NEW ENGLAND
CLEAN ENERGY
CONNECT

Site Location of Development Application Amendment for the Kennebec River Horizontal Directional Drill

New England Clean Energy Connect (NECEC)

CENTRAL MAINE
POWER

Prepared for:
Maine Department of Environmental Protection
Land Use Planning Commission
United States Army Corps of Engineers

October 19, 2018

1.0 DEVELOPMENT DESCRIPTION

Central Maine Power Company ("CMP") is amending its Site Location of Development ("Site Law") and Natural Resources Protection Act ("NRPA") Applications, filed September 27, 2017, to include a Horizonal Directional Drill ("HDD") crossing beneath the Upper Kennebec River, between West Forks Plantation ("Plt") and Moxie Gore. This document amends the September 27, 2017 Site Law application.

HDD is an installation method of underground utilities, which uses a drill rig to bore along an engineered alignment under and/or around various obstacles, such as a river crossing. HDD installation requires some temporary trenching in the transmission line segment between where the conductors exit the ground and where they come up into their respective termination stations. The crossing location of the Upper Kennebec River, designated as an Outstanding River Segment (38 M.R.S. § 480-P, referencing 12 M.R.S. § 403(7)), is a recreational resource used by whitewater rafters and anglers that provides regional and local economic benefit to Maine. This underground transmission line solution will fully preserve the scenic character of this section of the Kennebec River by eliminating the visual impacts of an overhead transmission line crossing from recreational users of the river.

The HDD crossing proposed for the Kennebec River consists of three main components: 1) the HDD bore, a subgrade conduit containing the HDVC line; 2) two termination stations, one on each side of the river, where the transmission lines transition from underground to overhead; and 3) trenching, a direct buried conduit used to carry the transmission cables from the HDD bore to the termination station. Construction of the HDD crossing will require a temporary drilling/receiving platform on each side of the river, which will be used to set up the drill rig and advance the HDD bore hole. These areas will be restored to pre-existing contours and revegetated after HDD is complete. Attachment 1 provides the Engineered HDD and Termination Station Plans.

The duration of construction associated with the entire HDD installation is anticipated to require 6-8 months, followed by 6 months of activity associated with the construction of the termination stations. More detail on the construction sequence is provided in the Construction Plan (Chapter 7.0) in the NRPA application amendment being submitted concurrently with this filing. Each component is described in further detail below.

1.1 HDD Bore

The HDD bore will travel underground approximately 3,000 feet from the Moxie Gore Termination Station on the east side of the Kennebec River to the West Forks Termination Station on the west side of the river. Five HVDC electrical conductors will be installed within a 36-inch steel conduit, through a 48-

inch bore hole. The depth of the HDD bore beneath the riverbed will range from approximately 55 to 75 feet.

The bore will begin with a pilot hole of 8-10 inch diameter on the east side of the Kennebec River. This hole will be enlarged by using progressively larger diameter drill heads to ream the hole, initially in a west to east direction and then east to west, continuing in this alternating progression until the desired borehole diameter is achieved. Steel casing will then be pulled though the borehole from west to east, to both retain the borehole in its full diameter, and to protect the electrical conductors and associated conduits to be located within the larger conduit.

Because the HVDC line will be underground from the entry point on the east side to the exit point on the west side, 1,450 feet of forested buffer on the east side and 1,160 feet of forested buffer on the west side will be retained on the Kennebec River banks and adjacent uplands, eliminating the visual impacts to recreational users of the river.

1.2 Termination Stations

Termination stations will be required on each side of the Kennebec River to transition the HVDC transmission lines from below ground to overhead. The Moxie Gore Termination Station (east side) and the West Forks Termination Station (west side) will be identical in size and structure, each designed with a minimal foot print of 135 feet by 135 feet. These yards will be fenced and finished with a crushed stone surface, typical of CMP's substation yards. The yard will consist of electrical equipment and associated foundations (conduit riser, bus support, equipment support, transmission dead-end structures, etc.) arranged to perform the required functionality in a compact footprint. The termination stations will be passive and will contain no sound producing or light emitting equipment. Permanent access will be attained by using existing land management roads on both sides of the river. These roads will require modifications and upgrades to accommodate construction equipment and maintenance vehicles. A short section of permanent gravel road will be constructed at both termination stations, extending the existing land management roads by approximately 156 feet and 728 feet at the Moxie Gore and West Forks termination stations, respectively. The permanent access at each termination station site will be maintained to allow access for routine and/or emergency maintenance of the termination station and overhead HVDC line.

1.3 Trenching

Trenching will be required to install buried conduit, used to carry the transmission cables from the HDD bore entry and exit points to the conduit risers within the termination stations. The buried conduit allows

for transition from the HDD to the cable riser structures. Specifically, it allows for separation of four DC cables (conductors) plus the spare cable (5 total) into their respective riser structures and terminators. The vault system designed into the trench allows for intermediate splicing in the event of an underground cable terminator failure. On the west side of the Kennebec River the trench avoids a small radius compound (i.e., horizontal plus vertical) bend in the HDD, which significantly simplifies the drilling effort. Trenching must be located between the borehole and the termination station because in the trenched section, poles converge or diverge from one bundle into separate components.

Three cable trenches extending approximately 350 feet will be required between each termination station and their respective HDD points of entry or exit. Typical trench dimensions will be 4 to 8 feet wide by 5 to 10 feet deep. Trenches will be temporary and will be backfilled and revegetated after construction. To eliminate the potential for roots to interfere with the underground cables, CMP will prevent large tree growth within the trenched sections and will maintain vegetation in these areas consistent with the NECEC Post-Construction Vegetation Maintenance Plan (August 2018).

1.4 Temporary Drilling/Receiving Platforms

A temporary drilling platform will be established on the east side of the Kennebec River just west of the Moxie Gore Termination Station and trenched buried conduit. A 125-foot by 150-foot level graded working area will be used for the HDD drill rig. This temporary work area will be arranged in conjunction with the contractor to promote a safe and efficient workflow. The drill rig will be set behind an excavated pit that will collect and retain the drilling fluid (mud). The pit is estimated to be approximately 15 feet wide by 25 feet long and 5 feet deep. The drill fluid and cuttings will be collected in this pit and removed as necessary to keep drilling operations active. The receiving pit will be a similar but slightly smaller pit. Both pits will be installed before drilling operations begin.

Similarly, a temporary receiving platform and smaller receiving fluid pit will be established on the west side of river east of the West Forks Termination Station and trenched buried conduit. The full length of conduit must be constructed on the receiving end of the bore and pulled through the bore hole in one consistent motion. To ensure the casing does not buckle, sufficient equipment including cranes, backhoes, staging and roller stands must be provided to suspend the casing at an elevation consistent with the bore hole entry angle and allowable bending radius of the casing. A construction area approximately equal to the length of the bore path and approximately 50 feet wide will be required in-line with the bore entry hole. This ROW is required for the fabrication of the casing and equipment used to suspend it in a catenary as it is pulled into the HDD bore. It is anticipated that the ROW will run within the current transmission ROW and no additional land will be impacted.

Both the drilling and receiving platforms and pits are temporary and will be used during the HDD installation. Once construction is complete, these areas will be restored to preconstruction contours and revegetated. Vegetation in these areas will be maintained consistent with the NECEC Post-Construction Vegetation Maintenance Plan (August 2018).

2.0 TITLE, RIGHT OR INTEREST

The proposed HDD and termination stations are located within the 300 foot -wide corridor previously acquired by CMP. Documentation of title, right or interest was provided for this area in the original Site Law application submitted by CMP on September 27, 2017.

3.0 FINANCIAL CAPACITY

The HDD project modification does not affect the financial capacity demonstration in Section 3.0 of the NECEC Site Law Application (September 27, 2017) or the updated Section 3.0 filed with the MDEP as part of CMP's Response to Additional Questions letter (July 31, 2018). Additionally, construction of the HDD alternative at the Kennebec River does not affect the line items or capital cost total detailed in the NECEC Project Capital Cost Estimate Table included with the cost estimate letter filed with the MDEP on December 12, 2017.

4.0 TECHNICAL ABILITY

CMP has consulted nationwide HDD contractors on the technical aspects of this crossing of the Kennebec River utilizing HDD methods. Their input and comments were incorporated into the design of the proposed underground Kennebec River crossing. CMP will select one of these highly qualified HDD contractors for the final design and construction of the Kennebec River HDD crossing. Along with CMP's extensive experience in construction of transmission lines, detailed in the September 2017 application, and CMP's stringent contractor evaluation process that will result in selection of a qualified and highly capable HDD contractor, CMP has the technical ability to design, construct, operate, and maintain the proposed development, including the HDD crossing. See Exhibit 4-1 for qualifications of representative HDD contractors.

Exhibit 4-1: Representative HDD Contractor Qualifications

Trenchless Design

BRIERLEY ASSOCIATES
Creating Space Underground

At Brierley Associates

Our nationwide and international experience allows us to understand the challenges involved with pipeline design and underground construction.

Our team is experienced in all aspects of trenchless pipe installation, feasibility and risk assessment, alignment selection, permit support, geotechnical site characterization, shaft design, value engineering, contractor procurement, construction management and dispute resolution.

We "Create Space Underground"

Trenchless Technologies

Brierley Associates supports owners, engineering design professionals and trenchless/geotechnical contractors with all aspects of trenchless technology. Our geologists, trenchless and underground engineers know how to deliver efficient, effective and constructible designs for:

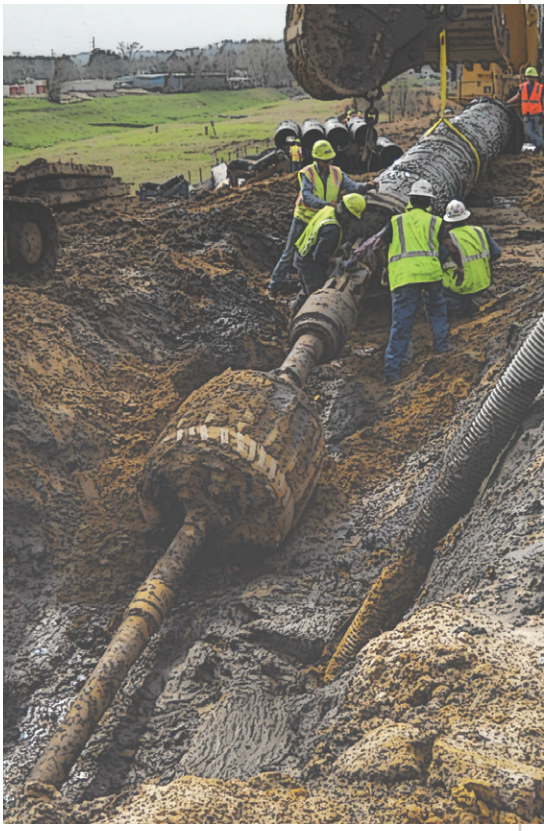
- Microtunneling
- Auger Boring
- Pipe Jacking
- Pipe Ramming
- Direct Pipe
- Horizontal Directional Drilling (HDD)
- Guided Boring Method (GBM)
- Hand Mining
- Pipe Rehabilitation, Relining and Bursting

Method Selection

Understanding the appropriate trenchless method, ground conditions and behavior is paramount to the success of your project. To mitigate risks that could be associated with trenchless installations, Brierley Associates evaluates…

- Site Geometry and Access
- Ground Conditions
- Pipe Materials
- Existing Infrastructure
- Project Cost and Schedule
- Permit Requirements
- Construction Risk and Third Party Impacts
- Ground Improvement Needs

Brierley Associates is federally certified by the Small Business Administration.



BrierleyAssociates.com

Constructability, Efficiency And Practicality

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Business and Engineering Focus

Tunnels, Shafts and Caverns
Trenchless Technology
Geostructural Design
Geotechnical Engineering
Dams
Design-Build
Abandoned Mine Land Mitigation

Market Sectors

Water, Wastewater, Stormwater
Transportation
Power Transmission
Mining and Resource Extraction
Deep Excavations for Vertical Construction
Natural Gas and Petroleum

Services

Subsidence Risk Assessment of Abandoned Mines
Pre-Bid, Design and Construction Engineering
Geologic Mapping and Evaluations
Tunnel Inspection and Rehabilitation
Blasting Design and Vibration Analysis
Ground Improvement and Grouting Design
Temporary Works Design
Value Engineering
Dispute Resolution
Construction Management
3D Finite Element Modeling
BIM
Feasibility Analysis and Peer Review

BrierleyAssociates.com

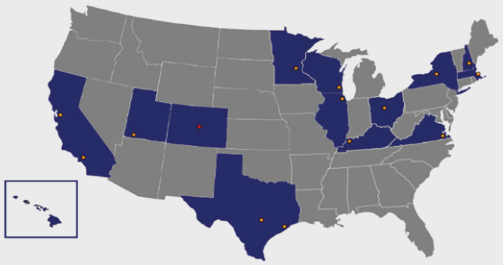
Brierley Associates operating philosophy is based on partnership and honesty with each other, our clients and peers.

Brierley Associates understands that planning, design, and construction of subsurface projects is a complex mixture of client needs, risk allocation, design criteria, and subsurface conditions.

At **Brierley Associates** we enjoy what we do and spend a great deal of time doing it.

All of us at **Brierley Associates** share a common business vision; one that is dedicated to the service of our clients, as we *"Create Space Underground."*

Contact Us



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Creating Space Underground - Coast to Coast

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HORIZONTAL DIRECTIONAL DRILLING

Brierley Associates has provided specialized Geotechnical, Tunnel, Trenchless, and Geostructural Engineering and Design services for over 20 years. Brierley Associates is privately owned by its founders and senior personnel. Brierley Associates has over 60 professionals serving owners, A/E firms, and contractors in the industry. Our firm's unique and broad experience in heavy civil underground construction projects with complex geologic conditions and geotechnical issues allow us to provide our clients with constructible and economic solutions to complex issues. Brierly specializes in horizontal directional drilling in the following areas:

GROUND CHARACTERIZATION:

Identification of the pertinent soil/rock properties to aid in excavation considerations such as bit consideration, whether or not a mud motor needs to be used, and drilling fluid additives, etc. After a thorough subsurface investigation or a complete review of existing geotechnical data, we are able to create a geologic profile that can be incorporated into the construction documents that will inform all parties of what is to be expected during the horizontal directional drilling program.

TRENCHLESS PIPE DESIGN:

Based on the size (length and diameter) along with the pressure capacity of the specific project, Brierley Associates can tailor the installation, from a standpoint of installation stresses, corrosion and abrasion considerations, etc. to steer the project towards success. Additionally, we can offer comparisons of pipe materials (e.g., PVC vs. HDPE vs. DIP, etc.) and develop a list of pros and cons for each material considered.

HDD DRILL PATH DEVELOPMENT:

Through the use of computer aided drafting (CAD), current state of successful practice and knowledge of the existing obstructions a design path that meets owner's requirements and contractor's methods can be developed.

SPECIFICATION CONSIDERATION:

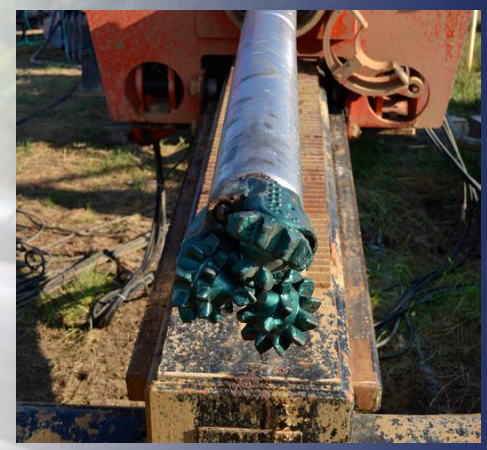
For a project where an existing specification dictates performance or design based, we can develop a work plan for/ with the contractor. Additionally, we can author a specification for the Horizontal Directional Drilling and associated portions of the project.

FRACOUT MITIGATION:

Permit requirements may require that unintentional release of drilling fluids to the surface not be allowed. We can develop a fracout plan that details the methods to reduce fracout risk in both design and contractor's approach. Additionally we can provide methods to control and contain the fracout as necessary.

FIELD OVERSIGHT:

We are capability to provide field oversight of install tasks (excavation, installation and grouting) to protect the interests of all parties involved. Our field oversight offers an avenue of open communication between the owner and can contractor while taking into consideration an understanding of all parties concerns.



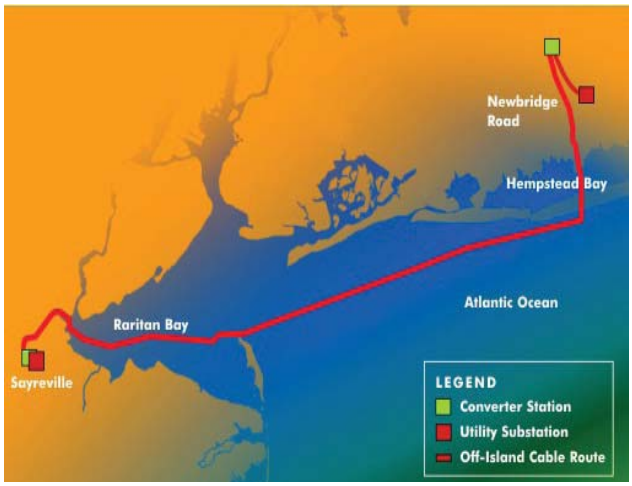
Neptune Regional Transmission System

Long Island, New York

Owner
Neptune Regional Transmission System

Project Features

• Installation of 500 kV high-voltage direct current electric cable
• Detailed design of 23 HDD cable crossings, ranging in length from 450 to 3,000-ft
• Installation of cables below highways, wetlands and marine environments.
• Innovative grout reduced thermal loads and lowered duct costs.



Key Personnel:
Nick Strater, PG
Brian Dorwart, PE, PG

The Neptune Regional Transmission Project involved installation of a 500 kV high-voltage, direct current electric transmission cable connecting power generation resources in New Jersey to electric consumers on Long Island, NY. The majority of the route - more than 50 miles - was located in New York Harbor and the Atlantic Ocean. However, 14 miles was buried in the existing right-of-way of the Wantagh State Parkway. The alignment of the 14 mile reach crossed numerous highways, wetlands and marine inlets. Horizontal Directional Drilling (HDD) was selected as the construction method of choice to complete these crossings with minimal disruptions to traffic, and disturbance to the environment. In addition, HDD was also selected as the construction method to make the cable shore landings on Long Island, and in Sayreville New Jersey, to minimize shoreline disturbance.

Representatives of Brierley Associates were engaged by the Project Owner to design the HDD crossings, and to provide construction consultation. Representatives of Brierley also developed a thermal grout design to backfill the HDD duct, and worked with the contractor to formulate a grout installation process that would not collapse the cable duct. In each case, a Brierley representative also provided field oversight of thermal grout installation.

Force Main Installation by HDD

Anne Arundel County, MD

Owner:
Anne Arundel County DPW
2662 Riva Dr # 130, Annapolis, MD 21401
Phone:(410) 222-7500

Project/Client Reference:
GHD
Thor Young, P.E.
16701 Melford Blvd., Suite 330, Bowie, Maryland 20715

Key Characteristics

-Interbedded coastal plain deposits consisting of silt, clay and sand

-Environmentally sensitive corridor with residences

-HDD actvities under South River limited to October 1 through December 15

Design Phase
Begin – Spring 2014
Complete – Summer 2015

Construction Phase
Begin – Summer 2015
Completed 2017

Construction Cost
$31.5 Million

Professional Fees:
$160,000

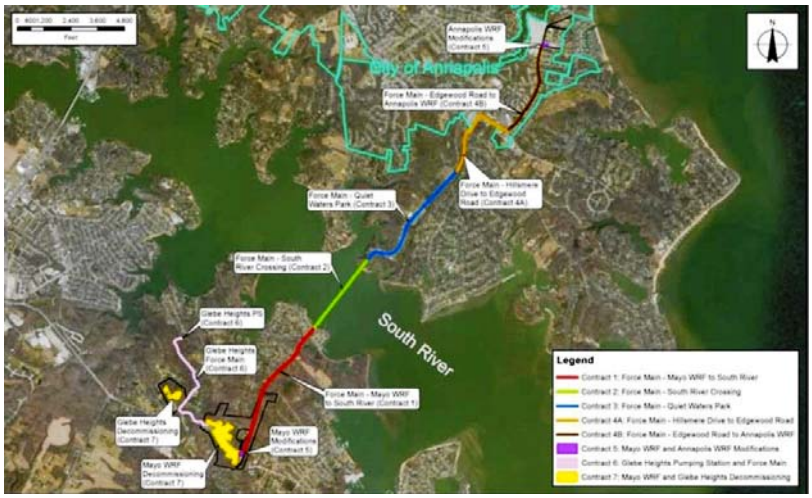
Key Personnel:
Nick Strater
Brian Dorwart
Tom Pullen
Nathan Stubley
Colby Jesset
James Duffy

The Mayo Water Reclamation Facility operated by Anne Arundel County receives septic tank effluent via a pump station system from Mayo peninsula residents. Since pump station capacity has been reached the County imposed a moratorium on future development.

GHD was selected by Anne Arundel County to assist with alternative analysis, project planning and design. GHD in-turn subcontracted with Brierley Associates to assist with trenchless concept development and design. The approved selected alternative involves construction of approximately 28,000-ft of new force main to convey wastewater from the Mayo area northward to the existing Annapolis Water Reclamation Facility (WRF). Once the new force main is in service, the Mayo WRF will be converted into a regional sewer pumping station.

Due to the length of this project, construction has been divided into five separate contracts. The first of these contracts (shown in bright green on the map below) is the 4,100-ft alignment beneath the South River. Given the sensitive ecosystem, Horizontal Directional Drilling (HDD) was selected as the mean to install this first section.

Brierley Associates led the HDD design team that was challenged by subsurface ground conditions consisting of deep, very soft soils. To mitigate the potential of inadvertent drill fluid losses, a bore depth of over 100-ft deep below river bottom, was chosen. Through our design analysis we selected 24-in diameter, DR-7 HDPE that was capable of withstanding the installation forces.



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Exelon/BGE, 1500-103 BGE Russett to Tipton Duct Bank, Laurel, MD.

Owner:
Baltimore Gas & Electric/Excelon

Client:
Black & Veatch

Owner Contact:
Jim Casey, PMP
Principal Project Manager
Phone 410-470-6708

Project Dates:
2014 - 2016

Key Personnel:
Nick Strater
Brian Dorwart
Colby Jesset

Baltimore Gas and Electric recently required installation of a new underground 230kV electric cable distribution system in south-central Maryland. The cable alignment passed through numerous upland wetlands, and crossed the Little Pawtuxtent River, which is a tributary to Chesapeake Bay. The Patuxent River was designated as a scenic river by the Maryland General Assembly, and is targeted for protection by the Maryland Department of the Environment (MDE). To minimize environmental disturbance, and to meet MDE permit requirements, five (5) separate sections of the cable alignment were designated for trenchless construction during project planning.

Brierley Associates was responsible for design of five (5) trenchless crossings, each involving three (3) parallel HDD installations of electric cable duct bundle. Each bundle consisted of 5, 10-in HDPE duct. Drill paths range from about 1,200 to 2,200 feet in length, located below wetlands, and the Pawtuxtent River. Provided drill path geometry, pull force and annular pressure calculations, and construction oversight.

Brierley Associates provided field oversight of the Contractor's activities, collected and assessed annular drill fluid monitoring data to help reduce the risk of fracout. Provided consultation to Owner and Contractor during construction.

City of Middletown Force Main HDD Installation

Middletown, CT

Owner:
City of Middletown

Client:
Maguire Group Inc.

Project Delivery Method:
Design-Bid-Build

Project Dates:
Design Start –2012
Construction Ongoing

Key Personnel
Nick Strater
Brian Dorwart

The project involves Installation of two parallel sewer force mains in Middletown, CT, to the west of the Connecticut River. The force main alignment extends from a new pump station located between Route 9 and the Route #17 North off ramp, northward to a treatment facility located to the north of the intersection of Route 9 and Main Street. The alignment also crosses the Sebethe River, and an existing railroad.

To minimize surface disturbance, the project includes two parallel, 2,950-ft long HDD pipe installations adjacent to Route 9 and an active railroad, and two parallel, 1,350-ft long HDD installations below the Sebethe River. The pipe selected for the HDD sections consists of 24-in fusible PVC.

Brierley Associates was contracted to provide design of the HDD installations. For each of the four (4) bores, Brierley developed a plan and profile HDD alignment, evaluated pipe installation stresses, and assessed risk of inadvertent drill fluid loss during construction. Brierley also assisted in the development of specifications for the product pipe and the HDD process.

Project construction began during Fall of 2014, and is scheduled to be completed during 2015. Brierley Associates is providing technical assistance to the construction manager for the HDD installations. In addition to submittal review, our field representatives are documenting the subusrface conditions encoutnered during drilling , and verifying that the pilot hole geometry is consistent with the design drawings.

Brierley is also monitoring pullback of the product pipe, to help ensure the installation loads do not exceed the limitations of the product pipe.

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Mears Group, Inc.

A QUANTA SERVICES COMPANY

HORIZONTAL DIRECTIONAL DRILLING


DANGER
WATCH YOUR HANDS AND FINGERS
DANGER
PELIGRO

WE DO MORE THAN JUST DRILL

The Mears reputation as a leading horizontal directional drilling (HDD) company has been earned by working hard and smart for our customers, gaining their confidence in our capabilities by completing complex and innovative projects. Our professional construction and engineering teams have experience, expertise and ingenuity that is well-known to the oil and gas, electrical and water/wastewater industries.

Mears is part of a professional network of companies under Quanta Services, Inc. (a Fortune 500 Company). As part of this network, Mears is able to provide customers with the nation's largest pool of skilled workers, equipment and specialized services to deliver infrastructure solutions to the power and pipeline industries all across the world.

HORIZONTAL DIRECTIONAL DRILLING

Changing regulations, safety and quality standards and environmental concerns are an ever-present challenge to pipeline, power and utility companies responsible for installing and maintaining pipelines, cables and conduits. Led by a team of in-house engineers, project managers, steering technicians, international logistics and field personnel, Mears navigates the concerns of our customers through even the most complex projects.

With support from our Certified Equipment Managers, our fleet of horizontal directional drilling rigs and support equipment can complete projects with pipe diameter up to 60-inches, and our drilling capabilities include continuous lengths of over 11,000 feet.

Our experience also includes:

- Conventional HDD Crossings
- Marine Crossings (Water-to-Water and Shore Approaches)
- Hard Rock Drilling
- Design/Build
- Engineering, Procurement and Construction
- Direct Pipe®

MEARS' COMMITMENT TO SAFETY, QUALITY & ENVIRONMENT

Our **Safety Management System (SMS)** has allowed Mears to maintain the highest standards in health and safety, and it is our company policy to provide and maintain safe and healthy conditions for all employees, customers and the public. Our commitment to safety is at the core of our company values and forms a foundation for operational excellence. The **OHSAS 18001:2007** standard has elevated our safety practices to an even higher level for our employees and customers.

Mears' **Quality Management System (QMS)** is thoroughly designed and implemented to ensure client expectations and needs are exceeded. Guided by the **ISO 9001:2008** standard, Mears Group monitors and documents quality performance, effectiveness and compliance.

Additionally, our maintenance program, run by AEMP Certified Managers (CEMs), helps reduce downtime on projects and increases overall productivity by keeping equipment in optimum running condition.

The **Environmental Management System (EMS)** was established to strengthen Mears' commitment to protecting the environment by conducting our business operations in an environmentally responsible and sustainable manner. We recognize that by reducing and, when possible, eliminating waste, the environmental impact of our activities is significantly decreased.

To further our commitment to protecting the environment, Mears attained the **ISO 14001:2004** certification, and continues to place the value of environmental management as central to our corporate success.

DESIGN/BUILD

At Mears, we offer our clients the opportunity to have their project designed and built as one turnkey operation. Benefits of design/build project delivery include:

- Reduced owner risk
- Shortened project schedules
- Single point of contact
- Increased cooperation
- Reduced owner resources
- An environment of design and construction innovation

ENGINEERING, PROCUREMENT & CONSTRUCTION

Mears' engineering, procurement and construction (EPC) services provide a single source of contact and responsibility to our clients, saving them time and money. Through our EPC process, Mears' engineers, construction teams and subcontractors can communicate clearly and consistently with each other, ensuring that informative and collaborative decisions are made throughout the project. Additionally, having a single source of responsibility on a job enhances the safety and productivity of the project.

A QUANTA SERVICES COMPANY

MEARS GROUP, INC.

HORIZONTAL DIRECTIONAL DRILLING
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Houston, TX 77056
281-448-2488
www.mearsHDD.net

Certified in Safety, Quality, and Environmental: OHSAS 18001:2007, ISO 9001:2008 and ISO 14001:2004

MEARS GROUP, INC. - HORIZONTAL DIRECTIONAL DRILLING

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Mears Group, Inc.
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PROJECT FACT SHEET

St. Lucie to Turnpike 230 kV Transmission Line Project

Awards/Recognition	*2017 ISTT No-Dig Project of the Year Award* *2016 NASTT Trenchless Technology Project of the Year Award*
Location	Port St. Lucie, FL
Date Completed	June 2016
Project Type	Electric
Equipment	Mears' 140,000 lb. rig and 1.1 Million lb. rig
Owner/Client	Florida Power & Light (FP&L)
Length, Pipe Diameter, Pipe Material	Two (2) HDD River Crossings: 30-inch FPVCP Casings installed at 7,020-feet with four 10 inch and two 3 inch high density polyethylene (HDPE) conduits surrounded by NoSet™ (a specially formulated thermal grout/slurry).
Type of Crossing	River
Project Summary	Record Breaking 30 inch Fusible PVC® Casing Installation/Successful Research & Development of XLPE Cable Installation of Lengths over 7,000 feet Two 30 inch Fusible PVC® casing pipes (FPVCP) were installed in two parallel HDD bores 60 feet below the Indian River. 7,020 foot of FPVCP casing was inserted through each of the bores representing the longest lengths that any FPVCP pipe has been installed in an uncased HDD application of any diameter. Each casing ultimately housed four 10 inch and two 3 inch high density polyethylene (HDPE) conduits in a specially formulated thermal grout/slurry. The project required complex HDD equipment site set-ups to accommodate the necessary rigs and support equipment. Mears' 1.3M lb. drilling rig was set-up at the entry side, with a Mears' 140,000 lb. drilling rig at the exit side on Hutchinson Island near the nuclear power plant. Support equipment included three mud recycling systems and pumping equipment that were staged approximately 2,000 feet from the drill exit site. Due to the distance between all equipment and activity, special remote controllers and constant communication between the team members were necessary to keep the operation running smoothly.

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HDD Division
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Houston, TX 77056
U.S.A.
Phone: 800-632-7727 ▪ 281-448-2488
www.mearsHDD.net

Certified in Safety, Quality, and Environmental:
OHSAS 18001:2007, ISO 9001:2008 and ISO 14001:2004

Mears Group, Inc.
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PROJECT FACT SHEET

Hayes-Yorktown 230kv Transmission Line Crossing - EPC

Location	Yorktown, VA & Gloucester, VA
Date Completed	January 2013
Project Type	Electric Transmission Line
Equipment	70,000 lb. rig, 140,000 lb. rig, 330,000 lb. rig
Owner/Client	Dominion Virginia Power
Engineer	Haley & Aldrich – HDD & Civil; EHV Power – Electrical; Antares Offshore – Structural; RCI – Offshore Consultant
Length, Pipe Diameter, Pipe Material	Two approx. 6,900-feet, two approx. 5,800-feet and two approx. 2,900-feet - for a total of approximately 35,200-feet., 8-inch steel bundled with 3-inch HDPE
Type of Crossing	Water-to-water, River Crossing
Project Summary	This project consisted of an installation of a 230 kV power line requiring a detailed, multi-disciplined approach necessary to design and construct a three mile river crossing project with multiple horizontal directional drilling (HDD) segments for an electric transmission system. The project was completed by the engineering, procurement and construction (EPC) method involving a large group of engineers and contractors to bring together the specialized technical resources required. Six HDD crossings were required for the parallel system of 8-inch steel and four temporary platforms constructed in the river to allow for HDD operations. This resulted in four shore approaches (two at each side of the river) and two water-to-water crossings between the platforms. After the HDD work was completed, electric cables were pulled through each pipe segment. The cables were then spliced on each shore and on each of the platforms. After the system was tested, the pipelines were lifted off the platforms and lowered into pre-excavated trenches within the York River and backfilled.

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Certified in Safety, Quality, and Environmental:

MICHELS®

Horizontal Directional Drilling

Michels® Leads the Way in HDD

Michels® Corporation is regarded as the North American leader in Horizontal Directional Drilling (HDD), and we are determined to stay on top. Our record-setting drills are supported by an unrivaled fleet of 84 drilling rigs of all sizes, including the largest fleet of 1.2 million pound thrust/pull force capacity rigs in the world.

Michels has successfully completed HDD crossings in all 50 states, Canada, along the U.S.-Canada and U.S.-Mexico borders, and internationally. Our highly respected HDD staff includes some of the most knowledgeable, talented, and experienced leaders in the industry. They work together to set industry records, develop new methods, and design and fabricate equipment to expand the possibilities for using HDD in increasingly challenging situations.

- **Largest fleet of 1.2 million pound thrust/ pull force capacity rigs in the world**
- **Completed crossing spans greater than 15,000 feet in single pull, capable of installing pipe up to 60 inches in diameter**
- **Trenchless technology protects natural resources such as wetlands by drilling beneath them**
- **Land-to-water and water-to-water crossings, impervious to shoreline erosion, ice movement, dredging, anchors and watercraft**

Water-to-Water Crossings

STATEMENT OF QUALIFICATION
MICHELS DIRECTIONAL CROSSINGS

Michels Directional Crossings, a division of Michels Corporation, has been utilizing Horizontal Directional Drilling (HDD) technology for trenchless installation of underground utilities since 1986. Michels Corporation has been in business and performing underground utility construction since 1960 and has since diversified and expanded into one of the most highly preferred HDD companies in North America as well as internationally. HDD is a trenchless method of underground utility construction where a conduit is installed from one surface location to another below the ground surface utilizing a guided directional drilling system. Michels has successfully completed thousands of HDD crossings throughout the United States, including Hawaii and Alaska, and several foreign destinations including the Caribbean and the Middle East. Since starting directional drilling operations, our HDD capacity has expanded in virtually every aspect of the technology, setting new industry standards year after year. As an industry leader, Michels continually tests and expands the HDD construction limits with our largest capacity equipment, while at the same time providing extremely reliable services for HDD projects of a less challenging nature, greatly succeeding at both ends of the spectrum. No HDD project is considered too large, too small, too difficult, or too distant for Michels.

When limitations to equipment capacity are exceeded, Michels' custom fabricates larger rigs, several of which are the largest rigs currently available anywhere in the world. When multiple rigs are required to complete a project on schedule, Michels provides virtually unlimited support and resources with our 84 owned & operated HDD rigs, each with highly experienced support crews. When unforeseen conditions are encountered on a project, Michels provides complete 24-hour machine shop fabrication support for manufacturing or repairing specialized equipment and down-hole drilling tools capable of overcoming some of the most difficult drilling conditions. The resources available to Michels Directional Crossings as a division of a much larger utility contractor provides our drilling division with unprecedented capabilities in the HDD industry and gives us a leg-up on our competition.

Michels' resources are matched only by our experience in HDD crossing technology. Michels has directionally drilled and installed virtually every type of utility under most conceivable crossing conditions, and many under inconceivable conditions. Michels drilling superintendents each have a minimum of 5 years experience and some have as many as 30 years experience. An HDD utility crossing typically crosses underneath locations where surface obstructions prevent traditional construction via conventional trenching methods or where disturbance to the surface is simply not feasible. From some of the hardest solid bedrock conditions, to massive boulders and cobbles, to soft silts, seashells, sands, and clays, Michels has successfully completed crossings up to 50" in diameter and crossed spans of over 15,700 Ft in length.

Michels HDD Crossing Length Summary
-Longest Pulled length: 15,700 Feet (6")
-Longest Drilled Rock: 12,902 Feet (8")
-Longest/Largest Drilled Rock: 9,040 Feet (36")
-Over 65 Greater Than 5,000 Feet
-Over 130 Greater Than 4,000 Feet
-Over 285 Greater Than 3,000 Feet
-Over 570 Greater Than 2,000 Feet
-Thousands Less Than 2,000 Feet

Michels HDD Crossing Diameter Summary
-Largest: 49.75"(3,200 Feet)
-Over 150 Greater Than 40"
-Over 545 Greater Than 30"
-Over 900 Greater Than 16"
-Over 980 Greater Than 12"
-Thousands Less Than 12"

Types of Crossings Performed By Michels

- River, stream, and canal crossings
- Water body crossings (lakes, ponds, tidal bays etc.)
- Environmentally sensitive areas including wetlands
- Heavily congested surface areas (roadways, railroad tracks, airport facilities, industrialized areas)
- Aesthetically sensitive locations (historical or archeological significant grounds and structures or pristine residential areas)
- Land to marine conduit transition locations (beach approaches)

- Water-to-Water crossings
- Hazardous waste contaminated areas
- Geologically unstable areas (landslides)
- Heavily laced utility corridors
- Pilot hole intersect and dual assist crossings

Larger diameter long length crossings are considered less risky and more feasible due to Michels' addition of the Herrenknecht Pipe Thruster to the assist arsenal. Over the past several years Michels has acquired (1) 300 Ton (1) 500 Ton and (2) 750 Ton Pipe Thrusters. Michels' deployment of this piece of equipment to large diameter long length crossings has proven dividends when required to assist with providing additional force necessary for assist with pull back alleviating stress and fatigue on downhole tooling which could otherwise fail if overstressed. Projects aided by thruster assistance include:

- Energy Transfer- DAPL (2017) 30" Coated Steel; 7,531'; Lake Oahe & Missouri River; Stiff Clay, Coal Seams, Fractured Rock, Dirt & Cobble
- Spectra Energy (2016) 36" Coated Steel; 3,829'; Flint River; Sands & Silts
- TransCanada (2016) 42" Steel Casing; 7,200'; Athabasca River; Oil Sands, Sands & Silts over Hard Limestone, Sandstone
- Texas Eastern Transmission (2016) 30" Coated Steel; 5,378'; Hudson River, New York, NY; No Blow count silt and Marine Sediments
- JEA Jacksonville Electric (2012) 36" Coated Steel; 6,575'; St. Johns River, Jacksonville, FL; Sands, Silts, Layered Limestone

Michels has diversified and adapted HDD techniques to successfully complete a relatively new technology called pilot hole intersect. This new technically advanced form of directional drilling allows never before attempted lengths to be completed and increases the possibility of reducing the risk for over-pressurizing the underlying geological formation. This not only mitigates the pressure beneath sensitive areas but reduces the risk for inadvertent returns in these locations. Pilot-hole-intersect technology is most valuable when drilling complex scenarios such as:

- Sensitive Levee crossing where requirements call for reduced downhole pressure when traversing beneath levee.
- Substantial elevation difference of more than 40' from entry to exit.
- Longer crossings where conventional HDD is greatly challenged.
- Unstable upper formation detrimental to drilled hole integrity at both entry and exit locations. This allows installation of conductor casing from both locations and a drill rig staged from both sides.

