795.8</u> 13		SUMN	IARY		
	Survey Coords	Top of C				
	Orilling Summary	Construction Ti	ne Log		-	
	Total Depth (ft): 24.7	ŀ	Sta	ert	Fin	1sh
4 - 50	Borehole Dlameter: 7.25"	Task	Date	Time	Date	Time
1 1/1 1/11	Casing Stickup Height: 3.05 ft.	Drilling : 0 - 24.7	10/19	1015	10/19	1110
	Driller: A. W. Pool, Inc. Andy Zavasky, Oriller	Geophys.Logging:	10, 13		10, 15	
1 / 1 1 1 1 1 1 1 1 1	Kilay 20 today, a ma	Casing:				
1 12 K/	Rig: Mobile Drill 8-51	C ₁	10/19	1112 :1111	10/19	1113
	Bit (s): 3.25-inch ID x 7.25-inch OO Hollow Stem Auger] J	10, 13	31111	10,13	1111
1 1/1//	Ballia Elvida anno	Filter Placement:	10/19	1115	10/19	1145
	Drilling Fluid: none	Bentonite Seal:	10/19	1145	10/19	1150
	Protective Casing none	Development:	11/04	1037	11/09	1239
	Well Design & Specifications					
1 121//	Basis: Geologic Log 🛛 Geophysical Log 🔲					I
	Casing String (s): C = Casing S = Screen	Well Developmen	nt .			
	Depth (ft) String (s) Elevation (MSL)			and num	ın	
	+3.05 - 14.65 C ₁ 632.77 -615.07	Developed with W Initial water le well volume = 2. Volume pumped =	vel = 11 97 gallo	.77 ft. ns	•	
	14.65 - 24.65 5, 615.07 -605.07	Volume gumped =	24.0 gal	lons		
	_ • • •					
	- 1	Clabilization To	-4 6544			
		Stabilization Te	at Data			
	'	Time pH	Spec. (Cond.	Тетр	(C)
	Casing: C1 2" ID Sch. 40 PVC, Flush joint	1154 7.08	268		15.	
		1209 7.27 1224 7.29	256 266		16. 16.	
	Easing: C2	1239 7.27	260		15.	
	Screen: St 2" ID Sch.40 PVC.]				
	0.10" slots, flush joint				;	
	Screen: S2	Recovery Data				
		a =		So =		
	Grout Seal: Cement bentonite grout O to 7.0 ft.					
			and Section 1	1 12		
	Bentonite Seal: Bentonite Pellets		***		• '	
= 5	7 to 10:0 ft.					
	Filter Pack: 20 - 40 Colorado Silica Sand					
	10 to 24.7 ft.					
	Comments	L				
네크 등에 투스될	• '	sure washer prior to o				

and the state of t 1996年1月1日 - 1996年 - 1997年 - 1997年 - 1997年 - 1997年 - 1997年 - 1997年 - 1997年 - 1997年 - 1997年 - 1997年 - 1997年 - 19 WELL No. P-15 100 Boring No X-Ref. P-15 PIEZOMETER CONSTRUCTION SUMMARY Survey Coords E=2731376.100, N=274174.971 Elevation Ground Level (MSL) 824.39 Top of Casing 827.28 Construction Time Log Drilling Summary Total Depth (ft): 27.2 Start Finish Date Task Date Tiae Time Borehole Diameter: 7.25 0 Drilling: Casing Stickup Height: 2.89 ft. 0 - 27.210/27 0915 10/27 1025 Driller: A. W. Pool Geophys.Logging: Andy, Zavasky, Driller Casing: C₁ 10/27 10/27 1028 1030 Rig: Mobile Drill 8-81 Muskogee Muskogee, S, 10/27 1027 10/27 1028 Bit (s): 3.25-inch ID x 7.25-inch OD Hollow Stem Auger 1045 Filter Placement: 10/27 1032 10/27 Orilling Fluid: none 10/27 10/27 1200 Bentonite Seal: 1100 SITE NAME LOCATION 11/03 1620 Development: 11/03 1500 Protective Casing: Anodized Aluminum Well Design & Specifications Basis: Geologic Log 🛛 Geoonysical Log 🗍 10 Casing String (s): C = Casing S = Screen Well Development String (s) Oeveloped with Waterra hand pump. Initial water level = 11.73 ft. well volume = 2.48 gallons Volume pumped = 30.0 gallons Elevation (MSL) Depth (ft) +2.89 - 17.11 C₁ 627.28 -607.28 607.28 -597.28 17.11 - 27.11 Stabilization Test Data эΗ Spec. Cond. Temp (C) Time Casing: Ct 2" ID Sch. 40 PVC, Flush joint 1537 7.30 4050 17.6 `. +> 4150 15.2 1552 7.19 1609 7:11 4150 15.1 Casing: C2 4210 18 2 20 1620 7.11 Screen: S1 2" ID Sch.40 PVC. 0.t0" slots, flush joint **Recovery Data** Screen: S2 0 = Grout Seal: Econoplug Bentonite grout 2 to 10.7 feet o. 25 The state of the s Б CHECKED Bentonite Seal: Bentonite Pellets 10.7 to 14.7 ft. 6. Hassett Filter Pack: 20 - 40 Colorado Silica Sand 30 14.7 to 27.2 ft. ₽ /93_ SUPERVISED B DATE 10/27/ Comments Orilling equipment was cleaned with hot water/high pressure washer prior to drilling. NOTE: For recovery data, see permeability data. T.D. = 27.2 ft.

APPENDIX G

RUSTENVIRONMENTA	& CALCULATION SHEET E	PAGE OF PROJECT NO	
PROJECT	SUBJECT	Prepared By Reviewed By Approved By	Date
P-1 Rising He	raci Tests ss, b= 27f2 x 12 m/f2 x 2	?54ml - 827	96 cm
Casing radius, N	z= lin	1340 July - 022	, 0 0 1
H: 3 see 6	aata sheek		
T= 12"/4	t= 4.7 min e 0	5 . A	
K= T/b = 0.023 K = 2.78;	im ² /sec x 1/822.96 cm		

 $\frac{\omega}{A_{7} e solve} \frac{f c n am}{f c n am}$ $\frac{\sigma}{\sigma} = 6.024 \times 10^{-3} \frac{f c^{2}}{min} \times (2)^{2} n^{2}/c \times (2.54)^{2} e m^{2}/c \times min / (2.52)$ $\frac{\sigma}{\sigma} = \frac{3.3 \times 10^{-2} c m^{2}/c c}{c m^{2}/c c} \times \frac{(2.54)^{2} e m^{2}/c c}{c} \times \frac{(2.54)^{2} e m^{2}/c c}{c} \times \frac{(2.54)^{$



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	<u> </u>															
							Pi Risir	ommunity (andiit		-					
				-												
40344	M(t).N	hit	Ho.ft	H(t) NHo-h		Empsed	R(t),lt	NA .	Ho,R	H(ŋ-le/Ho-h		ne,min	H(t),R	h.lt	Ho.ft	M(1)-14740-14
Time,min						Time min							49.789			4
0.0033	12.471			0.996857		0.3033 0.3066	13.878 13.894	62.58 62.58		0.968548		9,2 9.4	37.602 37.934	62.58 62.58	12.313	0.496907 0.490302
0.0068	12 487	62.58	12.313	0.997155		0.31	13.91	62.58		5.96823		9.6 9.8	38.282 38.614	62.58 62.58	12.313	0.483379 0.476774
0.0133 0.0166	12.503 12.519	62.58 62.58	12.313	0.995902	ı	0.3166	13,942	62.58	-12,313	0.967593		10	58.931 41.921	62.58 62.58	12,313	0.410985
0.02		62.58 62.58	12 313	0.995902	· · · ·	0.3233 0.3268	13.975	62,59 62,59	12.313	0.966976 0.966658		16	44,406	62.58 62.58	12,313 12,313	0.381349
0.0266	1255	62.58	12.313	0.995285 -0.994649		0.33	13,989	62.58	12,313	0.96658 0.96634		18	48.267	62.58	12313	0.284739
0.0333	12.598	62.58 62.58	12313	0.99433		0.35 0.3666	14.1	62.58 62.58	12.313	0.96445		20 22 24	51,163 52,302	62.58 62.58	12.313	0.227127
0.04	12,629	62.58	12313	0.993714		0.3833	14.258	62.58	12313	0.961307		26	53.3 54.154	62.58 62.58	12 313	0.184614
0.0433 0.0466	12.629	62.56	12.313	0.993077		0.4166	14 432	62.58	12.313	0.959735 0.957845		28 30	54.698	62.58	12.313	0.167625 0.152824
0.05 0.0633	12,645	62.58	12,313	0.993714 0.992759 0.993395		0.4333 0.45	14.511 14.574	62.58 62.58	12.313	0.956273 0.95502		32	55,563 56,133	62.58 62.58	12.313	0.139595 0.128255 0.118189
0.0566	12.724	62.58 62.58	12.313	0.992142		0.4666 0.4833	14,732	62.58 62.53	12,313	0.95502 0.953449 0.951877		36 38	56.639 57.098	62.58 62.58	12.313	0.109058
0.0633	12.74	62.58 62.58	12.313	0.991505		0.5 0.5166	14.811	62.58 62.58	12.313	0.950305 0.948734	-	40 42	57.494 57.858	62.58 62.58	12.313	0.093938
0.07	12,772	62.58 62.58	:12.313	0.990869		0.5333		62.58 62.58	12.313	0.947461 0.945889		45	\$8.175 \$8.46		12.313	0.087632
0.0766	12.788	62.58 62.58	12.313	0.9905S 0.989615		0 5666 0 5833	15.112	62.58 62.58	12.313	0.944317		48 50	58.713 58.935	62 58 62 58	12313	0.076929
0.0833 0.0866	12.835	62.58	12.313	0.989615		0.6	15.254	62.58 62.58	12 313	0.941492		- <u>52</u>	59.14 59.33	62 58 62 58	12,313	0.068435
0.09	12.882	62.58	12,313	0.98868		0.6166	15.412	62.58	12.313	0.938349		56	59,489	62.58	12.313	0.061492
0.0933 0.0966	12,914		-12.313	0.98868 0.988044		0.65 0.6666	15 554	62.58 62.58	12,313	0.936778		58 60	39.79	62.58 62.58	12,313	0.058348 0.055504
0.1033	12.946	62.58	12.313	0.986044		0.6833		62.58 82.58	12.313	0.933953		62 64	59.916 60.027	62.58 62.58,	12313	0.052997 0.050789
0.1066 0.11		62.58 62.58		0.987407		0.7156 0.7333	15,776 15,839	62.58 62.58	12 313 12 313	0.929855		66 68	60.138 60.248	62.58 62.58		0.046581
0.1133	12.993 13.009	62,58 62,58	12.313	0.986472 0.986154	· -	0.75 0.7666	15,910 15,981	62.58 62.58	12,313	0.928283		70	60.328 60.423	62.58 62.58		0.044801
0.12 0.1233	13,009	62.58 62.58	12.313	0.986154 0.985836		0.7833	18.045 16.124	62.58	12.313	0.925756		74	60.486 60.581	62.58 62.58	12.313	0.041658
0.1266 0.13	13.056		12.313	0.985219		0.8166	16.187	62.58 62.58	12,313	0.922932 0.921678		781	60.644 60.708	62.58 62.58	12.313	0.038514
0.1333	13.072	62.58	12.313	0.984901 0.984901		0.85	16,313	62.58	12.313	0.920425		82	60.771	62.58	12,313	0.035988
0.1366 0.14	13.104	62.58 62.58	12,313	0.984582 0.984264	· · ·	0.8666 0.8833	16,392 16,456	62.58	12 313	0.918853 0.91758		84 E	60.818 60.882	62.58 62.58	12.313	0.035053
0.1433 0.1468		62.58 62.58	12.313	0.983647		0.9166	16.582	62.58 62.58	12.313	0.916327 0.915074		88 90	60.929 60.977	62.58 62.58	12.313	0.032845
0.1533		62.58 62.58	12.313	0.983647		0.9333 0.95	16.709	62.58 62.58		0.91382		92 94 96	61.04 61.088	62.58 62.58	12,313	0.030636
0.1566 0.16	13,199	62.58 62.58	12,313	0.982374		0.9666	16,772	62.58	12,313	0.911294		96 98	61.119 61.167	62.58 62.58	12313	0.029065
0.1633 0.1666	13.23		12.313	0.982076 0.981757 0.981439		1.2	16.883	52.58	12.313	0.8908431		100	61.214	62.58 67.58	12.313	0.027175
6.17	13.246	62.58	12.313	0.981439		1.4	18.5111	62.58	12.313	0.8766981		140	61.674	62.58 62.58	12,313	0.018074
0.1733 0.1766	13.293	62.581	12.313	0.9805041		1.81	19.903	62.581	12.3131	0.8490061		180	61 895	62.58	12.313	0.013627
0.18 0.1833	13.3091	62.58	12.313	0.980504 i 0.980186 l		2.2	21.2151	62.58	12.313	0.835797		200 220	61.974 62.038	62.58 62.58	12.313	0.012056 0.010782
0.1866 0.19	13.341	62.58	12,313	0.979868		2.4	22.465	62.58	12 3 ! 3	0.8103131		240 T	62.101 62.148	62.58 62.58	12.313	0.008594
0.1966	13.357		12.313	0.979231		2.8	23,866	62.58 62.58	12,313	0.774146		260 300		62.58 62.58		0.007958
0.2033		62.58 62.58		0.978614		3.2 3.4		. 62.58 82.58		0.7625081		320 i	62.243 62.275	62.58 i		0.006704
0.2066	(3.42)	62,58	12.313	0.977978		3.8	25.39	62.58	12.313	0.7398491		360	62 307 62 323	62.58 62.58	12.313	0.005431
0.2133 0.2166	13 452	62.58	12.313	0.977341 0.977043		4.2	28.466	62.58	12.313	0.7184441		400	62.354 62.37	82.58 62.58	12.313	0.004496
0.2233	1 13.483	62.58 T	12,313	0.976724		4.4		62.53	12.313	0.6976941	- :-	440	62.388 62.402	62.58 62.58	12,313	0.003859
0.2266	13.545	62,58	12.313	0.976088		4.8	28.506	62.58	12.313	0.66766		480	62.417 62.433	52.58 62.58	12.3131	0.003243
0.23	13 546	62,58	12.313	0.975471		5,2	29.487	62.58	12.313	0.658344		500] 520]	62.449	62.58	12,313	0.002606
0.2356 0.24	13.578	62.58	12,313	0.975153 0.974834		5.4 5.6	30 42	62.58	12.313; 12.313	0.639784 0.639784		540 560	62.465 62.491	62.58	12,313	0.002268
0.2433 0.2466	13.61	52.58	12.313	0.974516		5.8	31.322	62.58	12.3131	0.0210331	-	580 600	62.497 62.512	62.58	12.313 12.313	0.001651
0.25	13.6251	62.58	12.313	0.973899		6.4			12.313	0.613046	I I	620 640	62.528 62.528	62.58 62.58	12,313)	0.001034
0.2566	13.657 i	62.59	12.313	0.973263		6.û	32.619		12.313	0.5960371		660			12,313	0.001034 0.000716 0.000716
0.2633 0.2666	13,8891	62.58	· 12.313	0.972626		7.2		82.58 62.58	123131	0.579684		700 i	62.544	62.58 62.58	12.313	0.000716
0 27	13 72	62.58	12,313	0 972009		7.4	34 248 •	62.5a	12.313	0.56363 :		740 i	62.56	62.58	12.313	0.000358
0.2733	13.752		12.313	0.971691		7 6 1 7.8	35.039		12.313	0.555752	:	760 : 780 :	62.56	52.58	12 313 (0.000358
0.28 0.2833	13,784	62.58	12.313	0.971053		8 2 8 2	35 798	62 58	12313	0.540335		800 820	62.561 62.561	62 58	12.313	0.000398 0.000398
0.28 66 3.29	13.815	62.58	12.313	0.970438		8.4 6 ô	36 162 36 5-12	62 58 62 59	12.313	0.517994		840 860	62.544 62.544	62.58 62.58	12 313	0 000716
0.2933 3.7988	13.831	52.58	12.313	0 97012 0 969801 0 969483		Š Š	36 542 26 906 37 254	62.58 62.58	12.313	0.510753 · 0.50383		680 900	62.544 62.528	62.58 62.58	12 313	0 000715
0.3	13.863	62.58	12.313	0.969165					2.4			920 - 940 -	62.544 62.56	8 2.58 -	(2 313)	0.000716
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	. !			!						•						

6210

S CYCLES 3

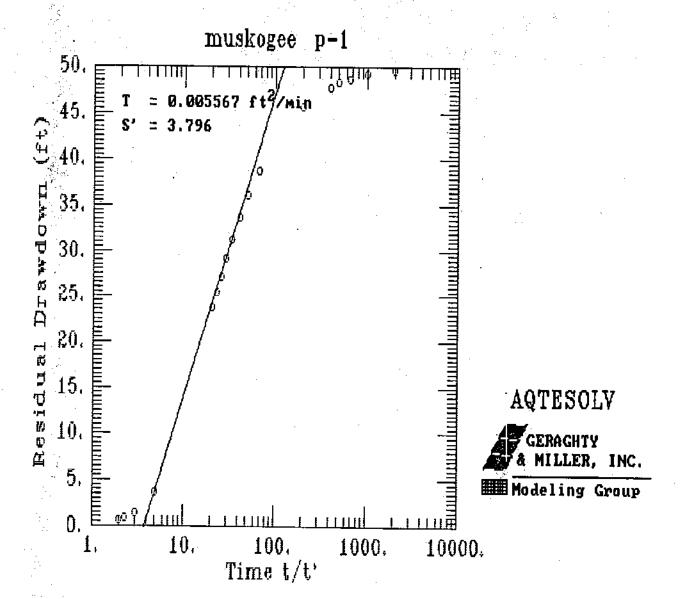
SEMI-LOGARITHMIC KEUFFEL & ESSER CO.

Ϋ́

SIRRINE FRONMENTAL CONSULTANTS

CALCULATION SHEET

CLIENT		LOCATIO	ON		JOB NO.	
SUBJECT	DATE		CHECKED BY		DATE	
H ₀ =	12.313	h = 62	58	5=	50.27	t=o
H ₄ =	12.914	. ••			49.67	t=.1
	13.38				49.20	- 2
- (4) (4) (1) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4	13.863	•			48.72	. 3
	14.337	e e e e e e e e e e e e e e e e e e e			48.24	4
	14.881				47.70	٠ ٤
	16.883				45.70	
	23.666				38.91	3.6
e e e e e e e e e e e e e e e e e e e	26.466				36.11	4.
	28.996				33.58	5
•	31.322				31.258	ب (
en en en en en en en en en en en en en e	33. 441			·	29,14	7
	35. 419			.**.	27.16	8
• • • •	37.254				25.33	9
	38,931		·		23.65	16
		·			3.64 1.37 0.78	50 100 160
				•	0.61	200



CLIENT WAG

Prepared By GH Date 12/10

PROJECT MUSKOGER

Reviewed By ____

of Agtesolve Program (Theiss Recorn) T= 5.59×10-3 122/min x (12) 3/4 x (2.54) 2 x min/wosec K=T/b = 8.66×10-2 cm2/sec x /365.76 cm K = 237×10-4 CA/SEC

Aquite Thickness, b = 12ft (filter pack) x 12m/g x 2.54cm/m Note How level elev. = 612.15 Top of shale elev. 597.71

Casing radius, ie = lin , Initial How Level = 21.23, from TOC

H = as noted in field notes

H/H0 = H-h/H0-h

Time H, from Toc Time H 3.5 55.98 1.0 65.64 60.74 CA. 84 1.5 4.0 59.68 20 64.04 4.5 2.5 63.0 5.0 62 80 8.0

15.0

43.5%

 CLIENT ________ SUBJECT _______ Prepared By ______ Date ____

 PROJECT _______ Reviewed By ______ Date _____

 Approved By ______ Date _____

Time H' Time H'

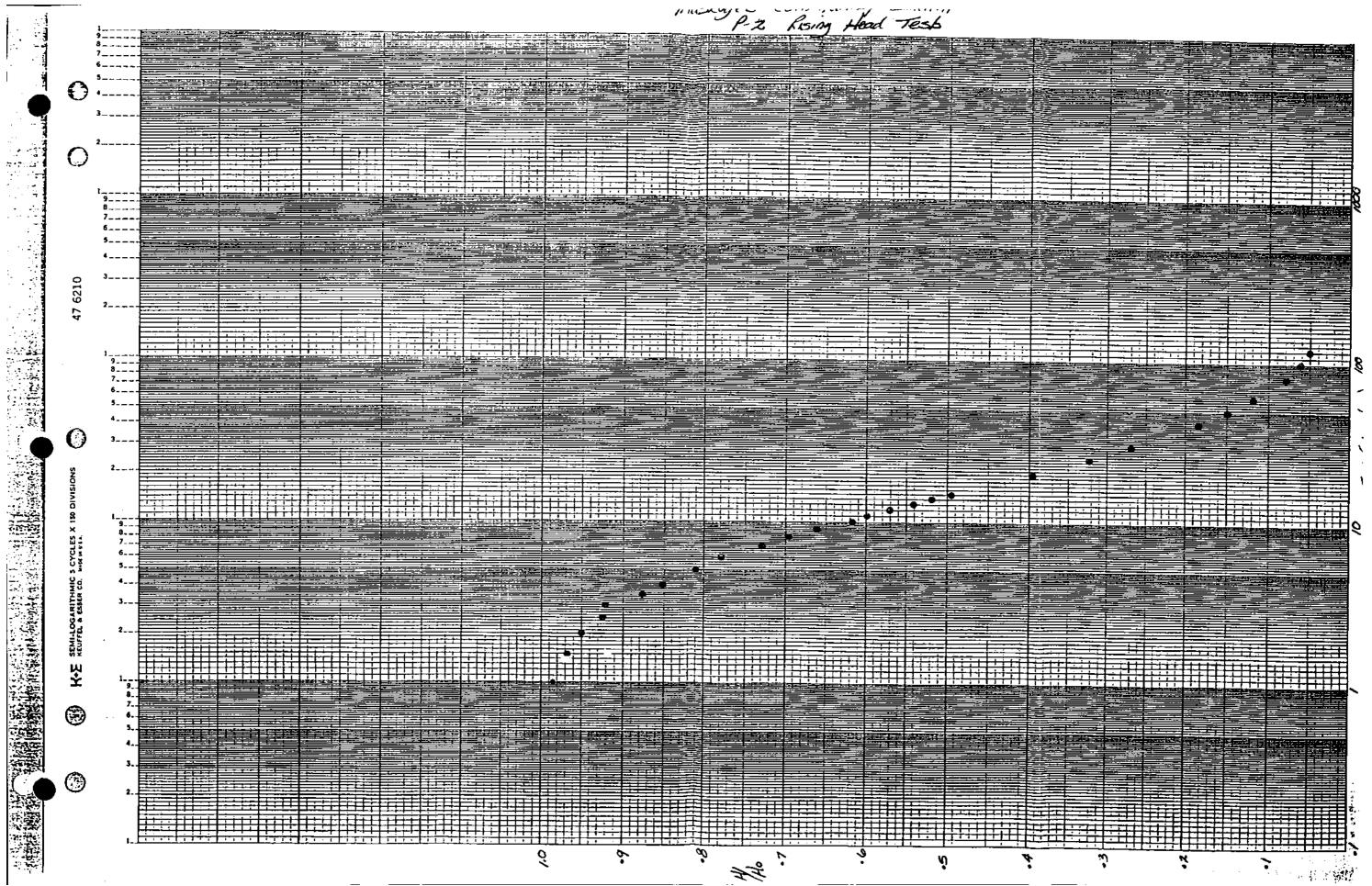
20.0 39.06 25.0 35.84 90 51.01 30.0 33.35 420 29.54 49.06 10.0 50.0 27.96 48.22 11:0 60.0 26.59 12.0 46.92 81.0 24.92 13.0 45.10 100.0 24.06 44.58 14.0 23.50 120.0

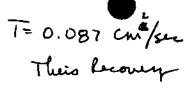
977. D

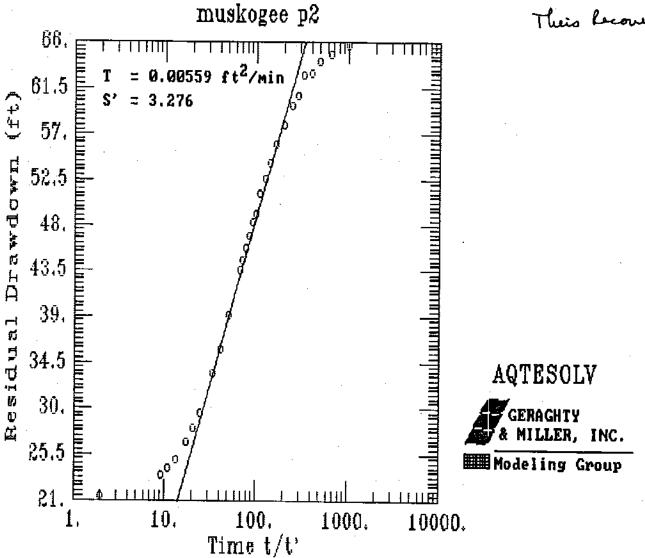
Time H/Hb Time HHO Time. Tirel 17.1 1.0 98.5 60 51.8 14.0 100 1.5 96.8 Z3.2° 7.0 15.0 49.5 120 5.00 2.0 39.6 95.0 8.0 69.6 20.0 977 0.5 25 92.7 9.0 66.2 250 32.4 30 92.2 30.0 26.9 10.0 61.7 3.5 87.7 11.0 18.4 59.9 42.0 4.0 *85.*3 12.0 510 50.0 14.9 4.5 13.0 543 60.0 11.9 81.1 5.0 8100 8.2

21.46

 $T \pm / I_c^2 = /$, $Q = 10^{-7}$ Q $\pm = 6$ roundles $T = I_c^2 / \pm$ $= (I_m)^2 / 6 m_m$ $= 0.167 \text{ in}^2 / \text{min} \times (2.54 \text{ cm}/\text{in})^2 \times \text{min} / \text{cosec}$ $T = 0.018 \text{ cm}^2 / \text{sec}$ $K = T/b = 0.018 \text{ cm}^2 / \text{sec}$ $K = 4.90 \times 10^{-5} \text{ cm/sec}$







INFRACTRUCTURE	CALCULATION SHEET SUBJECT <u>Perm Tesks</u>	PAGE OF PROJECT NO Prepared By GH Date 12/15/93 Reviewed By Date
	d Tests - Bave	_ Approved By Date
$K = r_c^{\prime 2} \ln \frac{ Re _{rec}}{2 Le}$	2) 1 ln /0/4	
r'c = [(1-n)/	2+ n/w2]/2	·· .
re = radrus rw = radrus = .30 + le = lenyth	of screened section of	to aquiter= 3.625 n y fly 12 in well = 10.0 fl
Re = effects Yo = water Yt = water	ive radial distance we be here at time, to be here at time to conce test began	- which fis dissipulad
Ho = 15.53 ft H = as per field notes n = 11.16 fb	H-h/Ho-h= 2	1/40
$\frac{\ln k_e}{\hbar \omega} = \int \frac{1.1}{2\pi \ell}$	(Lw/rw) + A+Bln E(H-	(w)/w]]-1
= [1 / la (1 2.55 + 0.40 (5.35/0.3)	<u>2n [(21.85-5.35)/0.3]</u> 53.33
In <u>Ke</u> = 1.9.	23	
ubt	r level for coloridation of Links level and bottom of sever water level and bottom 12/22/92 = 11.20', Toc	and Hod Frence
	E-8-191	* **

ENVIRONMENT & INFRASTRUCTURE	SUBJECT	PROJECT NO Dat
PROJECT		Reviewed By Dat Dat
P-3 Kising Head :		
rc = [(1-n)/c [(1-0.3)/c rc = 0.17	2 - nrw 27/2 (0.08) + c.3(0.3) 27	/z
K= 1'c 2 2n [Re/ru Z Le	o) 1 ln/0//2,	10=. 81 1/2 = .74 @ t = 500
= (0.17) ² (1.98) Z(10)	1 la (. 81/ 500	
K= 5.17 × 10-7	12/min x 12/1/2 x 2:	54cm/ x min/
K = 2.63 x10-7	Carlos	1/11 100302

w/ Aglesolve Program K= 1.461 × 10-6 f2/min × 12 in/2 × min/wsez × 2.54 cm/in K = 7. 42 ×10-1 24/322

. 508 cm/sec

CALCULATION SHEET

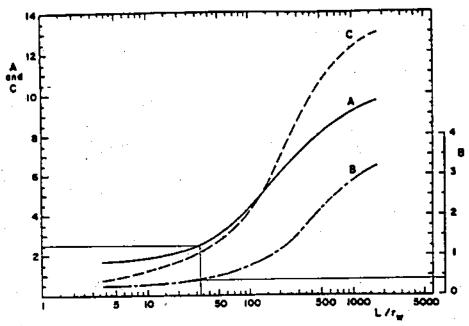
PAGE ____ OF _ PROJECT NO. __

SUBJECT_ Prepared By _____ Date _ Reviewed By Date __ 'ROJECT_

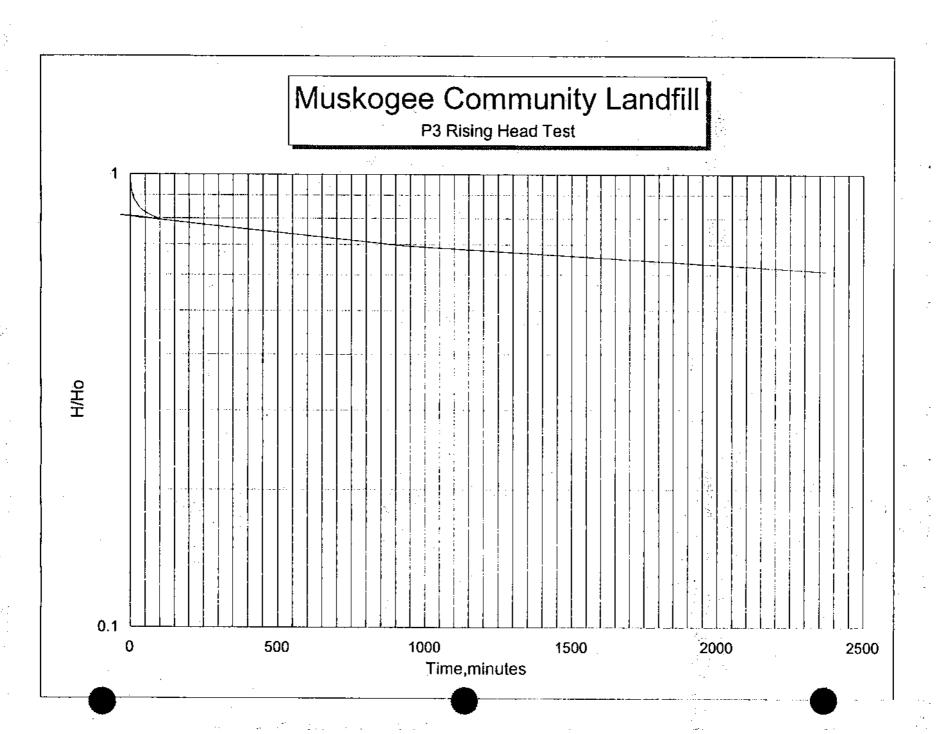
		Approved By	_ Date <u>-</u>
P-3 Rising Head Tosk			·
Time H. Lt	Time H. A.		
05 1541	11.0 15.04		
1.0 15.33	10 15.02		
1.5 15.30	130 15:01		
2.0 15.21	14.0 15.00	•	
25 .15.25	15.0 14.98		
30 15.26	20 14.94		
3.5 5.RZ	25.0 14.89		
4-0 15 A	30.0 14.65		
4.5 15.17	35.0 11.82		
5.0 15.15	90.0 14-80		
60 15.13	50.0 14.76		•
70 15.12	60.0 14.73		
8.0 15.10	700 14.70	< 80.00 14	.68
9.0 15.08	NO.6 14.63		
10.0 1506	936.0 14.20 2313.0 13.83		
Time H/Ho			1/1/
Time H/Ho	Time H/Ho	TIME	74/410
05 .973	10.0 .892	80.0	.005
1.0 .954	140 .888	100.0	,794
1.5 .947	120 . 563	236.0	1696
2.0 ,941	13.0 .881	238.0	.611
2.5 .936	40 .879		
3.0 .938	15.0 . 874		
3.5 .929	20.0 .865		
4.0 9.22	25.0 .854	•	
4.5 .918	<i>3</i> 00 . 844		
5.0 .913	35.0 , 838		
6.0 ,908	460 .833		
7.0 .906	50 150 · 624		
8.0 ,902	60.0 . 8/7		•
9.0 .897	10.0 -810		

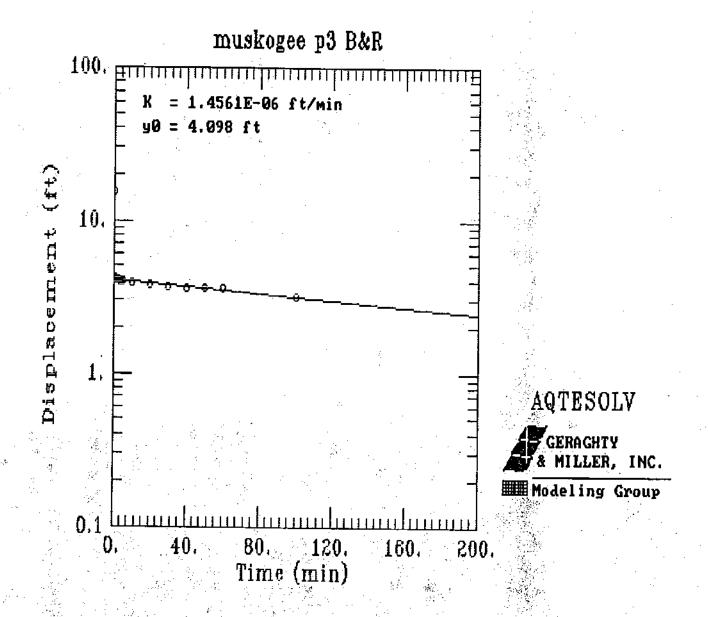
	esti. Maria de 1918			1 2 5 18 M	
				.	
		Muskogee 0	Community L	andfill	
			Head Test	·	
•	-				
			·		
,	Elapsed	H(t),ft	h,ft	Ho,ft	H(t)-h/Ho-h
	Time,min				
	0.5	15.41	11.16	15.53	0.97254
	1	15.33	11.16	15.53	0.954233
\$ 1	1.5	15.3	11.16	15.53	0.947368
	2	15.27	11.16	15.53	0.940503
	2.5	15.25	11.16	15.53	0.935927
	3	15.26	11.16	15.53	0.938215
	3.5	. 15.22	11.16	15.53	0.929062
	4	15.19	11.16	15.53	0.922197
	4.5	15.17	11.16	15,53	0.91762
	5	15.15	11.16	15.53	0.913043
_	6	15.13	11.16	15.53	0.908467
	7	15.12	11.16	15.53	0.906178
	8	15.1	11.16	15.53	0.901602
	9	15.08	11.16	15.53	0.897025
	10	15.06	11.16	15.53	0.892449
	11	15.04	11.16	15.53	0.887872
	12	15.02		15.53	0.883295
	13	15.01	11.16	15.53	0.881007
	14	15	11.16	15.53	0.878719
	15	14.98	11.16	15.53	0.874142
	20	14.94	11.16	15,53	0.864989
	25	14.89	11.16	15.53	
	30	14.85	11.16	15.53	0.844394
	35	14.82	11.16	15.53	0.837529
$\mathcal{G}_{\mathcal{A}}$	40	14.8	11.16	15.53	0.832952
	50	14.76	11.16	15.53	
	60	14.73	11.16	15.53	
	70	14.7	11.16	15.53	0.810069
	80	14.68	11.16	15.53	
	100	<u>'-</u>	11.16	15.53	
	936	14.2	11.16	15.53	
	2373	13.83	11.16	15.53	0.610984

P.3 Rising Head Test



Curves relating coefficients A, B, and C to L/r...





ENVIRONMENT & INFRASTRUCTUR		PAGE OF PROJECT NO	-
PROJECT	SUBJECT	Prepared By Reviewed By Approved By	Date .
P-4 Rising He	•		
Aquito Thickness	b = 120 - 109 = 11 ft b = 335.28 cm	* Duffe + 2.5	tem/in
Cosing Radius, le=	lin		
Ho = h = 12.58 ft H = as noted in	l, TOC Liebt notes Characture	volues)	
	1 0= 10-6 CL=		
T= 12	2/4		
ナ =	lin) 10 min 1 in 2/min x (2.54 cm/in) 011 cm2/see	1 /bosec	
$K = \frac{1}{\sqrt{2}}$	011 cm²/sec x 1/335 3-21 x 10-5 cm/sec	28 cm	
	3. 28		· ·

March Marc	<u> </u>						F						<u> </u>	— —	ļ			
### ### ### ### ### ### ### ### ### ##								Name of the Contract of the Co	annerity (-			-					
								P4 Rosen	Head Test					- -	-		 	
	-	HOS	'h,e	Но	H(D-WHo-h	-	- Elignad	H-G.R	n.t	Ho	HCD-IV-Ho-II		Elephon	HQ.R	h,A	Но	His ()-Partition	
Color Trip					-													
Control Cont	9				1.													
Section Column					1 0000													
150 150	0.01	0.78	70.88	0.774	0.999772		0.3133	1.485	70.88	0.774	0.969655	- "	9.0	19.126	70.66	0.774	0.738122	
Section Color Co															70.80			ļ <u> </u>
Color Table Tabl	0.02	0.421	70.88	0.774	0.999329		0.3233	1.501	70.86	9.774	0.009627		14	24.530	70.66	0.774	0.560959	
Total 1.5 1.																		_
ADM COL T. S. T. ADM COL T	0.03	0.837	79.66	- 0.774	0.009101		0.3333	1.517	70.84	0.774	0.080300		20	31,179	70.66	0.774	0.566176	
0.586 0.586 0.587 0.5864 0.582 0.5		0.653	70.86 70.88															
1,000 1,00	9.04	0.860	70,64	0,774	0.996645		0.3833	1.643	70.68				. 28	36,746	70.00	9.774	0.488718	
OSB OSB OSB CFT OSB																		
1566	0.05	0.885	70.88	0.774	0 998416		0.4333	1,77		0.774	Q.985789				70.66	0.774	0.419228	
0.000 0.00	0.0566	0.9	70.80	0,774	0.998202		0.4508	1.833	70.66	0.774	0.98489		36	44.215	70.56	0.774	0.360176	
\$1,000 \$	0.04	0.9	70.88	0.774	0.998202		0.4833	1,88	70.80	0.774								
Control Cont	0.0000	0.932	70,86	0.774	0.997748		0.5158	1.950	70.86	0.774	6.983092		- 42	47.808	70.66	0.774	0.32691	
10 10 10 10 10 10 10 10			70.88						70.88	0.774								
1932 1984 75 44 0774 08779 93 120 75 46 0774 08779 08789 088 084 084 08774 08779 08770 08787 0878	0.0766	0.948	70.86	0.774	0.997517		0 5868	2.07	70.86	0,774	0.981508		48	50.894	70.66	9.774	0.784879	
1000 1001 1004 1071 100729 1140 2141 74 27 27 100727 54 53 27 1008 177 1077 1008 177 1077 1009 177 1077 1009 177 1077 1009 177 1077 1009 177 1077 1009 177 1077 1009 177 1077 1009 177 1077 1009 177 1009 177 1009 177 1009 177 1009 177 1009 177 1009 177 1009 177 1009 1009 177 1009 177 1009 177 1009 177 1009 177 1009 1009 177 1009 177 1009 177 1009 177 1009 177 1009 1009 177 1009 10										0.774	0.980381		52	32.698		0.774	0 250139	
0.033	0.0866	0.964	70.86	0.774	0 997289		0.6166	2.181	70.88	0.774	0.979975		34	\$3.537	70.86	0.774	0.247188	
\$6000 \$7600 \$7700 \$7700 \$7700 \$60000 \$77	0.0933	0.979	70.84	0.774	0.997075		0.83	2.20	70.88	0.774	0.976707		54	55.072	70.66	0.774	0.225264	
1.103 1.61 1.52 1.07 1.08 0.774 0.98410 0.774 0.77725 0.64 0.77725 0.64 0.7774 0.97725 0.64 0.774 0.97725 0.64 0.774 0.9742 0.9742	0.0968	0.995	70.86	6.774	0.996647	•	0.6666	2.201										
\$1130 1.707 70.06 0.774 0.00057 0.7330 7.440 7.66 0.774 0.97481 48 55.707 70.017181 1130 1.707 70.007181 1130 1.70	0.1033	1.011	70.86	0.774	0.998618		0.7	2,37	70.88	0.774	0.977228		64	57,114	70.66	0.774	0.19813	
### 1756 7086 2774 050000 2785 2.481 7.685 0774 07740 1774 050000 0.774 0.10000 0.10000 0.10000 0.174 0.10000 0.10000 0.10000 0.10000 0.10000 0.10000 0.10000 0.174 0.100000 0.100000 0.10000 0.1000000 0.100000 0.1000000 0.100000 0.1000000 0.1000000												. ".						
0.12	0.1133	1.027	70.88	0.774	0.99630		0.75	2.481		0 774	0.975644		70	58.64	70.00	0.774	0.171504	
9.1286 1.095 70.98 0.774 0.985277 9.3533 0.774 0.97399 76 0.07633 77.99 0.774 0.154351 0.174 0.1543				0,774	0.996187	,												
913 1074 70 88 0.774 0.28972 0.8433 2.071 70.88 0.774 0.28972 0.85 2.718 70.88 0.774 0.27973] 89 9.214 70.88 0.774 0.28972 0.85 2.718 70.88 0.774 0.27973	0.1233	1.050	70.86	6,774	0.995948			2.807		0.774	0.973848		76	85.344	70.86	0.774	0.150044	
0.1535 1074 70.68 0774 076577 0.45 0.774 0.65049 0.774 0.65049 0.774 0.65049 0.774 0.65049 0.65049 0.774 0.65049 0.65049 0.65049 0.774 0.65049 0																		
0.114 1.994 70.68 0.774 0.960293 0.0 2.267 70.88 0.774 0.9711 0.1940 0.1941 0.1940 0.1941 0.1940 0.1941 0.1940 0.	0.1333	1.074	70.66	0.774	0.99572		0.85	2.718	70.88	0.774	0.072263		Q	81.628	70.68	0.774	0.131752	
6 1.155 1.066 70.86 0.774 0.995/33 0.9 2.297 70.81 0.774 0.910171 0.0 0.397 70.80 0.774 0.11142																		
0.1531 1.006 70.88 0.774 0.98533 0.9533 2.908 79.88 0.774 0.98652 42 33.383 70.86 0.774 0.08603 0.15301 1.172 70.08 0.774 0.986421 0.98642 2.971 70.88 0.774 0.98643 0.15301 1.172 70.08 0.774 0.986421 0.98642 2.971 70.88 0.774 0.98643 0.15301 1.172 70.08 0.774 0.986421 0.98642 2.971 70.88 0.774 0.98643 0.15301 1.172 70.08 0.774 0.986461 0.98642 2.971 70.88 0.774 0.98643 0.15301 1.172 70.08 0.774 0.986461 0.974 0.97452 0.974 0.98643 0.15301 1.172 70.08 0.774 0.986461 0.974 0.97452 0.974 0.98645 0.15301 1.172 70.08 0.774 0.986461 0.974 0.974 0.974 0.974 0.15301 1.172 70.08 0.774 0.98649 0.774 0.974 0.974 0.974 0.15301 1.172 70.08 0.774 0.98459 0.774 0.98459 0.774 0.98459 0.774 0.98459 0.15301 1.172 70.08 0.774 0.98459 0.774 0	0.1433	1,108	70.68	0.774	0.995263		0.9	2.829	70 88	0.774	0.970879		64	62.734	70.56	0.774	0.115943	
0.1530 1.127 70.68 0.774 0.986035 0.85 2.978 76.68 0.774 0.986127 0.																0,774	0.108683	
0.18 1.177 70.88 0.774 0.004421 0.04331 3.014 72.08 0.774 0.007526 100 54.577 70.08 0.774 0.000468 0.000668 0.000	0.1533	1.122																
1.53	0.16	1,137	70.88	0.774	0.994821			J,018	70.86	0.774	0.987982		14	84,238	70.86	0.774	0.094484	
0.171 1.180 70.88 0.774 0.994587 1.4 0.01 70.88 0.774 0.843771 140 17.785 79.95 0.774 0.944875 0.1753 1.180 70.88 0.774 0.994384 1.8 4.990 70.88 0.774 0.994384 1.8 4.990 70.88 0.774 0.994384 1.8 4.990 70.88 0.774 0.994384 1.8 4.990 70.88 0.774 0.99487 1.8																		
0.1744 1169 70 68 0.774 0.994384 1.8 4.990 70 881 0.774 0.994134 2.3 3.242 70.881 0.774 0.994271 200 69.495 70.881 0.774 0.994271 0.18531 1.185 70.881 0.774 0.994381 2.2 5.798 70.881 0.774 0.994271 220 89.495 70.881 0.774 0.994371 0.18531 1.185 70.881 0.774 0.994391 2.2 5.798 70.881 0.774 0.99271 2.20 89.495 70.981 0.774 0.993971 0.18531 1.185 70.881 70.781 0.195891 70.881 70.781 7	0.17	1.153	70.68	0.774	0.994592		1.4	4,014	70 88	0.774	0.953771		140	87.785	70.68	0.774	0.043675	
0.143 1.155 70.88 0.774 0.994138 2 3.342 70.88 0.774 0.94623 200 69.495 70.88 0.774 0.019478 0.1633 1.165 70.88 0.774 0.994307 2.4 6.211 70.88 0.774 0.92224 2.0 69.907 70.88 0.774 0.019568 0.1636 1.201 70.58 0.774 0.993007 2.4 6.211 70.68 0.774 0.92224 2.0 69.907 70.68 0.774 0.019115 0.193 1.201 70.58 0.774 0.993007 2.6 6.633 70.68 0.774 0.91311 0.193 1.218 70.88 0.774 0.993007 2.6 6.633 70.68 0.774 0.91311 0.193 1.218 70.88 0.774 0.993007 2.6 6.633 70.68 0.774 0.91311 0.193 1.218 70.88 0.774 0.993007 2.6 6.633 70.68 0.774 0.91311 0.193 1.218 70.88 0.774 0.993007 0.21 1.218 70.88 0.774 0.993007 0.22 1.222 70.68 0.774 0.993007 0.23 1.222 70.68 0.774 0.993007 0.24 1.222 70.68 0.774 0.993007 0.25 0.704 0.993007 0.25 0.704 0.993007 0.25 0.704 0.993007 0.26 0.774 0.993007 0.26 0.774 0.993007 0.27 0.774 0.993007 0.28 0.774 0.993007 0.29 0.774 0.993007 0.20 0.7	0.1733	1.169							70.88	0.774		-						
0.1965 1.701 70.96 0.774 0.993907 2.44 6.211 70.96 0.774 0.92342 240 49,329 70.96 0.774 0.013141	0.14	1.185	70.88	0.774	0.664136		21			0.774	0 934623						0.019476	
0.1933 1.218 70.88 0.774 0.993851 7.81 70.85 70.91 774 0.91375 300 70.71 70.98 0.774 0.009476 0.12 1.218 70.88 0.774 0.993485 3.21 7.887 70.89 0.774 0.09485 0.22 1.222 70.88 0.774 0.993485 3.22 7.887 70.89 0.774 0.09486 0.203 1.224 70.88 0.774 0.993485 3.22 7.887 70.89 0.774 0.09486 0.203 1.224 70.88 0.774 0.993487 3.81 70.89 0.774 0.09486 0.203 1.224 70.88 0.774 0.99271 3.81 8.709 70.88 0.774 0.09486 0.203 1.224 70.88 0.774 0.09271 3.81 8.709 70.88 0.774 0.00326 0.203 1.224 70.88 0.774 0.003271 3.81 9.12 70.88 0.774 0.00326 0.2131 1.248 70.88 0.774 0.90271 4.9 9.15 70.89 0.774 0.00326 0.223 1.224 70.88 0.774 0.90271 4.9 9.15 70.89 0.774 0.00326 0.223 1.234 70.88 0.774 0.90272 4.4 10.005 70.88 0.774 0.00326 0.223 1.281 70.89 0.774 0.90272 4.4 10.005 70.88 0.774 0.00326 0.223 1.281 70.89 0.774 0.90272 4.4 10.005 70.88 0.774 0.00326 0.223 1.281 70.89 0.774 0.90272 4.4 10.005 70.88 0.774 0.00326 0.223 1.281 70.89 0.774 0.90272 4.4 10.005 70.88 0.774 0.00326 0.223 1.281 70.89 0.774 0.90272 4.4 10.005 70.88 0.774 0.00326 0.223 1.281 70.89 0.774 0.90272 4.4 10.005 70.88 0.774 0.00326 0.223 1.281 70.89 0.774 0.90272 4.4 10.005 70.88 0.774 0.00326 0.233 1.298 70.89 70.794 0.90272 4.4 10.005 70.88 0.774 0.00326 0.233 1.298 70.89 70.794 0.90272 4.4 10.005 70.88 0.774 0.00326 0.233 1.298 70.89 70.794 0.90272 4.4 10.005 70.88 0.774 0.00326 0.234 1.311 70.89 0.774 0.90238 5.9 1.255 70.88 0.774 0.00326 0.234 1.311 70.89 0.774 0.90238 5.9 1.255 70.88 0.774 0.00326 0.235 1.298 70.89 70.74 0.90238 5.9 1.255 70.88 0.774 0.00326 0.236 70.74 0.9023																		
0.966 1.216 70,88 0.774 0.99383 31 7.476 70 89 0.774 0.904375 300 70.211 70.89 0.774 0.904604 0.2533 1.272 70,68 0.774 0.993485 3.4 6.384 70.68 0.774 0.893481 320 70.344 70.88 0.774 0.003565 0.2533 1.272 70,68 0.774 0.993485 3.4 6.384 70.68 0.774 0.893482 360 70.445 70.68 0.774 0.003565 0.2533 1.272 70,68 0.774 0.993271 3.8 6.799 70.88 0.774 0.890482 360 70.445 70.68 0.774 0.003666 0.2534 1.246 70.88 0.774 0.992371 3.8 6.12 70.88 0.774 0.890918 360 70.445 70.68 0.774 0.003627 0.213 1.246 70.88 0.774 0.99237 3.8 6.12 70.88 0.774 0.890918 360 70.490 70.646 0.774 0.003627 0.213 1.246 70.88 0.774 0.99237 3.8 6.12 70.88 0.774 0.800918 360 70.490 70.646 0.774 0.003627 0.213 1.261 70.88 0.774 0.99238 3.4 10.703 70.88 0.774 0.800818 3.00 70.490 70.646 0.774 0.003627 0.2231 1.28 70.88 0.774 0.99278 3.4 10.703 70.88 0.774 0.800818 3.00 70.590 70.88 0.774 0.003627 0.2231 1.28 70.88 0.774 0.99278 3.4 10.703 70.88 0.774 0.80388 3.00 70.890 70.88 0.774 0.003627 0.2231 1.28 70.80 0.774 0.99278 3.4 10.703 70.88 0.774 0.80388 3.00 70.890 70.88 0.774 0.003627 0.2231 1.28 70.80 0.774 0.99278 3.4 10.703 70.88 0.774 0.80389 3.000 70.890 70.88 0.774 0.003627 0.2231 1.28 70.80 0.774 0.99278 3.4 10.703 70.88 0.774 0.80389 3.000 70.890 70.88 0.774 0.003627 0.2231 1.28 70.80 0.774 0.80389 3.8 10.703 0.774 0.80389 3.000 0.774 0.80389 3.000 0.774 0.003627 0.2231 1.28 70.80 0.774 0.80389 3.8 10.774 0.80389 3.000 0.774 0.80389 3.000 0.774 0.80389 3.000 0.774 0.80389 3.000 0.774 0.80389 3.000 0.774 0.80389 3.000 0.774 0.80389 3.000 0.774 0.80389 3.000 0.774 0.80389 3	0.19	1,201 (70,68	0.7741	0.993907		2.6	6.638	70 66	0.774	0.918331		260	70.001	70.88	0.774	0.011115	
0.21 1.292 70.66 0.774 0.693465 3.22 7.657 70.88 0.774 0.693465 3.4 6.264 70.69 0.774 0.774 0.693466 340 70.597 70.56 0.774 0.690466 1.245 70.56 0.774 0.693727 3.6 0.779 70.56 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.693727 3.6 0.774 0.77	0,1968	1.218	70.88					7 476	70 68					70.271	70 88	Ç 774	0.008404	
0.208	0.2	1.232	70.66	0.774	0 993465		3.21	7.887	70 88	0.774	0.89851	- 1	320	70.334	70 88	Q.774	0.007505	
0.21	0.2064	1,248	70.88	0.774	0 293237		3.6	5.709	70.88	0 774	0.886782		360	70,445	70.68	0.774	0.005921	
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0.2733																		
0.261	0.2733	1.39	70.66	0,7741	0.9912111		7.6	15.997	70.86	0,774	0.782795	i	760	70.825	70.88	0,774	0.000499	
0.2833										0.774	0.778729					0.774	0.000499	
0.79	0.2633	1,406	70.68	0.774	0.990983		42	16.8831	70.68	0.7741	0.770154		520	70.825	70.88	0.774	0.000429	
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SEMI-LOGARITHMIC KEUPFEL & ESSER CO.

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PAGE _____ OF ____

CLIENT _____ Prepared By ____ Date ___
PROJECT ____ Reviewed By ____ Date ___
Approved By ____ Date ___

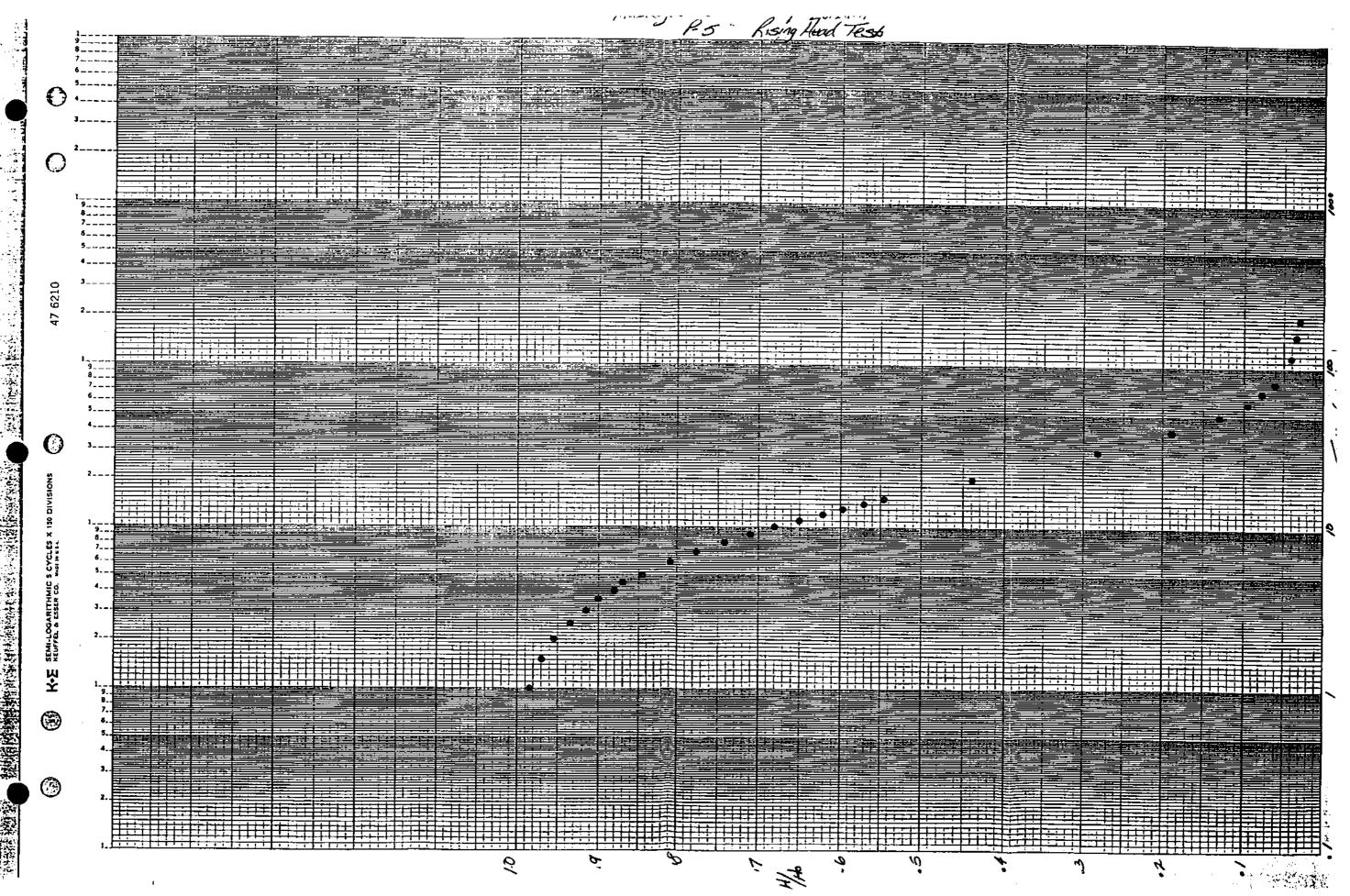
P-5	Rising Hea	d Tests		
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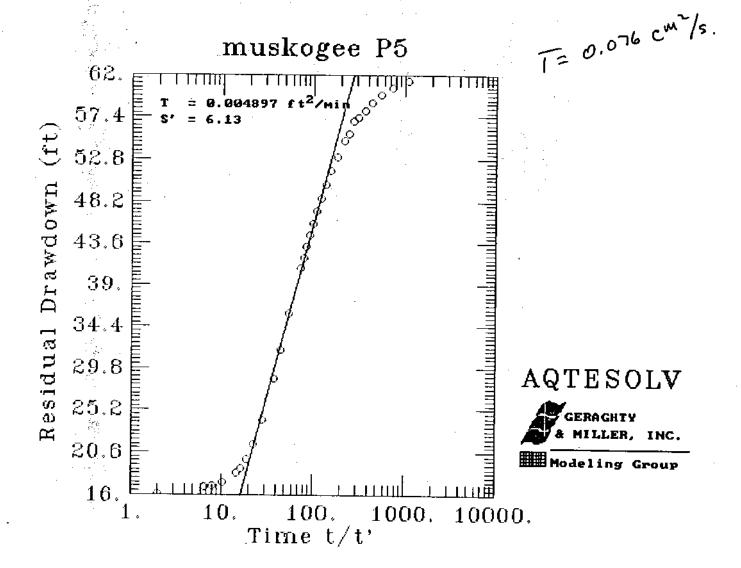
 $T = \frac{1c^2}{L}$ - $\frac{(1n)^2}{6mn}$ - $\frac{167 \cdot n^2}{mn} \times \frac{(2.54) en^2}{nn^2} = \frac{nn}{60 sec}$ - $\frac{0.018}{L} = \frac{n^2}{sec}$

K = T/b• 0.018 cm²/sec × 1/548.64 cm $K = 3.27 \times 10^{-5}$ cm/sec

W/ Aglasolue Program (These Recovery)

T= 4.891410-3 [\frac{1}{2} min \(12)^2 m^2 \), (0.54) \(2m^2 \) \(\times \) \(





121	ENVIRONMI INFRASTRUC	TURF	ALCULATIO		PAGE / OF /	56251.150
CLIEN	T_WMO	/ SUBJ	ECT LE	n Tests	_ Prepared By	
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30	22.50	20.0	18.89			
3.5		25.0	18.38			
4.0	22.13	30.0	17.93	< 35.0	17.54	
4.5	21.82	40.0	16.90			
5.0	21.49	50.0	15.45	260. 14	1.45	•
60	21 10	700	13.13			
70	20.87	80.0	13.27			
8.0	20.74	90.0	12.96			
90	20,55	100.0	12.74			

CALCULATION SHEET

PAGE ____ OF ____

CLIENT _____ SUBJECT ____ Prepared By ____ Date ____
PROJECT ____ Reviewed By ____ Date ____
Approved By ____ Date ____

Time	, 4/4	<u>6</u>	Time	+//
0.5	.923		11.0	. 592
1.0	.862		12.0	.582
15	83/		130	.57/
20	.810		14.0	.561
25	.193	•	150	. 549
30	.181		200	. 503
3.5	,166		25.0	.464
4.0	152		30.0	429
4.5	128	g para Africa	35.0	.399
50	.703	7	40.0	350
6.0	-613		500	.238
70	. 655		600	.162
8.0	645		70.0	,106
9.0	,631		80.0	.071
10.0	. 605		90.0	.047
	. 455	et e	100.0	,030
			179.0	0

 $T + / 1c^2 = 1$ $Q = 10^{-2}$ $C \neq = 18 mn$ $T = / (3^{-2}) / 10 min \times (2.54 cm)^2 / (n^2 \times min) / 60 sec$ $T = .006 cm^2 / sec$

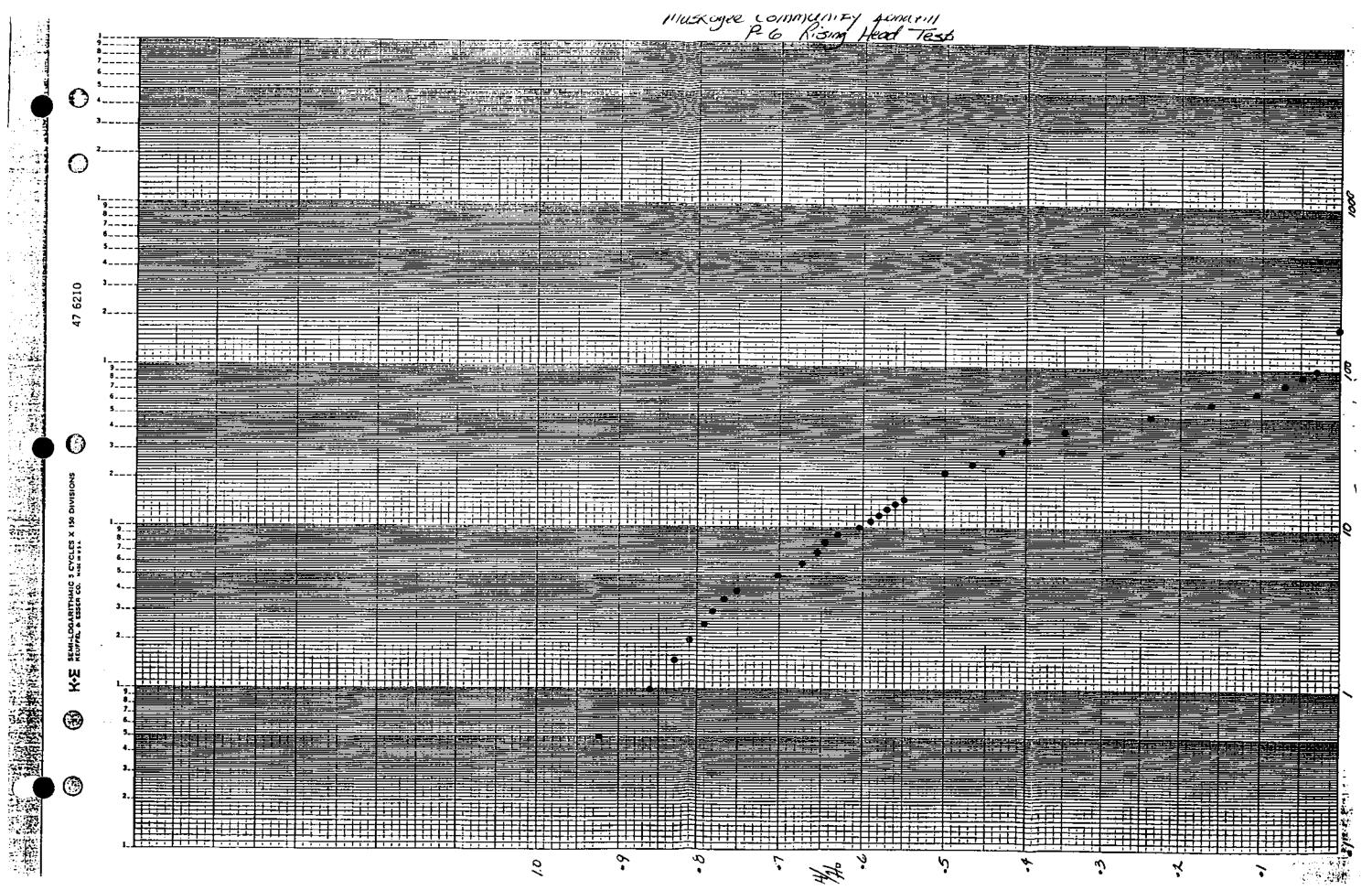
K= T/b = .006 cm²/see x 365.76 cm K = 1 63 x10-5 cm/sec

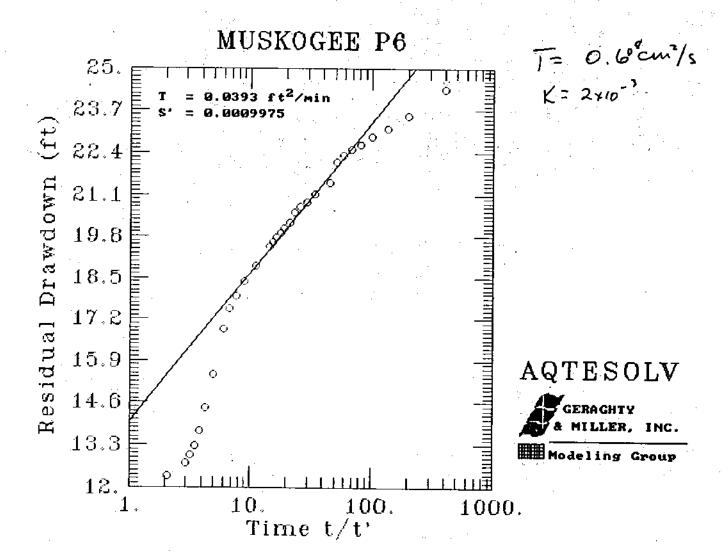
vi/ Aglesolve Fromon (Theiss Recorny)

T= 3.73 ×10-2 fl=/mn x min/wsec x (12)=10=/12 x (25+)=cr2/102

T= 6.09×10-10+2/sec

K= T/6= 1.66×10-30+/sec

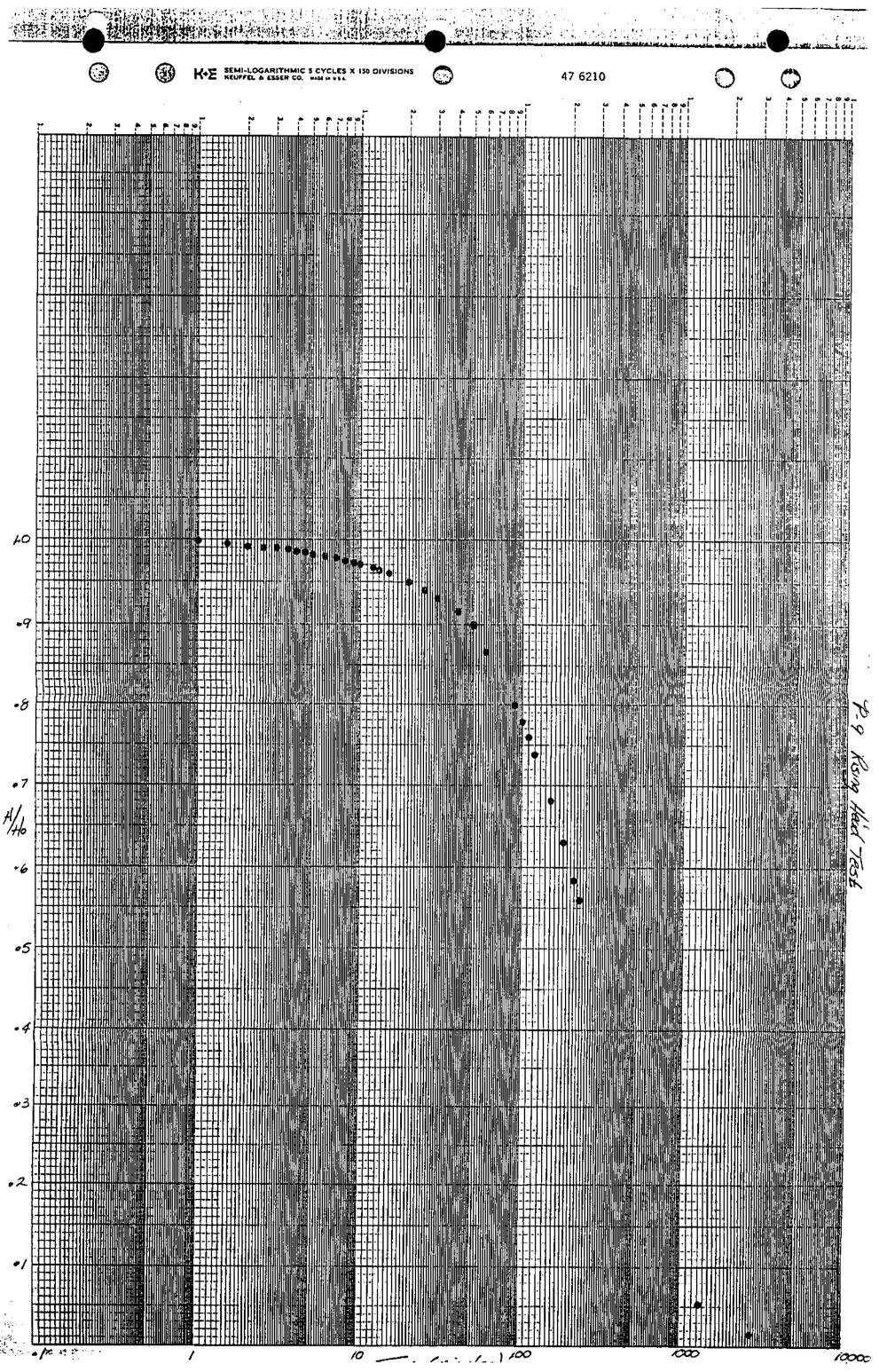


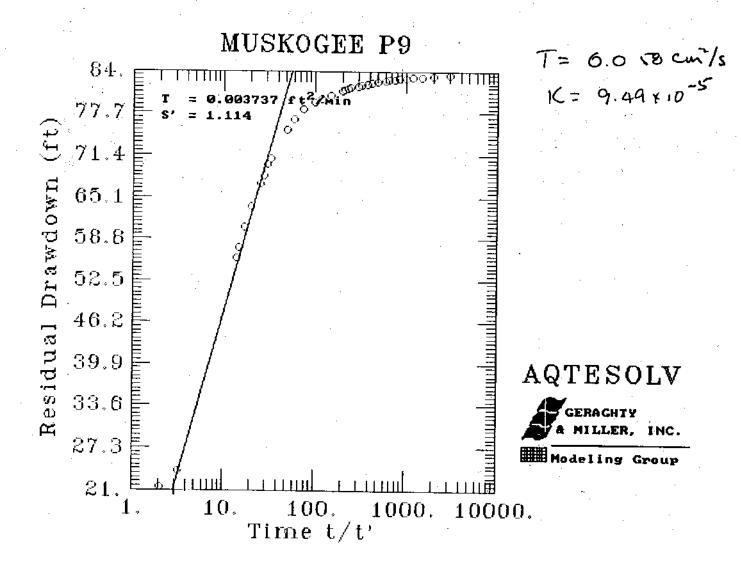


RUST ENVIRONMENT & INFRASTRUCTURE		CALCULATION SHEET		PAGE OF PROJECT NO		
CLIENT		_ SUBJECT	<u> </u>	Prepared By Date		
PROJEC	Т			Reviewed By	_ Date	
<i></i> _				Approved By	Date	
	29 Riang Had	Tack				
		,	4			
Ag	with thermess.	b= 85-65	= 20th	fille met 112	1/-	
	WAR BUCKESS,	0- 00 00	_	dus core	14	
•	N.	= 609.60	nn .		٠	
Casin	gradius, re= lin		-**	· · · · · · · · · · · · · · · · · · ·		
)					
Ho :	8365	4/40=	H-h/)	/ /		
4 =	As perficiel notes	1771	IA	6- <i>1</i> 7		
h=	20 56		,	•		
Time	nin H. Ab	TIME MIS	H, FE) '		
				_		
1.0	83.44	20.0	80.43			
1.5	<i>63.3</i> /	25.0	79.65			
20	<i>83.18</i>	30.0	79.32			
2.5	83.05	40.0	78.22	•		
30	82.99	300	76. A			
35	82.86	60.0	75.19			
4.0	82.77	70.0	-			
4.5	8269	හි.ග	-			
5.0	82.59	90.0	70.92			
6.0	82.42	100.0	69.63			
7.0	82.25	110.0	68.36			
80	82.08	1200	67.12			
90	81.94	150.0	63 W			
10.0	81-80	180.0	60.48			
11.0		· ·	57.46			
12.0	8/.53	228.0	55,82			
13.0	81.38	1321.0	23.90			

 $T = \frac{1}{16\pi n}$ QQ = 10-9 Q t = 16 min $T = \frac{10^{2}}{16\pi n}$ $(2.54 \text{cm/s})^{2} \times \frac{10^{10}}{16050}$ $T = .00/ \text{cm}^{2}/\text{sel}$

K = T/b= .00/ cm²/sec \times / 609.60 cm $K = 232 \times 10^{-6} \text{ cm}^2/\text{sec}$ $\frac{W}{Aglesole}$ $\frac{W}{Aglesole}$ $\frac{W}{Aglesole}$ $\frac{(2n)^2}{4} \times \frac{(3.52)^2 \text{ cm}^2}{100} \times \frac{(3.52)^2 \text{ cm}$





RUST ENVIRONMENT & INFRASTRUCTURE	CALCULATION SHEET	PAGE OF PROJECT NO	-
PROJECT	SUBJECT	Prepared By Reviewed By	
		Approved By	
P-8 Rising	Head Tests		
	es, b=35/2 x 12n/4 x	254cm/ = 10	966.80 CM
Cosing Modues, 10			
Ho = } see do	rza sheet	And the second	
h=)	• 1	vá.	
T=/1= 1	£= 3.7mme 0= 10-	· 4	
T = 102/2	3.7 min x (2.54cm) 12 x		

K = T/5= 0.029 cm²/zec × 1/066.30 cm $K = 2.72 \times 10^{-5}$ cm/sec

										I.——					<u> </u>
						Muskogee (ommunity to	andfill							
						PS Mea	ng Head 141								
								_							-
no,min	H(t),ft	h,ft	Ho,ft	H(t)-h/Ho-h	Empsed Time.min	H(t),#	Th.H	Ho,ft	H(I)-h/Ho-h		Empsed Time,min	H(c),ft	h.ft	Ho.N	H(t)-WHo
8	39.58	95.91	34.548	0.917995	6.3	38.725	95.91	34 548	0.931929		9.2	73.217	95.91	44	0.36982
0.00331	37 903 36 479	95.91 95.91	34.548	0.945324	0.3033 0.3066	38.788 38.757	95.91	34,548	0.930902		9.4 9.6	73.644 74.072	95.91 95.91	34.548	0.36286
0.01	35.34	95.91	34,548	0.987093	0.31	38.62	95,91	34.548	0.93038		9.8	74.484	95.91	34,548	0.34917
0.01331	34.548 35.577	95.91 95.91	34.548 34.548	0.983231	0.3133 0.3166	38.852	95.91 95.91	34.548	0.930902 0.929859		10	78.474	96.91 95.91	34.548	0.34275
0.0233	40.054 42.238	95.91 95.91	34,548 34,548	0.91027 0.874678	0.32 0.3233	38.788 38.867	95,91 95,91		0.930902 0.929614		14 16	81.294 83.543	95,91 95,91		0.23819
0.0266	42.744	95.91 95.91	34.548	0.866432 0.900476	0.3266 0.33	38.836	95.91 95.91	34.548	0.93012		16 20	85.349 86 791	95.91 95.91	34.548	0.1721
0.0333	39.374 37.428	96.91 96.91	34,548	0.921352	0.2333 0.35	38.899 39.042	96.91 95.91	34.548	0.929093		<u>22</u> 24	87.948 88.883	98.91 96.91	34,546	0.12975 0.11451
0.04	36.684 36.463	95.91 95.91	34.548		0.3666 0.3633	39 (52 39 294	95.91	34,548	0.92497		26	89.626	95.91	34.548	0.10240
0.0466	36,922	95.91	34,548	0.961312	0.4	39.39	95.91	34.548	0.921091		26 30	90.229 90.72	95.91 95.91	34.548 34.548	0.0845
0.05	37.728 38.314	95.91	34.548	0.948176 0.938627	0.4166 0.4333	39.406 39.564	95.91 95.91	34.548 34.548	0.92083 0.918256		32 34	91,116 91,465	95.91 95.91	34,548 34,548	0.07243
0.0566	38.82 38.836	95.91 95.91	34.548 34.548	0.93038 0.93012	0.45 0.4688	39.659 39.785	95.91 95.91	34.548 34.548	0.914654		36 38	91.75 91.987	95.91 95.91	34,548	0.06779
0.0633	38.63 38.203	95.91 95.91	34.548 34.548		0.4833 0.5	19.785 29.698	95.91 96.91	34.548	0.914654 0.012845		40	92,194 92,368	95.91 95.91	34.548	0.06055
0.07	37.855 37.602	95.91 95.91	34 548 34 548		0.5166 0.5333	39.959 40.023	95.91 95.91	34.548	0.911818		44	92.526 92.669	95.91	34.548	0.05514
0.0766	37.539	95.91 95.91		0.951256	0.55	40.086	95.91	34.548	0.909749		48	92,78	95.91	34.548	0.05100
0.08	37,602 37,776	95.91	34.548	0.947594	0.5666 0.5833	40.149 40.228	95.91 95.91	34.548	0.908722 0.907435		50 52	92.89 92.986	95,91 95,91	34,548	0.04921
0.0866	37.871 37.997	95.91 95.91	34.548	0.945846 0.943793	0.6 0.8166	40.26 40.371	95.91 95.91	34.548	0.906913 0.905104		54 56	93.081 93.16	95.91 95.91		0.04610 0.04481
0.0966	37.988 37.95	95.91 95.91	34.548 34.548		0.6333 0.65	40.45 40.529	95.91 95.91	34.548 34.548	0.903817		58 60	93,239 93,303	95,91 95,91		0.04352
0.1033	37.839 37.776	95.91 95.91	34,548 34,548	0 946367	0.6666 0.5833	40.624 40.687	95.91 95.91	34.548	0.900981		62 64	93 382 93 445	95.91 95.91	34.548	0.041194
0.1066	37.713	95.91	34.548	0.948421	0.7	40,782	95.91	34.548	0.898406		66	93.4931	95.91	34,548	0.039389
0. t 133	37.681 37.76	95.91 95.91	34.548	0.947655	0.7166 0.7333	40.861 40.94	95.91 95.91	34.548	0.895831		681 70	93.557 93.603	95.91 95.91	34.548	0.03834 0.03759
0.1166 0.12	37.681 37.839	95.91 95.91	34,548	0.948942 0.946367	0.7666	41.019 41.13	95.91 95.91	34.548	0.894544		72 74	93.651 93.699	95.91 95.91	34,548	0.03681
0.1233 0.1266	37.728 37.855	95.91 95.91	34,548 34,548	0.948176 0.946107	0.7833	41.209	95.91 95.91	34,548	0.891447 0.889899		76 78	93.747	95.91 95.91	34,548 34,548	0.0352
0.13	37.728 37.608	95.91 95.91	34.548	0.948176	1 0.8166 0.8333	41.399	95.91 95.91	34.548		!	80 82	93.826 93.873	95.91 95.91	34.548	0.033962
0.1366	37,697	95.91	34.548	0.948682	0.85	41 605	95.91	34.548	0.884994		84	93.9214	95.91	34.548	0.032414
0.14	37.792 37.728	95.91 95.91	34,548	0.947133 0.948176	0.8666 0.8833	41,747 41,826	95.91 95.91	34.548 34.548			86 :	93.9521 93.984	95.91 95.9 1	34.548	0.031909
0.1466 0.15	37.808 i 37.776	95.91 95.91	34.548	0.946873	0.91661		95.91 95.91	34.548 34.548	0.877514		901	94.018	95.91 95.91		0.030866
0.15 33 0.1566	37.823 37.839	95.91T 95.91		0.9466281	0.9333		95,91 95,91	34 548 34.548	0.875721		94	94.079	95.91 95.91	34.548 34.548	0.029839 0.029318
0,16	37.871	95.91 95.91		0.945846	0.9666 0.9833	42,444	95.91 95.91	34.548	0.871321 0.869789		98	94.142	95.91 95.91	34.548	0 028813
0.1566	37.871	95.91 95.91	34,5491	0.9458461	1.2	42.681		34.548	0.867459			94 412 94 602	95.91	34.548	0.021316
0.1733	37.918	95.91	34,548	0.94508	(.4)	45.782)	95.91	34.548	0.616923		160	94 744	95.91	34.548	0.019002
0.1766	37.934 37.981	95 91 F 95 91 i	34.548	0.941819	1.61	46.985) 48.061	95.91 95.91	34.548	0.7975181	i	180	94.871 94.983	95,91 95,91	34,548	0.016932
0.1833	37.981 37.981	95.91 95.91		0.944053	2.2	49,137 50,166	95,911 95,911		0.762247	+	220	95.0611 95.1411	95.91 95.91		0.013836
0.1933	38 029 37.997	96.91 96.91	34 548 34 548	0.943271	2.4	51.147 52.113	95,91	34.548	0.729491 0.713748		260 280	95 22 96 263	95.91 95.91		0.011245
0.1966	38.029 38.045	95.91 95.91	34.548	0.943271	2.8	53.03 53.933	95.91 95.91	34,548	0.698804 0.684088		300	95.2991 95.3471	95.91	34.548	0.009957
0.2033	38.045	95.91	34,5481	.0.94301	32	54,603	95.911	34,548 i	0.66991	:	340	95,394 i	95.91 95.91	34 548	0.009175
0.20661	38.092 38.077	95.91	34.548	0.942244	3.4 3.6	55.658 56.497		34.5481	0.6559761 0.6423031			95.4421 95.491		34,548	0.007627 0.006845
0.2133	38.14 j 38.14 j	95.91 95.91	34.5481	0.9414621	3.8	57.304 i	95.911 95.911	34 548 34,548	0.629152 0.616245		400 l		95.91 95.91	34.548	0.006339 0.005818
0.22	38,172	95.91 95.91	34 548 i	0.940696	: 421	58,871	95.91 95.91	34.548	0.616245 0.603615 0.591229	1	4401		95,91 95,91	34,548	0.005313
0.22661	38.235 38.235	95.91 95.91	34 548 34 548	0.939914		60.359	95.91 i 95.91 i	34,5481	0.579365		480	95 632 95 664	95.91 95.91	34,548	0.004009
0.2333	38.268	95.91 95.91	34,548 (0.939409	51	61.752	95,91 95,91	34,548	0.555664		520	95.6961	95.91	34 548	0.003488
0.241	38,33 (95.911	34.548	0.938887	5.2:	. 63 098	95.91	34,548)	0.5347281		\$40 \$60		95.91 95.91	34 548	0.003243 0.002982
0.24331	38.361 i 38.361 i	95,91 95,91	34 5481	0.937861	5.8		95.91 95.91	34.548	0.524396; 0.51408		600	95.7741	95.91 95.91	34.548	0.002473 0.002210
0.251	38.393 38.393	95,91 ī 95,91 ī	34.548	0.9373391	4 6.21	64.982	95.91 95.91	34.548	0.5040251	j	620 i	95.79 F 95.806 F	95.91 96.91	34,5481	0.001954
0.2566	38,409) 38,44 i	95.91 95.91		0.937078	6.4	66 756	95 91 95 91	34 548	0.4846651	,	660 T	95.822	95.91 95.91	34.548	0.001434
0.2633 0.2666	38 472	95.91 95.91	34,5481	0.936052	6.8	67.309 67.864	95 91 95 91	34.548	0.4570581		700 i	95.838	95.91	34.548	0.001173
0.27	38.55 t	95.91	34 548	0.934764:	7.2 '	68.36è	95.91	34,548	0.448551		7401	95.854+	95,911	34,548	0.000913
0.2733	38.551 38.599	95.91 95.91	24 549	0.033032	7.4:		95 91 :	34,548;	0.439784 0.431505	<u>.</u>	760 : 780 :		95.91: 95.91:	34.548	0 000653 0 000653
0.281	38.583 38.539	95.91 95.91	34 548 34 548	0 934243 0 933582 0 933982	7 3	69.939 70.429	95.91 ·		0.423212		800 820	95.686 95.686	95.91 95.91		0.00039
0.28661	38 599 38 646	95 91 95 91	34 548 34 548	0.933982	8.2	70.92 71.395	95 91 : 95 91 :	34 548	0.407255		840 i 860	95.886 95.886	95.911 95.911	34.548	0.000391
9.2933 0.2966	38 662 38 709	95 91 95 91	34 548	3.922955 3.932159	86	71 97 72.23	95 91	34 548	0.391773		-	77.000	:	J- J-01	- meas
9.23001	20,09	70 71		0 532 133	. E.ā 9 :	72.773	95.91 95.91		0.377057						
	<u></u>								:					:	
; ;	-														

W X

SECULTARY

Prepared By Date _

ROJECT.

Reviewed By _____ Date _ Approved By _____ Date

P-10 Rising Head Test

K= re In (k/rw) 1 la 10/4

la Re = I 1.1 en (20/20) + A+Bla I (H-Lw)/rw]]-1

= [1,1 + 1.75+0.35 ln [(13.42-14.17)/.3]]

Range (14.17/3) + 1.75+0.35 ln [(13.42-14.17)/.3]

In Re/10 = 1.56

Note: water level used for colewation of Iw and A Laken on 12/22/93

re = [(1-.3)(.08)2 + (3)(.3)2]2

K = 10 2 ln (12/10) 1 ln /0/4

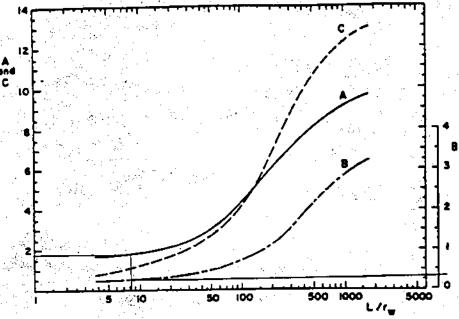
(0.17)2 (1.56) 1 2 (0.96/ 2 (2.5) 500 (1.89)

X = 1.37 410-6 f=/min x 1210/2 42.54 cm/n x mr/60 see

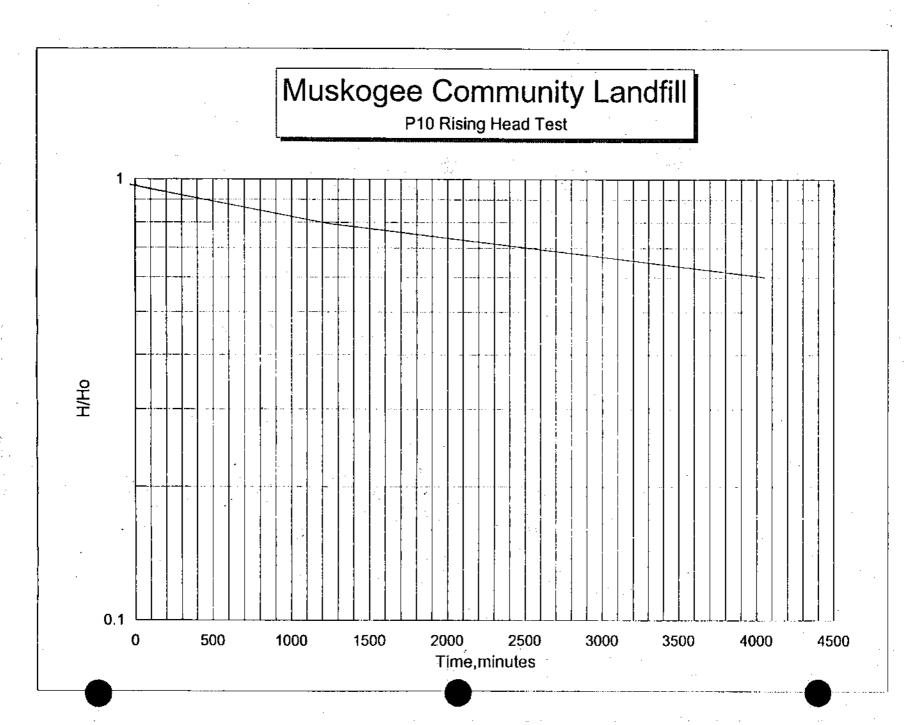
K = 6.94 × 10-7 on/sec

P-10 Rising Head Test

BOUWER AND RICE: GROUNDWATER HYDRAULICS



Curves relating coefficients A. B. and C to Life.



		. <u> </u>	<u> </u>	<u> </u>		
	Muskogee (Community I	andfill			
<u> </u>	Muskogee Community Landfill P10 Rising Head Test					
	F 10 Kising i	lead lest				
Elapsed	 H(t),ft	h,ft	Ho,ft	H(t)-h/Ho-h		
Time,min						
0	27.1	16.39	27.1	1		
0.5	26.95	16.39	27.1	0.985994		
1 :	26.95	16.39	27.1	0.985994		
1.5	26.91	16.39	27.1	0.98226		
2	26.88	16.39	27.1	0.979458		
2.5	26.87	16.39	27.1	0.978525		
3	26.85	16.39	27.1	0.976657		
3.5	26.84	16.39	27.1	0.975724		
4	26.83	16.39	27.1	0.97479		
4.5	26.81	16.39	27.1	0.972923		
6	26.79	16.39	27.1	0.971055		
7	26.78	16.39	27.1	0.970121		
8	26.77	16.39	27.1	0.969188		
9	26.76	16.39	27.1	0.968254		
10	26.75	16.39	27.1	0.96732		
15	26.73	16.39	27.1	0.965453		
20	26.71	16.39	27.1	0.963585		
30	26.68	16.39	27.1	0.960784		
60	26.62	16,39	27.1	0.955182		
90	26.57	16.39	27.1	0.950514		
120	26.53	16.39	27.1	0.946779		
1230	24.91	16.39	27.1	0.795518		
4055	22.84	16.39	27.1	0.602241		

CALCULATION SHEET

PAGE	OF	
PROJECT NO	<u> </u>	

CLIENT ______ SUBJECT _____ Prepared By ____

Reviewed By _____ Date ____

P-11 Rising Head Test - Maister Bouke & Rice

2n Re = 2.67

1'c = [(1-n)/c2 + n/w2]/2 = [(1-,3)(.08)2+(.3)(.3)2]/2 = 0.17

 $K = \frac{re^{2} \ln (Re/r\omega)}{2Le} + \ln (lo/y)$ $= \frac{(.17)^{2} (2.67)}{2(10)} + \frac{1}{200} \ln (.74/49)$

 $K = 7.95 \times 10^{-6} f_{0} / mn \times 12 m/2 \times 25 + cm/n \times mn/600000$ $K = 4.04 \times 10^{-6} cm/n$

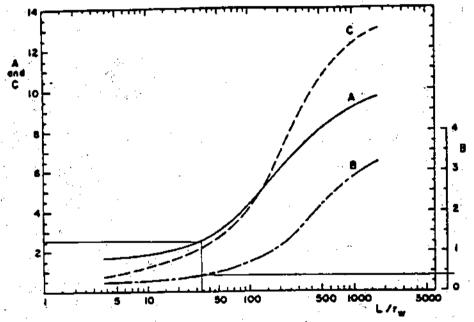
K = 4.04×10-6 cm/sec

W/ Aglandre Program

K= 5.41×10-5/2/mn x 1210/2× 2.54em/nx min/60sec

P-11 Rising Head Test

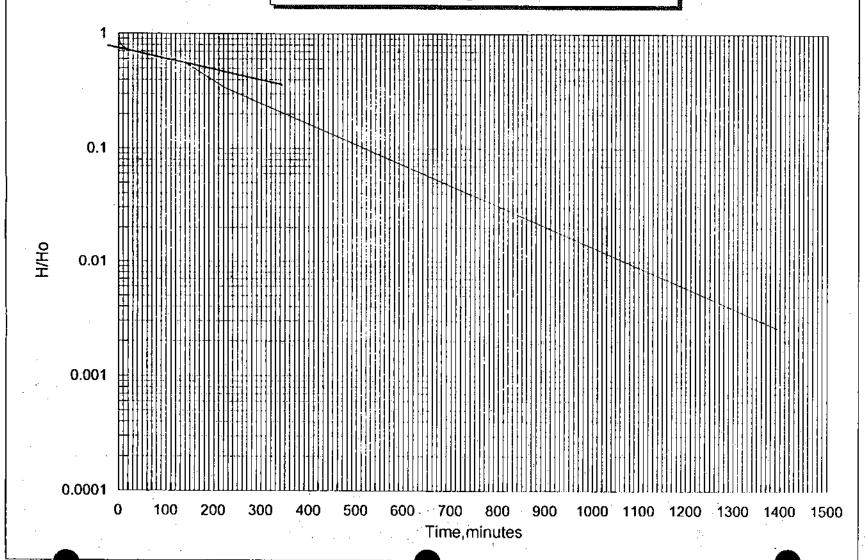
BOUWER AND RICE: GROUNDWATER HYDRAULH'S



Curves relating coefficients A. S. and C to L/r ...



P11 Rising Head Test



		Community L	andfili				
	P11 Rising	Head Test					
			<u> </u>				
Elapsed	H(t),ft	h,ft	Ho,ft	H(t)-h/Ho-h			
Time,min							
	-		1				
0	21.6	6.18	21.6	1	-		
1	20.94	6.18	21.6	0.957198	•		
1.5	20.34	6.18	21.6	0.918288			
2	19.86	6.18	21.6	0.88716	•		
2.5	19.5	6.18	21.6	0.863813	• 5.		
3	19.14	6.18	21.6	0.840467			
3.5	18.91	6.18	21.6	0.825551			
4	18.76	6.18	21.6	0.815824			
4.5	18.63	6.18	21.6	0.807393			
5	18.53	6.18	21.6	0.800908			
6	18.36	6.18	21.6	0.789883			
7	. 18.23	6.18	21.6	0.781453			
8	18.13	6.18	21.6	0.774968			
.9	18.04	6.18	21.6	0.769131			
10	17.95	6.18	21.6	0.763294			
11	17.88	6.18	21.6	0.758755			
12	17.81	6.18	21.6	0.754215			
13	17.74	6.18	21.6	0.749676			
14	17.68	6.18	21.6	0.745785			
15	17.63	6.18	21.6	0.742542			
20	17.41	6.18	21.6				
25	17.22	6.18					
30	17.07	6.18	i				
40	16.78	6.18					
50	16.52	6.18	 	0:670558			
60	16.29	6.18	21.6	0.655642			
70	16.07	6.18	21.6	0.641375			
80	15.84	6.18	21.6	0.626459			
90	15.66		21.6	0.614786			
100	15.46		21.6	0.601816			
139		6.18	21.6	0.557717			
157			21.6	0.505837			
222	11.42	6.18	21.6	0.339818			
1396	:	6.18	 				
1220	0.22	0.18	21.6	0.002594			

and the second of the second o

n.		RONMENT & ASTRUCTURE	CALCULATION S	HEET	PAGE OF PROJECT NO
	WMO		SUBJECT Fem 7	Tarke	Prepared By AH Date 10/13/4
CLIENT	T_Mul	er 1/ Mrs -	_ SUBJECT _7 GAL 7	<u>- w-</u>	
		X. HYWO-	<u> </u>		Approved By Date
ge ge	•			-	Approved by bate
<i>F</i>	211	lising Hand	Test		
	_				
Ag	urfa 7	hickness.	b= 21.6-9	' = 12.6	(filter pack) Ax Du y 2.54c
					The in
		· •.	= 384.05 C	H	•
Cas	na Radius	s, re = lin			
_	.	_		1. /	
Ho	= 21	60 ft	H/H0 =	4-11/16	-h
4:	- As	pe freld no	les	•	
h=	6.7	18 FE			
	•		•	1.	
	Time,	H.FE	Time,	H. F.	
•					
	1.0	20.94	200	17.41	
	15	20.34	250	17.22	
	20	19.86	300	17.07	
E	25	19.50	400	16.18	
ئت	3,0	19.14	50.0	16.52	
_	35	18.91	60.0	16.29	
•	4.0	18.76	70.0	16-07	. *
4	1.5	18.63	800	15.84	
٠. ٢	5.0	18.53	90.0	15.66	•
	6.0	18.36	1000	15.46	
	7.0	18.23	139.0	14-18	•
	8.0	18.13	1570	13.98	
	90	18.04	222.0	11.42	e de la companya de la companya de la companya de la companya de la companya de la companya de la companya de
7	00	17.95	1396.0	605	6 72
. /	11.0	17.88			
. /	2.0	17.81			
1.	30	17.74			
,	40	7 12.			

 CLIENT ________ SUBJECT _______ Prepared By ______ Date _____

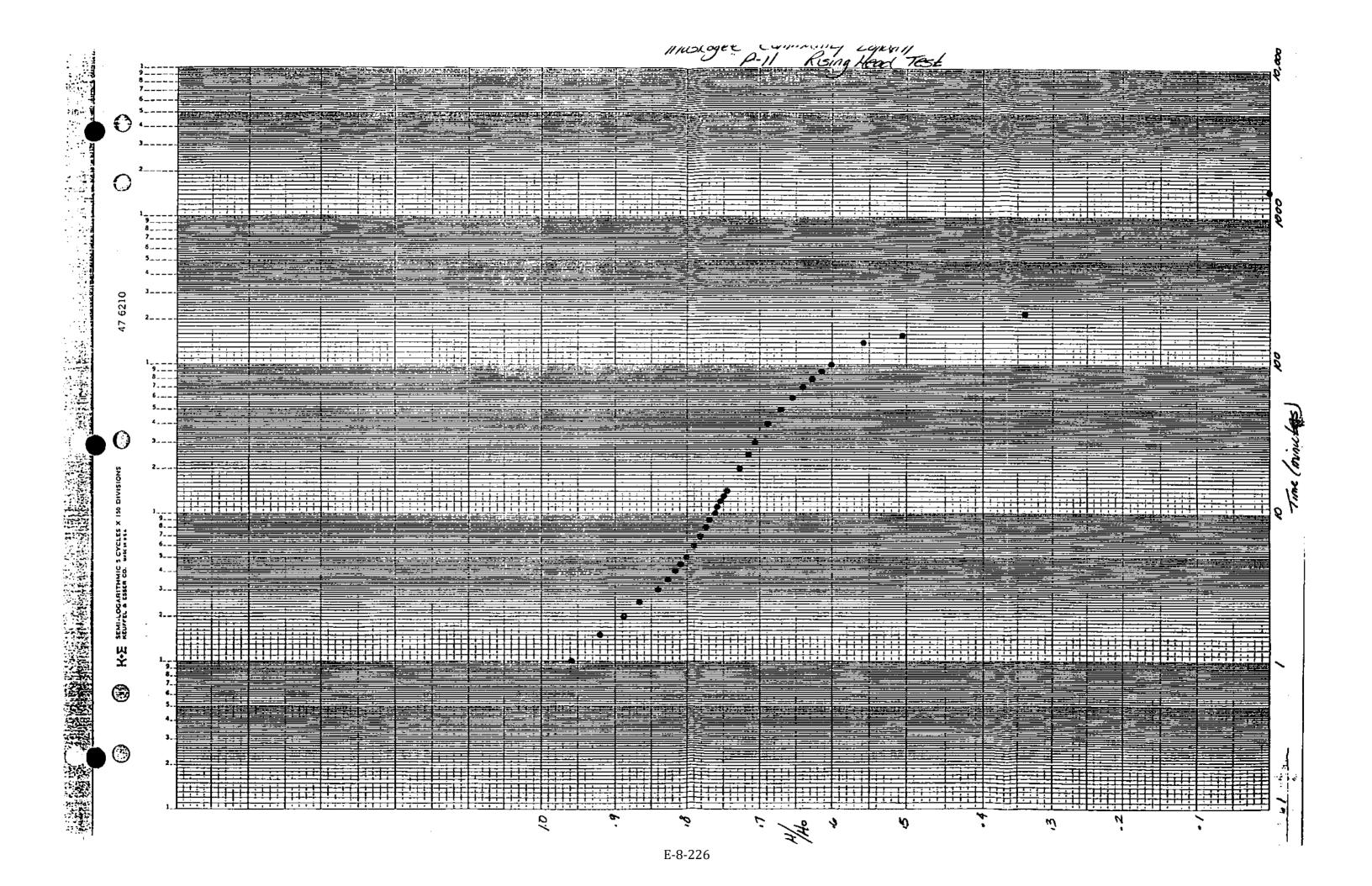
 PROJECT _______ Reviewed By ______ Date _____

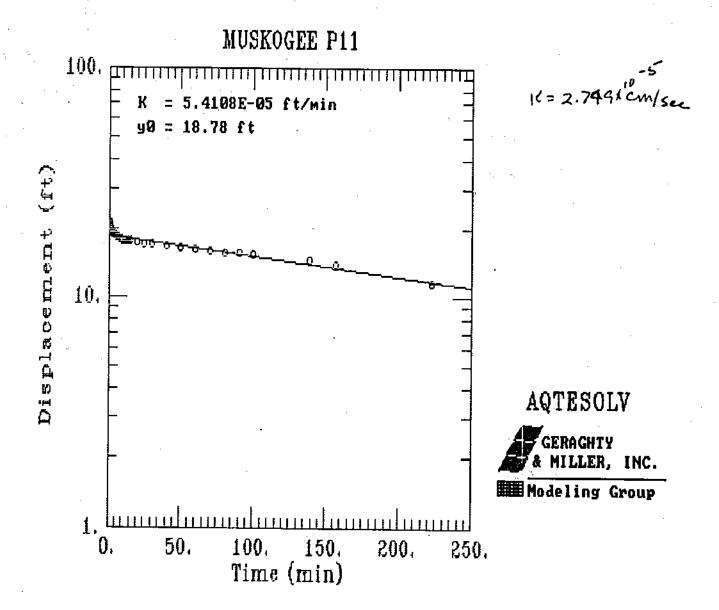
 Approved By ______ Date _____

P. 11 King Head Test

	- 13	,
Time	4/40	Time, +/16
1.0	,957	20.0 .728
1.5	. 918	25.6 .116
2.0	. 887	300 ,706
25	- 864	40.0 .681
3.0	- 840	50.0 1671
35	. 826	60.0 :656
4.0	. 816	70.0 (Al
4.5	. 807	80.0 .626
50	. 801	90 0 .615
60	.790	100.0 .602
70	,181	139.0 .558
8.0	,115	157.0 .506
9.0	.769	1220 .340
10.0	.163	1396.0 0.003
11.0	.759	•
120	. 154	
13.0	1750	
14.0	. 746	
150	.743	

 $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}$ $T = \frac{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45 \text{ minches}}{10^{-8} \text{ e. } t = 45$





Approved By _____ Date .

