I. Purpose: **This calculation package outlines the analysis and design for the proposed tangent pile wall to be constructed as part of the HAM-74-11.25 project (PID 113464).**

II. General Basis of Design

The design is based on the following information and engineering assumptions:

- The wall will be configured as a cantilevered tangent pile wall. The tangent pile wall will be comprised of drilled shafts that touch one another tangentially to form a continuous structure. "Structural" and "Plug" shafts will be alternated along the wall alignment. The Structural shafts will be reinforced and will carry the earth loads applied to the wall. Plug shafts will be unreinforced and will transfer earth loading applied to them to the structural shafts.
- Top of wall will be at El. 558.7 ft, at the top of the creek bank. At the time of construction, there is a sloping bank located in front of the wall. However, for design purposes the wall is assumed to have an exposed cantilever from top of bank to the channel bottom (which is at El. 539.7 ft). The wall is thus designed as a 19 ft cantilever.
- Shafts will be constructed with Class S concrete, with minimum compressive strength of 4,500 psi. Reinforcement will be Grade 60. A minimum 1% reinforcement ratio will be provided, and minimum spiral reinforcement will also be provided, per AASHTO 5.6.4.6-1.
- As described below, the wall will retain primarily weathered bedrock and bedrock. Loading demands are not particularly high. Therefore, 3 ft diameter shafts were selected, which is considered to be the smallest practical diameter for the tangent pile wall.
- Lateral capacity for the wall will be achieved by socketing the tangent piles into bedrock. The structural piles will have tip elevation that is a minimum of 15 ft below the existing channel bottom (which is at El. 539.7), per ODOT's request, so tip El. 534.7 ft. Plug piles will extend 5 ft below the channel bottom, so tip El. 544.7 ft.
- Analysis for cantilever wall was performed based on the p-y method using program LPILE 2013 and on AASHTO LRFD requirements. P-modification factors appropriate for a continuous wall were input to LPILE, as subsequently described herein.
- Structural design of the shafts (reinforcement) was performed using the Tedds 2017

program by Tekla and hand calculations.

- Geotechnical data for the specific location of the wall is not available. Information for a nearby ODOT slope repair project (PID 108177), which was implemented on the south bank of the Taylor Creek Channel near the I-74 ramp onto Harrison Road) has been used as a general basis for selecting geotechnical design parameters. The available information for this project is contained in a letter from Terracon, Inc. dated July 27, 2018, to Mr. Ryan Jones of ODOT.
- The wall is anticipated to have a relatively rigid response. Therefore, the design is based on an at-rest earth pressure condition.
- Typical cross section for the wall is shown in **Figure 1**.