<u>Pilot Hole Intersect – Most Notable Listed (145 such completed through April of 2017)</u>

- Transcontinental Gas (2017) 30" Stl; 2,278'; Chattahoochee River; GA; Gneiss Bedrock
- ETC-Energy Transfer (2017) 30" Stl; 7,531'; Lake Oahe/Missouri River; ND; Stiff Clay/Fractured rock/Coal Seams
- Alliant Energy (2016) 16" Stl; 6,693'; Wapsipinicon River; IA; Sand, Gravel, Clay, Rock
- ETC-Energy Transfer (2016) 30" Stl; 7,282'; Mississippi River; IL; Limestone w/zones of Chert
- ETC-Energy Transfer (2016) 30" Stl; 6,328'; Big Sioux SD/IA; Sand, Clay, Claystone Rock
- Paradigm Midstream (2016) 16" Stl; 11,397'; Lake Sakakawea SOUTH, ND; Stiff Clay w/Coal Seams
- Paradigm Midstream (2016) 16" Stl; 11,229'; Lake Sakakawea NORTH, ND; Stiff Clay w/Coal Seams
- Energy Transfer (2016) 30" Stl; 6,120'; Lake Whitney, TX; Sand, Fat Clay, Claystone/Mudstone
- TransCanada (2016) 42" Stl; 3,399'; McKay River Alberta; Clay, silts over Sandstone
- Martin Operating Partners (2016) 12" Stl; 11,548'; Union Canal & Martin Barge Canal, TX; Sands, swelling Clay
- TransCanada (2016) 42" Stl; 7,228'; Athabasca River, Fort McMurray Alberta; Sandstone, Mudstone
- Enterprise Products (2015) 24" Stl; 7,432'; Houston Ship Channel, TX; Swelling Clays and Sands
- Enterprise Products (2015) 24" Stl; 5,908'; Tabbs Bay, TX; Clay, Sand, Swelling Clay
- Magellan Midstream (2015) 12" Stl; 11,563'; Holland Bottoms Wetlands, AR; Sands, Silts, Clay & Limestone
- Enbridge Energy (2015) 36" Stl; 5,128'; Lake Ave & RR, Sauk Village, IL; Cobble/Rock
- Sunoco Logistics (2015) 10" Stl; 4,654'; Allegheny River, PA; Rock Shale/Sandstone 4,500-18,338 psi
- Phillips-66 (2015) 18" Stl; 12,459'; Houston Ship Channel, TX; Sands, silts and swelling clays

- City of Lake Oswego (2014) 36” Stl; 3,805’; Lake Oswego, OR; Willamette River; Cobbles over Basalt
- Williams-WPX Energy (2014) 6” Stl; 6,999’; Aztec, NM; Navajo Reservoir/San Juan River; Sand, sandstone/cobble
- Phillips-66 – (2014) 8” Stl; 7,321’; MP49.3 Landslide Area; Billings, MT; Clay, Bentonite, Mudstone
- Enbridge Energy - Flanagan South – (2014); 36” Stl, 9,040’; Quincy, IL; Mississippi River & Levees; Packed Sand & Gravel with areas of Shale
- InterPipeline Ltd, Canada – (2013); 42” Stl; 4,284’; Vermillion River, Alberta, Clay Till w/Boulder Layer above Clay Shale
- Kinder Morgan/Tennessee Gas – (2013); 30” Stl; 4,988’; Monksville Reservoir; NJ (Diorite/Gneiss/Granite)
- Jamaican Bay – (2013); 2 xings 12” Stl and 26” Stl; 6,215’; Brooklyn/Queens, NY (Silts, Sand, Seashells)
- SCANA – (2013); 8” Stl; Land to Water 7,304’; Water to Water 7,177’; SC (Sands and Clay)
- Texas Eastern Spectra Energy NJ/NY Expansion Project – (2013); 30” Stl; 6,544’; East 1st Street; NY (Diabase)
- Texas Eastern Spectra Energy NJ/NY – (2013); 30” Stl; 8,101’; Kill Van Kull; NY (Siltstone/Sandstone 15,000PSI)
- Texas Eastern Spectra Energy NJ/NY–(2013); 30” Stl; 4,441’; Goethals Bridge Tidal Area; NY (Rock, Siltstone/Sandstone/Diabase)
- Texas Eastern Spectra Energy NJ/NY – (2013); 30” Stl; 4,861’; 18th Street/Long Slip; NJ (Hard Rock, Diabase)
- Texas Eastern Spectra Energy NJ/NY – (2013); 30” Stl; 5,378’; Hudson River; NJ/NY (Very Soft Silty Clay, W.O.H. Blow Counts)
- AT&T Communication – (2012); 8” Stl; 10,053’ Potomac River; VA/MD (Soft Silty Clay)
- ConocoPhillips – (2012), 8” Stl; 2-Xings 4,475’ and 12,902’ MP-57 and MP-66; Wyola, MT (Clay, Shale, Gypsum)
- Shell Appalachian Pipeline – (2012), 8” Stl; 2,645’ High Elevation Change; Tioga Junction, PA (Sandstone/Shale)
- West Shore Pipeline (Buckeye) – (2012), 16” Stl; 5,754’; New Berlin, WI (Heavy Grey Clay, Cobble, Limestone)
- JEA – Jacksonville Electric Authority (2012), 36” Stl; 6575’; Jacksonville, FL (Sand, Marl and Limestone Layers)
- Progress Energy (2012) Cape Fear River, (2-separate) 8” Stl; 6,675’; Wilmington, NC (Limestone/Sand)
- TransCanada/Keystone (2012) S. Saskatchewan River, 36” Stl; 4,505’; Medicine Hat, Alberta, Canada (Clay over sandstone, cobbles sand, gravel)
- National Fuel/Empire Pipeline (2011) Chemung River, 24” Stl; 2,645’; Corning, NY (80’ of Nasty Overburden of Clay, Silt, Cobbles and Boulders over Shale/Limestone Bedrock)
- ConocoPhillips Pipeline (2011) Grand Lake, 10” Stl; 3,447’; Wyandotte, OK (20’ Layer of Gravel and Sand over Dolomitic Limestone with Shale up to 22,000 psi)
- Enterprise Pipeline (2011) Atchafalaya River and Levee System, 36” Stl; 4,992’; Melville, LA Corps Levee Crossing Requirements Met (Clay with Gravel, fine and coarse)
- Enterprise Pipeline (2011) Old River & I-49, 42” Stl; 5,732’; Melrose, LA (Silts, Sands, Hard Sticky Clay)
- Florida Gas Transmission (2011) Military Canal, 24” Stl; 6,091’; Homestead, FL (Sandy Limestone, Limestone with pockets of Sand)
- Tennessee Gas Pipeline (2011) Lake Conway, 30” Stl; 5,786’; Vernon, NJ. (Some of the Hardest Rock in NJ consisting of Amphibolite, Seyenite Gneiss with Quartz Veins, (Magnetic) Granite, up to 52,000psi)
- BC Hydro (2011) False Creek, 230kV (7)10” HDPE (5)4” HDPE Grout Pipes; Vancouver, BC (Sand, Gravel and Cobble over Bedrock; Sandstone/Siltstone/Mudstone)
- Enterprise Products (2011) Missouri River, (3-separate) 8” Stl; 7,020’; Decatur, NE (Sands, Gravel)
- Energy Transfer (2010) Saline Bayou, 42” Stl; 5,248’ Crowson, LA (Sand, Dense Silt)
- Carolina Gas Transmission (2010) Cooper River, 16” Stl; 9,932’; Charleston, SC (Hard Clay)
- Fayetteville Express (2010) Little Red River, 42“Stl; 3,497’ ; Plainview, AR (Hard Sandstone/Limestone)
- Rockies Express Pipeline (2009) Illinois River, 42“Stl; 2,975’ ; Milton, IL; (Gravel, Limestone/Shale)
- PSE&G (2009) Newark Bay, 16” Stl; 6,230’ ; Elizabeth, NJ (Rock, Dolerite/Shale)
- Enbridge Pipeline (2008) Kishwaukee River, 42”Stl; 2,564’ ; Belvidere, IL (Running Sands)
- PG&E (2008) Stone Lakes NWR, 24” Stl; 6,518’ ; Walnut Gove, CA (Clays, Sands, Sediments)
- Brunswick Pipeline (2008) St. Johns River, 30”Stl; 4,272’ ; St John, New Brunswick (Cobbles and Boulders over Fractured Diorite/Granite up to 30,000 psi)
- ExxonMobile (2008) Old River, 42” Stl; 6,017’; Port Arthur, TX (Silty Sands/Clay Very Dense)
- King County, WA (2007) High School & 6th St., 32” Stl w/28” HDPE 3,947’; Bellevue, WA (Sand/Gravel)
- PG&E (2007) Old River, 24” Stl; 6,779’ ; Sacramento, CA (Clayey Silt, Silty Sand)
- PG&E (2007) Latham Slough, 24” Stl; 6,418’ ; Sacramento, CA (Clayey Silt, Silty Sand)

- Enbridge Pipeline (2007) Flambeau River, 20” Stl; 2,280’ ; Ladysmith, WI (Mica Schist/Gneiss Bedrock)
- Niu Valley (2007) Niu Stream/Kalanianaole Hwy, 20” HDPE 3,250’ ; Honolulu, HA (Silt/Sand/Coral)
- City of Coronado, CA (2007) San Diego Bay, 30” HDPE, 3,086’; San Diego, CA (Sandy Clay)
- Okaloosa Gas District (2006) Choctawhatchee Bay, 10” Stl; 8,400’ ; Santa Rosa Beach, FL (Sand)
- Gaz Metropolitan (2005) St. Lawrence Seaway, 20” Stl; 7,455’ ; Trois-Rivieries, Canada (Limestone)
- SCG&E (2004) Cooper River, (2ea) Parallel 8” Stl; 7,074’; Charleston, SC (Cooper Marl Clay)
- Maritimes & NE (2003) Georges Island Water to Water, 30” Stl; 5,174’; Salem, MA (Meta Siltstone/Sandstone, Granite, Gneiss, Schist)
- Williams Gas Pipeline (2002) McClane Park, 30” Stl; 4,212’ ; Tumwater,WA (Fine-Coarse Gravel/Sand)
- North Carolina Gas (2000) Rock Creek/Hendrix Swamp, 30” Stl; 1,280’; Concord, NC (Granodiorite)
- Alliance Pipeline (1999) Peace River, 24” Stl; 3,557’ ; Taylor, British Columbia (Rock, Mudstone)

Crossings have been successfully completed by Michels for most of the major utilities in the United States with 100% satisfaction. Pipeline (Natural Gas & Fuel Products), Civil (Water & Sewer Force Mains), Telecommunications (Fiber Optics & Telephone Duct Banks), & Electrical (Cable Duct Banks) are the most common types of utilities installed by Michels. Michels is recognized by each of these utility industries as a leader in HDD technology, especially when it comes to completing the most difficult projects on schedule & within budget as exemplified by successful completion of numerous milestone projects in each of these industries.

Pipeline

- Cheniere Energy (2017) 48” Stl; 4-xings 2,263’- 3,291’; TX (Clay and Sand)
- Energy Transfer Co. DAPL Pipeline (2016-2017) 30” Stl; 16-xings 1,278’- 7,531’; IA/SD/ND (Clay, Sand, Cobble, Rock, Claystone and Fractured Rock)
- Vermont Gas(2016)12”Stl;10-xings 492’–3,144’;VT (Clay, Sand, Rock-Dolomite & Pink Quartzite up to 40,000 psi)
- Paradigm Midstream (2016) 16” Stl; 2-xings 11,229’ and 11,397’ Lake Sakakawea, ND; Clay, Claystone
- NICOR-AGL Resources (2015) (1)24”Stl 1,898’; (4)36”Stl; 1,755’-3,031’; IL; Fat Clay, Sand, Gravel
- Enbridge Energy (2015) 36” Stl 8-xings; 1,803’-5,128’; IN/IL; Clay, Sand, Cobble, Gravel, Rock
- Enterprise Products Pipeline (2015) 24” Stl; 3-xings 3,716’, 5,908’, 7,432’ (Corps Levee); TX; Clay/Sand
- Enbridge Pipeline, Canada (2015) (1)42”, (9)36” Stl; 1,411’-3,412’; Toronto, Canada; Clay/Sand/Cobble/Boulder
- Alabama Power (2014) 24” Stl; 4-xings 1,935’, 1,961’, 2,020’, 2,884’; AL (Fractured Rock, Karst Formation)
- Gulf South Pipeline (2014) 30” & 24” Stl; 6-xings 1,692’, 1,376’, 2,003’, 2,750’, 2,890’, 3,030’; MS (Clay, Gumbo)
- Enbridge Energy-Flanagan South (2013-2014) 36” Stl; 12-xings (1) 9,040’, (11) 1270’ – 5,690’; IL/MO (Dirt & Shale/Limestone)
- Kinder Morgan/Tennessee Gas (2013) 30” Stl; 3-xings 1,881’, 2,344’, 4,987’; PA/NJ (Sand, Cobbles; Quartz and Pegmatite, Granite/Gneiss Hard Rock.
- Texas Eastern Spectra Energy NJ/NY (2013) 30” Stl; 3-xings 8,101’, 4,861’, 5,378’; NY/NJ (Hard Rock to W.O.H. Blow Count Silt)
- Texas Eastern Spectra Energy NJ/NY (2013) 42” Stl; 2-xings 4,441’, 3,211’; NY/NJ (Siltstone up to 8,100 PSI)
- TransCanada/Keystone (2012-2013) 20-Xings 36” Stl; 1,500’ - 4,350’; TX, OK (Sandy Clays TX, Shale/ Sandstone OK)
- St. Clair Pipelines L.P. Union Gas (2012) 20” Stl; 3,048’ St. Clair River, Marysville, MI (Sands, Silts, Clay)
- Shell Appalachian Pipeline (Tioga Junction, PA) – (2012) 8”/16”/20” stl; Multiple Xings 2,500-3,900’; Gravel, Rock
- ConocoPhillips – (2012) - 8” Stl; 2-Xings 4,475’ and 12,902’ MP-57 and MP-66; Wyola, MT (Clay, Shale, Gypsum)
- Enterprise Pipeline (2011) – 9 Crossings (3) 36” and (6) 42”; All Crossings Pilot Hole Intersect and Several Completed using Gyroscope. Longest 36” KC RR @ 5,325 Ft; Longest 42” Old River/I-49 @ 5,735 Ft; Louisiana
- Tennessee Gas Pipeline (2011) – 30” Steel 5,786 Ft; New Jersey; (Hard Rock; Gneiss, Amphibolite, Magnetic)
- Enbridge Energy (2009) – 33 Crossings (12) 20” and (21) 36”; 1,000 Ft to 5,230 Ft; Minnesota (Clays, Gravel)
- Rockies Express (2008-2009) – 18 Crossings 42” 3,960 Ft; MO, IL, OH (Mixed Variation Gravel, Cobble & Rock)
- Exxon Mobil (2008) – 4 Crossings 42”; Crossings Pilot Hole Intersected; 3,700 Ft to 6,020 Ft; Texas; (Sand, Clay)
- Exxon Mobil (2008) – 13 Crossings x 42“ to 6,017 Ft; Texas; (Sands, Silts & Clay)

- Guardian Pipeline (2008) – 3 Crossings x 30“ to 3,078 Ft; Wisconsin; (Gravels & Clay)
- PG&E (2007) – 7 Crossings x 24“ to 6,779 Ft; California; (Clay, Silts and Sands)
- Enbridge Pipeline (2007)– 10 Crossings x 42“ & 20“ to 2,776 Ft; Wisconsin; (Limestone)
- Florida Gas (2007) – 12 Crossings x 36“ up to 3,505 Ft; Florida (sands, silts, Limestone)
- Northern Natural Gas (2007) – 11 Crossings x 24“ to 2,795 Ft; Minnesota; (Sands, Clay)
- Dominion Transmission (2007) – 6 Crossings 36” up to 4,652 Ft; Maryland (Range from Clayey Silt, to Cobble, Boulders and 27,000 psi Sandstone/Siltstone)
- Dominion Transmission (2007) – 3 Crossings 24” up to 3,382 Ft; Pennsylvania (Limestone/Dolomite/Shale)
- Gulf South Pipeline (2007) - 13 Crossings 42” up to 3,954 Ft; Louisiana (Poor Graded Sand/Well Graded Sand/Sandy Lean Clay)
- Okaloosa Gas (2006) – 1 Crossing x 10“ to 8,400 Ft; Florida; (Compacted Sand, Shells)
- Gaz Metro (2005) – 1 Hole Intersect Crossing x 20“ to 7,456 Ft; Quebec, Canada; (Limestone and Shale)
- Eastern NC Gas (2004) – 1 Crossing x 6“ to 15,713 Ft; North Carolina (Fine Sand, Silty Clay & Shell Fragments)
- Maritimes & Northeast Pipeline (2002-2003) – (1-Intersect) 7-Crossings x 24” or 30“ to 5,286 Ft; 3ea Land to Land/2ea Land to Water and 2ea Water to Water Xings; Massachusetts (Granite, Gneiss and Schist)
- Guardian Pipeline (2002) – 4 Crossings x 36“ to 3,045 Ft; Illinois; (Gravels Shale/Limestone Bedrock)
- Vector Pipeline (2000) – 6 Crossings x 42“ to 2,230 Ft; Michigan (Sandstone, Sands and Gravels)
- Alliance Pipeline (1999) – 6 Crossings x 36“ to 3,633 Ft; Illinois to Minnesota (Limestone, Sands/Gravels)
- Williams Transco (1998) – 1 Crossing x 24“ to 6,041 Ft; North Carolina (Granite and Sandstone)
- Pacific Pipeline (1998) – 6 Crossings x 20“ to 5,107 Ft; California (Granodiorite, Sands and Gravels)
- PNGTS Pipeline (1998) – 12 Crossings x 24” or 30“ to 2,868 Ft; New Hampshire to Maine (Gneiss, Schist and Phyllite)
- Northern Border Pipeline (1998) – 6 Crossings x 36“ to 3,727 Ft; Illinois to Iowa (Limestone, Sand/Gravel)
- Michigan Consolidated Gas (1996) – 12 Crossings x 36“ to 2,600 Ft; Michigan (sands, gravels, cobbles)
- Florida Gas Transmission (1994) – 32 Crossings x 22” thru 36“ to 4,044 Ft; Mississippi to Florida (Limestone, Sands and Gravels)
- ANR Pipeline/Empire State Pipeline (1993) – 4 Crossings x 24“ to 4,590 Ft; New York to Ontario, Canada (Limestone, Sands and Gravels)

Civil

- JEA-Jacksonville Electric (2016) - Design Build 42” Stl w/36” HDPE Water Main; 3,983 Ft; Jacksonville, FL (Sand Limestone cap w/Marl-Layered Limestone)
- Select Energy Services (2014) - 24” HDPE Intake; 1,060’; Charleston, ND; Lake Sakakawea Intake; Sandy Clay, Cobble
- Hampton Roads Sanitation (2014) - 28” HDPE Sewer; 1,740’; Norfolk, VA; Lafayette River; Cooper Marl
- City of Corpus Christi (2014) – 48” Steel Water Main; 2-Xings 2,060 Ft & 1,692 Ft; Corpus Christi, TX
- Virginia DOT (2013) – 48” HDPE Sewer Force Main; 2-Xings 1,943 Ft and 819 Ft; Virginia Beach, VA
- JEA-Jacksonville Electric (2012) - Design Build 36” Stl Water Main; 6,575 Ft; Jacksonville, FL (Sand/Marl-Layered Limestone)
- Memorial University of Newfoundland (2010) – 14” HDPE Intake 1,554 Ft; Newfoundland, Canada; (Hard Sandstone)
- Atlantic City Municipal Authority (2010) – 42” HDPE 1,010 Ft; New Jersey (Sand and Clay)
- City of Moncton (2009) - 36” HDPE Water Main to 1,873 Ft; New Brunswick, Canada (Mudstone/Sandstone)
- NAVFAC Mid Atlantic (2009) – 20”, 22”, 26” & 30” HDPE Sewer Force Mains to 4,968 Ft; NC (Sand/Shell)
- Guam Water Authority (2008) – (1) 34” HDPE (1) 42” HDPE Sewer Outfalls x 2,200 Ft; Guam; (Limestone/Sand)
- San Luis Obispo Cnty Flood Control & Water Conservation (2008) – (1)18” (3)24” to 3,000 Ft; California; (Stiff Clay Gravel and Cobble)
- US Dept of Navy (2008) – 30” HDPE Force Main x 1,572 Ft; Ford Island, Hawaii; (Coralline Gravel/Limestone)
- King County (2007) – 32“ Steel w/ 28“ HDPE Force Main Crossing to 3,947 Ft; Washington; (Sands & Gravels)
- City of Coronado (2007) – 30“ HDPE Force Main Crossing x 3,086 Ft; California; (Clay & Sands)
- City of Honolulu (2007) – 2 Steel w/ HDPE Force Main Xings x 50“ to 3,100 Ft; Hawaii;(Coral, Sand & Gravel)
- Metropolitan Utilities District of Omaha (2005) – 2 Steel Water Mains x 48” to 2,950 Ft; Nebraska; (Gravel)

- City of Corpus Christi, TX (2005) – 1 Steel Water Main Xing x 42” 3,283 Ft, Texas; (Clay)
- Army Corps of Engineers (2004) 1 HDPE Intake 10” 3,522 Ft; North Dakota (Silty Sands, Clay)
- City of Marysville (2004) – (2) 36” HDPE Wastewater Force Main to 2,648 Ft; Washington; (Alluvial Deposits)
- Ojai Valley Sanitary District (2003) – 36” Steel w (2)10” (1)12” 3,150 Ft; California; (Boulders over Sandstone)
- Covert Generating PSE&G (2002) – (1)20” HDPE Diffuser 3,232 Ft and (2) 42” HDPE Intakes 2,372 Ft; Michigan (Sand)
- City of Grand Forks (2002) – (1) 36” and (2) 30” Steel Water Intakes up to 2,850 Ft; North Dakota; (Clay Silt)
- Superior Water & Power (2000) – 1 Steel Water Main Xing x 24“ to 4,500 Ft; Wisconsin; (Sands and Gravels)
- St. Charles County (1998) – 1 Steel Water Main Xing x 42“ to 3,500 Ft; Missouri; (Limestone, Sands and Gravels)
- Nueces River Authority (1998) – 2 Steel Water Main Xings x 50“ to 2,360 Ft; Texas; (Silts and Sands)
- Massachusetts Water Resources (1997) – 1 HDPE Force Main Xing x 42“ to 2,025 Ft; Massachusetts; (Silts, Sands and Gravels)
- St. Peter Sanitary District (1997) – 1 HDPE Force Main Xing x 14“ to 3,333 Ft; Minnesota; (Sands and Gravels)
- Missouri American Water Works (1997) – 1 Steel Water Main Xing x 36“ to 4,605 Ft; Missouri; (Silts, Sands and Gravels)
- Public Utility Agency Of Guam (1994) – 1 HDPE Offshore Sewer Outfall x 28“ to 1,760 Ft; Guam; (Coral Reef)
- City Of Norfolk (1992) – 1 Steel Water Main Crossing x 48“ to 2,100 Ft; Virginia; (Silts and Sands)

Telecommunications

- AT&T (2012) – 8” Steel 10,053’; Potomac River, VA/MD
- AT&T – Over 800 Crossings Including Beach Approaches Throughout United States to 4,500 Ft
- U.S. Sprint – Over 200 Crossings Including Beach Approaches Throughout United States to 3,500 Ft
- MCI – Over 100 Crossings Throughout United States to 4,000 Ft
- Level 3 Communications – Over 50 Crossings Throughout United States to 3,800 Ft With up to 42x1.25“ Ducts
- MFN – Over 10 Crossings Throughout U.S., including 5,111 Foot Hudson R. to Manhatten, NY With 21x1.25“ Ducts

Electrical

- Dept of Navy (Land-to-Water) – 2016; 12” Steel; 1,178 and 1,023’; ME; Granite 20,000 – 30,000 psi
- Dominion – 2016; 4-10”/2-4” HDPE Bundle; 3,737’; VA; Gray Clay
- Wisconsin Public Service – 2015; 4-4” HDPE; 764; WI; Clay
- SCANA – 2013; 5-Xings 8” Stl; 2 each Land to Land 2,500’, 4,911’; 2 each Land to Water 3,580’, 7,304’; and 1 each Water to Water 7,424’; SC (Sands and Clay)
- Progress Energy Cape Fear River, (2-separate) 8” Stl; 6,675’; Wilmington, NC (Limestone/Sand)
- BC Hydro – 32” Bundle (7)10” HDPE (6)4” HDPE 230kV included thermal Grouting; 2,785 Ft; Vancouver, BC; Gravel Cobble over Mudstone/Sandstone
- Long Island Power Authority – Bundle (3)12” HDPE for 23 Drills Totaling 21,200 Ft; New York, Sandy Silt
- United Illuminating – 8 x 5“ HDPE bundle to 600 Ft; Interstate-95; Connecticut; Schist bedrock
- South Carolina Gas & Electric – 2 parallel 8” Stl 7,075 Ft 20’ Apart; South Carolina; Cooper Marl Clay
- Israel Electric Corp – (1)12” Stl and (3)30” Stl to 2,836 Ft; Israel; Sand
- NSP – 20“ Steel With 4 x 6“ HDPE bundle to 1,200 Ft; Mississippi R.; Minnesota; Sands
- Com Electric – 18“ Steel With 3 x 6“ HDPE bundle to 1,500 Ft; Maryland; Sands & Gravel
- Niagara Mohawk Power – 16” Steel 1,167 Ft; New York; Gravel, Cobble over Rock

Michels has recently mastered new technology (Pilot-Hole Intersect and Gyroscope tracking) expanding our capabilities for performing some of the most complex directional drills as seen by the lists compiled above.

Michels has also taken our experience to the water, completing several difficult land-to-water and water-to-water installations. Michels is not a marine contractor however, we have built sound relationships with several respected marine contractors for completion of these difficult Marine crossings.

Land-to-Water *(L-W)* and Water-to-Water *(W-W)* Xings (Marine Support)

- Dept of Navy *(L-W)* – 2016; 12" Steel; 1,178 and 1,023'; ME; Granite 20,000 – 30,000 psi
- Spectra Energy Transmission – (2015); 16" Steel; 1,508'; *L-W* (Boulder, Cobble above Dense Rock); Salem, MA;
- Select Energy Services – (2014); 24" HDPE; 1,061'; *L-W* (Sands and Fat Clay); Charleston ND;
- SCANA – (2013); 8" Stl; 2 each *L-W* 3,580', 7,304'; and 1 each *W-W* (Sands and Clay) 7,424'; SC; Gray Bay and Hamlin Sound, SC;
- Enbridge – (2011); 12" Stl; 1,612'; Cameron, *W-W* (sands, silts, clays), LA;
- Memorial University of Newfoundland (2010) – (1)14" HDPE 1,554 Ft; Water Intake *L-W* (Red/Purple Sandstone); Newfoundland;
- National Gas Co. of Trinidad & Tobago (2010) – (1)36" Stl 2,207 Ft, (1)34" HDPE 2,005' Sewer Outfalls *L-W (*Limestone); Guam;
- Guam Water Authority (2008) – (1)42" HDPE 2,207 Ft, (1)34" HDPE 2,005' Sewer Outfalls; *L-W* (Limestone); Guam;
- BP Billiton Petroleum (2006) – (1)30" Steel 6,028 Ft; *L-W* (Silt, Sand, Clay); Trinidad & Tobago;
- BG ECMA Dolphin Deep (2005) – (1)24" Steel 3,402 Ft; *L-W* (Silt, Sand, Clay); Trinidad & Tobago;
- Eastern North Carolina Gas (2004) – (1)6" Steel 15,684 Ft Pulled; *L-W* (Silt, Clay); Outer Banks, NC;
- Army Corps of Engineers (2004) – (1)10" HDPE 3,522 Ft; *L-W* (Fat Swelling Clay); Parshall, ND;
- Israel Electric Corp (2004) – (1)12" Stl and (3)30" Stl to 2,836 Ft; *L-W* (Sand); Israel;
- Coastal Corporation – (2003); 3-Xings 12" Stl; 3 each 2,735' Arthur Kill River, 1,668' N Shooters Island, 3,524' South Reach Channels; *L-W* (Red Sandstone); Linden, NJ/Bayonne, NY;
- Maritimes & NE – (2003); 4-Xings 30" Stl; 2 each 5,174' Georges Island, 5,286' Beverly Harbor; *W-W* (Meta-Siltstone/Sandstone, Diorite, Granodiorite/Schist Bedrock) Salem, MA; and 2 each *L-W* 4,829 Salem Landing, 3,068' Weymouth; MA;
- Covert Generating PSE&G (2002) – (1)20" HDPE Diffuser 3,232 Ft and (2) 42" HDPE Intakes 2,372 Ft; *L-W* (Sand); Lake Michigan, MI;
- Forest Oil (2002) – (4) 12" Steel Oil Transport Lines 1,750 Ft; *L-W* (Gravel/Cobble Overburden Over Sand); Traders Bay, Alaska;
- City of Grand Forks (2002) – (1) 36" and (2) 30" Steel Water Intakes up to 2,850 Ft; *L-W* (Clay Silt); Red Lake River and Red River of the North, North Dakota;
- Gulfstream Natural Gas (2001) – (1) 38" 1.25" wt Steel; Gas Pipeline 4,009 Ft; *L-W* (Limestone, sands, silts) Shooters Island, FL; Stolt Offshore;
- Public Utility Agency Of Guam (1994) – 1 HDPE Offshore Sewer Outfall x 28" to 1,760 Ft; *L-W* (Coral Reef); Ocean; Guam

Michels' broad range of HDD experience and capacity allows us to accurately estimate the resources required to complete a crossing and provide the utility owner with a reliable expectation of project costs and schedule. The accuracy of an estimate depends directly on the amount and quality of information provided regarding a given crossing. The more accurate and complete the information is, the more accurate the required resources can be estimated. The following is the type of information that helps Michels evaluate any given HDD crossing:

- Design Entry Angle, Minimum Depth, Exit Angle, Land Contours & Geometry of Alignment (Plan & Profile)
- Length of Crossing, Diameter of Utility, Tolerance Of Placement, Carrier Pipe Specification
- Ground Conditions (Soil-USCS Classification & Blow Count Density; Rock-Type, Unconfined Compressive Strength, Rock Quality, Rock Characteristics)
- Special Restrictions to Working Conditions (Time Constraints, Available Work Areas, Proposed Access)

Michels crews and equipment can be mobilized anywhere in the world to complete a wide range of HDD crossings.

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Date	*Utility*	*Prime Contractor*	*Contact*	*Phone No.*	*Diameter of Bore*	*Length*	*Location*
2018	NEXUS GAS	MICHELS PIPELINE	MEL JOHNSON NEXUS GAS MATTHEW WESTPHAL LATEX	(216) 393-6403 MEL (920) 539-1001 MATTHEW	36" STEEL	2,974'	WETLAND MP8.1 CHAMBERSBURG, OH
2018	NEXUS GAS	MICHELS PIPELINE	MEL JOHNSON NEXUS GAS MATTHEW WESTPHAL LATEX	(216) 393-6403 MEL (920) 539-1001 MATTHEW	36" STEEL	4,034'	MAUMEE RIVER MP181.7 WATERVILLE, OH
2018	NEXUS GAS	LATEX CONSTRUCTION	DEREK WELLS NEXUS GAS DAVE WILLIAMS LATEX	(903) 714-9053 DEREK (770) 760-0820 DAVE	36" STEEL	3,199'	VERMILLION RIVER MP104.4 OBERLIN, OH
2018	WILLIAMS TRANSCONTINENTAL GAS	LATEX CONSTRUCTION	MARK WUOLLET WILLIAMS SHAWN POMERLEAU LATEX	(713) 215-3743 MARK (207) 595-2379 SHAWN	42" STEEL	3,980'	SUSQUEHANNA RIVER MP 99.6 CATAWISSA, PA [1,6,7,11]
2018	HARBOUR RESOURCE PARTNERS (HRP)	MICHELS CANADA	JEREMY KLARENBACH - HRP MIKE VIDOMSKI - MICHELS CANANDA	(780) 232-3804 JEREMY (920) 955-2120 MIKE	42" STEEL	3,087'	VICTORIA HARBOR VICTORIA, BRITISH COLUMBIA, CANADA [1,4,7]
2018	ENBRIDGE	STRIKE USA	JERRELL BRYAN ENBRIDGE	(601) 504-0376	42" STEEL	3,717'	BAHIA GRANDE CHANNEL #2 LOS FRESNOS, TX [6,7]
2018	ENBRIDGE	STRIKE USA	JERRELL BRYAN ENBRIDGE	(601) 504-0376	42" STEEL	4,869'	BAHIA GRANDE CHANNEL #1 LOS FRESNOS, TX [6,7]
2017	ENBRIDGE	STRIKE USA	JERRELL BRYAN ENBRIDGE	(601) 504-0376	48" STEEL	3,235'	ARROYO COLORADO CANAL VILLA DEL SOL, TX [7]

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2017	ENBRIDGE	STRIKE USA	JERRELL BRYAN ENBRIDGE	(601) 504-0376	48" STEEL	3,085'	RANCHO VIEJO FLOODWAY LOS FRESNOS, TX [7]
2017	ENERGY TRANSFER COMPANY - ROVER PL	PRECISION PIPELINE	LEON BANTA ENERGY TRANSFER	(281) 620-3954	36" STEEL	5,841'	OHIO RIVER - MP 33.8 SARDIS OH & PADIN CITY WV [1,6,7,9]
2017	ENBRIDGE	STRIKE USA	JERRELL BRYAN ENBRIDGE	(601) 504-0376	48" STEEL	3,649'	IBWC NORTH FOODWAY SEBASTIAN, TX
2017	ENBRIDGE	STRIKE USA	JERRELL BRYAN ENBRIDGE	(601) 504-0376	48" STEEL	3,595'	ROAD 771 & CANAL SAN BENITO, TX
2017	TRANSCANADA/COLUMBIA PL	PRICE GREGORY	JORDAN CRANE TRANSCANADA	(281) 908-5104	36" STEEL	6,238'	OHIO RIVER BURLINGTON, OH/WESTMORELAND WV [1,6,7,9,11]
2017	ENERGY TRANSFER COMPANY - ROVER PL	PUMPCO	SETH WILLOUGHBY ENERGY TRANSFER COMPANY	(281) 840-1482	36" STEEL	7,194'	OHIO RIVER - MP 16.07 [1,6,7,9,11] TORONTO, OH & NEW CUMBERLAND, WV
2017	DEPARTMENT OF NAVY	HEALY TIBBITTS BUILDERS, INC	STANLEY SHEN DEPARTMENT OF NAVY ART LAMBERT HEALY TIBBITTS	ART LAMBERT (808) 487-3664	30" STEEL	3,483'	FORD ISLAND TO LANDING C HONOLULU, HI [1,6,7,11]
2017	ENERGY TRANSFER COMPANY-DAPL	PRECISION PIPELINE	JACK EDWARDS ENERGY TRANSFER COMPANY	(832) 421-5691	30" STEEL	7,531'	LAKE OAHE & MISSOURI RIVER CANNONBALL, ND [1,6,7,9]
2017	CHENIERE ENERGY	ASSOCIATED PIPELINE	SCOTT TIMPONE CHENIERE ENERGY	(713) 375-5723	48" STEEL	3,291'	POND: METER TO LNG FACILITY PORTLAND, TX

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2016	SPECTRA ENERGY TRANSMISSION	MPG PIPELINE	BRUCE AINSWORTH MPG PIPELINE	(713) 955-9910	36" STEEL	3,829'	FLINT RIVER ALBANY, GA [6,9,11]
2016	ENERGY TRANSFER COMPANY-DAPL	PRECISION PIPELINE	JACK EDWARDS ENERGY TRANSFER COMPANY	(832) 421-5691	30" STEEL	7,282'	MISSISSIPPI RIVER SANDUSKY, IA & NAUVOO, IL [1,7]
2016	ENERGY TRANSFER COMPANY-DAPL	MICHELS PIPELINE	JACK EDWARDS ENERGY TRANSFER COMPANY	(832) 421-5691	30" STEEL	6,328'	BIG SIOUX RIVER DAYTON TOWNSHIP, SD/IA [1,2,6,7]
2016	TRANSCANADA PIPELINE	BANISTER PIPELINES	YANIC GAUVIN-CLOUTIER BANISTER PIPELINE	(905) 795-3399	36" STEEL	4,311'	MAJOR MACKENZIE ROAD ONTARIO, CANADA [1,4,6,7]
2016	ENERGY TRANSFER COMPANY-DAPL	MICHELS PIPELINE	JACK EDWARDS ENERGY TRANSFER COMPANY	(832) 421-5691	30" STEEL	5,714'	JAMES RIVER PLEASANT VIEW, SD [6]
2016	ENERGY TRANSFER COMPANY-DAPL	MICHELS PIPELINE	JACK EDWARDS ENERGY TRANSFER COMPANY	(832) 421-5691	30" STEEL	2,991'	PCN-3/WETLAND REDFIELD, SD [2]
2016	ENERGY TRANSFER COMPANY-DAPL	PRECISION PIPELINE	JACK EDWARDS ENERGY TRANSFER COMPANY	(832) 421-5691	30" STEEL	3,352'	CLIFF CROSSING WATFORD CITY, ND [7,9]
2016	TRANSCANADA PIPELINE	BANISTER PIPELINES	YANIC GAUVIN-CLOUTIER BANISTER PIPELINE	(905) 795-3399	36" STEEL	3,901'	RUTHERFORD ROAD ONTARIO, CANADA [1,4,7]
2016	JEA - JACKSONVILLE ELECTRIC AUTHORITY	HASKELL DESIGN BUILD PROJECT	ELIZABETH A. DiMEO JEA	(904) 665-8139	42" STEEL WITH 36" HDPE	3,983'	ST. JOHN'S RIVER JACKSONVILLE, FL [1,10,11]
2016	ENERGY TRANSFER	STRIKE USA	WAYNE KLEMCKE ENERGY TRANSFER	(281) 744-8835	30" STEEL	6,119'	LAKE WHITNEY KOPPERL, TX [1,6,7]

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2016	TRANSCANADA PIPELINE	MICHELS CANADA	RICHARD PATRY TRANSCANADA PIPELINE	(587) 434-2683	30" STEEL	5,154'	LEIGE LATERAL-HOUSE RIVER WOOD BUFFALO, ALBERTA, CANADA [4]
2016	TRANSCANADA	MICHELS CANADA	JESSE BAJNOK TRANSCANADA	(403) 920-7607	42" STEEL	3,399'	MCKAY RIVER FORT MCMURRAY, AB, CANADA [1,4]
2016	TRANSCANADA	MICHELS CANADA	JESSE BAJNOK TRANSCANADA	(403) 920-7607	42" STEEL	3,885'	DOVER RIVER FORT MCMURRAY, AB, CANADA [1,4]
2016	ENBRIDGE	MICHELS CANADA	MATHEW BARIL ENBRIDGE	(780) 222-3197	36" STEEL	3,160'	CHRISTINA RIVER FORT MCMURRAY, AB, CANADA [1,4,7]
2015	TRANSCANADA	MICHELS CANADA	JESSE BAJNOK TRANSCANADA	(403) 920-7607	42" STEEL	7,205'	ATHABASCA RIVER FORT MCMURRAY, AB, CANADA [1,4,6,7]
2015	ENBRIDGE	MICHELS CANADA	TYLER HORTON ENBRIDGE	(416) 753-7811	36" STEEL	3,133'	PAMONA CREEK, TORONTO, ONTARIO, CANADA [4,7]
2015	ENBRIDGE ENERGY	PRICE GREGORY	CHRISTOPHER HAUX ENBRIDGE ENERGY	(218) 393-4192	36" STEEL	3,461'	KENNEDY AVE & GRIFFITH TERMINAL GRIFFITH, IL
2015	ENBRIDGE	MICHELS CANADA	TYLER HORTON ENBRIDGE	(416) 753-7811	36" STEEL	3,412'	E. DON RIVER TORONTO, ONTARIO, CANADA [2,4,7]
2015	ENBRIDGE	MICHELS CANADA	TYLER HORTON ENBRIDGE	(416) 753-7811	36" STEEL	2,992'	ALDEN ROAD TORONTO, ONTARIO, CANADA [4,7]
2015	ENBRIDGE ENERGY	PRICE GREGORY	CHRISTOPHER HAUX ENBRIDGE ENERGY	(218) 393-4192	36" STEEL	3,011'	HIGHWAY 41 & RR GRIFFITH, IL [6,7]

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2015	ENBRIDGE ENERGY	PRICE GREGORY	CHRISTOPHER HAUX ENBRIDGE ENERGY	(218) 393-4192	36" STEEL	5,128'	LAKE AVE & RR SAUK VILLAGE, IL [6]
2015	ENBRIDGE	MICHELS CANADA	TYLER HORTON ENBRIDGE	(416) 753-7811	36" STEEL	3,363'	STEELES AVENUE TORONTO, ONTARIO, CANADA [4,7,11]
2015	NICOR-AGL RESOURCES	PRECISION PIPELINE	ROBERT GRAHAM AGL RESOURCES	(630) 918-0265	36" STEEL	3031'	BNSF RR & AURORA ROAD AURORA, IL [2]
2015	TRANSCANADA	MICHELS CANADA	JESSE BAJNOK TRANSCANADA	(403) 920-7607	42" STEEL	3,114'	BEAVER LAKE FORT MCMURRAY, AB, CANADA [1,4]
2015	TRANSCANADA	MICHELS CANADA	JESSE BAJNOK TRANSCANADA	(403) 920-7607	42" STEEL	3,776'	MACKAY RIVER FORT MCMURRAY, AB, CANADA [4]
2014	LAKE OSWEGO-TIGARD WATER PARTNERSHIP	FRANK COLUCCIO CONSTRUCTION COMPANY	JOEL KOMAREK CITY OF LAKE OSWEGO	(503) 697-6588	36" STEEL	3,805'	WILLAMETTE RIVER LAKE OSWEGO, OR [1,3,7]
2014	ENBRIDGE ENERGY (FLANAGAN SOUTH PIPELINE)	MICHELS PIPELINE	DOUG RYDER ENBRIDGE ENERGY	(218) 464-5831	36" STEEL	9,040'	MISSISSIPPI RIVER & LEVEES QUINCY, IL/MO [6,7,8]
2013	ENBRIDGE ENERGY (FLANAGAN SOUTH PIPELINE)	MICHELS PIPELINE	DOUG RYDER ENBRIDGE ENERGY	(218) 464-5831	36" STEEL	5,687'	MISSOURI RIVER NEW FRANKFURT, MO [6,7,8]

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2013	SPRAGUE-ROSER CONTRACTING CO. LTD/ REGIONAL MUNICIPALITY OF WOOD BUFFALO	MICHELS CANADA	CRAIG CORNELL SPRAGUE-ROSER	(780) 463-5862	30" STEEL	4,400'	SALINE CREEK FORT MCMURRAY, AB, CANADA [1,4,6]
2013	ENBRIDGE ENERGY (FLANAGAN SOUTH PIPELINE)	MICHELS PIPELINE	DOUG RYDER ENBRIDGE ENERGY	(218) 464-5831	36" STEEL	3,544'	ILLINOIS RIVER HAVANA, IL [6,7,8]
2013	INTER PIPELINE LIMITED	MICHELS CANADA	KEVIN GEORGE INTER PIPELINE LIMITED	(403) 717-5747	42" STEEL	4,284'	VERMILLION RIVER VERMILLION, AB, CANADA [1,4,6,7]
2013	KINDERMORGAN/TN GAS	MICHELS PIPELINE	MARK HAMARICH KINDERMORGAN	(713) 819-7033	30" STEEL	4,987'	MONKSVILLE RESERVOIR W MILFORD, NJ[1,6,7,11]
2013	INTER PIPELINE LIMITED	MICHELS CANADA	KEVIN GEORGE INTER PIPELINE LIMITED	(403) 717-5747	42" STEEL	3,392'	N. SASKATCHEWAN RIVER ELK POINT, AB, CANADA [1,4]
2013	TRANSCANADA - KEYSTONE	MICHELS PIPELINE	DARRYL SANDQUIST TRANSCANADA	(403) 920-6941	36" STEEL	4,304'	BOIS D' ARC CREEK DIRECT, TX [6,7]
2013	TRANSCANADA - KEYSTONE	MICHELS PIPELINE	DARRYL SANDQUIST TRANSCANADA	(403) 920-6941	36" STEEL	3,892'	RED RIVER BENNINGTON OK/TX [1,6,7]
2013	TEXAS EASTERN TRANSMISSION	MICHELS DIRECTIONAL CROSSINGS	ED GONZALES TEXAS EASTERN TRANSMISSION	(201) 427-7550	42" STEEL	3,008'	I-95 & TIDAL WETLANDS LINDEN, NJ [1,6,7]
2013	TRANSCANADA - KEYSTONE	MICHELS PIPELINE	DARRYL SANDQUIST TRANSCANADA	(403) 920-6941	36" STEEL	3,077'	UP RR & JEFFERSON ST TUSHKA, OK [6]

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2013	TRANSCANADA - KEYSTONE	MICHELS PIPELINE	DARRYL SANDQUIST TRANSCANADA	(403) 920-6941	36" STEEL	3,239'	CLEAR BOGGY CREEK TALOAH, OK [7]
2013	TEXAS EASTERN TRANSMISSION	MICHELS DIRECTIONAL CROSSINGS	ED GONZALES TEXAS EASTERN TRANSMISSION	(201) 427-7550	30" STEEL	6,544'	EAST 1ST STREET BAYONNE, NJ[1,6]
2013	TEXAS EASTERN TRANSMISSION	MICHELS DIRECTIONAL CROSSINGS	ED GONZALES TEXAS EASTERN TRANSMISSION	(201) 427-7550	30" STEEL	4,905'	MERSELES STREET HAMILTON PARK, NJ[1,6,11]
2013	TEXAS EASTERN TRANSMISSION	MICHELS DIRECTIONAL CROSSINGS	ED GONZALES TEXAS EASTERN TRANSMISSION	(201) 427-7550	42" STEEL	4,441'	GOETHALS BRIDGE & TIDAL WETLANDS STATEN ISLAND, NY[1,6]
2013	TRANSCANADA - KEYSTONE	SUNLAND CONSTRUCTION	GARRET P. GUIDRY SUNLAND CONSTRUCTION	(337) 685-2167 EXT 122	36" STEEL	4,213'	MENARD CREEK RYE, TX
2013	TRANSCANADA - KEYSTONE	MICHELS PIPELINE	DARRYL SANDQUIST TRANSCANADA	(403) 920-6941	36" STEEL	3,607'	JOHNSON CREEK NEW SOMMERFIELD, TX[1]
2013	TRANSCANADA - KEYSTONE	MICHELS PIPELINE	DARRYL SANDQUIST TRANSCANADA	(403) 920-6941	36" STEEL	4,005'	CANADIAN RIVER ATWOOD, OK[1]
2013	TRANSCANADA - KEYSTONE	MICHELS PIPELINE	DARRYL SANDQUIST TRANSCANADA	(403) 920-6941	36" STEEL	3,571'	LUFKIN CULTURAL SITE & ANGELINA RIVER EDEN, TX
2013	TEXAS EASTERN TRANSMISSION	MICHELS DIRECTIONAL CROSSINGS	ED GONZALES TEXAS EASTERN TRANSMISSION	(201) 427-7550	30" STEEL	8,101'	KILL VAN KULL BERGEN PT. NJ/NY[1,6]
2013	TEXAS EASTERN TRANSMISSION	MICHELS DIRECTIONAL CROSSINGS	ED GONZALES TEXAS EASTERN TRANSMISSION	(201) 427-7550	30" STEEL	4,861'	18TH STREET/LONG SLIP NEWPORT, NJ [1,3,6,7,9,11]

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Directional Crossings

Date	*Utility*	*Prime Contractor*	*Contact*	*Phone No.*	*Diameter of Bore*	*Length*	*Location*
2013	TRANSCANADA - KEYSTONE	MICHELS PIPELINE	DARRYL SANDQUIST TRANSCANADA	(403) 920-6941	36" STEEL	4,342'	DEEP FORK RIVER OKLAHOMA CITY, OK
2013	TRANSCANADA - KEYSTONE	MICHELS PIPELINE	DARRYL SANDQUIST TRANSCANADA	(403) 920-6941	36" STEEL	3,314'	EAST FORK ANGELINA RIVER REKLAW, TX [7]
2013	TRANSCANADA - KEYSTONE	MICHELS PIPELINE	DARRYL SANDQUIST TRANSCANADA	(403) 920-6941	36" STEEL	2,908'	NECHES RIVER & UP RR CLARKS FERRY, TX [6]
2013	TEXAS EASTERN TRANSMISSION	MICHELS DIRECTIONAL CROSSINGS	ED GONZALES TEXAS EASTERN TRANSMISSION	(201) 427-7550	42" STEEL	3,211'	ARTHUR KILL STATEN ISLAND, NJ/NY [1,7]

Rock Bore[1]
Environmental Services[2]
Beach Approach[3]
Michels Directional/Canada [4]
Water to Water[5]
Hole Intersects[6]
Gyroscopic Survey[7]
Levee Crossing[8]
Thruster[9]
Design Build[10]
Noise Mitigation[11]

5.0 NOISE

CMP's consultant, Burns & McDonnell, developed a noise model to analyze noise impacts from HDD operations during construction of CMP's transmission lines under the Kennebec River. Using industry-accepted sound modeling software, Computer Aided Noise Abatement (CadnaA), the expected sound pressure levels from the HDD activities were predicted. The software is a scaled, three-dimensional program which takes into account each piece of equipment emitting sound on a site and predicts sound pressure levels over an area of interest.