CLIENT WMO

Prepared By GH Date 12/13/93

Reviewed By ___

__ Date ____

P-12 Rising Head Tests

Aguiter thickness, b = 22.7-10th = 12.7th (Pitopick) x 12 in/ x 2.54cm/

b= 381.10 cm

Casing Rodius, le = 1:n

Ho = 23.7 fg

H = Asportiell notes
h= 101 ft

H-h/H-h = H/H

Time 05 23,99 23,41 1.0 23.36 1.5 2.0 23.33 2.5 2330 30 23.28 3.5 23.25 4.0 23.23 23.21 4.5 50 23.19 60 23.15 7.0 23.12 8.0 23.09 9.0 23.06 23.03 10.0 11.0 23.01 12.0 12.97 22.94 130 A.O 22.91

15.0

22.84

Time, HA 22.18 20.0 22.65 25.0 22.54 30 O 22.34 40.0 22.12 50.0 21.94 60.0 يمالا المالي 90.0 20.30 120.0 1033.0 10.18 1204.0 9.60

RUST ENVIRONMENT & INFRASTRUCTURE

CALCULATION SHEET

PROJECT NO. _____

CLIENT _____ SUBJECT ____ Prepared By ____ Date ____
PROJECT ____ Reviewed By ____ Date ___

Approved By _____ Date ____

P.R. Kong Head Test

1-12	Nong Head less.		
	4/46	Time	21/46
_		_	
0.5	1987	11.0	. 959
10	. 983	12.0	.956
1.5	,980	130	.954
20	918	14.0	.953
25	. 976	150	.951
30	975	20.0	. 945
35	.973	25.0	, 937
4.0	.912	30.0	. 930
4.5	.97/	400	.919
5.0	.969	500	.905
6.0	. 967	90.0	. 857
7.0	.965	120.0	.796
80	. 963	1033.0	190
9.0	,962	1204.0	0/55
100	.960		-

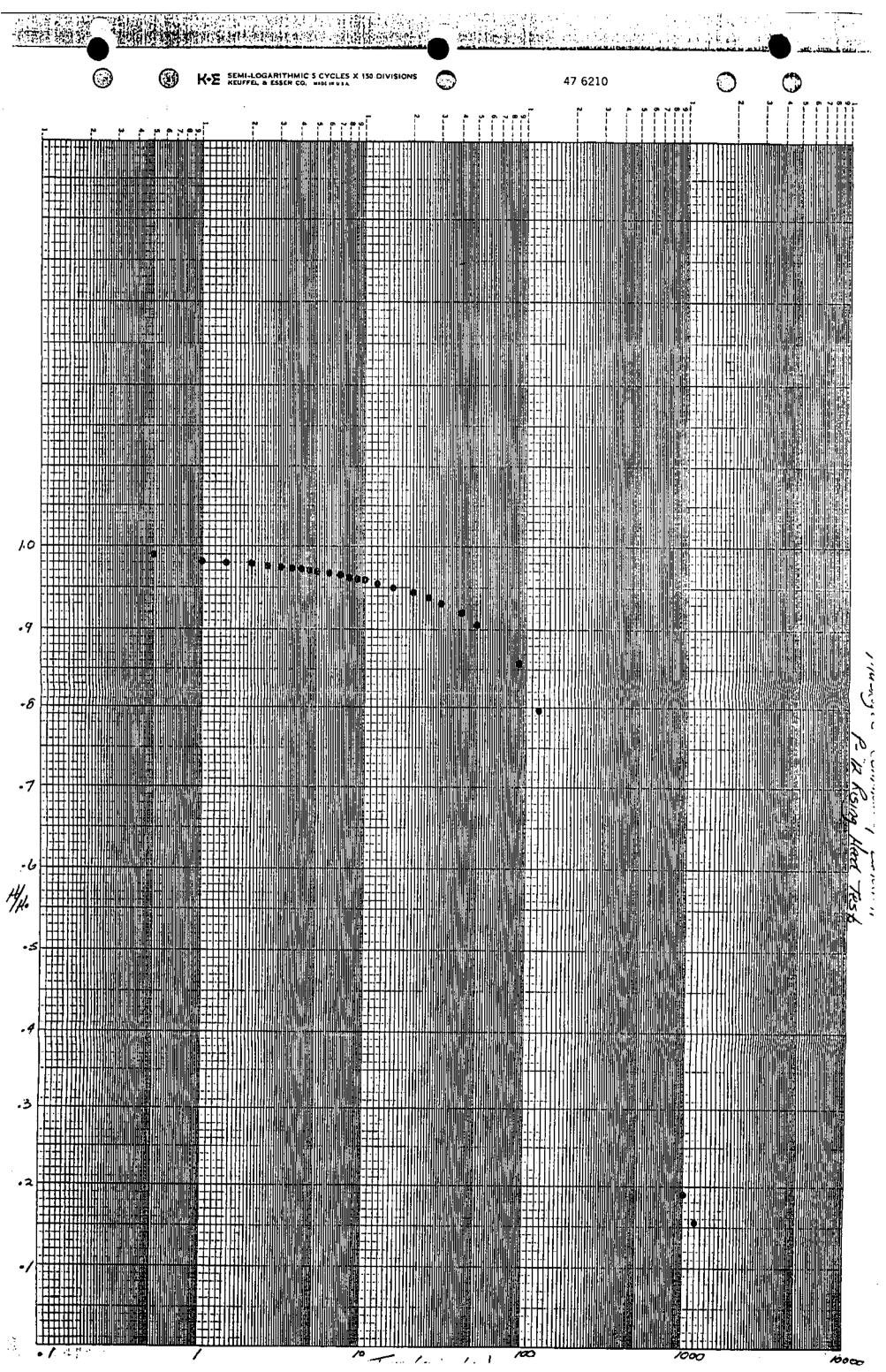
 $T = \frac{|c^{2}|b}{(\sin^{2})^{2}} \times \frac{(2.54 \text{ cm})^{2}}{\sin^{2}} \times \frac{|n|n}{100 \text{ sec}}$ $T = 0.001 \frac{\text{cm}^{2}}{\text{sec}}$

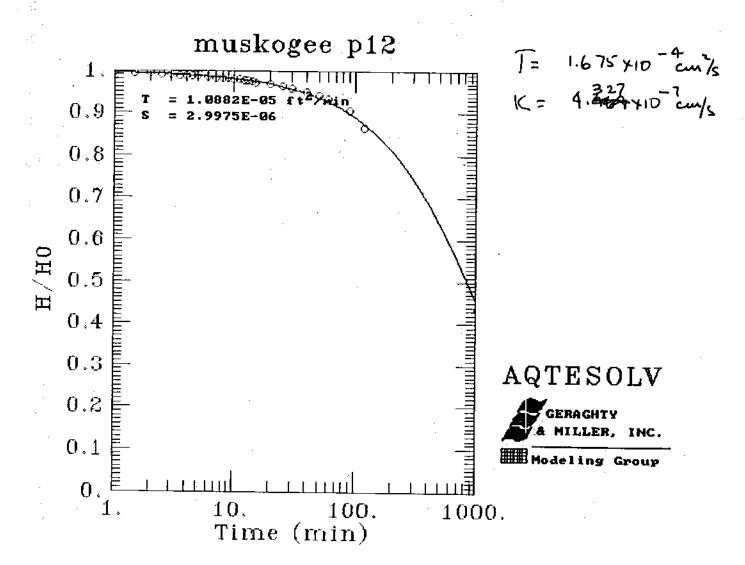
$$K = T/b$$
= 0.00/ cm²/sec x 1/387.10 cm
 $K = \frac{110}{2.50} \times 10^{-6}$ cm/sec

W/ Aglesolve Program

T= 1.082 ×10 5 fle/mnx 12 m) = 0.5+em) = mn/come

T = 1.68 ×10-42 m/20, K= T/6= 4.35 ×10-7 cm/sec





		en e		ar er e e ja
CLIENT WM CLIENT WM	VIRONMENT & RASTRUCTURE	SUBJECT Per Tests	PAGE OF PROJECT NO	Date <u>12/</u> 15/93
		TR36: = 19.3 - 7 A = 12.3 = 374.90 cm		
_	, .	1-h/Ho-h = H/Ho		

Time	H.A.	Time	4.4
0.5	20.50	1.0	15.12
10	25.18	DO	14.82
15	19.60	13.0	14-62
20	19.15	14-0	14.43
2.5	18.54	15.0	14-20
3.0	18.16	200	12.81
3.5	17.90	25.0	11.41
4.0	17.68	30.0	10.33
4.5	17.47	35.0	9.96
3.0	17.26	40.0	8.81
6.0	16.80	50-0	7.91
7.0	16.22	600	7.35
8.0	15.91	70.0	7.02
9.0	15.4	80.0	6.84
100	15.37	100.0	6.66
		120.0	6.58
e ^c		140.0	6.99
A 4.		166.0	6.47
•	•	241.0	6.44
	i e		

 CLIENT ________ SUBJECT ________ Prepared By ______ Date _____

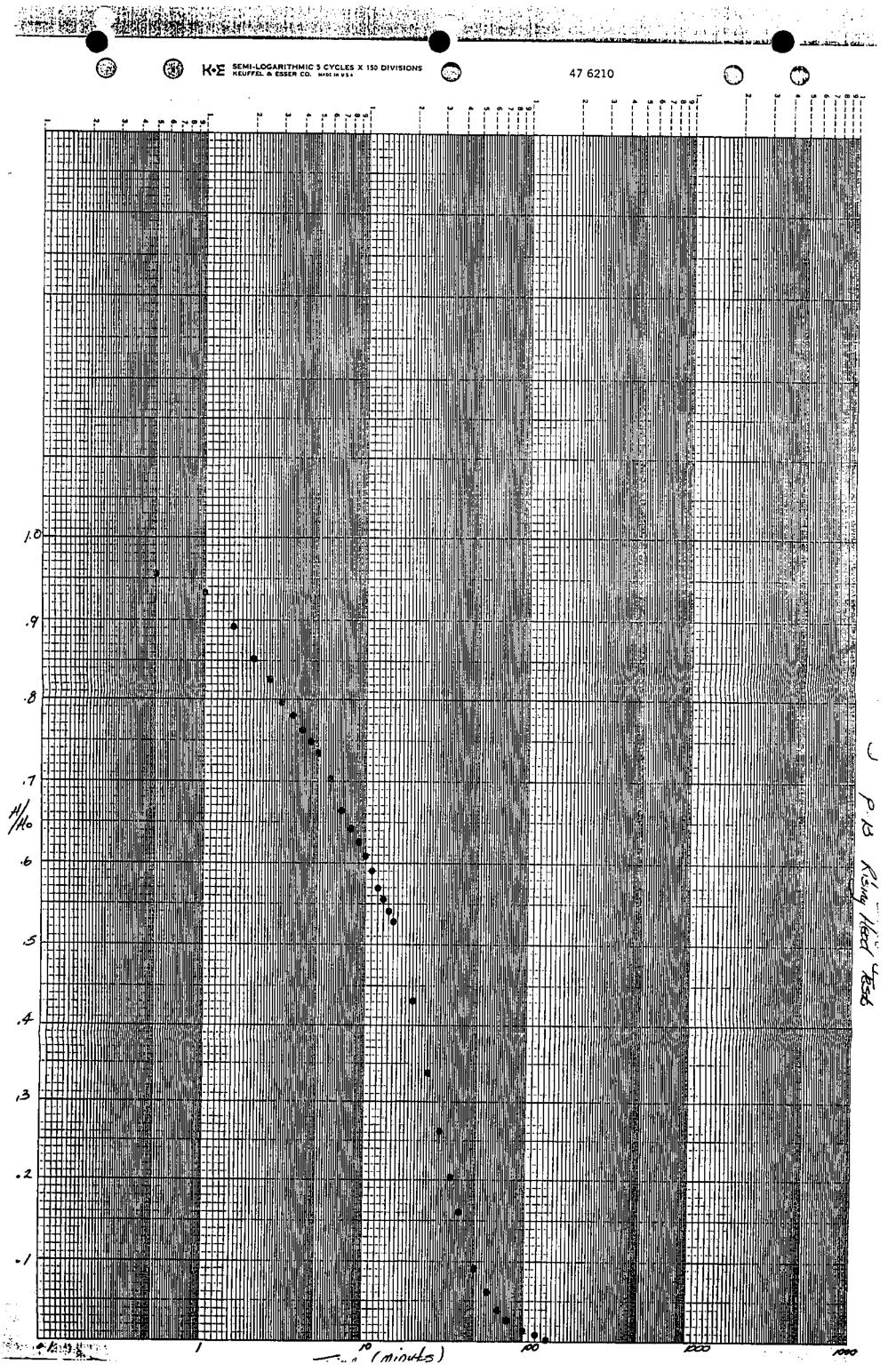
 PROJECT ________ Reviewed By ______ Date ______

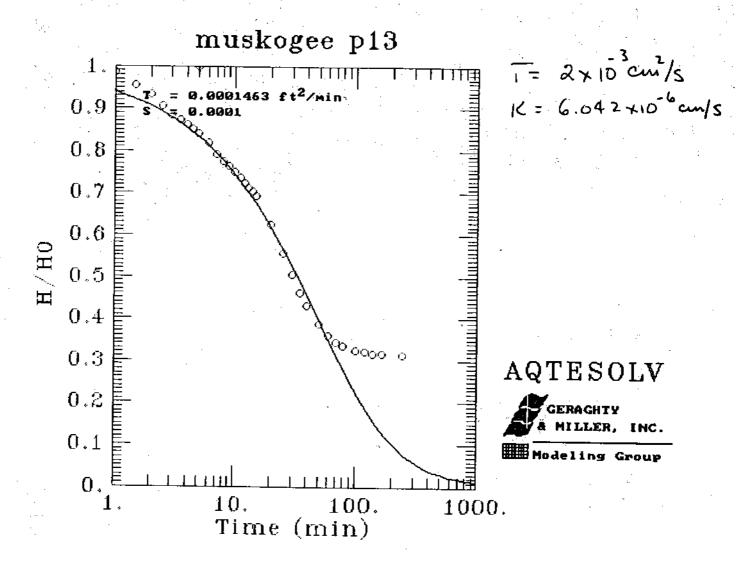
 Approved By ______ Date ______

PB	King Had Test		. •
Time	11/46	Time	4/46
0.5	.956	20.0	. 432
1.0	, 934	250	337
1.5	. 894	30.0	.263
20	. 864	35.0	. 1204 .
25	.826	40.0	.160
3.0	.796	50.0	1099
35	,779	600	,061
40	.764	70.0	1038
4.5	. 749	80.0	,026
5.0	,735	100.0	.014
60	.704	120.0	1008
7.0	. 664	190.0	1002
8.0	.UA3	16.0	,001
90	. 625	241.0	0
10.0	.607		•
11.0	,590		
120	.569		
13.0	1555		
14.0	.543		-
15.0	.527	•	

 $T = \frac{10^{2} f_{a}}{(10)^{2} / 18 min} \times (2.54 cm)^{2} / in^{2} \times \frac{min}{60.5ec}$ $T = \frac{1006 cm^{2}}{5ec}$ $K = \frac{1}{16}$

= .006 em²/sec × $\frac{1}{3749}$ cm $K = 1.59 \times 10^{-5}$ cm/sec



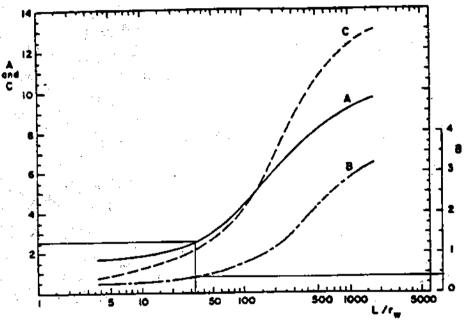


CLIENT		SUBJECT	PROJECT NO Prepared By Pevlewed By Approved By	Date
P	4 Kising He	rad Test - Modified	Bowler & Rice	
In Repu) = [1.1 en (Luy)	+ A+Blm [(h	1-4w)/1w]-1	H= 22. LW= 15.
	- [l. [15.	4 255 + 0.	4 Cm [[22.9-15.64)/, 33.33	<u> </u>
lnk	e/ = 2.55	· · ·		•
Note : vio	le level-for as	recolation of Liv of H	soren on 12/22,	193 = 12.00
		n Tw 2 7/2 + ,3(,3)27/2		
K = 10	2 (Re/12)	1 la 1/2		

 $= \frac{(.17)^{2}(255)}{2(10)} \frac{1}{150} \ln (1.0/1)$ $N = 65 \times 10^{-5} f_{min}^{2} \times 12 \ln f_{2} \times 2.54 em/1 \times min/20sec$ $K = 3.32 \times 10^{-5} em/see$

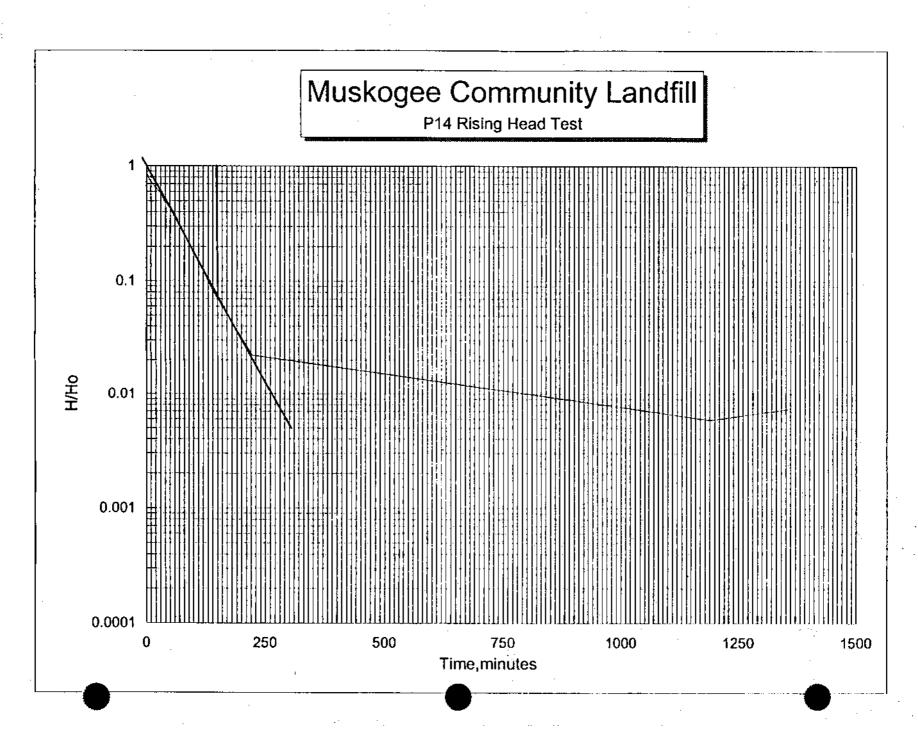
P.14 Rising Head Test

BOUWER AND RICE: GROUNDWATER HYDRAULKS



Curves relating coefficients A. B. and C to L/r.

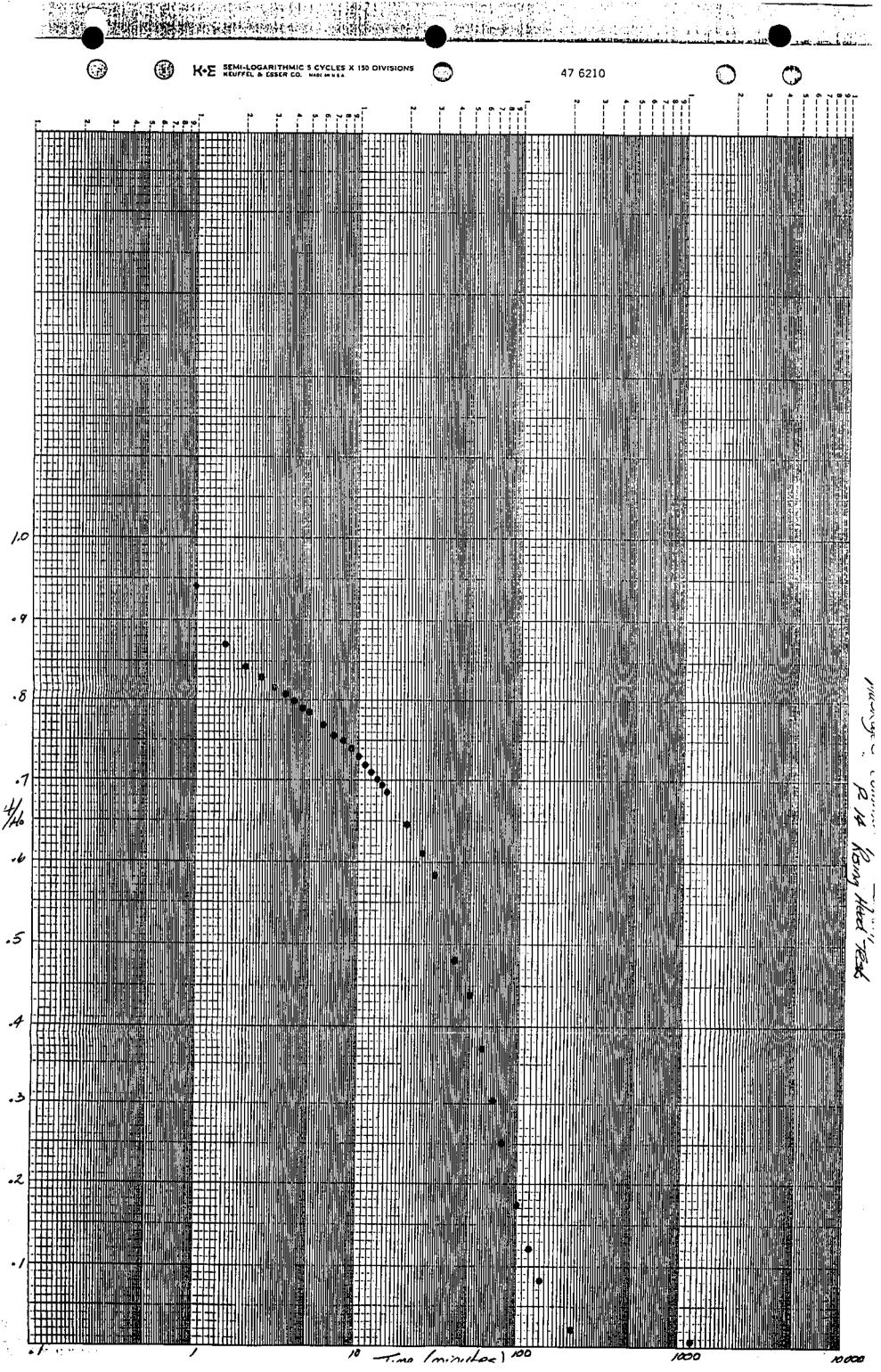
		Community L	andfill	
	P14 Rising	Head Test		
·			<u>-</u>	
Elapsed	H(t),ft	h,ft_	Ho,ft	H(t)-h/Ho-h
Time,min				
. 0	25.5	11.92	25.5	1
1	24.7	11.92	25.5	0.94109
1.5	23.74	11.92	25.5	0.870398
2	23.38	11.92	25.5	0.843888
2.5	23.2	11.92	25.5	0.830633
3	- 23	11.92	25.5	0.815906
3.5	22.86	11.92	25.5	0.805596
4	22.75	11.92	25.5	0.797496
4.5	22.65	. 11.92	25.5	0.790133
5	22.56	11.92	25.5	0.783505
6	22.35	11.92	25.5	0.768041
7	22.17	11.92	25.5	0.754786
8	22.09	11.92	25.5	0.748895
9	21.95	11.92	25.5	0.738586
10	21.83	11.92	25.5	0.72975
11	21.7	11.92	25.5	0.720177
12	21.58	11.92	25.5	0.71134
13	21.46	11.92	25.5	0.702504
14	21.34	11.92	25.5	0.693667
15	21.22	11.92	25.5	0.684831
20	20.69	11.92	25.5	0.645803
25	20.25	11.92	25.5	0.613402
30			25.5	
40	18.48	11.92	25.5	0.483063
50	17.86	11.92	25.5	
60	16.94	11.92	25.5	
20 200 2070	4.5.4.16.05		25.5	
80	15.36	11.92	25.5	0.253314
100	14.3	11.92	25.5	
120	13.59	11.92	25.5	0.122975
140	13.05	11.92	25.5	0.083211
222	12.22	11.92	25.5	0.022091
1191	12	11.92	25.5	0.005891
1355	12.02	11.92	25.5	0.007364



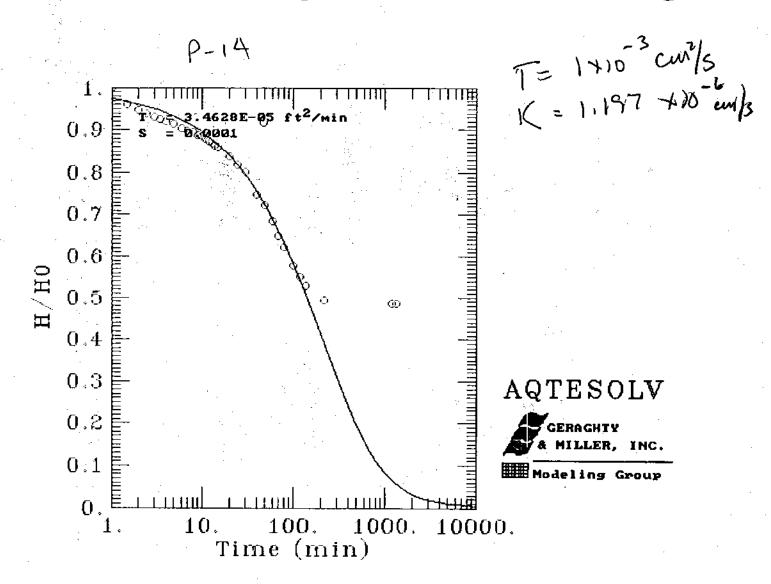
) Pi	ROJECT	NVIRONMENT & NFRASTRUCTURE OMO	_ SUBJECT	Ferm 7	EET	Prepared By Reviewed By Approved By	34 Date <u>D/4</u> 93 Date
		Thickness,		D = J.	4-7-F4 (bi)	lo pack) x D	in/ x 2.54em/
			= 448.0				fe jiii
	.)	radus re = 1 25.5' As por field 11.92'		14/16	<i>.</i> #	h/Ho-h	
	Time	4.16	-	Time	H.fz	· .	
				140	21.34		
,	1.0	24.7		15.0	422		
	1.5	23.14		20.0	20-69		
	ه م	23.38		25.0	20.25		
	2.5	23.20		30.0	19.05		
	3.0	25.0		40.0	18.48		
	35	22.86		50.0	17.86		
	4-0	22.75		60.0	16.94		
	45	22.65		70.0	16.05		
	50	22.56		80.0	1536	•.	
	6.0	22 35	· ·	100.0	1430		
	7.0	22.17		120.0	13.59		
, .	80	22.09		140.0	13.05		
	9.0	21.95		632.0	12.22		
	10.0	21.83	,	1191.0	12.00	٠.	
	11.0	21.70	4	355.0	12.02		
	12-	2150					

...

P-14 1	heing Head Tests	Appro
	4/46	Time H/Ho
		H-0 .694
10	,941	150 1685
1.5	, 876	20.0 ,646
20	844	256/3
25	. 831	30.0 .584
3.0	. 816	40.0 . 483
3.5	. 806	500 .437
4.0	, 191	600 1370
4.5	,190	70.0 ,304
5.0	,184	800 ,253
60	.168	100.0 ,175
70	, 755	120 ,123
80	.749	100 .083
90	, 139	222 0 ,022
10-0	, 130	1191.0 .006
110	.120	B55.0 1017
12.0	.711	
, 0	***	



E-8-242



ENVIRONMENT & INFRASTRUCTURI	ć
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CALCULATION SHEET

PAGE	OF
PROJECT NO	

CLIENT

Prepared By _____ Date

Reviewed By _____ Date

P-15 Kising Head Test - Modified Bowle & Rice

In Re/rw = [1.1 / 20/rw) + A+Blo [(H-Lw)/rw]]-1 H= 25.71 Le/rw] Lw= 18.82

= [1,1 2, (18.52/3) + 2.55+0.40 ln [(23.71-18.82)/.3]

2 Ke/m = 266

r'c = [(1-1)/2 + n/w2]/2 = [(1-13)(.05)=+ 13(.3)=]/2 r'c = .17

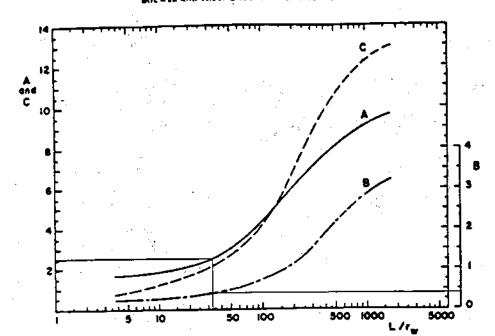
K= 12 la [Re/rw] 1 la 10/1

 $= \frac{(.17)^{2} (2.66)}{2(10)} \frac{1}{20} \frac{1}{10} \frac{1}{100} \frac{1}{1000}$

K= 8.57 40-4 (=/min x 12 m)/2 x 2.5430/10 x min kose

K = 1,20 x10-4 cm/sec

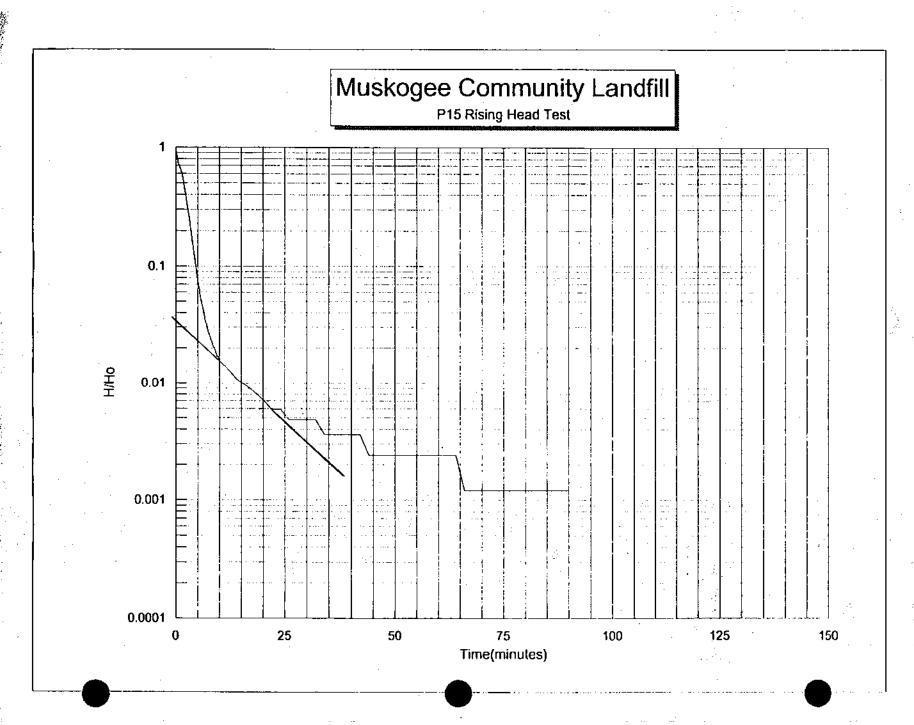
P-15 RISING Hand Test

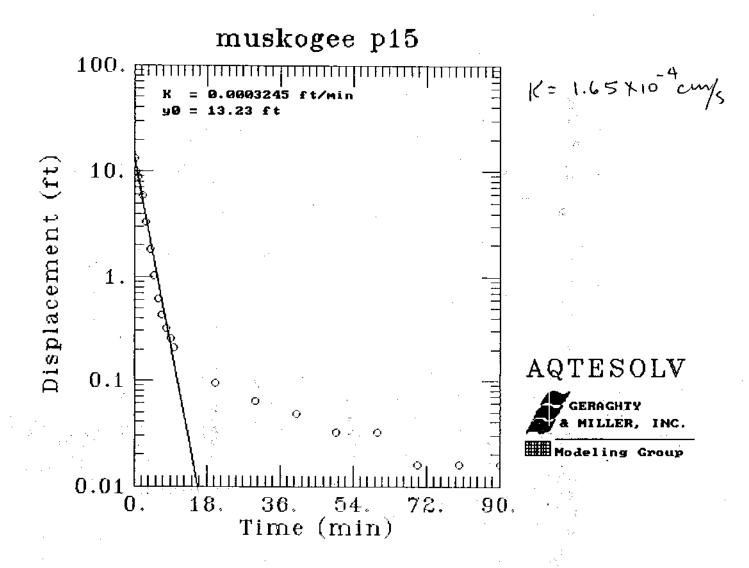


Curves relating coefficients A, B, and C to L/r_{ω} .

								<u> </u>						
							. t.,	: <u>-</u>			1			
				oxdot		Muskages (ommunity L	and it						
				 -		PIS Roun	Head Test		 					
epsed	H(t),ñ	Ho,n	N.ft	H(I)-IVHo-h	Elagsed	Hej.k	Ho.ft	n.h ·	H(t)-NHo-h	Elepsed	Hega	Ho.ft	hit	HUI)-horto-in
me(min)	144,2	1,12,11			Time(min)	14(12)		1.		Time(min)				,
0	5.01	5.01	18.29		0.2566	8,749	5.01	18.20	0.869051		16.456	3.01	18726	0.138102
0.0033	5.041	5.01	18.29	0.997566	0 26	5.764	5.Q1	18.29	0.867922	4.7	16.661	5.01	18.29	0.122666
0.0066	5.057 (5.089 (5.01 5.01		0.996461	0.2633 0.2666				0.865512 0.864307	4.0		5.01		0.108358
0.0133	\$.106 (5.01	18.29	0.992846	0.27	6.828	5.01	18.29	0.863102	4.0	17,136	5.01	18.29	0 086898
0.0168	5,136 5,152	5.01 5.01		0.990512	0.2733 0.2766		5.01 5.01	16.29	0.859563	5.7		5.01 5.01	18.29	0.07741 0.069051
0.0233	5.184	5,01	18.29	0.986898	0.28	6,891	5.01	18.29	0.858358	5.4	17,452	5.01	18.29	0.063102
0.0266	5,199 5,231	\$.01 6.01		0.985768	0.2833 0.2866	8.922 6.938	5,01 5,01		0.856024	5.6 5.6		5.01 5.01		0.055949
0.0335	5.247	-5.01	18.29	0.982154	0.29	8.954	5.01	19.29	0.853614		17.673	5.01	18.29	0.048451
0.0366	5.279 5.294	5.D1 \$.D1		0.979744	0.2933 0.2966		5.01	19.29 19.29	0.85241 0.85	6.2		5.01		0.042846
0.0433	5.326	5.01	16,29	0.976205	· 0.3	7.017	5.01	18.29	0.84887	6.0	17.8	5.01	18.29	0.036898
0.0466	5.342	5.01 5.01	16.29 18.29	0.975	0.3033		5.01 5.01		0.847666 0.845258	6.0		5.01		0.033358
0.0533	5.389	5.01	18.29	0.971461	0.31	7,081	5.01	18.29	0.844051	1.	17.895	5.01	18.29	0.029744
0.0568	5.421 5.437	5.01 5.01	18.29	0.969051 0.967846	0.3133 0.3166		5.01 5.01		0.842922 0.841717	7.4		5.01 5.01	18.29	0.02741
0.0633	5.468	\$.01	18.29	0.965512	0.32	7,144	5.01	18.29	0.839307	7.8	17.958	5.01	18.29	0.025
0.0666	5.484 5.516	5.01 5.01		-0.964307 0.961898	0.3233 0.3266	7.16 7.175	5.01 5.01		0.838102 0.836973	8.3		5.01 5.01	(8.29)	0.023795 0.022666
0.0733	5.531	\$.01	18.29	0.960768	0.33	7.191	5.01	18.29	0.835768	9.4	18.005	5.01	18 29	0 02 1461
0.0766	5.547 5.579	5.01 5.01	18.29	0.959563 0.957154	0.3333	7.223 7.334	5.01 5.01	18 29	0.833358	9.6		5.0t	18 29	0.020256
0.0833	5.611	5.01		0.954744	0.3666	7.4281		18.29	0.817922	9.9		5 O I	18.29	0.019051
0.0866	5.626	5.01		0.953614	0.3833	7.523 7.534	5.01 -\$.01	18.29	0.810768 Q.80241	9.2		5.01 5.01		0.017846
0.0933	5.642 5.674	5,01 \$,01	18.29		0.4166	7.745			0.794051	0.6	16.068	5.01		0.016717
0.0966	5.69 5.721	5.01 5.01		0.948795 0.946461	0.4333	7.839 7.95	5.01 5.01		0.786973	9.8		5.01 5.01		0.016717
0.1033	5.737	5.01		0.945258	0.4666	8.045	5.01		0.778614			5.01		0.015512
0.1066	5.7691 5.7841	5.01 5.01		0.942848	0 4633	8.14 8.234	5 01 5 01		0.764307	14		5.01 5.01		0.010693
0.1133	5.916	5.01	18.29	0.939307	0.5166	8.329	5.01	18.29	0.750075	16	18.179	5.01	18.29	0 008358
0.1166	5.832 5.848	5.01 5.01		0.938102	0.5333	8.424	5.01	18.29	0.742922	20	18.195 18.211	5.01		0.007154
0.1233	5.879	5.01	18.29	0.934563	0.5665	8.567	5.01	18.29	0.732154	24	28.211	5.01		0.005949
0.1266	5.895 5.927	5.01 5.01	18.29	0.933358	0.5853		5,01 5.01	18.29	0.72741	26 28		5.01		0.004819
0.1333	5.942	5.01		0.929819	0.61		5.01	18.29	0.719127	30		5.01 5.01		0.004819
0.1366	5 974 5.99 i	5.01		0.92741	0.6333		5 01		0 716717	32		5.01	18.29	0.004819
0.1433	6.021	5.01	18.29	0.926205	0.6666	6.851		18.29	0.713178 0.710768	34	18.242	5.01		0.003614
0.1466	6.037	\$.01	18.29	0.922666	0.6833	9.883 (9.914 i			0.708358	3.9		5.01		0.003614
0.1533	6.053)	5.01 5.01		0.919051	0.7168	8.946			0.703614	40		5.01		0.003614
0.1566	6.11	5.01		0.917922	0.7333	9.978	5.01		0.701205	44		5.01	18.29	
0,1633	6.116 6.148	5.01 5.01		0.916717	0.75	9.009) 9.041)		18.29 18.29	0.69887	46		\$.01 5.01	16 29	
0,1666	6.164		18.29	0.913102	0 7833	9.072		18 29	0.694127	50	18.258	5.01	18.29	0.00241
0.1733	8.195 i 6.211 i	\$.01 5.01	18.29	0.910768	0.8	9.136	5.D1	18.29	0.689307	\$2 54	18.258	5.01 5.01	18.29	0.00241
0.1766	6.227	5.01	18.29	0.9083581	0 8333	9,167 9,199	5.01	18.29	0.686973	. 56	18.258	5.01	18.29	0.00241
0.18	6 259 l 6.274 j	5.01 5.01		0.9059491	0.85	9 199	5.01	18.29	0.682229	58	18,258	5.01	18.291	
0,1866	6.306	5.01	18.29		0.8833	9.252	5 O1	18.29 (0.679819	62	18,258	5.01	18,291	0.00241
0.1933	6.338	5.01	18.29	0.9	0.9166		5.01	18.29	0.678614 0.676205	64 66	18.274	5.01	18.29	0.00241
0.1966	6.369	5.01	18.29	0.897666	0.9333	9.341	5,011	19.29	0.67387	68	18.274	5.01	18.29	0 001205
0.2033	6 385 i	5.01 5.01		0.8940511			5 0 1 i		0.6714611	70		5.01 i		0.001205
0.2066	ă.4321	* 5.01	18.29	0.892922	5.9833 d	9 42	5 011	18.29	0.667922	74	18 274	5.015	18.29	0.001205
0.21	6.48	5.01 : 5.01 :		0.891717;			5 01 :		0.665512	: <u>76</u>		5.011 5.011		0.001205
0.2166	6.496	5.01	18.29	0.8881021	1.43	10.4	5 01 :	18 29 î	0.594127	80	18 274	5.01	18 29	0.001205
0.2233	6.511 6.543	5.01	18.29	0.886973 0.884563	1.6		5.01;		0.541717	82		5.01) 5.01)		0.001205
0.2266	6 559	5.01	18.29	0.883358;	. 2	12,376	5.01	18.29	0.445331	86	18.2741	5.01	18.29	0.001205
0.2333	6.575	5.01 5.01		0.882154			5.01 l		0.359563	98		5.01 i	18.291 18.291	0.001205
0.2366	6.622	5.01	18 29	D.8786141	. 1 2.6	14,037	5.011	18 29 7	0.320256	. i 92	18.29	5.01 !	18 29	Ō
0.241	6 654	5.011 5.011		0.876205	2.81	14 511	5,01 r 5 01 i	18 29	0.284563	94 96		5.01) 5.01	18 29	0
0.2466	6.685	5.01	18.29	0.87387	. 3.2	15.317	5.01	18.29	0.22387	-98	18.29	5.011	18.29	0
0.25	6.7331	5.01 · 5.01 ·		0.870256	3 4		5.01	18 29 1	0 19887	100		5.01) 5.01)	18.29± 18.29±	0
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19.8. A. 152/1659 28 Signed Pip. A. A. 162/1659 Signed Pip. A. A. A. 162/1659 Signed Pip. A. A. A. 162/1659 Signed Pip. A. A. A. A. A. A. A.																
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Section Sect	Ho,R	h,R	HMHVHo-n			H(O,R	Ho,R	h,ft	H(0-hAHo-h			H(t),ft	Ho,R	h,R	H-OHN-(I)H	
Section Sect				-	And the Country						I MANAGEMENT I					
Section Sect			1								_					1.63
Section 12.0 Cabacol 12.07 Cabacol 12.07 Cabacol 11.07 Cabacol 1										11.526						1.62
Section Sect	5.01	18.29	0.004051	13.201	0.2666	6.512	5.01	18.29	0.864307	11.478		10.993				1.29
Section 1,125 0,1465 0																1.15
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Section 1.2 0.08555 1.050 0.2866 0.286 5.07 1.2.0 0.08419 1.1.32 5.8 17.70 5.07 1.5.0 0.051205 0.07 0	501	18.29	0.966898	13,106	128	6.691	5.01	18.29	0.858358	11.399	5.4	17.452	5.01	18.29	0.083102	0.83
SOI 12.20 CAMPAIL 11.943 0.785 6.864 5.91 11.20 0.85814 11.350 6.871 77.777 5.97 12.20 0.04469 0.21 77.777 5.97 12.20 0.04469 0.21 77.77 5.97 12.20 0.0475 17.20 0.0475 0.21 77.77 5.97 12.20 0.0475 17.20 0.0475 0.21 77.77 5.97 12.20 0.0475 17.20 0.0475 17.20 0.0475 0										11,368						0.74
507 1129 0.007944 1301 1326 0.2033 4897 530 1329 0.05241 1129 63 177967 537 1129 0.003527 6.6 507 1129 0.007969 12296 0.2080 7.007 537 537 1329 0.00241 1129 0.003527 6.6 507 1129 0.00776 12340 0.2080 7.007 537 537 1329 0.00241 1129 0.003527 6.6 507 1129 0.00776 12340 0.2080 7.008 537 1329 0.00252 1122 122 122 122 122 122 122 122 122						6,954										0.61
Sect 16.20 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.00000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.0000000 0.00000000					0.2933	-6.97	5.01	18.29	0.85241	11.32	6.2	17.721	5.01	18.29	0.042846	0.56
Section 1,279 0.0795 12,948 0.2303 7.030 5.01 11.79 0.0474684 11.257 4.8 77.447 5.01 18.79 0.033348 0.037154																0.52
Section 19.20 19				12.948		7.033										0.44
Section 18.29 0.889051 12.969 0.3133 7.566 5.071 18.20 0.82922 11.164 7.4 17.286 3.071 18.20 0.022025 0.02025 0.	5.01		0.972668	12.017		7.065	5.01	10.29	0.845258	11,225	7	17.663	5.01	18.29	0.032154	0.42
Section 18.28 Despite 12.652 Despite 12																0.34
Section Sect	5.01	15.29	0.987846	12.653	0.3166	7.112	5.01	16.29	0.641717	11.175	7.6	17.942	5.01	18.29		0.34
Sol 18-20 DePrint 17-76 DePrint 17-7						7,144		18,29		11.146	7.8	17.958	5.01	18.29	0.025	0.33
Section 18,220 Deb0008 12795 0.333 7.181 3.07 18,29 Deb505 1.000 8.4 16,000 5.01 12.70 0.021451 0.000025 0.0000000000000000000000000000000000																0.31
Soil 18.29 0.867744 12.711 0.35 7.354 3.01 18.28 0.825 10.866 8.8 18.027 5.01 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 18.20 0.0000051 0.501 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.0000051 0.501 0.000051 0.50	5.01	18.29	0.980768	12.750	0.33	7.191	5.01	18.29	0.835766	11,099	8.4	16,005	5.01	16.29	0.021481	0.28
Soil 16.29 0.864744 12.697 0.3866 7.428 5.07 16.29 0.80766 10.747 2.2 16.085 5.07 16.29 0.08076 10.27 0.8056 10.27 0.80574 12.264 0.385 7.523 5.07 16.20 0.80274 10.605 10.605 10.6																0.26
Soi 16.29 0.053914 12.694 0.4 7.554 5.01 16.29 0.07764 10.595 10.29 10.000 1	5.01		0.854744						0.817922							0.25
Soil 16-20 0.986 12-016 0.4168 7.745 Soil 18-20 0.746075 10.451 8.8 18-0696 Soil 18-20 0.01777 C.	5.01	10.29	0.963614	12.664	0.3833	7.523	5.01	18.29	0.810768	10.767	9.2	18.053	5.01	18.29	0.017848	0.2
Section 16.70 OseAPTINE 17,60 O.45331 7,639 501 16.70 O.756073 10.431 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10.04 10.14 10																0.23
Section 18,20 Os444481 12,560 O.45 7,865 Section O.776914 10,345 10 16,044 Section 18,20 Os45612 C.551 O.4508 Section O.776914 10,345 T.3 18,118 Section Section C.501 18,20 O.450814 C.501 T.520 O.776914 O	5.01	18.29	0.948796	12.6	0,4333	7.839										0.22
\$011 18.29 0.942848 12.271 0.4853 0.14 5.01 18.29 0.75407 10.15 14 18.145 5.01 18.29 0.000838 0.1	5.01	18.29		12.569	0.45	7.95	5.01	16.20	0.776814	10.34	10	18,064	5.01	18.29	0.015512	0.20
Soin 19,29 0,947177 12,509 0.55 6.224 S.07 18,29 0,7572729 10,559 16 18,165 S.07 18,29 0,0005635 0.01 0.0005637 0.0005																Q.17 Q.14
\$91 18.29 0.889102 12.448 0.5533 8.444 5.07 18.29 0.742922 9.868 20 18.196 7.000549 0.500549 0.501 18.29 0.005698 12.442 0.500549 0.501 18.29 0.005698 0.501 18.29	5.01	18,29	0.941717	12.508	0.5	8.234	5.01			10.056		18,163				0.12
\$01 18.79 0.838988 12.442 0.55																0.11
SOI 18.29 0.894563 12.411 0.5966 0.597 16.29 0.77241 0.972 24 18.211 5.01 18.29 0.005484 0.5																0.00
Soft 16.29 0.909949 12.963 0.6 6.653 5.01 16.29 0.726969 9.597 26 16.276 5.01 16.29 0.004649 0.0	5.01	18.29	0.934563	12411	0.5666	8.587	5.01	18.29	0.732154	9.723	. 24	18.211	5.01	18.29	0.005949	0,07
Sol 18.29 0.929619 12,346 0.6168 8.74 S.01 18.29 0.716177 9.55 30 18.226 S.01 18.29 0.0064619 0.05051 18.29 0.0064619 0.05051 18.29 0.0064619 0.05051 18.29 0.0064619 0.05051 18.29 0.006461 0.05051 18.29 0.006461 0.05051 18.29 0.00661 0.05051 18.29 0.00661 0.05051 18.29 0.00661 0.05051 0.00661 0.05051 0.00661 0.05051 0.00661 0.05051 0.00661 0.05051 0.00661 0.05051 0.00661																0.06
Section 18,29 0.99744 12,316 0.6333 8.772 5.01 18,29 0.713178 9.471 34 18,242 5.01 18,29 0.000469 4.00 5.01 18,29 0.0025705 12,20 0.6969 8.851 5.01 18,29 0.713178 9.471 34 18,242 5.01 18,29 0.0003614 0.00 5.01 18,29 0.002686 12,253 0.6633 8.863 5.01 18,29 0.706358 9.439 36 18,242 5.01 18,29 0.0003614 0.00 5.01 18,29 0.002686 12,253 0.6633 8.863 5.01 18,29 0.706358 9.407 38 18,242 5.01 18,29 0.0003614 0.00 5.01 18,29 0.002616 12,205 0.7166 8.944 5.01 18,29 0.002614 0.20 0																0.08
Soli 16.29 0.02267 12.269 0.0666 8.851 Soli 18.26 0.710768 9.459 36 16.242 Soli 18.29 0.003614 0.0			0.92741	12316	0.6333	8.772	5.01	18.29	0.716717	9.518	32	18.226	5.01	18.29	0.004819	0.08
\$01 16.29 0.922686 12.253 0.6833 8.863 5.01 18.29 0.708356 9.407 38 18.242 5.01 18.29 0.003614 0.0 \$01 18.29 0.932461 12.227 0.7 8.914 5.01 18.29 0.708356 9.407 38 18.242 5.01 18.29 0.003614 0.0 \$0.1 18.29 0.918051 12.205 0.7166 8.948 5.01 18.29 0.703614 9.334 42 18.242 5.01 18.29 0.003614 0.0 \$0.1 18.29 0.918051 12.205 0.7166 8.948 5.01 18.29 0.703614 9.334 42 18.242 5.01 18.28 0.003614 0.0 \$0.1 18.29 0.918051 12.205 0.7166 8.948 5.01 18.29 0.703614 9.334 42 18.242 5.01 18.28 0.003614 0.0 \$0.1 18.29 0.918717 12.774 0.75 9.008 5.01 18.29 0.703614 9.334 42 18.242 5.01 18.28 0.003614 0.0 \$0.1 18.29 0.918717 12.774 0.75 9.008 5.01 18.29 0.68887 9.211 46 18.258 5.01 18.28 0.003614 0.0 \$0.1 18.29 0.918717 12.774 0.75 9.008 5.01 18.29 0.68887 9.211 46 18.258 5.01 18.28 0.003614 0.0 \$0.1 18.29 0.918717 12.774 0.75 9.008 5.01 18.29 0.68847 9.211 46 18.258 5.01 18.28 0.003614 0.0 \$0.1 18.29 0.918761 12.2085 0.8 9.004 5.01 18.29 0.68847 9.249 48 18.258 5.01 18.28 0.003614 0.0 \$0.1 18.29 0.918761 12.2085 0.8 9.104 5.01 18.29 0.68847 9.249 48 18.258 5.01 18.28 0.003614 0.0 \$0.1 18.29 0.908503 12.079 0.8186 9.738 5.01 18.29 0.888307 9.154 54 18.258 5.01 18.28 0.003614 0.0 \$0.1 18.29 0.908503 12.079 0.8186 9.738 5.01 18.29 0.888307 9.154 54 18.258 5.01 18.28 0.00361 0.0 \$0.1 18.29 0.908503 12.079 0.8186 9.738 5.01 18.29 0.888307 9.154 54 18.258 5.01 18.28 0.00361 0.0 \$0.1 18.29 0.808499 12.031 0.855 9.169 5.01 18.29 0.888307 9.154 54 18.258 5.01 18.28 0.00361 0.0 \$0.1 18.29 0.808499 12.031 0.855 9.169 5.01 18.29 0.888307 9.133 54 18.258 5.01 18.28 0.00361 0.0 \$0.1 18.29 0.808499 12.031 0.855 9.169 5.01 18.29 0.888307 9.133 54 18.258 5.01 18.28 0.00361 0.0 \$0.1 18.29 0.808499 12.031 0.855 9.169 5.01 18.29 0.888307 9.134 54 18.258 5.01 18.28 0.00361 0.0 \$0.1 18.29 0.808499 12.031 0.855 9.169 5.00 18.29 0.888307 9.134 54 18.258 5.01 18.28 0.00361 0.0 \$0.1 18.29 0.808499 12.031 0.855 9.159 5.00 18.29 0.888307 9.134 54 18.258 5.01 18.28 0.00361 0.0 \$0.1 18.29 0.808499 12.031 0.885 9.325 5.01 18.29 0.888307 9.134 5.01 18.29 0.0036											34					0.04
Sol 16.29 0.91905f 12.205 0.7166 8.944 Sol 16.29 0.703614 9.344 42 18.242 Sol 16.28 0.003614 50.5 50.1 16.29 0.91677 12.174 0.753 8.976 Sol 16.29 0.703614 9.344 42 18.242 Sol 16.28 0.003614 50.5 50.1 16.29 0.91677 12.174 0.753 9.909 Sol 16.29 0.68687 9.241 44 18.255 Sol 18.29 0.00341 50.5 50.1 50.20 50.5 5	5.01															0.04
Soli	5.01															0.04
Soli 16,29 0.916717 12,174 0.75 9.008 5.01 18,29 0.69887 9.281 48 18,258 5.01 18,29 0.00241 0.00																0.03
Sol	5.01	16.29	0.916717	12,174	0.75	9.009	5.01	18.29	0.69887	9.281	48	18.258	5.01	18.29	0.00241	0.03
Sol																0.03
SOI																0.03
Soli	_ 5.01	18.29	0.909563	12,079	0.8166	9.136	5.01	18.29	0.689307	9.154	54	18.258	5.01	16.29	0.00241	0.03
S.01																0.03
5.01 18.29 0.90241 11.984 0.8833 9.282 S.01 18.29 0.679819 9.028 62 18.258 5.01 18.29 0.00241																0.03
5.01 16.29 0.9 11.952 0.9180 9.31 5.01 18.29 0.878205 8.98 66 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.89686 11.921 0.8333 9.341 5.01 18.29 0.87367 8.949 68 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.896461 11.905 0.95 9.373 5.01 18.29 0.87367 8.949 68 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.896401 11.905 0.95 9.373 5.01 18.29 0.87367 70 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.896401 11.873 0.9868 9.389 5.01 18.29 0.670256 8.901 72 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.892922 11.858 0.9833 9.42 3.01 18.29 0.670256 8.901 72 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.891717 11.842 1 9.452 5.01 18.29 0.687622 8.877 74 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.893907 11.81 1.2 9.815 5.01 18.29 0.685612 8.385 76 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.888102 11.794 1.4 10.4 5.01 18.29 0.684812 77 789 80 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.888102 11.794 1.4 10.4 5.01 18.29 0.584177 7.194 82 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.888531 11.779 1.8 11.094 5.01 18.29 0.54177 7.194 82 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.888531 11.779 1.8 11.098 5.01 18.29 0.54177 7.194 82 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.88358 11.731 1.8 1.178 5.01 18.29 0.451717 7.194 82 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.88358 11.731 2 12.378 5.01 18.29 0.45331 5.914 88 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.88358 11.731 2 12.378 5.01 18.29 0.45331 5.914 88 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.878614 11.984 2.4 13.515 5.01 18.29 0.45331 5.914 88 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.878614 11.984 2.4 13.515 5.01 18.29 0.45253 3.779 9.4 18.29 5.01 18.29 0.001205 0.0 5.01 18.29 0.878614 11.588 2.8 14.511 5.01 18.29 0.328623 4775 9.0 18.29 5.01 18.29 0.001205 0.0 5.01 18.29 0.878614 11.588 2.8 14.511 5.01 18.29 0.328623 4775 9.0 18.29 5.01 18.29 0.001205 0.0 5.01 18.29 0.87387 11.505 3.2 15.317 5.01 18.29 0.328623 2.79 9.4 18.29 5.01 18.29 0.001205 0.0 5.01 18.29 0.87387 11.505 3.4 15.540 5.01 18.29 0.328624 2.772 14.0 18.29 5.01 18.29 0.001205 0.0	5.01	18.29	0.902411	11,984	0.8833 (9,262	5.01	18.29	0.679819	9.028	62	18.258	5.01	18.29	0.00241	0.03
S.01 18.29 0.897696 11.921 0.8333 9.341 S.01 18.29 0.67387 8.949 68 18.274 S.01 18.29 0.001205 0.001																0.03
\$01	5,01	18.29	0.897666	11.921	0.8333	9.341	5.01	18.29	0.67367	8.949		18.274		18.29	0.001205	0.01
Soli 18.29 0.892922 11.858 0.9833 9.42 Soli 18.29 0.697922 8.87 74 16.274 Soli 18.29 0.001205 0.0								15.29	0.671461	8,917	701	18,2741	5.01	18.29	0.001205	0.01
5.01 18.79 0.691717 11.842 1 9.452 5.01 18.29 0.68512 8.88 76 18.274 5.01 18.29 0.001205 Q.0 5.01 16.29 0.888307 11.81 1.2 9.615 5.01 18.29 0.638176 6.475 76 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.884307 11.794 1.4 10.4 5.01 18.29 0.584177 7.89 80 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.8843073 11.779 1.8 11.098 5.01 18.29 0.541717 7.194 82 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.884563 11.747 1.8 11.78 5.01 18.29 0.491717 6.53 84 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.8843568 11.715																0.01
Soli	5.01	18.29	0.691717	11.842	1	9.452	5.01	18.29	0.665512	0.838	76	18.274	5.01	18.29	0.001205	0.01
5.01 18,29 0.886973 11.779 1.8 11.098 5.01 18,29 0.541717 7.194 92 18,274 5.01 18,29 0.001205 0.0 5.01 18,29 0.684563 11.747 1.8 11.781 5.01 18,29 0.491717 6.53 84 18,274 5.01 18.29 0.001205 0.0 5.01 18,29 0.883358 11,731 2 12,378 5.01 18,29 0.443331 5.91 88 18,274 5.01 18,29 0.001205 0.0 5.01 18,29 0.882154 11,715 2.2 12,961 5.01 18,29 0.40128 5.329 88 18,274 5.01 18,29 0.001205 0.0 5.01 18,29 0.873819 11,584 2.4 13,515 5.01 18,29 0.3359563 4,775 90 18,274 5.01 18,29 0.001205 0.0 5.01 18,29 0.873811 11,584								18.29]	0.638176							0.01
5.01 18.29 0.884563 11.747 1.8 11.76 5.01 18.29 0.491717 6.53 84 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.883358 11.731 2 12.376 5.01 18.29 0.445331 5.914 86 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.882154 11.715 22 12.961 5.01 18.29 0.445231 5.914 86 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.879819 11.884 2.4 13.515 5.01 18.29 0.40128 5.329 88 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.878614 11.886 2.6 14.037 5.01 18.29 0.30256 4.755 90 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.878614 11.886 2.6 14.037 5.01 18.29 0.30256 4.753 92 18.29 5.01 18.29 0.001205 0.0 5.01 18.29 0.876205 11.636 2.8 14.511 5.01 18.29 0.30256 4.753 92 18.29 5.01 18.29 0.001205 0.0 5.01 18.29 0.876205 11.636 2.8 14.511 5.01 18.29 0.24563 3.779 94 18.29 5.01 18.29 0 5.01 18.29 0.87387 11.605 3.1 14.838 5.01 18.29 0.25241 3.352 96 18.29 5.01 18.29 0 5.01 18.29 0.873887 11.505 3.2 15.317 5.01 18.29 0.22567 2.973 96 18.29 5.01 18.29 0 5.01 18.29 0.870268 11.588 3.4 15.849 5.01 18.29 0.2567 2.973 96 18.29 5.01 18.29 0 5.01 18.29 0.870268 11.589 3.4 15.849 5.01 18.29 0.2567 2.841 100 18.29 5.01 18.29 0 5.01 18.29 0.870258 11.589 3.4 15.849 5.01 18.29 0.156024 2.02 14.0 18.29 5.01 18.29 0																0.01
Soli	5.01	18.29	0.884563	11.747	1.8	11.76	5.01	18.29 (0.491717	6.53	84	18,274	5.01	18.29	0.001205	0.01
5.01 18.29 0.878919 11.884 2.4 13.515 5.01 18.29 0.358963 4.775 90 18.274 5.01 18.29 0.001205 0.0 5.01 18.29 0.878614 11.886 2.6 14.037 5.01 18.29 0.320284 4.253 92 18.29 5.01 18.29 0.0 18.29 0.201284 11.886 2.8 14.511 5.01 18.29 0.320284 4.253 92 18.29 5.01 18.29 0 0 18.29 18.29 5.01 18.29 0 0 18.29 18.29 5.01 18.29 0 0 18.29 18.29 5.01 18.29 0 0 18.29 18.29 5.01 18.29 0 0 18.29 1																0.01
5.01 18.29 0.878614 11.568 2.6 14.037 5.01 18.29 0.320258 4.253 92 18.29 5.01 18.29 0.079205 11.636 2.8 14.511 5.01 18.29 0.294563 3.779 94 18.29 5.01 18.29 0 5.01 18.29 0.87551 11.621 3 14.938 5.01 18.29 0.294563 3.779 94 18.29 5.01 18.29 0 5.01 18.29 0.87387 11.602 3 14.9388 5.01 18.29 0.25241 3.352 96 18.29 5.01 18.29 0 5.01 18.29 0.87387 11.505 3.21 15.317 5.01 18.29 0.22337 2.973 96 18.29 5.01 18.29 0 5.01 18.29 0.872688 11.589 3.4 15.849 5.01 18.29 0.19887 2.641 100 18.29 5.01 18.29																0.01
5.01 16.29 0.875 11.621 3 14.839 5.01 18.29 0.25241 3.352 96 18.29 5.01 18.29 0.07387 11.5051 3.2 15.3171 5.01 18.29 0.22587 2.973 96 18.29 5.01 18.29 0.0 5.01 16.29 0.872688 11.5849 3.4 15.849 5.01 18.29 0.9887 2.841 100 18.29 5.01 18.29 0 5.01 18.29 0.870258 11.557 3.6 15.95 5.01 18.29 0.178205 2.34 120 18.29 5.01 18.29 0 5.01 18.29 3.8 15.218 5.01 18.29 0.158024 2.072 140 18.29 5.01 18.29 0	5.01	18.29	0.878614	11.868	2.6	14.037	5.01	18.29	0.320258	4.253	92	18.29	5.01	18.29	0	
5.01 18.29 0.87387 11.505 3.2 15.3171 5.01 18.29 0.22387 2.973 98 18.29 5.01 18.29 0.0 5.01 18.29 0.872668 11.589 3.4 15.848 5.01 18.29 0.19887 2.841 100 18.29 5.01 18.29 0 5.01 18.29 0.870250 11.557 3.6 15.95 5.01 18.29 0.176205 2.34 120 18.29 5.01 18.29 0 3.81 18.218 5.01 18.29 0.156024 2.072 140 18.29 5.01 18.29 0																
5.01 18.29 0.872668 11.589 3.4 15.849 5.01 18.29 0.19867 2.641 100 18.29 5.01 18.29 0 5.01 18.29 0.176205 2.34 120 18.29 5.01 18.29 0 5																
3.8) 18.2181 5.01 18.29 0.156024 2.072 140 18.28 5.01 18.29 0	5.01	16.29	0.872668	11.589	3.4	15.649	5.01	18.29	0.19867	2641	100	18.29	5.01	18.29	-01	
	5.011		0.870258	11.557												
	· •															





APPENDIX H CONTINUOUS GROUND-WATER MONITORING DATA MW02R AND MW03R

Muskogee Community Landfill 2801 S. 54th Street W. Muskogee, Oklahoma 74401 (918) 632-7284 (918) 682-2867 fax



December 23, 1993

Mr. James Warram
Solid Waste Management Service
Department of Environmental Quality
1000 NE Tenth Street
Oklahoma City, OK 73117-1212

SUBJECT:

Groundwater Elevation Data Muskogee Community Landfill

Permit No. 3551020 Muskogee, Oklahoma

Dear Mr. Warram:

On behalf of Waste Management of Oklahoma, Inc., I am the forwarding the groundwater elevation data from monitor wells MW01R and MW02R for the month of November 1993; these wells are equipped with water level recorders. If you have questions or require additional information, please call me at (405)427-6030 or Dan Gibson at (918)437-7773.

Sincerely,

WASTE MANAGEMENT OF OKLAHOMA, INC.

Mark Daniels, P.E.

Environmental Engineer

Enclosure

cc:

Dan Gibson Mike McCloud Raymond DeBose Fenton Rood, DEQ

Carey Bell, Muskogee County DEQ

(FILE: GROUNDWATER ELEVATION DATA)

(MUSK\GWEL1193.RPT)

Groundwater Elevations During November 1993

From Continuous Recorders in MW01R and MW02R

	MW01R	MW02R	
Date	Elevation	Elevation	Comments
11/01/93	621.8	628.7	
11/02/93	621.8	628.6	
11/03/93	621.7	628.5	Data collector removed on
11/04/93			11-03-93 for downloading
11/05/93	621.7	628.6	Re-installed on 11-05-93
11/06/93	621.6	628.5	·
11/07/93	621.6	628.4	Groundwater sampling event on
11/08/93		628.5	11-09-93; recorded elevations were:
11/09/93	621.3	628.3	MW01R = 621.34, MW02R = 628.64
11/10/93		628.3	
11/11/93	621.3	628.4	
11/12/93	621.5	628.6	
11/13/93	621.5	628.5	
11/14/93	621.6	628.4	
11/15/93	621.5	628.4	
11/16/93	621.5	628.3	
11/17/93	621.5	628.3	
11/18/93	621.6	628.4	
11/19/93	621.7	628.4.	
11/20/93	621.5	628.2	
11/21/93	621.6	628.2	
11/22/93	621.7	628.2	
11/23/93	621.7	628.4	
11/24/93	621.7	628.4	
11/25/93	621.5	628.2	
11/26/93	621.4	628.1	
11/27/93	621.5	628.2	
11/28/93	621.5	628.2	
11/29/93	621.4	628.2	
11/30/93	621.3	628.2	
Minimum	621.2	628.1	Summary of Data
Average	621.54	628.32	November 1993
Maximum	621.8	628.6	

Note: The daily groundwater elevation data reported is the highest value of 96 data points; data was recorded every 15 minutes.

Printed on: 12/23/93 (123\MUSK\GWNOV93.WK1)

Muskogee Community Landfill 2801 S. 54th Street W. Muskogee, Oklahoma 74401 (918) 682-7284 '918) 682-2867 fax



December 13, 1993

Mr. James Warram Solid Waste Management Service Department of Environmental Quality 1000 NE Tenth Street Oklahoma City, OK 73117-1212

SUBJECT:

Groundwater Elevation Data Muskogee Community Landfill

Permit No. 3551020 Muskogee, Oklahoma

Dear Mr. Warram:

On behalf of Waste Management of Oklahoma, Inc., I am forwarding monthly groundwater elevation data for the monitor wells (MW) equipped with water level recorders. The data is collected from MW01R and MW02R as required by permit condition 2 of Attachment "C". For this report, data collection began 06-15-93 for MW01R and 07-08-93 for MW02R and continued through 10-31-93. Future submittals will be completed on a monthly basis.

If you have questions or require additional information, please call me at (405)427-6030 or Dan Gibson at (918)437-7773.

Sincerely,

WASTE MANAGEMENT OF OKLAHOMA, INC.

Mark Daniels, P.E.

Environmental Engineer

Enclosure

cc:

Dan Gibson Mike McCloud

Raymond DeBose Fenton Rood, DEQ

Carey Bell, Muskogee County DEQ

(FILE: GROUNDWATER ELEVATION DATA)

(MUSK/GWEL1093.RPT)

Groundwater Elevations During June 1993

From Continuous Recorders in MW01R and MW02R

i	MW01R	MW02R	
Date	Elevation	Elevation	Comments
06/01/93	·		Recorders not installed
06/02/93		· · · · · · · · · · · · · · · · · · ·	
06/03/93			
06/04/93	į į		
06/05/93	ļ		
06/06/93	.		
06/07/93	ļ		i
06/08/93			•
06/09/93			
06/10/93	ì		
06/11/93	ļ		
06/12/93	!	·	i ·
06/13/93			
06/14/93			· !
06/15/93	624.7	· 	Recorder installed in MW01R
06/16/93	624.7	·	
06/17/93		_	
06/18/93	624.7		
-06/19/93	624.7		
06/20/93	624.8	_	<u> </u>
06/21/93	624.8		
06/22/93	624.9		
06/23/93	624.9	<u></u>	
06/24/93	624.9		<u></u>
06/25/93	624.8		
06/26/93			
06/27/93	624.8		
06/28/93	624.9		
06/29/93	624.9		
06/30/93	624.81	· · ·	
Minimum	624.71	NoData	Summary of Data
Average	624.80	NoData	June 1993
<u>Maximum</u>	624.9	NoData I	

Note: The daily groundwater elevation data reported is the highest value of 96 data points; data was recorded every 15 minutes.

Printed on: 12/13/93 (123\MUSK\GWJUNE93.WK1)

Groundwater Elevations During July 1993

From Continuous Recorders in MW01R and MW02R

	MW01R	MW02R	
Date	Elevation	Elevation	Comments
07/01/93	624.8		Recorder not installed in MW02R
07/02/93	624.8		
07/03/93			
07/04/93	624.8		
07/05/93	624.8		
07/06/93	624.8		
07/07/93	624.5	_	
07/08/93	624.4	627.8	Recorder installed in MW02R
07/09/931	624.3	627.8	
07/10/93	624.1	627.7	
07/11/93		627.7	
07/12/93	623.9	627.7	
07/13/93	623.81	627.8	
07/14/93	623.7	627.8	
07/15/93	623.6	627.6	
07/16/93	623.5	627.6	
07/17/93	623.2	627.6	
07/18/93	623.0	627.6	:of
07/19/93	623.1	627.5	
07/20/93	623.2	627.5	
07/21/93	623.41	627.6	
07/22/93	623.4	627.5	
07/23/93	623.5	627.5	
07/24/93	623.3	627.6	
07/25/93	623.3	627.5	
07/26/93	623.3	627.5	
07/27/93	623.3	627.5	
07/28/93	623.3	627.5	
07/29/93	623.3	627.4	
07/30/93	623.4	627.4	
07/31/93	623.4	627.4	:.
Minimum	623.0	627.4	Summary of Data
Average	623.81	627.59	July 1993
Maximum	624.8	627.8	

Note: The daily groundwater elevation data reported is the highest value of 96 data points; data was recorded every 15 minutes.

Printed on: 12/13/93 (123\MUSK\GWJULY93.WK1)

Groundwater Elevations During August 1993

From Continuous Recorders in MW01R and MW02R

· ·	MW01R	MW02R	
Date	Elevation	Elevation	Comments
08/01/93	623.5	627.4	
08/02793	623.5	627.4	
08/03/93	623.5	627.4	
08/04/93	623.4	627.4	
08/05/93	623.6	627.5	
08/06/93	623.6	627.5	
08/07/93	623.6	627.4	
08/08/93	623.6	627.4	
08/09/93	623.5	627.4	
08/10/93	623.6	627.4	
08/11/93	623.6	627.6	
08/12/93	623.6	627.6	·
08/13/93	623.6	627.6	
08/14/93	623.6	627.6	
08/15/93	623.6	627.6	Groundwater sampling event on
08/16/93	623.6	627.6	08-17-93; recorded elevations were:
08/17/93	623.7	627.6	MW01R = 623.75, $MW02R = 627.63$
08/18/93	623.7	627.8	
08/19/93	623.6	627.8	
08/20/93	623.4	627.8	
08/21/93	623.1	627.9	
08/22/93	623.1	627.9	
08/23/93	623.1	627.9	
08/24/93	622.8	627.9	
08/25/93		627.9	
08/26/93			
08/27/93	622.7	628.0	
08/28/93	622.7	628.0	
08/29/93	622.4	628.1	
08/30/93	622.5	628.1	
08/31/93	•	628.1	
Minimum	622.4	627.4	Summary of Data
Average	623.28		August 1993
Maximum	623.7	628.1	

Note: The daily groundwater elevation data reported is the highest value of 96 data points; data was recorded every 15 minutes.

Printed on: 12/13/93 (123\MUSK\GWAUG93.WK1)

Groundwater Elevations During September 1993

From Continuous Recorders in MW01R and MW02R

	MW01R	MW02R	
Date	Elevation	Elevation	Comments
09/01/93	622.51	628.0	
09/02793	622.5	628.0	
09/03/93	622.5	628.0	
09/04/93	622.5	627.9	
09/05/93	622.5 i	627.9	·
09/06/93	622.5 i	627.9	
09/07/93	622.4	627.8	
09/08/93	622.5	627.9	
09/09/93	622.5	627.9	
09/10/93	622.5	627.9	7
09/11/93	622.5 i	627.9	
09/12/93	622.5 i	628.1	
09/13/93	622.9	628.3	
09/14/93	623.1	628.3	
09/15/93		627.91	
09/16/93	622.7	628.0	
09/17/93	622.6	628.0	
09/18/93	622.6	628.2	
09/19/93	622.7	628.2	
09/20/93	622.7	628.2	
09/21/93	622.6	628.1	
09/22/93			
09/23/93		628.1	
09/24/93		628.3	
09/25/93		628.3	
09/26/93		628.3	
09/27/93		628.2	
09/28/93	622.7	628.3	<u></u>
09/29/93	 -	628.3	
09/30/93		628.5	
Minimum :	622.4		
Average	622.61	628.10	September 1993
Maximum	623.1	628.5	

Note: The daily groundwater elevation data reported is the highest value of 96 data points; data was recorded every 15 minutes.

Printed on: 12/13/93 (123\MUSK\GWSEPT93.WK1)

Groundwater Elevations During October 1993

From Continuous Recorders in MW01R and MW02R

	MW01R	MW02R	
Date	Elevation	Elevation	Comments
10/01/93	622.5	628.7	
10/02/93	622.5	628.7	
10/03/93	622.3	628.5	
10/04/93	622.3	628.6	
10/05/93	622.2	628.7	
10/06/93	622.1	628.6	
10/07/93	622.2	628.7	<u>.</u> .
10/08/93	622.3	628.8	
10/09/93	622.2	628.7	
10/10/93	622.1	628.6	
10/11/93	622.1	628.7	
10/12/93	622.1	628.6	· .
10/13/93	622.1	628.7	
10/14/93	622.0	628.7	
10/15/93	622.1	628.7	1
10/16/93	622.3	628.8	
10/17/93	622.3	628.8	
10/18/93	622.3	628.8	7
10/19/93	622.3	628.8	
10/20/93	622.3	628.7	
10/21/93	622.1	628.6	
10/22/93	622.0	628.6	
10/23/93	622.1	628.6	
10/24/93	622.1	628.6	
10/25/93	622.2	628.8	
10/26/93	622.2	628.7	
10/27/93	622.1	628.7	<u> </u>
10/28/93	622.3	628.8	
10/29/93	622.3	628.8	
10/30/93	621.9	628.6	
10/31/93	621.8	628.5	
Minimum	621.8	628.5	Summary of Data
Average	622.18	628.68	October 1993
Maximum	622.5	628.8	

Note: The daily groundwater elevation data reported is the highest value of 96 data points; data was recorded every 15 minutes.

Printed on: 12/13/93 (123\MUSK\GWOCT93.WK1)

APPENDIX I ANALYTICAL GROUND-WATER DATA

Muskogee\86251dp2.3rd



6825 East 38th Street Tulsa, Oklahoma 74145 (918) 664-7767

MLTS 83-3576

October 21, 1983

M.R. McComas & Associates Inc. 1808 So. Main Broken Arrow, Ok 74012

Attn: Mr. Marty Smitz Schmicht

Dear Mr. Smitz.

In accordance with your instructions chemical analysis was performed on five (5) water samples submitted on October 14, 1983.

All testing was performed in accordance with EPA analytical guidelines. The results of the chemical analysis are summarized in Table I.

If you have any questions regarding this report please contact Mr. Dan Lawson or myself.

Sincerely,

HETLAB TESTING SERVICES, INC.

Tony Mummolo

Analytical Chemist

TCM/sc





MLTS 83-3576

Summary of Chemical Analysis of Five (5) Muskogee Water Samples
Tested for M.R. McComas and Associates, Inc.

Constituents	<u>Units</u>	MW-1	<u>HW-2</u>	<u>HW-3</u>	Abd. Well	Cody <u>Creek</u>	
As	mg/l	.002	< .001	.001	<.001	<.001	
Ba :	mg/l	<.30	<.30	<.30	65.4	۷.30	
Cd	mg/l	< .006	4.006	<.006	<.006	∠.006	
Cr	mg/l	< .05	4.05	<.05 [°]	4.05	4.05	
Pb	mg/l	∠.05	4.05.	<.05	<.05	∠ .05	
Нд	mg/l	0.0001	0.0004	< 0.0001	<0.0001	Z0.000i	
Nitrate Nitrogen	mg/1	5.6	9.1	1.0	48.	0.41	
Se	mg/l	0.010	<.001	<.001	< .001	<.001	
Total Dissolved Solids	mg/l	2449	9487	1120	45450	560	
рН	STD	7.60	7.18	7.50	7.41	7.16	
Chloride	mg/l	204	3693	119	24420	389.0	
Sulfate	mg/l	1600	102	51.0	16.0	21.0	
Alkalinity (as CaCO ₃)	mg/l	320.	318.	464.	432.	45.	
Color	(Pt. Co.)	10	10	. 5	30	50	
Fe	mg/l	⟨.03	< .03	< .03	-23	.50	
Mn	mg/l	<.02	1.43	<.02	. 12	< .02	

Approved by Tony Munner

Tony Mommolo, Analytical Chemist

mmhos/cm Specific

			Dp CC /		
Test 1	Hole	рН	Conductivity	Chlorides mg/l	Temp °
		•			
1					
2		5.6	4,100	100	16.
3		5.8	4,000	820	18.:
4	٠.	5.1	10,000	20,000	17.0
5	•				
6	•	6.0	800	50	18.0
7		5.4	10,000	3,700	19.0
. 8		, - -			
9					
10		6.4	1,300	25	17. f
11		6.2	1,200	50	17.1
12		5.9	2,600	500	18.0
13		6.0	1,600	150	17.0
14	•	5.6	10,000	825	17.0
15	·	6.1	1,400	250	16.
			•		
MWI		5.7	3,100	. 	16.(
MW2	• •	5.8	10,000	• •	
EWM	· · · · · · · · · · · · · · · · · · ·	6.0	1,650		

SAMPLES ANALYZED IN FIELD BY WM. BULLER, M. SCHMIDT





Sita

EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 ENS: MP: 92-13344 852921 00 / 01

Rev / Tank: Sample Type: Reported:

WELL 23-DEC-1992

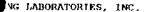
Analyte	Sample Point: Sample Number: Sampled:	852-01FB AG1339 24-NOV-1992	EML RL	852-MW01 AG1342 02-DEC-1992	EML RL	852-MW01R AG1345 23-NOV-1992	EML RL	Units
FIELD DATA: COLOR DEPTH TO WATER FROM TOP OF FIELD DISSOLVED OXYGEN GROUNDWATER ELEV. ODOR PH FIELD SPECIFIC CONDUCTANCE FIELD WATER TEMPERATURE IN DEGREE WELL DEPTH TOTAL		NA NA NA NA NA NA NA	- :	LT. YELLOW 15.90 NA 627.04 ROTTEN EGG 6.52 5810. 15.2 43.18	468 	I.T. BROWN 9.70 NA NONE 7.31 1910. 15.9 24.70	-624.31 M. Duriels	FT MG/L FT MSL PH UNITS UMMOS/CM DEGREES C FT
CHEMICAL METHODS & ROBOTICS: ALKALINITY, BICARBONATE CHEMICAL OXYGEN DEMAND CHLORIDE CYANIDE, TOTAL FLUORIDE NITROGEN, AMMONIA NITROGEN, NITRATE PH PHENOLS SOLIDS, TOTAL DISSOLVED SPECIFIC CONDUCTANCE SULFATE TOTAL ORGANIC CARBON TOTAL ORGANIC CARBON		ND 419 ND ND ND ND ND ND ND ND ND ND ND ND ND	10.000 10.000 0.500 0.020 0.050 0.050 0.050 0.050 5.000 1.000 1.000	536 21 305 ND 0.36 1.46 ND 6.81 ND 5010 5800 2580 3.1	10,000 10,000 5,000 0,020 0,050 0,050 0,050 0,050 1,000 1,000	290 ND 388 ND .0.47 ND 0.55 7.31 ND 964 1870 67.0 ND	10.000 10.000 0.500 0.020 0.020 0.050 0.050 0.050 0.050 5.000 1.000	MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L
INORGANICS: ARSENIC-TOTAL BARIUM-TOTAL BORON-TOTAL CADMIUM-TOTAL CALCIUM-TOTAL CHROMIUM-TOTAL COPPER:TOTAL IRON-TOTAL LEAD-TOTAL MAGNESIUM-TOTAL MAGNESE-TOTAL MERCURY-TOTAL POTASSIUM-TOTAL SELENIUM-TOTAL SOLUM-TOTAL SOLUM-TOTAL SOLUM-TOTAL		ND ND ND ND ND ND ND ND ND ND ND ND ND N	10.000 200.000 10.000 5.000 5000.000 10.000 25.000 5.000 5.000 40.000 5.000 25.000 25.000 25.000	ND ND 693 ND 460000 ND ND 1040 ND 241000 3000 HD HD HD HD HD HD	35,000 200,000 10,000 5,000 5000,000 10,000 25,000 100,000 25,000 0,200 40,000 25,000 25,000 25,000 25,000 25,000	ND ND 108 MD 107000 13.8 31.6 15600 5.1 35000 398 ND ND ND ND ND	10,000 200,000 10,000 5,000 5000,000 10,000 25,000 5000,000 15,000 0,200 40,000 5,000 5,000 5,000 5,000 5,000 5,000 5,000	UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71, UG71,
VOLATILE ORGANICS: 1,1,1,2-TETRACHLOROETHANE	; ;	DИ	5,000	ND	, . 5.000	ND ND	5,000	nevr

NA = Not Analyzed

ND - Not Detected

TBK = Trip Blank

a - EML Subcontract Data







Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 ENS: MP: Rev / Task: 92-13344 852921 00 / 01

Sample Type: Reported: WELL 23-DEC-1992

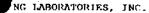
					Reported:	23-DEC-	1992	
Analyte	Sample Point: Sample Number: Sampled:	852-01FB AG1339 24-NOV-1992	EML RL	852-MW01 AG1342 02-DEC-1992	EML RL	852-MW01R AG1345 23-NOV-1992	EML RL	Units
 -	2.5		· ·		·			
1,1,1-TRICHLOROETHANE		ND	· E 000	j				
1,1,2,2-TETRACHLOROETHANE		ND.	5,000	ND ND	5.000	ND S	5.000	ug/t
1,1,2-TRICHLOROETHANE			5.000	ן היי	5.000	ND	5.000	UG/L
1,1-DICHLOROETHANE	•	ND	5,000	ND	5.000	ND .	5.000	∵UG/1₁
1,1-DICHLOROETHENE		ND	5.000	ND	5.000	ND	5.000	UG/I
		ND	5.000	ND	5,000	ND	5.000	UG/h
1,2,3-TRICHLOROPROPANE	_	ND .	10,000	ND	10.000	ND	10.000	UG/L
1,2-DIBROMO-3-CHLOROPROPANE		ND	10.000	ND	10,000	ND	10.000	UG/L
1,2-DIBROMOETHANE	•	ND	10.000	ND	10.000	ND -	10,000	UG/1
1,2-DICHLOROBENZENE		ND	10.000	. พอ	10,000	ND	10.000	06/1
1, 2-DICHLOROETHANE		ND	5.000	HD	5,000	ND I	5.000	UG/L
1,2-DICHLOROPROPANE	•	ND	5.000	ND	5.000	ND	5:000	UG/Ji
1,4-DICHLOROBENZENE		ND	10.000	ND	10,000	ND ON	10,000	ug/h
2-BUTANONE		ND	10,000	ND	10.000	23.	10,000	UG/15
2-HEXANONE		ND	10.000	ND	10,000	ີເໜ	10.000	UG/L
4-METHYL-2-PENTANONE		พช	10.000	ND	10.000	110	10.000	UG/h
ACETONE		ND	34.000	ND	34,000	ND :		0.57 11
ACRYLONITRILE		СИ	100.000	ND	100.000	ND I	34.000	UGZL
BENZENE		ND	5.000	ND			100.000	, UG/I
ROMOCHLOROMETHANE		ND	10.000		5.000	ND	5,000	OC\P
BROMODICHLOROMETHANE		ND	5.000	ND	10.000	ND	10.000	OG/L
BROMOFORM	·	ND		DИ	5.000	ND	5.000	ne\1
BROMOMETHANE			5.000	ND	5,000	, ND	5,000	OG/L
CARBON DISULFIDE	- **	ND	10.000	ND	10,000	. ND	10.000	UG/L
CARBON TETRACHLORIDE		ND	5.000	ND	5,000	ND	5.000	UC/ L
CHLOROBENZENE		ND	5.000	ND	5.000	. ND	5.000	0G/L
		ND	5.000	ND	5,000	ND	5.000	UG/L
CHLOROETHANE		מא	10.000	ND	10.000	ND '	10,000	UG/L
CHLOROFORM	· ·	ИD	5.000	ND	5.000	ND	5,000	UGZ I.
CILOROMETHANE	2.5	ND	10.000	ทบ	10.000	ND	10,000	UG/1.
CIS-1, 2-DICHLOROETHENE	· - ·	ND	10,000	ND	10.000	MD	10,000	UGZ b
CIS-1, 3-DICHLOROPROPENE		ND	5.000	ND	5.000	GRI	5.000	UG/L
DIBROMOCHLOROMETHANE		ND !	5.000	ИD	5.000	ND ND	5.000	UG/I
DIBROMOMETHANE	<i>i</i>	ND	10,000	ND	10,000	ND	10,000	
ETHYLBENZENE	each a contract	ND	5.000	HD :	5.000	ON.		UG/L
LODOMETHANE		ND	10.000	ND			5.000	UG/16
METHYLENE CHLORIDE		ND	5,000	MD	10.000	ND	10,000	ue\r
STYRENE	· .	ND	5.000		5.000	IID	5.000	ng\P
TETRACHLOROETHENE		. ND		HD TE	5.000	HD .	5.000	007F
TOLUENE	No.	ND I	5.000	IID	5.000	tip	5,000	0674.
TRANS-1, 2-DICHLOROETHENE			5.000	110	5,000	- ND	5,000	UGZ b
TRANS-1,3-DICHLOROPROPENE	- i	ND	10.000	ND	10.000	np	10,000	0G/L
FRANS-1,4-DICHLORO-2-BUTENE		ND	5.000	ND	5.000	: DD	5,000	ug/1.
	. j	ND	10,000	dit	10.000	· IID	10.000	0671.
FRICHLOROETHENE		ND	5.000	ИD	5.000	UD	5,000	007 L
RICHLOROFLUOROMETHANE		O\$1	10.000	ND	10,000	tib	19.000	06/1/
VINYL ACETATE	J	ND	10.000	110	10.000	iiii	10,000	UG/L
VINYL CHLORIDE	· i	11D	10,000	ND	10,000	dii	10,000	UGZL
XYLENE (TOTAL)		ND	10.000	dii	10.000	iib	10,000	11G7 b

NA = Not Analyzed

ND = Not Detected

TBK = Trip Blank

a = EML Subcontract Data





site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS: MP: Rev / Tank:

92-13344 952921 00 / 01 WELL 23-DEC-1992

Sample Type: Reported:

Analyte	Sample Point: Sample Number: Sampled:	852-MW02 AG1341 02-DEC-1992	EML RI,	852-MW02R AG1346 23-NOV-1992	EML RL	852-MW03 AG1347 23-NOV-1992	EML RL	Units
FIELD DATA: COLOR DEPTH TO WATER FROM TOP OF FIELD DISSOLVED OXYGEN GROUNDWATER ELEV. ODOR PH FIELD SPECIFIC CONDUCTANCE FIELD WATER TEMPERATURE IN DEGREE WELL DEPTH TOTAL		MD. BROWN 11.59 NA 615.93 NONE 6.97 5600. 15.8 29.50		DRK. GREY 9.50 NA NA NONE 6.82 4160. 17.7 29.70	p. Domes	LT. BROWN 12.10 NA 622.58 NONE 7.18 1670. 16.1 31.04		FT MG/L FT MSL PH UNITS UMHOS/CM DEGREES C FT
CHEMICAL METHODS & ROBOTICS: ALKALINITY, BICARBONATE CHEMICAL OXYGEN DEMAND CHLORIDE CYANIDE, TOTAL FLUORIDE NITROGEN, AMMONIA NITROGEN, NITRATE PH PHENOLS SOLIDS, TOTAL DISSOLVED SPECIFIC CONDUCTANCE SULFATE TOTAL ORGANIC CARBON TOTAL ORGANIC CARBON		369 63 1450 ND ND 0.47 ND 7.09 ND 2900 5270 142 2.0	10.000 10.000 5.000 0.020 0.050 0.050 0.050 0.050 5.000 1.000 50.000	717 15 360 ND 0.69 ND 0.057 6.92 ND 2580 4110 904 1.5	10.000 10.000 5.000 0.020 0.050 0.050 0.050 0.050 5.000 1.000 1.000	405 12 321 ND 0.58 ND 0.46 7.35 ND 956 1760 36.7 1.9	10.000 10.000 2.500 0.020 0.050 0.050 0.050 0.050 1.000	MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L
INORGANICS: ARSENIC-TOTAL BARIUM-TOTAL BORON-TOTAL CADMIUM-TOTAL CALCIUM-TOTAL CHROMIUM-TOTAL COPPER-TOTAL IRON-TOTAL LEAD-TOTAL MAGNESIUM-TOTAL MARGNESIUM-TOTAL MERCURY-TOTAL NICKEL-TOTAL POTASSIUM-TOTAL SILVER-TOTAL SOLUM-TOTAL SOLUM-TOTAL SOLUM-TOTAL		ND 765 288 ND 230000 19.8 41.0 21000 ND 115000 3000 ND ND ND 5950 ND ND 539000 79.6	35.000 200.000 10.000 5.000 5000.000 10.000 25.000 100.000 25.000 5000.000 40.000 5000.000 25.000 5000.000 25.000	ND ND 590 ND 140000 30.3 58.7 23600 ND 45600 661 ND 95.8 5820 ND HD	14,000 200,000 10,000 5,000 5,000 10,000 25,000 100,000 15,000 10,000 40,000 5,000 25,000 5,000 5,000 5,000 5,000 5,000	1.9 ND ND 129 ND 68100 UD ND 1988 ND 28100 60.0 ND MD ND ND ND ND ND ND ND ND ND ND ND ND ND	1.000 200,000 10.000 5.000 5.000 10.000 10.000 25.000 100.000 15.000 0.200 40.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000 5.000	MG/L UG/L
VOLATILE ORGANICS: 1,1,1,2-TETRACHLOROETHANE		но	5.000	ND	5,000	МD	5,000	ue\r

NA = Not Analyzed

ND - Not Detected

TBK = Trip Blank

s = EML Subcontract Data





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS:

MP: Rev / Tank: Sample Type: Reported: 92-13344 852921 00 / 01

WELL 23-DEC-1992

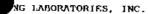
					Reported:	23-DEC-1	992	
Analyte	Sample Point: Sample Number: Sampled:	852-MW02 AG1341 02-DEC-1992	EML RL	852-MW02R AG1346 23-NOV-1992	EML RL	852-MW03 AG1347 23-NOV-1992	EMI, RI,	Unlts
· · · · · · · · · · · · · · · · · · ·		·		i				
,1,1-TRICHLOROETHANE		·						
1,1,2,2-TETRACHLOROETHANE		ND I	5.000	- ND	5.000	ИD	5.000	UG/I
1,1,2,2-IEIRACHLOROETHANE	47	ND	5.000	МD	5.000	ND	5.000	UG/L
1,1,2-TRICHLOROETHANE		DND	5.000	מא	5.000	ND	5.000	UG/L
,1-DICHLOROETHANE		[ND [5.000	ND .	5,000	ND	5.000	UG/L
; 1-DICHLOROETHENE		DND I	5.000	ND	5.000	MD	5.000	UG/L
.2,3-TRICHLOROPROPANE		ND	10.000	ND	10,000	ND	10.000	UG/1i
,2-DIBROMO-3-CHLOROPROPAN	E	เทย	10.000	ND	10.000	GM	10.000	0G/1 ₆
, 2-DIBROMOETHANE	•	ND	10,000	ND	10.000	ND	10.000	UG/L
, 2-DICHLOROBENZENE		ND	10.000	, ND	10.000	ND	10.000	UG/L
, 2-dichloroethane		סא	5.000	140	5,000	ND	5.000	UG/L
, 2-DICHLOROPROPANE		ND I	5,000	ND	5,000	ND	5.000	UG/L
,4-DICHLOROBENZENE		ND	10.000	NĐ	10.000	ND	10.000	UG/L
P-BUTANONE		ND	10.000	ND	10,000	ND	10.000	UG/L
?-HEXANONE		ND	10.000	ND	10.000	นัก	10.000	UG/I
-METHYL-2-PENTANONE		ND	10.000	ND	10.000	ND	10.000	UG/L
CETONE		dis	34,000	סא	34,000	QN QN		
CRYLONITRILE		ND DN	100000	ND	100.000		34.000	UG/L
ENZENE		ND I	5.000	ND		ND	100.000	ng/t
ROMOCHLOROMETHANE		ND ND	10.000		5.000	ND	5,000	UG/h
ROMODICHLOROMETHANE		ND		ND	10.000	ND	10,000	UG/Ii
ROMOFORM		ND ND	5.000	ND	5.000	. HD	5.000	ugZk
ROMOMETHANE	•	ND	5.000	ND	5.000	MD	5,000	ueyt
ARBON DISULFIDE	•	ND ND	10.000	ND	10,000	หอ	10,000	UGZ1,
ARBON TETRACHLORIDE			5.000	ND	5,000	ดห	5.000	ug/h
		ND .	5.000	ND	5.000	ดห	5,000	UG/L
HLOROBENZENE		ND	5.000	ND	5,000	MD	5,000	0G/4.
HLOROETHANE	•	NĐ	10.000	DIA	10,000	ND	10,000	UG/3.
HLOROFORM		ИD	5,000	ND	5,000	ND .	5,000	UG/L
HLOROMETHANE		ND	10.000	ND]	10,000	HD	10,000	ug/l.
IS-1, 2-DICHLOROETHENE		ND	10,000	ND]	10,000	131)	10,000	UG/6
IS-1, 3-DICHLOROPROPENE		ND	5.000	, ND	5.000	พบ	5,000	UG/L
IBROMOCHLOROMETHANE		ND	5.000	ND	5.000	ND	5.000	UG/I,
IBROMOMETHANE		MD	10,000	מוז	10,000	tib	10,000	UG/1.
THYLBENZENE		ND	5.000	DN D	5.000	ND	5,000	0676
ODOMETHANE		ND	10.000	ND I	10.000	. 100	10,000	967 L
ETHYLENE CHLORIDE		ND I	5.000	UD	5,000	HĐ	5,000	UG/L
TYRENE		ND	5.000	tib	5.000	dit	5,000	9676
ETRACHLOROETHERE		ND	5.000	HD	5.000	HD	5.000	9676
OLUENE		ND]	5.000	tip	5.000	HD	5,000	0671.
PANS-1, 2-DICHLOROETHENE	•	ND	10.000	ND OH	10.000	ND	10.000	0G/L
RANS-1, 3-DICHLOROPROPENE		ND	5.000	ND CIN	5.000			
RANS-1, 4-DICHLORO-2-BUTEN	F	מא				ND	5.000	uc/L
RICHLOROETHENE	•		10,000	IID	10.000	ND .	10,000	0671
RICHLOROF LUOROMETHANE		ND	5.000	ND	5,000	HD (5.000	UGZ1.
		ND	10.000	HD	10.000	tw	10,000	UG/L
INYL ACETATE		ND	10.000	no	10,000	, ND	10.000	UG/1.
THYL CHLORIDE	1	ND	10.000	HD	10.000	ND	10,000	OGZ L
(YLENE (TOTAL)		l ND !	10.000	DИ	10,000	110	10,000	UG/L

NA = Not Analyzed

ND - Not Detected

TBK - Trip Blank

s = EML Subcontract Data







Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 ENS: MP: 92-13344

Rev / Task:

852921 00 / 01 WELL

Sample Type: Reported:

23-DEC-1992

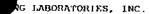
					Reported:	23-0EC-	1992	
Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AG1340 24-NOV-1992	EML RL	852-MW04 AG1344 02-DEC-1992	EML RL	852-MW06 AG1343 02-DEC-1992	EML RL	Unit.s
FIELD DATA: COLOR DEPTH TO WATER FROM TOP OF FIELD DISSOLVED OXYGEN GROUNDWATER ELEV. ODOR PH FIELD SPECIFIC CONDUCTANCE FIELD WATER TEMPERATURE IN DEGREE WELL DEPTH TOTAL		LT. BROWN 13.5 NA NONE 5.86 3970. 18.8 39.7	-630.66 pr. accorded	NONE 9.23 NA 645.64 NONE 6.72 8580. 18.0 34.90		MONE 25.83 NA 638.01 NONE 6.61 2570. 17.2 68.90		FT MG/L FT MSL PH UNITS UMHOS/CM DEGREES C
CHEMICAL METHODS & ROBOTICS: ALKALINITY, BICARBONATE CHEMICAL OXYGEN DEMAND CHLORIDE CYANIDE, TOTAL FLUORIDE NITROGEN, AMMONIA NITROGEN, NITRATE PH PHENOLS SOLIDS, TOTAL DISSOLVED SPECIFIC CONDUCTANCE SULFATE TOTAL ORGANIC CARBON TOTAL ORGANIC CARBON INORGANICS: ARSENIC-TOTAL BARIUM-TOTAL CADMIUM-TOTAL CALCIUM-TOTAL CALCIUM-TOTAL CHROMIUM-TOTAL CHROMIUM-TOTAL HEAD-TOTAL MAGNESSIM-TOTAL MAGNESSIM-TOTAL MERCURY-TOTAL POTASSIUM-TOTAL SELENIUM-TOTAL SELENIUM-TOTAL SODIUM-TOTAL SODIUM-TOTAL SODIUM-TOTAL SODIUM-TOTAL SODIUM-TOTAL		212 81 222 ND 0.43 1.21 ND 6.07 ND 3250 4430 1760 15.2 14.8 ND ND 255 ND ND 3460 ND ND 3460 ND ND 3460 ND ND 3460 ND ND 3460 ND ND 3460 ND ND ND ND ND ND ND ND ND ND ND ND ND	10.000 10.000 0.500 0.020 0.050 0.020 0.050 0.050 0.050 1.000 1.000 1.000 1.000 200.000 50.000 25.000 75.000 75.000 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.000 125.000	1110 105 943 ND ND ND 6.78 ND 7720 8790 3160 24.2 23.8 ND ND 2000 ND 569000 15.5 ND 1560 ND 1560 ND 15.5 ND 1570 ND 15.5 ND 15	10.000 10.000 5.000 0.020 0.050 0.050 0.050 0.050 5.000 1.000 1.000 1.000 1.000 10.000 10.000 25.000 15.000 15.000 15.000 15.000 15.000 25.000 15.000 25.000 15.000 25.000 15.000	542 32 168 ND 0.29 1.13 0.11 6.61 ND 1490 2350 437 2.0 2.0 2.0 ND ND 236 ND 116000 ND 316000 1830 ND 82700 1830 ND 1830 ND 1830 ND	10,000 10,000 2,500 0,020 0,050 0,050 0,050 0,050 1,000 1,000 1,000 1,000 10,000	MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L MG/L UMHOS/CM MG/L UMHOS/CM MG/L UG/L
VOLATILE ORGANICS: 1,1,1,2-TETRACHLOROETHANE		ND	5.000	20,8 ND	20.000 - 5.000	56.3 กก	20.000 5.000	0g/h 0g/h

NA = Not Analyzed

ND = Not Detected

TBK = Trlp Blank

s = EMB Subcontract Data





Site: 952 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 ENS; MP: 92-13344 852921 00 / 01

Rev / Task: Sample Type: Reported:

WELL 23-DEC-1992

 :		<u>-</u>			w.borcea:	23-08/2-1	1992	
Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AG1340 24-NOV-1992	EML RL	852-MW04 AG1344 02-DEC-1992	EML RL	852-MW06 AG1343 02-DEC-1992	EML RL	Units
***			· · · · · · · · · · · · · · · · · · ·			·		
1,1,1-TRICHLOROETHANE		· ND	5,000:	ND i	5,000	ND		
1,1,2,2-TETRACHLOROETHANE		ND	5.000	ND I	5.000	ND ND	5.000	UG/1.
1,1,2-TRICHLOROETHANE	*	ND I	5.000	ND	5.000		5.000	UG/L
1,1-DICHLOROETHANE	: *	ND I	5.000	I ND	5.000	ND.	5.000	UG/L
1,1-DICHLOROETHENE		ND I	5.000	ND ND	5,000	21.	5.000	0G/L
1,2,3-TRICHLOROPROPANE		ND I	10.000	ND	10,000	ND .	5.000	ac\r
1,2-DIBROMO-3-CHLOROPROPAL	NE .	ND	10.000	ND I	10.000	ND ·	10.000	ne\r
1,2-DIBROMOETHANE	·· -	ND	10.000	ND		ND	10.000	06/r
1,2-DICHLOROBENZENE		ND I	10.000	· ND	10.000	טא	10.000	0G/1 ₆
1,2-DICHLOROETHANE		ND	5.000	ND	10.000	ND	10.000	ne\r
1,2-DICHLOROPROPANE		ND I	5,000	1110	5.000	ND	5,000	ne\P
1,4-DICHLOROBENZENE		l ND l	10,000		5.000	ND I	5.000	UG/1.
2-BUTANONE		19.	10.000	ND	10.000	ND	10,000	UG/L
2-HEXANONE		ND ND		ND	10.000	סוו	10,000	nc\r
4-METHYL-2-PENTANONE		ND ND	10.000 10.000	ND	10.000	ND	10.000	UG/1.
ACETONE		סא	34.000	ND	10.000	no	10.000	UG/L
ACRYLONITRILE		ND I		ND	34.000	ND.	34.000	UG/I.
BENZENE		ם מא	100.000	ND	100.000	พบ	100.000	UG/L
BROMOCHLOROMETHANE		מא	5.000	ND	5.000	ND	5.000	UG/T.
BROMODICHLOROMETHANE			10.000	ND	10.000	เมอ	10.000	ug/Ii
BROMOFORM		ND ND	5.000	ND	5.000	· ND ·	5.000	UG/L
BROMOMETHANE		ND .	5.000	- ND	5.000	ND	5.000	9G/L
CARBON DISULFIDE	•	ND	10.000	ND	10.000	ND	10.000	UGZ L
CARBON TETRACHLORIDE		ND	5.000	ND	5.000	ND	5.000	0G/L
CHLOROBENZENE		ND	5.000	ND	5,000	11D	5.000	uc/I
CHLOROETHANE	1.	ND	5.000	ND	5.000	ИÐ	5,000	UG/L
CHLOROFORM	**	ND	10.000	ND	10.000	ND 1	10.000	UG/I,
CHLOROMETHANE	•	ND	5.000	ND	5.000	ND CIN	5.000	NG/1,
CIS-1, 2-DICHLOROETHENE		ND	10.000	ND	10.000	ИD	10.000	UG/1.
CIS-1, 3-DICHLOROPROPENE		ND	10.000	ИD	10.000	ND	10.000	HC\P
DIBROMOCHLOROMETHANE		ND	5.000	ND	5,000	ИD	5.000	UG/1
DIBROMOMETHANE		ND	5.000	ND	5.000	MD	5.000	06/3.
ETHYLBENZENE		ND	10.000	ND	10,000	ND	10.000	UG/1.
IODOMETHANE		ND	5.000	ND	5.000	ND	5.000	UG/1/
METHYLENE CHLORIDE		ND	10.000	ND	10.000	NO	10,000	BG/1.
STYRENE		ND	5.000	ND	5,000	סא	5,000	UG/Ti
TETRACHLOROETHENE	Si .	ND	5.000	ND]	5.000	HD	5,000	UG/1,
TOLUENE	·	ND	5,000	ND I	5.000	ND	5.000	UG/L
		ND	5.000	HD	5.000	เมอ	5,000	NG/L
TRANS-1, 2-DICHLOROETHENE	:	МÐ	10.000	ND	10.000	ND	10,000	0G/1,
TRANS-1, 3-DICHLOROPROPENE		ND	5.000	ND	5.000	ND	5,000	DG/1
TRANS-1, 4-DICHLORO-2-BUTEN	IE	ND	10,000	ND	10,000	ND	10,000	0671
TRICHLOROETHENE		ND	5.000	HD	5,000	ND	5,000	UGZ b
TRICHLOROFLUOROMETHANE	j	ND	10.000	ND	10,000	ND	10,000	uGZL
VINYL ACETATE	.]	ND	10,000	D	10,000	D	10.000	UG/1.
VINYL CHLORIDE		ND	10.000	ИD	10.000	DIA	10.000	0G/L
XYLENE (TOTAL)		ND [

NA ⇒ Not Analyzed

ND - Not Detected

TBK = Trip Blank

sim EML Subcontract Data







Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS:

92-13422

MP: Rev / Task: 852923 00 / 01

Sample Type: Reported:

WELL 22-DEC-1992

r	 		_		porceo.	22-DEC-1	226	
Λnalyte	Sample Point: Sample Number: Sampled:	852-01FB AG1730 24-NOV-1992	EML RL	852-MW01 AG1733 02-DEC-1992	EML RL	852-MW01R AG1727 23-NOV-1992	EML RL	Units
INORGANICS: ANTIMONY-TOTAL BERYLLIUM-TOTAL COBALT-TOTAL THALLIUM-TOTAL VAHADIUM-TOTAL		ND ND ND ND ND	100.000 5.000 50.000 10.000 50.000	ND ND ND ND	100.000 5.000 50.000 10.000 50.000	ND ND ND ND	100.000 5.000 50.000 10.000 50.000	UG/L, UG/L, UG/L, UG/L, UG/L,

NA = Not Analyzed

ND = Not Detected TBK - Trip Blank

s = EML Subcontract Data



WMI ENVIRONMENTAL MONITORIES, INC.

EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 ENS;

92-13422

MP; Rev / Task; 852923 00 / 01

Sample Type: Reported:

WELL 22-DEC-1992

λπalyte	Sample Point: Sample Number: Sampled:	852-MW02 AG1728 02-DEC-1992	EML RL	852-MW02R AG1731 23-NOV-1992	EML RL	852-MW03 AG1729 23-NOV-1992	EMI, RL	Units
INORGANICS: ANTIMONY-TOTAL BERYLLIUM-TOTAL COBALT-TOTAL THALLIUM-TOTAL VANADIUM-TOTAL		ND ND ND ND ND	100.000 5.000 50.000 10.000 50.000	130 ND ND ND ND	100.000 5.000 50.000 40.000 50.000	ND ND ND ND	100,000 5,000 50,000 10,000 50,000	UG/1. UG/1. UG/1. UG/1. UG/1.

TBK = Trip Blank

s = EML Subcontract Data





Site: 852 - MUSKOGEE LANDFILL

ENS: MD: 92-13422

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 Rev / Task: Sample Type: 852923 00 / 01 WELL

Reported:

22-DEC-1992

Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AG1732 24-NOV-1992	EML RL	852-MW04 AG1734 02-DEC-1992	EML RL	852-MW06 AG1735 02-DEC+1992	EML RL	Units
INORGANICS: ANTIMONY-TOTAL BERYLLIUM-TOTAL COBALT-TOTAL THALLIUM-TOTAL VANADIUM-TOTAL		ND NO ND ND ND	100.000 5.000 50.000 10.000 50.000	ND ND ND ND	500.000 5.000 50.000 10.000 50.000	HD ND ND ND ND	100.000 5.000 50.000 10.000 50.000	

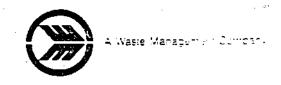
NA = Not Analyzed

ND = Not Detected

TBK - Trip Blank

s = EML Subcontract Data

2801 S. 54th Street W. Muskogee, Oklahoma 74401 (918) 682-7284 1918) 682-2867 fax



April 2, 1993

Mr. Fenton Rood, Chief Solid Waste Management Service - 0206 Oklahoma State Department of Health 1000 NE Tenth Street Oklahoma City, OK 73117-1299

SUBJECT: 1st Quarter 1993 Groundwater Monitoring

Muskogee Community Landfill

Permit No. 3551020 Muskogee, Oklahoma

Dear Mr. Rood:

On behalf of the Muskogee Community Landfill I am forwarding three (3) copies of the groundwater monitoring report for the sampling conducted on February 17, 1993. The three (3) new monitor wells recently installed by Waste Management of Oklahoma (#01R, #02R and #03R) and the five (5) existing City of Muskogee monitor wells (#01, #02, #03, #04 and #06) were sampled.

All wells were sampled for the parameters required by the OSDH and Federal Subtitle D regulations. We will repeat these sampling parameters at all wells again in the 2nd quarter 1993. If you have questions or require additional information, please call me or Dan Gibson at (918) 437-7773.

Sincerely,

WASTE MANAGEMENT OF OKLAHOMA, INC.

Mark Daniels, P.E.

Environmental Engineer

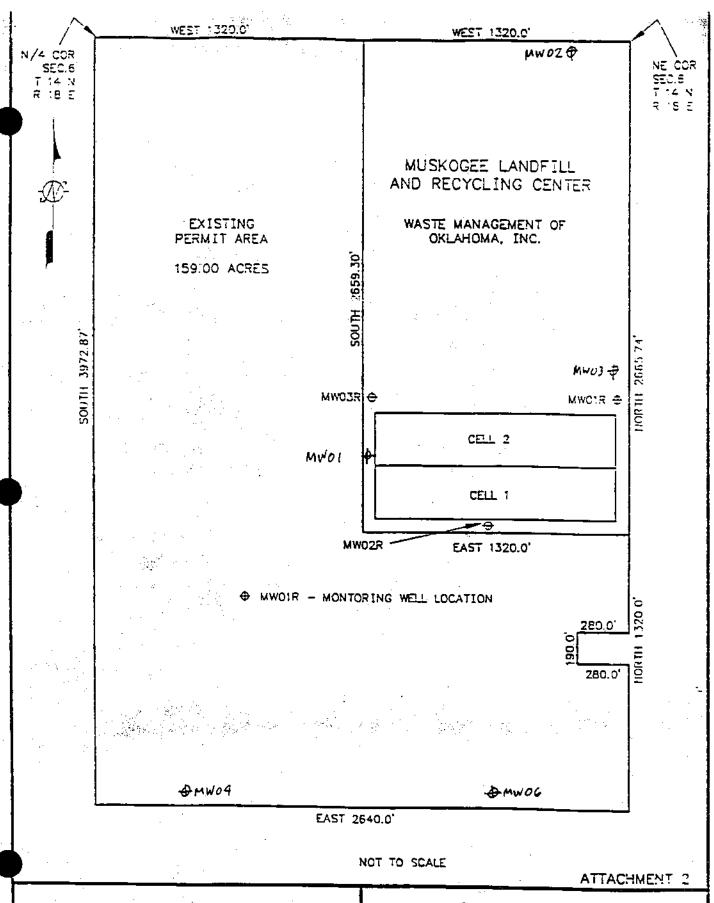
Enclosure

cc: Larry Cohn, WMNA South Mark Snyder, WMNA South

> Mike McCloud, Muskogee Landfill Dan Gibson, Quarry Landfill Walter Beckham, City of Muskogee

J.C. Shutler, Muskogee County Health Department

(MUSKOGEE\93GW10.LTR)





MUSKOGEE LANDFILL AND RECYCLING CENTER

MONITORING WELL CONTINUES





Site: 052 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 ENS; 9

93-10497 852931 00 / 01

Rev / Task: Sample Type:

WELL 12-MAR-1993

	1105110020 011 1511				Reported:	1.2-MAR=1	993	
Analyte	Sample Point: Sample Number: Sampled:	852-01FB. AG5211 17-FEB-1993	EML RL	852-MW01 AG5212 17-FEB-1993	EMI, RL	852-MW01R AG5213 -17-FEB-1993	EML RL	Units
FIELD DATA: COLOR DEPTH TO WATER FROM TOP OF FIELD DISSOLVED OXYGEN CROHIDWATER ELEV. OPOR PH FIELD SPECIFIC COMBUCTANCE FIELD WATER TEMPERATURE IN DEGRE WELL DEPTH TOTAL		NONE NA 10.40 HA NO 9.03 160. 3.3		NONE 14.44 5.80 628.50 NO 7.65 5860. 10.1 43.18		HONE 8.78 6.80 624.23 HO 7.51 1730. 14.5 29.25		FT MG/L FT MSL PH UNITS UMHOS/CM DEGREES C FT
CHEMICAL METHODS & ROBOTICS ALKALINITY, BICARBONATE CHEMICAL OXYGEN DEMAND CHLORIDE CYANIDE, TOTAL FLUORIDE HITROGEN, AMMONIA HITROGEN, NITRATE PH PHENOLS SOLIDS, TOTAL DISSOLVED SPECIFIC CONDUCTANCE SULFATE TOTAL DRGANIC CARBON TOTAL ORGANIC CARBON	·:	ND ND 7.12 ND ND 2.76 ND ND ND ND	10.000 10.000 0.500 0.020 0.050 0.050 0.050 0.050 5.000 1.000 1.000	539 11 340 ND 0,41 1.37 ND 6.64 ND 4990 6130 2990 2.3 2.3	10,000 10,000 5,000 0,020 0,050 0,050 0,050 0,050 25,000 1,000 1,000	278 ND 403 ND 0.45 DD 0.69 7.24 ND 965 1860 63.1	10.000 10.000 1.000 0.020 0.050 0.050 0.050 0.050 0.050 1.000	MG/L MG/L MG/L MG/L MG/L MG/L PH UNITS MG/L UMHOS/CM MG/L UMHOS/CM MG/L MG/L MG/L
INORGANICS: ARSENIC-TOTAL BARIUM-TOTAL BORON-TOTAL CADMIUM-TOTAL CALCIUM-TOTAL CHROMIUM-TOTAL CHROMIUM-TOTAL IRON-TOTAL IRON-TOTAL IEAD-TOTAL HAGHESIUM-TOTAL HAGHESIUM-TOTAL HERCURY-TOTAL HICKEL-TOTAL POTASSIUM-TOTAL SELEHIUM-TOTAL SILVER-TOTAL LIDVER-TOTAL LIDVER-TOTAL LIDVER-TOTAL COLUM-TOTAL COLUM-TOTAL		ND 35.9 ND 100 ND 100 ND 100 ND 100 ND 100 ND 110 ND 110 ND 110 ND 110 HD 110 HD 110 HD 110 HD 110	10.000 200.000 10.000 5.000 5000.000 10.000 25.000 100.000 5.000 5000.000 40.000 5000.000 5.000 25.000	ND ND 678 ND 468000 ND 1090 ND 244000 2910 ND ND ND ND ND ND	10.000 200.000 10.000 5.000 5000.000 25.000 100.000 25.000 5000.000 40.000 5000.000 25.000 25.000	ND ND 90.5 ND 116000 ND 221 ND 221 ND 22.7 ND 11D 11D 11D 11D 11D 11D 11D 11D 11D 1	10,000 200,000 10,000 5,000 5000,000 10,000 5,000 100,000 5,000 0,200 40,000 5,000 5,000 5,000 5,000 5,000 5,000 5,000 5,000 5,000 5,000 5,000 5,000 5,000 5,000 5,000	0G/L 0G/L
VOLATILE ORGANICS: 1,1,1,2-TETRACHLOROETHANE		HD	5,000	нь	5,000	то :	5,000	06 71 .

NA - Not Analyzed

ND - Not Detected

TBK = Trip Blank

B - EMI Subcontract Dala



Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 ENS; MP; 93-10497 852931 00 / 01

Rev / Task: Sample Type: Reported:

WELL 12-MAR-1993

AnalyLe	Sample Point: Sample Number: Sampled:	852-01FB AG5211 17-FEB-1993	EML RL	852-MW01 AG5212 17-FEB-1993	EML RL	852-MW01R AG5213 17-FEB-1993	EML RI.	Units
1, 1, 1-TRICHLOROETHANE		ND	5,000	ND	5.000	ND I	5,000	UG/1,
1, 1, 2, 2-TETRACHLOROETHANE	14.	ND	5.000	ו סוו	5,000	110	5.000	UG/1.
1.1.2-TRICHLOROETHANE	1.44	l IID	5.000	ND .	5.000	UD i	5.000	UG/L
1.1-DICHLOROETHANE		dit	5.000	โทก	5,000	IID .	5,000	UG/1a
1.1-DICHLOROETHENE		11D	5.000	D D	5,000	HD OH	5.000	UG/L
1,2,3-TRICHLOROPROPANE		เหย	10,000	ND I	10,000	tin)	10,000	UG/L
1,2-DIBROMO-3-CHLOROPROPA	ANE ·	MD	10.000	l ND I	10,000	rito	10,000	UG/L
1.2-DIBROMOETHANE		ND GR	10.000	ND	10,000	un	10,000	UG/L
1,2-DICHLOROBENZENE		np	10,000	liiD	10,000	वार	10,000	UG/L
1,2-DICHLOROETHANE		110	5,000	11D	5.000	lao l	5,000	UGZT
1,2-DICHLOROPROPANE	•	ND	5.000	ND	5.000	เมื่อ	5.000	UG/L
1,4-DICHLOROBENZENE		11D	10.000	ND	10.000	m	10.000	OG/L
2-BUTANONE		liid	10.000	ND	10,000	tm	30,000	UG/L
2-IIEXANONE		ND	10.000	MD	10.000	un	10,000	0G/L
4-METHYL-2-PENTANONE		ND	10.000	ND	10.000	ND	10,000	0G/1.
ACETONE		ND	34.000	ND	34,000	lab	34.000	0G/1 ₂
		liiD .	100.000	ND	100.000	dip	100.000	06/1,
ACRYLONITRILE		ND	5.000	ND	5.000	ON	5,000	UG/L
BENZENE		ND	10,000	ND .	10.000	ND	10,000	0G/L
BROMOCHLOROMETHANE					5,000	ND	5.000	06/L
BROMODICHLOROMETHANE		ND	5.000 5.000	ND ND	5.000	HD.	5,000	06/1
BROMOFORM		ND			10,000	liiD	10.000	06/1
BROMOMETHANE		พบ พบ	10,000 5,000	ND ND	5,000	nD	5.000	UG/1.
CARBON DISULFIDE						ND I	5,000	
CARBON TETRACHLORIDE		ND	5.000	ND	5.000			06/1,
CHLOROBENZENE		ND	5.000	ND	5.000	ND	5.000	0G/L
CHLOROETHANE		ND	10.000	ND	10,000	ND	10.000	UG/L
CHLOROFORM		ND	5,000	ND .	5.000	ND	5.000	UG/L
CHLOROMETHANE		ND	10,000	ND	10.000	IID	10.000	OG/L
CIS-1, 2-DICHLOROETHENE		ИD	10.000	ND	10,000	ND	10.000	0G/1.
C15-1, 3-DICHLOROPROPENE		ND	5,000	ND	5.000	HD	5.000	0G/1,
DIBROMOCHLOROMETHANE		ND	5.000	ND	5.000	ND	5.000	UG/L
DIBROMOMETHANE	•	ND	10.000	ND	10.000	RD	10,000	ng/r
ETHYI.BENZENE		ND	5.000	ND	5.000	HD	5.000	UG/I,
LODOMETHANE		ND	10,000	ND	10.000	ND	10.000	0G/L
HETHYLENE CHLORIDE		ND	5.000	ND	5.000	HD	5.000	UG/L
STYRENE		31D	5,000	ND	5.000	(11)	5.000	0G/1.
TETRACHLOROETHENE		ND	5,000	ND	5.000	100	5.000	UG/L
TOTATE		ND	5.000	HD	5,000	100	5.000	ug/L
TRANS-1,2-DICHLOROETHENE		ND	10.000	ND	10,000	LIID	10.000	UG/Ic
TRANS-1, 3-DICHLOROPROPENE		ND	5.000	ND	5.000	HD	5.000	OG/L
TRANS-1,4-DICHLORO-2-BUTE	ene	ND	10.000	tiD	10.000	110	10,000	ug/L
TRICHLOROETHENE		ND	5.000	UD	5,000	IDD .	5.000	UGAP
TRICHLOROFLUOROMETHANE		ND	10,000	เก	10.000	IIID	10,000	00/1
VIHYL ACETATE	-	ND	10,000	MD	10,000	100	10,000	UGZL
ATDAP CHPOSIDE		ND	10,000	tib	10,000	HD	10,000	OGZL
XYLEDE (TOTAL)		Ino	10,000	I HD	10.000	luo l	10.000	UG/3.

NA ≈ Not Analyzed

ND - Not Detected

TBK = Trip Blank

n is EMN, Subcontract Data



EVENT SUMM. X REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS; 93-10497

852931 00 / 01 MP: Rev / Tank: WISTAL

Sample Type: Reported: 12-MAR-1993

Analyte	Sample Point: Sample Number: Sampled:	852-MW02 AG5216 17-FE8-1993	EML RL	852-MW02R AG5214 17-FEB-1993	EMI, RI,	852-MW03 AG5215 17-FEB-1993	EMI, RI,	Units
FIELD DATA: COLOR DEPTH TO WATER FROM TOP OF FIELD DISSOLVED OXYGEN GROUNDWATER ELEV, ODOR PH FIELD SPECIFIC CONDUCTANCE FIELD WATER TEMPERATURE IN DEGRE		LT/GREY 11.32 7.80 615.42 NO 6.33 4970. 11.5 28.72		GREY 8.58 5.80 655.26 NO 7.28 3350. 16.2 30.01		10.84 7.40 622.80 HO 7.38 1960. 13.1 30.10		FT MG/L FT MSL PIL UNITS UMHOS/UM DEGREES C FT
CHEMICAL METHODS & ROBOTICS ALKALINITY, BICARBONATE CHEMICAL OXYGEN DEMAND CHLORIDE CYANIDE, TOTAL FLUORIDE HITROGEN, AMMONIA HITROGEN, NITRATE PH HHEHOLS SOLIDS, TOTAL DISSOLVED SPECIFIC CONDUCTANCE SULFATE TOTAL ORGANIC CARBON TOTAL ORGANIC CARBON	:	354 28 1340 ND 0.22 0.28 ND 6.96 ND 2750 5050 385 1.9 1.8	5,000 0,020 0,050 0,020	717 ND 382 ND 0.62 0.87 ND 6.92 ND 2620 4000 963 1.3 1.2	2,500 0,020 0,050 0,020 0,050 0,050 0,050 25,000 1,000	400 ND 353 NO 0.52 ND 0.49 7.37 RD 957 1900 40,5 ND	10.000 10.000 1.000 0.020 0.020 0.050 0.050 10.000 1.000 1.000 1.000	MG/L MG/L MG/L MG/L MG/L MG/L MG/L PH UNITS MG/L UMIOS/CM MG/L MG/L MG/L MG/L MG/L
INORGANICS: ARSENIC-TOTAL BARIUM-TOTAL BORON-TOTAL CALCIUM-TOTAL CALCIUM-TOTAL CHROMIUM-TOTAL COPPER-TOTAL IRON-TOTAL HAGHESIUM-TOTAL HARGANESE-TOTAL HARGANESE-TOTAL HICKEL-TOTAL HCTASSIUM-TOTAL SELENIUM-TOTAL SELENIUM-TOTAL SELENIUM-TOTAL SILVER-TOTAL CODIUM-TOTAL CODIUM-TOTAL CODIUM-TOTAL CODIUM-TOTAL		21.1 1090 262 ND 278000 23.7 26.8 25800 ND 114000 2940 ND 43.9 ND 11D 11D 557000 84.3	10,000 200,000 10,000 5,000 5000,000 25,000 100,000 25,000 40,000 25,000 5000,000 25,000 5000,000 25,000 5000,000 25,000	23.0 ND 686 ND 143000 ND 961 34.5 48400 670 ND IID 601000 IID	200,000 10,000 5,000 5000,000 10,000 25,000 100,000 25,000 5000,000 15,000 0,200 40,000 5000,000	ND 10 169 ND 86900 ND 1480 ND 37500 34.8 DD 100 HD	10,000 200,000 10,000 5,000 5000,000 25,000 100,000 5,000 600,000 40,000 5,000 5000,000 5,000 40,000 5,000 5,000 25,000	DG/L UG/L
VOLATILE ORGANICS: 1.1,1,2-TETRACHLOROGIHANE		ub	5.000	ND	5,000	1115	5,000	06273.

NA - Not Analyzed

ND - Not Detected

TBK - Trip Blank

a - EMB Subcontract Data

WMI ENVIRONMENTAL MONI

NG LABORATORIES, INC.



EVENT SUMM .. RY REPORT

Site: 852 - MUSKOGEE LANDFILL

2001 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 ENS: 93-10497 MP: 052931 Rev / Task: 00 / 01 Sample Type: WELL

Sample Type: WELL Reported: 12-MAR-1993

A1	Sample Point: Sample Number: Sampled:	852-MW02 AG5216 17-FEB-1993	EML RI	052-MW02R AG5214 17-FEB-1993	EMI, RI.	852-MW03 AG5215 17-FEB-1993	EMI, RI,	Unlks
Analyte	Sampreo:	11-550-1333	END KN	11-166-1993	E11) [VII	(7 (1.15 1993		
•				, i				
1,1,1-TRICHLOROETHANE		ND	5.000	ND	5,000	IID i l	5.000	UG/1,
1,1,2,2-TETRACHLOROETHANE		ND	5.000	ND	5,000	ND .	5,000	UG/1 ₆
1, 1, 2-TRICHLOROETHANE		ND:	5.000	ND	5.000	140	5.000	υG/1.
1,1-DICHLOROETHANE		ND	5.000	MD :	5. 000	[no	5.000	UG/Ii
1,1-DICHLOROETHENE		ND	5.000	ND	5,000	MD	5.000	UG/1.
1,2,3-TRICHLOROPROPANE		ND	10,000] ND	10,000	110	10.000	UG/L
1,2-DIBROMO-3-CHLOROPROPA	NE '	ИD	10.000	เหม	10,000	ND	10,000	UG/L
1,2-DIBROMOETHANE		ND	10,000	ND	10.000	tio and	10.000	UG/L
1,2-DICHLOROBENZENE		ND	10.000	ND.	10.000	140	10.000	UG/T,
1,2-DICHLOROETHANE		ND	5.000	ND	5,000	ND	5,000	UG/T
1, 2-DICHLOROPROPANE		dip	5.000	ND	5,000	ar	5,000	ug/L
1,4-DICHLOROBENZENE	**	ND .	10,000	ND	10.000	เหต	10.000	UG/L
2-BUTANONE		ан	10.000	ND	10.000	HD.	10,000	UG/T.
2-HEXANONE		ND	10,000	HD GH	10,000	מוז	10,000	UG/L
4-METHYL-2-PENTANONE		1110	10.000	ND	10,000	UD	10.000	ug/L
ACETORE		ND	34,000	ND	34,000	นอ	34,000	UG/L
ACRYLONITRILE		ND	100,000	ND	100.000	ND	100,000	UG/L
BENZENE	A S	ND .	5,.000	ND	5.000	110	5,000	UG/L
BROMOCHLOROMETHANE	•	an	10.000	lno i	10,000	luo 1	10,000	UG/L
BROMODICHLOROMETHANE		IND	5,000	ND	5.000	(up	5.000	UG/L
BROMOFORM		พอ	5,000	ND:	5,000	110	5,000	0G/L
BROMOMETHANE		ND	10.000	ND 1	10,000	MD dit	10,000	UG/L
CARBON DISULFIDE	1	ND	5.000	ND	5.000	lub	5.000	0G71 ₆
CARBON TETRACHLORIDE		ND	5,000	ND	5,000	m	5,000	UG/1.
CHLOROBENZENE		HD	5.000	ND	5,000	DD D	5,000	UG/L
CIII.OROETHANE		ND	10,000	иD	10,000	m	10,000	UG/L
CHLOROFORM		D	5.000	ND	5,000	IBD	5.000	0G/L
CHLOROMETHANE	•	ND	10.000	lno i	10,000	100	10,000	0671.
CIS-1, 2-DICHLOROETHENE		HD	10.000	ND	10,000	l Dia	10,000	UG/L
CIS-1, 3-DICHLOROPROPENE	· .	UD	5.000	ND	5,000	luo I	5.000	UG/L
DIBROMOCHLOROMETHANE		ND	5.000	ND	5.000	HD	5,000	UG/L
DIBROMOMETHANE		ND	10.000	ND	10.000	dit	10,000	UG/b
ETHYLBENZENE		ND	5,000	rip	5,000	tiD	5,000	UG/L
LODOMETHANE		ND	10,000	เมอ	10,000	tup	10,000	UG/1,
METHYLENE CHLORIDE		ND	5.000	ND	5.000	liio	5,000	OG/L
STYRENE		ND	5.000	lib	5.000	liib	5,000	0G/1.
TETRACHLOROETHERE		ND I	5.000	ND	5.000	liib	5,000	UG/L
TOLOGUE		iib	5.000	QUI	5.000	liib	5.000	0671.
TRAUS-1, 2-DICHLOROETHENE		ND	10,000	OU OU	10,000	100	10,000	0671.
TPANS-1, 3-DICHLOROPROPENE	:	no	5.000	liib l	5.000	lim	5.000	0G/ h
TRAUS-1, 4-DICHLORO-2-BUTE		ND	10,000	liib	10,000	100	10,000	067),
TRICHLOROETHENE		110	5.000	liii	5.000	110	5,000	0671.
TRICHLOROFLUOROMETHANE		lin	10,000	iiii	10,000	100	10,000	06/6
VIRYL ACETATE	•	liiii	10.000	1100	10,000	lib	10.000	0671.
VIDYL CHLORIDE		liii	10,000	110	10,000	110	10,000	06/1.
ZYLERE (TOTAL)		เมื่อ	10,000	dii	10,000	lin	. 10,000	11671.
A COMPANIE (LO LAND)		I'''	10,000	1''''	177,770	l''''	1.7, 1,117	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

NA - Not Analyzed

ND = Not Detected

TBK - Trlp Blank

s - EML Subcontract Data



Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 ENS: MP: 93-10497 852931 00 / 01

Rev / Task; Sample Type; Reported;

WF.L.1, 12-MAR-1993

. Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AG5219 17-FEB-1993	EML RL	852-MW04 AG5217 17-FEB-1993	EMI, RI.	B52-MW06 AG5218 17-FEB-1993	EMI, RL	Units
FIELD DATA: COLOR DEPTH TO WATER FROM TOP OF FIELD DISSOLVED OXYGEN GROUNDWATER ELEV. ODOR PH FIELD		SLT/YELLO 13.96 8.40 630.20 NO 7.34	-	NONE 5.18 2.80 646.19 NO 7.15		LT.BROWN 69.38 9.20 0.3 NO 8.08		FT MG/L FT MSL PH UNITS
SPECIFIC CONDUCTANCE FIELD WATER TEMPERATURE IN DEGRE WELL DEPTH TOTAL		4250. 9.6 40.76		9750. 6.2 .32.50		0.3 630.24		UMIJOSZCM DEGREES C PT
CHEMICAL METHODS & ROBOTICS	:	205	10.000		. 10 000	500	10 000	MG/I
ALKALINITY, BICARBONATE		225	10.000 10.000	1110	10.000 10.000	18	10,000 10,000	MG/L MG/L
CHEMICAL OXYGEN DEMAND		222	5.000	955	5,000	180	2,500	MG/L
CYANIDE, TOTAL		ND ·	0.020	ND	0,020	ND	0.020	MG/ L
FLUORIDE		0.45	0.050	0.080	0.050	0.30	0.050	MG/1a
HITROGEH, AMMONIA		1.15	0.020	ND	0.020	1.31	0.020	MG/L
HITROGEN, NITRATE		ND	0.050	ND	0.050	0.073	0.050	MG/L
PH		6.05	0.050	6.74	0.050	6.51	0.050	PH UNITS
PHENOLS		מא	0.050	ND	0.050	ND	0.050	MG/L
SOLIDS, TOTAL DISSOLVED		3620	25.000	7620	25,000	1680	10.000	MG/L
SPECIFIC CONDUCTANCE		4370	1.000	8990	1.000	2540	1,000	UMHOS/CM
SULFATE		2150	50.000	3610	50,000	589	25.000 1.000	MG/L
TOTAL ORGANIC CARBON		15.3 15.1	1.000 1.000	23.3 23.4	1,000 1,000	2.0	1.000	MG/I MG/I
TOTAL ORGANIC CARBON		15.1	1.000	23,4	1.000	2.2	1.000	MG/1/
INORGANICS:		ļ.,,	10.000		10 000		10.000	40.41
ARSENIC-TOTAL		ND ND	10.000 200.000	ND ND	10,000 200,000	ND ND	10,000 200,000	ng/t
BARIUM-TOTAL BORON-TOTAL		181	10,000	1780	10.000	110216	10.000	UG/I:
CADMIUM-TOTAL		ND	5.000	ND	5.000	ND D	5.000	UG/L
CALCIUM-TOTAL		378000	5000.000	599000	5000.000	117000	5000.000	UG/I
CHROMIUM-TOTAL		מא	10.000	12.3	10,000	ND	10,000	UG/I
COPPER-TOTAL		ΩИ	25,000	מא	25.000	ND	25,000	UG/1.
IROH-TOTAL		1840	100,000	168	100,000	4150	100.000	UG/15
LEAD-TOTAL		ир	25.000	ND	25,000	03.0	50,000	UG/1.
MAGNESIUM-TOTAL	•	129000	5000,000	655000	5000,000	80300	5000,000	UG/L
HAHGANESE-TOTAL		903	15,000	5260	15,000		15.000	ng\r\
MERCURY-TOTAL		ND	0.200.	ND	0.200	IND	0.200	0G/L
DICKEL-TOTAL		ND	40.000	40.2	40,000	DD	40.000	UG/L
POTASSIUM-TOTAL		ND	5000,000	7980	5000.000	HD HD	5000,000	UGZI.
SELENIUM-TOTAL SILVER-TOTAL		ND QU	25,000 25,000	ND	25,000 125,000	110	25,000 25,000	UG/L UG/L
SODIUM-TOTAL		437000	5000.000	766000	5000,000	307000	25.000 5000.000	0071. 0071.
SOUTOM-TOTAL SINC-TOTAL		34.0	20.000	140	20,000	712	20,000	11671.
10171	•	37,0	20.000	100	20.000	''"	EG. WIN	, 11
VOLATILE ORGANICS:]
1,1,1,2-TETRACHLOROETHANE		ND .	5.000	ND	5.000	[00]	5.000	UG/T.

NA = Not Analyzed

ND = Not Detected

TBK = Trlp Blank

B -- EMB Subcontract Data





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS: 93-10497 852931 00 / 01 MP: Rev / Task: Sample Type: Reported:

WELL

12-MAR-1993

Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AG5219 17-FEB-1993	EML RL	852-MW04 AG5217 17-FEB-1993	EML RL	852-MW06 AG5218 17-FEB-1993	EML RL	Units
	· v	٠.						
1,1,1-TRICHLOROETHANE		ND .	5.000	ND	5.000	5	5,000	UG/L
1, 1, 2, 2-TETRACHLOROETHANE		ND F	5,000	ND ·	5.000	ND	5.000	UG/L
1,1,2-TRICHLOROETHANE		ND	5.000	ทอ	5,000	ND	5,000	UG/L
1.1-DICHLOROETHANE		ND	5.000	ND I	5,000	30.	5.000	0G/L
1.1-DICHLOROETHENE		ND I	5.000	IND	5,000	ND .	5,000	UG/L
1, 2, 3-TRICHLOROPROPANE		IND I	10.000	ND	10,000	no i	10.000	UG/L
1: 2-DIBROMO-3-CHLOROPROPANI	₹.	ND	10.000	ND [10.000	ทอ	10.000	UG/L
1,2-DIBROMOETHANE	_	IND I	10.000	IND I	10,000	ND	10.000	UG/L
1.2-DICHLOROBENZENE		IND	10.000	ND.	10.000	พธ	10.000	UG/1.
1,2-DICHLOROETHANE		liiD	5.000	ND		ND	5,000	UG/1.
1,2-DICHLOROPROPANE		IND I	5.000	ND	5,000	ND	5.000	0G/L
1,4-DICHLOROBENZENE		ND	10.000	ND	10.000	ND	10.000	UG/I.
2-BOTANONE		IND I	10.000	ND	10.000	йD	10.000	UG/I
2-HEXANONE		ן אַס	10.000	ND	10.000	liib 1	10.000	ng\t
4-METHYL-2-PENTANONE		ND	10.000	ND	10.000	น้อ	10,000	0G/L
ACETONE		ND	34.000	ND	34.000	ND	34,000	0G/1.
ACRYLONITRILE		ND	100.000	ND	100.000	lio I	100.000	0G/L
		ND	5.000	מא	5.000	ND	5,000	UG/L
BENZENE		ND I	10.000	ND	10.000	ND	10.000	UG/L
BROMOCHLOROMETHANE		ND ND	5.000	ND	5.000	HD	5.000	UG/L
BROMODICHLOROMETHANE		IND CM	5.000	ND.	5.000	ND I	5.000	UG/L
BROMOFORM					10.000	ND	10.000	11G/L
BROMOMETHANE	•	ND ND	10,000 5 ,000	ND ND	5.000	IND I	5.000	UG/L
CARBON DISULFIDE					5,000	din din	5.000	
CARBON TETRACHLORIDE		ND	5,000	ND	5.000		5.000	UG/1. UG/1.
CHLOROBENZENE		ND	5.000	ND ·		IND TO		
CHLOROETHANE		ND	10.000	ND	10.000	38.	10.000	UG/L
CHLOROFORM		ND	5.000	ND .	5.000	110	5.000	UG/L
CHLOROMETHANE		ND	10.000	ND	10.000	1ND	10.000	UG/I,
CIS-1, 2-DICHLOROETHENE		ND	10.000	ND	10.000	ND	10.000	UG/L
CIS-1, 3-DICHLOROPROPENE		ND	5,000	ND	5.000	ND	5.000	UG/L
DIBROMOCHLOROMETHANE		ND	5,000	ND	5.000	ND .:	5.000	UG/L
DIBROMOMETHANE		ND	10,000	ND	10.000	ND	10.000	UG/L
ETHYLBENZENE		ND	5,000	ND '	5,000	ND	5,000	UG/L
IODOMETHANE	•	110	10.000	ND ·	10.000	ND	10.000	UG/1
METHYLENE CHLORIDE		liiD	5.000	ND I	5.000	6.	5.000	UG/1.
STYRENE		ND	5,000	ND :	5,000	ND	5.000	UG/L
TETRACHLOROETHENE		ND	5.000	ND	5,000	16. I	5,000	UG/L
TOI,UENE		ND	5.000	ND :	5,000	D CIN	5.000	UG/L
TRANS-1, 2-DICHLOROETHENE		IND	10.000	ND	10,000	ND I	10,000	UG/1.
TRANS-1, 3-DICHLOROPROPENE		nD	5,000	ND	5,000	1100	5.000	0671
TRANS-1, 4-DICHLORO-2-BUTEN	€.	ND	10.000	IID III	10,000	110	10,000	UG/L
TRICHLOROETHENE	_	ND	5.000	ino di	5,000	liiii	5.000	06/6
TRICHLOROF LUOROMETHANE		no	10.000	IID I	10,000	iiii	10,000	0671.
VIIIYI, ACETATE		lip	10.000	HD	10.000	liii	10,000	06Zh •
VINYI, CHLORIDE		ND	10.000	ND	10.000	liib i	10.000	067L
		ND	10.000	ND	10.000	NO	10,000	067 ti

NA = Not Analyzed

ND = Not Detected

TBK - Trip Blank

s = EML Subcontract Data

June 10, 1993

Mr. Fenton Rood, Chief Solid Waste Management Service - 0206 Oklahoma State Department of Health 1000 NE Tenth Street Oklahoma City, OK 73117-1299

SUBJECT: 2nd Quarter 1993 Groundwater Monitoring

Muskogee Community Landfill

Permit No. 3551020 Muskogee, Oklahoma

Dear Mr. Rood:

On behalf of the Muskogee Community Landfill, I am forwarding three (3) copies of the groundwater monitoring report for the sampling conducted on April 27, 1993. The three (3) new monitor wells recently installed by Waste Management of Oklahoma (#01R, #02R and #03R) and the five (5) existing City of Muskogee monitor wells (#01, #02, #03, #04 and #06) were sampled.

All wells were sampled for the parameters required by the OSDH and Federal Subtitle D regulations. If you have questions or require additional information, please call me or Mark Daniels at (405) 427-6030.

Sincerely,

WASTE MANAGEMENT OF OKLAHOMA, INC.

Dan P. Gibson

Environmental Engineer

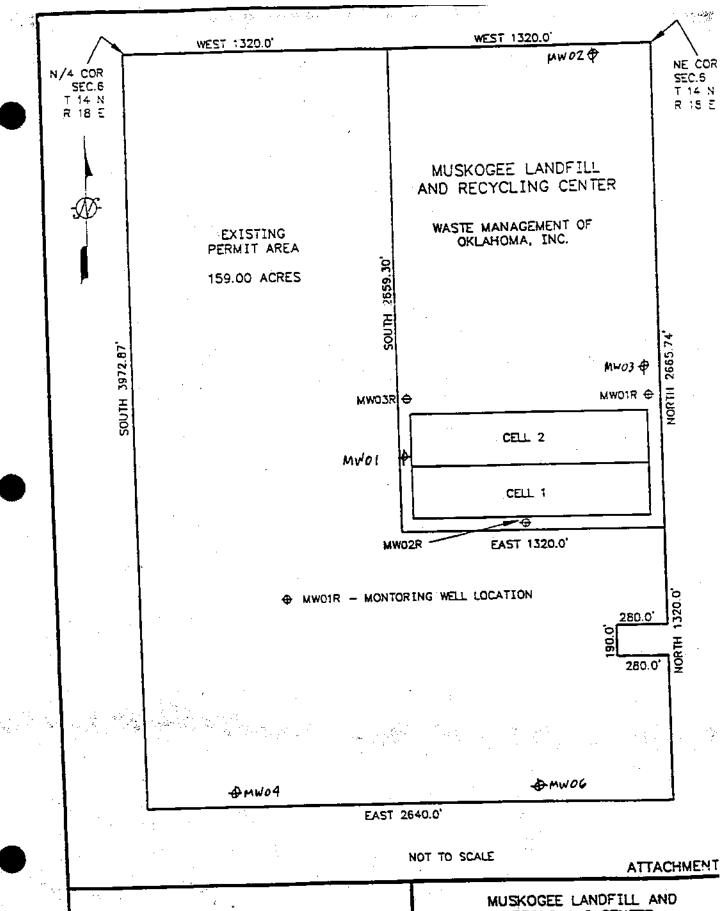
Enclosure

cc: Larry Cohn, WMNA South Mark Snyder, WMNA South

Mike McCloud, Muskogee Landfill Mark Daniels, East Oak Landfill Walter Beckham, City of Muskogee

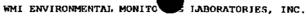
J.C. Shutler, Muskogee County Health Department

(MUSKOGEE\2093H20.LTR)



MUSKOGEE LANDFILL AND RECYCLING CENTER

MONITORING WELL LOCATION MAP





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS:

MP: Rev / Task: Sample Type: Reported: 93-11523 852931 01 / 01 WELL

20-MAY-1993

	11				Reported:	20-MAY-1	.993	
Analyte	Sample Point: Sample Number: Sampled:	852-01FB AH0591 27-APR-1993	EML RL	852-MW01 AH0585 27-APR-1993	EMI, RL	852-MW01R AH0587 27-APR-1993	EML RL	Units
IELD DATA: COLOR DEPTH TO WATER FROM TOP	OF CASING	CLEAR NA		BROWN 14.30	. (j.)	BROWN 8.68	·	FT
FIELD DISSOLVED OXYGEN GROUNDWATER ELEV. ODOR		7.50 NA NONE		3.50 628.56		6,10		MG/L FT MSL
PH FIELD		8.98		STRONG 6.52	<i>1</i>	NONE 6.96		PH UNITS
SPECIFIC CONDUCTANCE FIE	LD	45.1		5560	<u></u>	4850		UMROS/CM
WATER TEMPERATURE IN DEG	REES CELSIUS	20,9		14.8		14.8		DEGREES C
WELL DEPTH TOTAL		NA		43.18		29.25		FT
CHEMICAL METHODS & ROBOTIO	cs:				į	l		
CHEMICAL OXYGEN DEMAND	•	ND	10.	12	10.	ND	10.	MG/L
CYANIDE, TOTAL		ND	0.020	ND -	0.020	ИD	0.020	MG/L
NITROGEN, AMMONIA		0.27	0.020	1.30	0.020	ND	0.020	MG/L
NITROGEN, NITRATE		ND 6.87	0.050	ND	0.050	0.52	0.050	MG/L
PHENOLS		ND	0.05 0.050	6,67 ND	0.05	7.20	0.05	PH UNITS
SOLIDS, TOTAL DISSOLVED	•	11	5.	5800	0.050 25.	ND 1110	0.050	MG/L
SPECIFIC CONDUCTANCE		4.1	1.0	6120	1.0	1860	5. 1.0	MG/L UMHOS/CM
TOTAL ORGANIC CARBON		מא ל	1.0	2.4	1.0	ND	1.0	MG/L
TOTAL ORGANIC CARBON		ND	1.0	2.4	1.0	190	1.0	MG/L
NORGANICS:								ļ
ALKALINITY, BICARBONATE	+= · · ·	ND	10.	534	10.	282	10.	MG/L
ANTIMONY-TOTAL		ND	100.	ND	100,	ND	100.	UG/L
ARSENIC-TOTAL	•	ND .	0.01	ND	10.0	· ND	10.0	UG/I
BARIUM-TOTAL		ND	200.	ND .	200.	ND	200.	UG/L
BERYLLIUM-TOTAL		ND	5.0	ND	5.0	ИD	5.0	UG/I.
BORON-TOTAL		24.2	10.0	677	10.0	86.7	10.0	UG/L
CADMIUM-TOTAL	· "	ND	5.0	ND	5.0	ND	5,0	UG/L
CALCIUM-TOTAL CHLORIDE	·	ND	5000	461000	5000	133000	5000	UG/L
CHROMIUM-TOTAL		ND .	0.5	315	5.0	404	0.5	MG/L
COBALT-TOTAL		ND ND	10.0	ND	10.0	ND	10.0	UG/L
COPPER-TOTAL		GN	50.0 25.0	ND ND	50.0 25.0	110	50.0	UG/E
FLUORIDE		ON CON	0.050	0.38	0.050	ND 0.43	25.0 0.050	UG/1.
IRON-TOTAL	1, 11	ND .	100.	729	100.	622	100.	MG/L UG/L
LEAD-TOTAL		ND	5.0	ND	16.0	ND	5,0	ng/r
MAGNESIUM-TOTAL		ND	5000	240000	5000	41200	5000	UG/L
MANGANESE-TOTAL		ND	15.0	2960	15.0	20.8	15.0	UG/L
MERCURY-TOTAL		ND	0,20	ND	0.20	ND	0.20	UG/L
HICKEL-TOTAL	·	ИD	40.0	ND	40.0	พับ	40.0	UG/L
POTASSIUM-TOTAL		HD	5000	ND	5000	ND	5000	UG/L
SELENIUM-TOTAL		ND	5.0	ND	16.0	8fD	5.0	UG/L
SILVER-TOTAL		ND	25.0	ND	25.0	ND	25.0	UG/L
SODIUM-TOTAL		ND	5000	719000	5000	188000	5000	UG/L
SULFATE		ИD	5.0	2780	50.0	54.7	5,0	MG/Ti
THALLIUM-TOTAL		ND	10.0	11D	10.0	ND	10.0	UG/I,

LABORATORIES, INC. WMI ENVIRONMENTAL MONITO



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS:

MP; Rev / Task: Sample Type: Reported: 93-11523 852931 01 / 01 WELL

20-MAY-1993

· · · · · · · · · · · · · · · · · · ·				Reported: 20-MAI-1993					
Analyte	Sample Point: Sample Number: Sampled:	852-01FB AH0591 27-APR-1993	EML RL	852-MW01 AH0585 27-APR-1993	EML RL	852-MW01R AH0587 27-APR-1993	EML RL	Units	
VANADIUM-TOTAL ZINC-TOTAL		ND ND	50.0 20.0	ND ND	50.0 20.0	ND ND	50.0 20.0	UG/L	
VOLATILE ORGANICS:	. 19 1				1.7	,			
1,1,1,2-TETRACHLOROETHANE	£ .	ND	5.	ND	5.	ND .	5.	ՍG/L	
1,1,1~TRICHLOROETHANE		ND	5.	ND	5	ИD	5.	UG/L	
1,1,2,2-TETRACHLOROETHANE	•	ND	5.	ND .	5. 5.	ND 1	5.	UG/L	
1,1,2-TRICHLOROETHANE	İ	ND ND	5. 5.	ND ND	5.	ND ND	5. 5.	UG/L	
1,1-DICHLOROETHANE 1,1-DICHLOROETHENE		מא	5.	ND D	5.	ND ND	5.	UG/L UG/L	
1, 2, 3-TRICHLOROPROPANE		ND	10.	ND	10.	ND .	10.	UG/L	
1,2-DIBROMO-3-CHLOROPROPANE	•	ND	10.	ND .	10.	ND	10.	UG/L	
1,2-DIBROMOETHANE		ND	10.	ND	10.	ND	10.	UG/L	
1,2-DICHLOROBENZENE		ND	10.	l ND	iŏ.	ND I	10.	UG/L	
1,2-DICHLOROETHANE		ND	5.	ND	5.	ND	5.	UG/L	
1,2-DICHLOROPROPANE		ND	5.	ND .	5.	ND	5.	UG/L	
1,4-DICHLOROBENZENE	•	ND	10.	ND	10.	ND	10.	UG/L	
2-BUTANONE		אס י	10.	ND	10.	ND .	10.	UG/L	
2-HEXANONE		ND	10.	ND	10.	ND	10,	UG/L	
4-METHYL-2-PENTANONE	·	ND	10.	ND	10.	NÐ	10.	UG/L	
ACETONE	• •	ND	34.	ND	31.	HD	34.	UG/L	
ACRYLONITRILE		ND	100	ND	100	ND .	100	UG/L	
BENZENE BROMOCHLOROMETHANE	•	ND ND	5. 10.	ND ND	5. 10.	ND ND	5.	0G/I,	
BROMODICHLOROMETHANE		ND	5.	ND	5.	ND	10. 5.	UG/L UG/L	
BROMOFORM	***	ND ND	5.	ND	5.	ND	5.	UG/L	
BROMOMETHANE	•	ND ND	10.	ND ND	10.	ND	10.	UG/L	
CARBON DISULFIDE	•	ND	, iš.	ND.	5.	ND	15.	UG/L	
CARBON TETRACHLORIDE	N.	ND	5.	ND	l š.	ND :	5.	UG/L	
CHLOROBENZENE		ND	5.	ND	l. 5.	ND	5.	UG/L	
CHLOROETHANE		ND	10.	ND	10.	ND	10.	UG/L	
CHLOROFORM		ND	5.	ND	5.	ND	5.	UG/L	
CHLOROMETHANE	•	ND	10.	ND .	10.	ND	10.	UG/L	
CIS-1,2-DICHLOROETHENE	e e	ND	10.	ND	10,	ND	10.	UG/L	
CIS-1,3-DICHLOROPROPENE	and the second	ИĎ	5.	ND	5.	ND	5.	UG/L	
DIBROMOCHLOROMETHANE		ND	5.	ND	5.	ND	5.	UG/L	
DIBROMOMETHANE	•	ND	10.	ND	10.	ND	10.	UG/I.	
ETHYLBENZENE		ND	5.	ND	5.	11D	5.	UG/L	
IODOMETHANE		ND	10. 5.	110	10.	110	10.	UG/1,	
METHYLENE CHLORIDE STYRENE		ND ND	5.	ND ND	5. 5.	מון	5. 5.	UG/L UG/L	
TETRACHLOROETHENE		ND	5.	ND ND	5,	UD ON	5.	0G/L	
TOLUENE		סוו	5.	lib Oil	l ŝ.	ND	5.	ug/L	
TRANS-1,2-DICHLOROETHENE		ND ND	10.	NO	10.	130	10.	0071	
TRANS-1, 3-DICHLOROPROPENE		ND	15.	ND	5.	l no	l 'š.	0G/L	
TRANS-1, 4-DICHLORO-2-BUTEN	E	ND	10.	ND	10.	HD	10.	UG/L	
TRICHLOROETHENE		ND .	5,	ND	5.	ND	5.	UG/Ti	
TRICHLOROFLUOROMETHANE		מא	10.	ND	10.	ND	10.	ug/h	
				•		1		1	



WMI ENVIRONMENTAL MONITO 3 LABORATORIES, INC.

EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

ENS: MP:

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

Rev / Task:

93-11523 852931 01 / 01

Sample Type: Reported:

WELL 20-MAY-1993

Analyte	Sample Point: Sample Number: Sampled:	852-01FB AH0591 27-APR-1993	EML RL	852-MW01 AH0585 27-APR-1993	EML RL	852-MW01R AH0587 27-APR-1993	EML RL	Units
VINYL ACETATE VINYL CHLORIDE XYLENE (TOTAL)		ND ND ND	10. 10. 10.	ND ND ND	10. 10. 10.	ND ND ND	10. 10. 10.	ng/r ng/r

NA = Not Analyzed

ND - Not Detected

TBK - Trip Blank

s = EML Subcontract Data

WMI ENVIRONMENTAL MONITO , LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS:

93-11523

MP: Rev / Task: Sample Type: Reported:

The contract of the state of

852931 01 / 01 WELL

20~MAY-1993

	:		•	••	Reported:	20~MAY-1	993	
Analyte	Sample Point: Sample Number: Sampled:	852-MW02 AH0589 27-APR-1993	EML RL	852-MW02R AH0590 27-APR-1993	EML RL	852-MW03 AH0588 27-APR-1993	EML RL	Units
IELD DATA:	2. 1				and the same	1.55		,
COLOR	$i\theta/a$	CLEAR		CLEAR		CLEAR	1.45	
DEPTH TO WATER FROM TOP OF	CASING	19.72		8.50	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	9,39		FT
FIELD DISSOLVED OXYGEN	54 (4)	2.75	,	6:20	No. of the second	5.80		MG/L
GROUNDWATER ELEV.		607.02		655.34	124.74 A	624,25		FT MSL
ODOR	•	NONE		NONE	4 Danel	SLIGHT		11.102
PH FIELD	A	7.25		6;20	H. Uou	8.25	•	PH UNITS
SPECIFIC CONDUCTANCE FIELD	\	4880		3880	l* . ′	8850		UMHOS/CM
WATER TEMPERATURE IN DEGREE	ES CELSIUS	18.1		17.7		1 18.8		DEGREES C
WELL DEPTH TOTAL		28.72		30.01		30,10		FT
HEMICAL METHODS & ROBOTICS:		l						
CHEMICAL OXYGEN DEMAND		30	10.	ND.	10,	ND	10.	MG/L
CYANIDE, TOTAL		ND	0.020	ND	0.020	ND I	0.020	MG/L
NITROGEN, AMMONIA		0,15	0.020	0.96	0.020	ND	0.020	MG/L
NITROGEN, NITRATE		ND	0.050	ND ND	0.050	0.40	0.050	MG/L
PH		6.89	0.05	6.87	0.05	7.23	0.05	PIL UNITS
PHENOLS		ND	0.050	ND	0.050	סא	0.050	MG/L
SOLIDS, TOTAL DISSOLVED	• •	3180	25.	2380	25.	1040	5.	MG/L
SPECIFIC CONDUCTANCE		4930	1.0	4010	1.0	1920	1.0	UMHOS/CM
TOTAL ORGANIC CARBON	•	1.4	1.0	1.4	1.0	ND	1.0	MG/L
TOTAL ORGANIC CARBON		1,5	1.0	1.3	1.0	ND	1.0	MG/L
NORGANICS:						·		
ALKALINITY, BICARBONATE	+ 1	296	10.	710	10.	. 393	10.	MG/L
ANTIMONY-TOTAL		ND	100.	- ND	100.	·ND	100.	.UG/L
ARSENIC-TOTAL		17.2	10.0	ND	.10.0	ND ·	. 10,0	. UG/L
BARIUM-TOTAL		ND	200.	ND	200,	ND	200.	UG/L
BERYLLIUM-TOTAL		ND	5.0	ИD	5.0	ND	5.0	UG/L
BORON-TOTAL		230	10.0	773	10.0	146	10.0	UG/L
CADMIUM-TOTAL		ND .	5.0	ND	5.0	ND	5.0	UG/L
CALCIUM-TOTAL	• •	282000	5000	163000	5000	98400	5000	UG/L
CHLORIDE		1210	5.0	335	2.5	371	0.5	MG/L
CHROMIUM-TOTAL		ND	10.0	ND	10.0	ND	10,0	UG/L
COBALT-TOTAL		ND .	50.0	ND	50.0	ND	50.0	UG/L
COPPER-TOTAL	· .	ND	25.0	NĐ	.25.0	ND	25.0	UG/L
FLUORIDE		0.22	0.050	0.52	0.050	0.49	0,050	MG/L
IRON-TOTAL		3530	100.	2310	100.	2120	100.	UG/L
LEAD-TOTAL	17.5	ND	16,0	ND	16.0	ИД	5.0	UG/L
MAGNESIUM-TOTAL		117000	5000	57000	5000	40500	5000	UG/1,
MANGANESE-TOTAL		2640	15.0	779	15.0	52.3	15.0	UG/L
MERCURY-TOTAL		ND	0.20	ND	0.20	ND	0.20	ne\ir
NICKEL-TOTAL		ND	40.0	ND	40.0	ND	40.0	UG/L
POTASSIUM-TOTAL		ND	5000	ND	5000	ND	5000	UG/L
SELENIUM-TOTAL		ND	5.0	ND	16.0	ND	5.0	06/1/
SILVER-TOTAL		ND	25.0	ND	25.0	CONC	25.0	UG/L
SODIUM-TOTAL		584000	5000	706000	5000	255000	5000	UG/I
SULFATE		393	50.0	903	25.0	36.5	5.0	MG/I
THALLIUM-TOTAL		ND	10.0	ND	10.0	ND	10.0	ug/h

WMI ENVIRONMENTAL MONIT G LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

MR - Mak Basturad

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS:

MP: Rev / Task: 93-11523 952931 01 / 01

Sample Type: Reported:

WELL 20-MAY-1993

<u> </u>	<u> </u>			•	керогсеа:	. 50-WVI-1	993	
Analyte	Sample Point: Sample Number: Sampled:	852-MW02 AH0589 27-APR-1993	EML RL	852-MW02R AH0590 27-APR-1993	EML RL	852-MW03 AH0588 27-APR-1993	EML RL	Units
·								
ANADIUM-TOTAL		ND	50.0	ND	50.0	ทอ -	50.0	UG/L
INC-TOTAL		ND	20.0	ND I	20.0	ND	20.0	UG/L
		"	20.0	-7.45	20,0	. "	20.0	06/1
LATILE ORGANICS:			•	10 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1 Aug 1	·	•		
,1,1,2-TETRACHLOROETHANE		ND	5.	ND	5.	ND !	5.	UG/L
. 1.1-TRICHLOROETHANE		ND 1	5.	ND	5.	ND	5.	UG/L
,1,2,2-TETRACHLOROETHANE		ND I	5.	ND	5.	ND	5.	UG/L
, 1, 2-TRICHLOROETHANE		ND I	Š.	ND	5.	ND	5.	UG/L
, 1-DICHLOROETHANE		ND ND	5.	ND ND	5.	ND I	5.	UG/L
, 1~DICHLOROETHENE		ND	5.	ND	5.	ND ND	5.	UG/L
, 2, 3-TRICHLOROPROPANE		ND ND	10.	ND ND	10.	ND I	10.	UG/L
2-DIBROMO-3-CHLOROPROPANE	2	l ND	10.	ND	10.	ND ND	10.	UG/L
, 2-DIBROMOETHANE	-	ND	10.	ND	10.	ND I	10.	UG/L
, 2-DICHLOROBENZENE		ND ND	10.	ND	io.	ND	10.	UG/L
, 2-DICHLORGETHANE		ND I	5.	ND ND	5.	ND	5.	UG/L
2-DICHLOROPROPANE		ND	š.	ND	5.	סא	5.	UG/L
4-DICHLOROBENZENE		ND I	10.	ND ND	10.	ND D	10.	UG/L
BUTANONE	* *	ND	10.	ND	10.	ND	10.	UG/L
-HEXANONE		ND I	10.	ND	10.	אס סא	10.	UG/L
-METRYL-2-PENTANONE		ND	10.	ND ND	10.	ND	10.	UG/I
CETONE		ND	34.	ND	34.	ND CN	34.	UG/L
CRYLONITRILE	•	סמ	100	ND	100	ND ND	100	UG/L
ENZENE		NO	5.	ND ND	5.	סא סא	5.	
ROMOCHLOROMETHANE		ND -	10.	ND	10.	ND	10.	nG\r
ROMODICHLOROMETHANE	•	ND	5.	ND .	5.	· ND	5.	UG/L
ROMOFORM		ND ND	5.	ND	5.	ND ND	5.	UG/I
ROMOMETHANE		ND	10.	ND ND	10.	מא פא	10.	UG/L
ARBON DISULFIDE		ND ND	^š.	ND	5.	ND ND	5.	UG/L
ARBON TETRACHLORIDE		ND	š.	מא	5.	לא מא	5.	
HLOROBENZENE		ND	5.	ND	5.	· ND	5. 5.	UG/L
LOROETHANE		ND	10.	ND	10.	ND ND	10.	UG/L
LOROFORM		ND	5.	ND:	5.	ON CN		UG/L
HLOROMETHANE		ND	10.	ND	10.	UN D	5.	UG/L
IS-1,2-DICHLOROETHENE	:	ND	10.	מא	10.	DAND MIN	10.	UG/L
IS-1, 3-DICHLOROPROPENE		ND	10. 5.	מא	5.	UN ND	10.	UG/L
BROMOCHLOROMETHANE		מא	5. 5.	ND ND	5. 5.		5.	nc/r
IBROMOMETHANE		ND	10.	l ND	10.	לא מא	5.	UG/L
THYLBENZENE		ND	5.	ND ND	5.		10.	OC/P
DOMETHANE		ND	10.	ND ND	10.	ND ND	5.	UG/L
THYLENE CHLORIDE		ND ND	5.	ND	10. 5.	HD	10. 5.	UG/L
YRENE		ND	5. 5.	ND ND	5. 5.	ทอ ทอ	5.	BG/L
TRACHLOROETHENE		ND	5.	110	5. 5.			UG/L
DLUENE		ND .	5.			ND	5. E.	UG/L
RANS-1, 2-DICHLOROETHENE		ND	10.	17D ND	5. 10.	ND	5.	UG/L
RANS-1, 3-DICHLOROPROPENE		ND I	5.			110	10.	UG/L
RANS-1, 4-DICHLORO-2-BUTENE	•	ND		ND ND	5.	ND ND	5.	UG/L
RICHLOROETHENE	1	ND ND	10. 5.	ND ND	10.	ND	10.	UG/L
RICHLOROFLUOROMETHANE		ND ND		HD No.	5.	NO	5.	UG/L
THE THEORY OF TOWNS THE THEORY		I 40	10.	· ND .	10.	NO I	10.	UG/L



WMI ENVIRONMENTAL MONITO. 3 LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

ENS: MP: 93-11523

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

Rev / Task:

852931 01 / 01 WELL

Sample Type: Reported:

20-MAY-1993

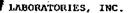
Analyte	Sample Point: Sample Number: Sampled:	852-MW02 AH0589 27-APR-1993	EML RL	852-MW02R AH0590 27-APR-1993	EML RL	852-MW03 AH0588 27-APR-1993	EML RL	Units
VINYL ACETATE VINYL CHLORIDE XYLENE (TOTAL)		ND ND ND	10. 10. 10.	ND ND ND	10. 10. 10.	ND ND ND	10. 10. 10.	UG/L UG/L

NA - Not Analyzed

ND - Not Detected

TBK - Trip Blank

9 - EML Subcontract Data







Site: 852 - MUSKOGEE LANDFILL

1918 - Hote Bealthand

WD - WAL D-L-I-I

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS:

MP: Rev / Task: Sample Type: Reported:

......

93-11523 852931 01 / 01

WELL 20-MAY-1993

				Reported:	20-FMI-1		
Sample Point: Sample Number: Analyte Sampled:	852-MW03R AH0586 27-APR-1993	EML RL	852-MW04 AH0583 27-APR-1993	EML RL	852-MW06 Ali0584 27-APR-1993	EML RL	Units
IELD DATA: COLOR DEPTH TO WATER FROM TOP OF CASING FIELD DISSOLVED OXYGEN GROUNDWATER ELEV. ODOR PH FIELD SPECIFIC CONDUCTANCE FIELD WATER TEMPERATURE IN DEGREES CELSIUS WELL DEPTH TOTAL	CLEAR 14.25 4.0 629.91 NONE 6.75 4100 15.5 40.76		CLEAR 4.70 2.9 646.67 NONE 7.12 8150 16.0 32.50		CLEAR 25,28 6.2 638,56 SLIGHT 6.70 2810 15.8 69,38	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	FT MG/L FT MSL PH UNITS UMHOS/CM DEGREES C FT
HEMICAL METHODS & ROBOTICS: CHEMICAL OXYGEN DEMAND CYANIDE, TOTAL HITROGEN, AMMONIA NITROGEN, NITRATE PH PHENOLS SOLIDS, TOTAL DISSOLVED SPECIFIC CONDUCTANCE TOTAL ORGANIC CARBON TOTAL ORGANIC CARBON	42 ND 0.96 ND 6.13 ND 3920 4430 13.3	10. 0.020 0.020 0.050 0.05 0.050 25. 1.0 1.0	94 ND ND ND 6.78 ND 7950 9010 21.9 21.9	10. 0.020 0.020 0.050 0.05 0.050 25. 1.0 1.0	ND ND 1.16 ND 6.45 ND 2140 2900 3.8 4.3	10, 0.020 0.020 0.050 0.05 0.050 25. 1.0	MG/L MG/L MG/L MG/L PH UNITS MG/L MG/L MG/L MG/L MG/L UMHOS/CM MG/L MG/L
INORGANICS: ALKALINITY, BICARBONATE ANTIMONY-TOTAL ARSENIC-TOTAL BARIUM-TOTAL BERYLLIUM-TOTAL BORON-TOTAL CADMIUM-TOTAL CALCIUM-TOTAL CALCIUM-TOTAL CHLORIDE CHROMIUM-TOTAL COPPER-TOTAL FLUORIDE IRON-TOTAL LEAD-TOTAL MAGNESIUM-TOTAL MARCANESE-TOTAL MERCURY-TOTAL NICKEL-TOTAL POTASSIUM-TOTAL SELEHIUM-TOTAL SODIUM-TOTAL SODIUM-TOTAL	220 ND ND ND ND 190 ND 421000 214 ND ND 0.43 6630 ND 146000 462 ND ND ND ND ND ND ND ND ND ND ND ND ND	10. 500. 10.0 200. 12.0 50.0 25.0 50.0 250. 125. 0.050 360. 16.0 5000 56.0 0.20 200. 5000	1110 ND ND ND 1700 ND 633000 862 12.8 ND ND 0.082 787 ND 678000 4420 ND 46.3 8020 ND ND	10. 100. 10.0 200. 5.0 10.0 5.0 5000 0.5 10.0 50.0 25.0 0.050 16.0 5000 15.0 0.20 40.0 5000 16.0 5000	490 ND ND ND ND 282 ND 148000 201 ND ND 0.27 5280 51.1 109000 2040 ND ND ND ND	10. 100. 10.0 200. 5.0 5.0 5.0 5.0 5.0 50.0 25.0 0.050 100. 5.0 5000 15.0 0.20 40.0 5000 55.0	MG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L U
SELENIUM-TOTAL	HD	16.0	ND	16.0	ND	5.0	UG/L

WMI ENVIRONMENTAL MONITO. LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS: MP: Rev / Task: Sample Type: Reported:

93-11523 852931 01 / 01 WELL

20-MAY-1993

λnalyte	Sample Point: Sample Number: Sampled:	852-MW03R AH0586 27-APR-1993	EML RL	852-MW04 AH0583 27-APR-1993	EML RL	852-MW06 AH0584 27-APR-1993	EML RL	Units
VANADIUM-TOTAL	-0.4 7-30	ND	96.0	ND	50.0	ND	50.0	UG/L
ZINC-TOTAL	** *	ND	84.0	ND	20.0	731	20.0	UG/L
OLATILE ORGANICS:	្តីវ	-					•	
1,1,1,2-TETRACHLOROETHANE	P	ND I	5.	ИD	5.	ND I	. 5.	UG/L
1,1,1-TRICHLOROETHANE	745 _.	ND	5.	ND .	5.	ND	5.	UG/L
1,1,2,2-TETRACHLOROETHANE	5.5	NO	5.	ND I	š.	ND I	5.	UG/L
1,1,2-TRICHLOROETHANE		ND	Š.	ND	5.	ND I	5.	UG/L
1,1-DICHLOROETHANE	•	ND	5.	ND	5.	30.	5.	UG/L
1,1-DICHLOROETHENE		ND I	5.	ND I	5.	ND I	5.	0G/L
1, 2, 3-TRICHLOROPROPANE		מא	10.	ND ND	10.	ND	10.	UG/1
1, 2-DIBROMO-3-CHLOROPROPANI	F	ND	10.	ND	10.	ND	10.	UG/L
1,2-DIBROMOETHANE		ND I	10.	ND ND	10.			
1,2-DICHLOROBENZENE		ND I	10.	ND ND	10.	NĐ ND	10.	UG/I.
1, 2-DICHLOROETHANE	•	ND I	5.	ND ND	5.	ND ND	10. 5.	UG/L UG/L
1, 2-DICHLOROPROPANE		ן מא	5.	ND ND	5. 5.		5. 5.	
1,4-DICHLOROBENZENE		ND ·	10.			ND		OG/L
2-BUTANONE				ND	10.	ND I	10.	NG/L
2-HEXANONE		ND :	10.	ND	10.	ND I	10.	UG/L
		ND .	10.	ND	10.	ND	10.	UG/I
4-METHYL-2-PENTANONE		ND	10.	ND	10.	ND 1	10.	NC/P
ACETONE	•	ND	34.	ND	34.	ND	34.	UG/L
ACRYLONITRILE		ND	100	i nd	100	ND I	100	UG/L
BENZENE		ND	5.	ND	5.	ND I	5.	UG/L
BROMOCHLOROMETHANE		ND:	10.	ND	10.	ND	10.	UG/L
BROMODICHLOROMETHANE		ND	5.	ND	5.	เดิด	5.	ՍG/L
BROMOFORM		, ND	5.	ND ND	5,	ИD	5.	UG/L
BROMOMETHANE	•	ND	10.	ND	10.	ND	10.	UG/L
CARBON DISULFIDE	•	סא	5.	ND	5.	ND	5,	UG/L
CARBON TETRACHLORIDE		סא [5.	ND 1	5.	ND	5.	UG/L
CHLOROBENZENE	•	GN	5.	ND .	5.	ND	5.	UG/L
CHLOROETHANE		ו מא	10.	ND I	10.	46,	10.	UG/L
CHLOROFORM	3	ND	5.	ND	5.	ND	5.	UG/L
CHLOROMETHANE		מא.	10.	ND	10.	ND	10.	UG/1,
CIS-1, 2-DICHLOROETHENE		ND	10.	ND	10.	ND .	10.	UG/L
CIS-1,3-DICHLOROPROPENE		ND	5.	ND	5.	ND	5.	UG/L
DIBROMOCHLOROMETHANE	•	ND I	5.	ND	5.	ND	5.	UG/1.
DIBROMOMETHANE		ן מא	10.	ND	10.	ND ND	10.	UG/L
ETHYLBENZENE		ND	5.	ND	5.	ND	5.	UG/L
IODOMETHANE		- סא	10.	מא	10.	ND I	10.	UG/L
METHYLENE CHLORIDE		ן מא	5.	מא	5.	8.	5.	UG/L
STYRENE		ND D	5.	ND	5.	ND ND	5.	UG/L
TETRACHLOROETHENE		ND	5.	ND	5.	ND	5.	UG/L
TOLUENE	•	ND ON	š.	ND	5.	ND	5.	UG/L
TRANS-1, 2-DICHLOROETHENE		D DN	10.	130	10.	ND	10.	
TRANS-1, 3-DICHLOROPROPENE		ND ND	5.		5.			UG/L
TRANS-1, 4-DICHLORO-2-BUTEN	F			ND ND		ND ND	5.	UG/I
TRICHLOROETHENE	ь	ND ND	10.	ND ND	10.	ND	10.	UG/L
TRICHLOROFLUOROMETHANE		ND ND	5.	ND	5.	ND	5.	UG/L
TATCHDONOL DOOKOUD THANK		ן עא ן	10.	ND	10.	ND	10.	UG/1.





852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS:

MP: Rev / Task: 93-11523 852931 01 / 01 WELL

Sample Type: Reported:

20-MAY-1993

Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AH0586 27-APR-1993	EML RL	852-MW04 AH0583 27-APR-1993	EML RL	852-MW06 AH0584 27-APR-1993	EML RL	Units
VINYL ACETATE VINYL CHLORIDE XYLENE (TOTAL)		ND ND NO	10. 10. 10.	ND ND ND	10. 10. 10.	ND ND ND	10. 10. 10.	UG/L UG/L

NA - Not Analyzed

ND - Not Detected

TBK - Trip Blank

s = EML Subcontract Data

WMI ENVIRONMENTAL MONITO LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 052 - MUSKOGEE LANDFILL

Symmetric Break Benedicting A.

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS: MP:

93-11523 852931 01 / 01

Rev / Task; Sample Type: Reported: WELL

And the state of the second

20-MAY-1993

				·	veborced.		
Analyte	Sample Point: Sample Number: Sampled:	TBK-MW03R AH0586 27-APR-1993	EML RL	,			Units
COLOR DEPTH TO WATER FROM TOP O	OF CARTING						
FIELD DISSOLVED OXYGEN GROUNDWATER ELEV.	JE CASING					19	FT MG/L FT MSL
ODOR PH FIELD SPECIFIC CONDUCTANCE FIEL WATER TEMPERATURE IN DEGREE WELL DEPTH TOTAL							 PII UNITS UMHOS/CM DEGREES C FT
HEMICAL METHODS & ROBOTIC CHEMICAL OXYGEN DEMAND CYANIDE, TOTAL HITROGEN, AMMONIA HITROGEN, NITRATE PH PHENOLS	CS:						MG/L MG/L MG/L MG/L PH UNITS MG/L
SOLIDS, TOTAL DISSOLVED SPECIFIC CONDUCTANCE TOTAL ORGANIC CARBON TOTAL ORGANIC CARBON	,	 					MG/L UMHOS/CM MG/L MG/L
NORGANICS: ALKALINITY, BICARBONATE ANTIMONY-TOTAL							MG/L UG/L
ARSENIC-TOTAL BARIUM-TOTAL BERYLLIUM-TOTAL BORON-TOTAL		·					UG/L UG/L UG/L UG/L
CADMIUM-TOTAL CALCIUM-TOTAL CHLORIDE CHROMIUM-TOTAL COBALT-TOTAL							UG/L UG/L MG/L UG/L
COPPER-TOTAL FLUORIDE IRON-TOTAL LEAD-TOTAL	:					•	UG/L UG/L UG/L
MAGNESIUM-TOTAL MANGANESE-TOTAL MERCURY-TOTAL DICKEL-TOTAL							0G/L 0G/L 0G/L
POTASSIUM-TOTAL SELENIUM-TOTAL SILVER-TOTAL SODIUM-TOTAL					į		UG/1, UG/1, UG/1,
SULFATE THALLIUM-TOTAL							MG\r MG\r

WMI ENVIRONMENTAL MONITO LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS:

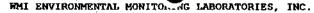
MP: Rev / Task: 93-11523 852931 01 / 01 WELL

Sample Type: Reported:

20-MAY-1993

				 	<u> </u>	 		
	Sample Point: Sample Number:	TBK-MW03R AH0586			. •			
Analyte	Sampled:	27-APR-1993	EML RL					Units
VANADIUM-TOTAL		!					Tvr	
ZINC-TOTAL				I -			1	UG/L
						l .		NG\r
OLATILE ORGANICS:	· · · · · · · · · · · · · · · · · · ·			i	1	ł · · ·		1
1, 1, 1, 2-TETRACHLOROETHANE		ND :	5.	·	1		1.	1.5.7.
1,1,1-TRICHLOROETHANE	<u>.</u>	ND I	5.	i]			UG/L
1,1,2,2-TETRACHLOROETHANE	##	ND	5.	1	i	ν.		UG/L
1, 1, 2-TRICHLOROETHANE		ן מא	5.					UG/L
1,1-DICHLOROETHANE		ND I	5.			}		UG/L
1,1-DICHLOROETHENE		ND I	5.	· ·			1	UG/L
1,2,3-TRICHLOROPROPANE		ן מא	10.	i	ł	i	i	UG/L
1,2-DIBROMO-3-CHLOROPROPA	NF	ן אס	10.	1	·¦	1		UG/L
1,2-DIBROMOETHANE		ND ND	10.					UG/L
1,2-DICHLOROBENZENE		ן מא	10.		1		1	UG/L
1,2-DICHLOROETHANE		ND	5.	1	1	1		UG/I,
1,2-DICHLOROPROPANE		ND I	5.	1		ł	ł	UG/L
1,4-DICHLOROBENZENE		I ND I	10.			ì	ì	UG/L
2-BUTANONE		מא	10.		1	j	•	UG/L
2-HEXANONE		ND 1	10.			1 .	ĺ	UG/L
-METHYL-2-PENTANONE		ON D	10.					UG/L
ACETONE	•	ND ND	34.		L			ne/r
ACRYLONITRILE	•	ND ND	100			l		UG/L
BENZENE		ND	5.			!		UG/L
BROMOCHLOROMETHANE		מא	10.				i	ne\r
BROMODICHLOROMETHANE		ND	5.					UG/L
BROMOFORM		ND ND	5. 5.				1	UG/L
BROMOMETHANE	•	• • • • • • • • • • • • • • • • • • • •						UG/L
CARBON DISULFIDE		ND ND	10.					UG/L
CARBON TETRACHLORIDE			5.					UG/L
CHLOROBENZENE		ND	5.	1		į		UG/L
CILOROETHANE		ND DN	5.			ł	ļ	UG/L
CHLOROFORM		מא	10. 5.			i		UG/L
CHLOROMETHANE	•	ND						UG/L
CIS-1,2-DICHLOROETHENE			10.			ŀ		UG/L
CIS-1, 3-DICHLOROPROPENE		ND ND	10. 5.		i	1		UG/L
DIBROMOCHLOROMETHANE		לא סא	5. 5.			1		06/1/
DIBROMOMETHANE		ON D			i	i		UG/L
THYLBENZENE		ND I	10.		1	ł	į	ng\r
ODOMETHANE			5.		1	[1	ug/L
ETHYLENE CHLORIDE		ND	10.		1	1	1	ug/I
TYRENE		ND	5.		1	1		ne/r
TETRACHLOROETHENE		ND	5.		1			OG/T
OLUENE		ND I	5.	1	1	1		ne\r
-		ND	5.	ŀ	ì	1		UG/L
TRANS-1, 2-DICHLOROETHENE		ND	10.			1		ne/r
RANS-1, 3-DICHLOROPROPENE		ND	5.		!	1		UG/L
RANS-1, 4-DICHLORO-2-BUTE	NE	ND	10.		1	1		UG/L
TRICHLOROETHENE		ND ,	5.				1	uG/L
TRICHLOROFLUOROMETHANE		ND I	10,		1	1	1	OC/F







Site: 852 - MUSKOGEE LANDFILL

ENS: MP: 93-11523 852931

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

Rev / Task; Sample Type: 01 / 01 WELL

Reported: 20-MAY-1993

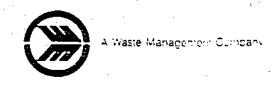
Analyte	Sample Point: Sample Number: Sampled:	TBK-MW03R AH0586 27-APR-1993	EML RL			Units
VINYL ACETATE VINYL CHLORIDE XYLENE (TOTAL)		ND ND ND	10. 10. 10.		A	UG/L UG/L UG/L

NA - Not Analyzed ND - Not Detected

TBK - Trip Blank

a = EML Subcontract Data

Muskogee Community Landfill 2801 S. 54th Street W. Muskogee. Oklahoma 74401 (918) 682-7284 (918) 682-2867 fax



September 28, 1993

Mr. Fenton Rood, Chief Solid Waste Management Service Department of Environmental Quality 1000 NE Tenth Street Oklahoma City, OK 73117-1299

SUBJECT: 3rd Quarter 1993 Groundwater Monitoring
Muskogee Community Landfill & Recycling Center
Permit No. 3551020

Muskogee, Oklahoma

Dear Mr. Rood:

On behalf of Waste Management of Oklahoma, Inc. (WMO), Muskogee Community Landfill & Recycling Center, we are forwarding three (3) copies of the groundwater monitoring report for the sampling conducted on August 17, 1993. WMO monitor wells (MWO1R, MWO2R and MWO3R) and City of Muskogee monitor wells (MWO1, MWO2, MWO3, MWO4 and MWO6) were sampled.

If you have questions or require additional information, please call me at 918/437-7773 or Mark Daniels at 405/427-6030.

Sincerely,

WASTE MANAGEMENT OF OKLAHOMA, INC.

Dan P. Gibson Staff Engineer

Enclosure

cc: Larry Cohn, WMNA South

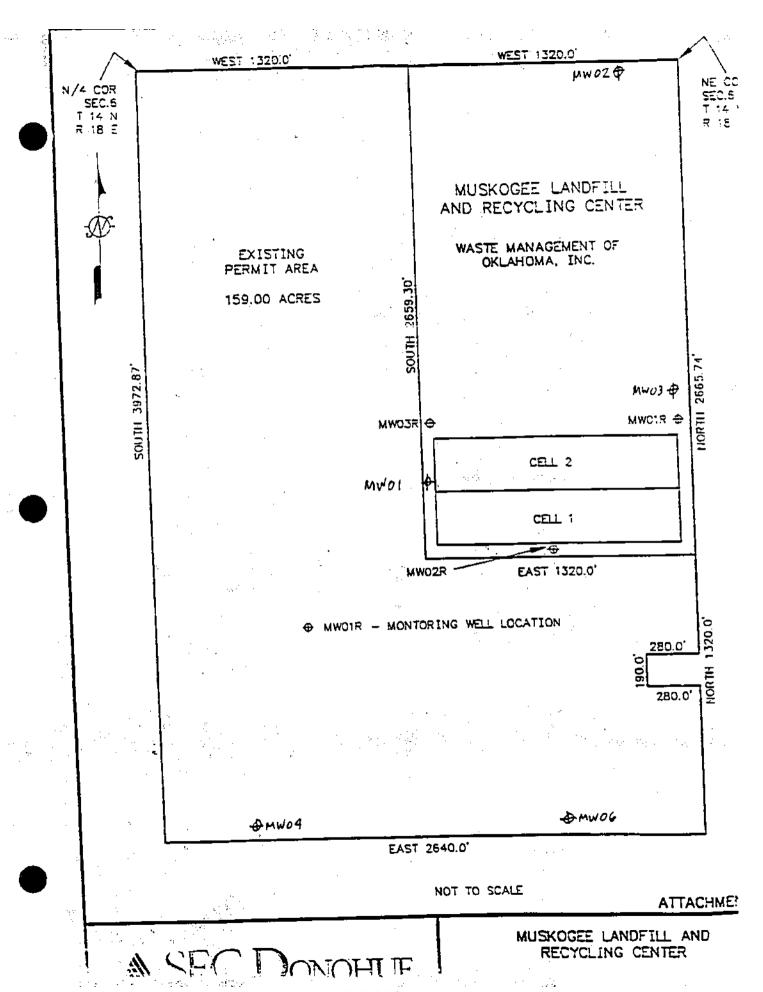
Mark Daniels, East Oak Landfill

Mark Snyder, WMNA South

Mike McCloud - Quarry Landfill

John Wickersham - TCCHD

(MUSK\3093H2O.LTR)



E-8-295





Site: 852 - MUSKOGEE LANDFILL

2001 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS: MP:

93-13150 852931 02 / 01

Rev / Tank: Sample Type: Reported:

WELL 8-SEP-1993

					reporces.	0-356-1	223	
	Sample Point: Sample Number: Sampled:	852-01FB AH8842 17-AUG-1993	EML RL	852-MW01 AH0835 17-AUG-1993	EML RL	852-MW01R AH8838 17-AUG-1993	EML RI.	Units
FIELD DATA: COLOR GROUNDWATER ELEV.	* * * * * * * * * * * * * * * * * * * *	NONE NA		NONE 629.73	÷ .	LT BROWN		,
ODOR		NO NA		NO 29.73	4 1	623.75 NO	•	FT MSI.
PH FIELD	•	8,59		6.73		7.32		PH UNITS
SPECIFIC CONDUCTANCE FIELD		7		5330		1579		UMHOS/CM
WATER TEMPERATURE IN DEGREE WELL DEPTH TOTAL	S CELSIUS	36.2 NA	•	23.1 43.18		24.6 29.25		DEGREES C
CHEMICAL METHODS & ROBOTICS:								
CHEMICAL OXYGEN DEMAND		ND	10.	12	10.	ND	10.	MG/L
CYANIDE, TOTAL		ND	0.020	סא	0.020	ND	0.020	MG/L
NITROGEN, AMMONIA		ND	0.020	1.30	0.020	ND	0.020	MG/L
NITROGEN, NITRATE	i	ND 5.89	0.050	ND	0.050	.66	0,050	MG/L
PII PIIENOLS		ND ND	0.05 0.050	6.78 ND	0.05	7,28	0.05	PH UNITS
SOLIDS, TOTAL DISSOLVED		17	5.	4320	0.050	ND 1000	0.050	MG/L
SPECIFIC CONDUCTANCE		1.4	1.0	5610	25; 1.0	1060 1830	5.	MG/L
TOTAL ORGANIC CARBON	•	ND ND	1.0	2.8	1.0		1.0	UMROS/CM
TOTAL ORGANIC CARBON		ND	1.0	2.9	1.0	ND 1.0	1.0	MG/L
TOTAL CHARACTE CARDON		""	1.0	2.3	1.0	1.0	1.0	MG/L
INORGANICS:								
ALKALINITY	•	ND	5.0	550	5.0	279	5.0	MG/L
CHLORIDE	•	ND	0.5	336	5.0	422	0.5	MG/I
FLUORIDE	**	ND	0.050	:40	0.050		0.050	MG/L
IRON-DISSOLVED		ND	100.	480	100.	460	100.	0G/1,
MANGANESE-DISSOLVED	•	ИD	15.0	2340	15.0	40.1	15.0	0G/I
SODIUM-DISSOLVED		ND	5000	602000	5000	181000	5000	UG/L
SULFATE.	••	ND	5.0	2780	50.0	62.8	5.0	MG/I
VOLATILE ORGANICS: 1,1,1,2-TETRACHLOROETHANE		ND	5.	НD			_	4-
1,1,1-TRICHLOROETHANE	•	ND	5.	מנו	5. 5.	ND ND	5.	nc/F
1, 1, 2, 2-TETRACHLOROETHANE		ND I	5.	ND .	5.		5.	11G/L
1,1,2-TRICHLOROETHANE	*	ND ND	5.	ND	5.	ND ND	5. 5.	UG/L
1,1-DICHLOROETHANE		ND ND	5.	ND	5.	ND ND	5. 5.	UG/L
1.1-DICHLOROETHENE		ND	5.	ND .	5.	ND ND	5. 5.	11G/L
1,2,3-TRICHLOROPROPANE		ND	10.	ND	10.	ND ND	10.	UG/L
1,2-D1BROMO-3-CHLOROPROPANE		ND	10.	ND	iŏ.	OK O	10.	UG/L
1,2-DIBROMOETHANE		ND	10.	ИD	ĵõ.	ND	10.	0G/L
1,2-DICHLOROBENZENE		ND	10.	ND	10,	ND	10.	UG/L
1,2-DICHLOROETHANE		ND	5.	110	5.	11D	5.	0G/L
1,2-DICHLOROPROPANE		ND .	5.	מא	5.	110	5.	0G/L
1, 3-DICHLOROBENZENE		ND	10,	иD	10.	सक	10,	0676
1, 4-DICHLOROBENZENE		ND	10.	ND	10.	कार	10,	UG/ti
2-BUTAHONE		ND	10,	UD	10.	वाह	10.	UG/1.
2-CHLOROETHYLVINYL ETHER		ND	20.	ND	20.	ND	20.	UG/1.
2-HEXAHONE		ND	10.	ND	10.	110	10.	UG/L
4-METHYL-2-PENTANONE	•	ND	10.	ND	10,	470)	10,	UG/L

NA = Not Analyzed

ND = Not Detected

TRK is Trip Blank

n ... EML Subcontract that a







Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS;

MP: Rev / Task: 93-13150 952931 02 / 01

Sample Type: Reported:

WELL.

8-SEP-1993

Sa	ample Point; ample Number; ampled;	852-01FB AH8842 17-AUG-1993	EML RL	852-MW01 AH8835 17-AUG-1993	EMI, RI.	852-MW01R AH8838 17-AUG-1993	EMI, RI,	Vnlts
ACETONE			2.4					
ACRYLONITRILE		ND ND	34. 100	ND NO	34.	ND	34.	UG/I.
BENZENE		- ND	5.	ND VD	100	ND	100	UG/I
BROMOCHLOROMETHANE	191	ND ND		ND	5.	ND	5.	UG/Ti
BROMODICHLOROMETHANE		ND ND	10.	ND	10.	ND	10.	UG/Ii
BROMOFORM		ND ND	5.	ND	, <u>5</u> .	ND I	5.	UG/T
BROMOMETHANE			5.	ND	.5.	ND .	5.	UG/I
CARBON DISULFIDE	•	ND UID	10. 5.	ND	10.	HĐ	10.	UG/L
CARBON TETRACHLORIDE			5. 5.	, ND	5.	NO	5.	ug/I
CHIOROBENZENE		ND		ND	5.	ND	5.	UG/L
		ND	.5.	ND	5.	ND	5.	UG/I
CHI.OROETHANE		ND	10.	1110	10.	ND	10.	OG/L
CHLOROFORM		ND	5.	ND	5.	Ott	5.	DG/L
CHLOROMETHANE		ДИ	10.	ND	10.	MD	10,	0G/L
CIS-1, 2-DICHLOROETHENE		ИD	10.	ND	10.	ND j	10.	UG/1.
CIS-1, 3-DICHLOROPROPENE		MD	5.	ND	5.	ND !	5.	UG/L
DIBROMOCHLOROMETHANE		ИÐ	5.	ND	5.	ND .	5.	UG/L
DIBROMOMETHANE		ND	10.	ND	10.	ND I	10.	UG/I,
ETRYLBENZENE		ИD	5.	ND	5.	ND	5.	HG/I,
IODOMETHANE	: 1	ND	10.	ND I	10.	ND	10.	UG/L
METHYLENE CHLORIDE		ND 1	5.	ND	5.	tiD (III	5.	UG/T
STYRENE	,	ND	5.	ND	5.	ND	5,	06/6
TETRACHI.OROETHENE		ND	5.	เก	. 5.	tio i	5.	UG/L
POLUENE		DII	5.	₽D	5.	ND I	5.	UG/L
TRANS-1, 2-DICHLOROETHENE		HD	10.	ND '	10.	ND	10.	UG/L
TRANS-1, 3-DICHLOROPROPENE		ND	5.	หด	5.	ND	5.	UG/L
TRANS-1,4-DICHLORO-2-BUTENE		ND	10.	tip.	10,	ND	10.	UG/L
richloroethene		ND	5.	110	5.	ND	5.	UG/I
TRICHLÒROF LUOROMETHANE		ND .	10.	tib	10.	110	10.	UG/1.
VIUYL ACETATE		ND	10.	HD I	10.	NO 1	10.	UG/L
VINYL CHLORIDE		ttD	10.	11D	10.	ND	10.	UG/L
XYLENE (TOTAL)		ND ·	10.	ub lib	i 0.	HD H	10.	06/1

NA = Not Analyzed

ND = Not Detected

TBK = Trip Blank

я = EML Subcontract Data





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSROGEE OK 74401

ENS:

MP: Rev / Task: 93-13150 852931 02 / 01

Sample Type: Reported:

WELL 8-SEP-1993

				•	-		
Sample Point: Sample Number: Analyte Sampled:	852-MW02 AH8840 17-AUG-1993	EML RL	852-MW02R AH8837 17-AUG-1993	EML RL	852-MW03 AH8839		
	17 NOG-1993	END KD	17-AUG-1993	EWP KP	17-AUG~1993	EML RI,	Units
FIELD DATA:	· 1						'
COLOR	LT BROWN		NONE	7.5	NONE		
GROUNDWATER ELEV.	615.76		-7 E C O'T		623.51	•	C 457
ODOR	NO:		NO 556.23)	6.27 6 3	NO 23.31		FT MSL
PN FIELD	7.01	* •	6.97		7.32	5 1 1	
SPECIFIC CONDUCTANCE FIELD	4340	i	3240	076	1561		PH UNITS
WATER TEMPERATURE IN DEGREES CELSIUS	23.1		25.3				UMHOS/CM
WELL DEPTH TOTAL	28.72		30.0x	9/27/93	23.5 30.10		DEGREES C
	••••		30.02	•	} 30.10		FT
CHEMICAL METHODS & ROBOTICS:					l i		
CHEMICAL OXYGEN DEMAND	34	10.	10		i I		
CYANIDE, TOTAL	ND I	0.020		10.	ND	10.	MG/I
NITROGEN, AMMONIA			ND	0.020	ם אם	0.020	MG/I
	.30	0.020	1.05	0.020	ם אם	0.020	MG/L
NITROGEN, NITRATE PH	ND ND	0.050	ND	0.050	.53	0.050	MG/L
	6.96	0.05	6.94	0,05	7.25	0.05	PH_UNITS
PITERIOLS	ND	0.050	ND	0.050	ND	0.050	MG/I
SOLIDS, TOTAL DISSOLVED	3030	25.	2040	25.	1020	5.	MG/L
SPECIFIC CONDUCTANCE	5260	1.0	3710	1.0	1838	1.0	UMHOS/CM
TOTAL ORGANIC CARBON	1.4	1.0	1.5	1.0	ND	1.0	MG/1,
TOTAL ORGANIC CARBON	1.5	1.0	1.7	1.0	ND	1.0	MG/L
			1	,	l	1,0	1407 15
NORGANICS:			1		j l		
ALKALINITY	344	5.0	739	5.0	394	5.0	MG/L
CHLORIDE	1460	5.0	377	2.5	372	0.5	MG/L
FLUORIDE	.23	0.050	.59	0.050	.58	0.050	
1RON-DISSOLVED	8710	100.	475	100.	131.30		MG/L
MANGANESE-DISSOLVED	3150	15.0	651	15.0		100.	UG/I.
SODIUM-DISSOLVED	576000	5000	678000	5000	ND	15.0	UG/I.
SULFATE	343	50.0	771	25.0	238000	5000	UG/1.
-	'''	30.0	''1	23,0	40.0	5.0	MG/1.
OLATILE ORGANICS:							
1,1,1,2-TETRACHLOROETHANE	ND I	5,	ND	5.	,,,,	_	
1, 1, 1-TRICHLOROETHANE	ND	5.	ND	5. 5.	ND	5.	UG/I.
1, 1, 2, 2-TETRACHLOROETHANE	ND I	5.			IID	Ş.	UG/I,
1, 1, 2-TRICHLOROETHANE	ND I	5. 5.	110	5.	140	5.	UG/1,
1, 1-DICHLOROETHANE			ND	5.	ND [5,	UG/1.
1, 1-DICHLOROETHENE	ND	5.	ND	5.	du	5.	UG/L
	מא	5.	ND	5.	04	5.	UG/1.
1, 2, 3-TRICHLOROPROPANE	סא	10.	MD	10.	ן מא ן	10.	UG/1.
1,2-DIBROMO-3-CHLOROPROPANE	ND	10,	ND	10.	MD	10.	UG/1.
1, 2-DIBROMOETHANE	ND	10.	ИD	10.	l no	10.	0G/L
1, 2-DICHLOROBENZENE	ND	10.	np	10.	tip	10.	06/15
1, 2-DICHLOROETHANE	מא	5.	l ND	5.	tip	Š.	0G/1 ₆
1, 2-DICHLOROPROPANE	ND	5.	HD	5.	110	5.	0G/L
1, 3-DICHLOROBENZENE	ND	10.	110	10.	1 100	10.	1076
1,4-DICHLOROBENZENE	ND	10.	110	10.	110	10.	
2-BUTANONE	ND	10.	ND	10.	tiD		06/1
2-CHLOROETHYLVINYL ETHER	ND	20.	110	20.		10.	0G/L
2-HEXANONE	I ND I	10.	NO		tiD	20.	967L
1-DETHYL-2-PENTANONE	ND I	10.	OII D	10.	no no	10.	UG/1.
· -	1 ""	10.	1 1117	10.	aut	10.	UG/L

NA = Not Analyzed

ND = Not Detected

TRK is Tella Black

in a letter godiname come of the





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS:

93-13150 852931

MP: Rev / Task:

02 / 01 WELL

Sample Type: Reported:

8-SEP-1993

				Reported:	8-2EP-1	993	•
Sample Point: Sample Number: Sampled:	852-MW02 AH8840 17-AUG-1993	EML RL	852-MW02R AH8837 17-AUG-1993	EML RI	852-MW03 AII8839 17-AUG-1993	EMI, RI,	Units
A CEMONIC				*			
ACETONE ACRYLONITRILE	ND :	34.	ND	34.	ИD	34.	UG/I,
MERIZENE BENZENE	ND 2	100	ND	100	ND	100	UG/L
BROMOCHLOROMETHANE	ND "	5.	ND	5.	ND	5.	UG/L
· · · · · · · · · · · · · · · · · · ·	ND	10.	ND	10.	ND	10.	UG/1,
BROMODICHLOROMETHANE BROMOFORM	ND	5.	ND	5.	ND .	5	UG/L
	ND	5.	ND	5.	. ИД	5.	UG/L
BROMOMETHANE	ND	10.	ND	10.	HD	10.	UG/I
CARBON DISULFIDE	ND	5.	ND	5.	ND	5,	UG/L
CARBON TETRACHLORIDE	ND [5.	ND	5. ,	ИD	5.	OG/L
CHLOROBENZENE	מא	5.	ND	5.	ND ·	5.	UG/L
CHLOROETHANE	ND	10.	ND	10,	ND	10.	UG/L
HLOROFORM	ир	5,	ND	5.	พอ	5.	UG/1
CHLOROMETHANE	ND	10.	ND	10.	ИD	10.	UG/L
CIS-1,2-DICHLOROETHENE	ND	10.	ND	10,	ND	10,	UG/1.
CIS-1,3-DICHLOROPROPENE	מא	5.	ND	5.	D	5.	UG/L
DIBROMOCHLOROMETHANE	מא	5.	ND	5.	ND	5.	UG/1,
DIBROMOMETHANE	ND	10	, ND	10.	ND	10.	UG/L
ÉTHYLBENZENE ;	ND	5.	ND I	5.	ND	5.	0G/1,
IODOMETHANE	ND	10.	ND	10,	ND	10.	0G/I
METHYLENE CHLORIDE	ND	5. 🐇	ND	5.	ND	5.	UG/1
STYRENE	ND I	5.	ND	5.	ND	5.	11G/1
TETRACHLOROETHENE	ND	5.	ND .	5.	nD	5.	0G/1 ₆
COLUENE	ND I	5.	ND ·	5.	ND	5.	0G/1.
FRANS-1, 2-DICHLOROETHENE	ND .	10.	ND ,	10.	QU	10.	UG/I
TRANS-1, 3-DICHLOROPROPENE	ND	5.	ND	5.	ND	5.	UG/L
RANS-1, 4-DICHLORO-2-BUTENE	ND	10.	ND	10.	ND	10.	UG/L
TRICHLOROETHENE	, MD	5.	ND	š.	ND OH	5.	UG/L
TRICHLOROF LUOROMETHANE	ИD	10.	ND	10.	иĎ	10.	UG/L
VINYL ACETATE	ND	10.	ND	10.	ND	10.	UG/L
VINYL CHLORIDE	ND	10.	ND	10.	ND	10.	UG/1,
XYI.ENE (TOTAL)	ND	10,	l ND	10.	ND	10.	UG/1,
						10.	76/1

NA = Not Analyzed

ND - Not Detected

TBK = Trip Blank

s = EMG Subcontract Data





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS: MP: 93-13150 852931

Rev / Task: Sample Type: Reported:

02 / 01 WELL

eported: 8-SEP-1993

Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AH8836 17-AUG-1993	; EML RL	852-MW04 AH8834 17-AUG-1993	EMI. RI.	852-MW06 AHB841 17-AUG-1993	EML RL	Units
IELD DATA:					-			
COLOR	N.	NONE	ı	NONE		NONE		i
GROUNDWATER ELEV.		631.16		657.04	•	630.62		FT MSL
ODOR	Free Commence of the Commence	NO		NO	. •••	ио -		
PH FIELD		6.31		6.45		6,83		PH UNITS
SPECIFIC CONDUCTANCE FIELD		3910		7540		2560		UMHOS/CM
WATER TEMPERATURE IN DEGRE	ES CELSIUS	23.5		21.9		[24.8		DEGREES C
WELL DEPTH TOTAL		40.76		32.50		69.38		FT
CHEMICAL METHODS & ROBOTICS	i:			·				
CHEMICAL OXYGEN DEMAND		51	10.	89	10.	l 12	10.	MG/L
CYANIDE, TOTAL		ND	0.020	l ND	0.020	l Ño l	0.020	MG/L
NITROGEN, AMMONIA		.98	0.020	ND I	0.020	1.19	0.020	
NITROGEN, NITRATE		ND	0.050	מא	0.050	1.13	0.020	MG/L MG/L
PH		6.01	0.05	6.98	0.05	6.76	0.05	
PHENOLS		ND	0.050	מא ו	0.050	ND ND	0.050	PH UNITS MG/L
SOLIDS, TOTAL DISSOLVED		2750	25.	7130	25,	2030	10.	MG/L
SPECIFIC CONDUCTANCE		4120	1,0	8180	1.0	2980	1.0	
TOTAL ORGANIC CARBON	•	15.0	1.0	22.1	1.0	2.2	1.0	UMHOS/CM
TOTAL ORGANIC CARBON		15.6	1.0	22.4	1.0	2.2	1.0	MG/L MG/L
NORGANICS:]		
ALKALINITY		229		l		l 1		
CHLORIDE		245	5.0	1140	5.0	529	5.0	MG/L
FLUORIDE			2.5	877	5.0	233	2.5	MG/I,
TRON-DISSOLVED		2350	0.050	.085	0.050	. 34	0.050	MG/I
MANGANESE-DISSOLVED			360.	259	100,	2770	100.	UG/I.
	,	767	56.0	4410	15.0	2220	15.0	1\DU
SODIUM-DISSOLVED		424000 .	8000	734000	5000	382000	5000	UG/1,
SULFATE		1950	25.0	3340	5 0 .0	864	25.0	MG/L
OLATILE ORGANICS:								
1,1,1,2-TETRACHLOROETHANE		ND .	5,	I ON I	5.	l nd l	5.	UG/L
1,1,1-TRICHLOROETHANE		ND	5.	ND	5.	ND	5.	UG/L
1,1,2,2-TETRACHLOROETHANE		ND	5.	ND	5.	ND	5.	UG/L
1, 1, 2-TRICHLOROETHANE		ND	5.	ND I	5.	ND I	5.	0G/L
1.1-DICHLOROETHANE		ND	5.	ND	5.	25.	š.	UG/1.
1,1-DICHLOROETHENE		ND	5.	I ND	5.	ND N	5.	06/1
1,2,3-TRICHLOROPROPANE		ND	10.	ND	10.	ן מון	10.	UG/1,
1,2-DIBROMO-3-CHLOROPROPAN	Έ	ND	10.	ND	10.	ND I	10.	UG/L
1,2-DIBROMOETHANE		ND	10.	ND	10.	ND	10.	UG/1,
1,2-DICHLOROBENZENE		ND	io.	ם מו	10.	1 110	10.	UG/1.
1,2-DICHLOROETHANE		HD	5.	ם מא	5.	1 100	5.	
1, 2-DICHLOROPROPANE		HD	5.	พื้อ	5.	110	5. 5.	UG/1. UG/1.
1,3-DICHLOROBENZENE		ND	10.	HD CH	10.	1 10	10.	0671
1, 4-DICHLOROBENZENE		ND	iŏ.	ND dis	10.	100	10.	0G/1.
2-BUTANONE		ND	10.	ND	10.	100	10.	0G/1. 0G/1.
2-CHLOROETHYLVINYL ETHER	•	HID	20.	ND	20.	130	20.	9671, 9671,
2-HEXATIONE		ND	10.	I ND	20. 10.	110	20, 10,	0671;

NA ⇒ Not Analyzed

ND = Not Detected

TRK = Trip Blank

n is EME Subcontract Data







Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS:

93-13150

MP: Rev / Task: 852931 02 / 01 WELL.

