REPORT

17-1016 S

June 19, 2018

Explorations and Geotechnical Engineering Services

Proposed Substation
Fickett Road
Pownal, Maine

Prepared For:
Central Maine Power
Attention: Gerry Mirabile
83 Edison Drive
Augusta, Maine 04336

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S.W.COLE ENGINEERING, INC.

- *Geotechnical Engineering*
- *Construction Materials Testing and Special Inspections*
- *GeoEnvironmental Services*
- *Test Boring Explorations*

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Attention: Gerry Mirabile
Manager of Environmental Projects
83 Edison Drive
Augusta, ME 04336

Subject: Explorations and Geotechnical Engineering Services
Proposed Substation
Fickett Road
Pownal, Maine

Dear Gerry:

In accordance with our Revised Proposal, dated March 12, 2018, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations and its contents are subject to the limitations set forth in Appendix A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our services was to obtain subsurface information at the site in order to develop geotechnical recommendations relative to foundations and earthwork associated with the proposed construction. Our scope of services included test boring explorations, laboratory testing, a geotechnical analysis of the subsurface findings and preparation of this report.

1.2 Site and Proposed Construction

The proposed substation site is located in the southwesterly quadrant of the intersection of Fickett and Allen Roads in Pownal, Maine. We understand the proposed substation will be on the order of 580 by 280 feet in plan dimensions and will likely include new structures (transformers, dead-end, switchgear and steel pole structures). We understand spread footings and deep foundations are being considered for foundation

support. Based on the information shown on the site plan dated March 6, 2018, prepared by Power Engineers, and our recent conversations, we understand the westerly side of the substation will have smaller surface equipment founded on concrete pads. The easterly side will have larger structures, including one or two A-frame or H-frame structures. Proposed equipment locations and structural loads are not available at this time. Existing grades vary from about elevation 195 to 179 feet within the proposed substation. We understand the proposed yard finish grade will be about elevation 183 feet requiring cuts and fills approaching about 12 and 4 feet, respectively.

Proposed and existing site features are shown on the "Exploration Location Plan" attached in Appendix B.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Thirteen test borings (B-1 through B-9A, B-9B, and B-10 through B-12) were made at the site on April 20 through 25, 2018 by S. W. Cole Explorations, LLC. The exploration locations were selected by Power Engineers and established in the field by S. W. Cole Engineering, Inc. (S.W.COLE) using GPS measurements. The approximate exploration locations are shown on the "Exploration Location Plan" attached in Appendix B. Logs of the explorations and a key to the notes and symbols used on the logs are attached in Appendix C. The elevations shown on the logs were estimated based on topographic information shown on the "Exploration Location Plan".

2.2 Field Testing

The test borings were drilled using a combination of hollow stem auger and cased wash-boring techniques. The soils were sampled at 2 to 5 foot intervals using a split spoon sampler and Standard Penetration Testing (SPT) methods. Pocket Penetrometer Tests (PPT) were performed where stiffer cohesive soils were encountered. Shelby tube sampling was performed where softer cohesive soils were encountered. Several Vane Shear Tests (VST) were attempted at the site, but there was no vane rotation due to sand layering in the clays. Upon encountering refusal in borings B-4, B-7, B-8 and B-9B were advanced into bedrock using an NQ2 rock core. SPT blow counts and PPT results are shown on the logs.

2.3 Laboratory Testing

2.3.1 Soil And Rock Testing

Soil and rock core samples obtained from the explorations were returned to our laboratory for further classification and testing. Atterberg Limits, moisture content and unconfined compression test results on clay and rock samples are noted on the logs. The results of soil gradation and one-dimensional laboratory consolidation testing are attached in Appendix D.

2.3.2 Laboratory Soil Chemistry Testing

Two soil samples from the upper few feet of soil at the test boring explorations were submitted to Katahdin Analytical Services (Katahdin) for determination of pH (SW9045), water soluble chloride content (EPA 325.2) and water soluble sulfate content (EPA 375.4) testing. The results of the pH, water soluble chloride and sulfate testing as well as sulfate exposure classifications in accordance with ACI 318 Table 4.2.1 are included in Appendix D and shown in the following table:

Exploration & Location	pH Testing (SW9045)	Chloride Testing (EPA 325.2)	Sulfate Testing (EPA375.4))	Sulfate Exposure Classification (ACI 318 Table 4.2.1)
B-5, 1-D	6.4	2600 ppm	1200 ppm	Moderate
B-8, 1-D	7.1	1200 ppm	4300 ppm	Severe

PQL – Procedure Quantification Limit
For chloride testing the PQL is 22 ppm and sulfate testing the PQL is 11 ppm.

3.0 SUBSURFACE CONDITIONS

3.1 Soil and Bedrock

In general, the test borings encountered a soils profile generally consisting of topsoil overlying clayey silt overlying a glaciomarine deposit of silty clay overlying granular soils (glacial till) overlying refusal surfaces (bedrock or probable bedrock). A surficial zone of fill and/or disturbed soil was encountered at boring B-10. The principal strata encountered are summarized below; refer to the attached logs for more detailed descriptions of the subsurface findings.

Fill: Boring B-10 encountered about 3 feet of loose sandy silt, some clay and gravel (fill) at the surface.

Topsoil: The topsoil varied from about 6 to 12 inches in thickness at the boring locations. Much of the site has been utilized as an agricultural field. Thus, thicker areas of topsoil/disturbed soil should be expected.

Clayey Silt: Where encountered below the topsoil, the explorations generally encountered a 1 to 1.5 foot thick layer of loose gray clayey silt with some rootlets and organics. This layer may be a previously tilled zone.

Glaciomarine Deposits: With the exception of borings B-1, B-3, B-9A and B-9B, the explorations encountered silty clay below the clayey silt. The silty clay transitioned generally from hard brown silty clay to medium to soft gray silty clay at a depth varying from about 8.5 to 10 feet below the existing ground surface. The medium to soft gray silty clay extends to depths varying from about 11 to 19 feet below the ground surface, where penetrated. Based on the laboratory consolidation testing at boring B-7, the softer gray silty clay deposit appears to be over consolidated by about 1 to 1.5 ksf with an OCR of about 2. In-situ vane shear testing was attempted in the softer gray silty clay, but the drillers could not turn the shear vanes, likely due to sand layers in the silty clay. The gray silty clay at boring B-8 appears stiffer based on laboratory consolidation testing.

Glacial Till: Medium dense granular soil generally consisting of silty gravelly sand was encountered below the marine deposit. The glacial till thickness varied from about 2 to 6 feet at the explorations. The glacial till may also contain some boulders.

Refusal: Where encountered, refusal surfaces (bedrock or probable bedrock) varied from about 3 to 24 feet below the existing ground surface. Rock was cored with an NQ2 (2-in) core bit at borings B-4, B-7, B-8 and B-9B. Based on the recovered rock core at these explorations, the bedrock is classified as Granite with RQD's (Rock Quality Designation) varying from about 53 to 100. Photos of the recovered rock core are attached in Appendix C.

Not all the strata were encountered at each exploration; refer to the attached logs for more detailed subsurface information.

3.2 Groundwater

The soils encountered at the test borings were moist to wet from the ground surface. Saturated soils were encountered at depths varying from at or near the ground surface to about 5 feet. Groundwater likely becomes perched on the relatively impervious silty clay and bedrock underlying the site. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, as well as changes in site use.

3.3 General Geologic Conditions

3.3.1 General Geological Conditions

The Maine Geological Survey (MGS) *Surficial Geologic Map of Maine* (Thompson and Borns, 1985) and the *Surficial Geologic Map of The North Pownal Quadrangle, Maine*[1] (Marvinney, C.L., 1999) indicate the surficial geology of the Proposed Fickett Road Substation Project area consists of silty to gravelly near-shore marine sand deposits with glacial till deposits to the west and several small wetland deposits near the proposed substation location. A bedrock outcrop was observed while at the site, adjacent to Fickett Road, near boring B-3.

The MGS *Bedrock Geologic Map of Maine*[2] (Osberg et al., 1985) interprets the bedrock in the region to be muscovite-alkali feldspar Granite. Based on the mapped bedrock geology, acid producing bedrock is not interpreted to be present. The observed rock core is generally consistent with the published geologic mapping.

3.3.2 Seismic – Faulting Data

Seismic activity can impact a site from two sources: ground rupture directly beneath a site or shaking produced at the site from nearby seismic activity. There are no documented cases of ground rupture that can be definitely attributed to seismic activity in New England since the departure of glaciers more than 10,000 years ago. Bedrock deformation has occurred over geologic time, however evidence of faulting in the project area is limited to inferred faults associated with bedrock contacts and observed healed angular bedrock conglomerate and wacke observed in the core.

3.3.3 Seismic and Frost Conditions

According to IBC 2015/ASCE 7, we interpret the following Seismic Site Classes using the N-Value method for soil:

- Seismic Site Class B (for foundations on sound bedrock)
- Seismic Site Class E (for foundations on compacted fill over native soil)

We recommend the following seismic design parameters for the 2,500-year design earthquake:

[1] Thompson, W. B. and Borns, H. B., eds., 1985, Surficial Geologic Map of Maine, Maine Geological Survey.
[2] Osberg, P. H., Hussey, A. M. , and Boone, G. M., eds., 1985, Bedrock Geologic Map of Maine, Maine Geological Survey.

RECOMMENDED SEISMIC DESIGN PARAMETERS (2,500-year Design Earthquake)		
Peak Ground Acceleration (PGA)	0.2-second Spectral Acceleration (S_s)	1-second Spectral Acceleration (S_1)
0.186	0.249g	0.081g

NOTE: Seismic design parameters from USGS accessed April 12, 2018. (https://earthquake.usgs.gov/designmaps/us/application.php)

Liquefiable soils typically consist of loose, fine sands and non-plastic silts below the groundwater table. Based on the subsurface findings, it is our opinion the soils at the site are not susceptible to liquefaction during a seismic event and therefore the risk of lateral spread and seismic induced settlement are negligible.

The 100-year Air Freezing Index for the Pownal, Maine area is about 1,500 Fahrenheit degree days, which corresponds to a frost penetration depth on the order of 5.0 feet. We recommend foundations exposed to freezing be covered with at least 5.0 feet of soil for frost protection.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings, the proposed construction appears feasible from a geotechnical standpoint. The principle geotechnical considerations include:

- Spread footing foundations and a slab-on-grade floors bearing on properly prepared subgrades appear suitable for proposed lightweight equipment foundations and control/switchgear buildings. Footings should bear on at least 12-inches of compacted Crushed Stone wrapped in geotextile fabric overlying undisturbed native non-organic soils or compacted fill. On-grade floor slabs for heated buildings should bear on at least 12-inches of properly compacted Structural Fill overlying properly prepared subgrades. Unheated structures should bear on at least 5 feet of compacted Structural fill or be underlain with rigid subgrade insulation.

- Foundations for heavy structures and foundations with overturning moments will need to be founded on bedrock and/or socketed into bedrock.

- All topsoil, fill, soils containing organics and loose or disturbed soil must be completely removed from beneath the proposed areas of construction and backfilled with properly compacted Structural Fill.

- Subgrades across the site will consist of sensitive silts and clays. Earthwork and grading activities should occur during drier, non-freezing weather of Spring, Summer and Fall. Rubber tired construction equipment should not operate directly on the native silt and clays when wet. Excavation of bearing surfaces should be completed with a smooth-edged bucket to lessen subgrade disturbance.

- The soil chloride and sulfate test results from near surface soils as noted above are higher than typically seen in native soils. The higher values reported may be due to agricultural practices at the site. The foundation engineer will need to assess the test results in foundation design. Additionally, the foundations should not be in contact with the native soils. It is not known how deep the higher values exist in the soil profile.

