

APPENDIX B

Monitoring Well Installation Forms

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B.1 DRILLING ACTIVITY LOG SHEETS

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TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Facility-wide Groundwater
RVAAP-66

PROJECT NO: October 2018 Sampling Event

Date: (mm/dd/yy): 10/23/18

Page 1 of 2

Task Team Members:

<u>Charles Spurr (Leidos)</u>	<u>Andreas Van Dalen (Frontz)</u>
<u>John Herbert (Leidos)</u>	<u>CS 10/23/18</u>
<u>Ricky Shanks (Frontz)</u>	

Narrative (include time and location):

0810 Drilling team on site at electric sub-station ^(ESS) No 3
Setup for drilling activities. (ES3)

0825 Complete drill rig operational checklist.

0840 Frontz sets up on ES3tw-003

0848 Take initial 4-gas reading CO: 0ppm H₂S: 0ppm LEL: 0%
O₂: 20.9% VOC: 0.0ppm

0903 UXO cleared to 2'-4" 003

0913 UXO cleared to 4'-6'

0925 UXO cleared to 6'-8'

0935 water encountered in ES3tw-003 @ 7.0' bgs UXO to 8'-10'

1008 Begin setting well - 9.0' bgs

1108 ES3tw-003 installation complete: 3x 50lb. Sidley #5 silica
Sand; 1x 50lb. 3/8" coarse grade Wyoming bentonite chip Holeplug
Bentonite hydrated w ~ 3 gallons of approved water.

1130 Drill team sets up on ES3tw-001 & takes lunch.

1150 Resume work at ES3tw-001

1158 UXO clear to 2'-4" in ES3tw-001

1206 UXO clear to 4'-6'

1215 UXO clear to 6'-8' water encountered @ 5.5' BGS

1242 UXO clear to 8'-10'

1300 Begin setting well ES3tw-001 - 8.0' BGS

CS 10/23/18

Daily Weather Condition: A.M. Sunny; 40°F

P.M. Partly cloudy; windy; 53°F

Recorded By: Allen [Signature] 10/23/18 (Signature) QC Checked by: [Signature] 11/12/18 (Signature)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Facility-wide Groundwater
RVAAP-66

PROJECT NO: October 2018 Sampling Event

Date: (mm/dd/yy): 10/23/18

Page 2 of 2

Task Team Members:

See page 1

~~CS 10/23/18~~

Narrative (include time and location):

1330 ES3tw-001 installation complete. 4x 50lb. Sidley #5 Silica Sand
1x 50lb. 3/8" coarse grade Wyoming bentonite chips Holeplug.

1350 Setup on location ES3tw 002 3 gallons approved water

1403 UXO cleared 2'-4'

1413 UXO cleared 4'-6'

1425 UXO cleared 6'-8' water encountered at 6' BGS

1434 UXO cleared 8'-10'

1525 ~~ES3tw-002~~ installation complete. 3 x 50lb.

Sidley #5 Silica Sand, 1x 50lb. 3/8" coarse grade
Wyoming bentonite chips Holeplug, hydrated
w/ 3 gallons approved water.

1545 Drill team transports equipment to NACA area

1555 Return to 1036

~~CS~~

~~10/23/18~~

Daily Weather Condition: A.M. ~~CS 10/23/18~~

P.M. Partly cloudy; windy; 53°F

Recorded By: Chris [Signature] 10/23/18
(Signature)

QC Checked by: [Signature] 11/6/18
(Signature)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Facility-wide Groundwater
RVAAP-66

PROJECT NO: October 2018 Sampling Event

Date: (mm/dd/yy): 10/24/18

Page 1 of 1

Task Team Members:

Charles Spurr (Leidos)
John Herbert (Leidos)
Ricky Shanks (Frontz)

Andreas Van Dalen (Frontz)
~~CS 10/24/18~~

Narrative (include time and location):

0820 Drill crew onsite at NACA test facility; Open demolition area #1 (ODAI)

0840 Location DAI tw-001 is moved north out of brush & UXO cleared by John (0'-2') *Approved by Kevin Sedlak *

0850 Daily rig inspection & Kill switch checks

0900 Commence drilling of DAI tw-001

0907 UXO cleared 2'-4'

0917 UXO cleared 4'-6'

0928 UXO cleared 6'-8'

0936 UXO cleared 8'-10'

4-gas: CO: 0 ppm H₂S: 0 ppm LEL: 0% O₂: 20.9% VOC: 0.0 ppm

0945 water encountered @ 12.0' BGS, John Herbert offsite.

1020 OEPA onsite

1025 Begin setting DAI tw-001. screen set @ 17' BGS

1135 Installation of DAI tw-001 complete. 6 x 50lb. Sidley #5 silica sand. 2 x 50lb. 3/8" coarse grade Wyoming bentonite chip Holeplug. Hydrated w/ 5 gallons approved water.

1152 Leave ODA1 & return to 1036.

1220 Depart to collect bottles/samples at DETmw-004

1535 Finish sample collection at DETmw-004

1545 Return to 1036

CS 10/24/18

Daily Weather Condition: A.M. Partly cloudy; 34° F

P.M. Cloudy; 46° F

Recorded By: CS 10/24/18
(Signature)

QC Checked by: [Signature] 11/16/18
(Signature)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Facility-wide Groundwater
RVAAP-66

PROJECT NO: October 2018 Sampling Event

Date: (mm/dd/yy): 10/25/18

Page 1 of 2

Task Team Members:

Charles Spurr (Leidos)
John Herbert (Leidos)
Ricky Shanks (Frontz)

Andreas Van Dalen (Frontz)
Jed Thomas (Leidos)
J.J. "Jules" [unclear]

Narrative (include time and location):

- 0900 Drill crew arrive at Sand Creek Landfill (SCL)
- 0930 Perform rig inspection of Geoprobe 6620DT.
- 0950 Setup at location SCLmw-002
- 0940 UXO cleared 0'-2'
- 1007 UXO cleared 2'-4'
- ~~1013~~ ¹⁰¹³ UXO cleared 4'-6' water encountered @ ~5.1' BGS
- 1027 UXO cleared 6'-8'
- 1050 Begin using hollow stem augers. Setting well @ 8' BGS
- 1120 Hold discussion w/ Heather Adams regarding setting well. A stick-up installation would cover the shallow screen in SCLmw-002 (3'-8' BGS). Possibility for flush mount completion to be a better option. Note: Kevin Sedluc is ok w/ bentonite chips to surface at these shallow wells.
- 1130 Installation of SCLmw-002 complete ^{2.5 x 50lb. filter sand} _{0.5 x 50lb. Hole plug}
- 1140 Setup at location SCLmw-001 UXO cleared 0'-2'
- 1149 UXO cleared 2'-4'
- 1153 UXO cleared 4'-6'
- 1157 UXO cleared 6'-8'
- 1235 No standing water in hole to 8'. UXO cleared 8'-10'
- 1250 Standing water in hole @ 7.5' BGS coming from upper unconsolidated material. Bedrock encountered w/ direct push @ ~10.5' BGS.

Daily Weather Condition: A.M. Sunny; some clouds; 34°F
P.M. Cloudy 53°F

Recorded By: [Signature] 10/25/18 (Signature) QC Checked by: [Signature] 11/6/18 (Signature)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Facility-wide Groundwater
RVAAP-66

PROJECT NO: October 2018 Sampling Event

Date: (mm/dd/yy): 10/25/18

Page 2 of 2

Task Team Members:

See p. 1

CS 10/25/18

Narrative (include time and location):

1300 Drillers take lunch.

1330 Resume work at SCLmw-001. Setup to use hollow stem augers.

1340 Stop Work: A bolt has broken in the head of the geoprobe that spins the augers. The bolt broke and the driller immediately caught the issue. Nothing went flying, no injuries, & no other damage. The geoprobe cannot spin augers and will need repaired. Crew will stop at SCLmw-001 for the day and move to setup on SCLmw-003 w/ CME 55.

1434 Location SCLmw-001 UXO cleared 0'-2'

1435 Perform daily rig inspection of CME 55 LC & Kill switch test.

1443 SCLmw-001 water @ 3' BGS. Augers sitting at 10' BGS

1452 UXO cleared 2'-4'

1505 UXO cleared 4'-6'

1514 UXO cleared 6'-8'

1525 UXO cleared 8'-10'

1545 Augers @ 10'. Crew is cleaned up & returns to 1036

CS

10/25/18

Daily Weather Condition:

A.M. CS 10/25/18

P.M. Cloudy; 53°F

Recorded By:

CLM [Signature] 10/25/18
(Signature)

QC Checked by:

[Signature] 11/6/18
(Signature)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Facility-wide Groundwater
RVAAP-66

PROJECT NO: October 2018 Sampling Event

Date: (mm/dd/yy): 10/29/18

Page 1 of 1

Task Team Members:

Charles Spurr (Leidos)
Ricky Shanks (Frontz)
Andreas Van Dalen (Frontz)

CS 10/29/18

Narrative (include time and location):

0810 Drill crew onsite at Sand Creek Landfill (SCL) to
 setup and complete well installation for SCLmw-003
 & SCLmw-001. Perform daily rig inspection/Killswitch test.

0905 Drillers begin grouting SCLmw-003.
 (1 x 94lb. Type I/II cement, 6 gallons water, &
 2^{gals} bentonite powder)

0925 Grouting complete. Wait for grout to set and move
 to location SCLmw-001 for well installation.

1045 Installation of SCLmw-001 complete. 4 x 50lb #5 sand.
 1 x 50lb. Bentonite chip holeplug. Bedrock shale was sealed
 w/ 2 ft. of bentonite (10'-12') & 1 ft. sand above (9'-10')
 - Drill team begins cleanup activities (remove augers, rigs, etc.)

1145 Return to 1036 for decon & to go pickup additional
 concrete.

1345 Return to SCL, Drillers set well pads & guard posts.
 Leidos begins well development activities.

1530 Pause development of SCLmw-003 ~8 gallons bailed
 *Well pad and guard posts are set for SCLmw-003-

1600 Well pad and guard posts are set for SCLmw-001
 Team departs for 1036.

CS 10/29/18

Daily Weather Condition: A.M. Cloudy; rain; 43° F

P.M. Cloudy; 46° F

Recorded By: CS for 10/29/18 (Signature) QC Checked by: [Signature] for 11/6/18 (Signature)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Facility-wide Groundwater
RVAAP-66

PROJECT NO: October 2018 Sampling Event

Date: (mm/dd/yy): 10/29/18

Page 1 of 1

Task Team Members:

Eli Rogatz (Lidos)
Bryan (Frantz)

~~_____~~
~~_____~~

Narrative (include time and location):

0800 Eli departs field office to develop wells at substation, need to pick up driller from drilling site.
0845 Eli picks up driller, drive to electric substation for well development.
0937 Begin development of ES3TW-003 using whaler mult-stage pump. Well is continuously pumped dry and allowed to recharge.
1052 Remove whaler pump from well and replace with peristaltic to continue well development.
1130 Decon whaler pump and use it to start development of ES3TW-001. Well is continuously allowed to pump dry and recharge.
1400 Complete development of ES3TW-001. 50 gallons of water have been purged from the well.
1401 End purge on ~~001~~⁰⁰³ ES3TW-003 after purging 16 gallons from well. Parameters have stabilized except for turbidity.
1415 Install submersible pump at ES3TW-001 using the "Equipment Rinse" marked submersible pump. Top of pump is at 7.56' btoe.
1425 Install submersible pump at ES3TW-003. Top of pump is at 10.15' btoe.
1452 Decon whaler pump and install at ES3TW-002 to begin development. Well is continuously pumped dry and allowed to recharge.
1550 End development on ES3TW-002. 11 gallons were purged from well and parameters stabilized. Pump will be installed on 10/30/18. Eli off site.

Daily Weather Condition: A.M. 45°F, cloudy, light rain, light wind
P.M. ↓ ↓

Recorded By: Eli Rogatz (Signature) 10/29/18

QC Checked by: [Signature] 11/2/18 (Signature)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Facility-wide Groundwater
RVAAP-66

PROJECT NO: October 2018 Sampling Event

Date: (mm/dd/yy): 10/30/18

Page 1 of 1

Task Team Members:

Rich Sprinzel
Charles Spurr
Ricky Shanks

~~_____~~
~~_____~~
~~_____~~

Narrative (include time and location):

0815 Crew on site to continue development & finish well pads / guard posts. Continue on SCLmw-003
1045 Ohio EPA on site
1130 Ohio EPA offsite
1152 Begin development of SCLmw-002
1230 Development of SCLmw-002. 25 gallons removed
* Begin assisting with land restoration,
* Note SCLmw-003 pumping dry. Development is taking an extended amount of time.
1430 Dedicated bladder pump (well wizard) is set in SCLmw-002. Intake set ~ 1.8' off bottom of well. TD: 7.80'
1603 Complete development of SCLmw-003. Dedicated bladder pump (well wizard) is set ~ 4' off bottom of well, TD: 25.40'
1610 Return to 1036.

~~_____~~
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~~_____~~
~~_____~~

Daily Weather Condition: A.M. Cloudy; 42°F
P.M. Sunny; 55°F

Recorded By: Charles Spurr 10/30/18 (Signature)
QC Checked by: [Signature] 11/2/18 (Signature)

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Facility-wide Groundwater
RVAAP-66

PROJECT NO: October 2018 Sampling Event

Date: (mm/dd/yy): 10/31/18

Page 1 of 1

Task Team Members:

Eli Rogatz

Charles Spurr

~~CS 10/31/18~~

Narrative (include time and location):

0800 On site at Sand Creek Landfill (SCL) to complete development activities.

0835 Begin development of SCLmw-001

~~0945~~^{CS 10/31/18} Recharge is slow. Wait 2 hours. Assist

1005 others with land restoration at SCL.

1205 Resume pumping/development. Well is pumped dry every 30 minutes and reading is taken.

~ 0.5 gallons removed at each 30 minute pumping interval.

1505 > 4 hours has passed and only 10.8 gallons removed of required 23.5, consult Heather Adams.

* Decision made to finish development & set pump.

1550 Pump is set in SCLmw-001. ~ 7' BTCL - intake set. Bladder pump (well wizard)

1610 Return to 1036

~~10/31/18~~

~~CS~~

Daily Weather Condition: A.M. Cloudy; Rain; 53° F

P.M. Cloudy; Rain; 61° F

Recorded By: Eli A. [Signature] 10/31/18
(Signature)

QC Checked by: [Signature] 11/2/18
(Signature) ^{11/2/18}

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B.2 HTRW DRILLING LOGS

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HTRW DRILLING LOG		DISTRICT USACE- Louisville	BOREHOLE NUMBER DA1tw-001
1. COMPANY NAME LEIDOS		2. DRILLING SUBCONTRACTOR Frontz	
3. PROJECT Facility-wide Groundwater RVAAP-66		4. LOCATION 8451 State Route 5 Ravenna OH 44266	
5. NAME OF DRILLER Ricky Shanks		6. MAKE/MODEL OF DRILL CME 55 LC	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT 2' x 1.5" split spoon		8. BOREHOLE LOCATION Open Demolition Area # 1	
		9. DRILL DATE/TIME STARTED: 10/24/18 0900 COMPLETED: 10/24/18 1135	
11. OVERBURDEN THICKNESS N/A		10. DEPTH GROUNDWATER ENCOUNTERED 12.0'	
13. DEPTH DRILLED INTO BEDROCK N/A		12. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION NA	
15. TOTAL DEPTH OF BOREHOLE 18.0'		14. CHEMICAL SAMPLES (circle) Pesticides Explosives VOC SVOCs TAL Metals PAHs PCBs Propellants	
16. DISPOSITION OF BOREHOLE BACKFILL TYPE: <input type="checkbox"/> GROUT <input type="checkbox"/> BENTONITE <input checked="" type="checkbox"/> TEMPORARY WELL POINT <input type="checkbox"/> MONITORING WELL			
17. NOTES BKG: s Background BGS: Below Ground Surface PPM: Parts per Million ▽ : First Water Encountered ▼ : Static Water Level NA: Not Applicable			
LOCATION SKETCH/COMMENTS		SCALE: None	
GEOLOGIST SIGNATURE/DATE Clemson 10/24/18		QA/QC SIGNATURE/DATE El Procy 10/27/18	
		BOREHOLE NUMBER DA1tw-001	

HTRW DRILLING LOG

DISTRICT	BOREHOLE NUMBER
USACE- Louisville	DA1tw-001
1. COMPANY NAME	2. DRILLING SUBCONTRACTOR
LEIDOS	Frontz
SHEET 2 OF 3	

3. PROJECT	4. DIRECTION OF BOREHOLE	DEGREES
Facility-wide Groundwater RVAAP-66	<input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED	

5. NOTES PID MAKE/MODEL: Rae Systems MultiRae+ PID SERIAL#: Pine 13389 Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition

ELEVATION	DEPTH (Feet)	USCS	CLASSIFICATION OF MATERIALS	RECOVERY (ft)	MONITORING (PPM)	REMARKS (Sample IDs/Depths/Etc.)
			, little organics			
	1		0'-0.25' Medium sand + Clay 10YR5/3 Brown very soft; moist, medium plasticity	1.0' / 2.0'	Ambient 0.0	Blow counts 1
	2		0.25'-2.0' Clay some silt 10YR5/6 very soft, moist, med. plasticity			1 2
	3		2.0'-4.0' Clay little silt 10YR5/6 mottled w/ 10YR6/1 very soft, moist, med. plasticity	1.0' / 2.0'		1 1 1 3
	4		4.0'-4.5' S.A.A.			
	5		4.5'-6.0' Clay little silt 10YR5/4 mottled w/ 10YR7/1 soft, damp, low plasticity (med)	1.8' / 2.0'		2 4 6 6
	6		5.5' increased plasticity decreased silt content (little)			
	7		6.0'-8.0' Clay some silt 10YR5/4 mottled w/ 10YR7/1 soft, damp, low plasticity	2.0' / 2.0'		3 5 7
	8		8.0'-10.0' S.A.A.			11
	9			2.0' / 2.0'		4 5 8 9
	10		For 10/24/10			

GEOLOGIST SIGNATURE/DATE	QA/QC SIGNATURE/DATE	BOREHOLE NUMBER
<i>[Signature]</i> 10/24/10	<i>[Signature]</i> 10/25/10	DA1tw-001

HTRW DRILLING LOG

DISTRICT: USACE- Louisville
 BOREHOLE NUMBER: DAItw-001

1. COMPANY NAME: LEIDOS
 2. DRILLING SUBCONTRACTOR: Frontz
 SHEET 3 OF 3

3. PROJECT: Facility-wide Groundwater RVAAP-66
 4. DIRECTION OF BOREHOLE: VERTICAL INCLINED DEGREES

5. NOTES: PID MAKE/MODEL: pg. 2
 PID SERIAL#: pg. 2
 Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition

ELEVATION	DEPTH (Feet)	USCS	CLASSIFICATION OF MATERIALS	RECOVERY (ft)	MONITORING (PPM)	REMARKS (Sample IDs/Depths/Etc.)
	11		10.0' - 11.75' Clay ^{little} some silt 10YR5/4 mottled w/ 10YR7/1 Soft, damp, med. plasticity	1.75' 2.0'	Ambient 0.0	3 Blow count
	12		11.75' - 12.0' sand (coarse med. & fine) some gravel little clay; little silt very 10YR5/6 yellow brown soft moist to wet, non-plastic			4 7 11
	13		12.0' - 14.0' S.A.A. wet to saturated	1.5' 2.0'		8 water @ 12.0' 8 BGS 5 saturated zone 5 12'-18'
	14		↓ ↓			
	15		14.0' - 16.0' S.A.A. saturated	1.0' 2.0'		2 3 3 3
	16		↓ ↓			
	17		16.0' - 18.0' S.A.A.			3 3 2 2
	18		↓ ↓			
	19		terminated at 18.0' BGS			
	20			CS 10/24/18		

GEOLOGIST SIGNATURE/DATE: *Ch...* 10/24/18
 QA/QC SIGNATURE/DATE: *El...* 10/25/18
 BOREHOLE NUMBER: DAItw-001

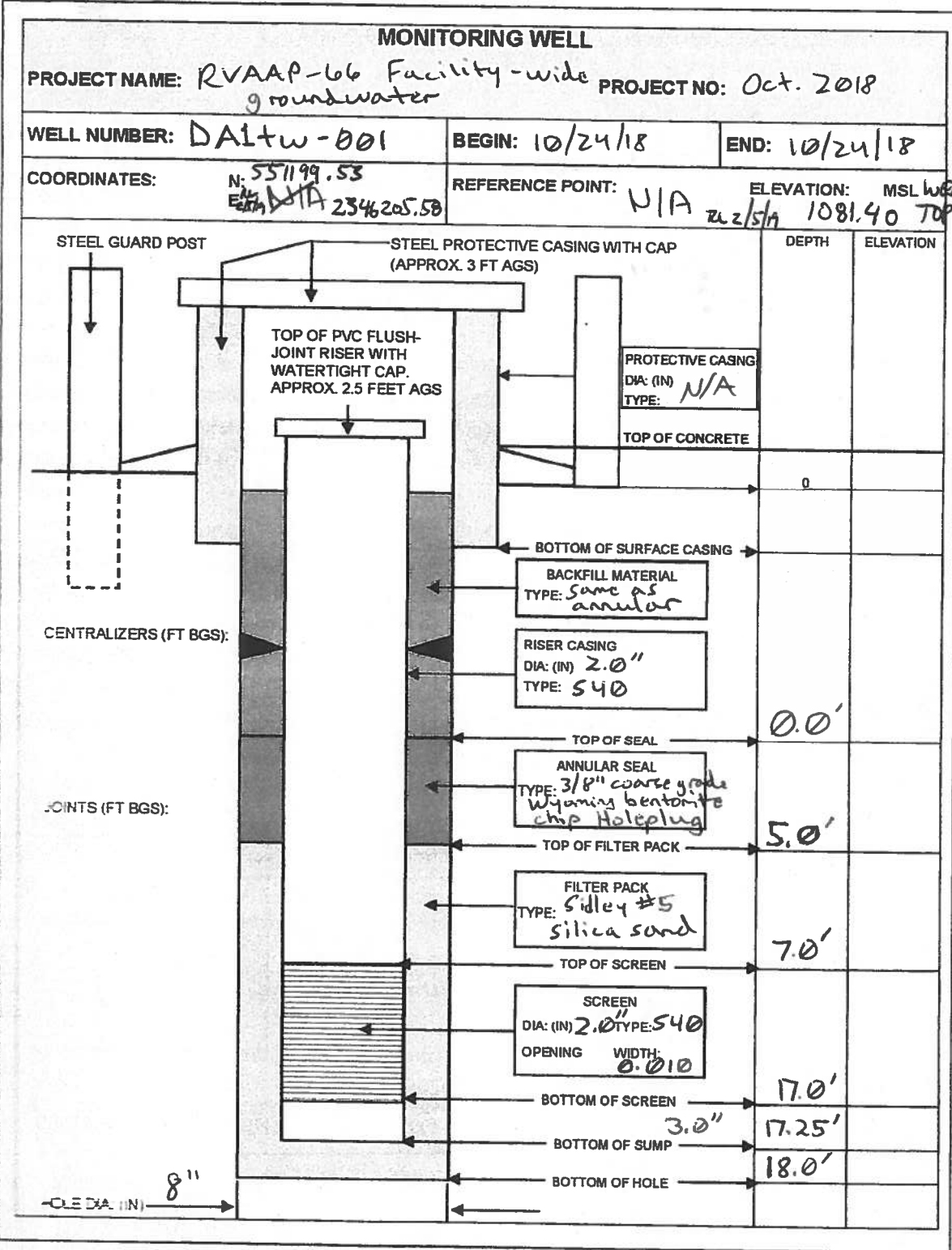


Figure 5-10. Example of Well Construction Diagram Used in Logbooks

HTRW DRILLING LOG		DISTRICT USACE- Louisville	BOREHOLE NUMBER SCLmw-001
1. COMPANY NAME LEIDOS		2. DRILLING SUBCONTRACTOR Frontz	SHEET 1 OF 3
3. PROJECT Facility-wide Groundwater RVAAP-66		4. LOCATION 8451 State Route 5 Ravenna OH 44266	
5. NAME OF DRILLER Ricky Shanks		6. MAKE/MODEL OF DRILL Geoprobe 6620DT	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT 1.5" x 4' acetate liner direct push dual tube 2.25"		8. BOREHOLE LOCATION Sand Creek Landfill	
		9. DRILL DATE/TIME STARTED 10/25/18	COMPLETED 10/29/18
		10. DEPTH GROUNDWATER ENCOUNTERED 5.5'	
11. OVERBURDEN THICKNESS N/A		12. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION NA	
13. DEPTH DRILLED INTO BEDROCK N/A		14. CHEMICAL SAMPLES (circle) VOC SVOCs PAHs PCBs	
15. TOTAL DEPTH OF BOREHOLE 12.0'		Pesticides Explosives TAL Metals Propellants	
16. DISPOSITION OF BOREHOLE			
BACKFILL TYPE: <input type="checkbox"/> GROUT <input type="checkbox"/> BENTONITE <input type="checkbox"/> TEMPORARY WELL POINT <input checked="" type="checkbox"/> MONITORING WELL			
17. NOTES BKG: ≤ Background BGS: Below Ground Surface PPM: Parts per Million ▽ : First Water Encountered ▼ : Static Water Level NA: Not Applicable			
LOCATION SKETCH/COMMENTS			SCALE: None
GEOLOGIST SIGNATURE/DATE Cee for 10/29/18		QA/QC SIGNATURE/DATE [Signature] 11/29/18	BOREHOLE NUMBER SCLmw-001

HTRW DRILLING LOG

DISTRICT: USACE- Louisville
 BOREHOLE NUMBER: SCLmw-001
 1. COMPANY NAME: LEIDOS
 2. DRILLING SUBCONTRACTOR: Frontz
 SHEET 2 OF 3

3. PROJECT: Facility-wide Groundwater RVAAP-66
 4. DIRECTION OF BOREHOLE: VERTICAL INCLINED DEGREES

5. NOTES: PID MAKE/MODEL: MultiRae + PID SERIAL#: Pine 13389
 Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition

ELEVATION	DEPTH (Feet)	USCS	CLASSIFICATION OF MATERIALS	RECOVERY (ft)	MONITORING (PPM)	REMARKS (Sample IDs/Depths/Etc.)
	1		0-2.0' Silt & Clay 10YR 3/3 trace organics damp to moist very soft non-plastic	0.4' / 2.0'	Ambient 0.0	
	2		2.0'-4.0' Fine sand & silt little clay	1.3' / 2.0'		
	3		10YR 5/4 mixed with 10YR 5/2 very soft moist to wet non-plastic			
	4		~3.5' wet S.A.A. 4.0' - 5.0' S.A.A.			
	5		5.0' - 5.25' coarse sand & clay 10YR 4/1	0.75' / 2.0'		wet but not saturated. No standing down water to 8'
	6		Very soft, wet, med. plasticity			
	7		5.25' - 6.0' Clay some silt little fine sand 10YR 5/1 very soft, wet, low plasticity	1.3' / 2.0'		standing water @ 7.5' BGS
	8		6.0' - 6.5' S.A.A. 6.5' - 8.0' Clay & silt little gravel 10YR 5/1			
	9		soft, moist, non-plastic 8.0' - 10' S.A.A. increased gravel content	1.8' / 4.0'		
	10					

GEOLOGIST SIGNATURE/DATE: *Celler* 10/29/18
 QA/QC SIGNATURE/DATE: *[Signature]* 11/20/18
 BOREHOLE NUMBER: SCLmw-001

HTRW DRILLING LOG		DISTRICT		BOREHOLE NUMBER	
1. COMPANY NAME		2. DRILLING SUBCONTRACTOR		SHEET 3 OF 3	
3. PROJECT		4. DIRECTION OF BOREHOLE		DEGREES	
5. NOTES		PID MAKE/MODEL:		PID SERIAL#:	
ELEVATION		DEPTH (Feet)		USCS	
CLASSIFICATION OF MATERIALS		RECOVERY (ft)		MONITORING (PPM)	
REMARKS (Sample IDs/Depths/Etc.)		Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition			
11	10'-10.5' S.A.A.	1.8'	Ambient	Hole plug placed 10'-12' to seal bedrock interface	
12	10.5' - 12.0' weathered shale bedrock damp to dry 10YR 4/1	2.0' 4.0'	0.0		
13					
14					
15					
16					
17					
18					
19					
20					
GEOLOGIST SIGNATURE/DATE		QA/QC SIGNATURE/DATE		BOREHOLE NUMBER	
Cen from 10/29/18		[Signature] 11/16/18		SCLmw-001	