Sample Type: Reported:

	<u> </u>	<u> </u>		· ·	Reported:	0-SEP-1	993	
Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AH8836 17-AUG-1993	EML RL	852-MW04 AH8834 17-AUG-1993	EML RL	852-MW06 AH8841 17-AUG-1993	EML RL	Units
*		_						
ACETONE	Service of the servic	ND	34.	ND	34.	ND	34.	UG/I.
ACRYLONITRILE		ND	100	ND	100	ND	100	UG/L
BEIIZENE		ND	5-	ND '	5.	, ND	5.	UG/L
BROMOCHLOROMETHANE		ND	10.	ND	10.	ND	10.	UG/L
BROMODICHLOROMETHANE	- N* *	ND	5.	, ND	5,	ND	5.	∍UG/T.
BROMOFORM		ND	5.	ND	5.	ND [5.	"UG/L
BROMOMETHANE		ND	10.	ND	10.	ND ·	10.	UG/I.
CARBON DISULFIDE		ND	5.	ND	5,	ND	5.	ne\r' -
CARBON TETRACHLORIDE		ND	5.	ND .	5.	ND	5.	UG/L
CHLOROBENZENE		ND	5.	ИĎ	5.	ND	5.	UG/L
CHLOROETHANE		, ND	10.	ИD	10.	20.	10.	UG/I
CHLOROFORM		ON D	5.	ND	5.	ND .	5.	UG/I,
CHLOROMETHANE	•	ND	10.	ИD	10.	ND	10,	UG/L
CIS-1, 2-DICHLOROETHENE		ND	10.	ND	10.	ND	10.	UG/I.
CIS-1,3-DICHLOROPROPENE		ND	5.	ND	5.	ND	5,	UG/1,
DIBROMOCHLOROMETHANE		ND I	5.	ND .	5.	ND	· 5.	UG/L
DIBROMOMETHANE	• •	ND :	10%	ND	10.	ND	10.	.0G/T.
ETHYLBENZEN E	•	ND	5.	ND 1	5.	СИ	5.	UG/L
IODOMETHANE		ND	10.	ND 1	10.	ИD	10.	UG/I
METHYLENE CHLORIDE	•	ND	5.	ND	5,	ND	5.	UG/1.
STYRENE		ND	5.	ND	5.	ND	5.	06/1.
TETRACHLOROETHENE		ND '	5.	ND .	5.	ND	5.	0G/I
TOLUENE	<u>}</u>	· ND	5.	ND	5.	ND	5.	UG/1.
TRANS-1, 2-DICHLOROETHENE		· ND	10	ND ·	10.	ND	10.	06/1
TRANS-1, 3-DICHLOROPROPENE		ND	5.	ND	. 5.	ND	5.	UG/L
TRANS-1, 4-DICHLORO-2-BUTENE	S -5	ND :	10.	ND	10.	ND	10.	UG/1.
TRICHLOROETHENE		ND I	5.	ND	5.	ND	5.	UG/I
TRICHLOROFLUOROMETHANE	5	ND	10.	l หือ	10.	. ND	10.	UG/I
VINYL ACETATE		ND	10	ND	10.	ND I	10.	UG/I
VINYL CHLORIDE	r et e	ND	10.	ND	îo.	10.	10.	UG/L
XYLENE (TOTAL)		ND	iŏ.	ND	10.	ND I	10.	UG/L

NA = Not Analyzed

ND = Not Detected

TBK = Trip Blank

s = EMI. Subcontract Data

NG LABORATORIES, INC.





EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS: MP: Rev / Task: 93-13150 852931 02 / 01 WELL

Sample Type: Reported:

8-SEP-1993

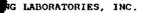
						0 000		
Analyte	Sample Point: Sample Number: Sampled:	TBK-MW02R AH8837 17-AUG-1993	EML RL			* *.		Units
FIELD DATA: COLOR								
GROUNDWATER ELEV.	<u> </u>	1					1	FT MSI
ODOR PH FIELD		·			¥	5.	1 :	PH UNITS
SPECIFIC CONDUCTANCE FIELD								UMHOS/CM
WATER TEMPERATURE IN DEGRE	ES CELSIUS			·	·			DEGREES C
WELL DEPTH TOTAL								FT
CHEMICAL METHODS & ROBOTICS	:]					i	}
CHEMICAL OXYGEN DEMAND		1]					!	MG/L
CYANIDE, TOTAL					i .			MG/I
NITROGEN, AMMONIA NITROGEN, NITRATE					1		ì	MG/L
PH								MG/I. PH UNITS
PHENOLS		į	l				ļ	MG/L
SOLIDS, TOTAL DISSOLVED	<i>:</i>	[Į.	MG/L
SPECIFIC CONDUCTANCE		:					i	UMHOS/CM
TOTAL ORGANIC CARBON							ľ	MG/L
TOTAL ORGANIC CARBON			•					MG/L
INORGANICS;		i		'	1			
ALKALINITY					:		i	MG/Ti
CHLORIDE	•							MG/L
F1.UORIDE				·			1	MG/L
TRON-DISSOLVED MANGANESE-DISSOLVED					•	·	ļ	1/G/L
SODIUM-DISSOLVED							t	UG/L
SULFATE	•							UG/L MG/L
VOLATILE ORGANICS:				'				'', "
1,1,1,2-TETRACHLOROETHANE		ND	5.					
I, 1, 1-TRICHLOROETHANE	1 · .	ND	5.					UG/L
1,1,2,2-TETRACHLOROETHANE	, t.	ND	5.	:	i			0G/1, 0G/1,
1,1,2-TRICHLOROETHANE		ND	5.				ł	UG/I
1,1-DICHLOROETHANE		ND	5.		ļ			UG/1,
1,1-DICHLOROETHENE	·	MD	5.				İ	UG/Ii
1,2,3-TRICHLOROPROPANE 1,2-D1BROMO-3-CHLOROPROPAN	-	ND	10.					UG/L
1,2-DIBROMO-3-CHEOROPROPAN	4	ND ND	10. 10.					ug/li
1,2-DICHLOROBENZENE	:	MD (40	10.		[UG/L
1,2-DICHLOROETHANE	•	ND	5.				1	UG/L UG/L
1,2-DICHLOROPROPANE		HD	5.					0GZTi
1, 3-DICHLOROBENZENE		HD	10,		1			0G/L
1,4-DICHLOROBENZENE		up au	10.		·	ŀ		0674
2-BUTANOME 2-CHLOROETHYLVINYL ETHER	†	ND	10.					nevi
		110	20.	1	1	I	I	UG/L
2-HEXANONE		THD .	10.	1				8G/1.

NA = Not Analyzed

ND = Not, Detected

TBK a Trip Blank

B. BMG Subsect sact But a







Site: 852 - MUSKOGEE LANDFILL

MUSKOGEE OK 74401

2801 S. 54TH STREET WEST

ENS: MP: Rev / Task: 93-13150 852931 02 / 01 WEJ.L

Sample Type: Reported:

0-SEP-1993

				 ·	
Analyte	Sample Point: Sample Number: Sampled:	TBK-MW02R AH8837 17-AUG-1993	EML RL		 Units
ACETONE ACRYLONITRILE BENZENE BROMOCHLOROMETHANE BROMODICHLOROMETHANE BROMOFORM BROMOMETHANE CARBON DISULFIDE CHLOROBENZENE CHLOROBENZENE CHLOROFORM CHLOROMETHANE CIS-1, 2-DICHLOROETHENE CIS-1, 3-DICHLOROFORPENE DIBROMOCHLOROMETHANE DIBROMOCHLOROMETHANE ETHYLBENZENE IODOMETHANE METHYLENE CHLORIDE STYRENE TETRACHLOROETHENE TOLUENE TRANS-1, 2-DICHLOROETHENE TRANS-1, 3-DICHLOROPROPENE TRANS-1, 4-DICHLOROFORPENE TRANS-1, 4-DICHLOROFORPENE TRANS-1, 4-DICHLOROPROPENE TRANS-1, 4-DICHLOROPROPENE TRANS-1, 4-DICHLOROPROPENE TRANS-1, 4-DICHLOROPROPENE TRANS-1, 4-DICHLOROPROPENE TRANS-1, 4-DICHLOROPROPENE TRAIS-1, 4-DICHLOROPROPENE TRICHLOROETHENE		ND ND ND ND ND ND ND ND ND ND ND ND ND N	34. 100 5. 10. 5. 10. 5. 10. 5. 10. 5. 10. 5. 10. 5. 10. 5. 10. 5. 10. 5. 10. 5.		UG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L
TRICHLOROFLUOROMETHANE VINYL ACETATE VINYL CHLORIDE XYLENE (TOTAL)		ND ND ND ND	10. 10. 10. 10.		UG/L UG/L UG/L UG/L

NA = Not Analyzed

1.5454

ND → Not Detected

TBK - Trip Blank

s = EML Subcontract Data





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS: MP:

93-13151

Rev / Task: Sample Type: Reported: 852931 02 / 01 WELL

17-SEP-1993

Analyte	Point: 852-01FB Number: AH8843 d: 5 17-AUG-199	93 EML RL	852-MW01 AH8849 17-AUG-1993	EML RL	852-MW01R AH8847 -17-AUG-1993	EML RL	Units
INORGANICS: ANTIMONY-TOTAL ARSENIC-TOTAL BARIUM-TOTAL BERYLLIUM-TOTAL CADMIUM-TOTAL CHROMIUM-TOTAL COPPER-TOTAL COPPER-TOTAL LEAD-TOTAL NICKEL-TOTAL SELENIUM-TOTAL SILVER-TOTAL THALLIUM-TOTAL VANADIUM-TOTAL 2INC-TOTAL	ND ND ND ND ND ND ND ND ND ND ND ND ND N	300. 10.0 200. 5.0 5.0 10.0 50.0 25.0 40.0 5.0 25.0 10.0 5.0	ND ND ND ND ND ND NO NO ND ND	300. 14.0 200. 5.0 10.0 50.0 25.0 16.0 40.0 16.0 25.0 50.0	ND ND ND ND 14.4 ND ND 11.1 101 ND ND ND ND	300. 10.0 200. 5.0 5.0 10.0 50.0 25.0 40.0 5.0 25.0 10.0 50.0	0G/L 0G/L 0G/L 0G/L 0G/L 0G/L 0G/L 0G/L

NA - Not Analyzed

ND = Not Detected

TBK: Trip Blank.

s - EML Subcontract Data







Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS: MP:

93-13151

Rev / Task:

852931 02 / 01

Sample Type: Reported:

WELL. 17-SEP-1993

Analyte		Sample Point: Sample Number: Sampled:	852-MW02. AHBB45 17-AUG-1993	EML RL	852-MW02R AH884B 17-AUG-1993	EML RL	852-MW03 AH8846 17-AUG-1993	EML RI.	elin0
NORGANICS:			. .			·		_··	
ANTIMONY-TOTAL		. 4	ND	300.	DN D	300.	ND	300.	UG/1,
ARSENIC-TOTAL			ND	10.0	ND ·	10.0	ND a	10.0	UG/L
BARIUM-TOTAL	* :		527	200.	ND.	200	ND I	200.	UG/L
BERYLLIUM-TOTAL			ND	5.0	ND	5,0	หก	5.0	UG/L
CAUMIUM-TOTAL			ND	5.0	ND	5.0	l no	5.0	-0G/L
CHROMIUM-TOTAL	•		18.0	10.0	ND	10.0	ND	10.0	UG/L
COBALT-TOTAL			ND ND	50.0	ND	50.0	ND	50.0	UG/L
COPPER-TOTAL				25.0	ND	25,0	ND	25.0	UG/L
LEAD-TOTAL			ND	16.0	, ND	16.0	l ND	5.0	UG/I,
NICKEL-TOTAL		1	ND	40.0	111	40.0	. ND	40,0	UG/L
SELENIUM-TOTAL			ND	5.0	ND	5.0	l ND	5.0	UG/L
SILVER-TOTAL			ND	25.0	ND I	25.0	ND	25.0	UG/L
THALLIUM-TOTAL			ND	10.0	ND I	10.0	ND	10.0	UG/L
VAUADIUM-TOTAL			ND	50.0	ND	50.0	ND	50.0	UG/L
ZINC-TOTAL			64.3	20.0	53.3	20.0	ND	20.0	06/1,

NA = Not Analyzed

ND - Not Detected

TBK = Trip Blank

s = EML Subcontract Data





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS:

93-13151

MP: 852931 Rev / Task:

02 / 01 WELL

Sample Type:

				٠		r 		-1
Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AH8850 17-AUG-1993	EML RL	852-MW04 AH8851 17-AUG-1993	EML RL	852-MW06 AH8844 ∞17-AUG-1993	EML RL	Units
ORGANICS:	-			7				
ARSENIC-TOTAL		ND ND	300.	ND :	1000	ND	300,	UG/L
BARIUM-TOTAL	30	262	10.0 200.	, ND	14.0	I NO I	10.0	UG/L
BERYLLIUM-TOTAL		ND	5.0	ND	200.	ND	200.	UG/L
ADMIUM-TOTAL		ИD		ND	5.0	ND	5.0	UG/L
CHROMIUM-TOTAL		ND	5.0	ND .	5.0	ND	5.0	ng/r
COBALT-TOTAL		ND IID	10.0	ND	10.0	ND	10.0	UG/L
COPPER-TOTAL	\		50.0	ND	50.0	ND	50.0	UG/L
EAD-TOTAL		29.9	25.0	, ND	25.0	ND	25.0	UG/L
ICKEL-TOTAL		ND	16.0	ND ·	16.0	41.0	16.0	UG/L
	·	ND	40.0	ND	40.0	ND	40.0	OG/L
SELENIUM-TOTAL		ND	16.0	ND	16.0	ND	5.0	UG/L
SILVER-TOTAL	•	ND	25.0	ИD	25.0	αи	25.0	UG/L
THALLIUM-TOTAL		ND	10.0	ND	10.0	ND	10.0	UG/L
VANADIUM-TOTAL		ИD	50.0	ИD	50.0	ND	50,0	UG/L
ZINC-TOTAL		392	20.0	ИD	20,0	529	20.0	UG/L

NA - Not Analyzed

ND - Not Detected

TBK = Trip Blank

s = EML Subcontract Data

Muskogee Community Landfill 2801 S. 54th Street W. Muskogee, Oklahoma 74401 (913) 662-7284 (918) 662-2867 fax



December 17, 1993

Mr. Fenton Rood, Chief Solid Waste Management Department of Environmental Quality 1000 NE Tenth Street Oklahoma City, OK 73117-1212

SUBJECT: 4th Quarter 1993 Groundwater Monitoring

Muskogee Community Landfill & Recycling Center

Permit No. 3551020 Muskogee, Oklahoma

Dear Mr. Rood:

On behalf of Waste Management of Oklahoma, Inc. (WMO), Muskogee Community Landfill & Recycling Center, we are forwarding three (3) copies of the groundwater monitoring report for the sampling conducted on November 9, 1993. WMO monitor wells (MW01R, MW02R and MW03R) and City of Muskogee monitor wells (MW02, MW04 and MW06) were sampled. City of Muskogee monitor wells MW01 and MW03 were recently plugged by WMO after obtaining approval from the ODEQ.

By copy of this letter, the analytical results for City of Muskogee monitor wells MW02, MW04 and MW06 are being sent to Mr. Walter Beckham, City Manager for the City of Muskogee, for submittal to the ODEQ. If you have questions or require additional information, please call me at 918/437-7773 or Mark Daniels at 405/427-6030.

Sincerely, 3

WASTE MANAGEMENT OF OKLAHOMA, INC.

Dan P. Gibson Staff Engineer

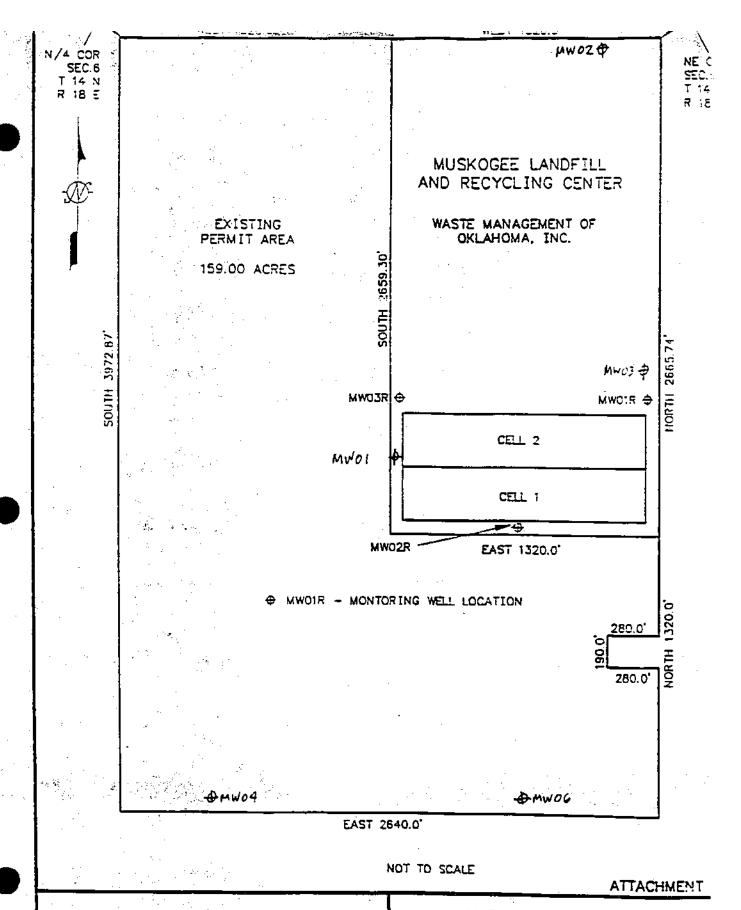
Enclosure

cc: Larry Cohn Mark Daniels Mike McCloud

John Wickersham, TCCHD

Walter Beckham, City of Muskogee

(MUSK\4093N20.LTR)





MUSKOGEE LANDFILL AND RECYCLING CENTER

MONITORING WELL LOCATION MAP



Site: 852 - MUSKOGEE LANDFILL

STR of Street Rains Committee of

- - - - -

2001 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS:

MP; Rev / Task; Sample Type: Reported: 93-14416 852931 02 7 0) WELL

	MUSKOGEE OK 7440	1			Sample Type Reported:	E: WELL 6-DEC-1	993	
Analyte	Sample Point: Sample Number: Sampled:	852-01FB A15684 09-NOV-1993	EMI, RI,	852-MW01R A15682 09-NOV-1993	EML RI.	852-MW02 A15681 09-NOV-1993	EML RL	Units
FIELD DATA:			· · · · · · · · · · · · · · · · · · ·					
GROUNDWATER ELEV.		NA ·		621:34		615.52		
PH FIELD		7.96		7,20		6.78	3.1	FT MSt
SPECIFIC CONDUCTANCE FIELD	D	. 3		1255		3880		PIL UNITS
WATER TEMPERATURE IN DEGRI WELL DEPTH TOTAL	EES CELSIUS	14.5	4. 1 . 1	16.3	,	16.3		UMHOS/CM DEGREES C
WELL DEPTH TOTAL		NA .		29.25	-	28.72		FT
CHEMICAL METHODS & ROBOTICS	S:				r _{email}			
CHEMICAL OXYGEN DEMAND		ND	10.	ND I				
HITROGEN, AMMONIA	4.1	8D -	0.020	100	10.	37	10,	MG/1,
HITROGEN, HITRATE		810	0.050	0.61	0.020 0.050	0.40	0.020	MG/1,
PHENOLS		ОИ	0.050	NID.	0.050	MD MD	0.050	MG/1
SOLIDS, TOTAL DISSOLVED		7	5.	978	5.	3480	0,050 25.	MG/L
INORGANICS:					.,,	7747	A3.	MG/L
CHLORIDE								
IRON-DISSOLVED		ИD	0.5	417	0.5	1750	2,5	MG/1.
MANGANESE-DISSOLVED		HD Ott	100.	IJD	100.	3690	100.	UG/1,
SODIUM-DISSOLVED		Dtt DN	15.0	ND	15.0	2720	15.0	UG/1.
SULFATE		ND ND	5000	194000	5000	681000	5000	UG/1i
1		! ""	5.0	60.1	5.0	274	-25.0	MG/L
VOLATILE ORGANICS:		[1				i I
1,1,1-TRICHLOROETHANE	•	IID '	5.	ND -	<u>.</u>			
1,1,2,2-TETRACHLOROETHANE		ND :	š.	110	5. 5.) DD	5:	UG/J/
1,1,2-TRICHLOROETHANE		ND.	5.	up	5.	HD HD	5.	UG/h
1, 1-DICHLOROETHANE	**	ND	5.	HD	5.	110	5. 5.	UG/1,
1,1-DICHLOROETHENE		ND	5.	110	š.	7 DD	5. 5.	UG/1.
1,2-DICHLOROBENZENE 1,2-DICHLOROETHANE		ND	10,	HD	10.	1115	16.	0G/1, 0G/1,
1,2-DICHLOROPROPANE	•	ND	5.	100	5.	DD		UG/1.
1, 3-DICHLOROBENZENE		HD	5.	HD	5.	1315	Š.	iiG/ii
1, 4-DICHLOROBENZENE		ND UD	10,	tip	10.	, IJD .	10.	UG/I,
2-CHLOROETHYLVINYL ETHER		110	10.	110	10	HD	10.	UG/Ii
BENZENE	•	สต	20. 5.	110	20.	• DD	20.	UG/L
BROMODICHLOROMETHANE		ND	5.	. NO NO	-5,	(II)	5.	0G/1 ₆
BROMOFORM		IID I	š.	110	5.	IJD	5.	DG/T.
BROMOMETHANE		l1D	10.	dip	5. 10.	IID III	.5.	967h
CARBON TETRACHLORIDE	•	ND	5.	nib	5.	111)	10.	UG/Ii
CHLOROBENZENE		an	5.	l iib	5.	11D 11D	5. 5.	UG/Ii
CHLOROETHANE	•	90	10.	110	10.	100	3. 10.	0G/1.
CHLOROFORM CHLOROMETHANE		100	5.	ND	5,	1117	5.	UG/1. UG/1.
CIS-1, 3-DICHLOROPROPENE	•	BD	10.	HD :	10.	700	10.	0G/1.
DIBROMOCHLOROMETHANE		[D]) 205	5.	UD	5.	HÞ	5.	Liigzi.
ETHYLBENZENE		110 110	5.	IJD	5.	40	5.	UG/L
METHYLENE CHLORIDE		110	5.	HD	5.	HD .	5.	UG/1,
TETRACIII.OROETHEHE		air	5.	110	5.	HD	5.	067 h
TOLUENE		410	5. 5.	130	S .	HD	5.	UG/L
TRANS-1, 2-DICHLOROETHENE	•	เมื่อ	10,	11D 11D	5. 10.	IID	.5.	UG/L
•		<u> </u>	, ·	I '"'	10,	IID	10.	UG/L





Site: 852 - MUSKOGEE LANDFILL

2001 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS:

MP; Rev / Task: 93-14416 852931 02 / 01

Sample Type: Reported:

WELL 6-DEC-1993

					Reported:	6-DEC-1	993	
Analyte	Sample Point: Sample Number: Sampled:	852-01FB AI5684 09-NOV-1993	EML RL	852-MW01R A15682 09-NOV-1993	EML R1,	852-MW02 AI5681 09-NOV-1993	EMI, RI,	. Units
TRANS-1, 3-DICHLOROPROPENE TRICHLOROETHENE TRICHLOROF LUOROMETHANE VINYL CHLORIDE		ND ND ND ND	5. 5. 10. 10.	ND ND ND	5. 5. 10.	ND 11D 14D 14D	5. 5: 10.	UG/L UG/L UG/L UG/L

NA = Not Analyzed

ND = Not Detected

TBK = Trip Blank

s = EMI, Subcontract Data



Site: 852 - MUSKOGEE LANDFILL

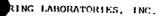
MA & Not Applyant

2801 S. 54TH STREET WEST MUSKOGEE OK 74401 ENS: MP: 93-14416 852931 02 / 01

Rev / Tank: Sample Type:

WELL 6-DEC-1993

			<u></u>		Reported:	- 6-0EC-1	1993	
Analyte	Sample Point: Sample Number: Sampled:	852-MW02R AI5683 09-NOV-1993	EML RL	852-MW03R A1568D 09-NOV-1993	EMI. RI,	852-MW04 A15679 09-NOV-1993	EML RI,	Unlls
FIELD DATA:				- 3				
GROUNDWATER ELEV.	1.	حر. 24 557	4.28.64	631.83	· .	645.14		F
PH FIELD		6.95		6.06	.* 1	6.66	•	FT MSL
SPECIFIC CONDUCTANCE FIELD		2480	1) 6-8501	2700	7	5340		PH UNITS UMBOS/CM
WATER TEMPERATURE IN DEGRE	ES CELSIUS	17.1		15.8	4.4	16.6	ž.,	DEGREES C
WEILD DEETH TOTAL	. 7	30,01		40.76		32.50	· · · .	FT
CHEMICAL METHODS & ROBOTICS				,		· !		
CHEMICAL OXYGEN DEMAND	•	11	10					
NITROGEN, AMMONIA		1.06	10. 0.020	, 54	10.	84	10.	MG/I
NITROGEN, NITRATE	+ 1	ND ND	0.020	1.05	0.020	HD	0.020	MG/I
PHENOLS	** *	QN QN	0.050	ND ND	0.050	MD	0.050	MG/Ti
SOLIDS, TOTAL DISSOLVED		2100	25.	2870	0.050	ND CATE	0.050	MG/1.
			~ ~ ·	, ,	25.	6450	25,	MG/L
INORGANICS:	599							,
CHLORIDE		377	2.5	258	2.5	848	5.0	
IRON-DISSOLVED	÷	ОИ	100	1580	100.	100	100.	MG/1
MANGANESE-DISSOLVED SODIUM-DISSOLVED		529	15∜0	344	15.0	4560	15.0	UG/L UG/L
SULFATE	• .	662000	5000	402000	5000	702000	5000	UG/L
John Ale	· .	745	25.0	1990	50.0	3590	50.0	MG/1.
VOLATILE ORGANICS:	•				_			l '*'' ''
1,1,1-TRICHLOROETHANE		ND			`.			Ì
1, 1, 2, 2-TETRACHLOROETHANE		ND	5. I 5.	HD	<u>5</u> .	ND ND	5.	UG/L
1,1,2-TRICHLOROETHANE	**	ND	5. 5.	ND DD	5.	hD	5.	UG/L
1,1-DICHLOROETHANE		ND	5.	lip	5. 5.	ND	5.	UG/Ti
1.1-DICHLOROETHENE		ND	5.	ND	5. 5.	100	5.	UG/1.
1.2-DICHLOROBENZENE		ND	10.	HID	10.	P RD ND	5.	0G/1,
1,2-DICHLOROETHANE	•	ND	5.	l no	5,	100	10, 5.	UG/L
1,2-DICHLOROPROPANE 1,3-DICHLOROBENZENE	1.4	HD.	5.	ND	Š.	tto	5.	06/1,
1, 4-DICHLOROBENZENE		ND	10.	ND '	10.	HĎ	10.	0G/L UG/L
2-CHLOROETHYLVINYL ETHER		110	10.	DD .	10.	110	10.	UG/1,
BENZENE	<i>;</i>	IID	20.	110	20.	HĐ	20	06/1/
BROMODICHLOROMETHANE		ND ND	5.	ND	5.	qu	5.	0671.
BROMOFORM		ND ND	5. 5.	110	5.	ND	5.	0671
BROMOMETHANE		ND	10.	11D	5.	100	5.	0671,
CARBON TETRACHLORIDE		tib	10. 5.	dib Ott	10,	BD	10.	UG/1.
CHLOROBENZENE		dit	5.	60	<u>5</u> .	180	5.	0G/1,
CHLOROETHANE	•	ND	10.	HD .	5. 10.	10	5.	06/1 ₀
CHLOROFORM	<i>:</i>	UD	5.	100	5.	ND	10.	UG/L
CHLOROMETHANE		ДИ	1ő.	เมื่อ	10.	11D 11D	5.	ne\r
CIS-1, 3-DICHLOROPROPENE		वध	5.	dii	5.	11D	10, 5.	11G/16
DIBROMOCHLOROMETHALIE ETHYLBENZENE		110	5.	BD	5.	100	5.	0676
METHYLENE CHLORIDE		110	5.	181)	5.	(10)	5. 5.	0671. 0671.
TETRACHLOROETHENE		NO	<u>5</u> .	100	5.	HD	61	0071
TOLUENE		ND	5.	(1)	5.	BD	5.	0G7 fi
TRANS-1, 2-DICHLOROETHENE		ND 11D	5.	IID	5.	110	5.	9671.
I		L ''''	10.	(11)	10,	96	10.	OGZ L







Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS: MP:

93-14416

Rev / Tank: Sample Type:

852931 02 / 01 WELL

Reported;

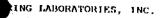
6-DEC-1993

Mialyte	Sample Point: Sample Number: Sampled:	852-MW02R A15683 09-NOV-1993	EMI. Ri,	852-MW03R A15680 09-NOV-1993	EMI, RI,	852-MW04 A15679 09-NOV-1993	EML RL	Onlts
TRANS-1, 3-DICHLOROPROPENE TRICHLOROETHENE TRICHLOROFLUOROMETHANE VINYL CHLORIDE		ND ND ND NO	5. 5. 10. 10.	100 1110 1110	5. 5. 10.	40 (4) 110 (4) 110 (4)	5. 5. 10.	UG/L UG/L UG/L UG/L UG/L

NA = Not Analyzed

ND = Not Detected - TBK = Trip Blank - Ka = EMt. Subcontract Data

WMX ENVIRONMENTAL MOD





EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS: MP:

93-14416 052931 02 / 01

Rev / Task: Sample Type:

WELL

	<u> </u>	11 11 11 11		•	Reported:	6-DEC-1993	
Analyte	Sample Point: Sample Number: Sampled:	852-MW06 A15678 09-NOV-1993	EML RL	TBK-MW02 A15681 09-NOV-1993	EMI, RI.		Units
FIELD DATA: GROUNDWATER ELEV. PH FIELD SPECIFIC, CONDUCTANCE FIELD WATER TEMPERATURE IN DEGREE WELL DEPTH TOTAL		638.62 .6.43 2370 14.3 69.38		*			FT MSL PH UNITS UMHOS/CM DEGREES C
CHEMICAL METHODS & ROBOTICS: CHEMICAL OXYGEN DEMAND NITROGEN, AMMONIA HITROGEN, NITRATE PHENOLS SOLIDS, TOTAL DISSOLVED	:	11 1.05 0.31 ND 2170	10. 0.020 0.050 0.050 10.				MG/E MG/L MG/L MG/L MG/L
INORGANICS: CHLORIDE CHLORIDE IRON-DISSOLVED MANGANESE-DISSOLVED SODIUM-DISSOLVED SULFATE		243 247 2080 379000 1050	2,5 100, 15,0 5000 25,0	vi		-	MG/L UG/L UG/L UG/L UG/L MG/L
VOLATILE ORGANICS: 1,1,1-TRICHLOROETHANE 1,1,2,2-TETRACHLOROETHANE 1,1,2-TRICHLOROETHANE 1,1-DICHLOROETHANE 1,1-DICHLOROETHANE 1,2-DICHLOROENZENE 1,2-DICHLOROETHANE 1,2-DICHLOROPROPANE		ND	5. 5. 5. 10.	ND ND ND ND ND ND ND	5. 5. 5. 5. 10.		UG/L UG/L UG/L UG/L UG/L UG/L
1,3-DICHLOROBENZENE 1,4-DICHLOROBENZENE 2-CHLOROETHYLVINYL ETHER BENZENE BROMODICHLOROMETHANE BROMOFORM BROMOMETHANE CARBON TETRACHLORIDE		ND ND ND ND ND ND ND	5. 10. 20. 5. 5. 10.	ND HD HD ND ND HD	5. 10. 20. 5. 5. 5.	·	06/1. 06/1. 06/1. 06/1. 06/1. 06/1. 06/1.
CHLOROBENZENE CHLOROETHANE CHLOROFORM CHLOROMETHANE CIS-1,3-DICHLOROPROPENE DIBROMOCHLOROMETHANE ETHYLBENZENE METHYLENE CHLORIDE		ND 64 ND ND ND ND ND ND	5. 10. 5. 10. 5. 5.	110 110 110 110 110 110 110 110	5. 10. 5. 10. 5. 5. 5.		067L 067L 067L 067L 067L 067L 067L
TETRACHLOROETHENE TOLUENE TRANS-1, 2-DICHLOROETHENE		7.9 8.3 110	5. 5. 5. 10.	110 110 110 110 110	5. 5. 5. 10.		10G/E 10G/E 10G/E 10G/E 10G/E

NA = Not Analyzed | ND = Not Detected | The Tries of the |

The state of the





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS:

MP: Rev / Task: 93-14416 852931 02 / 01 WELL,

Sample Type: Reported:

6-DEC-1993

Analyte S	ample Point: ample Number: ampled:	852-MW06 A15678 09-NOV-1993	EML RL	TBK-MW02 A15681 09-NOV-1993	EML RI.	÷ 4	-Onits
TRANS-1, 3-DICHLOROPROPENE TRICHLOROFTHENE TRICHLOROFLUOROMETHANE VINYL CHLORIDE		ND ND ND 17	25. 5. 10. 10.	ND , HD , HD ,	5. 5. 10.		0G/1, 0G/1, 0G/1, 0G/1,

ND = Not Detected

TBK = Trlp Blank

a = EML Subcontract Data



Site: 852 - MUSKOGEE LANDFILL,

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS:

MI²: Rev / Task: 93-14417 852931 02 7 01

Sample Type:

·	MUSKOGEE OK 7440	· .			Sample Type Reported:	e: WELL 8-DEC-1	993	
	Sample Point:	952-01FB		852-MW01R	· · · · · · · · · · · · · · · · · · ·	·		· · · · · · · · · · · · · · · · · · ·
	Sample Number:	A15691		A15689		852-MW02 A15688		
Analyte	Sampled:	09-NOV-1993	EMI. RI,	09-HOV-1993	EMI, RI.	09-fi0A-1993	EMI, RI.	Onits
INDRGANICS:	11.1							
AUTIMONY-DISSOLVED		310	300	tiD.	2010			1 [
AHTIMOHY-TOTAL		110	300.	110	300,	ND	300.	υ ζ/ 1,
ARSENIC-DISSOLVED		110 34	10.0	HD HD	300	100	300.	UG/1,
ARSENIC-TOTAL -		110	10.0	110	10.0	22.0	10.0	0G/h
BARTUM-DISSOLVED		31D	1 200.	100	10.0	17.6	10.0	UG/Lb
BARIUM-TOTAL		110	200.	ND	200. 200.	HD	200.	UG/L
BERYLLIUM-DISSOLVED	•	ND OIL	5.0	130		tm	200.	06/1.
BERYLLIUM-TOTAL		110	5.0	1. 100	5.0 5.0	110	5.0	UG/A
CADMIUM-DISSOLVED		IID III	5.0	l in	5.0	HD	5.0	UG/L
CADMIUM-TOTAL		No	5.0	l iii	5.0	IJD	5.0	UG/1.
CHROMIUM-DISSOLVED	·	l du	10.0	1 110	10.0	IID	5.0	UG/1,
CHROMIUM-TOTAL		เมื่อ	10.0	1 110	10.0	ND	10.0	UG/L
COBALT-DISSOLVED		เมื่อ	50.0	1 116	10.0 50.0	MD viii	10.0	BG/L
COBALT-TOTAL		DI D	50.0	135	50.0	tib	50.0	UG/15
COPPER-DISSOLVED	•	228	25.0	qu	25.0	110	50.0	UG/1,
COPPER-TOTAL		237	25.0	1 115	25.0	111) titi	25.0	UG/1 ₆
LEAD-DISSOLVED	· .	ND	5.0	100	5.0	NO I	25.0	UG/1,
1.EAD-TOTAL		ND	5.0	6.1	5.0	an an	16.0	UG/Ii
HICKEL-DISSOLVED		ND	40,0	l ₄ 55.4	40.0	1 115	16.0	UG/L
HICKEL-TOTAL		ND	40.0	65.3	40.0	dii l	40.0	UG/L
SELENTUM-DISSOLVED	-	110	5.0	tin	5,0	410	40.0	UG71.
SELENIUM-TOTAL		. 310	5.0	120	5.0	lib.	5.0 16.0	UG/L
SILVER-DISSOLVED SILVER-TOTAL		អូម	25.0	80 1	25.0	ND I	25.0	UG/1,
THALLIUM-DISSOLVED		qu	25.0	ND	25.0	ND	25.0	UG/L
THALLIUM-TOTAL		ИĎ	10.0	dib [10.0	(10)	10.0	UG/L
VANADIUM-DISSÖLVED	•	ND	10.0	tio i	10.0	100	16.0	UG/Ii
VANADIUM-TOTAL		ND	50.0	tib	50.0	นอ	50.0	UG/L
ZINC-DISSOLVED	. * •	ND	50.0	IID I	50,0	tio	50.0	UG/L
ZINC-TOTAL		nb	20.0	20.3	20.0	90	20.0	1 0G/L
A AL	•	เนอ	20.0	30.7 :	20.0	110	20.0	UG/L
VOLATILE ORGANICS:		,					= 0 . 17	037 11
1,1,1,2-TETRACHLOROETHANE	. *	ДИ	_	200				
1,1,1-TRICHLOROETHANE		QU QU	5.	пр ди	5.	HO H	5.	ug/J,
1,1,2,2-TETRACHLOROETHANE		100	5, 5,	ND I	5	00	5.	UG/1,
1,1,2-TRICHLOROETHANE		10)	3. 5.	ND	5.	DD .	5.	UG/1 ₁
1,1-DICHLOROETHANE	•	110	5.	171)	<u> </u>	Jap	5.	UG/L
1,1-DICHLOROETHERE	:	110	5.	100	5.	#10	5.	0G7 h
1,2,3-TRICHLOROPROPANE	•	dii	10.	1110	5.	1111	5.	UG71,
1,2-DIBROMO-3-CHLOROPROPAL	ŀΕ	iib	10.	1110	10.	tib	10,	UG/L
1,2-DIBROMOETHAME		ini	}0.	i no	10.	tip (iii	10.	067 h
1,2-DICHLOROBENZENE		110	10.	110 110	10.	DD	10,	0G71a
1,2-DICHLOROETHANE		110	5.		10,	HD tu:	10.	11G/1.
1,2-DICHLOROPROPAHE		tio	5.	110	5. 5.	DD DV	5.	UG/1,
1,4-DICHLOROBENZENE		ND	10.	1116	10.	NO tus	.5.	UG/L
2-BUTANONE		110	10.	l ini	10.	tio (n.	10.	0674
2-HEXAHONE		HD	10.	1 110	10.	(ID .	10,	0G/1. '
4-METHY12-PENTANONE		100	10.	in	10.	HD HD	10.	neyr -
		·I.		f		,,,,,	3.00	0671.



Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS;

MP; Rev / Task: .. Sample Type: Reported: 93-14417 852931 02 / 01 WELL

8-DEC-1993

Analyte S	ample Point: ample Number: ampled:	852-01FB AI5691 09-ноv-1993	EML R1,	852-MW01R A15689 09-NOV-1993	EML RI,	852-MW02 AI5688 09-แดบ-1993	EMI, RI.	Units
- 11						- 		
CE1 ONE	•	ND	34.	i no l	34.	no.		
RYLOHITRILE //		MD	100	iii	100	110	34.	06/1.
ENZENE		11D	5.	liD l	5	100	100	06/1/
ROMOCHLOROMETHANE S		11D	10.	IID	10.	ND	. 5.	UG/I.
ROMODICHLOROMETHANE	*	เหอ	5.	iiD'	5.		10.	UG/Ti
ROMOFORM		ND	5.	1110	5.	ND ·	<u>5</u> 7.	ug/1.
ROMOMETHANE		. ND	10.	ino l	10.	TID I	5.	OG/L
RBON DISULFIDE		00	5.	. no	5.	HD.	10.	0G/6
RBON TETRACHLORIDE		iiD	š.	tio	5. 5.	HD.	5.	UG/L .
I.OROBENZENE		HD	5.	100		MD	5.	UG/L .
ILOROETHANE		ND	10,	div	5 .	HD	5.	UG/L 🗀
LOROFORM		7.73	5.	ND	10,	IID (III	10.	UG/L
LOROMETHANE		ND	10.		5.	tip-	5.	UG/1.
5-1, 2-DICHLOROETHENE		QII	10.	110	10.	nb an	10,	UG/1.
S-1, 3-DICHLOROPROPENE		ND		80	10.	605	10,	UG/L
BROMOCHLOROMETHANE		ND ND	5.	\$ 1 0	5.	HD	5.	0G/h
BROMOMETHANE			5.	HD .	5,	tip '	5.	UG/L
HYLBENZENE		ND	10.	ND	10.	нo	10.	UG/L
DOMETHANE		ND	5.	ND	5.	ND	Š.	UG/L
		ND	10.	, ND i	10.	ND	10.	
THYLENE CHLORIDE		ND	5.	, ND	5.	UD U	5.	UG/1.
		ND	5.	510	5.	ND		UG/Ja
TRACHLOROETHENE	,	ND	5.	1110	5.	ND I	5.	OG/L
LUENE		ND	5.	HD	5	ND I	<u>,</u> 5 .	0G/1,
ANS-1, 2-DICHLOROETHENE		ND	10.	ND	10.	ND .	5.	0G/1,
ANS-1, 3-DICHLOROPROPENE	•	ND	5.	HD	5.	ND I	10.	UG/L
ANS-1, 4-DICHLORO-2-BUTENE		ND	10.	I D [10	11D	5.	ne\1'
ICHLOROETHENE		ND	5.	ND	5.		10.	UG/1.
ICHLOROFLUOROMETHANE	•	ND	10.	ND	10.	13D	5.	UG/L
NYL ACETATE		ND	10.	ND		HD .	10.	UG/I.
HAT CHICKIDE		HD	10.	110	10	ND	10.	UG/I,
(LENE (TOTAL)	1	ND	10	80 80	10.	ND	10.	UG/L
		,,,,	40.	tan	10,	ND I	10.	UG/I

TDK = Trip Blank

s = EM% Subcontract Data



Site: 852 - MUSKOGEE LANDFILL

2801 S. SATH STREET WEST MUSKOGEE OK 74401

ENS:

MP: Rev / Task: 93-14417 852931 02 / 01

Sample Type: Reported:

WK151 8-08C-1993

				_	Reported;	8-DEC-1	993	
	Sample Point: Sample Number:	852-MW02R A15690	· · · · · · · · · · · · · · · · · · ·	852-MW03R A15687		852-MW04]
Analyte	Sampled:	09-110A-1883	EML RL	09-NOV-1993	EMI, RI,	A15686 09-NOV-1993	EMI, RI.	Units
ORGANICS:								
WITHOUT-DISSOLVED		ND 1	300.	1 110 - 1	1000			
MITIMONY-TOTAL		iiii	300		1000	ND	1000	UG/1.
ARSENIC-DISSOLVED		iiii	10.0	tip s	300.	DD I	300	UG/1,
RSENIC-TOTAL		IJD ·		HD	10.0	IID I	10.0	0671
ARTUM-DISSOLVED		186	10.0	NO	10.0	110	10.0	UG/1.
BARIUM-TOTAL			200.	NO	200.	110	200.	UG/I
ERYLLIUM-DISSOLVED		110	200,	an	200.	ND 1	200.	06/1
		no	5.0	l ND	12.0	111)	5.0	UG/L
BERYLLIUM-TOTAL		NO	5.0	· DD	5.0	MD	5.0	
CADMIUM-DISSOLVED		00	5.0	110	25.0	1110	5.0	10G/Tr
ADMIUM-TOTAL		NO	5.0	13D	5.0	un		UG/L
CHROMIUM-DISSOLVED		00	10.0	1 100	50.0	iib	5.0	UGZL
CHROMIUM-TOTAL		140	10.0	110	10.0	Hb	10.0	UG/L
OBALT-DISSOLVED		110	50.0	IID	250.	(40)	10.0 50.0	UGZL .
COBALT-TOTAL		110	50.0	เมม	50.0	100		0674
COPPER-DISSOLVED		MD	25.0	HD	125.	90	50.0	06/1,
COPPER-TOTAL		HD	25.0	HD 1	25.0		25.0	UG/L
LEAD-DISSOLVED		(11)	16.0	ND	16.0	8D	25.0	UG/L
LEAD-TOTAI,		HO	16.0	üp		110	16.0	UGZ L
NICKEL-DISSOLVED		42.7	40.0	iib	16.0	(II)	16.0	UG/1.
HICKEL-TOTAL		171	40.0	100	200.	41.2	40.0	0671.
SELENIUM-DISSOLVED	,	no	16.0		40.0	110	40.0	UGZI
SELENIUM-TOTAL		ND	16.0	100	16.0	HD	16.0	UG/1,
SILVER-DISSOLVED	•	120	25.0	ND	16.0	HD	16.0	UG/1.
SILVER-TOTAL		ND		iip	125,	111)	125.	UG/L
THALLIUM-DISSOLVED			25.0	ИD	25.0	110	25.0	0G/1.
THALLIUM-TOTAL	i	ND	10.0	an	10.0	du	10.0	UG/L
VANADIUM-DISSOLVED		IAD	16.0	an an	16.0	110	16.0	06/1
VANADIUM-TOTAL	;	141)	50.0	1312	96.0	110	50.0	
		17D	50.0	IID.	50.0	110	50.0	UG/L
ZINC-DISSOLVED	•	DD DIE	20.0	1115	84.0	HD	20.0	06/1
ZINC-TOTAL		28,8	20.0	33.0	20.0	110		06/1
A					•		20.0	06/1
OLATILE ORGANICS:								!
1, 1, 1, 2-TETRACHLOROETHANE		ND D	5.	1 100	5.	HO		1
1, 1, 1-TRICHLOROETHANE		ND]	5.	l iib	5.	100	5.	UG/J.
1, 1, 2, 2-TETRACHLOROETHANE		UD	5.	011	6.		5.	06/1.
1,1,2-TRICHLOROETHANE	-	HD.	5.	l iii	5.	110	5.	UG/1,
1. I-DICHLOROETHANE		110	5.	l iii	9. 5.	110	5.	UG/L
I, I-DICHLOROETHERE		att	5.	1115		111)1	5.	HGZ4.
1.2,3-TRICHLOROPHOPANE		140	10.	1115	5.	10)	5.	HG/L
l, 2-DIBROMO-3-CHI,OROPROPANI	Ε	jjo I	10,		10.	110	10.	ugzi,
1,2-DIBROMOETHANE		100	10.	7101	10.	TIU	10.	0671.
1, 2-DICHLOROBENZENE		110	10.	116	10.	110	10,	0G71.
L, 2-DICHLOROETHANE	i	110	5.	l III	10.	110	10.	0G/ L
L, 2-DICHLOROPROPANE		00		IID III	ja .	110	5	0671.
1, 4-DICHLOROBEHZENE		ub	5.	IID I	5.	HD	5.	UGZ i.
2 - BIITAHONE		uo Uo	10.	(JD	10.	tio	10.	ugz16
: HEXAMONE			10,	100	10.	110	10.	0G71.
4-METHYL-2-PENTANONE		iib iis	10.	100	10,	111)	10.	UGZ I
4 ADMINISTRE		140 [10.	1 110 1	10.	106	10.	UGZ1.





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST ... MUSKOGEE OK 74401

ENS:

93-14417

MP: Rev / Tank: 052931 02 / 01 WELL

Sample Type: Reported:

8-DEC~1993

Analyte	Sample Point: Sample Number: Sampled:	852-MW02R A15690 09-NOV-1993	EML RL	852-MW03R A15687 09-NOV-1993	EMI, ŘÍ,	852-MW04 A15686 09-NOV-1993	EMI, RI,	Units
ACETONE	i o	4m ()						1
ACRYLONE TRILE		(110	34.	ND	34	tio .	34.	UG/L
BENZENE		tin Lin	, 10 <u>0</u>	, ND	100	(8)	100	UG/1.
BROMOCHLOROMETHANE	· .	111)	5.	nb	·, 5.	100	5.	0G/L
BROMODICHLOROMETHANE	•	110	10.	an	10.	100	10.	UG/L
BROMOFORM	•	MD	5.	MD	5,] 100 [5.	UG/I.
BROMOMETHANE		ND	<u>, 5</u> .	HD	5.	00	5.	UG/1.
CARBON DISULFIDE		110	10.	ND	10,	dit	10.	0G/L
CARBON TETRACHLORIDE		HD	5.	· ND	5.	ND I	5.	UG/1.
CHLOROBENZENE		ND	5.	111)	5.	100	5.	UG/L
CHLOROETHANE	•	tib	5.	14D	5.	I ND	5:	UG/I.
CILLOROFORM		HD	10.	110	10.	110	10.	UG/1.
CHLOROMETHANE		tro	5.	110	5.	1 110	5.	UG/1.
CIS-1, 2-DICHLOROETHENE		ND	10,	ND	10.	100	10.	UG/L
C1S-1, 3-DICHLOROPROPENE		ND	10.	ND	10.	110	10.	UG/L
DIBROMOCHLOROMETHANE		ND	<u>5</u> .	NO	5.	110	5.	OG/L
DIBROMOMETHANE		ND	5.	90	5.	80	š.	UG/1
		- BD	10.	MD	10.	l ab	10.	UG/I
ETHYLBENZENE Fodomethane		ND	5.	ND .	5.	110	5.	UG/L
		ND	10	: , NO	- 10.	no	10.	06/1
METHYLENE CHLORIDE		ND	5.	ND	5.	ND	5.	0G/1.
STYRENE		HD .	5.	140	5.	tib	š.	
TETRACHLOROETHENE		₩D	5.	no	5.	l un	5.	UG/1,
TOLUENE		110	5.	ND	š.	1 . 1115	5. 5.	UG/1,
TRANS-1, 2-DICHLOROETHENE		ND	10.	110	10.	ND	10.	0G/L
TRANS-1, 3-DICHLOROPROPENE		110	5.	210-	5.	iib .	5.	UG/I
TRANS-1, 4-DICHLORO-2-BUTENE		an	10.	100	10	ND I	10	06/1
RICHLOROETHENE		tiD	5.	110	5.	iib	5.	OG/L
RICHLOROFLUOROMETHANE	•	OII I	10.	ND	10.	110	10.	UG/I
VINYI, ACETATE		ND	10.	นก	10.	1 116	10.	UG/L
VINYL CHLORIDE		au	10.	no	in.	MD ·	10.	06/1
XYLENE (TOTAL)		IID	10.	tio	10.	ND I	10.	0G/1, 0G/1,

NA = Not Analyzed

ND = Not Detected

TBK = Trip Blank

s = EML Subcontract Data





Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS:

93-14417

MP; Rev / Task: Sample Type: Reported: 852931 02 / 01 WELL

MUSKOGEE OK 74401			Sample Type: WELL Reported: 8-DEC-1993					
Analyte	Sample Point: Sample Number: Sampled:	852-MW06 A15685 09-NOV-1993	EML RI,	49 33	·			Units
INORGANICS:								[
AHTIMONY-DISSOLVED		ND	300.	Language State of	* : *.:			tig/i.
AHT IMORY TOTAL	<u> </u>	100	300		4			HG/L
ARSENIC-DISSOLVED		(11)	10.0					· ug/i.
ARSENIC-TOTAL	X."	100 (10.0					0671.
BARIUM-DISSOLVED		ND	200					UG/1.
BARIUM-TOTAL	1	ND	200.			172		. 0071
BERYLLLIUM-DISSOLVED		ND	5.0			·.		OG/L
BERYLLLUM-TOTAL		ND .	5.0	1.		i		UG/L
CADMIDM-DISSOLVED	•	100	5.0					UG/L
CADMIUM-TOTAL	Ç.	HD	5.0		·			06/1.
CHROMIUM-DISSOLVED		ND	10.0		. 1			ug/i.
CHROMIUM-TOTAL		110	10.0			'		UG/L
COBALT-DISSOLVED	•	l IID	50.0					067b
COBALT-TOTAL		110	50,0					0G/1.
COPPER-DISSOLVED		110	25.0			,	·	UG/I.
COPPER-TOTAL	•	11D	25., 0					UG/L
LEAD-DISSOLVED		ND	5.0			٠,		UG/II
LEAD-TOTAL		43.5	16,0		1 ' '			UG/L
HICKEL-DISSOLVED		ND	40.0		1		i .	UG/L
HICKEL-TOTAL		HD.	40.0	1				11G/16
SELENIUM-DISSOLVED		ND	5.0	·			1	UG/I.
SELENIUM-TOTAL		ND	16.0					
SILVER-DISSOLVED		lio i	25.0	i				UG/L UG/L
SILVER-TOTAL	* *	ND.	25.0	1				
THALLIUM-DISSOLVED		ND	10.0			'		UG/L
THALLIUM-TOTAL		ND	10.0	ľ		'	· '	UG/L
VANADIUM-DISSOLVED		· ND	50.0	Į.			i ·	UG/L
VAHADIUM-TOTAL	· .	HD	50.0	ļ				UG/L
21NC-DISSOLVED		142	20.0	1				UG/1,
2111C-TOTAL	a.	370	20.0				ļ	UG/L
VOLATILE ORGANICS:	···						1	ug/L
1, 1, 2-TETRACHLOROETHAN			· <u>· ·</u>	,	ļ ·			
1.1,1-TRICHLOROETHANE	Ł	ND	5.		l .			UG/1
1.1,2,2-TETRACHLOROETHAN		1110	5.		[116/1
1,1,2-TRICHLOROETHANE	E .	100	5.		[UG/E
1, 1-DICHLOROETHANE		ND	5.				ĺ	UG/1.
1, 1-DICHLOROETHENE		22,8) .	1				UGZ II
1, 2, 3-TRICHLOROPROPANE		ND	5.	1				UG/I
1.2-DIBROMO-3-CHLOROPROPA	B. b.les	HD	10.	į				lig/ii
1,2-DIBROMOETHANE	ANE	ND	10,	1				067L
1,2-DIEROMOETHARE		ND.	10.					UG/1.
1,2-DICHLOROETHARE		110	10.					0G/A
		311)	5.					11G/1.
1,2-D1CHLOROPROPAUE		OD	5.				Į.	UG/L
1,4-DICHLOROBENZEHE		tib	10.				i	0671,
2-BUTAHONE	**	110	30.				Ì	0671.
2-HEXAHONE		100	10,				ļ	UG/L
4 METHYL-2-PENTANONE	• .	110)	10.				1	0671.



Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 74401

ENS:

93-14417

MP: Rev / Task:

852931 02 / 01

Sample Type:

WELL 8-DEC-1993

· · · · · · · · · · · · · · · · · · ·	÷				Reported:	8-DEC-1:	993
Analyte	Sample Point: Sample Number: Sampled:	852-MW06 A15685 D9-NOV-1993	EML RL				Units
	- 15/22-1			-		· 	
ACETONE	4.3	l du	34].		
ACRYLONITRILE	15 PM	110	100		1		UG/1,
PEHZENE .	等 5%。	110					10G/T
BROMOCHLOROMETHANE	A + 2 * 5	QII	10.		1		0G/1
BROMODICHLOROMETHANE	W.	ND	5.	ļ	ļ		OG/T/
BROMOFORM	Marine Company	ND	5.	i	·		ng\r
BROMOMETHANE		ПD	10.	i			üĞ\I
CARBON DISULFIDE		ND	5.	,	1		UG/1,
CARBON TETRACHLORIDE	·.	ND 1	5.				UG/1,
CHLOROBENZENE		ND	5.				UG/1.
CHLOROETHANE	•	103	10.				uG/1,
CIILOROFORM	_	ND	5.	1	[tig/1,
CHLOROMETHANE	And Park	I ND	10.		i l		ug/i.
CIS-1, 2-DICHLOROETHENE	• .	13.4	10.				UG/L
CIS-1, 3-DICHLOROPROPENE	5.	ND	5.	ŀ			UG/I
DIBROMOCHLOROMETHANE	K	I ND	5.	1			UG/1,
DIBROMOMETHANE	.5	tto dis	10.		1		UG/1,
ETHYLBENZENE		GN	5.				UG/1.
IODOMETHANE		ND	10.	1			UG/1.
METHYLENE CHLORIDE	· · · · · · · · · · · · · · · · · · ·	ND	5.				UG/1,
STYRENE	*	ND I	š.				ug/L
TETRACHLOROETHENE		7.86	5.	'			ng/r
TOLUENE		I ND	5.			· •	UG/I.
TRANS-1, 2-DICHLOROETHENE		ND I	10.				uG/I,
TRANS-1, 3-DICHLOROPROPENE		ND I	5.	•		·	ug/I,
TRANS-1, 4-DICHLORO-2-BUTEN	E se	ND	10.				UG/I.
TRICHLOROETHENE	= ; = " .	ND I	5.		1		UG/I,
TRICHLOROFLUOROMETHANE		I ND	10				UG/I.
VINYL ACETATE		GN	10.		1		UG/I.
VINYL CHLORIDE	- · .	17.4	10.	·			UG/f.
XYLENE (TOTAL)		ND ND	10.				UG/1.
			10.				0G/1,

NA = Not Analyzed

ND = Not Detected

TBK = Trip Blank

s = EML Subcontract: Data

APPENDIX J GEOTECHNICAL LABORATORY DATA

Muskagee\86251dp2.3rd

LAW ENGINEERING, INC.

SUMMARY OF TEST DATA TRACT A

RUST E & I MUSKOGEE LANDFILL

9	ample	╡	Moisture			·	Cation Exchange	Day.		1		i nama r	1111
Identification			Content	Organica	Compression	%	Med	Dry Density		Pocket		ERBERG L	
	Depth	Material Description	%	%	ksf	Strein	Ne/100g	per	ρН	pen.	Uquid Limit	Plastic Limit	Plastic Index
B-1	0-1	Light Brown Silty Clay	20.2	- ~ -			11001009	. ри	Pr	Peri.	Linkit	Lillion	INDOX
B-1	3-5	Ten Silly Clay	21.8		3.14	5.85	 	101.67					·
B-1.	8-10	Tan Silty Clay w/Fe Nodules	19.6		4.50	4,79	 -	106.88	7.05				
B-1	13:15	Yellow Brown Silty Clay w/Fe Stains	18.9			7,75	1	100.00	7.03	 	 i		├──
B-1	18-20	Light Brown Clayey Shale	17.3				 			-	52	25	. 27
B-2	0-2	Light Brown Sifty Clay	19.3	7.6						 	34		
B-2	2-4	Brown Silty Clay	16,8			-	 - 		··		47	16	31
B-2	4-6	Br Mottled Silty Clay w/Fe Nodules	17.8				 				7,		. 31
9-2	6-8	Tan Silty Clay	18.5		 -	· · · · · · · · · · · · · · · · · · ·	6.26			 	46	14	32
8-2	13-15	Yellow Brown Silty Clay w/Fe Nodules	16.8		6.70	3.21	 •••	113,77					32
B-2	18-20	Brown & Gray Clayey Shele	14.7		7.77	0.21	 	110,11		 	44	23	21
B-2	23-25	Light Brown Clayey Shele	10,9		·		 						
B-3	0-2	LI Reddish Brown & Tan Silty Clay	21.7	3.3			 			 			
B-3	2.4	LI Br & Yellow Br Silty Clay w/Fe Nadula	21.1									·	·
B-3	6.8	Yellow Brown Mottled St Cl w/Fe Steins	21.2	[11			 	··		
B-3	8-10	Yellowish Br & Dk Gr Fat Cl w/Fe Nodul	17.5				!		7.1	†	38	15	23
B-3	10-12	Light Brown & Yellow Brown Silty Clay	19.1	l			† i			 			
B-3	12-14	Brown Clayey Shale w/Fe Nodules	16,9				1				44	24	20
8-3	18-20	Tan & Gray Weathered Shele	11.7	<u> </u>			† 				43	24	19
Ð-3	23-24	Grey Weathered Shale	11.8		· ·		1			 	 -		<u>; </u>
B-4	0.5	Light Brown Silty Clay	19,1	3.4			1			1			
B-4	2-4	Br & Yellow Br Silty Clay w/Fe Nodules	22.2		·		†I						
B-4	4-6	Yellow Brown Silly Clay w/Fe Nodules	21.4		•					†——·	40	15	25
B-4	8-10	Yellowish Br & Lt Gr Stiff Fat Clay	22.2				†·· ··	,					
8-4	13-15	Yellowish Br & Lt Gr Stiff Fat Clay	16.0		5.00	2.68		115.39		<u> </u>			
8-4	18-20	Brown Clayey Shele	- 14.7							1	44	24	20
B-5	#4	Gray Shale Rock Core	4.86	i	252.09		†	138.02		·	29	19	10
B-5	0.2	Light Brown Silty Clay	23.5	3.3			 						
B-5	2.4	Light Brown Silty Clay w/Fe Nodules					12.0			 			i
B.5	4.6	Lt Brown Mottfed Silty Clay w/Fe Steins	20.8			-	† 	<u>-</u>		 	47	18	29
B-5	8-10	Tan Silty Clay w/Fe Nodules	19.1		3.63	3.82	 	106.50	7.25				- 29
B-5	18-20	Light Brown Clayey Shale	11.6				┪		:::::	 			i——
B-6	1-2	Ten & Gray Silty Clay	18,4			. – – – – .				3.75			i
8-6	2-4	Ten Slightly Sandy Clay	23.1	4.0		· · · · · · · · · · · · · · · · · · ·	1			 			l
8-6	4-6	Tan Silty Clay	24.2				† 			2.75			l
8-6	6-7	Ten & Light Brown Silty Clay	20.5	 			 			2.5			

LAW ENGINEERING, INC. SUMMARY OF TEST DATA RUST E & I MUSKOGEE LANDFILL TRACT A Catlon Sample Molsture Exchange ATTERBERG LIMIT Dry Identification Content Organica Compression % Meg Density **Pocket** Liquid Plastic Plastic Hole # Depth Meterial Description % ksf Strain: Ne/100g ρН Limit Limit pcf pen. Index 7-9 Tan Silty Clay 21.3 2.0 16 46 30 B 6 9-11 Tan Silty Clay with Ferrous Nodules 17.2 2.0 8-6 12-13 Tan Silty Clay with Ferrous Seams 32.8 3:25 B-6 16-17 Tan Slightly Sandy Clayey Shale 11.9 42 16 26 Light Brown Shaley Silty Clay B-6 17-18 12.9 1.5 B-6 Dark Brown Shaley Silty Clay 22-23 18.7 44 24 20 Gray Shale Rock Core 1.23 456.22 141.16 19 20 1 0-2 Lt Br Mottled Silly Clay w/Fe Nodules 25.6 1.8 2.4 Yellow Brown Silty Clay w/Fe Streaks 20,5 48 16 32 6-8 Yellow Br & Lt Br Silty Clay w/Fe Nodule 20.2 46 15 31 B-7 B-10 Tan Shaley Silty Clay w/Fe Seams 12.1 5,36 6.72 115.73 4.5 + 8.7 Light Brown Clayey Shale 13-14 11.7 11.0

69.24

297.38

4.06

5.03

3.90

7.29

6.00

3.31

3.44

4.25

14.1

7.4

6.7

7,3

4,5+

4.5

4.5

22

77

18

15

16

18

21

16

12

6

26

30

28

19

32

34

49

24

41

46

46

40

144.69

161.32

115.05

113,19

109.19

112.83

11.7

6.16

20.2

16.5

21.4

16,8

14.2

2.10

21.8

21.9

19.6

15.0

22.9

18.3

21,1

18.0

19.0

16.9

18.6

20.1

19.3

5.8

21.4

20,1

18.7

4.4

7.2

8.7

B-0

B-8

B.8

B-9

0.9

8.9

8-9

B-10

B-10

B-10

B-10

B-10

B-10

B-10

B-11

B-11

B-11

B-12

B-12

18-20

#3

2.4

4-6

6.0

13-14

16-19

#6

0.2

2-4

4.6

6.8

0.5

2-4

4-6

6-8

8-10

13-15

18-20

2.4

6-8

0.2

2.4

18-19

Light Brown Clayey Shale

Light Brown & Brown Silty Clay

Light Brown & Yellow Brown Silty Clay

Lt Br w/Yellow Br Sifty Clay w/Fe Nodule

Ught Brown & Yellow Brown Shaley Cla

Yellow Br & LI Br Silty Clay w/Fe Nodule

Br & Yellow Br Silty Clay w/Fe Nodules

Yellow Br & Lt Br Silty Clay w/Fe Nodule

Tan Brown Silty Clay w/Fe Nodules

Brown & Light Brown Silty Clay

Tan Silty Clay w/Fe Nodules

Brown Highly Weathered Shale

Ught Brown Silly Clay w/Fe Nodules

Tan & Gray Silty Clay w/Fe Stains

Yellow Brown Silty Clay w/Fe Nodules

LI Tan & Gr Sl Cl w/Fe Nodules & Steins

Yellow Brown Silly Clay w/Fe Nodules

Gray Shale Rock Core

Brown Clayey Shale

Gray Shale Rock Core

Tan & Brown Silly Clay

Light Brown Silty Clay

Tan & Gray Silty Clay

Gray Shaley Silty Clay

Tan Silty Clay

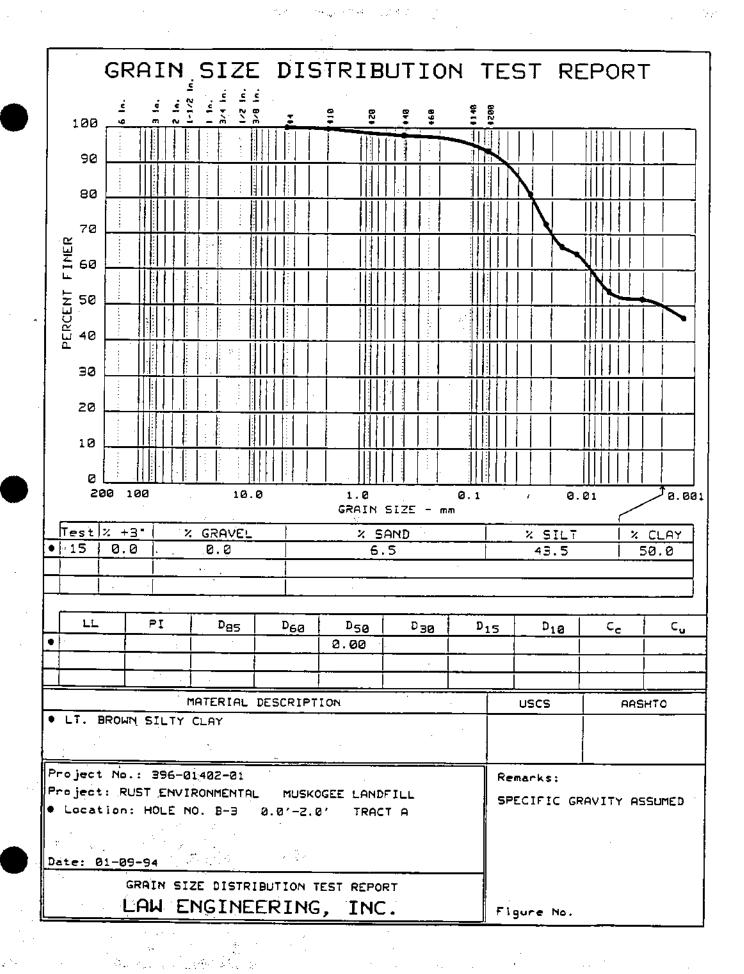
LAW ENGINEERING, INC.

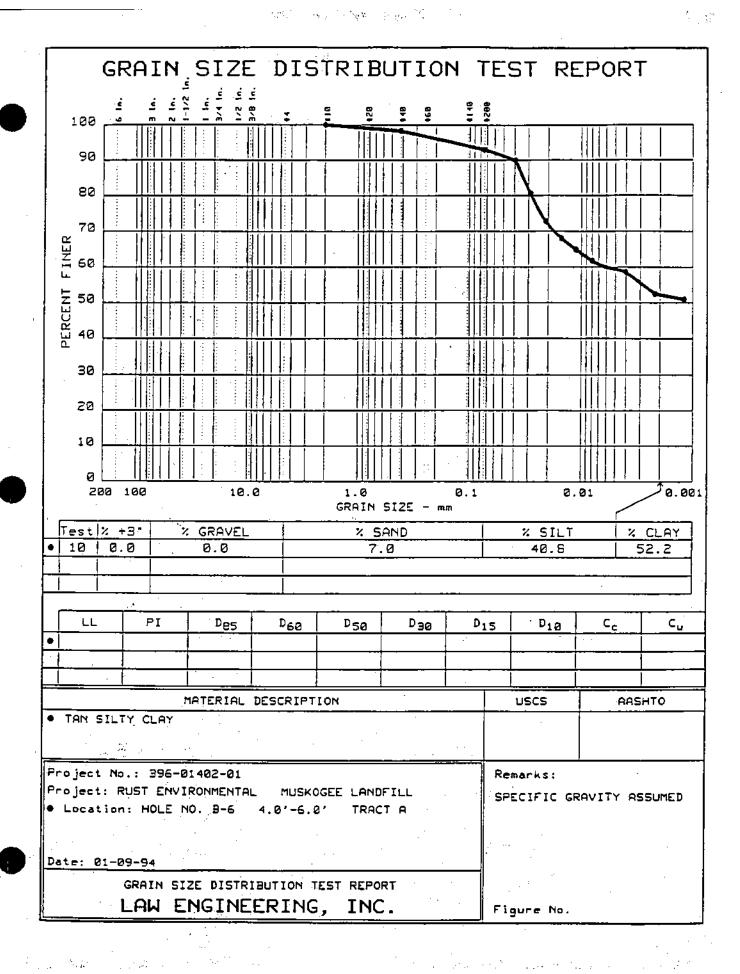
SUMMARY OF TEST DATA TRACT A

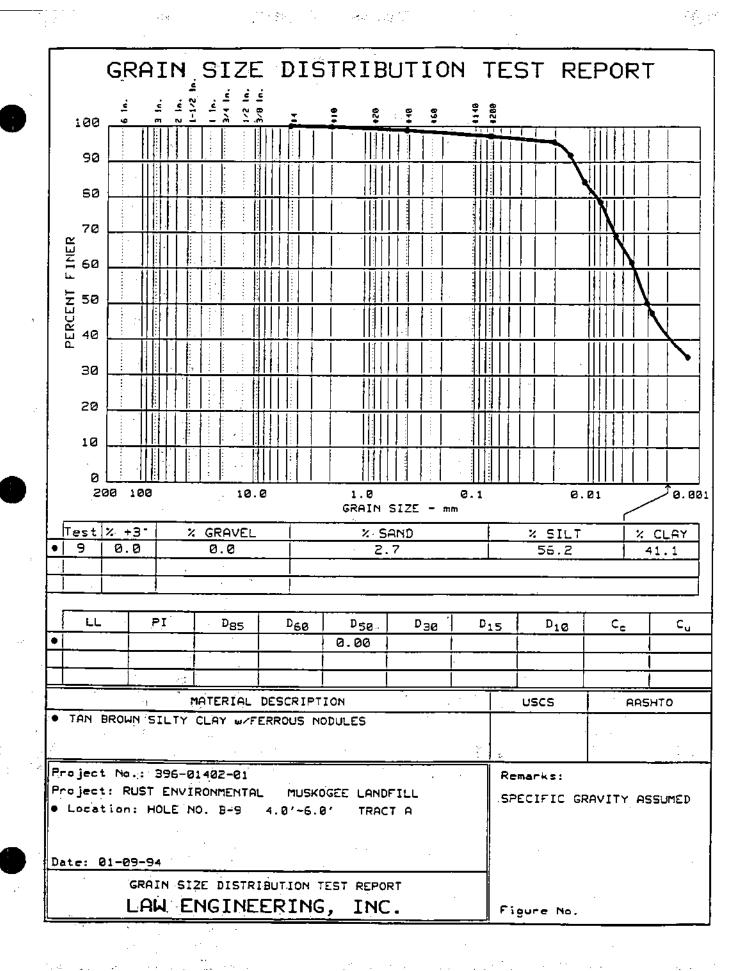
RUST E & I MUSKOGEE LANDFILL

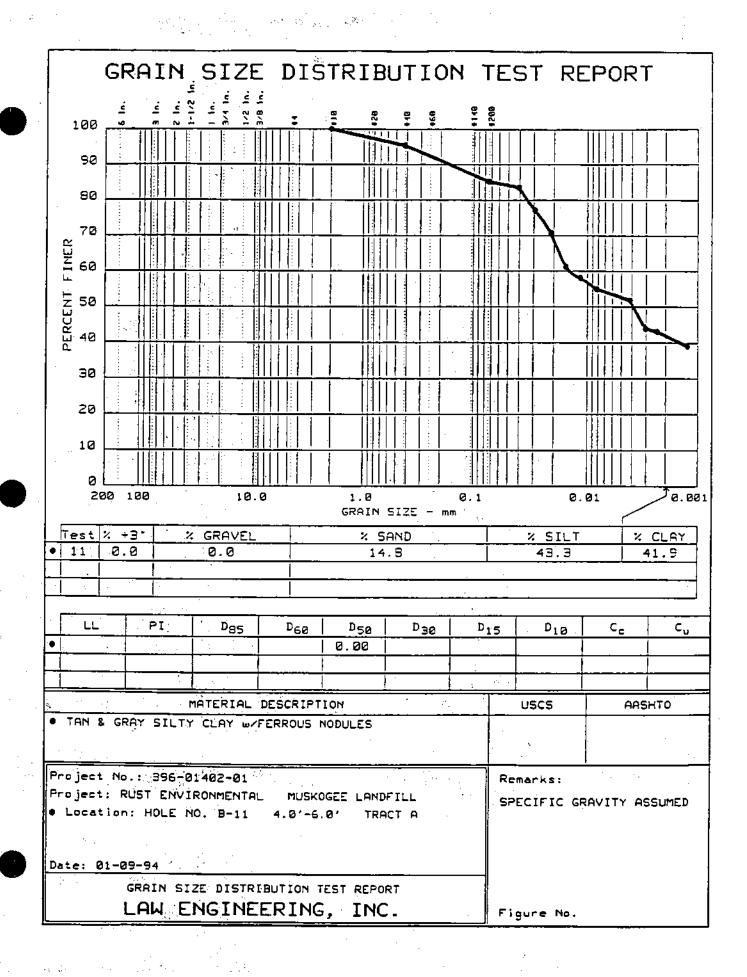
4 F F		_					Cation						
	ample		Moisture			i	Exchange			!		ERBERG I	,IMIT
	ification	_	Content	Organica	Compression	%	Meq	Density	i	Pocket	Llquid	Plastic	Plastic
	Depth	Material Description	%	· %	ksf	Strain	Na/100g	pcl	·· pH	pen.	Umit	Limit	Index
	8-10	Tan & Gray Silty Clay w/Fe Nodules	16.9			<u> </u>		- 11		4.5+			
B-12	13-15		11.3	2.8		4.							
B-12	18-20	Tan Shaley Silty Clay	11.6		12 to 12 to		1 1 2	14		4.5 ∞			
	0.2	Light Brown Clay	23.6	7	teach of the		V 15		1 197	3.25	58	21	37
B 13 _	4-6	Tan & Gray Sitty Clay w/Fe Nodules	19.2	2.5									
	6.8	Tan & Gray Silty Clay w/Fe Nodules	18.9		,		11.8			4.25			
	8-10	Yellow Br & Gr Silty Clay w/Fe Nodules	23.5	120	2.97	2.18		103.28		3.5			1
B-13	13-15	Tan Slightly Shaley Silty Clay	12.3						7.4		32	⁻ 20	12
B-14	1-2	Brown Silty Clay w/Organics	14.9										1
	2-4	Tan Clay	17.4								50	16	34
B-14	4-6	Tan & Gray Silty Clay	17.1	2.7								<u> </u>	
B-14	11-12	Ten & Gray Silty Clay	18.0			T	1						
B-14	12-14	Lt. Tan Silty Clay, Slightly Shaley	28.4		_	·	1						
B 14	14-16	Tan & Gray Shaloy Silty Clay	13.1								35	21	14
B-14	19-21	Ten Shaley Silty Clay	14.3										
B-14	22-24	Gray Shaley Silty Clay	11.9			1			· · · ·				
B-14	27-29	Dark Gray Shale	15.4			· · · · · · ·			,:-				
B-15	#4	Gray Shale Rock Core	4.72	-	211.23		1 <u>1</u>	138.78	<u>-</u>		30 ·	20	10
B-15	0-2	Lt Brown Slightly Clayey Silt w/Organics	15.4				1	7		2.0			 ` · ·
B-15	2.4	Light Brown & Ten Clay	16.4			····	1			4.5+	54	17	37
B-15	4.5	Tan & Gray Silty Clay	14.8				 . 	<u></u> .		4.5+			
B-15	6.8	Light Brown Silty Clay w/Fe Stains	18.8	3,9	6.51	5.00	· · · · · · ·	105.16		4.5+			
B-15	8-10	Yellowish Br Stiff Fat Clay	19.9				1			3.75		 	· · · - ·
B-15	13-14	Lt Brown & Tan Slightly Shaley Silty Cla	13,7			٠.	 	 -			43.	25	18
B-16	0.5	Tan & Brown Silty Clay	19.8				1		·	4.5+			 ' -
B-16	2-4	Tan & Gray Silly Clay				 	 		7.5	······································	·	 	
B-16	4.6	Yellowish Br & Lt Gr Still Fat Clay	21.7			 	 			2.75	47.	15	32
	6.8	Tan Silty Clay	26.4			 	13.2				 _		
B-16	8-10	Tan Silty Clay w/Shale Fragments	18.8	5.1	Sample to short	to test	 	109.79		4.25		 -	
B-17	#1	Gray Shale Rock Core	9.34		37.58	100.	I	117.15		***	39 -	22 -	17
	0.2	Light Brown Silty Clay	20.6			 	 	117.13		4.5 +		<u></u>	
	2-4	- Brown Clay	25.6			 	 		<u> </u>	2,25	55.	- 18	37
B-17	4.6	Li Br Silty Clay w/Fe Stains & Nodules	22.2		3.72	6.15	- 	102:32		2.5	55	- 10	- 31
B-17	8 10	Tan and Gray Silty Clay	20.7	· · · · · · · · · · · · · · · · · · ·	3.72	0.13	 	102.02	<u> </u>	4.25		 	
B-17	13-15	Tan & Gray Clay	21.3			 	 		<u> </u>	3,5	52'	17	35
B-17	18-19	Light Tan Silty Clay	12.0		 -	 	-} -			3,25	52	 ''	-35
B-18	#5	Gray Shale Rock Core	4.13		215,93		{	140.39	[3,23	30		
	0.2	Yellowish Ten Silty Clay	14.3	<u> </u>	213,93		- 	140.39		46.		18	12
	2.4	Tan & Gray Silty Clay w/Fe Nodules	19.7	—	 	-	+1		ļ	4.51	42	14	. 28
B-19	4.6						-lI			l—, -		<u> </u>	
	8-10	Yellow & Brown Silty Clay w/Fe Nodules Tan Silty Clay w/Fe Pockets	19.0		3.80	3.47	.↓]	107.55	ļ	4.5	47	16	31
			20.5	·		⊢ —	.			2.25	34	14	20
B-18	13-15	Ten Silly Clay	18.6	3.7	··		18.4		· <u>-</u>			<u> </u>	<u> </u>

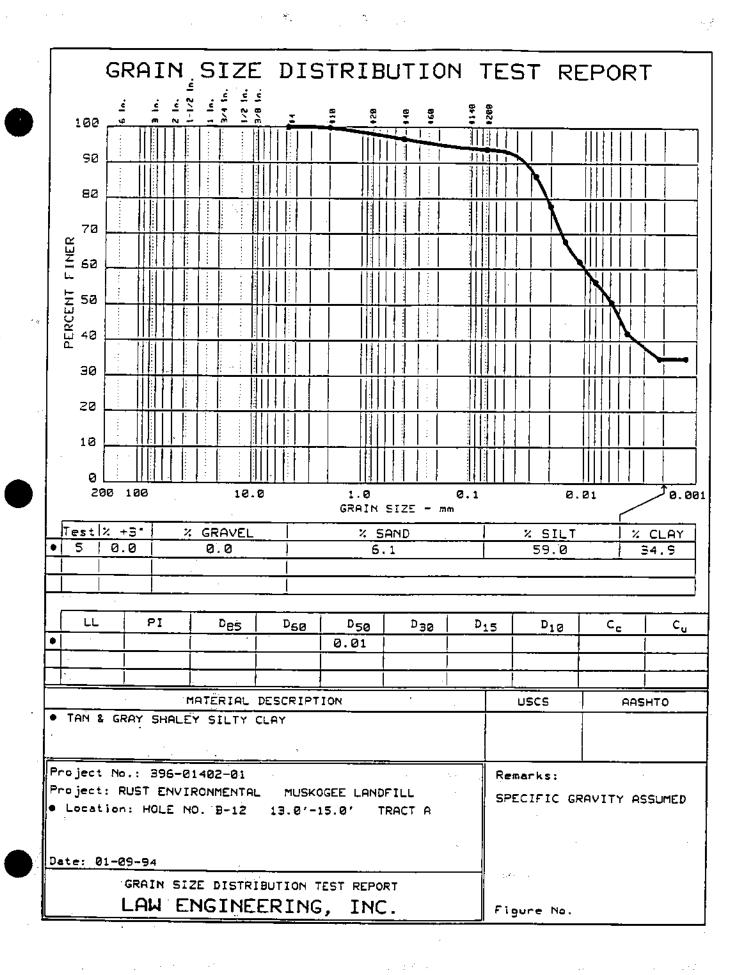
LAW ENGINEERING, INC.					SUMMARY OF TEST DATA TRACT A						RUST E & F MUSKOGEE LANDFILL			
Sample Identification		- 711111-	Moisture			%	Cation Exchange Meq	Density	,	Pocket	ATTERBERG LIMIT			
				Organics	Compression						Liquid	Plastic	Plastic	
Hole #		Material Description	%	%	ksf	Strain	Na/100g	pcf	³ pH	pen.	Llmlt	Limit	Indox	
B-18 B-19	18-19	Ten Silty Clayey Shale	10.8	ļ					6.8					
	20-22	Tan & Gray Silty Clay	22.1	ŀ		·	I I					i		
B-19	22-24	Tan Silty Clay with Ferrous Nodules	21.5	·	3.05	9.20	1	103.59		2.75				
B-20	0:2	Ten & Gray Silty Clay w/Fe Nodules	14.0				12.3			4.5+				
B·20	2.4	Tan & Gray Cley w/Fe Pockets	18.6	· · · · · · · · · · · · · · · · · · ·	•		·			4.5+	54	17 -	37	
8-20	4.6	Yellow & Brown Sitty Clay w/Fe Nodules	21.5		1.46	6.08		111.40	6.6	1.75				
B-20	8-10	Tan Silty Clay	19.6	3.3		-	1 1					··		
B-20	23-25	Gray Silly Clay	19.6				1 1			2.5				
B-20	28-29	Gray Stightly Shaley Silty Clay	17.7				1. 1	·		0.75			·	
B-21	17-19	Ten & Gray Silty Clayey Shale	19,2	1			i			l	49	16	33	
B-21	19-21	Ten & Gray Silty Clay w/Fe Nodules	18	4.0		•	1							
B-21	21-22	Tan Silty Clay with Ferrous Nodules	19.1				†		l	4,5			<u> </u>	
B-21	22-24	Tan Silty Clay with Fe Nodules & Seams	19.3	1 1			1		 	4.25				
B-21	24-26	Tan & Gray Silty Clay	22.0	i			1			1,75				
B-21	29-31	Dark Gray Silty Clayey Shale	21.3	<u> </u>			1			1.75	51	17	34	

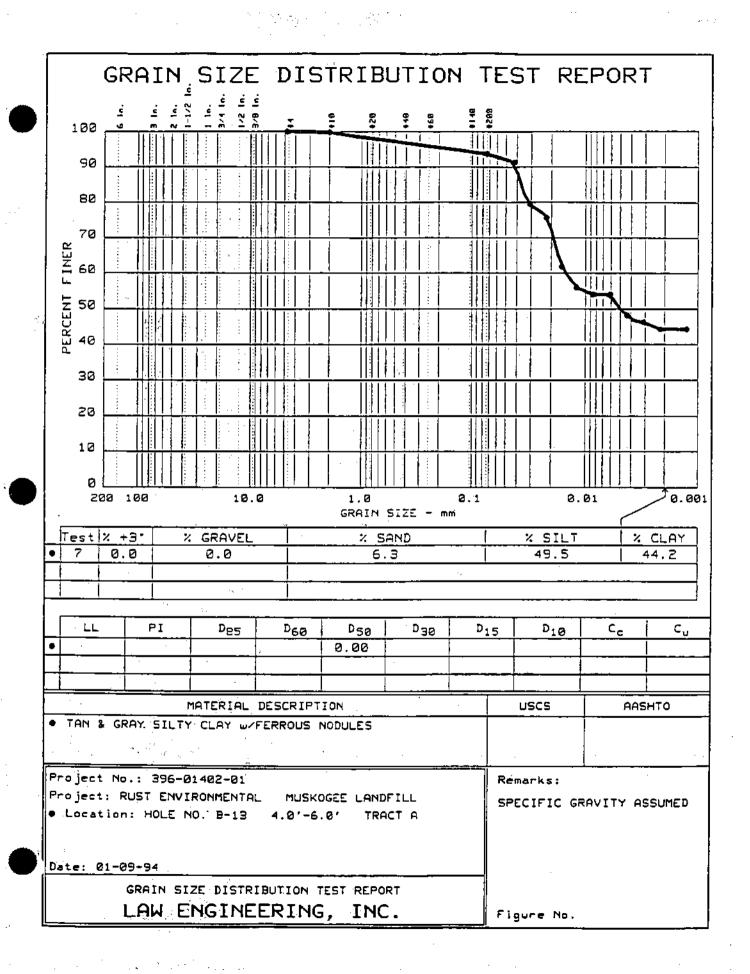


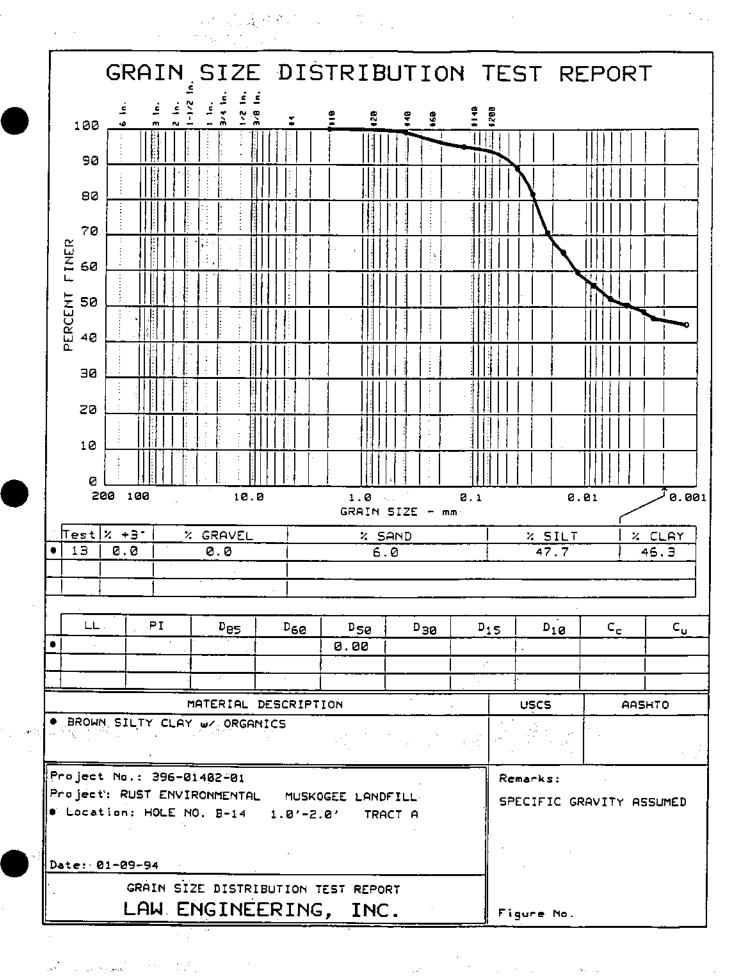


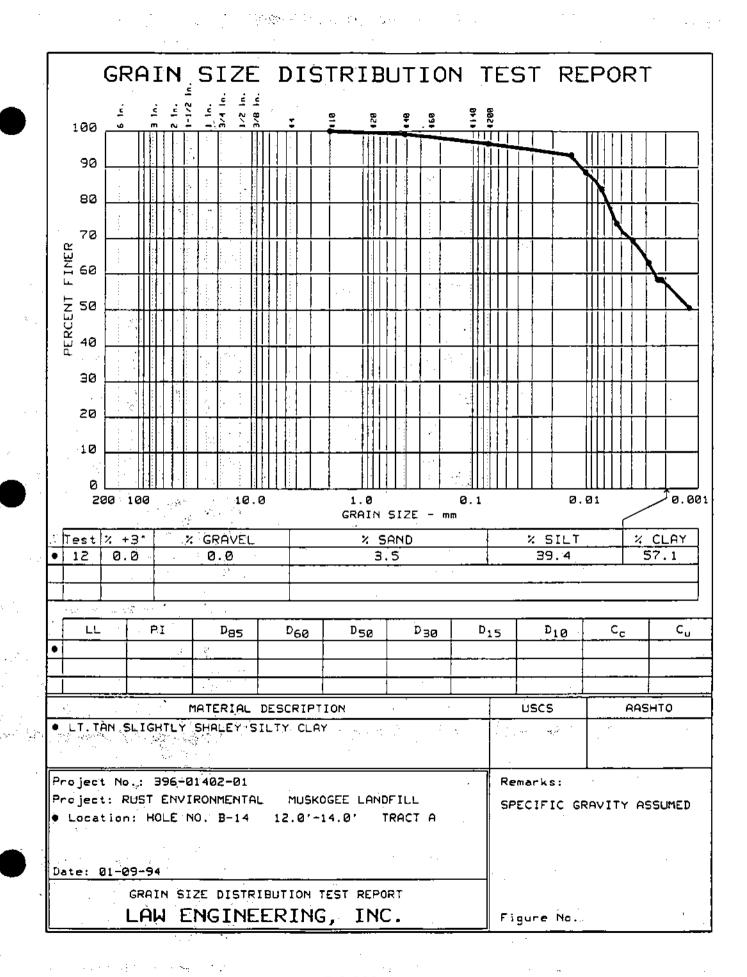


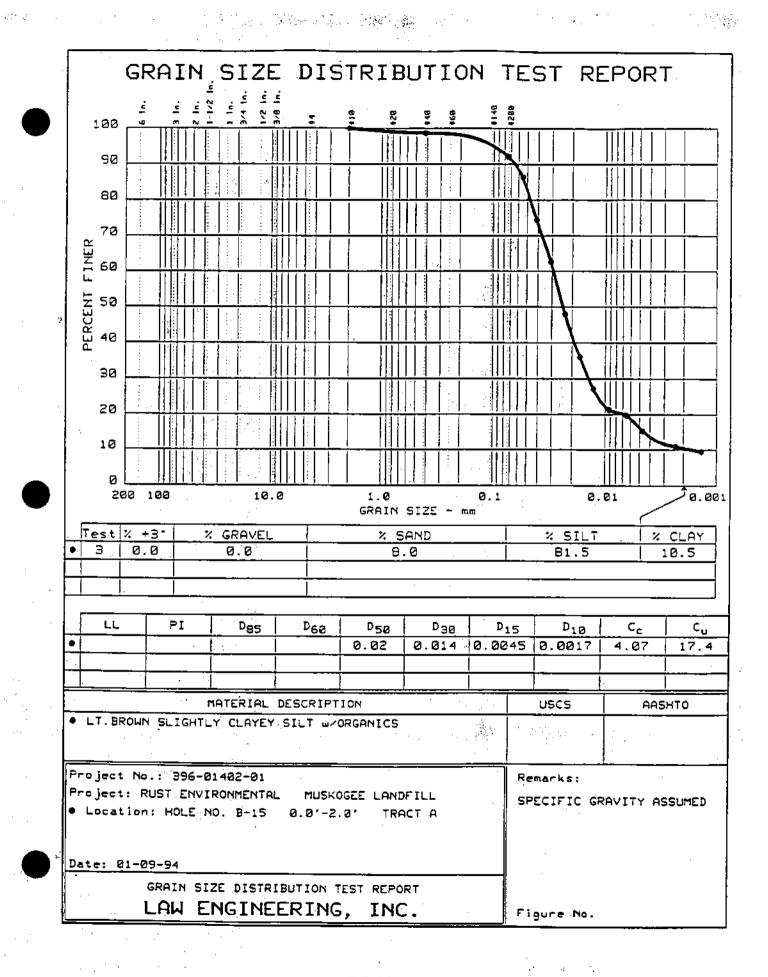


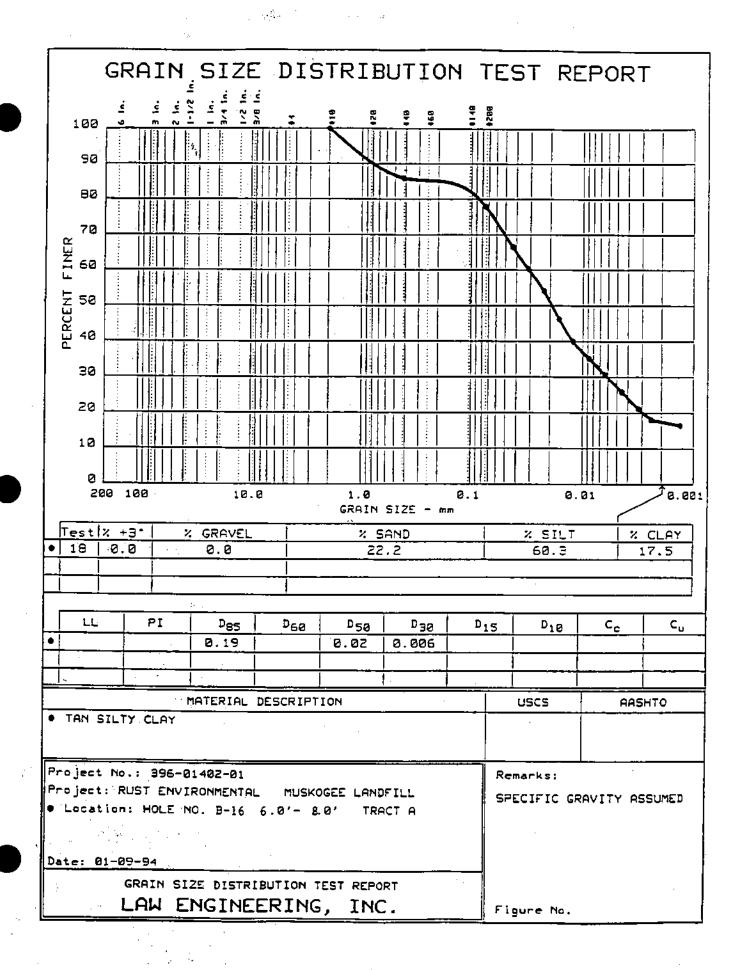


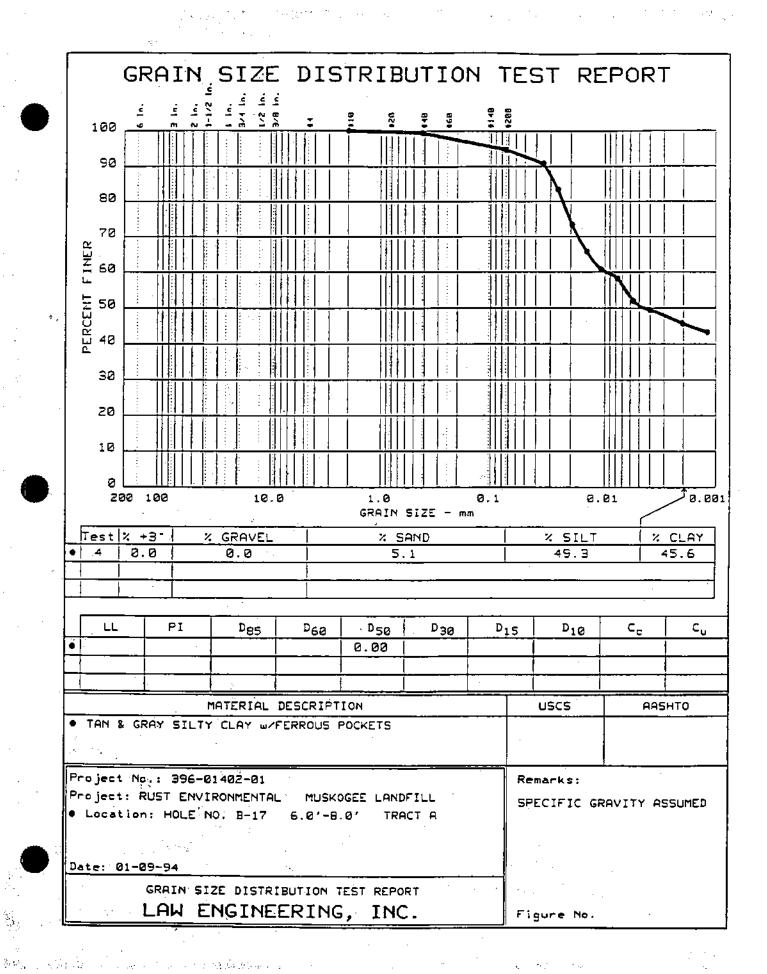


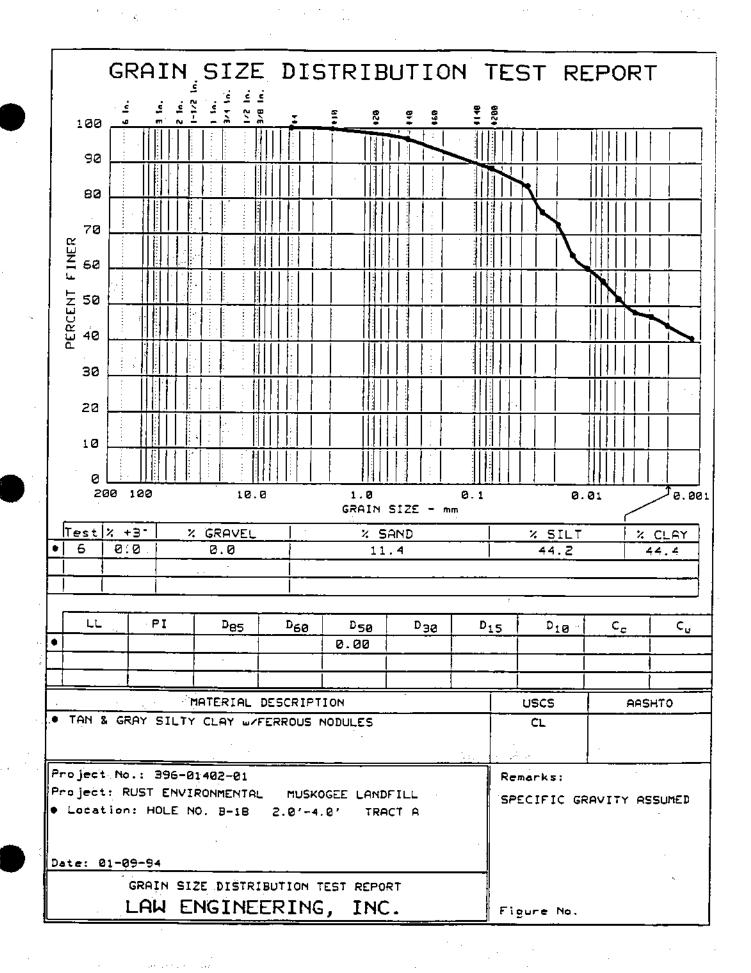


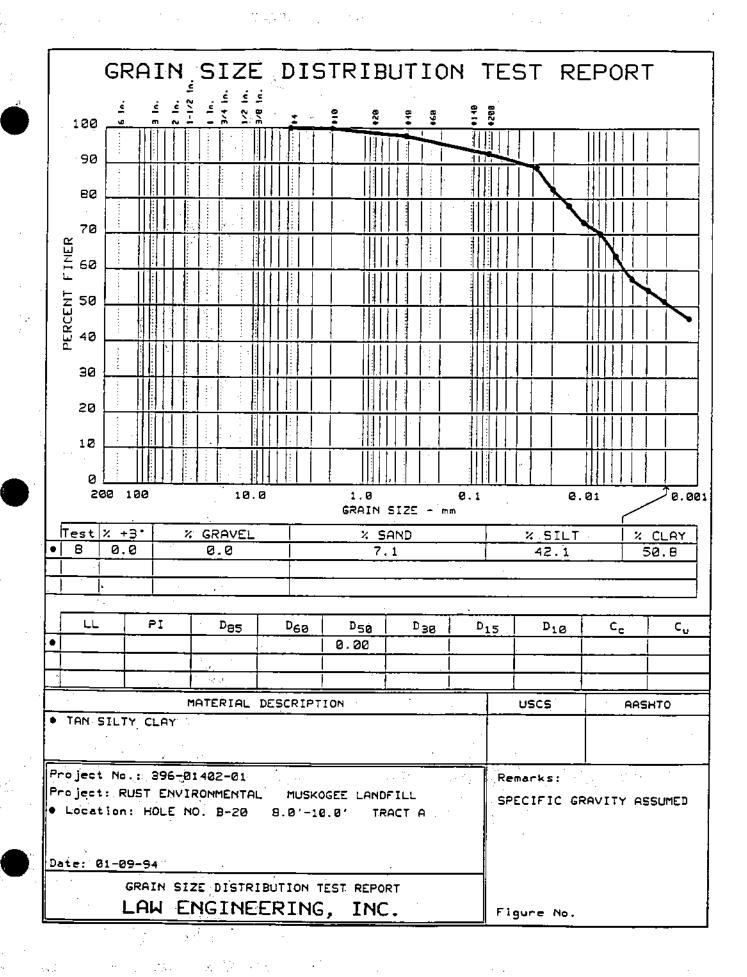


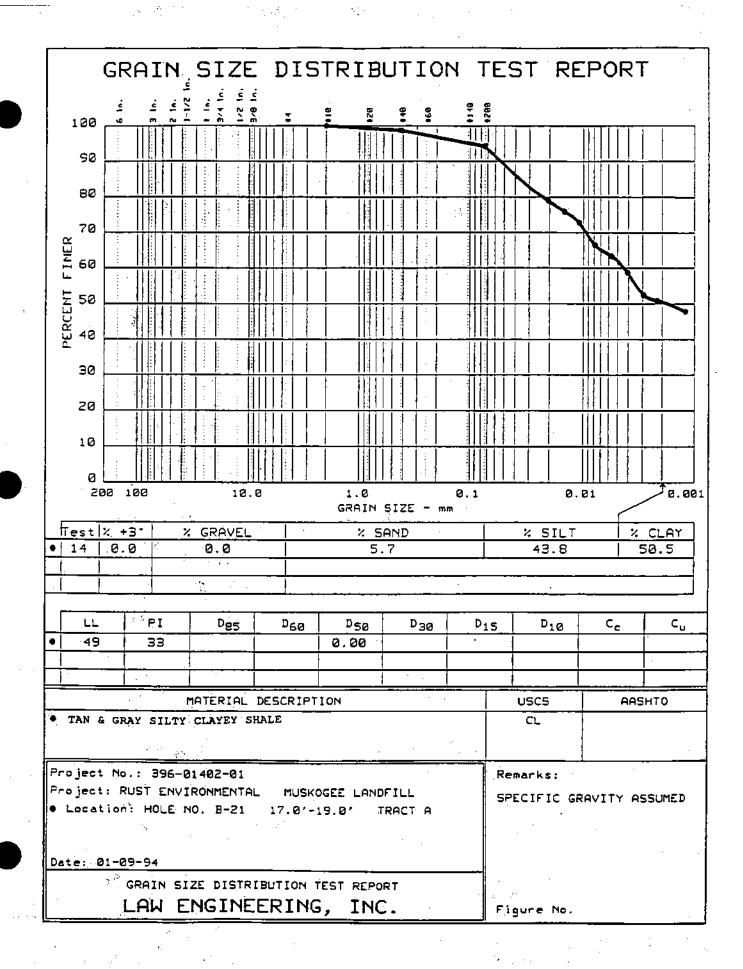














GEOTECHNICAL ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS 1540 NORTH 107TH EAST AVENUE TULSA, OKLAHOMA 74116 PHONE: 918-834-4700 FAX: 918-835-2545 REPORT NO.____ DATE: 11-08-93 396-01402-01

MOISTURE - DENSITY CURVE

CLIENT:

Rust Environmental

PROJECT:

Muskogee Landfill

MATERIAL:

Light reddish brown and tan silty clay

MATERIAL SOURCE:

Tract A

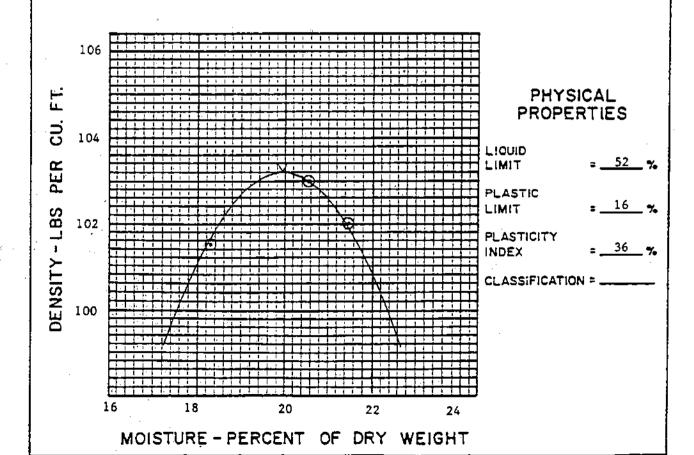
B-3 0'-2'

TEST RESULTS

METHOD OF TEST ASTM D-698

MAXIMUM DRY DENSITY = 103.2 LBS PER CU. FT.