4.2 Settlement, Stability and Liquefaction Evaluations

The soft gray silty clay underlying the site is compressible under new loading from the proposed site fills and foundation loads. We have estimated post-construction settlement due to consolidation of the silty clay considering the following:

- The findings at the test borings;
- The results of the one-dimensional consolidation testing performed on samples of the gray silty clay obtained from borings B-7 and B-8;
- The existing and proposed site grading shown on the “Exploration Location Plan” and a finish yard elevation of 183 feet; and
- A soil bearing capacity of 3.0 ksf, or less.

Proposed equipment pad locations and loads are not available at this time. For preliminary planning, we have made an estimate of the post construction settlement due to consolidation of the underlying silty clay soils based on a finish yard elevation of 183 and a typical 10 by 10 foot square equipment foundation. We estimate that post-construction settlement may approach 1.5 inch total and 1 inch differential across the substation pad. The magnitude of post construction settlement will vary across the site due to varying foundation loads and varying compressible silty clay thickness. To help reduce post-

construction settlement, we recommend fill needed to achieve subgrade elevation be placed as soon as practicable prior to placing foundations.

4.2 Site and Subgrade Preparation

We recommend that site preparation begin with the construction of an erosion control system to protect adjacent drainage ways and areas outside the construction limits. Surficial organics, roots and topsoil should be completely removed from areas of proposed fill and construction. As much vegetation as possible should remain outside the construction areas to lessen the potential for erosion and site disturbance.

Based on the subsurface findings, the thickness of topsoil and organics and forest duff varies from about 6 to 12 inches. The contractor should anticipate areas where the soil is disturbed and/or roots and soils containing organics may extend several feet below the ground surface in some areas. The methods used by the contractor for removal and the moisture condition of the site will affect the volume of material removal required. Topsoil and organics may be stockpiled and screened for reuse as a new topsoil layer in landscape areas. Suitability of the topsoil re-use from a nutrient and fertility standpoint should be evaluated by soil testing prior to its use.

4.3 Excavation and Dewatering

4.3.1 Excavations

Excavation work will generally encounter forest duff and topsoil, clayey silt and silty clay soils, some fills and bedrock. Care must be exercised during construction to limit disturbance of the bearing soils. Earthwork and grading activities should occur during drier, non-freezing weather of Spring, Summer and Fall. Rubber tired construction equipment should not operate directly on the native silt and clays. Low ground pressure tracked equipment will be needed and temporary haul roads overlying geotextile fabric may be necessary. Final cuts to subgrade should be performed with a smooth-edged bucket to help reduce strength loss from soil disturbance. Should subgrades become disturbed, the subgrade should be over-excavated to expose suitable soil and replaced with compacted Structural Fill or Crushed Stone and be compacted. A woven geotextile fabric may be needed at subgrade elevation prior to placing new fills if the soils are soft and wet.

Based on the proposed grading and subsurface conditions, some bedrock removal may be needed to achieve the required subgrade elevations, particularly in the areas of borings B-1, B-3, B-9A and B-9B. Bedrock removal will likely require drilling and blasting techniques. We recommend a licensed blasting contractor be engaged for bedrock removal. Pre-blast surveys should be completed on surrounding structures (including interior walls), water supply wells and infrastructure within 500 feet of the site prior to commencing blasting activities. Vibrations due to blasting should be monitored during construction. In addition, we recommend the subcontractor submit a detailed drilling and blasting plan with qualifications and references prior to blasting.

Temporary, unsupported soil excavations should be sloped back to 1½(H):1(V) or flatter. In all cases, excavations must be properly shored and/or sloped according to OSHA regulations to prevent sloughing and caving of the sidewalls during construction.

4.3.2 Dewatering

Sumping and pumping and the use of temporary diversion ditching dewatering techniques should be adequate to control water inflow into excavations above the groundwater table. Controlling the water levels to at least one foot below planned excavation depths will help stabilize subgrades during construction.

4.4 Embankment Construction

The proposed topographic information shown on the plan indicates fill soil slopes for the substation pad will generally be constructed with slopes of 3(H):1(V) or flatter and cut slopes will generally be constructed with slopes of 3(H):1(V) or flatter.

4.4.1 General

Fill slopes should be constructed as level benches, which are overbuilt to facilitate compaction. The final slope face should be constructed by cutting back into the compacted core prior to placing slope surface materials. Fill slopes constructed on existing terrain steeper than 3(H):1(V) should be keyed into the existing ground surface with continuous level benches. Fill slopes constructed on existing slopes flatter than 3(H):1(V) do not need continuous benching. We recommend a 10 foot wide and 1-foot thick drainage blanket be placed on native, non-organic soil beneath the toe of fill slopes prior to placing new fills. The drainage blanket should consist of Gravel Borrow or Structural and be placed on non-woven geotextile fabric and day-lighted for gravity drainage.

4.4.2 Fill Slopes 2(H):1(V) or Flatter

Fill materials needed to construct fill slopes at inclinations of 2(H):1(V) or flatter should consist of compacted Gravel Borrow or Structural Fill. Exposed soil slopes will be susceptible to surface erosion, slumping and sloughing, particularly during heavy rain and freeze/thaw events. Exposed slopes should be surfaced with an erosion control blanket and loam and seed, as soon as practicable, to create a vegetated mat. In areas of concentrated surface water, we recommend 8-inch minus rip-rap overlying a geotextile fabric be used in lieu of the erosion blanket and loam and seed.

4.4.3 Cut Slopes 2(H): 1(V) or Flatter

We recommend proposed soil cut slopes less than 15 feet in height consider slope inclinations of 2H: 1V or flatter. Cut slopes in bedrock should be sloped back to a stable condition, which will depend on rock fracturing, as well as bedrock formation strike and dip in relation to slope orientation. We recommend a representative from S.W.COLE observe the bedrock slopes during construction.

We recommend a minimum 5-foot wide bench be constructed at the interface of the overburden soil and bedrock to reduce potential erosion that could cause soils, cobbles and boulders to wash down the rock slopes potentially clogging drainage swales and causing blocking hazards.

In areas of concentrated surface water or locations of groundwater seeps, rip-rap should be used in lieu of the erosion blanket and loam/seed. We recommend cross-slope stone lined drainage channels underlain with geotextile fabric be constructed into the slope when the height of the slope exceeds 25 feet.

4.4.4 Slope Surface Erosion Control

Unprotected and un-established slopes, regardless of inclination, will be susceptible to surface erosion, slumping, and sloughing especially during precipitations and freeze/thaw events. Topsoil and seed should be installed, as soon as practicable, to create a vegetated mat over the entire surface of the slope. We recommend the use of UV resistant synthetic erosion control mesh to reinforce the surface soils until the vegetated mat is established, particularly if constructed during the winter or spring seasons.

4.5 Foundations

4.5.1 Building and Equipment Foundations:

We recommend proposed building foundations be supported on spread footings founded on at least 12-inches of compacted Crushed Stone fully wrapped with a non-woven geotextile fabric such as Mirafi 180N overlying undisturbed stiff native soils or compacted Gravel Borrow. Non-moment-carrying equipment foundations and lightweight equipment pads should be founded on at least 12-inches of compacted Structural Fill or Crushed Stone overlying at least 4 feet of compacted Gravel Borrow or Structural Fill. For foundations bearing on properly prepared subgrades, we recommend the following geotechnical parameters for design consideration:

GEOTECHNICAL PARAMETERS	
Net Allowable Soil Bearing Pressure	3.0 ksf or less (Spread Footings and Mat Foundations on compacted fill or Crushed Stone)
Net Allowable Bedrock Bearing Pressure	15.0 ksf (Clean, sound, intact bedrock)
Design Frost Depth of Footings on Soil	5.0 ft min
Design Frost Depth for Footings Pinned to Sound Bedrock Depth	2.5 ft min
Base Friction Factor	0.35 (Mass concrete to structural fill)
Base Friction Factor	0.45 (Mass concrete to bedrock)
Passive Lateral Earth Pressure Coeff. (K_p)	3.0 (compacted Structural Fill)
Equivalent Fluid Pressure (Passive)	390 psf/ft (compacted Structural Fill)
Active Lateral Earth Pressure Coeff. (K_a)	0.3 (compacted Structural Fill)
Equivalent Fluid Pressure (Active)	40 psf/ft (compacted Structural Fill)
At-Rest Lateral Earth Pressure Coeff. (K_o)	0.5 (compacted Structural Fill)
Equivalent Fluid Pressure (At-Rest)	60 psf/ft (compacted Structural Fill)
Total Unit Weight of Backfill (γ_t)	125 pcf (compacted Structural Fill)
Internal Friction Angle (Φ)	32 degrees (compacted Structural Fill)

Spread footings should be at least 24 inches in width regardless of the bearing pressure. We understand all foundations and concrete structures and slabs will be designed by others. Foundations and backfill will need to be designed for buoyancy at the existing ground surface if deeper drainage is not achievable.

4.5.2 Rock Anchorage:

Based on the subsurface conditions and guidance from the Post-Tensioning Institute's manual entitled *Recommendations for Prestressed Rock and Soil Anchors* (PTI, 2004), we recommend the use of prestressed, Class I corrosion protection, grouted rock

anchors be considered by the foundation designer where rock anchors are being considered. We recommend the following geotechnical parameters for preliminary rock anchor design consideration:

GEOTECHNICAL PARAMETERS FOR ROCK ANCHORS	
RQD of Rock Core (see boring logs)	55 to 100%
Average Dry Unit Weight of Bedrock Samples	160 pcf
Rock Cone Pull-Out Angle (from vertical)	45 degrees (from vertical)
Average Ultimate Grout to Bedrock Bond Strength	120 psi

The bonded length will depend upon the uplift load and the diameter of the drill hole. Rock anchor spacing should be at least 1.2 times the free-stressing length; closer spacing will reduce allowable anchor loads. Rock anchors installed in groups should be designed with consideration of pullout resistance from overlapping failure surfaces extending from the midpoint of the anchor bond zone to the bedrock surface.

The drill-hole for each rock anchor should be cleaned of any drilling fines and tightness tested to determine the need for pre-grouting. Rock anchors should be installed, tested and locked-off according to the design engineer's recommendations.

4.5.3 Foundations Bearing On Bedrock

We anticipate A-Frame and/or H-frame structures will be constructed within the easterly portion of the proposed substation. Structural loads and actual equipment locations are not known at this time. Based on the findings at the explorations, depths to bedrock may vary from a few feet to about 25 feet below the existing ground surface at the site.

Depending upon anticipated structural loads, we anticipate A-Frame and/or H-frame foundations will need to derive support from the underlying bedrock. Depending upon the location, the foundation could consist of a large mat foundation bearing on and pinned to bedrock, or if rock is deep, drilled shafts socketed into bedrock. Soft, weathered bedrock, if encountered, should be removed. An allowable bearing contact pressure of 15.0 ksf or less should be considered for sound, intact bedrock. A concrete leveling mat may be placed on the prepared bedrock surface prior to placing reinforced concrete foundations. The foundation should be anchored to the bedrock if the rock is sloping steeper than 3(H):1(V) and/or if structural loads dictate. The leveling mat should extend beyond the footing edges or piers by at least 24 inches. Rock anchors extending into bedrock will likely be needed to provide uplift capacity for the A-Frame

and/or H-frame pier foundations. We understand foundation type and design will be by the project structural engineer.

4.5.4 Foundations On Drilled Shafts

The proposed A-frame and/or H-frame structures may be supported on drilled shafts socketed into bedrock. Drilled shafts should be socketed at least 2 feet into competent bedrock. Deeper rock sockets may be required depending on the load requirements.

The base of the rock sockets should be leveled and cleaned of loose material and soil. We recommend deep foundations be drilled using steel casing within the overburden soils in order to maintain sidewall stability. Prior to installing reinforcing steel, S.W.COLE should observe the base of each drilled foundation. Temporary steel casings should be removed during concrete placement while maintaining a positive head of concrete above the casing bottom to maintain shaft sidewall stability.