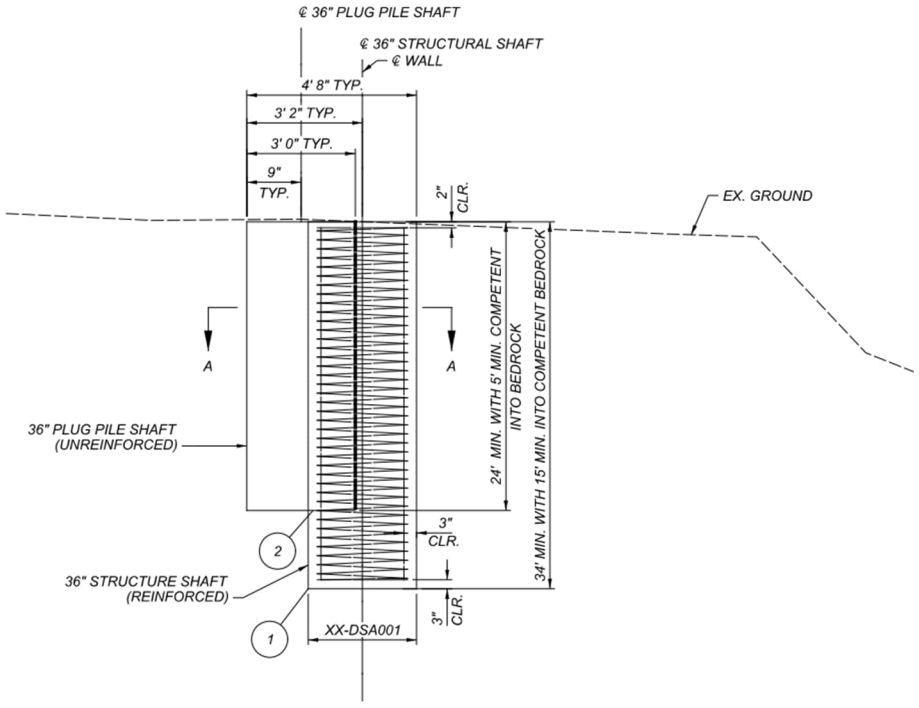

Figure 1: Typical Cross Section of Tangent Pile Wall

III. Stratigraphy and Material Properties

An idealized soil profile was developed from the available geotechnical data and is provided in **Table 3** below. The 2018 Terracon letter indicates that bedrock on site consists of weathered

shale. Based on site visits and photos of the wall site (see Attachment A), an upper zone of soil is apparent, followed by weathered shale. Thicknesses of these zones have been conservatively estimated for design purposes. Material properties have been estimated based on conservative engineering judgement. While earth pressures from the shale bedrock are anticipated to be minimal, a nominal earth pressure coefficient was assigned to this layer.

Table 3: Idealized Subsurface Profile and Ultimate (Unfactored) Material Parameters For Analysis of Cantilever Tangent Piles

Layer Description	Top Depth (ft)	Bottom Depth (ft)	Total Unit Weight (pcf)	Friction Angle (deg)	At-Rest Earth Pressure Coefficient, K_0	LPILE Material Model	k_{rm}	q_u (psi)	Rock Mass Modulus (psi)	RQD (%)
Alluvium and/or Residuum	0 (Ground Surface)	6	125	28	0.54	-	-	-	-	-
Weathered Shale	6	12	145	45	0.29	-	-	-	-	-
Shale	12	Bottom of Shaft	155	-	0.05	Weak Rock	$1x10^{-4}$	400	500,000	50

IV. Loading Conditions

Two load conditions were considered in this analysis: Service Condition I and Strength Condition I. Specific load combination and load factors are shown in the following.

Table 3.4.1-1—Load Combinations and Load Factors

Load Combination Limit State	*DC DD DW EH EV ES EL PS CR SH*	*LL IM CE BR PL LS*	*WA*	*WS*	*WL*	*FR*	*TU*	*TG*	*SE*	Use One of These at a Time: *EQ*	*BL*	*IC*	*CT*	*CV*
Strength I (unless noted)	γ_p	1.75	1.00	—	—	1.00	0.50/1.20	γ_{TG}	γ_{SE}	—	—	—	—	—
Service I	1.00	1.00	1.00	1.00	1.00	1.00	1.00/1.20	γ_{TG}	γ_{SE}	—	—	—	—	—

Table 3.4.1-2—Load Factors for Permanent Loads, γ_p

Type of Load, Foundation Type, and Method Used to Calculate Downdrag		Load Factor	
		Maximum	Minimum
DC: Component and Attachments		1.25	0.90
DC: Strength IV only		1.50	0.90
DD: Downdrag	Piles, α Tomlinson Method	1.40	0.25
	Piles, λ Method	1.05	0.30
	Drilled shafts, O'Neill and Reese (2010) Method	1.25	0.35
DW: Wearing Surfaces and Utilities		1.50	0.65
EH: Horizontal Earth Pressure			
• Active		1.50	0.90
• At-Rest		1.35	0.90
• *AEP* for anchored walls		1.35	N/A
ES: Earth Surcharge		1.50	0.75

Per AASHTO LRFD (2017), load factor for at-rest earth loading (i.e. EH: At-Rest) is 1.35 for the Strength Condition.

AASHTO 3.11.3 states that hydrostatic forces should be added to earth pressures. Hydrostatic forces are factored using the same 1.35 load factor for the Strength I condition.

All load factors were 1.0 for the Service Condition.

A resistance factor of 0.75 is applied to the lateral resistance from soil/rock in the Strength Condition.

V. Load Calculations

The typical design cross section showing calculated loading on the tangent pile wall is shown in **Attachment B**.

Considerations when developing loading on the wall were as follows:

Earth Loading:

- Loading is based on a level backfill configuration and on the material parameters presented in Section III.

- The loading corresponds to a long-term, drained loading condition. By inspection, the drained loading condition will be higher than the temporary, undrained loading condition that will exist while the wall is being constructed, since most of the retained zone consists of weathered bedrock or bedrock.