OPTIMUM MOISTURE CONTENT = 20.0 %





GEOTECHNICAL ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS 1540 NORTH 107TH EAST AVENUE TULSA, OKLAHOMA 74116 PHONE: 918-834-4700 FAX: 918-835-2545 REPORT NO._____ DATE: 11-08-93

396-01402-01

MOISTURE - DENSITY CURVE

CLIENT:

Rust Environmental

PROJECT:

Muskogee Landfill

MATERIAL:

Tan and brown silty clay

MATERIAL SOURCE:

Tract A

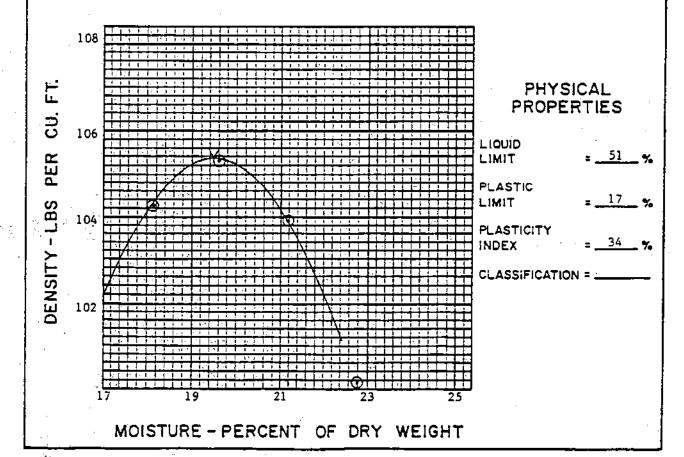
B-16 0'-2'

TEST RESULTS

METHOD OF TEST ASTM D-698

MAXIMUM DRY DENSITY = 105.4 LBS PER CU. FT.

OPTIMUM MOISTURE CONTENT = 19.5 %





GEOTECHNICAL ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS

1540 NORTH 107TH EAST AVENUE TULSA, OKLAHOMA 74116 PHONE: 918-834-4700 FAX: 918-835-2545

REPORT NO. DATE: 11-29-93

396-01402-02

MOISTURE - DENSITY CURVE

人名英格兰人姓氏克尔

CLIENT:

Rust Environmental

PROJECT: Muskogee Landfill

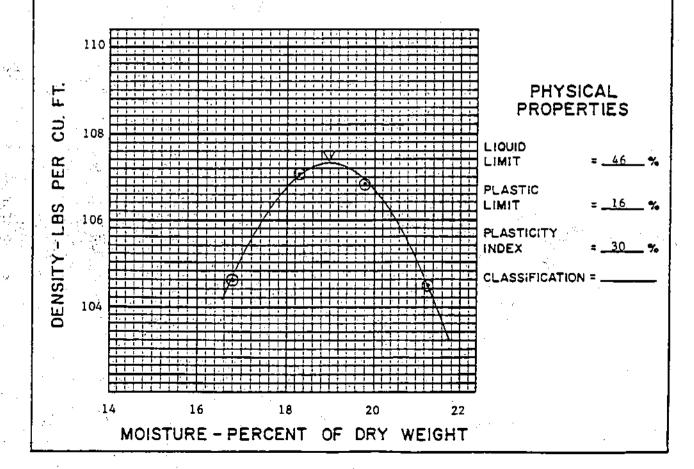
MATERIAL: Yellowish tan silty clav

MATERIAL SOURCE:

Tract A B-18 0'-2'

TEST RESULTS

METHOD OF TEST _ ASTM D-698 MAXIMUM DRY DENSITY = 107.4 LBS PER CU. FT. OPTIMUM MOISTURE CONTENT = 19.0 %





GEOTECHNICAL ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS .

1540 NORTH 107TH EAST AVENUE TULSA, OKLAHOMA 74116 PHONE: 918-834-4700

FAX: 918-835-2545

REPORT NO. DATE: 11-08-93

396-01402-01

MOISTURE - DENSITY CURVE

CLIENT:

Rust Environmental

PROJECT: Muskogee Landfill

MATERIAL:

Tan and light brown silty clay

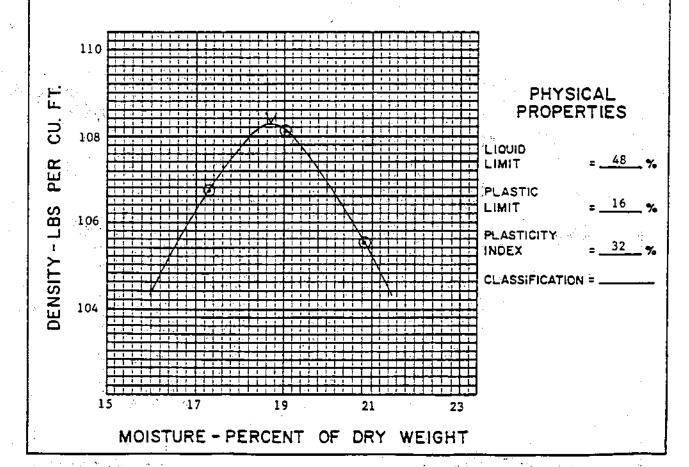
MATERIAL SOURCE:

Tract A

TEST RESULTS

METHOD OF TEST ASIM D-698

MAXIMUM DRY DENSITY = 108.2 LBS PER CU. FT. OPTIMUM MOISTURE CONTENT = 18.7





GEOTECHNICAL ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS

1540 NORTH 107TH EAST AVENUE TULSA, OKLAHOMA 74116 PHONE: 918-834-4700 FAX: 918-835-2545

REPORT NO._ DATE: November 8, 1991 396-01402-01

MOISTURE - DENSITY CURVE

CLIENT:

Rust Environmental

PROJECT: Muskogee Landfill

MATERIAL. Tan and light brown silty clay

MATERIAL SOURCE:

Tract A .

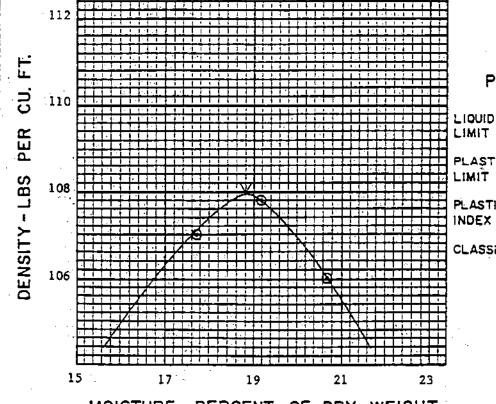
P-12 01-21

TEST RESULTS

METHOD OF TEST _ASTM D-698

MAXIMUM DRY DENSITY = 108.0 LBS PER CU. FT.

OPTIMUM MOISTURE CONTENT =



PHYSICAL PROPERTIES

PLASTIC

16 %

PLASTICITY

CLASSIFICATION = _



GEOTECHNICAL ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS

1540 NORTH 107TH EAST AVENUE TULSA, OKLAHOMA 74116 PHONE: 918-834-4700 FAX: 918-835-2545

REPORT NO._ DATE: 11-08-93

396-01402-01

MOISTURE - DENSITY CURVE

CLIENT:

Rust Environmental

PROJECT:

Muskogee Landfill

MATERIAL: Tan and light brown silty clay

MATERIAL SOURCE:

Tract A

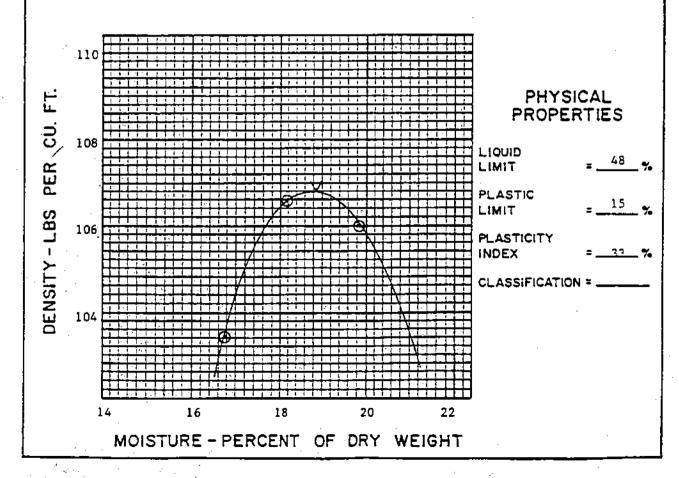
P-15 2'-7'

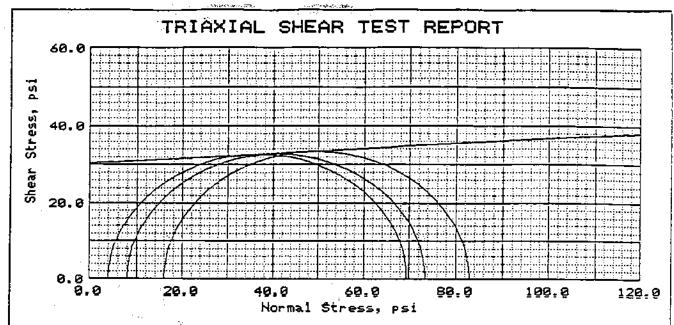
TEST RESULTS

METHOD OF TEST _ ASTM D-698

MAXIMUM DRY DENSITY = 106.8 LBS PER CU. FT.

OPTIMUM MOISTURE CONTENT = 18-8





Type of Test: Unconsolidated undrained Sample Type: UNDISTURBED

No.	FLUID PRE	SS. psi	MAX. STRE	NGTH psi	ULT STRE	ENGTH psi	PRINCIPAL AT FAIL	STREESES
	Cell	Back	Deviator	Pone	Deviator	Pore	ø,	0,
1	400	9	65.4	0.0	· ·		69.4	4.0
2	8	. 0	65.5	0.0			73.5	8.0
3	16	0	1 66.9	0.0			82.9	16.8
L :								

l		SAMPLE PARAMETERS						
No.	% Water Content	Dry Dens. Pcf	Satur-	Void Ratio	Diameter in	Height in	Strain rate	
1	19.5	110.6	100.6 %		2.70	5.83	0.030	
2	19.5	110.6	100.6 %	0.5246	2.79	5.83	0.030	
3	19.5	110.6	100.6 %	9.5246	2.70	5,83	0.030	
1		1	1		1		1	

HUMR-COOLUMB STRENGTH PARAMETERS	MATERIAL DESCRIPTION
Total Strength intercept, c= 30.3 psi Friction angle, 0 = 3.7 deg Tangent 0 = 0.06	TAN & GRAY SILTY CLAY LL= PI=

CLIENT: RUST ENVIRONMENT AND

INFRASTRUCTURE

PROJECT: MUSKOGEE LANDFILL TRACT A

LOCATION: HOLE NO. B-5 6.0'-8.0'

TRIAXIAL SHEAR TEST REPORT LAW ENGINEERING, INC.

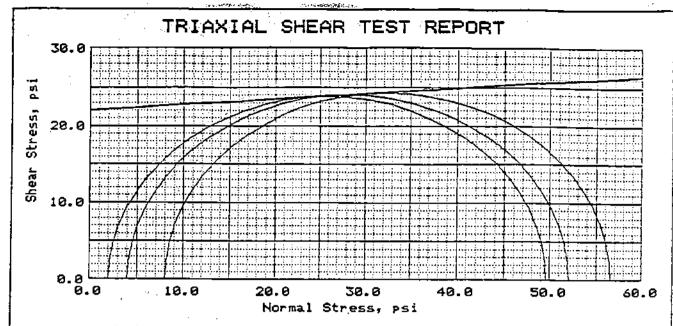
DATE: 01-14-94 File: RUST56-8

REMARKS:

RUN BY J.ALEXANDER

MULTIPLE-STAGE

Proj. No.: 3960140201



Type of Test: Unconsolidated undrained Sample Type: INDISTURBED

No.	FLUID PR	ESS. psi	MAX. STREN	MAX. STRENGTH psi		ENGTH psi	PRINCIPAL STRESSES AT FAILURE +61	
	Cell	Back	Deviator	Pore	Deviator	Pore	σ,	I 0,
1	2	0	47.6	0.0			49.6	2.8
2	4	0	48.0	0.0			52.0	4.0
3	8	0	48.5	0.0			56.5	8.0
1	<u> </u>		j					T

l	SAMPLE PARAMETERS						
No.	% Water Content	Dry Dens.	Satur- Void ation Ratio	Diameter in	Height in	Strain rate	
_ 1	20.0	109.2	99.3 % 0.5430	2.71	5,78	0.030	
2	20.0	109.2	99.3 % 0.5430	2.71	5.78	0.030	
3_	20.0	109.2	99.3 % 0.5430	2.71	5.78	0.030	
1	i - ,	·	· i	· ·			

MOHR-COULOMB STRENGTH PARAMETERS	MATERIAL DESCRIPTION		
Total Strength intercept, c= 22.0 psi Friction angle, 0 = 4.2 deg Tangent0 = 0.07	TAN & GRAY SILTY CLAY LL= PI=		

CLIENT: RUST ENVIRONMENT AND

INFRASTRUCTURE!

PROJECT: MUSKOGEE LANDFILL TRACT A

- 115001 6

LOCATION: HOLE NO. B-7 4.0'-6.0'

TRIAXIAL SHEAR TEST REPORT LAW ENGINEERING, INC.

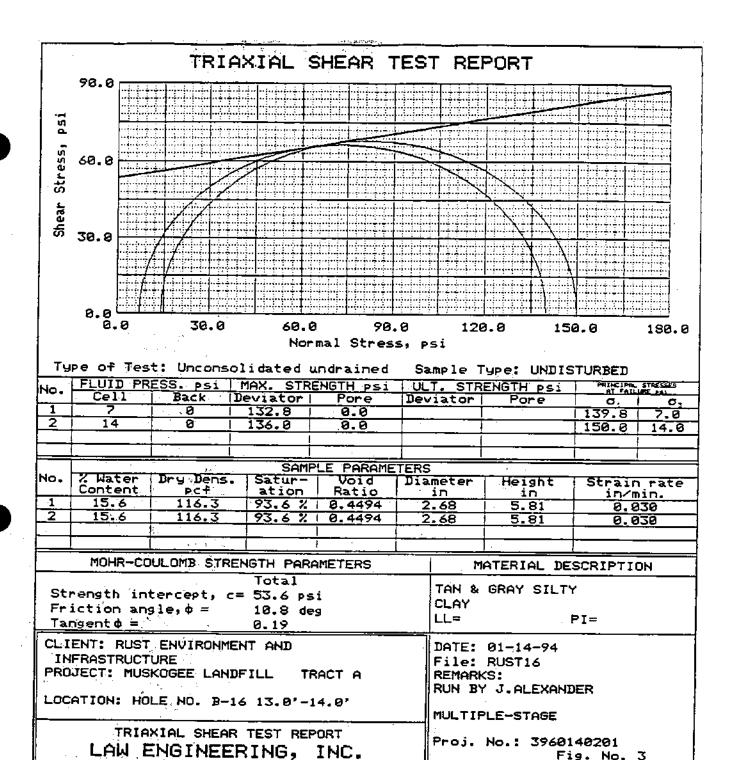
DATE: 01-14-94 File: RUST74-6

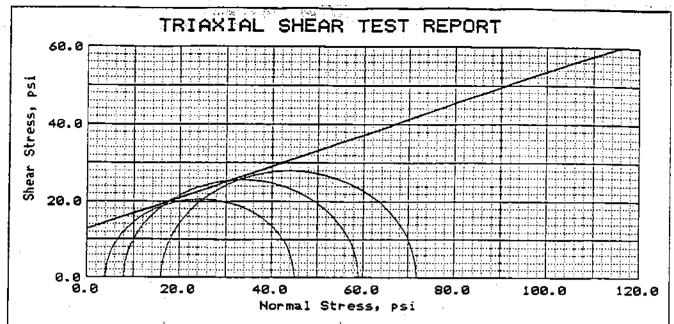
REMARKS:

RUN BY J.ALEXANDER

MULTIPLE-STAGE

Proj. No.: 3960140201





Type of Test: Unconsolidated undrained | Sample Type: SHELBY TUBE

No.	FLUID PR	ESS. psi	MAX. STR	ENGTH psi	ULT. STR	ENGTH psi	PRINCIPAL AT FAIL	STRESSES
	Cell	Back	Deviator	Pore	Deviator	Pore	a.	σ,
_ 1	4	Ø:	41.1	0.0		• • • • • • • • • • • • • • • • • • • •	45.1	4.0
2	. 8	. 0	51.1	0.0	. 1		59.1	8.0
3_	16	0	55.8	0.0	<u>i </u>		71.8	16.0
		117			T * * * * * * * * * * * * * * * * * * *		<u>. </u>	

l	SAMPLE PARAMETERS						
No.	% Water	Dry Dens.	Satur-	Void	Diameter	Height	Strain rate
-	Content	pcf	ation	Ratio	in	in	∐ in/min.
1	19.5	107.2	93.3 %	0.5610	2.73	5.91	0.030
2	19.5	107.2	93.37	0.5610	2.73	5.91	0.030
3	19.5	107.2	93.3 %	0.5610	2.73	5.91	0.030
Ł	-]				

MOHR-COULOMB	

Total

Strength intercept, c=12.8 psi Friction angle, $\phi=22.2$ deg

Tangent d =

0.41

CLIENT: RUST ENVIRONMENT AND

INFRASTRUCTURE

PROJECT: MUSKOGEE LANDFILL

TRACT A

LOCATION: HOLE NO. 3-20 6.0'-0.0'

TRIAXIAL SHEAR TEST REPORT LAW ENGINEERING, INC.

MATERIAL DESCRIPTION

TAN & GRAY SILTY CLAY W/FERROUS MODULES

LL= PI=

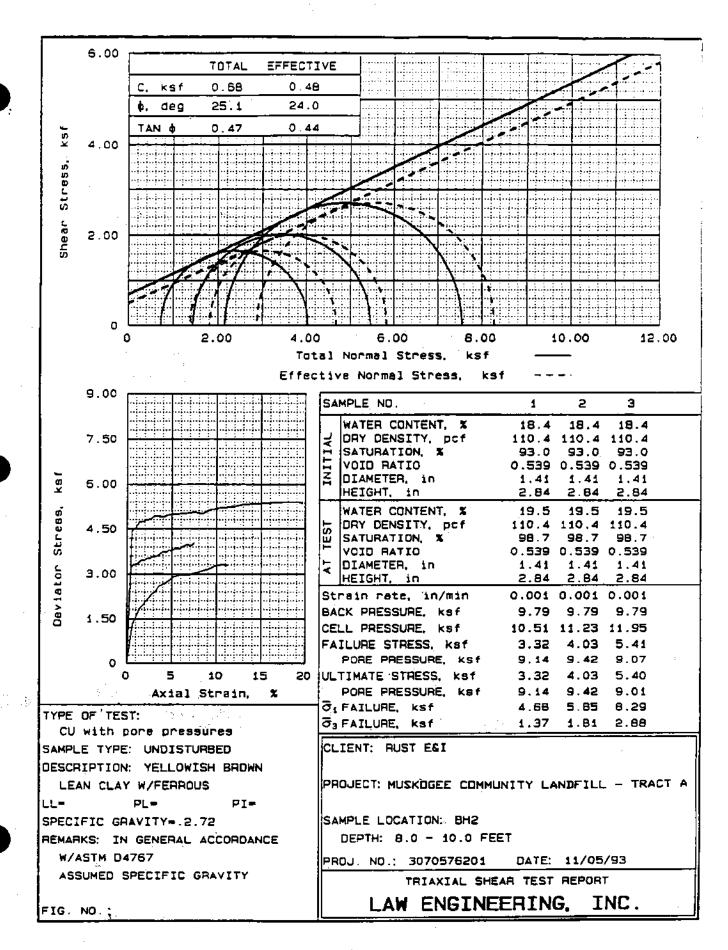
DATE: 01-13-94 File: RUSTB20

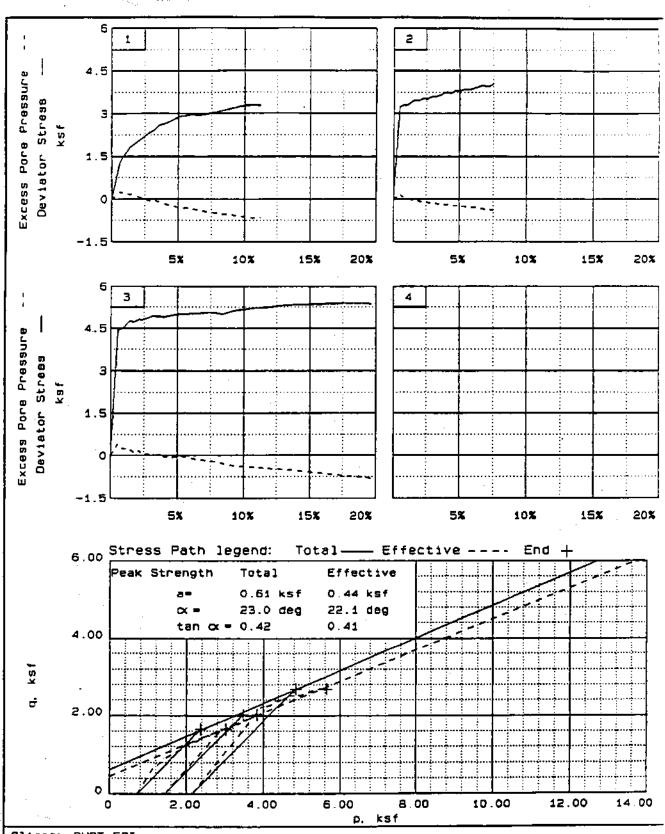
REMARKS:

RUN BY J.ALEXANDER

MULTIPLE-STAGE

Proj. No.: 3960140201





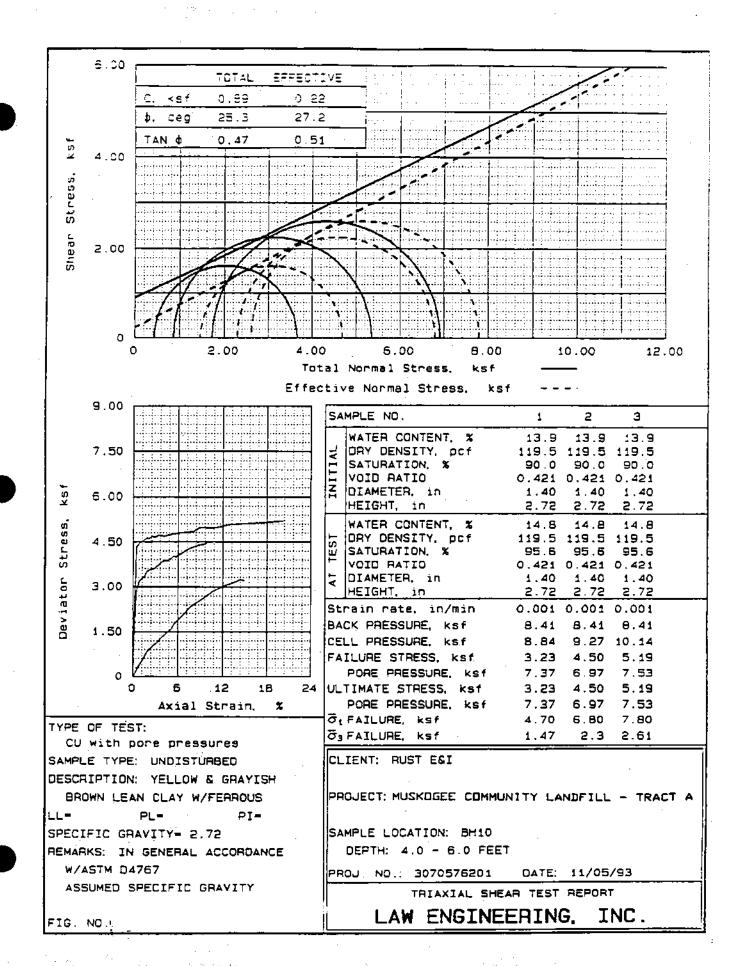
Client: RUST E&I

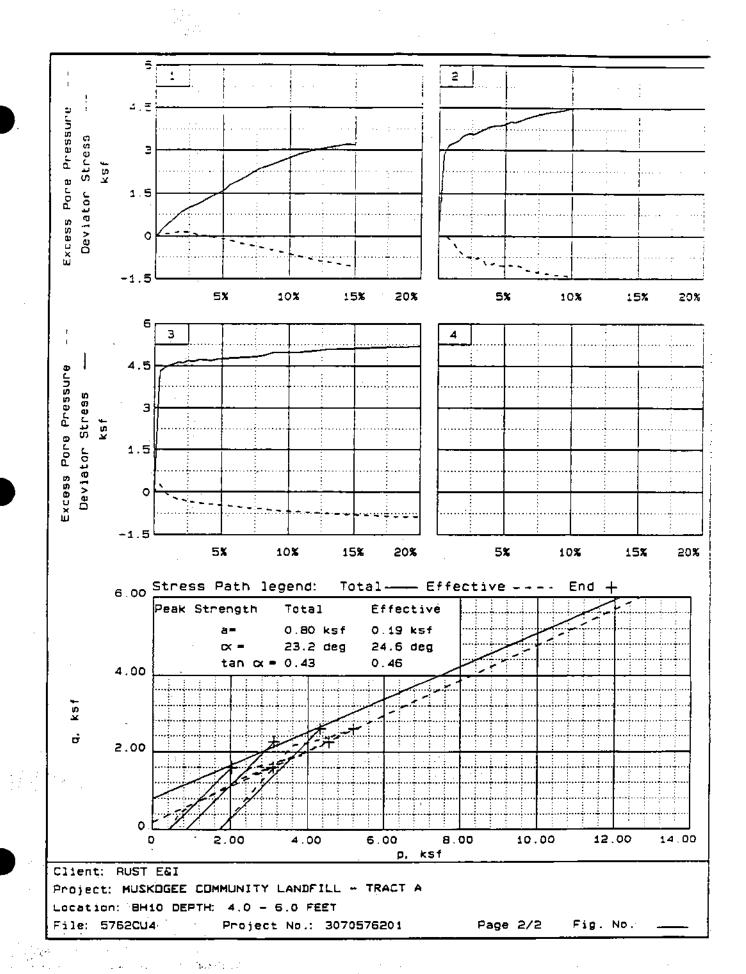
Project: MUSKOGEE COMMUNITY LANDFILL - TRACT A

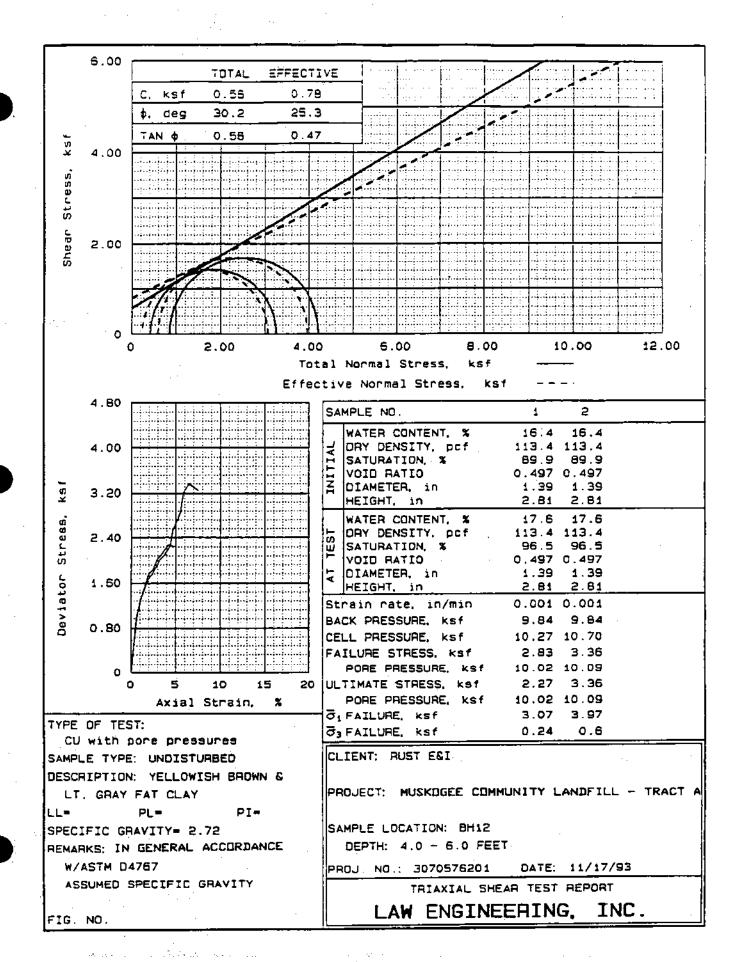
Location: BH2 DEPTH: 8.0 - 10.0 FEET

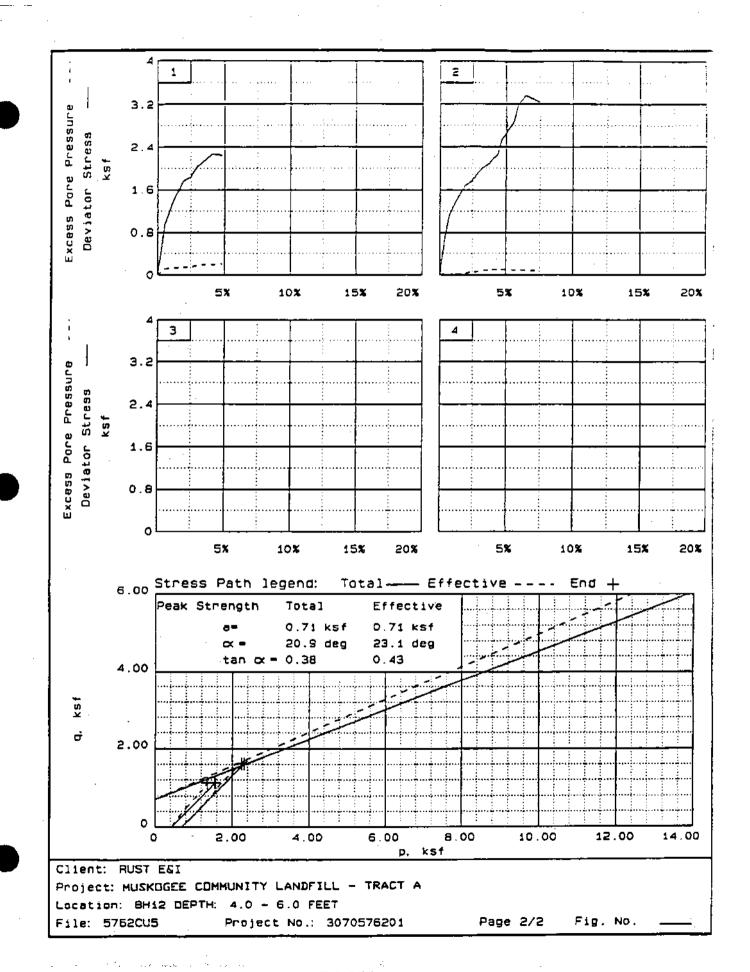
File: 5762CUP3 Project No.: 3070576201

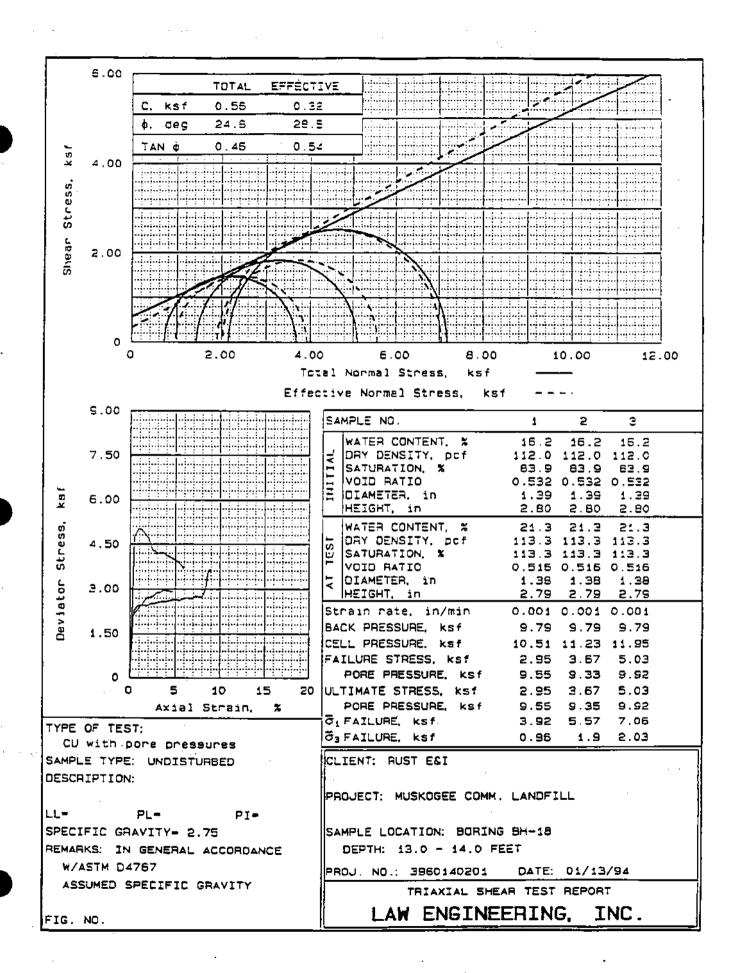
Page 2/2

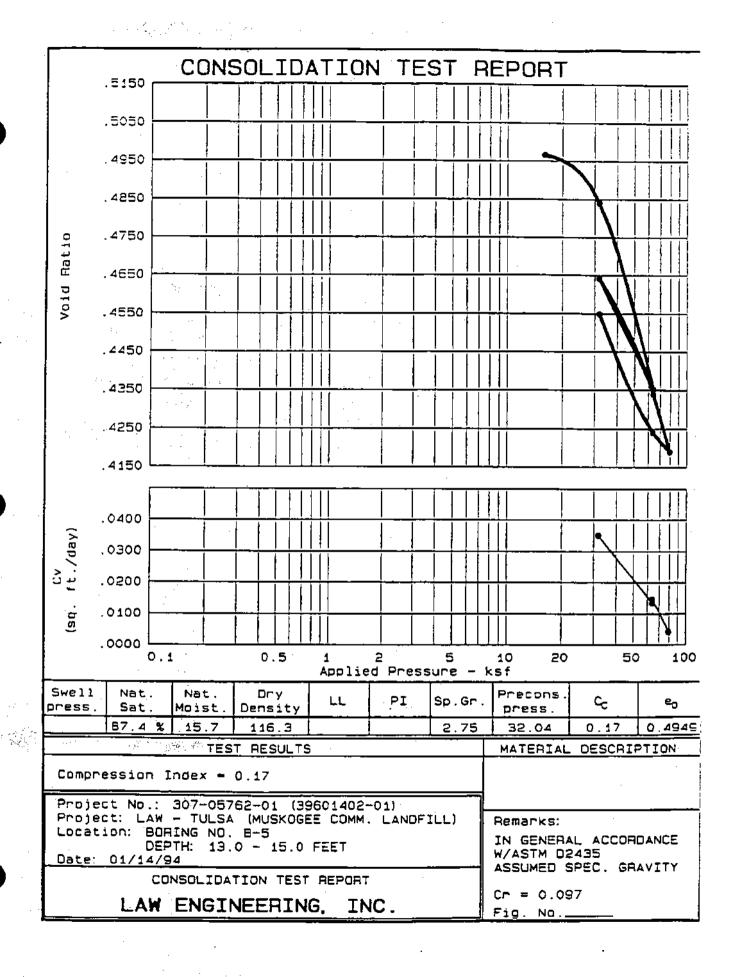


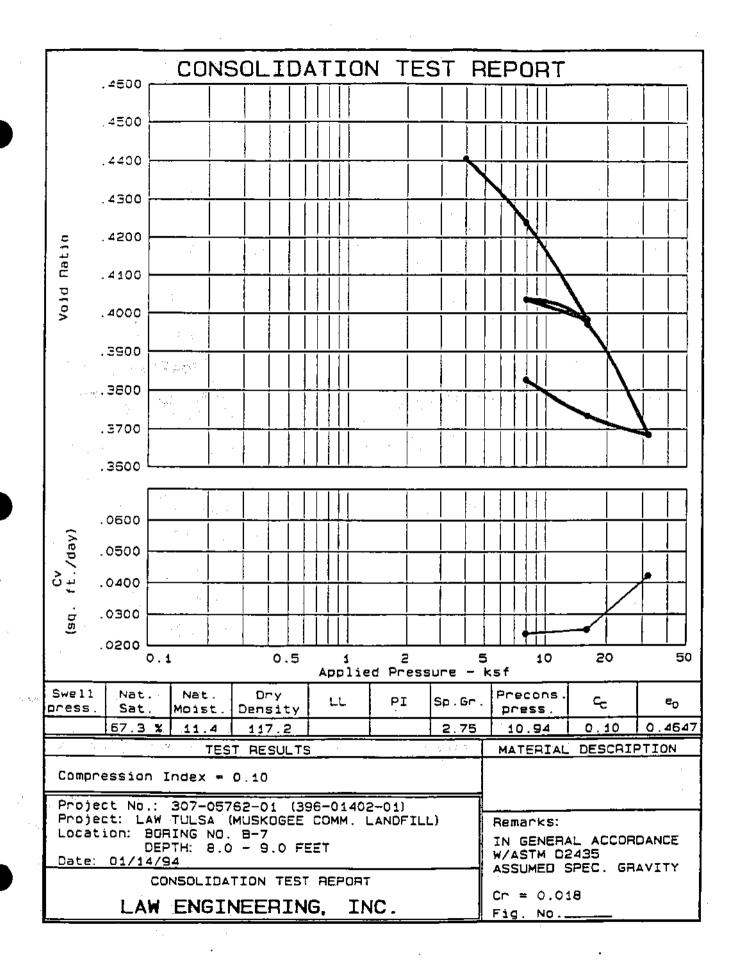




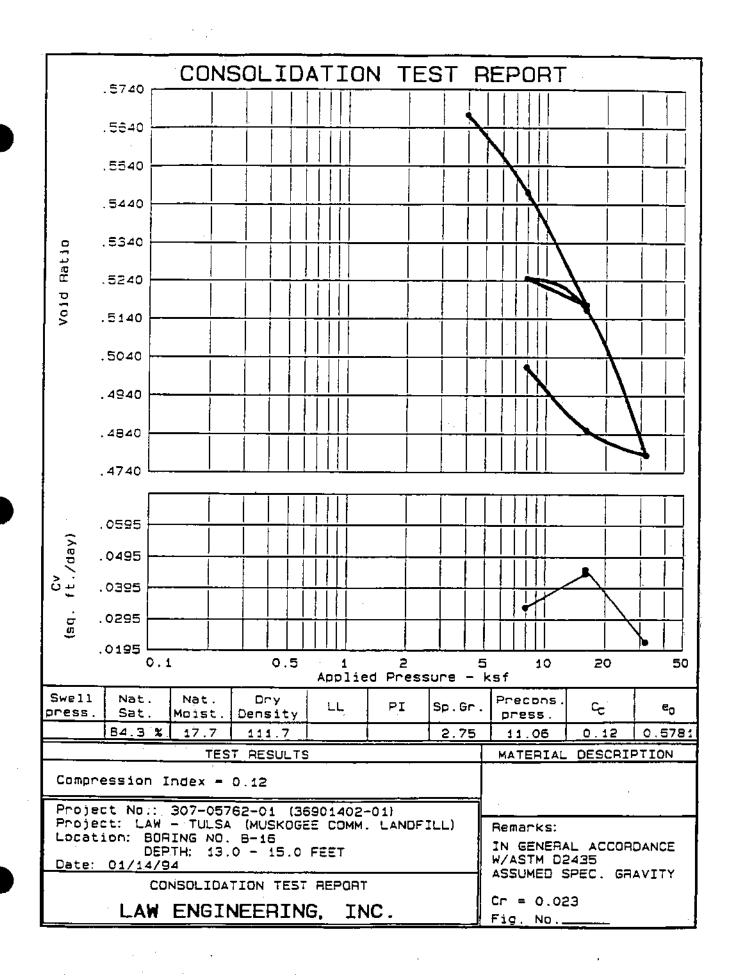


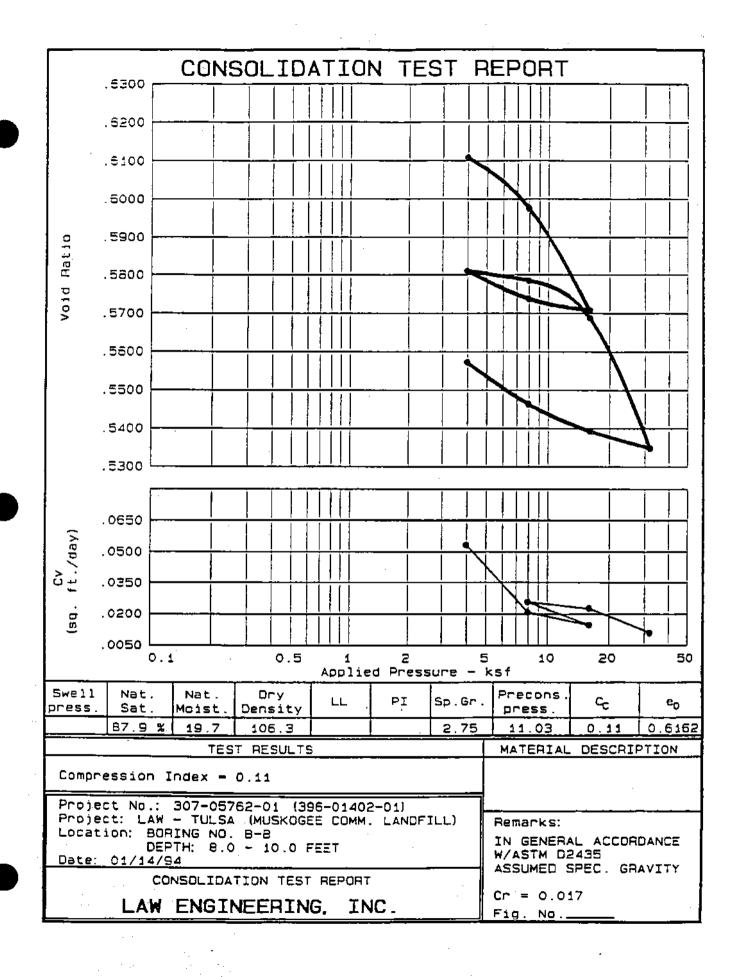






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HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	1 of 2
DATE:	12/29/93

PROJECT NAME:	LAW - TULSA (RUST E & I)
PROJECT NUMBER:	307-05762-01 (396-01384-01) LAB NO.: 05
SAMPLE LOCATION:	TRACT "A", B-3, 0-2 FT.
DESCRIPTION OF SOIL:	LIGHT REDDISH-BROWN AND TAN, SILTY CLAY
TYPE OF SPECIMEN:	UNDISTURBED[] REMOLDED[X] ASTM D698
PERMEANT:	DE-AIRED TAP WATER

SAMPLEDATA		
	INITIAL	FINAL
DIAMETER OF SAMPLE(cm)	7.20	7.23
AREA OF SAMPLE(cm2),A	41.63	41.10
LENGTH OF SAMPLE(cm),L	9.05	9.01
MOISTURE CONTENT(%)	21.0	25.2
DRY DENSITY(pcf)	98.9	99.1
SATURATION(%)		97.2

13 (18) 13 (18)	AD ICCONDUCTIVENOUS)
k20 =	2.4 E-09 cm/sec
	(or)
k20 =	2.4 E-11 m/sec

 $k = (aL/2At)^{n}\ln(h1/h2)$

pipette length = 25.380 cm

k20 = kRt

pipette volume = 25.0 cm ^ 3

Rt = (-0.02452T CELSIUS + 1.495)

 $a = ain = aout = 0.985 cm^2$

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

<u>PAGE NO. </u>	2 of 2
DATE:	12/29/93

PROJECT NAME: LAW - TULSA (RUST E & I)

PROJECT NUMBER: 307-05762-01 (396-01384-01) LAB NO.: 05

RACK PRESSURE SATURATION (CONDITIONS)

EFFECTIVE STRESS (psi):

2.0

1) B COPPLETENT > ar = 0.95

SATURATION METHOD:

1

I PINALIATURATION CALCULATED 100 + ar = 10

5) VOLUME CRANGE DURING TEST

CONSDIDATION CONDITIONS

CONFINING PRESSURE(psi):

56.0

CONSOLIDATION PRESSURE(psi):

48.0

EFFECTIVE STRESS(psi):

8.0

PHIMEATION (CONDING) S

CONFINING PRESSURE(psi):

62.0

INFLUENT PRESSURE(psi):

52.0

psi = 70.34 = cm

EFFLUENT PRESSURE(psi):

50.0

HYDRAULIC GRADIENT, i:

	=3\11\12\1 =3\11\12\1	ener Sieren	(envice)	8 (3.3 0 % 1 € 1 € 1 € 1 € 1 € 1 € 1 € 1 € 1 € 1	RYASELE Van	C2 017/20
1075	64500	4.30	21.30		1	
1430	85800	4.35	21.25	0.102	0.88	2.9 E-09 cm/sec
2540	152400	4.45	21.15	0.203	0.90	1.8 E-09 cm/sec
3870	232200	4.60	21.00	0.305	0.91	2.4 E-09 cm/sec
5380	322800	4.80	20.85	0.355	0.92	2.5 E-09 cm/sec

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO. 1 of 2 DATE: 1/31/94

PROJECT NAME:	LAW - TULSA (RUST E & I)	
PROJECT NUMBER:	307-05762-01 LAB NO.: 14	
SAMPLE LOCATION:	B-3,8-10 FT. TRACT "A"	
DESCRIPTION OF SOIL:	YELLOWISH BROWN & DK GRAY FAT CLAY W/FER.	NOL
TYPE OF SPECIMEN:	UNDISTURBED[X] VERTICAL AXIS [x]	
PERMEANT:	DE-AIRED TAP WATER	

SAMPLEDATA		
	INITIAL	FINAL
DIAMETER OF SAMPLE(cm)	6.96	6.99
AREA OF SAMPLE(cm2),A	38.05	39.37
LENGTH OF SAMPLE(cm),L	4.04	4.06
MOISTURE CONTENT(%)	18.0	18.6
DRY DENSITY(pcf)	113.8	112.6
SATURATION(%)		97.6

A SECURITOR OF THE PROPERTY OF	AUTIC CONDUCTIVITY OF SOIT AND AN ARROY OF REST TOUR K20 readings)
k20 =	2.1 E-08 cm/sec
	(or)
k20 =	2.1 E-10 m/sec

 $k = (aL/2At)^{\bullet} \ln(h1/h2)$

pipette length = 28.542 cm

k20 = kRt

pipette volume = $25.0 \text{ cm} \cap 3$

Rt = (-0.02452T CELSIUS + 1.495)

 $a = ain = aout = 0.876 cm^2$

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	2 of 2
DATE:	1/31/94

PROJECT NAME:

LAW - TULSA

PROJECT NUMBER:

307-05762-01

LAB NO.:

14

BACK PRESSURE SATURATION CONDITIONS

EFFECTIVE STRESS (psi):

2.0

1) B COFFICIENT > or = 0.95

SATURATION METHOD:

2) FINAL SATURATION CALCULATED 100 + ot - 34

3) VOLUME CHANGE DURING TEST

CONSOLIDATION CONDITIONS:

CONFINING PRESSURE(psi):

86.0

CONSOLIDATION PRESSURE(psi):

78.0

EFFECTIVE STRESS(psi):

8.0

HERMENIEN CONDITIONS

CONFINING PRESSURE(psi):

86.0

INFLUENT PRESSURE(psi):

79.5

 $psi \times 70.34 = cm$

EFFLUENT PRESSURE(psi):

78.0

HYDRAULIC GRADIENT, i:

V epite, pp.	12	SigVE!	al-vine(e.(e		TY READIN	ČS)
ELAPS			1000 1000	Personal Control	e i i	NO, arysec
0	0	12.00	12.00			
480	28800	12.60	11.40	1.370	0.94	1.9 E-08 cm/sec
1560	93600	14.00	10.00	3.197	0.94	2.1 E-08 cm/sec
1920	115200	14.30	9.50	1.142	0.94	2.3 E-08 cm/sec
2820	169200	15.50	8.50	2.283	0.94	1.8 E-08 cm/sec

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	1 of 2
DATE:	1/31/94

PROJECT NAME:	LAW - TULSA (RUST E & !)
PROJECT NUMBER:	307-05762-01 LAB NO.: 15
SAMPLE LOCATION:	B-4, 8 - 10 FT. TRACT "A"
DESCRIPTION OF SOIL:	YELLOWISH BROWN & LIGHT GRAY STIFF FAT CLAY
TYPE OF SPECIMEN:	UNDISTURBED[X] VERTICAL AXIS [X]
PERMEANT:	DE-AIRED TAP WATER

SAMPLEDATA		
	INITIAL	FINAL
DIAMETER OF SAMPLE(cm)	6.91	6.93
AREA OF SAMPLE(cm2),A	37.50	37.72
LENGTH OF SAMPLE(cm),L	3.96	3.99
MOISTURE CONTENT(%)	18.2	22.1
DRY DENSITY(pcf)	110.9	107.0
SATURATION(%)		100.7

#FMDR ave	AUEC CONDUCTIVITY C rage of lest four K20 read	FSOLUTION (SECTION)
k20 =	1.2 E-08 cm/sec	-
	(or)	
k20 =	1.2 E-10 m/sec	_

 $k = (aL/2At)^*in(h1/h2)$

pipette length = 25.400 cm

k20 = kRt

pipette volume = 25.0 cm ^ 3

Rt = (-0.02452T CELSIUS + 1.495)

 $a = ain = aout = 0.984 cm^2$

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	_2 of 2
DATE:	1/31/94

PROJECT NAME: AW - TULSA

PROJECT NUMBER: 307-05762-01 LAB NO.: 15

BACK PRESSURE SATURATION CONDITIONS:

EFFECTIVE STRESS (psi):

2.0

1) B COFFICIENT > or = 0.53

SATURATION METHOD:

1

2) FINAL SATURATION CALCULATED 100 + or - 3%

3) VOLUME CHANGE DURING TEST

CONSOLIDATION CONDITIONS:

CONFINING PRESSURE(psi):

86.0

CONSOLIDATION PRESSURE(psi):

78.0

EFFECTIVE STRESS(psi):

8.0

PERMEATION CONDITIONS

CONFINING PRESSURE(psi):

86.0

INFLUENT PRESSURE(psi):

79.5

 $psi \times 70.34 = cm$

EFFLUENT PRESSURE(psi):

78.0

HYDRAULIC GRADIENT, i:

				TORAULIC C		TY FEWN	
6	ELAPS			VOII.		7.0	AS, enjece
	n#i;	590			**************************************		
	U	0	12.00	12.00	0.406	0.04	0.0 5 00 000 /000
ļ	480	28800	12.20	11.80	0.406	0.94	9.2 E-09 cm/sec
	1560 1920	93600 115200	12.90	11.10 10.90	1.422 0.406	0.94	1.4 E-08 cm/sec
			13.10		0.400	0.94	1.3 E-08 cm/sec
	2820	169200	13.50	10.50	0.013	0.94	1.0 E+08 cm/sec

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	1 of 2
DATE:	1/31/94

PROJECT NAME:	LAW - TULSA (RUST E & !)
PROJECT NUMBER:	307-05762-01 LAB NO.: 16
SAMPLE LOCATION:	B-15,8 - 10 FT. TRACT "A"
DESCRIPTION OF SOIL:	YELLOWISH BROWN STIFF FAT CLAY
TYPE OF SPECIMEN:	UNDISTURBED[X] VERTICAL AXIS [X]
PERMEANT:	DE-AIRED TAP WATER

SAMPLE DATA		
	INITIAL	FINAL
DIAMETER OF SAMPLE(cm)	6.86	3.88
AREA OF SAMPLE(cm2),A	! 36.96	37.18
LENGTH OF SAMPLE(cm),L	4.09	4.11
MOISTURE CONTENT(%)	16.3	23.2
DRY DENSITY(pcf)	113.4	106.7
SATURATION(%)		104.9

77.25 K	HYDE Eve	AU Merces, No Destruits Progesti less soutification	OF SOIL
:	k20 =	4.9 E-09 cm/sec	<u> </u>
••		(or)	
	k20 =	4.9 E-11 m/sec	<u></u>

k = (aL/2At)*ln(h1/h2)

pipette length = 25.400 cm

k20 = kRt

pipette volume = 25.0 cm ^ 3

Rt = (-0.02452T CELSIUS + 1.495)

 $a = ain = aout = 0.984 cm^2$

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	2 of 2
DATE:	1/31/94

PROJECT NAME: LAW - TULSA

PROJECT NUMBER: 307-05762-01 LAB NO.: 16

BACK PRESSURE SATURATION CONDITIONS

EFFECTIVE STRESS (psi):

2.0

I) B COFFICIENT > or = 0.95

SATURATION METHOD:

1

2) FINAL SATURATION CALCULATED 100 + or - 5%

3) VOLUME CHANGE DURING TEST

CONSOLIDATION CONDITIONS:

CONFINING PRESSURE(psi):

86.0

CONSOLIDATION PRESSURE(psi):

78.0

EFFECTIVE STRESS(psi):

8.0

PERMEATION CONDITIONS:

CONFINING PRESSURE(psi):

86.0

INFLUENT PRESSURE(psi):

79.5

 $psi \times 70.34 = cm$

EFFLUENT PRESSURE(psi):

78.0

HYDRAULIC GRADIENT, i:

ELAPSI min.		inativetti Vii Medazo:	yan=	estationiv President (en)	- 11 11 11 11 11 11 11 11 11 11 11 11 11	cs K20, anysec
0	0	12.00	12.00	ĺ	ļ	
480	28800	12.20	11.80	0.406	0.94	6.8 E-09 cm/sec
1560	93600	12.50	11.50	0.610	0.94	4.6 E-09 cm/sec
1920	115200	12.60	11.40	0.203	0.94	4.6 E-09 cm/sec
2820	169200	12.80	11.20	0.406	0.94	3.7 E-09 cm/sec

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	1 of 2
DATE:	12/29/93

PROJECT NAME:	LAW - TULSA (RUST E & I)
PROJECT NUMBER:	307-05762-01 (396-01384-01) LAB NO.: 04
SAMPLE LOCATION:	TRACT "A", B-16 0-2 FT.
DESCRIPTION OF SOIL:	TAN AND BROWN SILTY CLAY
TYPE OF SPECIMEN:	UNDISTURBED[] REMOLDED[X] ASTM D698
PERMEANT:	DE-AIRED TAP WATER

第二条		3-12-3
	INITIAL	FINAL
DIAMETER OF SAMPLE(cm)	7.23	7.23
AREA OF SAMPLE(cm2),A	41.04	41.01
LENGTH OF SAMPLE(cm),L	9.19	9.08
MOISTURE CONTENT(%)	21.5	24.9
DRY DENSITY(pcf)	101.0	100.1
SATURATION(%)		97.4

HYDE RV	AUII(@@@NFIUFINFINFINFINFINFINFINFINFINFINFINFINFINF
k20 =	2.7 E-09 cm/sec
-	(or)
k20 =	2.7 E-11 m/sec
•	

 $k = (aL/2At)^{\circ}ln(h1/h2)$

pipette length = 28.600 cm

k20 = kRt

pipette volume = $25.0 \text{ cm} ^3$

Rt = (-0.02452T CELSIUS + 1.495)

 $a = ain = aout = 0.874 cm^2$

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO. 2 of 2 DATE: 12/29/93

PROJECT NAME: PROJECT NUMBER:		(A (RUST E & I) -01 (396-01384-01) LAB NO.: 04
PACKETESZEEZATERATONIO		
EFFECTIVE STRESS (psi):	2.0	1) 8 COPPICIENT > er = 0.55
SATURATION METHOD:	1	2) FINAL SATURATION CALCULATED 100 + or + 3%
		3) VOLUME CHANGE DURING TEST
CONSOLIDATION CONDITIONS		
CONFINING PRESSURE(psi):	56.0	
CONSOLIDATION PRESSURE(psi):	45.0	
EFFECTIVE STRESS(psi):	11.0	
BERMEATION (CONDITIONS		
CONFINING PRESSURE(psi):	62.0	
INFLUENT PRESSURE(psi):	52.0	psi x 70.34 = cm
EFFLUENT PRESSURE(psi):	50.0	
HYDRAULIC GRADIENT, i:	17	

		NEW EXPERIENCE		PAPASAN	##4# = %#%	22
ELAPS	≣ ⊉i₹8[/ = / ` .	7,7	`~_ <u>``</u> (2.5	e de la cos	- (5.	72. 617.2 9 =
1500	90000	5.95	22.05			
2575	154500	6.10	21.90	0.343	0.88	1 2.8 E-09 cm/sec
4040	242400	6.25	21.75	0.343	0.88	2.0 E-09 cm/sec
4400	264000	6.30	21.70	0.114	0.86	2.8 E-09 cm/sec
5455	327300	6.45	21,55	0.343	0.92	3.0 E-09 cm/sec

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO. 1 of 2 DATE: 1/31/94

PROJECT NAME:	LAW - TULSA (RUST E & I)	
PROJECT NUMBER:	307-05762-01 LAB NO.: 13	
SAMPLE LOCATION:	B-16, 4 - 6 FT. TRACT "A"	
DESCRIPTION OF SOIL:	YELLOWISH BROWN AND LIGHT GRAY STIFF FAT CLAY	_
TYPE OF SPECIMEN:	UNDISTURBED[X] VERTICAL AXIS [x]	
PERMEANT:	DE-AIRED TAP WATER	

SAMPLEDATA		
	INITIAL	FINAL
DIAMETER OF SAMPLE(cm)	6.86	6.88
AREA OF SAMPLE(cm2),A	36.96	37.18
LENGTH OF SAMPLE(cm),L	4.061	4.09
MOISTURE CONTENT(%)	20.6	22.9
DRY DENSITY(pcf)	106.9	105.1
SATURATION(%)		99.5

	AULIC CONDUCTIVITY rage of last rour k20 re	
k20 =	2.6 E-09 cm/sec	
	(or)	
k20 =	2.6 E-11 m/sec	_

 $k = (aL/2At)^*ln(h1/h2)$

pipette length = 28.542 cm

k20 = kRt

pipette volume = $25.0 \text{ cm} ^3$

Rt = (-0.02452T CELSIUS + 1.495)

 $a = ain = aout = 0.876 cm^2$

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

			PAGE NO.	
			DATE:	1/31/94
PROJECT NAME:	LAW - TULSA			
PROJECT NUMBER:	307-05762-01		LAB NO.:	13
BACKPRESSURE/SAMURATION (ONDITIONS:	14 (44)		
EFFECTIVE STRESS (psi):	2.0	() B COFFICIENT > or = 0.95		
SATURATION METHOD:	1	2) FINAL SATURATION CALCL	LATED 100 + or - 5%	
		3) VOLUME CHANGE BURING	TEST	
CONSOLIDATION CONDITIONS				
CONFINING PRESSURE(psi):	86.0			
CONSOLIDATION PRESSURE(psi):	78.0			
EFFECTIVE STRESS(psi):	8.0			
PERMENTION CONDITIONS				
CONFINING PRESSURE(psi):	86.0			
INFLUENT PRESSURE(psi):	79.5	psi x 70.34 = 0	c m	
EFFLUENT PRESSURE(psi):	78.0			
HYDRAULIC GRADIENT, i:	26	*.		

		VALUE (FILE)	TORAULO	ONDESTIV	INVERSION	S
\$1.50 Per 200 per 200	ED INE()	N/O	Voit	ien/loss	-A	e RZI, cn/sec
min.	Sec.**	12.00	12.00			
480	28800	12.10	11.90	0.228	0.94	3.4 E-09 cm/sec
1560	93600	12.30	11.70	0.457	0.94	3.0 E-09 cm/sec
1920	115200	12.35	11.65	0.114	0.94	2.3 E-09 cm/sec
2820	169200	12.45	11.55	0.228	0.94	1.8 E-09 cm/sec

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO. 1 of 2 DATE: 01/13/94

PROJECT NAME:	LAW TULSA (RUST E & I)
PROJECT NUMBER:	307-05762-01 (396-01402-01) LAB NO.: 16
SAMPLE LOCATION:	TRACT "A", B-18 0-2 FT.
DESCRIPTION OF SOIL:	YELLOWISH TAN SILTY CLAY
TYPE OF SPECIMEN:	UNDISTURBED[] REMOLDED[X] ASTM D698
PERMEANT:	DE-AIRED TAP WATER

	INITIAL	FINAL
DIAMETER OF SAMPLE(cm)	7.52	7.32
AREA OF SAMPLE(cm2),A	41.31	42.06
LENGTH OF SAMPLE(cm),L	8.99	9.05
MOISTURE CONTENT(%)	21.1	24.1
DRY DENSITY(pcf)	102.7	101.5
SATURATION(%)		98.8

incernos presentas de la Companya de
5.0 E-09 cm/sec
(or)
5.0 E-11 m/sec

k = (aL/2At)*in(h1/h2)

pipette length = 25.40 cm

k20 = kRt

pipette volume = 25.0 cm ^3

Rt = (-0.02452T CELSIUS + 1.495)a = ain = aout = 0.095 cm ^2

HYDRAULIC CONDUCTIVITY **ASTM D5084** METHOD C (FALLING HEAD RISING TAILWATER)

					PAGE NO. 2	2 of 2 01/13/94
	PROJECT NAME: PROJECT NUMBER:	LAW - TI	JLSA (RUST	E&I)		
* #	. <u> </u>		62-01 (396	-01402-01) LAB NO.: 1	6
	是是自己的。 1000年的1000年的1000年的1000年的1000年	SATISTICAL PROPERTY.	85 <u>- 1</u>			
	EFFECTIVE STRESS (psi):	2.0	1) 1	B COFFICIENT >	or = 0.95	
	SATURATION METHOD:	1	2) I	FINAL SATURAT	TON CALCULATED 1	.00 + or - 5%
			3) T	VOLUME CHANG	se during test	
		(See				
	CONFINING PRESSURE(psi):	53.5				
	CONSOLIDATION PRESSURE(psi):50.0				
	EFFECTIVE STRESS(psi):	3.5	_			
	Handlerale same Versile she					
	CONFINING PRESSURE(psi):	54.5		The second second		
	INFLUENT PRESSURE(psi):	52	_	psl x 70.34	= cm	
	EFFLUENT PRESSURE(psi):	50_				
	HYDRAULIC GRADIENT, i:	17	<u>.</u>			
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		TO THE STATE OF TH	E PERO LOS			
	294 17640 2 2 40					
	240				<u> </u>	
	4000		0.762	0.95	7.7 E-09 cr	n/sec
	1686 113160 2.90 2756 165360 3.10		0.203	0.90	4.1 E-09 cr	TI/Sec
į	3031 181860 3.10		0.356	0.92	4.4 E-09 cr	n/sec

0.102

0.91

3.9 E-09 cm/sec

14.00

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	1 of 2
DATE:	12/29/93

PROJECT NAME:	LAW - TULSA (RUST E & !)
PROJECT NUMBER:	307-05762-01 (396-01384-01) LAB NO.: 06
SAMPLE LOCATION:	TRACT "A", P-11 0-2 FT.
DESCRIPTION OF SOIL:	TAN AND LIGHT BROWN, SILTY CLAY
TYPE OF SPECIMEN:	UNDISTURBED[] REMOLDED[X] ASTM D698
PERMEANT:	DE-AIRED TAP WATER

2007	The state of the s	
	INITIAL	FINAL
DIAMETER OF SAMPLE(cm)	7.21	7.21
AREA OF SAMPLE(cm2),A	40.84	40.87
LENGTH OF SAMPLE(cm),L	9.15	9.09
MOISTURE CONTENT(%)	22.3	21.9
DRY DENSITY(pcf)	1 102.4	102.9
SATURATION(%)		95.5

5 (5)	AU SCONDICTIVITYO (SOIL CARES OF A
k20 =	1.9 E-09 cm/sec
	(or)
k20 =	1,9 E-11 m/sec

 $k = (aL/2At)^* ln(h1/h2)$

pipette length = 25.484 cm

<u>k20 = kRt</u>

pipette volume = 25.0 cm ^ 3

Rt = (-0.02452T CELSIUS + 1.495)

 $a = ain = aout = 0.981 cm^2$

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	2 07 2	
DATE:	12/29/93	
·		

PROJECT NAME:	LAW - TULSA (RUST E & I)	<u> </u>
PROJECT NUMBER:	307-05762-01 (396-01384-01) LAB NO.:	06

EXPORTANCE CONTRACTOR OF THE PROPERTY OF THE P

EFFECTIVE STRESS (psi):

2.0

A COPPICIENT > = CJS

SATURATION METHOD:

1

2) FINAL SATURATION CALCULATED 100 + er - 5%

3) VOLUME CHANGE DURING TEST

CONSOCIDATION CONDITIONS

CONFINING PRESSURE(psi):

36.0

CONSOLIDATION PRESSURE(psi):

30.0

EFFECTIVE STRESS(psi):

6.0

BEHMEANION (SOND) (IONS)

CONFINING PRESSURE(psi):

71.0

INFLUENT PRESSURE(psi):

63.0

 $psi \times 70.34 = cm$

EFFLUENT PRESSURE(psi):

60.0

HYDRAULIC GRADIENT, i:

		Manyah	AND MEMORY			CS - C
Eldes	⊒ 3 . k[• =				215	
		Seminary of the Color of the Co	200 (2011) To 100	Sec. (2) 11 20 Car.	5 - 10 - 10 - 10 - 10 - 10 - 10 - 10 - 1	
2741	<u>164</u> 460	5.25	19.25			1
4274	256440	5.40	19.10	0.306	0.93	1.5 E-09 cm/sec
4895	293700	5.50	19.00	0.204	0.93	2.5 E-09 cm/sec
5722	343320	5.60	18.90	0.204	0.93	1.9 E-09 cm/sec
7250	435000	5 <u>.7</u> 5	18.75	0.306	0.94	1.5 E-09 cm/sec

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C

(FALLING HEAD RISING TAILWATER)

PAGE NO.	1 of 2
DATE:	12/29/93

PROJECT NAME:	LAW - TULSA (RUST E & I)
PROJECT NUMBER:	307-05762-01 (396-01384-01) LAB NO.: 02
SAMPLE LOCATION:	TRACT "A", P-12 0-2 FT.
DESCRIPTION OF SOIL:	TAN AND LIGHT BROWN, SILTY CLAY
TYPE OF SPECIMEN:	UNDISTURBED[] REMOLDED[X] ASTM D698
PERMEANT:	DE-AIRED TAP WATER

SAIRLEDATA		
	INITIAL	FINAL
DIAMETER OF SAMPLE(cm)	7.26	7.24
AREA OF SAMPLE(cm2),A	41.44	41.19
LENGTH OF SAMPLE(cm), L	9.06	8.95
MOISTURE CONTENT (%)	20.8	23.5
DRY DENSITY(pcf)	102.1	103.0
SATURATION(%)		99.8

* 11/18 t	Krimer of the real residence of the control of the
k20 =	2.3 E-09 cm/sec
	(or)
k20 =	2.3 E-11 m/sec

 $k = (aL/2At)^{n}\ln(h1/h2)$

k20 = kRt

Rt = (-0.02452T CELSIUS + 1.495)

 $a = ain = aout = 0.118 cm^2$

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	2 of 2	
DATE:	12/29/93	

PROJECT NAME:	LAW - TULSA	(RUST E & I)		
PROJECT NUMBER:		(396-01384-01)	LAB NO.:	02
EXCKPRESSURE SATURATION OF	ONDITIONS			
EFFECTIVE STRESS (psi):	2.0	1) % COPPICIENT > == 0.35	·	
SATURATION METHOD:	1	2) FINAL SATURATION CALCU		
		3) VOLUME CRANGE DURING	TEST	
(CONSOLEDATION CONDITIONS				
CONFINING PRESSURE(psi):	68.0			
CONSOLIDATION PRESSURE(psi):	60.0			•
EFFECTIVE STRESS(psi):	10.0	•		
CONFINING PRESSURE(psi):	71.0			
INFLUENT PRESSURE(psi):	62.0	psi x 70.34 = 6	m	
EFFLUENT PRESSURE(psi):	60.0			

	E239[7 = 3			0 (3 b 0 = 11/)		65 60 FHT =
1720	103200 I	(011 120) 0.36	(2011/20). 1.31		l	
2680_	160800	0.47	1.22	1.689	0.93	2.4 E-09 cm/sec
3190	191400	0.52	1.16	0.929	0.88	2.4 E-09 cm/sec
4048	242880	0.61	1.08	1.435	j 0.92	2.3 E-09 cm/sec
4330	259800	0.64	1.06	0.422	0.92	2.0 E-09 cm/sec

HYDRAULIC GRADIENT, i:

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO.	1 of 2
DATE:	12/29/93

PROJECT NAME:	LAW - TULSA (RUST E & I)
PROJECT NUMBER:	307-05762-01 (396-01384-01) LAB NO.: 03
SAMPLE LOCATION:	TRACT "A", P-15 2-7 FT.
DESCRIPTION OF SOIL:	TAN AND LIGHT BROWN, SILTY CLAY
TYPE OF SPECIMEN:	UNDISTURBED[] REMOLDED[X] ASTM D698
PERMEANT:	DE-AIRED TAP WATER

STATE OF THE SAME PROPERTY.		
	INITIAL	FINAL
DIAMETER OF SAMPLE(cm)	7.20	7.26
AREA OF SAMPLE(cm2),A	40.73	41.39
LENGTH OF SAMPLE(cm),L	9.26	9.16
MOISTURE CONTENT(%)	22.6	26.1
DRY DENSITY(pcf)	100.4	97.8
SATURATION(%)		96.6

k20 =	3.3 E-09 cm/sec	•
	(or)	
·	·	

 $k = (aL/2At)^{n}\ln(h1/h2)$

k20 = kRt

Rt = (-0.02452T CELSIUS + 1.495) a = ain = aout = 0.118

HYDRAULIC CONDUCTIVITY ASTM D5084 METHOD C (FALLING HEAD RISING TAILWATER)

PAGE NO. 2 of 2 DATE: 12/29/93

PROJECT NAME: LAW - TULSA (RUST E & I)
PROJECT NUMBER: 307-05762-01 (396-01384-01) LAB NO.: 03

Blokshessiffs to have the fields

EFFECTIVE STRESS (psi):

2.0

IN B COFFICIENT > er = 0.95

SATURATION METHOD:

1

2) Final saturation calculated 100 + 🕳 – 9%

3) VOLUMB CRANCE BURING TEST

DONE DE DATION COMBILIONS

CONFINING PRESSURE(psi):

56.0

CONSOLIDATION PRESSURE(psi):

47.0

EFFECTIVE STRESS(psi):

9.0

CONFINING PRESSURE(psi):

60.0

INFLUENT PRESSURE(psi):

52.0

 $psi \times 70.34 = cm$

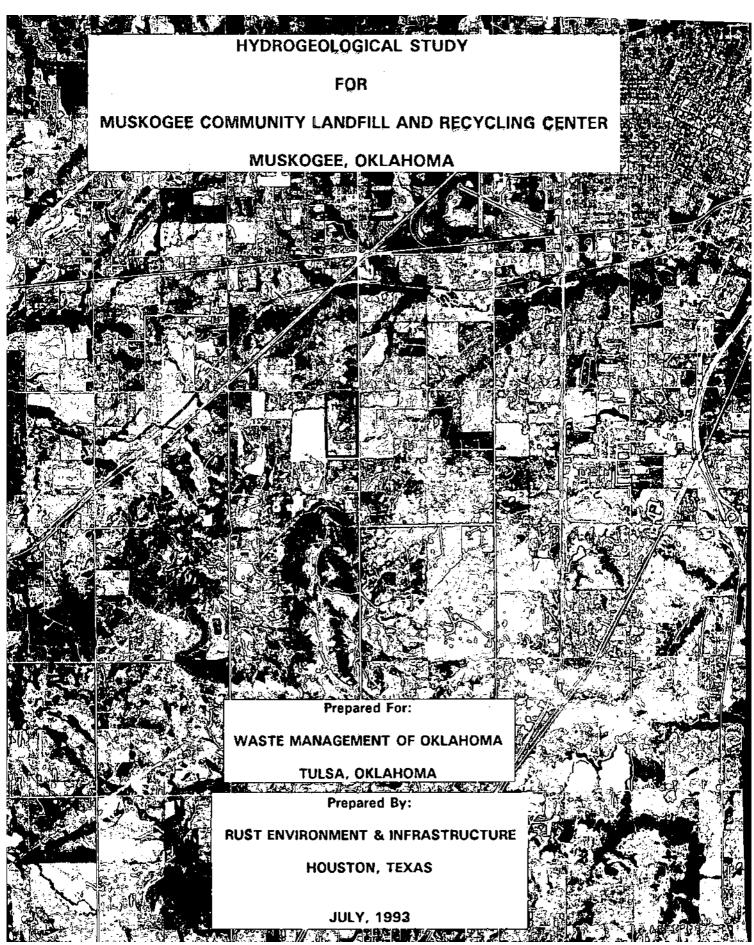
EFFLUENT PRESSURE(psi):

50.0

HYDRAULIC GRADIENT, i:

			(18)	0	INCHES EN	
ELAPS			(7.11)			20 ST(538
1473	88380	0.0123		(4. 5.2.)	When the second section is the second section of the second section of the second section sect	
1878	112680	0.43	1.37 1.31	1.013	0.91	3.3 E-09 cm/sec
2988	179280	0.54	1.15	2617	0.91	3.2 E-09 cm/sec
3383	202980	0.69	1.09	0.929	0.91	3.2 E-09 cm/sec
4393	263580	0.84	0.93	2.617	0.92	3.6 E-09 cm/sec

RUST HYDROGEOLOGICAL STUDY REPORT (1993)



MARK S. COLEMAN
Executive Director

DAVID WALTERS
GOVERNOR

State of Oklahoma

DEPARTMENT OF ENVIRONMENTAL QUALITY

August 24, 1993

Mr. Mark Daniels Waste Management of Oklahoma, Inc. Route 4, Box 310 Oklahoma City, Oklahoma 73111

Re:

Hydrogeological Study DEQ Log Number 93-140

Muskogee Community Landfill & Recycling Center

Muskogee County

Dear Mr. Daniels:

Pursuant to "Procedures of the Department of Environmental Quality", Oklahoma Administrative Code (OAC) 310:360-9-3, the above referenced report was submitted on July 28, 1993. We conducted a thorough technical review and subsequently determined the proposed hydrogeological investigative activities are deficient with respect to OAC 310:360-9-3.

The following is a list of review comments and deficiencies found in the referenced report sections:

5.4.2 Potentiometric Surface Map

Determining the minimum distance between waste placement and ground water as specified in OAC 310:360-5-1(27), requires collection of monthly ground water elevation data. Based on the collected data, OAC 310:360-9-3(19)(D) and (E) require the construction of a contour map identifying the highest measured water levels or potentiometric surface, depending on whether the aquifer is unconfined or confined, respectively. Therefore, Phase II shall provide said map prior to determining the minimum elevation for the placement of waste.

Mr. Mark Daniels August 24, 1993 Page 2 of 2

7.1.2 Geotechnical Boring Procedure

Pursuant to OAC 310:360-9-3(10) the elevation of ground water, if encountered, shall be measured in ALL boreholes. Furthermore, if the elevation of the saturated zone is above the depth where ground water was anticipated, then drilling shall be halted, a piezometer installed and screened in the shallow zone and a new boring, located within ten feet of the piezometer, shall be drilled to the original proposed total depth.

8.0 Conclusions

The Department agrees with recommendations to install nested piezometers on the hill south of the site and gather information on existing private wells in the vicinity to better define the aquifer system.

If there are any questions concerning the hydrogeological report or the Muskogee Community Landfill and Recycling Center, please do not hesitate to contact me at (405) 271-8135.

· Sincerely,

James Warram

Environmental Engineer

Solid Waste Permitting Section

c: Carey Bell, R.S., Muskogee County Department of Environmental Quality David Freede, R.S., District Sanitarian
Penny Carpenter, Rust Environment & Infrastructure

PROPOSAL FOR

HYDROGEO STUDY WITH LANDFILL DESIGN

MUSKOGEE LANDILL

PRESENTED TO:

WASTE MANAGEMENT OF OKLAHOMA

OKLAHOMA CITY, OKLAHOMA

PRESENTED BY:

RUST ENVIRONMENT & INFRASTRUCTURE

HOUSTON, TEXAS

RUST E & I PROPOSAL NO. 0403M.H3

FEBRUARY 23, 1993

1.0 Introduction

RUST Environmental and Infrastructure (RUST E & I) is submitting a proposal to perform a hydrogeological study for Waste Management of Oklahoma (WMO) on a Type I-B municipal solid waste landfill in Muskogee, Oklahoma. The proposed project site is located in southwest Muskogee, Muskogee County, Oklahoma, south of Hancock Road and west of 51st Street. The purpose is to develop geotechnical and hydrogeological information sufficiently detailed to meet the Oklahoma State Department of Health (OSDH) site characterization standards, be in general accordance with the Waste Management, Inc. Site Assessment Manual (SAM) and to support the following requirements:

- Preparation of landfill design plans to upgrade the currently permitted 80 acre site
 owned by WMO (Permit No. 1057020). The study must allow preparation of a
 permit application for a Type I-B landfill that will be acceptable to the OSDH in
 accordance with Solid Waste Management Regulations shown as provided.
- Evaluation of two adjacent 80 acre tracts (City of Muskogee Permit Nos. 1057008
 and 1057009) currently owned by the city and previously utilized for landfilling by
 the trench method below existing grade. WMO desires to ascertain if these tracts
 may be economically developed as future landfill areas by WMO.
- Evaluation of an adjacent 225 acre site as a soil borrow area and possible future landfill site.
- The final product will be a hydrogeological study suitable for submission to and permitting by the Solid Waste Management Service (SWMS) at the OSDH.

2.0 Scope of Work

The following proposal is based on a detailed scope of work which addresses the various activities as separate task items. The scope of work for this project is broken into the following tasks.

WMO-Muskogee Landfill

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- Task 1: Review of existing, available data and preparation of a boring plan for submission to the SWMS; a trip to the OSDH to present the plan will likely be required.
- Task 2: Field and laboratory investigations of the site(s) to include evaluation of soils for suitability as liner construction material and installation of piezometers in accordance with the approved boring plan.
- Task 3: Evaluation of the existing city-owned permitted sites with a recommendation as to which areas, if any, might be purchased from the city for future landfilling.
- Task 4: Preparation of a draft version of the hydrogeologic study to justify to the SWMS locations of new monitoring wells.
- Task 5: Preparation of the final version of the hydrogeologic study to be included in the permit application.

2.1 Task 1 - Phase I Investigation and Preparation of Boring Plan

Task 1 will be divided into two parts: a Phase I investigation and the preparation of a boring plan. A Phase I investigation is designed to provide a comprehensive overview of available information concerning a site. A boring plan is required by the OSDH and must be submitted to the SWMS and approved prior to beginning a field investigation.

2.1.1 Phase I Investigation

A Phase I investigation is considered an important planning action that summarizes any available information, including the basic geologic and hydrogeologic factors: This review will be supplemented by a site reconnaissance to document the available data and ascertain additional information, if possible.

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2.1.1.1 Literature Review

The literature review will identify hydrogeologic complexities and contingencies that may require further analyses in later phased investigations and provide a basis for the development of the field investigation. The following topics will be covered in the literature review:

- Land use, including topographic maps and air photographs.
- Climatology, determining ten-year-average annual temperature and precipitation, seasonal variations, landfill water balance.
- Surface water hydrology, determining drainage patterns, runoff volumes, delineation of the 100-year floodplain.
- Geology, obtaining soils maps, geologic maps, and stratigraphic columns.
- Hydrogeology, obtaining and/or generating regional cross sections, isopachs of the uppermost aquifer and confining units, regional and previously defined site-specific hydraulic conductivity, transmissivity, storage coefficient or specific yield, thickness of uppermost aquifer and confining unit(s), gradient, flow direction, recharge source, discharge areas, general water quality and surface water/groundwater relationships.

2.1.1.2 Site Reconnaissance

RUST E & I will conduct a site reconnaissance to identify significant surface characteristics, structural features, surface drainage, erosional conditions, and vegetation.

2.1.1.3 Well Inventory

RUST E & I will develop a preliminary conceptual model of the hydrogeologic system. Such a model is useful in understanding potential ground-water flow paths and will enable RUST E & I to fine-tune the field investigation program.

WMO-Muskogec Landfill

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2.1.2 Boring Plan

RUST E & I will develop a boring plan and submit it to SWMS as required by the OSDH site characterization standards. Elements of the boring plan will include a regional hydrogeological study composed of the following parts:

- Narrative information on the regional hydrogeology of the proposed site
- A regional surface geological map
- Illustrations of the regional stratigraphic column and geologic or hydrogeologic cross-sections
- Description of regional ground-water quality and identification of underground drinking water sources
- References indicating the source of information

Drilling activities will not begin until the boring plan is received by the SWMS and RUST E & I receives written authorization to proceed.

2.2 <u>Task 2 - Phase II Field Investigation</u>

Subsurface hydrogeologic investigations must be of sufficient intensity to determine the conditions that may influence the design and construction of both the landfill and the ground-water monitoring system. The exploration program proposed by RUST E & I consists of:

- Determining and interpreting subsurface conditions
- Taking samples of soil and rock for analysis, and
- Preparation of a final report with recommendations of monitoring well locations

WMO-Muskogee Landfill

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RUST E & I will use the subdivisions as defineated by WMO at the Muskogee Landfill.

- Tract A, WMO's currently permitted 80-acre site (Permit No. 1057020).
- Tract B, City of Muskogee's 80-acre tract, west of Tract A (Permit No. 1057008).
- Tract C, City of Muskogee's 80-acre tract, south of Tract A (Permit No. 1057009).
- Borrow Area, 225 acres west of Tracts A, B, and C.

2.2.1 Tract A Investigation

RUST E & I has developed a field investigation program for Tract A that meets OSDH site characterization standards and is in general accordance with the Waste Management, Inc. SAM. The Tract A investigation contains tasks ranging from deep stratigraphic borings to engineering evaluation concerning the suitability of soils for liner and borrow material.

2.2.1.1 Deep Stratigraphic Borings

The subsurface investigation is designed to detect all saturated zones encountered while drilling. The goal of this investigation is to determine the uppermost saturated zone that can be monitored for ground-water contaminants. The OSDH site characteristic standards from the Oklahoma Administrative Code (OAC) 310:360-9-3 (3) (E) indicates at least three borings shall be drilled a minimum of 10 feet into the uppermost saturated zone or to a depth of 250 feet, whichever is less. The OAC also indicates regardless of the depth at which ground water is encountered, at least one of the borings shall be drilled to a depth to determine the saturated thickness of all underground drinking water sources underlying the proposed sites, or 100 feet, whichever is less. Shallow saturated conditions are expected to be encountered 16 to 30 feet below ground surface based on the boring logs from three ground-water monitoring wells installed in November 1992.

To meet this requirement, RUST E & I proposes to drill six deep stratigraphic borings to a depth of 100 feet. Four of the boreholes will be located at the approximate corners of Tract A. Two additional borings will be placed in the middle of the tract, within the proposed disposal area. The borings will be continuously sampled and logged, paying particular attention to the presence of shallow ground water. The upper portions of the deep

WMO-Muskogee Landfill

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stratigraphic borings will be selected for the collection of samples for geotechnical analysis. Each boring will be logged continuously, for its entire depth, using visual classification techniques. Lithologic sample logs will be made of each borehole drilled and will include the following items:

- Geotechnical information about drilling, such as penetration rates and drill bit changes.
- Identification of all soil and rock layers encountered during drilling describing:
 - color, texture, thickness, degree of compaction or consolidation and amount of moisture present in each layer.
 - soil classifications based on the Unified Soil Classification System.
 - rock classifications as defined in the Dictionary of Geological Terms.
- The depths at which ground water was encountered and stabilized ground water elevations.

The boreholes will be advanced to a depth of 10 feet into bedrock. Thereafter, two of the six borings will use wet rotary techniques while continuously sampling with a rock core barrel to depths of 100 feet.

Percentage recovery of the rock core and the Rock Quality Designation (RQD) will be calculated for every core run. The RQD is a modified core recovery measurement used to characterize the quality of the rock mass. To calculate RQD, all pieces of a core run over 4-inches in length of the core run are added together and divided by the total length that is recovered, and is expressed as a percent. Listed below is a table showing the relationship of RQD and rock quality.

ROD %	Description of Rock Quality
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

The lower the RQD value a rock unit has, the easier the rock unit will be to open pit mine.

WMO-Muskogee Landfill

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The remaining four borings will be advanced to the 100-foot termination depth with air rotary techniques. Samples will be collected and logged using the standard penetration test and/or examination of drilling cuttings. (Note: based on the drilling contractor's experience, rock coring with air rotary is difficult. Water must be used to collect sufficient rock cores for lithologic examination.) Upon completion of drilling and sampling, all deep stratigraphic borings will be grouted with bentonite grout using a tremie line.

2.2.1.2 Downhole Geophysical Logging

The six deep stratigraphic borings will be logged with geophysical logging tools consisting of spontaneous potential, single-point resistance, and natural gamma tools in the two deep borings drilled with wet rotary techniques. Only the natural gamma tool will be able to be used in the air rotary borings and in the steel casing of the hollow stem augers. The following table summarizes the aspects of the downhole geophysical logging:

	Water Filled Hole, Saturated Zone		Dry Hole, Unsaturated Zone	
Technique/Application	<u>Uncased</u>	Steel	Uncased	<u>Steel</u>
Natural Gamma soil & rock identification, geologic correlation	Yes	Yes	Yes	Yes
Spontaneous Potential soil & rock identification, geologic correlation	Yes	No	No	No
Single-Point Resistance soil & rock identification, geologic correlation, resistive rock fracture detection	Yes	No	No	No

2.2.1.3 Geotechnical Borings

RUST E & 1 proposes to drill an additional 14 borings at Tract A, thus raising the total number of borings to 20, as required in OAC 310: 360-9-3 (3)(c). The borings shall be located so as to give complete coverage to the entire 80 acres. All borings shall be drilled a minimum of 30 feet below the deepest proposed excavation. Geotechnical borings are expected to be 50 to 60 feet in depth. The borings will be continuously sampled and advanced with hollowstern augers to total depth, paying particularly close attention to the presence of shallow ground water.

All drilling activities will cease upon encountering shallow ground water. The rise of water within the borehole will then be measured in five-minute increments until equilibrium is reached or for a maximum period of 30 minutes, whichever is less. Drilling activities will continue upon completing the water-level readings. The borings will be logged and classified as previously described in Section 2.2.1.1. All geotechnical borings will be grouted with a bentonite grout, using a tremie line.

2.2.1.4 Piezometer Installation

The placement of piezometers in the Phase II Field Investigation provide an opportunity to address the site-specific hydrogeology. The following items can be determined:

- In-place permeability of geologic units
- Direction of ground-water flow
- Rates of ground-water flow
- Maximum high elevation of piezometric surfaces
- Ground-water recharge and discharge areas
- Background water quality

The piezometer program for Tract A requires six piezometers to be installed in the shallow saturated zone, and six piezometers to be installed in the residual soils above the saturated zone. There will be six nested piezometer locations that will be pre-selected and distributed evenly throughout the northern three-quarters of the 80 acres.

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Three ground-water monitoring wells in the southern one-quarter of the tract will provide sufficient hydrogeological information in that area. Four of the nested piezometer locations will be along the periphery of the tract; the two other locations will be within the disposal area.

Each nested piezometer location will be within a 10-foot diameter area of a geotechnical boring and within 10-feet of each other. At each location the screened portion of one piezometer will extend 5-feet into the shallow saturated zone from the first noted occurrence of ground water. The hollowstem augers will be advanced approximately 5-feet into the saturated zone. If the surrounding material is competent, the augers will then be raised 5-feet, and if conditions warrant, backflushed with potable water through a tremie line. This will clear the annulus of turbid water and facilitate development. The piezometer screen and casing will be set, and the 20-40 graded filter pack sand will be poured through the top of the augers. In accordance with the SAM, no more than 10-feet of augers will be pulled if in competent material.

The filter pack will extend two-feet above the top of the screen, followed by a 3 to 5-foot bentonite pellet seal, hydrated if needed, and tamped into place. The remainder of the annulus will be grouted to the surface with a bentonite grout tremied into place. The piezometer material will consist of 1 1/4-inch, schedule 40 PVC with flush-threaded joints. The screened portion of each piezometer will consist of the same PVC material, 5-feet in length, with 0.010-inch slots. The second piezometer at each nested location will be constructed to the same standards as the first, but the bottom of the screen will be set 5-feet above the first piezometer filter pack. Due to anticipated dry conditions, the annulus will not be backflushed with water. Potable water, however, will be used to hydrate the bentonite pellet seal. The piezometer borings will not be sampled and logged for lithology due to the proximity to each geotechnical boring. Three nested piezometer locations will be selected for potential analysis for background water quality. The piezometers and equipment used for installation will be decontaminated with a high pressure washer/steam cleaner.

The first piezometer of each nested location will be used to gather data concerning the shallow saturated zone. The second piezometer will be used to document that the residual

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clay soils above the shallow ground water act as a confining unit. Thus, shallow ground water will not impact the landfill operations if the bottom of the excavation is below or near the piezometric surface, assuming adequate thickness of clay soils between shallow ground water and the liner to prevent hydraulic pressure buildup and liner blow out.

2.2.1.5 Piezometer Development

All piezometers yielding shallow ground water will be developed by ASTM standards to help restore the natural hydraulic properties of the transmissive unit. The piezometers will be allowed to reach static water level prior to development. A minimum of two days upon completion of the installation will be allowed for the water levels to reach equilibrium in each piezometer. Multiple water level readings will be taken during this interim period to ascertain static levels.

Once static conditions are reached the water level will be determined and recorded immediately prior to development. The amount of one well volume will be determined, and development will proceed using a Waterra® inertial hand pump until a minimum of three well volumes are removed. Piezometers for background water quality will be developed by pumping until a minimum of three well volumes are removed and when field measurements of pH, specific conductance, and temperature have stabilized.

If fine sediments are a problem, development will continue to an appropriately low level of suspended material in the water.

2.2.1.6 Surveying

Upon completion of all the piezometers, the location of the wells and top of PVC casing will be surveyed by licensed professional surveyor in the State of Oklahoma. The elevations will be surveyed to the nearest 0.01 foot above mean sea level; the location will be given in terms of latitude and longitude of the piezometer at least to the nearest tenth of a second.

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2.2.1.7 In-Situ Permeability Testing

Hydraulic conductivity tests will be performed for all six piezometers measuring the piezometric surface of the shallow ground water of Tract A. Hydraulic conductivity will be evaluated using rising-head slug tests, and will commence after development, once the hydraulic properties of the transmissive zone has been restored. RUST E & I will wait for a time period in which the static water level have been attained. The following sequence of events will occur during each slug test:

- 1. Determine the static water level.
- 2. Lower the Waterra® hand pump into place and remove a known volume (slug) of water from the piezometer. The analysis assumes an instantaneous change in volume when the slug is removed. The elapsed time equal to zero will be recorded immediately upon cessation of pumping. The pump will be removed and an electric water-level meter will determine the rise of water within the piezometer.
- Water levels in the piezometer will be recorded every 30-seconds for five minutes, then every minute until 15 minutes have elapsed. Measurements will then continue with water levels taken every five minutes until 30 minutes have elapsed; whereafter, water levels will be taken every 10 minutes until one hour has elapsed.
- 4. Successive time-depth measurements will proceed on an hourly basis until the static water level has met 95% recovery.

Transmissivity and hydraulic conductivity will be evaluated using the Copper et. al. Method for a confined ground-water system.

2.2.1.8 Geotechnical Laboratory Analysis

Geotechnical analyses of the soils are designed to provide information on the quantity and physical characteristics of both borrow and landfill cut areas. Soil samples will be evaluated by performing the following analyses:

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- Particle-Size Analysis
- Atterburg Limits
- Standard Proctor
- Organic Content
- Falling-Head Test
- Test for Unconsolidated, Undrained Strength of Cohesive Soils in Triaxial Compression
- Consolidation Tests
- Cation Exchange Capacity
- Soil pH

The underlying shale formation will be evaluated by measuring the hydraulic conductivity of rock plugs. RUST E & I will detail the results of the geotechnical analysis and how the soil and rock impact landfill design.

2.2.1.9 Testing of Background Water Quality

Characterizing existing quality of ground water establishes the baseline conditions of evaluating risks to human health and the environment throughout the operational and post-closure periods of the landfill. In addition, existing ground-water quality, in part, determines current uses and affects future uses. Both the shallow ground water and deep ground water from drinking water sources will be evaluated.

As part of the Phase II field investigation of Tract A, RUST E & I will preselect and designate three piezometers as potential sampling points for background water quality and use construction standards equivalent with monitoring well standards. At the end of the Phase II field investigation of Tracts A, B, C, and the borrow area, water level measurements of all the piezometers and monitoring wells within the study area will be taken within a 24-hour time period. A potentiometric map of the shallow ground water will be constructed. Hydraulic parameters of shallow ground water such as direction of groundwater flow will be determined. If the three sampling points exist in an area upgradient of a potential source of contamination, RUST E & I will sample the three piezometers for the following ground-water parameters:

pH
Chemical Oxygen Demand (COD)
Specific Conductance
Chlorides
Total Dissolved Solids

Ground-water sampling will be conducted in accordance with the Waste Management, Inc. Manual for Groundwater Sampling. The shallow ground water will be evaluated with respect to the classification of ground waters and protection levels, as detailed in OAC 310:360-3.2. During development and purging, RUST E & I will document the withdrawal rate from all piezometers in order to evaluate the ground water based on OSDH production criteria. RUST E & I will note the maximum pumping rate of the Waterra® inertial hand pump.

2.3 Tract B and Tract C Field Investigation

Tract B and Tract C are located west and south of Tract A, respectively. Both are previously permitted landfilling areas owned by the City of Muskogee. WMO is interested in determining the potential of both tracts for future landfilling. The focus of the field investigation is primarily on Tract B, and to a limited degree, Tract C. RUST E & I will also determine the impact of both tracts on ground-water flow and rate of flow.

2.3.1 Piezometer Installations

RUST E & I will install six piezometers around Tracts B and C to measure the potentiometric surface of the shallow ground water. The piezometers will be installed using hollowstern auger techniques. The residual soils will be continuously sampled to determine the first occurrence of the shallow ground water. The piezometers will be screened in the 5-foot interval beyond the first occurrence of shallow ground water.

The standards for the construction of the piezometers will be the same as those previously detailed in Section 2.2.1.4. Piezometer development will occur as detailed in Section 2.2.1.5. The piezometers will be surveyed as detailed in Section 2.2.1.6. The location of the six piezometers are as follows:

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Tract B

Center of the west side

Center of northern one-quarter of the tract

Tract C

Southeast Corner

Center of the south side

Southwest Corner

Northwest Corner

2.3.2 Geophysical Survey

RUST E & I will retain the services of a contractor to perform a geophysical survey of Tract B, and to a small extent, Tract C, in order to define the areal and vertical extent of previously placed refuse. The survey will employ electromagnetic (EM) methods to determine the conductivity of the overlying terrain. A 100-foot grid will be established for Tract B, and EM 34 geophysical unit will read the conductivity of each intersection point of the grid. A similar survey will be conducted over the western one-quarter of Tract C. The contractor will produce a contour map showing the ground conductivity for the two areas, and interpret the location and size of specific anomalous sites consistent with refuse burial.

In addition, the contractor will define the vertical extent of specific refuse areas found on Tract B and as defined by the EM survey. Seismic refraction will be used to define the base of the refuse area on Tract B. Seismic refraction will not be used on Tract C. The contractor proposes to use standard compression wave refraction data to evaluate the depth of the refuse. Shear wave refraction data will be used if complications arise from water saturation in the refuse pits.

2.4. Borrow Area Investigation

RUST E & I proposes to install 10 piezometers and conduct geotechnical testing of collected samples to evaluate the borrow area as a potential landfill area and borrow source. Ten piezometers will be spread evenly throughout the 225-acre property, and will measure the potentiometric surface of the shallow ground water. The borings will be continuously sampled and logged. Soil samples will be tested in a geotechnical laboratory using only those tests suitable to evaluate potential borrow material. Three piezometers will be constructed using the same standards used in ground-water monitoring wells. Upon

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completion of the installation of the Phase II field investigation, RUST E & I will measure the water levels of all piezometers and construct a potentiometric map of the shallow ground water. If the upgradient area of a potential source of contamination exists within the borrow area, the three specially-designated piezometers will be sampled in accordance with WMI standards in order to determine background water quality. The testing parameters will be those mentioned in Section 2.2.1.9. The shallow ground-water will be characterized in accordance with OAC 310: 360-3.2.