General sound levels for the drilling rig, mud pump, shaker, and generator from other HDD projects were used to estimate sound level impacts. The equipment included in the model is listed in Table 5-1. There would be additional equipment used in drilling such as pipe racks and operator trucks. However, sound emitted by these sources is variable and minimal compared to the drilling rig, pumps, and generator.

Table 5-1 HDD Entry and Exit Location Equipment

HDD Entry		HDD Exit	
Equipment	**Sound Power Level (dBA)**	**Equipment**	**Sound Power Level (dBA)**
Drilling Rig	118.4	--	--
600 hp Mud Pump	114.8	600 hp Mud Pump	114.8
500 hp Generator	111.6	--	--
Shale Shaker	94.7	--	--

Reflections and shielding were considered for sound waves encountering physical structures. Sound levels around the HDD locations can be influenced by the sound reflections from physical structures nearby. The order of reflections for the model was set at two. Some structures onsite were considered acoustically transparent (e.g., structural steel, bus work) and were not included. Trees and other vegetation (i.e., shrubbery) were not included in the model to avoid taking too much attenuation into account in the model. Terrain was included to account for surface effects such as ground absorption, and the large elevation difference between the drilling sites and the Kennebec River.

Predictive modeling was completed for the drilling operations. The expected sound levels of the operations can be seen in Figure 5-1 below, which shows a graphical representation in 5 dBA contours of the sound generated from the HDD construction equipment. The model utilized equipment sound levels from past projects with similar HDD equipment. Table 5-2 shows the sound level impacts at the edges of

the right-of-way and on the Kennebec River. The sound levels shown are for the HDD equipment only and do not include any sound generated by background sources.

Table 5-2: Modeled HDD Construction Sound Levels

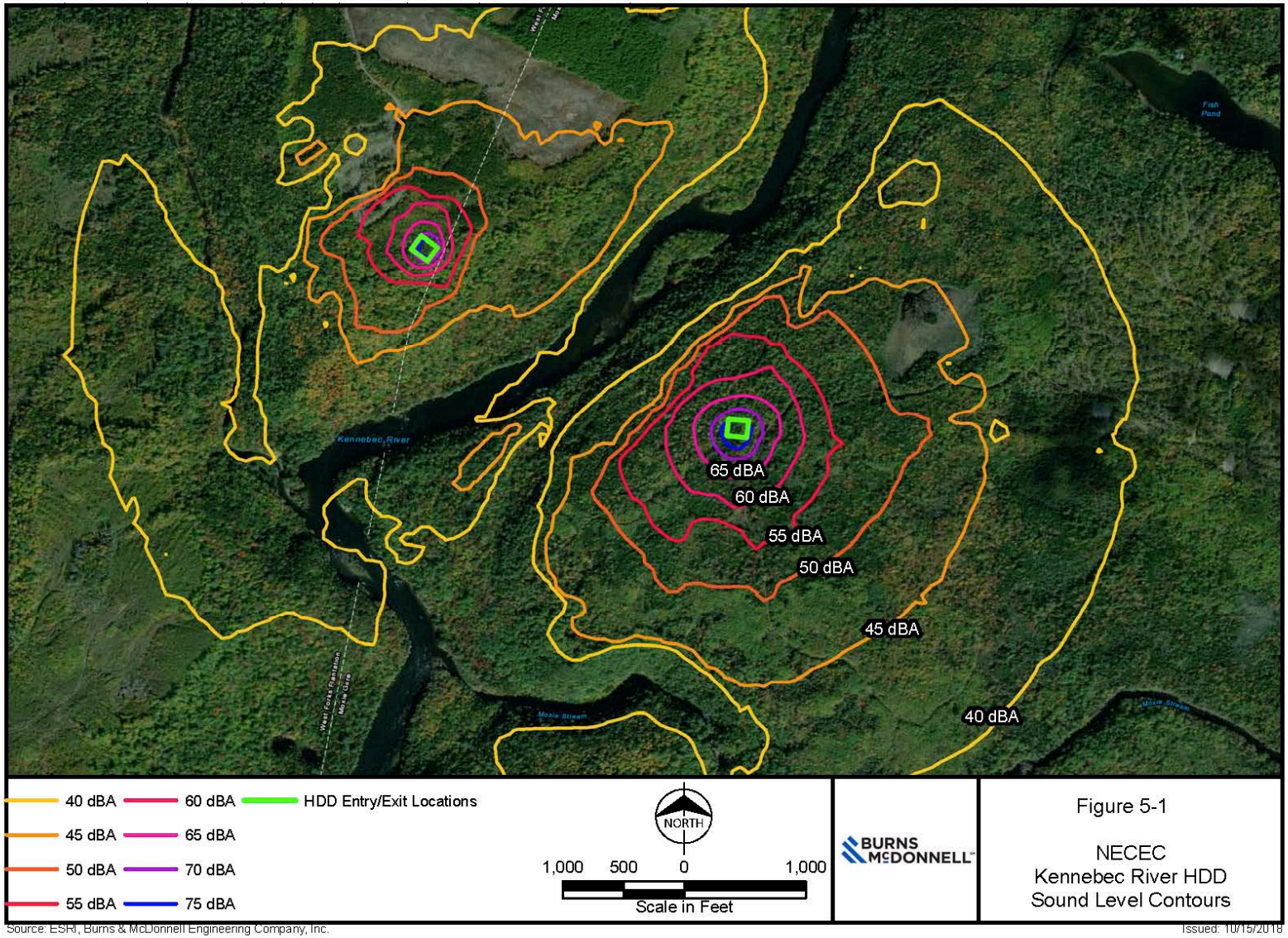
Modeled Receptor	Modeled Sound Level (dBA)
Max on River	40.7
Max at HDD Entry ROW	80.1
Max at HDD Exit ROW	70.8

HDD installation will require construction activity 24 hours a day. Maine DEP Ch. 375.10(1)(a) limits nighttime construction operation sound levels to 75 dBA at any property line of the development or contiguous property owned by the developer, and to 50 dBA at any protected location not predominantly zoned commercial, transportation, or industrial.

The HDD operations are predicted to be below the Maine DEP sound level requirements along the Kennebec River. It is expected that HDD operations may be audible on the Kennebec River to rafters. However, the impacts would be minimal, and the river would not be used during nighttime hours.

Maine DEP Ch. 375.10(2)(a)(III) permits higher levels of nighttime construction sound when a duly issued permit authorizing nighttime construction sound in excess of the Maine DEP limits has been granted by the local municipality when the duration of the nighttime construction activity is less than or equal to 90 days. In this case, the "local municipality" is LUPC.

Sound levels along the Kennebec River would be below those required by the Maine DEP for protected locations. In addition, there are no residences within a ½-mile radius of either drilling location. The construction permit would need to allow for increased sound level limits along the right-of-way for a short period of time during HDD operations.


65 dBA
60 dBA
55 dBA
50 dBA
45 dBA
40 dBA
Kennebec River
40 dBA
45 dBA
50 dBA
55 dBA
60 dBA
65 dBA
70 dBA
75 dBA
HDD Entry/Exit Locations
NORTH
1,000 500 0 1,000
Scale in Feet
BURNS McDONNELL
Figure 5-1
NECEC
Kennebec River HDD
Sound Level Contours
Source: ESRI, Burns & McDonnell Engineering Company, Inc.
Issued: 10/15/2018

6.0 VISUAL QUALITY AND SCENIC CHARACTER

Terrence J. DeWan and Associates ("TJDA") evaluated the proposed HDD project modification to determine whether the proposed Moxie Gore or West Forks Termination Stations would be visible from the Kennebec River. The evaluation included developing a three-dimensional model of the termination stations, with data provided by TRC, and inserting that data into the 3D Studio Max model previously developed for the overhead crossing option. TRC provided the overall project file including a 3D model of the structures, drilling platforms, and clearing limits within the corridor. Previous field investigations determined that the actual average tree height on the hillsides on either side of the river is 75 feet; and was modeled as such.

TJDA evaluated potential visibility from six locations where photographs were previously taken by both TJDA and Power Engineering. (Photosimulations of the overhead crossing were previously developed and submitted from 5 of the 6 locations evaluated for the termination station visibility.) From 4 of the 6 locations evaluated, the existing terrain would block all potential views of the termination stations. From two locations located south and west of the termination stations, the modeling indicated the potential for a portion of the termination stations to be visible above the existing terrain. However, when 75-foot tree 'cylinders' were added to the model, the Termination Stations were completely screened from the river viewpoints.

Included with this submission in Exhibit 6-1 are computer model illustrations that demonstrate that both the Moxie Gore and West Forks Termination Stations will be screened by the 75-foot vegetation on the hillsides above the rivers. From each viewpoint analyzed we have included a panoramic photograph of existing conditions, a normal existing conditions view, a computer model showing just terrain and the respective termination station, a computer model showing the addition of 75-foot trees, and then a combined overlay to show how the model and photograph are registered.

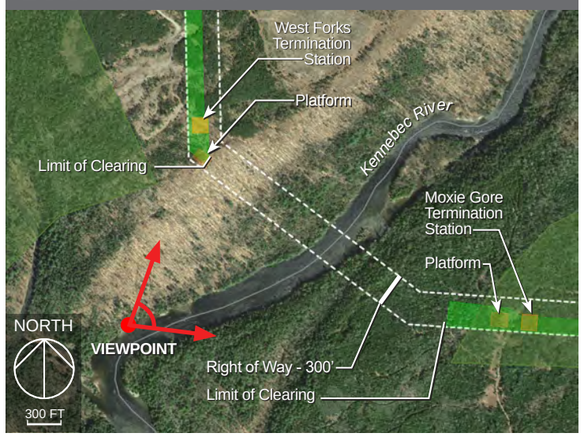
Exhibit 6-1: Photosimulations

MOXIE GORE TERMINATION STATION VISIBILITY EVALUATION
KENNEBEC RIVER, Looking East

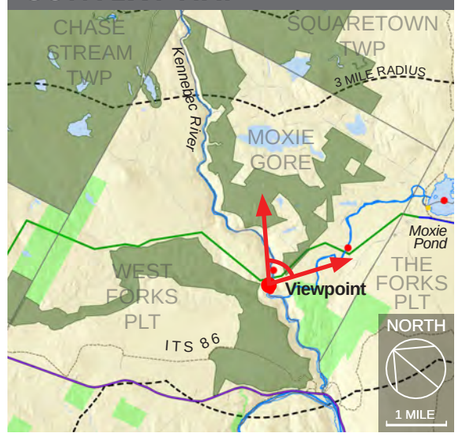
NEW ENGLAND CLEAN ENERGY CONNECT

Existing Conditions: Panoramic view looking from north to east from the Kennebec River, approximately 3,600 feet west of the proposed Moxie Gore Termination Station. The Moxie Gore Termination Station will not be visible from the river. A forested buffer of approximately 1,000 in length will be preserved within the corridor between the southeast shoreline and the Station.

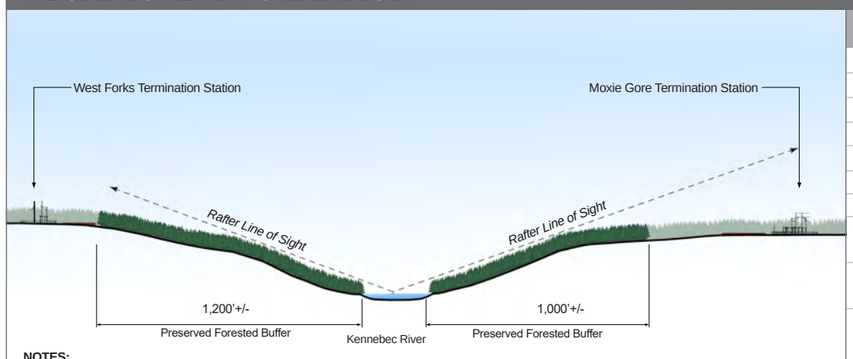
LOCATION MAP



CONTEXT MAP



TECHNICAL INFORMATION



NOTES:
-Looking north at proposed Termination Stations; West Forks Station (west side) and Moxie Gore Station (east side)
-Base information from TRC.
-Average height of vegetation within the forested buffer is 75'.

Photograph / Photosimulation Information	
Location	45.371014°, -69.949912°
Viewing Direction	Northeast to East
Horizontal Angle of View	84°
Date and Time	08/15/16 at 1:30 pm
Camera Focal Length	50 mm
Camera Make/Model	Canon EOS 5D Mark III
Photo Source	Powers Engineering
Proposed Structures Visible	None

CENTRAL MAINE POWER

tjd&a

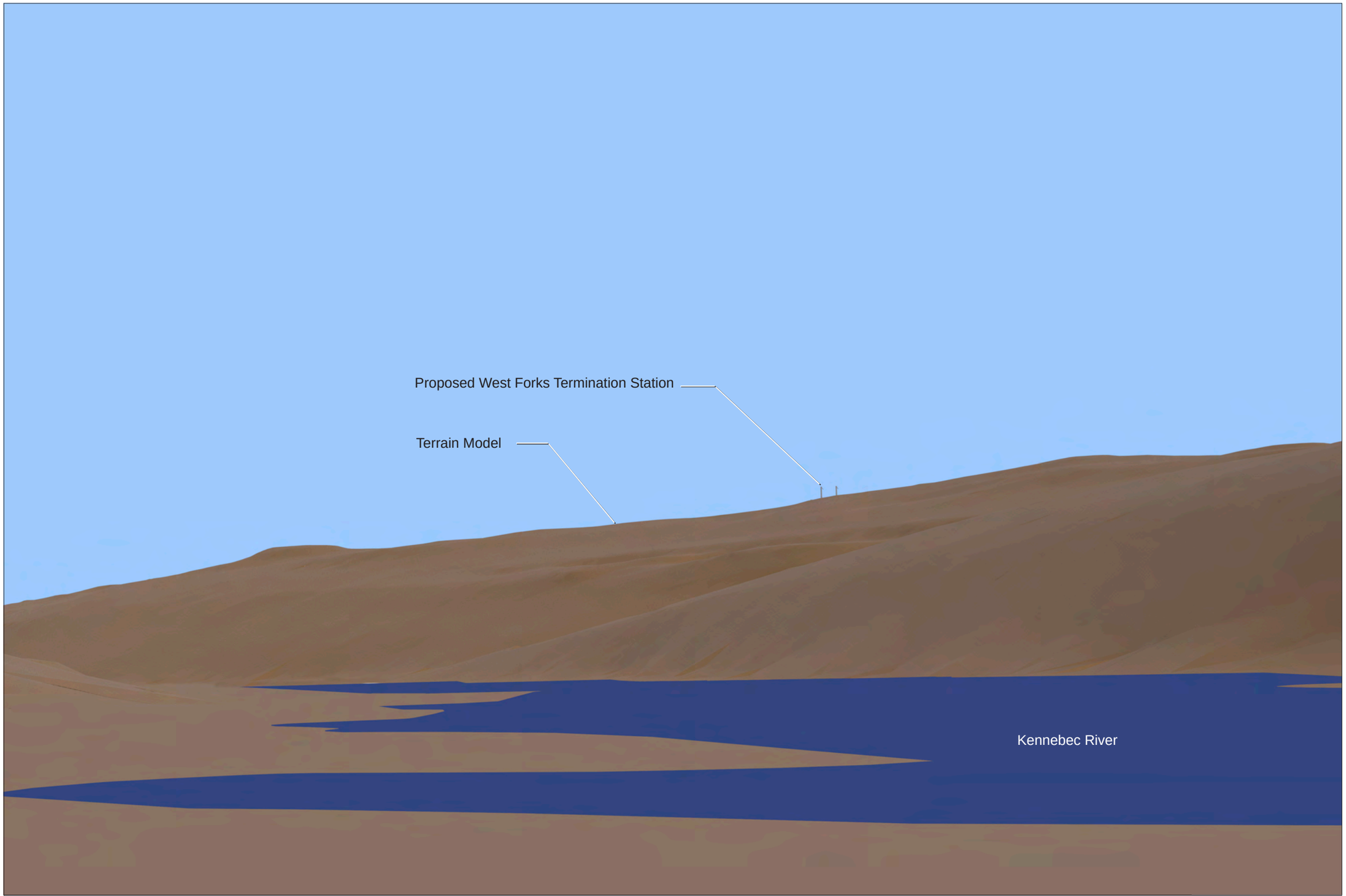
MOXIE GORE TERMINATION STATION VISIBILITY EVALUATION
KENNEBEC RIVER, Looking East

NEW ENGLAND CLEAN ENERGY CONNECT

Existing Conditions B: Normal view looking east from the Kennebec River, approximately 3,600 directly west of the proposed Moxie Gore Termination Station

MOXIE GORE TERMINATION STATION VISIBILITY EVALUATION
KENNEBEC RIVER, Looking East

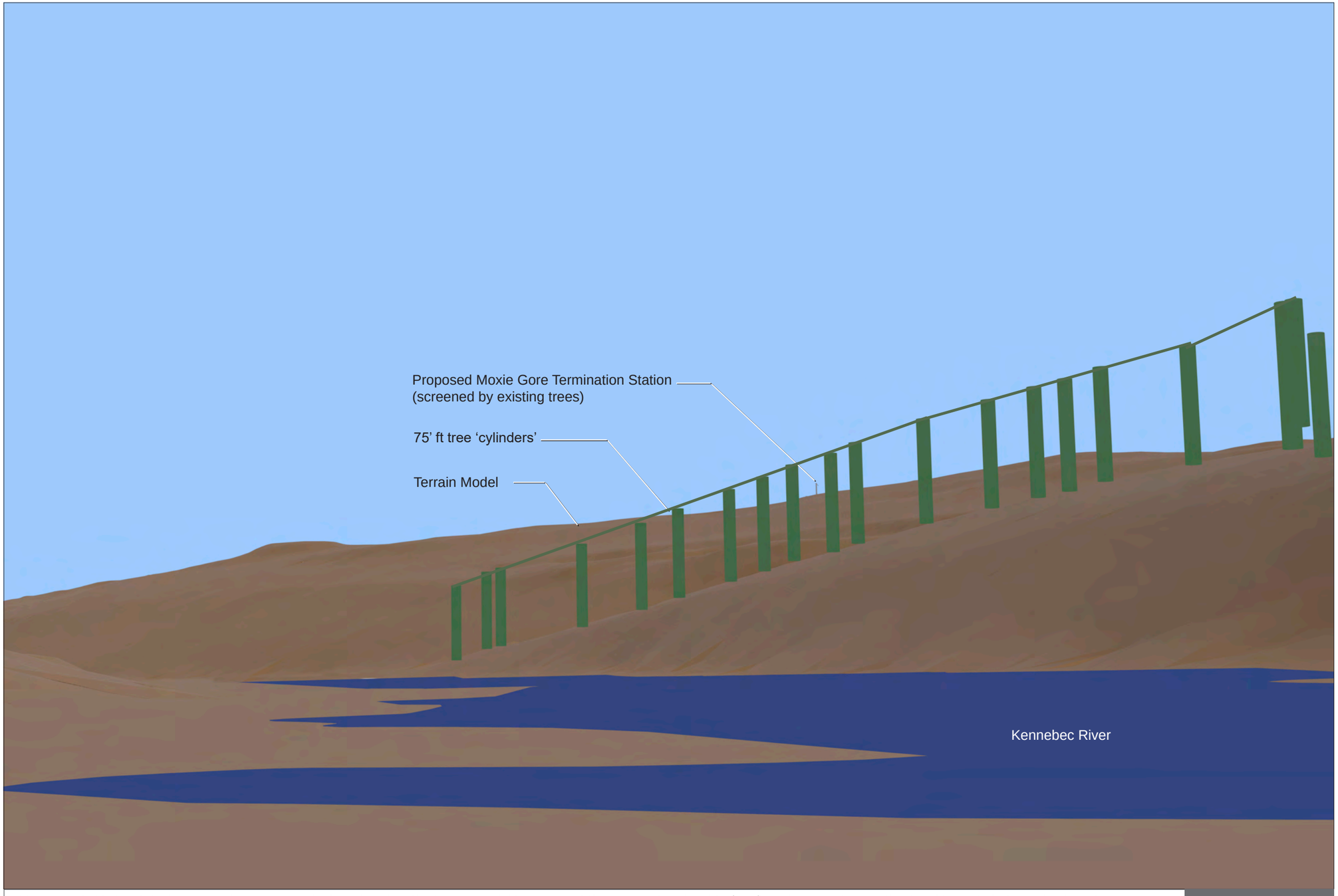
NEW ENGLAND CLEAN ENERGY CONNECT



COMPUTER MODEL B-1: This image is generated from a 3D Model developed for the Project and shows the existing terrain when looking from the viewpoint depicted in the Existing Conditions B photograph. Modeling indicates a portion of the proposed Moxie Gore Termination Station would be visible from this location if there was no vegetation on the hillside. The existing terrain would block the lower portion of the Station.

MOXIE GORE TERMINATION STATION VISIBILITY EVALUATION
KENNEBEC RIVER, Looking East

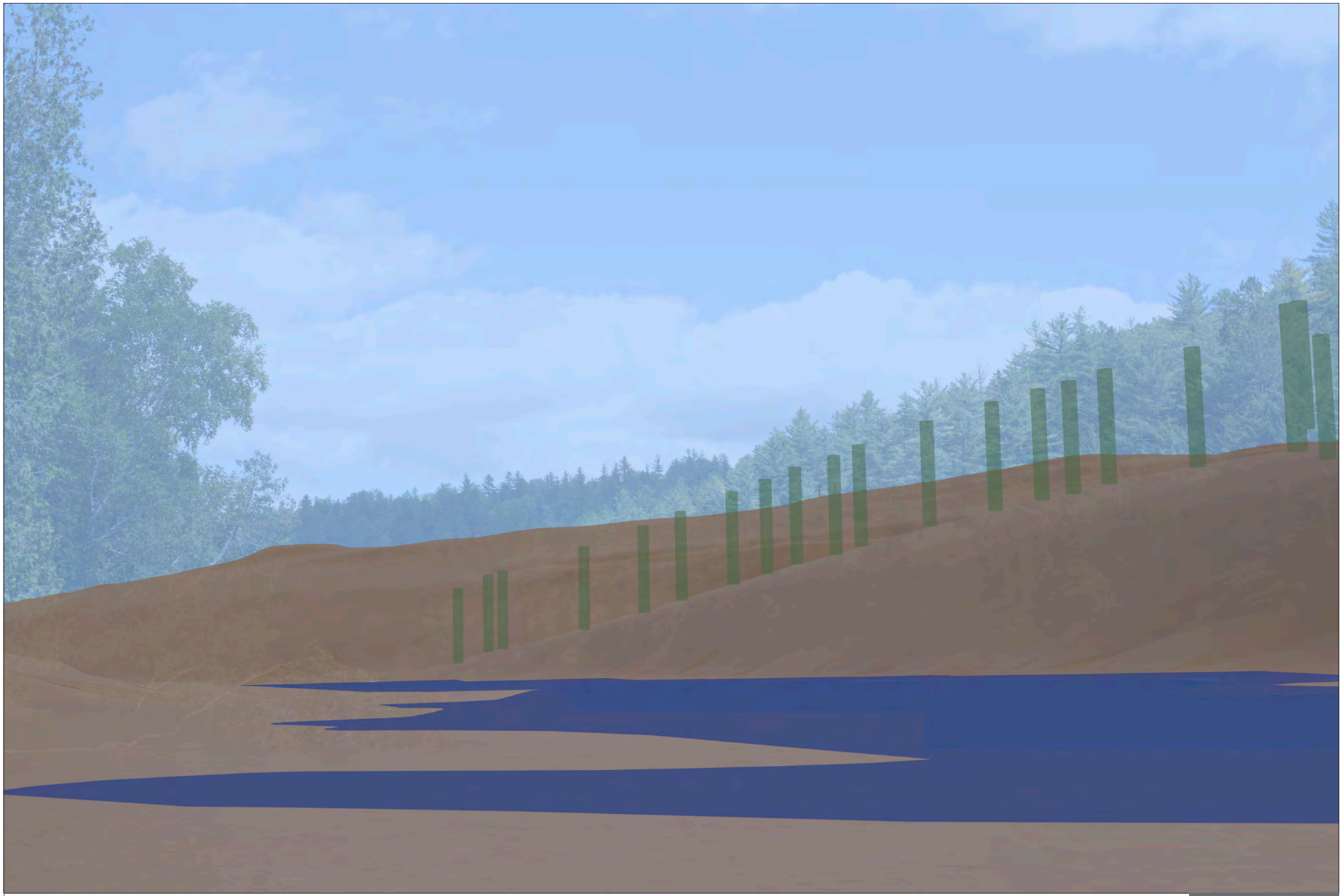
NEW ENGLAND CLEAN ENERGY CONNECT



COMPUTER MODEL B-2: This image shows green cylinders placed on the terrain model to represent the average tree height of 75 ft as shown on the Existing Conditions B photograph. These tree representations are placed between the river’s edge and the clearing limits surrounding the proposed Moxie Gore Termination Station. The modeling indicates that the 75 ft trees will screen the Termination Station from the River.

MOXIE GORE TERMINATION STATION VISIBILITY EVALUATION
KENNEBEC RIVER, Looking East

NEW ENGLAND CLEAN ENERGY CONNECT



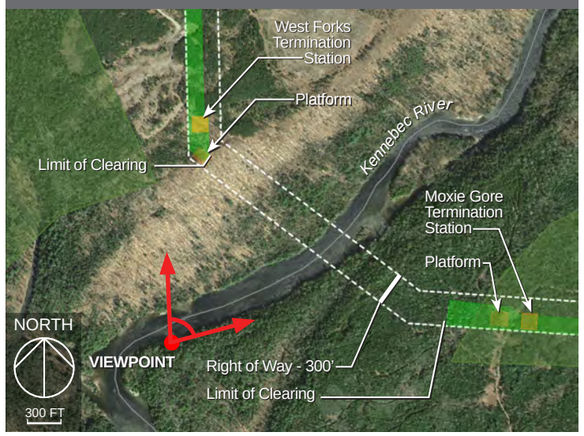
COMPUTER MODEL B-3: This image shows the computer model (terrain and 75' tree cylinders) overlaid and registered with the Existing Conditions photo. The preserved vegetation on the hillside will completely screen the Moxie Gore Termination Station from the Kennebec River.

WEST FORKS TERMINATION STATION VISIBILITY EVALUATION
KENNEBEC RIVER, Looking North

NEW ENGLAND CLEAN ENERGY CONNECT

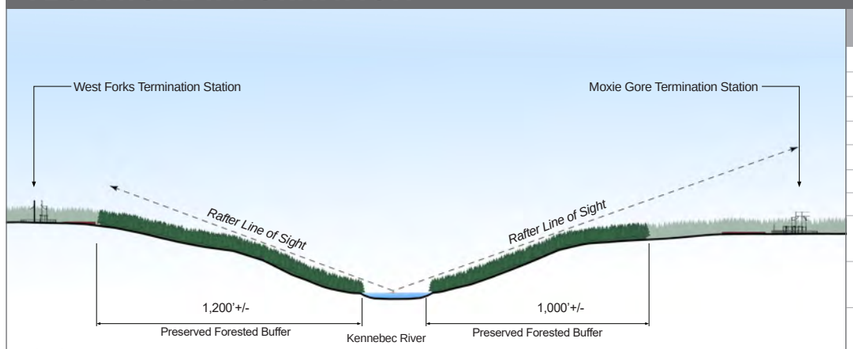
Existing Conditions: Panoramic view looking from north to east from the Kennebec River, approximately 1,900 feet south of the proposed West Forks Termination Station. The West Forks Termination Station will not be visible from the river. A forested buffer of approximately 1,200 in length will be preserved within the corridor between the northwest shoreline and the Station. This photograph was used in the previously submitted Photosimulation 11.

LOCATION MAP



CONTEXT MAP

TECHNICAL INFORMATION



NOTES:
-Looking north at proposed Termination Stations; West Forks Station (west side) and Moxie Gore Station (east side)
-Base information from TRC.
-Average height of vegetation within the forested buffer is 75'.

Photograph / Photosimulation Information	
Location	45.374107°, -69.940380°
Viewing Direction	North to East
Horizontal Angle of View	84°
Date and Time	08/15/16 at 1:21 pm
Camera Focal Length	50 mm
Camera Make/Model	Canon EOS 5D Mark III
Photo Source	Powers Engineering
Proposed Structures Visible	None

CENTRAL MAINE POWER

tjd&a

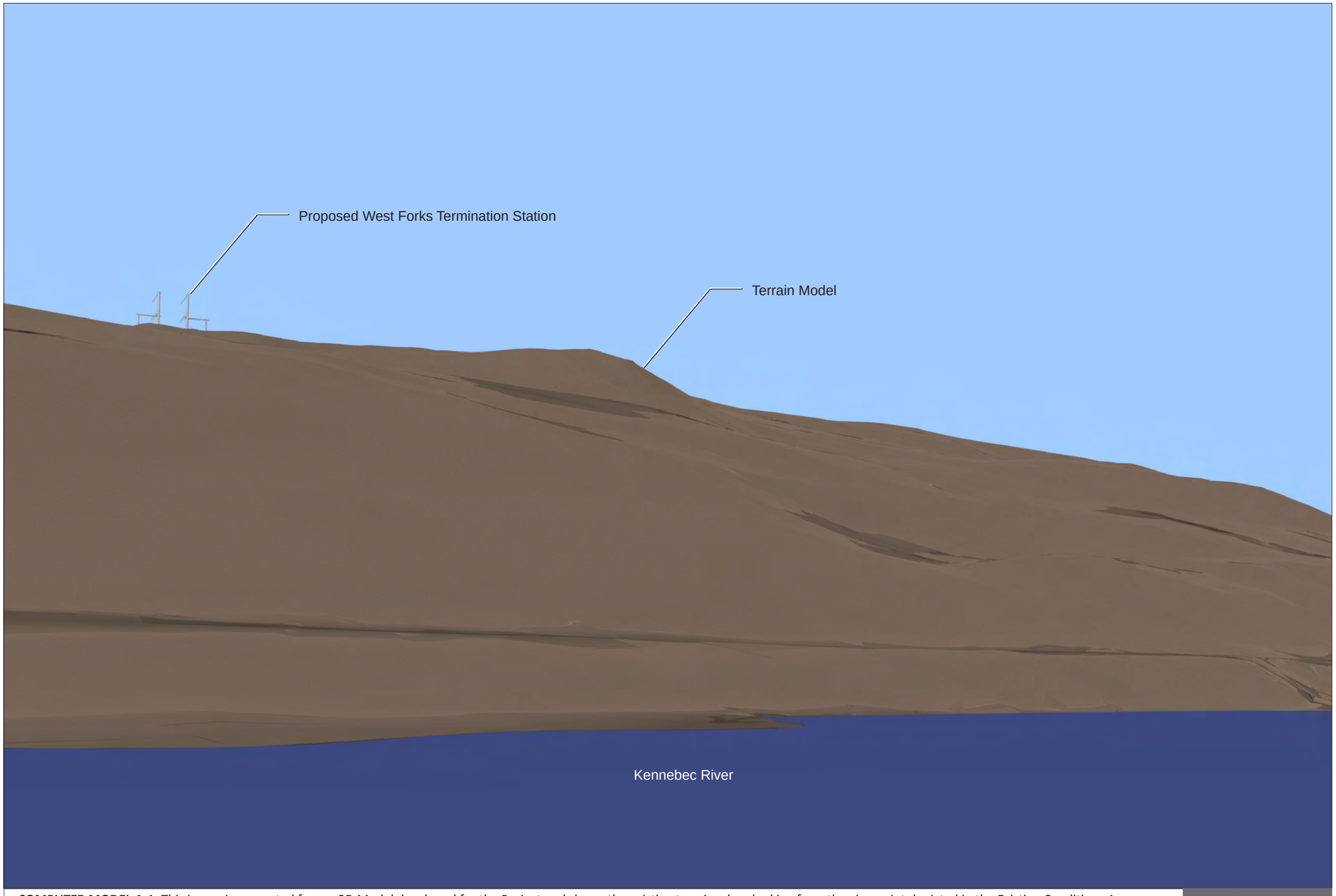
WEST FORKS TERMINATION STATION VISIBILITY EVALUATION
KENNEBEC RIVER, Looking North

NEW ENGLAND CLEAN ENERGY CONNECT

Existing Conditions A: Normal view looking northeast from the Kennebec River, approximately 1,900 directly south of the proposed West Forks Termination Station

WEST FORKS TERMINATION STATION VISIBILITY EVALUATION
KENNEBEC RIVER, Looking North

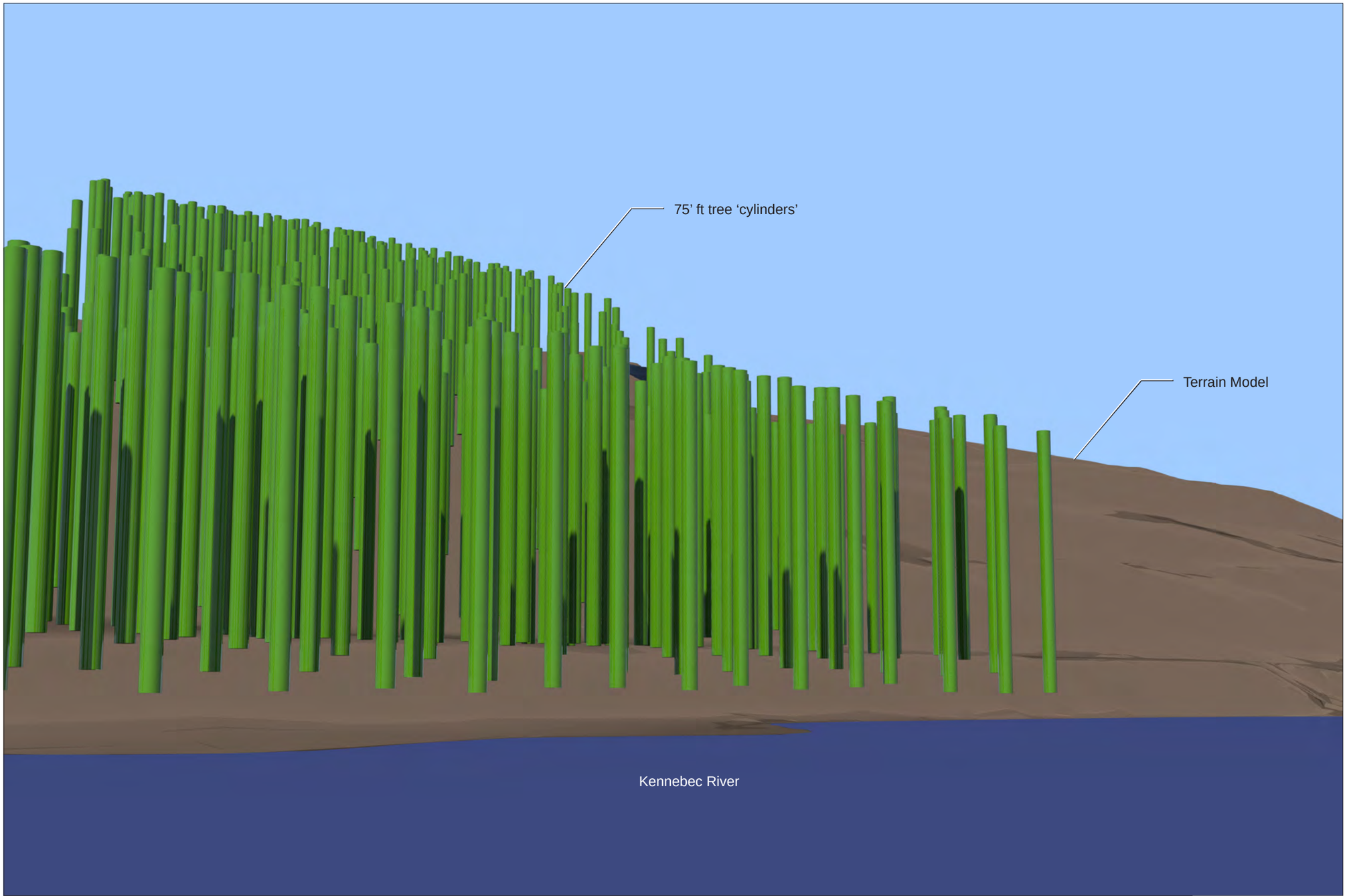
NEW ENGLAND CLEAN ENERGY CONNECT



COMPUTER MODEL A-1: This image is generated from a 3D Model developed for the Project and shows the existing terrain when looking from the viewpoint depicted in the Existing Conditions A photograph. Modeling indicates a portion of the proposed West Forks Termination Station would be visible from this location if there was no vegetation on the hillside. The existing terrain would block the lower portion of the Station.

WEST FORKS TERMINATION STATION VISIBILITY EVALUATION
KENNEBEC RIVER, Looking North

NEW ENGLAND CLEAN ENERGY CONNECT



COMPUTER MODEL A-2: This image shows green cylinders placed on the terrain model to represent the average tree height of 75 ft as shown on the Existing Conditions A photograph. These tree representations are placed between the river’s edge and the clearing limits surrounding the proposed West Forks Termination Station. The modeling indicates that the 75 ft trees will screen the Termination Station from the River.

TERMINATION STATIONS VISIBILITY EVALUATION, KENNEBEC RIVER, Looking North

NEW ENGLAND CLEAN ENERGY CONNECT

COMPUTER MODEL A-3: This image shows the computer model (terrain and 75’ tree cylinders) overlaid and registered with the Existing Conditions photo. The preserved vegetation on the hillside will completely screen the West Forks Termination Station from the Kennebec River.

7.0 WILDLIFE AND FISHERIES

7.1 Introduction

The HDD crossing includes the construction of two termination stations, one on each side of the river, a section of underground conduit, and a temporary work area for the HDD drill rig set-up (See Section 1.0 Development Description, above, for further detail).

No additional natural resource surveys were needed to document the in-corridor natural resource impacts in the area of the HDD improvements. Surveys which were conducted as part of the September 27, 2017 permit applications included the entire 300-foot wide corridor, as well as an additional 100 feet on each side of the corridor. The HDD construction and long-term operation will require upgrades to existing access roads such as road base improvements, widening, minor tree clearing and trimming, or turning radius expansions to make roads accessible for heavy construction equipment. In October 2018, natural resource surveys were conducted in the vicinity of the off-ROW access road improvements. On the east side of the river, two portions of the old gravel access road have reverted to wetland. The gravel road base will be upgraded in these locations.

7.2 Habitat Type Conversion

A change in the clearing area limits, as proposed in the September 27, 2017 Site Law application, will be required for the HDD installation and the construction and operation of the termination stations, trenched areas, and access road improvements. Some additional clearing will be required adjacent to the termination stations, temporary HDD drill pad and for access roads; and some tree clearing will be reduced within the river buffers due to the underground design of the HDD. Overall, the HDD design change will result in a net reduction of 7.16 acres of forest clearing.

The termination stations will alter wildlife habitat in those locations, but the effects of such changes will be minimal, as the footprints of the termination station yards are modest and there is sufficient similar habitat in the vicinity of both sites. The termination stations have been sited so that no permanent impact to wetlands will occur.