- As stated previously, earth loading is assumed to be carried by the Structural shafts. Each Structural shaft will support a tributary length of wall of 5 ft (accounting for the proposed 6-inch overlap between adjacent shafts). Therefore, the total earth load on a single Structural shaft was calculated based on the total earth pressure times a tributary width of 5 ft.

Hydrostatic Loading:

- Due to the construction method and configuration and since most of the wall will be embedded into weathered bedrock or bedrock, construction of effective drainage behind the wall will not be practical. As such, the wall will be designed to support hydrostatic forces. It is assumed that hydrostatic pressures exist within the upper 10 ft of the wall only, which includes the assumed soil zone and a portion of the weathered rock zone of the retained earth. A load factor of 1.0 was applied for hydrostatic loading in all load cases.

Earth Surcharge Loading:

- The wall will not experience traffic surcharges, as it is not adjacent to any roadways. It is possible that transient surcharges from construction equipment or similar sources may be applied in the future, but magnitudes are not defined. As such, a nominal surface surcharge load of 125 psf was included in the design and treated as a live loading. A load factor of 1.75 was applied for the Strength I condition.

VI. Analysis Methodology

General

- Analysis was performed in LPILE 2013. The entire wall (free-standing cantilever as well as embedded portion were input to LPILE. This analysis yields deflections and bending moments along the entire soldier pile length of cantilever wall.

LPILE Model

The LPILE models were constructed as follows:

- An entire Structural shaft element (the exposed, free-standing portion of the shaft plus the embedded portion) was modeled in LPILE. Separate model files were created for the Service and Strength I conditions.

- The boundary condition applied to the top of shaft consists of zero shear and zero moment (free head condition).

- The shaft was modeled using the "Round Concrete Shaft (Bored Pile) section type. 1% reinforcement was entered to begin with.

- A basic p-multiplier of 0.50 was applied in the model, to correct the resistance of the wall element to correspond to a continuous wall. In addition, a resistance factor of 0.75 needs to be applied for the Strength I condition, per AASHTO LRFD. Therefore, for analyses of the Strength Condition, a p-multiplier of 0.50*0.75 = 0.375 was used in LPILE analysis. For analyses of the Service Condition, the p-multiplier was 0.50.

- The loading described in Section V above and presented in Attachment B was applied as a distributed lateral load in LPILE for each loading condition. Design loads and parameters were chosen from Section III and IV above.

Axial Loading

The shafts will not support any axial loads, so none were applied.

VII. Results of Analysis

The results of the analyses are summarized in **Table 5**. These results correspond to a reinforcement ratio of 1% and an embedment of 15 ft. Complete outputs of the LPILE runs are shown in **Attachment B**.

Table 5: Summary Results

Load Condition	Embedment Depth and Elevation (ft)	Structural Shaft Reinforcement Ratio (%)	Service Deflection At Top of Pile (in)	Maximum Bending Moment in Shaft (kip-ft)	Maximum Shear in Shaft (kip)
Strength I	15 ft, tip El. 524.7	1.0	--	418.2	152
Service			0.95	345.9	130

- The service deflection is considered to be acceptable.

VIII. Structural Checks

The LPILE-derived reinforcement ratio and maximum Strength I moment/shear were checked for adequacy using the Tedds 2017 software. Calculations are provided in Appendix B. The analysis indicates that a reinforcement ratio of 1% is sufficient to develop the maximum Strength I bending moment of 418.2 K*ft. The factored shear capacity of the 36-inch diameter concrete shaft is also well above maximum shear within the shaft, when accounting for both concrete and spiral reinforcement shear contributions.

IX. Conclusion

The analysis presented herein indicates that the following design configuration for the tangent pile wall is appropriate:

- 3 ft shaft diameter shafts constructed with Class S concrete (ODOT CMS Item 499) and Grade 60 reinforcement.
- Structural Shafts installed to tip El. 534.7 (15 ft below the lowest channel bottom at the wall) and plug shafts installed to El. 544.7.
- Reinforcement ratio of 1%, achieved with (8) #10 bars in a circular arrangement. Spiral reinforcement consisting of #5 bar at 3” spiral pitch.