Considering the subsurface conditions encountered, we anticipate drilled shaft axial capacity will be controlled by the concrete compressive strength. We recommend an allowable end-bearing pressure of 15 ksf utilizing a factor of safety of 2.0. For piers socketed deeper than two feet, additional axial compressive capacity can be mobilized from skin friction between the pier and rock socket. For a design concrete strength of 4,000 psi, a unit skin friction of 15 ksf can be considered for he portion of the pier socketed greater than 2 feet into rock.

Uplift resistance of drilled shafts can be developed from skin friction between the drilled shaft and soil and bedrock, as well as the dead weight of the drilled shaft. The top 2 feet of soil and rock should not be included in design uplift capacity. S.W.COLE can assist with uplift capacities as deemed necessary by the structural engineer.

Lateral loads may be resisted from earth pressures acting on the sides of shafts, grade beams and pile caps backfilled with compacted Gravel Borrow or Structural Fill considering a total unit weight of granular backfill (γt) of 125 pcf, an angle of internal friction of 30 degrees with an at-rest lateral earth pressure coefficient (Ko) of 0.5. Additional resistance to lateral loads can be mobilized along the pile shafts, if needed. S.W.COLE can assist with lateral capacities using L-Pile, as deemed necessary by the structural engineer.

4.6 Foundation Drainage

We recommend an underdrain system be installed on the outside edge of the perimeter of building structures with spread footings. The underdrain pipe should consist of 4-inch diameter, perforated SDR-35 foundation drain pipe bedded in Crushed Stone and covered with non-woven geotextile fabric. The underdrain pipe must have a positive gravity outlet protected from freezing, clogging and backflow. Surface grades should be sloped away from the building and other structures for positive surface water drainage. We anticipate there will be a perimeter drainage swale around the substation yard to help drain new fills. We anticipate the groundwater at the site is at or near the existing ground surface seasonally and during periods of heavy precipitation and/or snowmelt. Thus, it appears gravity drainage may be difficult to achieve, depending upon final yard grade elevation and depths to bottom of foundations. Where foundations extend below the existing ground surface elevation and are not provided with foundation drainage, we recommend foundations be designed for buoyancy considering a groundwater table at about existing ground elevation and a submerged backfill unit weight of 58 pcf.

4.7 Slab-On-Grade

On-grade floor slabs in heated areas may be designed using a subgrade reaction modulus of 120 pci (pounds per cubic inch) provided the slab is underlain by at least 12-inches of compacted Structural Fill placed over properly prepared subgrades. The structural engineer or concrete consultant must design steel reinforcing and joint spacing appropriate to slab thickness and function.

We recommend a sub-slab vapor retarder particularly in areas of the building where the concrete slab will be covered with an impermeable surface treatment or floor covering that may be sensitive to moisture vapors. The vapor retarder must have a permeance that is less than the floor cover or surface treatment that is applied to the slab. The vapor retarder must have sufficient durability to withstand direct contact with the sub-slab base material and construction activity. The vapor retarder material should be placed according to the manufacturer's recommended method, including the taping and lapping of all joints and wall connections. The architect and/or flooring consultant should select the vapor retarder products compatible with flooring and adhesive materials.

The floor slab should be appropriately cured using moisture retention methods after casting. Typical floor slab curing methods should be used for at least 7 days. The architect or flooring consultant should assign curing methods consistent with current

applicable American Concrete Institute (ACI) procedures with consideration of curing method compatibility to proposed surface treatments, flooring and adhesive materials.

4.8 Fill, Backfill and Compaction

We recommend the following fill and backfill materials: recycled products must also be tested in accordance with applicable environmental regulations and approved by a qualified environmental consultant.

Common Borrow: Fill to raise grades in landscape areas should be non-organic compactable earth meeting the requirements of 2014 MaineDOT Standard Specification 703.18 Common Borrow.

Gravel Borrow: Use as general yard fil, as well as to repair soft areas, should be sand or silty sand meeting the following gradation:

Gravel Borrow		
Sieve Size	**Percent Finer by Weight**	
6 inch	100	100
Portion Passing 3 inch Sieve		
1/4 -inch	0 to 70	0 to 70
No. 200	0 to 10	0 to 20

In our opinion, 2014 MaineDOT Standard Specification 703.20 Gravel Borrow meets the requirements of Gravel Borrow.

Structural Fill: Use as general yard fill, backfill for foundations, slab base material and material below exterior entrances slabs should be clean, non-frost susceptible sand and gravel meeting the gradation requirements for Structural Fill as given below:

Structural Fill	
Sieve Size	**Percent Finer by Weight**
4 inch	100
3 inch	90 to 100
¼ inch	25 to 90
No. 40	0 to 30
No. 200	0 to 6

Crushed Stone: Crushed Stone, used beneath foundations and for underdrain aggregate should be washed ¾-inch crushed stone meeting the requirements of 2014 MaineDOT Standard Specification 703.22 Underdrain Backfill Material Type C is suitable for use as Crushed Stone.

Reuse of Site Soils: The on-site soils are unsuitable for reuse within the proposed yard area, but likely could be used in landscape areas. Blasted and crushed bedrock can likely be reused to blend with sand and gravel borrow and processed to create Gravel Borrow. The native stiff silty clay may be suitable for reuse as Common Borrow, such as pond berms, provided it is at a compactable moisture content at the time of reuse.

Placement and Compaction: Fill should be placed in horizontal lifts and compacted such that the desired density is achieved throughout the lift thickness with 3 to 5 passes of the compaction equipment. Loose lift thicknesses for grading, fill and backfill activities should not exceed 12 inches. We recommend that fill and backfill in building and paved areas be compacted to at least 95 percent of its maximum dry density as determined by ASTM D-1557. Crushed Stone should be compacted with 3 to 5 passes of a vibratory plate compactor having a static weight of at least 500 pounds.

4.9 Weather Considerations

Construction activity should be limited during wet and freezing weather and the site soils may require drying or thawing before construction activities may continue. The contractor should anticipate the need for water to temper fills in order to facilitate compaction during dry weather. If construction takes place during cold weather, subgrades, foundations and floor slabs must be protected during freezing conditions. Concrete and fill must not be placed on frozen soil; and once placed, the concrete and soil beneath the structure must be protected from freezing.

4.10 Design Review and Construction Testing

S.W.COLE should be retained to review the construction documents prior to bidding to determine that our earthwork, foundation and pavement recommendations have been properly interpreted and implemented.

A soils and concrete testing program should be implemented during construction to observe compliance with the design concepts, plans, and specifications. S.W.COLE is available to observe earthwork activities, the preparation of foundation bearing surfaces

and pavement subgrades, as well as to provide testing and IBC Special Inspection services for soils, concrete, steel, spray-applied fireproofing, structural masonry and asphalt construction materials.

4.11 Recommendations for Additional Study

We understand design of the substation pad, buildings and equipment is still in development. Additional explorations, laboratory soils and rock testing and evaluation may be needed as design of the substation progresses. Field soil resistivity and an acidic rock evaluation should also be made. Additional soil chloride and sulfate testing is recommended considering the higher than anticipated values reported.

5.0 CLOSURE

It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

Sincerely,

S. W. Cole Engineering, Inc.

Paul F. Kohler, P.E.
Senior Geotechnical Engineer

PFK:mas

APPENDIX A

Limitations

This report has been prepared for the exclusive use of Central Maine Power Company for specific application to the proposed Substation on Fickett Road in Pownal, Maine. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

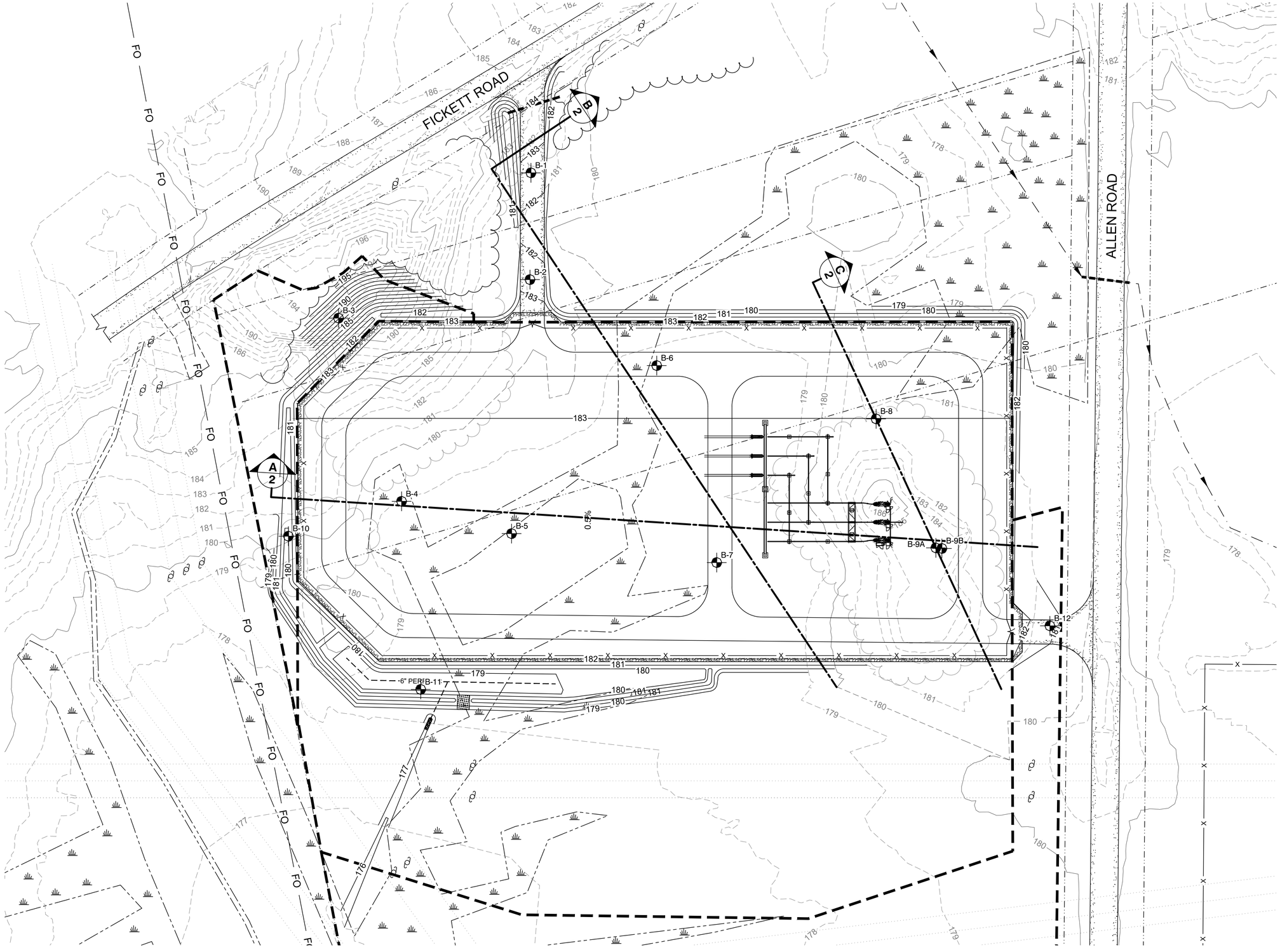
Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

APPENDIX B

Figures



LEGEND:

APPROXIMATE BORING LOCATION

NOTES:

1. EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=50' SCALE PLAN OF THE SITE ENTITLED "BORING LOCATION PLAN, PROPOSED CONDITIONS," PREPARED BY POWER ENGINEERS, INC., DATED 4/10/2018.
2. THE BORING LOCATIONS WERE SELECTED BY POWER ENGINEERS, INC. AND LOCATED IN THE FIELD BY GPS SURVEY BY S. W. COLE ENGINEERING, INC. USING A MAPPING GRADE TRIMBLE GPS RECEIVER.
3. THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
4. THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.

0 40 80 Feet

NO.	DATE	DESCRIPTION	BY
1	05/29/2018	INTERPRETIVE GEOLOGIC PROFILES	CEM
0	05/16/2018	PRELIMINARY FINDINGS SUBMISSION	CEM

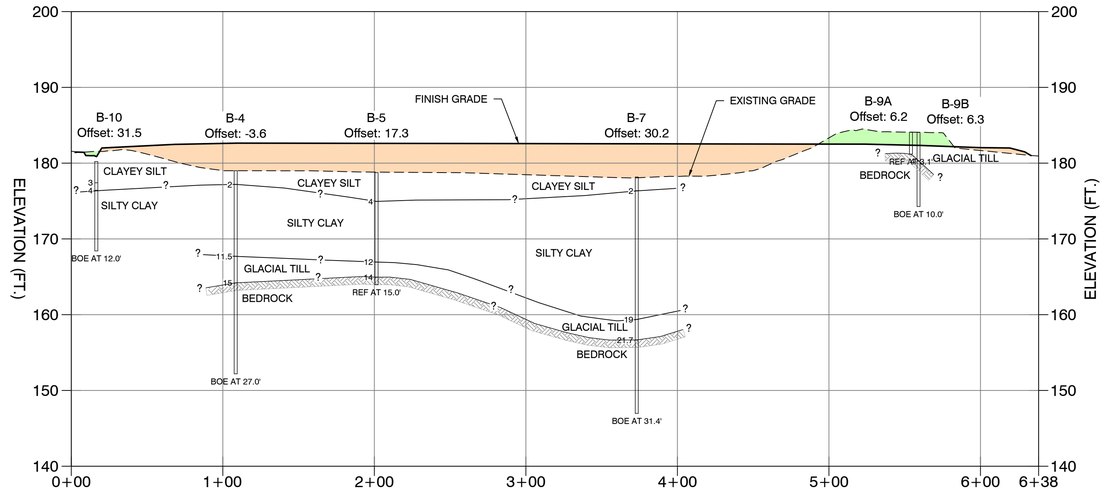
S.W.COLE ENGINEERING, INC.

CENTRAL MAINE POWER

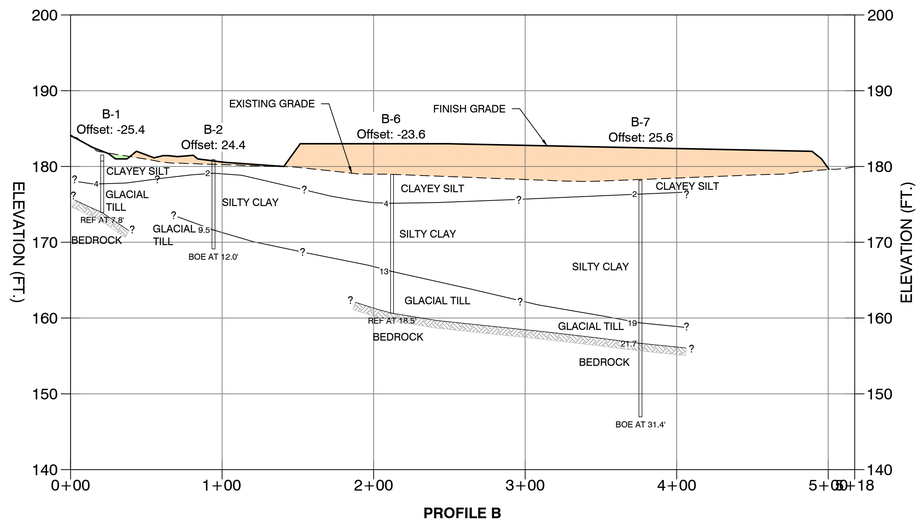
EXPLORATION LOCATION PLAN

PROPOSED FICKETT ROAD SUBSTATION
FICKETT ROAD
POWNAL, MAINE

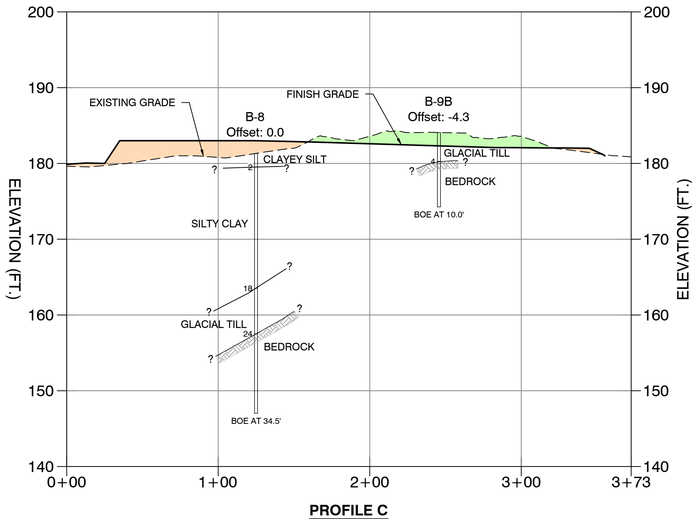
Job No.: 17-1016 Scale: As Noted
Date : 05/16/2018 Sheet: 1



PROFILE A
SCALE: 1" = 50' HORIZ.
1" = 10' VERT.



PROFILE B
SCALE: 1" = 50' HORIZ.
1" = 10' VERT.



PROFILE C
SCALE: 1" = 50' HORIZ.
1" = 10' VERT.

LEGEND

B-9 **(Offset: 5')**	BORING NUMBER OFFSET FROM PROFILE
	APPROXIMATE EXISTING GROUND SURFACE
7	STRATA CHANGE
SILT	STRATA DEFINITION
BOE	BOTTOM OF EXPLORATION
REF	REFUSAL - PROBABLE BEDROCK

NOTES:

1. THE DEPTH AND THICKNESS OF THE SUBSURFACE STRATA INDICATED ON THE SECTION WERE GENERALIZED FROM AND INTERPOLATED BETWEEN EXPLORATION LOCATIONS. THE TRANSITION BETWEEN MATERIALS MAY BE MORE OR LESS GRADUAL THAN INDICATED. INFORMATION ON ACTUAL SUBSURFACE CONDITIONS EXISTS ONLY AT THE SPECIFIC LOCATIONS INDICATED AND AT THE TIME OF EXPLORATION. SEE BORING LOGS FOR MORE DETAILED INFORMATION.

2. THIS PROFILE SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHINCAL REPORT AND IS NOT TO BE USED FOR CONSTRUCTION.

NO.	DATE	DESCRIPTION	BY
1	05/29/2018	INTERPRETIVE GEOLOGIC PROFILES	CEM
0	05/16/2018	PRELIMINARY FINDINGS SUBMISSION	CEM

S.W.COLE ENGINEERING, INC.

CENTRAL MAINE POWER

INTERPRETIVE GEOLOGIC PROFILES A, B & C

PROPOSED FICKETT ROAD SUBSTATION
FICKETT ROAD
POWNAL, MAINE

Job No.:	17-1016	Scale:	As Noted
Date :	05/16/2018	Sheet:	2

APPENDIX C

Exploration Logs and Key

S.W.COLE ENGINEERING, INC.

BORING LOG

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B- 1
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/20/2018
DATE FINISH: 4/20/2018

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 181.5' +/- | **TOTAL DEPTH (FT):** 7.8 | **LOGGED BY:** Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Solid Stem Auger
RIG TYPE: Track Mounted CME 850 | **AUGER ID/OD:** N/A / 4 1/2 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic | **HAMMER WEIGHT (lbs):** 140 / 140 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.81 | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): 4/20/2018 Soils wet at 5'
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
180			1D		0-2	24/20	WOH-1-2-6			0.5 Loose, grass / topsoil Very stiff to stiff, gray-brown clayey SILT, some sand with rootlets		
			2D		2-4	24/24	6-9-12-14	q_P=8 ksf		4.0 Medium dense, brown silty gravelly SAND		
	5		3D		5-7	24/15	8-9-14-18					
175										7.8 Refusal at 7.8 feet Auger refusal, probable bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 1

S.W.COLE ENGINEERING, INC.

BORING LOG

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B- 2
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/20/2018
DATE FINISH: 4/20/2018

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 181' +/- | **TOTAL DEPTH (FT):** 12.0 | **LOGGED BY:** Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Solid Stem Auger
RIG TYPE: Track Mounted CME 850 | **AUGER ID/OD:** N/A / 4 1/2 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic | **HAMMER WEIGHT (lbs):** 140 / 140 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.81 | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): ▽ 0.5 ft 4/20/2018 Free water at 0.5'
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level; ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
180			1D		0-2	24/18	1-2-3-4			0.5 Loose, grass / topsoil	▽	
			2D		2-4	24/18	5-8-12-14	q_P=9 to 8 ksf		2.0 Loose, brown clayey SILT, some sand with organics Hard to stiff, brown silty CLAY		
	5											
175			3D		5-7	24/24	4-4-5-7	q_P=5 to 3 ksf				
	10									9.5 Medium dense, brown silty gravelly SAND		
170			4D		10-12	24/16	7-9-8-50			12.0 Bottom of Exploration at 12.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

S.W.COLE ENGINEERING, INC.

BORING LOG

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B- 3
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/25/2018
DATE FINISH: 4/25/2018

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): 194' +/-
TOTAL DEPTH (FT): 3.5
LOGGED BY: Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC
DRILLER: Jeff Lee
DRILLING METHOD: Solid Stem Auger
RIG TYPE: Track Mounted CME 850
AUGER ID/OD: N/A / 4 1/2 in
SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic
HAMMER WEIGHT (lbs): 140 / 140
CASING ID/OD: N/A /N/A
CORE BARREL:
HAMMER EFFICIENCY FACTOR: 0.81
HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): 4/25/2018 No free water observed
GENERAL NOTES: Moved 3' +/- southeast of B-3. Auger refusal at 3'.

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0-2	24/7	1-1-2-8			Loose, forest duff / brown sandy SILT with organics		
										1.0 Loose, brown silty gravelly SAND		
										3.5 Refusal at 3.5 feet Auger refusal, probable bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B- 4
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/24/2018
DATE FINISH: 4/24/2018

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 179' +/- **TOTAL DEPTH (FT):** 27.0 **LOGGED BY:** Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Jeff Lee **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted CME 850 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic **HAMMER WEIGHT (lbs):** 140 / 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:** NQ2
HAMMER EFFICIENCY FACTOR: 0.81 **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): 4/24/2018 Water introduced during drilling
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level; ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling; D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear; Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot; WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D	D	0-2	24/20	1-1-3-4			Very loose, grass / topsoil		
										1.0 Loose, gray-brown sandy clayey SILT with roots and organics		
			2D	D	2-4	24/16	4-7-12-17	q_P=9 ksf		2.0 Hard, gray-brown silty CLAY, some sand		
175	5		3D	D	5-7	24/24	3-6-7-8	q_P=6.5 to 4 ksf		4.0 Very stiff to stiff, brown silty CLAY		
170	10		4D	D	10-12	24/22	1-2-5-15	q_P=3 to 1 ksf		9.0 Medium, olive brown silty CLAY		
										11.5 Dense, brown silty gravelly SAND with weathered rock		
165	15		5D	D	15-15.9	11/6	34-50/5"			15.0 Highly weathered rock between 15-16'		
			1R	R	17-22	60/54	77			Roller cone through bedrock from 15.9-17'		
160	20									1R - Light gray GRANITE; hard, non-foliated, fresh-slightly weathered, fractures at 0-5, 30-40 and 55 degrees from horizontal.		
			2R	R	22-27	60/60	93			2R - fresh-slightly weathered, fractures at 0-5 degrees from horizontal.		
155	25									27.0 Bottom of Exploration at 27.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 4

BORING LOG

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B- 5
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/24/2018
DATE FINISH: 4/24/2018

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 179' +/- | **TOTAL DEPTH (FT):** 15.0 | **LOGGED BY:** Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted CME 850 | **AUGER ID/OD:** N/A / N/A | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic | **HAMMER WEIGHT (lbs):** 140 / 140 | **CASING ID/OD:** 4 in / 4 1/2 in | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.81 | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): 4/24/2018 Water introduced during drilling
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/18	1-2-3-4			0.5 Loose, grass / topsoil		
			2D		2-4	24/24	4-6-9-12	q_P=7 to 4 ksf		2.0 Loose, gray clayey SILT with roots and organics; Very stiff, gray-brown sandy clayey SILT		
175	5		3D		5-7	24/24	4-4-5-8	q_P=6.5 to 4 ksf		4.0 Very stiff to stiff, brown silty CLAY		
170	10		4D		10-12	24/24	1-1-8-7	q_P=3 to 1 ksf		8.5 Medium, olive-brown silty CLAY		
										12.0 Probable silty gravelly SAND		
165	15									14.0 Advanced by roller cone through probable bedrock; 15.0 Bottom of Exploration at 15.0 feet; Probable bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B- 6
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/20/2018
DATE FINISH: 4/20/2018

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 179' +/- | **TOTAL DEPTH (FT):** 18.5 | **LOGGED BY:** Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted CME 850 | **AUGER ID/OD:** N/A / N/A | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic | **HAMMER WEIGHT (lbs):** 140 / 140 | **CASING ID/OD:** 4 in / 4 1/2 in | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.81 | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): 4/23/2018 Water introduced during drilling
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/18	1-3-5-5			0.4 Loose, grass / topsoil Stiff, gray-brown clayey SILT, some sand		
			2D		2-4	24/22	5-9-11-13	q_P=7 ksf				
175	5		3D		5-7	24/24	3-4-5-7	q_P=6 ksf		4.0 Very stiff to stiff, brown silty CLAY		
170	10		4D		10-12	24/24	WOH FOR 12"-2-2	q_P=2 to 1 ksf w =37.5 %		8.5 Medium, gray silty CLAY 11.0 Medium, olive brown silty CLAY, some sand		
165	15		5D		15-17	24/12	6-12-18-20	w =11.6 %		13.0 Medium dense to dense, brown silty gravelly SAND 18.5 Refusal at 18.5 feet Probable bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B- 7
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/20/2018
DATE FINISH: 4/20/2018

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 179' +/- **TOTAL DEPTH (FT):** 31.4 **LOGGED BY:** Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Jeff Lee **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted CME 850 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic **HAMMER WEIGHT (lbs):** 140 / 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:** NQ2
HAMMER EFFICIENCY FACTOR: 0.81 **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): 4/20/2018 Ponded water at ground surface. Water introduced during drilling at 10'.
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0-2	24/18	2-3-6-9			0.5 Loose, grass / topsoil Loose, brown sandy clayey SILT with rootlets		
			2D		2-4	24/20	6-8-12-12	q_P=8 to 7 ksf		2.0 Very stiff to stiff, brown silty CLAY		
175	5		3D		5-7	24/22	3-3-4-5	q_P=6 ksf				
170	10		4D		10-12	24/24	WOH FOR 18"-2	q_P=0.5 ksf w =40.3 %		8.5 Medium, gray silty CLAY		
165	15		1U		15-17	24/24		q_U=1.2 ksf				
			1V		17-17	0/0		W_L=55 W_P=24 w =41.6 %				
160	20		5D		20-21.8	22	2-3-8-50/4"			19.0 Medium, brown silty gravelly SAND		
			1R		22-27	60/55	59	Rock compressive strenth: 15.7 kSI		21.7 Roller cone through probable bedrock from 21.8-22' 1R - Light gray GRANITE; hard, non-foliated, fresh-slightly weathered, fractures at 10-30 degrees and 45 degrees from horizontal.		
155	25		2R		27-31.3	51/39	58			2R - slightly weathered, fractures at 0-10 degrees and 30 degrees from horizontal.		
150	30									31.4 Bottom of Exploration at 31.4 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG

S.W.COLE ENGINEERING, INC.

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B- 8
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/23/2018
DATE FINISH: 4/23/2018

Drilling Information

LOCATION: See Exploration Location Plan **ELEVATION (FT):** 181' +/- **TOTAL DEPTH (FT):** 34.5 **LOGGED BY:** Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC **DRILLER:** Jeff Lee **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted CME 850 **AUGER ID/OD:** N/A / N/A **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic **HAMMER WEIGHT (lbs):** 140 / 140 **CASING ID/OD:** 4 in / 4 1/2 in **CORE BARREL:** NQ2
HAMMER EFFICIENCY FACTOR: 0.81 **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): 4/23/2018 Water introduced during drilling
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level; ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling; D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear; Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot; WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
180			1D	D	0-2	24/24	1-2-3-6			0.5 Loose, grass / topsoil Loose, gray clayey SILT with roots and organics		
			2D	D	2-4	24/18	6-9-12-12	q_P=9 to 8 ksf		2.0 Hard to stiff, brown silty CLAY		
	5		3D	D	5-7	24/18	3-4-6-7	q_P=7 ksf				
175										9.0 Medium, olive-gray silty CLAY		
	10		4D	D	10-12	24/24	1-1-2-3	q_P=0.5 ksf w =35.8 %				
170										13.0 Medium, gray silty CLAY with frequent sand seams below 17'		
	15		1U	U	15-17	24/24		q_U=2.8 ksf q_P=0.5 ksf W_L=48 W_P=22				
165			5D	D	17-19	24/20	1-6-8-10	w =42.2 %		18.0 Medium dense, gray silty gravelly SAND		
	20		6D	D	20-22	24/10	7-6-4-8	q_P=0.5 ksf w =11.7 %				
160										24.0 Roller cone through probable bedrock from 24-24.5' 1R - Light gray GRANITE, abundant biotite mica from 24.5-25.7'; hard, non-foliated, fresh-slightly weathered, fractures at 15-45 degrees from horizontal. 2R - fresh-slightly weathered, fractures at 25-35 degrees from horizontal.		
	25		1R	R	24.5-29.5	60/60	60					
155												
	30		2R	R	29.5-34.5	60/60	92					
150										34.5 Bottom of Exploration at 34.5 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

S.W.COLE ENGINEERING, INC.

BORING LOG

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B- 9A
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/23/2018
DATE FINISH: 4/23/2018

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): 184' +/-
TOTAL DEPTH (FT): 3.1
LOGGED BY: Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC
DRILLER: Jeff Lee
DRILLING METHOD: Solid Stem Auger
RIG TYPE: Track Mounted CME 850
AUGER ID/OD: N/A / 4 1/2 in
SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic
HAMMER WEIGHT (lbs): 140 / 140
CASING ID/OD: N/A /N/A
CORE BARREL:
HAMMER EFFICIENCY FACTOR: 0.81
HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): 4/23/2018 No free water observed
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_20 Depth	Remarks
			1D		0-1.7	20/6	1-2-4-50/2"			0.5 Forest duff Medium dense, brown silty gravelly SAND with cobbles (Reworked) 3.1 Refusal at 3.1 feet Auger refusal, probable bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

S.W.COLE ENGINEERING, INC.

BORING LOG

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B- 9B
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/25/2018
DATE FINISH: 4/25/2018

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 184' +/- | **TOTAL DEPTH (FT):** 10.0 | **LOGGED BY:** Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Cased Boring
RIG TYPE: Track Mounted CME 850 | **AUGER ID/OD:** N/A / N/A | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic | **HAMMER WEIGHT (lbs):** 140 / 140 | **CASING ID/OD:** 4 in / 4 1/2 in | **CORE BARREL:** NQ2
HAMMER EFFICIENCY FACTOR: 0.81 | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): 4/25/2018 No free water observed
GENERAL NOTES: Moved 7' +/- northwest of B-9A

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
										0.5 Forest duff / brown SILT and SAND with organics Brown silty gravelly SAND		
180	5		1R		5-10	60/60	55	Rock compressive strength: 13.3 kSI		4.0 Roller cone through probable bedrock 4-5' Gray GRANITE (pegmatite zone from 5 to 8'); hard, fresh-slightly weathered, fractures at 0-5, 30-40 and 55 degrees from horizontal.		
175	10									10.0 Bottom of Exploration at 10.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B- 9B

S.W.COLE ENGINEERING, INC.

BORING LOG

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B-10
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/25/2018
DATE FINISH: 4/25/2018

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): 179.5' +/-
TOTAL DEPTH (FT): 12.0
LOGGED BY: Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC
DRILLER: Jeff Lee
DRILLING METHOD: Solid Stem Auger
RIG TYPE: Track Mounted CME 850
AUGER ID/OD: N/A / 4 1/2 in
SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic
HAMMER WEIGHT (lbs): 140 / 140
CASING ID/OD: N/A /N/A
CORE BARREL:
HAMMER EFFICIENCY FACTOR: 0.81
HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): 4/25/2018 Soils wet below 10'
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/6	1-3-3-2			Loose, gray-brown sandy SILT, some clay, some gravel (Reworked)		
			2D		2-4	24/16	2-2-3-5	q_P=7 ksf		3.0 Very stiff to stiff, gray-brown clayey SILT, some sand		
175	5		3D		5-7	24/18	6-7-9-15	q_P=9 to 6 ksf		4.0 Hard to stiff, brown silty CLAY, some sand		
170	10		4D		10-12	24/22	4-4-5-5	q_P=4 to 1 ksf		10.0 Stiff to medium, olive-gray silty CLAY, some sand		
										12.0 Bottom of Exploration at 12.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

S.W.COLE ENGINEERING, INC.

BORING LOG

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B-11
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/25/2018
DATE FINISH: 4/25/2018

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): 178.5' +/-
TOTAL DEPTH (FT): 12.0
LOGGED BY: Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC
DRILLER: Jeff Lee
DRILLING METHOD: Solid Stem Auger
RIG TYPE: Track Mounted CME 850
AUGER ID/OD: N/A / 4 1/2 in
SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic
HAMMER WEIGHT (lbs): 140 / 140
CASING ID/OD: N/A /N/A
CORE BARREL:
HAMMER EFFICIENCY FACTOR: 0.81
HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): 4/25/2018 Soils saturated at 10'
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		0-2	24/18	1-1-2-4			0.5 Loose, grass / topsoil Loose, gray-brown clayey SILT, some SAND with roots		
			2D		2-4	24/24	5-9-12-14	q_P=8 ksf		2.0 Hard to stiff, brown silty CLAY		
175	5		3D		5-7	24/24	3-4-5-6	q_P=6 to 5 ksf				
170	10		4D		10-12	24/24	1-1-2-1	q_P=0.5 ksf		9.0 Medium, gray silty CLAY 12.0 Bottom of Exploration at 12.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG

CLIENT: CMP
PROJECT: Proposed Substation
LOCATION: Fickett Road, Pownal, Maine

BORING NO.: B-12
SHEET: 1 of 1
PROJECT NO. 17-1016
DATE START: 4/23/2018
DATE FINISH: 4/23/2018

Drilling Information

LOCATION: See Exploration Location Plan | **ELEVATION (FT):** 180.5' +/- | **TOTAL DEPTH (FT):** 12.0 | **LOGGED BY:** Patrick Otto
DRILLING CO.: S. W. Cole Explorations, LLC | **DRILLER:** Jeff Lee | **DRILLING METHOD:** Solid Stem Auger
RIG TYPE: Track Mounted CME 850 | **AUGER ID/OD:** N/A / 4 1/2 in | **SAMPLER:** Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic | **HAMMER WEIGHT (lbs):** 140 / 140 | **CASING ID/OD:** N/A /N/A | **CORE BARREL:**
HAMMER EFFICIENCY FACTOR: 0.81 | **HAMMER DROP (inch):** 30 / 16
WATER LEVEL DEPTHS (ft): 4/23/2018 No free water observed
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level: ▽ At time of Drilling; ▼ At Completion of Drilling; ▼ After Drilling
D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear
Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot
WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.; q_U = Unconfined Compressive Strength, kips/sq.ft.; N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
180			1D		0-2	24/24	1-1-3-6			0.5 Loose, grass / topsoil		
			2D		2-4	24/20	7-9-13-13	q_P=9 to 8 ksf		2.0 Loose, gray-brown clayey SILT with roots and organics Hard to very stiff, brown silty CLAY		
175	5		3D		5-7	24/24	2-4-5-5	q_P=6 to 4 ksf		8.5 Medium to soft, gray silty CLAY		
170	10		4D		10-12	24/24	1-1-1-1	q_P=0.5 ksf w =35 %		12.0 Bottom of Exploration at 12.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

S.W.COLE ENGINEERING, INC. • Geotechnical Engineering • Field & Lab Testing • Scientific & Environmental Consulting

KEY TO NOTES & SYMBOLS
Test Boring and Test Pit Explorations

All stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q_u	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S_v	-	field vane shear strength, kips/sq. ft.
L_v	-	lab vane shear strength, kips/sq. ft.
q_p	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W_L	-	liquid limit - Atterberg test
W_P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ_T	-	total soil weight
γ_B	-	buoyant soil weight

Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
"Y"	12 to 35%
And	35+%
With	Undifferentiated

Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to 1/2" thickness
Layer:	½" to 12" thickness
Varved:	Alternating seams or layers
Occasional:	one or less per foot of thickness
Frequent:	more than one per foot of thickness

REFUSAL: **Test Boring Explorations** - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: **Test Pit Explorations** - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

B-7, 1R and 2R & B-8, 1R and 2R

B-4, 1R and 2R & B-9B, 1R

APPENDIX D

Laboratory Test Results

S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

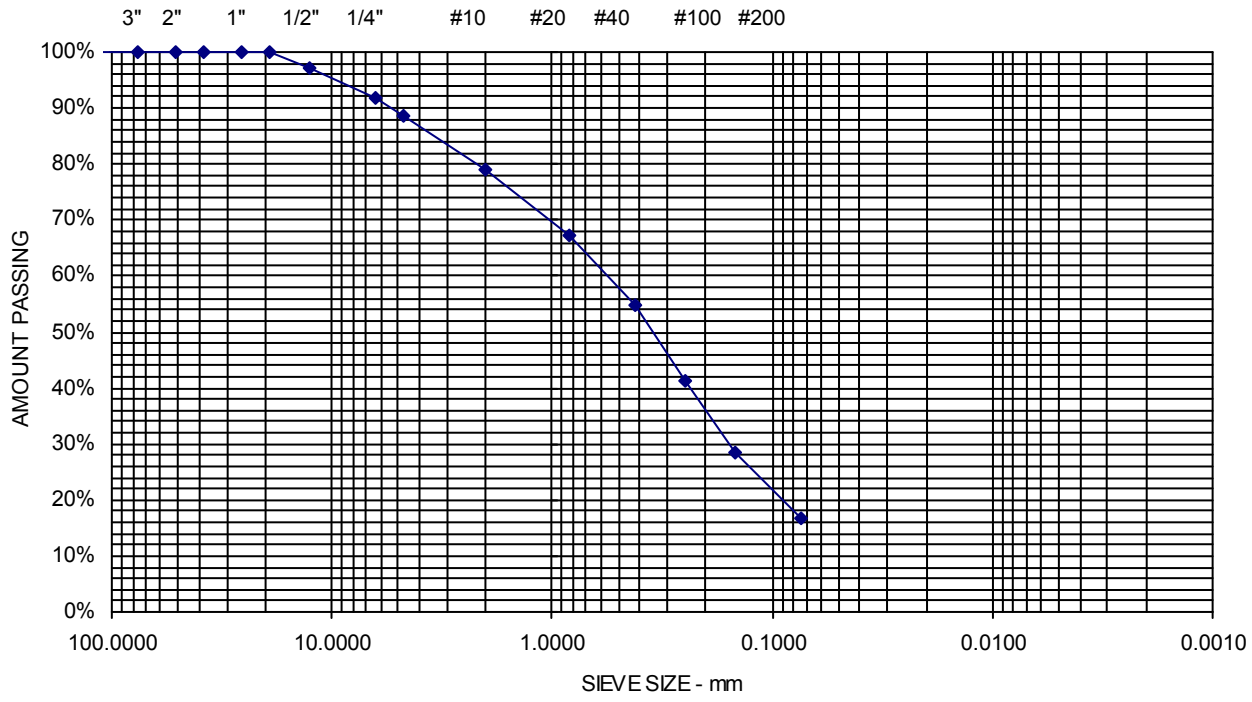
Project Name: POWNAL ME - FICKETT ROAD CMP SUBSTATION EXPANSION - GEOTECHNICAL ENGINEERING SERVICES

Client: CENTRAL MAINE POWER COMPANY

Material Source: **B-6 5D 15-17**

Project Number: 17-1016
Lab ID: 23707G
Date Received: 5/4/2018
Date Completed: 5/7/2018
Tested By: PAUL SHAFFER

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
125 mm	**5"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**100**	
12.5 mm	**1/2"**	**97**	
6.3 mm	**1/4"**	**92**	
4.75 mm	**No. 4**	**89**	11.4% Gravel
2.00 mm	**No. 10**	**79**	
850 um	**No. 20**	**67**	
425 um	**No. 40**	**55**	71.9% Sand
250 um	**No. 60**	**41**	
150 um	**No. 100**	**28**	
75 um	**No. 200**	**16.7**	16.7% Fines



Comments: w = 11.6%

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S.W.COLE ENGINEERING, INC.

Report of Gradation

ASTM C-117 & C-136

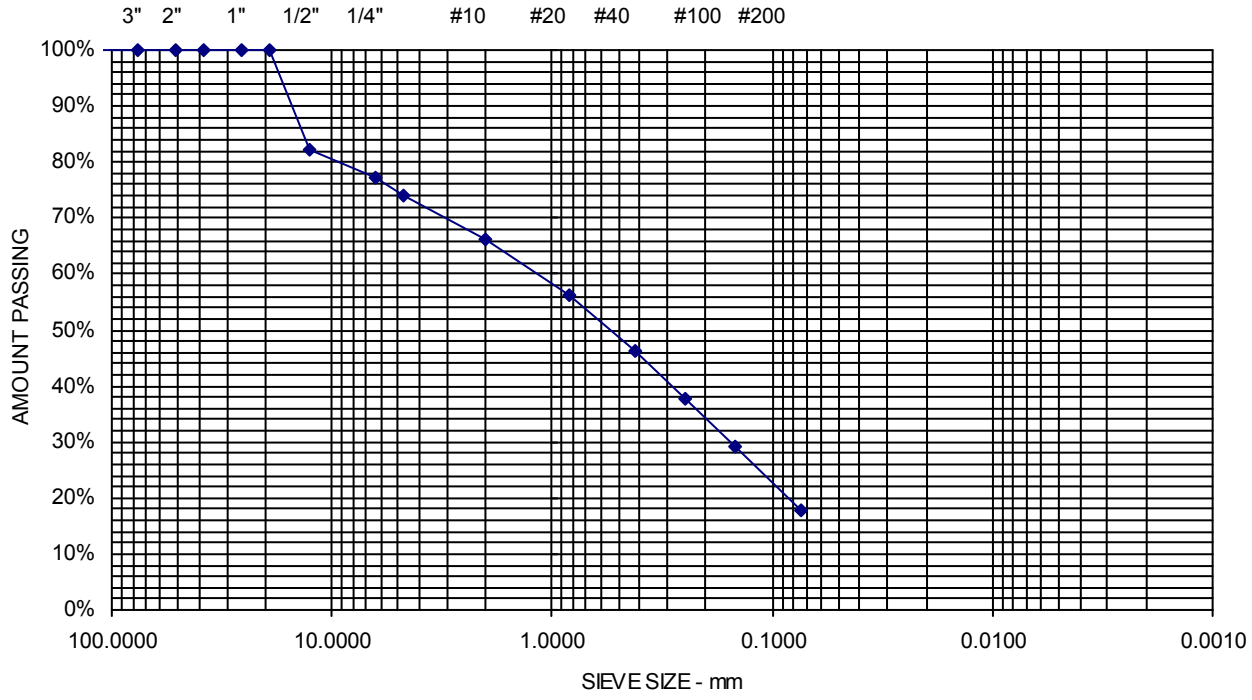
Project Name: POWNAL ME - FICKETT ROAD CMP SUBSTATION EXPANSION - GEOTECHNICAL ENGINEERING SERVICES

Client: CENTRAL MAINE POWER COMPANY

Material Source: **B-8 6D 20-22**

Project Number: 17-1016
Lab ID: 23710G
Date Received: 5/4/2018
Date Completed: 5/7/2018
Tested By: PAUL SHAFFER

STANDARD DESIGNATION (mm/µm)	SIEVE SIZE	AMOUNT PASSING (%)	
150 mm	**6"**	**100**	
125 mm	**5"**	**100**	
100 mm	**4"**	**100**	
75 mm	**3"**	**100**	
50 mm	**2"**	**100**	
38.1 mm	**1-1/2"**	**100**	
25.0 mm	**1"**	**100**	
19.0 mm	**3/4"**	**100**	
12.5 mm	**1/2"**	**82**	
6.3 mm	**1/4"**	**77**	
4.75 mm	**No. 4**	**74**	26% Gravel
2.00 mm	**No. 10**	**66**	
850 um	**No. 20**	**56**	
425 um	**No. 40**	**46**	56.2% Sand
250 um	**No. 60**	**38**	
150 um	**No. 100**	**29**	
75 um	**No. 200**	**17.9**	17.9% Fines



Comments: w = 11.7%

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S.W.COLE ENGINEERING, INC.

Consolidation Test

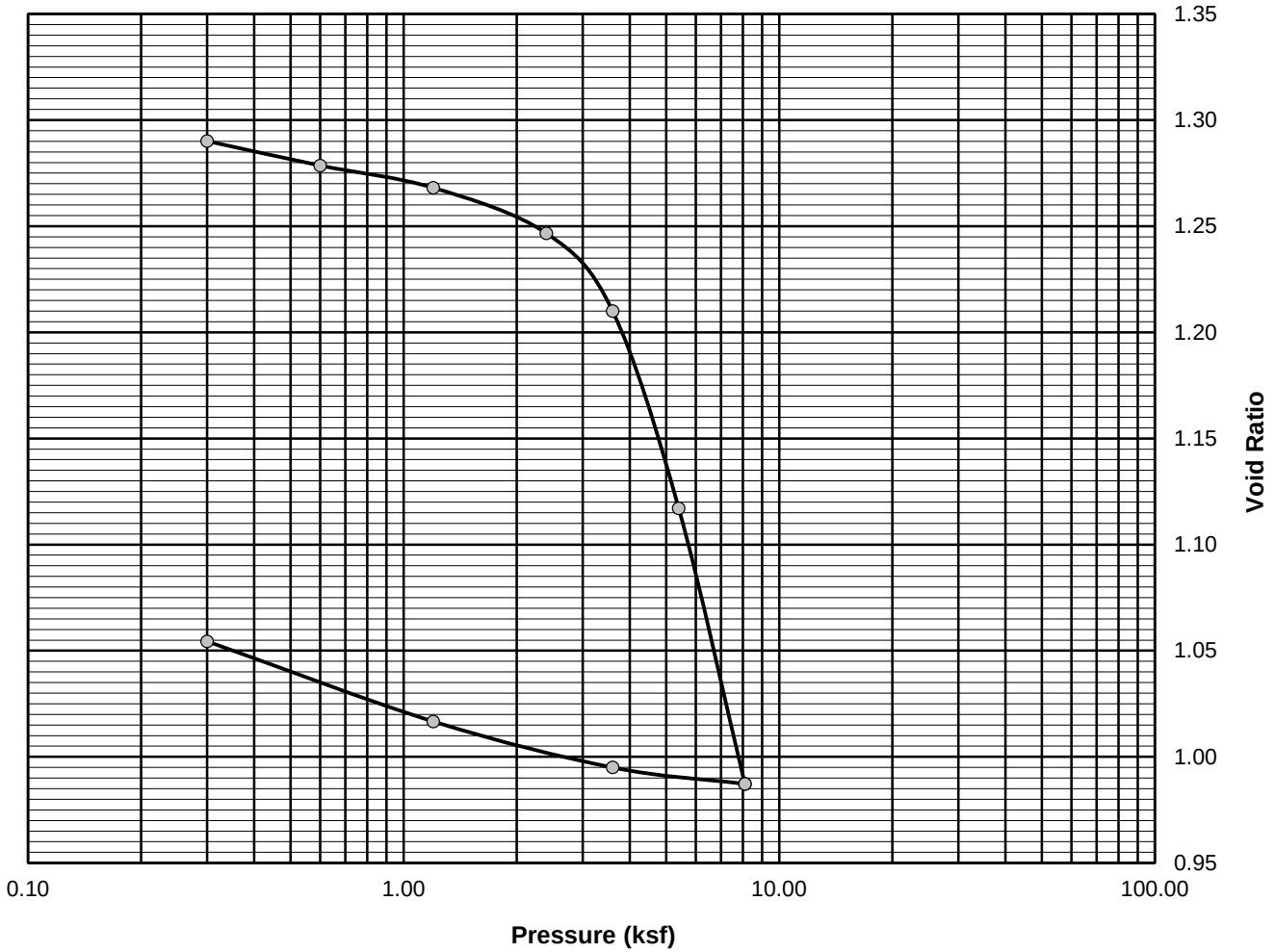
ASTM D-4767

Project Name: Fickett Road, Pownal - CMP Substation
Client: CMP

Project Number: 17-1016
Lab ID: 21478B
Date: 5/1/2018

Boring: B-7
Sample: 1U
Depth: 15-17'

P_C =	3.5 KSF
C_C =	0.74
C_R =	0.03
w =	41.6%
W_L =	55
W_P =	24



Comments:

EMW
Reviewed By

S.W.COLE ENGINEERING, INC.

Consolidation Test

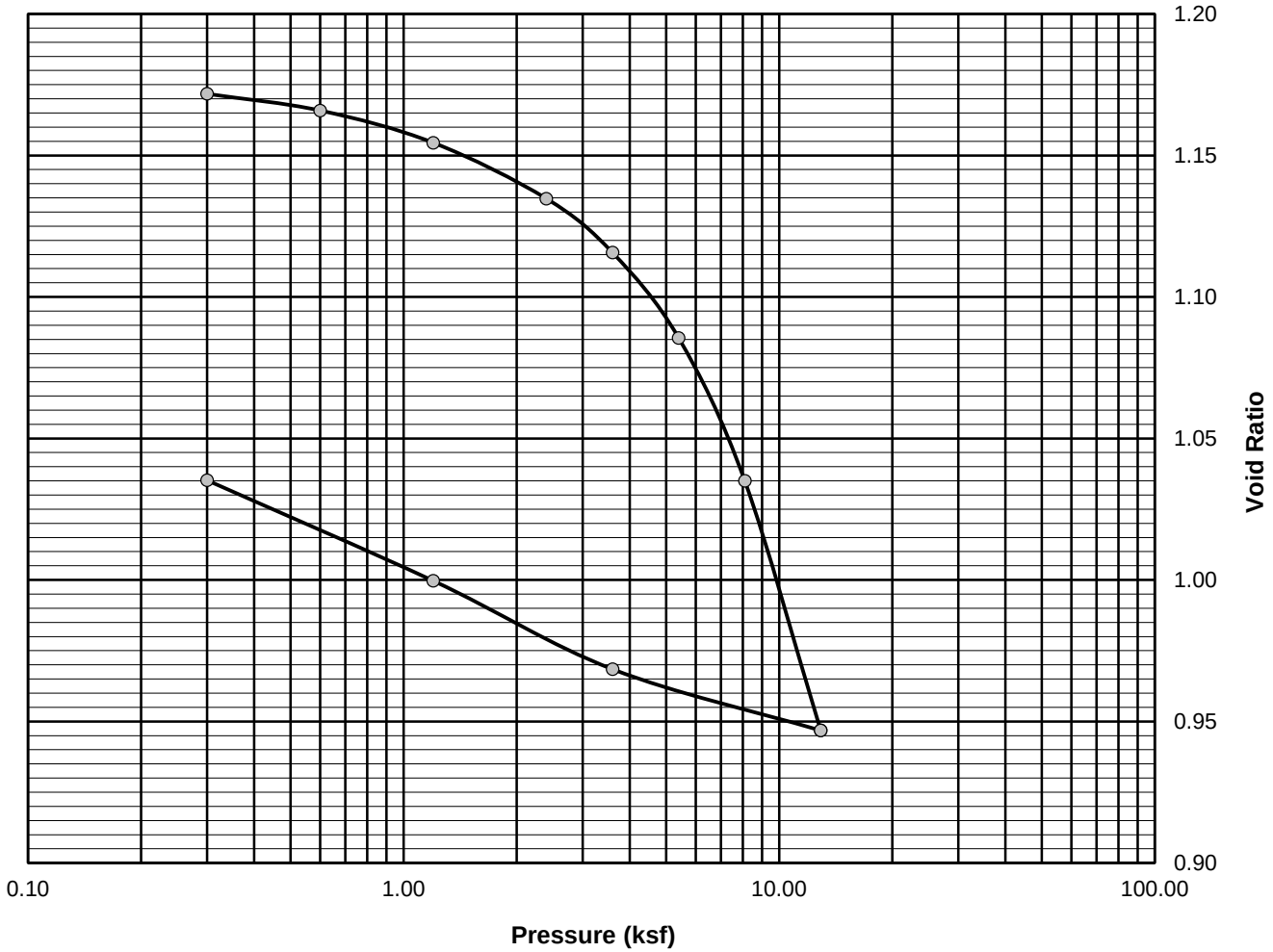
ASTM D-4767

Project Name: Fickett Road, Pownal - CMP Substation
Client: CMP

Project Number: 17-1016
Lab ID: 21479B
Date: 5/1/2018

Boring: B-8
Sample: 1U
Depth: 15-17'

P_C =	5.5 KSF
C_C =	0.43
C_R =	0.3
w =	42.2%
W_L =	48
W_P =	22



Comments:

EMW
Reviewed By

Katahdin
ANALYTICAL SERVICES

Lab. ID. 2001(non-air)
Lab. ID. 11121 (air only)

June 5, 2018

Mr. Paul Kohler
S. W. Cole Engineering, Inc.
286 Portland Road
Gray,ME 04039

RE: Katahdin Lab Number: SL4518
Project ID: Pownal / 17-1016
Project Manager: Mr. Galen Nickerson
Sample Receipt Date(s): May 23, 2018

Dear Mr. Kohler:

Please find enclosed the following information:

* Report of Analysis (Analytical and/or Field)
* Quality Control Data Summary
* Chain of Custody (COC)
* Login Report

A copy of the Chain of Custody is included in the paginated report. If requested, the original COC is attached as an addendum to this report.

Should you have any questions or comments concerning this Report of Analysis, please do not hesitate to contact the project manager listed above. The results contained in this report relate only to the submitted samples. This cover letter is an integral part of the ROA.

We certify that the test results provided in this report meet all the requirements of the NELAC standards unless otherwise noted in an attached technical narrative or in the Report of Analysis.

We appreciate your continued use of our laboratory and look forward to working with you in the future. The following signature indicates technical review and acceptance of the data.

Please go to http://www.katahdinlab.com/cert for copies of Katahdin Analytical Services Inc. current certificates and analyte lists.

Sincerely,
KATAHDIN ANALYTICAL SERVICES

Leslie Dimond

Leslie Dimond - Quality Assurance Officer

06/05/2018

Date

KATAHDIN ANALYTICAL SERVICES – INORGANIC DATA QUALIFIERS

The sampled date indicated on the attached Report(s) of Analysis (ROA) is the date for which a grab sample was collected or the date for which a composite sample was completed. Beginning and start times for composite samples can be found on the Chain-of-Custody.

U Indicates the compound was analyzed for but not detected above the specified level. This level may be the Practical Quantitation Level (PQL) (also called Limit of Quantitation (LOQ)), the Limit of Detection (LOD) or Method Detection Limit (MDL) as required by the client.

Note: All results reported as "U" MDL have a 50% rate for false negatives compared to those results reported as "U" PQL "U" LOQ or "U" LOD, where the rate of false negatives is <1%.

E Estimated value. This flag identifies compounds whose concentrations exceed the upper level of the calibration range of the instrument for that specific analysis.

J Estimated value. The analyte was detected in the sample at a concentration less than the laboratory Practical Quantitation Level (PQL) (also called Limit of Quantitation (LOQ)), but above the Method Detection Limit (MDL).

I-7 The laboratory's Practical Quantitation Level (PQL) or LOQ could not be achieved for this parameter due to sample composition, matrix effects, sample volume, or quantity used for analysis.

A-4 Please refer to cover letter or narrative for further information.

H_ Please note that the regulatory holding time for _____ is "analyze immediately". Ideally, this analysis must be performed in the field at the time of sample collection. _____ for this sample was not performed at the time of sample collection. The analysis was performed as soon as possible after receipt by the laboratory.

H1 - pH H2 - DO H3 - sulfite H4 - residual chlorine

T1 The client did not provide the full volume of at least one liter for analysis of TSS. Therefore, the PQL of 2.5 mg/L could not be achieved.

T2 The client provided the required volume of at least one liter for analysis of TSS, but the laboratory could not filter the full one liter volume due to the sample matrix. Therefore, the PQL of 2.5 mg/L could not be achieved.

M1 The matrix spike and/or matrix spike duplicate recovery performed on this sample was outside of the laboratory acceptance criteria. Sample matrix is suspected. The laboratory criteria was met for the Laboratory Control Sample (LCS) analyzed concurrently with this sample.

M2 The matrix spike and/or matrix spike duplicate recovery was outside of the laboratory acceptance criteria. The native sample concentration is greater than four times the spike added concentration so the spike added could not be distinguished from the native sample concentration.

R1 The relative percent difference (RPD) between the duplicate analyses performed on this sample was outside of the laboratory acceptance criteria (when both values are greater than ten times the PQL).

MCL	Maximum Contaminant Level	NL	No limit
NFL	No Free Liquid Present	FLP	Free Liquid Present
NOD	No Odor Detected	TON	Threshold Odor Number

D-1 As required by Method 5210B, APHA Standard Methods for the Examination of Water and Wastewater (21st edition), the BOD value reported for this sample is 'qualified' because the check standard run concurrently with the sample analysis did not meet the criteria specified in the method (198 +/- 30.5 mg/L). These results may not be reportable for compliance purposes.

D-2 The measured final dissolved oxygen concentrations of all dilutions were less than the method-specified limit of 1 mg/L. The reported BOD result was calculated assuming a final oxygen concentration equal to 1 mg/L. The reported value should be considered a minimum value.

D-3 The dilution water used to prepare this sample did not meet the method and/or regulatory criteria of less than 0.2 or 0.4 mg/L dissolved oxygen (DO) uptake over the five day period of incubation. These results may not be reportable for compliance purposes.

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Report of Analytical Results

Client: Paul Kohler
S. W. Cole Engineering, Inc.
286 Portland Road
Gray,ME 04039

Lab Sample ID: SL4518-1
Report Date: 04-JUN-18
Client PO: 17-1016
Project: Pownal / 17-1016
SDG: SL4518

Sample Description	Matrix	Date Sampled	Date Received
B5, 1D	SL	23-MAY-18 08:30:00	23-MAY-18

Parameter	Result	Adj PQL	Adj MDL	Anal. Method	QC Batch	Analysis Date	Prep. Method	Prep. Date	Analyst	Footnotes	RPD/RSD
Chloride	2600 mg/Kgdrywt	120	60.	EPA 325.2	WG229257	25-MAY-18 17:40:23	EPA 300.0	25-MAY-18	ZF		
Sulfate-Turbidimetric	1200 mg/Kgdrywt	61.	12.	EPA 375.4	WG229563	01-JUN-18 13:01:13	EPA 300.0	25-MAY-18	AP		
Total Solids	79. %	1		SM2540G	WG229148	28-MAY-18 18:12:49	SM2540G	26-MAY-18	BF		
pH(Soil)	6.4 pH	0.10	0.10	SW846 9045D	WG229009	23-MAY-18 18:45:38	SW846 9045C	23-MAY-18	SC		

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Report of Analytical Results

Client: Paul Kohler
S. W. Cole Engineering, Inc.
286 Portland Road
Gray,ME 04039

Lab Sample ID: SL4518-2
Report Date: 04-JUN-18
Client PO: 17-1016
Project: Pownal / 17-1016
SDG: SL4518

Sample Description	Matrix	Date Sampled	Date Received
B8, 1D	SL	23-MAY-18 08:30:00	23-MAY-18

Parameter	Result	Adj PQL	Adj MDL	Anal. Method	QC Batch	Analysis Date	Prep. Method	Prep. Date	Analyst	Footnotes	RPD/RSD
Chloride	1200 mg/Kgdrywt	24.	12.	EPA 325.2	WG229257	25-MAY-18 17:22:27	EPA 300.0	25-MAY-18	ZF		
Sulfate-Turbidimetric	4300 mg/Kgdrywt	180	36.	EPA 375.4	WG229563	01-JUN-18 13:29:46	EPA 300.0	25-MAY-18	AP		
Total Solids	79. %	1		SM2540G	WG229148	28-MAY-18 18:13:01	SM2540G	26-MAY-18	BF		
pH(Soil)	7.1 pH	0.10	0.10	SW846 9045D	WG229009	23-MAY-18 18:50:05	SW846 9045C	23-MAY-18	SC		

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ANALYTICAL SERVICES

Cert No E87604

Quality Control Report

Blank Sample Summary Report

Chloride

Samp Type	QC Batch	Anal. Method	Anal. Date	Prep. Date	Result	PQL
MBLANK	WG229257	EPA 325.2	25-MAY-18	N/A	U 1.0 mg/L	2.0 mg/L

Sulfate-Turbidimetric

Samp Type	QC Batch	Anal. Method	Anal. Date	Prep. Date	Result	PQL
MBLANK	WG229563	EPA 375.4	01-JUN-18	25-MAY-18	U 1.0 mg/L	1.0 mg/L

Total Solids

Samp Type	QC Batch	Anal. Method	Anal. Date	Prep. Date	Result	PQL
MBLANK	WG229148	SM2540G	28-MAY-18	26-MAY-18	100 %	1 %

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ANALYTICAL SERVICES

Cert No E87604

Quality Control Report

Laboratory Control Sample Summary Report

Chloride

Lab Sample Id	Samp Type	QC Batch	Analysis Date	Prep Date	Units	Spike Amt.	Result	Recovery	Acceptance Range	RPD
WG229257-2	LCS	WG229257	25-MAY-18	N/A	mg/L	35	36.	102	80-120	

Sulfate-Turbidimetric

Lab Sample Id	Samp Type	QC Batch	Analysis Date	Prep Date	Units	Spike Amt.	Result	Recovery	Acceptance Range	RPD
WG229563-2	LCS	WG229563	01-JUN-18	25-MAY-18	mg/L	15	15.	101	80-120	

Total Solids

Lab Sample Id	Samp Type	QC Batch	Analysis Date	Prep Date	Units	Spike Amt.	Result	Recovery	Acceptance Range	RPD
WG229148-2	LCS	WG229148	28-MAY-18	26-MAY-18	%	90	90.	100	90-110	

pH(Soil)

Lab Sample Id	Samp Type	QC Batch	Analysis Date	Prep Date	Units	Spike Amt.	Result	Recovery	Acceptance Range	RPD
WG229009-1	LCS	WG229009	23-MAY-18	23-MAY-18	pH	7	7.0	100	90-110	

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Cert No E87604

Quality Control Report

Duplicate Sample Summary Report

Total Solids

Duplicate Sample ID	Original Sample ID	QC Batch	Analysis Date	Result Units	Sample Result	Duplicate Result	RPD(%)	RPD Limit
WG229148-3	SL4518-1	WG229148	28-MAY-18	%	79.	79.	1	20

Katahdin Analytical Services, LLC.

Sample Receipt Condition Report

Client: SW Cole	KAS PM:	Sampled By: Client
Project:	KIMS Entry By:	Delivered By: Client
KAS Work Order#: SL 4517, 4518	KIMS Review By: AMH	Received By: KF
SDG #:	Cooler: 1 of 1	Date/Time Rec.: 5/23/18 10:10

Receipt Criteria	Y	N	EX*	NA	Comments and/or Resolution
1. Custody seals present / intact?		✓			
2. Chain of Custody present in cooler?	✓				
3. Chain of Custody signed by client?	✓				
4. Chain of Custody matches samples?	✓				
5. Temperature Blanks present? If not, take temperature of any sample w/ IR gun.	✓				Temp (°C): 2.7°C
Samples received at <6 °C w/o freezing?	✓				Note: Not required for metals (except Hg soil) analysis.
Ice packs or ice present?	✓				The lack of ice or ice packs (i.e. no attempt to begin cooling process) or insufficient ice may not meet certain regulatory requirements and may invalidate certain data.
If yes, was there sufficient ice to meet temperature requirements?	✓				
If temp. out, has the cooling process begun (i.e. ice or packs present) and sample collection times <6hrs., but samples are not yet cool?				✓	Note: No cooling process required for metals (except Hg soil) analysis.
6. Volatiles: **Aqueous:** No bubble larger than a pea?	✓				
Soil/Sediment: Received in airtight container?				✓	
Received in methanol?				✓	
Methanol covering soil?				✓	
D.I. Water - Received within 48 hour HT?				✓	
Air: Refer to KAS COC for canister/flow controller requirements.	√ if air included				
7. Trip Blank present in cooler?				✓	
8. Proper sample containers and volume?	✓				
9. Samples within hold time upon receipt?	✓				
10. Aqueous samples properly preserved? Metals, COD, NH3, TKN, O/G, phenol, TPO4, N+N, TOC, DRO, TPH – pH <2	✓				
Sulfide - >9				✓	
Cyanide – pH >12				✓	

* Log-In Notes to Exceptions: document any problems with samples or discrepancies or pH adjustments.

Katahdin ANALYTICAL SERVICES

600 Technology Way
Scarborough, ME 04074
Tel: (207) 874-2400
Fax: (207) 775-4029

EMAIL PMOHLER@SWCOLE.COM

CHAIN of CUSTODY

PLEASE BEAR DOWN AND PRINT LEGIBLY IN PEN

Client	Contact	Phone #	Fax #
S.W. COLE ENG INC	PAUL MOHLER	(207) 657-2866	( )

Address	City	State	Zip Code
286 PORTLAND RD	GRAY	ME	04039

Purchase Order #	Proj. Name / No.	Katahdin Quote #
	POWNAL / 17-1016	

Bill (if different than above)	Address

Sampler (Print / Sign)	Copies To:

LAB USE ONLY

WORK ORDER #: SL 4518

KATAHDIN PROJECT NUMBER _____

REMARKS: _____

SHIPPING INFO: ☐ FED EX ☐ UPS ☐ CLIENT

AIRBILL NO: _____

TEMP°C _____ ☐ TEMP BLANK ☐ INTACT ☐ NOT INTACT

★	Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.	ANALYSIS AND CONTAINER TYPE PRESERVATIVES: Filt. ☐Y ☐N — PH	Filt. ☐Y ☐N — CHLORIDES, SULFATE
	B5 1D	5-23 / 08:30	SOIL	1	X	X
	B8, 1D	" / "	"	1	X	X
		/				
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COMMENTS

Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)
Paul F. Mohler	5/23/18 9:20	Doug Bunk	Doug Bunk	5/23 10:00	
Doug Bunk	5/23/ 10:00	K Tw 5-23-18 10:00			
Relinquished By: (Signature)	Date / Time	Received By: (Signature)	Relinquished By: (Signature)	Date / Time	Received By: (Signature)

Katahdin
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Katahdin Analytical Services

Login Chain of Custody Report (lno1)

May. 23, 2018
04:25 PM

Login Number: SL4518

Account: SWCOLE001 NoWeb
S. W. Cole Engineering, Inc.

Project:

Primary Report Address:
Paul Kohler
S. W. Cole Engineering, Inc.
286 Portland Road

Gray,ME 04039
pkohler@swcole.com

Primary Invoice Address:
Accounts Payable
S. W. Cole Engineering, Inc.
37 Liberty Drive

Bangor,ME 04401

Report CC Addresses:
Invoice CC Addresses:

Quote/Incoming:

Login Information:

ANALYSIS INSTRUCTIONS	:	
CHECK NO.	:	
CLIENT PO#	:	17-1016
CLIENT PROJECT MANAGE	:	
CONTRACT	:	
COOLER TEMPERATURE	:	2.7
DELIVERY SERVICES	:	Client
EDD FORMAT	:	KAS064QC-XLS
LOGIN INITIALS	:	JCB
PM	:	GN
PROJECT NAME	:	Pownal / 17-1016
QC LEVEL	:	II+
REPORT INSTRUCTIONS	:	Please send final report and EDD to Paul (pkohler@swcole.com)
SDG ID	:	
SDG STATUS	:	
VERBAL TAT	:	

Laboratory Sample ID	Client Sample Number	Collect Date/Time	Receive Date	PR	Verbal Date	Due Date	Mailed
SL4518-1	B5, 1D	23-MAY-18 08:30	23-MAY-18			04-JUN-18	

Matrix		Product	Hold Date (shortest)	Bottle Type	Bottle Count	Comments
Solid	S	E325.2-CHLORIDE	20-JUN-18	100g Glass		
Solid	S	E375.4-SULFATE	20-JUN-18	100g Glass		
Solid	S	SW9045C-PH SOIL	20-JUN-18	100g Glass		
Solid	S	TS-ME	30-MAY-18			

Laboratory Sample ID	Client Sample Number	Collect Date/Time	Receive Date	PR	Verbal Date	Due Date	Mailed
SL4518-2	B8, 1D	23-MAY-18 08:30	23-MAY-18			04-JUN-18	

Matrix		Product	Hold Date (shortest)	Bottle Type	Bottle Count	Comments
Solid	S	E325.2-CHLORIDE	20-JUN-18	100g Glass		
Solid	S	E375.4-SULFATE	20-JUN-18	100g Glass		
Solid	S	SW9045C-PH SOIL	20-JUN-18	100g Glass		
Solid	S	TS-ME	22-JUN-18	100g Glass		

Total Samples: 2 ***Total Analyses: 8***