3.0 Task 3 - Evaluation of Tracts B and C as Future Landfill Areas

RUST E & I will evaluate the existing city-owned permitted site with a recommendation as to which areas, if any, might be purchased from the City of Muskogee for future landfilling. Potential options range from capping the existing refuse to excavation of shallow refuse and construction of new cells. The recommended options(s) will be based on the geophysical survey, standard and acceptable landfill design practices in the State of Oklahoma, and economic considerations.

4.0 Preparation of Hydrogeological Report

A draft report of the Hydrogeological Study performed will be prepared. The report will be an assimilation of all the data obtained in the Phase I and Phase II investigations described in this proposal. The report will include, but not be limited to, the following information:

- A description of the depositional history in the area.
- Delineation of the uppermost aquifer and significant confining units in cross sections or fence diagrams.
- Estimates of ground-water flow paths, gradient and potential direction.
- A description of all field activities and summaries of the data obtained for each tract.
- Description and conclusions of the geophysical survey.
- An assessment of the site hydrogeology and the hydraulic analysis including a
 description of the potential for contaminant migration from the waste facility.
- Development of a preliminary conceptual model of the hydrogeologic regime.

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The draft report will be written in accordance with the Waste Management SAM. The draft report will be submitted to WMO for review and comments. Upon receipt of comments, the report will be finalized.

5.0 Task: 5 - Final Report

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The comments from the draft report will be addressed. Once the report has been finalized, it will then be submitted to OSDH with Waste Management approval. If WMO so desires, all field data, conclusions and recommendations for Tracts B and C will be written up as a separate letter report.

WMO-Muskogee Landfill

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Waste Management of Oklahoma Muskogee Landfill RUST E & I Proposal No. 0403M,H3

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A.	Phase I Studies		
	ES III Roundtrip Airfare Per Diem Car Rental Misc. (phone calls, copies, faxes, fil	56 hours x \$63/hour 1 trip x \$300/trip 2 days x \$85/day 2 days x \$40/day	্রান্ত্র \$300 ডিফ্রা \$170 \$80
В.	Boring Plan for OSDH		
	ES VI ES IV Word Processor CADD Misc. (copies, phone, Federal Expre Roundtrip Airfare Per Diem Car Rental	12 hours x \$83/hour 40 hours x \$70/hour 8 hours x \$35/hour 8 hours x \$73/hour ess, etc.) 2 persons x \$300/each 2 persons x 1 day x \$85/day 1 day x \$40/day	\$2,800 \$280 \$584 \$100 \$600
	Subtotal Task 1	: 	\$9,698
TASK	2		
A.	Tract A		
	ES IV ES III Airfare Per Diem Car Rental Misc. (phone, copies, etc.)	200 hours x \$70/hour	\$3,780 \$600
	Subcontractors: Surveyor Driller Equipment Rental Logging Tools & Computer: 7 days x \$190/day \$250 set-up fee + \$30 Consumable Supplies		\$1,045 \$30,478 \$200 \$1,880
	Subtotal Task 2A		

В.	Tracts B and C	
-	ES IV Per Diem Car Rental	48 hours x \$70/hour
	Subcontractors: Geophysical Study Drillers Equipment Rental	\$15,400 \$4,257 \$200
	Subtotal Task 2B	\$20,607
C.	Воггом Агеа	
	ES IV Roundtrip Airfare Per Diem Car Rental	64 hours x \$63/hour \$4,480 \$300 8 days x \$85/day \$680 8 days x \$40/day \$320
	Subcontractors: Driller Equipment Rental	\$6,930 \$300
	Subtotal Task 2C	
	TOTAL TASK 2A - 2C	\$89,750
TASI	ES IV ES III Word Processor Misc. (computer time)	16 hours x \$70/hour \$1,120 4 hours x \$63/hour \$252 4 hours x \$35/hour \$140 \$50
	TOTAL TASK 3	\$1,562
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	EX. A. C. T. C.	

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WMO-Muskogee Landfill

TASK 4	
CADD	24 hours x \$83/hour \$1,992 40 hours x \$70/hour \$2,800 80 hours x \$70/hour \$5,600 80 hours x \$63/hour \$5,040 32 hours x \$35/hour \$1,120 40 hours x \$73/hour \$2,920 phone, faxes, etc.) \$300
TOTAL TASK 4	· · · · · · · · · · · · · · · · · · ·
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	andrio Contant
TASK 5	Pen in officy Text (by the line)
ES VI ES IV ES III CADD Word Processing Misc. (copies, etc.)	16 hours x \$83/hour \$1,328.67 24 hours x \$70/hour \$1,680 24 hours x \$63/hour \$1,512 24 hours x \$73/hour \$1,7520 16 hours x \$35/hour \$560 \$300
TOTAL TASK 5	
GRAND TOTAL (without Geotechnical la	aborabory costs) \$118,216
GRAND TOTAL (with Geotechnical laborate	atory costs) \$143,390

COST ESTIMATE FOR GEOTECHNICAL TESTING

en	Num	ber of Tests		
Geotechnical Test	Tract A	Borrow Area	Unit Cost	<u>Total</u>
280,28				
Particle Size Analysis	60	20 (61)	\$40	\$3,200
Atterburg Lifthits.	60	20	\$35	\$2,800
Standard Proctor	15	10	\$150	\$3,750
Organic Content	10	5	\$25	\$375
Permeability Test (Falling Head)	15	10	\$230	\$5,750
Triaxial Test	10	0	\$450	\$4,500
Consolidation Test	10	0	\$250	\$2,500
Cation Exchange Capacity	10		\$90	\$900
Soil pH Control of the second	10		\$20	<u>\$200</u>
TOTAL, PLUS 5% MARKUP				\$25,174

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PHASE I - HYDROGEOLOGICAL STUDY FOR MUSKOGEE COMMUNITY LANDFILL AND RECYCLING CENTER

Prepared For: WASTE MANAGEMENT OF OKLAHOMA TULSA, OKLAHOMA

MUSKOGEE, OKLAHOMA

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PROJECT NO. 86251,100

93-140 1093

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Section 1

1.0 INTRODUCTION

Rust Environment and Infrastructure (RUST E&I) is presenting the results of the Phase I Hydrogeological Investigation for Muskogee Community Landfill and Recycling Center (Muskogee Community Landfill) in Muskogee, Oklahoma. Muskogee Community Landfill is owned and operated by Waste Management of Oklahoma, Inc. (WMO). This report was prepared in response to WMO's acceptances of RUST E&I's proposal for a hydrogeological study with landfill design, dated April, 1993. Authorization to proceed was given by Mr. Lawrence R. Cohn, P.E., Environmental Engineering Manager for Waste Management of North America - South (WMNA) on May 5, 1993.

1.1 Purpose and Scope

The Phase I Hydrogeological Investigation for Muskogee Community Landfill summarizes the available data for this facility and the surrounding region, identifies current data gaps and provides recommendations on required hydrogeologic activities. This report incorporates the original geotechnical studies which were a part of the permit application and subsequent information. The scope of this report includes:

- A thorough review of existing literature and technical information;
 - Preliminary site reconnaissance;
- Development of the regional and site-specific geology and hydrogeology as understood by the existing literature;
- Development of initial regional and site-specific hydrogeologic conceptual models;
- Use of the acquired information to establish target monitoring zones and identify limiting design criteria;
- Development of a geotechnical boring plan to meet WMO engineering design practices and Oklahoma State Department of Health regulations;

 and

Development of piezometer installation plan to monitor the piezometric surface underlying the site.

The scope of this report represents the first phase of the project; the second phase is the field investigation. The goals of the project are to:

- Establish potentiometric surfaces for landfill design purposes and the ground-water monitoring plan.
- Establish a new geotechnical data, geological data, and hydrogeological data base.
- Design a ground-water monitoring plan for Tract A.
 - Determine if the landfills on Tracts B and C are impacting Tract A.
 - Use the geotechnical analyses to aid in the landfill design.

1.2 Previous Investigations

An investigation was conducted on Tract A by Poe and Associates, Inc. in 1984. The two reports written were similarly entitled: Geotechnical and Hydrogeological Evaluation of Proposed Muskogee Landfill Update, Revised October, 1984, and Geotechnical and Hydrogeological Evaluation of Muskogee Landfill Update, Revised October, 1984. The first report was included in the City of Muskogee Sanitary Landfill Permit Application, also prepared by Poe and Associates, Inc. in May, 1985. The second report was prepared after the permit application was accepted. The original reports to the Poe & Associates "Updates" were not available for review.

The information from the Poe and Associates' investigation was reviewed, validated, and used to aid in this hydrogeological investigation. The investigation, herein, fills the gaps of the Poe and Associates' reports with the available information necessary to develop a preliminary hydrogeological conceptual model for the landfill.

Both geotechnical and hydrogeological evaluations by Poe and Associates summarize the regional geology coupled with a site-specific soils investigation. Sixteen soil borings on Tract A, ranging in depth from 20 to 50 feet below land surface, were evaluated for geotechnical properties. The depths of the borings were insufficient to define the deep stratigraphy and hydrogeologic units underneath Tract A and also fulfill the current OSDH regulations. The borings were able to roughly define the residual soils underlying the site, though lacking detailed descriptions. As a result, the information obtained from the Poe and Associates' reports is used to aid in the development of a boring plan for Tract A, further discussed in Section 7.0.

1.3 Sources of Information

The sources of information obtained for this study were acquired from the local files at Muskogee Community Landfill, the Oklahoma Geological Survey (OGS), the United States Geological Survey (USGS), the Oklahoma Water Resources Board, the Oklahoma Corporation Commission, Sooner Well Service, and Ace Aerials. Geosource Inc. in Austin, Texas was subcontracted to assist in gathering all the historical aerials and maps for the facility and surrounding areas.

Section 2

2.0 SITE CONDITIONS

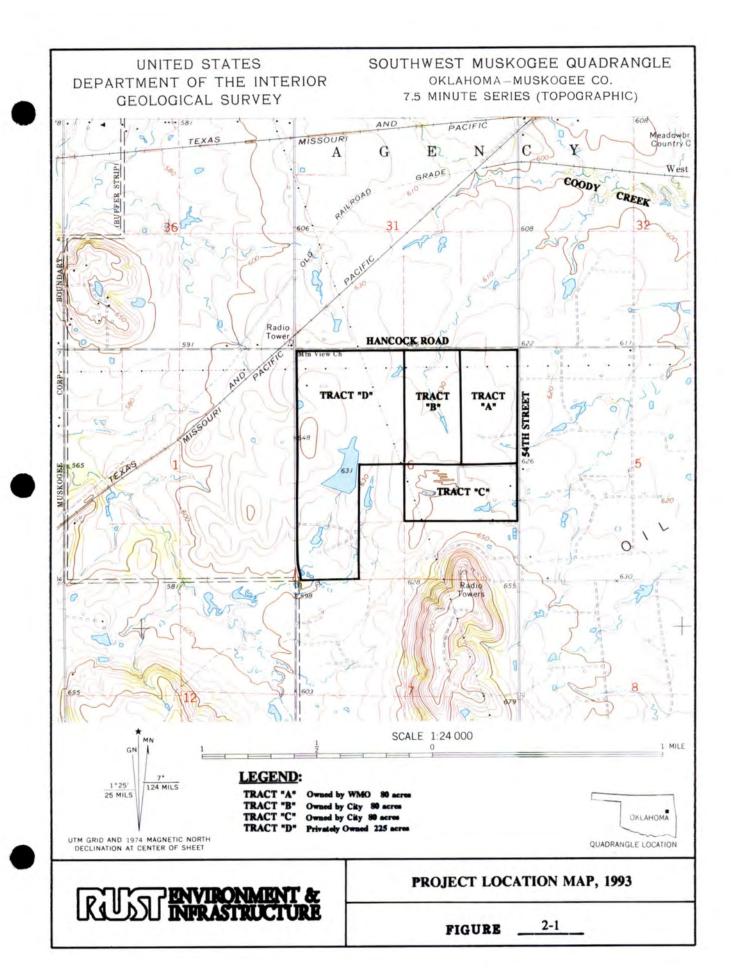
This section describes site-specific conditions including location, history, aerial photography, physiography, topography, climate and previous investigations.

2.1 Location

Muskogee Community Landfill, located southwest of the City of Muskogee in Muskogee County, Oklahoma, south of Hancock Road and west of 54th Street, is identified as Tract A in Figure 2-1. Reference to the "facility" in this report refers only to Tract A. The northeast corner of the facility is approximately 1.5 miles west of Highway 69 and one-half mile south of the Texas-Pacific and Missouri-Pacific Rail lines. The entrance is off 54th Street, one-half mile south of the intersection with Hancock Road. The facility is located in Lot 1 and the SE ¼ of the NE ¼ of Section 6, Township 14 North, Range 18 East.

Also shown in Figure 2-1, Tract B is located directly to the west of Tract A; Tract C is located directly to the south. Both of these tracts are Type I-B municipal solid waste facilities. Tract D, located west of Tract B, is a potential borrow source and is currently owned by James M. and Eileen R. Hewgley.

The land use of the surrounding area includes a residential neighborhood threequarters mile to the west just north of Hancock Road, another neighborhood about one mile to the north, undeveloped pasture and farmland north, east and west, and a public animal shelter and additional undeveloped property to the south. There are several oil wells around and within the property.



2.2 Landfill History

The original permits for landfill operations for Tracts A, B, and C were all initially issued to the City of Muskogee by the Oklahoma State Department of Health (OSDH). Permit No. 3551020 for Tract A was issued on April 4, 1987. Permit No. 3551009 for Tract B was issued on August 18, 1976. Permit No. 3551002 for Tract C was issued on February 16, 1972.

The City of Muskogee excavated, filled with trash, and covered a single trench in the southwest corner of Tract A in the winter of 1983. Additional excavation was also carried out in the southern portion but no landfill operations took place. In December, 1992 the name of the owner/operator was changed/transferred to Waste Management of Oklahoma, Inc. (WMO) and the name of the facility was changed to Muskogee Community Landfill and Recycling Center. The Muskogee Community Landfill is a Type I-B municipal solid waste facility which, according to OSDH regulations, is approved to receive non-hazardous commercial residential and industrial solid waste. The currently permitted area of the facility encompasses approximately 80 acres, 69.5 acres of which will be used for landfill operations. A population equivalent of about 60,000 is being served.

During a recent 12-month period, the landfill received a monthly waste volume of 23,100 yd³ on average. The estimated life of the facility was approximately 2.8 years prior to approval of a permit amendment by OSDH in December, 1992, which allowed an increase in height of fill by an average of 10 feet over the facility. Under this scenario, the current life of the facility is approximately 7.5 years based on a total available waste volume of 2,070,000 yd³.

Operation of Tracts B and C began shortly after the permits were issued using the trench landfilling method. Operations on Tract B ceased by the early 1980s. Approximately 20 acres in the northern part of Tract B were never filled.

Operations for Tract C started in the western half of the tract. The City of Muskogee is currently filling the southeastern corner with construction debris.

2.3 Aerial Photographs

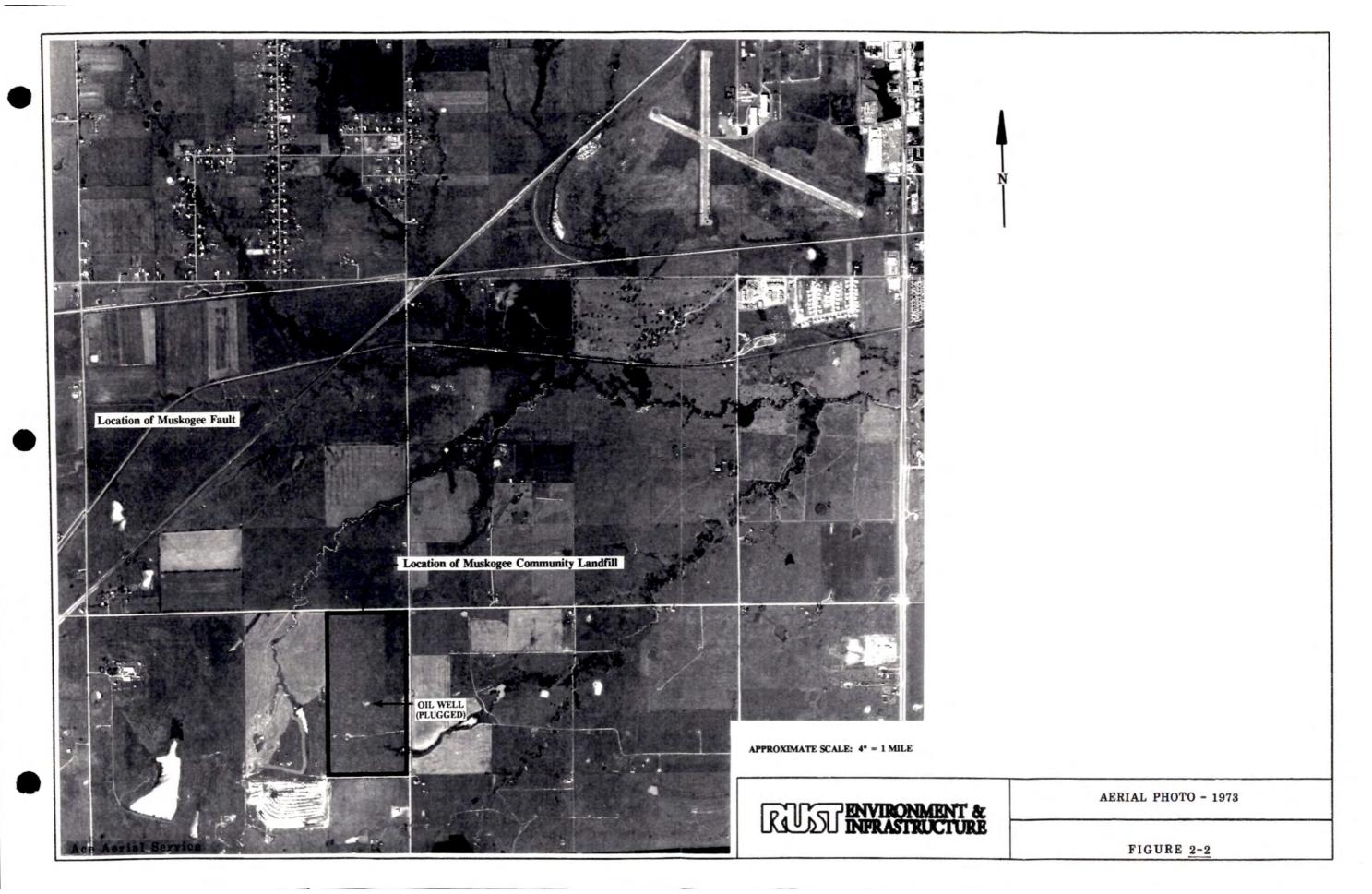
Aerial photographs were reviewed for the years 1973, 1980, 1991, and 1992. There were no aerial photographs available prior to 1973, and the most recent aerial photograph available was from June, 1992.

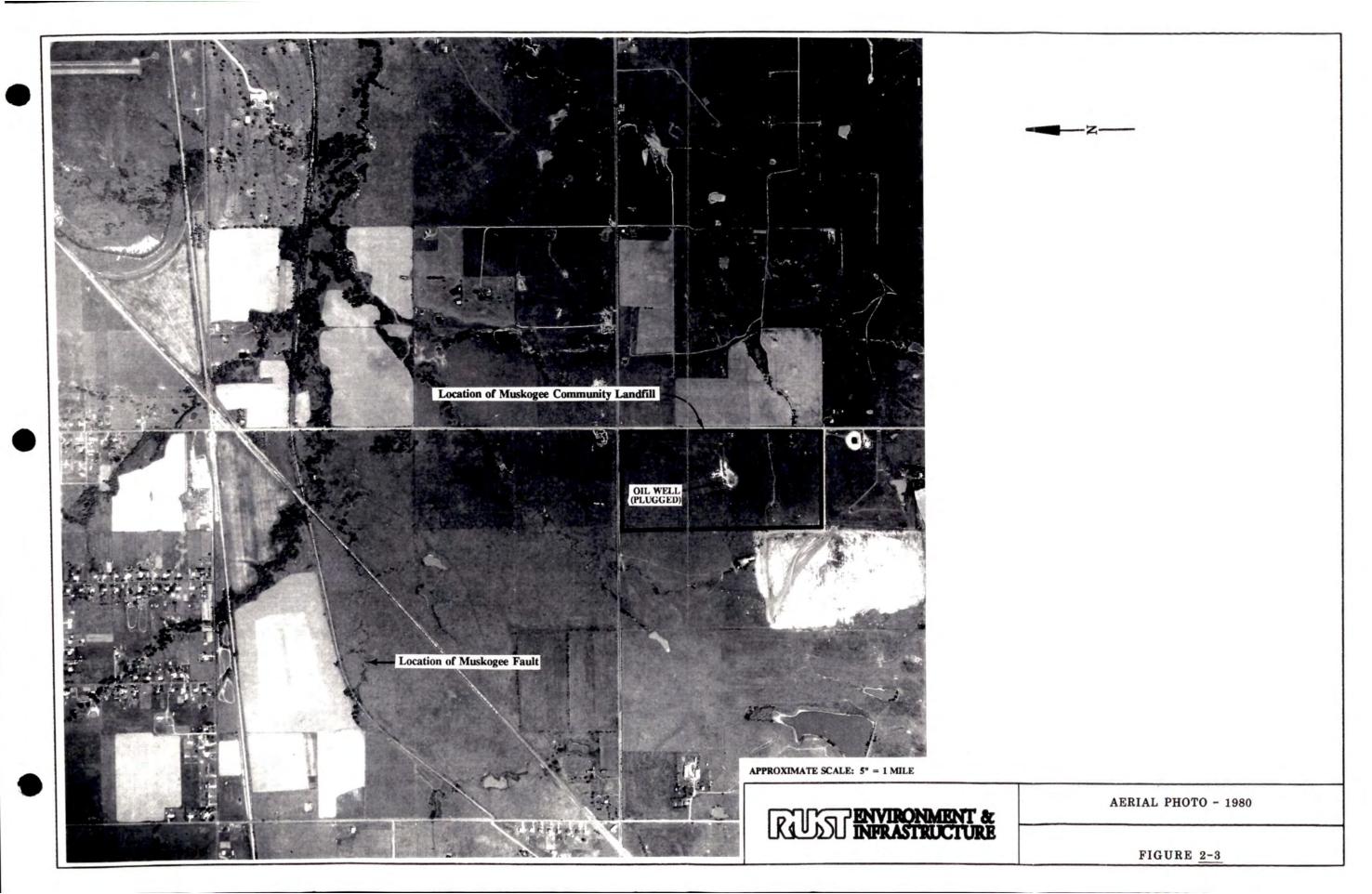
On September, 28, 1973, Tracts A, B, and D were undeveloped land, as shown on Figure 2-2. The small light spot in the center of the Tract A shows an area of dead vegetation. The vegetation was reportedly killed due to brine water seeping from a poorly plugged oil well. This issue is addressed in Section 4.6, Petroleum Geology, later in this report.

Tract B has a small pond which was connected to an intermittent stream. The stream was a tributary of Coody Creek located to the northeast. The western half of Tract C was being landfilled by the trench landfilling method. Tract D is farmland surrounding a lake and a small pond.

As indicated, on the October 8, 1980 photograph, Tract A was still undeveloped, and the dead vegetation due to the flowing brine water had radially expanded (Figure 2-3). The southern third and western half of Tracts B and C were being landfilled. The stream which was connected to the pond on Tract B appears to have been obstructed by the landfill. It also appears that the excavation of Tract B had reached the pond, and the pond was being filled in. Tract D was still undeveloped.

By April, 1991, the southern-most part of Tract A had been excavated. The trench in the southwestern corner had been filled and covered by the City of Muskogee. The area of dead vegetation was still present.





Landfill operations had ceased in Tract B with trenches filled and covered. Most of the western portion of Tract C appeared to be finished and covered with vegetation. Part of the eastern half was also covered with vegetation.

The June, 1992 aerial photograph showed that Tract A remained basically unchanged. The area of dead vegetation was still present. Tract B appeared the same. Landfilling operations for Tract C were active in the southeastern part of the landfill.

2.4 Physiography and Topography

Muskogee County is mainly in the Arkansas Valley section of the Ouachita Province and in the Osage Plains section of the Central Lowlands Province. The Arkansas River forms the northern border of the county then flows south through the eastern third of the county. The Canadian River flows northeast-southwest to the south of the county. The general drainage is towards these rivers and the overall slope of the county is to the south and east. Topographic differences across the county range from moderately steep slopes in the northeast corner to nearly level floodplains along the Arkansas River. Elevations range from about 1,100 feet mean sea level (msl) in the northeast to about 450 feet msl in the south.

The local topography for the area around the landfill is shown in Figure 2-1. The land surface slopes toward the northeast across Tract A, B, and C. There is a prominent topographic high about one-half mile to the south of Tract A.

Figure 2-4 shows the site-specific topography for Tract A as existing on June 22, 1992. The highest elevation on Tract A is 639.8 feet msl located on top of a mound of trash near the southwest corner of the tract. This mound is full of trash deposited by the City of Muskogee prior to the transfer of ownership to WMO. The mound is approximately 100 feet wide at its widest point with steep slopes to a base elevation of approximately 620 feet msl. The lowest elevation in the



excavation area of Cell 1 is about 621 feet msl. The topography of the undeveloped portion of Tract A slopes to the northeast, ranging in elevation from approximately 639 feet msl on the west side of the property to an elevation of 621 feel msl on the northeast side of the property.

2.5 Climate

Table 2-1 gives historical averages on temperature and precipitation for the Muskogee area as recorded by the National Oceanic and Atmospheric Association for the last 30 years. In winter, the average temperature is 40.8 degrees Fahrenheit (F), and the average daily minimum is 31 degrees F. The lowest temperature of -9 degrees F occurred on January 10, 1977. In summer the average temperature is 80.6 degrees F, and the average daily maximum temperature is 92 degrees F. The highest recorded temperature, which occurred at Muskogee on July 13, 1954 is 114 degrees F.

The average annual precipitation for the past 30 years is 40.00 inches. Of this, 24.46 inches, or 61 percent, usually falls from April through September. The growing season for most crops occurs within this period. In two years out of ten, the rainfall in April through September is less than 19 inches. Table 2-2 is a histogram representation of the monthly averages for temperature and precipitation. The largest amount of rainfall occurs during the spring and fall with a moderate decrease in the summertime. The least amount of rainfall occurs during the winter months. Thunderstorms occur on about 50 days each year and most occur in the summer.

The average relative humidity in mid-afternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in the summer and 55 percent in winter. The prevailing wind is from the south. The average windspeed is 12 miles per hour with the highest winds occurring in the spring (Soil Conservation Services, 1988).

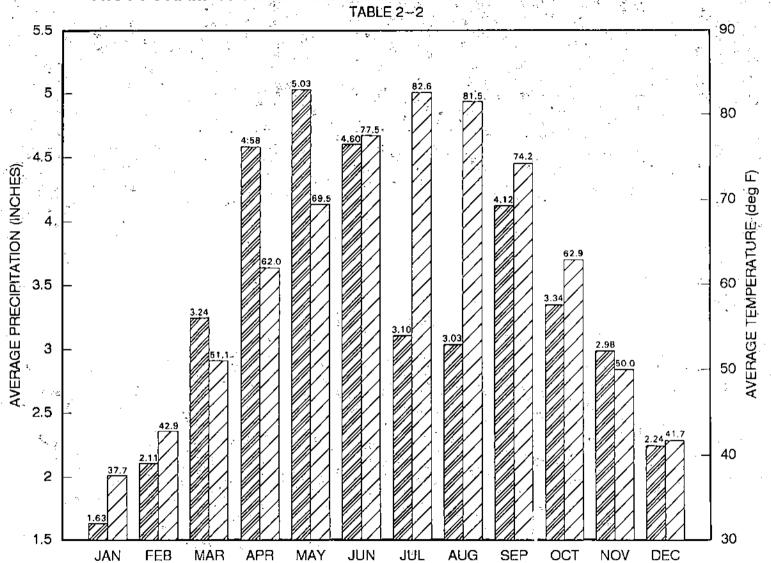
TABLE 2-1
TEMPERATURE AND PRECIPITATION

MONTH	AVERAGE TEMPERATURE (°F)	AVERAGE PRECIPITATION (inches)
January	37.7	1.63
February	42.9	2.11
March, %	51.1	3.24
April	62.0	4.58
May	69.5	5.03
June 18	77.5	4.60
July	82.6	, 3.10
August	81.5	3.03
September	74.2	-4.12
October A	62.9	3.34
November	50.0	2.98
December	41.7	2.24
YEARLY AVERAGE	61.2°F	40.00 inches

Note:

All data are averaged for the years 1962 through 1991. National Oceanic and Atmospheric Administration. Climatological Data Annual Summary, Oklahoma 1991, Volume 100, Number 13

HISTOGRAM OF AVERAGE TEMPERATURE AND PRECIPITATION



Section 3

3.0 SOILS AND VEGETATIVE COVER

The following section describes the general soils of the region, site-specific soils, and vegetative cover and erosion potential of the study area. This section gives information about soil types, general physiography and drainage, and soil management.

3.1 Géneral Soil Types

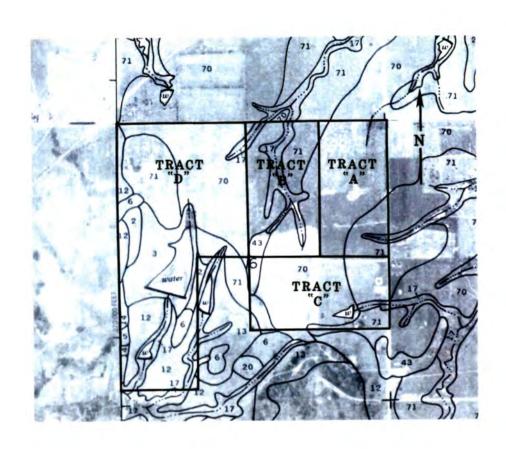
The general soils of the region consist mainly of two types: the Taloka-Parsons-Stigler soils and the Dennis-Bates-Coweta soils (Figure 3-1). Approximately 28 percent of Muskogee County consists of this soil series. It is about 32 percent Taloka soils, 22 percent Parsons soils, 21 percent Stigler soils, and 25 percent soils of minor-extent (Soil Conservation Service, 1988). About 36 percent of the region is made up of Dennis-Bates-Coweta soils. Approximately 44 percent of this map unit consists of the Dennis soils, 24 percent of the Bates soils, 9 percent Coweta soils, and 23 percent soils of minor extent.

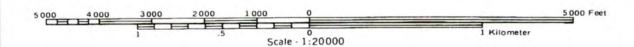
3.1.1 Taloka-Parsons-Stigler Soils

The Taloka-Parsons-Stigler map unit consists of soils that are nearly level to very gently sloping. The slopes range from zero to three percent. The soils are formed on broad, smooth uplands and high terraces or prairies. There are no prominent landforms in this unit. The water features in the area are farm ponds and scattered drainageways.

These soils are deep, somewhat poorly drained, and have low permeability. They have a loamy surface layer and a clayey subsoil.

Concerns in management for these soils include preventing erosion, maintaining soil tilth and fertility, and improving water intake. Terraces are needed for these soils to decrease soil erosion where slopes





Legend of Soil Units:

- 2 Bates Loam (1 3% slope)
- 3 Bates Loam (3 5% slope)
- 5 Bates-Coweta Fine Sandy Loams (1 3% slope)
- 6 Bates Coweta Fine Sandy Loams (3 5% slope)
- 12 Dennis Silt Loam (1 3% slope)
- 13 Dennis Silt Loam (3 5% slope)
- 14 Dennis Sitt Loam (2 5% eroded slope)
- 17 Dennis-Verdigris Complex
- 43 Oil-Waste Land
- 70 Taloka Silt Loam (0 1% slope)
- 71 Taloka Silt Loam (1 3% slope)

Modified from Soil Conservation Service, 1988.



LOCAL SOILS MAP

FIGURE 3-1

exceed one percent. These soils have low potential for most urban uses. Low strength, wetness, and the high shrink-swell potential are the main limitations (Soil Conservation Service, 1988).

3.1.2 Dennis-Bates-Coweta Soils

This unit is very gently sloping to moderately steep, and is on moderately long, smooth slopes on uplands with occasional sandstone outcrops. The slope ranges from one to 15 percent and is drained by small streams. Soils from this unit, particularly Coweta soils, are present approximately one-half mile to the south of Tract A. Water features consists of farm ponds and streams that are major drainageways. Other land uses are oil and gas production, coal strip mining, and flagstone production.

Dennis soils are on smooth, convex side slopes of uplands. These soils are deep, sloping, moderately well drained, and slowly permeable. They have a loamy surface layer and a clayey subsoil.

Bates soils are in higher positions than Dennis soils on smooth, slightly convex side slopes. Bates soils are moderately deep, very gently to gently sloping, well drained, and moderately permeable. They also have a loamy surface layer and a loamy subsoil. These soils formed in residuum weathered from sandstone and thin layers of shale.

Coweta soils are on convex ridges and side slopes of uplands. These soils are shallow, very gently sloping to strongly sloping, well drained and somewhat excessively drained, and moderately permeable. They have a loamy surface layer and subsoil underlain by soft sandstone. The soils of this map unit are used mainly for native grasses or tame pasture. The main concerns are erosion control and maintenance of

soil tilth and fertility. Terraces and residue management are used to help control erosion. These soils have low potential for most urban uses. (Soil Conservation Service, 1988).

3.2 Site-Specific Soil Types

The site-specific soil types are described by the Poe and Associates' investigation and the information available from the Muskogee County Soil Conservation Service.

3.2.1 Soils Investigation by Poe and Associates

During the geotechnical evaluation performed by Poe and Associates, residual clay soils were identified to overlie the majority of the site. It was determined that within this clay unit exists two soil types. The upper two feet consists of a highly weathered and leached topsoil zone. Clay subsoil thickness ranges from 11 to 19 feet. The subsoils have developed as a result of in-situ physio-chemical weathering processes acting on the silty shales of the Savanna Formation (described in Section 4.1) for the past 10,000 years or more. In the field, the soil was described as a brown and gray mottled clay, containing numerous iron-manganese stains and nodules. These characteristics indicated the internal soil drainage is very slow and the soil remains moist during most of the year. It should be emphasized that the subsurface clay is continuous across Tract A. Minor changes in thickness are to be expected but the physical properties show very little variation across the existing landfill site.

3.2.2 Soil Conservation Services Soil Survey

According to the Muskogee County Soil Survey, Tract A consists of approximately 75 percent Taloka silt loam (zero to one percent slope) with the remaining 25 percent Taloka silt loam (one to three percent slope).

Taloka silt loam (zero to one percent slope) is deep, nearly level, and a somewhat poorly drained soil. Typically, the surface layer and subsurface layer are very dark, grayish brown silt loam. The subsoil is clay (Soil Conservation Service, 1988).

This soil is medium in natural fertility, and the organic matter content is low. The surface layer is slightly acid to strongly acid. Permeability is very low, and the available water capacity is high. The soil has good tilth and can be worked throughout a moderate range of moisture content.

The remaining 25 percent of Tract A consists of Taloka silt loam (one to three percent slope). This type of soil is much like the soils described above, with only slight variations in thicknesses of the loam and subsurface layers (Soil Conservation Service, 1988).

3.3 <u>Vegetation Cover and Erosion Potential</u>

The vegetative cover for the Taloka silt loam soils is used for tame pasture or for native range or hayland. This soil has a high potential for native grasses and tame pasture (a combination of Bermuda grass or tall fescue and clover). Soil erosion is considered a major concern, and erosion is decreased with fertility and tilth maintenance of vegetative cover. Control of erosion is also aided by controlling storm-water runoff from the facility.

Section 4

4.0 GEOLOGIC SETTING

The following section describes the setting of surface and subsurface geologic units across the region and at the facility. The following topics will be discussed: regional geology, stratigraphy, structural features, geologic history and environment of deposition, site geology, and petroleum geology.

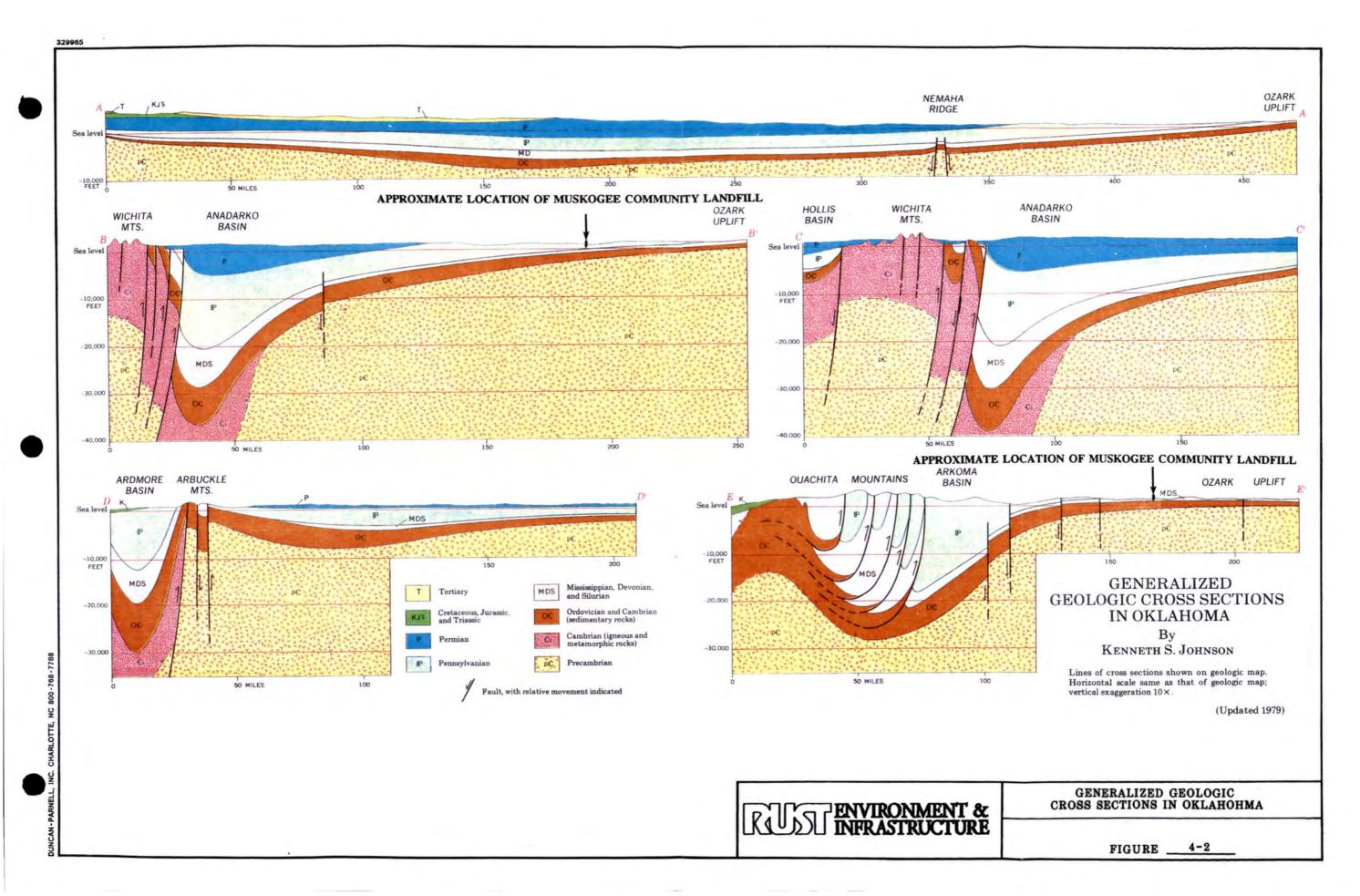
4.1 Regional Geology

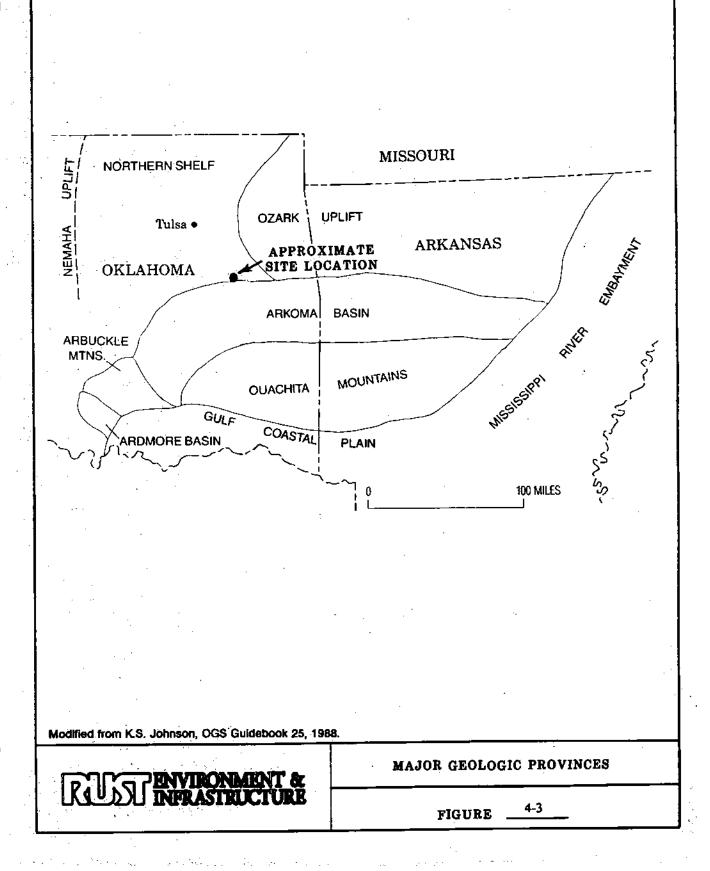
The regional geology of the area consists of sedimentary rocks ranging in age from the Quaternary period to the Mississippian period. Quaternary alluvium and terrace deposits are located along the Arkansas River and along portions of Coody Creek and Pecan Creek. Pennsylvanian marine shales, interbedded with sandstone, limestone, and coal are found adjacent to the alluvium and terrace deposits of the Arkansas River. Mississippian shales, limestones, and cherts are located northwest of Muskogee County, while additional Pennsylvanian rocks are found north, east and south of Muskogee County. Figure 4-1 presents the surface geology of Oklahoma and Figure 4-2 presents the generalized subsurface stratigraphy and structural features of Oklahoma. Note that cross sections B-B' and E-E' show the stratigraphy closest to the study area.

4.2 Stratigraphy

The facility sits atop the transition zone of the Arkoma Basin and the Northern Shelf near the Ozark Uplift. Figure 4-3 shows the locations of the Arkoma Basin, Northern Shelf and Ozark Uplift throughout northeastern and central Oklahoma. The Arkoma Basin consists of the Desmoinesian, Atokan and Morrowan series as it developed through the Pennsylvanian period. Table 4-1 shows the geologic framework of the Arkoma Basin. The Desmoinesian series is made up of the Boggy, Savanna, McAlester, and Hartshorne Formations. As shown in Figure 4-4, the Savanna Formation underlies the facility with the Boggy Formation cropping

SOUTH ON THE NAME OF THE PARTY





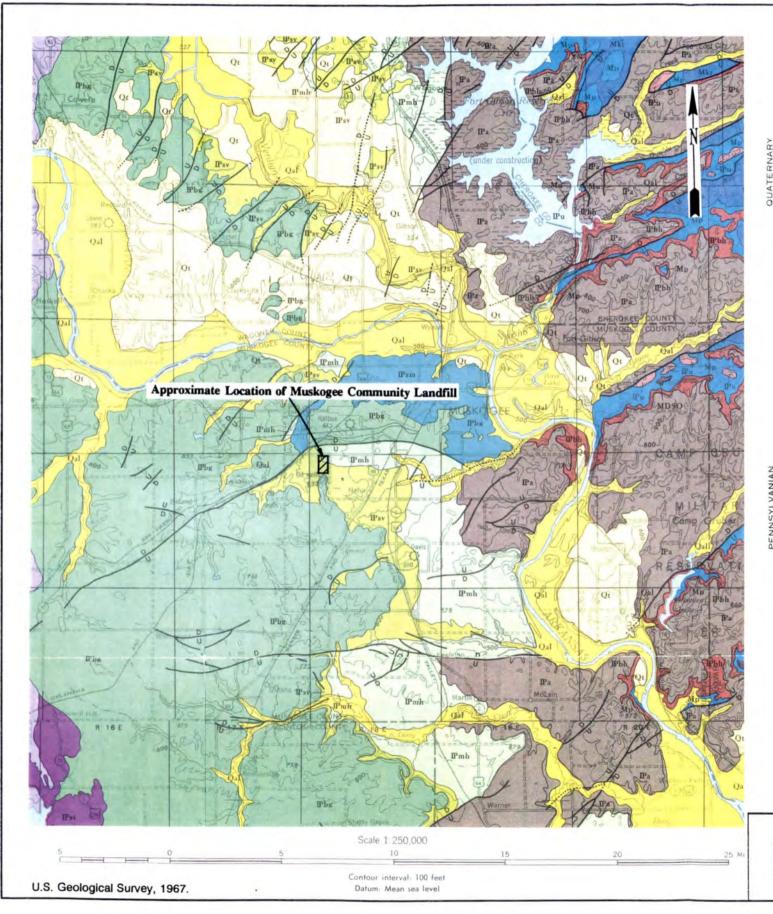
T					_			
1		SERIES		ARKOMA BASIN				
		Desmoinesian		Boggy Fm.	₽bg			
	PENNSYLVANIAN		Krebs Gp.	Savanna Fm.	Psv			
				McAlester Fm.	Pma			
				Hartshorne Fm. Upper Lower	Phs			
		Atokan		₽a				
Ì				₽m				
l		Morrowan						
	MISSISSIPPIAN	Chesterian						
		Meramecian		MD				
ł		Osagean						
l		Kinderhookian						
İ	NAS	Upper						
	DEVO	Lower	غ	Frisco Ls. Bois d'Arc Ls. Haragan Ls.				
	SILURIAN DEVONIAN	Upper	Hunton Gp.	Henryhouse Fm.	DSOhs			
١		Lower	된	Chimneyhill				
ŀ		Lower		Subgroup				
I		Upper						
I			Viola Gp.	Welling Fm. Viola Springs Fm.				
l	_	Middle	Simpson Gp.	Bromide Fm.	Ovs			
١	ORDOVICIAN			Tulip Creek Fm.				
I				McLish Fm.				
				Oil Creek Fm. Joins Fm.				
1		Lower	Timbered Arbuckle Gp.	West Spring Creek Fm.				
				Kindblade Fm.				
				Cool Creek Fm.				
				McKenzie Hill Fm. Butterly Dol.				
	CAMBRIAN	Upper		Signal Mountain Ls.	QCa			
				Royer Dol.				
				Fort Sill Ls.				
				Honey Creek Ls.				
	<u> </u>			Reagan Ss.				
	PR	ECAMBRIAN	ŀ	p€				

Modified from K.S. Johnson, OGS Guidebook 25, 1988.



STRATIGRAPHIC CHART FOR THE ARKOMA BASIN

TABLE 4-1



EXPLANATION

ALLUVIUM

Gravel, sand, silt, and clay. Yields large amounts of water of good quality along the Arkansas River and probably will yield moderate to large amounts along the Canadian River.



TERRACE DEPOSITS

Gravel, sand, silt, and clay. Yield moderate to large amounts of water of good quality locally along the Arkansas River; smaller amounts elsewhere.



STUART SHALE

Shale and minor sandstones. Probably will yield only limited amounts of water of poor quality.



THURMAN SANDSTONE

Sandstone and shale. Probably will yield only limited amounts of water of poor quality.



BOGGY FORMATION

Shale, sandstone, and coal; includes Bluejacket Sandstone Member at base. Yields limited amounts of water of poor quality.



SAVANNA, MCALESTER, AND HARTSHORNE

FORMATIONS

- IPsv Savanna Formation, shale, sandstone, and coal. Yields limited amounts of water of poor quality.
- Pub McAlester and Hartshorne Formations (undifferentiated), shale, sandstone, and coal. Yield limited amounts of water of poor
- IPsm Savanna and McAlester Formations (undifferentiated; T. 15 N., Rs. 18, 19 E.), shale and minor sandstones. Yield limited amounts of water of poor quality.



ATOKA, BLOYD, AND HALE FORMATIONS

- IPa Atoka Formation, shale and sandstone. Yields limited amounts of water of poor quality.
- IPhh Bloyd Formation, shale and limestone; and Ilale Formation, limestone and sandstone. Probably will yield only small amounts of water of fair to poor quality.



MISSISSIPPIAN ROCKS ABOVE CHATTANOOGA SHALE Mu Undifferentiated.

Mp Pitkin Formation, limestone; Fayetteville Formation, shale and limestone; Hindsville Formation, limestone and shale; and

Moorefield Formation, limestone.

Mkr Keokuk Formation, chert; Reeds Spring Formation, chert and limestone; and St. Joe "Group," limestone and marlstone.

Yield small to moderate amounts of water of fair to good quality.



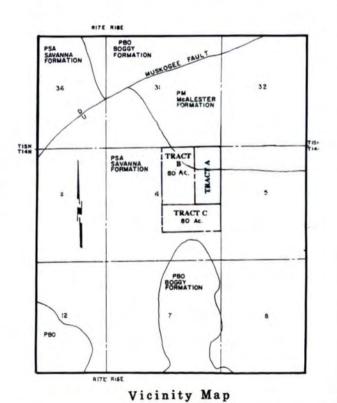
MISSISSIPPIAN, DEVONIAN, SILURIAN, AND ORDOVICIAN ROCKS, UNDIFFERENTIATED Mississippian and Devonian. Chattanooga Shale, shale.

Devonian. Sallisaw Formation, limestone, sandstone, and chert; and Frisco Formation, limestone.

Silurian. Quarry Mountain Formation, limestone; Tenkiller Forma-tion, limestone; and Blackgum Formation, limestone and dolomite.

Ordovician. Sylvan Shale, shale: Fernvale Limestone, limestone: Fite Limestone, limestone; Tyner Formation, shale, sandstone, dolomite, and limestone; Burgen Sandstone, sandstone and minor shales and limestones; and Cotter Dolomite, dolomite.

Limestone, dolomite, and sandstone units may yield small to mod-erate amounts of water of fair to good quality; shale units probably will yield only limited amounts of water of poor to fair quality.



REGIONAL GEOLOGIC MAP

FIGURE 4-4

out directly to the south; the McAlester and Hartshorne Formations are located on the northeastern corner of the property.

The Savanna Formation consists of shales, silty shales and sandstones, with discontinuous limestone beds and coal seams. The silty shales and shales are highly variable in thickness and character; in this portion of Muskogee County, the Savanna Formation has been determined to be about 170 feet thick (Poe and Associates, 1988). The outcrops trend in a northwest-southeast direction, and as with other Pennsylvanian formations in the area, the Savanna becomes thinner to the north and dips gently to the west-southwest, except where it intercepts structural features.

There are seven coal beds which have been identified by the OGS within the Savanna Formation. Of the seven, four are of sufficient thicknesses to be named. Thickness of these beds ranges from 0.1 to 3.0 feet. The four beds are the Drywood coal, the Rowe coal, the Sam Creek coal, and the Tallahassee coal (OGS Guidebook 25, 1988). The Rowe coal has been encountered in previous drilling activities at the facility.

Located directly to south of the facility is a topographic feature with an elevation of approximately 800 feet msl. This feature is made up of the Boggy Formation which is the youngest of the Pennsylvanian shales, sandstones, and coal beds. The formation includes the Bluejacket Sandstone Member at the base which yields limited amounts of water of poor quality. This sandstone unit forms resistant ridges which are common in Muskogee County (Oklahoma Geological Society, 1988). Three coal beds -- an unnamed coal, the Secor coal, and the Secor rider coal – have been identified with confidence in the lower Boggy Formation in this part of the Arkoma Basin. The Secor coal occurs almost immediately above the Bluejacket Sandstone in the area. It is generally overlain by a shale or siltstone unit (OGS Guidebook 25, 1988).

The McAlester and Hartshorne Formations are located on the northeast corner of Tract A. The two formations are undifferentiated and consist of shale, sandstone, and coal. These formations yield limited amounts of poor quality water (OGS, 1988).

4.3 <u>Structural Features</u>

Two important geological structures exist near the site. The first is the Muskogee Fault, a northeast trending normal fault with about 600 feet of vertical displacement (Figure 4-4). The upthrown block occurs on the south side of the fault trace and the surface expression is 1.5 miles north of the site. At the present time, it is unknown whether the fault is active or has been active in recent years. A seismicity study is currently being conducted as part of the Subtitle D Siting Criteria. Geologic maps prepared by the Oklahoma Geologic Survey document this fault and the fault can be identified on aerial photographs. The section of the Muskogee fault, seen in Figure 2-2, is trending east-west approximately three-quarter mile (following Coody Creek) north of Tract A. The fault trace can be seen in the area northwest of Tract A between the railroad tracks. The creeks running both northwest and southeast off Coody Creek are very linear and may represent splays running off the main fault.

The second geologic structure is a broad, gentle, northward plunging anticline with the axis one-half mile east of the site. This feature is suggested by local outcrop mapping, strike and dip measurements, attitude of coal seams, and the position of the Muskogee Oil Field to the east. This anticline is not documented on maps but appears in cross sections from oil and gas surveys from the OGS.

The Oklahoma Geologic Survey indicates two additional faults approximately five miles east of the site (Figure 4-4). One fault trends in a west-southwest to east-northeast direction and the surface expression is concealed in the Quaternary alluvium of Coody Creek. The second fault is in the McAlester Formation and

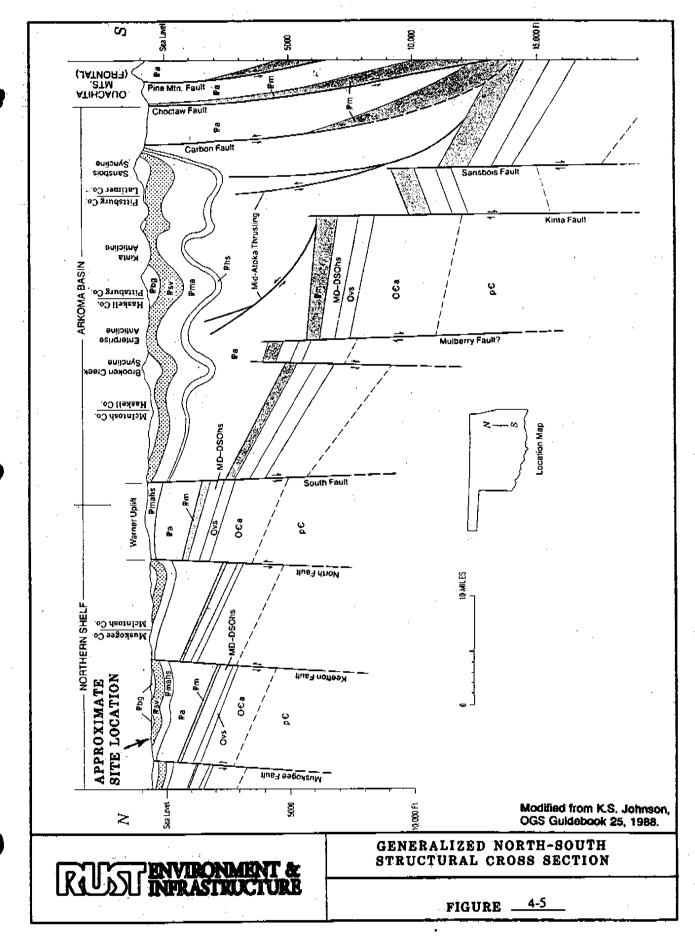
trends south-southwest to north-northeast, masked by the alluvial deposits of Coody Creek and tributaries. Figure 4-5 presents the generalized geologic cross section in Oklahoma.

4.4 Geologic History and Environment of Deposition

The facility is located on the transition of the Arkoma Basin Province and the Northern Shelf Province. The Arkoma Basin is a major tectonic province geographically located in eastern Oklahoma and central and western Arkansas (Figure 4-3). The Arkoma Basin is bounded to the north by the Ozark Uplift and grades northwestward onto the Northern Shelf Province. To the southwest, the basin is bound by the Arbuckle Mountains, and to the south by the Ouachita Mountains. The development of the Arkoma Basin is tied closely to that of the Ouachita Province. Both tectonic features were most active during the Early and Middle Pennsylvanian periods.

During the pre-Pennsylvanian times, the Arkoma Basin consisted of a broad epicontinental shelf that received shallow-water carbonates and clastics deposited during the Cambrian through Mississippian periods. These sediments graded southward into a deep-water basins consisting of black shales and cherts that accumulated in the Ouachita geosyncline. Morrowan and early Atokan sediments were deposited in a similar fashion of shelf sedimentation in the Arkoma Basin and deep-water sedimentation in the Ouachita trough. Deposition of the Atokan Series strata were through meandering fluvial and deltaic process with their source areas being to the north and northwest.

These processes continued through the late Atokan time, in which the Ouachita Trough experienced orogenic activity, including folding, thrusting, and marked uplift of the Ouachita facies. This uplift, called the Ouachita orogeny, resulted from the collision of the South American plate into the North American Craton and the resultant destruction of the Ouachita Trough.



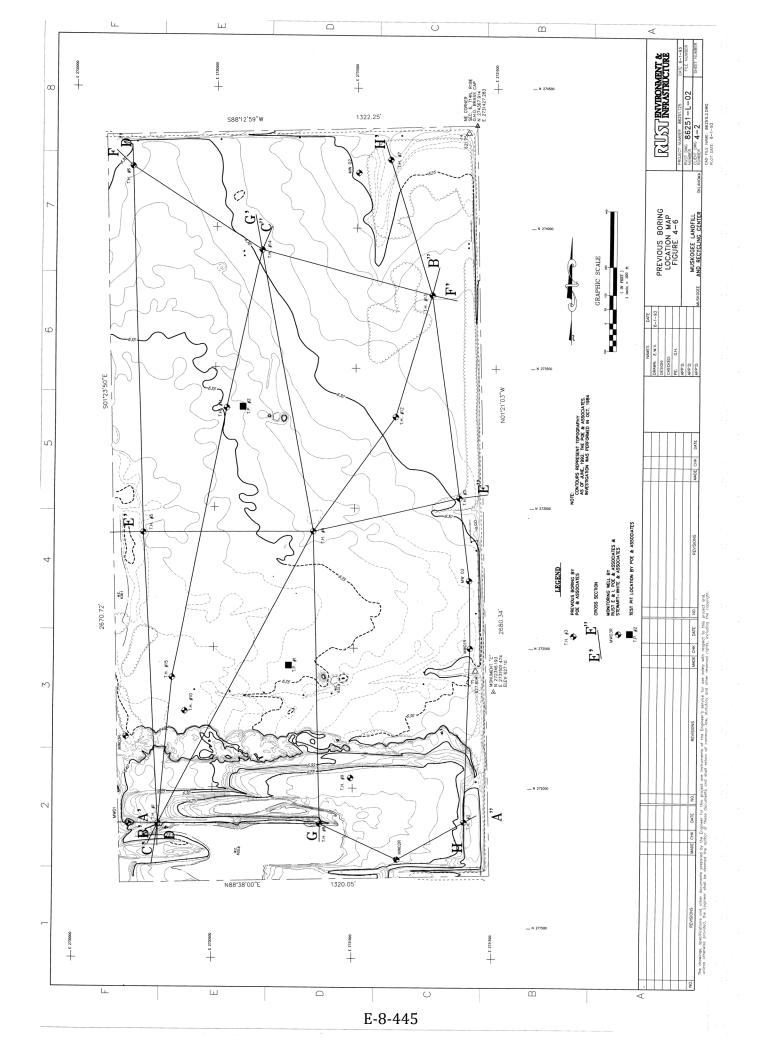
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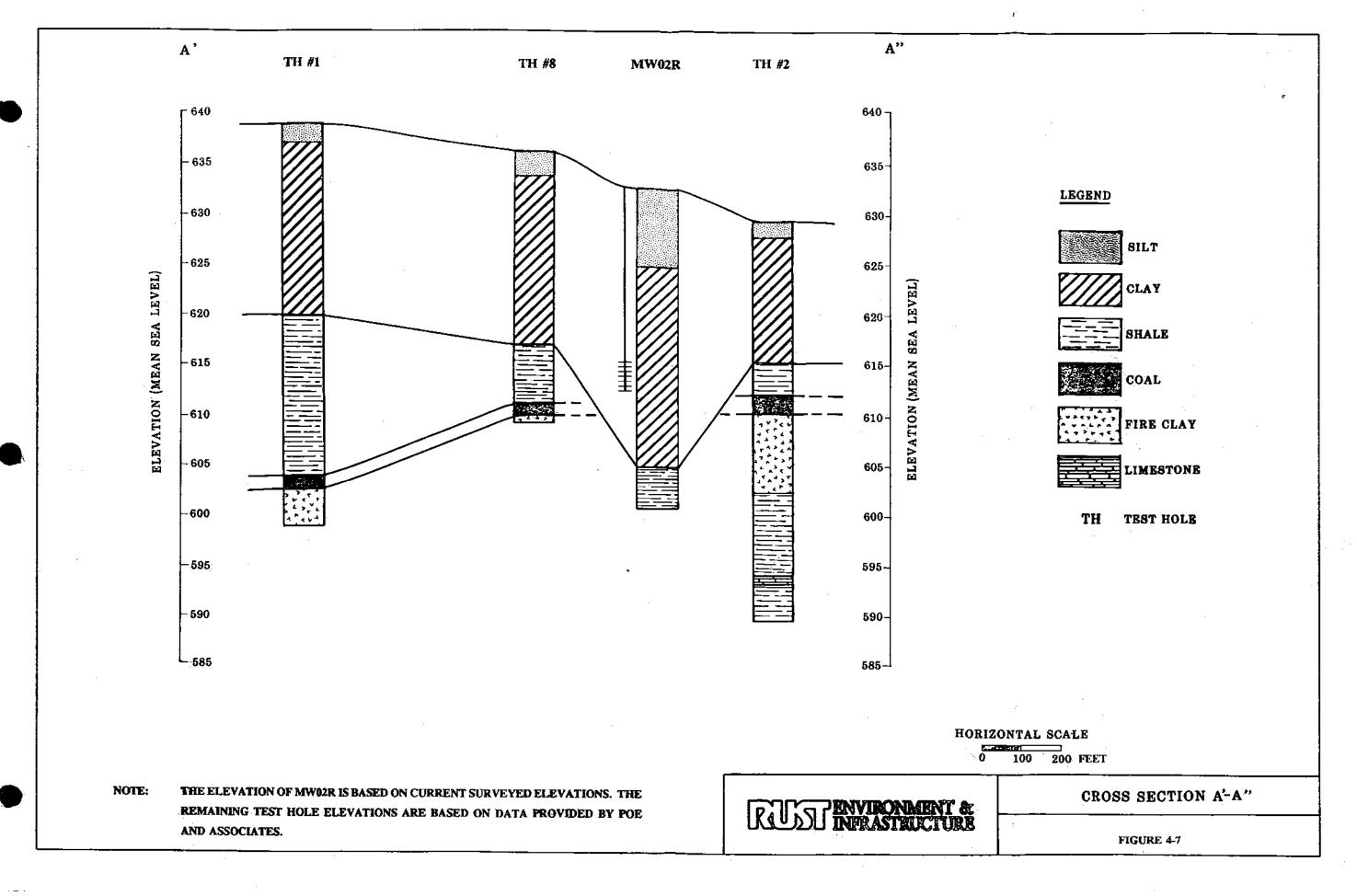
With the destruction of the Ouachita Trough, the center of deposition was shifted northwest in the Arkoma Basin. The derivation of sediments continued from northern sources, and the basin continued to intermittently subside through Desmoinesian time. Early Desmoinesian formations, like the Savannah and Boggy Formations, were formed as the depositional environments passed through transgressive marine sedimentation, deltaic sedimentation, and into fluvial sedimentation, in which coal swamps developed during episodes of marine regression (OGS Guidebook 25, 1988).

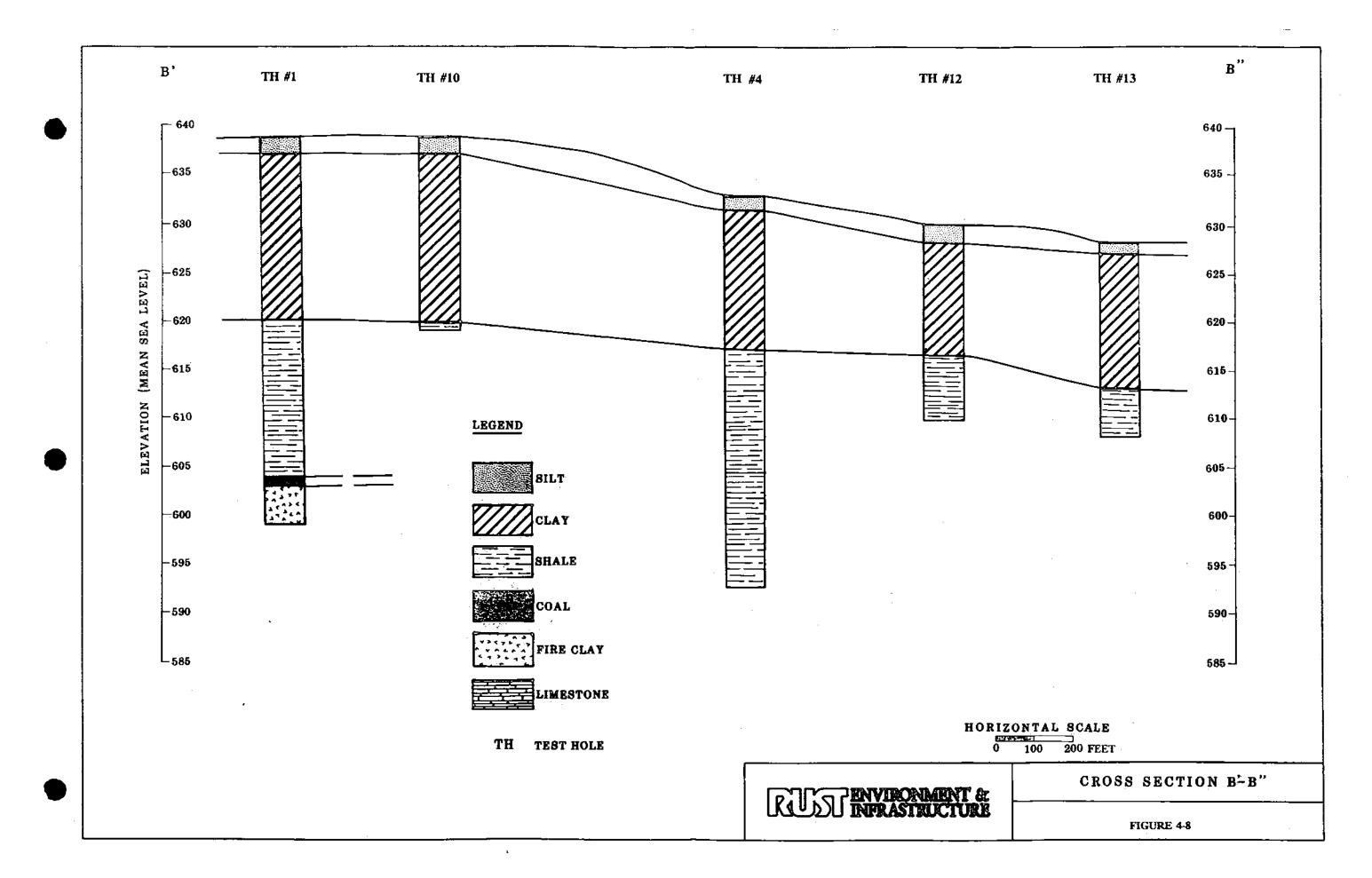
4.5 Site Geology

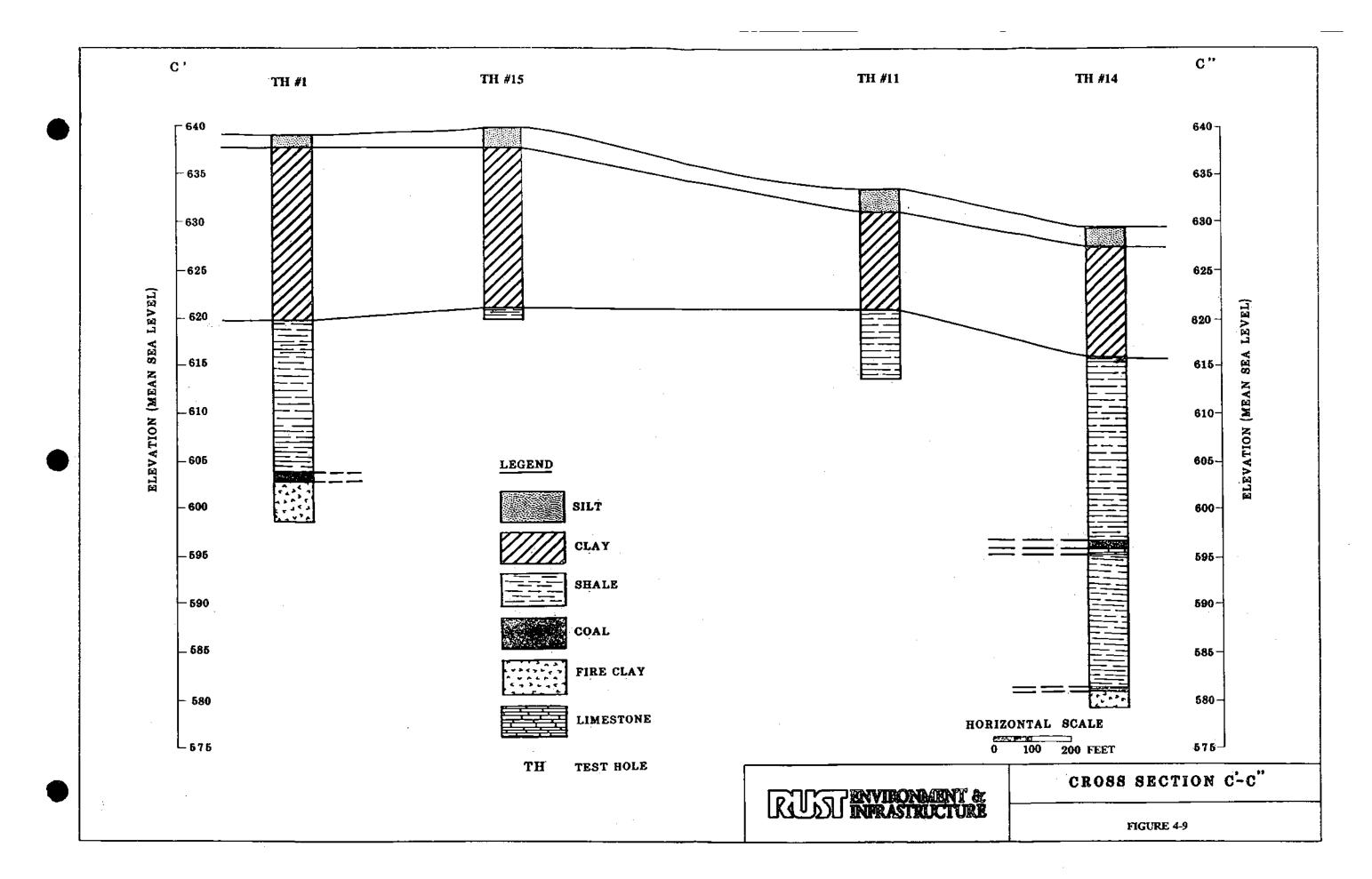
As documented by the geotechnical report by Poe and Associates, and the soils boring logs of three ground-water monitoring wells installed by RUST E&i in November, 1992, the subsurface conditions of the site consist of residual clay soils underlain by shale. These sediments are primarily part of the Savannah Formation. The location of all the previous borings, ground-water monitoring well, and orientation of cross section lines are presented in Figure 4-6. The residual soils are continuous across Tract A, as shown in Figures 4-7 through 4-14 which demonstrate cross sections of the borings performed by Poe and Associates across Tract A.

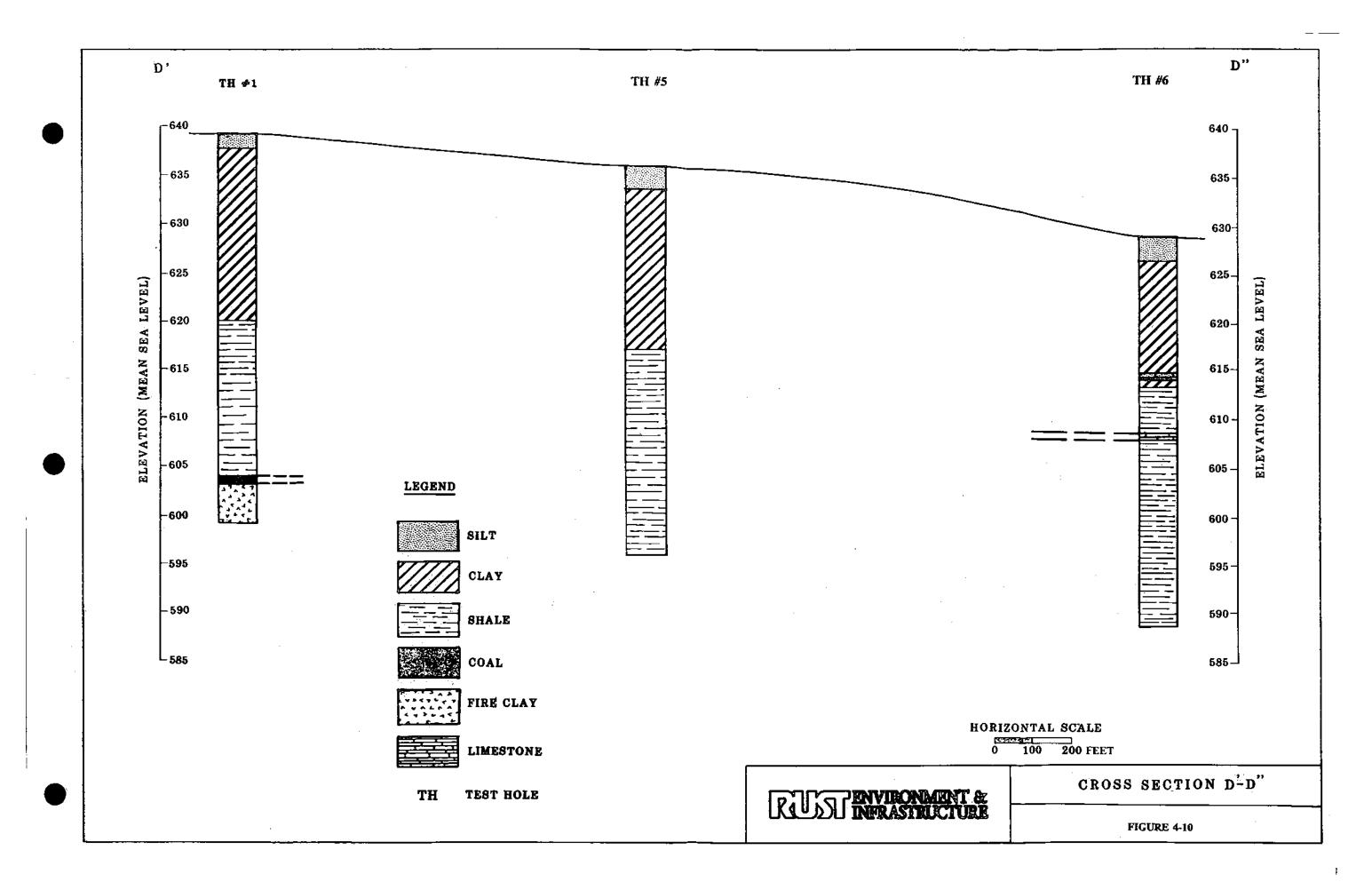
The Poe and Associates report differentiates between weathered shale and unweathered shale. The shale logged in the RUST E&I borings corresponds closely to the unweathered shale as picked by Poe and Associates. The weathered shale zone ranges from eight to 20 feet in thickness. Other encountered lithologies include coal seams, sandstone and siltstone layers, and limestone beds. Figure 4-15 presents a composite stratigraphic section for Tract A. Appendix A presents all soil borehole logs. It is important to note the convention used in the presentation of borehole logs 1 through 15. The depths marked indicate the base of the bed, not the top of the bed.

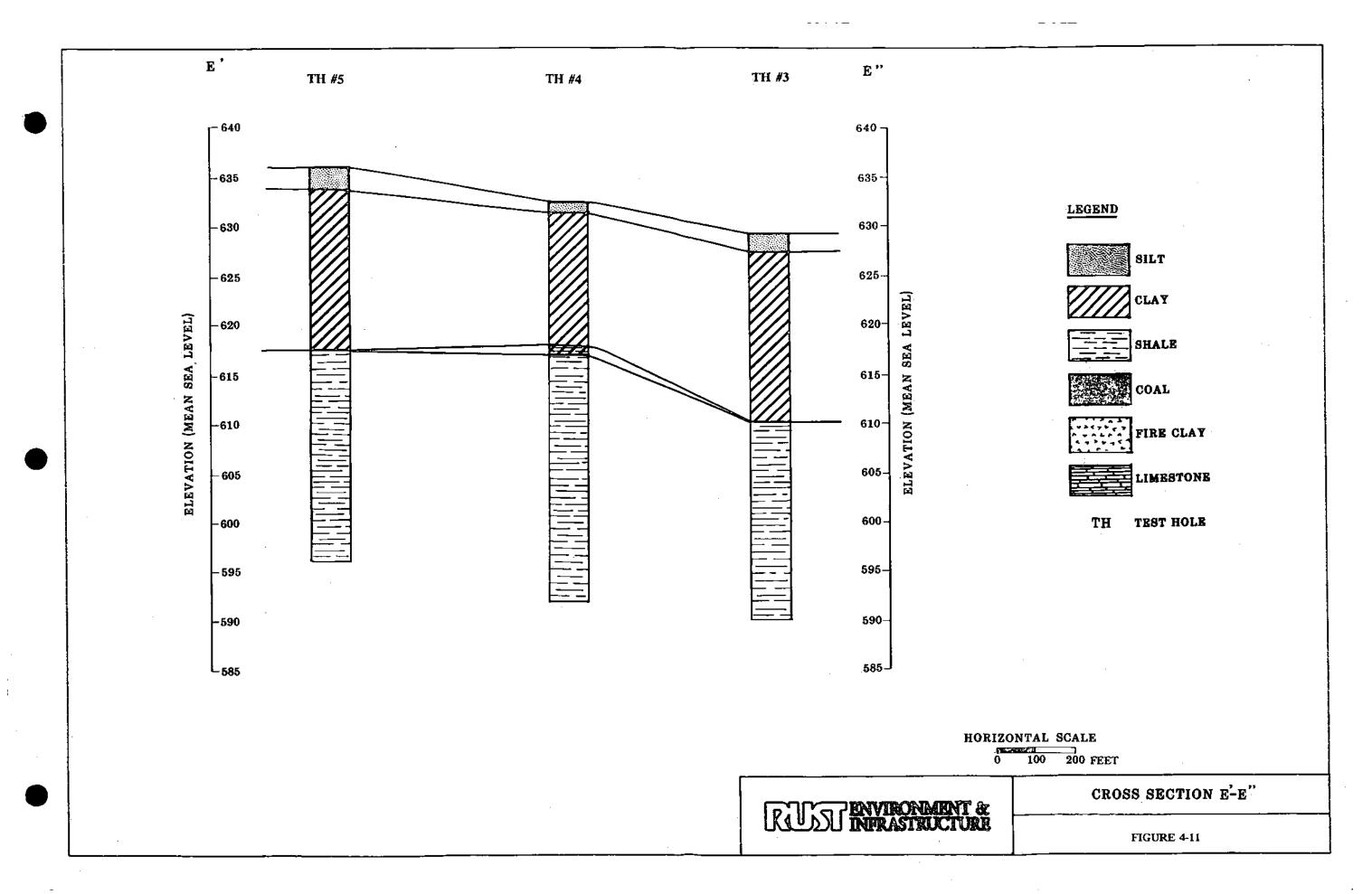


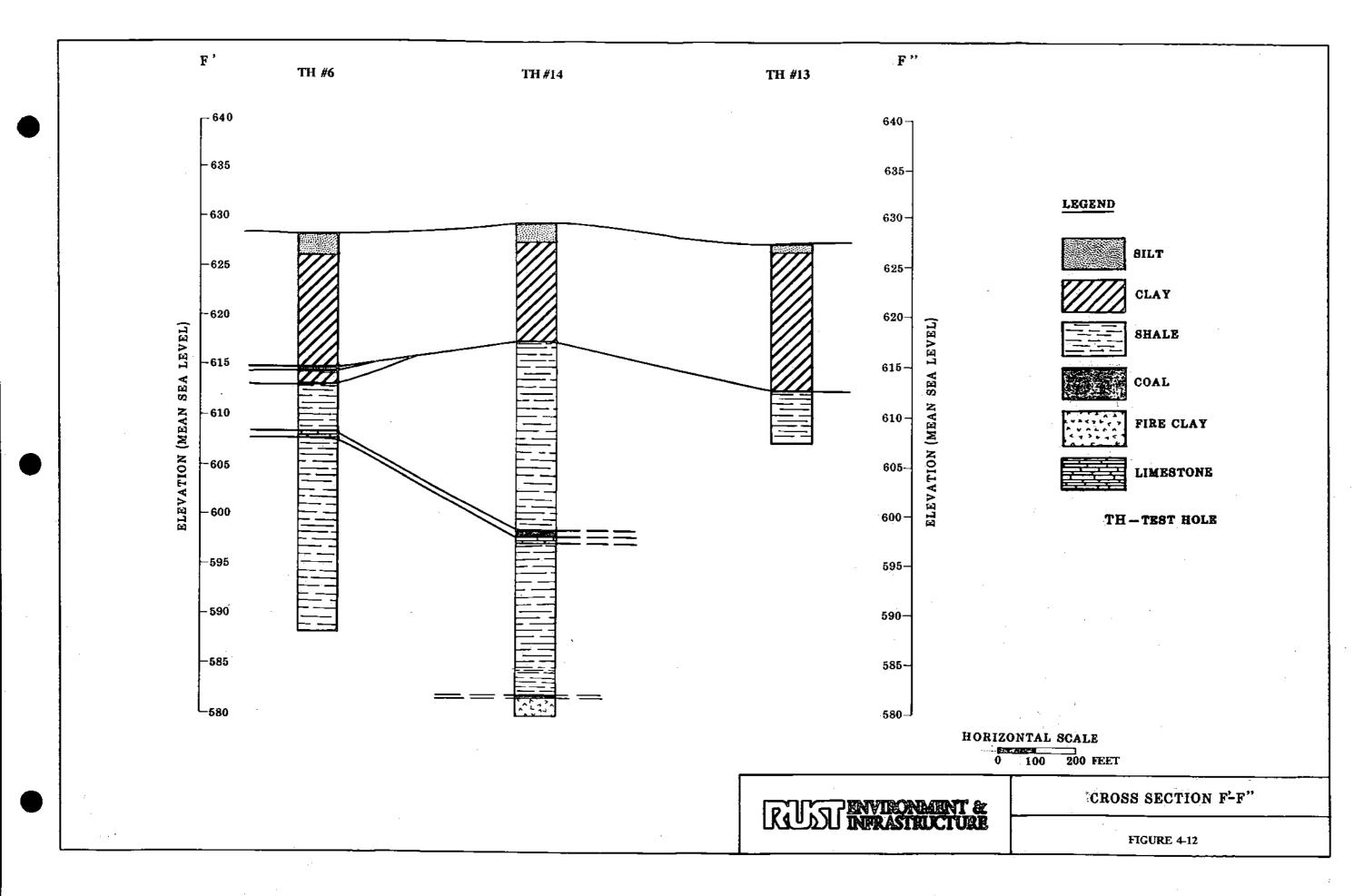


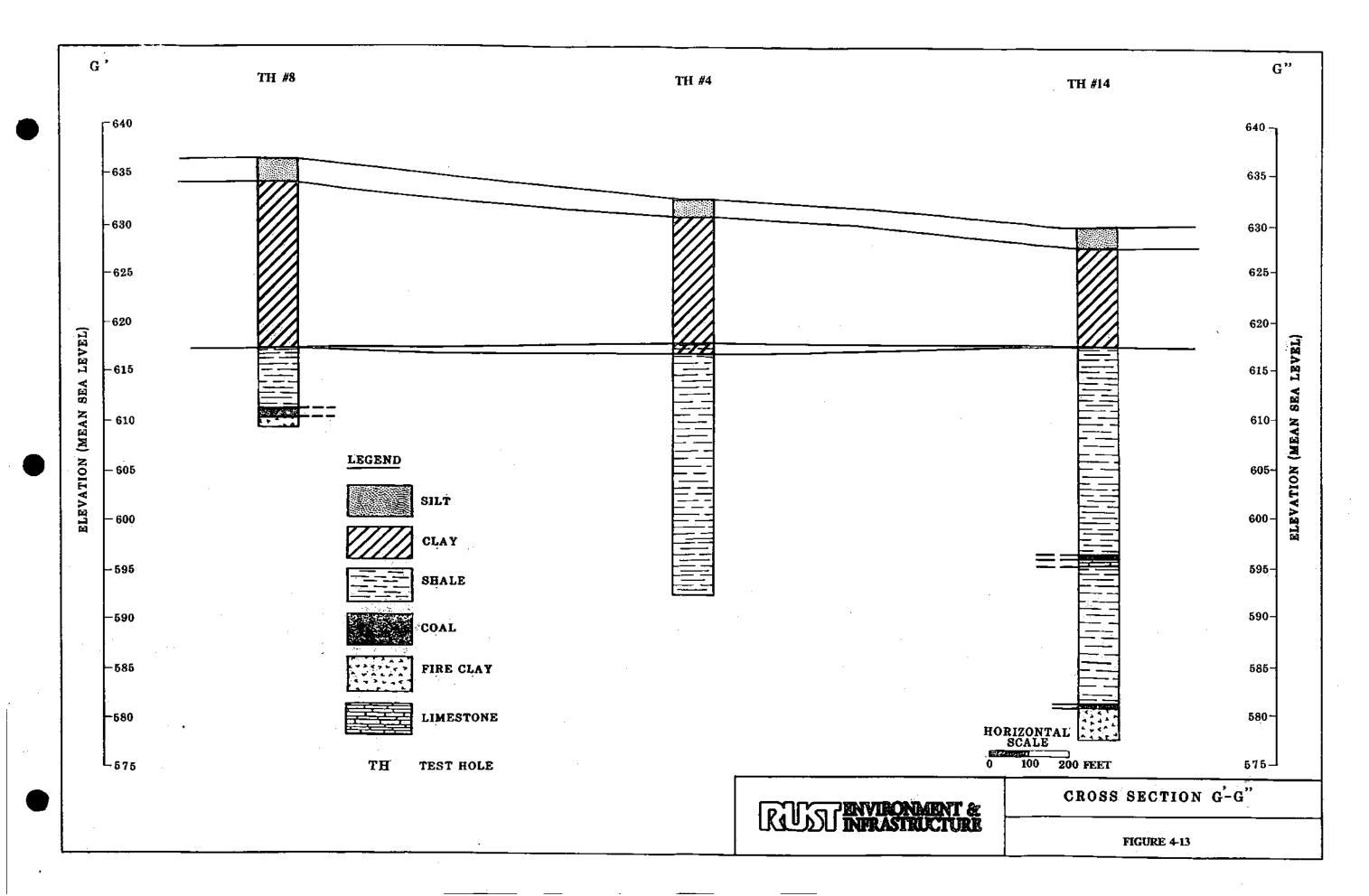


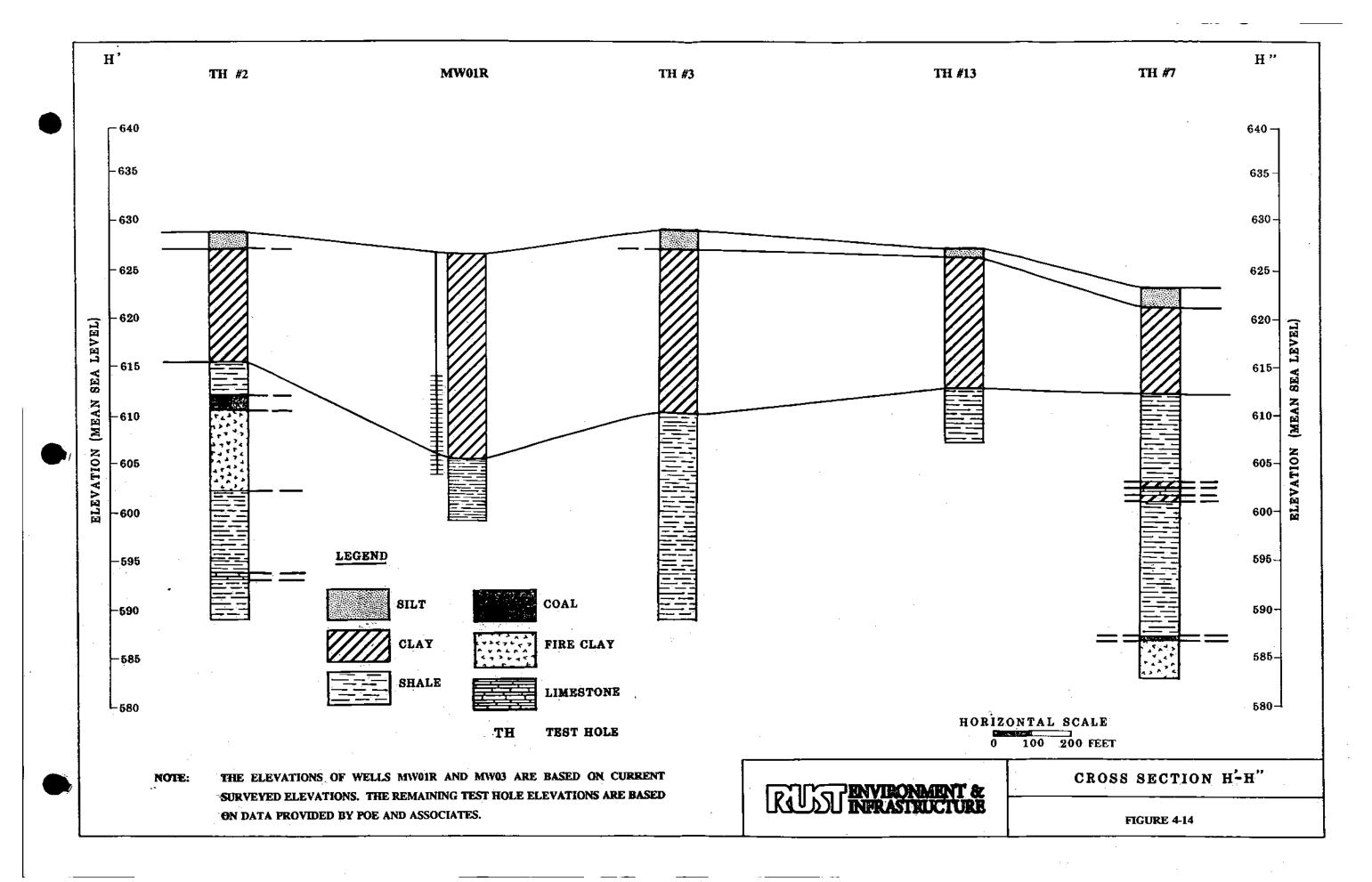










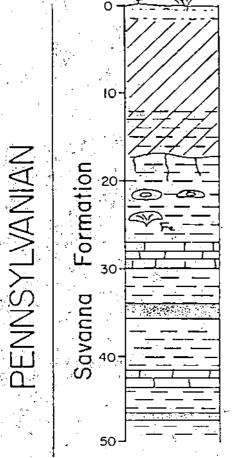


COMPOSITE TYPE SECTION PROPOSED

MUSKOGEE LANDFILL

FORMATION

LITHOLOGIC DESCRIPTION



Light brown silt,

Brown clay mottled with Gray zones, numerous Fe-Mn stains and Fe-Mn nodules

Olive gray weathered shale Ferruginous concretions

Fossiliferous timonite beds

Fossiliferous limestone (Donley limestone)

Coal bed (Rowe coal)

Dark gray shale, interbedded with lenticular fossiliferous timestone and coal seams, unweathered

COMPOSITE STATIGRAPHIC SECTION

POE & ASSOCIATES, INC.

665-8800

11-8-83

DATE

FIGURE 4-1:

The composite stratigraphic section shows iron-rich concretions and fossiliferous limonite beds which in most cases marks the contact between the clay soil and the weathered shale (Poe and Associates). Figure 4-16, taken from the Poe and Associates report, shows the depth to the top of the weathered shale. The map suggests the surface is undulatory and dips very gently to the east with a northeastern dip becoming more dominant in the northern third of the site.

Coal seams which range in thickness from 0.1 to 1.0 foot, are found in seven borings. In both the Poe and Associates and RUST E&I investigations, the bituminous grade coal appeared highly fractured and yielded water quite readily when encountered during drilling operations. The seams appear discontinuous across the site and more than one unit is probably present. The Rowe coal is most likely represented in the section. Test holes No. 7 and 14 both encountered thin coal stringers near fossiliferous limestone beds fairly deep in the borings within the unweathered shale.

4.5.1 Site Geotechnical Data

Geotechnical testing data by Poe and Associates is summarized in Table 4-2. The test hole and test pit locations can be found on Figure 4-6.

Geotechnical laboratory testing by Poe and Associates reveals falling-head permeabilities of Shelby tube samples to be 9.7×10^{-9} cm/sec and 3.2×10^{-9} cm/sec at eight feet (TH10) and 10 feet (TH11), respectively. Poe and Associates also reported field test results for falling-head permeabilities at five feet and 10 feet according to ASTM STP 74 6C. The results indicate permeabilities of 3.0×10^{-7} cm/sec at a depth of five feet (Test Pit 1), 2.9×10^{-6} cm/sec at a depth of 10 feet (Test Pit 1), and 1.4×10^{-6} cm/sec at a depth of 10 feet (Test Pit 2).

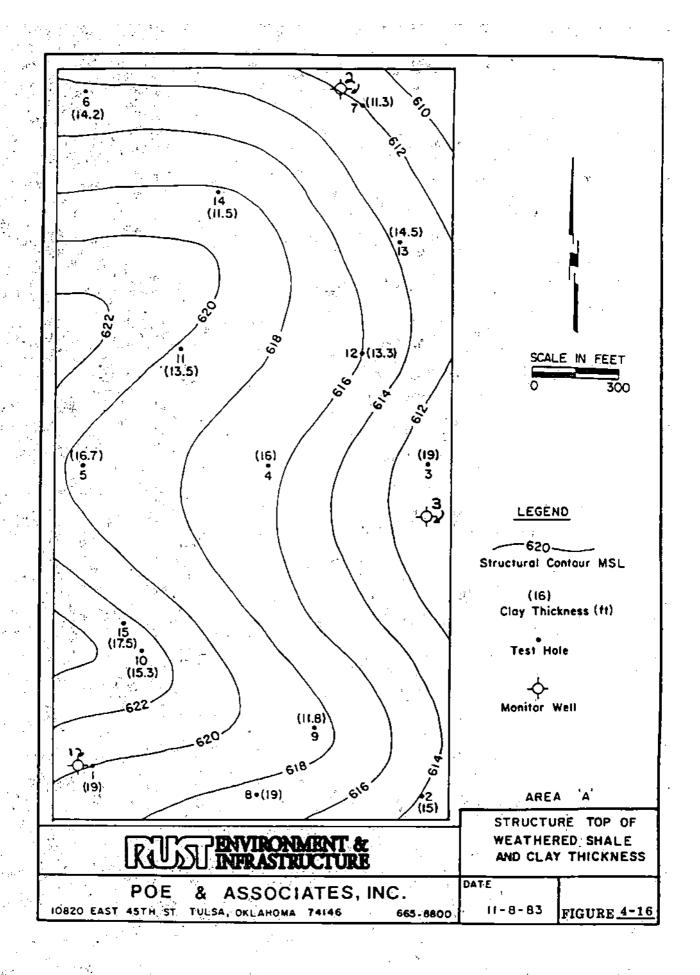


TABLE 4-2

GEOTECHNICAL AND HYDROGEOLOGIC PROPERTIES

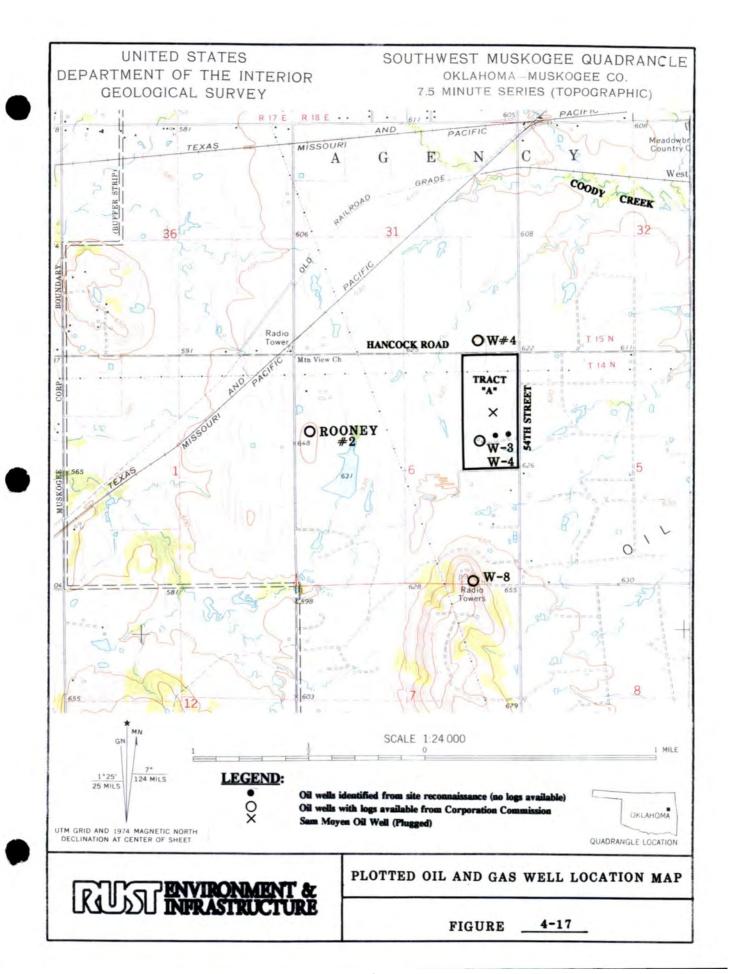
							<u> </u>	<u> </u>	
	SOIL SAMPLE	PERMEABILITY	ATTERBERG S			MAXIMUM DRY	%		
LOCATION			щ	PL	PI	DENSITY, pcf	MOISTURE	METHOD	
Test Pit 1	Subsoil Clay (5.0 ft)	3.0 x 10 ⁻⁷ cm/sec	40	19	21	••		Field ASTM Std 746	
Test Pit 1	Subsoil Clay (10.0 ft)	2.9 x 10 ⁻⁶ cm/sec	42	20	22			Field AStM Std 746	
Test Pit 2	Subsoil Clay (10.0 ft)	1.4 x 10 ⁻⁶ cm/sec	42	20	22			Field ASTM Std 746	
Test Hole 10	Subsoil Clay (8.0 ft)	9.7 x 10 ⁻⁷ cm/sec		•		108.7	23.6	Lab (in situ) Lambe (1951), Chap 6, Variable Head Permeability	
Test Hole 11	Subsoil Clay (10.0 ft)	3.2 x 10 ⁻⁸ cm/sec				107.7	23.9	Lab (in situ) Lambe (1951), Chap 6, Variable Head Permeability	
LOCATION	LOCATION HYDRAULIC CONDUCTIVITY					HYDRAULIC GRADIE	METHOD		
MW02 (Tract A) 8.56 x 10 ⁻⁴ cm/sec			0.007				Rising Head Pump Test		
MW03 (Tract A) 1.16 x 10 ⁻⁴ cm/sec					0.005	Rising Head Pump Test			
MW04 (Tract C) 6.5 x 10 ⁻⁴ cm/sec				0.01				Rising Head Pump Test	

The monitoring wells are screened generally within the weathered shale zone. Rising head pump tests indicate a range of hydraulic conductivities from 1.16 x 10⁻⁴ cm/sec (MW03) to 8.56 x 10⁻⁴ cm/sec (MW02). The fact that well MW02 has a greater hydraulic conductivity than well MW03 may be attributed to there being no seal between the filter pack and the infilled cuttings in the well. Well MW02 may be monitoring the full drilled zone below the surface grout. Hydraulic gradients varied around the monitoring wells from 0.01 near MW04 (in the southern part of Tract C) down to 0.005 near MW03.

The soil has an average liquid limit of 42, a plastic limit of 20, and a plasticity index of 22. The current liner construction testing for Cell 2A has a liquid limit of 47, a plastic limit of 17, and a plasticity index of 30. Based on the Unified Soil Classification, the residual soils are classified as CL, inorganic clay of low-medium plasticity. The cation exchange capacity was 14 meg/100-year soil, indicating that most of the clay minerals are of the single lattice kaolinitic type, with little expansion capability.

4.6 Petroleum Geology

As documented in the OGS Bulletin 40-FF, the site is located in the Muskogee Oil Field. The drilling of the field first began in the early 1900s and continued through the 1960s. As a result of the exploratory drilling effort, many hundreds of wells have been drilled within the limits of this field. According to the Dunn & Bradstreet Corporation, Petroleum Information Records, there have been a total of 30 oil wells drilled on Tracts A, B, C, and D. Research of the archives of the Corporation Commission, Oil and Gas Conservation Department in Oklahoma City reveals only five registered wells in the area (Figure 4-17). Appendix B includes a map of the oil wells drilled in the area as documented by Dunn & Bradstreet Corporation, and well summaries for four wells.



During a reconnaissance of the site, only five wells were accounted for on Tract A. Three wells on the tract have not yet been abandoned but will be plugged in accordance with the requirements of the Corporation Commission. In the center of Tract A, an extensive seep of water enriched with brine was encountered by facility personnel. At the location, small amounts of gas and brine are continuously bubbling out at the ground surface. The source of this brine has been determined to be coming from the Sam Moyen, No. 11 Robert Wrigley oil well. The brine is reportedly injection water originally used in water flooding operations for oil production. The well was drilled to a depth of 1,263 feet and plugged in March, 1935. Plugging records filed with the Oklahoma Corporation Commission indicated that all casing (1,193 feet of 6-5/8 inch and 12.5 feet of ten inch) was removed and the hole was filled with mud laden fluid to the surface (Poe and Associates, 1984).

Review of the available well summaries yielded general deep stratigraphic information surrounding the site. Several relatively shallow sand units were encountered in the wells. The stratigraphic depths and elevations are summarized in Table 4-3. Well W-3, located in Tract A, encountered two sand units of interest at elevations 581-577 feet msl and 522-485 feet msl. The shallowest sand corresponds to a depth range of 49 to 53 feet. The Rooney No. 2 well, drilled to the west on Tract B, also encounters a shallow sand with a depth range of 45 to 65 feet. This sand may be continuous between the wells and will be a target in the hydrogeological study. The other target sands, encountered in well W-3, corresponds to elevation range 522 feet msl to 485 feet msl. Depth to the top of the sand is 108 feet. Specifics of the target zones in the hydrogeological study are discussed further in Section 6.

TABLE 4-3 STRATIGRAPHIC DEPTHS OF SHALLOW SAND UNITS

	WELL NUMBER								
	Rooney #2	W-8	W-3	W-4 (Sect 6)	W-4 (Sect 31)	Unmarked⁴			
Approximate Ground Elevation, feet msl 652		799.5	630	630	630	700			
Type of Well	O/G¹	O/G	O/G	O/G	O/G	WW²			
Elevation Ranges of	607 - 587	799 - 780	581 - 577	No					
Shallow Sand Units	415 - 402	728 - 722	522 - 485	logging of shallow	348 - 345	697 - 658			
		528-505	111212221421112112222222222222222222222	sand units					
Depths from Ground		0.5 - 19.5	49 - 53	NA³	282 - 285	3 - 42			
Surface of Shallow Sand Units	45 - 65	71.5 - 77.5							
	215 - 228	271.5 - 294.5	108-145						

Notes:

- O/G indicates oil and gas well
 WW indicates water well
 Not applicable
 Beyond map range of Figure 4-17, direction and distance is approximately two miles to the southwest of Tract D.

Section 5

5.0 HYDROLOGY

The following section describes the hydrology, hydrogeology and ground-water chemistry.

The following topics are addressed: regional hydrology, site-specific hydrology, the 100-year flood plain, ground-water resources, well inventory and ground-water quality.

5.1 Regional Hydrology

Within East-Central Oklahoma, man-made lakes and reservoirs constitute a major part of the area's water resources and are the prime source of water for municipal and industrial use. Development of storage is necessary to provide dependable water supplies because of the limited availability of ground water in most of the area and the lack of sustained base flow in the smaller streams.

5.2 Site-Specific Surface Water

The major surface-water features near the site are the Arkansas River to the north, Coody Creek to the northeast, and Pecan Creek to the northwest. Both Coody Creek and Pecan Creek are perennial tributaries of the Arkansas River and ultimately discharge into the Arkansas River, as shown on Figure 4-17. Several smaller tributaries branch off of Coody Creek with one tributary located one-half mile directly east of Tract A.

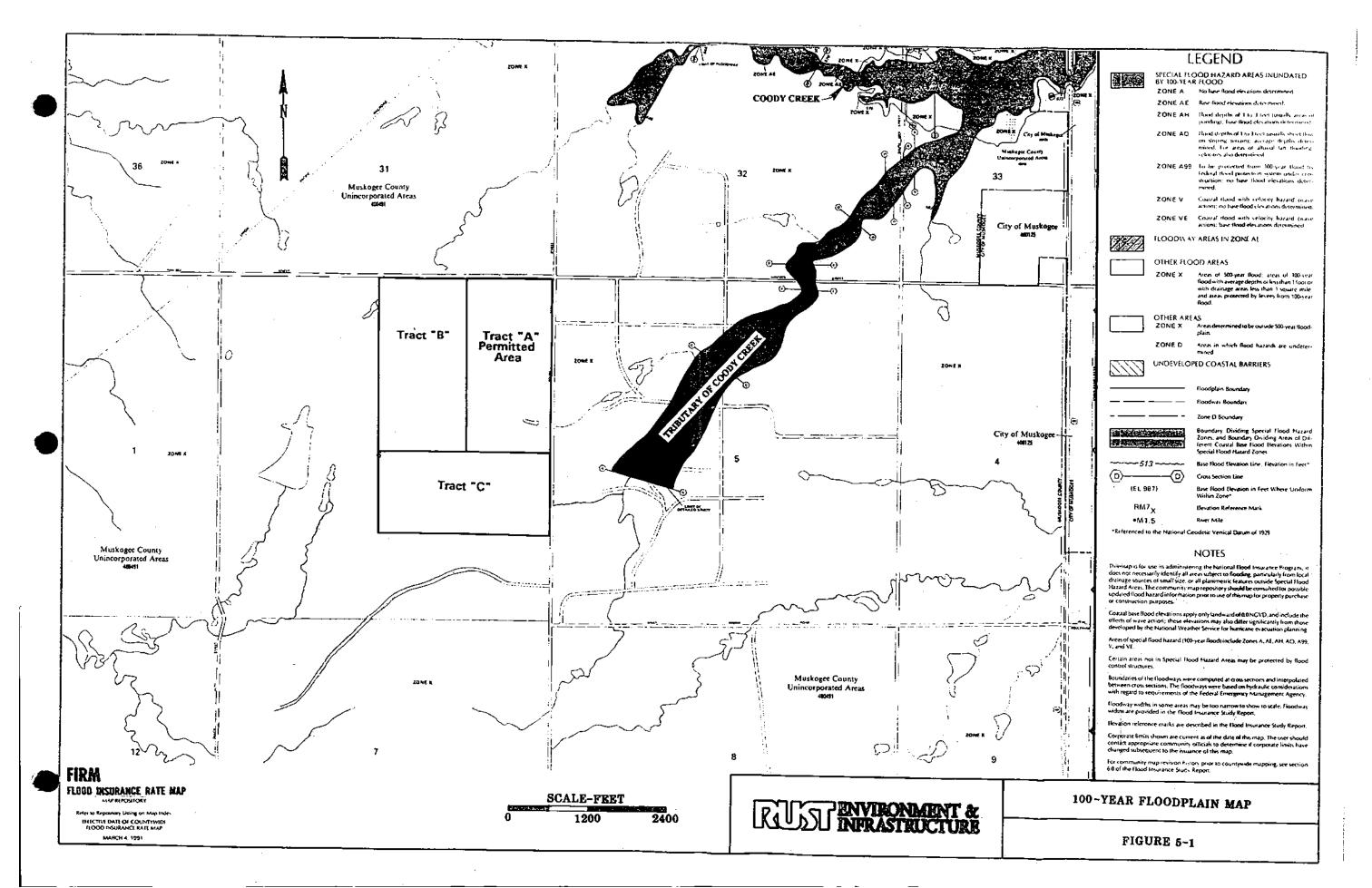
There are no ponds or manmade lakes located within the boundaries of Tract A. The nearest surface water to Tract A is to the west on Tract D with one 10-acrelake and two small ponds. The water from the ponds and lake are used mainly for stock watering. Data compiled by the Oklahoma Water Resources Board indicate that about 18,000 farm ponds in Oklahoma provide water for stock.

Drainageways run down the east side of the property line along 54th Street. The area, as shown previously on the topographic map, gently slopes toward the north-northeast on Tract A. As a result, storm-water runoff from south of the facility generally runs north by Tract B and Tract A and ultimately ends up in Coody Creek. The site reconnaissance of the facility revealed approximately five shallow trenches, oriented in a north-south direction to an approximate depth of two feet. These trenches were dug by WMO to promote drainage of the land and are located a minimum of 100 feet from landfilling activities. The trenches are recent and do not appear on the aerial photographs.

There are a few intermittent streams, or losing streams, which exist around the area, though none of these streams occur on Tract A. The intermittent streams generally connect the small ponds and lakes in the area during heavy rainfall events. The intermittent streams to the north of the site act as small tributaries of Coody Creek, a perennial creek, and contain running water during heavy storm events. The streams are considered losing streams which may be feeding fractures near the Muskogee Fault system.

5.3 <u>100-Year Flood Plain</u>

According to Federal Emergency Management Agency, Flood Insurance Rate Maps (FIRM), Muskogee Community Landfill is not located within the 100-year floodplain limit of any adjacent stream system. Figure 5-1 shows the 100-year floodplain for the area. Pecan Creek is located approximately three miles northwest of Muskogee Community Landfill and Coody Creek is located approximately 4.5 miles to the northeast. A tributary of Coody Creek is located one-half mile east of Tract A making the 100-year flood zone approximately 500 feet from the eastern property boundary. These creeks are the main tributaries of the Arkansas River that have any probability of flooding. The 100-year floodplain of the Arkansas River is located approximately 5.5 miles north of Muskogee Community Landfill. The location of the 100-year floodplain and the contour



intervals are based on USGS data delineated on the FIRM map. As shown on the FIRM, the 100-year floodplain elevation of the Coody Creek tributary is approximately 623 feet msl.

5.4 Ground-Water Resources

The ground-water resources vary throughout the region. Residents living adjacent to the Arkansas River obtain their drinking water directly from the river or from the unconsolidated alluvium adjacent to the river. Ground water used for human consumption is treated prior to use. Localized areas of Muskogee County once obtained their ground water from coal seams, though the water is of very poor quality. The following sections describe the ground-water resources on a regional and site-specific basis.

5.4.1 Regional Resources and Recharge Areas

Regionally, the main occurrence of ground water is in the alluvial and terrace deposits along the Arkansas River and its main tributaries. The deposits consist mainly of unconsolidated sand, silt, clay and gravel laid down by rivers and streams that flow generally to the east and southeast across the state.

The alluvial and terrace deposits typically are 10 to 50 feet thick, although they can reach 100 feet in thickness along major rivers such as the Arkansas River. The alluvial and terrace deposits commonly consist of sand and gravel layers that are highly porous and permeable which typically contain important ground-water resources. The quantity of water that can be produced from wells completed in alluvium or terrace deposits is highly variable, but many wells produce from 10 to 500 gallons per minute (gpm). Some exceptional wells produce several thousand gpm.

Well yield and water quality are controlled mainly by the type of rock in which a well is completed. In general, alluvium is the most favorable type of geologic unit for large well yields, followed by terrace deposits in local areas and, in order of decreasing favorability, weathered chert, limestone, sandstone, and siltstone, with shale the least favorable.

Ground water in this region is derived from precipitation falling directly upon the area and is controlled by fractures or sand beds exposed at the surface. Approximately 5 to 25 percent of the rainfall in the area enters the soil and slowly percolates downward to become ground water. The important factors controlling the amount of water entering the ground-water reservoir are the thickness and permeability of the soil and the permeability and storage capacity of the underlying rocks. In those parts of the area underlain by shale, the overburden soils are generally thin and poorly permeable so they cannot recharge rapidly; therefore, rainfall runs off quickly (OGS, 1988). In areas where there is an occurrence of large subsurface fractures, ground water tends to accumulate within those fractures. Water supplies for residences can sometimes be obtained from these fractures if sufficient quantities are available. Most wells in the shale, siltstone, and sandstone yield only a fraction of a gallon per minute (gpm). A few wells are reported to yield as much as 20 gpm. The other principal source of ground water in alluvial and terrace deposits is upward or lateral flow from underlying bedrock formations.

Hydrologic maps generated by the OGS indicate the facility is located approximately four miles south of the edge of the Arkansas River alluvium, two miles southwest of the Coody Creek alluvium, and two miles southeast of the Pecan Creek alluvium. Prior to being connected to a municipal water supply, the neighborhood located north and northwest of the site obtained their water from wells set in the local coal

seams of the Rowe coal, though this water is highly mineralized and of poor quality.

5.4.2 Site-Specific Resources

The site is underlain mainly by the Savanna Formation consisting of shale, sandstone and coal. The Savanna Formation yields limited amounts of poor-quality water and is located in an area which is considered least favorable for ground-water supplies.

The uppermost water-bearing unit currently being monitored is the weathered shales of the Savanna Formation. The overlying clay, with low hydraulic conductivity, acts as a confining unit. During their drilling operations, the uppermost water-bearing unit was identified near the middle of the highly weathered shale zone at a depth of approximately 28 feet below land surface (bls). Recent water-level readings taken from the wells installed by RUST E&I in November, 1992, indicated that the ground-water head is nine to 13 feet bls, or at an elevation ranging from 623.99 to 630.51 feet msl. During the installation of the three ground-water monitoring wells, RUST E&I encountered ground water in the borehole at the approximate elevation of 612 feet msl for all three wells. Table 5-1 lists the most recent water-level readings of all monitoring wells installed on the site.

Rising head pump tests were conducted by Poe and Associates on the monitoring wells, MW02 and MW03, installed during the 1984 investigation. From the tests, aquifer parameters of the weathered shale indicate a mean hydraulic conductivity of 4.86×10^{-4} cm/sec, or 8.56×10^{-4} cm/sec for MW02 and 1.16×10^{-4} cm/sec for MW03. The hydraulic

TABLE 5-1
WATER-LEVEL MEASUREMENTS

APRIL, 1993

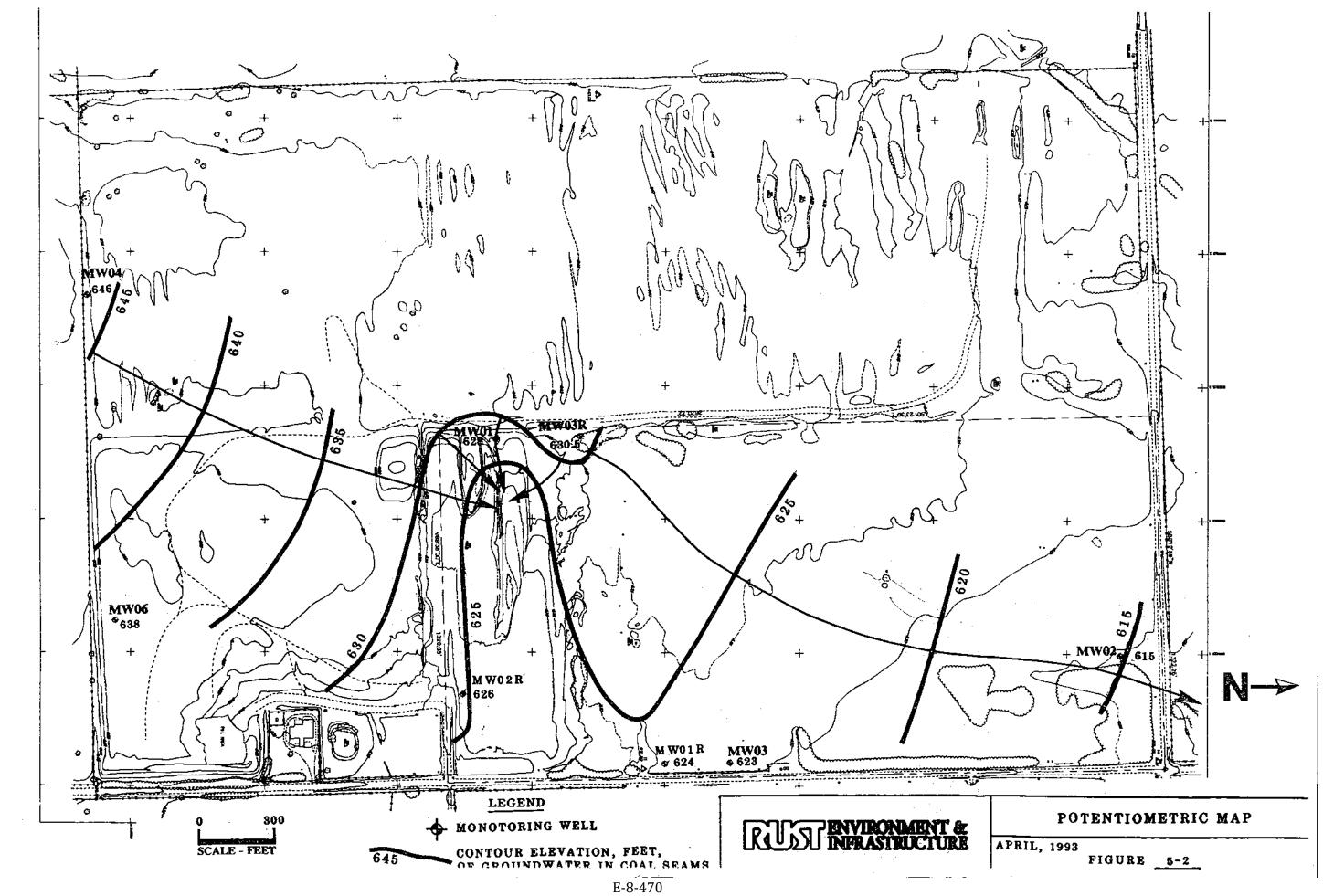
WELL NO.	ПМЕ	CASING ELEVATION* (msl) (A)	DEPTH TO WATER (ft) (B)	GROUND-WATER ELEVATION (msl) (A-B)
MW01R	2:40 pm	633.01	9.02	623.99
MW02R	3:15 pm	635.24	8.90	626.34
MW03R	2:05 pm	644.16	13.65	630.51
MW01	2:20 pm	642.94	14.70	628.24
MW02	2:55 pm	627.52 ^s	12.20	615.32
WW03	2:45 pm	634,68 ^s	11.30	623.38
MW04	3:40 pm	654.87 ^{\$}	8.50	646.37
MW06	2:25 pm	663.84	25,55	638.29

- Top of PVC casing unless otherwise noted.
- * Top of steel-protective casing

msl Mean Sea Level

ft Feet

gradient of the static water table for the Poe and Associates' investigation was calculated to be between 0.007 and 0.005. The direction of flow was found to be in a northeasterly direction across the site before excavation of Tract A had started (Poe and Associates, 1984). Recent water-level measurements of April, 1993, indicate the ground-water gradient was influenced by cell excavations previously done by the City of Muskogee. The City had excavated the western part of Cell 1 and encountered ground water. This area was left open until recently when WMO backfilled the area and started liner construction. Ground-water flow was influenced directly in the area of Cell 1 by excavation by the City of Muskogee causing flow to be diverted into the cell. Figure 5-2 represents the potentiometric surface



for the April, 1993 water-level measurement event. At the time of the Poe and Associates' investigation, the landfill had not been in operation.

Theoretically, recharge of the ground water at the site is from the Bluejacket Sandstone member of the Boggy Formation located directly to the south of the facility. The Bluejacket Sandstone crops out in the form of resistant knobs of upland sandstone. This sandstone unit is thought to be more permeable than the residual clays which are present on the site. However, hydraulic conductivity testing of this sandstone unit has not been performed to substantiate this theory.

5.5 Well Inventory

Monitoring wells were previously installed by Stewart-White and Associates (MW01 and MW02), Poe and Associates, Inc. (MW03, MW04, and MW05), and RUST E&I (MW01R, MW02R, and MW03R). Well MW06 was formerly a water-supply well later designated a monitoring well by the City of Muskogee. Of these wells, MW04 and MW06 are on Tract C, the remaining wells are all on Tract A. Monitoring well MW05 no longer exists. The construction details and logs of monitoring wells installed by Stewart-White and Associates and Poe and Associates and RUST E&I are provided in Appendix C. Well completion details and logs for MW05 and MW06 are not available.

Monitoring wells MW01, MW02, MW03 and MW04 are not constructed to WMO and ASTM standards. Since no logs are available to review, it is unknown whether the construction of MW06 meet WMO standards. Wells MW01 and MW02 do not have a bentonite seal above the filter pack; the annulus is filled to three feet bls with drill cuttings then grouted to surface. MW03 does have a sufficient bentonite seal above the filter pack, but the remaining annulus above the seal is filled with drilling cuttings to three feet bls. The remaining annulus is grouted to surface. The borehole of MW04 was overdrilled by seven feet from where the bottom of the

screen is set. The bottom six and one-half feet of the borehole is backfilled with drill cuttings with a one-half-foot bentonite seal separating the well from the cuttings. Like the other wells, drill cuttings were backfilled in the annulus to approximately two feet bis. A concrete apron was then grouted to surface.

A water-well survey yielded minimal information for the study area. A water well search was performed for a two-mile radius around the facility; providing only one water-well log. The water well is a private supply well located approximately two miles southwest of Tract D. There were no well logs on file with the Oklahoma Water Resources Board for the neighborhood located to the northwest. This, however, does not mean that there are no wells present. The well logs were not required to be filed with the state until 1988. To verify the existence of wells prior to 1988 would require canvasing the area. Individual residences will need to be contacted.

5.6 Ground-Water Quality

The ground water is sampled in different areas of the state by the USGS, U.S. Army Corps of Engineers, and the U.S. Public Health Service to determine the availability of drinking water throughout the state. These tests are performed on a regional basis to determine if the ground water is up to U.S. Drinking Water Standards as outlined by the Environmental Protection Agency and the Oklahoma Water Resources Board. Ground-water quality testing is also performed on samples taken quarterly from the monitoring wells at the facility. The following sections describe the regional and site-specific ground-water quality.

5.6.1 Regional Ground-Water Quality

The state and federal agencies specifically sample for sulfate, chloride, nitrate, and Total Dissolved Solids (TDS) to help classify the type of ground water present. Generally, in western Muskogee County the ground water is highly mineralized due to the number of oil fields. Such contamination might be caused by seepage from waste pits, defective well casing, and water-flooding operations of the oil fields. Without detailed chemical analyses, available contamination caused by oil-well brine is difficult to distinguish from that occurring naturally.

The chemical quality of the ground water is classified in the study area by the Oklahoma Geological Society as generally poor to fair. Of the water samples tested throughout the state, 57 percent contained more than 250 parts per million (ppm) sulfate, 10 percent contained more than 250 ppm chloride, and 53 percent contained more than 500 ppm TDS. Water from sandstone is least mineralized, whereas that from shale, particularly shale that contains coal beds, is highly mineralized. Table 5-2 summarizes the water-quality data obtained by the USGS for Muskogee County. Table 5-3 summarizes the water-quality data for the samples analyzed specifically in the City of Muskogee (Oklahoma Geological Society, 1988).

All ground water in Muskogee County is classified, according to the state water laws, as Class IIB, general-use ground water including all minor ground-water basins. Class II ground waters are capable of being used as drinking water supply with no treatment or with conventional treatment methods, and also have the potential to be used for other beneficial uses. General use ground waters have an average concentration of TDS of less than 3,000 milligrams per liter (ppm) as determined by the Oklahoma Water Resources Board ground-water quality network (OWRB 787:45-7-3(b)(1)(A)(2)).

REGIONAL GROUND-WATER QUALITY FOR MUSKOGEE COUNTY

LOC	CATION OF WE	LL	Depth of Well,	Date of	Specific Conductance	pН	Temperature	Sulfate Dissolved
Section	Township	Range	Total (ft)	Sample	(umhos)	(units)	(°C)	(mg/L as SO ₄)
3	14N	15 E	16	7/17/81	1230	6.1	18.0	200
, 14	14N	15E	9	7/16/81	173	7.0	20.0	15
15	14N	15E	30	7/16/81	1540	7.3	17.0	99
15	14N	15E	15	7/16/81	801	8.0	17.0	28
17	14N	15 E	14	7/16/81	1110	7.3	18,5	110
22	14N	15 E	74	7/15/81	1500	7.8	19.0	3.7
22	14N	15 E	17	7/16/81	894	7.4	18.5	3.3
17	11N	20E	151	8/6/81	4426	7.7	20,0	. 12
18	11N	20E	46	8/6/81	% <u>-</u>	7.6	19.0	73
19	11N	20E	100	8/5/81	2729	. 7.8	22.0	8.6
20	*1,1N ₆	20E	32	8/5/81	916	√ 7.0	19.0	59
. 29	11N	20E .	100	8/6/81	2122	7.0	20.0	[*] 320
25	11N	21E	155	8/6/81	922	8,4	21.0	15
25	11N	21E	140	8/7/81	922	6.9	21.6	92
29	1.1N `	22E	69	8/6/81	1698	7.1	16.5	210

mg/Ļ °C

milligrams per liter.

degrees Colcius

Fevee, Date M. Ground-Water Quality Data for Oktahoma, USGS Open-File Report 83-686. Oktahoma City, Oktahoma, 1983.

TABLE 5-3
GROUND-WATER QUALITY FOR CITY OF MUSKOGEE, OKLAHOMA
SUMMARY OF AVAILABLE CHEMICAL DATA

PARAMETER		CONCENTRATION (ppm)
Hardness		67
Sulfate		6.0
<u>Chloride</u>		6.3
Nitrate	· \$2	ND
Total Dissolved Solids		225

Oklahoma Geological Society. <u>Recognaissance of the Water Resources of the Fort Smith Quadrangle, East Central Oklahoma</u>: Hydrologic Atlas, Sheet 3: Chamical Quality of Ground Water, 1988.

mg/L -

milligrams per liter Parts per Million

ppm - Parts per Milli ND - Not Detected

Ground-water quality data of the water within the Rowe Coal Seam was not available for review. The only information available regarding the ground-water quality is that it is highly mineralized and of "poor quality".

5.6.2 Site-Specific Ground-Water Quality

All the monitoring wells are sampled on a quarterly basis. Appendix D includes the water quality report for April 27, 1993, which is a typical example of the analytical results for the landfill. Also included in Appendix D are the analytical results of the testing performed by Poe and Associates in 1984.

Background or "upgradient" water quality for Tract A has yet to be defined. Poe and Associates inappropriately defined MW01 as the upgradient well and MW02 as a downgradient well without sufficient hydrological data available. As a result, assumptions were made as to

the sources of "contamination" in the monitoring wells. The sources actually remain to be established.

The brine-enriched oil well was sampled twice in 1984 by Poe and Associates and had chloride concentrations of 45,450 milligrams per liter (mg/l) and 24,420 mg/l. MW01. contained a 2,449 mg/l concentration of TDS and a 204 mg/l concentration of chloride. MW02 had concentrations of 9,487 mg/l and chloride 3,693 mg/l for TDS and chloride, respectively. The concentrations of chlorides and TDS are higher than the concentrations of the newly installed wells by RUST E&I.

Due to previous water-flooding operations of brine water within Muskogee Oil Field, the concentrations of TDS and chlorides are expected to be higher around the facility than the non-oil field areas of the county. However, without establishing background water quality, it is inappropriate to define whether the concentration of any parameter is high or low as compared to background.

Poe and Associates sampled the ground water in all of their test holes for pH, specific conductivity, temperature, and chloride. The purpose of the sampling was to define the magnitude of brine contamination of Tract A. The sampling techniques used were not described, so the data cannot be validated. The data is included in Appendix D with the other water quality data. A concentration of 20,000 mg/l of chloride was detected for Test Hole No. 4, which is closest to the brine-enriched well. The same test hole had detected levels of 5.1 for pH and 10,000 mg/l for specific conductance.

Section 6

6:0 PRELIMINARY HYDROGEOLOGICAL CONCEPTUAL MODEL

One of the primary focuses of the Phase I study is to develop the preliminary conceptual model. Information obtained from the site reconnaissance, along with data secured during the literature search, has provided the basis for the development of the conceptual model at Muskogee Community Landfill. This model will be used to develop the field investigation. The conceptual model will be tested and constantly evaluated as new data is obtained. The simple conceptual model is presented in Figure 6-1. The target monitoring zones are summarized in Table 6-1, and Table 6-2 presents the actual zones screened by the current monitoring wells. The objective for the conceptual model is to evaluate these zones and to determine the following hydrogeologic parameters:

- Hydraulic conductivity,
- Depth to ground water,
- Potentiometric surface,
- Hydraulic gradients, and
- Vertical components of flow.

TABLE 6-1
GENERALIZED TARGET MONITORING ZONES FOR CONCEPTUAL MODEL

ZONE	AVERAGE ELEVATION RANGES (msl)	AVERAGE THICKNESS (ft)	LITHOLOGY
A	630 - 617	13	Clay
В	617 - 600	17	Weathered shales and associated interbedded coals, sands, sandstone lenses limestones
Ç	596 - 580	1	Rowe Coal
D	581 - 577 522 - 485	4 - 37	Sands

Assumptions: 1) Clay thickness based from surface elevations.

²⁾ Elevation ranges based on average depths to lithologic surfaces.

B) Data used is Foe & Associates test holes 1-15 (Zone A,B,C); oil wells (Zone D)

⁴⁾ Zone C - Elevation ranges represent top and base of zone in which Rowe Coal was encountered.

⁵⁾ Zone D - Specific sands encountered from oil well (W-3) on Tract A.

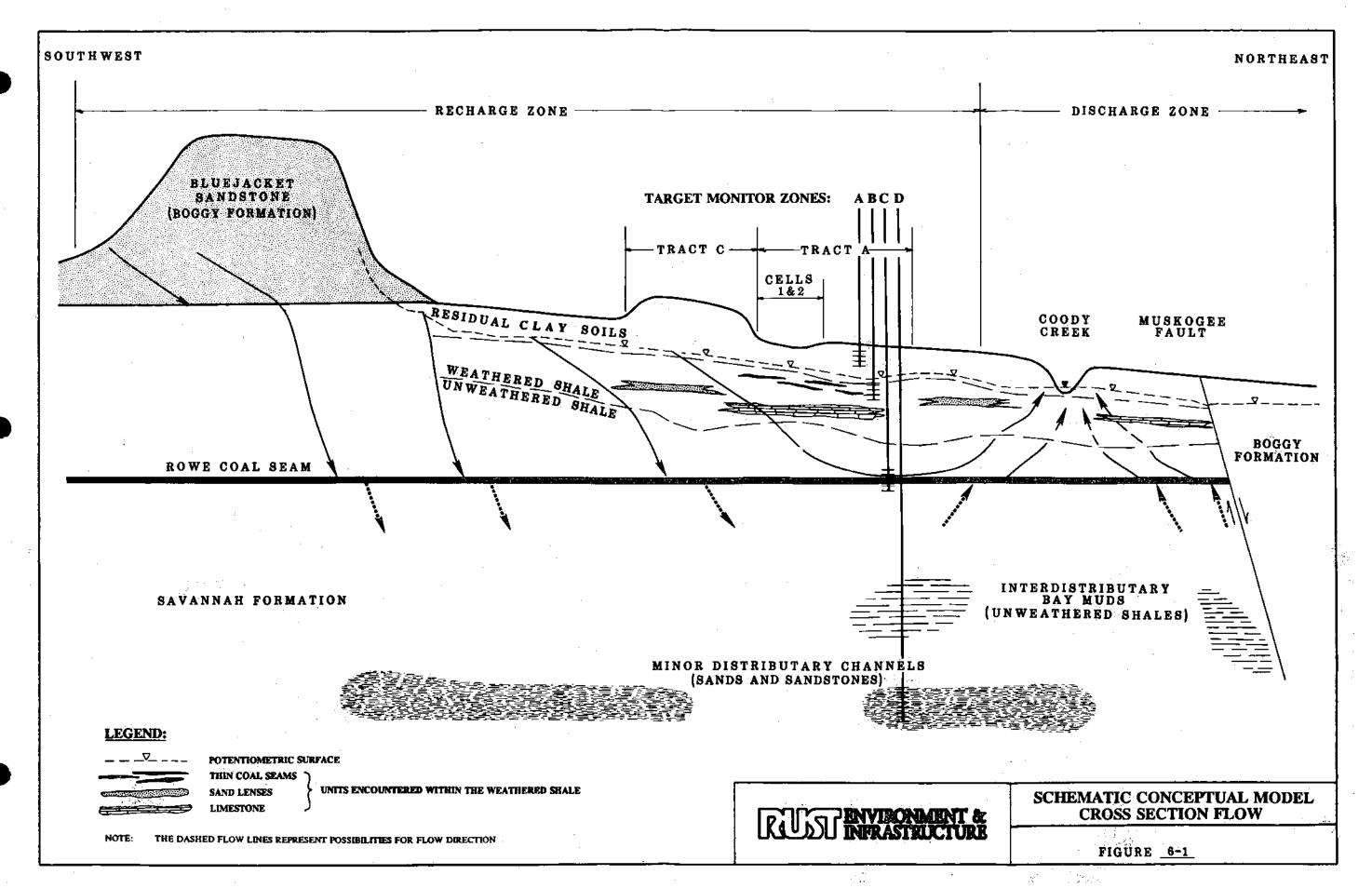


TABLE 6-2

ZONES SCREENED BY CURRENT MONITORING WELLS

MONITORING WELLS	FILTER PACK INTERVAL ELEVATIONS (msl)	FILTER PACK INTERVAL DEPTHS (ft bis)	ZONE INTERVALS
MW01R	615.7 - 603.7	14.5 - 26.5	A, B
MW02R	617.2 - 604.2	15 - 28	A, B
MW03R	615.4 - 602.5	26.1 - 39	В
MW01	621 - 614	18 - 25	A, B
MW02	: 600 - 594	23.5 - 29.5	A, B
MW03	613 - 603	17 - 27	A, B
MW04	635 - 615	10 - 30	В
MW05	, Doe	es not exist. No log availa	ble.
MW06	Sec. 1	No log available.	

Notes:

Zones based on well lithology descriptions and weathered shale structure map.

msi Mean Sea Level

ft bis | Feet Below Land Surface

The following comprises the elements of the model.

The geologic setting consists of Pennsylvanian sediments of the Savannah and Boggy Formations deposited during transgressive sea and regressive sea environments. These environments were cyclic in nature. Marine shales were deposited during transgressive episodes. As the seas receded, deltaic sediments were deposited atop the marine shales. Sediments, such as distributary channel sands and interdistributary muds and coal swamps, represent fluvial environments and were deposited atop the deltaic sediments. This cycle is repeated multiple times within the Savannah and Boggy Formations with coal seams culminating each cycle.

- The major lithologies below the facility include residual soils, weathered shale, unweathered shale, and coal seams. Limestones and sands are found sporadically interbedded in the shales. Well log summaries for the oil wells indicate sand units at depth. Table 6-3 presents elevation data for major lithologies found in the borings. Four target monitoring zones, names A, B, C, and D were assigned based in part upon lithologies encountered.
- Zone A is composed of the residual clay soils of the Savannah Formation. Previous data, as summarized in Table 4.2, indicate field permeabilities of 3.0 x 10⁻⁷ cm/sec and 1.4 x 10⁻⁶ cm /sec. Laboratory permeabilities were 9.7 x 10⁻⁹ cm/sec and 3.2 x 10⁻⁸ cm/sec. Zone A will be monitored to determine if the clay soils are saturated.
 - Zone B is represented by the weathered shale of the Savannah Formation. Zone B consists of weathered shale, sands and sandstone lenses, limestone, and coal seams of up to 12 inches thick. Results from rising-head pumping tests on monitoring wells MW02 and MW03 indicate a mean hydraulic conductivity of 4.86 x 10⁻⁴ cm/sec. MW04 (Tract C) had a hydraulic conductivity of 6.5 x 10⁻⁴ cm/sec. These wells, along with the remaining monitoring wells in Tract A, are fully screened or partially screened in Zone B, as shown in Table 6-12. Overlap occurs by having the screen and/or filter pack extend either into the overlying clay, or underlying unweathered shale. Poe and Associates' data indicate hydraulic gradients range from 0.005 to 0.007. No data is available to determine vertical flow velocities and gradients. Zone B, at this time, is considered the uppermost saturated zone and will be monitored as such.
 - Zone C is represented by the various coal seams and stringers comprising the Rowe Coal within the unweathered shale of the Savannah Formation. The coal seams readily yielded water when encountered during drilling operations. Although the water was highly mineralized and of poor quality, many residences to the northwest of Muskogee Community Landfill have used the coal seams as a source of drinking water prior to being converted to municipal water supply. The

TABLE 6-3

CURRENT BOREHOLE LITHOLOGIC/ELEVATION DATA

BORING/WELL	SURFACE ELEVATION (msl) (Top of Clay)	ELEVATION - TOP WEATHERED SHALE (msl)	ELEVATIONTOP UNWEATHERED SHALE (msl)	ELEVATION - TOP COAL (msl)	ELEVATION - SAND INTERVAL (msl)
TEST HOLE					
1 1	639	620	612	604.5	
2	629	614	602	612	
.3	629.5	610.5	596		_
. 4	632.5	616.5	597		· <u>-</u>
5	636	619.3	601.6		÷
6	628.5	614.3	594	· · ;	
+ e S - 7	. ^{>>} 623.5	612.2	594.2	587	<u>-</u>
j 8 j	636	617		611	
9	630	618.2	•	618.2	
10	639	623.7			
11	633.5	620	-		
12	629.5	616.2		·	_^
13	627.5	613			_
14	629.5	618		596; 581	
15	640	622.5	-		
16	631	·	_	-	-

BORING/WELL	SURFACE ELEVATION (msl) (Top of Clay)	ELEVATION - TOP WEATHERED SHALE (msl)	ELEVATION - TOP UNWEATHERED SHALE (msl)	ELEVATION - TOP COAL (msl)	ELEVATION SAND INTERVAL (msl)
- 17	6401	629	607		
22	.630¹	622			
23					
MONITOR WELL				**************************************	
MW01R	627.7		602.7		-
MW02R	632.2	<u>-</u>	604.2		
MW03R	641.5	·	606.5		<u>.</u>
MW01	6391	-		- 5 <u></u>	4
MW02	623.5 ¹	- - \			
MW03	630¹	611	<u></u>	-	- -
MW04	6451	638	632		
OIL WELL			\$ \$		
wз	- 630¹	**	•	. 	581 - 577
W-3	630¹		_		522 - 485
W-4 (Sect.6)	630¹			·	
W-4 (Sect 31)	630¹	·	<u> </u>		.348 - 335
W-8	799,5		· 	 `	528 - 505
Rooney #2	652				607 - 587

¹ Elevations approximate on these wells/borings.

⁻ Not Applicable

coal unit which subcrops beneath the unweathered shale may be continuous across the site. Zone C will be monitored as the second water-bearing zone.

Zone D is represented by deep sands encountered by oil wells drilled on and around Tract A. There are two sand units of interest for this model at depths of approximately 50 and 100 feet bls. These sands are targeted to determine if they are saturated and possibly continuous across Tract A.

් 6.

- Ground water was encountered at elevations 581 feet msl to 612 feet msl. Ground-water flow for the currently monitored zone (primarily Zone B) is to the north-northwest direction. Ground water in Zone B generally follows topography as well as the bearing of coal seams. Ground-water gradients are apparently influenced by previous excavations in Cell 2A according to the latest data of April, 1993. The excavated cell has been recently backfilled with clay material to above ground-water level to enable WMO to start liner construction.
- The Blue Jacket Sandstone, located within the Boggy Formation to the south, is considered a water-bearing unit and is also considered a recharge zone for the ground water within the coal seams and the weathered shale.
- 9. The City of Muskogee landfills, Tracts B and C, potentially recharge the weathered shale and coal seams, and could impact ground-water monitoring at the Muskogee Community Landfill.
- 10. Discharge of the ground water in the weathered shale is in Coody Creek. Coody Creek is a gaining stream, flowing year-round. The intermittent streams are considered drainage features only, and therefore do not significantly contribute to the recharge/discharge system for the coal seams and weathered shale.
- 11. For geotechnical purposes, the deepest proposed excavation of Muskogee

 Community Landfill is to the top of the weathered shale.

Section 7

7.0 FIELD EXPLORATION PROGRAM

The field exploration program described herein is designed to fill the data gaps necessary to establish a hydrogeologic conceptual model for WMO based on sound engineering and geologic practices, and to meet OSDH requirements. Based on OAC 310:360-9-3(3)(C), a minimum of 19 soil borings are required per OSDH site characterization standards. RUST E&I proposes a total of 25 boreholes to be drilled at the designated locations as shown on Figure 7-1. Of the 25 boreholes, 15 borings will be drilled strictly for geotechnical testing, six borings for piezometers and geotechnical testing and four borings for piezometers.

7.1 Soil/Rock Borings

The purposes of the field exploration program are to explore the subsurface conditions of Tract A; determine the thickness of any U.S. Drinking Water aquifer underlying the facility, if any; and to determine the uppermost saturated zone to be monitored. In addition, soil and rock samples will be taken during drilling and tested for physical and engineering properties for landfill design purposes. The information obtained will be used to prepare a final report with recommendations of monitoring well locations and prepare a site-specific ground-water monitoring plan. The program is prepared on the assumption that the deepest proposed excavation will be the top of the weathered shale, not taking the depth to ground water into account. Figure 7-1 shows the locations of all geotechnical and plezometric borings to be performed in the exploration program and the buffer zone around the landfill. This buffer zone will be 50-feet wide along the southern and western property boundaries, and 75-feet wide along the northern and eastern boundaries. The locations of the borings may be altered in the field due to accessibility to each location.



Formerly SEC Donohue

September 1, 1993

RUST Environment & Infrastructure Inc. 100 Glenborough, Suite 300 Houston, TX 77067 Tel. (713) 875-0004 • FAX (713) 874-8964

Solid Waste Service

Mr. Dan Gibson Quarry Landfill 4041 N. 141st East Avenue Tulsa, Oklahoma 74116

RE:

ADDITIONAL PIEZOMETERS, MUSKOGEE COMMUNITY LANDFILL RUST E&I PROJECT NO. 86251.130

Dear Mr. Gibson:

During our conference call with Ms. Theresa Talty, regarding the Phase I Hydrogeological Study, Ms. Talty suggested adding five piezometers to the boring plan. The intention was to cover the entire landfill since the piezometers were mainly around the perimeter of the footprint area. By installing the additional piezometers, the geotechnical boreholes will no longer remain open for seven days for water-level measurements.

The enclosed Table 7-1 and Figure 7-1 from the Hydrogeological Study have been modified to include the additional piezometers. Table 7-1 shows the designated piezometer labelling, the zones to be monitored, and the depths of each piezometer along with the geotechnical borings to be drilled in the field investigation. Figure 7-1 shows the piezometer and geotechnical boring locations. The additional five piezometers will be constructed in accordance with WMI Site Assessment Manual and the OSDH regulations.

The borings/piezometers will be located (approximately) in the field according to Figure 7-1 for the Phase II Field Investigation. Once the borings are completed, the locations will be surveyed.

If you have any questions or comments, please do not hesitate to call me at (713) 874-8973.

Sincerely,

Penny P. Carpenter Project Geologist

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Mark Daniels, East Oak Theresa Talty, WMI-South

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TABLE 7-1

BOREHOLE DEPTH CALCULATIONS WASTE MANAGEMENT OF OKLAHOMA MUSKOGEE COMMUNITY LANDFILL AND RECYCLING CENTER, OKLAHOMA September 1, 1993

. September 1, 1995					
BORING	30 FEET BELOW DEEPEST PLANNED EXCAVATION ¹ (msl) (A)	SURFACE ELEVATION OF BORING (8)	DEPTH OF GEOTECHNICAL BORINGS (B-A)	MODIFIED BORING DEPTH ²	
B-1	583	624	41	45	
B-2	582	628	46	50	
B-3	582	629	47	50	
8-4	582	631	49	50	
B-5/P-1	586	631	45	Zone D ⁴ ~ 150	
B-6/P-2	586	631	45	Zone C ⁴ <u>~</u> 50	
P-3	586	631	NA ³	Zone A ⁴ ~ 15	
B-7	586	628	42	45	
B-8	587	630	43	45	
B-9	588	632	44	45	
B-10	588	635	47	50	
B-11	589	635	46	50	
B-12	. 587	637	50	50	
B-13/P-4	587	630	43	Zone D⁴ <u>~</u> 150	
B-14/P-5	587	630	43	Zone C ⁴ ~ 50	
P-6	587	630	NA ³	Zone B ⁴ ~ 20	
P-7	587	630	NA ³	Zone A ⁴ ~ 15	
B-15	588	633	45	45	
B-16	590	637	43	45	
B-17	588	637	49	50	
B-18	589	638	49	50	
B-19	589	62 6	37	40	
8-20/P-8	589	641	52	Zone D ⁴ ~ 150	

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Table 7-1 (cont.)

			·- <u>-</u>	
BORING	30 FEET BELOW * DEEPEST PLANNED EXCAVATION ' (msi) (A)	SURFACE ELEVATION OF BORING (B)	DEPTH OF GEOTECHNICAL BORINGS (B-A)	MODIFIED BORING DEPTH ²
B-21/P-9	589	641	52	Zone C ⁴ <u>~</u> 50
P-10	589	641	NA ³	Zone A ⁴ ~ 15
P-11	589	636	NA ³	Zone B
P-12	588	634	NA ³	Zone B
P-13	588	634	NA ³	Zone B
P-14	587	629	NA ³	Zone B
P-15	583	624	NA ³	Zone B

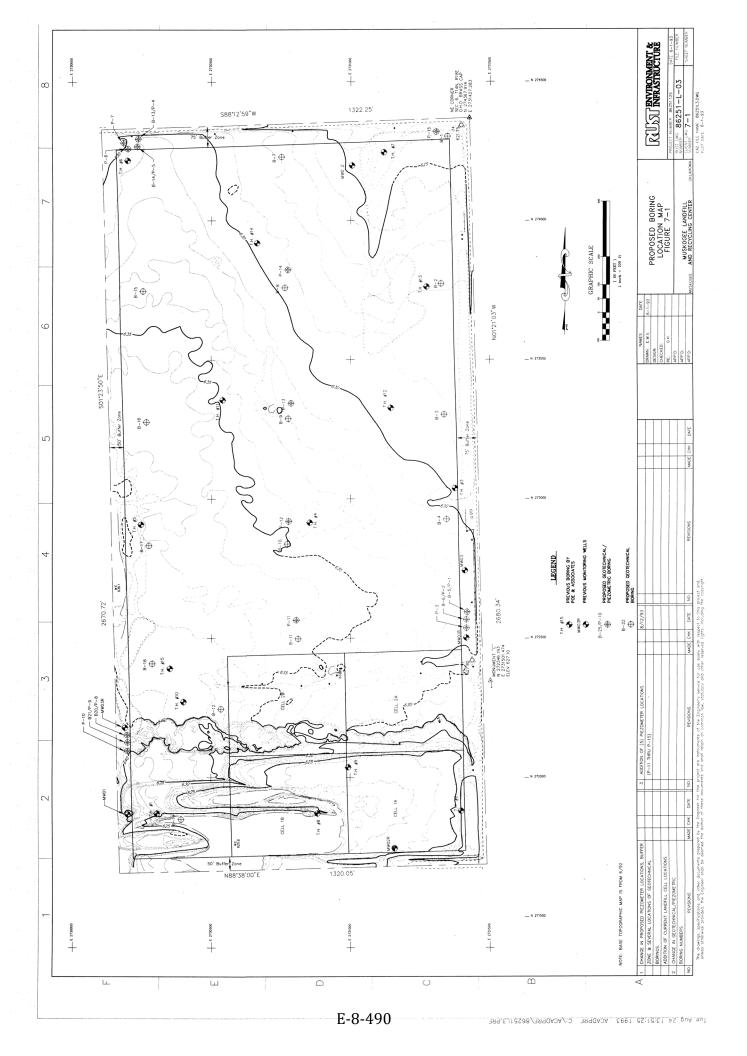
¹ The deepest planned excavation is defined at the elevation where top of weathered shale is encountered per previous boring data at the site.

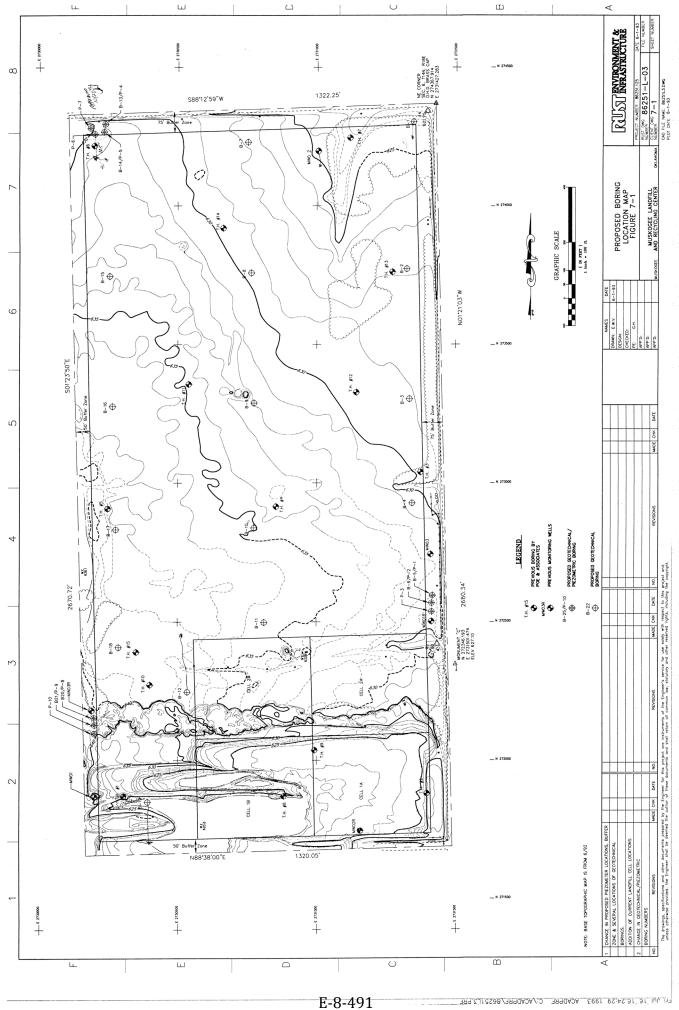
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² Boring depths are rounded off to the nearest five feet.

³ This boring is strictly for a piezometer; no geotechnical testing will be performed.

The boring depth will be modified to the approximate depth of each zone. Zone A through D are described in detail in Section 6. A piezometer will be set in this boring to monitor the assigned zone.





7.1.1 Piezometric Borings

The subsurface investigation is designed to detect all saturated zones encountered while drilling and to obtain a field description of the deep stratigraphy underlying the facility. The anticipated target zones for saturated conditions are discussed in detail in Section 6. Six of the 25 borings to be drilled will meet dual purposes by being a piezometric boring and a geotechnical boring in one. These borings will be located within the buffer zone around the periphery of the landfill.

The piezometric borings will be drilled with hollowstern auger until refusal, then air rotary methods will be used. The borings for will be continuously logged and sampled using visual classification techniques, paying particular attention to the presence of shallow ground water.

Soil samples for geotechnical analyses will be collected from six of the ten piezometric borings; geotechnical sampling is further discussed in Section 7.1.2. Lithologic sample logs will be made of each borehole and will include the following items:

- Drilling data such as drilling method and type of rig used;
- Description of all soil and rock layers encountered using ASTM 2487 methods including:
 - Name, color, texture, thickness, structure and amount of moisture present in each layer,
 - Approximate soil classifications,
 - Rock classification as defined in the Dictionary of Geological Terms,
 - Secondary features such as slickensides, fossils, fractures, seams, calcite healing, organic debris, ferrous nodules or staining;

The depths at which ground water was encountered and stabilized ground-water elevations.

Table 7-1 defines the boring/piezometer location number, the approximate topographic elevation where the boring is to be located, and the estimated depth or zone of all piezometric/geotechnical borings.

When rock conditions are encountered, the rock name, color, bedding, weathering, structure, and any other applicable descriptors will be recorded on the field log for each borehole. Percent recovery of the rock core and the Rock Quality Designation (RQD) will be calculated for every core. The RQD is a modified core recovery measurement used to characterize the quality of the rock mass. To calculate RQD, all pieces of a core over four inches in length are added together and divided by the total length of the core run, and is expressed as a percentage. Listed below is a table showing the relationship of RQD and rock quality.

Description of Rock Quality
Very Poor
Poor
Fair
Good
Excellent

TABLE 7-1

BOREHOLE DEPTH CALCULATIONS WASTE MANAGEMENT OF OKLAHOMA MUSKOGEE COMMUNITY LANDFILL AND RECYCLING CENTER, OKLAHOMA July 16, 1993

	30 FEET BELOW			
BORING	30 FEET BELOW DEEPEST PLANNED EXCAVATION ¹ (msl) (A)	SURFACE ELEVATION OF BORING (B)	DEPTH OF GEOTECHNICAL BORINGS (B-A)	MODIFIED BORING DEPTH ²
B-1	583	624 «	41	45
B-2	582	628	46	50
B-3	582	629	47	50
B-4	582	631	49	50
B-5/P-1	586	631	45	Zone D ⁴ <u>~</u> 150
B-6/P-2	586	631	45	Zone C ⁴ <u>~</u> 50
Р-3	586	631	NA ³	Zone A⁴ <u>~</u> 15
B-7	586	628	42	45
B-8	587	630	43	45
B-9	588	632	44	45
B-10	588	635	9 47	50
. B-11	589	635	46	50
B-12	587	637	50	50
B-13/P-4	587	630	43	Zone D ⁴ <u></u> 150
B-14/P-5	587	630	43	Zone C ⁴ <u></u> 50
P-6	587	630	NA³	Zone B ⁴ <u></u> 20
P-7	587	630	NA ³	Zone A ⁴ <u></u> 15
B-15	588	633	45	45
B-16	590	637	43	45
B-17	588	637	.49	50
B-18	589	638	49	50
B-19	589	626	37	40
B-20/P-8	589	641	52	Zone D ⁴ <u>-</u> 150
B-21/P-9	્ર 589	641	52	Zone C ⁴ <u></u> 50
P-10	589	641	NA ³	Zone A ⁴ <u>-</u> 15

The deepest planned excevation is defined at the elevation where top of weathered shale is encountered per previous boring data at the site.

Boring depths are rounded off to the nearest five feet.

This boring is strictly for a piezometer; no geotechnical testing will be performed.

The boring depth will be modified to the approximate depth of each zone. Zone A through D are described in detail in Section 6. A piezometer will be set in this boring to monitor the assigned zone.

The detailed logs in the field will be recorded on WMO forms and reported upon completion of the field work. Once drilling activities are completed on each borehole, geophysical testing will be performed, as described in Section 7.2.

7.1.2 Geotechnical Borings

A total of 21 geotechnical borings will be drilled for landfill design purposes with depths detailed in Table 7-1. The borings will be sampled continuously for the first ten feet and on five-foot intervals thereafter. The borings will be advanced by hollowstem auger to refusal, then air rotary method will be used, paying close attention to the presence of shallow saturated conditions. It is anticipated to pass through the residual soils, beyond the weathered bedrock, and into unweathered bedrock. The borings will be logged as previously described for the piezometric borings.

All drilling activities will cease upon encountering shallow saturated conditions. The rise of water within the borehole will then be measured in five-minute increments until equilibrium is reached, or for a maximum period of 30 minutes, whichever is less. Drilling activities will continue upon completion of the water-level readings. The borings will be plugged with a bentonite grout. The cores will be prepared for storage according to ASTM standards and shipped to an WMO approved testing laboratory for later determination of the geotechnical tests to be run on each core. Upon review of the logs for each boring, the landfill design engineer will assign the geotechnical tests to be performed on each core. The soil samples will be evaluated by performing the following tests:

- Sieve Analysis #4, #10, #40, #200,
- Percent Fines (ASTM 1140),
- Particle-Size Analysis (ASTM D422),
- Atterberg Limits (ASTM D4318),
- Moisture Content,
- Standard Proctor (ASTM D698).
- Organic Content,
- Soil Permeability Test (ASTM 5084),
- Unconsolidated, Undrained Triaxial Test,
- Consolidation Tests,
- Cation Exchange Capacity, and
- Soil pH.

Note that the test assignment for each borehole may vary according to the engineer's design requirements.

7.2 <u>Downhole Geophysical Logging</u>

Prior to the installation of the piezometers, geophysical logging of six of the boreholes will be done to meet state requirements OAC 310: 360-9-3(7). The logs will be run on the three deep piezometric borings and three of the geotechnical borings. The purpose of the downhole geophysical logging is to obtain high-resolution geologic data from within the borings. The tools used will consist of spontaneous potential, single-point resistance, and natural gamma tools in the six borings. Table 7-2 summarizes the aspects of the downhole geophysical logging to be performed.

TABLE 7-2

GEOPHYSICAL LOGGING

TECHNIQUE/APPLICATION		LED HOLE, ED ZONE	DRY HOLE, UNSATURATED ZONE	
	UNCASED	PVC	UNCASED	PVC
Natural Gamma - Soil and rock identification, geologic correlation	Yes	Yes	Yes	Yes
Spontaneous Potential - Soil and rock identification, geologic correlation	Yes	No	No	No
Single-Point Resistance - Soil and rock identification, geologic correlation, resistive rock fracture detection	Yes	No	No	No

7.3 Piezometer Installation

To address the site-specific hydrogeology, a total of ten piezometers will be installed. The purpose of the piezometers is to adequately monitor pressure head within individual zones, and determine the potentiometric surface within each zone. The piezometers will aid in determining the following information:

- In-situ permeability of geologic units;
- Direction of ground-water flow in the uppermost saturated zone, and within the deep saturated zones, if any;
- Rates of ground-water flow;
- Maximum high elevation of piezometer surfaces;
- Ground-water recharge and discharge areas.

A total of ten piezometers will be installed which meet the OSDH requirements of at least six piezometers for an 80-acre tract (OAC-9-3(11)(B)).

A piezometer will be installed in each piezometric boring and screened within the specified zones. Three piezometers will be set in Zone A, one in Zone B, three in Zone C, and three in Zone D. The actual completion depth of each piezometer will be determined in the field after review of the logs and the geophysical logging. The screened interval within each piezometer will be either five or ten feet and will be based on drilling observations of the permeable zones, with the exception of Zone C. The screened interval for Zone C will be either two-and-one-half feet or five feet.

Existing monitoring wells MW01R and MW03R will be used to monitor Zone B. The Poe and Associates' well MW02 will not be used to monitor a specific zone. The well is not sealed around the filter pack and therefore is not definitively monitoring Zone A or B. The interval being monitored is from one foot bls to depth of screen and is considered too long of an interval to aid in this investigation. Monitoring wells MW01 and MW03 are appropriately designed for piezometers and are monitoring Zones A and B; however, the locations of the wells are not spatially distributed across the property from the other wells to give a thorough overview of the potentiometric surface for Zone A/B.

Each piezometer group will be clustered together in the same general location. In other words, piezometers P-1, P-2, P-3, and monitoring well MW03R will be grouped together in one general location along the eastern buffer zone. Piezometers P-4, P-5, P-6, and P-7 will be located in the northwestern corner of the property. Piezometers P-8, P-9, and P-10 will be located along the western boundary next to monitoring well MW01R.

All piezometers will be constructed according to the WMI Site Assessment Manual and ASTM standards. The piezometers will be constructed of two-inch diameter, flush-threaded, Schedule 40 PVC, with a five or 10-foot screen, 0.010-inch slot, and a 40 to 60 washed Colorado silica sand filter pack. The filter pack will be tremied down hole to two feet above the screen to prevent bridging. Bentonite pellets will

be tremied above the filter pack for a three foot seal. The bentonite pellets will be hydrated using potable water. A 4-foot by 4-foot concrete pad will be set with a four-inch diameter protective casing around the piezometers.

All piezometers yielding ground water will be developed, if possible, in accordance with ASTM standards to help restore the natural hydraulic properties of the transmissive unit. The piezometers will be allowed to reach static water level prior to development. Static conditions are reached when water-level measurements, taken daily for two consecutive days, are within 90 percent of each other.

Once static conditions are reached, the water levels will be determined and recorded immediately prior to development. Development will proceed using a Waterra® inertial hand pump or QED® development pump until specific conductance, pH, and temperature are stabilized for three consecutive readings. If fine-grained sediments are a problem, development will continue to an appropriately low level of suspended material in the water.

7.4 In-Situ Permeability Testing

Hydraulic conductivity tests will be performed for all piezometers. Hydraulic conductivity will be evaluated using rising-head and/or falling head slug tests. The tests will commence after development, once the hydraulic properties of the transmissive zone has been restored. After development, static water levels will be allowed to equilibrate. The following sequence of events will occur during each slug test:

- Determine the static water level.
- 2. Lower the pump into place and remove a known volume (slug) of water from the piezometer, or add a slug of water into the piezometer. The analysis assumes an instantaneous change in volume when the slug is removed or added. The elapsed time equal to zero will be recorded

immediately upon cessation of pumping or the addition of water. An electric water-level meter will measure the rise of water or fall within the piezometer.

- 3. Water levels in the piezometer will be recorded every 30-seconds for five minutes, then every minute until 15 minutes have elapsed. Measurements will then continue with water levels taken every five minutes until 30 minutes have elapsed; whereafter, water levels will be taken every 10 minutes until one hour has elapsed.
- Successive time-depth measurements will proceed on an hourly basis until the static water level has met 90 percent recovery.

Transmissivity and hydraulic conductivity will be evaluated using the appropriate approach for the defined ground-water system.

7.5 Surveying

Prior to the initiation of the exploration program, the proposed locations of all boreholes and piezometers will be staked in the field by a professional surveyor licensed in the State of Oklahoma. The actual locations are dependent on accessibility and will be adjusted in the field if necessary.

Upon the installation of all the piezometers, the location of the piezometers and the top of PVC casing will be surveyed. The elevations will be surveyed to the nearest 0.01 foot using a USGS benchmark or National Geodetic Vertical Datum; the location will be given in terms of latitude and longitude of the piezometer at least to the nearest tenth of a second, based on the State of Oklahoma coordinate system. A "notch" will be cut into the top of casing to indicate the location from where the survey point was taken. The elevations of the casing and piezometer number will be permanently stamped on the cover of the protective casing for future reference.

Section 8

8.0 CONCLUSIONS

This report presents information pertaining to the historical activities, physical setting and subsurface conditions of the Muskogee Community Landfill and Recycling Center, and outlines the goals for the Phase II Field investigation. The available data was used to develop a hydrogeological conceptual model and field exploration program. The field investigation will be undertaken to establish new geotechnical, geological and hydrogeological data. This data will aid in the landfill design and development of a ground-water monitoring plan for Tract A.

Interpretation of the data from the Phase II Field Investigation will enable potentiometric surfaces to be mapped. Additionally, it is necessary to determine if the landfills on Tracts B and C are impacting Tract A. As field investigations proceed, additional information will be sought regarding hydrogeologic information of the area. It is recommended to obtain permission to install four nested piezometers on the hill south of the site. This piezometer will help determine the hydrogeologic conditions and to verify if this area is a recharge area for the facility. Also, a door-to-door search is recommended for the neighborhood north and northwest of the facility to see if any wells exist and are in use. The Phase II-Field Investigation will proceed once the OSDH has approved the field exploration program.

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Appendix A

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	7,9,		CLAT (CIT)	•				-	-1,1		- 1					
- 32	16		- H20 within 1-inch co	al seam @ 3	0 feet			-	- 		H					
•			1975 - 1975 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 - 1975 -	-					3		- {					~
- 34			- Coal seams, 32 to 35	feet		•		! <u>-</u>	3 [ļ				2
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NOTE

THE POE AND ASSOCIATES' BORING LOGS NEED TO BE READ IN A CERTAIN MANNER. THE FOLLOWING TABLE SUMMARIZES THE TEST HOLE INFORMATION AND IS PERTINENT IN INTERPRETING THE BORING LOGS. THE TABLE CORRELATES WHERE THE BASE OF THE CLAY AND THE TOP OF THE UNWEATHERED SHALE IS IN EACH TEST HOLE. THE DEPTH OF THE STRATA ON THE BORING LOGS REPRESENTS THE BASE OF THE STRATA.

For example, the silt stratum for Test Hole #1 is from zero to 1.8 feet below land surface (bls). The clay stratum starts at 1.8 feet bls down to 19.2 feet bls. This depth of the clay corresponds to the table with the clay thickness (including the silt) being 19.0 feet. The top of weathered shale starts at 19.2 feet bls or at an elevation of 619.8 feet msl (or 620 ft msl). After thorough evaluation of the Poe and Associates' data and as it is shown in this example, it is concluded that they randomly round off their numbers.

TABLE 2

TEST HOLE DATA

			12 75			
Test	Surface	Depth of	Clay	Тор	Тор	Тор
<u>Hole</u>	Elev.MSL	Hole (ft.)	Thickness	Weathered	Coa 1	Unweathere
,			(ft.)	Shale MSL	MSL	Shale M:
· · · · · ·				E.		
1	639.0	40	19.0	620.0	604.5	612.0
2	629.0	40	15.0	614.0	612.0	602.0
3	629.5	40	19.0	610.5		596.5
4.4	632.5	40	16.0	616.5		597.0
5	636.0	40	16.7	619.3		601.6
6	628.5	40	14.2	614.3		594.0
7	623.5	40	11.3	612.2		594.2
8	636.0	27	19.0	617.0	611.0	•
9	630.0	20	11.8	618.2	618.2	
10	639.0	. 20	15.3	623.7		
11	633.5	20	13.5	620.0		
12.	629.5	20	13.3	616.2		
13	627.5	20	14.5	613.0		
14	629.5	50	11.5	618.0		·
15	640.0	20	17.5	622.5		
16	631.0	27	n.			*.
				· • • • • • • • • • • • • • • • • • • •		
Test	erii De cara		10.0	.		
Pit 1	633.0	22 .	18.0			 .
Test		••	10.0			
Pit 2	634.5	18	12.0			- -

◆ COMPLETE WATER WELL INSTALLATION 1

STAN WITHAM MOLA OKLAHOMA (818) 543-6637 NELBON HOSS PE 07844 TULBA OKLAHOMA (818) 746-0258

			ATE:
DE DADI	TED TO	L. H. McComas PROJECT Lan	dfill
•	. Art		
	, .		AF 000 1100
DATE D	RILLED_	10-6-93 DRILLER Gabby METHOD C	
SURFAC	E ELEV	ATION WATER TABLEDEPT	TH OF HOLE40*
ELEV	DEPTH	DESCRIPTION OF MATERIAL TYPE, TEXTURE, COLOR, CONSISTENCY	PENETRATION TE
27. 7			•
	1.2	Silt, sandy, brown	
	1.5	Silt, sandy, clayey, brown	
	4.7	Clay, sandy, silty, brown to tan w/traces of red	
77	e.Ł	Clay, sandy, brown to tan w/yellow & traces of grey	
1	11.0	Clay, ten to yello w/grey	SHELBY TUBES
	19.2	Clay, slightly sandy, yellow w/grey	NO. FROM TO
	24.0	Shale, weathered, tan to grey	
	25.7	Shale, black	
	27.2	Shale, tan to grey, soft	
	33.5	Shale, black, moist	
	34.7	Shale, blue, grey	
	35.7	Coal 12"	CORING
			FROM TO LO
	40.0	Fireclay	
	· .		
	1.		

+ POUNDATION COME - BOIL TESTING *

COMPLETE WATER WELL INSTALLATION +

ETAN WITHAM MOLA OKLAHOMA (918) E43-6637 NELBON HOSS PE 07868 TULBA OKLAHOMA (818) 746-0288

	÷ .	REPO DATE	ORT NO	
		REPORT OF TEST HOLE NO 2		
REPORT	TED 5 TO	F. R. McComas PROJECT Landf	111	
JOB LO	CATION	Muskogee, OK HOLE LOCATION		
DATE D	RILLED	10-t-83 DRILLER Gabby METHOD OF	DRILLINGA	<u>1</u> r
		ATION WATER TABLEDEPTH		
ELEV	DEPTH	DESCRIPTION OF MATERIAL TYPE, TEXTURE, COLOR, CONSISTENCY	PENETRATION FROM TO	TE:
	2.0	Silt, sandy, brown.		
٠	3.4	Clay, sandy, brown to tan w/traces of grey		
*	9.4	clay, sandy, tan to yellow #/grey		
	13.5	Clay, yellow w/grey		
	17.0	Shale, weathered, tan to grey w/clayey layers	SHELBY TU	JBE
	18.5	Coal, smutty (cropline), wet	1.0.	
	27.0	Fireclay		
	.34 • 5	Shale, grey w/occas. sandstone layers		F
5	30.0	limestone w/occas. Shale lenses		
	40.0	Snale, grey		
- · ·			CORING	
·. :			FROM TO	L
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	<u> </u>			
				+

POUNDATION - COMP - BOIL TESTING

STAN WITHAM MOLA OKLAHOMA (814) 843-8437 NELSON HORS
PE 07000
TULBA ONLAHOMA
1015 745-0258

		REPORT OF TEST HOLE NO3	ORT NO) 	_
		M. R. McComas PROJECT Landfi	11		—
		Muskogee, OK HOLE LOCATION	NOU 1 IM	<u> </u>	
		10-6-83 DRILLER Gabby METHOD OF			
ELEV	DEPTH	DESCRIPTION OF MATERIAL TYPE, TEXTURE, COLOR, CONSISTENCY	PENET FROM	RATION TO	TES BLC
	2.2	Silt, sandy, brown		,	
	4.0	sandy			
	7.4	Clay, sandy, tan to yellow w/traces of grey			Ė
Book Comments	1t.2	Clay, yellow w/grey			<u> </u>
	19.0	Clay, shaley, tan to yellow w/grey		LBY TU	JBES
	31.0	Snale, weathered, tan to grey		<u> </u>	-
	33.2	Shale, tan to grey, moist (water 31')	-		
2*	4C.0	Snale, blue, grey			F
950°					
			FROM	CORING	1 10
			PROM	10	1
300	186 - 1971 1971 1971				二
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Since

* POUNDATION - COME - BOIL TESTING *

STAN WITHAM MOLA DISLAHOMA (818) 843-8637 HELSON HOSS PE 67868 TULBA OKLAHOMA (818) 745-0254

				REP	ORT NO). <u> </u>	
	1.a.,	REPORT OF TEST					
		M. R. McComas			111		
JOB LO	CATION	Muskogee, OK	HOLE LOCATION_				1
DATE D	RILLED	10-6-83 DRILLER	Gabby METH	D OF	DRILLIN	3 <u>A</u>	<u>ir</u>
SURFAC	E ELEV	ATION WATER T	ABLEC	EPTH	OF HOL	E4	0 •
ELEV	DEPTH	DESCRIPTION TYPE, TEXTURE,	OF MATERIAL COLOR, CONSISTENCE	Y	PENET	RATION TO	TE:
			The state of the s	-			\vdash
	1.7	Cilt, sandy, brown			,		-
	÷ 2, 5	Clay, sandy, silty,	, brown			<u> </u>	二
	3.3	Clay, redish brown					
	1	Clay, tan to yellow	v m/grey				<u> </u>
	14.3		_				+
		Shaley clay			SHE	LBY TI	UBE
3					NO.	FROM	Ϊ
i	28.0	male, tan to grey	, weathered, wat	er at			‡
	34.0	Shale, grey w/tan	•				<u> </u>
gesta in 19 V	40.0	11.0					╀
	40.0	Suarc, sauc, g. c.	•			<u>.:</u>	\vdash
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OMPLETE WATER WELL INSTALLATION +

		REPO	ORT OF TES	IT HOLE NO	5	DATE		<u>-</u>	<u> </u>
REPORT	TED TO	M. R. I	McComas	PR	OJECT_L3	ndfil	1		
		Muskoge		7.0					
		10-ε-83			-	OF C	RILLING	A:	ir
		ATION					OF HOLE		
	DEPTH		DESCRIPT	ION OF MAT	ERIAL		PENETR		TES
			· · · · · · · · · · · · · · · · · · ·	1					F
] · ·	2.2	Silt,	sandy, bro	wn 🦠					F
	3-4	Clay.	brown to t	an w/red			===		<u> </u>
	15.5	Clay,	tan to yel	low w/grey					Ħ
	16.7	Clay,	shaley, ye	llow x gre	y				·
	34.5	Shale.	tan to gr	ey, weathers, (calcar	red, moi:	t,			
	40.0	<i>*</i>	•	y w/occas.	11	1e .	SHEL NO:	BY TU	JBES L
	13.3	layers				ł			
S. S. A.	,								\vdash
		And the state of t							\vdash
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	r All Med								F
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POUNDATION - CORE - COR. TESTING +
 COMPLETE WATER WELL INSTALLATION 4

BTAN WITHAM MOLA OKLAHOMA (818) 649-6637 NELSON HORS PE 07868 TULBA OKLAHOMA MYS 745-0288

		DAT		·	_
DE DOD	TEN TO	N. R. McComas PROJECT Landfi	11	_	
2.5	CATION				
•	•	10-1-93 DRILLERMETHOD OF	DRILLING	, Aí	ir
		ATION WATER TABLE DEPTH			٥٠
ELEV	DEPTH	DESCRIPTION OF MATERIAL TYPE, TEXTURE, COLOR, CONSISTENCY	PENET		TES
	2.0	Silt, sandy, brown			
,	3.2	Clay, brown to tan w/red			<u>_</u>
	13.4	Clay, tan to yellow w/grey			
	13.7	Clay, sandy, yellow w/grey			<u>,</u>
	14.0	Siltetone, broken			
	14.7	Clay, moist, yellow w/grey	SHE	LBY TU	BES
	10.0	Shale, clayey		FROM	
%****	20.0	Shale, sandy, tan */occas. siltstone layers			
	20.2	Limentone			· · ·
	35.0	Shale, the to grey, wet at 20 w/occas siltatone layers			<u> </u>
	40.	Snels, blue, grey			_
				CORING	
	1		FROM	TO	Ļ,O
					_

* POUNDATION COME BOIL TESTING *

ETAN WITHAM MOLA DKLAHOMA (818) 843-8537 MELBON HOBB PE 07068 TULSA OKLAHOMA (018) 748-0256

NO.

	r .	REPORT OF TEST HOLE	NO. <u>7</u>	DATE:
REPORT	ED TO	a. n. McComae	PROJECT	Landfill
.1		Muskogee, UK HOLE		<u> </u>
	•	10-6-85 DRILLER Gab		OF DRILLING A1:
SURFACE	ELEVA	TION WATER TABLE	DEP	TH OF HOLE 40
ELEV	DEPTH	DESCRIPTION OF TYPE, TEXTURE, COLOR	MATERIAL CONSISTENCY	PENETRATION TO
	2.0	Silt, sandy, brown		
	5.2	Clay, brown to tan w/re	d _i ,	
	7.0	Clay, ten to yellow w/g	· • • • • • • • • • • • • • • • • • • •	
	8.2	Clay, yellow & grey w/		
		Snale, tan, soft w/clay	i i i i i i i i i i i i i i i i i i i	ni s t
	17.7 20.0		11 19 1	NO. FROM
	20.5	Clay, shaley, black	, r	
	21.5	Limestone		
	22.0	Clay, shaley, moist		
	23.3		\$ 1. *** \$ 1. ** \$ 1. **	
	36.0	Shale, sandy, blue, gre lense	y wyrannscone	
i k	31 .2		i L	FROM TO
21-	40.0	Fireclay		
			.4 + .4 +	
<u> </u>		<u>** - </u>		

+ POUNDATION - COME - SOIL TESTING + + COMPLETE WATER WELL INSTALLATION +

BTAN WITHAM MOLA ORZAHOMA (018) \$43-8637 NELSON HOSE PE 67968 TURBA OKLAHOMA (018) 745-0256

		•	DATE	ORT NO). ———	
	PEROPT	FD TO	REPORT OF TEST HOLE NO	i.l.l		
			Muskogee OKHOLE LOCATION	•		
			10-7-83 DRILLER Gabby METHOD OF C	SRILLING	3 4	
	4.	781 TO	ATION WATER TABLE DEPTH (
	ELEV	DEPTH.	DESCRIPTION OF MATERIAL TYPE, TEXTURE, COLOR, CONSISTENCY	FROM	RATION TO	TES BLC
				•	-	<u> </u>
		2.1	Silt, sandy, brown		:	
		3.3	Clay, brown to tan w/red		· · · · ·	
		8.5	Clay, tan to yellow w/grey			
	rain C	15.5	Clay, yellow w/grey			
	. Qe	19.0	Clay, sheley			匚
	*	21.0			LBY TU	JBES
		23.5		NO.	FROM	
:		14				\vdash
· · :		25.0		· · · -		\vdash
٠.		26.0				二
٠	7.44	27.0	Fireclay	<u> </u>		二
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& COMPLETE WATER WELL INSTALLATION &

ETAN WITHAM MOLA OKLAHOMA (818) 643-0437 NELSON HOSS FE 07055 TULSA OKLAHOMA (816) 745-0256

r.				REPORT NO DATE:	:
		. A.		PORT OF TEST HOLE NO	_
				OK HOLE LOCATION_	<u>-</u>
	***	7		DRILLER METHOD OF DRILLING A	
		DEPTH	1	DESCRIPTION OF MATERIAL PENETRATION	
			Section 1		
		1.8	Silt	, sandy, brown	
		2.3	Clay	, brown to tan w/red	
		12.0	Clay	, tan to yellow w/grey	
		12.3	Clay	, tan w/black (coal smut) (crooline	F
		15.0	Clay	, tan to yellow w/grey & red	F
	. A S	17.2		, shaley, tan w/grey SHELBY TU	
		20.0		e, tan w/clayey layers	
		20.0	1. V. HAI.	e, tan wyclaj cj. 10, cr.	
		10			
·	Section 1				F
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* COMPLETE WATER WELL INSTALLATION *

ETAN WITHAM MOLA OKLAHOMA 18125 543-4537 NELBON HOSS PE 07066 TULBA OKLAHOMA (018) 746-0258

		DAT	PORT NO	<u>'</u>	<u> </u>
REPOR	ŤED TO	REPORT OF TEST HOLE NO. 10	ndfill		
_		Muskogee OK HOLE LOCATION		-	
		10-7-83 DRILLER Gabby METHOD OF	DRILLING		
	7.5° 7	ATION WATER TABLEDEPTH			
SURFAC	E ELEV	DESCRIPTION OF MATERIAL		ATION TI	
ELEV	DEPTH	TYPE, TEXTURE, COLOR, CONSISTENCY	FROM		
					_
A* 1	2.0	Silt, sandy, brown			<u> </u>
	2.7	Clay, brown to tan			<u> </u>
	5.4	Clay, tan to yellow w/grey			_
	19.0		ř.		<u> </u>
	19.5	N. C. C. C. C.			_
			SHE	BY TUBE	
	20.0	Chale, tan		FROM	<u> T</u>
					_
					_
					
	,				
<i>2</i>					
				20000	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			FROM	CORING TO I	LO
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* COMPLETE WATER WELL INSTALLATION *

STAN WITHAM INOLA CKLAHOMA (818) 643-6637 NELSON HOSS PE #7868 TULSA OKLAHOMA (918) 746-0258

	DAT	E:	
REPORTED TO	REPORT OF TEST HOLE NO. 11 PROJECT Landfi	11	
	Muskogee, OK HOLE LOCATION	2	
	10-7-83 DRILLER Gabby METHOD OF	DRILLING	Air
	ATION WATER TABLE DEPTH		
ELEV DEPTH	OSCORIOTION OF MATERIAL	PENETRATION	
2.3	Silt, sandy, brown		
10.8			
13.0	Clay, ten to yellow w/grey, shaley w/siltstone layers		+
20.0			+
		SHELBY	TUBES
		NO. FROM	
			+
		205	土
		FROM TO	LO
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A COMPLETE WATER WELL INSTALLATION &

STAN WITHAM NIOLA OKLAHOMA (918) 843-8637

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HELBON HOSS PE 97658 TULSA ORLAHOMA (818) 745-0258

			REPORT	OF TEST	HOLE NO.	12	REPO	RT NO) 	
REPOR	TED TO	<u>.</u> .	h. McC	omas	PRO	JECT	Land fi	111		
JOB LC	CATION	<u>Ku</u>	skogee,	45	HOLE LOCA					
		5, 5	_		<u>Gabby</u>		OF D	RILLIN	<u> </u>	Air
		11.15			ABLE	_	•			
ELEV	DEPTH		TYPE,	ESCRIPTION TEXTURE,	COLOR, CON	RIAL SISTENCY		PENET	TO	TEST
\$20 T	2.0	i	lt, sand	ly, brown						
e.				-	w/traces	of red				
** **	13.,0	, Cla	ay, tan	to yello	w/grey		- [
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* POUNDATION - COME - BOIL TESTING *

* COMPLETE WATER WELL INSTALLATION *

STAN WITHAM INOLA OKLAHOMA (918) 843-8837 NELBON HOSS PE 07968 TULBA OKLAHOMA (918) 746-0258

·		and the second second	REPORT OF TEST HOLE NO. 13 No. H. McComas PROJECT Muskogee, OK HOLE LOCATION			
:	DATE D	RILLED	10-7-83 DRILLER Gabby METHOD OF WATER TABLE DEPTH			
		DEPTH	DESCRIPTION OF MATERIAL	PENETR		<u> </u>
h						
٠.		1.0 3.4	Silt, sandy, brown Clay, brown to tan			
			clay, tan to yellow w/grey			
· **.		20.0	Shale, tan, weathered w/occas. silt-			
: '				SHEL	BY TU	BES
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STAN WITHAM MOLA OKLAHOMA (918) 643-6537 NELBON HOSS PE 07068 TULBA OKLAHOMA (816) 745-0758

**************************************		PORT OF TEST	VOLE: NO	14	DATE:	···	_ _
REPORTED		McComas			andfill_		
		ogee. OK	. 5				
and the state of t	in the second	ORILLER Ga	·		OF DRILLI	NG	Air
		WATER 1			14 d		
ELEV DEP	TH	DESCRIPTION	N OF MATER	IAL	PENE	TRATION	
140		Tre, textone,			T NOM		BLC
1,		randy, brown	ş -				+
3	Clay,	, brown to tar	w/red			<u> </u>	<u> </u>
12	.O Clay,	ten to yello	grey/#				
20	.0 Sn=le	e, ten w/occas	. siltaton	e layer	·s		‡_
33	.O Snale	, tan to grey	r -	•		 	
33	.3 Shale	, blue grey			i	ELBY TO	UBES
. 33	.5 Cosl,	water 33.5'			NO.	FROM	
34	.3 Limes	tone		. •			二
39	.0 Shale	, blue grey,	soft, wate	r 39'			士
48	.0 Shale	, candy, grey	w/sandsto	ne lene	er		士
4:	.1 Coal				<u></u>	<u> </u>	
50	.0 Firec	lay				 	
	1.					CORING	
			·		FROM	TO	LO.
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* FOUNDATION - CORE - BOIL TESTING *

. STAN WITHAM MOLA OKLAHOMA (018) 643-8637 NELBON HORE PE 07068 TULBA OKLAHOMA (918) 746-0258

1 T			REPORT NO Date:	
REPORT	TED TO	REPORT OF TEST HOLE NO. 15	ndfill	
		Muskogee, OK HOLE LOCATION		
		10-7-93 DRILLER Jabby METHOD		Air
- A		ATION WATER TABLEDEP	A Committee of the Comm	
ELEV	ОЕРТН	DESCRIPTION OF MATERIAL TYPE, TEXTURE, COLOR, CONSISTENCY	PENETRATIO	
	10			
	2.0	Silt, sandy, brown		
	3.0	Clay, brown to tan w/red		
	17.2	Clay, ten to yellow w/grey		
5	19.5			
Asy is	20.0	Shale, clajey, tan	SHELBY	TUBES
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* POWDATION - CORE - BOIL TESTING *

STAN WITHAM INOLA OKLAHOMA (918) 643-6627 NELBON HOSS PE #7968 TULSA OKLAHOMA 1918/746-0258

		DAT	PORT N	O	
REPOR	TED TO	REPORT OF TEST HOLE NO. 16 MW. R. McComas PROJECT Land	fill		
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		ON WATER TABLE DEPTH	-		
ELEV	DEPTH	DESCRIPTION OF MATERIAL TYPE, TEXTURE, COLOR, CONSISTENCY	PENET	RATION	TE:
				4-	
	2.4	Silt, eandy, brown			#_
	3.0	Clay, brown to tan w/red			\pm
	7.7	Clay, tan to yellow w/traces of grey			╁
		Clay, yellow w/grey o tan			F
	16.8				丰
		Shaley clay w/siltstone fragments	CHE		
	17.1	Siltstone	NO.	FROM	JBES
	8 (3.00)	Clay, snaley, tan & grey			
	23.5	Shale, tan w/siltstone layers	<u>.</u>		╆
	27.0	Sn le, tan to grey			
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	, [FROM	CORING	
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Petroleum Information

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	Company of the state of the sta	CI#580	A Part of Control of the Control of	1 1827 (R23 Clayron Darra) 1829 (R23 Clayron Darra) 1829 (LA Mer-McDec Corp (Pr Surl) 1829	Geo M Sciences Singles
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<u>1</u> 6	TIDEWATER - OPR.	G.W. POLLARD, JR.	K.R.MCKINNEY & J.K GILL - OPRS. (ABND 1969)	-Columbs Coll # mes Mes M. Place V. Clark	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
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7 1	Jim Amerson 17, 5 5 9 8 2 (Pt.)				
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map prices become effective July 1, 1961. MIDCONTINENT MAP COMPANY 205 Costle Bldg. Phone: LU 4-7221 TULSA 3, OKLAHOMA MIDCONTINENT MAP COMPANY 205 CASTLE BLDG. 114 W.3RD.ST. TULSA 3, OKLAHOMA LUTHER 4-7221 LEGEND SHEET LOCATION RIG UP DRILLING WELL PRODUCING OIL WELL PRODUCING GAS WELL COMBINATION OIL & GAS WELL GAS STORAGE WELL (ILL.ONLY) DRY HOLE INPUT WELL e" SUPPLY WELL WATER INPUT WELL (ILL.ONLY) "W" BEFORE WELL NO. DENOTES CONVERSION TO INPUT WELL CONVERSION FROM OIL WELL TO WATER INPUT WELL (ILL,ONLY) ABANDONED OIL WELL ABANDONED GAS WELL ABANDONED COMBINATION WELL ABANDONED INPUT WELL STORAGE TANK SALT WATER DISPOSAL WELL SALT WATER DISPOSAL WELL (ILL.). (TO) TAX DEED (LE) LIFE ESTATE (SD) SHERIFF'S DEED (0) RESTRICTED INDIAN LANDS (CP) CERTIFICATE OF PURCHASE CONTRACT FOR DEED OR CONTRACT FOR SALE (CD) ~L→ LEASES GENERALLY ARE THE SAME ON TRACTS JOINED BY ←M→ MINERALS GENERALLY ARE THE SAME ON TRACTS JOINED BY THIS SYMBOL ←LM→ LEASES AND MINERALS GENERALLY ARE THE SAME ON TRACTS JOINED BY THIS SYMBOL (NP) NON-PARTICIPATING MINERAL OR ROYALTY INTERESTS HAVE BEEN CONVEYED OR RESERVED UNDER TRACTS BEARING THIS SYMBOL

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I, the undersigned, being first duly swom upon each, state that this well record in true, correct complete according to the records of this office and to the best of my knowledge and belief.

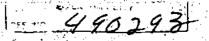
Name and tille of representative of company

Subscribed and sworn to before me this day of Managuestic Science 19
My Commission expires 9-30-62
Never Biblic

1			OIL MID	GAS CC	NSERVATION	WELL BECK				water, 6H	iled descrip or goe.				<u></u>	EF. NO.	34-	<u> 3/6</u>	
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yes Rig	301000	<u> </u>), the undersigned, less complete according to the					-d in trud	1

CORPORATION COMMISSION OIL AND GAS CONSERVATION DEPT OKLAHOMA CITY, OKLAHOMA



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COMPANY.	William H. Pine		SEC.	
PADIA	Rooney # 2		6	
LOCATION-	. NW SW NW Muskogeb			
COUNTY—· TOTAL DEPTI	TAAHA	įi	TWP.	
PRODUCTION	[ОП		14N	
ROCK PRESSU		531 Gre	ound 652	
DRILLING CO	MMENCED	1-20-49	RGE	
DRILLING CC	MPLETED—	112-27-4	9 18I	E

William H.Pine Okmuigee, Oklahoma.

This record received by the Corporation Commission Dec. 12,1949

of court Line and 275! East of West Line plus 32' at 750 to minus 7' at 2082.

Date of first Production 11-20-49 Completed 11-20-49.

OIL OR CAS SANDS OR ZONES: bend - Sho oil 752 756 1240 1252 Wapanucka-Sho O&G 1776 1789 Simpson Dola. Wtr. Sandy Lime, stain 1970 1982 2018 2025 Sand- Sho Oil & wtr. 2:33 - 2035 Sand- Sho oil

NOTE: All above measurements are taken SW NW OF SEC. 6-14N-18E- 990! North from Lane Wells Logs which are off from

> The shows in the Burgen below 2018 prob. justify drilling out to 2082 T.D. running string 52" & cementing above Simpson. Re- run Gamma Ray & Neutron & Perf. off same line. If Production is obtained rip off pipe above Simpson & produce all three zones.

This well drilled to 2021' by McAdam & wallace, bristow, and taken over at 2021 by Williams H .Pine.

PERFORATING RECORD:	- No.3	hots FCRIAT	ri (N	TOP	HOTTOM
	1.7	O holes Clay,	yellow		¥
	38 1	4 holes Shale	From the	5 -	45
200		4 holes Sand		45	65
		4 notes only		65	237
Burgen 1976 19		6 holes shale			
Burgen 1976 19	89 50 0	Gals. Sand	1. St. 1.	237	. 250
		3hale		250	298
SHOT RECORD:	٤٤	size shot Lime,	bro!ren	298	301.
		17 holes shale		301	425
		500 Gall Lime		425	437
oimpson Dolo. 1785	• • • •	200 darrane	그 경취 기가 되었다.	437	498
Hapanucka 1244	,	34 holes Shale			
Wapanucka 1239	9 1244	17 holes Sand,	sho, Gas	498	506
. Wapanuka 1239	1254	1000 Gal Shale		506	510
Simpson Dolo 1785	· · · · · · · · · · · · · · · · · · ·	17 holes Sand.	wtr. 3 blr./hr.	510	524
	1794	500 gal. Shale		524	635
Simpson Dolo. 178		Ol halas idah		635 •	645
Wapanucka 1244		34 holes Lime			
Wapanucka 1239		17 holes Shale		645	752
Yapanucka 1239) 1254	1000 gal Sand,	SO	752	756
Wapanucka 1239	1254	4000 gal hale	الحاج في المسوفاً	756	796
77		1 hole Lime	7-96	796	811
		10 holeshale		811	996
Booch 753			CONT. PAGE # 2.		,,,-
Beoch 75	3章 754章	Hydrafrac	CONT . LAGE A C.	Militar Tric	

Okmulgee, Oklahoma.

NW SW NW OF SEC. 6-14N-18E Muskogee County. FARE: NAME: Rooney # 2.

Page # 2. William H. Pine Filled to top with rotary mud. Fulled 85/8" casing- Ran Schlumberger Ran 7" Casing and cemented. Bailed hole dry & ran Gamma Ray & Neutron

		TO DESCRIPTION OF THE PARTY OF
FORLATION	TOP BOY	PERFORATING, PLUG BACK, ACIDIZING AND
Sand HFW	996 10	HYDRAFRACING RECORD
Sandy lime	1013 10	122
Sand	1022 10/	K CATATION NO. OK Size Results
Shale		150 Eurgen 2035 2040 To notes HF SW
Lime	1059	vac nurgen 2024 2031 14 " Nothing shn
shale		82 Burgan 2011 2018 14 " Nothing shwn
Lime		086
· · · · · · · · · · · · · · · · · · ·		Lane Wells Eridging Plug 1993' Leaking
Shale		26 Lane-Wells " " 1987 Shut off.
Lime		.20
Shale		1989 1982 26 holes N. Shwn
Sand, no sho		00 Bungen 1060 1002 500 enl 3 Coming
Shale ै		(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)
sand		Tana Walle Duideine Dlue 2002 Ch. 1000
Sha le		Dolomita 1779 1767 17 1-1-1 1-1-1
Lime		
Shale •		shown Dolomite 1778 1787 500 gals. Est.
Lime, blk	1236 12	.au
Wapanucka , SD	1240 12	65 30 bbls. SW/day
Shale	1265 13	in the second se
Lime	1301 13	16 Lane wells bridging Plud 12/1 Shut off
Shale	1316 13	29
· · · · · · · · · · · · · · · · · · ·	1329 13	39 Waranucka 1239 1254 51 holes Sho-
chale 50		gas- est. 1 gal. oil/day.
Lime		39 Wapanucka 1239 1254 1000 Gals.
Shale		Inc. in gas.
Lime		36 Wapanucka 1239 1254 4000 Gals.
Shale		200 1/2 02- 2 113
		UOUCO Deideine Dide doub
Hunton Lier		
Shale		50 65 Booch 757 758 10 holes- est.
Fiola Lime		1 112
Dense:		Pooch geg geo gain
Dolomite		34 113
Sandy Dolo.		70
Wilcox wtr. 2 blrs. /hr.	1796 18	O5 Drilled out plus at 7001 to
Green Sandy shale		Drilled out plug at 790' & producing from both Booch & Wapanucka.
Sand, hd.		Market 1 to
Gr en sandy shale		70
sandy lime, stain		83
Lime	1983 20	06
Sand		GASING RECORD:
Sand, oil & wtr.	2018 20	25 10-3/4" 40# 8 Used At. Set
Sand, So 20332 wtr. 2041	2025 20	17 10 N. D
Lime	2044 20	62 0 3/8" 32# 8 Used 1071 All P
Sandy lime, wtr.	1 '	70 /" 1/# 10 Used 2082 N.P.
Sand		LINER RECORD: NONE.
TOTAL DEPTH		dot
		CEMENTING AND MUDDING.
	•	7" Amt. set 2082! sax- cem 300 HOWCO
		Comented to abt 700 st to-

Cemented to abt. 700 ft. top. Cont. Page # 3. Wm.H.Pine

Page # 3. William H. Pine Okmulgee, Oklahoma.

NW SW NW OF SEC. 6-14N-18E FARE NAME: Rooney # 2. Muskogee, Oklahoma.

Botton hole Flugs used.

CABLE TOOLS FROM o to 2082'

TYPE RIG: Wichita Falls Spudder.

INITIAL PRODUCTION TEST: Pusping thru 2" tubing.

Amount of Oil Production 5 bbls. Length of test 24 hrs; Gravity of Oil 410 PUMP 1 5/8" Thompson.

TOTAL DEPTH 20821

Signed: G.S. Pine, Office Manager.

Stenciled: 2-17-50.p.c.

NATIONAL C.L WELL INDEX CO. OKCAHOM - CITY REF. NO. 490293

WATER WELL SEARCH HANCOCK RD. AND 51ST ST. MUSKOGEE, OKLAHOMA PROJECT #: 86251

RUST E & I



Geosovice Incorporated

May 20, 1993

Project #: 86251

Penny Carpenter Rust E & I 100 Glenborough #300 Houston, Texas 77067

In re: Water well search for a site at Hancock Rd. and 51st St. in Muskogee, Oklahoma.

Dear Ms. Carpenter,

Geosource Inc. (GI) has performed a water well search for a site in Muskogee County. GI utilized data provided by the State of Oklahoma Water Resources Board. The board is the central depository for water well logs from the licensed water well drillers in the state. The data is what the board currently has within their files. GI was able to identify four total wells: #1-three monitor wells and #2-1 domestic well within the area of review. The location map will have two locations.

If you have any questions concerning this project or need additional information, please call me at 512 474 6721.

Sincerely,

Floy Det Bosque

Enclosures

WELL RECORDS
HANCOCK RD. AND 51ST ST.
MUSKOGEE COUNTY

White - Water Resources Board Canary - Delliers Copy Pink - Drillers Copy

> Rated Capacity Depth of Bowls or Cylinder

Form 414-0884

MULTI-PURPOSE WATER WELL REPORT

STATE OF OKLAHOMA WATER RESOURCES BOARD

Application No.	
Aguifer	
Steam System Code	
Use Code	
County	
County	

#23573 1000 N:E. 10th St., P.O. Box 53585 Oklahoma City, Oklahoma 73152 ADDRESS Tahlequah, OK 74464 1. OWNER B.E. Davis PHONE. EIM (Circle One) 2. LEGAL DESCRIPTION OF WELL WIM 14N S: RGE -ECM: COUNTY SE 11_: TWP_ . % of _ _SE__ ¼ of _ . 14 of sec. . 4. USE Domestic NON-DOMESTIC 5. DRILLING METHOD 3. TYPE OF WORK 📑 Rev. Rolary ☐ Irrigation X) Rouny 🗴 New Well ☐ Plugging Reconditioning Work C Stock Municipal □ Cable Other . ☐ Test/Monitoring 📋 Industrial D Air Commercial
Other THE PROPERTY OF THE PERSON OF From To " If this well is Non-Domestle, has this location been permitted? Material Yes No Permit No. . Overburden 42 102 3 42 Sandstone Shale ENEWWELL CONSTRUCTION DATASET FURTHER BOOK TO BE 7/23/86 7/23/86 DATES: Staned Contractor Venture Drilling. Orifier Steve Lindwig 102 Diameter Hole ... Total Depth CASING RECORD Diameter 182TA Inside Outside Cement Grout Surface Seal Z Yes D No Type of Surface Seal: . Depth of Seal GRAVEL PACKED: Gravel Packed From Amount Used: .. PERFORATION RECORD Type/Size R. To From ft. To Fram ft. To WELL TEST DATA Static Water Level Below Land Surface 11. PLAT if Artesian: Flows . Approximate Yield . TO PERCONCIDATA IN THE WINE WAS A SHOP OF THE PERCONCIDATA IN THE 10_{AC} Backfilled With Material To Grouted or Cemented From ft. To Plot Location in Item 11. Show Distances From 2 Section Lines. Date Completed ☐ Replaced Cacing From ft. To ☐ Replaced Screen From lt. To ħ: Deepened Well From ft. To Redeveloped Well By ŞΕ 11 SE Wast SEC 14 CERTIFICATION (Circle One) 17E EIM, WIM, ECM TWP 12. PUMP INFORMATION The work described above was done under my supervision, and this report is true and correct to the best of my knowledge. Pump Type WD-216 Steve Ludwig Power Source P.O. Box

USE ADDITIONAL SHEETS IF NECESSARY

OKLAHOMA WATER RESOURCES BOARD

DOO N. HARVEY AVE

P.O. BOX 150 (-)

OKLAHOMA CITY, OK 73101-0150

Legal Description

mile											
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į	<u> </u>	١	_	Ė			Į Į				

Legal Description

	1/4 <u>NE</u> 1/4 d		6 Two	14N Rec.	
Well Owner SEC	Donohue enharqueh, Sult	300. Haus	tan. TX 770	hone (713) 875	
Finding location US Highway 69	1/2 mile south	of Hancock	Road and 1-	1/2 mile west	of

	1 36 L		4 · · · · · · · · · · · · · · · · · · ·
Type of work: Centechnical Basing Contechnical Basing Pump III Reconsider Conservation Well Conservation Well Conservation Contechnical Cont	at Hole I	G) 1	G.W. Use Drilling Method
	10 10		Non-Domestic Permitting
Lithologic Log	From To	10100	If this well is for other than domestic USE for at rate to bounds
Fill: silty clay, tan	0 ,2	1	specials of lone, and dempity complet up to the desirable or the desirable of the lone of
clay, tan and gray	2 39		New Boring or Well Construction Data Out: Storted 11-18-92 Completed 11-20-92
Weathered Shale, gray			firm Terracon Consultants, Inc.
and the second of the second o		1.	Operator Allan Brantley
المانية منابع المانية			Type of Construction & Opén Mole O Cased Hole Hale Clameter 8" Inches 10tal depth 39.5 lect Hale Clameter inches total depth leet
		Ι.	CASING RECORD
et Vii			Surface pipe diameter from to test will casing 2 inches -0.5 feet 39.5 feet
e de la companya ya de la companya de la companya de la companya de la companya de la companya de la companya de la co			Well cosing inches feet feet feet feet feet feet
			SCREEN or PERFORATION RECORD Type and Stot Size to the to the total stot Screen PVC 25.5 feet 39.5 feet
		٠.	0.010 Slot Screen eVC 25.5 feel 39.5 feel loct lo
		, Še	GRAYEL PACK from to 10 10 10 10 10 10 10 1
			SEAL Cement Grout Surface Seal Installed ED Yes." 13 No.
			Type of Surface SediEnvironrout Irgm feet 28.5 feet Aquiter Sedi Type 1/8" hentonite 24.5 feet 27.5 feet
**************************************			HYDROLOGIC DATA First Water Zone Encountered
			Plugging Data Date Plugged Backfilled From feet type Cement Grouted From feet feet
* two additional monitor wells installed	SIMIE	 	Reconditioning Work, Replaced Caing/Screen From
DEC	21 1392	W	Certification The work described above was done under my supervision. This report is correct to the best of my knowledge.
Ordahonia Wa	ter Resources	Bozro	Nome Terracon Consultants, Inc. Lie. No. 0P-0315 Address 5865 S. Garnett Phone 918 250 0461 Signed C. Hiller Brand Odie 12-17-92

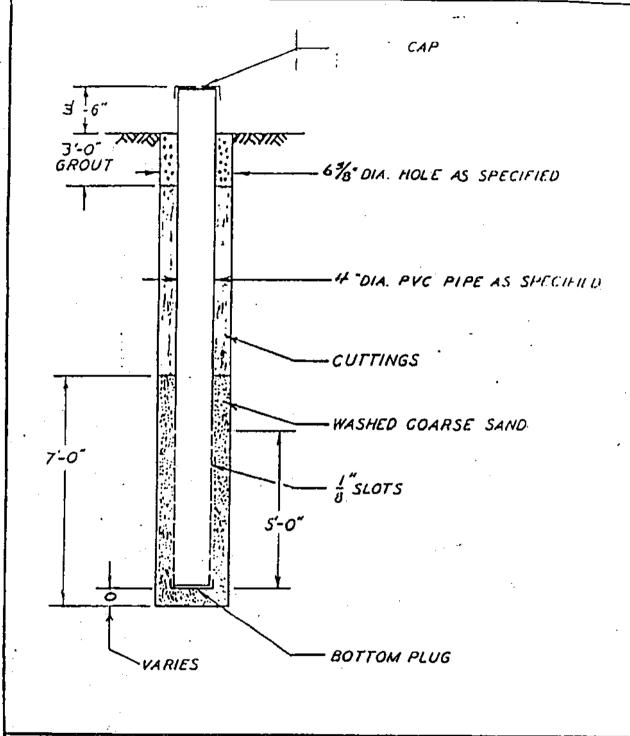
Appendix C

	1	Well NoMW-01R											
638.	Boring No. X-Ref: B-1												
	MONITOR WELL CONSTRUCTION SUMMARY												
	Survey Coords: N272500.8	Elevation Ground Level630.2 ft											
_5 \ \ \\\\	E2731415.1	Top of Casing 633.01 ft											
625.2	Drilling Summary:	Construction Time Log:	l ag										
		Start Finish	Landfill Oklahoma										
	Total Depth 29.25 feet from toc	Task Date Time Date Time	왕										
520. k	Borehole Diameter 7 inches Casing Stick-up Height: 2.81 ft	O to 25 ft 11/18 14:30 11/1815:30											
	Driller Terracon Environmental, Inc.		80 80										
	Driller - Allen Brantley	Geophys.Logging: NA NA	Muskogee,										
	Helper - Matt Johnson Rig CME 75	Casing:	로 로										
515.2	$A = \frac{3z - inch I.D. \times 7 - inch O.D.}{1}$	C1 11/18 15:30 11/18 15:32 11/18 15:35 11/18 15:35											
	hollow-stem augers Drilling Fluid None		A AM										
		Filter Placement: 11/18 15:40 11/18 15:47	SITE NAME										
-20 510.2	Protective Casing 6-inch anodized alumir	Time menting: 11/18 16:15 11/18 16:30 17:10 Development: 11/19 16:15 11/19 17:10	SIT										
	Well Design & Specifications	Development.											
		<u> </u>											
	Basis: Geologic Log X Geophysical Log Casing String (s): C = Casing S = Screen.	Well Development: B-K Hand Pump	ထ										
25 505.2		Initial H ₂ O level = 15.10 feet	24										
	Depth String(s) Elevation +2.81 - 16.44 C1 633 - 614	TOC/Well volume = 1.7 gallons	က										
	+2.81 - 16.44 C1 633 - 614 16.44 - 26.44 S1 614 - 604	Amount developed = 10 gallons or 5.8 well volumes	0										
30		3.0 Well volumes	Ş ≪										
600.2	and the state of t	Stabilization Test Data:	42 E										
!		Time pH Spec. Cond. Temp (C)											
<u> </u>	Casing: C1 2-inch schedule 40 PVC,	Time p H Spec. Cond. Temp (C) 16:30 6.90 31.8 61.6°F											
 35	flush-jointed with O-rings	16:40 7.03 34.9 61.2°F											
	#2	16:50 7.05 32.5 61.1°F 17:10 7.10 32.3 60.3°F											
<u> </u>	2-inch schedule 40 PVC, Screen: S1 flush-jointed with O-rings	17,110 7,120 32,10 40,00											
	0.010-inch slots	Recovery Data:	إبد										
	\$7	Q= 10 gallons S _o = 15.10 ft	Greg Hassett 92										
	Filter Pack: 10-20 washed Colorado silica sand, 14.5 to 26.5 ft	- 1 % 100	Has										
		R eo	80										
 - 	Grout Seal: Envirogrout bentonite grout, 2 to 11.5 ft	8 60	BY Gr 11/18/92										
	groat, 2 to 11.5 ft	E 40	18										
1	Bentonite Seal: 2-inch bentonite pelle	t R 20	9 11										
	11.5 to 14.5 ft	20 40 60 80 100	SEC										
[. TIME (minutes)	SUPERVISED BY DATE 11,										
	Comments: Borehole open to 27.5 f	t: 2675 to 275 feet, auger cuttings.	SUPE										
T	Centralizers (stainless steel) surface.	at 5.5 ft and 24.5 ft from ground											
		vation 627.7 to 630.2 ft prior to comple											
	of MW01R concrete pad. Adjuste	d depth and dimensions from the MWO1R from the mwo1	ield										
		report accordingly.											