ATTACHMENT A

Site Photo and Geotechnical Information From Adjacent Project


3 to 5 ft
Top of Weathered Rock

Historical geotech information from adjacent project along I-74 ramp

Approximate Toe Slide Limits
(Based on 7/27/2018 Site Visit)

Electrical Resistivity Survey Line

Approximate Main Slide Limits
(Based on 7/27/2018 Site Visit)

WOODED

B-002-1-18
B-002-2-18
B-002-3-18
B-004-1-18
B-005-1-18
B-008-1-18
B-008-0-07
B-004-0-12
B-003-0-12
B-005-0-12
B-007-0-07

WHITE STRIPE
YELLOW STRIPE
GUARD RAIL
SIGN
ASPHALT PAVEMENT
CONC. WALL

P.I. STA. 10+10.35
Δ = 40° 22′ 51″ (RT)
Dc = 7° 47′ 55″
R = 734.70′
T = 270.18′
L = 517.80′
E = 48.10′

PCC Sta. 14

HORIZONTAL SCALE IN FEET
0 10 20 40

DRAWN KJM
CHECKED DWW

LANDSLIDE EXPLORATION
RAMP Y - STA. 8+00 TO STA. 11+60

HAM-74-11.00

1 / 1

N:\HCN Projects\AutoCAD\2018\118\1185271\780831YP002.dgn Design 7/23/2018 6:34:25 AM kjmankin

PROJECT: HAM-74-11.14	DRILLING FIRM / OPERATOR: ODOT / BM	DRILL RIG: DIEDRICH D-50	STATION / OFFSET: 6+69, 138' LT.	EXPLORATION ID B-002-1-18
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: ODOT / DWW	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: 74	
PID: 108177 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/15/16	ELEVATION: 555.4 (MSL) EOB: 16.5 ft.	PAGE 1 OF 1
START: 7/13/18 END: 7/13/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.9	COORD: Not Recorded	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Temporary Bench Fill Material (approx.)	555.4	1																
	552.4	2																
Overburden Soils		3																
		4																
		5																
		6																
		7																
		8																
		9																
		10																
		11																
	543.4	12																
Gray Shale		TR 13																
		14																
		15																
	538.9	16																
		EOB																

NOTES: BEDROCK SOUNDING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

PROJECT: HAM-74-11.14	DRILLING FIRM / OPERATOR: ODOT / BM	DRILL RIG: DIEDRICH D-50	STATION / OFFSET: 7+62, 127' LT.	EXPLORATION ID B-002-2-18
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: ODOT / DWW	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: 74	
PID: 108177 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/15/16	ELEVATION: 558.1 (MSL) EOB: 19.0 ft.	PAGE 1 OF 1
START: 7/16/18 END: 7/16/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.9	COORD: Not Recorded	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Temporary Bench Fill Material (approx.)	558.1	1 2 3 4 5 6 7																
Overburden Soils	550.6	8 9 10 11 12 13 14																
Gray Shale	543.1	TR 15 16 17 18																
	539.1	EOB 19																

NOTES: BEDROCK SOUNDING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 7/26/18 17:28 - N:\PROJECTS\2018\N1185271\WORKING FILES\N1185271 ODOT HAM-74-11.GPJ

PROJECT: HAM-74-11.14	DRILLING FIRM / OPERATOR: ODOT / BM	DRILL RIG: DIEDRICH D-50	STATION / OFFSET: 8+73, 124' LT.	EXPLORATION ID B-002-3-18
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: ODOT / DWW	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: 74	
PID: 108177 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/15/16	ELEVATION: 561.8 (MSL) EOB: 19.0 ft.	PAGE 1 OF 1
START: 7/16/18 END: 7/16/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.9	COORD: Not Recorded	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
Temporary Bench Fill Material (approx.)	561.8	1 2 3 4 5 6 7 8 9																
Overburden Soils	551.8	10 11 12 13 14																
Gray Shale	546.8	TR 15 16 17 18																
	542.8	EOB 19																

NOTES: BEDROCK SOUNDING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 7/26/18 17:28 - N:\PROJECTS\2018\N1185271\WORKING FILES\N1185271 ODOT HAM-74-11.GPJ

PROJECT: HAM-74-11.14	DRILLING FIRM / OPERATOR: ODOT / RM	DRILL RIG: DIEDRICH D-50	STATION / OFFSET: 9+47, 128' LT.
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: ODOT / DWW	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: 74
PID: 108177 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/15/16	ELEVATION: 563.4 (MSL) EOB: 21.5 ft.
START: 7/17/18 END: 7/17/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.9	COORD: Not Recorded