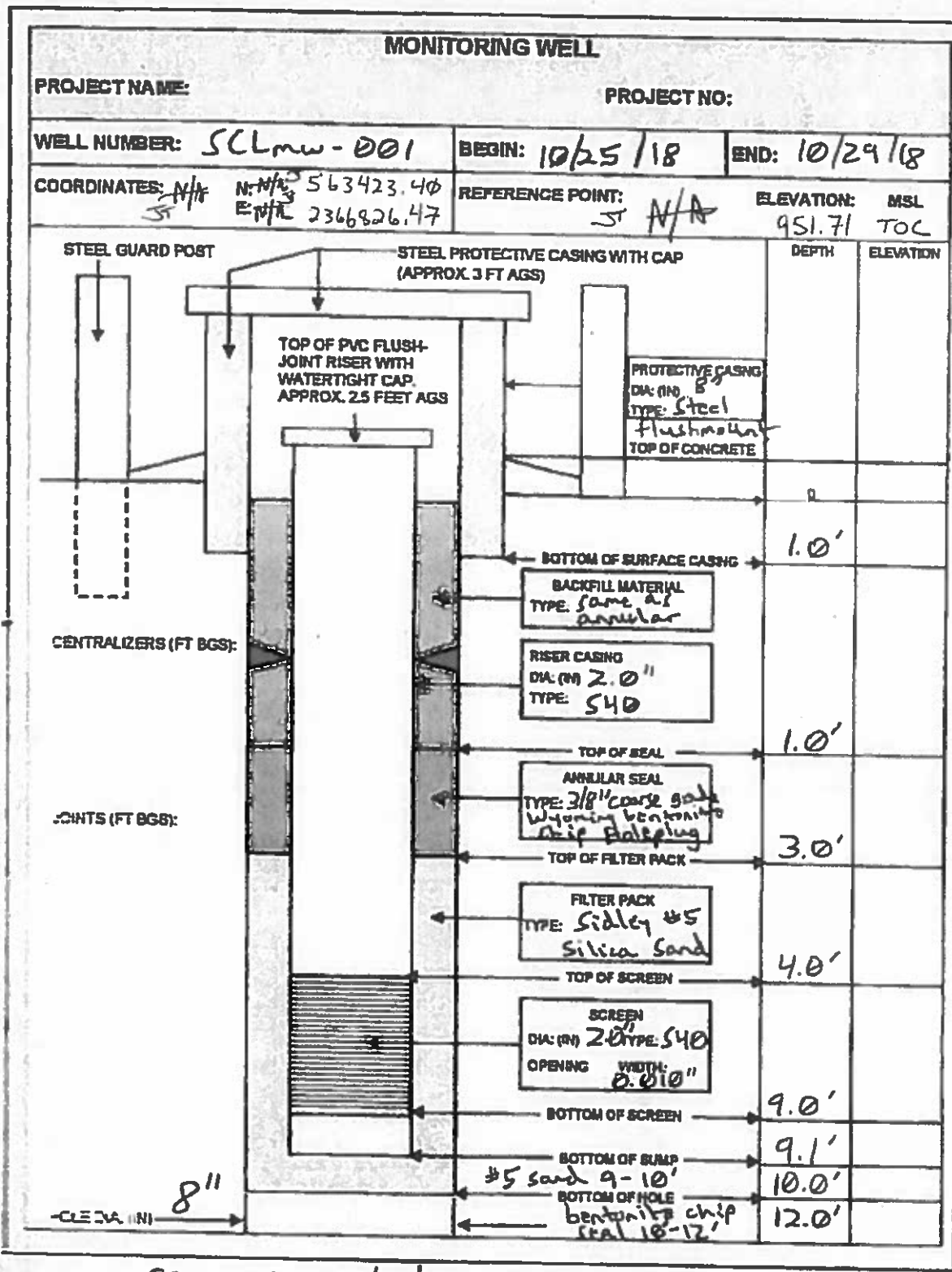
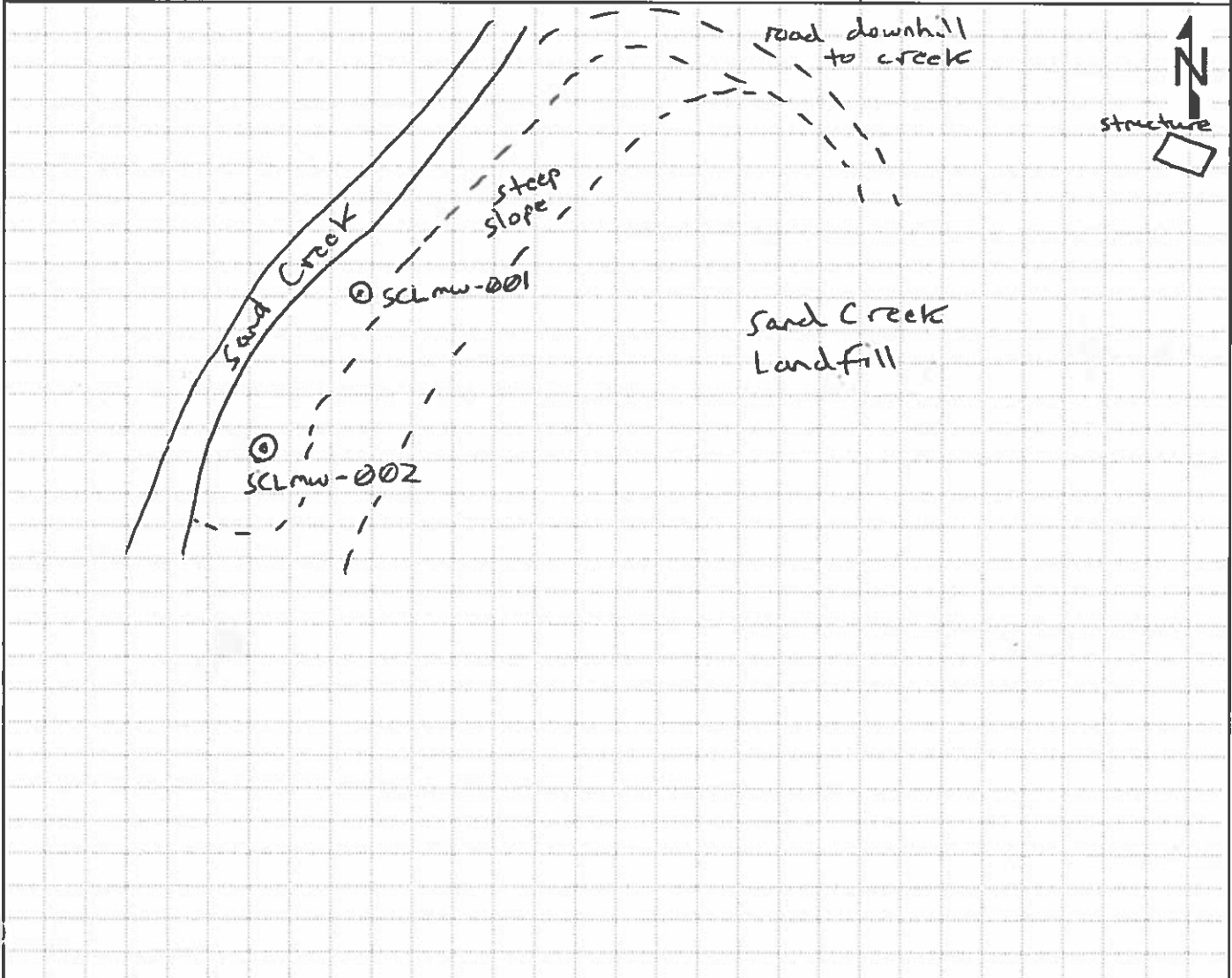


FIGURE 5-10: *Clear for 10/29/18* QA performed by: *[Signature]* *11/2/18*

Figure 5-10. Example of Well Construction Diagram Used in Logbooks

HTRW DRILLING LOG		DISTRICT USACE- Louisville	BOREHOLE NUMBER SCLmw-002
1. COMPANY NAME LEIDOS		2. DRILLING SUBCONTRACTOR Frontz	
3. PROJECT Facility-wide Groundwater RVAAP-66		4. LOCATION 8451 State Route 5 Ravenna OH 44266	
5. NAME OF DRILLER Ricky Shanks		6. MAKE/MODEL OF DRILL Geoprobe 6620 AT	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT 1.5" x 4.0' acetate liner direct push dual tube 2.25"		8. BOREHOLE LOCATION Sand Creek Landfill	
		9. DRILL DATE/TIME STARTED: 10/25/18 0950 COMPLETED: 10/25/18 1130	
		10. DEPTH GROUNDWATER ENCOUNTERED 5.1'	
11. OVERBURDEN THICKNESS N/A		12. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION NA	
13. DEPTH DRILLED INTO BEDROCK N/A		14. CHEMICAL SAMPLES (circle) VOC SVOCs PAHs PCBs Pesticides Explosives TAL Metals Propellants	
15. TOTAL DEPTH OF BOREHOLE 8.0'			
16. DISPOSITION OF BOREHOLE BACKFILL TYPE: <input type="checkbox"/> GROUT <input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> TEMPORARY WELL POINT <input checked="" type="checkbox"/> MONITORING WELL			
17. NOTES BKG: ≤ Background BGS: Below Ground Surface PPM: Parts per Million ▽ : First Water Encountered ▼ : Static Water Level NA: Not Applicable			

LOCATION SKETCH/COMMENTS SCALE: None



GEOLOGIST SIGNATURE/DATE Cler [Signature] 10/25/18	QA/QC SIGNATURE/DATE [Signature] for 11/16/18	BOREHOLE NUMBER SCLmw-002
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HTRW DRILLING LOG

DISTRICT: USACE- Louisville
 BOREHOLE NUMBER: SCLmw-002

1. COMPANY NAME: LEIDOS
 2. DRILLING SUBCONTRACTOR: Frontz
 SHEET 2 OF 2

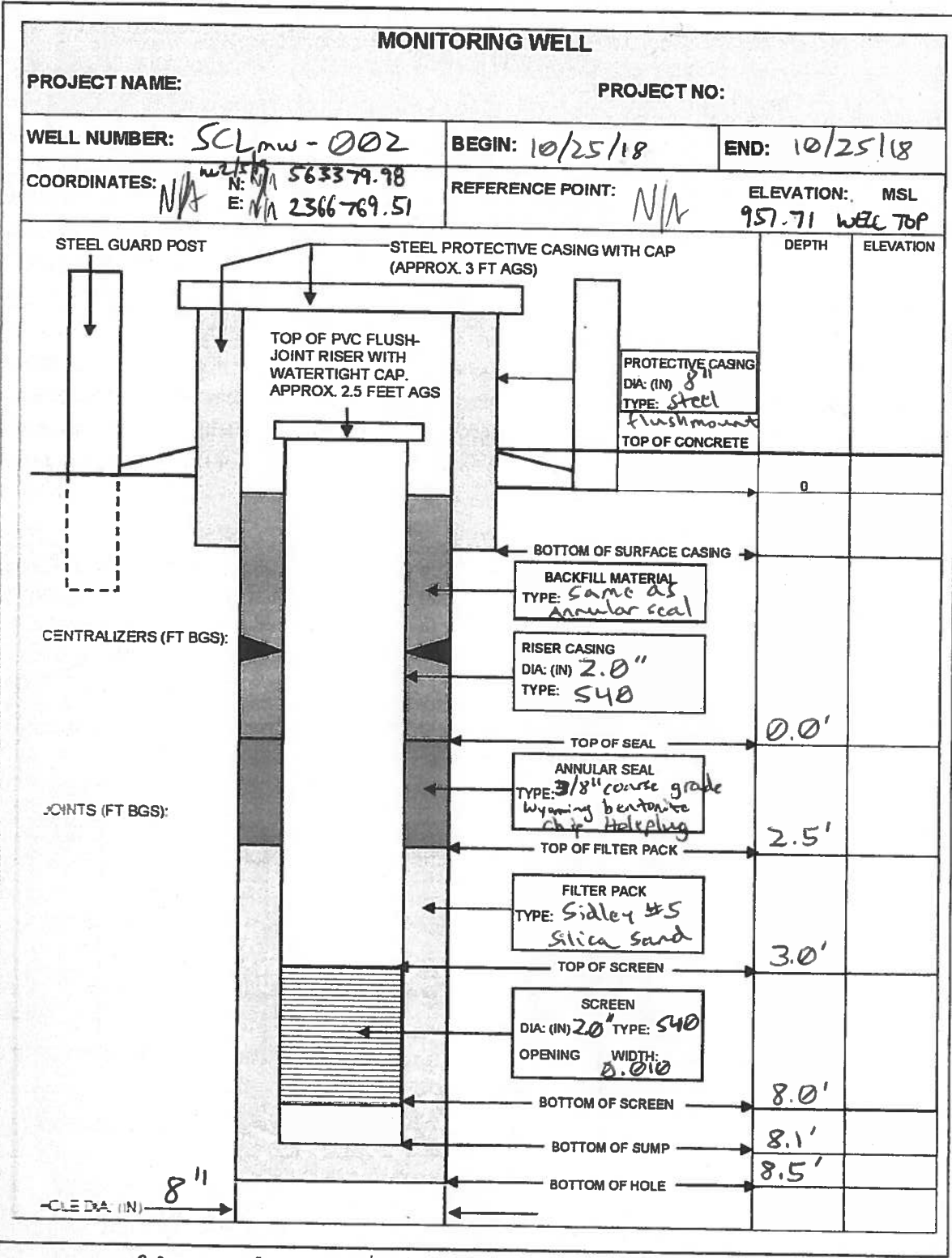
3. PROJECT: Facility-wide Groundwater RVAAP-66
 4. DIRECTION OF BOREHOLE: VERTICAL INCLINED DEGREES

5. NOTES: PID MAKE/MODEL: *Rac MultiRac +* PID SERIAL#: *Pine 13389* Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition

ELEVATION	DEPTH (Feet)	USCS	CLASSIFICATION OF MATERIALS	RECOVERY (ft)	MONITORING (PPM)	REMARKS (Sample IDs/Depths/Etc.)
	1		<u>0'-0.5'</u> Sand (course, med. + fine) and gravel some silt 10YR 7/6 DRY	$\frac{0.6'}{2.0'}$	Ambient 0.0	
	2		<u>0.5'-2.0'</u> Silt some clay 10YR 5/4 very soft damp, non-plastic			
	3		<u>2.0'-3.0'</u> S.A.A.			
	4		<u>3.0'-4.0'</u> Silt & fine sand little clay 10YR 5/6 very soft, moist, non-plastic	$\frac{1.0'}{2.0'}$		
	5 ∇		<u>4.0'-5.75'</u> Fine sand some silt 10YR 5/6 mixed w/ 10YR 5/2 wet to saturated	$\frac{1.0'}{2.0'}$		First water @ 5.1
	6		<u>5.75'-6.0'</u> fine & medium sand little silt 10YR 5/1 saturated			
	7		<u>6.0'-7.0'</u> S.A.A.	$\frac{0.9'}{2.0'}$		
	8		<u>7.0'-8.0'</u> Sand (course, med., + fine) some gravel little silt 10YR 4/1 saturated			
	9					
	10					

CS
10/25/18

GEOLOGIST SIGNATURE/DATE: *Cen for 10/25/18*
 QA/QC SIGNATURE/DATE: *Shel for 11/6/18*
 BOREHOLE NUMBER: SCLmw-002



PL 2/5/19

Recorded by: *Allen for 10/25/18* QA performed by: *[Signature]* 11/2/18

Figure 5-10. Example of Well Construction Diagram Used in Logbooks

HTRW DRILLING LOG		DISTRICT USACE- Louisville	BOREHOLE NUMBER SCLmw - 003
1. COMPANY NAME LEIDOS		2. DRILLING SUBCONTRACTOR Frontz	SHEET 1 OF 4
3. PROJECT Facility-wide Groundwater RVAAP-66		4. LOCATION 8451 State Route 5 Ravenna OH 44266	
5. NAME OF DRILLER Ricky Shanks		6. MAKE/MODEL OF DRILL CME55 LC	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT 1.5" acetate liner CS 10/25/18 2.25" bent tube direct push 2' x 1.5" split spoon		8. BOREHOLE LOCATION Sand Creek Landfill	
		9. DRILL DATE/TIME STARTED: 10/25/18 COMPLETED: 10/26/18	
		10. DEPTH GROUNDWATER ENCOUNTERED 20'	
11. OVERBURDEN THICKNESS N/A		12. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION NA	
13. DEPTH DRILLED INTO BEDROCK N/A		14. CHEMICAL SAMPLES (circle) VOC SVOCs PAHs PCBs Pesticides Explosives TAL Metals Propellants	
15. TOTAL DEPTH OF BOREHOLE 26.0'			
16. DISPOSITION OF BOREHOLE BACKFILL TYPE: <input type="checkbox"/> GROUT <input type="checkbox"/> BENTONITE <input type="checkbox"/> TEMPORARY WELL POINT <input checked="" type="checkbox"/> MONITORING WELL			
17. NOTES BKG: s Background BGS: Below Ground Surface PPM: Parts per Million ▽ : First Water Encountered ▼ : Static Water Level NA: Not Applicable			
LOCATION SKETCH/COMMENTS			SCALE: None
<p>The sketch shows a curved line representing Sand Creek on the left. A dashed line indicates a steep slope. A solid line represents an access path/road. Three monitoring wells are marked with circles: SCLmw-001 is near the creek, SCLmw-002 is further down the slope, and SCLmw-003 is at the bottom right. A north arrow points up, and a rectangle labeled 'structure' is shown in the upper right.</p>			
GEOLOGIST SIGNATURE/DATE Cee for 10/25/18		QA/QC SIGNATURE/DATE Shank for 11/6/18	BOREHOLE NUMBER SCLmw - 003

HTRW DRILLING LOG			DISTRICT	BOREHOLE NUMBER		
COMPANY NAME			USACE- Louisville	SCLmw-003		
LEIDOS			2 DRILLING SUBCONTRACTOR	SHEET 2 OF 4		
Frontz			4. DIRECTION OF BOREHOLE	<input checked="" type="checkbox"/> VERTICAL	<input type="checkbox"/> INCLINED	DEGREES
3. PROJECT Facility-wide Groundwater RVAAP-66			5. NOTES PID MAKE/MODEL: Rac MultiRac+			PID SERIAL#: Pine 13389
			Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition			
ELEVATION	DEPTH (Feet)	USCS	CLASSIFICATION OF MATERIALS	RECOVERY (ft)	MONITORING (PPM)	REMARKS (Sample IDs/Depths/Etc.)
	1		0'-0.5' Clay little coarse sand little organics 10YR 3/2 very soft, moist, med. plasticity	1.0' 2.0'	Ambient 0.0	3 Blow count 6
	2		0.5'-2.0' Highly weathered shale fragments 10YR 4/1 Dry			6 possible erratic shale 5 pulverized by split spoon
	3		2.0'-3.5' S.A.A. 3.5'-4.0' Clay & Silt 10YR 5/6 very soft damp, low plasticity	0.8' 2.0'		3 Clays beneath 3 2 3
	4		4.0'-5.0' S.A.A.			
	5		5.0'-6.0' Clay some silt trace fine sand & gravel 10YR 5/6 mottled w/ 10YR 7/1 Soft, damp, non-plastic	1.0' 0.8' 2.0'		3 5 6 10
	6		6.0'-6.5' S.A.A.			
	7		6.5'-8.0' Clay & Silt trace organics & gravel 10YR 6/4 soft damp non-plastic trace iron staining throughout	1.5' 2.0'		3 3 5 8
	8		8.0'-9.0' S.A.A. increased stiffness (med.) Dry No organics			
	9		9.0'-10' S.A.A. increased gravel content	1.8' 2.0'		6 11 12 14
	10					

GEOLOGIST SIGNATURE/DATE

Cler for 10/26/18

QA/QC SIGNATURE/DATE

Sues for 11/16/18

BOREHOLE NUMBER

SCLmw-003

HTRW DRILLING LOG			DISTRICT	BOREHOLE NUMBER		
COMPANY NAME			USACE- Louisville	SCLmw-003		
LEIDOS			2. DRILLING SUBCONTRACTOR		SHEET 3 OF 4	
3. PROJECT			4. DIRECTION OF BOREHOLE		DEGREES	
Facility-wide Groundwater RVAAP-66			<input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			
5. NOTES			PID SERIAL#		Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition	
PID MAKE/MODEL: see pg. 2			see pg. 2			
ELEVATION	DEPTH (Feet)	USCS	CLASSIFICATION OF MATERIALS	RECOVERY (ft)	MONITORING (PPM)	REMARKS (Sample IDs/Depths/Etc.)
	11		10'-12.0' Clay some silt trace gravel 10YR 6/4 mottled w/ 10YR 7/6 & 10YR 7/1 Hard, damp, low-plasticity med. stiffness	1.5' 2.0'	Ambient 0.0	4 Blow count 9 8 13
	12		12.0'-13.0' S.A.A. w/ trace fine sand & organics	1.75' 2.0'		10 16
	13		13.0'-14.0' Clay some silt trace gravel 10YR 5/1 med. stiffness, damp, low plasticity			14 19
	14		14.0-16.0' S.A.A. soft + moist	1.3 2.0'		4 5 7 10
	15		16.0'-17.0' S.A.A.	1.5' 2.0'		3 3 6 10
	16		17.0-18.0' Clay & Silt 10YR 6/1 very soft, damp, non-plastic			10
	17		18.0'-20.0' Silt little Clay 10YR 5/1 very soft, moist, non-plastic	1.5' 2.0'		4 13 17 20
	18					
	19					
	20					

GEOLOGIST SIGNATURE/DATE Cen for 10/26/18	QA/QC SIGNATURE/DATE Dud for 11/6/18	BOREHOLE NUMBER SCLmw-003
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HTRW DRILLING LOG DISTRICT: USACE- Louisville BOREHOLE NUMBER: SCLmw-003

COMPANY NAME: LEIDOS 2. DRILLING SUBCONTRACTOR: Frantz SHEET 4 OF 4

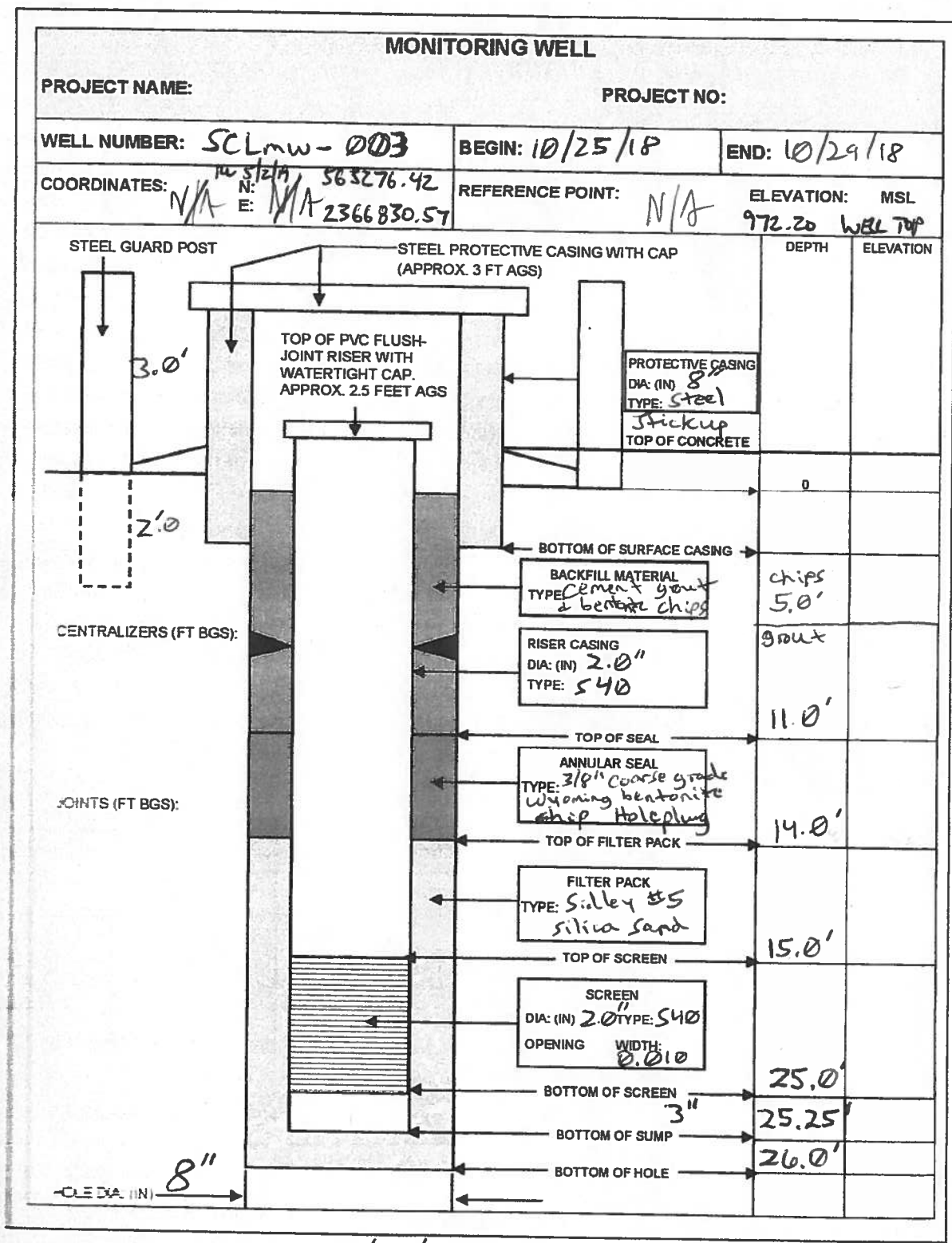
3. PROJECT: Facility-wide Groundwater RVAAP-66 4. DIRECTION OF BOREHOLE: VERTICAL INCLINED DEGREES

5. NOTES: PID MAKE/MODEL: SCA pg. 2 PID SERIAL#: see pg. 2 Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition

ELEVATION	DEPTH (Feet) ▽	USCS	CLASSIFICATION OF MATERIALS	RECOVERY (ft)	MONITORING (PPM/CPM)	REMARKS (Sample IDs/Depths/Core Box/Etc.)
	20'		20.0' - 21.3' Silt some Fine sand, little clay	1.7'	Ambient 0.0	Blow count 7
	21' ▽		10YR 5/1 very soft, wet, non-plastic	2.0'		10 wet zone 14 20'-21.3'
	22		21.3' - 22.0' decreasing sand content wet to moist			13
	23		22.0' - 23.0' Silt little clay 10YR 5/1 very soft, wet to moist non-plastic	1.75'		3
	24		23.0' - 24.0' Silt some clay 10YR 5/1 soft, moist to damp, non-plastic	2.0'		4 7 14
	25		24.0' - 26.0' S.A.A. trace gravel	1.8'		5 9 10 10
	26			2.0'		
	27					
	28					
	29					
	30					

CS 10/26/18

GEOLOGIST SIGNATURE/DATE: [Signature] 10/26/18 QA/QC SIGNATURE/DATE: [Signature] 11/01/18 BOREHOLE NUMBER: SCLmw-003



Checked by: Cell for 10/26/18 QA performed by: [Signature] 11/2/18

Figure 5-10. Example of Well Construction Diagram Used in Logbooks

HTRW DRILLING LOG		DISTRICT USACE- Louisville	BOREHOLE NUMBER ES3tw-001	
1. COMPANY NAME LEIDOS		2. DRILLING SUBCONTRACTOR Frontz		SHEET 1 OF 2
3. PROJECT Facility-wide Groundwater RVAAP-66		4. LOCATION 8451 State Route 5 Ravenna OH 44266		
5. NAME OF DRILLER Ricky Shanks		6. MAKE/MODEL OF DRILL CME 55 LC		
7. SIZES AND TYPES OF SAMPLING EQUIPMENT 2' x 1.5" split spoon		8. BOREHOLE LOCATION Electric Sub-Station No. 3		
		9. DRILL DATE/TIME STARTED: 10/23/18 1150 COMPLETED: 10/23/18 1330		
		10. DEPTH GROUNDWATER ENCOUNTERED 5.5'		
11. OVERBURDEN THICKNESS N/A		12. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION NA		
13. DEPTH DRILLED INTO BEDROCK N/A		14. CHEMICAL SAMPLES (circle) Pesticides Explosives VOC SVOCs PAHs PCBs TAL Metals Propellants		
15. TOTAL DEPTH OF BOREHOLE 10'		16. DISPOSITION OF BOREHOLE		
BACKFILL TYPE: <input type="checkbox"/> GROUT <input type="checkbox"/> BENTONITE <input checked="" type="checkbox"/> TEMPORARY WELL POINT <input type="checkbox"/> MONITORING WELL				
17. NOTES BKG: ≤ Background BGS: Below Ground Surface PPM: Parts per Million ▽ : First Water Encountered ▼ : Static Water Level NA: Not Applicable				
LOCATION SKETCH/COMMENTS			SCALE: None	
GEOLOGIST SIGNATURE/DATE Celan 10/23/18		QA/QC SIGNATURE/DATE El. Puff 10/25/18		BOREHOLE NUMBER ES3tw-001

HTRW DRILLING LOG	DISTRICT	BOREHOLE NUMBER
	USACE- Louisville	ES3tw-001

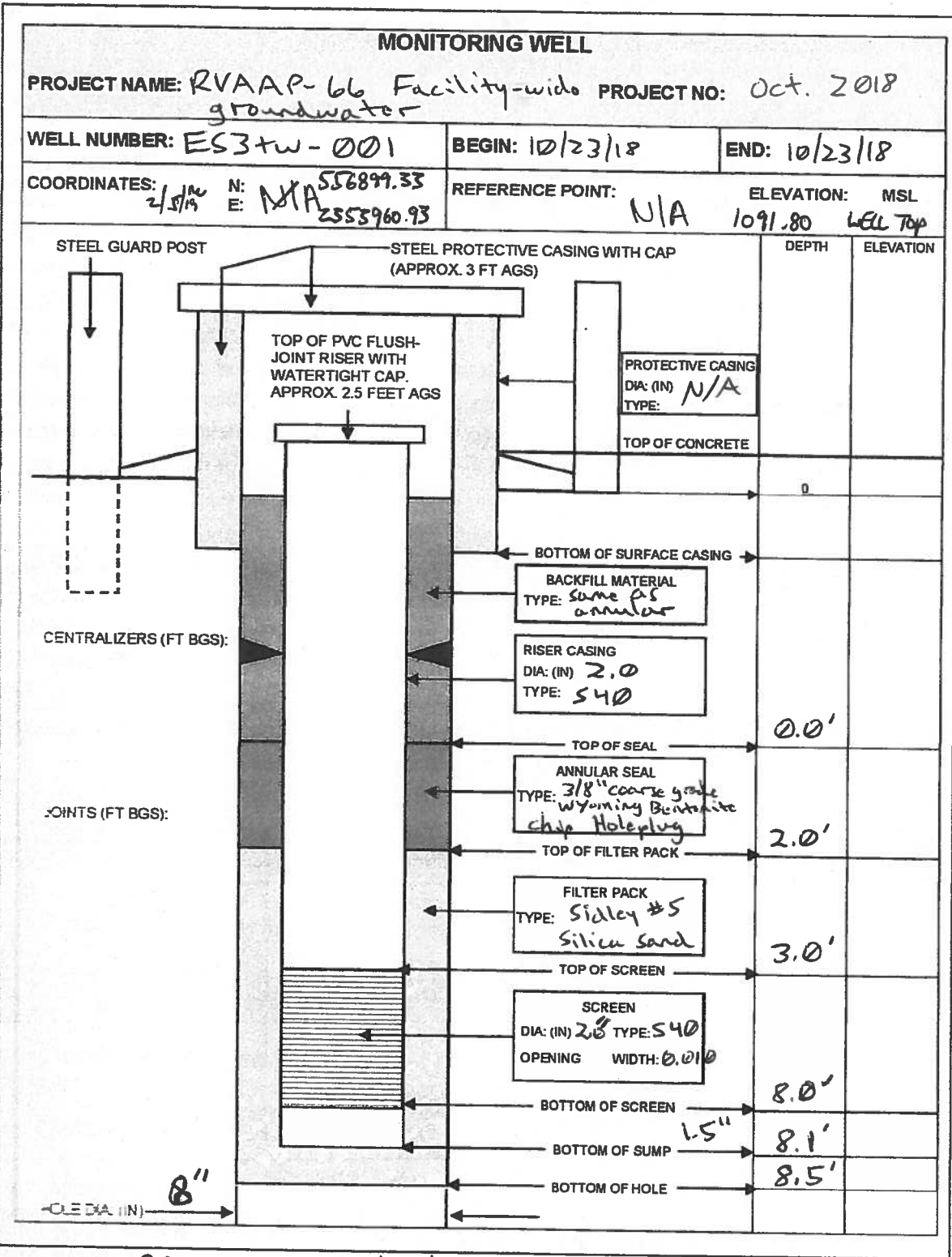
COMPANY NAME	2 DRILLING SUBCONTRACTOR	SHEET 2 OF 2
LEIDOS	Frontz	

3 PROJECT	Facility-wide Groundwater RVAAP-66	4 DIRECTION OF BOREHOLE	<input checked="" type="checkbox"/> VERTICAL	<input type="checkbox"/> INCLINED	DEGREES
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5 NOTES PID MAKE/MODEL: Rae Systems MultiRae+ PID SERIAL#: Pine 13389 Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition

ELEVATION	DEPTH (Feet)	USCS	CLASSIFICATION OF MATERIALS	RECOVERY (ft)	MONITORING (PPM)	REMARKS (Sample IDs/Depths/Etc.)
	1		0'-0.25' medium sand little gravel & organics 10YR5/4 yellowish brown moist	0.75 2.0'	Ambient 0.0	blow counts 1
	2		0.25-2.0' Clay trace gravel 10YR5/6 mottled w/ 10YR6/1 Soft, damp, med. plasticity			2 4 3
	3		2.0'-3.0' S.A.A. ↓ ↓	1.0' 2.0'		4 8 8
	4		3.0-4.0' Clay some silt little med. sand & gravel 10YR5/4 Soft, damp, non-plastic			7
	5		4.0'-5.0' S.A.A. very soft; moist low plasticity	1.4' 2.0'		3 6
	6		5.0'-5.5' fine sand some silt; little clay 10YR5/6 very soft wet non-plastic			10 water @ 5.5' 10
	7		5.5'-6.0' Sand (fine med. & coarse) some gravel little clay & silt 10YR5/6 very soft, wet to saturated, non-plastic	1.5' 2.0'		2 7 saturated zone 10 6.0-7.5' 5.5'-7.5'
	8		6.0'-7.5' S.A.A. 7.5'-8.0' silt some clay 10YR6/4 very soft moist non-plastic			10 10
	9		8.0'-8.5' S.A.A. 8.5'-10' Clay some silt little gravel 10YR5/1 Gray med. stiffness damp non-plastic terminate @ 10' logs	1.0' 2.0'		5 9 10 9

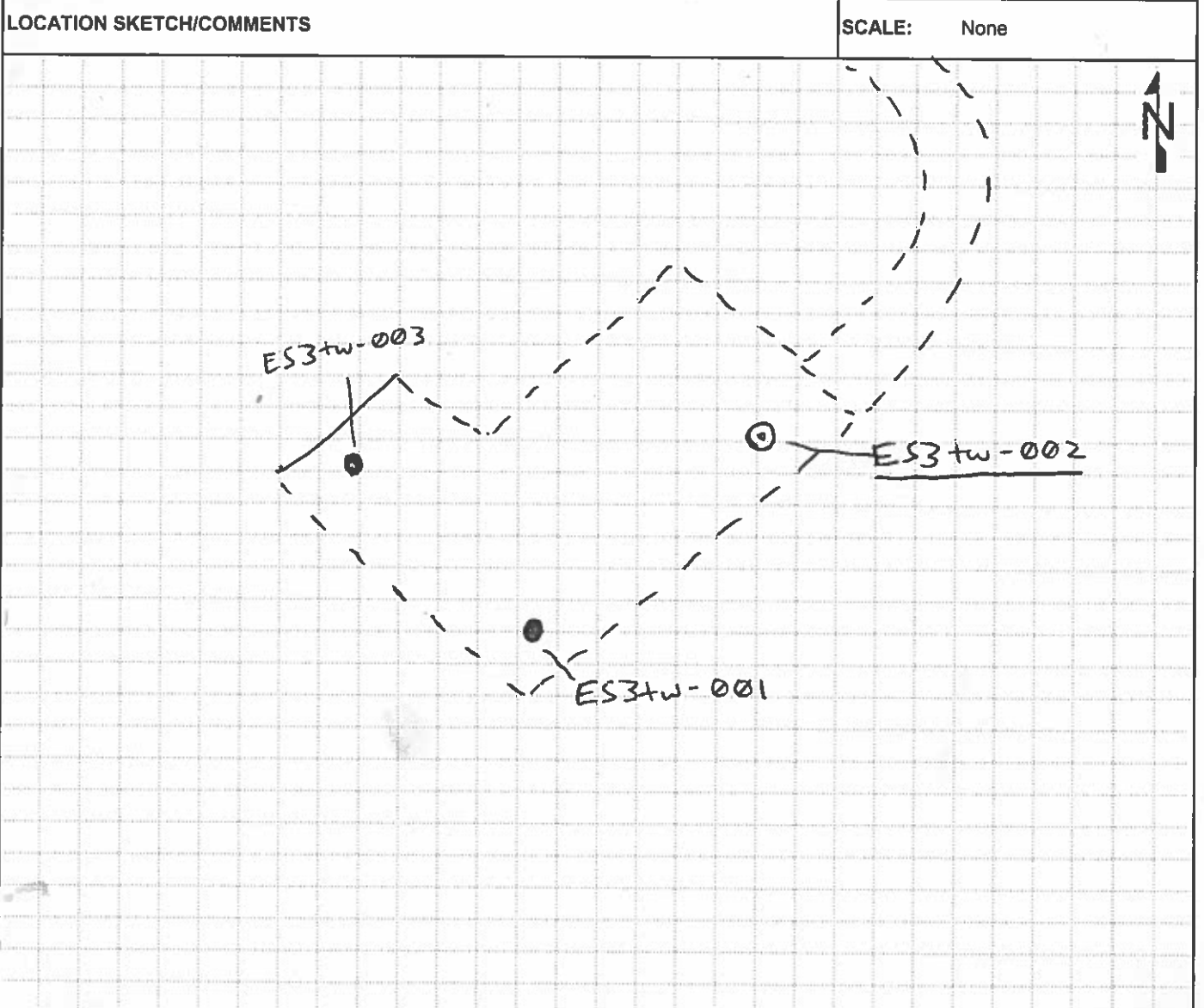
GEOLOGIST SIGNATURE/DATE	QA/QC SIGNATURE/DATE	BOREHOLE NUMBER
Clem [signature] 10/23/18	El. Pro [signature] 10/25/18	ES3tw-001



DESIGNED BY: Chris from 10/23/18 QA performed by: [Signature] 11/5/18

Figure 5-10. Example of Well Construction Diagram Used in Logbooks

HTRW DRILLING LOG		DISTRICT USACE- Louisville	BOREHOLE NUMBER ES3tw-002
1. COMPANY NAME LEIDOS		2. DRILLING SUBCONTRACTOR Frontz	
3. PROJECT Facility-wide Groundwater RVAAP-66		4. LOCATION 8451 State Route 5 Ravenna OH 44266	
5. NAME OF DRILLER Ricky Shanks		6. MAKE/MODEL OF DRILL CME 55LC	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT 2' x 1.5" split spoon		8. BOREHOLE LOCATION Electric Substation No. 3	
		9. DRILL DATE/TIME STARTED: 10/22/18 1350 COMPLETED: 10/23/18 1525	
11. OVERBURDEN THICKNESS N/A		10. DEPTH GROUNDWATER ENCOUNTERED 6' bgs	
13. DEPTH DRILLED INTO BEDROCK N/A		12. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION NA	
15. TOTAL DEPTH OF BOREHOLE 10.0'		14. CHEMICAL SAMPLES (circle) Pesticides Explosives TAL Metals Propellants VOC SVOCs PAHs PCBs	
16. DISPOSITION OF BOREHOLE			
BACKFILL TYPE: <input type="checkbox"/> GROUT <input type="checkbox"/> BENTONITE <input checked="" type="checkbox"/> TEMPORARY WELL POINT <input type="checkbox"/> MONITORING WELL			
17. NOTES BKG: ≤ Background BGS: Below Ground Surface PPM: Parts per Million ▽ : First Water Encountered ▼ : Static Water Level NA: Not Applicable			



GEOLOGIST SIGNATURE/DATE Clem [Signature] 10/23/18	QA/QC SIGNATURE/DATE El. Rogay 10/25/18	BOREHOLE NUMBER ES3tw-002
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HTRW DRILLING LOG

DISTRICT: USACE- Louisville
 BOREHOLE NUMBER: ES3tw-002

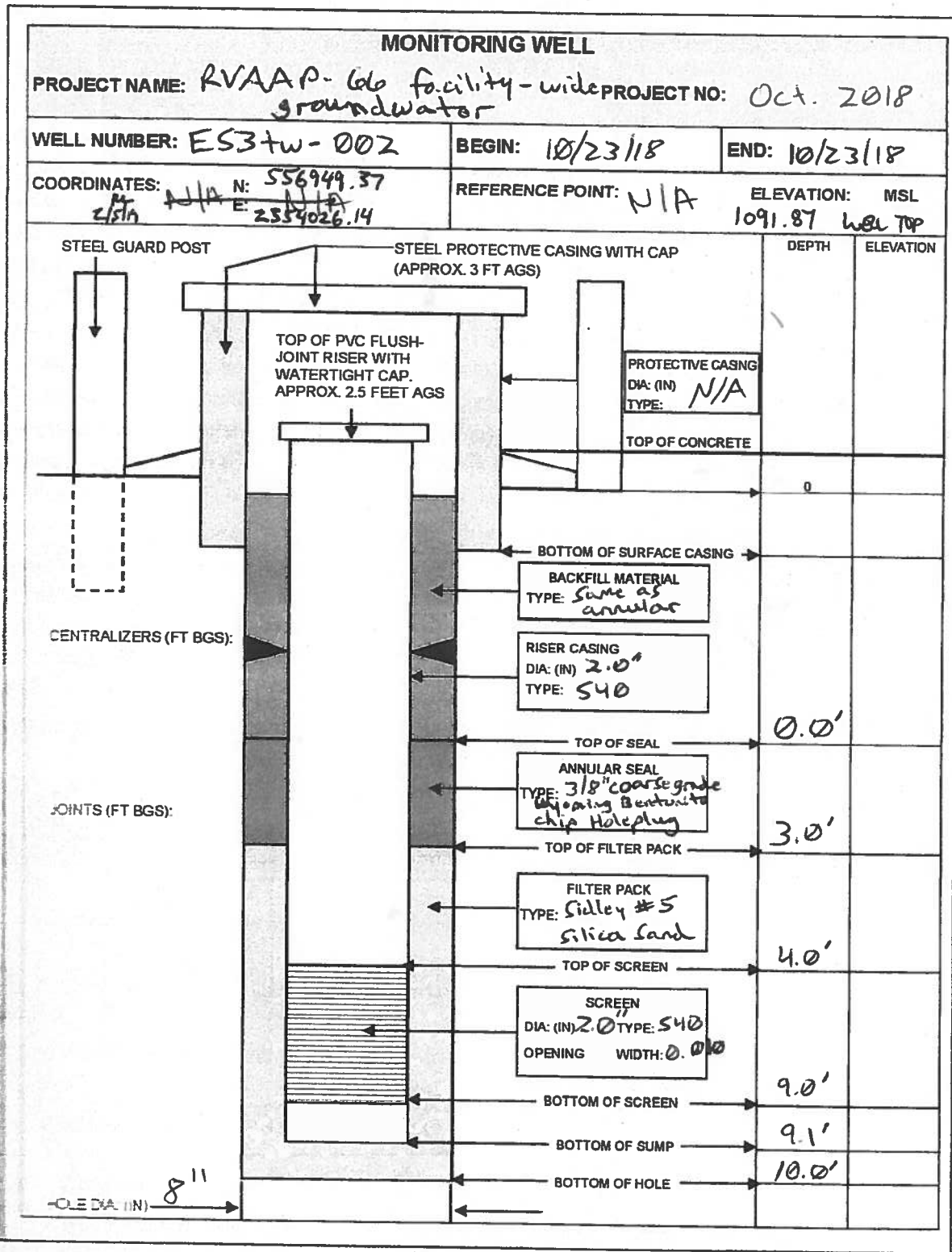
1. COMPANY NAME: LEIDOS
 2. DRILLING SUBCONTRACTOR: Frontz
 SHEET 2 OF 2

3. PROJECT: Facility-wide Groundwater RVAAP-66
 4. DIRECTION OF BOREHOLE: VERTICAL INCLINED DEGREES

5. NOTES: PID MAKE/MODEL: Rae Systems Multirac+ PID SERIAL#: Pine 13389
 Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition

ELEVATION	DEPTH (Feet)	USCS	CLASSIFICATION OF MATERIALS	RECOVERY (ft)	MONITORING (PPM)	REMARKS (Sample IDs/Depths/Etc.)
	1		0-0.25' Coarse Sand & Gravel 10YR5/4 trace organics moist	1.0'	Ambient 0.0	3
	2		0.25-2.0' Coarse Sand & Gravel 10YR7/1 damp (possible fill material?)	2.0'		10 7 3
	3		2.0-3.0' Clay some Silt 10YR6/1 mottled w/ 10YR6/6 Soft, damp, med. plasticity	1.2' 2.0'		2 3
	4		3.0-4.0' increased silt content S.A.A. 3.5'-4.0' Clay some Silt 10YR6/6 mottled w/ 10YR6/1 Soft, damp, low plasticity			4 6
	5		4.0-4.5' S.A.A. 4.5'-6.0' Sand (med + fine) Some silt trace clay & gravel 10YR5/6 very soft, moist to wet non plastic	1.8' 2.0'		2 9 9 8
	6		5.5' increased medium sand content; wet no clay			8 water @ 6'
	7		6.0'-8.0' Sand (coarse, med, + fine) some silt & gravel, trace clay very soft wet to saturated non-plastic	1.0' 2.0'		2 saturated zone 3 6'-8' 8 8
	8		8.0'-8.5' Silt some clay trace gravel 10YR6/4 very soft, moist, non-plastic			4
	9		8.5'-10.0' Clay some sand silt 10YR5/1 Gray moist, non-plastic	1.4' 2.0'		5 6 7
	10		Terminate @ 10' logs			

GEOLOGIST SIGNATURE/DATE: *cel* 10/23/18
 QA/QC SIGNATURE/DATE: *El. P...* 10/25/18
 BOREHOLE NUMBER: ES3tw-002

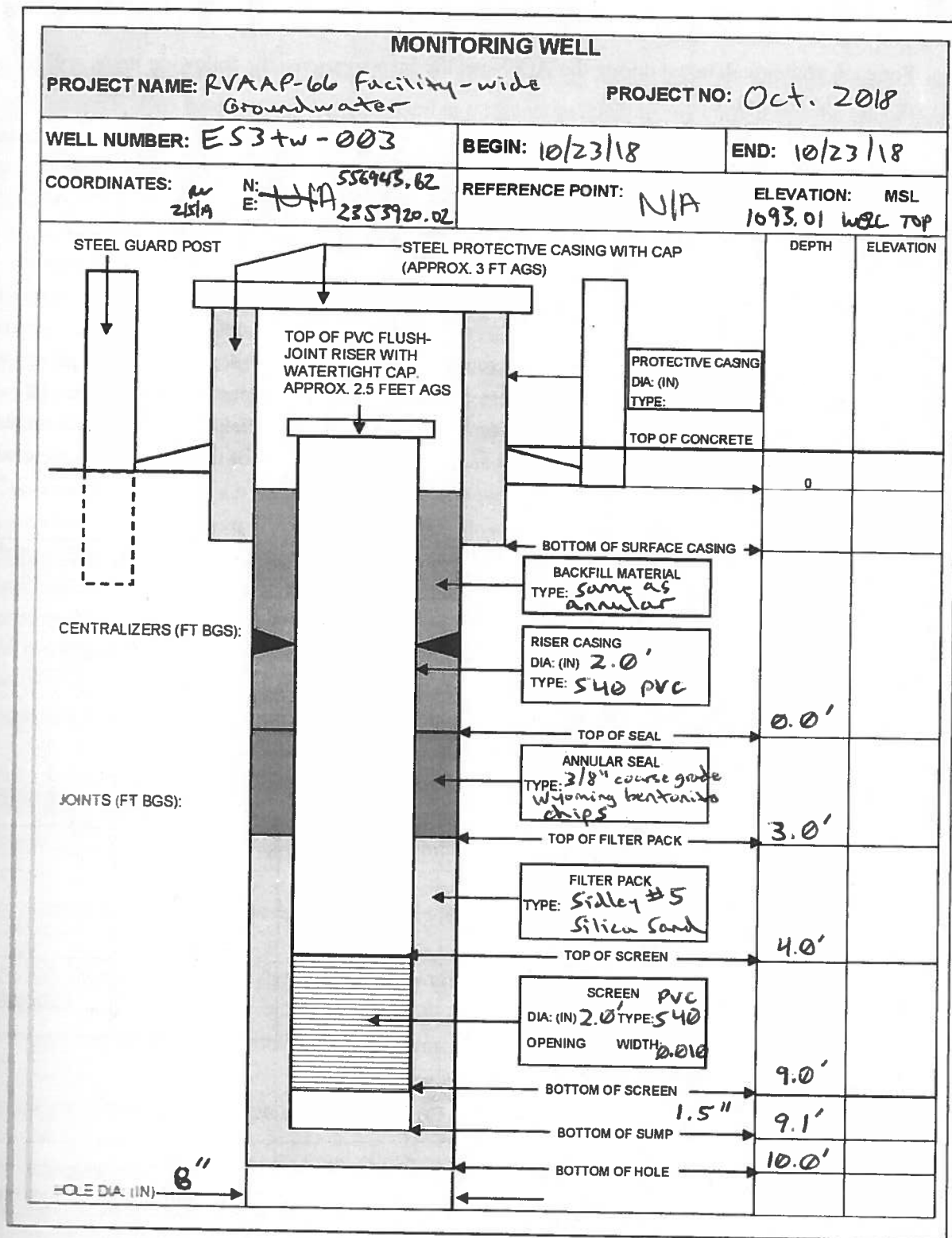


Records of: Clean for 10/23/18 QA performed by: [Signature] 11/5/18

Figure 5-10. Example of Well Construction Diagram Used in Logbooks

HTRW DRILLING LOG		DISTRICT USACE- Louisville	BOREHOLE NUMBER ES3tw-003
1. COMPANY NAME LEIDOS		2. DRILLING SUBCONTRACTOR Frontz	
3. PROJECT Facility-wide Groundwater RVAAP-66		4. LOCATION 8451 State Route 5 Ravenna OH 44266	
5. NAME OF DRILLER Ricky Shanks		6. MAKE/MODEL OF DRILL CME 55LC	
7. SIZES AND TYPES OF SAMPLING EQUIPMENT 2'x 1.5" split spoon		8. BOREHOLE LOCATION Electric Sub-station No. 3	
		9. DRILL DATE/TIME STARTED: 10/23/18 0840 COMPLETED: 10/23/18 1108	
		10. DEPTH GROUNDWATER ENCOUNTERED 7.0'	
11. OVERBURDEN THICKNESS N/A		12. DEPTH TO WATER/ELAPSED TIME AFTER BOREHOLE COMPLETION NA	
13. DEPTH DRILLED INTO BEDROCK N/A		14. CHEMICAL SAMPLES (circle) VOC SVOCs PAHs PCBs Pesticides Explosives TAL Metals Propellants	
15. TOTAL DEPTH OF BOREHOLE 10.0' BGS		16. DISPOSITION OF BOREHOLE	
BACKFILL TYPE: <input type="checkbox"/> GROUT <input type="checkbox"/> BENTONITE <input checked="" type="checkbox"/> TEMPORARY WELL POINT <input type="checkbox"/> MONITORING WELL			
17. NOTES BKG: ≤ Background BGS: Below Ground Surface PPM: Parts per Million ▽ : First Water Encountered ▼ : Static Water Level NA: Not Applicable			
LOCATION SKETCH/COMMENTS		SCALE: None	
GEOLOGIST SIGNATURE/DATE Cem [Signature] 10/23/18		QA/QC SIGNATURE/DATE El. Rogay 10/25/18	
		BOREHOLE NUMBER ES3tw-003	

HTRW DRILLING LOG			DISTRICT	BOREHOLE NUMBER		
			USACE- Louisville	ES3tw-003		
1. COMPANY NAME			2. DRILLING SUBCONTRACTOR		SHEET 2 OF 2	
LEIDOS			Frontz			
3. PROJECT			4. DIRECTION OF BOREHOLE		DEGREES	
Facility-wide Groundwater RVAAP-66			<input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			
5. NOTES PID MAKE/MODEL: Rae Systems MultiRot + PID SERIAL#: 13389 Colors from Munsell Soil Color Chart, Rev 2000 Revised Edition						
ELEVATION	DEPTH (Feet)	USCS	CLASSIFICATION OF MATERIALS	RECOVERY (ft)	MONITORING (PPM)	REMARKS (Sample IDs/Depths/Etc.)
	1		0'-0.25' medium sand some gravel little organic 10YR 5/4 yellowish brown wet	1.1' 2.0'	Ambient 0.0	Blow count 2 2
	2		0.25'-2.0' Clay little silt little gravel 10YR 6/6 mottled w/ 10YR 6/1 damp soft low plasticity			4 7
	3		2.0'-4.0' Clay some silt 10YR 5/6 damp soft low plasticity	1.8' 2.0'		4 5 7 7
	4		↓ ↓			
	5		4.0'-6.0' S.A.A. moist ; trace gravel	1.5' 2.0'		3 4 6 6
	6		↓ ↓			
	7		6.0'-7.0' Clay some silt trace gravel 10YR 5/4 very soft, moist, low plasticity	1.7' 2.0'		2 water @ 7' 3 saturated zone 5 ~7'-7.5' 10
	8		7.0'-7.3' Medium Sand some clay 10YR 5/4 wet, very soft, non-plastic			
	9		7.3'-8.0' Silt some clay 10YR 6/4 moist to damp very soft non-plastic	0.8' 2.0'		2 3 5 5
	10		8.0'-10.0' S.A.A. moist Terminate @ 10ft base			
GEOLOGIST SIGNATURE/DATE			QA/QC SIGNATURE/DATE		BOREHOLE NUMBER	
Cler for 10/23/18			El. Rogay 10/25/18		ES3tw-003	



Recorded by: Charles Spurr Allen for 10/23/18 QA performed by: [Signature] for 11/5/18

Figure 5-10. Example of Well Construction Diagram Used in Logbooks

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B.3 MONITORING WELL DEVELOPMENT FORMS

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MONITORING WELL DEVELOPMENT FORM

Project: RVAAP	Location ID: DATW-001	Date Developed: 10/30/18
Personnel Conducting Development: Ell Rogatz	Date Installed: 10/30/18	
Development Method Used (circle one): Bailer Submersible Pump Peristaltic Pump	Pump / Bailer Type (size/model): Whaler multi-stage	Pumping Rate (gal/min) = 0.75 gal/min
Development Criteria: (1) Turbidity >10 NTU. or if natural Turbidity >10 NTU, water is clear to the unaided eye and turbidity \pm 10% (2) Sediment thickness < 0.1 ft. or Sediment thickness < 1% well screen Top of pump = 17.3' btoc (3) Removal 5X well volume. See calculation below. (4) 3 consecutive readings of development parameters Pump set at 1310 on 10/30/18		
DEVELOPMENT CONFIRMATION MEASUREMENTS (minimum 24 hours after development)		
Date / Time: 10/31/18	Total Depth (ft btoc): 22 4/16	Depth to water (ft btoc): 4/10/18

PURGE VOLUME CALCULATION			
Well Total Depth before development (ft btoc) =	20.13	Length of screen = (ft)	10'
Depth to Water before development (ft btoc) =	14.54	Saturated thickness of filter pack /screen (Hfp) (ft toc) =	11'
Total water column (H)(ft) =	5.59	Assumed porosity (-) =	0.3
Volume of Riser Casing (gal) = (H) x (V) =	0.91 gal	Volume of Filter Pack (gal) = (Hfp x V x 0.3) - (Hfp x V) =	3.93
Total Well Volume = (Volume of Riser Casing) + (Volume of Filter Pack) =		4.84 gal	
Minimum purge volume = 5 x (Total Well Volume) =		24.2 gal	
Height of casing above ground surface (ft) =	2.54'	Estimated Rate of Recharge (gal/min) =	1/2 gal/min

Diameter of casing (in) (circle one)	Gallons per foot of depth (V) (circle one)
2	0.163
4	0.653
6	1.469
8	2.611
9	3.305
10	4.080
12	5.875

INDICATOR PARAMETERS								
Date / Time	Volume purged (gal)	Temp (°C)	pH (s.u.)	Cond. (mS/cm)	Turb. (NTU)	ORP (mV)	DO (mg/L)	Comments (color, odor)
	Min. 5X Total Volume	($\pm 0.5^\circ\text{C}$)	(± 0.2)	($\pm 3\%$)	(<10 NTU or $\pm 10\%$)	($\pm 20\text{mV}$)	whichever is greater: ($\pm 10\%$ or $< 0.2\text{mg/L}$)	
10/27	2	12.4	7.41	0.702	597.0	136.4	5.52	very turbid / well went dry
11/08	4	12.6	6.99	0.779	1226.9	58.8	4.84	
11/24	6	12.9	6.90	0.685	2250.7	104.8	4.55	
11/23	8	13.0	6.94	0.634	2495.8	158.0	5.41	
12/05	10	12.9	6.91	0.603	2616.8	114.3	5.81	
12/10	14	13.1	6.92	0.564	5428.1	108.1	5.27	
12/30	18	12.9	6.99	0.527	4618.5	184.5	6.50	
12/35	22	12.9	6.90	0.527	1839.4	178.7	4.42	
12/40	27	12.9	6.74	0.404	1116.6	178.7	5.15	
12/55	32	13.3	7.02	0.479	295.7	186.0	6.12	
13/00	35	12.9	6.90	0.481	287.6	180.7	5.72	

QC: 11/12/18

MONITORING WELL DEVELOPMENT FORM

Project: <u>RVAP-66</u> <u>Facility wide groundwater</u>		Location ID: <u>SCLmw-001</u>	Date Developed: <u>10/31/18</u>
Personnel Conducting Development: <u>Charles Spurr</u>		Date Installed:	
Development Method Used (circle one): Bailer <u>Submersible Pump</u> Peristaltic Pump		Pump / Bailor Type (size/model): <u>whaler</u>	Pumping Rate (gal/min) = <u>1.0 initial</u> <u>0.015 final</u>
Development Criteria: (1) Turbidity >10 NTU. or if natural Turbidity >10 NTU, water is clear to the unaided eye and turbidity ± 10% (2) Sediment thickness < 0.1 ft. or Sediment thickness < 1% well screen (3) Removal 5X well volume. See calculation below. (4) 3 consecutive readings of development parameters			
DEVELOPMENT CONFIRMATION MEASUREMENTS (minimum 24 hours after development)			
Date / Time: <u>N/A</u>		Total Depth (ft btoc): <u>N/A</u>	Depth to water (ft btoc): <u>N/A</u>

PURGE VOLUME CALCULATION			
Well Total Depth before development (ft btoc) =	<u>8.87'</u>	Length of screen = (ft)	<u>5.0</u>
Depth to Water before development (ft btoc) =	<u>3.96'</u>	Saturated thickness of filter pack /screen (Hfp) (ft toc) =	<u>6.0</u>
Total water column (H)(ft) =	<u>4.91</u>	Assumed porosity (-) =	<u>0.3</u>
Volume of Riser Casing (gal) = (H) x (V) =	<u>0.80</u>	Volume of Filter Pack (gal) = (Hfp x V x 0.3) - (Hfp x V) =	<u>4.70</u> <u>3.90</u>
Total Well Volume = (Volume of Riser Casing) + (Volume of Filter Pack) =			<u>4.70</u>
Minimum purge volume = 5 x (Total Well Volume) =			<u>23.5</u>
Height of casing above ground surface (ft) =	<u>Flush mount</u>	Estimated Rate of Recharge (gal/min) =	<u>~0.015</u>

Diameter of casing (in) (circle one)	Gallons per foot of depth (V) (circle one)
2	0.163
4	0.653
6	1.469
8	2.611
9	3.305
10	4.080
12	5.875

INDICATOR PARAMETERS								
0835	Volume purged (gal)	Temp (°C)	pH (s.u.)	Cond. (mS/cm)	Turb. (NTU)	ORP (mV)	DO (mg/l)	Comments (color, odor)
Date / Time	Min. 5X Total Volume	(±0.5°C)	(±0.2)	(±3%)	<10 NTU or ±10%	(±20mV)	whichever is greater: (±10% or <0.2mg/L)	
<u>10/31/18</u>								
<u>0839</u>	<u>~4</u>	<u>13.44</u>	<u>6.66</u>	<u>0.592</u>	<u>>1000</u>	<u>119</u>	<u>7.24</u>	<u>turbid, grayish brown no odor</u>
<u>0849</u>	<u>~5</u>	<u>13.78</u>	<u>7.19</u>	<u>0.510</u>	<u>>1000</u>	<u>88</u>	<u>11.17</u>	<u>same</u>
<u>0904</u>	<u>~5.25</u>	<u>12.84</u>	<u>7.34</u>	<u>0.568</u>	<u>>1000</u>	<u>91</u>	<u>11.70</u>	<u>↓</u>
<u>0925</u>	<u>~5.5</u>	<u>12.87</u>	<u>7.53</u>	<u>0.327</u>	<u>>1000</u>	<u>95</u>	<u>13.65</u>	<u>↓</u>
<u>0945</u>	<u>~5.75</u>	<u>12.67</u>	<u>7.50</u>	<u>0.569</u>	<u>>1000</u>	<u>100</u>	<u>13.06</u>	<u>↓</u>
<u>1005</u>	<u>~5.9</u>	<u>13.03</u>	<u>7.50</u>	<u>0.580</u>	<u>615</u>	<u>104</u>	<u>13.61</u>	<u>↓</u>
<u>1205</u>	<u>~7.15</u>	<u>12.87</u>	<u>7.82</u>	<u>0.564</u>	<u>>1000</u>	<u>105</u>	<u>12.89</u>	<u>↓</u>
<u>1235</u>	<u>~8</u>	<u>12.71</u>	<u>7.67</u>	<u>0.572</u>	<u>>1000</u>	<u>111</u>	<u>12.76</u>	<u>↓</u>
<u>1305</u>	<u>~8.7</u>	<u>12.93</u>	<u>7.62</u>	<u>0.576</u>	<u>>1000</u>	<u>115</u>	<u>13.45</u>	<u>↓ 13.45</u>
<u>1335</u>	<u>~9.3</u>	<u>13.04</u>	<u>7.60</u>	<u>0.582</u>	<u>>1000</u>	<u>116</u>	<u>13.19</u>	

QC: [Signature] 11/2/18
 02/11/2/4

brown no odor
ran dry

MONITORING WELL DEVELOPMENT FORM (CONTINUED)

Project: RVAAP-66

Location ID: SCLmw-001

INDICATOR PARAMETERS

Date / Time	Volume purged (gal)	Temp (°C)	pH (s.u.)	Cond. (mS/cm)	Turb. (NTU)	ORP (mV)	DO (mg/L)	Comments (color, odor)
	<i>Min. 5X Total Volume</i>	<i>(±0.5°C)</i>	<i>(±0.2)</i>	<i>(±3%)</i>	<i>(<10 NTU or ±10%)</i>	<i>(±20mV)</i>	<i>whichever is greater: (±10% or <0.2mg/L)</i>	
10/31/18	9.8	13.01	7.55	0.579	>1000	111	12.96	turbid: grayish brown
1435	10.3	13.07	7.63	0.573	983	114	13.00	pumped dry
1505	10.8	13.11	7.58	0.578	>1000	112	13.10	1
Development complete ~11 gallons total removed								
<i>CS</i> <i>10/31/18</i>								

QC [Signature] 11/2/18

MONITORING WELL DEVELOPMENT FORM

Project: RVAAP-66	Location ID: SCLmw-002	Date Developed: 10/30/18
Personnel Conducting Development: C. Spurr	Date Installed: 10/25/18	
Development Method Used (circle one): Bailer Submersible Pump Peristaltic Pump	Pump / Bailor Type (size/model): 2 stage whaler	Pumping Rate (gal/min) = ~ 0.8
Development Criteria: (1) Turbidity >10 NTU. <u>or</u> if natural Turbidity >10 NTU, water is clear to the unaided eye and turbidity ± 10% (2) Sediment thickness < 0.1 ft. <u>or</u> Sediment thickness < 1% well screen (3) Removal 5X well volume. See calculation below. (4) 3 consecutive readings of development parameters		
DEVELOPMENT CONFIRMATION MEASUREMENTS (minimum 24 hours after development)		
Date / Time: 10/30/18	Total Depth (ft btoc): 7.85	Depth to water (ft btoc): 4.48

** Taken before setting pump*

PURGE VOLUME CALCULATION			
Well Total Depth before development (ft btoc) =	7.80'	Length of screen = (ft)	5.0
Depth to Water before development (ft btoc) =	4.54'	Saturated thickness of filter pack /screen (Hfp) (ft toc) =	1120/0
Total water column (H) (ft) =	3.26	Assumed porosity (-) =	0.3
Volume of Riser Casing (gal) = (H) x (V) =	12.16 gal	Volume of Filter Pack (gal) = (Hfp x V x 0.3) - (Hfp x V) =	12.91
Total Well Volume = (Volume of Riser Casing) + (Volume of Filter Pack) =			4.79
Minimum purge volume = 5 x (Total Well Volume) =			23.9
Height of casing above ground surface (ft) =	- 0.25	Estimated Rate of Recharge (gal/min) =	> 0.8

INDICATOR PARAMETERS								
Date / Time	Volume purged (gal)	Temp (°C)	pH (s.u.)	Cond. (mS/cm)	Turb. (NTU)	ORP (mV)	DO (mg/L)	Comments (color, odor)
start 1152								
	Min. 5X Total Volume	(±0.5°C)	(±0.2)	(±3%)	(<10 NTU or ±10%)	(±20mV)	whichever is greater: (±10% or <0.2mg/L)	
10/30/18								
1158	~ 3	11.29	6.66	0.686	> 1000	- 56	6.69	turbid gray, no odor
1208	~ 8	11.49	6.60	0.697	168	- 76	6.63	
1213	~ 12	11.86	6.61	0.692	36.5	- 72	5.28	
1218	~ 16	11.95	6.66	0.706	8.0	- 77	6.33	
1223	~ 20	11.98	6.73	0.710	9.3	- 79	5.94	
1228	~ 24	12.09	6.77	0.718	4.3	- 81	6.36	visibly clear, no fines

QC: [Signature] 11/20/18

MONITORING WELL DEVELOPMENT FORM

Project: RMAAP-66 Facility-wide Groundwater		Location ID: SCLmw-003	Date Developed: 10/29-30/2018
Personnel Conducting Development: C. Spurr / R. Sprinzl		Date Installed: 10/26/18 (Frontz Drilling)	
Development Method Used (circle one): Bailer <u>Submersible Pump</u> Peristaltic Pump		Pump / Bailor Type (size/model): DP Fine Env. Teflon 2" x 36" Bailor Multi-stage PVC Pumps	Pumping Rate (gal/min) = 4.1 → 0.8
Development Criteria: (1) Turbidity >10 NTU. <u>or</u> if natural Turbidity >10 NTU, water is clear to the unaided eye and turbidity ± 10% (2) Sediment thickness < 0.1 ft. <u>or</u> Sediment thickness < 1% well screen (3) Removal 5X well volume. See calculation below. (4) 3 consecutive readings of development parameters			
DEVELOPMENT CONFIRMATION MEASUREMENTS (minimum 24 hours after development)			
Date / Time: 10/29/18		Total Depth (ft btoc): 12.1/2014	Depth to water (ft btoc): 11/29/18

PURGE VOLUME CALCULATION																				
Well Total Depth before development (ft btoc)=	26.40	Length of screen = (ft)	10	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Diameter of casing (in) (circle one)</th> <th>Gallons per foot of depth (V) (circle one)</th> </tr> </thead> <tbody> <tr><td>2</td><td>0.163</td></tr> <tr><td>4</td><td>0.653</td></tr> <tr><td>6</td><td>1.469</td></tr> <tr><td>8</td><td>2.611</td></tr> <tr><td>9</td><td>3.305</td></tr> <tr><td>10</td><td>4.080</td></tr> <tr><td>12</td><td>5.875</td></tr> </tbody> </table>	Diameter of casing (in) (circle one)	Gallons per foot of depth (V) (circle one)	2	0.163	4	0.653	6	1.469	8	2.611	9	3.305	10	4.080	12	5.875
Diameter of casing (in) (circle one)	Gallons per foot of depth (V) (circle one)																			
2	0.163																			
4	0.653																			
6	1.469																			
8	2.611																			
9	3.305																			
10	4.080																			
12	5.875																			
Depth to Water before development (ft btoc)=	17.71	Saturated thickness of filter pack /screen (Hfp) (ft toc) =	8.69																	
Total water column (H) (ft)=	8.69	Assumed porosity (-) =	0.3																	
Volume of Riser Casing (gal) = (H) x (V) =	1.39	Volume of Filter Pack (gal) = (Hfp x V x 0.3) - (Hfp x V)=	5.38																	
Total Well Volume = (Volume of Riser Casing) + (Volume of Filter Pack) =		6.7																		
Minimum purge volume = 5 x (Total Well Volume) =		33.5																		
Height of casing above ground surface (ft) =		Estimated Rate of Recharge (gal/min) =	0.1																	

INDICATOR PARAMETERS								
Date / Time	Volume purged (gal)	Temp (°C)	pH (s.u.)	Cond. (mS/cm)	Turb. (NTU)	ORP (mV)	DO (mg/L)	Comments (color, odor)
	Min. 5X Total Volume	(±0.5°C)	(±0.2)	(±3%)	(<10 NTU or ±10%)	(±20mV)	whichever is greater: (±10% or <0.2mg/L)	
10/29/18 1520	~8	11.4	7.59	1.214	1426	96.4	3.27	very turbid, gray, no odor #Bailer
10/30/18 0929	~2.6	9.7	6.83	1.059	2716.28	124.0	8.76	very turbid, gray, ~1L/min
0938	~1.8	11.1	7.12	1.078	2004.43	106.1	7.90	Flow ~700ml/min
0948	~1.6	11.1	7.14	1.965	2393.75	68.5	5.38	~600ml/min
0958	~0.5	—	—	—	—	—	—	No Flow Check Pump Depth/tubing (DRY)
1015	0	10.8	7.17	0.984	2578.78	104.7	4.60	~1100ml/min
1025	~1	—	—	—	—	—	—	Dry → Recharge
1035	~0	11.1	7.18	1.021	2785.67	81.4	5.63	~700ml/min
1048	~0.5	—	—	—	—	—	—	Dry → Recharge upto ~21.15'
1113	0	11.4	7.20	0.852	145.90	68.0	3.76	~700ml/min, slightly less turbid
1118	~0.5	11.4	7.16	1.004	2194.5	57.6	6.33	~500ml/min

R Spurr 10/30/18

QC: *[Signature]* 11/20/18

MONITORING WELL DEVELOPMENT FORM (CONTINUED)

Project: RMAP-66 FW GROUNDWATER

Location ID: SCLMW-003

INDICATOR PARAMETERS

Date / Time	Volume purged (gal)	Temp (°C)	pH (s.u.)	Cond. (mS/cm)	Turb. (NTU)	ORP (mV)	DO (mg/L)	Comments (color, odor)
	Min. 5X Total Volume	(±0.5°C)	(±0.2)	(±3%)	(<10 NTU or ±10%)	(±20mV)	whichever is greater: (±10% or <0.2mg/L)	
10/30/18 1123	~1	11.6	7.16	0.892	2262.70	33.4	3.60	Flow ~300ml/min, WLC Top of pump (23' Bore)
1128	~1	11.8	7.21	0.907	2273.10	19.6	2.59	
1132	~0.5 (~19)	—	—	—	—	—	—	Dry → Recharge
1234	0	11.8	7.30	0.857	1687.09	17.0	2.75	WL ~20.45', ~1400ml/min
1239	~1.5	11.5	7.10	1.042	1791.70	43.0	6.06	~1200ml/min
1243	~1	—	—	—	—	—	—	Dry → Recharge
1336	0	11.7	7.18	0.878	6029.5	16.6	3.17	WL ~20.6', ~700ml/min, turbid ↓
1341	~1	11.6	7.23	0.934	1349.07	39.5	7.63	turbid ↑, ↓
1346	~1	11.6	7.10	1.067	1340.15	57.5	6.30	~500ml/min
1348	~0.5	—	—	—	—	—	—	Dry → Recharge
1400	0	—	—	—	—	—	—	Charged Pump → No Flow
1410	—	—	—	—	—	—	—	Changed Battery → No Flow (WL ~26.2')
1425	—	—	—	—	—	—	—	Changed pump
1440	0	12.6	7.31	0.931	2466.32	99.5	8.15	WL ~20.1', Flow ~3 l/min (0.86 gal)
1443	~3 (~27)	—	—	—	—	—	—	Dry → Recharge
1453	~1	12.2	7.25	1.017	1648.50	90.9	7.50	WL ~23' (10 min Recharge)
1514	~0.5	12.1	7.14	1.006	2180.20	78.9	6.68	Very turbid, ~20 min Recharge
1516	~1	—	—	—	—	—	—	Dry → Recharge, ~1" silt in bucket
1527	0	12.2	7.21	0.789	1080.20	51.5	2.54	~3 l/min (0.8 gal/min)
1528	~1	—	—	—	—	—	—	Dry → Recharge
1539	0	11.9	7.22	0.869	2409.10	43.0	3.45	
1540	~0.5	—	—	—	—	—	—	Dry → Recharge
1548	0	12.0	7.25	0.735	384.09	70.2	6.49	
1550	~1	—	—	—	—	—	—	Dry → Recharge
1555	0	11.2	7.23	0.696	399.05	61.5	5.00	
1557	~1	—	—	—	—	—	—	Dry → Recharge
1602	~0.75	12.1	7.28	0.911	995.01	74.7	6.73	
1603	~0.25 (34)	12.1	7.28	—	—	—	—	Dry; 5x Well Volume Removed → Development Completed.
1605	—	—	—	—	—	—	—	NEW WELL WIZARD PUMP INSTALLED BY C. SPURR.
(Cont.)	—	—	—	—	—	—	—	

RS mg 10/30/18

QC [Signature] 11/20/18

Photo Log: IMG-3801 (silt)

MONITORING WELL DEVELOPMENT FORM

Project: RVAAP	Location ID: ES3TW-001	Date Developed: 10/29/18
Personnel Conducting Development: ER	Date Installed: 10/29/18	"Equipment Rinse"
Development Method Used (circle one): Bailer Submersible Pump Peristaltic Pump	Pump / Bailor Type (size/model): Whaler	Pumping Rate (gal/min) = 0.75 gal/min
Development Criteria: (1) Turbidity >10 NTU. or if natural Turbidity >10 NTU, water is clear to the unaided eye and turbidity \pm 10% (2) Sediment thickness < 0.1 ft. or Sediment thickness < 1% well screen (3) Removal 5X well volume. See calculation below. (4) 3 consecutive readings of development parameters		
DEVELOPMENT CONFIRMATION MEASUREMENTS (minimum 24 hours after development)		
Date / Time: 11/2/18	Total Depth (ft btoc): 12.11/18	Depth to water (ft btoc): 12.4/18

PURGE VOLUME CALCULATION			
Well Total Depth before development (ft btoc) = 5.95	Length of screen = (ft) 5'	Diameter of casing (in) (circle one)	Gallons per foot of depth (V) (circle one)
Depth to Water before development (ft btoc) = 5.95	Saturated thickness of filter pack /screen (Hfp) (ft toc) = 6' x 1.461 = 8.81	2	0.163
Total water column (H) (ft) = 5.15'	Assumed porosity (-) = 0.3	4	0.653
Volume of Riser Casing (gal) = (H) x (V) = 5.15 x 0.163 = 0.839	Volume of Filter Pack (gal) = (Hfp x V x 0.3) - (Hfp x V) = 8.81 - 0.839 = 7.97	6	1.469
Total Well Volume = (Volume of Riser Casing) + (Volume of Filter Pack) = 7.97		8	2.611
Minimum purge volume = 5 x (Total Well Volume) = 39.87		9	3.305
Height of casing above ground surface (ft) = 3.45'	Estimated Rate of Recharge (gal/min) = 4 gal/min	10	4.080
		12	5.875

INDICATOR PARAMETERS								
Date / Time	Volume purged (gal)	Temp (°C)	pH (s.u.)	Cond. (mS/cm)	Turb. (NTU)	ORP (mV)	DO (mg/L)	Comments (color, odor)
	Min. 5X Total Volume	($\pm 0.5^\circ\text{C}$)	(± 0.2)	($\pm 3\%$)	<10 NTU or $\pm 10\%$	($\pm 20\text{mV}$)	whichever is greater: ($\pm 10\%$ or $< 0.2\text{mg/L}$)	
1130	7 gal	10.56	7.18	0.274	>1000	230	7.99	well went dry
1140	12 gal	12.13	7.13	0.260	>1000	231	9.90	well went dry
1152	18 gal	12.13	7.15	0.181	>1000	200	8.71	well went dry
1223	25 gal	12.42	7.50	0.265	>1000	205	10.41	well went dry
1243	32 gal	12.44	7.56	0.267	>1000	201	9.25	well went dry
1324	39 gal	12.12	7.56	0.262	>1000	211	9.14	well went dry
1343	44 gal	13.02	7.52	0.264	>1000	196	9.27	well went dry
1354	47 gal	13.27	7.57	0.263	>1000	192	9.19.12	well went dry
1400	50 gal	13.41	7.58	0.264	>1000	191	9.10	well went dry

QC [Signature] 11/2/18

MONITORING WELL DEVELOPMENT FORM

Project: RUIAAP	Location ID: ES3TW-002	Date Developed: 10/29/18
Personnel Conducting Development: Eli Rogatz	Date Installed: 10/29/18	
Development Method Used (circle one): Bailer <u>Submersible Pump</u> Peristaltic Pump	Pump / Bailor Type (size/model): Whalar Multi-stage	Pumping Rate (gal/min) = 0.75 gal/min
Development Criteria: (1) Turbidity >10 NTU. or if natural Turbidity >10 NTU, water is clear to the unaided eye and turbidity \pm 10% (2) Sediment thickness < 0.1 ft. or Sediment thickness < 1% well screen (3) Removal 5X well volume. See calculation below. (4) 3 consecutive readings of development parameters		
DEVELOPMENT CONFIRMATION MEASUREMENTS (minimum 24 hours after development)		
Date / Time: 10/29/18	Total Depth (ft btoc): 11.69	Depth to water (ft btoc): 6.08

PURGE VOLUME CALCULATION			
Well Total Depth before development (ft btoc) =	11.69	Length of screen = (ft)	5'
Depth to Water before development (ft btoc) =	5.61	Saturated thickness of filter pack /screen (Hfp) (ft toc) =	6'
Total water column (H) (ft) =	6.08	Assumed porosity (-) =	0.3
Volume of Riser Casing (gal) = (H) x (V) =	6.08 x 0.163 = 0.99 gal	Volume of Filter Pack (gal) = (Hfp x V x 0.3) - (Hfp x V) =	6 x 1.469 x 0.3 - 6 x 1.469 = 3.264 gal
Total Well Volume = (Volume of Riser Casing) + (Volume of Filter Pack) =		0.99 + 2.64 = 3.63 gal	
Minimum purge volume = 5 x (Total Well Volume) =		18.15 gal	
Height of casing above ground surface (ft) =	ER 7, 2.50'	Estimated Rate of Recharge (gal/min) =	0.25 gal/min

INDICATOR PARAMETERS								
Date / Time	Volume purged (gal)	Temp (°C)	pH (s.u.)	Cond. (mS/cm)	Turb. (NTU)	ORP (mV)	DO (mg/L)	Comments (color, odor)
	Min. 5X Total Volume	($\pm 0.5^\circ\text{C}$)	(± 0.2)	($\pm 3\%$)	(<10 NTU or $\pm 10\%$)	($\pm 20\text{mV}$)	whichever is greater: ($\pm 10\%$ or < 0.2mg/L)	
11/2	2 gal	12.56	7.02	0.308	1000	215	7.71	well went dry
1524	5 gal	12.62	6.97	0.230	>1000	210	8.52	well went dry
1533	7 gal	12.93	6.81	0.217	>1000	214	10.12	well went dry
1543	9 gal	12.96	6.89	0.222	>1000	211	10.24	well went dry
1556	11 gal	13.77	6.81	0.218	>1000	204	9.91	well went dry
ER 10/29/18								

QC Mr. [Signature] 11/2/18

MONITORING WELL DEVELOPMENT FORM

Project: RVAAP		Location ID: ES3TW-003		Date Developed: 10/29/18	
Personnel Conducting Development: Eli Rogate			Date Installed: 10/29/18		
Development Method Used (circle one): Bailer <input type="checkbox"/> <u>Sdbmersible Pump</u> <input type="checkbox"/> Peristaltic Pump <input type="checkbox"/>			Pump / Bailor Type (size/model): Whaler Multi Stage		Pumping Rate (gal/min) = 0.75 gal/min
Development Criteria: (1) Turbidity >10 NTU. or if natural Turbidity >10 NTU, water is clear to the unaided eye and turbidity \pm 10% (2) Sediment thickness < 0.1 ft. or Sediment thickness < 1% well screen (3) Removal 5X well volume. See calculation below. pump set at 1425 on 10/29 (4) 3 consecutive readings of development parameters Top of pump = 10.15' btoc					
DEVELOPMENT CONFIRMATION MEASUREMENTS (minimum 24 hours after development)					
Date / Time: 11/12/18		Total Depth (ft btoc): 12.14/18		Depth to water (ft btoc): 12.11/18	

PURGE VOLUME CALCULATION					
Well Total Depth before development (ft btoc) =	11.90'	Length of screen = (ft)	5.0'	Diameter of casing (in) (circle one)	Gallons per foot of depth (V) (circle one)
Depth to Water before development (ft btoc) =	5.01'	Saturated thickness of filter pack /screen (Hfp) (ft toc) =	6'		
Total water column (H)(ft) =	6.89'	Assumed porosity (-) =	0.3	2	0.163
Volume of Riser Casing (gal) = (H) x (V) =	1.12 gal	Volume of Filter Pack (gal) = (Hfp x V x 0.3) - (Hfp x V) =	7.69	4	0.653
Total Well Volume = (Volume of Riser Casing) + (Volume of Filter Pack) =			8.81 gal	6	1.469
Minimum purge volume = 5 x (Total Well Volume) =			44.05	8	2.611
Height of casing above ground surface (ft) =	2.90'	Estimated Rate of Recharge (gal/min) =	0.25 gal/min	9	3.305
				10	4.080
				12	5.875

INDICATOR PARAMETERS								
Date / Time	Volume purged (gal)	Temp (°C)	pH (s.u.)	Cond. (mS/cm)	Turb. (NTU)	ORP (mV)	DO (mg/L)	Comments (color, odor)
	Min. 5X Total Volume	($\pm 0.5^\circ\text{C}$)	(± 0.2)	($\pm 3\%$)	(<10 NTU or $\pm 10\%$)	($\pm 20\text{mV}$)	whichever is greater: ($\pm 10\%$ or < 0.2mg/L)	
10/31/18	1	13.51	6.61	0.368	>1000	204	10.13	well went dry
10/42	2	13.42	7.14	0.361		211	10.58	dry
10/50	3	13.08	7.26	0.352		230	9.98	dry
10/12	4	12.41	7.10	0.352		245	11.52	dry
10/34	5	12.48	7.01	0.350		248	13.61	dry
10/52	6	11.34	7.52	0.350		239	8.60	dry
12/17	8	11.93	7.61	0.298		201	8.78	dry
12/57	10	12.71	7.64	0.294		203	9.49	dry
13/24	12	12.60	7.58	0.294		201	9.32	dry
13/50	14	13.06	7.64	0.296		198	9.30	dry
14/01	16	12.98	7.58	0.294	↓	192	9.21	dry

QC [Signature] 11/12/18

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B.4 MONITORING WELL SURVEY REPORT

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SURVEYING

Technical Land Consultants, Inc.

11453 Market St. North Lima, Oh 44432

330-549-9261, 330-549-0738 Fax

20190201 Report: Positioning Camp James A. Garfield Monitoring Wells.

DA1tw-001, ES3tw-001, ES3tw-002, ES3tw-003, SCLmw-001, SCLmw-002, SCLmw-003

Horizontal Datum: Ohio State Plane North Zone (3401) NAD83 (2011) U.S. Survey Feet

Established with Ohio VRS (Virtual Reference System): +/- 1 ft.

Vertical Datum: NAVD 88 U.S. Survey Feet

Vertical Positions: Established by Differential Leveling from Values Provided by Online Positioning User Service (<https://www.ngs.noaa.gov/OPUS/>), Precise Ephemeris: +/- 0.01 ft. relative to Bench Marks.

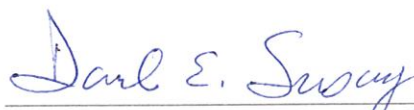
Name	Northing	Easting	Elv 1 Well Top	Elv 2 Ground	Desc.
F011001	551199.53	2346205.58	1081.40	1078.49	DA1tw-001 PVC pipe
F011002	556949.37	2354026.14	1091.87	1089.57	ES3tw-002 PVC pipe
F011004	556899.33	2353960.93	1091.80	1089.30	ES3tw-001 PVC pipe
F011005	556943.62	2353920.02	1093.01	1089.71	ES3tw-003 PVC pipe
F011006	563276.42	2366830.57	972.20	969.70	SCLmw-003 Pipe in Housing
F011007	563423.40	2366826.47	951.37	952.06	SCLmw-001 Pipe in Housing
F011008	563379.98	2366769.51	951.71	952.14	*SCLmw-002 Pipe in Housing
F011009	563389.92	2367124.63	970.11	n/a	**PT 72_Trav Nail TBM
F011003	556938.30	2353999.91	1090.54	n/a	**TPES Top of Bolt TBM

*SCLmw-002 was found to be completely inundated. Rather than risk contaminating the well Elevation was taken on the top of the plastic cap covering the well casing. The ground elevation is on the northerly edge of the metal housing.

** Two additional points positioned for Bench Marks.

All "tw" wells positioned on Northerly Top Edge of PVC pipe and marked with Permanent marker.

All "mw" wells positioned on Northerly Tope Edge of pipe at "V" notch (found).


Daniel E. Susany Ohio PS 6927 7-29-19



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