The cleared areas required for the trenching and HDD drill pad will be allowed to revegetate to early successional habitat (scrub-shrub) and will be maintained according to CMP's Post Construction Vegetation Management Plan ("VMP") (revised August 2018).

The changes in forest conversion associated with the HDD crossing does not change the discussion in the September 27, 2017 Site Law Application, Section 7.4.1.1. In summary, this section of the application concludes:

In general, given the existing landscape characteristics of the overall NECEC Project area, construction and maintenance of the transmission line corridors will result in habitat conversion that is already common to the area, i.e. forested to scrub-shrub. It is anticipated that local wildlife populations will adapt and respond to any additional alterations much as they already do to uses within the vicinity of the transmission line corridor. Impacts of habitat conversion along the proposed transmission line corridor are expected to be minimal, beneficial to some species while detrimental to other species.

7.3 Significant or Sensitive Wildlife Habitats

The September 27, 2017 NECEC Site Law Application, Section 7.0, identifies four major categories of protected significant or sensitive wildlife habitats within the NECEC transmission line corridors or substation areas. These resources include: bald eagle nest sites, deer wintering areas ("DWAs"), inland wading bird and waterfowl habitat ("IWWH"), and significant vernal pool habitat ("SVPH"). Project changes as a result of the HDD proposal will not change impact to any IWWHs or SVPHs, and therefore are not discussed further within this application amendment. Project changes which may impact wildlife and fisheries, either directly or indirectly, are discussed below.

7.3.1 Bald Eagle Nest Sites

Based on a review of GIS information provided by the United States Fish and Wildlife Service ("USFWS"), there are no documented bald eagle nest sites within 660 feet of the HDD development. As committed to in the September 27, 2017 Site Law application, in order to identify potential new and unmapped bald eagle sites within the area of the Kennebec River HDD, as well as within all other areas of the NECEC transmission line corridor, CMP will perform an aerial survey each spring prior to construction. This aerial survey will focus on target areas near waterbodies that support eagle activity, including the Kennebec River. Surveys will be conducted in cooperation with MDIFW.

If an eagle nest is identified within 660 feet of the HDD development, potential disturbance to eagle nests will be avoided by timing construction to coincide with times of the year when the nests are not occupied. Based on recommendations from MDIFW, CMP will avoid construction of the NECEC between March 1 and August 31 within 660 feet of known nest sites. Exceptions to this timing restriction may be requested of MDIFW in site-specific locations.

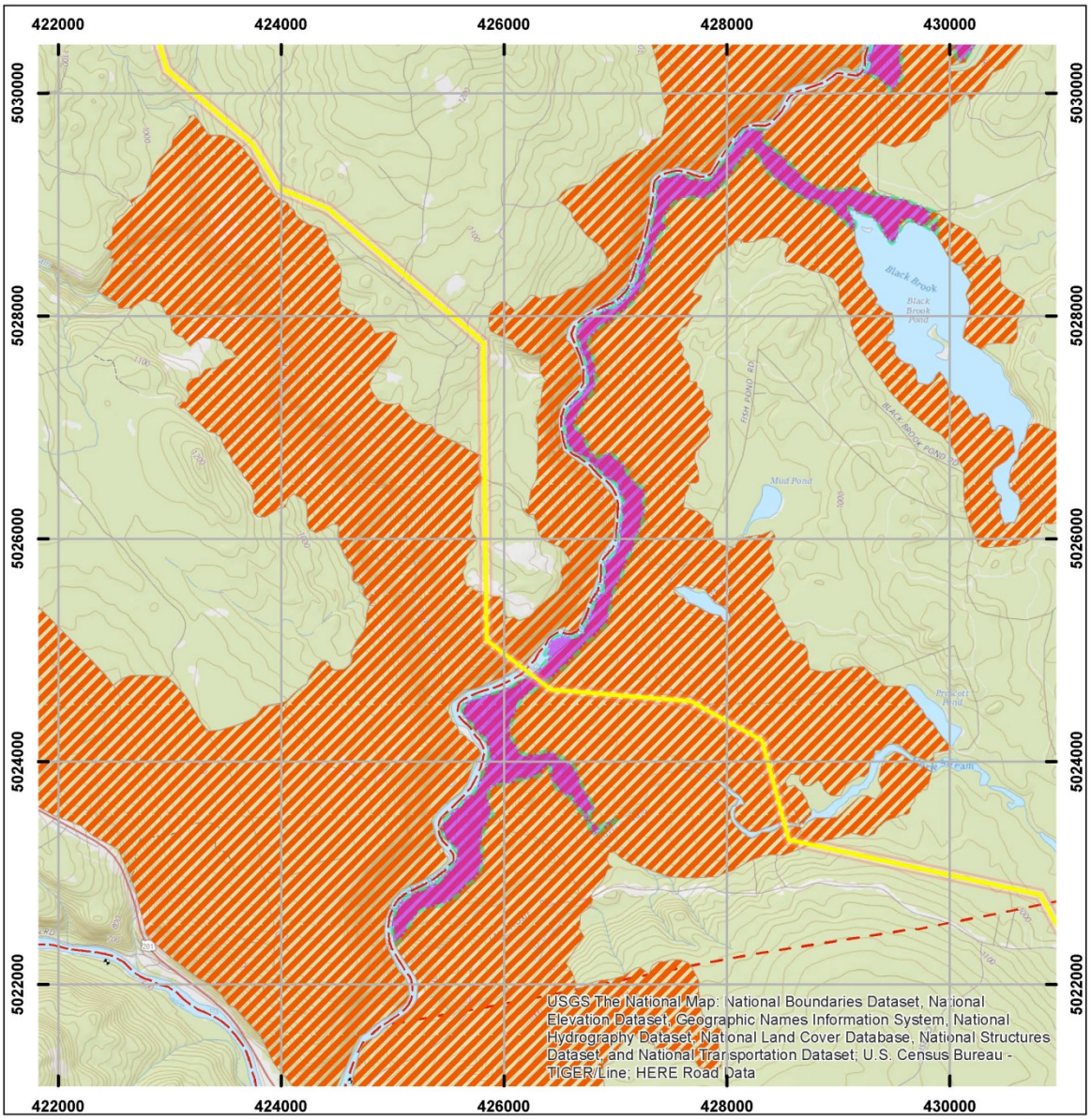
7.3.2 Deer Wintering Areas

The HDD development is located within a deer wintering area ("DWA"). The DWA, shown in Figure 7-1 below, is "non-regulatory, but still important for consideration in planning to accommodate needs of

wintering deer" according to Bob Cordes, MDIFW (email correspondence 8/15/17). Project impacts within the project modification area include 5.75 acres of tree clearing, and 0.84 acres of permanent impact from construction of the termination stations. When compared with the overhead alternative proposed within the September 27, 2017 Site Law Application, the HDD design change will reduce the impact of tree clearing within the DWA by 7.16 acres.

Unavoidable impacts will occur within this DWA due to the construction of the HDD development. The HDD minimizes impact to the DWA by retaining approximately 1,450 feet and 1,160 feet of forested buffer on the east and west sides of the Kennebec River, respectively. Intact, mature riparian buffers or vegetation bridges provide good travel corridors for wintering deer and are particularly valuable in this portion of Maine, which experiences high snow depths in winter.

All DWAs crossed by the Project are classified by the MDIFW as indeterminate in value, which means that they are recognized as candidate Significant Wildlife Habitat under the NRPA, but currently have no formal value rating. Although not required by NRPA, they have been considered for habitat enhancement within the NECEC Compensation Plan (updated October 19, 2018). Within this plan, CMP commits to the enhancement of wildlife habitat in and around DWAs, "to revegetate disturbed soils in upland areas with a Wildlife Seed Mix, promoted by SAM and developed with Maine Seed Company. This wildlife friendly seed mix will offer nutrition to deer and other wildlife such as moose, rabbits, ruffed grouse, geese, and wild turkeys during late fall and early spring when woods forage is sparse. The tender shoots derived from SAM's seed mix offer forage that is high in calories and protein, and deer find them to be highly digestible." See the Compensation Plan, updated and filed on October 19, 2018, for further details.



Environmental Review of Fish and Wildlife Observations and Priority Habitats

Project Name: ER Tool Test (Version 1)

Maine Department of Inland Fisheries and Wildlife

Miles

0 0.275 0.55 1.1 1.65 2.2

Projection: UTM, NAD83, Zone 19N

Date: 20170815

Figure 7-1

Legend

LUPC Zoned P-FW sub-district

DWA_NUMBER

060065 *Non-Regulatory Biologically Important Wintering Deer Areas*

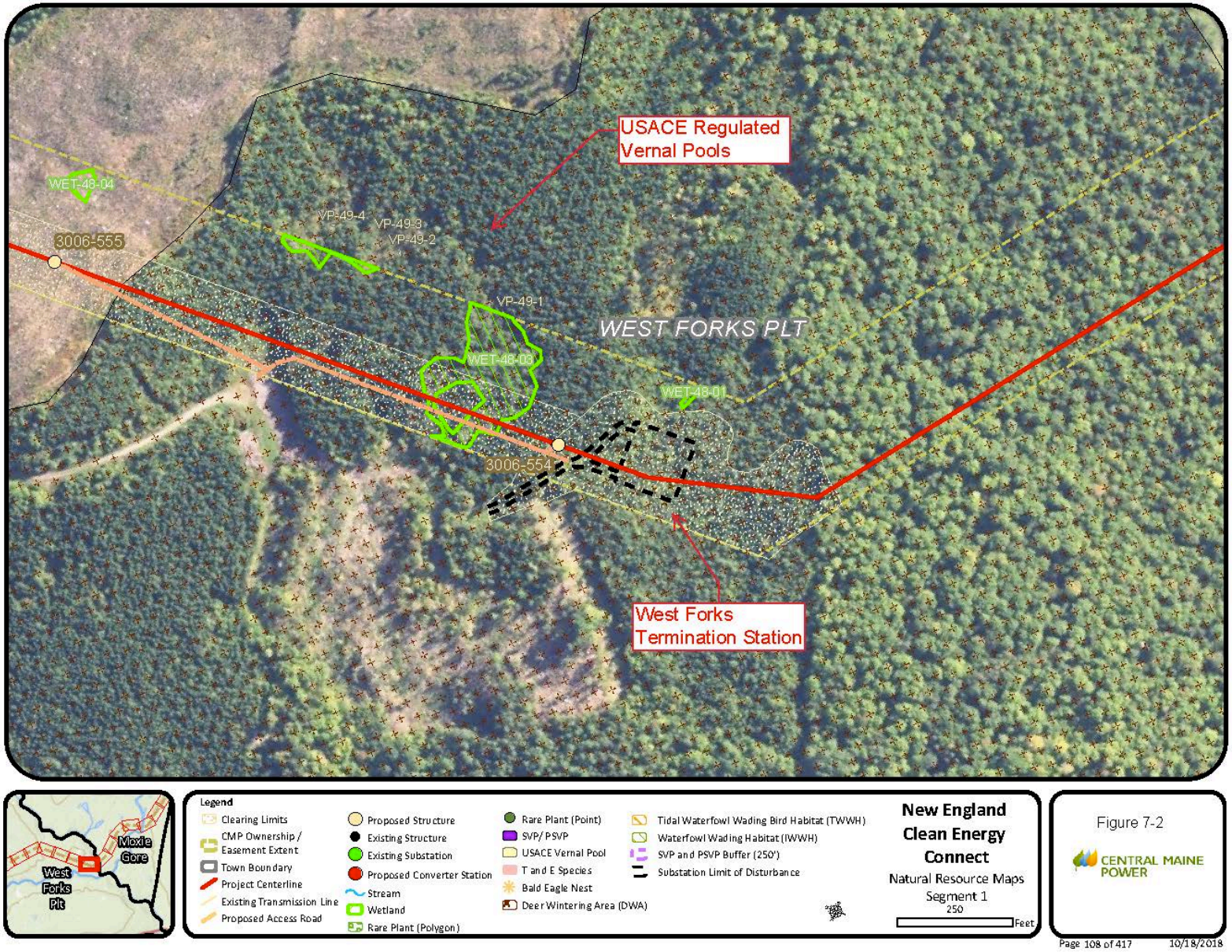
7.3.3 Vernal Pools

As noted in Section 7.1, no significant vernal pool habitats, defined in NRPA Chapter 335, will be impacted by the HDD development.

Three vernal pools regulated by the United States Army Corps of Engineers ("USACE") under the provisions of Section 404 of the Clean Water Act, that do not meet the NRPA definition, exist in the vicinity of the HDD development. The USACE regulates activities within a distance of 750 feet from the vernal pool depression, also referred to as the "vernal pool management area," which includes the pool depression, the envelope (area within 0 to100 feet of the vernal pool depression edge), and the critical terrestrial habitat (area within 100 to 750 feet of the vernal pool depressions edge).

The three vernal pools identified, depicted on Figure 7-2 below, are not located within CMP's corridor, but were inventoried as part of the field survey efforts in 2015, 2016, and 2017. There will be an additional clearing impact of 0.89 acres within the 750 foot vernal pool management area as a result of the HDD design change.

Impacts associated with the HDD development have been evaluated and considered in the NECEC Compensation Plan (updated October 19, 2018). Additionally, an updated USACE Vernal Pool Table (Exhibit 7-6) is being provided concurrently with this filing as a component of CMP's October 19, 2018 supplemental application materials submittal.


USACE Regulated Vernal Pools
WET-48-04
VP-49-4
VP-49-3
VP-49-2
3006-555
VP-49-1
WEST FORKS PLT
WET-48-03
WET-48-01
3006-554
West Forks Termination Station
Moxie Gore
West Forks Plt
Legend
Clearing Limits
CMP Ownership / Easement Extent
Town Boundary
Project Centerline
Existing Transmission Line
Proposed Access Road
Proposed Structure
Existing Structure
Existing Substation
Proposed Converter Station
Stream
Wetland
Rare Plant (Polygon)
Rare Plant (Point)
SVP/ PSVP
USACE Vernal Pool
T and E Species
Bald Eagle Nest
Deer Wintering Area (DWA)
Tidal Waterfowl Wading Bird Habitat (TWWH)
Waterfowl Wading Habitat (IWWH)
SVP and PSVP Buffer (250')
Substation Limit of Disturbance
New England Clean Energy Connect
Natural Resource Maps
Segment 1
250
Feet
Figure 7-2
CENTRAL MAINE POWER
Page 108 of 417
10/18/2018

7.3.4 RTE Wildlife and Species of Special Concern

CMP conducted a review of all state listed and federally listed species and species of special concern (collectively, "RTE" or "RTE species") which may potentially occur within the vicinity of the NECEC Project components in the Site Law application filed on September 27, 2017. This application amendment will address potential impacts to those species as a result of the HDD development. Based on this review, state and federally listed bat species require additional discussion due to the tree clearing associated with the termination stations and clearance requirements. Other RTE or Special Concern species did not require further consideration due to the lack of habitat or documented occurrence in the vicinity of the HDD development, and are addressed fully in the September 27, 2017 Site Law Application.

7.3.4.1 Bats

Of the eight bat species that occur in Maine, three are protected under MESA: little brown bat (State Endangered), eastern small footed-bat (State Threatened), and Northern Long-eared bat (State Endangered). The Northern Long-eared bat ("NLEB") is also federally listed as Threatened under the ESA. The remaining five species are of Special Concern and are considered in the NECEC Project's protection of bat species: big brown bat, red bat, hoary bat, silver-haired bat, and tri-colored bat. MDIFW species profiles indicate that, except for the eastern small-footed bat, which is found within the southern half of the state, bat species are widely distributed throughout Maine and can be found in nearly all areas (MDIFW 2017). Based on information provided by MDIFW, there are no documented occurrences of these species' individuals within the NECEC Project corridor, however there is presumed occurrence of roosting bats in the northern hardwood and conifer forests consistent with areas found along the NECEC route and in the vicinity of the HDD development.

The NECEC will not adversely affect any of the eight (8) bat species that could be present along the Project route. As discussed in the September 27, 2017 NECEC Site Law Application, the primary threat to bats is White Nose Syndrome (WNS), particularly in the northeast where some bat species populations have declined up to 99 percent (USFWS 2017). The White Nose Syndrome Zone (WNSZ) includes the entire State of Maine and most areas of the eastern and midwestern United States. The NECEC is wholly located within the WNSZ but not near any known hibernacula or maternity roost trees.

The HDD development will result in a net reduction of 7.16 acres of additional tree clearing. According to the USFSW January 5, 2016, intraService Programmatic Biological Opinion (BO) in the Final 4(d) Rule, tree clearing in areas not near known hibernacula or known maternity roost trees is not a major contributor to the species decline, but because populations of bats are depressed by WNS, human activities that were not previously

believed to be significant may be so now (USFWS 2017). In WNS affected areas, MDIFW recommends, although does not require, an attempt to minimize tree removal during the maternity season when the pups are not able to fly and escape a falling tree. Maternity roost season occurs between June 1 and July 31 in Maine. Removal of trees outside this period, when most bats can fly and are more dispersed, is less likely to result in a direct injury or mortality. As a conservation effort to protect all federal and state protected bat species, the NECEC will suspend tree clearing activities during the maternity roost season of June 1 to July 31. CMP will maintain this commitment to any new tree clearing required as part of the HDD development.

7.4 Fisheries Resources

There are no direct or indirect impact to fisheries resources associated with the HDD development.

8.0 HISTORIC SITES

The NECEC cultural resources survey corridor includes the development area associated with the HDD and termination stations proposed on either side of the Project's Kennebec River crossing in Moxie Gore and West Forks Plt. The archaeological analysis of this area as part of the Project's sensitivity assessment (Freedman et al. 2017) identified the areas on both sides of the river for archaeological investigation. These investigations (Clement et al. 2018a; Clement et al. 2018b) did not identify archaeological resources that could be impacted by the HDD project modifications.

Architectural review of the Project corridor identified a single resource near the south bank of the river (Lost Camp; Dunham et al. 2018a). This resource has been recommended NRHP eligible, however a finding of no adverse effect is being recommended. Although the camp is within the NECEC direct area of potential effects it will not be directly impacted by construction activities. Crossing of the river through HDD will not have visual effects on this resource.

9.0 UNUSUAL NATURAL AREAS

CMP consulted with both federal and state agencies to determine the location of any rare, threatened, or endangered ("RTE") plant species and unusual natural communities in the vicinity of the NECEC Project. The locations of federal and state botanical resources, including RTE plants and rare and exemplary natural communities in Maine, are mapped by the U.S. Fish and Wildlife Service ("USFWS") and the Maine Natural Areas Program ("MNAP"). In addition, CMP completed a field survey for rare plants and exemplary natural communities in July 2018, following the recommendations of USFWS and MNAP. No RTE species or exemplary natural communities were identified within the HDD and termination station development areas.

10.0 BUFFERS

The HDD project modification will result in an increase to the forested buffers on both the east and west sides of the Upper Kennebec River, thereby avoiding visibility of the Project by recreational uses on the river (see discussion in Section 6.0). There are no other protected natural resources requiring buffers within or adjacent to the HDD and termination station development areas.

The HDD project modification will increase the buffers on the east and west side of the river by 1,150 feet and 660 feet, respectively. The total vegetated buffer retained is 1,450 feet and 1,160 feet on the east and west sides of the river, respectively.

Trenching will be required from the HDD entry and exit points to the termination stations. To eliminate the potential for roots to interfere with the underground cables, CMP will prohibit tree growth on top of the trench area and maintain the vegetation growth consistent with the NECEC Post-Construction Vegetation Maintenance Plan (August 2018).

11.0 SOILS

A Class B high intensity soil survey was conducted by Robert Vile Soil Consulting within a 5 +/- acre area at both the proposed Moxie Gore and West Forks termination stations on October 12 and 13, 2018 (Exhibit 11-1). In addition, CMP evaluated the local geology to evaluate the feasibility of HDD at this location. Soils information and a discussion of the local geology are provided below.

The soil report for the Moxie Gore Termination Station identified two different soil series within the survey area: Peru and Brayton Series. Brayton soils are considered hydric, while Peru are non-hydric. The Brayton soils were identified within a wetland area that is outside of the HDD and termination station project modification area.

The soil report for the West Forks Termination Station identified three different soil series on the parcel: Tunbridge, Lyman, and Brayton. Brayton soils are considered hydric, while Tunbridge and Lyman are non-hydric. The Brayton soils were identified within a wetland area that is outside of the HDD and termination station project modification area.

Robert Vile Soil Consulting provided a letter opinion, based on the Class B High Intensity Soil Surveys, which addresses the potential construction limitations at the termination station sites (included in Exhibit 11-1). In the locations where soils have limitations, proper engineering techniques will be implemented to overcome the limitations of the soils. This may include the removal of native soils and the importation of adequate soils.

CMP's consultant, TRC, evaluated the local geology and the general risks and challenges of HDD in the context of the Upper Kennebec River compared to other locations (Exhibit 11-2). TRC concluded that based on the review of the available information regarding the geology of the Upper Kennebec River crossing site, HDD is a feasible technology for the installation of the power transmission lines under the river.

Exhibit 11-1: Class B High Intensity Soil Surveys

Class B High Intensity Soil Survey

For

Central Maine Power Company Proposed Electrical Substation

Moxie Gore, ME

Soil Survey completed by Robert Vile Soil Consulting Inc

October 16, 2018

Robert Vile
Licensed Site Evaluator
Certified Soil Scientist

P.O. Box 114, Cates Rd.
Dixmont, ME 04932

Telephone:
(207)234-2451

Date: October 16, 2018

To: Sackett & Brake Survey, Inc.
P.O. Box 207
Skowhegan, Me. 04976

Re: Soil Suitability for a proposed CMP Electrical Substation in Moxie Gore, Me.

Findings: On October 12, 2018 I conducted a Class B High Intensity Soil Survey on the above captioned +- 5 acre parcel. Two different soil series were identified on the parcel. Most of the site is Peru soils. These soils are moderately well drained glacial till soils with little disadvantages for development. The natural slopes on the property are gentle for the most part. The only steep area is just above a small wetland area that contains the Brayton soil series. The forested wetland will require proper permitting if plans are to fill in or disturb the soils in the wetland area. In general I would say the site is suitable for the proposed project.

Sincerely,

Robert G. Vile jr.
C.S.S. # 201
L.S.E. S204

Robert Vile
Licensed Site Evaluator
Certified Soil Scientist

P.O. Box 114, Cates Rd.
Dixmont, ME 04932

Telephone:
(207)234-2451

Date: October 16, 2018

To: Sackett & Brake Survey, Inc.
P.O. Box 207
Skowhegan , Me. 04976

Re: Class B High Intensity Soil Survey of a +- 5 Acre parcel of land located in Moxie Gore, Me. for a Central Maine Power proposed electrical substation.

Findings: On October 12,2018 I investigated the above captioned parcel. The purpose of the investigation was to conduct a Class B High Intensity Soil Survey of the site. The boundaries of the survey were marked by Land surveyors. Soils were described by means of hand shoveled test pits and many soil auger borings do to difficult access for an excavator. The soil test pit locations as well as a two foot contour map at a scale of 1" = 50' were provided by Sackett & Brake Survey, Inc. This soil survey was conducted for the use in planning a Central Maine Power Company proposed electrical substation. This Class B High Intensity Soil Survey was mapped following these minimum standards described in Guidelines For Maine Certified Soil Scientists For Soil Identification And Mapping:

Class B (High Intensity)

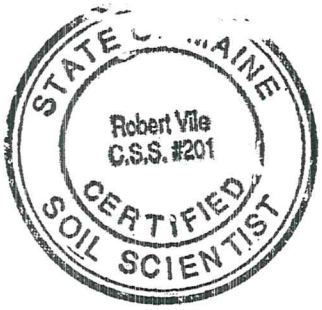
1. Map units will not contain dissimilar limiting individual inclusions larger than one acre. Dissimilar limiting inclusions may total more than one acre per map unit delineation, in the aggregate, if not continuous.
2. Scale of 1"=200' or larger.
3. Ground control-test pits for which detailed data is recorded are located by means of compass by chaining, pacing, or taping from known survey points; or other methods of equal or greater accuracy.
4. Base map with 5-foot contour lines.

Two different Soil Series were identified on the parcel. Peru and Brayton soil series. The Peru soils are classified as Coarse-loamy , isotic, frigid Aquic Haplorthods by Soil Taxonomy. These soils are moderately well drained soils that formed in lodgment till on the upland portions of this parcel. Peru soils are deeper than 40 " to bedrock. These soils exist in the forested uplands on this property with slopes ranging from 2 to 40 % . Some what firm basil till was found about 30" below the mineral surface and seasonal water table depths ranged from 18"-24". A typical pedon for this series is described at Test Pit #3. Please see attached test pit logs. Peru soils are a Class C Hydrologic Soil Group.

Surface run-off is medium and permeability is moderate in the upper horizons and moderately slow in the lower horizons. There is no hazard to flooding in the areas mapped Peru on this site. Inclusions which may exist within the Peru map units include the somewhat poorly drained Colonel Series or the Tunbridge Series. The Peru soils will have a very little negative impact on the proposed development.
The Brayton soils are classified Loamy,mixed,active,nonacid,frigid,shallow Aeric Endoaquepts by Soil Taxonomy. These soils are deep, poorly drained glacial till found in a lowland depression on this parcel. Brayton soils are hydric soils and occur within the wetland area on this site. The Brayton soils have thick organic horizons and are very bouldery on this parcel. Seasonal water tables are at the mineral surface and ponding is possible within the wetland area. Brayton soils occur on 0-3% slopes at this site. A typical pedon for this series is described at Test Pit # 1. Please see attached test pit logs. Brayton soils are a Class C Hydrologic Soil Group. Surface run-off is slow to none on this site. Inclusions within the Brayton map unit may be the very poorly drained Peachem Soil Series. The limiting factor of the Brayton soils for this project is the high seasonal water table and they are found in the forested wetland.
The accompanying soil profile descriptions, soil survey map and this soil narrative report dated October 16, 2018 were done in accordance with the standards adopted by the Maine Association of Professional Soil Scientists and presented in the " Guidelines for Maine Certified Soil Scientists for Soil Identification and Mapping" latest revision and prepared by Robert G. Vile jr. " Certified Soil Scientist # 201.
If you have any questions regarding the investigation please feel free to contact me at the above number.

Sincerely,

Robert G. Vile jr.
C.S.S. # 201
L.S.E. S204



FORM F 1/01

SOIL PROFILE / CLASSIFICATION INFORMATION

DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT PROJECT SITES

Project Name: Electrical Substation

Applicant Name: Central Maine Power Co.

Project Location (municipality): Moxie Gore

Exploration Symbol: #1 ■ Test Pit ☐ Boring

15" Organic horizon thickness Ground surface elev. ____

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	Boulder	Friable	Black	wet
6–12	Organic material		↓	
12–18	Sandy Loam		Grey	
18–24	Gravelly Sandy Loam	15" limit of excavation (free water)		
24–30				
30–36				
36–42				
42–48				

soil data by S.E.: Soil Profile 3; Classification Condition E; Slope Percent 0; Limiting Factor Depth 0; ■ Groundwater ☐ Restrictive Layer ☐ Bedrock

soil data by S.S.: Soil series/phase name: Brayton; ■ Hydric ☐ Non-hydric; Hydrologic Soil Group C

Exploration Symbol: #2 ■ Test Pit ☐ Boring

2" Organic horizon thickness Ground surface elev. ____

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	Gravelly Fine Sandy Loam	Friable	Reddish Grey / Strong Brown / Yellowish Brown	None
6–12				
12–18				
18–24	Stony Gravelly Loam		Light Olive Brown	Common Distinct
24–30		Firm in place		
30–36				
36–42				
42–48				

soil data by S.E.: Soil Profile 3; Classification Condition C; Slope Percent ____; Limiting Factor Depth 18"; ■ Groundwater ☐ Restrictive Layer ☐ Bedrock

soil data by S.S.: Soil series/phase name: Peru; ☐ Hydric ■ Non-hydric; Hydrologic Soil Group C

Exploration Symbol: #3 ■ Test Pit ☐ Boring

2" Organic horizon thickness Ground surface elev. ____

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	Stony Gravelly Fine Sandy Loam	Friable	Grey / Strong Brown / Yellowish Brown	None
6–12				
12–18				
18–24				
24–30			Light Olive Brown	Common Distinct
30–36		Firm in Place		
36–42				
42–48				

soil data by S.E.: Soil Profile 3; Classification Condition C; Slope Percent ____; Limiting Factor Depth 24"; ■ Groundwater ☐ Restrictive Layer ☐ Bedrock

soil data by S.S.: Soil series/phase name: Peru; ☐ Hydric ■ Non-hydric; Hydrologic Soil Group C

Exploration Symbol: #4 ■ Test Pit ☐ Boring

0" Organic horizon thickness Ground surface elev. ____

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	Stony Gravelly Sandy Loam	Friable	Yellowish Brown	None
6–12				
12–18				
18–24				
24–30			Light olive Brown	Common Distinct
30–36		Firm in place		
36–42				
42–48				

soil data by S.E.: Soil Profile 3; Classification Condition C; Slope Percent ____; Limiting Factor Depth 24"; ■ Groundwater ☐ Restrictive Layer ☐ Bedrock

soil data by S.S.: Soil series/phase name: Peru; Hydrologic Soil Group

INVESTIGATOR INFORMATION AND SIGNATURE

Signature: Robert G. Vile jr.

Date: 10-15-18

Name Printed/typed: Robert G. Vile jr.

Cert/Lic/Reg. # 55 401

Title: ■ Licensed Site Evaluator ☐ Certified Geologist ■ Certified Soil Scientist ☐ Other:

STATE OF MAINE — Robert Vile C.S.S. #201 — CERTIFIED SOIL SCIENTIST — affix professional seal

LOCATION PERU NH+MA ME NY VT

Established Series
Rev. HRM-RFL-DHZ
06/2016

PERU SERIES

The Peru series consists of moderately well drained soils that formed in loamy lodgment till on hills and mountains in glaciated uplands. They are moderately deep to a dense substratum and very deep to bedrock. Estimated saturated hydraulic conductivity is moderately high or high in the solum, and moderately low or moderately high in the dense substratum. Slope ranges from 0 to 60 percent. Mean annual precipitation is about 1180 mm, and mean annual temperature is about 6 degrees C.

TAXONOMIC CLASS: Coarse-loamy, isotic, frigid Aquic Haplorthods

TYPICAL PEDON: Peru fine sandy loam, on a north facing, 15 percent slope in a very stony wooded area. (Colors are for moist soil unless otherwise noted.)

Oe--0 to 3 cm; black (10YR 2/1) moderately decomposed plant material; very friable; very strongly acid (pH 4.9); abrupt smooth boundary. (O horizon thickness is 0 to 10 cm.)

A--3 to 13 cm; dark brown (7.5YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many very fine and fine and few coarse roots; 5 percent rock fragments; very strongly acid (pH 4.8); abrupt wavy boundary. (0 to 10 cm thick)

E--13 to 15 cm; light brownish gray (10YR 6/2) fine sandy loam; weak medium granular structure; friable; common fine roots; 5 percent rock fragments; very strongly acid (pH 4.8); abrupt broken boundary. (0 to 10 cm thick)

Bs1--15 to 18 cm; dark brown (7.5YR 3/4) fine sandy loam; weak fine granular structure; friable; common fine and few coarse roots; 5 percent rock fragments; very strongly acid (pH 5.0); abrupt broken boundary.

Bs2--18 to 33 cm; strong brown (7.5YR 4/6) fine sandy loam; weak fine granular structure; friable; common fine and few coarse roots; 5 percent rock fragments; very strongly acid (pH 5.0); clear wavy boundary.

Bs3--33 to 46 cm; dark yellowish brown (10YR 4/6) fine sandy loam; weak medium subangular blocky structure; friable; common fine roots; 5 percent rock fragments; strongly acid (pH 5.2); abrupt wavy boundary. (Combined thickness of the Bs horizon is 7 to 38 cm).

BC--46 to 54 cm; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine subangular blocky structure; friable; few fine roots; common fine faint olive brown (2.5Y 4/3) iron depletions in the matrix; 5 percent rock

fragments; strongly acid (pH 5.2); abrupt smooth boundary. (0 to 38 cm thick)

Cd1--54 to 94 cm: olive brown (2.5Y 4/3) fine sandy loam; 85 percent moderate medium plates and 15 percent sandy lenses; firm; common medium faint olive gray (5Y 4/2) iron depletions in the matrix; 5 percent rock fragments; strongly acid (pH 5.2); clear wavy boundary.

Cd2--94 to 165 cm; olive gray (5Y 4/2) fine sandy loam; 95 percent moderate thick plates and 5 percent sandy lenses; firm; common medium faint olive brown (2.5Y 4/3) masses of iron accumulation on faces of peds; 5 percent rock fragments; strongly acid (pH 5.2).

TYPE LOCATION: Merrimack County, New Hampshire; Town of New London; located about 275 meters west of County Road on Northwood Lane, and 35 meters south of the road; USGS Sunapee Lake North, NH topographic quadrangle; latitude 43 degrees 24 minutes 04 seconds N. and longitude 72 degrees 01 minutes 17 seconds W., NAD 83.

RANGE IN CHARACTERISTICS: The thickness of the mineral solum and depth to densic materials from the mineral surface range from 50 to 100 cm. Depth to bedrock is greater than 150 cm. Texture is typically fine sandy loam, sandy loam, or loam in the fine-earth fraction but includes silt loam and very fine sandy loam in the upper part of the solum. The weighted average of clay in the particle-size control section is 10 percent or less. The silt content in the solum and underlying till averages less than 50 percent, but ranges to 50 percent or more in the upper 25 cm of the solum. Rock fragments are dominantly gravel with some cobbles and stones and typically range from 5 to 30 percent throughout the mineral soil. Some pedons have horizons with less than 5 percent rock fragments. Reaction ranges from extremely acid to slightly acid in the solum, and from very strongly acid to slightly acid in the substratum.

The O horizons, where present, consist of slightly, moderately, and/or highly decomposed organic material. The Oe and Oa horizons have hue of 2.5YR to 10YR, value of 2 to 4, and chroma of 1 to 4.

The A, or Ap horizon where present, has hue of 5YR to 10YR and value and chroma of 2 to 4.

The E horizon is neutral or has hue of 5YR to 2.5Y, value of 4 to 7, and chroma of 0 to 2.

The Bhs horizon, where present, is up to 13 cm thick and has hue of 2.5YR to 10YR, a value of 2 to 3, and a chroma of 1 to 3.

The Bs horizon has hue of 5YR to 10YR, value of 3 to 5, and chroma of 3 to 8.

The BC horizon has hue of 10YR to 5Y, value of 3 to 6, and chroma of 2 to 6.

Some pedons have an E or E' horizon below the B horizon. It has hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 or 3. Typically, it has a coarser texture than the overlying horizon.

Some pedons have a friable C horizon up to 20 cm thick that has color and texture similar to the underlying Cd horizon.

The Cd horizon has hue of 10YR to 5Y, value of 3 to 6, and chroma of 2 to 4. Consistence is firm or very firm. Arrangement of soil particles into plates is considered to be geogenic. Loose or fri ble segregated sand lenses with a horizontal orientation compose up to 20 percent of the densic materials. The lenses are typically coarse, medium, or fine sand ranging from 2 to 25 mm thick.

COMPETING SERIES: These are the [illegible], [illegible], [illegible], [illegible], Ragmuff, Skerry, Sunapee, and Worden series. Chesuncook soils have a weighted average of more than 10 percent clay in the particle-size control section. Crary soils have a mantle of eolian or water deposited sediments ranging from 40 to 100 cm thick over till. Dixmont and Sunapee soils are formed in loamy supraglacial till and do not have densic materials within 100 cm of the mineral soil surface. Howland soils have a weighted average of more than 50 percent silt in the particle-size control section. Ragmuff soils are moderately deep to bedrock. Skerry soils have more than 20% sandy lenses in the Cd horizon. Worden soils are somewhat poorly drained.

GEOGRAPHIC SETTING: Peru soils are on nearly level to steep slopes in glaciated uplands. Typically they are on linear or convex areas of backslopes, footslopes, and toeslopes, but they also occur in concave positions. The soils formed in loamy lodgment till derived mainly from schist, gneiss, phyllite, and granite. Slope ranges from 0 to 60 percent. The mean annual precipitation is 790 to 1640 mm, and the mean annual temperature is 2 to 7 degrees C. The frost-free period ranges from 90 to 160 days. Elevation ranges from about 2 to 800 meters above sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Berkshire, Brayton, Cabot, Colonel, Lyman, Marlow, Monadnock, Peacham, Pillsbury, Sunapee, and Tunbridge soils. Berkshire, Lyman, Monadnock, Sunapee, and Tunbridge soils are formed in supraglacial till and do not have densic materials. Additionally, Lyman soils are shallow to bedrockk, and Tunbridge soils are moderately deep to bedrock. Peru soils are in a drainage sequence with the well drained Marlow soils, somewhat poorly drained Colonel soils, poorly drained Brayton, Cabot, and Pillsbury soils, and very poorly drained Peacham soils.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Moderately well drained. Estimated saturated hydraulic conductivity is moderately high or high in the solum, and moderately low or moderately high in the dense substratum.

USE AND VEGETATION: Most areas are wooded. The common trees are sugar maple, eastern white pine, balsam fir, red spruce, white spruce, white ash, yellow birch, paper birch, eastern hemlock, American beech, and red pine. Areas cleared of stones are used mainly for hay and pasture and some cultivated crops.

DISTRIBUTION AND EXTENT: Maine, Massachusetts, New Hampshire, New York, and Vermont. The soils of this series are extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Berkshire County, Massachusetts, 1923.

REMARKS: 1. Dixfield soils were recorrelated to Peru soils as part of the national Soil Data Join Recorrelation initiative. Revisions to the Peru Range in Characteristics incorporate values from the Dixfield Official Series Description. As a result of this revision to Peru, the Dixfield series status has been changed to

inactive.

2. Diagnostic horizons and features recognized in this pedon are:

a. Ochric epipedon - the zone from 0 to 15 cm (Oe, A, and E horizons).
b. Spodic horizon - the zone from 15 to 33 cm (Bs1 and Bs2 horizons).
c. Aquic conditions - redoximorphic features at 43 cm below the mineral soil surface (BC, Cd1, and Cd2 horizons).
d. Densic materials - the zone from 54 to 165 cm (Cd1 and Cd2 horizons).

ADDITIONAL DATA: Characterization data for Peru and similar soils is available through the National Cooperative Soil Survey Soil Characterization Database: http://ncsslabdatamart.sc.egov.usda.gov/

National Cooperative Soil Survey
U.S.A.

LOCATION BRAYTON ME+CT MA NY VT

Established Series
Rev. KJL-DEW-ANA
09/2013

BRAYTON SERIES

The Brayton series consists of very deep, poorly drained soils on toeslopes and depressions of glaciated uplands. These soils formed in dense till. Saturated hydraulic conductivity is moderately high or high in the solum and moderately low or moderately high in the dense substratum. Slope ranges from 0 to 25 percent. Mean annual temperature is about 7 degrees C, and mean annual precipitation is about 1092 mm.

TAXONOMIC CLASS: Loamy, mixed, active, nonacid, frigid, shallow Aeric Endoaquepts

TYPICAL PEDON: Brayton fine sandy loam, in a gently sloping, very stony forested area. (Colors are for moist soil unless otherwise stated.)

Oi--0 to 2 cm; slightly decomposed leaves, needles and twigs.

Oa--2 to 13 cm; black (5YR 2/1) highly decomposed organic material; weak very fine granular structure; very friable, many very fine, fine and medium, and common coarse roots; extremely acid; abrupt wavy boundary. (Combined thickness of the O horizons is 0 to 15 cm.)

A--13 to 18 cm; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 6/1) dry; weak fine and medium granular structure; very friable; many very fine, fine and medium, and common coarse roots; 10 percent rock fragments; extremely acid; abrupt wavy boundary. (0 to 15 cm thick)

Eg--18 to 25 cm; gray (10YR 5/1) gravelly fine sandy loam; few medium distinct pinkish gray (5YR 6/2) masses of iron accumulation and few fine faint gray (10YR 6/1) iron depletions; weak very fine subangular blocky structure; friable; many very fine and fine, and common medium roots; 20 percent rock fragments; extremely acid; abrupt wavy boundary. (0 to 10 cm thick)

Bg--25 to 41 cm; grayish brown (2.5Y 5/2) fine sandy loam; weak very fine and fine subangular blocky structure; friable; common very fine and fine roots; many medium prominent dark yellowish brown (10YR 4/6) masses of iron accumulation and few fine faint gray (10YR 6/1) iron depletions; 10 percent rock fragments; strongly acid; clear wavy boundary. (13 to 51 cm thick)

BC--41 to 58 cm; light olive brown (2.5Y 5/4) fine sandy loam; weak thin platy structure; firm; many medium faint dark yellowish brown (10YR 4/4) masses of iron accumulation and few fine prominent gray (10YR 6/1) iron depletions; 10 percent rock fragments; moderately acid; clear wavy boundary. (0 to 25 cm thick)

Cd1--58 to 74 cm; olive (5Y 5/3) fine sandy loam; moderate thin and medium platy; very firm; many medium prominent yellowish brown (10YR 5/6) and common medium prominent dark yellowish brown masses of iron accumulation, few fine prominent gray (10YR 6/1) iron depletions; 10 percent rock fragments; slightly acid; clear wavy boundary.

Cd2--74 to 165 cm; olive (5Y 4/3) fine sandy loam; massive; very firm; common medium distinct dark yellowish brown (10YR 4/4) masses of iron accumulation, few fine prominent gray (10YR 6/1) iron depletions; 10 percent rock fragments; slightly acid.

TYPE LOCATION: Hancock County, Maine; town of Mariaville; off Maine Route 181, about 1.3 miles north of the bridge spanning the West Branch of Union River, about 500 feet southeast of highway; USGS Amherst topographic quadrangle; lat. 44 degrees 46 minutes 47 seconds N. and long. 68 degrees 22 minutes 15 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: The combined thickness of the A, E, B and BC horizons is 25 to 50 cm. Depth to bedrock from the mineral soil surface is more than 152 cm. Reaction ranges from extremely acid to moderately acid in the A and Eg horizons and from strongly acid to slightly acid in the B and BC horizons. One or more subhorizons in the subsoil below a depth of 25 cm have pH greater than 5.5. The Cd layer ranges from moderately acid to neutral. Rock fragments in the mineral soil range from 5 to 35 percent by volume. The proportions of rock fragments are about 80 percent gravel, 15 percent cobbles, and 5 percent stones. Some pedons have channers and flagstones. Stones and boulders cover from 0 to 25 percent of the surface. Textures of the solum are silt loam, loam, very fine sandy loam, fine sandy loam, or sandy loam in the fine-earth fraction with less than 10 percent clay. The substratum textures are loam, very fine sandy loam, fine sandy loam, or sandy loam in the fine-earth fraction with less than 10 percent clay. Consistence is very friable to firm in the solum and firm or very firm in the dense substratum.