EXPLORATION ID B-004-1-18

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 563.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
STIFF TO VERY STIFF, BROWN TRACE GRAY, **CLAY**, LITTLE ROCK FRAGMENTS, TRACE SILT, TRACE DEBRIS (GEOGRID), (FILL), MOIST		1	2 2 2	5	22	SS-1	2.50	-	-	-	-	-	-	-	-	16	A-7-6 (V)	
		2																
		3	2 2 1	4	17	SS-2	-	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
		4																
		5	3 3 5	11	67	SS-3	3.00	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
	555.9	6																
		7																
STIFF, BROWN, **SILTY CLAY**, TRACE SAND, TRACE ORGANICS, TRACE ROCK FRAGMENTS, (FILL), MOIST		8	2 2 3	7	44	SS-4	2.00	5	4	4	39	48	40	21	19	33	A-6b (12)	
	553.4	9																
		10																
VERY STIFF, BROWN, **CLAY**, SOME ROCK FRAGMENTS, TRACE SAND, TRACE SILT, (FILL), MOIST		11	6 6 16	30	33	SS-5	-	-	-	-	-	-	-	-	-	13	A-7-6 (V)	
	550.9	12																
		13																
MEDIUM STIFF, GRAY, **SILTY CLAY**, SOME SAND, TRACE ORGANICS, SOME ROCK FRAGMENTS, MOIST		14	2 2 9	15	67	SS-6	0.75	-	-	-	-	-	-	-	-	28	A-6b (V)	
		15																
		16	6 6 8	19	67	SS-7	-	25	13	6	27	29	-	-	-	18	A-6b (V)	
	545.9	17																
		TR																
SHALE, GRAY, UNWEATHERED TO SLIGHTLY WEATHERED, VERY WEAK, LAMINATED.		18	40 40	-	72	SS-8	-	-	-	-	-	-	-	-	-	4	Rock (V)	
		19																
		20																
	541.9	21	38 38	-	100	SS-9	-	-	-	-	-	-	-	-	-	9	Rock (V)	
		EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

PROJECT: HAM-74-11.14	DRILLING FIRM / OPERATOR: ODOT / RM	DRILL RIG: DIEDRICH D-50	STATION / OFFSET: 9+98, 135' LT.	EXPLORATION ID B-005-1-18
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: ODOT / DWW	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: 74	
PID: 108177 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/15/16	ELEVATION: 568.4 (MSL) EOB: 24.0 ft.	PAGE 1 OF 1
START: 7/17/18 END: 7/17/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.9	COORD: Not Recorded	

MATERIAL DESCRIPTION AND NOTES	ELEV. 568.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
STIFF TO VERY STIFF, BROWN TRACE GRAY, **CLAY**, TRACE ORGANICS, TRACE ROCK FRAGMENTS, TRACE SILT, (FILL), MOIST		1	3 3 1	5	56	SS-1	4.50	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
		2																
		3	3 1 1	3	33	SS-2	3.50	-	-	-	-	-	-	-	-	24	A-7-6 (V)	
		4																
		5																
		6	2 8 5	18	44	SS-3	1.25	-	-	-	-	-	-	-	-	24	A-7-6 (V)	
	560.9	7																
VERY STIFF, BROWN, **CLAY**, TRACE ROCK FRAGMENTS, TRACE SAND, SOME SILT, (FILL), MOIST		8	3 5 5	14	33	SS-4	2.25	0	1	2	41	56	44	22	22	22	A-7-6 (14)	
		9																
		10																
		11	4 5 7	16	56	SS-5	4.25	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
		12																
		13	50	-	100	SS-6	1.75	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
		14																
		15																
		16	3 6 7	18	44	SS-7	2.25	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
	550.9	17																
VERY STIFF, GRAY TRACE BROWN, **SILTY CLAY**, LITTLE SAND, TRACE ORGANICS, TRACE ROCK FRAGMENTS, MOIST		18	3 11 48	81	44	SS-8	3.50	3	6	10	34	47	39	21	18	22	A-6b (11)	
	547.9	19																
SHALE, GRAY, UNWEATHERED TO SLIGHTLY WEATHERED, VERY WEAK, LAMINATED.		TR 20																
		21	3 12 50	85	83	SS-9	4.00	-	-	-	-	-	-	-	-	23	Rock (V)	
		22																
		23																
	544.4	EOB 24	50	-	100	SS-10	-	-	-	-	-	-	-	-	-	7	Rock (V)	

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

PROJECT: HAM-74-11.14	DRILLING FIRM / OPERATOR: ODOT / RM	DRILL RIG: DIEDRICH D-50	STATION / OFFSET: 10+57, 142' LT.	EXPLORATION ID B-008-1-18
TYPE: LANDSLIDE	SAMPLING FIRM / LOGGER: ODOT / DWW	HAMMER: DIEDRICH AUTOMATIC	ALIGNMENT: 74	
PID: 108177 SFN:	DRILLING METHOD: 3.25" HSA	CALIBRATION DATE: 8/15/16	ELEVATION: 571.3 (MSL) EOB: 34.5 ft.	PAGE 1 OF 2
START: 7/17/18 END: 7/17/18	SAMPLING METHOD: SPT	ENERGY RATIO (%): 81.9	COORD: Not Recorded	

MATERIAL DESCRIPTION AND NOTES	ELEV. 571.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
VERY STIFF, BROWN, **CLAY**, TRACE ROCK FRAGMENTS, TRACE SILT, (FILL), MOIST	568.8	1	2 3 3	8	39	SS-1	4.00	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
SOFT TO MEDIUM STIFF, BROWN, **CLAY**, TRACE ROCK FRAGMENTS, TRACE SILT, (FILL), MOIST	563.8	3	2 3 5	11	72	SS-2	0.50	-	-	-	-	-	-	-	-	21	A-7-6 (V)	
		6	1 3 3	8	56	SS-3	0.75	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
VERY STIFF, BROWN TRACE GRAY, **CLAY**, TRACE GRAVEL, TRACE ROOTS, (FILL), MOIST	561.3	8	2 3 5	11	61	SS-4	2.50	-	-	-	-	-	61	19	42	25	A-7-6 (V)	
STIFF TO VERY STIFF, GRAY TRACE BROWN, **CLAY**, WITH SHALE FRAGMENTS, TRACE ROOTS, TRACE GRAVEL, (FILL), MOIST	558.8	11	1 8 6	19	17	SS-5	2.00	-	-	-	-	-	-	-	-	18	A-7-6 (V)	
VERY STIFF, BROWN AND GRAY, **CLAY**, TRACE SHALE FRAGMENTS, TRACE SILT, TRACE SAND, MOIST		13	3 22 6	38	67	SS-6	2.25	6	4	3	38	49	43	20	23	19	A-7-6 (14)	
		16	4 8 6	19	100	SS-7	3.00	-	-	-	-	-	-	-	-	22	A-7-6 (V)	
		18	5 6 7	18	72	SS-8	3.25	3	1	2	32	62	41	21	20	23	A-7-6 (12)	
		21	3 6 5	15	100	SS-9	2.00	-	-	-	-	-	-	-	-	20	A-7-6 (V)	
	546.3	23	5 25 17	57	39	SS-10	-	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
STIFF TO VERY STIFF, DARK GRAY, **CLAY**, TRACE SILT, TRACE ROOTS/ORGANICS, LITTLE ROCK FRAGMENTS, MOIST		26	3 4 7	15	78	SS-11	2.00	-	-	-	-	-	46	25	21	30	A-7-6 (V)	
	541.3	28	7 11 14	34	50	SS-12	2.25	-	-	-	-	-	-	-	-	31	A-7-6 (V)	

PID: 108177	SFN:	PROJECT: HAM-74-11.14	STATION / OFFSET: 10+57, 142' LT.	START: 7/17/18	END: 7/17/18	PG 2 OF 2	B-008-1-18

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
SHALE, GRAY, UNWEATHERED TO SLIGHTLY WEATHERED, VERY WEAK, LAMINATED.	541.3	TR	11															
		31	50/50	137	83	SS-13	-	-	-	-	-	-	-	-	-	-	Rock (V)	
		32																
		33	50	-	100	SS-14	-	-	-	-	-	-	-	-	-	-	Rock (V)	
	536.8	34 EOB																

NOTES: NONE

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS