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Figure 4-2. Metal Concentrations in Soil Samples against the Site Background Sample at Area 41 of Camp Carroll.

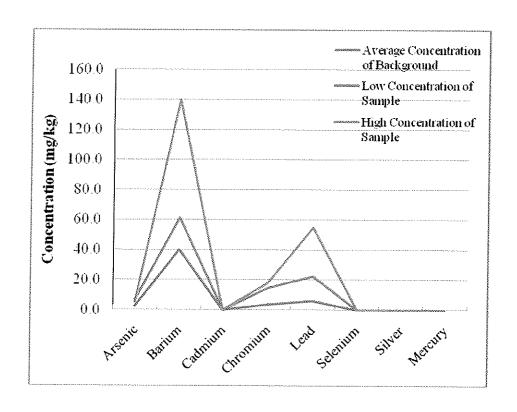


Figure 4-3 DDT Concentration in Soil at Area 41 of Camp Carroll. Note that the Distribution of DDE and DDD is very similar to This Pattern.

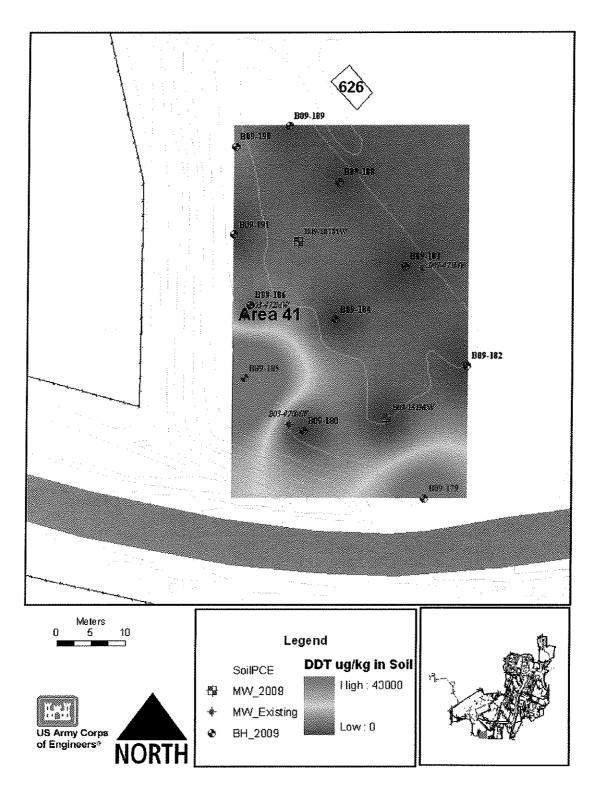


Figure 4-4 Groundwater Flow Direction Contour Diagram at Area 41 of Camp Carroll.

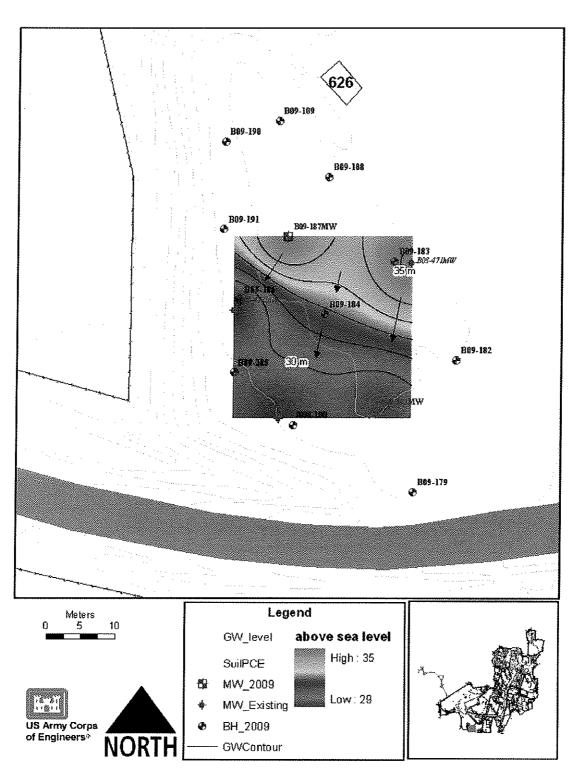


Figure 4-5. PCE Concentration in the Subsurface Soil of Area 41 of Camp Carroll.

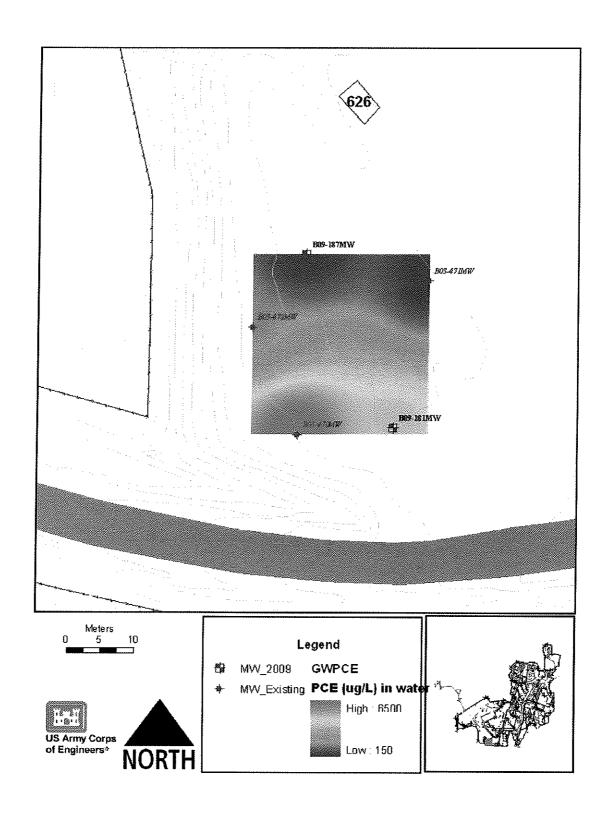
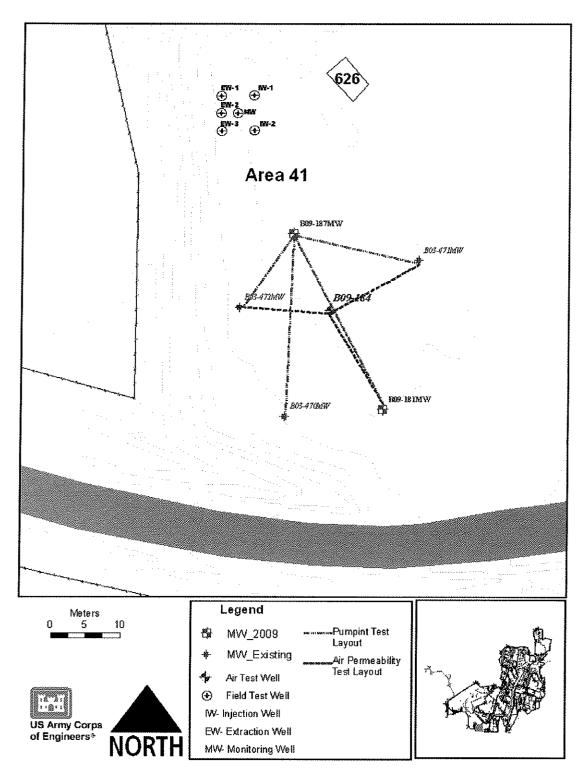


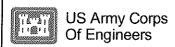
Figure 4-6 Hydrologic, Air Permeability Test Layouts and Field Test Well Locations at Area 41 of Camp Carroll.



#### 5. References

- Department of Defense (DoD), 2009. DoD Quality Systems Manual for Environmental Laboratories, Version 4.1. Based on NELAC Voted Revision, June 5, 2003.
- DoD, 2005. Department of Defense Directive 4715.1E. Environment, Safety, and Occupational Health (ESOH), 19 March 2005.
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- Samsung Corporation. 2004. Camp Carroll Area D and Area 41 Site Investigation, Camp Carroll, Korea. Prepared for US Army Corps of Engineers, Far East District, Contract #DACA81-00-D-0049, Delivery Order #24July 2004
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- USACE FED, 2009. Work Plan for Environmental Site Investigation/Risk Assessment at Six Sites of Camp Carroll: Bachelor's Enlisted Quarters (BEQ) Hill, Area 41, Area D, Land Farm Building 565 and Building 326. Prepared for: Environmental Division, DPW, Camp Carroll, USA Garrison Daegu IMKO-ADP-PWE (Mr. Kim Chom-Tong), UNIT#15748, APO AP 96260-5748, Prepared by: Geotechnical and Environmental Engineering Branch (Dr. U-Yong Chon), US Army Corps of Engineers, Far East District, January 6, 2009.
- United States Forces Korea Regulation 200-1, *United States Forces Korea Remediation Regulation*, 2 October 2007
- United States Forces Korea Pamphlet 200-1, *Environmental Governing Standards*, 25 March 2005
- US EPA, 1996. Test Methods for Evaluating Solid Waste, SW-846. 3rd ed. Final Update III. Washington. GPO. November.
- Woodward Clyde. 1992. Baseline Groundwater Investigation, Camp Carroll, 1992

Appendix I: Soil Borehole Logs



# EXPLORATION LOG HOLE NO. B09-179

Far East District

PROJE					Camp (	Carroll					
LOCAT								08-036E		PECTOR:	1 1 1 1 1 1 1 1
DATES					b 09		HED:	23 Feb 09	_ DRI	LLER:	
DRILLII											
DRILLI	NG AC	SENCY	′:	<u>'ar Eas</u>				: <u>5 cm</u>	_ TO	TAL DEPTH: _	
OVERE								6.0 m	VVA	TER DEPTH:	MOI
							AMINATION	39.37 m	_ DA		MSL
TVDE	AD CC	JVER.	Diozon	notor	□ Moni	***************************************	☐ Test Pit	ı. □ Auger Hole	П,		
'   '   '	<i>n</i> 110	<b>'L</b> . i	3 F 102011	16161	LIVIOIII	toring vven	LIFESTER	L. Auger Hole	L1 \	)II 161	
ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA	D	ESCRIPTION OF	MATERIALS		FIELD DATA	LAB DATA
39-			77200000		FILL	subangular fine	to coarse Sand (	t; subangular (max.2 nax.4.8mm); no plas no odor; centain org	ticity;	%Recovery = 45 PID = 1.5ppm FC = F2	
38-	S1				FILL	subangular fine	rong brown; mois to coarse Sand (i fill material (SM);	t; subangular (max.2 nax.4.8mm); no plasi no odor.	cm); ticity;	FC = F2	
2					SM	SILTY SAND: ye gravel (max.1cm	ellowish brown; m	oist; subangular fine dium to coarse Sand ; residual soil; no od	i	FC = F3	
37										%Recovery = 50 PID = 1ppm	
	S2										
36											
-4										%Recovery = 48	
35										PID = 3.5ppm	
——————————————————————————————————————	S3										
34											
6											
								35	90,	8	

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## **EXPLORATION LOG** HOLE NO. B09-180