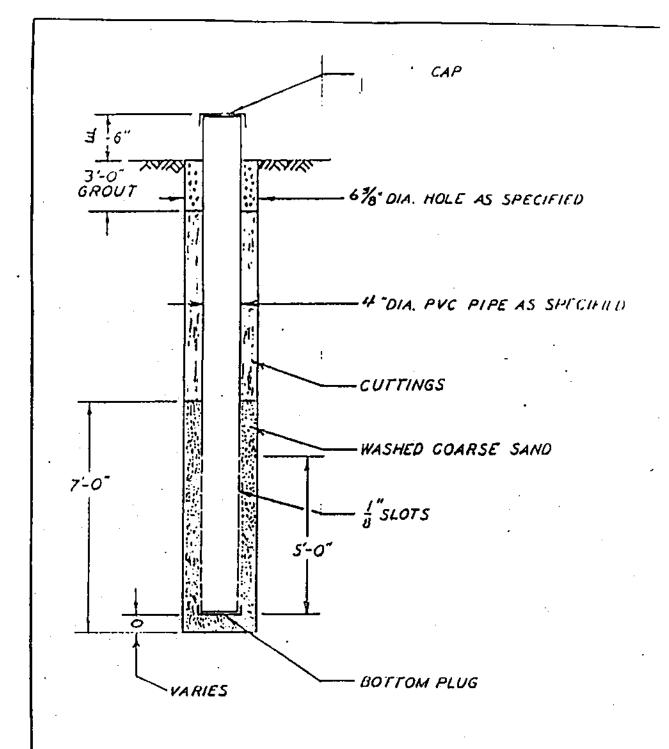
		$\neg \neg$	Well No. MWOZR										
63 2 2	MIN	<u></u>	Boring No. X-Ref: B-2										
032.12		Δ Δ	MONITOR WELL CONSTRUC										
	N	ΔΔ	Survey Coords: <u>1</u> 1271744.8	Elevation Ground Level 632.2 ft									
L 5 N	N		£2731158.9	Top of Casing 635.24 ft		_							
627.2		ΔΔ			=	Ome							
	N	\\^{\bullet}_{\bullet}\	Drilling Summary:	Construction Time Log: Start Finish	Landfill	Oklahoma							
		abla	Total Depth 30 feet from toc	Task Date Time Date Time	Lan								
10			Rorehole Diameter 7 inches	Drilling 0 - 30 ft 11/18 09:00 11/18 10:00	e l	Muskogee.							
622.8	1		Casing Stick-up Height: 3 feet Driller Terracon Environmental Inc.	0 - 30 10 11/18 05:00 11/18 10:00	Muskogee	ğ							
			Driffer - Allen Brantley		usk	usķ							
_15			Helper - Matt Johnson	Geophys Logging: NA NA NA	اخ	Σ							
_15 617.2.	MOR		Rig CME 75 Bit(s) 3½-inch I.D. x 7 inch O.D.	Casing: C1 11/18 13:30 11/18 13:31 S1 11/18 13:31 11/18 13:34									
01/ (2)	<u> </u>		hollow-stem augers	S1 11/18 13:31 11/18 13:34	Σ	Z							
		`	Drilling Fluid <u>None</u>	Filter Placement: 11/18 13:40 11/18 14:00	SITE NAME	OCATION							
			Protective Casing 6-inch anodized alumin	11/18 16:00 11/18 16:19	Ë	ç							
_20 612 2	≣ :		Protective Casing V India and India	Development: 11/18 14:30 11/19 16:10	(I)	_							
[.	≣ :		Well Design & Specifications										
	<u> </u> ≡ :	IN.	Basis: Geologic Log <u>X</u> Geophysical Log	Well Development: B-K Hand Pump Initia	.T	_							
_25	<u></u> ≡:		Casing String (s): C = Casing S = Screen.	H,O level (estimated) = 9.50 ft,	A.L.	ر ر							
-25 607 2	 ≣ :	$ \mathcal{N} $	Depth , String(s) , Elevation	H ₂ O level (estimated) = 9.50 ft, TOC/well volume = 3.5 gallons		0							
L	Ħ.		+3.0 - 17.0 <u>C1</u> <u>635 - 615</u>	Amount developed = 31 gallons or 8.8 well volumes		7							
			17.0 _ 27.0 S1 615 _ 605	Of 5.5 Well Volumes		· ·							
-30		<i>=</i>				C/W							
602 2	* * * -	 	water framewater and water and an interpretation	Stabilization Test Data:अर्थान्य अर्थान्य व	5.05								
		H	<u> </u>	Time p H Spec. Cond. Temp (C)									
]]	Ι.	Ш	Casing C1 2-inch schedule 40 PVC,	15:25 6.88 32.4 63.5°F									
-35 597 2		!	flush-jointed with: Q-ring	s 15:30 6.79 32.9 63.4°F 15:35 6.63 33.3 63.0°F		1							
	1	11	C2	16:00 6.79 33.4 61.5°F									
		11	Screen: S1 2-inch schedule 40 PVC	16:05 6.86 33.3 61.9°F									
Lì		Ш	flush-jointed with 0-rings xx 0.010-inch slots	Recovery Data:	بر								
1				Q= 31 gallons So= 9.50	Set								
1	1	Π	Filter Pack: 10-20 washed Colorado silica sand, 15 to 28 feet	- 1 % ¹⁰⁰	Hassett								
1 1			SIIICA SAIN, 15 to 25 feet	R 80 E 0 C 60	Greg	y.							
L 1	1	\mathbf{H}	Grout Seal: Envirogrout, bentonite 2 to 12 feet grout	- 8 60 - 1	Į Š	14 0 100							
1		11	2 to 12 feet grout	_ V 40		4							
1	1	11	Bentonite Seal: 4-inch bentonite	R 20	À	-							
1 1		1]	pellets, 12 to 15 feet	20 40 60 80 100		į							
 -				TIME (minutes)	N N	:							
			77.	antilement of fines 20 to 20 fact	SUPERVISED BY	<u> </u>							
			Comments: borenoie collapse and	settlement of fines 28 to 30 feet, stainless steel) at 3 feet and 25 feet	ζ,) (
7.			from ground surface.		ŀ								
j]]	1	Tron ground satisfact										
			7										

			Well No. MW-03R	
-0 541. M		· .	Boring No. X-Ref: B-3	
541.		MONITOR WELL CONSTRU		
	MM	Survey Coords: N272179.4	Elevation Ground Level641.5 ft	
_5 636.5)] [/\	E2730189.7	Top of Casing 644.16 ft	!
636.		Drilling Summary:	Construction Time Log:	g
\mathbb{N}	/////		Start Finish	Muskogee Landfill Muskogee, Oklahoma
L10N	71 N	Total Depth 39 feet	Task Date Time Date Time	K G
631.5	NN	Borehole Diameter 7 inches Casing Stick-up Height: 2.66 feet	- Drilling 0 to 39.5 11/19 09:00 11/19 10:35	آن ا <u>تا</u>
132.N N	MN	Driller Terracon Environmental, Inc.		Muskogee I Muskogee,
	M/M	Driller - Allan Brantley	_	8 8
15[]	// J.	Helper - Matt Johnson Rig CME 75	Geophys.Logging: NA NA	ush ush
_15 626.5	$\langle \rangle \rangle$	Bit(s) 32-inch I.D. x 7-inch O.D.	- Casing: 11/19 11:00 11/19 11:02	
	$\langle M \rangle$	hollow-stem augers	S1 11/19 11:05 11/19 11:08	³ ≝ ≳
	MK	Drilling Fluid None	- Filter Placement: 11/19 11:15 11/19 11:45	SITE NAME
_20	/ J.P.	Protective Casing 6-inch anodized alumi	num Cementing 11/19 11:45 11/19 12:00	SITE NAME,
521.	MM	Trocours Outsing 5 Estate Stat	Development: 11/20 08:15 11/20 09:12	, w ¬
[N	M/	Well Design & Specifications		
	M /	Basis: Geologic Log XX Geophysical Log	Well Development: B-K Hand Pump	
_25		Casing String (s): C = Casing S = Screen.	i	8
_25 516. 5	劉 / /	Depth , String(s) , Elevation	Initial H ₂ O level = 13.7	\sim
	$/\Lambda$ E	+2.66 - 28.1 <u>C1 644 - 61</u>	I IVV/WELL VOIGHE - 4.3 EGILONS 1	03
		28.1 - 38.1 S1 613 - 60		
-30 	M	_ _		× ×
		The same of the sa	Stabilization Test Data:Inoperable Meter	State Committee
	\mathbb{K}		Time p H Spec. Cond. Temp (C)	
l ₃[:[≣]	\mathbb{Z}	Casing: C1 2-inch schedule 40 PVC,		
‰. ⊨	1 =	flush-jointed with O-ring	<u>s</u>	ı
l : ⊟		#7		
	기근	Screen: S1 2-inch schedule 40 PVC		
40	= =	flush-jointed with O-ring	Recovery Data:	
601.5		\$1 0.010-inch slots	Q= 45 gallons So= 13.7 feet	11
		Filter Pack: 10-20 washed Colorado	— * 100 — 1 1 1 1 1 1 1 1 1	
		silica sand, 26.1 to 39 ft	_ R 80	Hay
		Grout Seal: Envirogrout bentonite		Greg Hassett 11/19/92
]		grout, 2 to 23 ft	─▐▝▗₀ ▊ ▎ ▍ ▍▋	년 전 전
i '		Bentonite Seal: 2-inch bentonite pell	_ E R 20	_ ≿' ∓
		23.1 to 26.1 ft		٥
L ·		-		1 <u>S</u> E
			TIME (minutes)	E E
L			s steel) at 3 feet and 36 feet from	SUPERVISED BY_ DATE 1:
		ground surface. Auger	cuttings 39 to 39.5 feet	
\vdash \mid \mid	.		· · · · · · · · · · · · · · · · · · ·	

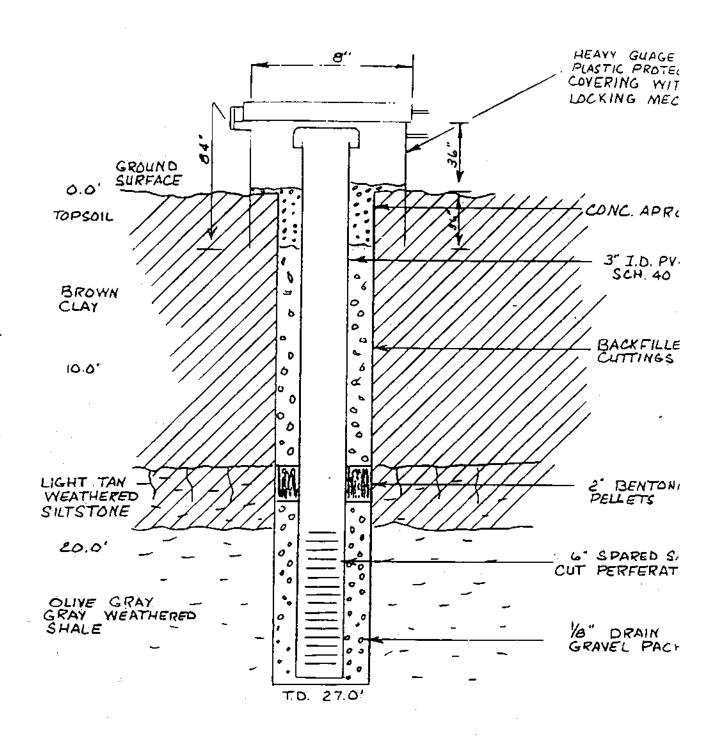
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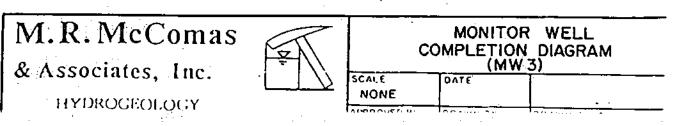


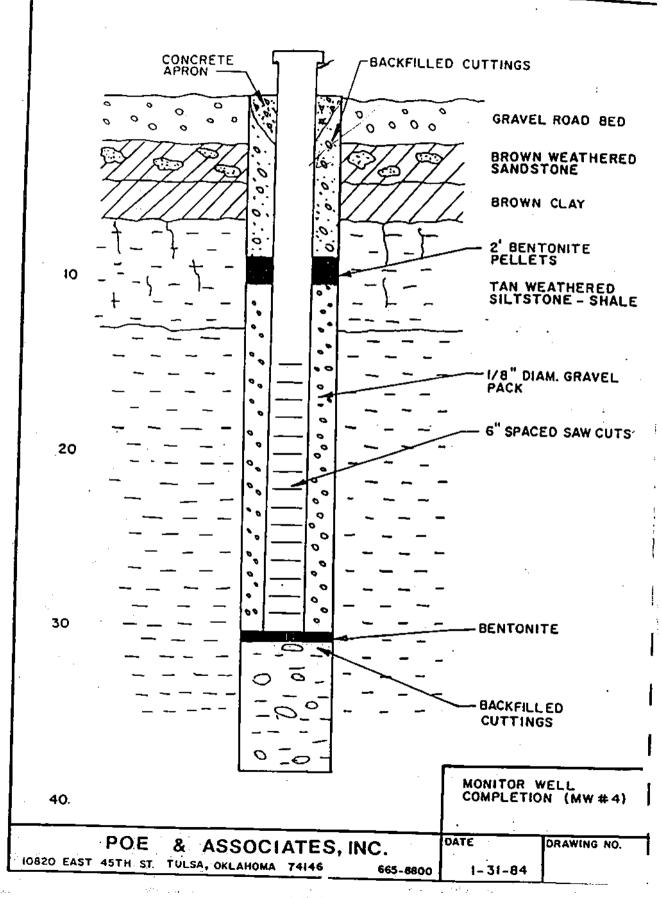
	CITY OF MUSKOGEE, OKLAHOMA	į	C) C)	MONITORING WELL
	Well located near entrance Depth 25.0 feet	×c	7.	SCALE: NONE
ğ		1,654		STEWART, WHITE & ASSOCIATES, I Tules, Oktohomo



	City of Muskogee, Oklahoma Land Fill Southwest of City	, CA	Ų,	MONITORING WELL NO. 2
	Well located Northeast area Depth 30.0 feet.	8	ŧ	SCALE: NONE STEWART, WHITE & ASSUCIATES.
		1.		Tulse, Oktahorne
S S		1		







Appendix D

WMI ENVIRONMENTAL MONITOR OF LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000 Sign Blank'

ENS: MP: 93-11523 852931 01 / 01

Rev / Task: Sample Type:

WELL 20-MAY-1/993

	·	8/00		1	Reported:	20-MAY-1	993	
	e Point: e Number; ed:	852-01FB AH0591 27-APR-1993	EML RL	852-MW01 AH0585 27-APR-1993	EML RL	852-MW01R AH0587 27-APR-1993	EML RL	Units
FIELD DATA:								· · ·
COLOR		CLEAR		BROWN		BROWN		
DEPTH TO WATER FROM TOP OF CASIN	IG	NA NA		14.38		8.68		FT
FIELD DISSOLVED OXYGEN		7.50		3,50		6.10		MG/L
GROUNDWATER ELEV.		NA		628.56		624.33		FT MSL
ODOR		NONE		STRONG		NONE		LI MOD
PH FIELD		8.98		6.52		6.96		PH UNITS
SPECIFIC CONDUCTANCE FIELD		45.1	-	5560		4850		UMHOS/CM
WATER TEMPERATURE IN DEGREES CEL	STUS	20.9		14.8		14.8		DEGREES C
WELL DEPTH TOTAL	.0100	NA		43.18		29.25		FT
CHEMICAL METHODS & ROBOTICS:		!						
CHEMICAL OXYGEN DEMAND		ND	10.	12	10.	DÜ	1.0	MG/L
CYANIDE, TOTAL		ND ND	0.020	ND ND	0.020	ND DND	10. 0.020	MG/L MG/L
NITROGEN, AMMONIA		0.27	0.020	1.30	0.020			
NITROGEN, NITRATE		ND ND	0.020	ND I	0.020	ND 0.52	0.020	MG/L
PH THE TENE		6.87	0.05	6.67	0.05	7.20	0.050	MG/L
PHENOLS		ND ND	0.050	ND I	0.050	/.20	0.05	PH UNITS
SOLIDS, TOTAL DISSOLVED		111	5.	5800			0.050	MG/L
SPECIFIC CONDUCTANCE		4.1	1.0	6120	25. 1.0 ⁻	1110 1860	5.	MG/L
TOTAL ORGANIC CARBON		ND ND	1.0		1.0		1.0	DMHOS/CM
TOTAL ORGANIC CARBON		ND	1.0	2.4	1.0	ND ND	1.0	MG/L MG/L
INORGANICS:								
ALKALINITY, BICARBONATE		ND	10.	534	10.	282		140-79
ANTIMONY-TOTAL		ND ND	100.	ND ND			10.	MG/L
ARSENIC-TOTAL		ND	10.0	ND ND	100.	ND	100.	UG/L
BARIUM-TOTAL		ND	200.	ND ND	10.0	ND I	10.0	UG/L
BERYLLIOM-TOTAL		ND ND	200. 5.0	ם או	200.	ND	200.	UG/L
BORON-TOTAL		24.2	10.0	677	5.0	ND	5.0	UG/L
-CADMIUM-TOTAL		ND ND	5.0		10.0	86.7	10.0	UG/L
CALCIUM-TOTAL		ND	5000	ND ACNOON	5.0	ND	5.0	UG/L
CHLORIDE		ND ND	0.5	461000	5000	133000	5000	UG/L
CHROMIUM-TOTAL		מא		315	5.0	404	0.5	MG/L
COBALT-TOTAL		עמ עמ	10.0 50.0	ND	10.0	ND	10.0	UG/L
COPPER-TOTAL		ND ND	25.0	ND	50.0	ND	50.0	UG/L
FLUORIDE		ם מא	25.0 0.050	ND	25.0	ND 13	25.0	UG/L
IRON-TOTAL		ם מא		0.38	0.050	0.43	0.050	MG/L
LEAD-TOTAL		ND ND	100.	729	100.	622	100.	UG/L
MAGNESIUM-TOTAL		ND I	5.0	ND	16.0	[מא	5.0	OG/L
MANGANESE-TOTAL		ND I	5000	240000	5000	41200	5000	UG/L
MERCURY-TOTAL		ND I	15.0	2960	15.0	20.8	15.0	UÇ/L
NICKEL-TOTAL		ND ND	0.20	ND	0.20	ND I	0.20	OG/L
POTASSIUM-TOTAL		ND I	40.0	ND	40.0	ND 1	40.0	QC/T
SELENIUM-TOTAL		ND ND	5000	ND	5000	ND	5000	UG/L
SILVER-TOTAL			5.0	ND	16.0	ND :	5,0	UG/L
		ND I	25.0	ND T	25.0	ND	25.0	UG/L
SODIUM-TOTAL SULFATE		ND I	5000	719000	5000	188000	5000	UG/L
		i um l		0700				
THALLIUM-TOTAL		ND ND	5.0 10.0	2780 ND	50.0 10.0	54.7 ND	5.0 10.0	MG/L UG/L

WMI ENVIRONMENTAL MONITO G LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS: MP; Rev / Task: 93-11523 852931 01 / 01 WELL

Sample Type: Reported:

20-MAY-1993

					Reported:	20-MAY-1	. 773	
Analyte	Sample Point: Sample Number: Sampled:	852-01FB AH0591 27-APR-1993	EML RL	852-MW01 AH0585 27-APR-1993	EML RL	852-MW01R AH0587 27-APR-1993	EML RL	Units
			•					
VANADIUM-TOTAL		ND	50.0	ND	50.0	ND	50.0	DG/L
ZINC-TOTAL		- ND	20.0	ND	20.0	ND	20.0	UG/L
OLATILE ORGANICS:								
1,1,1,2-TETRACHLOROETHANE	?	ND	5.	ND	5.	ND	5.	UG/L
1,1,1-TRICHLOROETHANE	•	ND I	š.	ND ND	š.	ND ND	5.	UG/L
1, 1, 2, 2-TETRACHLOROETHANE	5	ND ND	Š.	ND I	5.	ND I	5.	UG/L
1,1,2-TRICHLOROETHANE	_	ND I	5.	ND I	5.	ND I	5.	UG/L
1,1-DICHLOROETHANE		ND I	5.	ND ND	5.	ם מא	š.	UG/L
1,1-DICHLOROETHENE		ND	5.	ND	5. 5.	ND	5.	UG/L
1,2,3-TRICHLOROPROPANE		ן מא ן	10.	ND	10.	ND I	10.	UG/L
1,2-DIBROMO-3-CHLOROPROPA	NE.	I ND I	10.	ND .	10.	ND ND	10.	UG/L
1.2-DIBROMOETHANE	112	ND	10.	ND ND	10.	ND ND	10.	
1,2-DICHLOROBENZENE		ND D	10.	ND ND				UG/L
1,2-DICHLOROETHANE		ם מא	5.	ND	10. 5.	ND	10.	UG/L
1,2-DICHLOROPROPANE		ם מא	5. 5.	ND I		ND	5.	UG/L
1,4-DICHLOROBENZENE		שא	10.		5.	ND	5.	DG/L
2-BUTANONE				ND	10.	ND	10.	UG/L
		ND	10.	ND	10.	ND	10.	UG/L
2-HEXANONE		ND	10.	ND	10.	ND	10.	UG/L
4-METHYL-2-PENTANONE		מא	10.	ИD	10.	ND	10.	UG/L
ACETONE		. מא	34.	ND	34,	ND	34.	UG/L
ACRYLONITRILE		ND	100	ND	100	ИD	100	UG/L
BENZENE		NO	5.	ND	5.	ND	5.	UG/L
BROMOCHLOROMETHANE		ND	10.	ND	10.	ND	10.	UG/L
BROMODICHLOROMETHANE		ND	5.	ND	5.	ND	5.	UG/L
BROMOFORM		ND ND	5.	ND	5.	ND DN	5.	UG/L
Bromomethane		ND	10.	ND	10.	ND	10.	UG/L
CARBON DISULFIDE		ND j	5.	ND	5.	ND	5.	UG/L
CARBON TETRACHLORIDE		ND {	5.	ND	5,	ND	5.	UG/L
CHLOROBENZENE		ND	5.	ND	5.	ו מא	5.	UG/L
CHLOROETHANE		ND	10.	ND	10.	ND I	10.	UG/L
CHLOROFORM		ND	5.	מא	5.	ן מא	5.	UG/L
CHLOROMETHANE '		ND I	10.	ND	10.	ND	10.	UG/L
CIS-1,2-DICHLOROETHENE		ND	10.	ND	10.	ND	10.	UG/L
CIS-1, 3-DICHLOROPROPENE		ND	5.	ND	-š.	ND	5.	UG/L
DIBROMOCHLOROMETHANE		ND .	5.	ND	š.	ND I	5.	UG/L
DIBROMOMETHANE		ND	10.	ND	10.	ND	10.	UG/L
ETHYLBENZENE		ND I	5.	ND	5.	ND	5.	
IODOMETHANE		ND I	10.	ND I	10.	ND D		UG/L
METHYLENE CHLORIDE		ND I	5.	ND ND	5.	DND DN	10.	UG/L
STYRENE		ND I	5.	ND UND	5. 5.	ND DN	5 .	UG/L
TETRACHLOROETHENE		ND	5.	ND ND	5. 5.		5.	UG/L
TOLUENE		ND I	5.	DN DN		ND	5.	DG/L
TRANS-1, 2-DICHLOROETHENE		ND ND	10.	DN DN	5.	ND	,5.	UG/L
TRANS-1, 3-DICHLOROPROPENE	•	ND I	10. 5.		10.	ND	10.	UG/L
TRANS-1, 4-DICHLORO-2-BUTE		ND	3. 10.	ND ND	5.	ND	5.	UG/L
TRICHLOROETHENE	14411	ND	5.	ND ND	10.	ND	10.	UG/I,
TRICHLOROFLUOROMETHANE		ND ND	5. 10.		5.	ND	.5.	DG/L
TOTAL DOLONGE THENE		ן שיי ן	IU.	ND	10.	ND I	10.	UG/L

NA = Not Analyzed

ND = Not Detected

TBK - Trip Blank



WMI ENVIRONMENTAL MONITO G LABORATORIES, INC.



EVENT SUMMARY REPORT

site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS:

MP;

93-11523 852931 01 / 01

Rev / Task: Sample Type: Reported:

WELL 20-MAY-1993

Analyte	Sample Point: Sample Number: Sampled:	852-01FB AH0591 27-APR-1993	EML RL	852-MW01 AH0585 27-APR-1993	EML RL	852-MW01R AH0587 27-APR-1993	EML RL	Units
VINYL ACETATE VINYL CHLORIDE XYLENE (TOTAL)		ND ND ND	10. 10. 10.	ND ND ND	10. 10. 10.	ND ND ND	10. 10. 10.	DG/L DG/L

NA - Not Analyzed

ND = Not Detected

TBK - Trip Blank

WMI ENVIRONMENTAL MONITO LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS: MP:

93-11523 852931 01 / 01 WELL

Rev / Task: Sample Type: Re

mubro ribo:	""
eported:	20-MAY-199

Analyte	Sample Point: Sample Number: Sampled:	852-MW02 AH0589 27-APR-1993	EML RL	852-MW02R U AH0590 27-APR-1993	EML RL	852-MW03 ✓ AH0588 27-APR-1993	EML RL	Unita
FIELD DATA: COLOR DEPTH TO WATER FROM TO FIELD DISSOLVED OXYGEN GROUNDWATER ELEV. ODOR PH FIELD SPECIFIC CONDUCTANCE F WATER TEMPERATURE IN D WELL DEPTH TOTAL	CIELD	CLEAR 19.72 2.75 607.02 NONE 7.25 4880 18.1 28.72		CLEAR 8.50 6.20 655:34 NONE 6.20 3880 17.7 30.01	626.74 H. Daisel	CLEAR 9.39 5.80 624.25 SLIGHT 8.25 8850 18.8 30.10		FT MG/L FT MSL PH UNITS UMHOS/CM DEGREES C FT
CHEMICAL METHODS & ROBO CHEMICAL OXYGEN DEMAND CYANIDE, TOTAL 2 NITROGEN, AMMONIA 3 NITROGEN, NITRATE 4 PH PHENOLS 6 SOLIDS, TOTAL DISSOLVED SPECIFIC CONDUCTANCE 3 TOTAL ORGANIC CARBON 7 TOTAL ORGANIC CARBON		30 ND 0.15 ND 6.89 ND 3180 4930 1.4	10. 0.020 0.020 0.050 0.05 0.050 25. 1.0	ND ND 0.96 ND 6.87 ND 2380 4010 1.4 1.3	10, 0.020 0.020 0.050 0.05 0.050 25, 1.0 1.0	ND ND ND 0.40 7.23 ND 1040 1920 ND	10. 0.020 0.020 0.050 0.05 0.050 5. 1.0	MG/L MG/L MG/L MG/L PH UNITS MG/L MG/L UMROS/CM MG/L MG/L
INORGANICS: ALKALINITY, BICARBONATE ANTIMONY-TOTAL A ARSENIC-TOTAL A BARIUM-TOTAL A BERYLLIUM-TOTAL A CALCIUM-TOTAL A CALCIUM-TOTAL A CHORIDE A CHORIDE A INON-TOTAL A INON-TOTAL A INON-TOTAL A MAGNESIUM-TOTAL A MAGNESIUM-TOTAL A MERCURY-TOTAL A NICKEL-TOTAL A SELENIUM-TOTAL A SELENIUM-TOTAL A SULFATE S SU	Z ···	296 ND 17.2 ND ND 230 ND 282000 1210 ND ND ND ND 0.22 3530 ND 117000 2640 ND ND ND ND ND ND ND ND ND ND ND ND ND	10. 100. 100. 200. 5.0 10.0 5.0 5.0 50.0 25.0 0.050 16.0 5000 15.0 0.20 40.0 5000 55.0 5000 55.0	710 ND ND ND ND 163000 335 ND ND ND 0.52 2310 ND 57000 779 ND ND ND ND ND ND ND ND ND ND ND ND ND	10. 100. 10.0 200. 5.0 10.0 5.0 5000 2.5 10.0 50.0 25.0 0.050 100. 16.0 5000 15.0 0.20 40.0 5000 16.0 25.0 5000	393 ND ND ND 146 ND 98400 371 ND ND 0.49 2120 ND 40500 52.3 ND ND ND ND 40500 52.3 ND ND ND ND ND 146 ND ND ND ND ND ND ND ND ND ND	10. 100. 100. 200. 5.0 10.0 5.0 5.0 5.0 0.5 10.0 55.0 25.0 0.050 100. 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	MG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L U

NA = Not Analyzed

ND = Not Detected

TBK - Trip Blank

WMI ENVIRONMENTAL MONITO G LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS; MP:

93-11523 852931 01 / 01 WELL

Rev / Task: Sample Type: Reported:

20-MAY-1993

					Reported.	20-MAI-1		
	Sample Point: Sample Number: Sampled:	852-MW02 AH0589 27-APR-1993	EML RL	852-MW02R AH0590 27-APR-1993	EML RL	852-MW03 AH0588 27-APR-1993	EML RL	Units
VANADIUM-TOTAL		мр 35	50.0	ND ·	50.0	ND	50.0	UG/L
ZINC-TOTAL		ND 35	20.0	ND	20.0	DO	20.0	UG/L
	•	""						
VOLATILE ORGANICS: 1,1,1,2-TETRACHLOROETHANE		ND ND	5.	110	-		_	
1,1,1-TRICHLOROETHANE		םמ	5. 5.	ND	5. 5.	ND	5.	UG/L
1,1,2,2-TETRACHLOROETHANE			5. 5.	ND	5. 5.	ND	5.	UG/L
1,1,2,2-TETRACHLOROETHANE 1,1,2-TRICHLOROETHANE		ND ND	5. 5.	ND		ND	5.	UG/L
			5. 5.	ND	5.	ND	5.	ne\r
1,1-DICHLOROETHANE		ND		ND	5.	ND	5.	UG/L
1,1-DICHLOROETHENE		ND	5.	ND .	5.	ND	5.	UG/L
1,2,3-TRICHLOROPROPANE		ND	10.	ND	10.	ND	10.	DG/L
1,2-DIBROMO-3-CHLOROPROPANE		ND	10.	ND	10.	ND	10.	UG/L
1,2-DIBROMOETHANE		ND	10.	ND	10.	ND D	10.	UG/L
1,2-DICHLOROBENZENE		ND	10.	ND	10.	ИD	10.	UG/L
1,2-DICHLOROETHANE		ND	5.	ND	5.	סמ	5.	UG/L
1,2-DICHLOROPROPANE		ND	5.	ND	5.	ND	5.	DG/L '
1,4-DICHLOROBENZENE		ND	10.	ND	10.	ND	10,	UG/L
2-BUTANONE		מא	10.	ND	10,	ND	10.	UG/L
2-HEXANONE		ND	10.	ND	10.	ND	10,	DG/L
4-METHYL-2-PENTANONE		ND	10.	ND	10.	ND	10.	UG/L
ACETONE		ND	34.	ND	34.	ND	34.	UG/L
ACRYLONITRILE		ND	100	ND	100	ND	100	DG/L
BENZENE		ND	5.	ND	5.	ND	5,	UG/L
BROMOCHLOROMETHANE		ND	10.	ND	10.	ND	10.	UG/L
BROMODICHLOROMETHANE		ИD	5.	ND	5.	ND	5.	UG/L
BROMOFORM		ND	5.	ND	5.	ND	5.	UG/L
BROMOMETHANE		ND	10.	ND	10.	ND I	10.	UG/L
CARBON DISULFIDE		ND	5.	ND I	5.	ND	5.	UG/L
CARBON TETRACHLORIDE		ND	5.	ND	5.	ND	5.	UG/L
CHLOROBENZENE		NĎ	5.	ND	5.	ND	5.	UG/L
CHLOROETHANE		ND I	10.	ND I	10.	ND I	10.	DG/L
CHLOROFORM		ND	5.	ND	5.	ND	5.	UG/L
CHLOROMETHANE		ND	10.	ND	10.	ND	10.	UG/L
CIS-1, 2-DICHLOROETHENE		ND	10.	ND I	10.	ND	10.	UG/L
CIS-1, 3-DICHLOROPROPENE		ND	5.	ND I	5,	מא	5.	UG/L
DIBROMOCHLOROMETHANE		ND	5.	ND	5.	ND	5.	UG/L
DIBROMOMETHANE		ND	10.	ND ND	10.	ND	10.	UG/L
ETHYLBENZENE		I ND	Š.	ND	5.	ND	5.	DG/L
IODOMETHANE		ND	10.	ND	10.	ND	10.	UG/L
METHYLENE CHLORIDE		ND !	5.	ND .	5.	ND ND	5.	DG/L
STYRENE		ND	5.	סא ו	5.	ND	5. 5.	UG/L
TETRACHLOROETHENE		I ND	5.	ND	5. 5.	ND	5. 5.	UG/L UG/L
TOLUENE		ND I	5.	ND	5. 5.	מא	5. 5.	UG/L
TRANS-1, 2-DICHLOROETHENE		ND	10.	ND	10.			
TRANS-1, 3-DICHLOROPROPENE		ND ND	5.	ND DND		ND	10.	UG/L
TRANS-1, 3-DICHLOROPROPENE TRANS-1, 4-DICHLORO-2-BOTENE					5.	ND	.5.	UG/L
		ND	10.	ND	10.	ND	10.	UG/L
TRICHLOROETHENE		ND	5.	ND	5.	ND	5.	ng/r
TRICHLOROFLUOROMETHANE		ND	10.	ND	10.	ND	10.	UG/L

NA - Not Analyzed

ND = Not Detected

TBK - Trip Blank



G LABORATORIES, INC.

EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS: MP:

Rev / Task:

93-11523 852931, 01./ 01

Sample Type: Reported:

WELL 20-MAY-1993

Analyte	Sample Point: Sample Number: Sampled:	852-MW02 AH0589 27-APR-1993	EML RL	852-MW02R AH0590 27-APR-1993	EML RL	852-MW03 AH0588 27-APR-1993	EML RL	Onits
VINYL ACETATE		ND	10.	ND	10.	ND	10.	UG/L
VINYL CHLORIDE		ND	10.	ND	10.	ND	10.	UG/L
XYLENE (TOTAL)		ND	10.	ND	10.	ND	10.	UG/L

NA = Not Analyzed

ND - Not Detected

TBK = Trip Blank

WMI ENVIRONMENTAL MONITOR LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

ENS: MP:

93-11523 852931 01 / 01 WELL

oampie type:	بريد المريدي
Reported:	20-MAY-1993011

2801 S. 54TH MUSKOGEE OK		/	Buckeyon	MP: Rev / Task Sample Typ Reported:	e: WELL 20-MAY-1	Q.105661	
Sample Point Sample Number Sample Number Sampled:		eml Rl	852-MW04 AH0583 27-APR-1993	EML RL	852-MW06 4K AH0584 27-APR-1993	EML RL	Units
FIELD DATA: COLOR DEPTH TO WATER FROM TOP OF CASING FIELD DISSOLVED OXYGEN GROUNDWATER ELEV. ODOR PH FIELD SPECIFIC CONDUCTANCE FIELD WATER TEMPERATURE IN DEGREES CELSIUS WELL DEPTH TOTAL	CLEAR 14.25 4.0 629.91 NONE 6.75 4100 15.5 40.76		CLEAR 4.70 2.9 646.67 NONE 7.12 8150 16.0 32.50		CLEAR 25.28 6.2 638.56 SLIGHT 6.70 2810 15.8 69.38		FT MG/L FT MSL PH UNITS UMHOS/CM DEGREES C FT
CHEMICAL METHODS & ROBOTICS: CHEMICAL OXYGEN DEMAND CYANIDE, TOTAL NITROGEN, AMMONIA NITROGEN, NITRATE PH PHENOLS SOLIDS, TOTAL DISSOLVED SPECIFIC CONDUCTANCE TOTAL ORGANIC CARBON TOTAL ORGANIC CARBON	42 ND 0.96 ND 6.13 ND 3920 4430 13.3 13.1	10. 0.020 0.020 0.050 0.05 0.050 25. 1.0 1.0	94 ND ND ND 6.78 ND 7950 9010 21.9 21.8	10. 0.020 0.020 0.050 0.05 0.050 25. 1.0 1.0	ND ND 1.16 ND 6.45 ND 2140 2900 3.8 4.3	10. 0.020 0.020 0.050 0.05 0.050 25. 1.0	MG/L MG/L MG/L MG/L PH UNITS MG/L MG/L UMHOS/CM MG/L MG/L
INORGANICS: ALKALINITY, BICARBONATE ANTIMONY-TOTAL ARSENIC-TOTAL BARIUM-TOTAL BERYLLIUM-TOTAL BORON-TOTAL CADMIUM-TOTAL CALCIUM-TOTAL CALCIUM-TOTAL CHLORIDE CHROMIUM-TOTAL COPPER-TOTAL FLUORIDE IRON-TOTAL LEAD-TOTAL MACRESIUM-TOTAL MAGANESE-TOTAL MERCURY-TOTAL NICKEL-TOTAL SELENIUM-TOTAL SELENIUM-TOTAL SILVER-TOTAL SULFATE THALLIUM-TOTAL	220 ND ND ND ND ND 190 214 ND ND 421000 214 ND ND 146000 462 ND ND ND ND ND ND ND ND ND ND ND ND ND	10. 500. 10.0 200. 12.0 50.0 250.0 50.0 50.0 250.0 125. 125. 360. 16.0 5000 56.0 0.20 200. 5000 16.0 125. 8000 50.0	1110 ND ND ND 1700 ND 633000 862 12.8 ND 0.082 787 ND 678000 4420 ND 46.3 8020 ND ND 753000 3420 ND	10. 100, 10.0 200, 5.0 10.0 5.00 5.00 0.5 10.0 5.00 25.0 0.050 100. 16.0 5000 40.0 5000 16.0 25.0 5000 50.0	490 ND ND ND ND 282 ND 148000 201 ND ND 0.27 5280 51.1 109000 2040 ND ND ND ND ND 0.27	10. 100. 100. 200. 5.0 10.0 5.0 5.0 5.0 50.0 25.0 0.050 100. 5.0 5000 15.0 40.0 5000 25.0 5000 25.0 5000 25.0	MG/L UG/L UG/L UG/L UG/L UG/L UG/L UG/L U

NA - Not Analyzed

ND = Not Detected

TBK = Trip Blank



WMI ENVIRONMENTAL MONITORING LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS;

MP: Rev / Task: Sample Type: Reported: 93-11523 852931 01 / 01 WELL

20-MAY-1993

Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AH0586 27-APR-1993	EML RL	852-MW04 AH0583 27-APR-1993	EML RL	852-MW06 AH0584 27-APR-1993	EML RL	Units
VANADIUM-TOTAL	·	ND	96.0	ND ND	50.0	ND	50.0	UG/L
ZINC-TOTAL		ND I	84.0	ND	20.0	731	20.0	UG/L
OLATILE ORGANICS:				·				1
1,1,1,2-TETRACHLOROETHANE		ם מו	5.	ND I	5.	ND I	5.	UG/L
1.1.1-TRICHLOROETHANE		ND I	5.	ND	5.	ND I	5.	UG/L
1,1,2,2-TETRACHLOROETHANE		ND	5.	ND	5.	ND I	5.	UG/L
1,1,2-TRICHLOROETHANE		l nd	5.	ND	5.	ND	5.	UG/L
1,1-DICHLOROETHANE		ND	5.	ND	5.	30.	5.	UG/L
1,1-DICHLOROETHENE		l nd l	5.	ND .	5.	סמ	5.	UG/L
1,2,3-TRICHLOROPROPANE		ND	10.	ND I	10.	ИD	10.	0G/L
1,2-DIBROMO-3-CHLOROPROPAN	IE.	ND	10.	ND ND	10.	ND	10.	UG/L
1,2-DIBROMOETHANE	-	ND	10.	ND D	10.	ND I	10.	UG/L
1,2-DICHLOROBENZENE		ND	10.	ND I	10.	DO	10.	UG/L
1,2-DICHLOROETHANE		ND ND	5.	ND	5.	ND	5.	OG/L
1,2-DICHLOROPROPANE		NO	5.	I ND I	5.	ND I	5.	UG/L
1,4-DICHLOROBENZENE		ND	10.	ND ND	10.	ND I	10.	UG/L
2-BUTANONE		ND	10.	I DI	10.	ND I	10.	UG/L
2-HEXANONE		I ND	10.	ן מא	iŏ.	ND I	10.	OG/L
4-METHYL-2-PENTANONE	•	ND D	10.	ND I	10.	ן אס	10.	OG/L
ACETONE		ND ND	34.	ND I	34.	ND I	34.	OG/L
ACRYLONITRILE		ND I	100	ND	100	ND ND	100	OG/L
BENZENE		ND ND	5.	ND ND	5.	ND	5.	UG/L
BROMOCHLOROMETHANE		ND ND	10.	ND	10.	ND	10.	OG/L
BROMODICHLOROMETHANE		ND ND	5.	ND	5.	ND		
BROMOFORM		ן אס	5. 5.	ND			5.	UG/L
BROMOMETHANE					5.	ND	5.	OG/L
		ND ND	10. 5.	ND	10.	NĐ	10.	OG/L
CARBON DISULFIDE		ND ND	5. 5.	ND	5.	ND	5.	UG/L
CARBON TETRACHLORIDE		ND ND		ND	5.	ND	5.	OG/L
			5.	ND	.5.	ND	. 5 .	OG/L
CHLOROETHANE		ND	10.	ND	10.	46.	10.	QG/L
CHLOROFORM		ND	5.	ND I	5.	ND	5.	ŰG/L
CHLOROMETHANE		ND	10.	ND	10.	ND	10.	OG/L
CIS-1, 2-DICHLOROETHENE		ND ND	10.	ND	10.	ND	10.	OG/L
CIS-1, 3-DICHLOROPROPENE		ND	5.	ND I	5.	ND	5.	UG/L
DIBROMOCHLOROMETHANE		ND	5.	ND	5.	ND	5.	UG/L
DIBROMOMETHANE		סא	10.	ND	10.	ND	10.	DC/T
ETHYLBENZENE		ND 	5.	ND	5.	ИD	5.	UG/L
ODOMETHANE		ND ·	10.	ND I	10.	ND	10.	UG/L
METHYLENE CHLORIDE		ND	5.	ND I	5.	8.	5.	UG/L
STYRENE		מא	5.	ND	5.	ND	5.	UG/L
TETRACHLOROETHENE		ND -	5.	ND]	5.	ND	5.	UG/L
TOLUENE		ND	5.	ND 1	5.	ND	5.	DG/L
TRANS-1, 2-DICHLOROETHENE		ND	10.	ND	10.	ND	10.	UG/L
TRANS-1, 3-DICHLOROPROPENE		ND	5.	ND 1	5.	ND	5.	UG/L
trans-1,4-dichloro-2-buten	Œ	ND	10.	ן אס	10.	ND	10.	DG/L
TRICHLOROETHENE TRICHLOROFLUOROMETHANE		ND ND	5. 10.	ND ND	5. 10.	ND ND	5. 10.	UG/L UG/L

NA ⇒ Not Analyzed

ND - Not Detected

TBK = Trip Blank



WMI ENVIRONMENTAL MONITO G LABORATORIES, INC.



EVENT SUMMARY REPORT

Site: 852 - MUSKOGEE LANDFILL

2801 S. 54TH STREET WEST MUSKOGEE OK 73111-0000

ENS: MP:

Rev / Task:

93-11523 852931 01 / 01 WELL 20-MAY-1993

Sample Type: Reported:

Analyte	Sample Point: Sample Number: Sampled:	852-MW03R AH0586 27-APR-1993	EML RL	852-MW04 AH0583 27-APR-1993	EML RL	852-MW06 AH0584 27-APR-1993	EML RL	. Units
VINYL ACETATE		ND	10.	ND	10.	ND	10.	UG/L
VINYL CHLORIDE		ND	10.	ND	10.	ND	10.	UG/L
XYLENE (TOTAL)		ND	10.	ND	10.	ND	10.	UG/L

NA = Not Analyzed

ND = Not Detected

TBK - Trip Blank



6825 East 38th Street Tulsa, Oklahoma 74145 (918) 664-7767

MLTS 83-3576

October 21, 1983

M.R. McComas & Associates Inc. 1808 So. Main Broken Arrow, Ok 74012

Attn: Mr. Marty Smitz Schmicht

Dear Mr. Smitz.

In accordance with your instructions chemical analysis was performed on five (5) water samples submitted on October 14, 1983.

All testing was performed in accordance with EPA analytical guidelines. The results of the chemical analysis are summarized in Table I.

If you have any questions regarding this report please contact Mr. Dan Lawson or myself.

Sincerely,

METLAB TESTING SERVICES, INC.

Tony Mummolo

Analytical Chemist

TCM/sc



10° 50°



MLTS 83-3576

Table I

Summary of Chemical Analysis of Five (5) Muskogee Water Samples
Tested for M.R. McComas and Associates, Inc.

Constituents	Units	<u>MW-1</u>	<u>MW-2</u>	<u>MW-3</u>	Abd. Well	Cody Creek
As	mg/l	.002	<.001	.001	<.001	<.001
Ba	mg/l	<.30	<.30	۷.30	65.4	∠.30
Cd	mg/l	< .006	۷.006	<.006	<.006	∠.006
Cr	mg/l	4.05	4.05	<.05	۷.05	۷.05
Pb .	mg/l	< .05	۲.05.	<.05	∠.05	∠.05
нд	mg/l	0.0001	0.0004	< 0.0001	<0.0001	<0.0001
Nitrate Nitrogen	mg/l	5.6	9.1	1.0	48.	0.41
Se	mg/l	0.010	<.001	<.001	< .001	<.001
Total Dissolved Solids	mg/l	2449	9487	1120	45450	560
рН	STD	7.60	7.18	7.50	7.41	7.16
Chloride	mg/l	204	3693	119	24420	389.0
Sulfate	mg/l	1600	102	51.0	16.0	21.0
Alkalinity (as CaCO ₃)	mg/l	320.	318.	464.	432.	45.
Color	(Pt. Co.)	10	10	· 5	30	50
Fe	mg/l	< .03	< .03	< .03	.23	.50
Mn	mg/l	<02	1.43	<.02	. 12	02. کے

Approved by Tony Mumanol

Tony Mommolo, Analytical Chemist

mmhos/cm Specific

Test Hole	рН	Conductivity	Chlorides mg/l	Temp °C	
* <u>-</u>					
1		- ,-		, - -	
2	5.6	4,100	100	16.0	
3	5.8	4,000	820	18.0	
4 5	5.1	10,000	20,000	17.0	
¹ 5					
6	6.0	800	50	18.0	
7	5.4	10,000	3,700	19.0	
8	·	-			
9			- -	, -	
10	6.4	1,300	25	17.0	
11	6.2	1,200	50	17.0	
12	5.9	2,600	500	18.0	
13	. 6.0	1,600	150	17.0	
14	5.6	10,000	825	17.Ō	
15	6.1	1,400	250	16.5	
MW1	5.7	3,100		16.0	
MW2	5.8	10,000	·		
MW3	6.0	1,650	·		

SAMPLES ANALYZED IN FIELD BY WM. BULLER, M. SCHMIDT

APPENDIX F

GROUNDWATER SAMPLING AND ANALYSIS PLAN (GWSAP)

Note: This appendix includes the following.

- The Groundwater Sampling and Analysis Plan.
- This GWSAP was previously submitted to ODEQ in January 2016 as part of a Tier I Permit Modification permit process.
- ODEQ approved the Tier I Permit Modification on January 26, 2016.



SCOTT A. THOMPSON Executive Director

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

MARY FALLIN Governor

January 26, 2016

Mr. Pete Schultze Waste Management, Inc. 2801 S. 54th St. W. Muskogee, OK 74401

Re: Permit Modification - Groundwater Sampling and Analysis Plan

Muskogee Recycling & Disposal Facility (Permit No. 3551020)

Muskogee County

Dear Mr. Schultze:

The Oklahoma Department of Environmental Quality (DEQ) received the Permit Modification to update the Groundwater Sampling and Analysis Plan dated January 7, 2016, submitted by Biggs & Mathews Environmental on behalf of Waste Management of Oklahoma, Inc. for the Muskogee Recycling and Disposal Facility. On January 25, 2016, DEQ received a revised Table 6-1 via email from Biggs & Mathews Environmental. The modification was processed as a Tier I permit modification in accordance with Oklahoma Administrative Code (OAC) 252:4-7-58(2)(A)(ii).

The updated Groundwater Sampling and Analysis Plan was submitted in response to DEQ correspondence dated December 4, 2015, that approved the proposed alternative list of groundwater constituents contained in the *Groundwater Detection Monitoring Optimization Evaluation* report. The alternative list of constituents was approved in accordance with OAC 252:515-9-72.

The permit modification has been approved and includes the following updates to the Groundwater Sampling and Analysis Plan: alternative list of constituents, field procedures, analytical procedures, and statistical approach. A copy of the permit modification is enclosed with this letter. If you have any questions or concerns, please contact Rachel Hanigan at (405) 702-5196.

Sincerely,

Hillary Young, P.E.

Chief Engineer

Land Protection Division

HY/rh

cc: Michael Snyder, Biggs & Mathews Environmental

Paula Carboni, Waste Management

Enclosure: Solid Waste Permit Modification



SCOTT A. THOMPSON Executive Director

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

MARY FALLIN Governor

SOLID WASTE PERMIT MODIFICATION

The Oklahoma Department of Environmental Quality hereby approves the following modification:

Permit Number: 3551020

Facility: Muskogee Community Recycling & Disposal Facility

Facility Type: Municipal Solid Waste Landfill

County: Muskogee County

<u>Modification</u>: Modify the existing permit to update the Groundwater Sampling and Analysis

Plan.

Incorporated By Reference:

Revisions dated January 2016 to Sections 5.0 through 9.0 of the Groundwater Sampling and Analysis Plan, previously approved in July 1993.

Table 8-1 Detection Monitoring Parameter List

Table 8-2 Water Quality Parameters List

Conditions:

1. If sampling data indicates significant changes in groundwater quality, the constituents listed in Table 8-2 *Water Quality Parameters List* (calcium, chemical oxygen demand, dissolved solids, iron, magnesium, manganese, potassium, sodium, and sulfate) may require semi-annual sampling and analysis.

The permittee is authorized to operate in conformity with the application dated January 7, 2016, submitted to the Land Protection Division. Commencing operations under this modification constitutes acceptance of, and consent to, the conditions contained herein.

Hillary Young, l

Chief Engineer

Land Protection Division

Date: 1-76-16

MUSKOGEE RECYCLING AND DISPOSAL FACILITY MUSKOGEE COUNTY, OKLAHOMA DEQ PERMIT NO. 3551020

PERMIT MODIFICATION

GROUNDWATER SAMPLING AND ANALYSIS PLAN (GROUNDWATER MONITORING PLAN, SECTIONS 5.0 THROUGH 9.0)

Prepared for

Waste Management of Oklahoma

Approved July 1993

Revised January 2016



Prepared by

BIGGS & MATHEWS ENVIRONMENTAL

1700 Robert Road, Suite 100 • Mansfield, Texas 76063 • 817-563-1144

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INTRODUCTION

The following Groundwater Sampling and Analysis Plan for the Muskogee Recycling and Disposal Facility (RDF) was created following the approval of the *Groundwater Detection Optimization Evaluation*, approved by the Oklahoma Department of Environmental Quality (DEQ) on December 4, 2015. The Optimization Evaluation included a request to update the currently approved monitoring plan with an optimized Detection Monitoring Parameter List, in accordance with OAC 252:515-9-72.

While updating the currently approved Groundwater Monitoring Plan (July 1993) with the revised Detection Monitoring Parameter List, it was determined that the procedures for collecting representative samples from the Muskogee RDF groundwater monitoring wells and the laboratory requirements for obtaining valid defensible data also needed to be updated in accordance with; the federal requirements in 40 CFR Part 258, the current U.S. Environmental Protection Agency (USEPA) guidance documents, and the Oklahoma Administrative Code (OAC) 252:515 Municipal Solid Waste Landfill (MSWLF) Regulations. Therefore, the following Groundwater Sampling and Analysis Plan will replace Sections 5.0 through Section 8.0 of the currently approved monitoring plan, including all Tables and Figures referenced in these sections. In addition, Section 9.0 (References) has been revised to include all references used in the updated Sections 5.0 through Sections 8.0.

5.0 GROUNDWATER SAMPLING PROCEDURES

Proper sampling procedures are the most important and fundamental aspect in an effective monitoring program. All environmental quality sampling at the site will be accomplished by personnel trained in proper sampling protocol.

This section summarizes specific tasks involved in sampling of the groundwater monitoring system and presents the proposed groundwater monitoring parameters and sampling schedule for the Muskogee RDF.

5.1 Well Inspection

Prior to performing any purging or sampling each monitoring well will be inspected to assess its integrity. The condition of each well will be evaluated for any physical damage that may have been caused by the operation of site equipment of other vehicular traffic. The security of each well will be assessed in order to confirm that no outside source constituents have been introduced to the well. All inspection information, as well as the date and time, general weather conditions, and sampling personnel identification, will be documented on the Field Information Form (Figure 5-1) or equivalent form and a copy will be maintained in the site operating record.

5.2 Equipment Decontamination

Any non-dedicated equipment used for purging and the collection of groundwater samples will be decontaminated prior to use at each well location. An appropriate decontamination procedure will be sufficient to avoid (and prevent) the introduction of any contaminant into a well and to not allow any contaminant to be transported between wells that will create false sample results or otherwise harm the environment.

5.3 Water Level Measurements

Prior to groundwater purging and sampling, water level measurements will be taken at each well location utilizing a portable water level indicator, fiberglass tape, or other suitable measuring device. Water level measurements will be collected over a period of time short enough to avoid temporal variations in water levels. Water levels will be measured from a permanent, clearly marked location at the top of the well riser or dedicated sampling device cap. Measurements will be recorded to the nearest hundredth of a foot.

5.4 Purging/Bailing

Prior to sampling at each well location, water will be evacuated until a minimum of three

well volumes has been purged, until the well has been pumped or bailed dry, or until an appropriate amount of water has been purged to achieve the collection of a representative sample. Groundwater will be considered representative once pH, specific conductance, temperature, and turbidity drop to levels consistent with historical readings for the site. If low flow/minimal drawdown purging has been approved, the procedures described in EPA/540/S-95/504 will be followed. This will ensure that samples are drawn from the water bearing unit and not from stagnant water left in the well screen between sampling events. If the well contains less than three well volumes, the well will be pumped or bailed dry, allowed to recover and immediately sampled. If sufficient water is not available for sampling within 24 hours of purging for slowly recovering wells, the well will be considered dry and the well will not be sampled during that sampling event. As discussed previously a dedicated sampling device or a properly decontaminated (or disposable) bailer will be utilized for this task. Purge water will be disposed of properly.

5.5 Sample Collection

Each monitoring well in the groundwater monitoring system will have a dedicated sampling device (e.g., a Well WizardTM bladder pump or equivalent or a Teflon® or stainless steel bailer). If a non-dedicated sampling device is used it will be properly decontaminated prior to its use. For bladder pumps, flow rates when sampling should not exceed the EPA recommended 0.1 liters per minute for collection of volatile organic compounds (VOCs). The sample collection rate is to be maintained between 0.1 and 0.5 liters per minute for all other organic and inorganic analytes.

Sampling for analysis of VOCs involves extra care. Water should flow slowly from the sampling device into each sample vial until a positive meniscus is formed over the top of the container. After the cap has been placed on the vial and tightened, the vial should be checked for air bubbles by turning it upside down and tapping with your finger. If an air bubble is seen rising to the bottom of the vial, the sample should be discarded and the process outlined above should be repeated. If no air bubbles are seen in each vial, the sample is accepted.

5.6 Sample Preservation and Filtering

It is recommended that an in-line flow system be used. When using an in-line flow system a minimum of three pump cycles of water must be allowed to pass through the in-line flow system before obtaining a sample. All equipment must be properly decontaminated prior to use at each well. As required by 252:515-9-3(c), samples will not be filtered prior to laboratory analysis. The material and use of prefiltration bottles must be noted on the Field Information Form (Figure 5-1) and Chain of Custody Record (Figure 5-2).

The appropriate sample container and preservative requirement for each analyte is listed on Table 5-1. Pre-labeled containers may be supplied by the laboratory or sampling personnel for each sampling event. The appropriate preservatives will be added to each sample container based on the analytical method.

5.7 Sample Shipment

After collection and sample preservation, the sample bottles will he wiped clean, checked for proper labeling and placed into an insulated, plastic-shelled cooler or other suitable shipping container with frozen ice packs or ice. The samples will be maintained at about 4°C. The temperature of the samples will be recorded when the shipping container arrives at the analytical laboratory to assure that the appropriate sample temperature was maintained during shipment. All samples included in the cooler will be packed in such a manner to minimize the potential for container breakage. VOA vials and TOX bottles (if any) will never be placed directly on the ice packs. A Field Information Form (Figure 5-1) and Chain of Custody Record (Figure 5-2) will be sealed in a water resistant bag and placed with the appropriate sample bottle set. Actual forms used may vary in format, but the information indicated is considered typical. The coolers will then be properly sealed with a tamper proof custody seal and sent to the designated analytical laboratory. All shipments will be scheduled for next day delivery. Upon arrival of the shipping container at the laboratory, the cooler will be opened and the Chain of Custody forms will be signed and time/dated by the person taking custody of the samples. If the cooler is shipped, this person will affix the bill of lading or receipt to the Chain of Custody form.

5.7.1 Chain of Custody

Appropriate Chain of Custody procedures for samples will be implemented to ensure sample integrity, and to provide technically and legally defensible groundwater quality data. At the time each sample is collected, the Field Information Form (Figure 5-1) and Chain of Custody Record (Figure 5-2) will be completed and placed in the shipping container. The Field Information Form will include general sampling event information including location, time, weather conditions, sampler identification, sample observations, any numerical field data values and well purging procedures.

6.1 Laboratory Analytical Methods/Procedures

Table 6-1 presents the methodologies used by Waste Management of Oklahoma's (WMO) designated laboratory for each parameter or group of parameters. All methods are USEPA approved.

6.2 Quality Assurance/Quality Control

In addition to strict chain of custody procedures, field blanks and trip blanks are used to assure the integrity of the sampling and shipping process. A record of laboratory sample receipt, storage and analysis procedures will be kept for each sample received. A summary of this record will be part of the laboratory analysis report. Any internal quality control problem associated with the submitted sample/analyte will be identified on the data qualifier report included with each sample's analytical client report.

Field Sampling QA/QC

Field Procedures. As quality assurance procedures are an integral part of each segment of field sampling methodology, the quality assurance procedures associated with each step of the field sampling routine (e.g., proper well purging, field sampling and preservation methodologies) have been directly incorporated into each respective field sampling subsection of this document.

Field and Trip Blanks. The trip blank, containing laboratory-grade distilled water, will remain unopened and be packaged and sent from and to the laboratory in the same manner as the site environmental samples. The trip blank will be provided by the analytical laboratory supplying the sample bottles and shipping containers. One trip blank will be taken and analyzed for volatile organic compounds (VOCs) only in each groundwater sampling event.

The field blank will be prepared in the field by pouring the supplied laboratory-grade distilled water into one of the clean sample containers opened in the field. The field blank will then be sealed and shipped in the same manner as the environmental samples. One field blank will be collected and analyzed for VOCs only in each groundwater sampling event.

Laboratory QA/QC

Analytical Blanks and Spikes. The selected laboratory will use method quality control procedures that are equivalent to those described in SW-846. Duplicate samples, method blanks, instrument/reagent blanks, matrix spikes, blank/water reagent spikes and surrogate spikes are typical quality control checks performed throughout the

analysis process at the analytical laboratory. With the exception of instrument/reagent blanks and surrogate spikes, these checks are performed at a frequency of 5% or 10% (i.e., 1 in 20 samples, 1 in 10 samples). Instrument/reagent blanks and surrogate spikes are performed on a daily or per sample (where required by method) frequency. Each of the above applied quality control checks will be compared against the acceptance criterion for each quality control check to ensure that analytical quality is maintained.

Instrument Calibration. Applicable instruments are calibrated using calibration standards and method specified calibration criteria. A solution containing various compounds of known concentrations is diluted and analyzed to establish calibration curves and performed daily or per the method to monitor the accuracy and precision of the instrument. Instrument calibration is verified by analyzing a solution containing a known concentration of the pure compound(s) of interest and comparing it against the calibration curve. This standard compound is taken from the same stock as that used to develop the calibration curve. Calibration verification is done at a 5% frequency, or as the method requires, checking the stability of the calibration curve as well as the accuracy and precision of the system or analyst.

All standards and reagents used in laboratory procedures will be inventoried, labeled, logged and documented in accordance with the designated laboratory's documentation procedures. All stock standards are purchased as certified primary solutions from reputable, commercial lab suppliers, and are prepared from neat chemicals with certified purity. Stock standards are combined and/or diluted into secondary dilution standards, which are then diluted into working standards.

Instrument Maintenance. Routine maintenance is performed and documented for all major instruments. In addition, any service agreements for laboratory equipment are renewed annually. The EPA's "Good Automated Laboratory Practices" (GALPs) are followed in the laboratory.

7.0 ESTABLISHMENT OF BACKGROUND GROUNDWATER QUALITY

Background groundwater quality will be established for all upgradient and downgradient wells in the groundwater monitoring system on a quarterly basis for two full years to establish background water quality, as required by OAC 252:515-9-31(a).

Constituents to be monitored for establishment of background are listed in Table 7-1. This background constituent list, as required by 252:515-9-31(d), consists of pH, chemical oxygen demand, specific conductivity, chloride, sulfate, calcium, magnesium, nitrates, sodium, carbonates, potassium, those constituents listed in Appendix A of OAC 252:515, as well as alkalinity, total dissolved solids, iron, and manganese.

8.0 DETECTION AND ASSESSMENT MONITORING

The Detection and Assessment Monitoring Program procedure for the site is summarized and discussed in the following subsections.

8.1 Groundwater Detection Monitoring Parameters

Parameters that will be monitored during detection monitoring are listed in OAC 252:515-9-31(d), unless alternative constituents are approved in accordance with OAC 252:515-9-72. The site-specific detection monitoring parameters list has been included as Table 8-1.

In accordance with OAC 252:515-9-72(c), "The DEQ may approve the use of an alternative list of indicator constituents, in lieu of some or all of the heavy metal constituents of the approved groundwater monitoring program, if the alternative constituents provide a reliable indication of inorganic releases from the disposal facility to groundwater," a *Groundwater Detection Optimization Evaluation* was conducted by WMO and approved by the DEQ in December 2015. The Optimization Evaluation modified the list of constituents for statistical analysis to only those that are inherent to waste streams and that will facilitate a statistical program that will be more protective of human health and the environment by lowering the false positive rate and raising the statistical power to more accurately identify real releases from the landfill to the environment.

Therefore, the indicator and general water quality parameters have been removed from the Detection Monitoring Parameter List and are listed separately in Table 8-2, Water Quality Parameters List. As stipulated in the approved Groundwater Detection Optimization Evaluation, the water quality parameters will not be included in statistical analysis but instead be presented annually using Piper and Stiff plots. WMO will also reevaluate the leachate constituents on an annual basis to monitor any increases or additions to the constituent list.

8.2 Groundwater Detection Monitoring Frequency

After the establishment of background groundwater quality (Refer to Section 4), in accordance with 252:515-9-73, groundwater from each monitoring well shall be sampled and analyzed at least semi-annually during the active life of the facility and during the post-closure monitoring period. The DEQ may, in the future, approve alternate sampling and analysis frequencies in the approved detection monitoring program. Alternative detection monitoring frequencies shall not be less than annual during the active life, but may be less than annual during the post-closure monitoring period.

8.3 Reporting Requirements

Within 60 days after sampling, a statistical analysis evaluation shall be performed on the groundwater monitoring results to determine whether there has been a statistically significant increase (SSI) over background values at each monitoring well and the groundwater monitoring analytical report and the results of the statistical evaluation shall be submitted to the DEQ.

To determine if an SSI has occurred, first the groundwater quality of each chemical parameter or hazardous constituent at each monitoring well shall be compared to the background value of that constituent in the upgradient well (inter-well comparison), according to the specified statistical procedures and performance standards. If an SSI over background values in any parameter or constituent is evident, that is, if it has failed the inter-well comparison, then the groundwater quality of each parameter or constituent that failed the inter-well analysis shall be compared to the background value of that parameter or constituent in the same well (intra-well comparison), according to the specified statistical procedures and performance standards.

If there is an SSI over background (that is exceedance of both inter-well and intra-well analysis) for one or more of the constituents at any monitoring well, the owner/operator:

- (1) must notify the DEQ in writing within 14 days of the determination and place a notice in the operating record indicating which constituents have shown statistically significant changes from background levels; and
- (2) must establish an assessment monitoring program meeting the requirements of Part 9 of 252:515-9 within 90 days of the determination, and have the assessment monitoring program approved by the DEQ; or
- (3) may, during the 90-day development of an assessment monitoring program, demonstrate that a source other than the facility causes the contamination or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. A report documenting this demonstration shall be submitted to the DEQ for approval.

If a successful demonstration is approved by the DEQ, then the landfill may return to detection monitoring. If at the end of the 90-day period, a successful demonstration is not made, the assessment monitoring program must be initiated.

8.4 Statistical Method

Statistical analysis will be conducted in accordance with OAC 252:515-9. The most appropriate method will be selected for each individual parameter based on the analysis of the data. The statistical method has not been selected at this time and is dependent upon the evaluation of the analytical data selected to be representative of background groundwater quality. Additionally, the background groundwater quality may require the statistical method to include procedures to control or correct for seasonal and spatial variability, as well as temporal conditions in the data. An appropriate statistical methodology will be selected in accordance with ASTM D 6312-98, "Standard Guide for Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring

<u>Programs</u>" (ASTM, 2005). The statistical evaluation methodology will be established such that the statistical method(s) chosen are technically sound and are the most appropriate method(s) to be protective of human health and the environment.

8.4.1 Volatile Organic Compounds

Practical quantitation limits (PQLs) assure that the true value of the analyte is close to the measured value. Conversely, method detection limits (MDLs), indicate that the analyte is present in the sample with a specified degree of confidence. For analytes with estimated concentrations greater than the MDL but not the PQL, it can only be concluded that the true concentration is greater than zero; the actual concentration cannot be determined. Comparison of a detected concentration to any regulatory standard (such as a maximum contaminant level [MCL]), or any other concentration limit, is by definition not meaningful unless the concentration is greater than the PQL.

If a MSWLF facility actually produces a release to groundwater, multiple constituents contained in the leachate are typically associated with the source fluids and are subsequently detected by the groundwater monitoring program. A single constituent at very low concentration (i.e., below the PQL) typically is not the signature that is produced from an actual release.

VOCs represent very effective indicators of a release from a solid waste unit. Because these compounds are rarely detected in background groundwater samples, establishing monitor well-specific limits for VOCs is generally not an option. Therefore, detection decision rules based on laboratory-specific PQLs will be used.

8.4.2 Inorganic Parameters

The statistical analysis methodology for inorganic parameters with a detection frequency greater than 25% will be based on a combined Shewhart-cumulative sum (CUSUM) control chart that is capable of detecting both sudden and gradual changes in groundwater chemistry (Gibbons, 1994). Combined Shewhart-CUSUM control charts will be constructed for each well and parameter monitored to provide a statistical/visual tool for detecting trends and abrupt changes in inorganic groundwater chemistry. For inorganic parameters with a detection frequency less or equal to 25%, calculation of non-parametric or Poisson prediction limits will be conducted. Some facilities may require alternate methods (such as normal prediction limits) based on the number of statistical comparisons required for the site and the alternatives allowed to manage the site-wide false positive and false negative rates.

The combined Shewhart-CUSUM procedure requires a minimum of eight historical independent samples (i.e., background data) to provide a reliable estimate of the mean and standard deviation of each constituent in each well. The combined Shewhart-CUSUM control chart procedure assumes that the data are independent and normally distributed with a fixed mean and constant variance. Shewhart-CUSUM control charts are not recommended for data sets of less than 8 independent samples except as time-series plots and evaluation of trends. Once background data are obtained from each detection monitor well, subsequent sample results are statistically compared to the estimated control limit both in terms of their absolute magnitude and cumulative sum.

If all inorganic parameter data collected during the background period (minimum of 8 independent events) are not detected in concentrations greater than the respective PQLs, the PQL will be used as the non-parametric prediction limit. The collection of thirteen (13) samples in background for this detection frequency provides a 99% confidence non-parametric prediction limit with one re-sample. Note that 99% confidence is equivalent to a 1% false positive rate and pertains to a single comparison (that is, well and constituent) and not the site-wide error rate (all wells and constituents), which is set to 5%. If the detection frequency is greater than zero but less than 25%, the non-parametric prediction limit is the largest of the 13 background samples (for 1 verification re-sample) or 8 background samples if a pass "1 of 2" verification re-sampling program is implemented.

8.5 Statistical Analysis

The statistical analysis program for inorganic parameters DUMPStat® will be based on combined Shewhart-CUSUM control charts or prediction limits at all compliance point wells. Future intra-well measurements that do not exceed the statistical limits and do not exhibit a significant trend will be combined with historical data to update these estimates every two years.

In selecting the statistical evaluation methodology using DUMPStat®, a screening procedure based on the data set and total number of statistical comparisons per event should be conducted for each monitoring event to allow for management of the site-wide false positive rate. Following selection of the monitoring points and parameters, a statistical power curve should be computed to allow the determination of a site-wide false positive rate. The EPA guidance document entitled "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance" (USEPA, 2009) recommends that the selected statistical method for multiple constituent comparisons provide a site-wide false positive rate of 5% or less while maintaining a statistical power (1 minus the false negative rate) from the EPA reference power curve (correlating to a statistical power of >50% for a 3-sigma release and >80% for a 4-sigma release). If this cannot be achieved through a parameter or monitoring point reduction, then options available within DUMPStat® can be used. Adjustments to the control chart factor (for intra-well control charts) and verification re-sampling options, or the use of normal prediction limits may be implemented to achieve the statistical standards recommended by USEPA (2009) and Robert Gibbons (1994).

8.5.1 Detection Verification Procedure

Once groundwater analysis results have been collected, checked for QA/QC consistency and determined to be above the appropriate statistical level, the results must be verified in accordance with the objectives of 40 CFR Part 258.53. Verification re-sampling is an integral part of the statistical methodology described by EPA's Addendum to Interim Final Guidance Document. Without verification re-sampling, much larger statistical limits would be required to achieve site-wide false positive rates of 5% or less. Furthermore, the resulting false negative rate would be greatly increased. The following procedure will be performed for each compound determined to be initially above its statistical limit. Only compounds that initially exceed their statistical limit will be sampled for verification purposes. The use of "pass 1 of 1" or "pass 1 of 2" verification options will be evaluated on a per event basis based on the calculated site-wide false positive rate.

8.5.1.1 Volatile Organic Compounds

If one or more VOCs are detected above their statistical limit (i.e., PQL), up to two verification resamples will be scheduled no sooner than 30 days apart to provide sample independence. A statistically significant increase (SSI) will be recorded if any single VOC is verified in each of the scheduled re-sampling events in a concentration greater than the PQL.

8.5.1.2 Inorganic Constituents

If one or more of the inorganic parameters are detected above their statistical limit (i.e., Shewhart-CUSUM control chart computation value/prediction limit), up to two verification re-samples will be collected at the next sampling event with the re-sampling event scheduled no sooner than 30 days apart to provide sample independence. A SSI will be recorded if verification of one elevated parameter is confirmed in a concentration greater than the control/prediction limit for each of the discrete verification re-samples. If the re-sampling program confirms that the initial sample represented a laboratory or sampling-induced outlier, the verification sample will replace the original reported value to eliminate bias from the CUSUM calculation, which considers all data points collected at the site.

8.6 Assessment Monitoring

Assessment monitoring will be conducted if, during detection monitoring, an SSI over background is detected and verified for the constituents identified in Section 5.1, Groundwater Detection Monitoring Parameters, in accordance with DEQ regulations. Upon commencement of assessment monitoring, a minimum of one groundwater sample will be collected from each downgradient well and a minimum of four independent samples from each well to establish background for any OAC 252:515 Appendix C constituents detected. In accordance with 252:515-9-94, the DEQ may specify a subset of wells to be sampled and analyzed during assessment monitoring. This sampling (assessment monitoring) will occur within a period of 180 days from the date of notice to the DEQ of the SSI identified during detection monitoring. Samples collected for assessment monitoring will be analyzed for the assessment constituents listed in Appendix C of OAC 252:515 and for the detection monitoring constituents identified in Table 8-1. For assessment monitoring, an abbreviated list of assessment constituents may be approved by the DEQ in accordance with OAC 252:515-9-93.

If one or more assessment monitoring constituents are detected at statistically significant levels above the groundwater protection standard of OAC 252:515-9-96 in any sampling event, the owner/operator shall comply with all procedures listed in OAC 252:515-9-95(c) within 14 days of this finding.

Data evaluation during assessment monitoring will consist of the establishment of 95% Lower Confidence Limits (LCLs) for any Appendix II constituent detected in concentrations greater than the PQL, assuming that a minimum of four background samples exist for each parameter detected during the assessment monitoring program. If inadequate background data exists, sufficient background data will be collected to provide adequate sample size for statistical analysis. According to USEPA technical guidance, if the 95% Lower Confidence Limit (LCL) of one parameter exceeds action

levels defined as MCLs, if applicable, or a health-based alternate groundwater protection standard (GWPS), the facility is to initiate an assessment of corrective measures.

The use of LCLs for assessment monitoring is stipulated by USEPA in the 2009 statistical guidance document and supported by Dr. Kirk Cameron (statistical consultant to USEPA), Jim Brown (USEPA), and Dr. Robert Gibbons. In accordance with the USEPA document entitled "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance" (USEPA, 2009), Section 21,

"Confidence intervals are the recommended general statistical strategy in compliance/assessment or corrective action monitoring. Groundwater monitoring data must typically be compared to a fixed numerical limit set as a GWPS. In compliance/assessment, the comparison is made to determine whether groundwater concentrations have increased above the compliance standard. In corrective action, the test determines whether concentrations have decreased below a clean-up criterion or compliance level. In compliance/assessment monitoring, the lower confidence limit [LCL] is of primary interest, while the upper confidence limit [UCL] is most important in corrective action."

"Furthermore, Section 21.1.1 states, "Confidence intervals around the mean of a normal distribution should only be constructed if the data are approximately normal or at least are reasonably symmetric. An inaccurate confidence interval is likely to result if the sample data are highly non-normal... Therefore, checking for normality is an important first step. A confidence interval should not be constructed with less than 4 measurements per compliance well, and preferably 8 or more." This is important because, "...statistically significant evidence of a violation during compliance/assessment or success during corrective action is indicated only when the entire confidence interval is to one side of the standard."

If the concentrations of all assessment constituents are at or below the established statistical limit for two consecutive assessment monitoring events, normal detection monitoring can be resumed in subsequent events, if approved by the DEQ.

9.0 REFERENCES

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TABLES

5-1	Sample Collection, Preservation and Holding Times
6-1	Methodologies for Testing and Analysis
7-1	Background Monitoring Parameter List
8-1	Detection Monitoring Parameter List
8-2	Water Quality Parameters List

Table 5-1
Muskogee Recycling and Disposal Facility
Sample Collection, Preservation, and Holding Times

PARAMETER Acid Extractables	SAMPLE COLLECTION ¹ AND CONTAINER 1000 ml Glass only (amber) with Teflon liner	SAMPLE ^{2,3} PRESERVATION Cool, 4°C	RECOMMENDED ⁴ HOLDING TIMES Extract within 7 days; analyze within 40 days
Alkalinity	100 ml P, G	Cool, 4°C	14 days
Ammonia	125 ml P, G	Cool, 4°C H ₂ SO ₄ to pH < 2	28 days
Base/Neutral Extractables (priority pollutants)	1000 ml Glass only (amber) with Teflon liner	Cool, 4°C	Extract within 7 days; analyze within 40 days
Biochemical Oxygen Demand, 5 day (BOD 5)	1000 ml P, G	Cool, 4°C	48 hours
Calcium (dissolved)	500 ml P, G	Filter on site, HNO ₃ to pH< 2	6 months
Chemical Oxygen Demand (COD)	125 ml P, G	Cool, 4° C H ₂ SO ₄ to pH < 2	28 days
Chloride	250 ml P, G	None required	28 days
Coliform, fecal and total	100 ml P, G sterilized	Cool, 4°C	24 hours
Cyanide	1000 ml P, G	Cool, 4°C NaOH to pH > 12 0.6 g ascorbic acid	14 days
Fluoride	250 ml P	None required	28 days
Hardness	100 ml P, G	HNO_3 to $pH < 2$	6 months
Metals			
Chromium (hexavalent)	200 ml P, G	Cool, 4°C	24 hours
Mercury (dissolved)	1000 ml P, G	Filter on site HNO ₃ to pH < 2	28 days
Mercury (total)	1000 ml P, G	HNO_3 to $pH < 2$	28 days

Table 5-1 (Cont'd) Muskogee Recycling and Disposal Facility Sample Collection, Preservation, and Holding Times

PARAMETER	SAMPLE COLLECTION ¹ AND CONTAINER	SAMPLE ^{2,3} PRESERVATION	RECOMMENDED⁴ HOLDING TIMES
Other Metals, (dissolved) (Arsenic, Antimony, Barium, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Sodium, Silver, Sodium, Thallium, Vanadium, Zinc)	1000 ml P, G	Filter on site HNO ₃ to pH < 2	6 months
Other Metals, (totals) (Arsenic, Antimony, Barium, Beryllium, Boron, Cadmium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Sodium, Silver, Sodium, Thallium, Vanadium, Zinc)	1000 ml P, G	HNO ₃ to pH < 2	6 months
Nitrate	125 ml P, G	Cool, 4°C	48 hours
Nitrite	125 ml P, G	Cool, 4°C	48 hours
Oil and grease	1000 ml G only	Cool, 4° C H ₂ SO ₄ to pH < 2	28 days
PCB (Priority Pollutant)	1000 ml Glass only (amber) with Teflon liner	Cool, 4°C	Extract within 7 days; analyze within 40 days
Pesticides Endrin Lindane Toxaphene Methoxychlor	1000 ml Glass only (amber) with Teflon liner	Cool, 4°C	Extract within 7 days; analyze within 40 days
pH (field)	25 ml P, G	None required	Analyze immediately
Phenols	500 ml G only	Cool, 4° C H ₂ SO ₄ to pH < 2	28 days
Phosphorus (total)	125 ml P, G	Cool, 4° C H ₂ SO ₄ to pH < 2	28 days

Table 5-1 (Cont'd)

Muskogee Recycling and Disposal Facility Sample Collection, Preservation, and Holding Times

PARAMETER	SAMPLE COLLECTION ¹ AND CONTAINER	SAMPLE ^{2,3} PRESERVATION	RECOMMENDED ⁴ HOLDING TIMES
Specific Conductance (field)	100 ml P, G	None required	Analyze immediately
Sulfate	50 ml P, G	Cool, 4°C	28 days
Temperature (field)	1000 ml P, G	None required	Analyze immediately
Total Dissolved Solids Residue on evaporation (TDS/ROE) 180°C	1000 ml P	Cool, 4°C	7 days
Total Organic Carbon (TOC)	2-40 ml P	Cool, 4° C H ₂ SO ₄ to pH < 2	28 days
Total Suspended Solids (TSS)	1000 ml P	Cool, 4°C	7 days
Volatile Organic Acids, Priority pollutants	4-40 ml glass vial with septum caps	Cool, 4°C	14 days

- 1. Plastic (P) or Glass (G). For metals, polyethylene with polypropylene cap (no liner) is preferred.
- 2. Simple preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the same time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
- 3. When any sample is to be shipped by common carrier or sent through the United States mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring each compliance. For the preservation requirements of Table 5-4, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCL) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO₃) in water solutions and concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H₂SO₄) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).
- 4. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid; samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of sample under study are stable for the longer time, and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

Table 6-1 Muskogee Recycling and Disposal Facility Methodologies for Testing and Analysis

PARAMETER	METHOD DESCRIPTION	METHOD
Acid Extractables	GC/MS	EPA 625/8270C(D)
Alkalinity	Colorimetric, Automated Methyl Orange/Titrimetric	(A)310.2/310.1
Ammonia	Colorimetric, Automated Phenate	(A)350.1
Base/Neutral Extractables	GC/MS	EPA 625/8270C(D)
Biological Oxygen Demand, 5 day (BOD5)	BOD (5 day, 20°C)	(A)405.1
Calcium	Atomic Emission Spectrometric	(A)200.7/6010B(D)
Chemical Oxygen Demand (COD)	Colorimetric, Automated; Manual	(A)410.4
Chloride	Colorimetric, Automated Ferricyanide/Ion Chromatography	(A)325.2/300.0A
Coliform (fecal)	Standard Membrane Filtration	(B)9221
Coliform (total)	Standard Membrane Filter Procedure	(B)9222
Cyanide (total)	Colorimetric, Automated UV	(A)335.3/9012(D)
Fluoride	Potentiometric, Ion Selective Electrode	(A)340.2
Hardness	Calculation	(C)2340B
Metals, dissolved	Atomic Abcorntion furnous technique ICD	(A)200 7/70/4/6040B(D)
Antimony Arsenic	Atomic Absorption, furnace technique, ICP Atomic Absorption, furnace technique, ICP	(A)200.7/7041/6010B(D) (A)200.7/7060A/6010B(D
Barium	ICP) (A)200.7/6010B(D)
Beryllium	ICP	(A)200.7/6010B(D)
Boron	ICP	(A)200.7/6010B(D)
Cadmium	ICP	(A)200.7/6010B(D)
Chromium	ICP	(A)200.7/6010B(D)
Chromium (hexavalent)	Colorimetric	7196A
Copper	Atomic Absorption, Furnace, ICP	(A)200.7/6010B(D)
Iron	ICP	(A)200.7/6010B(D)
Lead	Atomic Absorption, Furnace, ICP	(A)200.7/7421/6010B(D)
Magnesium	ICP	(A)200.7/6010B(D)
Manganese	ICP	(A)200.7/6010B(D)
Mercury	Atomic Absorption, cold vapor technique	7470A
Nickel	ICP	(A)200.7/6010B(D)
Potassium	ICP	(A)200.7/6010B(D)
Selenium	Atomic Absorption, furnace technique, ICP	(A)200.7/7740/6010B(D)

Table 6-1 (Cont'd)

Muskogee Recycling and Disposal Facility Methodologies for Testing and Analysis

PARAMETER	METHOD DESCRIPTION	METHOD
Metals. dissolved		
Silver	ICP	(A)200.7/6010B(D)
Sodium	ICP	(A)200.7/6010B(D)
Thallium	ICP	(A)200.7/7841/6020(D)
Zinc	ICP	(A)200.7/6010B(D)
Metals, total		
Antimony	Atomic Absorption, furnace technique, ICP	(A)200.7/7041/6010B(D)
Arsenic	Atomic Absorption, furnace technique, ICP	(A)200.7/7060A/6010B(D)
Barium	ICP	(A)200.7/6010B(D)
Beryllium	ICP	(A)200.7/6010B(D)
Boron	ICP	(A)200.7/6010B(D)
Cadmium	ICP	(A)200.7/6010B(D)
Chromium	ICP	(A)200.7/6010B(D)
Chromium (hexavalent)	Colorimetric	7196A
Copper	Atomic Absorption, Furnace, ICP	(A)200.7/6010B(D)
Iron	ICP	(A)200.7/6010B(D)
Lead	Atomic Absorption, Furnace, ICP	(A)200.7/7421/6010B(D)
Magnesium	ICP	(A)200.7/6010B(D)
Manganese	ICP	(A)200.7/6010B(D)
Mercury	Atomic Absorption, cold vapor technique	7470A
Nickel	ICP	(A)200.7/6010B(D)
Potassium	ICP	(A)200.7/6010B(D)
Selenium	Atomic Absorption, furnace technique, ICP	(A)200.7/7740/6010B(D)
Silver	ICP	(A)200.7/6010B(D)
Sodium	ICP	(A)200.7/6010B(D)
Thallium	ICP	(A)200.7/7841/6020(D)
Zinc	ICP	(A)200.7/6010B(D)
Nitrate	Colorimetric, Automated, Cadmium	(A)353.2/300.0A
	Reduction, Ion Chromatography	, ,
Nitrite	Colorimetric, Automated, Cadmium Reduction, IC	(A)353.2/300.0A
Oil and Grease	Gravimetric, Seperatory Funnel Extraction	1664A
PCB (priority pollutants)	Gas Chromatography	EPA 608/8083
Pesticides	Gas Chromatography	EPA 608/8081A
pH (field)	Electrometric	(A)150.1
Phenols	Colorimetric, Automated 4-AAP	(A)420.2/9066(D)
	with Distillation	(· ·/ ·20.2/000(D)
Phosphorous, Total	Colorimetric, Automated Ascorbic Acid	(A)365.3

Table 6-1 (Cont'd)

Muskogee Recycling and Disposal Facility Methodologies for Testing and Analysis

PARAMETER	METHOD DESCRIPTION	METHOD
Specific Conductance (field)	Wheatstone bridge	(A)120.1
Sulfate	Turbidimetric, Ion Chromatography	(A)375.4/300.0A
Temperature (field)	Revering Thermometer	(B)212.7
Total Dissolved Solids (TDS)	Gravimetric, Dried at 180°C	(A)160.1
Total Organic Carbon (TOC)	Combustion or Oxidation	(A)415.1
Total Suspended Solids (TSS)	Gravimetric, Dried at 103-105°C	(A)160.2
Volatile Organic Compounds	Purge and Trap/GC/MS	EPA 624/8260B(D)

^{*}NOTE: Analytical methods listed above may be substituted for as deemed necessary provided that the alternate methods provide adequate analytical data to fulfill monitoring requirements and meet regulatory standards.

References:

- A: Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-0920, EMSL, Cincinnati, Revision (March 1983).
- B: Standard Methods for the Examination of Water and Wastewaters, 15th Edition, APHA-AQWQA-WPCF, 1980.
- C*: Standard Methods for the Examination of Water and Wastewaters, 18th Edition, APHA-AWWA-WEF, 1992.
- D: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, July 1992 (as Revised).

^{* 2340}B is the same in the 18th Edition as in the 17th Edition.

Table 7-1

Muskogee Recycling and Disposal Facility Background Monitoring Parameter List

Inorganic Parameters:	CAS RN
Alkalinity	Total
Ammonia, Nitrogen	
Antimony	Total
Arsenic	Total
Barium	Total
Beryllium Cadmium	Total Total
Calcium	Total
Chloride	Total
Chromium	Total
Cobalt	Total
Chemical Oxygen Demand	Total
Copper	Total
Dissolved Solids	Total
Iron	Total
Lead	Total
Magnesium	Total
Manganese	Total
Nickel	Total
Nitrate	
рН	
Potassium	Total
Selenium	Total
Silver	Total
Sodium	Total
Specific Conductance	
Sulfate	T - (- 1
Thallium	Total
Vanadium Zinc	Total Total
ZIIIC	Total
Organic Constituents:	
Acetone	67-64-1
Acrylonitrile	107-13-1
Benzene	71-43-2
Bromochloromethane	74-97-5
Bromodichloromethane	75-27-4
Bromoform (tribromomethane)	75-25-2
Carbon disulfide	75-15-0
Carbon tetrachloride	56-23-5
Chlorobenzene	108-90-7
Chloroethane (ethyl chloride)	75-00-3
Chloroform (trichloromethane)	67-66-3
Dibromochloromethane (chlorodibromomethane)	124-48-1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8
1,2-Dibromoethane (ethylene dibromide, EDB)	106-93-4

Table 7-1 (Cont'd) Muskogee Recycling and Disposal Facility Background Monitoring Parameter List

Owner's Oraclifornia	040 511
Organic Constituents:	CAS RN
o-Dichlorobenzene (1,2-dichlorobenzene)	95-50-1
p-Dichlorobenzene (1,4-dichlorobenzene)	106-46-7
trans-1,4-Dichloro-2-butene	110-57-6
1,1-Dichloroethane (ethylidene chloride)	75-34-4
1,2-Dichloroethane (ethylene dichloride)	107-06-2
1,1-Dichloroethylene (1,1-dichloroethene, vinylidene chloride)	75-35-3
cis-1,2-Dichloroethylene (cis-1,2-dichloroethene)	156-59-2
trans-1,2-Dichloroethylene (trans-1,2-dichloroethene)	156-60-5
1,2-Dichloropropane (Propylene dichloride)	78-87-5
cis-1,3-Dichloropropene	10061-01-5
trans-1,3-Dichloropropene	10061-02-6
Ethylbenzene	100-41-4
2-Hexanone (methyl butyl ketone)	591-78-6
Methyl bromide (bromomethane)	74-83-9
Methyl chloride (chloromethane)	74-87-3
Methylene bromide (dibromomethane)	74-95-3
Methylene chloride (dichloromethane)	75-09-2
Methyl ethyl ketone (MEK, 2-butanone)	78-93-3
Methyl iodide (iodomethane)	74-88-4
4-Methyl-2-pentanone (methyl isobutyl ketone)	108-10-1
Styrene	100-42-5
1,1,1,2-Tetrachloroethane	630-20-6
1,1,2,2-Tetrachloroethane	79-34-5
Tetrachloroethylene (tetrachloroethane, perchloroethylene)	127-18-4
Toluene	108-88-3
1,1,1-Trichloroethane (methylchloroform)	71-55-6
1,1,2-Trichloroethane	79-00-5
Trichloroethylene (trichloroethene)	79-01-6
Trichlorofluoromethane (CFC-11)	75-69-4
1,2,3-Trichloropropane	96-18-4
Vinyl acetate	108-05-4
Vinyl chloride	75-01-4
Xylenes (total)	1330-20-7
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Table 8-1

Muskogee Recycling and Disposal Facility Detection Monitoring Parameter List

COMMON NAME	
Inorganic Parameters¹:	<u>CAS RN</u>
Alkalinity	Total
Ammonia, Nitrogen Arsenic	Total
Barium	Total
Chloride	rotai
Chromium	Total
Nickel	Total
Zinc	Total
Organic Constituents:	
Acetone	67-64-1
Acrylonitrile	107-13-1
Benzene	71-43-2
Bromochloromethane	74-97-5
Bromodichloromethane	75-27-4
Bromoform (tribromomethane)	75-25-2
Carbon disulfide	75-15-0
Carbon tetrachloride	56-23-5
Chlorobenzene	108-90-7
Chloroethane (ethyl chloride)	75-00-3
Chloroform (trichloromethane)	67-66-3
Dibromochloromethane (chlorodibromomethane)	124-48-1
1,2-Dibromo-3-chloropropane (DBCP) 1,2-Dibromoethane (ethylene dibromide, EDB)	96-12-8 106-93-4
o-Dichlorobenzene (1,2-dichlorobenzene)	95-50-1
p-Dichlorobenzene (1,4-dichlorobenzene)	106-46-7
trans-1,4-Dichloro-2-butene	110-57-6
1,1-Dichloroethane (ethylidene chloride)	75-34-4
1,2-Dichloroethane (ethylene dichloride)	107-06-2
1,1-Dichloroethylene (1,1-dichloroethene, vinylidene chloride)	75-35-3
cis-1,2-Dichloroethylene (cis-1,2-dichloroethene)	156-59-2
trans-1,2-Dichloroethylene (trans-1,2-dichloroethene)	156-60-5
1,2-Dichloropropane (Propylene dichloride)	78-87-5
cis-1,3-Dichloropropene	10061-01-5
trans-1,3-Dichloropropene	10061-02-6
Ethylbenzene	100-41-4
2-Hexanone (methyl butyl ketone)	591-78-6
Methyl bromide (bromomethane)	74-83-9
Methyl chloride (chloromethane)	74-87-3
Methylene bromide (dibhoromethane)	74-95-3
Methylene chloride (dichloromethane)	75-09-2

Table 8-1 (Cont'd) Muskogee Recycling and Disposal Facility Detection Monitoring Parameter List

COMMON NAME

Organic Constituents:	CAS RN
Methyl ethyl ketone (MEK, 2-butanone)	78-93-3
Methyl iodide (iodomethane)	74-88-4
4-Methyl-2-pentanone (methyl isobutyl ketone)	108-10-1
Styrene	100-42-5
1,1,1,2-Tetrachloroethane	630-20-6
1,1,2,2-Tetrachloroethane	79-34-5
Tetrachloroethylene (tetrachloroethane, perchloroethylene)	127-18-4
Toluene	108-88-3
1,1,1-Trichloroethane (methylchloroform)	71-55-6
1,1,2-Trichloroethane	79-00-5
Trichloroethylene (trichloroethene)	79-01-6
Trichlorofluoromethane (CFC-11)	75-69-4
1,2,3-Trichloropropane	96-18-4
Vinyl acetate	108-05-4
Vinyl chloride	75-01-4
Xylenes (total)	1330-20-7

Notes:

¹Inorganic parameters have been optimized in accordance with OAC 252:515-9-72(c).

Table 8-2

Muskogee Recycling and Disposal Facility Water Quality Parameters List

Indicator Parameters:	<u>CAS RN</u>
Calcium Chemical Oxygen Demand	Total
Dissolved Solids	Total
Iron	Total
Magnesium	Total
Manganese	Total
Potassium	Total
Sodium	Total
Sulfate	Total

FIGURE 5-1 FIELD INFORMATION FORM

(For informational purposes only. Actual may vary.)

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L			MM DD Y Passive		g, replac		400 Hr C Vol in C		nd "Well V	4	:min) ged" w/	Water Vol	in Tubing/	Flow Ce	(Gallor Il and Tul		Cell Vols	Purged.	(Galle Mark		ecord fiei	PURGE d data, below	
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S/SAN	EQUIPMENT					B-Peris	taltic Pu	ımp	E-Pis	ston Pui			Filter	Type:			Pressure	sposao		Other			
URGE	EQU	Sampling X-Other:	g Device	: 	_	C-QED	Bladde	r Pump	F-Dij	pper/Bo	ttle 	Sam	ple Tube	Type:			Teflon Stainless	Steel		PVC Polypropy	X-Ot	ther:	
_	τ.	Well Ele	wation		1 1		1 1		Depth to	Water	(DTV		1 1	1 1	1		oundwate			I I	1 1	1 1 1	
WELL DATA	V	(at TOC					(ft		from TC		(DIV	"Ц			(ft)		e datum,						ft/msl)
1		Total We		h			l l		tick Up from gro	ound ele	vation)			(ft)	Ca: ID	sing	₆	n)	Casing Materia	,		
3		Note: Tot	al Well L				, etc. are	optional	and can b	e from h	istorica	al data, unle	ess require		/Permit.			W, and C		water Elev	ation mu.	st be current.	
Ι.		ample Tin 400 Hr Clo		Rate/	Unit	pH (std			uctance (hos/cm @) 	Temp. (°C)			rbidity (ntu)		D.C (mg/L -			eH/ORI (mV)	,	DT\	
		1			1 st		1	st					J L		١				L				
_		1			2 nd		2	nd					」L								Ш		
iona					3 rd	1	3	rd				1 1			Ι.								
(Op					4 th		4	th	1 1						Ι.								
ATA												1 1] [
STABILIZATION DATA (Optional)		1			7 [1 [1 1	7 [
ATIC		1			7 I	i							7 [
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TAB		1 1 1			7	<u> </u>					1 [7 [
s		1 1 1			7	<u> </u>					1 [7 [
		gested range Permit/State			igs or	+/- 0	.2		+/- 3%		1		7 F				+/- 10	%		+/- 25 mV	,	Stabil	lize
																						ements are re separate she	
ATA		SAMPLI (MM D		Е		pH (std)			NDUCT.			TEMP.			BIDITY	,	DO (mg/L)			eH/ORI (mV)		ther:	
FIELD D.			1			(sta)			l	23 ()			$ \cdot $	ΙÌ	ntu)		(mg/L-ı						-
FIE	Fina	al Field Re	adings ar	re requir	ed (i.e.	record)	field med	isuremei	nts, final s	stabilize	d readi	ings, passi	e sample	reading	s before	sampling	for all fie	ld para	meters	required	by State	Permit/Site.	
	Sar	mple App	earance	e:							Od	or:			_	Color	:			Other:			
		eather Co										ction/Spee	d:		_ '	Outlook	:			Prec	ipitatio	n: <u>Y</u> or _	N
	Spe	ecific Con	nments	(includ	ing pu	irge/we	ll volun	ne calcu	lations	if requi	red):	_											
YTS.	_																						
ME	_																						
_	-																						_
SO.	_																						
LD CON																							
FIELD COMMENTS	_	Sa. 5 -		A. 444				5. 6. 912	5 6 5 4 7 4	0.66													
Greek C	I ce	ertify that	samplin	g proced	lures v	vere in a	necordar	nce with	applical	ole EPA	, State	e, and WN	f protoco	ols (if m	ore than	one san	npler, all	should	sign):				
Greek C	I ce	ertify that	samplin	g proced	lures v	vere in a	accordar	nce with	applical	ble EPA	, State	e, and WN	I protoec	ols (if m	ore than	one san	npler, all	should	sign):).			
IMENTS	We		ndition	s (requir						if requi	Direc									_		n: Y or _	N_

FIGURE 5-2 CHAIN-OF-CUSTODY RECORD

(For informational purposes only. Actual may vary.)

Chain of Custody Record

Sampler ID		To
Temperature on Recei	pt	ie:
Drinking Water? Yes	□ No □	THE LEA



TAL-4124-280 (0508)																													
Client																Da	te				(Chain of Custody Number							
Address		Telephone Number (Area Code)/Fax Number													La	Lab Number						Page of							
City		Site Contact Lab Contact														An	alysis re sp	llysis (Attach list if space is needed)											
Project Name and Location (State)	Carrier	/Way	Waybill Number				1																_						
Contract/Purchase Order/Quote No.						Matrix				Containers & Preservatives																Specia Conditi	ll Instructions/ ons of Receipt		
Sample I.D. No. and Description (Containers for each sample may be combined on one line) Date					Air	Aqueous	Sed.	Soil		Unpres.	H2SO4	HNO3	HCI	NaOH	NaOH														
										1	+	+	+	+	+	+	-			1					+				
			4												1														
																	+			1	+				+				
												-					1												
							\blacksquare			-			-	-			1					-							
																	3												
Possible Hazard Identification Non-Hazard Flammable Skin Irritant Poison B						ample Re					☐ Disposal By Lab ☐ Archive For QC Requirements (Specify)									(A fee may be asses Months longer than 1 month					asses: month)	ssed if samples are retained h)			
Turn Around Time Required 24 Hours 48 Hours 7 Days	П	14 Days	21 Days	Ott	har					1	QC F	Requ	ireme	ents ((Spe	cify)													
1. Relinquished By Date												1. Received By																Time	
2. Relinquished By							Tin	ne		2	2. Received By															Date		Time	
3. Relinquished By				Date			Tin	ne		1	3. Re	eceiv	ed By	У												Date		Time	
Comments																													

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy