Subject:

RE: Work Plan for Piezometer Abandonments & Out-of-Waste Extraction Well Relocations, Eco-Vista Class 1 Landfill, Solid Waste Permit No. 0290-S1-R3, AFIN 72-00144

AFIN: 72-00144
PMT#: 0290-S1-R3
Received
By Haley Griffith at 4:01 pm, Jun 19, 2023
DOC ID#: 84235
TO: BS>FILE <hg< td=""></hg<>

From: Steve Jett <steve.jett@jettenviro.com> Sent: Monday, June 19, 2023 12:35 PM

**To:** gwreports < gwreports@adeq.state.ar.us>

**Cc:** Conrad, David <dconrad@wm.com>; Reynolds, Jodi <jreyno10@wm.com>; Michael Caldwell <mcaldwell@wm.com>; Small, Blake <bsmall@wm.com>; Travis Doll <travis.doll@jettenviro.com>; Travis Atwood (adpce.ad) <travis.atwood@adeq.state.ar.us>

**Subject:** Work Plan for Piezometer Abandonments & Out-of-Waste Extraction Well Relocations, Eco-Vista Class 1 Landfill, Solid Waste Permit No. 0290-S1-R3, AFIN 72-00144

On behalf of Eco-Vista, LLC, Jett Environmental Consulting is submitting the attached Work Plan for Piezometer Abandonments & Out-of-Waste Extraction Well Relocations for the Eco-Vista Class 1 Landfill.

If you have any questions or comments regarding this submittal, please do not hesitate to contact us.

Sincerely,

Steve Jett, P.G. Owner Jett Environmental Consulting 18 Lexington Oaks Court Foristell, MO 63348 314-496-4654 <u>steve.jett@jettenviro.com</u> www.jettenviro.com



June 19, 2023

Submitted via Electronic Mail

Mr. Travis Atwood, Geologist Arkansas Department of Energy and Environment Division of Environmental Quality 5301 Northshore Drive North Little Rock, AR 72118

#### Re: Work Plan for Piezometer Abandonments & Out-of-Waste Extraction Well Relocations Eco-Vista, LLC, Class 1 Landfill (Permit No. 0290-S1-R3) AFIN: 72-00144

Dear Mr. Atwood:

On behalf of Eco Vista, LLC, Jett Environmental Consulting is pleased to submit this Work Plan to the Arkansas Department of Energy and Environment, Division of Environmental Quality (ADEQ) for work to be conducted at the Eco-Vista Class 1 Landfill.

The site intends to abandon four piezometers (PZ-1D, PZ-2D, PZ-3S, and PZ-3D) and nine out-of-waste (OW) extraction wells (OW-5 through OW-10, and OW-19 through OW-21) that are in the footprint of the future Class 1 Landfill expansion area (see **Figure 1**).

In addition, the site plans to install up to five new OW wells (OW-204 through OW-208) just northwest of the future Class 1 Landfill expansion area (see **Figure 1**).

## ABANDONMENT

The abandonment of the four piezometers and nine OW wells will be performed by an Arkansas-licensed driller. The piezometers will be abandoned in general conformance with American Society for Testing and Materials (ASTM) D5299-99, US Environmental Protection Agency (EPA) (160014-891034), and Arkansas Water Well Construction Commission (AWWCC) guidance documents.

The equipment to be used for abandonment will be cleaned and decontaminated prior to the first piezometer/OW and between decommissioning locations. The protective outer casing, pipe bollards, and concrete pad will be removed. An attempt will be made to remove the inner-casing. The associated annular materials and any remaining inner-casing will attempt to be removed by overdrilling. Each piezometer will be overdrilled to its total installed depth using sonic core barrels, air rotary, or hollow-stem augers fitted with a guide pipe. Once each piezometer has been overdrilled to its total depth, the borehole will be tremie grouted to the ground surface. It is recommended to use bentonite grout to backfill the boreholes due to their location in the future Class 1 cell, where a portion of the backfilled material may have to be removed. Construction logs for each point proposed for abandonment are included in **Attachment 1**.

## INSTALLATION

Based on boring logs of the piezometers, existing OW wells, and nearby monitoring wells MW-1N, MW-19 and NE-4, we suspect that the target zone for the screened interval of the new OW wells may be within the epikarst zone, approximately 20 feet above the top of the bedrock. It is estimated that the 20-foot length screened interval will be located at an approximate depth of 40 to 60 feet below ground surface (ft bgs). Actual depths may vary depending on topography and local variations in depth to the target stratum encountered in the field.

The following is a summary of the decision process on where, and how many, new OW wells will be installed. The exact number and locations are to be determined in the field based on subsurface conditions encountered during the pilot borings. The final number of OW wells is contingent on if/where the epikarst zone is encountered. The epikarst zone is the optimal flow zone for potential landfill gas migration and extraction.

The purpose of the existing OW wells (OW-5 through OW-10, and OW-19 through OW-21) was for landfill gas control. According to the site, OW-10, OW-19, OW-20, and OW-21 have consistently exhibited significant amounts of landfill gas, and OW-5 through OW-9 have not had significant amounts of landfill gas. Past investigations have identified possible NW-SE trending lineaments/fractures just west and east of these OW wells. Therefore, extending the NW-SE lineament to the northwest (outside of the Class 1 waste area and the proposed Class 1 waste expansion area) would optimally place additional (i.e., replacement) OW wells in the lineament path towards MW-1N. It is proposed to drill the first OW pilot boring at OW-204, as shown on **Figure 1**.

The target zone for the screened interval of an OW well is the epikarst zone, which generally has consisted of silty/sandy gravel and weathered chert/limestone above competent bedrock. The epikarst zone would be the ideal pathway for landfill gas to migrate, if present.

Step 1: The initial pilot boring (i.e., PB-204) would be drilled in an attempt to encounter the epikarst zone. If encountered, then an OW-well (i.e., OW-204) would be installed within the pilot boring.

Step 2: If the epikarst zone is encountered (Step 1), then the next OW-well would be drilled approximately 100 feet north of OW-204, continuing on 100-foot spacings (i.e., OW-205, OW-206, and OW-207) until OW-208 is reached (see **Figure 1**).

Step 3: If no epikarst zone is encountered (i.e., no silty/sandy/gravelly/cherty weathered zone between the silty/cherty clay and overlying bedrock), then the pilot boring would be terminated, backfilled with grout, and the next pilot boring would be attempted approximately 50 feet north of PB-204 (or any subsequent boring).

Step 4: Upon conclusion of PB-208/OW-208, then the drilling of the pilot borings/wells would be considered complete. The maximum number of OW-wells anticipated is five (OW-204 through OW-208), as shown on **Figure 1**.

Drilling and well installation will be performed by an Arkansas-licensed driller. To install the wells, the driller will advance borings and install the wells using sonic (rotary vibratory), air rotary, or hollow-stem auger drilling methods. Each boring will be logged by either observation of the cuttings or by a continuous sampler. Soils will be logged and classified according to the Unified Soil Classification System by a qualified geologist contracted separately by the facility. The wells will be constructed and developed in general conformance with ASTM D5092 construction protocols and in accordance with EPA 160014-891034 and AWWCC guidance documents.

The equipment to be used for well installation will be cleaned and decontaminated prior to the first boring and between drilling locations.

Each OW well will have the following design components:

- The well borings will be advanced using sonic core barrels, hollow stem augers, or air rotary utilizing a sufficient diameter to maintain a minimum of 2 inches of annular space between the well casing and borehole wall.
- The polyvinyl chloride (PVC) well casing at each well will have a locking cap, which is vented to allow equilibration of water levels with atmospheric pressure.
- The top of casing at each well will be permanently marked, or notched, for future use as a reference point for water-level measurements.
- Each well will be secured at the surface with a locking, protective steel or aluminum casing; concrete pad; and protective pipe bollards. A weep hole will be drilled in the protective casing approximately 6 inches above ground surface to allow for drainage.
- The well identifications will be clearly marked on the outside protective casings.
- Well casings and screens will be constructed of 4-inch-diameter, Schedule 80 PVC with flush-threaded casing; a minimum 20-ft long, 10-slot (i.e., 0.010-inch) well screen; and a bottom end cap.
- A filter pack consisting of well-rounded, 3/8-inch washed pea gravel will be placed in the annular space to a minimum distance of 3 ft above the top of the screen.
- The bentonite seal will be followed by a well-mixed bentonite cement grout filled to the ground surface and installed using a tremie pipe.

Slight adjustments to well construction may be required in the field based on the observed lithology at each well location. Any deviations from well design will conform to recommendations in the above-referenced guidance documents.

#### WELL SURVEY

An Arkansas-licensed surveyor will survey the horizontal and vertical location of each new monitoring point. The vertical locations of the top of PVC casing will be surveyed to the nearest 0.01 ft, with the horizontal locations surveyed to the nearest 0.1 ft. The vertical locations of the top of concrete and nearest ground surface will be surveyed to the nearest 0.1 ft.

The survey report will include horizontal and vertical coordinates based on the landfill's site-referenced coordinate system, which is based on established site-specific benchmarks.

#### **INSTALLATION & ABANDONMENT REPORT**

Within 60 calendar days of completion of the proposed field work, a report will be submitted documenting field activities. The report will be certified by the supervising professional per Regulation 22.1103(f) and will include the following:

- A site map that includes the locations of the abandoned points and surveyed locations of the newly installed monitoring points,
- Boring logs and construction diagrams for the new monitoring points,
- Completed Abandonment Forms for each point,
- Summary of work quality and methods, and
- The certified survey report from an Arkansas-licensed surveyor containing vertical and horizontal location coordinates for the newly installed monitoring points.

If you have any questions or comments, please contact me at steve.jett@jettenviro.com or 314-496-4654.

Sincerely,

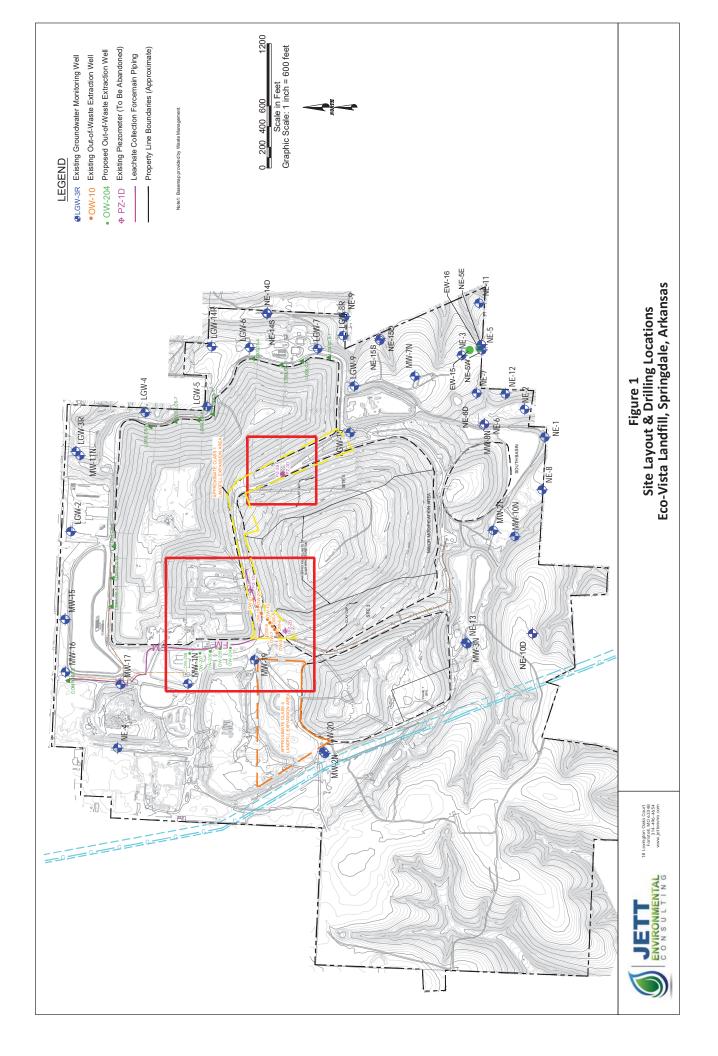


Steve Jett, P.G. No. 1826 Owner

 Attachments:
 Figure 1 – Site Layout & Piezometer/Extraction Well Locations

 Attachment 1 – Boring Logs & As-Builts

cc: Jodi Reynolds – WM (PDF via Email) Dave Conrad – WM (PDF via Email) Michael Caldwell – WM (PDF via Email)



-				PROJECT: Eco-Vista, L LOCATION: Eco-Vista, L	LC Landfill			BORING ID: <b>PZ-1D</b> NORTHING, FT SRC: <b>664908.0</b>	PIEZO PZ-1 EASTII 6458	D NG, F 33.0	r SRC:
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		<b>F</b> Associat	es Ltd.	DRILLING EQUI				WELL DEPTH, FT BELOW MF 80.3			ON DATES: / <b>2019</b>
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lli.				PROJECT: Eco-Vist LOCATION: Eco-Vist DRILLING C	a, Ll	LC La	andfill				BORING ID: PZ-1D NORTHING, FT SRC: 664908.0 GROUND SURFACE,	FT SRF	PZ EAS <sup>*</sup> 64	20METE - <b>1D</b> TING, F 5833.0	T SRC:
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NOTES									Consulti		l eport dated August § 3 of 3	0, 2019. SRE=site referenced el	evation, SRC	C=site refere	nced coordinates,

	PROJECT: Eco-Vista, LLC Class 1 Landfill GH		PIEZOMETER ID: PZ-3S
<u> </u>	LOCATION:		EASTING, FT SRC:
	Eco-Vista, LLC Landfill, Tontitowr DRILLING CONTRACTOR: Walker-Hill Environmental, Inc.	-	646951.1 TOC MP, FT SRE: 1265.71
Associates Ltd.	DRILLING EQUIPMENT: Versa-Drill VersaSonic	WELL DEPTH, FT BELOW MP: 72.9	INSTALLATION DATES: 6/27-7/29/2019
water resources / environmental consultants	DRILLING METHOD:	· · · · ·	
TN Project # R06820-0100-013	Sonic with 4x6 in dia. core and ca	se	
OGGED BY:	SAMPLING METHOD:		
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	CALIPER GAMMA SPR		
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0 - ML	I Important	SILT, light grey with some clay and rootlets, stiff, moist. FAT CLAY with gravel, reddish brown, gravel (<3" dia), increasing moisture with depth.	Above ground completion including 2.5x2.5 concrete pad, fou pipe bollards, and locking outer aluminum casing 62.7 ft of 2 in dia. Sch. 40 PVC soli riser, including 3. ft of stickup
10 - ML GC 0 0 100 - ML 100 CH	Manna Man	ASPHALT CHERT, orange staining. SILT, tan to orange, loose, moist. CHERT, orange staining. CLAYEY GRAVEL, orange, moist. SILT, tan to orange, loose, moist. FAT CLAY with gravel, yellowish orange, medium stiff to soft, moist.	
- ML	Man	<ul> <li>SILT, orange with some clay throughout, moist.</li> <li>@ 20-20.5 ft bgs chert white with weathering along fractures.</li> <li>FAT CLAY with gravel, dark red, gravel (&lt;3" dia). @ 21.5-22 ft bgs weathered chert with orange and black staining along fractures.</li> </ul>	Cement/bentoniting grout from 0 ft bg to 52.0 ft bgs
100 GP-GC 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		POORLY GRADED GRAVEL with clay and sand, increasing chert with depth.	
		CHERT, orange, weathered. FAT CLAY with gravel, dark red, gravel (<3" dia) CHERT, orange, weathered.	Cement/bentonit grout from 0 ft bg to 52.0 ft bgs
IOTES: Horizontal and vertical TOC=top of casing, M		report dated August 9, 2019. SRE=site referenced elevation, SI	$\times$ $\times$

<u> </u>		PROJECT: Eco-Vista, L LOCATION:				BORING ID: PZ-3S NORTHING, FT SRC:	PZ-39	G, FT SRC:
		Eco-Vista, L		Tontitown,	AR	664604.5 GROUND SURFACE, FT SRE	64695	
		DRILLING CONT Walker-Hill E		al, Inc.		1262.7	1265.	, FT SRE: <b>71</b>
	,	DRILLING EQUIF				WELL DEPTH, FT BELOW MP		
ASSOCIO	ates Ltd.	Versa-Drill V				72.9	6/27-7	7/29/2019
TN Project #		DRILLING METH		ore and cas	e			
R06820-0100-013		SAMPLING MET	HOD:		-			
OGGED BY: <b>AJP</b>		Continuous	with 10 ft, 4	in dia. core	e barrel			
	U	CALIPER	GAMMA	SPR				Well
Depth (feet) % REC USCS	Graphic Log	8.4 10.4 12.4		- 0.25 - 0.5 - 0.75	-	Description	C	onstruction
100 ML 100 - GC/GI 100 - GC/GI 100 GW 100 - GW 100 CH CL/MI CH			Maran Mar		red lenses of c CLAYEY GRA orange, grave @ 38-38.8 ft b dark red fat cla @ 40.5-41 ft b dark red fat cla weathered of FAT CLAY, da LEAN CLAY to lenses of clay, FAT CLAY, da moist. @ 53.5 and sand, loos	VEL to SILTY GRAVEL, tan to (<4" dia). gs tan silt layer with lenses of ay. gs tan silt layer with lenses of ay. ED GRAVEL, black and red fractures. @ 45.5-46 ft bgs grey chert. It red with some chert, soft, mo Soft, moist. It red with some chert, soft, -54 ft bgs with reddish brown silt se, moist.	st.	bentonite pellet seal from 52.0 ft bgs to 55.8 ft bgs
- 60 — 71			Mamm		weathered into (<4" dia), mois @ 60-70 ft bgs	s color changes to white, chert is		Silica size 20/40 filter pack from 55.8 ft bgs to 70 bgs Depth to water:
			MMMMMMMMMMMMMMMM		loosely cemer			64.21 ft below M (7/29/2019) 10.0 ft of 2 in dia 0.010 in slot, Sch 40 PVC screen 0.19 ft, 2 in dia., Sch. 40 PVC enc cap
-						AND CHERT, interbedded, nestone is light gray, chert is whi	te.	Drilling terminate at 71.0 ft bgs

				PROJECT:				BORING ID:	PIEZOMETE	R ID:
				Eco-Vista,	LLC Class 1 L	andfill GH.	I	PZ-3D	PZ-3D	
	<u> </u>			LOCATION: Eco-Vista,	LLC Landfill,	Tontitown,	, AR	NORTHING, FT SRC: 664592.8	EASTING, F 646955.6	
		3		DRILLING COI Walker-Hil	NTRACTOR: Environment	al, Inc.		GROUND SURFACE, FT SRE: 1262.9	TOC MP, F1 1265.73	SRE:
		FU		DRILLING EQU				WELL DEPTH, FT BELOW MP:		
		Associa	t <u>es Ltd</u> .		VersaSonic			90.8	6/25-7/29	9/2019
	sources / er Projec	vironmental c t #	onsultants	DRILLING ME		ro and oac	o in coile on	d air rotary in bedrock		
		00-013		SAMPLING ME				u all foldry in bedrock		
	GED B	Y:			and 10 ft UO care have	al in badra	ok			
				CALIPEF		SPR		oil and 10 ft HQ core barre		CK
Depth (feet)	0	S	hic		-		г	Description		Well
epth	REC	nscs	Graphic Log	9.2 11.2	0 20 40	-58.8 -58.3 -57.8	L	Description	Cor	struction
ă	%				հսուհասև					Above ground
0 -	_ _ _ _ 100	ML CH-GC			MWW WWW		FAT CLAY wit	y with some clay and rootlets, stif h gravel, reddish brown, gravel easing moisture with depth.	f,	Above ground completion including 2.5x2.5 ft concrete pad, four pipe bollards, and locking outer aluminum casing
10 –	- 80 - 100	ML			Mary Mary Mary Mary Mary Mary Mary		ASPHALT CHERT, orang SILT, tan to or CHERT, orang	range, loose, moist.		80.6 ft of 2 in dia., Sch. 40 PVC solid riser, including 2.8 ft of stickup
		GC	1	7	M.			VEL, orange, moist.	- 88	
	-	ML	ÍΠ	$\Pi \leq$			SILT, tan to or	range, loose, moist.		
	-	СН			A Mark		FAT CLAY wit medium stiff to	h gravel, yellowish orange, o soft, moist.		
	_	ML		$\begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$			SILT, orange	with some clay throughout, moist.		
20 –	- 100			$\downarrow$	M		@ 20-20.5 ft b along fracture	ogs white chert with weathering s.		
	_	СН			Marrow		FAT CLAY wit dia). @ 21.5-2	h gravel, dark red, gravel (<3" 22 ft bgs weathered chert with ack staining along fractures.		
	_	GP-GC	()	0	Mary M. M. Mary Mary Mary Mary			ADED GRAVEL with clay and ng chert with depth.		
			0 0 0		$\rightarrow$		CHERT, orang	ne weathered		
30 -	80	СН			$\leq$			h gravel, dark red, gravel (<3" dia	a).	Cement/bentonite
	_				MMM			ge, weathered.		grout from 0 ft bgs to 60.0 ft bgs
NOTE	ES: Hor TO	izontal and C=top of ca	l vertical o asing, MP	lata are based on th =surveyed measuri	e Mason Surveying & g point on TOC.	Consulting, Inc., r	eport dated August S	9, 2019. SRE=site referenced elevation, S	RC=site referen	ced coordinates,

				PROJEC <sup>®</sup>		LC Class 1 L	andfill GH		BORING ID: PZ-3D	PIEZOMETI PZ-3D	ER ID:
				LOCATIC Eco-Vi		LC Landfill, <sup>-</sup>	Tontitown,	AR	NORTHING, FT SRC: 664592.8	EASTING, F	
				DRILLING	G CONT	RACTOR:			GROUND SURFACE, FT SRE 1262.9	: TOC MP, F 1265.73	SRE:
		F L		DRILLING					WELL DEPTH, FT BELOW MF		
wator recou	A	<u>(SSOCIO</u> /ironmental c	es Ltd.			/ersaSonic			90.8	6/25-7/2	9/2019
FTN Pr			viisuitaiits	DRILLING			re and cas	e in soils an	d air rotary in bedrock		
R0682	0-010	0-013		SAMPLIN							
LOGGE	ED BY	':					in dia com	harrel in so	oil and 10 ft HQ core bar	rel in hedro	ck
AJP ⊋					IPER	GAMMA	SPR				
Depth (feet)	REC	NSCS	Graphic Log	9.2	1 i2	0 0 4 6 0 0	-58.8 -58.3 -57.8	[	Description	Cor	Well struction
De	%	ر				լհահահ					
_		ML			•	why have		red lenses of a	VEL to SILTY GRAVEL, tan to	nin XXXX	
_						M		@ 38-38.8 ft b dark red fat cla	gs tan silt layer with lenses of ay.		
40 —	100	GC/GM	0000	0000	>	Muruh		@ 40.5-41 ft b dark red fat cla	gs tan silt layer with lenses of ay.		
_	100	GW			) ) >	M. M			ED GRAVEL, black and red fractures. @ 45.5-46 ft bgs grey chert.	nin X X X X X X X X X X X X X X X X X X	
50 —		СН			}	M MM		FAT CLAY, da	ark red with some chert, soft, mc	ist.	
_		CL/ML			>	M		lenses of clay,	o SILT, tan silt with dark red soft, moist. ark red with some chert, soft,		
_	80	СН				MMMM			-54 ft bgs with reddish brown sil		
_					5	Marrie			OCHERT/EPIKARST, chert is a well-graded gravel, tan, grav st.	el	
60 —					N	Maria		@ 60-71 ft bg: loosely cemer	s color changes to white, chert is ted.		Depth to water: 64.64 ft below MP (7/29/2019
_	70										Slow-release bentonite pellet seal from 60.0 ft bgs to 74.1 ft bgs
70 —	100		A A	A							
	100		ΛŢΛ	2				LIMESTONE	AND CHERT, interbedded.		
	- Horiz	zontal and	l vertical c	lata are base	d on the I	Mason Surveying & ( point on TOC.	Consulting, Inc., re		9, 2019. SRE=site referenced elevation,	SRC=site referen	ced coordinates

water reso FTN F		<b>FU</b> <u>SSOCIO</u> <i>vironmental</i>	t <u>es Ltd.</u> onsultants	Ecc LOC/ Ecc DRIL Wa DRIL Ver DRIL	ATION D-Vis LING Iker- LING Sa-E	ita, Ll ita, Ll cont Hill E EQUIF Drill V	LC La RACTC INVIRO PMENT: CersaS	nment	Tonti al, Inc	town, c.	AR	1262.9 WELL DEPT 90.8	JRFACE, FT SRE: H, FT BELOW MP:	PZ EAS <sup>-</sup> 640 TOC 120 INST	COMETER -3D TING, FT 6955.6 MP, FT 65.73 CALLATIC 25-7/29	SRC: SRE:
R0682	20-010	0-013				G MET		dia. co	ore an	d cas	e in solis an	d air rotary	/ in bedrock			
LOGG		:		Co	ntinu	ious	with 1	0 ft, 4	in dia	a. core	barrel in so	oil and 10 f	t HQ core barr	el in	bedroc	:k
Depth (feet)	REC	SS	Graphic Log	C		PER	GA o ನಿ	MMA		-58.3 <b>J</b>	ſ	Descripti	ion			Well
Depth	% RI	USCS	Gra		- 9.2	7			-58	-58	•	00001101			Con	struction
<ul> <li>△</li> <li>-</li> <li>-</li> <li>-</li> <li>80</li> <li>-</li> <li>-</li></ul>	<u>8</u> 999 97 97						- Marine Ma				@ 71-81 ft bg: 0-90° off horiz was shut off a 70 ft bgs. @ 81-90 ft bg;	s no air loss, F ontal. After run nd water level s no air loss, F ontal, increasi	, chert is white. RQD 36%, fractures n was completed, a was measured at RQD 66%, fractures ng competency wit	ir		Silica size 20/40 filter pack from 74.1 ft bgs to 89.0 ft bgs 10.0 ft of 2 in dia., 0.010 in slot, Sch. 40 PVC screen 0.19 ft, 2 in dia., Sch. 40 PVC end cap Native materials from 89 to 90 ft bgs Drilling terminated at 90.0 ft bgs
NOTE	S: Horia TOC	zontal and =top of c	d vertical o asing, MP	lata are =survey	based /ed me	on the M asuring	Aason Su point on T	rveying & OC.	Consultin	ng, Inc., re 3 of 3		), 2019. SRE=site	referenced elevation, §	SRC=sit	e reference	ed coordinates,

<b></b>					Dril	lin	g	Log	ř.							
Project	[wm	2		Project N	niber (	İBZU	2104	15.00			Boring	Number	OW	-57		
	Elevation 1294	1.4	Locatio	- n						ъ.	Page			of	1	
	itoring Equipment		•					(a			Total	Footage	73			
	riling Type	Hole S		Overburde		ge		Bedrock		e	No. C	of Sample:			ore Boxes	3
	Company Fin	10(1-	•	- 44	/	e.	-	29			•					
Oriling F	1.11	ein Bros			418		1	ier (s)	Mari	ius. Fi	ippin					
Date	2/22/02-		То					e of ipler d Observ	or (+)		<u></u>	12				
Depth						T				Mark		DTD /		T		_
(feet)		Descriptio	n		Class	Bk Cou	ow unt	Recov.	Run/ Time	Sample Desig.	BZ	PID (ppi	n, S	Re	marks/ er Levels	
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1_	Clay, w/si	H. Trace p	Astricity,	Damp,	•							*				-
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4-	Linestor	e witchest	fragm	ents	15										•	-
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# Drilling Log

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	d Elevation 128	38.6	- 110						Page		1		of (	
	nitoring Equipment	······································							Total	Fool	age	6	7'	
	Orling Type	Hole Size	Overburde		18	Bedrock		ie	No.	01 Sa	mples	-	No. Of Core Bo	xes
	Company El.		39			ZB				_				11
Oriling		pin Bros		S R		Driller (s) Type of Sampler	Marin	Flig	<u>Dia</u>	h				
Date	2125/02	То	2			Sampler Field Observ	Pr (s)			ų.	2			
Depth								Mark			(ppm)			
(feet		Description		Class	Blo Cou		Run/ Time	Sample Desig.	BZ		BH BH	S	Remarks, Water Levi	/ els
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e Hole S=Sa

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				Dril	ling	j Log	}					•
Project	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	-2	Project Nu	08201045.00					Boring Number			
	Elevation 129	1.2 Locat	lon .						Page Of (			
$\square$	Vonitoring Equipment								Total F	ootage	72	
	riling Type	Hole Size	Overburde		ge	Bedrock		8	No. Of Samples			No. Of Core Boxes
	Air Robary 1011- 29 Drilling Company Fligpin Bros					44			,			
		. 🖲		Driller (s)	Marco	<u>s Fl</u>	ippin			·		
Oate	2/25/02	То	2		! <sup>§</sup>	Sampler Field Observ	er (s)	icA.	k Oriz	<u>а</u>		
Depth					Blo					· ·ID (ppm	.)	
(feet)		Description		Class	Cour		Run/ Time	Sample Desig.	BZ	вн	'' S	Remarks/ Water Levels
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			Brisht						2		•	
2-	brangish -m	ed,		a					•			
3-	0'-2	28									R <sub>et</sub>	· -
4-	34 ·		2	-				. ×			35	а. <b></b>
		100 m	c.									
Q	Limestone ,	I chert france	+	25				•				× -
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14 - 87-84	athing Zone	BH=Bore Hole S=Sa										

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# Drilling Log

	t Name WM	ίŝ.	Project N	mber	ÖB	201045.	00		Boring Number OW-8.				
	Elevation	3.0	Location	•	W					Page		1	of /
	nitoring Equipment	· · · · · · · · · · · · · · · · · · ·	•					6		Total I	Footage	74'	the second s
	Drilling Type	Hole S		Overburd	-	ge		k Footag	e	No. O	f Sample		No. Of Core Boxes
	- Kitary	10"-		50	!	1	24	'	~				
<b> </b>		in Bros			. •		Driller (s)	Mary	ivs. Fl	inpul			14
	Juncamm		-	· · · · · · · · · · · · · · · · · · ·			Type of Sampler	~					
Date	2/25/02		То				Field Obsei	rver (s)	Mark	0	a <sup>11</sup> 21		
Depth (feet)			Class	Bio	nt Recov	Run/	Sample Desig.		PID (pp	ጠ)			
		Descriptio						1350	Desig.	BZ	BH	S	Water Levels
	Clay, w/si	H. Trace 1	plisticity.	Damp.				1532			•		
1	Abundomit									- 11 <b>4</b>	*		
			mann s.	Dright								(h))	~
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Project	Namo			A REAL PROPERTY OF THE OWNER.	ling	g Log	}					ŝ	
	Elevation		Project N	under	08	201045.	90		Boring	Number	. Ou	2-9	
	[29]	3.9 Locat	on .						Page	1		of /	
and the second second	itoring Equipment								Totai F	ootage	62	and the second	
4	riling Type	Hole Stza	Overburd		ga	Bedroc	k Footag	e				No. Of Core	Boxes
	Company Eli-	10"-	62	r									
)rilling F		pin Bros				iype or	Mari	ius.F	lippia			· · · · · · · · · · · · · · · · · · ·	
)ate	2/25/02		Sampler Field Observ	ver (s)	ΛΛ	1.0			<u> </u>				
Depth					Blo				K Orr	PID (pp		T	
(feet)		Description		Class	Cour	nt Recov.	Run/ Time	Sample Desig		вн	s s	Remark Water Le	cs/ evels
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BZ=Bre	athing Zone	8H=Bore Hole S=Sa											<u> </u>

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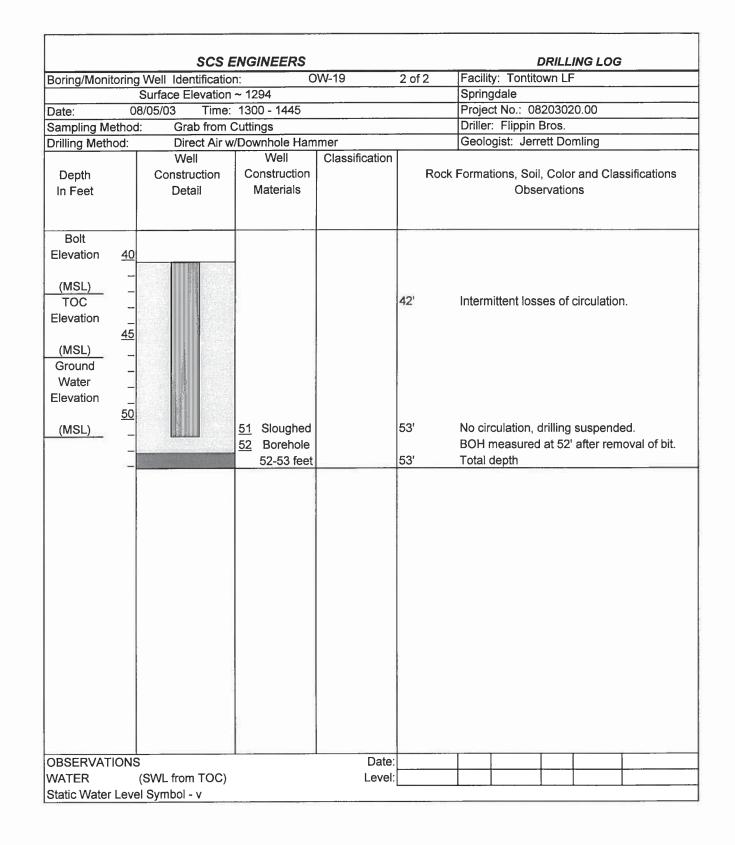
roject Name WM	8	Project N	under ()	187M	1045.00	>		Boring Number	
round Elevation	94.6 Loca	ition ·		own	0.00		<u>_</u>	Page	W-10
Nonitoring Equipmen	t			13				Total Footage	of /
Orting Type	Hole Size	Overburd	en Footag		Bedroci	. Facility			74'
Air Rodary	10"-		41	a  }	bedioci	Pootag	a la	No. Of Samples	No. Of Core Box
	pih Bros				rilier (s)				A.
iling Rig Schenm			14 E	T	ype of	Marcu	<u>s Fli</u>	P. A.	~
te zlzuloz		127/02			ampler ield Observ	rer (s)	M	. 0	
epth								Pr	128
eet)	Description		Class	Blow Count		Run/ Time	Sample Desig.		Remarks/
	11 - 11			_		1105		BZ BH S	; Water Level
1_ CIAY, w/ 5T	17. Trace plasticit chert frogments.	y. Pomp.	·					•	
Abundant	chert frogments.	Bright						4: 10	9 in 12
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Poring/Monitoria	g Well Identification	ENGINEERS	W-19	1 of 2	DRILLING LOG Facility: Tontitown LF
sonng/wonitorin	Surface Elevation		VV-19	1012	Springdale
Date: 0		1300 - 1445			Project No.: 08203020.00
Sampling Metho		rom Cuttings			Driller: Flippin Bros.
Drilling Method:		/Downhole Ham	mer		Geologist: Jerrett Domling
gg	Well	Well	Classification	1	
Depth In Feet	Construction Detail	Construction Materials		Rock	Formations, Soil, Color and Classifications Observations
Bolt Elevation 0 (MSL) - TOC - Elevation 5 (MSL) - Ground - Water - Elevation 10 (MSL) - (MSL) - 20 20		+/- 3' Stick-Up <u>0</u> 3/8-inch Chip Bentonite 0-16 feet 4-inch Schad. 80 PVC Solid Riser 0-17 feet <u>16</u> <u>17</u> 3/8-inch Washed Pea Gravel 16-52 feet 4-inch Slotted		0' - 10' 10' - 14' 14' - 27' 27' - 53'	Start drilling @ 1:00. Silty Clay with coarse / very coarse chert fragments, 2.5 YR 4/6. Increasing high plastic clay content 2.5 YR 3/6 decreasing chert fragments, decreasing particle size. Silty clay with chert fragments 2.5 YR 6/8.
- - <u>30</u>		Slotted Schad. 80 PVC Screen		27' - 53' 53'	Material fall-in, drill stem locking in hole. Water introduced to bore hole.
 		17-51 feet		27 - 53'	Weathered limestone and chert fragments (very coarse), Fossiliforous, Light Brown/ Tan.
BSERVATION	S		Date:		
JOSEKVALUN	5		Date:		

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In Feet Detail Materials Bolt Boring: 10" +/- 3' Stick-Up 0' - 12' (MSL)	Facility: Tontitown LF         Springdale         Project No.: 08203020.00         Driller: Flippin Bros.         Geologist: Jerrett Domling         Sk Formations, Soil, Color and Classifications Observations         Start drilling @ 8:15.         Silty clay, moist, chert fragments, 2.5 YR 4/6.
Bampling Method:       Grab from Cuttings         Drilling Method:       Direct Air Rotary with Downhole Hammer         Depth       Well       Classification         Depth       Construction       Construction       Roc         Bolt       Boring: 10"       +/- 3' Stick-Up       0' - 12'         (MSL)       -       -       3/8-inch       0' - 12'         [MSL)       -       -       -       -         [MSL)       -       -       -       -         [MSL)       -       -       -       -         [Incompleted by the second by	Driller: Flippin Bros. Geologist: Jerrett Domling K Formations, Soil, Color and Classifications Observations Start drilling @ 8:15. Silty clay, moist, chert fragments,
Bampling Method:       Grab from Cuttings         Drilling Method:       Direct Air Rotary with Downhole Hammer         Depth       Well       Classification         Depth       Construction       Construction       Roc         Bolt       Boring: 10"       +/- 3' Stick-Up       0' - 12'         (MSL)       -       -       3/8-inch       0' - 12'         (MSL)       -       -       -       0' - 12'         Ground       -       -       -       -         Water       -       -       -       -         In Feet       -       -       -       0' - 12'         Bolt       Boring: 10"       -       -       0' - 12'         (MSL)       -       -       -       -         TOC       -       -       -       -         Image: Construction       -       -       -       -         Ground       -       -       -       -       -         Image: Construction       -       -       -       -       -         Image: Construction       -       -       -       -       -       -         Image: Construction       -	Geologist: Jerrett Domling k Formations, Soil, Color and Classifications Observations Start drilling @ 8:15. Silty clay, moist, chert fragments,
Drilling Method:       Direct Air Rotary with Downhole Hammer         Depth       Well       Classification         Depth       Construction       Construction       Roci         Bolt       Boring: 10"       +/- 3' Stick-Up       0' - 12'         (MSL)       -       3/8-inch       0' - 12'         TOC       -       Stick-Up       0' - 12'         (MSL)       -       -       3/8-inch         Elevation       -       -       0-20 feet         (MSL)       -       -       -         TOC       -       -       -         Elevation       -       -       -         TOC       -       -       -         Elevation       -       -       -         10       -       -       -	k Formations, Soil, Color and Classifications Observations Start drilling @ 8:15. Silty clay, moist, chert fragments,
Depth In Feet       Construction Detail       Construction Materials       Rock         Bolt Elevation       Boring: 10" Casing: 4"       +/- 3' Stick-Up 0       0' - 12'         (MSL)       - TOC       - Elevation       3/8-inch Chip Bentonite 0-20 feet       0' - 12'         (MSL)       - 5       - 4-inch Schad. 80       -       -	Observations Start drilling @ 8:15. Silty clay, moist, chert fragments,
Elevation         0         Casing: 4"         0         0' - 12'           (MSL)         -         -         3/8-inch Chip Bentonite 0-20 feet         0' - 12'           (MSL)         -         -         0' - 12'         0' - 12'           (MSL)         -         -         0' - 12'         0' - 12'           (MSL)         -         -         0' - 12'         0' - 12'           (MSL)         -         -         0' - 12'         0' - 12'           (MSL)         -         -         0' - 12'         0' - 12'           (MSL)         -         -         0' - 12'         0' - 12'           (MSL)         -         -         0' - 12'         0' - 12'           (MSL)         -         -         0' - 12'         0' - 12'           Water         -         -         -         0' - 12'           Elevation         -         -         -         -           10         -         -         -         -	Silty clay, moist, chert fragments,
_(MSL)	Increasing high plastic clay content.
20 20 21 3/8-inch Washed Pea Gravel 20-46 feet	
_ 28'	Weathered chert limestone, 2.5 YR 7/4.
30 - - - - - - - - - - - - -	Low cutting return, experiencing problems with fall-in.
35 - - - -	Water added and circulation returns.
DBSERVATIONS Date:	

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SCS ENGINEERS           Boring/Monitoring Well Identification:         OW-20         2 of 2         Facility:	DRILLING LOG Tontitown LF
Surface Elevation ~1297 Springda	
	No.: 08203020.00
	Flippin Bros.
	st: Jerrett Domling
WellWellClassificationDepthConstructionConstructionIn FeetDetailMaterials	ns, Soil, Color and Classifications Observations
TOC	
OBSERVATIONS         Date:           WATER         (SWL from TOC)           Static Water Level Symbol - v	

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a sin a /B d a side sin d	g Well Identificatio		W-21	1 of 2	DRILLING LOG
sonng/wonitoring	Surface Elevation		VV-2 I	1012	Springdale
Date: 0	7/30/03 Time:				Project No.: 08203020.00
Sampling Method	d: Grab	from Cuttings			Driller: Flippin Bros.
Drilling Method:	Direct Air w	/Downhole Ham			Geologist: Brett Engard
Depth In Feet	Well Construction Detail	Well Construction Materials	Classification	Rock	Formations, Soil, Color and Classifications Observations
Bolt         0           Elevation         0           (MSL)         -           TOC         -           Elevation         5           (MSL)         -           Ground         -           Water         -           Elevation         10           (MSL)         -           10         -           110         -           115         -	Boring: 10" Casing: 4"	+/- 3' Stick-Up <u>0</u> 3/8-inch Chip Bentonite 0-17 feet 4-inch Schad. 80 PVC Solid Riser 0-23 feet		0'- 28'	Silty clay, moist, medium, chert fragments, 2.5 YR 5/8.
- - 20 - - 25 - - - 30 - - - - 30 - - - - - - - - - -		17 3/8-inch Washed Pea Gravel 23 17-43 feet 4-inch Slotted Schad. 80 PVC Screen 23-43 feet		28'	Weathered cherty limestone, fossilifrous.
			Data		
BSERVATION	6 (SWL from TOC)		Date: Level:		

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		NGINEERS	W-21	2 of 2	Facility: Tontitown LF
Boring/Moni	itoring Well Identification Surface Elevation		VV-21	2 01 2	Springdale
Date:	07/30/03 Time:				Project No.: 08202035.00
Sampling M		rom Cuttings			Driller: Flippin Bros.
Drilling Meth	nod: Direct Air w	Downhole Ham	mer		Geologist: Brett Engard
Drilling wet	Well	Well	Classification		
Depth In Feet	Construction Detail	Construction Materials		Rock	Formations, Soil, Color and Classifications Observations
Bolt Elevation (MSL) TOC Elevation	40 			43'	Loss of return, added foam to increase circulation, rig down, well set 8/5/03. Total depth
(MSL) Ground Water Elevation					
(MSL)					
OBSERVAT			Date:		
WATER	(SWL from TOC)		Level:		
Static Water	r Level Symbol - v				