Far East District

PROJ	ECT: ]	ESI/RE	cat Are	<u>a 41 of</u>	Camp (	Carro	<u>                                     </u>						
LOCA.	TION:	Camp	carroll	***************************************			G&EE NO.:	0	8-036E	_ INS	PECTOR:		
	STAR				09		FINISHED:	24	Feb 09	_ DRI	LLER:		davida i
				PMENT:									
DRILL	ING AC	SENCY	: <u>I</u>	Far East	<u>t Distric</u>	<u>et</u>	HOLE DIAM	ETER:	5 cm		TAL DEPTH		
1				S:			DEPTH DRIL	-		_ WA	TER DEPTI	H:	
				<u> 892.3</u> E	: <u>446,6</u>	62.7	GROUND EL	_EV.:	39.48 m	_ DAT	"UM:	ľ	MSL
GROU							CONTAMINA		***************************************				
TYPE	OF HO	LE: (	☐ Piezon	neter	☐ Moni	toring V	Vell ☐ Test	Pit [	☐ Auger Hole		other		
	Т.	1		1	1	1						r	
_	긢	TED	Ę			]						1	
<u> </u>	SAMPLE TYPE NUMBER	O N	BLOW COUNT	w	_ ا		DESCRIPT	ION OF M	ATEDIAI C		FIELD DAT	. ]	LAB DATA
ET X	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	E SE	N S	l D	\S\/		DESCRIPT	IOIVOI IVA	ATERIALO		TILED DAT	^	LAB DATA
ELEVATION / DEPTH (meters)	SAN	GRAPHIC LOG CONTAMINATED	BLO	SPT N-VALUE	USCS/ STRATA								
<u></u> 0	<b>—</b>	XXXX			FILL	CII TV	/ SAND: grayish bro	uni maniati		······	%Recovery = 4	_	
					SM	subar	ngular fine to coarse	Sand (ma:	x.4.8mm); no plast		PID = 0.3ppm	°	
39					SIVI		; fill material (SM); n ' SAND: brown; mois			/	FC = F3 FC = F3		
					SM		(max.4.8mm); no pl			10 /	FC = F3		
	S1					SILTY	'SAND: yellowish br				10-10		
38							e Sand (max.4.8mm ial soil; no odor.	); no plasti	city; medium dens	e;			
38													
2													
											%Recovery = 4 PID = 0.6ppm	9	
37													
-3	S2												
İ													
36													
4	1			1									

# EXPLORATION LOG HOLE NO. B09-181MW



										_ , ,			
DATI DRIII DRIII OVE	CATION: E STAR LLING M LLING A ERBURD DRDINA DUND C	Cam RTED: METHO GENO DEN TH TES: N OVER	p carrol D/EQUI Y: HICKNE I: 3,982, Idirt	24 Fe IPMENT Far Eas SS:	b 09 ∴ <u>Drec</u> st Distri 4.0 n Ξ: <u>446</u> ,	t-Push ict n 674.8	G&EE NO.: FINISHED: HOLE DIAMET DEPTH DRILLE GROUND ELEV CONTAMINATI	24 I ER: ED: V.: ON: _	036E Feb 09 5 cm 14.7 m 39.78 m	_ DRI _ TO _ WA _ DA	PECTOR: ILLER: TAL DEPTH: TER DEPTH: TUM: Other	MSL	
ELEVATION / DEPTH	(meters) SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED BLOW COUNT	SPT N-VALUE	USCS/ STRATA		DESCRIPTION	OF MATI	ERIALS		FIELD DATA	LAB DATA	
37—	2 sz				FILL	subar (max. odor, <u>SANE</u> Sand soil; n <u>SILTY</u> coars residu	r SAND WITH GRAVEL.  ngular (max.1.5cm); sub 4.8mm); no plasticity; ve contain organics.  PY Sit.T: brown; moist; s (max.4.8mm); no plastic to odor.  SAND: yellowish brown e Sand (max.4.8mm); no all soit; no odor.  illing to install groundwa ion soil sample. No har intered	angular fii ery loose; ubangular city; medit n; moist; s o plasticity	ne to coarse Sa fill material (SM fine to coarse im dense; resid ubangular fine t r; medium dens	lual to e;	%Recovery = 46 PID = 19.2ppm FC = F3 FC = F3  **Recovery = 50 PID = 1.5ppm		The state of the s

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PAGE 1 of 2

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	Of Engineers

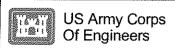
# EXPLORATION LOG HOLE NO. B09-181MW

Far East District

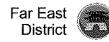


PROJE	CT: J	ESI/R	E at Are	ea 41 of	Camp (	Carro	11						
PROJECT: ESI/RE at Area 41 of Camp Carroll  LOCATION: Camp carroll G&EE NO.: 08-036E INSPECTOR:  DATE STARTED: 24 Feb 09 FINISHED: 24 Feb 09 DRILLER:													
							FINISHED:	24	Feb 09	_ DRI	LLER:		1
1			D/EQUIF				······································						
DRILLI			***************************************			***************************************	HOLE DIAME				FAL DEPTH: _		
1			HICKNES			••••				_ WA	TER DEPTH:	Mei	
GROUN				894.2 E			GROUND EL			_ DAI	ГUM:		
Ŧ.			☐ Piezon						Auger Hole				
ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER		CONTAMINATED BLOW COUNT	SPT N-VALUE	USCS / STRATA		DESCRIPTI	ION OF MA	ATERIALS		FIELD DATA	LAB DATA	
28————————————————————————————————————	¥												

IRO-EXPLORATION LOG 08-135E AREA 41 CARROLL GPJ USACE SK

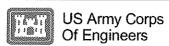


HOLE NO. B09-182



	PROJECT: ESI/RE at Area 41 of Camp Carroll												
LOCATION: Camp carroll G&EE NO.: 08-036E INSPECTOR:													
DATE S	TART	ED:		24 Feb	09		FINISHED:	2	4 Feb 09	_ DRI	LLER:		
DRILLIN	IG ME	THOD	/EQUIF	PMENT:	Drect	-Push							
DRILLIN	IG AG	ENCY	:	Far East	Distric	:t	HOLE DIAME	ETER:	5 cm		FAL DEPTH:		
OVERB	URDE	EN THI	CKNES	SS:	4.0 m		DEPTH DRIL	LED:	4.0 m	_ WA	TER DEPTH:		
							GROUND EL	EV	39.74 m	DA <sup>-</sup>	ГUМ:	MSL	
GROUN	ID CO	VER:	dirt				CONTAMINA						
TYPE O	F HO	LE: C	] Piezon	neter	☐ Moni	toring V	Vell 🔲 Test I	Pit	☐ Auger Hole		other		
	I	····		1				······································			T	<del></del>	
~	SAMPLE TYPE / NUMBER	GRAPHIC LOG CONTAMINATED	5										
<u>N</u>	<u>\</u>	υ K	ā	100			DECODIET		********		CIEL D DATA	145.54	- 4
Ers)	PE	PHI	> ≥	5	S/ ATA		DESCRIPTI	ON OF A	MATERIALS		FIELD DATA	LAB DA	IA.
ELEVATION / DEPTH (meters)	ASA UNITED	S S S	3LOW COUNT	SPT N-VALUE	USCS / STRATA								
~				0,2									
_  `					FILL / SM	SILTY suban	SAND WITH GRAV	<u>EL</u> : grayi bangular	sh brown; moist; fine Sand; verv loc	se; fill ∫	%Recovery = 25 PID = 2.7ppm		
						mater	ial (SM); no odor; co	ntain org	anics.				
39					CL	\Sand;	SAND: yellowish bromedium dense; fill r	own; moi naterial (	st; subangular line SM); no odor.	ſ			
-1	S1	444			MŁ	SAND	Y LEAN CLAY: redd and; medium stiff; fill	ish brown	: moist; subangula	r /			
-					IVIL	SAND	Y SILT: yellowish bro	own; sub	angular medium Sa	and;			
-					SM		m dense; fill materia ial (1.3cm).	il (SM); n	o odor; contain woo	od /			
38	ſ					SILTY	SAND: reddish brov	vn; subar	ngular medium San	/ d;			
-2						dense	; residual soil; no od	or.			%Recovery = 50		
1 1	ŀ	事[] [									PID = 0ppm		
-													
37												1	
3	S2	44											
1 1	ŀ												
36	]:				ĺ								
	[:												

/IRO-EXPLORATION LOG 08-036E AREA 41 CARROLL GPJ USACE SKOREA GDT



HOLE NO. B09-183



PROJE	CT: I	ESI/RI	at Are	ea 41 of	Camp (	Carrol	<u>I</u>						<i></i>
PROJECT: ESI/RE at Area 41 of Camp Carroll  LOCATION: Camp carroll G&EE NO.: 08-036E INSPECTOR:  DATE STARTED: 24 Feb 09 FINISHED: 24 Feb 09 DRILLER:													
DATE S	TART	ED:		24 Feb	09		FINISHED: _	2	4 Feb 09	DRI	LLER:		b)
DRILLIN	IG ME	THOD	)/EQUII	PMENT:	Drect	-Push							
DRILLIN	IG AG	ENCY	<u>':</u>	Far East	t Distric	et	HOLE DIAME.	TER:	<u>5 cm</u>		TAL DEPTH:		
OVERB	URDE	N THI	CKNES	SS:	4.0 m		DEPTH DRILL	.ED:	4.0 m	_ WA	TER DEPTH:		
							GROUND ELE			_ DA1	ГUМ:	MS	SL
							CONTAMINAT						
TYPE O	F HO	LE: [	] Piezor	neter	☐ Moni	itoring V	Vell ☐ Test P	it l	☐ Auger Hole		other		
		T	r	1	1	f					<b>!</b>		
-	TYPE.	GRAPHIC LOG CONTAMINATED	E										
Į į	<u>     </u>	U E	SLOW COUNT	ш			DESCRIPTIC	IN OF A	MATERIALS		FIELD DATA		LAB DATA
TATY TH (tens)	ABE	YPH TAN	_ ≥	J AF	XX/		DECOM NO	11 01 11	and Charles		TILLO DATA		CAO DATA
ELEVATION / DEPTH (meters)	SAMPLE 1 NUMBER	GRAPHIC LOG CONTAMIN	BLC	SPT N-VALUE	USCS/ STRATA								
<u>0</u>		XXXX			FILL	CII TV	SAND WITH GRAVE	I · dod	brown moiat		%Recovery = 50		
					FILL	∖suban	gular (max.2cm); sub	angular;	; very loose; fill mat	erial 🗐	PiD = 0.1ppm		
-				] !	ML SM	(SM);	no odor; contain orga 'SAND: brown; moist;	angula	r: fill material (SM):	no /			
39						odor.	Y SILT: light yellowish	-		- 11			
-1	S1					residu	al soil; no odor.		•				
-						SILTY odor.	SAND: brown; moist;	subang	gular medium Sand;	no			
				İ İ	CL	LEAN	CLAY: figh ofive brow	n; mois	t; (max.0.43mm);				
382						mediu	m plasticity; very stiff;	no odor	r.				
2.										ĺ	%Recovery = 48 PID = 1.2ppm		
7_													
37	ŀ				SM		SAND: ligh brown; me	oist; anç	gular; residual soil;	no			
3	S2					odor.				İ			
	ľ												
	į												
36	ļ				İ								
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O-EXPLORATION LOG 08-0362 AREA 41 CARROLLIGPJ USACE SKOREA GDT 6/

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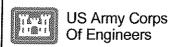
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# EXPLORATION LOG HOLE NO. B09-184



PROJE	CT· I	rsi/p	F of	Aro	2 41 of	Camp (	arro							
LOCATI						Camp (	Jui 1 V	G&EE NO.:	0.9	8-036E	INS	PECTOR:		1/
DATES						. 00		FINISHED:		Feb 09		LLER:	an Salaman da sa	$\tilde{\mathcal{D}}$
DRILLIN									——————————————————————————————————————	1000	DIV		-	<u> </u>
								HOLE DIAME	TER.	5 cm	TΩ	TAL DEPTH:	40 m	
								DEPTH DRIL				TER DEPTH:		
								GROUND EL				TUM:	MSI	
GROUN					<u> </u>			CONTAMINA		37,17 H				
					eter	□ Moni	torina V	Vell ☐ Test F		Auger Hole	П	other		
		i i	{\$ 1 17	UZOI1	io (G)	[] 1VIOIII	willing v	Yeir1eat1	"	J Augel Hole	L_J (			
ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS / STRATA		DESCRIPȚIO	ON OF MA	TERIALS		FIELD DATA	LAB DATA	
<u></u>		XXXX				FILL ,	_ SILTY	SAND WITH GRAVI	FI : dark he	owe: moist:		%Recovery ≈ 40		
39	S1		7700000	1000		FILL	subar mater SAND	igular (max.2.5cm); n ial (SM); no odor; cor I <mark>Y FAT CLAY</mark> ; reddish 2.5cm); high plasticit	io plasticity ntain orgar h brown; m	r; very loose; fill nics. oist; subangular		FC = F3 FC = F4		
38						SM	SILTY dense	SAND: ligh brown; n ; residual soil; no odd	noist; no pi or.	asticity; medium		FC = F3		
37—						- maximum						%Recovery = 50 PtD = 0ppm		
36-	82		-			SM SM	suban dense SILTY	SAND WITH GRAVE gular fine gravel (ma: ; residual soil; no odd SAND WITH GRAVE gular fine gravel (ma)	x.1cm); no or. L: ligh bro	plasticity; mediur				
~~   <sub>4</sub>		1.17	1		1			al soil; no odor.	•	. , , ,				

O-EXPLORATION LOG 08-336E AREA 41 CARROLL.GPJ USACE SKOREA.GDT 6

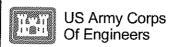


## **EXPLORATION LOG** HOLE NO. B09-185

Far East District



PROJE	CT: I	ESI/RE	at Are	<u>a 41 of</u>	Camp (	Carrol	<u> </u>					/
PROJECT: ESI/RE at Area 41 of Camp Carroll  LOCATION: Camp carroll G&EE NO.: 08-036E INSPECTOR:  DATE STARTED: 25 Feb 09 FINISHED: 25 Feb 09 DRILLER:												
DATES	TART	ED: _		25 Feb	) 09		FINISHED:	25	Feb 09	DRI	LLER:	bearing be
DRILLIN	NG ME	ETHOD	/EQUIF	PMENT:	: <u>Drect</u>	-Push						
							HOLE DIAME				TAL DEPTH: _	
							DEPTH DRIL			_ WA	TER DEPTH:	
			<u>3,982,9</u>	<u> 200.0</u> E	.: <u>446,6</u>	54.0	GROUND EL	.EV.;	39.38 m	_ DAT	ГUМ:	MSL
GROUN			<u>dirt</u>				CONTAMINA	TION:				
IYPEU	F HO	<b>∟</b> E:	J Piezon	neter	∐ Moni	toring v	Vell ☐ Test	Pit L	Auger Hole		other	
	55			T		T	***************************************				<u> </u>	1
ž	SAMPLE TYPE / NUMBER	GRAPHIC LOG CONTAMINATED	SLOW COUNT	'	!							
ELEVATION / DEPTH (meters)	표없	GRAPHIC LOG CONTAMIN	Ö	<u>m</u>	!		DESCRIPTI	ION OF MA	TERIALS		FIELD DATA	LAB DATA
EV/	MB	N S S	Ŏ.	SPT N-VALUE	USCS / STRATA							
피유훈	δž	유구성	՝	ßż	3.E				······································	***************************************		
o		XXX		]	FILL		SAND WITH GRAV				%Recovery = 43	
39-			!		ML		30%; about40% fine oose; fill material (SN				PID = 162ppm FC = F3	
			ŀ			SAND	Y SILT: brown; mois	st; fine to co			FC = F4	
	S1		ŀ			Star; re	esidual soil; weak so	NVeru.				
'			ļ		SM		Y SILT: reddish brov	wn; moist; fi	ine to medium Sa	ınd;	FC = F4	
38-	,	344	ļ			stiff; w	veak solvent.					
	. [		!		ML.	SILT:	yellowish brown; mo	oist; fine Sar	nd; stiff; weak			
72			1			solven					%Recovery = 50	
37											PID = 143ppm	
"  -						I						
_						i						
-3	52											
36—					i						:	
											1	
+4		1111			ML.	CO T.	2.6.1		1:75		- 50	
	S3				IVIL		yellowish brown; mo eak solvent.	ist; tine San	id; very stat; resid	lual	%Recovery = 50 PID = 72.4ppm	
35							······			I		



# EXPLORATION LOG HOLE NO. B09-186

Far East District



LOCAT DATE S DRILLII DRILLII OVERE COORI GROUN	TION: START NG ME NG AG BURDE DINAT ND CC	Camp FED: _ ETHOD SENCY EN THI ES: N:	CARROLL  O/EQUII  CKNES  3,982,9  dirt	25 Fet PMENT: Far Eas SS: 910.6 E	0 09 Drece t District 10.0 n	t-Push ct n 654.8	G&EE NO.: FINISHED:	Z5 ETER: LED: LEV.: ATION:	5 cm 10.0 m 39.57 m	TO' WA	TUM:	10.0 m  MSL
ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS/ STRATA		DESCRIPTI	ON OF MA	TERIALS		FIELD DATA	ŁAB DATA
39 - 1 38 - 2 37 - 3 36 - 4	S1				FILL FILL SM SM SM SM SM	subar very is SILTY mater SILTY solver SILTY grave SILTY	Y SAND WITH GRAY ngular (max.1.5cm); s foose; fill material (SA) Y SAND; reddish brov rial (SM); no odor. Y SAND: reddish brov ual soil; weak solvent Y SAND: reddish brov int. Y SAND: reddish brov int. Y SAND: reddish brov si; medium dense; mo Y SAND. Y SAND.	subangular M); no odor; wn; moist; v wn; moist; n i. wn; moist; lo wn; moist; s	fine to coarse Sar, contain organics, cery loose; fill medium dense; cose; moderate subangular fine	nd;	%Recovery = 50 PID = 98.4ppm %Recovery = 50 PID = 219ppm %Recovery = 50 PID = 61.9ppm	
33—-6 33—-7 32—-8 31—-9 30—-	\$4 \$5				ML ML	SILT: r	grayish brown; moist, moist; very stiff; faint : moist; very stiff; no oc	solvent.	solvent.		%Recovery = 45 PID = 132ppm %Recovery = 50 PID = 13.5ppm	

# EXPLORATION LOG HOLE NO. B09-187MW



							·····		<del></del>
					•	Carroll	00.00	NODEOTO	/
LOCAT DATE S				***************************************	P 00	G&EE NO.: FINISHED:		INSPECTOR:	THE STATE OF THE S
DRILLI							20 FCD 09	DRILLER,	
DRILLI							5 cm	TOTAL DEPTH:	15.0 m
OVERB								WATER DEPTH:	
				<u>919.7</u> l	≣: <u>446</u> ,	661.6 GROUND ELEV.:		DATUM:	MSL
GROUN							***************************************		
TYPE C	)F HO	LE:	∐ Piezo	meter	∐ Moi	nitoring Well	☐ Auger Hole	other	<del></del>
<u> </u>	Tii	Ţ	a .	7					
ELEVATION / DEPTH (meters)	SAMPLE TYPE NUMBER	GRAPHIC LOG	BLOW COUNT						
ATE (S	끭	를 기		5	- ₹	DESCRIPTION OF	MATERIALS	FIELD DATA	LAB DATA
LEV mete	AMP	GRAPHIC LOG	5 5	SPT N-VALUE	USCS / STRATA				
<u>шо</u>	0.2	0 1 0	م د	02	ا ت				
					FILL	SILTY SAND: brown; moist; subar plasticity; very loose; fill material (		%Recovery = 50 PID = 10.4ppm	
-					FILL	organics. SILTY SAND: reddish brown; mois		- /1	
39-					CL SM		• •		
-1	S1	**		ĺ	J.V.	SILTY SAND: dark brown; moist; r dense; fill material (SM); no odor.	-		
-						LEAN CLAY WITH SAND: reddish plasticity; stiff; CL; no odor.			***************************************
38-						SILTY SAND: yellowish brown; mo medium dense; residual soil; weak	ist; no plasticity;		
-2		44			SM	SILTY SAND: yellowish brown; no		%Recovery = 50	
				1	J.W.	dense; faint solvent.	piasticky, medium	PID = 3.7ppm	
-									
37—									
-3	S2 .								
1 1	į.								
36-	:								
4		3515				Soil drilling to install groundwater n	nonitoring well withou	1	***************************************
-						collection soil sample. No hard be encountered	drock was not		
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US Army Corp Of Engineers
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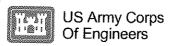
HOLE NO. B09-187MW



PROJE LOCAT					of Camp	Carro	JI G&EE NO.:	0	8-036E	INS	PECTOR:		•
DATE S	START	ED:		26 I	Feb 09		FINISHED:		Feb 09		ILLER:		
					VT: <u>Dre</u>		····			~~~		A # A	
DRILLIN OVERB					ast Distr 4.0 r		HOLE DIAME DEPTH DRILL		5 cm 15.0 m		TAL DEPTH: _ .TER DEPTH:	15.0 m	
				••••			GROUND ELE	_	39.80 m		TUM:		
GROUN	ID CO	VER:	: <u>dir</u> t				CONTAMINA						
TYPE O	F HO	LE:	☐ Pie	zometer	□ Мо	nitoring V	Well ☐ Test P	'it [	Auger Hole		other		
ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG	CONTAMINATED BLOW COLINT	SPT SPT SPT SPT SPT SPT SPT SPT SPT SPT	USCS / STRATA		DESCRIPTIC	ON OF MA	ATERIALS		FIELD DATA	LAB DATA	
29—11 28—12 27—13 26—14		TOTAL TOTAL											
	-	77000											_

WIRO-EXPLORATION LOG 08-036E AREA 41 CARROLL GPJ USACE SKC

39/8



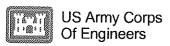
# EXPLORATION LOG HOLE NO. B09-188

Far East District

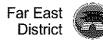


PROJE	CT: ]	ESI/RE	at Are	ea 41 of	Camp (	Carro	1					
LOCAT	ION:	Camp	carroll	<u> </u>			G&EE NO.:			INS	SPECTOR:	
DATE S		_		***************************************				26	Feb 09	DR	ILLER:	
DRILLI						···		****				
											TAL DEPTH: _	
							DEPTH DRIL				TER DEPTH:	<u> </u>
COOKL		ES: N:	3,982,5	928.4 E	: <u>446,6</u>	67.7	GROUND EL	EV.: _	39.82 m	, DA	TUM:	MSL
TYPE	とこころ	VEK:	<u>airt</u>		[""] \$.4 a.a.i		CONTAMINA Vell   Test F	HON:				
ITPEC	JF HU	LE: L	_J Płezon	neter	LJ Moni	toring v	Vell Liest F	'It L	☐ Auger Hole	<u> </u>	other	
ELEVATION / DEPTH (meters)	SAMPLE TYPE / NUMBER	GRAPHIC LOG CONTAMINATED	BLOW COUNT	SPT N-VALUE	USCS/ STRATA		DESCRIPTIO	ON OF MA	ATERIALS		FIELD DATA	LAB DATA
					FILL	(max.	SAND WITH GRAVE 3.5cm); subangular, r	no plasticit	ty; very toose; fill	,	%Recovery = 50 PID = 2.5ppm	
39					SM	SILTY	ial (SM); no odor; cor SAND: brown; moist m dense; residual so	l; subangu	ılar; no plasticity;			
1  1 	S1				SM	SILTY residu	SAND: fight brown; r al soil; no odor.	noist; no p	olasticity; dense;			
382					614							
37—	83				SM	very d	<b>SAND</b> : light brown; r ense; residual soil; no	noist; sub: odor.	angular; no plastici	ity;	%Recovery = 50 PID = 3.7ppm	
-3												

XPLORATION LOG 03-036E AREA 41 CARROLL GP.) USACE SKORFA GDT 6/2/

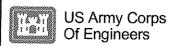


HOLE NO. **B09-189** 



PROJECT: ESI/RE at Area 41 of Camp Carroll LOCATION: Camp carroll G&EE NO.: 08-036E INSPECTOR: DATE STARTED: 26 Feb 09 FINISHED: 26 Feb 09 DRILLER: DRILLING METHOD/EQUIPMENT: Drect-Push DRILLING AGENCY: Far East District HOLE DIAMETER: 5 cm TOTAL DEPTH: OVERBURDEN THICKNESS: 4.0 m DEPTH DRILLED: WATER DEPTH: \_ 4.0 m COORDINATES: N: 3,982,936.6 E: 446,660.4 GROUND ELEV.: 39.62 m DATUM: GROUND COVER: dirt CONTAMINATION: TYPE OF HOLE: ☐ Piezometer ☐ Monitoring Well ☐ Test Pit ☐ Auger Hole □ other SAMPLE TYPE, NUMBER BLOW COUNT ELEVATION / DEPTH (meters) GRAPHIC LOG SPT N-VALUE **DESCRIPTION OF MATERIALS** FIELD DATA LAB DATA USCS/ STRATA <u>SiLTY SAND</u>: dark brown; moist; subangular; very loose; fill material (SM); no odor; contain organics. %Recovery = 50 PID = 0.8ppm SILTY SAND: brown; moist; medium dense; residual soil; 39 SM SILTY SAND: light brown; dense; no odor. 38 %Recovery = 50 PID = 1.7ppm SILT: dark brown; stiff; no odor. SILTY SAND; light brown; dense; no odor. 37 SM SILTY SAND: reddish brown; subangular fine gravel (max.1cm); dense; no odor.

RO-EXPLORATION LOG 08-036E AREA 41 CARROLL GPJ USACE SKOREA GDT 6

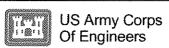


HOLE NO. B09-190



OVERBURD COORDINAT	Camp can TED: ETHOD/ECGENCY: EN THICKI ES: N: 3,9	rroll 26 Fel QUIPMENT: Far Eas NESS: 82,933.6 E	0 09 Drect-F t District 6.0 m : 446,655	G&EE NO.: FINISHED:	ER: 5 cm ED: 6.0 m /.: 39.59 m	DR TO WA DA	TUM:	6.0 m MSL
ELEVATION / DEPTH (meters) SAMPLE TYPE / NUMBER	GRAPHIC LOG CONTAMINATED	SPT N-VALUE	USCS / STRATA	DESCRIPTION	OF MATERIALS		FIELD DATA	LAB DATA
39— 1 sı 38— 2 37— 2 37— 3 s² 36— 4 35— 5 s3			FILL FILL SM III	SILTY SAND WITH GRAVEL. about 15% subangular (max.2m plasticity; very loose; fill mater organics. SILTY SAND; brown; moist; si Sand (max.2mm); no plasticity odor. SILTY GRAVEL WITH SAND; subangular (max.3cm); dense SILTY SAND; dark brown; mo solvent. SANDY SILT; reddish brown; solvent. SILTY SAND; light brown; moi solvent.	cm); about65% subang im); about20% Fines; n rial (SM); no odor; conta ubangular fine to mediu y; loose; fill material (SM grayish brown; moist; ; fill material (SM); no o ist; residual soil; weak moist; residual soil; weak	o ain m wl); no dor.	%Recovery = 43 PID = 24.6ppm FC = F3 %Recovery = 50 PID = 58.6ppm %Recovery = 50 PID = 3.7ppm	

VIRO-EXPLORATION LOG 08-036E AREA 41 CARROLL GPJ USACE



HOLE NO. B09-191





PROJE LOCAT DATE S	ION: C	Camp D: _	carroll	26 Feb	09		G&EE NO.: _ FINISHED: _		8-036E Feb 09	-	PECTOR: _	
DRILLIN DRILLIN OVERB COORD GROUN	NG AGE URDEN SINATE	NCY: NTHIC S: N: ;	KNES 3,982,9	ar East S: <u>20.8</u> E	Distric 4.0 m	t	HOLE DIAME	_ED: _ Ev.:	5 cm 4.0 m 39.54 m	_ WA	TAL DEPTH: _ TER DEPTH: _ TUM:	
ELEVATION/ DEPTH (meters)	F HOLI				USCS / STRATA W	oring V		Pit [	Auger Hole		other	LAB DATA
39—- 38—- 38—-	SI SI	יבי ק אינייייייייייייייייייייייייייייייייייי	18	ΰŻ	FILL FILL FILL SM	SAND mater CLAY angul	/ SAND: grayish brow; fill material (SM); no DY LEAN CLAY: reddirial (CL); no odor. /EY SAND WITH GRA ar; fill material (SC); r/ SAND: reddish brow d; medium dense; resi	odor; cor sh brown; VEL: dark so odor. n: moist::	ntain organics.  moist; loose; fill  brown; moist;		%Recovery = 44 PID = 5.7ppm	
37—3 36—	82		***************************************		SM	SILTY	<b>( SAND</b> : brown; moist	no odor.			%Recovery = 45 PID = 1.8ppm	
L4 h	F	: 121 1										
							<i>•</i>	37 .	22			

Appendix II: Monitoring Well Construction Logs

# MONITORING WELL LOG WELL NO. B09-181MW



PROJECT: ESI/RE at Area 41 of Camp Carroll LOCATION: Camp carroll G&EE NO.: 08-036E INSPECTOR: DATE STARTED: 24 Feb 09 FINISHED: \_\_\_ 24 Feb 09 DRILLER: DRILLING METHOD/EQUIPMENT: <u>Drect-Push</u> DRILLING AGENCY: <u>Far East District</u> HOLE DIAMETER: 5 cm TOTAL DEPTH: 14.7 m OVERBURDEN THICKNESS: 4.0 m DEPTH DRILLED: 14.7 m WATER DEPTH: COORDINATES: N: 3,982,894.2 E: 446,674.8 GROUND ELEV.: 39.78 m DATUM: \_\_\_ MSL GROUND COVER: dirt TOP of WELL RISER CASING ELEV.: WELL GRAPHIC ELEVATION / DEPTH (meters) WELL CONSTRUCTION SAMPLE FIELD DATA USCS / STRATA DETAILS Depth Protective PROTECTIVE CASING casing Diameter: 30 cm Elevation: 39.71 m Type: Manhole Interval: -0.02 to 0.18m %Recovery = 46 PID = 19.2ppm WELL RISER CASING FC = F3Diameter: 2 inch FC = F3 39-Type: Schedule 40 PVC SM FC = F3 Interval: -0.01 to 5.55m Cement Grout 38-WELL SCREEN -2 %Recovery = 50 Diameter: 2 inch PID = 1.5ppmType: 0.01 Slot Sch 40 Interval: 5,55 to 14,65m Well Casing 37---3 2 3 Bentonite Seal WELL POINT Type: Schedule 40 PVC 36 Interval: 14.65 to 14.8m **CONCRETE PAD** Diameter: 0.3m 35--5 5-Interval: -0.05 to 0.15m GROUT Type: Portland Type II -6 6 Interval: 0.0 to 3.0m Quantity: 10 bags of 20 kg 7 ~ SEAL. Type: Bentonite Interval: 3.0 to 3.5m 32 Quantity: 1.5 gal -8 8 SAND PACK 31 Type: medium sand 9 Filter Pack Interval: 3.5 to 14.7m Quantity: 80 kg Grain Size: 0.4-1.2 mm Note: Remarks: ☑ Ground-water level at completion of borehole 03/03/09 11.2m Ground-water level on Product level on

USACE SKOREA.GDT 6,28/11

GP.

CARROLL

08-036E AREA 41

# MONITORING WELL LOG

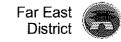
WELL NO. B09-181MW





	PROJE	CT: ESI/RE at	Area 41 of Ca	amp (	Carrol	l				A STATE OF THE STA
	i .	ION: <u>Camp car</u>				G&EE NO.:		08-036E	INSPECTOR:	
	1	STARTED:	· · · · · · · · · · · · · · · · · · ·		~	FINISHED:		24 Feb 09	DRILLER:	
		NG METHOD/EC								
		NG AGENCY:							TOTAL DEPTH:	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
		URDEN THICKN							WATER DEPTH:	
		ID COVER: dir		440,0	/4.8				DATUM: <b>39.</b>	
	Ortoo:	DOOVER. un				TOP OF WELL	LINIO	EN CASING LLI	V., <u></u>	71 111
		WELL OF	ADI NO							
	N O	WELL GR	APRIC	6		_~			WELL CON	STRUCTION
	VAT TH ers)			ĬĬ.	S/ ATA	PLE BEF		FIELD DATA	DET	
	ELEVATION / DEPTH (meters)			GRAPHIC LOG	USCS/ STRATA	SAMPLE	Depth			
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MONITORING WELL LOG 08-035E AREA 41 CARROLL GPJ USACE SKOREA GDT 6/28/11										
WEL	Remarks:	☑ Ground-water lev	al at completion	of boro	acle Oo	/03/00 11 2m		Note:		
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OLI			761 UH				Same J	a mon		
õ		▲ Product level on					.5	9 95		

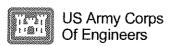
# MONITORING WELL LOG WELL NO. B09-187MW



PROJECT: ESI/RE at Area 41 of Camp Carroll LOCATION: Camp carroll G&EE NO.: \_\_\_\_ 08-036E INSPECTOR: DATE STARTED: \_\_\_\_ 26 Feb 09 FINISHED: 26 Feb 09 DRILLER: DRILLING METHOD/EQUIPMENT: Drect-Push DRILLING AGENCY: <u>Far East District</u> HOLE DIAMETER: \_ 5 cm TOTAL DEPTH: OVERBURDEN THICKNESS: 4.0 m DEPTH DRILLED: 15.0 m WATER DEPTH: COORDINATES: N: 3.982,919.7 E: 446,661.6 GROUND ELEV.: 39.80 m DATUM: GROUND COVER: dirt TOP of WELL RISER CASING ELEV.; 39.75 m ELEVATION / DEPTH (meters) WELL GRAPHIC WELL CONSTRUCTION FIELD DATA DETAILS Depth (m) Protective **PROTECTIVE CASING** casing Diameter: 30 cm Elevation: 39.75 m Type: Manhole Interval: -0.02 to 0.18m FILL %Recovery = 50 PID = 10.4ppmWELL RISER CASING Diameter: 2 inch 39-Type: Schedule 40 PVC Interval: -0.01 to 6.1m 38-**WELL SCREEN** SM %Recovery = 50 PID = 3.7ppm Diameter: 2 inch Cement Grout Type: 0.01 Slot Sch 40 Interval: 6.1 to 15.2m 37 -3 Well Casing 2 3 -**WELL POINT** Type: Schedule 40 PVC 36-Interval: 15.2 to 15.32m **CONCRETE PAD** Bentonite Seal 35-Diameter: 0.3m -5 5 Interval: -0.05 to 0.15m GROUT  $\nabla$ Type: Portland Type II -6 6 Interval: 0.0 to 4.5m Quantity: 10 bags of 20 kg 33-SEAL Type: Bentonite Interval: 4.5 to 5.0m 32-Quantity: 1.5 gal -8 8 SAND PACK 31 Type: medium sand 9 Interval: 5.0 to 15.2m Quantity: 80 kg Grain Size: 0.4-1.2 mm ☑ Ground-water level at completion of borehole 03/03/09 5.81m Ground-water level on ▲ Product level on

USACE SKOREA.GDT

8



## MONITORING WELL LOG

WELL NO. B09-187MW



DATE STATED: 26 Feb 09 FINISHED: 26 Feb 09 DRILLER:  DATE STATED: 15 Feb 09 FINISHED: 26 Feb 09 DRILLER:  DRILLING METHODICQUIPMENT: Drece-Push  DRILLING METHODICQUIPMENT: Drece-Push  DRILLING AGENCY: Far East District  OVERBURDEN THICKNESS: 4.0 ps.  COORDINATES: N: 3982,919.7 E: 446.661.6  GROUND COVER: dirt: TOP of WELL RISER CASING ELEV: 39.75 m  Well GRAPHIC  STATE PUSH  Well GRAPHIC  Well Screen  Well Screen  Well Screen  Well Screen  Well Screen  Well Screen  Well Screen  Well Screen  Well Screen  Well Screen  Note:  Top Ground-water level at completion of borehole 03/03/09 5.81 m  Note:  Top Ground-water level at completion of borehole 03/03/09 5.81 m  Note:  Top Ground-water level at completion of borehole 03/03/09 5.81 m  Note:	PROJE	CT: ESI/RE at Area 41 of C	amp Carro	 []			
DATE STARTED: 26 Feb 99 FINISHED: 26 Feb 99 ORILLER:  DRILLING AGENCY: Far East District OVERBURDEN THICKNESS: 4.0 m COORDINATES: 3.392,191.7 €: 446.661.6 GROUND ELEV: 39.80 m GROUND COVER: dirt  WELL GRAPHIC  WELL GRAPHIC  STORY  WELL GRAPHIC  STORY  Well Screen					08-036E	INSPECTOR:	AMARINE 6
DRILLING METHODICQUIPMENT: Drect-Push DRILLING AGENCY: Far East District OVERBURDEN THICKNESS: 4.0 m CCOORDINATES: N: 3932,919.7 E: 440.661.6 GROUND COVER: dirt  WELL GRAPHIC  WELL GRAPHIC  Well Streen  Well Streen  Well Screen  Well Screen  Top of WELL RISER CASING ELEV: 39.75 m  FIELD DATA  Well CONSTRUCTION DETAILS  FIELD DATA  Well CONSTRUCTION DETAILS  Well Screen  Top of WELL RISER CASING ELEV: 39.75 m  FIELD DATA  Well Construction DETAILS  Well Screen  Top of WELL RISER CASING ELEV: 39.75 m  FIELD DATA  Well Construction DETAILS  Well Construction			)9				Mary and the conference
DRILLING AGENCY: Far East District OVERBURDEN THICKNESS: 4.0 m   DRILLED: 15.0 m   WATER DEPTH: J5.0 m   COORDINATES: N: 3.982.919.7 E: 446.661.6 GROUND COVER: dirt	3			•			
DEPTH DRILLED: 1.9.m WATER DEPTH.  COORDINATES: N. 3.98.2919.7 E: 446.661.6 GROUND CLEV: 39.80 m DATUM: MSI.  TOP of WELL RISER CASING ELEV: 39.75 m  WELL GRAPHIC  DETAILS  WELL GRAPHIC  Well Screen  Field DATA  Well Construction DETAILS  Well Screen  Well Screen  Well Bottom  Well Bottom  Borehole Bottom  Remarks:   Ground-water level at completion of borehole 0303009 5.81m  Note:  Cround-water level at completion of borehole 0303009 5.81m  Note:					TER: 5 cm	TOTAL DEPTH:	15.0 m
COORDINATES: N. 3,982,919.7 E: 446.661.6 GROUND ELEV: 39.80 m DATUM: MSL TOP of WELL RISER CASING ELEV: 39.75 m  WELL GRAPHIC  Vell GRAPHIC  Vell GRAPHIC  Vell Screen  Files Pack  Vell Screen  Files Pack  Vell Screen  Files Pack  Vell Screen  Files DATA  Vell Screen  Files DATA  Vell Screen  Files DATA  Vell Screen  Top of WELL RISER CASING ELEV: 39.75 m  Vell CONSTRUCTION DETAILS  Vell Screen  Files DATA  Vell Screen  Top of WELL RISER CASING ELEV: 39.75 m  Vell CONSTRUCTION DETAILS  Vell Screen  Files DATA  Vell Screen  Top of WELL RISER CASING ELEV: 39.75 m  Vell CONSTRUCTION DETAILS  Vell Screen  Top of WELL RISER CASING ELEV: 39.75 m  Vell CONSTRUCTION DETAILS  Vell CONSTRUCTION DETAILS  Vell Screen  Top of WELL RISER CASING ELEV: 39.75 m  Vell CONSTRUCTION DETAILS  Vell Bottom  Top of WELL RISER CASING ELEV: 39.75 m  Vell CONSTRUCTION DETAILS  Vell Bottom  Top of WELL RISER CASING ELEV: 39.75 m  Vell CONSTRUCTION DETAILS  Vell Bottom  Top of WELL RISER CASING ELEV: 39.75 m  Vell CONSTRUCTION DETAILS  Vell CONSTRUCTION DETAILS  Vell Bottom  Top of WELL RISER CASING ELEV: 39.75 m  Vell CONSTRUCTION DETAILS  Vell Bottom  Top of WELL RISER CASING ELEV: 39.75 m  Vell CONSTRUCTION DETAILS  Vell Bottom  Top of WELL RISER CASING ELEV: 39.75 m  Vell Construction Details  V	OVERB	URDEN THICKNESS:	4.0 m	DEPTH DRILL	.ED: 15.0 m	WATER DEPTH:	
Remarks:   ☐ Ground-water level at completion of borehole 03/03/09 5.81m    Control water level at completion of borehole 03/03/09 5.81m    Control water level at completion of borehole 03/03/09 5.81m    Control water level at completion of borehole 03/03/09 5.81m    Control water level at completion of borehole 03/03/09 5.81m	COORD	DINATES: N: 3.982.919.7 E:	446.661.6	GROUND ELE	EV.: 39.80 m	DATUM:	MSL
WELL GRAPHIC    Part	GROUN	ID COVER: dirt		TOP of WELL	RISER CASING EL	.EV.: 3	9.75 m
Remarks:   Remarks:			, , , , , , , , , , , , , , , , , , , ,				
Remarks:   Remarks:		WELL CHARLIC					
Remarks:   Remarks:	S O	WELL GRAPHIC	0	~		WELL CO	NSTRUCTION
Remarks:   Remarks:	TA∃ £RS		HA /S		FIEED DATA		
Remarks:   Remarks:	a de de de		186 SRA 186 SR				
Well Screen  Well Screen  11- 12- 13- 28- 14- 25- 15  Well Bottom  Well Bottom  Borehole Bottom  Note:  ***  ***  ***  ***  **  **  **  **		∵ - Filter Pack	103 30	0/2	(m)		
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Well Bottom Borehole Bottom    15	-						
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MONITORING WELL LOG 08-036E AREA 41 CARROLL.GPJ USACE SKOREA.GDT 6/23/11

Appendix III: Hydrologic Test Result

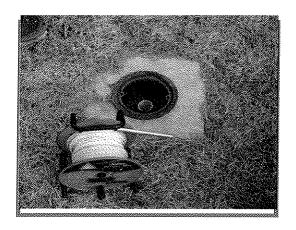


### **Far East District**

## **Draft Final Report**

**FOR** 

# TASK ORDER NO.0014 CAMP CARROLL REMEDIAL EVALUATION



### Prepared for:

US Army Corps of Engineers, Far East District Geotechnical and Environmental Engineering Branch Unit #15546, APO AP 96205-5546

Contract # W912UM-07-D-0001 Task Order # 0014

Prepared by:



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#### 1. INTRODUCTION

#### 1.1 Project Background

BEC has prepared this fianl report for the FED under contract NO. W912UM-07-D-0001, Task Order No.0014. This report summarizes the result to analyze for slug, pumping and air permeability test at Camp Carroll.

#### 1.2 Project Progress

Field tests were performed in the camp Carroll during the period of 9 November,  $2009 \sim 13$  November, 2009(1st) and 22 February,  $2010 \sim 25$  February,  $2010(2^{nd})$ . Hydrologic field test was conducted at Area 41 of Camp Carroll such as slug, pumping, and air permeability tests. (Table 1).

#### 2. ANALYSIS MATHOD

### 2.1 Slug test

The slug test method involves the instantaneous injection or withdrawal of a volume or slug of water or solid cylinder of known volume. This is accomplished by displacing a known volume of water from a well and measuring the artificial fluctuation of the groundwater level. The primary advantages of using slug tests to estimate hydraulic conductivities are numerous. First, estimates can be made in-situ, thereby avoiding errors incurred in laboratory testing of disturbed soil samples. Second, tests can be performed quickly at relatively low costs because pumping and observation wells are not required. Lastly, the hydraulic conductivity of small discrete portions of an aquifer can be estimated (e.g., sand layers in a clay)(EPA,1994).

The most commonly used method for determining hydraulic conductivity in groundwater investigation is the Bouwer and Rice slug test shown schematic groundwater level drawdown zone through withdrawal of dummy(Hammm et al, 2001).

Bouwer and Rice's expression for hydraulic conductivity (K) is:

$$K = \frac{r_c^2 \ln(R_c/R)}{2L_e} \frac{l}{T} \ln \frac{H_t}{H_0}$$

Where:

K = hydraulic conductivity [ft/sec]

 $R_e$  = filter pack (borehole) radius [ft]

R =screen radius [ft]

 $r_c$  = casing radius [ft]

 $L_e$  = length of open screen (or borehole)[ft]

 $H_{\theta}$  = drawdown at t = 0

 $H_t = \text{drawdown at } t \geq H_\theta$ 

The simplest interpretation of piezometer recovery is that of Hvorslev(1951). The analysis assumes a homogenous, isotropic medium in which soil and water are incompressible(EPA,1994).

$$K = \frac{r2 \ln(L/R)}{2L T_0} \quad for L/R > 8$$

Where:

K = hydraulic conductivity [ft/sec]

r = casing radius [ft]

L = length of open screen (or borehole)[ft]

**R** = filter pack (borehole) radius [ft]

 $T_{\theta}$  = Basic Time Lag [sec]; value of t on semi-logarithmic

plot of H-h/H-H0 vs. t, where H-h/H-H = 0.370

H = initial water level prior to removal of slug

 $H_{\theta}$  = water level at t = 0

h – recorded water level at t > 0

#### 2.2 Pumping test

The most reliable and commonly used method of determining aquifer characteristics is by controlled aquifer pumping tests. Groundwater flow varies in space and time and depends on the hydraulic properties of the rocks and the boundary conditions imposed on the groundwater system. Pumping tests provide results that are more representative of aquifer characteristics than those predicted by slug or bailer tests. Aquifer characteristics that may be obtained from pumping tests include hydraulic conductivity (K), transmissivity (T), specific yield (Sy) for unconfined aquifers, and storage coefficient (S) for confined aquifers(EPA,1994).

Pumping test is estimated by Cooper-Jacob method. The pumping curves were plotted drawdown as a function of the logarithm of elapsed time since pumping started. Employing the Jacob's Straight-Line method requires fitting a straight line through the straight section of the graph.

Pumping test is recorded the drawdown of well and pumping capacity. The drawdown (after start of pumping) and recovery (after stop of pumping) of the hydraulic head in the pumping well and surrounding monitoring wells are measured. Pumping capacity is constant that is recorded proper interval. Drawdown of well is recorded using DIVER and Interface meter.

Cooper-Jacob's expression for t hydraulic conductivity (K) is:

$$T = \frac{2.3Q}{4\pi \Delta s} \qquad S = \frac{2.25Tt_0}{r^2} \qquad K = \frac{T}{b}$$

Where:

K = hydraulic conductivity [m/day]

 $T = \text{transmissivity}[\text{m}^2/\text{day}]$ 

Q = pumping capacity [m<sup>3</sup>]

 $\Delta s$ = Slope of the straight part of the drawdown on a semi-logarithmic graph (m)

 $T_{\theta}$  = Basic Time Lag [sec]; value of t on semi-logarithmic

b = length of aquifer[m]

#### 3. ANALYSIS RESULT

#### 3.1 Information of Monitoring Wells

Next is the information is performed at camp Carroll. The test is performed by in 9 Nov.~12 Nov and chosen one well that test is possible. The depth, natural groundwater level, radius, order of wells was checked before the test. Water level measured for time after injected the dummy using diver. If water level has been stable, withdrew the dummy so water level measured. Sometimes, rise up with diver when the dummy is withdrew that get tangled fixed each line of the dummy and diver in well. Also, water level after injected the dummy rose up more than natural groundwater level. It should pay attention to analysis of test result (Table 1).

Table 1. Information of slug test is performed wells

		m:	D				
Site	Well No.	Time	Dummy -	D <sup>1)</sup> (m)	WR <sup>2)</sup> (mm)	NG <sup>3)</sup> (m)	Remark
		1052	withdrawal				
	3402 471	1358	injection	12.10	C 1	5.055	Diver rise up with dummy
	M03-471	1415	withdrawal	12.10	51	5.055	when it's withdrawal
Area 41	102 474	1433	injection	15.40	<i>C</i> 1	5.065	
(10 Nov.)	M03-474	1445	withdrawal	15.40	51	5.065	
	M03-475	1341	injection	15.00	51	10.635	
	14103-473	1353	withdrawal	15.00	31	10.055	

<sup>1)</sup> well depth, 2) well radius, 3) natural groundwater level(blg)

### 3.2 Description for the slug test at Site

Slug test performed at the site. Generally, groundwater level showed a fluctuation by injection and withdrawal of dummy. Groundwater level data of withdrawal is less than a noise the groundwater level data of injection. Groundwater level had been stable within minutes beyond the stress(dummy). Some data of wells are distinct with other trend of wells. When the slug test analyzed the range of groundwater was assumed in the aquifer

The diagrams are plots of injection and withdrawal that slug test was performed each in the sites. Each plots of injection and withdrawal is the head (H/H0) against the elapsed time. The Plots is drew the fitting line above interval which is consistent on head (H/H0). The analysis for slug test needs the initial drawdown data of water level. Sometimes, the initial drawdown of water level have the noise of data to be different with general trend so the initial drawdown is selected by an analyst is based the hydrogeology. The  $slop(\Delta s)$  to need analysis can obtain from fitting line is drew on drawdown of water level.

#### 3.2.1 Area41

The Slug test conducted B09-187(M03-474), B03-471 and B09-181(M03-475) in the Area41. The Groundwater level(blg) of MW(monitoring wells) was checked from 5.06m to 10.64m and the depth of MW is from 12.10m to 15.40m.

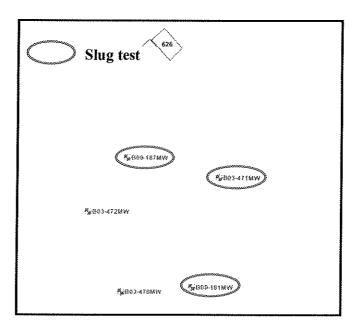
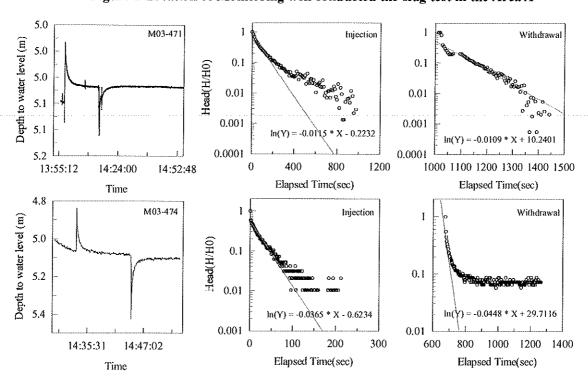


Figure 1 Location of Monitoring well conducted the slug test in the Area41



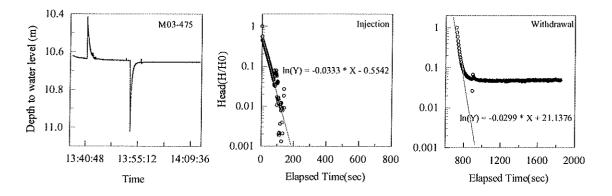


Figure 2 Curve-fitting results against elapsed time at constant slug tests in the Area41.

# 3.3 Description for the Pumping Test at Sites

Pumping test is performed at Area 41 of Camp Carroll(Table 1).

## 3.3.1 Area41

The pumping test was performed during the period of 25 February,  $2010 \sim 26$  February,  $2010(2^{\text{nd}})$ . The pumping well is B07-187, the monitoring well are MW1\_B03-472, MW2\_B03-470, MW3\_B09-181 and MW4\_B03-471. The start time of pumping is on Wednesday, Feb 25, at 11:48, stop time is on Thursday, Feb 25, at 20:28. The elapsed pumping time is about 8hour. The pumping capacity is about 8.526 L/min.

Table 2. Information of pumping test wells performed in the Area41.

Well	No.	NG <sup>1)</sup> (m)	D <sup>2)</sup> (m)	WD <sup>3)</sup> (m)	Note
PW	B07-187	5.36	14.88	_	
MW1	B03-472	11.21	14.50		start time
MW2	B03-470	11.17	13.15		16:31 Stop time
MW3	B09-181	11.24	14.40		01:02
MW4	B03-471	5.35	11.40		

<sup>1)</sup> natural groundwater level(blg), 2) well depth, 3) well distance

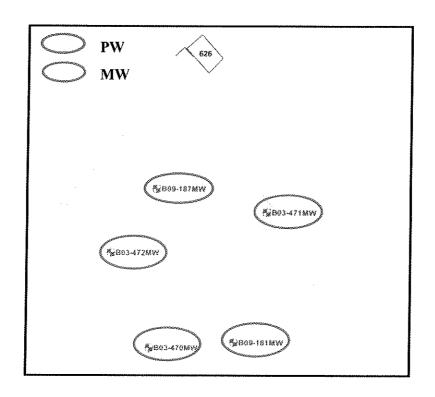
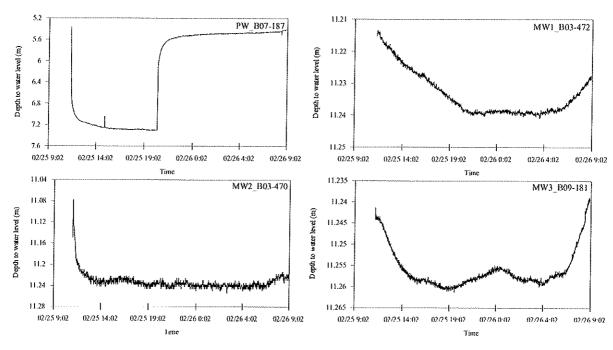


Figure 3 Location of Test wells conducted the Pumping test in the Landfarm.



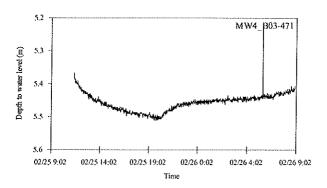
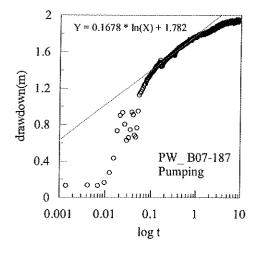
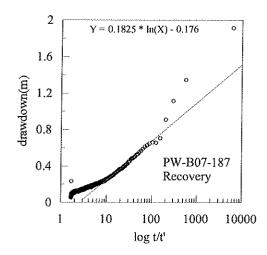


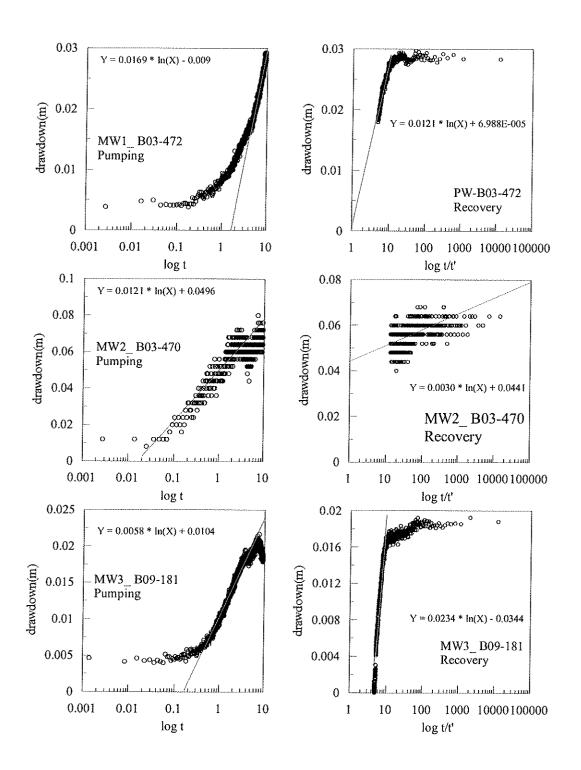
Figure 4 Diagram of elapsed time-depth to water level(blg) during pumping test in the Landfarm

Hydrogeological trend of groundwater level at each wells during pumping test. Groundwater level of B07-187 pumping well showed a fluctuation by pumping and recovery. Groundwater level drawdown of pumping well successfully cleared the general trend of the pumping well. MW1, MW3, MW is showed the response but not clear for start and stop by pumping.

Analysis of pumping test is calculated using Cooper-Jacob's method. The plots are the drawdown against the elapsed log-time. The slop  $(\Delta s)$  to be analyze is obtained with the fitting line on plots. The fitting line for pumping test has to consider the boundary effect in drawdown.







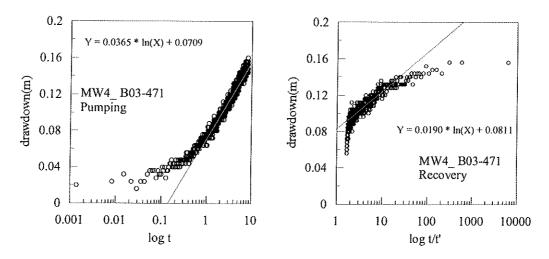
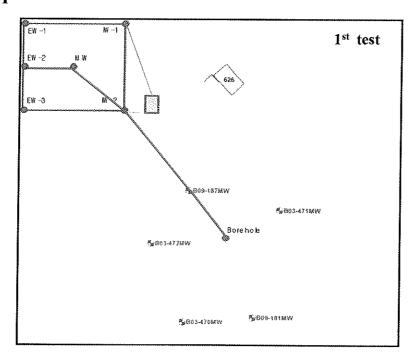


Figure 5 Curve-fitting results against elapsed log-time at constant pumping test in the Area41.

# 3.4 Description for the Air permeability Test at Sites

# 3.4.1 Area41



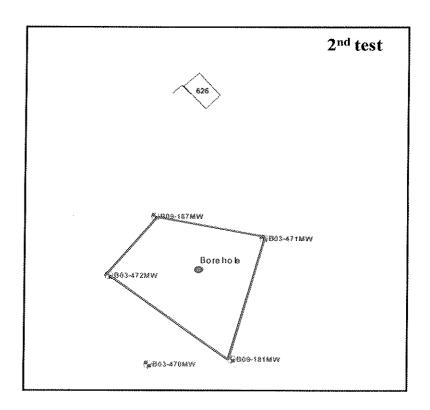


Figure 6 Location of Test wells conducted the 1st air permeability test in the Area41.

A series of air permeability test were conducted on 19 March 2010, to evaluate subsurface air flow patterns and radius of influence in adjacent to Area41 in the Camp Carroll. The layouts of the permeability test were determined based on the location of existing groundwater monitoring wells and the pre-installed air permeability test well. Figure 15 presents the well layout of 1<sup>st</sup> and 2<sup>nd</sup> air permeability tests at the project site at Area41.

Air permeability tests were conducted at five wells (as a set) consisting of one air extraction well and four observation wells. The extraction well was attached to a vacuum pump to control the air extraction rate. The extraction valves and measurement devices were securely attached and sealed at the top of each well pipe to prevent introducing any ambient air.

Upon starting the vacuum pump for subsurface air extraction, field measurement data was collected from both extraction and observation wells. During the entire air permeability test, the extraction vacuum was maintained at a constant rate and the monitoring wells' down pressure was monitored indications in change of pressure.

The 1<sup>st</sup> test was two times performed for total about 50 minutes, with air flow rate of each 20 / 30 cubic meters per hour. The extraction vacuum used during the test was about  $10 \sim 30$  kPa. Table 5 shows air permeability test well information in Area41. Figure  $20\sim23$  presents the observation results versus elapsed time.

The 2<sup>nd</sup> test was two times performed for total about 90 minutes, with an air flow rate of 30 cubic meters per hour. The extraction vacuum used during the test was about 30 kPa. Table 6 shows air permeability test well information in Area41. Figure 24~25 presents the observation results versus elapsed time.

Table 3. Information of 1st air permeability test wells performed in the Area41.

Classify	Classify Well ID		Water level (m)	Water column(m)	Distance (m)
Extraction well	MW	4.69	••	4.69	(standard)
Monitoring well 1	EW-2	4.77	-	4.77	2.60
Monitoring well 2	IW-2	4.05		4.05	3.47
Monitoring well 3	В09-187	15.52	5.04	10.48	16.30
Monitoring well 4	Bore hole	6.06	-	6.06	28.80

Table 4. Information of 2<sup>nd</sup> air permeability test wells performed in the Area41.

Classify	Well ID	Well Depth(m)	Water level (m)	Water column(m)	Distance (m)
Extraction well	Bore hole	6.06	-	6.06	(standard)
Monitoring well 1	B09-181	15.00	11.16	3.84	16.12
Monitoring well 2	B03-471	12.10	5.01	6.09	13.90
Monitoring well 3	B09-187	15.52	5.04	10.48	12.58
Monitoring well 4	В03-472	15.14	11.09	4.05	14.40

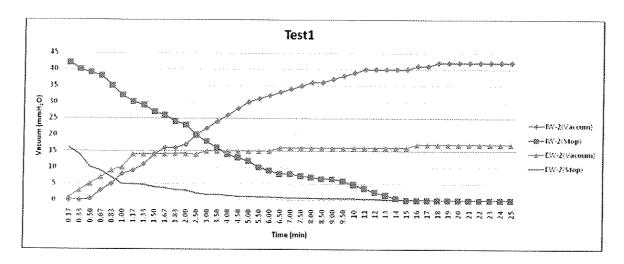


Figure 7 Observation results versus elapsed time at extraction flow rate 20 m³/hr

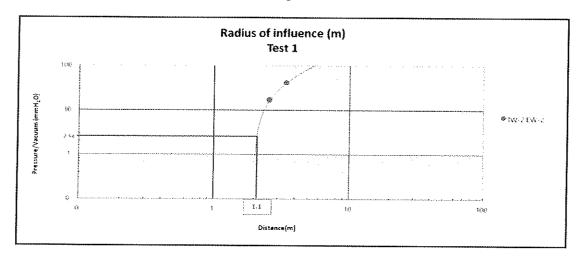


Figure 8 Radius of influence (ROI) at extraction flow rate 20 m³/hr

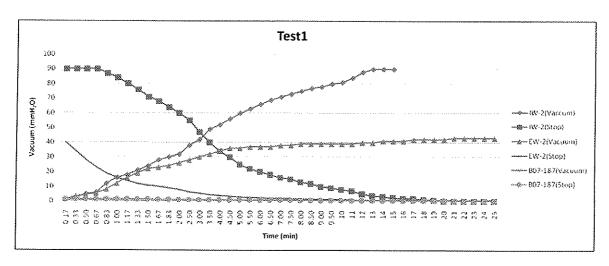


Figure 9 Observation results versus elapsed time at extraction flow rate 30 m<sup>3</sup>/hr

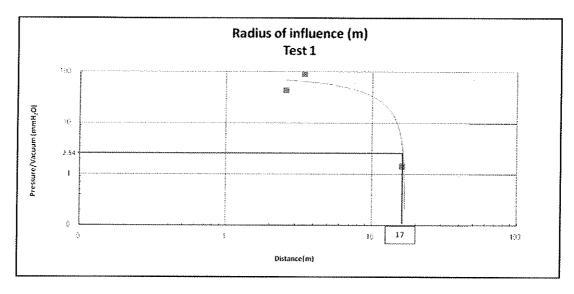


Figure 10 Radius of influence (ROI) at extraction flow rate 30 m³/hr

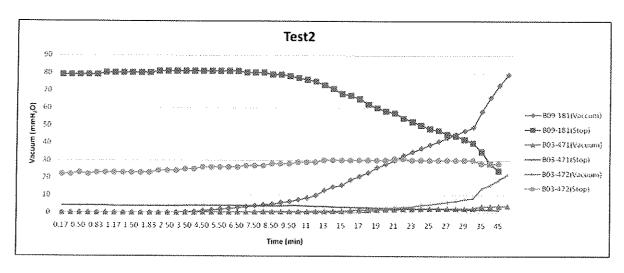


Figure 11 Observation results versus elapsed time at extraction flow rate 30 m<sup>3</sup>/hr

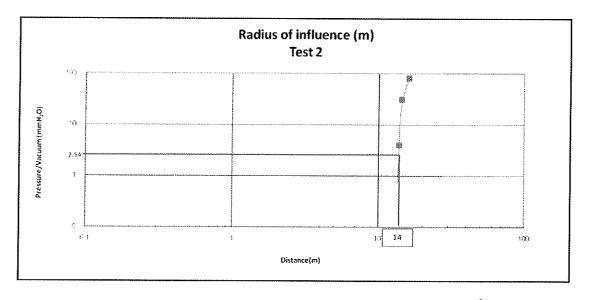


Figure 12 Radius of influence (ROI) at extraction flow rate 30 m<sup>3</sup>/hr

### 3.5 Result

## 3.5.1 Slug test

The hydraulic conductivity(K) is calculated by the Hvorslev and the Bouwer & Rice methods ranges from 9.39E-06 cm/sec to 1.98E-03 cm/sec and from 8.42E-06 cm/sec to 1.76E-03 cm/sec. Average hydraulic conductivity(K) for slug tests were calculated using the Hvorslev/Bouwer&Rice methods to be;

### • 1.02E-03 / 9.08E-04 cm/sec in the Area 41

Calculated results of the injection are greater than the withdrawal. In theory, hydraulic conductivity(K) have to be calculated the same value irrespective of injection and withdrawal of the slug. This is estimated a condition of the test apparatus or to be the skin effect around test wells(Lee et al., 1999, Ham et al.,2001). Also, calculated results using Horvslev method is a little differences with the Bouwer&Rice method. A correlation coefficient is 0.99 calculated results using between Horvslev method and the Bouwer&Rice method and it is nearly consistent.

Table 5 Hydraulic conductivity (K) estimated from the slug tests using the Horvslev and Bouwer & Rice method

Site	Well	Dummy	K(m/sec) (Horvslev)	K(m/sec) (B& R)	K(m/day) (Horvslev)	K(m/day) (B&R)	Average K (cm/sec) Horyslev	Average K (cm/sec) B&R
	M03-471	injection	4.0E-06	3.4E-06	0.34739	0.29577	201501	2 225 24
	WIU5-4/1	withdrawal	3.8E-06	3.2E-06	0.32802	0.27927	- 3.91E-04	3,33E-04
	M03-474 Area 41	injection	9.3E-06	7.8E-06	0.80213	0.67675		8.72E-04
		withdrawal	1.1E-05	9.6E-06	0.98479	0.83086	- 1.03E-03	
Area 41		injection	1.7E-05	1.6E-05	1.47763	1.38126		1.52E-03
	M03-475	withdrawal	1.5E-05	1.4E-05	1.32906	J.24238	1. <b>62E-03</b>	
		withdrawal	1.3E-06	1.2E-06	0.11189	0.10548		
	B09-225	injection	4.2E-06	4.2E-06	0.36696	0.36308		
		withdrawal	4.1E-06	4.1E-06	0.35765	0.35387	- 4.19E-04	4.15E-04

# 3.5.2 Pumping test

The hydraulic conductivity(K) is calculated by the Cooper&Jacob's methods ranges from 1.56E-03 cm/sec to 2.73E-01 cm/sec in the Area41. Average hydraulic conductivity(K) for pumping tests were calculated using the Cooper&Jacob's methods to be:

#### 8.73E-02 cm/sec in the Area41

Calculated results of the pumping test were greater than general hydraulic conductivity(ex: case of silty sand is about  $10^{-5} \sim 10^{-3}$ ). Except pumping well in each study areas, drawdown for most of monitoring well at pumping was within 10cm. It cannot be free from the effect with water level change by the atmospheric pressure.

Table 6 Hydraulic result estimated from the pumping tests using the Cooper&Jacob's method in Area 41

NO.	well	Maximum drawdown of WL(m)	Q (m³/day)	Slop (⊿s)	T (cm <sup>2</sup> /sec)	K (cm/sec)	Average K (cm/sec)	Storativity
Pumping	B07-187 (pumping)	1,956	12.278	0.168	1.55	1.63E-03	1,56E+03	
well	B07-187 (recovery)	1.200	12.278	0.183	1.43	1.50E-03	1,500,403	
Monitoring	B03-472 (pumping)	0.031	12.278	0.017	15.4	4.68E-02	£ 61E 00	2 707 05
well 1	B03-472 (recovery)	0.031	12,278	0.012	21.51	6.54E-02	5.61E-02	3.78E-05
Monitoring	Monitoring B03-470 (pumping)	0.096	12.278	0.012	21.51	1.09E-01	0.725.01	1.157.07
well 2	B03-470 (recovery)	0.090	12.278	0.003	86.74	4.38E-01	2.73E-01	1.15E-07
Monitoring	B09-181 (pumping)	0.022	12.278	0.006	44.87	1.42E-01	0.075.00	2047.06
well 3	B09-181 (recovery)	0.022	12.278	0.023	11.12	3.52E-02	8.86E-02	2.04E-06
Monitoring	B03-471 (pumping)	0.164	12.278	0.037	7.13	1.18E-02	1.72E+02	7.22E-07
well 4	B03-471 (recovery)		12.278	0.019	13.7	2.26E-02		

# 3.5.3 Air permeability test

Table 11 shows the results of the air permeability test was calculated with the Hyperventilate program in Area41. An arbitrary point was selected on a coincident segment, W(u), u, gauge vacuum, and t were determined. With those values,  $k_a$  was thus determined.

a. 
$$k_a = \{Q_v \mu\}/\{4\pi b(P-P_{atm})\}$$

Figure 10 shows the radius of influence (ROI) results of vacuum/pressure(mmH<sub>2</sub>O) vs elapsed time. ROI is generally 1.5 m (clay)  $\sim$  30 m (sand). The ROI for test1 was about 1.1 / 17m depending on gas flow rate which was approximately 20 / 30 cubic meters per hour. The ROI for test2 was about 14m depending on gas flow rate which was approximately 30 cubic meters per hour.

Table 7 The results of the air permeability test was calculated with the Hyperventilate program

Test	Well ID	Pressure	K(darcy[A])	ROI(m)
	IW-2	vacuum	18.79028	
Test1(20m³/hr)	1W-2	stop	-19.677898	1.
EW : MW	EW-2	vacuum	65.849558	1.1
	EW-Z	stop	-66.202391	
	IW-2	vacuum	12.247302	
	1W-2	stop	-12.213995	
Test1(30m³/hr)	EW-2	vacuum	27.093349	1.7
EW: MW		stop	-38.411305	17
	B09-187	vacuum	785.821223	
		stop	-355.308108	
	B09-181	vacuum	26.490415	
2	D09-101	stop	-36.785834	
Test1(30m³/hr) EW: Bore	B03-471	vacuum	240.330929	1.4
hole	DU3-4/1	stop	-375.123444	14
	B03-472	vacuum	142.77886	
	DU3-4/2	stop	154.415329	

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Appendix IV: Project Data Quality Discussion

## DATA QUALITY DISCUSSION.

## 1. Laboratory Quality Control (QC).

Laboratory QC consists of those procedures that a laboratory utilizes to verify that the entire analytical system is producing data of known quality. The contact laboratory utilized internal quality control procedures that are specified in the individual EPA test method. Neither laboratory reported difficulty with the sample analysis. The laboratory monitored internal quality through the use of matrix spikes (sample fortification with contaminants) and replicate analysis of selected extracts or digests. Laboratory reports were also reviewed by FED chemist (Dr.

## 2. Field QC Samples.

Field QC samples submitted to the laboratory in this project consists of trip blank and field duplicate samples for monitoring the quality of chemical data during the ESI/RE project sampling and shipments at Camp Carroll. Temperature blanks were also collected and placed into each ice cooler as same as for sample.

## 2.1. Trip Blank (TB).

Analysis of TB could be able to provide whether a sample bottle was contaminated during shipment from the manufacturer, while in bottle storage, in shipment to the laboratory, or during/after sample collection, or during analysis at lab. A total of eleven blank samples were provided by the contract lab to FED before sampling, and resubmitted to the lab together with soil and groundwater samples for VOCs analysis after sampling. A total of 6 VOC components,2-Butanone, carbon disulfide, chloroform, chloromethane, toluene and methylene chloride were reported above the sample reporting limits. The reasons of detections in the trip blanks are not certain. Since the blanks have not been opened up in the field, the involvement of such chemicals could come from during blank sample preparation or from blank sample analysis together with samples. However, the level of contamination in the blanks are not significant compared to the sample test result and do not appear to be significant in the data quality and interpretation. Table 1 shows the analytical results for VOCs of TB.

### 2.2. Duplicate samples.

A total of three field duplicate samples were prepared and submitted to the laboratory to check the reproducibility of sampling and analytical results. The data for the duplicate samples should agree each other within certain permissible range. The duplicate samples reflect an indication of the laboratory precision (precise reproducibility) if the samples were well-mixed and homogenized before sampling. Agreement does not necessarily mean that the reported value is accurate, since the lab might have a systemic error. Data quality check was performed by a comparison of the chemical results from the sample duplicates. The data comparison is expressed as a Relative Percent Difference (RPD) using to compare how close the result is to the true value. When used with duplicate samples, the RPD measures precision: the lower the value is the more precise the results. It can also measure accuracy, when one of your results is the true value, such as the quality control lab results for a split sample, or the actual concentration of a known

or unknown sample. Table 2 shows the criteria established by the Corps of Engineers in determining the agreement between samples.

All duplicate chemical data were compared according to the RPD criteria, with an assumption of all the estimated values as actual detections. Table 3~4 presents the data comparison between the duplicate samples. Most of the data comparison fall into "AGREEMENT" category according to Table 2 or are not compared due to very low detection below the quantitation limit.

TABLE 1. CHEMICAL TEST RESULT FOR TRIP BLANK SAMPLES OBTAINED DURING REMEDIAL INVESTIGATION/FEASIBILITY STUDY AT CAMP CARROLL.

Init			***************************************	* ** **	Area 41								
	TB1	TB2	TB3	TB4	TB5	TB6	TB7	TB8					
g/L	_*	-	1.2J**	1.1J	-	-	0.42J	0.42J					
g/L	-	_	-	0.44J	-	-		_					
g/L	1.9	1.9	0.66J	0.54J	0.66J	1.9	-	-					
g/L	0.42J	0.34J	1	+	•	0.42J	-	_					
g/L	1.1	1.1	12	10	14	1.6	1.8	2.4					
g/L	12	7.2	2.1	1.5	14	18	11	7					
1	g/L g/L g/L g/L	g/L - g/L 1.9 g/L 0.42J g/L 1.1 g/L 12	g/L	g/L	g/L     -     -     0.44J       g/L     1.9     1.9     0.66J     0.54J       g/L     0.42J     0.34J     1     -       g/L     1.1     1.1     12     10       g/L     12     7.2     2.1     1.5	g/L     -     -     0.44J     -       g/L     1.9     1.9     0.66J     0.54J     0.66J       g/L     0.42J     0.34J     1     -     -       g/L     1.1     1.1     12     10     14       g/L     12     7.2     2.1     1.5     14	g/L         -         -         0.44J         -         -           g/L         1.9         1.9         0.66J         0.54J         0.66J         1.9           g/L         0.42J         0.34J         1         -         -         0.42J           g/L         1.1         1.1         12         10         14         1.6           g/L         12         7.2         2.1         1.5         14         18	g/L         -         -         0.44J         -         -         -           g/L         1.9         1.9         0.66J         0.54J         0.66J         1.9         -           g/L         0.42J         0.34J         1         -         -         0.42J         -           g/L         1.1         1.1         12         10         14         1.6         1.8					

TABLE 2. CRITERIA FOR COMPARING FIELD, QC, AND QA SAMPLE DATA.

Matrix	Parameter	Disagreement	Major Disagreement
All	All	>5x difference when one result is < DL	>10x difference when one result is < DL
All	All	>3x difference when one result is < LRL	>5x difference when one result is < LRL
Water	All except TPH	>2x difference	> 3x difference
Soil	All except metals, VOCs, BTEX, and TPH	>4x difference	>5x difference
Soil	Metals	>2x difference	>3x difference
Water and Soil	ТРН	Arbitrary (suggest >3x difference)	Arbitrary (suggest >5x difference)
Soil	VOCs and BTEX	Arbitrary (suggest >5x difference	Arbitrary (suggest >10x difference)

DL: Laboratory Detection Limit

QL: Quantitation Limit, the lowest level of the analyte that can accurately be determined.

2X difference is equivalent to an RPD of 67%; 3X 100%; 5X 133%; 10X 167%

Reference: CRREL Special Report No. 96-9, "Comparison Criteria for Environmental Chemical Analyses of Split Samples Sent to Different Laboratories - Corps of Engineers Archived Data", Grant, C.G., Jenkins, T.F., and Mudambi, A.R., USACE Cold Regions & Environmental Research Laboratory, Hanover NH, May 1996.

The above criteria shall be applied when comparing field and QC sample pair data, as well as when comparing project and QA sample pair data. With the exceptions of volatile organic compounds (VOCs) in soil; and benzene, toluene, ethylbenzene, and xylenes (BTEX) in soil; and of total petroleum hydrocarbons (TPH) in either water or soil, the above criteria will be used for all data comparisons. There is no definitive data for establishing comparison criteria for TPH (in water or soils) because of the wide variety of method modifications used by laboratories in the SW-846 8015M method ("M" is for "Modified"). The same is true for VOC and BTEX in soils because of the large potential for introducing error during the conventional sample handling process. Result pairs are considered to disagree whether they are in the "Disagreement" or "Major Disagreement" category.

From: Chemical Quality Assurance for HTRW Projects, Engineer Manual EM 200-1-6

TABLE 3. FIELD SOIL DUPLICATE SAMPLE COMPARISON RESULT FOR VOCS. ACCORDING TO THE TABLE 2 GUIDANCE. THE DISAGREEMENT IN VOCS IS LIKELY DUE TO SAMPLING PROCEDURE.

Component (ug/kg)	B09-184		B09-	B09-186		B09-186
Component (ug/kg)	S1		S3	S3		RPD
Acetone	1300B*	1100B	_**	T -	NA****	NA
n-Butylbenzene	-	-	110	120	NA	9%
sec-Butylbenzene	-	_	83	96	NA	15%
Chloroform	-	-	-	-	NA	NA
Chloromethane	-	-	-	9.9J	NA	NA
cis-1,2-Dichloroethene	29J****	25J	24J	29J	NA	NA
Ethylbenzene	-	-	70	55J	NA	NA
Isopropylbenzene	-	-	32J	27J	NA	NA
p-Isopropyltoluene	-	-	44J	44J	NA	NA
Methylene chloride	120	98	-		20%	NA
Naphthalene	-	-	35J	31J	NA	NA
n-Propylbenzene	-	-	74	64	NA	14%
1,1,2,2-Tetrachloroethane	••	-	~	-	NA	NA
Tetrachloroethene	300	240	1100	1100	22%	0%
Toluene	-		43J	13J	NA	NA
1,2,3-Trichlorobenzene	-	-	-	-	NA	NA
Trichloroethene	27J	18J	34J	28J	NA	NA
1,2,4-Trimethylbenzene		_	640	680	NA	6%
1,3,5-Trimethylbenzene		-	150	160	NA	6%
m-Xylene & p-Xylene	-	-	220	180	NA	20%
o-Xylene	_	-	160	130	NA	21%

<sup>\*-</sup>The analyte found in a blank associated with the sample. \*\*- not detected

<sup>\*\*\*</sup> Relative percent difference, \*\*\*\* RPD calculation was NOT APPLICABLE, \*\*\*\*\*-Estimated result. Result is less than reporting limit.

TABLE 4. FIELD SOIL DUPLICATE SAMPLE COMPARISON RESULT FOR OC-PESTICIDE. RPD IS ACCORDING TO THE TABLE 2 GUIDANCE.

Component (ug/kg)		B09-184	4	
Component (ug/kg)		S1	RPD*	
alpha-BHC	_	-	NA**	
gamma-BHC (Lindane)	_	-	NA	
Heptachlor	-	_	NA	
Aldrin	-	_	NA	
beta-BHC	_	-	NA	
delta-BHC	_	_	NA	
Heptachlor epoxide	-	-	NA	
Endosulfan I	-	-	NA	
gamma-Chlordane	-	_	NA	
alpha-Chlordane	-	-	NA	
4,4'-DDE	1.7	1.8 J	NA	
Dieldrin	-		NA	
Endrin	- J	-	NA	
4,4'-DDD	0.43	0.64 J	NA	
Endosulfan II	-	-	NA	
4,4'-DDT	0.55J	0.89 J	NA	
Endrin aldehyde	-	-	NA	
Methoxychlor	- J	-	NA	
Endosulfan sulfate	-		NA	
Toxaphene	-	-	NA	
Chlordane (technical)	_	-	NA	
J- Estimated result. Result is less than reporing limit.				

<sup>\*</sup> Relative percent difference, \*\* RPD calculation was NOT APPLICABLE.