The O horizon, where present, is fibric, hemic and/or sapric material.

The A or Ap horizon, where present, has hue of 10YR to 5Y, value of 2 to 4, and chroma of 1 to 4. Structure is granular.

The Eg horizon, where present, has hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or 2.

The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It has subangular blocky, granular or platy structure.

The BC horizon, where present, has hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 to 4. It has subangular blocky or platy structure.

One or more subhorizon in the subsoil has matrix chroma of 2 or less. The combined thickness of the B and BC horizons is at least 6 inches.

The Cd layer has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 to 4. It is prismatic parting to platy, platy or it is massive. Aggregations bounded by planes or zones of weakness are considered inherent in the parent material.

COMPETING SERIES: This is the [illegible] series. Aurelie soils have 18 to 27 percent clay throughout the particle size control section. Monarda and Pillsbury are in closely related families. They have pH less than 5.5 in the subsoil below a depth of 25 cm and Monarda soils have 10 to 18 percent clay in the particle-size control section.

GEOGRAPHIC SETTING: Brayton soils are in depressions and on toeslopes of glaciated uplands. Slopes range from 0 to 25 percent. The soils formed in dense till derived mainly from granite, phyllite, schist, slate, and shale of Wisconsin age. The climate is humid and cool temperate. Mean annual temperature ranges from 3 to 8 degrees C, and mean annual precipitation commonly ranges from 864 to 1219 mm but includes up to 1524 mm in the coastal area of Mt. Desert Island, Maine. The frost-free season ranges from 90 to 160 days. Elevations range from about 2 to 762 m above mean sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Colonel, Dummerston, Dixfield, Fullam, Hubbardton, Lyman, Macomber, Marlow, Peru, Skerry, Taconic, Tunbridge, and Peacham soils. The Colonel, Dixfield, Lyman, Marlow, Peru, Skerry, and Tunbridge soils have spodic horizons, are better drained, and are on higher topographic positions. Peacham soils have a histic epipedon and are in lower topographic positions. The Dummerston, Fullam, Hubbardton, Macomber, and Taconic soils are better drained and are on higher topographic positions.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Poorly drained. A perched water table is above the dense substratum from autumn through spring. Estimated saturated hydraulic conductivity is moderately high or high in the solum and moderately low or moderately high in the dense substratum.

USE AND VEGETATION: Most areas of this soil are forested. Some areas are cleared and used for hay and pasture. Forest vegetation is mainly red spruce, white spruce, black spruce, balsam fir, eastern white pine, red maple, northern white cedar, and paper birch, yellow birch and hemlock.

DISTRIBUTION AND EXTENT: Connecticut, Maine, Massachusetts, New York, and Vermont. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Essex County, New York, 1954.

REMARKS: After reviewing location, geographic coordiantes changed from USGS Amherst topographic quadrangle; lat. 44 degrees 46 minutes 48 seconds N. and long. 68 degrees 22 minutes 19 seconds W., NAD 27.

Diagnostic horizons and features recognized in this pedon include:
1. Ochric epipedon - the zone from 0 to 18 cm (Oi, Oa and A horizons).
2. Cambic horizon - the zone from 25 to 58 cm (Bg and BC horizons).
3. Densic contact - very firm, dense basal till at a depth of 58 cm.
4. Aeric Feature - both value and chroma of 3 or more in the zone from 41 to 58 (BC horizon).
5. Aquic conditions - redox depletions throughout the subsoil. (Eg, Bg and BC horizons).

The Aurelie series is included in the competing soils section with a previous revision.

Previous remarks June, 2004 revision:
The type location is changed with this revision based on consensus that placement in the shallow family is reflective of the dominant characteristics of the series. It is acknowledged that historically the series exceeded 50 cm to densic contact in some places. The series is re-classified from Epiaquepts to Endoaquepts in accordance with Soil Taxonomy which, in reference to applying keys, stipulates that diagnostic horizons and properties below a densic contact are excluded. It is assumed the depth to bedrock from the mineral surface of this pedon exceeds 152 cm. This soil was previously type located in New York and classified as Coarse-loamy, mixed, nonacid, frigid Aeric Fragiaquepts. The classification was changed as a result of the Northeast Fragipan Study. This series also included somewhat poorly drained soils but has since been restricted to poorly drained.

ADDITIONAL DATA: Source of the data used in establishing taxonomic class and range in characteristics is Maine Agricultural Experiment Station Technical Bulletin 94, September 1979.
Soil Interpretation Record Numbers for the Brayton Series are: Brayton, ME0100; Brayton, stony, ME0101; Brayton bouldery, ME0123; Brayton, variant ME0090.

National Cooperative Soil Survey
U.S.A.

ROBERT VILE SOIL CONSULTING, INC.
P.O. BOX 114 DIXMONT, MAINE 04932

CLASS B HIGH INTENSITY SOIL SURVEY

FOR:

CENTRAL MAINE POWER COMPANY

LOCATION:

CENTRAL MAINE POWER COMPANY CORRIDOR
MOXIE GORE, SOMERSET COUNTY, MAINE

FIELD SURVEY: ROBERT VILE	OCTOBER 16, 2018
CERTIFIED SOIL SCIENTIST #201	SCALE 1"=50'

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

LEGEND

- = 3/4" IRON REBAR SET WITH RED PLASTIC CAP INSCRIBED S.W. GOULD PLS 2318 (unless otherwise noted).
- = UTILITY POLE
- = WETLANDS
- = INDEX CONTOUR (NAVD 88 FEET)
- = INTERMEDIATE CONTOUR (NAVD 88 FEET)

NOTES

NOTE...1 BOUNDARY AND TOPOGRAPHIC INFORMATION PROVIDED BY SACKETT & BRAKE SURVEY, INC.

NOTE...2 WETLAND DELINEATION PERFORMED BY ROBERT VILE.

SOILS LEGEND

Br - Brayton Series - Poorly Drained
Pr - Peru Series - Moderately Well Drained

Slope Phases

A : 0% to 3% Slope
B : 3% to 8% Slope
C : 8% to 15% Slope
D : 15% to 40% Slope

Br/A — Soil Series / Slope Phase

TP : Soil Test Pit
: Soil Boundary

STATE OF MAINE
Robert Vile
C.S.S. #201
CERTIFIED SOIL SCIENTIST

ROBERT VILE
CSS#201

2018245(MG)-SOILS

2018245 FULL restore.dwg 2018245 MOXIE 10/16/2018 15:15:09 1 : 1

Class B High Intensity Soil Survey

For

Central Maine Power Company Proposed Electrical Substation

West Forks Plantation, ME

Soil Survey completed by Robert Vile Soil Consulting Inc

October 16, 2018

Robert Vile
Licensed Site Evaluator
Certified Soil Scientist

P.O. Box 114, Cates Rd.
Dixmont, ME 04932

Telephone:
(207)234-2451

Date: October 16, 2018

To: Sackett & Brake Survey, Inc.
P.O. Box 207
Skowhegan, Me. 04976

Re: Soil Suitability for a proposed CMP Electrical Substation in West Forks Plt., Me.

Findings: On October 12 and 13, 2018 I conducted a Class B High Intensity Soil Survey on the above captioned +- 5 acre parcel. Three different soil series were identified on the parcel. Tunbridge , Lyman and Brayton. The Tunbridge and Lyman soils have bedrock as the limiting factor. The Brayton soils occupy a small forested wetland area in the proposed site. If this area will be filled or disturbed then proper permitting will be required. Because of the natural sloping topography of the site it will be a cut and fill site. The shallow to ledge areas will require blasting but will produce some excellent material to fill the lower areas. The site has potential for the proposed substation.

Sincerely,

Robert G. Vile jr.
C.S.S. # 201
L.S.E. S204

Robert Vile
Licensed Site Evaluator
Certified Soil Scientist

P.O. Box 114, Cates Rd.
Dixmont, ME 04932

Telephone:
(207)234-2451

Date: October 16, 2018

To: Sackett & Brake Survey, Inc.
P.O. Box 207
Skowhegan , Me. 04976

Re: Class B High Intensity Soil Survey of a +- 5 Acre parcel of land located in West Forks Plantation, Me..for a Central Maine Power proposed electrical substation.

Findings: On October 12 and October 13,2018 I investigated the above captioned parcel. The purpose of the investigation was to conduct a Class B High Intensity Soil Survey of the site. The boundaries of the survey were marked by Land surveyors. Soils were described by means of hand shoveled test pits and many soil auger borings do to difficult access for an excavator. The soil test pit locations as well as a two foot contour map at a scale of 1" = 50' were provided by Sackett & Brake Survey, Inc. This soil survey was conducted for the use in planning a Central Maine Power Company proposed electrical substation. This Class B High Intensity Soil Survey was mapped following these minimum standards described in Guidelines For Maine Certified Soil Scientists For Soil Identification And Mapping:
Class B (High Intensity)

1. Map units will not contain dissimilar limiting individual inclusions larger than one acre. Dissimilar limiting inclusions may total more than one acre per map unit delineation, in the aggregate, if not continuous.
2. Scale of 1"=200' or larger.
3. Ground control-test pits for which detailed data is recorded are located by means of compass by chaining, pacing, or taping from known survey points; or other methods of equal or greater accuracy.
4. Base map with 5-foot contour lines.

This parcel is bedrock controlled. Three different Soil Series were identified on the parcel. Tunbridge , Lyman and Brayton soil series.
The Tunbridge soils are classified Coarse-loamy, isotic, frigid Typic Haplorthods by Soil Taxonomy. These soils are moderately deep, well drained soils formed in supraglacial till on the forested upland portions of the parcel. Tunbridge soils have bedrock between 20" and 40" on this site. They exist on slopes ranging from 3 to 40% on this site. No restrictive layers or seasonal water table was observed in these soils. A typical pedon for this series is described at Test Pit #1. Please see attached test pit logs. Tunbridge soils are

a Class C Hydrologic Soil Group. Surface run-off is medium and permeability is moderately high or high throughout the profile. There is no hazard of flooding on these soils. Inclusions within the Tunbridge mapping unit include the Lyman series and the Peru soil series. The limiting factor of the Tunbridge soils for this project will be the depth to ledge. Blasting may be required.

The Lyman soils are classified Loamy, isotic, frigid Lithic Haplorthods by Soil Taxonomy. These soils are somewhat excessively drained , shallow to bedrock and formed in loamy supraglacial till. They occur on the forested uplands on this parcel. These soils have bedrock between 6 to 19" on this parcel with several bedrock outcrops. There is no seasonal watertable or restrictive layer associated with these soils. A typical pedon for this series is described at soil test boring # 5. Please see attached test pit logs. Lyman soils are a Class C/D Hydrologic Soil Group. Surface run-off is very high to high within these map units. Permeability is moderately high to high in the Lyman soils. There is no hazard of flooding within these map units. Inclusions within the Lyman map unit include the Tunbridge series where bedrock is found 20" or deeper below the mineral surface. The limiting factor with the Lyman series for this project is ledge. Blasting may be required.

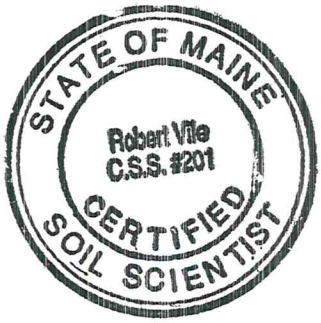
The Brayton soils are classified Loamy,mixed,active,nonacid,frigid,shallow Aeric Endoaquepts by Soil Taxonomy. These soils are deep, poorly drained glacial till found in a lowland depression on this parcel. Brayton soils are hydric soils and occur within the wetland area on this site. The Brayton soils have thick organic horizons and are very bouldery on this parcel. Seasonal water tables are at the mineral surface and ponding is possible within the wetland area. Brayton soils occur on 0-3% slopes at this site. A typical pedon for this series is described at Test Pit # 4. Please see attached test pit logs. Brayton soils are a Class C Hydrologic Soil Group. Surface run-off is slow to none on this site. Inclusions within the Brayton map unit may be the very poorly drained Peachem Soil Series. The limiting factor of the Brayton soils for this project is the high seasonal water table and they are found in the forested wetland.

The accompanying soil profile descriptions, soil survey map and this soil narrative report dated October 16, 2018 were done in accordance with the standards adopted by the Maine Association of Professional Soil Scientists and presented in the " Guidelines for Maine Certified Soil Scientists for Soil Identification and Mapping" latest revision and prepared by Robert G. Vile jr. " Certified Soil Scientist # 201.

If you have any questions regarding the investigation please feel free to contact me at the above number.

Sincerely,

Robert G. Vile jr.
C.S.S. # 201
L.S.E. S204



FORM F 1/01

SOIL PROFILE / CLASSIFICATION INFORMATION

DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT PROJECT SITES

Project Name: Electrical Substation

Applicant Name: Central Maine Power Co.

Project Location (municipality): West Forks PLT,

Exploration Symbol: #1 ■ Test Pit ☐ Boring

2 " Organic horizon thickness Ground surface elev. _____

Depth below mineral soil surface (inches)

	Texture	Consistency	Color	Mottling
0–6	gravely	friable	Grey	
6–12	SANDY	friable	Strong Brown	
12–18	LOAM	friable	Strong Brown	NONE
18–24	↓	↓	Yellowish Brown	
24–30			Light olive Brown	
30–36	/	36" HAND Dig	Refusal	
36–42		/	/	
42–48				

soil data by	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	
S.E.	2	A III		36"	☐ Groundwater ☐ Restrictive Layer ■ Bedrock

soil data by	Soil series/phase name:		Hydrologic Soil Group
S.S.	Tunbridge	☐ Hydric ■ Non-hydric	C

Exploration Symbol: #2 ■ Test Pit ☐ Boring

2 " Organic horizon thickness Ground surface elev. _____

Depth below mineral soil surface (inches)

	Texture	Consistency	Color	Mottling
0–6			Strong	
6–12	gravely	friable	Brown	
12–18	Fine	friable		NONE
18–24	SANDY		Yellowish	
24–30	LOAM		Brown	
30–36	/	24" Refusal	HAND Dig	
36–42		/	/	
42–48				

soil data by	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	
S.E.	2	A III		24"	☐ Groundwater ☐ Restrictive Layer ■ Bedrock

soil data by	Soil series/phase name:		Hydrologic Soil Group
S.S.	Tunbridge	☐ Hydric ■ Non-hydric	C

Exploration Symbol: #3 ■ Test Pit ☐ Boring

2 " Organic horizon thickness Ground surface elev. _____

Depth below mineral soil surface (inches)

	Texture	Consistency	Color	Mottling
0–6	gravely		Dark Brown	
6–12			Strong Brown	
12–18	Fine	Friable		NONE
18–24	SANDY LOAM		Yellowish Brown	
24–30	/	24" HAND Dig	Refusal	
30–36				
36–42		(	?	
42–48				

soil data by	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	
S.E.	2	A III		24"	☐ Groundwater ☐ Restrictive Layer ■ Bedrock

soil data by	Soil series/phase name:		Hydrologic Soil Group
S.S.	Tunbridge	☐ Hydric ■ Non-hydric	C

Exploration Symbol: #4 ■ Test Pit ☐ Boring

6 " Organic horizon thickness Ground surface elev. _____

Depth below mineral soil surface (inches)

	Texture	Consistency	Color	Mottling
0–6	Bouldery		DARK Grayish Brown	COMMON
6–12	Fine	FRIABLE		DISTINCT
12–18	SANDY LOAM		olive grey	
18–24				
24–30		18" Free water in Pit		
30–36				
36–42				
42–48				

soil data by	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	
S.E.	3	E		0	■ Groundwater ☐ Restrictive Layer ☐ Bedrock

soil data by	Soil series/phase name:		Hydrologic Soil Group
S.S.	Brayton	■ Hydric ☐ Non-hydric	D

INVESTIGATOR INFORMATION AND SIGNATURE

Signature: Robert G Vile jr

Date: 10-15-18

Name Printed/typed: Robert G. Vile jr.

Cert/Lic/Reg. # 55 201

Title: ■ Licensed Site Evaluator ■ Certified Soil Scientist ☐ Certified Geologist ☐ Other:

STATE OF MAINE — Robert Vile C.S.S. #201 — CERTIFIED SOIL SCIENTIST

affix professional seal

FORM F 1/01

SOIL PROFILE / CLASSIFICATION INFORMATION

DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT PROJECT SITES

Project Name: Electrical Substation

Applicant Name: Central Maine Power Co.

Project Location (municipality): West Forks Plt.

Exploration Symbol: #5 ☐ Test Pit ☒ Boring

2 " Organic horizon thickness Ground surface elev. _____

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	Fine Sandy Loam	Friable	Dark Yellowish Brown	None
6–12	/	8" Ledge	/	/
12–18	/	/	/	/
18–24				
24–30				
30–36				
36–42				
42–48				

soil data by	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	Groundwater / Restrictive Layer / Bedrock
S.E.	2	A1		8"	☐ ☐ ■

soil data by	Soil series/phase name:	Hydric / Non-hydric	Hydrologic Soil Group
S.S.	Lyman	☐ ■	C/D

Exploration Symbol: #6 ☐ Test Pit ☒ Boring

2 " Organic horizon thickness Ground surface elev. _____

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6			Strong	
6–12	Gravelly		Brown	
12–18	Fine	Friable		
18–24	Sandy /		Yellowish Brown	None
24–30	Loam			
30–36			Light Olive Brown	
36–42	/	36" Refusal	/	/
42–48	/	/	/	/

soil data by	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	Groundwater / Restrictive Layer / Bedrock
S.E.	2	A1		36"	☐ ☐ ■

soil data by	Soil series/phase name:	Hydric / Non-hydric	Hydrologic Soil Group
S.S.	Tunbridge	☐ ■	C

Exploration Symbol: _____ ☐ Test Pit ☐ Boring

_____ " Organic horizon thickness Ground surface elev. _____

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6				
6–12				
12–18				
18–24				
24–30				
30–36				
36–42				
42–48				

soil data by	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	Groundwater / Restrictive Layer / Bedrock
S.E.					☐ ☐ ☐

soil data by	Soil series/phase name:	Hydric / Non-hydric	Hydrologic Soil Group
S.S.		☐ ☐	

Exploration Symbol: _____ ☐ Test Pit ☐ Boring

_____ " Organic horizon thickness Ground surface elev. _____

Depth below mineral soil surface (inches)	Texture	Consistency	Color	Mottling
0–6	/			
6–12				
12–18				
18–24				
24–30				
30–36				
36–42				
42–48				

soil data by	Soil Profile	Classification Condition	Slope Percent	Limiting Factor Depth	Groundwater / Restrictive Layer / Bedrock
S.E.					☐ ☐ ☐

soil data by	Soil series/phase name:	Hydric / Non-hydric	Hydrologic Soil Group
S.S.		☐ ☐	

INVESTIGATOR INFORMATION AND SIGNATURE

Signature: Robert G. Vile jr. Date: 10-15-18

Name Printed/typed: Robert G. Vile jr. Cert/Lic/Reg. # SS 201

Title: ■ Licensed Site Evaluator ☐ Certified Geologist ■ Certified Soil Scientist ☐ Other:

STATE OF MAINE — Robert Vile C.S.S. #201 — CERTIFIED SOIL SCIENTIST

DEP Form F Rev. 1/01

LOCATION TUNBRIDGE VT+MA ME NH NY

Established Series
Rev. RLM-SHG-RFL
01/2016

TUNBRIDGE SERIES

The Tunbridge series consists of moderately deep, well drained soils on glaciated uplands. They formed in loamy supraglacial till. Saturated hydraulic conductivity is moderately high or high throughout the mineral soil. Slope ranges from 0 to 80 percent. Mean annual precipitation is about 1180 mm, and mean annual temperature is about 6 degrees C.

TAXONOMIC CLASS: Coarse-loamy, isotic, frigid Typic Haplorthods

TYPICAL PEDON: Tunbridge fine sandy loam, on a west-facing, 58 percent slope under mixed northern hardwoods. (Colors are for moist soil.)

Oe--0 to 8 cm; black (7.5YR 2.5/1) moderately decomposed plant material; many very fine and fine roots; clear wavy boundary.

Oa--8 to 13 cm; black (10YR 2/1) highly decomposed plant material; many very fine and fine and common medium roots; abrupt wavy boundary. (Combined thickness of the O horizons is 0 to 15 cm.)

E--13 to 20 cm; dark gray (10YR 4/1) fine sandy loam; weak fine subangular blocky structure; friable; common fine and medium roots; 5 percent gravel and 5 percent cobbles; very strongly acid (pH 4.8); abrupt wavy boundary. (0 to 20 cm thick)

Bhs--20 to 28 cm; dark reddish brown (5YR 2.5/2) fine sandy loam; weak fine subangular blocky structure; friable; common fine and medium roots; 10 percent gravel and 2 percent cobbles; very strongly acid (pH 4.8); gradual wavy boundary.

Bs--28 to 66 cm; dark reddish brown (5YR 3/3) and reddish brown (5YR 4/4) fine sandy loam; weak fine subangular blocky structure; friable; common fine, many medium, and common coarse roots; 10 percent gravel and 3 percent cobbles; strongly acid (pH 5.2); abrupt smooth boundary. (Combined thickness of the Bhs and Bs horizons is 10 to 60 cm.)

BC--66 to 71 cm; dark yellowish brown (10YR 3/4) fine sandy loam; weak fine subangular blocky structure; friable; few medium roots; 5 percent gravel; strongly acid (pH 5.4); abrupt wavy boundary. (0 to 40 cm thick)

R--71 cm; granite bedrock.

from strongly acid to slightly acid in the substratum. Rock fragments range from 5 to 35 percent throughout the mineral soil. They are mostly gravel, channers, and cobbles, but the range includes stones. The weighted average of clay in the particle-size control section is 1 to 10 percent. The silt content in the solum and substratum is typically less than 50 percent. Stony and bouldery phases of the Tunbridge series are recognized.

The O horizons, where present, consist of slightly, intermediately, and/or highly decomposed plant material.

Some pedons have an A or Ap horizon that is neutral or has hue of 5YR to 10YR, value of 2 to 5, and chroma of 0 to 4. It is typically loam, very fine sandy loam, fine sandy loam, or sandy loam in the fine-earth fraction, but the range includes silt loam. It is up to 15 cm thick.

The E horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 1 or 2. It is typically loam, very fine sandy loam, fine sandy loam, sandy loam, loamy fine sand, or loamy sand in the fine-earth fraction, but the range includes silt loam.

Some pedons have a BE horizon that has hue of 5YR to 10YR, value of 4 to 6, and chroma of 2 to 4. Textures are similar to the E horizon.

The Bhs horizon has hue of 5YR to 10YR, with value and chroma of 3 or less.

The Bs horizon has hue of 5YR to 2.5Y, value of 3 or more and chroma of 4 or more.

The BC horizon has hue of 7.5YR to 2.5Y, value of 3 to 5, and chroma of 3 to 8.

The B horizons are typically loam, very fine sandy loam, fine sandy loam, or sandy loam in the fine-earth fraction, but the range includes silt loam. Some BC horizons have a texture of loamy sand.

Some pedons have a C horizon that has hue of 10YR to 5Y, value of 3 to 6, and chroma of 2 to 6. It is typically loam, very fine sandy loam, fine sandy loam, or sandy loam in the fine-earth fraction, but the range includes silt loam and loamy sand. It is up to 45 cm thick.

Bedrock is slightly weathered schist, gneiss, phyllite, granite, or meta-anorthosite.

COMPETING SERIES: These are the Bangor, Berkshire, Dekapen, Elliottsville, Groveton, Houghtonville, Penquis, Potsdam, Revel, and Welcome series. Bangor, Berkshire, Dekapen, Groveton, Houghtonville, Potsdam, and Welcome soils have a depth to bedrock greater than 100 cm below the mineral soil surface. Elliottsville soils have a weighted average of more than 10 percent clay in the particle-size control section. Revel soils have a paralithic contact between 50 and 100 cm and average 35 to 65 percent weathered gravel in the

particle-size control section. Penquis soils contain pararock fragments of calcareous metasiltstone and metasandstone, or metalimestone throughout the soil.

GEOGRAPHIC SETTING: Tunbridge soils are on nearly level to very steep glaciated uplands. They are on the tops and sides of hills and mountains. Slope ranges from 0 to 80 percent. The soils formed in loamy supraglacial till of Wisconsin age derived mainly from micaceous schist, gneiss, phyllite, granite, and meta-anorthosite. The mean annual precipitation is 790 to 2420 mm, and the mean annual temperature is -3 to 7 degrees C. The frost-free period is from 60 to 160 days. Elevation ranges from about 2 to 800 meters above mean sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the [illegible], Rawsonville, Marlow, Peru, and Sunapee soils. The very deep to bedrock Becket, Berkshire, Colonel, Marlow, Peru, and Sunapee soils are typically on footslopes and backslopes in lower positions than nearby Tunbridge soils. Additionally, Becket, Colonel, Marlow, and Peru soils formed in loamy lodgment till. Rawsonville soils are in positions similar to Tunbridge soils and have 6 percent or more organic carbon in a layer 10 cm or more thick within the spodic horizon. Tunbridge soils are often closely intermingled with shallow Lyman soils in places where local relief is controlled by the underlying bedrock.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Well drained. Saturated hydraulic conductivity is moderately high or high throughout the mineral soil.

USE AND VEGETATION: Most areas are wooded. The common trees are American beech, white ash, yellow birch, paper birch, northern red oak, sugar maple, eastern white pine, eastern hemlock, red spruce, white spruce, and balsam fir. Some areas have been cleared and are primarily used for hay and pasture. A few cleared areas are used for cultivated crops.

DISTRIBUTION AND EXTENT: Vermont, Maine, Massachusetts, New Hampshire, and New York. MLRAs 143, 144A, and 144B. The series is extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Orange County, Vermont, 1975.

REMARKS: 1. Tunbridge is the official State Soil of Vermont.

2. Albic horizons may be difficult to locate because tree throws and other disturbances have destroyed them in many areas of Tunbridge soils. Albic horizons are often thin, may be discontinuous, and located within 10 cm of the soil surface.

3. The use of the Tunbridge series in MLRA 144A is in question. Tunbridge has a frigid temperature regime which is not typical in 144A.

4. The diagnostic horizons and features recognized in this pedon are:
a. Ochric epipedon - the zone from 0 to 20 cm (Oe, Oa, E horizons).
b. Albic horizon - the zone from 13 to 20 cm (E horizon).

c. Spodic horizon - the zone from 20 to 66 cm (Bhs, Bs horizons).

ADDITIONAL DATA: Laboratory characterization data for Tunbridge and similar soils is available through the National Cooperative Soil Survey Soil Characterization Database: http://ncsslabdatamart.sc.egov.usda.gov/

National Cooperative Soil Survey
U.S.A.

LOCATION LYMAN MA+ME NH NY VT

Established Series
Rev. WHT-CAW-RFL-GWS
02/2016

LYMAN SERIES

The Lyman series consists of shallow, somewhat excessively drained soils on glaciated uplands. They formed in loamy supraglacial till. Estimated saturated hydraulic conductivity is moderately high or high throughout the mineral soil. Slope ranges from 0 to 80 percent. Mean annual precipitation is about 1175 mm, and mean annual temperature is about 5 degrees C.

TAXONOMIC CLASS: Loamy, isotic, frigid Lithic Haplorthods

TYPICAL PEDON: Lyman loam, on a northwest facing, 55 percent slope in a very rocky forested area. (Colors are for moist soil.)

Oe --0 to 3 cm; moderately decomposed plant material. (O horizon thickness is 0 to 15 cm.)

A--3 to 8 cm; black (N 2/0) loam; weak fine granular structure; very friable; many fine and medium roots; extremely acid; abrupt wavy boundary. (0 to 10 cm thick)

E--8 to 13 cm; reddish gray (5YR 5/2) fine sandy loam; weak fine granular structure; very friable; many fine and medium roots; 10 percent gravel; extremely acid; abrupt broken boundary. (0 to 25 cm thick)

Bhs--13 to 18 cm; very dusky red (2.5YR 2.5/2) loam; weak fine granular structure; friable; many fine and medium roots; 10 percent fine gravel; extremely acid; abrupt broken boundary.

Bs1--18 to 28 cm; dark red (2.5YR 3/6) loam; weak fine and medium granular structure; friable; many fine and medium roots; 10 percent fine gravel; few mica flakes; very strongly acid; clear wavy boundary.

Bs2--28 to 46 cm; brown (7.5YR 4/4) grading with depth to brown (10YR 5/3) channery loam; weak coarse subangular blocky structure parting to medium and fine granular; friable; many fine and medium roots; 15 percent channers of schist and quartzite; common flakes of mica; very strongly acid; abrupt smooth boundary. (Combined thickness of the Bhs and Bs horizons is 10 to 43 cm.)

R--46 cm; dark gray mica schist bedrock.

TYPE LOCATION: Franklin County, Massachusetts; Town of Monroe; located about 550 meters west southwest of the village of Monroe Bridge and about 55 meters south of the Deerfield River; USGS Rowe, MA topographic quadrangle; lat. 42 degrees 43 minutes 12.53 seconds N. and long. 72 degrees 56 minutes 52.71

seconds W., NAD 83.

RANGE IN CHARACTERISTICS: The thickness of the mineral solum ranges from 25 to 50 cm, and corresponds to the depth to bedrock. The weighted average of clay in the particle-size control section is 1 to 10 percent. Reaction ranges from moderately acid to extremely acid throughout, unless limed. Rock fragments range from 0 to 35 percent throughout the mineral soil. They are mostly gravel and channers, but the range includes cobbles and stones.

Some pedons have Oi, Oe, and/or Oa horizons that consist of slightly, moderately, or highly decomposed organic material, respectively.

The A horizon is neutral or has hue of 5YR to10YR, value of 2, 2.5, or 3, and chroma of 0 t0 2. Some pedons have an Ap horizon with value and chroma of 2 to 4. Ap horizons are typically 15 cm or more thick. The A or Ap horizon is sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam in the fine-earth fraction.

The E horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 1 or 2. It is loamy sand, loamy fine sand, sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam in the fine-earth fraction.

The Bhs horizon has hue of 2.5YR to 10YR, with value and chroma of 3 or less.

The Bs horizon has hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 3 to 8.

Some pedons have a BC horizon with hue of 10YR to 5Y, value of 3 to 5, and chroma of 3 or 4. Texture of the B and BC horizons is sandy loam, fine sandy loam, very fine sandy loam, loam or silt loam in the fine-earth fraction. Some pedons have a loamy sand BC horizon.

Bedrock is slightly weathered schist, gneiss, phyllite, or granite.

COMPETING SERIES: These are the , , and series. Abram soils have bedrock at a depth of less than 25 cm from the mineral soil surface. Creasey soils have sandstone or conglomerate bedrock. Monson soils average more than 10 percent clay in the particle-size control section.

GEOGRAPHIC SETTING: Lyman soils are on nearly level to very steep glaciated uplands. They are on the tops and sides of hills and mountains. Slope ranges from 0 to 80 percent. The soils formed in loamy supraglacial till of Wisconsin age derived mainly from micaceous schist, gneiss, phyllite, and granite. The mean annual precipitation is 790 to 2420 mm, and the mean annual temperature is -3 to 9 degrees C. The frost-free period is from 60 to 160 days. Elevation ranges from about 2 to 800 meters above mean sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the , , , , Marlow, Peru, Skerry, Sunapee, and Tunbridge soils. The very deep to bedrock Becket, Berkshire, Colonel, Marlow, Peru, Skerry, and Sunapee soils are typically on footslopes and backslopes in lower positions than nearby Lyman soils. In addition, Becket, Colonel, Marlow, Peru, and Skerry soils are formed in loamy lodgment till. Hogback soils are in positions similar to Lyman soils and have 6 percent or more organic carbon in a layer 10 cm or more thick within the spodic horizon. Lyman soils are often closely intermingled with the moderately deep Tunbridge soils in places where local relief is controlled by the underlying bedrock.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Somewhat excessively drained. Potential runoff is very high. Estimated saturated hydraulic conductivity is moderately high or high in the mineral soil.

USE AND VEGETATION: Most areas are wooded. The common trees are American beech, white ash, yellow birch, paper birch, northern red oak, sugar maple, eastern white pine, eastern hemlock, red spruce, white spruce, and balsam fir. Some areas have been cleared and are primarily used for hay and pasture. A few cleared areas are used for cultivated crops.

DISTRIBUTION AND EXTENT: Northern New England, western Massachusetts, and northern New York. Principally in the Green and White Mountains, the Adirondack Mountains, the Berkshire uplands, and eastern and western Maine. MLRAs 143, 144A, and 144B. The series is extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Grafton County, New Hampshire, 1935.

REMARKS: 1. The use of the Lyman series in MLRA 144A is in question. Lyman has a frigid temperature regime which is not typical in 144A.

2. Diagnostic horizons and features recognized in this pedon are:
a. Ochric epipedon - the zone from 0 to 13 cm (Oe, A, and E horizons).
b. Albic horizon - the zone from 8 to 13 cm (E horizon).
c. Spodic horizon - the zone from 13 to 46 cm (Bhs, Bs1, and Bs2 horizons).
d. Lithic feature - bedrock at 43 cm from the mineral soil surface.

ADDITIONAL DATA: Characterization data for Lyman and similar soils is available through the National Cooperative Soil Survey Soil Characterization Database: http://ncsslabdatamart.sc.egov.usda.gov/

National Cooperative Soil Survey
U.S.A.

LOCATION BRAYTON ME+CT MA NY VT

Established Series
Rev. KJL-DEW-ANA
09/2013

BRAYTON SERIES

The Brayton series consists of very deep, poorly drained soils on toeslopes and depressions of glaciated uplands. These soils formed in dense till. Saturated hydraulic conductivity is moderately high or high in the solum and moderately low or moderately high in the dense substratum. Slope ranges from 0 to 25 percent. Mean annual temperature is about 7 degrees C, and mean annual precipitation is about 1092 mm.

TAXONOMIC CLASS: Loamy, mixed, active, nonacid, frigid, shallow Aeric Endoaquepts

TYPICAL PEDON: Brayton fine sandy loam, in a gently sloping, very stony forested area. (Colors are for moist soil unless otherwise stated.)

Oi--0 to 2 cm; slightly decomposed leaves, needles and twigs.

Oa--2 to 13 cm; black (5YR 2/1) highly decomposed organic material; weak very fine granular structure; very friable, many very fine, fine and medium, and common coarse roots; extremely acid; abrupt wavy boundary. (Combined thickness of the O horizons is 0 to 15 cm.)

A--13 to 18 cm; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 6/1) dry; weak fine and medium granular structure; very friable; many very fine, fine and medium, and common coarse roots; 10 percent rock fragments; extremely acid; abrupt wavy boundary. (0 to 15 cm thick)

Eg--18 to 25 cm; gray (10YR 5/1) gravelly fine sandy loam; few medium distinct pinkish gray (5YR 6/2) masses of iron accumulation and few fine faint gray (10YR 6/1) iron depletions; weak very fine subangular blocky structure; friable; many very fine and fine, and common medium roots; 20 percent rock fragments; extremely acid; abrupt wavy boundary. (0 to 10 cm thick)

Bg--25 to 41 cm; grayish brown (2.5Y 5/2) fine sandy loam; weak very fine and fine subangular blocky structure; friable; common very fine and fine roots; many medium prominent dark yellowish brown (10YR 4/6) masses of iron accumulation and few fine faint gray (10YR 6/1) iron depletions; 10 percent rock fragments; strongly acid; clear wavy boundary. (13 to 51 cm thick)

BC--41 to 58 cm; light olive brown (2.5Y 5/4) fine sandy loam; weak thin platy structure; firm; many medium faint dark yellowish brown (10YR 4/4) masses of iron accumulation and few fine prominent gray (10YR 6/1) iron depletions; 10 percent rock fragments; moderately acid; clear wavy boundary. (0 to 25 cm thick)

Cd1--58 to 74 cm; olive (5Y 5/3) fine sandy loam; moderate thin and medium platy; very firm; many medium prominent yellowish brown (10YR 5/6) and common medium prominent dark yellowish brown masses of iron accumulation, few fine prominent gray (10YR 6/1) iron depletions; 10 percent rock fragments; slightly acid; clear wavy boundary.

Cd2--74 to 165 cm; olive (5Y 4/3) fine sandy loam; massive; very firm; common medium distinct dark yellowish brown (10YR 4/4) masses of iron accumulation, few fine prominent gray (10YR 6/1) iron depletions; 10 percent rock fragments; slightly acid.

TYPE LOCATION: Hancock County, Maine; town of Mariaville; off Maine Route 181, about 1.3 miles north of the bridge spanning the West Branch of Union River, about 500 feet southeast of highway; USGS Amherst topographic quadrangle; lat. 44 degrees 46 minutes 47 seconds N. and long. 68 degrees 22 minutes 15 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: The combined thickness of the A, E, B and BC horizons is 25 to 50 cm. Depth to bedrock from the mineral soil surface is more than 152 cm. Reaction ranges from extremely acid to moderately acid in the A and Eg horizons and from strongly acid to slightly acid in the B and BC horizons. One or more subhorizons in the subsoil below a depth of 25 cm have pH greater than 5.5. The Cd layer ranges from moderately acid to neutral. Rock fragments in the mineral soil range from 5 to 35 percent by volume. The proportions of rock fragments are about 80 percent gravel, 15 percent cobbles, and 5 percent stones. Some pedons have channers and flagstones. Stones and boulders cover from 0 to 25 percent of the surface. Textures of the solum are silt loam, loam, very fine sandy loam, fine sandy loam, or sandy loam in the fine-earth fraction with less than 10 percent clay. The substratum textures are loam, very fine sandy loam, fine sandy loam, or sandy loam in the fine-earth fraction with less than 10 percent clay. Consistence is very friable to firm in the solum and firm or very firm in the dense substratum.

The O horizon, where present, is fibric, hemic and/or sapric material.

The A or Ap horizon, where present, has hue of 10YR to 5Y, value of 2 to 4, and chroma of 1 to 4. Structure is granular.

The Eg horizon, where present, has hue of 10YR to 5Y, value of 5 or 6, and chroma of 1 or 2.

The B horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 4. It has subangular blocky, granular or platy structure.

The BC horizon, where present, has hue of 10YR to 5Y, value of 4 to 6, and chroma of 2 to 4. It has subangular blocky or platy structure.

One or more subhorizon in the subsoil has matrix chroma of 2 or less. The combined thickness of the B and BC horizons is at least 6 inches.

The Cd layer has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 to 4. It is prismatic parting to platy, platy or it is massive. Aggregations bounded by planes or zones of weakness are considered inherent in the parent material.

COMPETING SERIES: This is the [illegible] series. Aurelie soils have 18 to 27 percent clay throughout the particle size control section. Monarda and Pilsbury are in closely related families. They have pH less than 5.5 in the subsoil below a depth of 25 cm and Monarda soils have 10 to 18 percent clay in the particle-size control section.

GEOGRAPHIC SETTING: Brayton soils are in depressions and on toeslopes of glaciated uplands. Slopes range from 0 to 25 percent. The soils formed in dense till derived mainly from granite, phyllite, schist, slate, and shale of Wisconsin age. The climate is humid and cool temperate. Mean annual temperature ranges from 3 to 8 degrees C, and mean annual precipitation commonly ranges from 864 to 1219 mm but includes up to 1524 mm in the coastal area of Mt. Desert Island, Maine. The frost-free season ranges from 90 to 160 days. Elevations range from about 2 to 762 m above mean sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Colonel, Dummerston, Dixfield, Fullam, Hubbardton, Lyman, Macomber, Marlow, Peru, Skerry, Taconic, Tunbridge, and Peacham soils. The Colonel, Dixfield, Lyman, Marlow, Peru, Skerry, and Tunbridge soils have spodic horizons, are better drained, and are on higher topographic positions. Peacham soils have a histic epipedon and are in lower topographic positions. The Dummerston, Fullam, Hubbardton, Macomber, and Taconic soils are better drained and are on higher topographic positions.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Poorly drained. A perched water table is above the dense substratum from autumn through spring. Estimated saturated hydraulic conductivity is moderately high or high in the solum and moderately low or moderately high in the dense substratum.

USE AND VEGETATION: Most areas of this soil are forested. Some areas are cleared and used for hay and pasture. Forest vegetation is mainly red spruce, white spruce, black spruce, balsam fir, eastern white pine, red maple, northern white cedar, and paper birch, yellow birch and hemlock.

DISTRIBUTION AND EXTENT: Connecticut, Maine, Massachusetts, New York, and Vermont. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Essex County, New York, 1954.

REMARKS: After reviewing location, geographic coordiantes changed from USGS Amherst topographic quadrangle; lat. 44 degrees 46 minutes 48 seconds N. and long. 68 degrees 22 minutes 19 seconds W., NAD 27.

Diagnostic horizons and features recognized in this pedon include:
1. Ochric epipedon - the zone from 0 to 18 cm (Oi, Oa and A horizons).
2. Cambic horizon - the zone from 25 to 58 cm (Bg and BC horizons).
3. Densic contact - very firm, dense basal till at a depth of 58 cm.
4. Aeric Feature - both value and chroma of 3 or more in the zone from 41 to 58 (BC horizon).
5. Aquic conditions - redox depletions throughout the subsoil. (Eg, Bg and BC horizons).

The Aurelie series is included in the competing soils section with a previous revision.

Previous remarks June, 2004 revision:
The type location is changed with this revision based on consensus that placement in the shallow family is reflective of the dominant characteristics of the series. It is acknowledged that historically the series exceeded 50 cm to densic contact in some places. The series is re-classified from Epiaquepts to Endoaquepts in accordance with Soil Taxonomy which, in reference to applying keys, stipulates that diagnostic horizons and properties below a densic contact are excluded. It is assumed the depth to bedrock from the mineral surface of this pedon exceeds 152 cm. This soil was previously type located in New York and classified as Coarse-loamy, mixed, nonacid, frigid Aeric Fragiaquepts. The classification was changed as a result of the Northeast Fragipan Study. This series also included somewhat poorly drained soils but has since been restricted to poorly drained.

ADDITIONAL DATA: Source of the data used in establishing taxonomic class and range in characteristics is Maine Agricultural Experiment Station Technical Bulletin 94, September 1979.
Soil Interpretation Record Numbers for the Brayton Series are: Brayton, ME0100; Brayton, stony, ME0101; Brayton bouldery, ME0123; Brayton, variant ME0090.

National Cooperative Soil Survey
U.S.A.

ROBERT VILE SOIL CONSULTING, INC.
P.O. BOX 114 DIXMONT, MAINE 04932

CLASS B HIGH INTENSITY SOIL SURVEY

FOR:

CENTRAL MAINE POWER COMPANY

LOCATION:
CENTRAL MAINE POWER COMPANY CORRIDOR
WEST FORKS, SOMERSET COUNTY, MAINE

FIELD SURVEY: ROBERT VILE	OCTOBER 16, 2018
CERTIFIED SOIL SCIENTIST #201	SCALE 1"=50'

GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

LEGEND

= 3/4" IRON REBAR SET WITH RED PLASTIC CAP INSCRIBED K.A. SARGENT PLS 2450 (unless otherwise noted).

= UTILITY POLE

= WETLANDS

= INDEX CONTOUR (NAVD 88 FEET)

= INTERMEDIATE CONTOUR (NAVD 88 FEET)

NOTES

NOTE...1 BOUNDARY AND TOPOGRAPHIC INFORMATION PROVIDED BY SACKETT & BRAKE SURVEY, INC.

NOTE...2 WETLAND DELINEATION PERFORMED BY ROBERT VILE.

SOILS LEGEND

Br - Brayton Series - Poorly Drained
Tb - Tunbridge Series - Well Drained
Ly - Lyman Series - Well Drained

Slope Phases

A : 0% to 3% Slope
B : 3% to 8% Slope
C : 8% to 15% Slope
C : 15% to 40% Slope

Br/A = Soil Series / Slope Phase

TP : Soil Test Pit

: Soil Boundary

STATE OF MAINE
Robert Vile
C.S.S. #201
CERTIFIED
SOIL SCIENTIST

ROBERT VILE
CSS#201

2018245(WF)-SOILS

2018245 FULL restore.dwg 2018245 WEST FORKS 10/16/2018 15:16:01 1 : 1

Exhibit 11-2: Geotechnical Feasibility Review Memorandum

249 Western Avenue
Augusta, ME 04330

207.621.7000 PHONE
207.621.7001 FAX

www.trcsolutions.com

Sent Via ProjectWise

October 17, 2018

Adam Desrosiers
Program Manager – NECEC Project
83 Edison Dr.
Augusta, ME 04336

RE: NECEC Kennebec River Crossing – HDD Conceptual Design
Geotechnical Feasibility Review
TRC Job No. 315641

Dear Mr. Desrosiers,

TRC is pleased to provide Avangrid (CMP) with the following information regarding the geotechnical feasibility of the proposed NECEC Kennebec River crossing. This review was performed to assess the suitability of using Horizontal Directional Drilling (HDD) for the Kennebec River crossing from the eastern termination station located in Moxie Gore, Somerset County, Maine to the western termination station in West Forks Plantation, Somerset County, Maine.

Bedrock Geology

According to the geologic map for the area[1], the project site is generally underlain by Devonian, massive, dark gray slate of the Carrabassett Formation. This slate may locally contain alternating thin beds of graywacke and pelite. The slate is steeply dipping (dip from 53º to 89º) with the bedding planes orientation (strike) approximately southwest to northeast.

The geologic map for the area indicates the easternmost portion of the crossing area may be underlain by Silurian, thinly bedded, gray-brown, dolostone, limestone, and calcareous siltstone of the Forks Formation, which grades upward into variegated, medium bedded, calcareous sandstone and phyllite. Silurian volcanic rock may be encountered near the contact with the Carrabassett Formation.

A copy of the bedrock geology map is included as an attachment.

1 Burroughs, W. and Marvinney, R.G., 1981, *Reconnaissance Bedrock Geology of the Forks Quadrangle, Maine*, Open File No. 81-10, Maine Geological Survey, Department of Conservation.

Surficial Materials Geology

The surficial materials at site appear to be soils of the Monson-Elliottsville-Knob Lock (MEK) complex or the Danforth-Elliottsville (DE) association[2]. Soils in the MEK complex are generally clayey silts with sand and the underlying bedrock is fairly shallow (i.e. two to seven feet below the ground surface). Soils in the DE association are generally gravelly, sandy silt or gravelly, silty sand and the underlying bedrock is expected to be more than seven feet below the ground surface.

Within the Kennebec River, the surficial materials are expected to consist of coarse sand to boulders. Based on observations from aerial photographs of the area, this stretch of the river is rapids, so surficial materials are expected to be less than five to ten feet beneath the water surface and the bedrock is expected to be fairly shallow.

Rock Mechanical Classification for HDD

When considering the overall effect on the drillability of bedrock, the following rock characteristics are considered to be important in understanding the feasibility of HDD:

- Hardness
- Abrasiveness
- Texture
- Structure
- Breaking characteristics

These characteristics are typically determined from the following rock properties obtained in a geotechnical investigation:

- Rock Quality Designation (RQD) – correlates with abrasiveness, texture, structure, and breaking characteristics,
- Core Run Percent Recovery – correlates with texture, structure, and breaking characteristics,
- Unconfined Compressive Strength (UCS) – correlates with texture and breaking characteristics, and
- Mohs Hardness – correlates with hardness and abrasiveness.

Although UCS values for bedrock in the Carrabassett and Forks Formations was not available, typical values for similar rocks in Vermont[3] indicate that the UCS will be in the range of 4,000 to 10,500 pounds per square inch (psi), with the expected UCS to be about 6,000 to 8,000 psi.

Based on past experience with similar formations, the RQD and core recovery have been in the range of 50% to 80% and 12 to 50 inches, respectively, for NQ or NX rock cores (approximately 2 inches in diameter) obtained with a five-foot long core barrel.

---

[2] NRCS. 2018. Soil Map—Somerset County Area and Parts of Franklin and Oxford Counties, Maine, Web Soil Survey National Cooperative Soil Survey, U.S. Department of Agriculture, Natural Resources Conservation Service

[3] Thomas, E.J. and Eliassen, T.D. 2015. *Unconfined Compressive Strengths of Vermont Rock, State of Vermont*, Agency of Transportation, Construction and Materials Bureau, Geotechnical Engineering Division.

The majority of rock in the Carrabassett and Forks Formations is expected to be relatively unweathered and the hardness is expected to be moderately soft to hard.

Based on the estimated rock properties and characteristics for the bedrock that will be encountered by HDD for the Kennebec River crossing, HDD appears to be feasible. However, Maine Directional Boring Contractors notes on their website that a tricone bit may be required to drill through the bedrock[4].

HDD in Maine

An internet search identified several HDD contractors in New England, including contractors in Maine. Their websites indicate that they have experience performing HDD in Maine's geology and with HDD through bedrock in particular.

These firms include:

- Enterprise Trenchless Technologies, Inc.
- Maine Boring Contractors
- Henniker Directional Drilling, LLC
- Northeast Directional Drilling.

Conclusions

Based on our review of the available information regarding the geology of the NECEC Kennebec River crossing site, HDD appears to be a feasible technology for the installation of the power transmission lines under the river. Although the surficial and bedrock geology do not appear to impose constraints on using HDD, site-specific information regarding the soils and, especially, the underlying bedrock at the site will need to be obtained. Therefore, a suitable geotechnical investigation, including borings with rock cores adjacent to the proposed HDD alignment, should be conducted and testing of the rock materials should be performed. In this investigation, rock coring should be conducted to a depth of at least 20 feet below the depth of the alignment to properly characterize the bedrock.

We sincerely appreciate this opportunity and hope the information provided herein is in line with your expectations. Should you have any questions regarding this information, please feel free to contact me at (207) 620-3886 or via email at wnarinvancourt@trcsolutions.com.

Sincerely,

Wade A. Narin van Court, PhD, PE
Geotechnical Engineer

Attachments:
Reconnaissance Bedrock Geology of the Forks Quadrangle, Maine

[4] http://maineboringcontractors.com/services/hard-rock-maine-directional-boring/

12.0 STORMWATER MANAGEMENT

The stormwater narrative, calculations and plans for the Moxie Gore and West Forks termination stations are provided as Exhibit 12-1.

Exhibit 12-1: Stormwater Plans

STORMWATER MANAGEMENT REPORT

Prepared for the

CENTRAL MAINE POWER COMPANY
NEW ENGLAND CLEAN ENERGY CONNECT
KENNEBEC RIVER CROSSING TRANSITION STATIONS

Location

West Forks Plantation &
Moxie Gore,
Maine 04985

Owner

Central Maine Power Company
83 Edison Drive
Augusta, Maine 04336

Prepared by

6 Ashley Drive
Scarborough, ME 04074
(207) 274-2631
October 2018

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12.2.1 *Kennebec River Crossing HDD Transition Stations Project*

The purpose of this section is to describe and quantify the pre- and post-development stormwater characteristics and to demonstrate that construction of the new HDD Transition Stations will comply with the applicable Maine Department of Environmental Protection (MDEP) Chapter 500 stormwater management requirements. The stormwater management system for this development must meet the Basic Standards, General Standards, and Flooding Standards of Chapter 500.

The HDD Transition Stations will be located within the transmission line right of way on both sides of the Kennebec River Gorge. A transition station is required for each side of the crossing to convert the transmission line from overhead to underground. The eastern transition station will be located in Moxie Gore, Somerset County, Maine, as shown on the plans. The western transition station will be located in West Forks Plantation, Somerset County, Maine, as shown on the plans. The transition stations will be identical in size, measuring 135 feet x 135 feet and will be built to substation yard specifications. Each transition station will have a gravel access road constructed which will connect to existing logging roads. The West Forks transition station (West Forks Station) will occupy approximately 0.77 acre of the 300-foot wide right of way owned by Central Maine Power Company (CMP). The Moxie Gore transition station (Moxie Gore Station) will occupy approximately 0.72 acre within the transmission right of way owned by CMP.

The new transition stations will be located on sites that are primarily thickly wooded with some scrub/shrub vegetation.

At the West Forks Station, approximately 2.48 acres of right of way will be disturbed during construction. The land disturbance will be required for the access road, transition station and the temporary working platform/laydown yard for the HDD receiving site.

Following construction, approximately 1.43 acres of the disturbed area will be restored and revegetated. Approximately 1.03 acres will remain as a permanently developed area and will contain the new transition station yard, access road, and associated impervious areas (foundations and steel structures).

For the Moxie Gore Station, approximately 2.30 acres of right of way will be disturbed during construction. The land disturbance will be required for the access road, transition station and the temporary working platform for the HDD drill operations site.

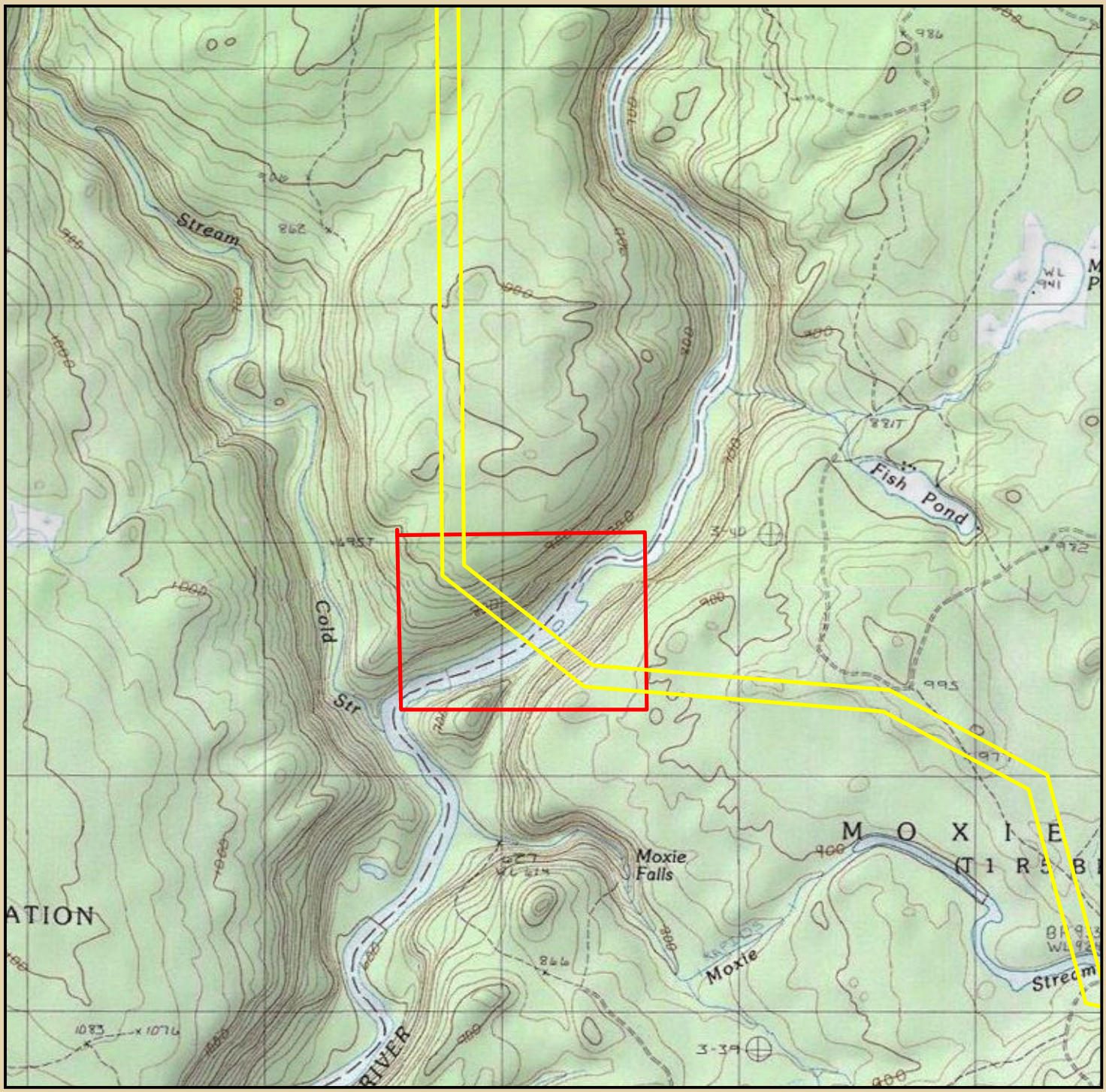
Following construction, approximately 1.44 acres of the disturbed area will be restored and revegetated. Approximately 0.86 acre will remain as a permanently developed area and will contain the new transition station yard, access road, and associated impervious areas (foundations and steel structures).

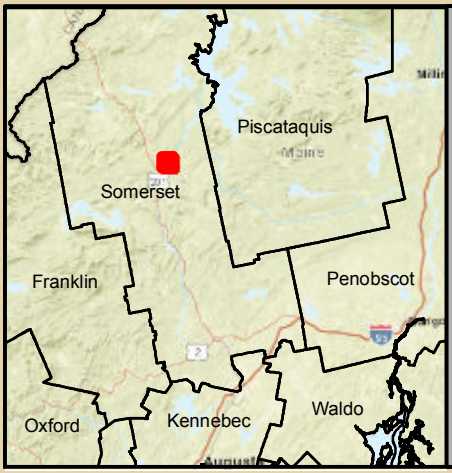
12.2.1.1 Surface Water on or Abutting the Site

There are no water bodies on the project site. The Kennebec River is approximately 1,500 feet from both sites.

Exhibit 12-1

Figure 12-1. Site Location Map





NECEC Project Area

HDD Crossing Location

N

0 0.25 0.5

Miles

Sources: ESRI, CMP, MEGIS, TRC

Map Coordinate System:
NAD 1983 UTM Zone 19N

CENTRAL MAINE POWER

New England Clean Energy Connect

Location of the Kennebec Gorge HDD Crossing

Created:
10/5/2018

TRC

14 Gabriel Drive
Augusta, ME 04330

12.2.1.2 Downstream Ponds and Lakes

The transition stations are not located in the watershed of a "Lake Most at Risk from Development" or an "Urban Impaired Stream," as defined in Chapter 502. The two sites are located on either side of the Kennebec River as shown on Exhibit 12-1.

12.2.1.3 General Topography

The topography of the land surface for the West Forks Station site ranges from 5 to 28 percent slope, generally draining from northeast to southwest. Elevations across the site range from approximately 972 to 900 feet above mean sea level

The topography of the land surface for the Moxie Gore Station site ranges from 3 to 25 percent slope, generally draining from east to west. Elevations across the area site range from approximately 911 to 872 feet above mean sea level.

Contour information for both sites were obtained from LiDAR data provided by CMP.

12.2.1.4 Flooding

There are no apparent flooding concerns for the two Transition Stations locations. Based on the available FEMA information the stations are located within an unmapped area of Maine.

12.2.1.5 Alterations to Natural Drainage Ways

Alterations to natural drainage ways are not required.

12.2.1.6 Alterations to Land Cover Within the Watershed

The West Forks Station and associated access road will consist of approximately 0.17 acre of new impervious areas (gravel roads, foundations, and concrete pads). The crushed stone switchyard will cover approximately an additional 0.47 acre.

The Moxie Gore Station and associated access road will consist of approximately 0.09 acre of new impervious areas (gravel roads, foundations, and concrete pads). The crushed stone switchyard will cover approximately an additional 0.47 acre.

A summary of the pre- and post-development cover types within the subcatchment analyzed is presented in Table 12-1.

Table 12-1. West Forks Station - Watershed Cover Types

Cover Type	Pre-development Area, acres	Post-development Area, acres	Net Change, acres
Foundations/Pads	0.00	0.01	0.01
Gravel	0.00	0.15	0.15
Yard Surface (crushed stone)	0.00	0.47	0.47
Woods	5.89	4.92	(-)0.97
Brush	0.14	0.48	0.34
Total Area	**6.03**	**6.03**	**0.00**

Table 12-2. Moxie Gore Station - Watershed Cover Types

Cover Type	Pre-development Area, acres	Post-development Area, acres	Net Change, acres
Foundations/Pads	0.00	0.01	0.01
Gravel	0.25	0.38	0.13
Yard Surface (crushed stone)	0.00	0.47	0.47
Woods	11.57	10.71	(-)0.86
Brush	0.58	0.83	0.25
Total Area	**12.40**	**12.40**	**0.00**

12.2.1.7 Modeling Assumptions

The stormwater runoff was estimated using HydroCAD, Version 10.0. HydroCAD is based on methodologies developed by the United States Department of Agriculture Soil Conservation Service (USDA-SCS), namely *Urban Hydrology for Small Watersheds*, Technical Release 55 and Technical Release 20 (TR-55 and TR-20), in combination with other hydraulic and hydrologic calculations. Based on site specific information and rainfall data, the program estimates inflow and outflow hydrographs for a subcatchment. The USDA-SCS is now called the Natural Resources Conservation Service (USDA-NRCS).

The pre- and post-development subcatchment boundaries and hydrologic flow lines used to determine the times of concentration are indicated on the Pre- and Post-Development Drainage Plans located in Appendix 12-2. Within the areas proposed to be developed, the subcatchment boundaries were determined from the surveyed (LiDAR) one-foot contours. Subcatchment boundaries outside areas proposed for development were determined from two-foot contours extrapolated from the USGS topographic quadrangle map. The times of concentration were determined from the surveyed contour information.

The pre- development stormwater analysis for the West Forks Station consists of one subcatchment (1S) totaling approximately 6.03 acres in size. The Post-development consists, of two subcatchments (1S & 1SA) totaling approximately 6.03 acres in size. For the pre-development stormwater analysis for Moxie Gore Station there is one subcatchment (2S) totaling approximately 12.40 acres in size. The Post-development consists, of two subcatchments (2S & 2SA) totaling approximately 12.40 acres in size.

Both sites use study points (SPx) as the boundary node for the subcatchment for the pre- and post-development analysis. Control points are located at the down slope intersection of the Tc hydrologic flow lines and the subcatchment boundaries.

The results of the pre- and post-development site runoff analyses are shown and compared in Tables 12-3 through 12-8, located in Section 12.5: Runoff Analysis.

Storm events modeled for the pre- and post-development analyses assumed precipitation events with a 24-hour duration having a type II distribution and rainfall amounts of 2.44, 3.80, and 4.23 inches, with return frequencies of 2-, 10-, and 25-years, respectively. The storm type and rainfall amounts are based on the NOAA Atlas 14, Volume 10, Version 2, Point Precipitation Frequency Estimates.

Additional assumptions made to complete the pre- and post-development runoff analysis are provided in Section 12.5.

12.3 MAPS

12.3.1 *USGS Quadrangle Map with Site Boundaries (Exhibit 12-1)*

An excerpt from the USGS Quadrangle map (scale 1:24,000) with the site boundaries shown is provided as Exhibit 12-1.

12.3.2 *Watershed Map (Exhibit 12-3)*

A watershed map is provided as Exhibit 12-3.

12.3.3 *NRCS Soils Map*

An excerpt from the USDA-NSCS Soils Survey Map is provided in Appendix 12-1.

12.4 DRAINAGE PLANS

The Pre-Development Watershed Plans and the Post-Development Watershed Plans for the proposed project are provided in Appendix 12-2. The plans include contours, land cover types, soil groups, subcatchment boundaries and analysis points, hydrologic flow lines, time of concentration flow lines, existing features, and drainage ways where applicable. The Post-Development Watershed Plans include the locations of proposed buildings, roads, and stormwater management structures.

12.5 RUNOFF ANALYSIS

The pre- and post-development stormwater analysis calculations are provided in Appendix 12-1. The runoff routing calculations were performed with the use of HydroCAD Version 10.0 software. The analyses include computations for determining the runoff curve numbers (CN values) for the pre- and post-development subcatchments and the HydroCAD output, which includes peak discharge calculations for the 24-hour storms of 2- 10-, and 25-year frequencies and routing calculations.

A summary of the pre- and post-development peak runoff at the control points is provided in Table 12-3 through 12-8.

Exhibit 12-4

Figure 12-4. NRCS Soils Survey Map

Table 12-3. Pre-Development Peak Runoff by Subcatchment

West Forks Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP1	Total
2-Year	0.85	0.85
10-Year	4.02	4.02
25-Year	5.30	5.30

Table 12-4. Post-Development Peak Runoff by Subcatchment

West Forks Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP1	Total
2-Year	0.79	0.79
10-Year	3.78	3.78
25-Year	4.99	4.99

Table 12-5. Net Change in Peak Runoff by Subcatchment

West Forks Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP1	Total
2-Year	(-)0.06	(-)0.06
10-Year	(-)0.24	(-)0.24
25-Year	(-)0.31	(-)0.31

Table 12-6. Pre-Development Peak Runoff by Subcatchment

Moxie Gore Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP2	Total
2-Year	1.83	1.83
10-Year	7.94	7.94
25-Year	10.38	10.38

Table 12-7. Post-Development Peak Runoff by Subcatchment

Moxie Gore Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP2	Total
2-Year	1.76	1.76
10-Year	7.70	7.70
25-Year	10.10	10.10

Table 12-8. Net Change in Peak Runoff by Subcatchment

Moxie Gore Station Discharge Rates, cfs		
Storm Frequency	Boundary Node SP2	Total
2-Year	(-)0.07	(-)0.07
10-Year	(-)0.24	(-)0.24
25-Year	(-)0.28	(-)0.28

West Forks Station

The calculations show a net decrease to peak runoff rates in every storm event for the West Forks Station from the pre-development condition to the post developed condition.

Moxie Gore Station

The calculations show a net decrease to peak runoff rates in every storm event for the Moxie Gore Station from the pre-development condition to the post developed condition.

A summary of each node is as follows:

Study Point SP1 (West Forks Station)

Node SP1 is located on the southwest side of the CMP right of way. Node SP1 shows a 6 percent decrease in runoff following a 25-year, 24-hour storm event in the post-development condition. Most of the decrease can be attributed to the runoff curve number being lower because of the increased infiltration of stormwater into the gravel/crushed stone surface of the switchyard placed on top of the existing soils.

Study Point SP2 (Moxie Gore Station)

Node SP2 is located on the South side of the CMP right of way. Node SP2 shows a 3 percent decrease in runoff following a 25-year, 24-hour storm event in the post-development condition. Most of the decrease can be attributed to the runoff curve number being lower because of the increased infiltration of stormwater into the gravel/crushed stone surface of the switchyard placed on top of the existing soils.

Curve Number Computations

A summary of the land cover types, hydrologic soil group (HSG), and curve numbers for the pre- and post-development subcatchments are provided in the stormwater calculation package in Appendix 12-1. Cover types for the impacted area were determined from the topographic field survey and a site visit and are indicated on the Pre- and Post-Development Watershed Plans.

The soils and hydrologic soil group information for the project study area are based on the Web Soil Survey mapping obtained from the USDA-NRCS *Soil Survey of Somerset County Area, Maine dated September 2017*. The soils and hydrologic soil groups within the runoff analysis areas are shown on the Pre- and Post-Development Watershed Plans.

The runoff curve numbers were developed from Appendix A-12: "Runoff Curve Numbers for use in TR-55 and TR-20" of the MDEP *Maine Stormwater Best Management Practices Manual, Volume III* and HydroCAD, based on the observed cover types and hydrologic soil groups. The only curve number that is not referenced directly from TR55 and TR20 is the one used for the switchyard. An engineering study was conducted by TRC Environmental Corporation (TRC), detailing the "typical" cross section and surface materials of a switchyard covered with gravel and crushed stone to calculate its permeability rate. The study was reviewed by John Simon, a USDA-NRCS engineer in Maine. The conclusions of this report were used as the basis of an agreement between CMP and MDEP that a CN value of 55 may be used for switchyards that are mapped as HSG "A", "B", "C", and a CN value of 60 must be used when the area is mapped as HSG "D". A copy of the letter agreement is included at the back of the stormwater calculations (Appendix 12-1).

12.5.1 *Time of Concentration Calculations*

Times of concentration were calculated using USDA-SCS TR-55 methodologies for each subcatchment considering the hydrologic flow lengths, slope, vegetative cover, surface roughness, and each stage-storage relationship. The type and length of each hydrologic flow line for determining time of concentration and travel times in the area to be developed are indicated on the Pre- and Post-Development Drainage Plans. The maximum sheet flow length used for this analysis was 150 feet. For flow lengths beyond 150 feet were assumed to be shallow concentrated flows. Shallow concentrated flow lengths varied for each subcatchment and were extended until they reached the end of the subcatchment or concentrated flow channel. A summary of the input data used to estimate the time of concentration for each subcatchment is provided in the calculation package.

12.5.2 *Travel Time Calculations*

The travel time for each subcatchment was calculated using a spreadsheet based on equations prepared by the USDA-NRCS. These times were then input directly into HydroCAD. The calculation spreadsheets are included in Appendix 12-1.

12.5.3 *Peak Discharge Calculations*

Peak discharge calculations are included in the HydroCAD output. A summary comparison of pre- and post-development peak discharge calculations at each boundary node is presented in Section 12.5, above.

12.5.4 *Reservoir Routing Calculations*

Reservoir routing calculations are included in the HydroCAD output. The "dynamic storage-indication" method was used in the post development analysis. This method recalculates the water surface elevation based on the downstream tailwater condition when performing the routing calculations.

12.6 FLOODING STANDARD

12.6.1 *Variance Submissions*

A variance from the peak flow standard is not necessary for the proposed transition stations. As determined in the pre-application meeting with MDEP staff and documented in the CMP/MDEP agreement letter, water quantity control is not necessary since there is a decrease in runoff, compared to the existing conditions, due to the greater infiltration properties (lower CN value) of the gravel and crushed stone switchyard surface, as compared to the native soils. In addition, the proposed stormwater management system will include several forested treatment buffers adjacent to the level spreaders to retain the pre-development flow regime. As stated previously, the runoff from the developed site will not adversely affect downstream properties.

12.6.2 *Sizing of Storm Drains and Culverts*

The calculations for the sizing of proposed culverts under the access road and other conveyance structures are presented in the stormwater calculation package (Appendix 12-1). The proposed culverts, conveyance swales and level spreader are designed to manage the limited runoff from the access road and switchyard without creating erosive velocities. Detailed drawings for the proposed on-site conveyance structures, including vegetated drainage swales, culverts with inlet and outlet protection, the level spreader and the forested buffers, are shown on the Post-Development Watershed Plan, Site Grading Sections & Details drawings located in Appendix 12-2. Stabilization methods are designed, and will be constructed and maintained in accordance with CMP's *Environmental Guidelines for Construction and Maintenance Activities on Transmission Line and Substation Projects*, dated June 2018 (the CMP's Environmental Guidelines), which is consistent with the *Maine Erosion and Sedimentation Control BMPs*, dated March 2016. Please refer to Section 14: Basic Standards Submissions for a detailed description of the site-specific erosion control measures and practices to be utilized during construction of the switchyard.

12.6.3 *Stormwater Ponds*

Stormwater ponds are not required for runoff treatment or attenuation. As discussed with MDEP staff, facilities (such as substations and termination stations) built to the specifications in the 2008 CMP/MDEP agreement letter will meet the required General Standards and will not necessitate any further treatment of runoff. The use of vegetated swales in conjunction with the level spreaders and forested buffers will be used to collect and treat the runoff from the termination station access roads. The use of on-site vegetated buffers will be maximized to allow for improved natural sheet flow.

12.6.4 *Infiltration Systems*

No infiltration systems are proposed for this project.

12.6.5 *Drainage Easement Declarations*

The proposed stormwater buffers are located entirely on CMP property associated with the Site Location of Development Act (SLODA) permit issued for this project. As a result, any alteration of these buffer areas will require review and approval by the MDEP. No drainage easements are needed. All vegetated buffers shown on the plans will be protected by deed restrictions (Declaration of Restrictions, per MDEP Chapter 500) applied to these areas.

12.7 STORMWATER QUALITY TREATMENT PLAN

12.7.1 *Basic Standards Submissions*

In accordance with the Basic Standards, the proposed switchyard, access road, and associated features will be constructed and stabilized using erosion and sedimentation (E&S) Best Management Practices (BMPs). The site will receive routine maintenance to ensure their continued function and to prevent or correct erosion problems. A level spreader is provided at the northwest corner of the switchyard to return concentrated flows from collector swales along the sides of the yard to non-erosive sheet flows. During and after construction at the Transition Stations, CMP's E&S Plan will be utilized to prevent erosion from occurring, as well as to correct any problems that may develop. The CMP's Environmental Guidelines updated and provided to the MDEP in June 2018, incorporates the applicable procedures of the *Maine Erosion and Sediment Control BMPs*, dated March 2016. The CMP's Environmental Guidelines contains the details and specifications for general stabilization measures to be used during construction and stabilization of the switchyard. These measures will be used to protect exposed soils during construction and during the service life of the project.

The stabilization measures for the site will include temporary and permanent erosion and sedimentation controls; appropriate design of swales, culverts, and erosion protection for earthen cut and fill slopes; and provisions for future maintenance of the site. The vegetated swales, culverts, buffers and level spreader design calculations are included in Appendix 12-3.

12.7.2 *General Standard Submissions*

Since the proposed development is part of a Site Law project compliance with the General Standards is required. Runoff from the gravel access roadway will be treated by the use of level spreaders and vegetated treatment buffers. MDEP staff has stated that as long as the facilities are built to the specifications in the 2008 CMP/MDEP agreement letter, the General Standard requirements will be met for these termination stations and no further water quality treatment of stormwater from the yard itself is required.

12.7.3 *Phosphorus Control Plan*

The transition station are not located in a lake watershed. Therefore, a Phosphorus Control Plan is not required for this application.

12.7.4 *Off-Site Credits*

Off-site credits for total suspended solids (TSS) or phosphorus are not required for the proposed switchyard.

12.7.5 *Runoff Treatment Measures*

The drainage design for this project includes vegetated conveyance swales along the access road that will collect and direct runoff to level spreaders which are adjacent to a forested buffer per the MDEP manual *Design of Stormwater Best Management Practices,* October 2016. The level spreader will convert the channelized flow to sheet flow prior to the runoff leaving the site. The transition stations will provide water quality treatment because they will be built in accordance with the materials and specifications shown on the drawings; *i.e.*, 6 inches of crushed stone on top of 18 inches of the Maine Department of Transportation (MDOT) 703.06 Type A gravel fill. The cross section and materials incorporated in this design exceed the specifications in the CMP/MDEP agreement letter.

12.7.6 *Control Plan for Thermal Impacts to Coldwater Fisheries*

Due to the use of vegetated buffers for treatment of runoff, there will be no thermal impacts.

12.7.7 *Control Plan for Other Pollutants*

A control plan for other pollutants in stormwater runoff is not required.

12.7.8 *Engineering Inspection of Stormwater Management Facilities*

CMP ensures that a qualified engineer will inspect the construction site periodically to verify that the transition stations, stormwater conveyance swales and level spreader are constructed in accordance with the plans and specifications shown on the design drawings, and that these structures are functioning properly. These inspections will commence with the initial earth moving activities on the site and will continue, as needed, during any period when construction activity affecting the stormwater management system occurs, until the site is permanently stabilized.

Additional inspections of the site will be conducted during and after construction to evaluate and maintain the condition and effectiveness of stormwater management structures and erosion and sedimentation control measures. BMPs for erosion control and stormwater pollution prevention during construction will include weekly (minimum) or more frequent inspections and maintenance of items such as temporary and permanent erosion control measures; stabilization of the switchyard site, road ditches, and the ROW; and to correct any erosion or sedimentation that is occurring. The inspection and maintenance of erosion control measures are described in more detailed in CMP's Environmental Guidelines (Update provided to MDEP in June 2018).

12.8 COMPONENTS OF KENNEBEC RIVER GORGE HDD TRANSITION STATIONS POST-CONSTRUCTION STORMWATER MAINTENANCE PLAN

Both of the transition stations will be owned, operated, and maintained by Central Maine Power Company.

12.8.1 *Facilities to be Maintained*

The stormwater management facilities to be maintained at the West Forks and the Moxie Gore Stations include:

- Stormwater conveyance swales and level spreader associated with the access road and transition stations;
- Culverts with inlet and outlet protection;
- Permanent access roads;
- Transition station surface (crushed stone);
- Revegetated areas and embankments; and
- Water quality treatment buffers.

12.8.2 *General Inspection and Maintenance Requirements*

The proposed facility will be operated and maintained in a manner consistent with good utility practices, including monthly on-site substation inspections and maintenance of stormwater management system components, as needed. A post-construction maintenance and inspection log is provided in Appendix 12-3.

Maintenance issues associated with specific areas and facilities at the substation are identified in the following sections.

12.8.2.1 Drainage Conveyance Systems

The vegetated swales, level spreader, and culverts will be inspected on a quarterly basis. Any signs of existing or developing blockage of flow, trash, erosion, channeling or excessive buildup of sediment will be removed/repaired, as needed. Vegetated swales and other vegetated structures will be mowed or otherwise maintained to control the growth of woody vegetation within the channel, but no more than once per year.

12.8.2.2 Roadways

The access roadway will typically require little on-going maintenance, owing to the limited use by heavy vehicles. These areas will be inspected quarterly, and signs of existing or developing erosion, rutting, trash or unwanted vegetation will be removed/repaired as needed.

12.8.2.3 Transition Station Surface

The transition station surfaces will be inspected quarterly. Any signs of existing or developing erosion, rutting, trash, or unwanted vegetation within the switchyard will be removed/repaired as needed.

12.8.2.4 Revegetated Areas and Embankments

Revegetated areas and embankments will be inspected quarterly. Any signs of erosion or inadequate revegetation of these areas will be corrected as needed.

12.8.2.5 Water Quality Treatment Buffers

Quarterly inspections of the water quality treatment buffers will be made to ensure the integrity of the undisturbed, forested buffers. Any signs of developing erosion will be repaired and revegetated as needed.

APPENDIX 12-1

Stormwater Calculation Package

CENTRAL MAINE POWER COMPANY
NECEC
KENNEBEC RIVER GORGE TRANSITION STATIONS
STORMWATER CALCULATIONS
OCTOBER 2018

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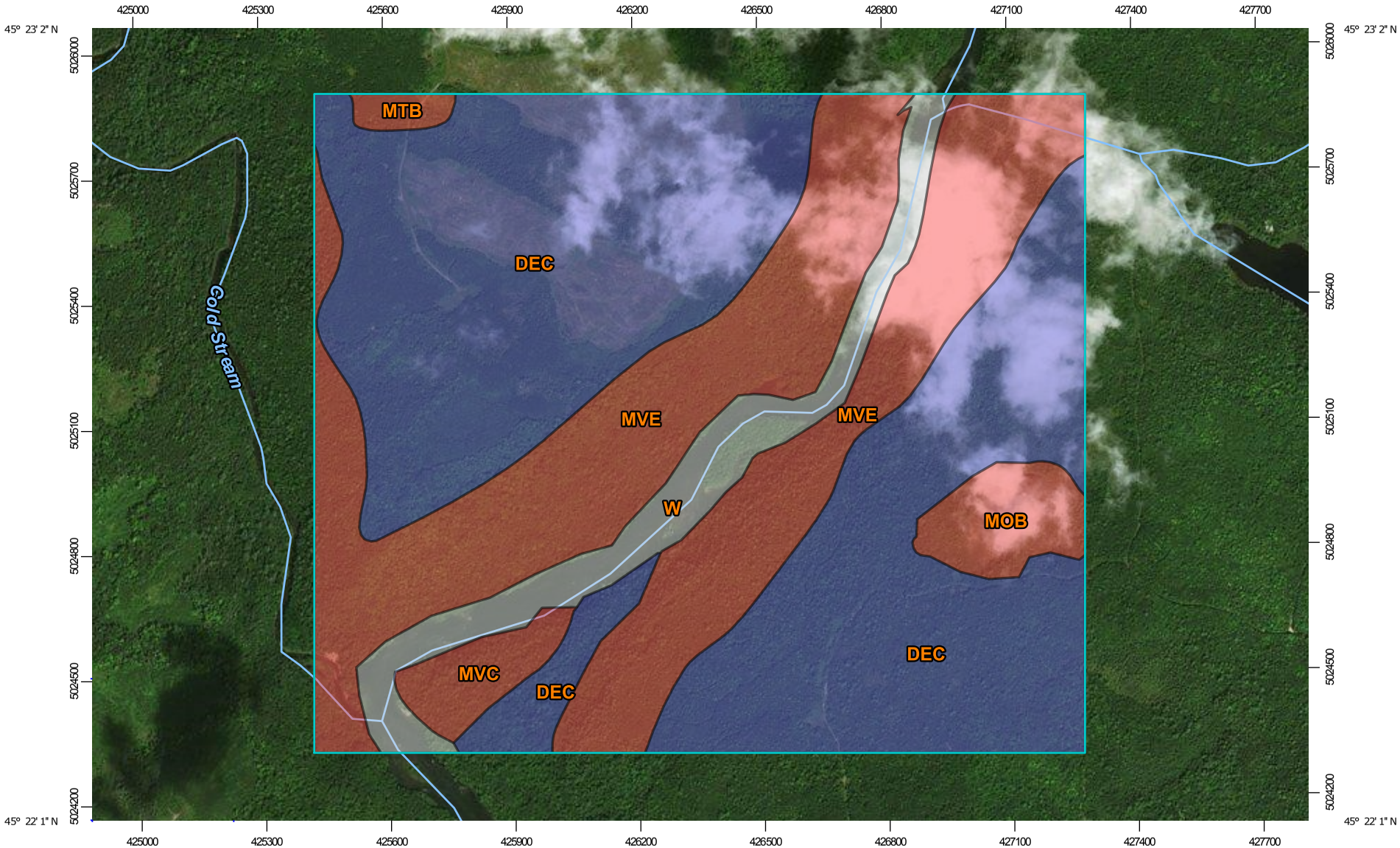
Hydrologic Soil Group—Somerset County Area and Parts of Franklin and Oxford Counties, Maine
(Kennebec Crossing)



Map Scale: 1:13,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 150 300 600 900

Feet
0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Somerset County Area and Parts of Franklin and Oxford Counties, Maine
Survey Area Data: Version 22, Sep 11, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 24, 2014—Sep 21, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
DEC	Danforth-Elliottsville association, 3 to 15 percent slopes	B	393.6	54.1%
MOB	Monarda-Burnham complex, 0 to 3 percent slopes, very stony	D	21.1	2.9%
MTB	Monarda-Telos complex, 0 to 8 percent slopes, very stony	D	4.9	0.7%
MVC	Monson-Elliottsville-Knob Lock complex, 8 to 30 percent slopes, very rocky	D	15.6	2.1%
MVE	Monson-Elliottsville-Knob Lock complex, 30 to 60 percent slopes, very rocky	D	238.4	32.8%
W	Water bodies		53.4	7.3%
Totals for Area of Interest			**727.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 10, Version 2
Location name: Town of Moxie Gore, Maine, USA*
Latitude: 45.3731°, Longitude: -69.9425°
Elevation: 618.28 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.255** (0.203-0.317)	**0.309** (0.245-0.383)	**0.396** (0.313-0.493)	**0.468** (0.368-0.586)	**0.567** (0.430-0.739)	**0.644** (0.477-0.856)	**0.720** (0.517-0.990)	**0.815** (0.552-1.14)	**0.941** (0.611-1.36)	**1.04** (0.656-1.53)
10-min	**0.362** (0.288-0.449)	**0.437** (0.347-0.543)	**0.560** (0.443-0.698)	**0.663** (0.521-0.830)	**0.803** (0.609-1.05)	**0.912** (0.676-1.21)	**1.02** (0.732-1.40)	**1.16** (0.782-1.62)	**1.33** (0.866-1.93)	**1.47** (0.929-2.16)
15-min	**0.426** (0.338-0.528)	**0.514** (0.408-0.639)	**0.659** (0.521-0.822)	**0.780** (0.613-0.976)	**0.945** (0.717-1.23)	**1.07** (0.795-1.43)	**1.20** (0.861-1.65)	**1.36** (0.920-1.91)	**1.57** (1.02-2.27)	**1.73** (1.09-2.55)
30-min	**0.570** (0.453-0.708)	**0.689** (0.547-0.856)	**0.883** (0.698-1.10)	**1.04** (0.820-1.31)	**1.26** (0.959-1.65)	**1.44** (1.06-1.91)	**1.61** (1.15-2.21)	**1.82** (1.23-2.55)	**2.10** (1.36-3.03)	**2.31** (1.46-3.40)
60-min	**0.715** (0.569-0.888)	**0.864** (0.686-1.07)	**1.11** (0.875-1.38)	**1.31** (1.03-1.64)	**1.58** (1.20-2.07)	**1.80** (1.33-2.39)	**2.01** (1.44-2.76)	**2.28** (1.54-3.19)	**2.62** (1.70-3.80)	**2.89** (1.83-4.26)
2-hr	**0.947** (0.757-1.17)	**1.11** (0.888-1.37)	**1.38** (1.10-1.71)	**1.60** (1.27-2.00)	**1.91** (1.46-2.48)	**2.15** (1.61-2.85)	**2.38** (1.73-3.28)	**2.72** (1.85-3.78)	**3.15** (2.06-4.53)	**3.49** (2.22-5.10)
3-hr	**1.10** (0.886-1.36)	**1.28** (1.03-1.58)	**1.58** (1.26-1.94)	**1.82** (1.45-2.25)	**2.15** (1.66-2.79)	**2.41** (1.82-3.19)	**2.67** (1.95-3.66)	**3.05** (2.08-4.22)	**3.55** (2.32-5.07)	**3.93** (2.50-5.71)
6-hr	**1.40** (1.13-1.71)	**1.63** (1.31-1.99)	**1.99** (1.61-2.44)	**2.30** (1.84-2.83)	**2.72** (2.10-3.49)	**3.05** (2.31-3.99)	**3.37** (2.48-4.59)	**3.84** (2.64-5.28)	**4.47** (2.94-6.33)	**4.94** (3.17-7.13)
12-hr	**1.73** (1.41-2.09)	**2.03** (1.65-2.46)	**2.52** (2.04-3.06)	**2.93** (2.36-3.58)	**3.49** (2.71-4.44)	**3.92** (2.98-5.09)	**4.36** (3.20-5.85)	**4.94** (3.41-6.73)	**5.71** (3.77-8.02)	**6.29** (4.05-9.00)
24-hr	**2.08** (1.70-2.50)	**2.44** (2.00-2.94)	**3.04** (2.48-3.68)	**3.54** (2.87-4.30)	**4.23** (3.30-5.33)	**4.76** (3.63-6.11)	**5.29** (3.89-7.01)	**5.94** (4.12-8.03)	**6.81** (4.52-9.49)	**7.47** (4.83-10.6)
2-day	**2.46** (2.03-2.94)	**2.86** (2.35-3.41)	**3.51** (2.88-4.21)	**4.05** (3.30-4.88)	**4.79** (3.76-5.98)	**5.36** (4.11-6.81)	**5.94** (4.38-7.78)	**6.61** (4.61-8.85)	**7.49** (5.00-10.3)	**8.16** (5.30-11.5)
3-day	**2.74** (2.27-3.25)	**3.15** (2.61-3.76)	**3.84** (3.17-4.59)	**4.41** (3.61-5.29)	**5.19** (4.09-6.44)	**5.79** (4.45-7.32)	**6.39** (4.73-8.32)	**7.08** (4.96-9.44)	**7.99** (5.36-11.0)	**8.68** (5.65-12.1)
4-day	**2.97** (2.47-3.53)	**3.41** (2.83-4.05)	**4.13** (3.41-4.92)	**4.72** (3.88-5.65)	**5.54** (4.38-6.85)	**6.17** (4.75-7.77)	**6.80** (5.04-8.81)	**7.51** (5.27-9.97)	**8.44** (5.67-11.6)	**9.14** (5.97-12.8)
7-day	**3.60** (3.01-4.24)	**4.08** (3.41-4.82)	**4.88** (4.06-5.77)	**5.54** (4.57-6.59)	**6.44** (5.11-7.91)	**7.14** (5.52-8.91)	**7.84** (5.82-10.1)	**8.57** (6.05-11.3)	**9.54** (6.44-13.0)	**10.3** (6.73-14.2)
10-day	**4.19** (3.52-4.93)	**4.71** (3.95-5.55)	**5.57** (4.64-6.57)	**6.27** (5.20-7.43)	**7.24** (5.76-8.85)	**7.99** (6.19-9.92)	**8.74** (6.50-11.1)	**9.48** (6.71-12.4)	**10.4** (7.07-14.1)	**11.2** (7.34-15.4)
20-day	**6.00** (5.07-7.01)	**6.61** (5.57-7.72)	**7.59** (6.38-8.89)	**8.40** (7.02-9.89)	**9.53** (7.62-11.5)	**10.4** (8.09-12.7)	**11.3** (8.38-14.1)	**12.0** (8.54-15.6)	**12.9** (8.80-17.3)	**13.6** (9.00-18.6)
30-day	**7.49** (6.35-8.70)	**8.16** (6.91-9.49)	**9.25** (7.81-10.8)	**10.2** (8.52-11.9)	**11.4** (9.17-13.7)	**12.4** (9.66-15.1)	**13.3** (9.95-16.6)	**14.1** (10.1-18.2)	**15.0** (10.3-20.0)	**15.8** (10.4-21.4)
45-day	**9.30** (7.92-10.8)	**10.1** (8.56-11.7)	**11.3** (9.59-13.1)	**12.4** (10.4-14.4)	**13.8** (11.1-16.5)	**14.9** (11.7-18.1)	**16.0** (12.0-19.8)	**16.8** (12.1-21.6)	**17.8** (12.2-23.6)	**18.6** (12.3-25.2)
60-day	**10.8** (9.22-12.4)	**11.6** (9.94-13.4)	**13.0** (11.1-15.1)	**14.2** (12.0-16.5)	**15.8** (12.8-18.8)	**17.0** (13.4-20.6)	**18.3** (13.7-22.5)	**19.1** (13.8-24.6)	**20.3** (13.9-26.8)	**21.1** (14.1-28.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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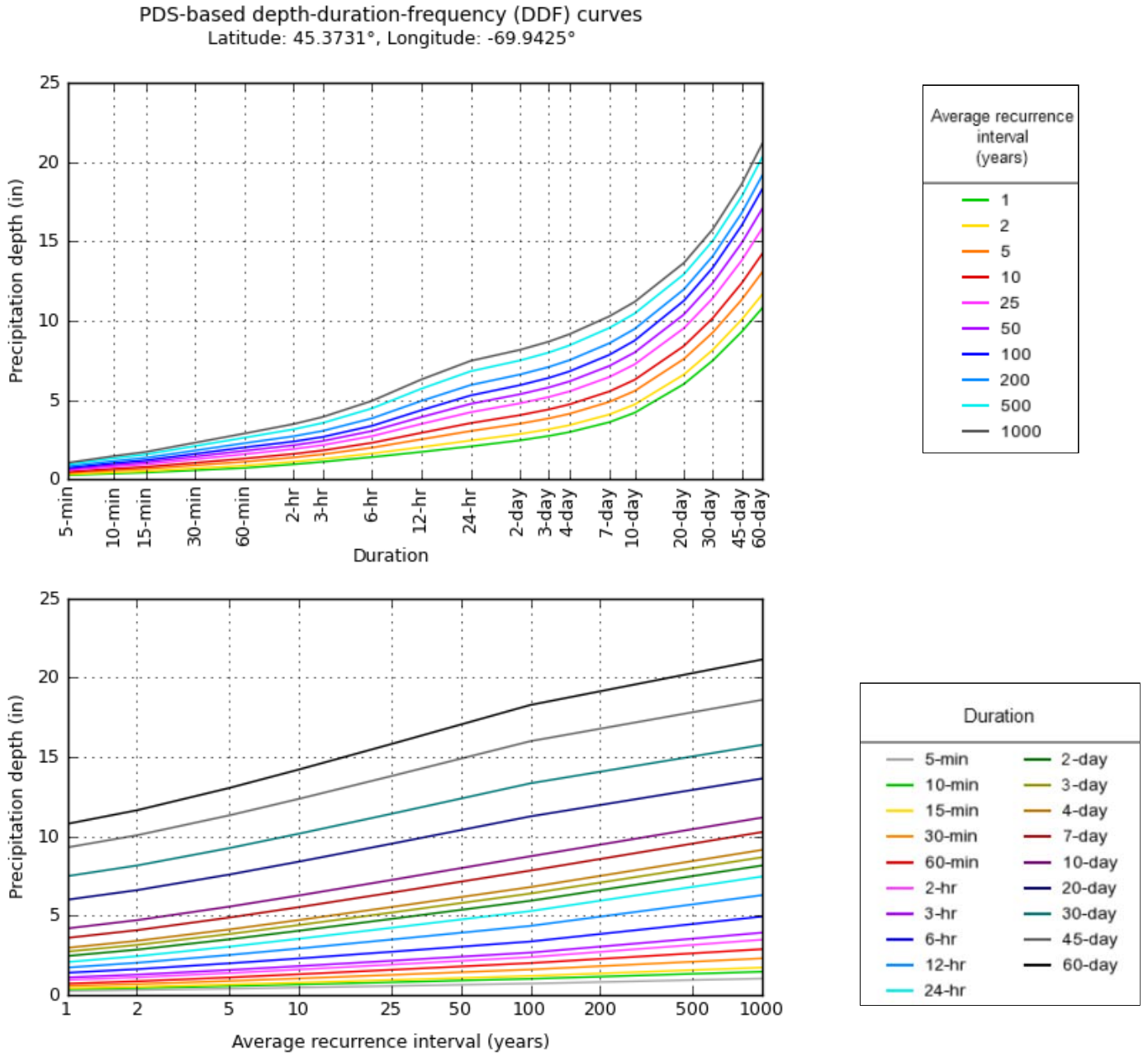
PF graphical



NOAA Atlas 14, Volume 10, Version 2

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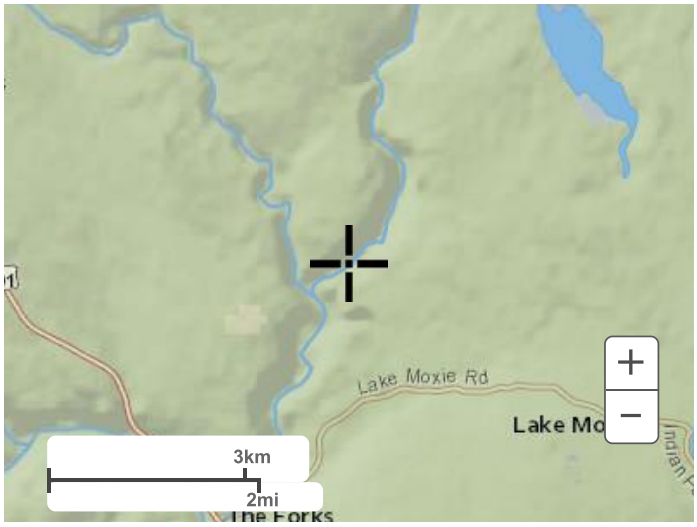
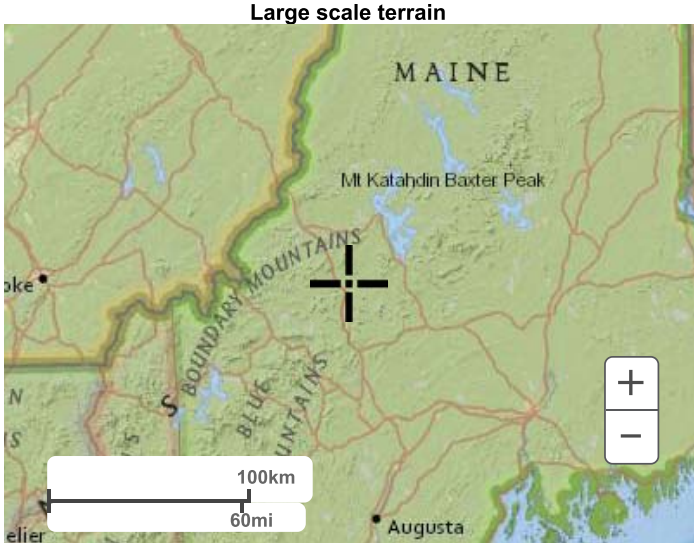
Maps & aerials

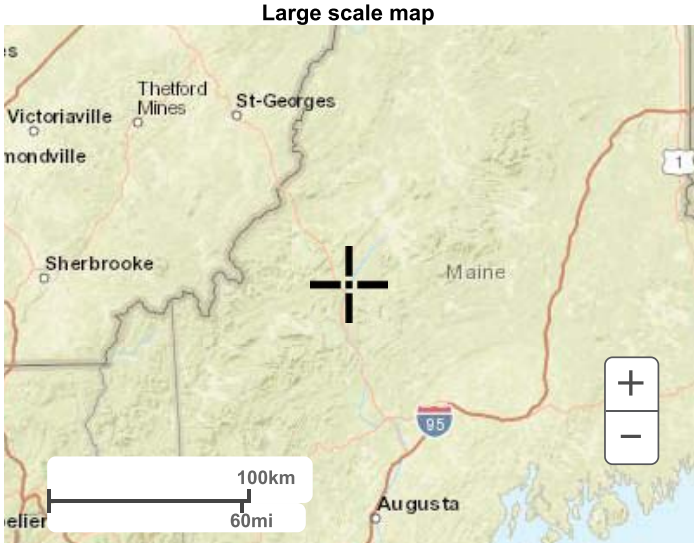
Small scale terrain



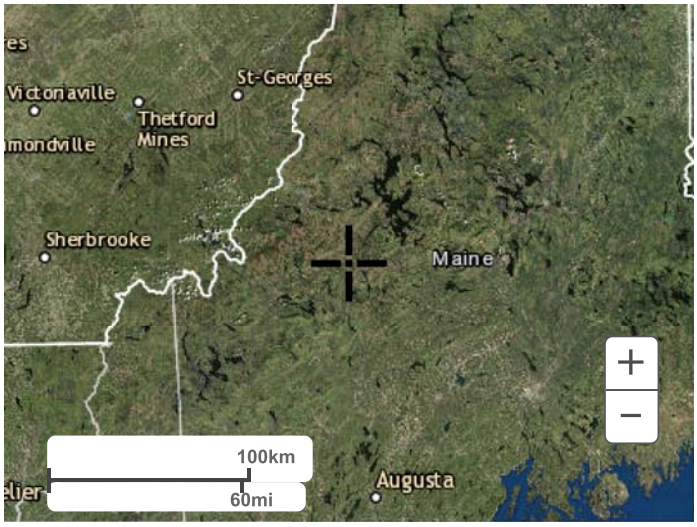
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

PROJECT:	**Avangrid - CMP**	**Calculated By:**	PGT
	Kennebec River Crossing Transition Stations	**Date:**	10/17/2018
TRC Proj. No.:	**306390.0000.00000**	**Checked By:**	DTB
	Time of Concentration Summary	**Date:**	

Time of Concentration Equations:

1. Where $T_t := \frac{0.007 \cdot (N \cdot L)^{0.8}}{P_2^{0.5} \cdot S^{0.4}}$ from SCS TR-55. For Sheet Flow (300 feet or less)

2. Where $V := 20.3282 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Paved surfaces)

3. Where $T_t := \frac{L}{3600 \cdot V}$ from the SCS Upland Method *Channel Flow Chart* Travel time equation

4. Where $V := 16.1345 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Unpaved surfaces)

5. Where: $v = 7\sqrt{s}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Short Grass Pasture)

6. Where: $v = 5\sqrt{s}$ from the SCS Upland Method *Channel Flow Chart* For Shallow Concentrated Flow (Woodland)

7. Where $V := 12 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Waterways and Swamps, No Channels

8. Where $V := 15 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Grassed Waterways and Roadside Ditches

9. Where $V := 21 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Small Tributary & Swamp w/Channels

10. Where $V := 35 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Large Tributary

11. Where $V := 60 \cdot \sqrt{S}$ from the SCS Upland Method *Channel Flow Chart* For Channel Flow - Main River

12. Where $V := \frac{1.49 \cdot R^{.667} \cdot \sqrt{S}}{N}$ For Channel Flow - Culvert Flow

13. Where P_2 = 2-Year, 24 Hour Rainfall (in) (Somerset, County: P_2= 2.44 inches)

Mannings Roughness Coefficients Table

Surface Description	n - value
Smooth surfaces	0.011
Crush Stone/Substation Yards	0.025
Fallow	0.050
Cultivated: Residue<=20%	0.060
Cultivated: Residue>=20%	0.170
Grass: Short	0.150
Grass: Dense	0.240
Grass: Bermuda	0.410
Range	0.130
Woods: Light underbrush	0.400
Woods: Dense underbrush	0.800

PROJECT:	**Kennebec River Gorge Transition Stations**		**Calculated By:**	PGT
	West Forks Plantation		**Checked By:**	DTB
TRC Proj. No.:	**306390.0000.00000**		**Date:**	10/17/18
Subcatchment:	**PRE & POST DEV 1S**		**Revised:**	

Time of Concentration Determination Worksheet, SCS Methods

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7		
SHEET FLOW									
Manning's No.	0.8	0.4							
Length, ft	117	33							
P2 , in	2.44	2.44							
Slope, ft/ft	0.1227	0.1824							
T_t[1], hr	0.392	0.070							0.4614
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Unpaved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Short Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t[3], hr									0.0000
Woodland									
Length, ft		551							
Slope, ft/ft		0.081							
Velocity[5], ft/sec		1.4265							
T_t[3], hr		0.107							0.1073
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft									
Slope, ft/ft									
Velocity[6], ft/sec									
T_t[3], hr									0.0000
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t, hr									0.0000

HR	0.569
Min	**34.12**

PROJECT:	**Kennebec River Gorge Transition Stations**	**Calculated By:**	PGT
	West Forks Plantation	**Checked By:**	DTB
TRC Proj. No.:	**306390.0000.00000**	**Date:**	10/17/18
Subcatchment:	**POST DEV** **T Yard** 1SA	**Revised:**	

Time of Concentration Determination Worksheet, SCS Methods

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7		
SHEET FLOW									
Manning's No.	0.0111								
Length, ft	140								
P2 , in	2.44								
Slope, ft/ft	0.02								
T_t[1], hr	0.030								0.0305
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Unpaved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Short Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t[3], hr									0.0000
Woodland									
Length, ft									
Slope, ft/ft									
Velocity[5], ft/sec									
T_t[3], hr									0.0000
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft									
Slope, ft/ft									
Velocity[6], ft/sec									
T_t[3], hr									0.0000
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t, hr									0.0000

HR	0.030
Min	**1.83**

(6 Minutes Minimum)

PROJECT:	**Kennebec River Gorge Transition Stations**						**Calculated By:**		PGT
	Moxie Gore						**Checked By:**		DTB
TRC Proj. No.:	**306390.0000.00000**						**Date:**		10/17/18
Subcatchment:	**PRE & POST DEV 2S**						**Revised:**		

Time of Concentration Determination Worksheet, SCS Methods

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7		
SHEET FLOW									
Manning's No.	0.8								
Length, ft	150								
P2 , in	2.44								
Slope, ft/ft	0.1187								
T_t[1], hr	0.484								0.4841
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Unpaved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Short Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t[3], hr									0.0000
Woodland									
Length, ft		569							
Slope, ft/ft		0.053							
Velocity[5], ft/sec		1.1500							
T_t[3], hr		0.137							0.1374
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft			178						
Slope, ft/ft			0.0087						
Velocity[6], ft/sec			1.119						
T_t[3], hr			0.044						0.0442
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t, hr									0.0000

HR	0.666
Min	**39.95**

PROJECT:	**Kennebec River Gorge Transition Stations**	**Calculated By:**	PGT
	Moxie Gore	**Checked By:**	DTB
TRC Proj. No.:	**306390.0000.00000**	**Date:**	10/17/18
Subcatchment:	**POST DEV T Yard**	**Revised:**	

Time of Concentration Determination Worksheet, SCS Methods

	Seg 1	Seg 2	Seg 3	Seg 4	Seg 5	Seg 6	Seg 7		
SHEET FLOW									
Manning's No.	0.0111								
Length, ft	140								
P2 , in	2.44								
Slope, ft/ft	0.02								
T_t[1], hr	0.030								0.0305
SHALLOW CONCENTRATED FLOW									
Paved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Unpaved									
Length, ft									
Slope, ft/ft									
Velocity[2], ft/sec									
T_t[3], hr									0.0000
Short Grass Pasture									
Length, ft									
Slope, ft/ft									
Velocity[4], ft/sec									
T_t[3], hr									0.0000
Woodland									
Length, ft									
Slope, ft/ft									
Velocity[5], ft/sec									
T_t[3], hr									0.0000
CHANNEL FLOW									
Waterways & Swamps, No Channels									
Length, ft									
Slope, ft/ft									
Velocity[6], ft/sec									
T_t[3], hr									0.0000
Grassed Waterways/Roadside Ditches									
Length, ft									
Slope, ft/ft									
Velocity[7], ft/sec									
T_t, hr									0.0000
Small Tributary & Swamp w/Channels									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Large Tributary									
Length, ft									
Slope, ft/ft									
Velocity[8], ft/sec									
T_t, hr									0.0000
Culvert									
Diameter, ft									
Area, ft^2									
Wetted Perimeter, ft									
Hydraulic Radius, R, ft									
Slope, ft/ft									
Manning's No.									
Velocity[12], ft/sec									
Length, L, ft									
T_t, hr									0.0000

HR	0.030
Min	**1.83**

(6 Minutes Minimum)

PRE-DEVELOPMENT
MODEL

Subcat Reach Pond Link

Routing Diagram for 2018-09-20 West Forks PLT Pre-Dev Model
Prepared by TRC, Printed 10/17/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.720	67	Brush, Poor, HSG B (1S, 2S)
0.250	96	Gravel surface, HSG B (2S)
17.460	66	Woods, Poor, HSG B (1S, 2S)
18.430	**66**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
18.430	HSG B	1S, 2S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
18.430		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.720	0.000	0.000	0.000	0.720	Brush, Poor	1S, 2S
0.000	0.250	0.000	0.000	0.000	0.250	Gravel surface	2S
0.000	17.460	0.000	0.000	0.000	17.460	Woods, Poor	1S, 2S
0.000	**18.430**	**0.000**	**0.000**	**0.000**	**18.430**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=6.030 ac 0.00% Impervious Runoff Depth=0.30"
Tc=34.1 min CN=66 Runoff=0.85 cfs 0.152 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=12.400 ac 0.00% Impervious Runoff Depth=0.33"
Tc=40.0 min CN=67 Runoff=1.83 cfs 0.343 af

Reach SP1: (SP1) Inflow=0.85 cfs 0.152 af
Outflow=0.85 cfs 0.152 af

Reach SP2: (SP2) Inflow=1.83 cfs 0.343 af
Outflow=1.83 cfs 0.343 af

Total Runoff Area = 18.430 ac Runoff Volume = 0.495 af Average Runoff Depth = 0.32"
100.00% Pervious = 18.430 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 0.85 cfs @ 12.40 hrs, Volume= 0.152 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

Area (ac)	CN	Description
5.890	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
6.030	66	Weighted Average
6.030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 1.83 cfs @ 12.48 hrs, Volume= 0.343 af, Depth= 0.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

Area (ac)	CN	Description
11.570	66	Woods, Poor, HSG B
0.250	96	Gravel surface, HSG B
0.580	67	Brush, Poor, HSG B
12.400	67	Weighted Average
12.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.030 ac, 0.00% Impervious, Inflow Depth = 0.30" for 2-Year event
Inflow = 0.85 cfs @ 12.40 hrs, Volume= 0.152 af
Outflow = 0.85 cfs @ 12.40 hrs, Volume= 0.152 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.400 ac, 0.00% Impervious, Inflow Depth = 0.33" for 2-Year event
Inflow = 1.83 cfs @ 12.48 hrs, Volume= 0.343 af
Outflow = 1.83 cfs @ 12.48 hrs, Volume= 0.343 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=6.030 ac 0.00% Impervious Runoff Depth=0.97"
Tc=34.1 min CN=66 Runoff=4.02 cfs 0.487 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=12.400 ac 0.00% Impervious Runoff Depth=1.02"
Tc=40.0 min CN=67 Runoff=7.94 cfs 1.058 af

Reach SP1: (SP1) Inflow=4.02 cfs 0.487 af
Outflow=4.02 cfs 0.487 af

Reach SP2: (SP2) Inflow=7.94 cfs 1.058 af
Outflow=7.94 cfs 1.058 af

Total Runoff Area = 18.430 ac Runoff Volume = 1.544 af Average Runoff Depth = 1.01"
100.00% Pervious = 18.430 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 4.02 cfs @ 12.33 hrs, Volume= 0.487 af, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

Area (ac)	CN	Description
5.890	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
6.030	66	Weighted Average
6.030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 7.94 cfs @ 12.40 hrs, Volume= 1.058 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

Area (ac)	CN	Description
11.570	66	Woods, Poor, HSG B
0.250	96	Gravel surface, HSG B
0.580	67	Brush, Poor, HSG B
12.400	67	Weighted Average
12.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.030 ac, 0.00% Impervious, Inflow Depth = 0.97" for 10-Year event
Inflow = 4.02 cfs @ 12.33 hrs, Volume= 0.487 af
Outflow = 4.02 cfs @ 12.33 hrs, Volume= 0.487 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.400 ac, 0.00% Impervious, Inflow Depth = 1.02" for 10-Year event
Inflow = 7.94 cfs @ 12.40 hrs, Volume= 1.058 af
Outflow = 7.94 cfs @ 12.40 hrs, Volume= 1.058 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=6.030 ac 0.00% Impervious Runoff Depth=1.23"
Tc=34.1 min CN=66 Runoff=5.30 cfs 0.616 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=12.400 ac 0.00% Impervious Runoff Depth=1.29"
Tc=40.0 min CN=67 Runoff=10.38 cfs 1.332 af

Reach SP1: (SP1) Inflow=5.30 cfs 0.616 af
Outflow=5.30 cfs 0.616 af

Reach SP2: (SP2) Inflow=10.38 cfs 1.332 af
Outflow=10.38 cfs 1.332 af

Total Runoff Area = 18.430 ac Runoff Volume = 1.948 af Average Runoff Depth = 1.27"
100.00% Pervious = 18.430 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 5.30 cfs @ 12.32 hrs, Volume= 0.616 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

Area (ac)	CN	Description
5.890	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
6.030	66	Weighted Average
6.030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 10.38 cfs @ 12.40 hrs, Volume= 1.332 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

Area (ac)	CN	Description
11.570	66	Woods, Poor, HSG B
0.250	96	Gravel surface, HSG B
0.580	67	Brush, Poor, HSG B
12.400	67	Weighted Average
12.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.030 ac, 0.00% Impervious, Inflow Depth = 1.23" for 25-Year event
Inflow = 5.30 cfs @ 12.32 hrs, Volume= 0.616 af
Outflow = 5.30 cfs @ 12.32 hrs, Volume= 0.616 af, Atten= 0%, Lag= 0.0 min

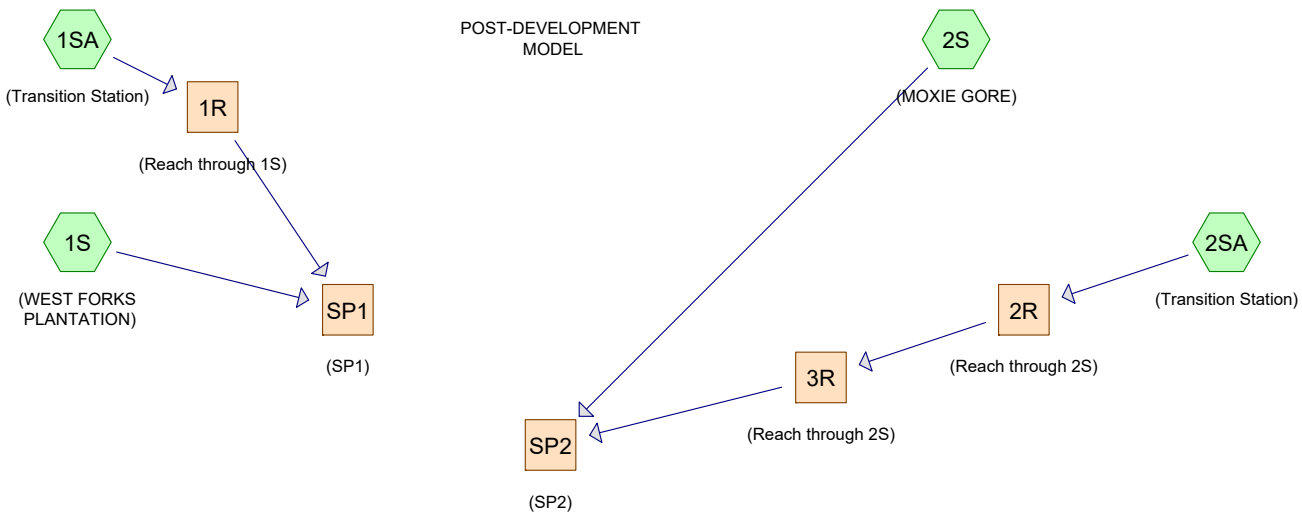
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.400 ac, 0.00% Impervious, Inflow Depth = 1.29" for 25-Year event
Inflow = 10.38 cfs @ 12.40 hrs, Volume= 1.332 af
Outflow = 10.38 cfs @ 12.40 hrs, Volume= 1.332 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs



Subcat Reach Pond Link

Routing Diagram for 2018-10-17 West Forks PLT Post-Dev Model
Prepared by TRC, Printed 10/17/2018

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.340	56	Brush, Fair, HSG B (1S)
0.970	67	Brush, Poor, HSG B (1S, 2S)
0.020	98	Foundations, HSG B (1SA, 2SA)
0.530	96	Gravel surface, HSG B (1S, 2S)
0.940	55	Substation Surface (1SA, 2SA)
15.630	66	Woods, Poor, HSG B (1S, 2S)
18.430	**66**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
17.490	HSG B	1S, 1SA, 2S, 2SA
0.000	HSG C	
0.000	HSG D	
0.940	Other	1SA, 2SA
18.430		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.340	0.000	0.000	0.000	0.340	Brush, Fair	1S
0.000	0.970	0.000	0.000	0.000	0.970	Brush, Poor	1S, 2S
0.000	0.020	0.000	0.000	0.000	0.020	Foundations	1SA, 2SA
0.000	0.530	0.000	0.000	0.000	0.530	Gravel surface	1S, 2S
0.000	0.000	0.000	0.000	0.940	0.940	Substation Surface	1SA, 2SA
0.000	15.630	0.000	0.000	0.000	15.630	Woods, Poor	1S, 2S
0.000	**17.490**	**0.000**	**0.000**	**0.940**	**18.430**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=5.550 ac 0.00% Impervious Runoff Depth=0.30"
Tc=34.1 min CN=66 Runoff=0.78 cfs 0.140 af

Subcatchment 1SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.09"
Tc=6.0 min CN=56 Runoff=0.01 cfs 0.003 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=11.920 ac 0.00% Impervious Runoff Depth=0.33"
Tc=40.0 min CN=67 Runoff=1.76 cfs 0.330 af

Subcatchment 2SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.09"
Tc=6.0 min CN=56 Runoff=0.01 cfs 0.003 af

Reach 1R: (Reach through 1S) Avg. Flow Depth=0.00' Max Vel=0.47 fps Inflow=0.01 cfs 0.003 af
n=0.030 L=331.0' S=0.1043 '/' Capacity=147.87 cfs Outflow=0.01 cfs 0.003 af

Reach 2R: (Reach through 2S) Avg. Flow Depth=0.01' Max Vel=0.23 fps Inflow=0.01 cfs 0.003 af
n=0.030 L=235.0' S=0.0067 '/' Capacity=11.79 cfs Outflow=0.01 cfs 0.003 af

Reach 3R: (Reach through 2S) Avg. Flow Depth=0.00' Max Vel=0.27 fps Inflow=0.01 cfs 0.003 af
n=0.030 L=747.0' S=0.0358 '/' Capacity=86.69 cfs Outflow=0.00 cfs 0.003 af

Reach SP1: (SP1) Inflow=0.79 cfs 0.144 af
Outflow=0.79 cfs 0.144 af

Reach SP2: (SP2) Inflow=1.76 cfs 0.333 af
Outflow=1.76 cfs 0.333 af

Total Runoff Area = 18.430 ac Runoff Volume = 0.477 af Average Runoff Depth = 0.31"
99.89% Pervious = 18.410 ac 0.11% Impervious = 0.020 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 0.78 cfs @ 12.40 hrs, Volume= 0.140 af, Depth= 0.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

Area (ac)	CN	Description
4.920	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
0.340	56	Brush, Fair, HSG B
0.150	96	Gravel surface, HSG B
5.550	66	Weighted Average
5.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 1SA: (Transition Station)

Runoff = 0.01 cfs @ 12.41 hrs, Volume= 0.003 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 1.76 cfs @ 12.48 hrs, Volume= 0.330 af, Depth= 0.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

	Area (ac)	CN	Description
	10.710	66	Woods, Poor, HSG B
	0.380	96	Gravel surface, HSG B
	0.830	67	Brush, Poor, HSG B
	0.000	48	Brush, Good, HSG B
*	0.000	55	Station Surface
	0.000	98	Roofs, HSG B
	11.920	67	Weighted Average
	11.920		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2SA: (Transition Station)

Runoff = 0.01 cfs @ 12.41 hrs, Volume= 0.003 af, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 2-Year Rainfall=2.44"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

Summary for Reach 1R: (Reach through 1S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.09" for 2-Year event
Inflow = 0.01 cfs @ 12.41 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 12.91 hrs, Volume= 0.003 af, Atten= 12%, Lag= 30.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.47 fps, Min. Travel Time= 11.8 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 11.8 min

Peak Storage= 4 cf @ 12.91 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 147.87 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 331.0' Slope= 0.1043 '/'
Inlet Invert= 936.00', Outlet Invert= 901.49'

Summary for Reach 2R: (Reach through 2S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.09" for 2-Year event
Inflow = 0.01 cfs @ 12.41 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 12.96 hrs, Volume= 0.003 af, Atten= 13%, Lag= 32.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.23 fps, Min. Travel Time= 17.3 min
Avg. Velocity = 0.19 fps, Avg. Travel Time= 20.4 min

Peak Storage= 6 cf @ 12.96 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 11.79 cfs

2.00' x 1.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 235.0' Slope= 0.0067 '/'
Inlet Invert= 890.80', Outlet Invert= 889.22'

Summary for Reach 3R: (Reach through 2S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.09" for 2-Year event
Inflow = 0.01 cfs @ 12.96 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 14.10 hrs, Volume= 0.003 af, Atten= 18%, Lag= 68.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.27 fps, Min. Travel Time= 45.4 min
Avg. Velocity = 0.27 fps, Avg. Travel Time= 45.4 min

Peak Storage= 13 cf @ 14.10 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 86.69 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 747.0' Slope= 0.0358 '/'
Inlet Invert= 889.22', Outlet Invert= 862.45'

Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.030 ac, 0.17% Impervious, Inflow Depth = 0.29" for 2-Year event
Inflow = 0.79 cfs @ 12.40 hrs, Volume= 0.144 af
Outflow = 0.79 cfs @ 12.40 hrs, Volume= 0.144 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.400 ac, 0.08% Impervious, Inflow Depth = 0.32" for 2-Year event
Inflow = 1.76 cfs @ 12.48 hrs, Volume= 0.333 af
Outflow = 1.76 cfs @ 12.48 hrs, Volume= 0.333 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=5.550 ac 0.00% Impervious Runoff Depth=0.97"
Tc=34.1 min CN=66 Runoff=3.70 cfs 0.448 af

Subcatchment 1SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.49"
Tc=6.0 min CN=56 Runoff=0.32 cfs 0.020 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=11.920 ac 0.00% Impervious Runoff Depth=1.02"
Tc=40.0 min CN=67 Runoff=7.63 cfs 1.017 af

Subcatchment 2SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.49"
Tc=6.0 min CN=56 Runoff=0.32 cfs 0.020 af

Reach 1R: (Reach through 1S) Avg. Flow Depth=0.01' Max Vel=0.72 fps Inflow=0.32 cfs 0.020 af
n=0.030 L=331.0' S=0.1043 '/' Capacity=147.87 cfs Outflow=0.20 cfs 0.020 af

Reach 2R: (Reach through 2S) Avg. Flow Depth=0.12' Max Vel=0.93 fps Inflow=0.32 cfs 0.020 af
n=0.030 L=235.0' S=0.0067 '/' Capacity=11.79 cfs Outflow=0.26 cfs 0.020 af

Reach 3R: (Reach through 2S) Avg. Flow Depth=0.01' Max Vel=0.35 fps Inflow=0.26 cfs 0.020 af
n=0.030 L=747.0' S=0.0358 '/' Capacity=86.69 cfs Outflow=0.07 cfs 0.020 af

Reach SP1: (SP1) Inflow=3.78 cfs 0.468 af
Outflow=3.78 cfs 0.468 af

Reach SP2: (SP2) Inflow=7.70 cfs 1.037 af
Outflow=7.70 cfs 1.037 af

Total Runoff Area = 18.430 ac Runoff Volume = 1.504 af Average Runoff Depth = 0.98"
99.89% Pervious = 18.410 ac 0.11% Impervious = 0.020 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 3.70 cfs @ 12.33 hrs, Volume= 0.448 af, Depth= 0.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

Area (ac)	CN	Description
4.920	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
0.340	56	Brush, Fair, HSG B
0.150	96	Gravel surface, HSG B
5.550	66	Weighted Average
5.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 1SA: (Transition Station)

Runoff = 0.32 cfs @ 12.00 hrs, Volume= 0.020 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 7.63 cfs @ 12.40 hrs, Volume= 1.017 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

	Area (ac)	CN	Description
	10.710	66	Woods, Poor, HSG B
	0.380	96	Gravel surface, HSG B
	0.830	67	Brush, Poor, HSG B
	0.000	48	Brush, Good, HSG B
*	0.000	55	Station Surface
	0.000	98	Roofs, HSG B
	11.920	67	Weighted Average
	11.920		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2SA: (Transition Station)

Runoff = 0.32 cfs @ 12.00 hrs, Volume= 0.020 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 10-Year Rainfall=3.80"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

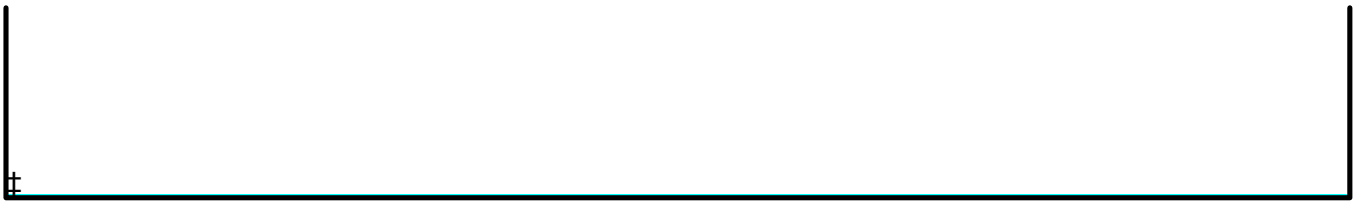
Summary for Reach 1R: (Reach through 1S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.49" for 10-Year event
Inflow = 0.32 cfs @ 12.00 hrs, Volume= 0.020 af
Outflow = 0.20 cfs @ 12.07 hrs, Volume= 0.020 af, Atten= 38%, Lag= 4.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.72 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 11.7 min

Peak Storage= 91 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 147.87 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 331.0' Slope= 0.1043 '/'
Inlet Invert= 936.00', Outlet Invert= 901.49'



Summary for Reach 2R: (Reach through 2S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.49" for 10-Year event
Inflow = 0.32 cfs @ 12.00 hrs, Volume= 0.020 af
Outflow = 0.26 cfs @ 12.04 hrs, Volume= 0.020 af, Atten= 20%, Lag= 2.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.93 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 0.31 fps, Avg. Travel Time= 12.7 min

Peak Storage= 65 cf @ 12.04 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 11.79 cfs

2.00' x 1.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 235.0' Slope= 0.0067 '/'
Inlet Invert= 890.80', Outlet Invert= 889.22'

Summary for Reach 3R: (Reach through 2S)

[61] Hint: Exceeded Reach 2R outlet invert by 0.01' @ 12.34 hrs

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.49" for 10-Year event
Inflow = 0.26 cfs @ 12.04 hrs, Volume= 0.020 af
Outflow = 0.07 cfs @ 12.35 hrs, Volume= 0.020 af, Atten= 73%, Lag= 18.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.35 fps, Min. Travel Time= 35.4 min
Avg. Velocity = 0.28 fps, Avg. Travel Time= 44.9 min

Peak Storage= 147 cf @ 12.35 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 86.69 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 747.0' Slope= 0.0358 '/'
Inlet Invert= 889.22', Outlet Invert= 862.45'

Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.030 ac, 0.17% Impervious, Inflow Depth = 0.93" for 10-Year event
Inflow = 3.78 cfs @ 12.32 hrs, Volume= 0.468 af
Outflow = 3.78 cfs @ 12.32 hrs, Volume= 0.468 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.400 ac, 0.08% Impervious, Inflow Depth = 1.00" for 10-Year event
Inflow = 7.70 cfs @ 12.40 hrs, Volume= 1.037 af
Outflow = 7.70 cfs @ 12.40 hrs, Volume= 1.037 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Time span=0.00-72.00 hrs, dt=0.02 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: (WEST FORKS Runoff Area=5.550 ac 0.00% Impervious Runoff Depth=1.23"
Tc=34.1 min CN=66 Runoff=4.88 cfs 0.567 af

Subcatchment 1SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.67"
Tc=6.0 min CN=56 Runoff=0.49 cfs 0.027 af

Subcatchment 2S: (MOXIE GORE) Runoff Area=11.920 ac 0.00% Impervious Runoff Depth=1.29"
Tc=40.0 min CN=67 Runoff=9.98 cfs 1.280 af

Subcatchment 2SA: (Transition Station) Runoff Area=0.480 ac 2.08% Impervious Runoff Depth=0.67"
Tc=6.0 min CN=56 Runoff=0.49 cfs 0.027 af

Reach 1R: (Reach through 1S) Avg. Flow Depth=0.01' Max Vel=0.90 fps Inflow=0.49 cfs 0.027 af
n=0.030 L=331.0' S=0.1043 '/' Capacity=147.87 cfs Outflow=0.35 cfs 0.027 af

Reach 2R: (Reach through 2S) Avg. Flow Depth=0.16' Max Vel=1.09 fps Inflow=0.49 cfs 0.027 af
n=0.030 L=235.0' S=0.0067 '/' Capacity=11.79 cfs Outflow=0.42 cfs 0.027 af

Reach 3R: (Reach through 2S) Avg. Flow Depth=0.01' Max Vel=0.43 fps Inflow=0.42 cfs 0.027 af
n=0.030 L=747.0' S=0.0358 '/' Capacity=86.69 cfs Outflow=0.13 cfs 0.027 af

Reach SP1: (SP1) Inflow=4.99 cfs 0.594 af
Outflow=4.99 cfs 0.594 af

Reach SP2: (SP2) Inflow=10.10 cfs 1.307 af
Outflow=10.10 cfs 1.307 af

Total Runoff Area = 18.430 ac Runoff Volume = 1.901 af Average Runoff Depth = 1.24"
99.89% Pervious = 18.410 ac 0.11% Impervious = 0.020 ac

Summary for Subcatchment 1S: (WEST FORKS PLANTATION)

Runoff = 4.88 cfs @ 12.32 hrs, Volume= 0.567 af, Depth= 1.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

Area (ac)	CN	Description
4.920	66	Woods, Poor, HSG B
0.140	67	Brush, Poor, HSG B
0.340	56	Brush, Fair, HSG B
0.150	96	Gravel surface, HSG B
5.550	66	Weighted Average
5.550		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.1					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 1SA: (Transition Station)

Runoff = 0.49 cfs @ 11.99 hrs, Volume= 0.027 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

Summary for Subcatchment 2S: (MOXIE GORE)

Runoff = 9.98 cfs @ 12.40 hrs, Volume= 1.280 af, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

	Area (ac)	CN	Description
	10.710	66	Woods, Poor, HSG B
	0.380	96	Gravel surface, HSG B
	0.830	67	Brush, Poor, HSG B
	0.000	48	Brush, Good, HSG B
*	0.000	55	Station Surface
	0.000	98	Roofs, HSG B
	11.920	67	Weighted Average
	11.920		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
40.0					**Direct Entry, See Spreadsheet**

Summary for Subcatchment 2SA: (Transition Station)

Runoff = 0.49 cfs @ 11.99 hrs, Volume= 0.027 af, Depth= 0.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Type II 24-hr 25-Year Rainfall=4.23"

	Area (ac)	CN	Description
*	0.470	55	Substation Surface
*	0.010	98	Foundations, HSG B
	0.480	56	Weighted Average
	0.470		97.92% Pervious Area
	0.010		2.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, 6 minutes (Minimum)**

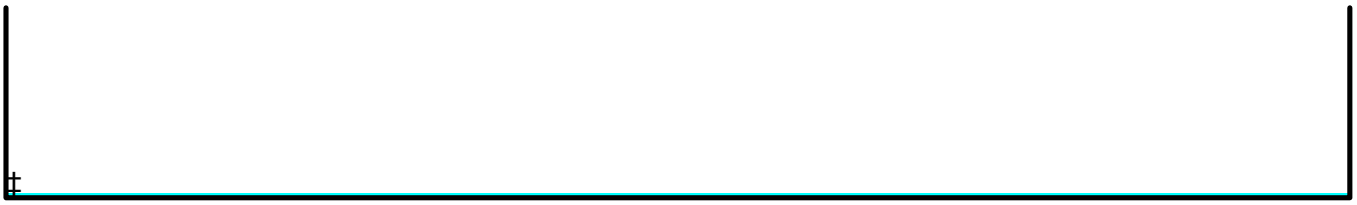
Summary for Reach 1R: (Reach through 1S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.67" for 25-Year event
Inflow = 0.49 cfs @ 11.99 hrs, Volume= 0.027 af
Outflow = 0.35 cfs @ 12.05 hrs, Volume= 0.027 af, Atten= 28%, Lag= 3.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.90 fps, Min. Travel Time= 6.1 min
Avg. Velocity = 0.48 fps, Avg. Travel Time= 11.6 min

Peak Storage= 129 cf @ 12.05 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 147.87 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 331.0' Slope= 0.1043 '/'
Inlet Invert= 936.00', Outlet Invert= 901.49'



Summary for Reach 2R: (Reach through 2S)

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.67" for 25-Year event
Inflow = 0.49 cfs @ 11.99 hrs, Volume= 0.027 af
Outflow = 0.42 cfs @ 12.03 hrs, Volume= 0.027 af, Atten= 14%, Lag= 2.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 1.09 fps, Min. Travel Time= 3.6 min
Avg. Velocity = 0.34 fps, Avg. Travel Time= 11.6 min

Peak Storage= 90 cf @ 12.03 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 4.0 sf, Capacity= 11.79 cfs

2.00' x 1.00' deep channel, n= 0.030 Short grass
Side Slope Z-value= 2.0 '/' Top Width= 6.00'
Length= 235.0' Slope= 0.0067 '/'
Inlet Invert= 890.80', Outlet Invert= 889.22'

Summary for Reach 3R: (Reach through 2S)

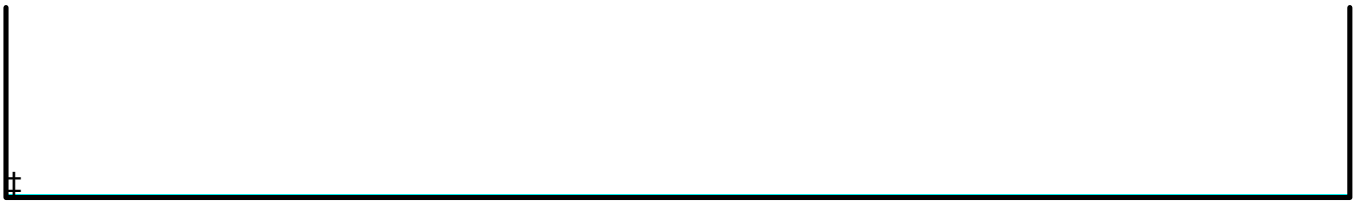
[61] Hint: Exceeded Reach 2R outlet invert by 0.01' @ 12.22 hrs

Inflow Area = 0.480 ac, 2.08% Impervious, Inflow Depth = 0.67" for 25-Year event
Inflow = 0.42 cfs @ 12.03 hrs, Volume= 0.027 af
Outflow = 0.13 cfs @ 12.23 hrs, Volume= 0.027 af, Atten= 70%, Lag= 12.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs
Max. Velocity= 0.43 fps, Min. Travel Time= 29.0 min
Avg. Velocity = 0.28 fps, Avg. Travel Time= 44.1 min

Peak Storage= 217 cf @ 12.23 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 0.50' Flow Area= 15.0 sf, Capacity= 86.69 cfs

30.00' x 0.50' deep channel, n= 0.030 Short grass
Length= 747.0' Slope= 0.0358 '/'
Inlet Invert= 889.22', Outlet Invert= 862.45'



Summary for Reach SP1: (SP1)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.030 ac, 0.17% Impervious, Inflow Depth = 1.18" for 25-Year event
Inflow = 4.99 cfs @ 12.32 hrs, Volume= 0.594 af
Outflow = 4.99 cfs @ 12.32 hrs, Volume= 0.594 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

Summary for Reach SP2: (SP2)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 12.400 ac, 0.08% Impervious, Inflow Depth = 1.26" for 25-Year event
Inflow = 10.10 cfs @ 12.40 hrs, Volume= 1.307 af
Outflow = 10.10 cfs @ 12.40 hrs, Volume= 1.307 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.02 hrs

PROJECT:	**CMP**	**Calculated By:**	PGT
	Kennebec HDD Transition Stations	**Checked By:**	PMM
TRC Proj:		**Date:**	October 17, 2018
		Revised:	

VEGETATED BUFFER AND STONED BERMED LEVEL SPREADER SIZING

Use of stone bermed level lip spreader in lieu of ditch turnout level spreaders.

Design Criteria:

Per BMP manual Volume III chapter 5.2.2 Buffer with Stone Bermed Level Lip Spreader
Reference Tables 5-4, 5-5 and 5-6

The given road section is: 15 ft wide gravel road
12 ft wide ditch section (3 ft bottom including side slopes)

Sub-Watershed 1S - West Forks Station

Vegetated Buffer B-1

Required Length of flow path through a meadow buffer (0-8% slope) = 150 ft
Provided is a 150 ft long meadow buffer. (average slope exceeds 8%)

Treatment for roadway		
Impervious areas		
15 x 65 =	975	0.02 Ac
15 x 368 =	5520	0.13 Ac
Concrete foundations		0.01 Ac
Total Impervious Area		**0.16 Ac**
Pervious area		
12 x 164	1968	0.05 Ac
12 x 307 =	3684	0.08 Ac
Total Landscaped Area		**0.13 Ac**

Level Spreader LS-1

Using Hydrologic Soil group B Soils

Per acre of impervious area =	100 Ft
Per acre of Lawn area =	30 Ft
Length for Impervious area =	16 LF
Length for Lawn area =	4 LF
Total length required =	**20 LF**
Provided =	**30 LF**

Note: Buffer slope is 16% so additional length of level spreader is provided to compensate for the increased slope.

PROJECT:	**CMP**	**Calculated By:**	PGT
	Kennebec HDD Transition Stations	**Checked By:**	PMM
TRC Proj:		**Date:**	October 17, 2018
		Revised:	

Sub-Watershed 2S - Moxie Gore Station

Vegetated Buffer B-2

Required Length of flow path through a meadow buffer (0-8% slope) = 150 ft
Provided is a 150 ft long meadow buffer.

Treatment for roadway			
Impervious areas			
15 x 88 =	1320	0.03	Ac
15 x150 =	2250	0.05	Ac
Concrete foundations		0.01	Ac
Total Impervious Area		**0.09**	**Ac**
Pervious area			
12 x 65	780	0.02	
12 x 320 =	3840	0.09	Ac
Total Landscaped Area		**0.11**	**Ac**

Level Spreader LS-2

Using Hydrologic Soil group B Soils		
Per acre of impervious area =	75	Ft
Per acre of Lawn area =	25	Ft
Length for Impervious area =	7	LF
Length for Lawn area =	3	LF
Total length required =	**10**	**LF**
Provided =	**30**	**LF**

Note: Runoff from transition station yard contributes to level spreader but no water quality treatment is needed.

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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GOVERNOR

DAVID
COM

June 5, 2008

Roy Koster
Central Maine Power
83 Edison Drive
Augusta, ME 04336

RE: DEP Stormwater Management Regulations and how they apply to Central Maine Power Company Substations and Switchyards

Dear Mr. Koster:

I am writing to provide clarification on how substations and switchyards designed by Central Maine Power Company (CMP) can meet DEP Stormwater Management rules, Chapter 500 and the Site Location of Development Law. This letter supersedes a previous DEP letter on this subject dated February 29, 2008 and is a follow-up to further discussions between CMP and DEP staff.

Based on the report prepared by John Simon of Balance Engineering, dated March 8, 2008, regarding the stormwater runoff coefficient at CMP substations and switchyards, the required gravel fill and surface nature of these structures performs differently than most common construction practices and a modeling variance will be allowed for CMP substations and switchyards as follows:

When Flooding Standard requirements apply to a CMP project, modeling must demonstrate that peak runoff from the substation structure does not exceed predevelopment flow rates at the property line. Because of the permeability plus storage within the gravel fill and roughness of the crushed rock surface, the curve number (CN) specified in John Simon's report (March 2008) may be used for the substation area. As reported, a CN of 55 may be used for substations and switchyards that are built on areas that are mapped as HSG "A", "B", and "C", and a CN of 60 must be used when the area is mapped as HSG "D" for the HydroCAD model. However, all impervious surfaces will have to be added for an averaged curve number.

The General Standards of Chapter 500 (water quality) will be considered as met by the CMP substation/switchyard design specifications as long as the structure includes the typical CMP substation profile overlaying the natural ground surface. The soil layers within the CMP substation profile consist of 4 inches of crushed stone, 50:50 mix of 1.5"

USTA
ATE HOUSE STATION
USTA, MAINE 04333-0017
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BLDG., HOSPITAL ST.

BANGOR
106 HOGAN ROAD
BANGOR, MAINE 04401
(207) 941-4570 FAX: (207) 941-4584

PORTLAND
312 CANCO ROAD
PORTLAND, MAINE 04103
(207) 822-6300 FAX: (207) 822-6303

PRESQUE ISLE
1235 CENTRAL DRIVE, SKYW
PRESQUE ISLE, MAINE 0476
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and 0.75" diameter stone overlaying 18 inches or more of gravel fill, MDOT 703.06 Type A. Saturation within the granular fill will detain and provide treatment for the one-inch design standard under that requirement. Groundwater can never be any higher than 18 inches below the top of the gravel fill. Other treatment considerations will need to be provided for all impervious structures anticipated on the substation and switchyard and for the roadway.

The Basic Standards of Chapter 500 (erosion and sedimentation control, inspection and maintenance, and housekeeping) will be met by the standard CMP substation and switchyard design specification and erosion control/construction plan as developed by CMP for each Stormwater Management application. These are minimum erosion control measures that will need to be maintained until the site is fully stabilized. However, based on site and weather conditions during construction, additional erosion control measures may be needed.

While there are several ways to approach the design standards discussed above, these must be considered the minimum requirements in meeting the Stormwater Management and Site Location of Development Laws. However, in some situations where the local hydrology and site conditions warrant more resource protection, additional BMPs may be required. Also, the access drive and associated roadside swales are included in the disturbed area for permitting purposes and the treatment of these areas must be addressed separately from the substation or switchyard and be treated with standard practices. The natural hydrology of these areas will need to be maintained and will have to meet all applicable standards as established in Chapter 500 (page 11, Section 5).

I hope this addresses your request and will make the DEP permitting process more straight forward. If you have further questions, please contact Marianne Hubert at (207) 287-4140.

Sincerely,

Don Witherill, Director
Watershed Management Division
Bureau of Land and Water Quality

Cc: Marianne Hubert, PE, DEP program manager
Andy Fisk, DEP L&W Bureau Director
Dan Butler, PE, TRC
Gerry Mirabile, CMP

APPENDIX 12-2

315641 SW-1 West Forks Pre-Development Watershed Plan

315641 SW-2 West Forks Post-Development Watershed Plan

315641 SW-3 Moxie Gore Pre-Development Watershed Plan

315641 SW-4 Moxie Gore Post-Development Watershed Plan

APPENDIX 12-3

Post-Construction Stormwater Inspection and Maintenance Log

CMP West Forks Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Revegetated Areas and Embankments:				
Inspect all revegetated areas and embankments.	**X**			
Replant bare areas or areas with sparse growth.		**As Required**		
Armor areas with rill erosion with an appropriate lining or divert the erosive flows to on-site areas able to withstand concentrated flows.		**As Required**		
Drainage Conveyance Systems:				
Inspect swales and level spreaders for evidence of erosion, debris, woody growth, and excessive sediment.	**X**			
Remove any obstructions and accumulated sediments or debris.		**As Required**		
Control vegetated growth and woody vegetation.		**As Required**		
Repair any erosion of the swale lining.		**As Required**		
Mow vegetated swales.		**Annually**		
Clean-out any accumulation of sediment within the spreader bays.		**As Required**		
Remove woody vegetation growing through riprap.		**As Required**		
Repair any slumping side slopes.		**As Required**		
Replace riprap where underlying filter fabric is showing or where stones have dislodged.		**As Required**		
Culverts:				
Inspect culvert inlet, outlet, and structure.	**X**			
Remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit.		**As Required**		
Repair any erosion damage at the culvert's inlet and outlet.		**As Required**		

CMP West Forks Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Roadway Surfaces:				
Inspect access road surfaces and shoulders for erosion, false ditches, and excess accumulation of sand that could impede water flow.	**X**			
Remove excess sand either manually or with a front-end loader.		**As Required**		
Grade gravel roads and shoulders.		**As Required**		
Transition Station Yard:				
Inspect for existing or developing erosion, rutting, trash, and unwanted vegetation.	**X**			
Correct any erosion/rutting and/or remove trash or vegetation.		**As Required**		
Water Quality Treatment Buffers:				
Inspect treatment buffers for evidence of erosion, concentrated flow, or encroachment by development.	**X**			
Manage the buffer's vegetation consistent with the requirements in any deed restrictions.		**As Required**		
Repair any sign of erosion within a buffer.		**As Required**		
Inspect and repair down-slope of all level spreaders and turn-outs for erosion.	**X**			

CMP West Forks Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Maintenance Needed and When:				

CMP Moxie Gore Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Revegetated Areas and Embankments:				
Inspect all revegetated areas and embankments.	**X**			
Replant bare areas or areas with sparse growth.		**As Required**		
Armor areas with rill erosion with an appropriate lining or divert the erosive flows to on-site areas able to withstand concentrated flows.		**As Required**		
Drainage Conveyance Systems:				
Inspect swales and level spreaders for evidence of erosion, debris, woody growth, and excessive sediment.	**X**			
Remove any obstructions and accumulated sediments or debris.		**As Required**		
Control vegetated growth and woody vegetation.		**As Required**		
Repair any erosion of the swale lining.		**As Required**		
Mow vegetated swales.		**Annually**		
Clean-out any accumulation of sediment within the spreader bays.		**As Required**		
Remove woody vegetation growing through riprap.		**As Required**		
Repair any slumping side slopes.		**As Required**		
Replace riprap where underlying filter fabric is showing or where stones have dislodged.		**As Required**		
Culverts:				
Inspect culvert inlet, outlet, and structure.	**X**			
Remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit.		**As Required**		
Repair any erosion damage at the culvert's inlet and outlet.		**As Required**		

CMP Moxie Gore Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Roadway Surfaces:				
Inspect access road surfaces and shoulders for erosion, false ditches, and excess accumulation of sand that could impede water flow.	**X**			
Remove excess sand either manually or with a front-end loader.		**As Required**		
Grade gravel roads and shoulders.		**As Required**		
Transition Station Yard:				
Inspect for existing or developing erosion, rutting, trash, and unwanted vegetation.	**X**			
Correct any erosion/rutting and/or remove trash or vegetation.		**As Required**		
Water Quality Treatment Buffers:				
Inspect treatment buffers for evidence of erosion, concentrated flow, or encroachment by development.	**X**			
Manage the buffer's vegetation consistent with the requirements in any deed restrictions.		**As Required**		
Repair any sign of erosion within a buffer.		**As Required**		
Inspect and repair down-slope of all level spreaders and turn-outs for erosion.	**X**			

CMP Moxie Gore Station				
Stormwater Management System Inspection & Maintenance Log				
	Schedule		**Inspector Initials and Date**	**Inspector Comments**
	Quarterly Inspection	**Maintenance**		
Maintenance Needed and When:				

APPENDIX 12-4

Buffer Declaration of Restrictions

3. Meadow buffer

DECLARATION OF RESTRICTIONS (Non-Wooded Meadow Buffer)

THIS DECLARATION OF RESTRICTIONS is made this _____day of _____, 20___, by _____, _____
(name) (street address)
_____, _____County, Maine,_____, (herein referred to as the
(city or town) (county) (zip code)
"Declarant"), pursuant to a permit received from the Maine Department of Environmental Protection under the Stormwater Management Law, to preserve a buffer area on a parcel of land near _____, _____ .
(road name) (known feature and/or town)

WHEREAS, the Declarant holds title to certain real property situated in _____, Maine
(town)
described in a deed from _____ to _____, dated
(name) (name of Declarant)
_____, 20____, and recorded in Book ____ Page ____ at the _____County Registry of Deeds, herein referred to as the "property"; and

WHEREAS, Declarant desires to place certain restrictions, under the terms and conditions herein, over a portion of said real property (hereinafter referred to as the "Restricted Buffer") described as follows: (Note: Insert description of restricted buffer location here)

WHEREAS, pursuant to the Stormwater Management Law, 38 M.R.S. Section 420-D and Chapter 500 of rules promulgated by the Maine Board of Environmental Protection ("Stormwater Management Rules"), Declarant has agreed to impose certain restrictions on the Restricted Buffer Area as more particularly set forth herein and has agreed that these restrictions may be enforced by the Maine Department of Environmental Protection or any successor (hereinafter the "MDEP"),

NOW, THEREFORE, the Declarant hereby declares that the Restricted Buffer Area is and shall forever be held, transferred, sold, conveyed, occupied and maintained subject to the conditions and restrictions set forth herein. The Restrictions shall run with the Restricted Buffer Area and shall be binding on all parties having any right, title or interest in and to the Restricted Buffer Area, or any portion thereof, and their heirs, personal representatives, successors, and assigns. Any present or future owner or occupant of the Restricted Buffer Area or any portion thereof, by the acceptance of a deed of conveyance of all or part of the Covenant Area or an instrument conveying any interest therein, whether or not the deed or instrument shall so express, shall be deemed to have accepted the Restricted Buffer Area subject to the Restrictions and shall agree to be bound by, to comply with and to be subject to each and every one of the Restrictions hereinafter set forth.

1. **Restrictions on Restricted Buffer Area**. Unless the owner of the Restricted Buffer Area, or any successors or assigns, obtains the prior written approval of the MDEP, the Restricted Buffer Area must remain undeveloped in perpetuity. To maintain the ability of the Restricted Buffer Area to filter and absorb stormwater, and to maintain compliance with the Stormwater Management Law and the permit issued thereunder to the Declarant, the use of the Restricted Buffer Area is hereinafter limited as follows.

   a. No soil, loam, peat, sand, gravel, concrete, rock or other mineral substance, refuse, trash, vehicle bodies or parts, rubbish, debris, junk waste, pollutants or other fill material will be placed, stored or dumped on the Restricted Buffer Area, nor may the topography or the natural mineral soil of the area be altered or manipulated in any way;

   b. A dense cover of grassy vegetation must be maintained over the Restricted Buffer Area, except that shrubs, trees and other woody vegetation may also be planted or allowed to grow in the area. The Restricted Buffer Area may not be maintained as a lawn or used as a pasture. If vegetation in the Restricted Buffer Area is mowed, it may be mown no more than two times per year.

   c. No building or other temporary or permanent structure may be constructed, placed or permitted to remain on the Restricted Buffer Area, except for a sign, utility pole or fence (whether constructed of wood, steel or other materials) and appurtenant equipment such as guys and guy anchors;

   d. No trucks, cars, dirt bikes, ATVs, bulldozers, backhoes, or other motorized vehicles or mechanical equipment may be permitted on the Restricted Buffer Area, except for vehicles used in mowing;

   e. Any level lip spreader directing flow to the Restricted Buffer Area must be regularly inspected and adequately maintained to preserve the function of the level spreader.

   Any activity on or use of the Restricted Buffer Area inconsistent with the purpose of these Restrictions is prohibited. Any future alterations or changes in use of the Restricted Buffer Area must receive prior approval in writing from the MDEP. The MDEP may approve such alterations and changes in use if such alterations and uses do not impede the stormwater control and treatment capability of the Restricted Buffer Area or if adequate and appropriate alternative means of stormwater control and treatment are provided.

2. **Enforcement**. The MDEP may enforce any of the Restrictions set forth in Section 1 above.

3. **Binding Effect**. The restrictions set forth herein shall be binding on any present or future owner of the Restricted Buffer Area. If the Restricted Buffer Area is at any time owned by more than one owner, each owner shall be bound by the foregoing restrictions to the extent that any of the Restricted Buffer Area is included within such owner's property.

4. **Amendment**. Any provision contained in this Declaration may be amended or revoked only by the recording of a written instrument or instruments specifying the amendment or the revocation signed by the owner or owners of the Restricted Buffer Area and by the MDEP.

5. **Effective Provisions of Declaration**. Each provision of this Declaration, and any agreement, promise, covenant and undertaking to comply with each provision of this Declaration, shall be deemed a land use restriction running with the land as a burden and upon the title to the Restricted Buffer Area.

6. **Severability**. Invalidity or unenforceability of any provision of this Declaration in whole or in part shall not affect the validity or enforceability of any other provision or any valid and enforceable part of a provision of this Declaration.

7. **Governing Law**. This Declaration shall be governed by and interpreted in accordance with the laws of the State of Maine.

_____
(NAME)

STATE OF MAINE, _____, County, dated _____, 20__ .
(County)

Personally appeared before me the above named _____, who swore to the truth of the foregoing to the best of (his/her) knowledge, information and belief and acknowledged the foregoing instrument to be (his/her) free act and deed.

_____
Notary Public

_____

13.0 URBAN IMPAIRED STREAMS

The Urban Impaired Streams Watersheds GIS data, updated February 6, 2016, provided by MDEP's Bureau of Land Resources, was reviewed in relation to the NECEC Project locations. This review indicated that no components of the Project will be constructed in or near an Urban Impaired Stream and/or Watershed. Additionally, a review of the MDEP Chapter 502- Direct Watersheds of Lakes Most at Risk from New Development and Urban Impaired Streams List confirmed these findings.

14.0 BASIC STANDARD SUBMISSIONS

As described in CMP's September 27, 2017 Site Law application submittal, CMP will use the best practices described in its standard manual, "Environmental Guidelines for Construction and Maintenance Activities on Transmission Line and Substation Projects" ("Environmental Guidelines"). This manual contains effective and proven erosion and sedimentation control requirements, standards, and methods that will be used to protect soil and water resources during construction of the various NECEC Project components, including the HDD installation and termination station construction. Methods for erosion control, consistent with CMP's Environmental Guidelines, are depicted in the permitting plan set included as Exhibit 12-1 in the Stormwater Section of the Site Law application. Information regarding best practices for construction dewatering and avoiding and responding to releases of HDD drilling fluids is provided below.

CMP will implement specific dewatering control measures where applicable (e.g. trench de-watering). Construction dewatering procedures will include, but are not limited to, the following:

- Open excavations and/or trenches will be dewatered and kept free of standing water and muddy conditions as necessary for the safe and proper execution of the work.
- All trench excavations and trenches will be dewatered prior to the placement of backfill.
- Construction dewatering will be conducted in a way to prevent sedimentation associated with the management of water removed during construction from excavations, trenches, cofferdams, and other work areas that trap stormwater and groundwater. To facilitate this, pump hose intakes will be elevated from the trench bottom using a floatation device to prevent sediments from the trench bottom from being discharged.
- Dewatering of excavations and or trenches will involve pumping the water to a discharge point, which will include measures/devices to slow water velocities and trap any suspended sediment. Such measures/devices may include but are not limited to a dirt bag with a sand berm and hay bale barrier, hay bale corral lined with geotextile fabric, and/or sediment basin of appropriate size with a well-vegetated upland buffer. An erosion control mix berm may also be incorporated with silt fence or hay bale corral.
- Dewatering activities will not result in the direct discharge of water into any streams or wetlands and will be conducted in accordance with the Project's site-specific erosion and sedimentation control plan (see Exhibit 12-1). Discharge from dewatering activity is not permitted within 75' of

a stream or wetland. Wooded buffers and flat to moderate slopes provide the best opportunity for filtration and absorption.

- Dewatering will not occur during heavy rain or when the infiltrative capacity of the soil is exceeded.
- Inspection of all dewatering activity and discharge points will be done on a daily basis, with more frequent oversight as site conditions warrant.

The typical HDD consists of three main steps: drilling a pilot hole, back reaming, and pulling of the casing and conduit into the hole. The pilot hole involves drilling the entire length of the bore with a small diameter drill head. Once the pilot hole has been established a reamer is placed on the drill head and then is pulled back through the bore hole to widen the hole. Finally, the casing is attached to the drill head and pulled back through the bore hole. Typically, the drilling fluid is composed of water and clay particulates consisting of bentonite. The main component of bentonite is montmorillonite clay. This clay has a high shrink-swell capacity. Bentonite attracts water and bonds to it and therefore is capable of absorbing up to seven times its weight in water and swelling up to eighteen times its dry volume. The bentonite and water work together to lubricate and cool the drill head, seal and fill pore spaces surrounding the hole, and prevent the drill hole from collapsing. It also suspends the cuttings of the native soil and removes them.

During the HDD process there is a small possibility of drilling fluids reaching the ground surface by following a vertical bedrock fracture. This is referred to as an inadvertent release. CMP has developed an Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan ("Plan") (see Exhibit 14-1) that outlines the details of the HDD process, the monitoring and prevention procedures, and the measures that would be in place to respond to an inadvertent release of drilling fluids.

The Plan includes:

- Typical scenarios under which inadvertent release of drilling fluid could occur, and measures to prevent it;
- The required reporting process to Project personnel, CMP and state regulatory agencies;
- Procedural measures that would be taken to mitigate for a release;
- The type of drilling operation adjustments that could be made to minimize or prevent any additional releases; and
- equipment or supplies available to contain an inadvertent release, and the disposal process for all collected directional drilling fluids.

Exhibit 14-1: Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan

REQUIREMENTS FOR INADVERTENT FLUID RELEASE PREVENTION, MONITORING, AND CONTINGENCY PLAN FOR HDD OPERATIONS

Prepared for the

CENTRAL MAINE POWER COMPANY
NEW ENGLAND CLEAN ENERGY CONNECT
KENNEBEC RIVER CROSSING

Location

West Forks Plantation &
Moxie Gore,
Maine 04985

Owner

Central Maine Power Company
83 Edison Drive
Augusta, Maine 04336

Prepared by

6 Ashley Drive
Scarborough, ME 04074
(207) 274-2631
October 2018

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Requirements for Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan for HDD Operations

This document lists the minimum requirements for a site-specific inadvertent fluid release plan that shall be prepared by the Horizontal Directional Drilling (HDD) Contractor selected for this project. The purpose of this plan is to prevent any inadvertent fluid releases, to quickly identify any inadvertent fluid releases that do occur, and to contain, minimize, and remediate any environmental impacts associated with any release of HDD drilling fluids.

The final inadvertent fluid release pprevention, mmonitoring, and contingency plan will be provided to the Owner, and relevant regulatory agencies before the commencement of drilling activities.

1 PROJECT SUMMARY

Avangrid – Central Maine Power Company (CMP) (Owner) intends to contract for HDD services for the NECEC Kennebec River Crossing project.

This project generally consists of installation of a HVDC electric power transmission line under the Kennebec River in the area of Moxie Gorge. This section of the Kennebec River is designated as an Outstanding River Segment and requires measures to prevent and minimize environmental impacts. As part of this project the Owner requires development of an inadvertent fluid release prevention, monitoring, and contingency plan (Plan) and implementation of the plan during all HDD operations for the Kennebec River Crossing.

The HDD drill site will be on the east side of the river at the Moxie Gore termination station and the receiving site is on the west of the river at the West Forks termination station. There is a vertical drop of more than 300 feet from the termination stations to the river valley and the HDD is approximately 3,000 feet in horizontal length.

2 PLAN SUBMITTAL REQUIREMENTS

The Contractor shall submit for Owner approval a Plan that includes the address of the regulatory agencies and the 1-800 spill hotline number for reporting releases of drilling fluids into water resources, a description of the means, methods, materials and equipment the Contractor will use prior to, during and after the HDD operations required for this project. The Contractor shall revise and resubmit the Plan if site conditions warrant any changes. Written approval of the Plan by the Maine Department of Environmental Protection and the Owner shall be obtained prior to the start of work.

3 RELEASE PREVENTION

The Contractor is responsible for the engineering design of the HDD for this project and this Inadvertent Fluid Release Plan shall be prepared in conjunction with their detailed design.

This plan shall document preventative measured incorporated into the design. This includes but is not limited to measures such as:

- Subsurface and geotechnical investigations that were performed.
- Engineering standards employed.
- Design assumptions used.
- Calculations made to estimate soil/bedrock fracturing under planned fluid pressures.
- HDD alignment changes required (increased depth, poor soil avoidance, etc.) based on site conditions.
- Design features used for this project that were used successfully on similar projects or that are used to remedy prior problems.
- Drilling fluid composition for anticipated soil conditions.

4 DRILLING FLUID

The Contractor's Plan shall discuss the purpose and use of drilling fluids in HDD operations, including, but is not limited to:

- A description of how the drilling fluids remove cuttings and spoils from the bore hole, lubricate and cool the drill head and keep the bore hole from collapsing.
- A description of mud motors and how the drilling fluids are pumped through the drill steel and out of the drill head.
- A description of how the high-pressure fluid used during drilling creates a chance of an inadvertent release of drilling fluids due to weak spots/seams in the overlying soils that cannot contain the fluid pressure and allows migration of the fluids to the surface.
- A description of the chemical composition and characteristics of drilling fluid and any/all additives. Drilling fluid is comprised of water and naturally occurring clay called sodium montmorillonite (bentonite). Bentonite is a non-toxic, non-reactive, inert material that allows the HDD Contractor to monitor and adjust the viscosity of the drilling fluid to achieve the desired carrying and lubricating properties.
- Documentation that the drilling fluid composition complies with all Federal, State, and local environmental regulations.
- Documentation that no contamination is introduced into the soil during the drilling, reaming, or conduit installation processes.

4.1 Additives

The Plan will include how and why additives are used in the drilling fluid to adjust the viscosity, improve hole integrity, prevent, or reduce fluid release, and how adjustments to the drilling fluid characteristics are made during the drilling operations. The Plan will describe the names and chemical compositions of additives proposed for this project including clays, organic fibers, modified starches and non-reactive polymers. Petroleum-based additives shall not be used. Safety Data Sheets for all additives used will also be included in the Plan.

Additives that are not listed in the approved Plan shall not be used.

4.2 Disposal

The Plan shall describe drilling fluid and spoils collection, segregation, transportation and disposal. Recycling and reuse of drilling fluids shall be used to limit disposal quantities. Prior to drilling operations, the HDD contractor shall identify one or more licensed landfills or off-site facilities for disposal of the cuttings, spoils and excess drilling fluid, and shall include the names and licenses of these facilities in this Plan.

The HDD contractor will dispose of all fluids in a manner that is in compliance with all permits and applicable Federal, State, and local regulations.

5 DESIGN CONSIDERATIONS

The Owner and its Consultants will undertake several steps during design to minimize the occurrence of an inadvertent release of drilling fluid.

5.1 Identify Soil and Subsurface Conditions

The Owner and its Consultants will undertake geotechnical investigations to identify the materials being drilled through, resistance to drilling operations, and resistance to fluid migration. The Owner will provide the geotechnical report to the Contractor for their use in designing the HDD for this project.

5.2 Drill Design

The Contractor shall prepare detailed design calculations and plans identifying the drill path, expected spoils volumes, pipe installation stresses and fluid pressures.

5.3 Additional Modeling for Kennebec River Crossing

For the HDD crossing of the Kennebec River, the drilling fluid will need to circulate at a high pressure. The Contractor shall perform site-specific modeling to estimate the ability of the overlying soils to withstand fluid migration (Hydrofracture Modeling). These models shall be

used in conjunction with the expected fluid pressures to determine the appropriate installation depth.

5.4 Drill Fluid Return Estimates

The Plan shall describe how a complete recovery of all circulating drilling fluids is not expected due to naturally occurring voids and low-density areas within the soil which will be filled by the fluids immediately adjacent to the borehole during the drilling process. The plan shall estimate typical expected fluid return volumes along the borehole alignment during all the HDD phases, including pilot hole, 1st reaming, 2nd reaming etc. so that abnormal/low fluid returns can be monitored and evaluated/investigated.

6 MONITORING AND ACTION PLAN

The Plan shall include the Contractors monitoring of HDD activities along the drilling path and downstream of the drilling path, including on the river, and the Contractors actions required for various site conditions. The Plan shall describe how HDD operations will be coordinated/scheduled with the Harris Hydropower Dam owner (Brookfield Renewables) to facilitate inadvertent fluid release monitoring during periods of low river flow. The Monitoring and Action Plan shall include but is not limited to the following:

Table 5-1:

Drilling Fluid Monitoring and Action Plan Summary		
Condition	Status	Actions
Condition 1: Normal Drilling Conditions	Normal drilling fluid circulation is	• Perform routine collection of drilling fluid at endpoints • Perform routine drilling data collection

Drilling Fluid Monitoring and Action Plan Summary		
Condition	Status	Actions
	maintained	• Conduct routine visual monitoring for surface releases along drill path
Condition 2: Loss or Reduction of Circulation	Loss or significant reduction of fluid circulation	• Notify Owner • Adjust drilling parameters to regain circulation • Increase visual monitoring for surface release • Continue drilling if no release is detected
Condition 3: Drilling Fluid Release and Remediation	Drilling fluid release is confirmed	• Notify Owner • Monitor and document release area • Contain and collect release if feasible • Suspend HDD operations if containment is not feasible

6.1 Condition 1: Normal Drilling Conditions

The HDD Contractor shall maximize recirculation of drilling fluid surface returns and provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse.

The Contractor shall at all times provide and maintain instrumentation which accurately locates the pilot hole, measures drill string axial and torsional loads, and measures the drilling fluid discharge rate and pressure.

The Owner and authorized regulatory agency representatives shall have access to these instruments and their readings upon request. A log of all recorded readings shall be maintained by the Contractor at the drill rig site and shall become part of the construction record.

Routine visual monitoring under Condition 1 shall consist of periodic visual examination by the HDD Contractor personnel along the drilled alignment. Due to the land cover and terrain at the Kennebec River crossing these visual inspections will be made on foot.

These examinations shall be made periodically on a time interval not to exceed one hour. The name of the inspector, time of the examination, and observations shall be kept in a log at the drill rig site and shall be available for inspection.

6.2 Condition 2: Loss or Reduction of Circulation

Condition 2 actions shall be implemented if the drilling fluid fails to circulate as expected. Drilling fluid circulation shall be evaluated on the basis of comparing actual quantities against the planned quantities for the volume of fluid being recovered, drilling fluid pressures, and location of fluid recovered.

The Contractor shall continuously compare estimated fluid returns with measured returns to monitor for drilling fluid loss and inadvertent fluid release. The following minimum actions shall be implemented if a loss or significant reduction of drilling fluid circulation occurs.

6.2.1 HDD Contractor will notify the Owner who may notify regulatory agency representatives that drilling is continuing under Condition 2.

6.2.2 The Contractor shall increase monitoring frequency from Routine to Focused monitoring. Focused monitoring consists of continuous monitoring of the drill alignment by personnel with no other duties. Sufficient personnel will be used to ensure that each portion of the alignment is inspected at least once every 30 minutes.

6.2.3 HDD Contractor shall immediately take steps to restore circulation. These steps shall include, but are not be limited to:

- Size the hole. Sizing (Swabbing) involves withdrawing the drill string to mechanically clean the drilled hole.

- Adjust drilling fluid viscosity and gelling properties to encourage annular flow and stabilize the entire structure.

6.2.4 The HDD Contractor shall consider the following adjustments in addition to the above steps.

- Adding additional pre-approved filling or stabilizing materials to potentially seal fissures in the soil.
- Adjust the drill cutting heads and speeds for potential soil pockets.

Once circulation is restored, drilling shall continue under Condition 2 for a period of not less than eight (8) drilling hours. If a release is not identified, and loss or significant reduction of drilling fluid circulation does not re-occur, the HDD Contractor shall notify the Owner, who may notify regulatory agency representatives that drilling under Condition 1 has resumed.

The HDD Contractor will keep the Owner notified about changes to circulation status, including if circulation has been restored or partially restored. The Owner may notify regulatory agency representatives about these changes.

6.3 Condition 3: Drilling Fluid Release, Containment and Remediation

This section covers the general principles for Condition 3 and drilling fluid containment. More detailed requirements for containment and equipment are included in Section 6 of this plan. If a drilling fluid release is detected the Contractor shall at a minimum take the following immediate actions.

6.3.1 The HDD Contractor shall immediately notify the Owner that a fluid release has been detected. The Owner will notify regulatory agency representatives as soon as possible, however no later than 24 hours after a fluid release has been detected.

6.3.2 HDD Contractor shall immediately begin containment efforts. See Section 6 for discussion of containment methods and equipment requirements.

6.3.3 The Contractor shall take steps to reduce released fluid volumes and pressures that include but are not limited to:

- Size and swab the bore hole
- Adjust drilling fluid viscosity and gel properties to restore circulation
- Add additional pre-approved filling or stabilizing materials to potentially seal fissures in the soil.

6.3.4 Once containment has been established HDD drilling will continue under Condition 3. If the amount of the release occurring exceeds that which can be contained and collected, drilling operations will be suspended until released volumes can be properly contained.

6.3.5 The Contractor shall continue Focused Monitoring, as discussed in section 5.2.2, as well as downstream of the drilling alignment, to ensure additional fluid releases have not occurred.

6.3.6 All measures necessary will be undertaken to prevent release of drilling fluid to the Kennebec River.

If the amount of any drilling fluid release, either on land or within the waters, exceeds that which can be feasibly contained and collected, drilling operations will be suspended and the HDD Contractor shall notify the Owner, who will notify regulatory agency representatives that drilling cannot continue until effective fluid containment measures are developed and implemented without a continuous release of drilling fluid. Drilling will not resume until the Owner and regulatory agencies have approved a plan for continuing with limited releases or recovering drilling equipment and halting drilling activities.

Drilling fluid returns may stop as the drilling fluid consistency changes. If drilling fluid stops returning the surface containment measures shall be maintained in place and drilling will continue under Condition 2.

The HDD Contractor shall keep the Owner and regulatory agency representatives notified when fluid circulation has been restored, as well as the status of any additional releases and their containment.

7 CONTAINMENT METHODS AND EQUIPMENT

The Contractors Plan shall describe containment methods and equipment required based on the potential locations of the release and potential volume of fluid.

The Plan shall describe in detail site specific containment methods, equipment requirements, equipment staging, communication responsibilities, contractors' personnel training and staffing during a release incident. The equipment required to response to an inadvertent fluid release shall be on site, accessible and ready for deployment during all drilling activities.

7.1 Kennebec River Crossing, In Water

The Plan shall describe river low-flow and high-flow conditions and how release monitoring will be coordinated with and shall occur during low river flow conditions. The Plan will document the communication process such as chain of command, responsible parties, and reporting and remediation time frames.

The Plan shall describe how drilling fluid is heavier than water and is typically released at low velocities and settles in low areas. The Plan shall detail how to place barriers around a release in the river, how to divert the river flow away from the release site, how to create a sump within the river diversion, how to pump the released fluid out of the sump, how to collect and transport fluid for disposal, how the inadvertent fluid release site is restored, and how the river diversion is removed.

The Contractors Plan shall describe containment material and equipment staging near the river bank above high water levels. This list of additional containment materials should include barriers, sump pumps, power sources, and hoses and containment tanks that will be staged at the HDD entry or exit points within 1,000 feet of the river.

Specific barriers and equipment shall be identified by the HDD Contractor for the Kennebec River crossing.

7.2 Kennebec River Crossing, On Land

The Plan shall describe spill prevention materials for the HDD entry and exit points.

The HDD Contractor shall discuss how a fluid release containment sump will be constructed on land in soil areas and in shallow bedrock areas, and describe how contained fluids are managed, transported and disposed of.

Any fluid released before a containment can be established shall be contained with temporary barriers such as sand bags, silt fence or filter bags, and then swept back into the containment sump or contained in low areas and vacuumed into holding tanks.

Specific barriers and equipment shall be identified by the HDD Contractor in this Plan.

8 REMEDIATION

The Contractor shall develop and provide a site specific plan for remediation of fluid releases in water and on land to the Owner and regulatory agencies for their review and approval, as part of this Plan, before commencement of drilling activities.

If a fluid release occurs, the HDD Contractor shall contain all fluids, remove drilling fluid that can be vacuumed or swept up, and shall restore the release site.

8.1 Kennebec River Crossing, In Water

The Plan shall discuss removal of drilling fluid from the collection sump and the level of remediation that will be achieved. The Plan will document the communication process and remediation efforts with ample documentation for the Owner and regulatory agencies. The Owner and/or regulatory agencies shall observe the Contractors remediation activities.

After the sump and containment have been remediated and removed the Contractor shall inspect the riverbed a minimum of 500 feet downstream from the fluid release site looking for pockets of

slower moving water where drilling fluid may have collected. Any pockets located shall be evaluated to determine if drilling fluid is present and, if so, whether and how it can be removed.

8.2 Kennebec River Crossing, On Land

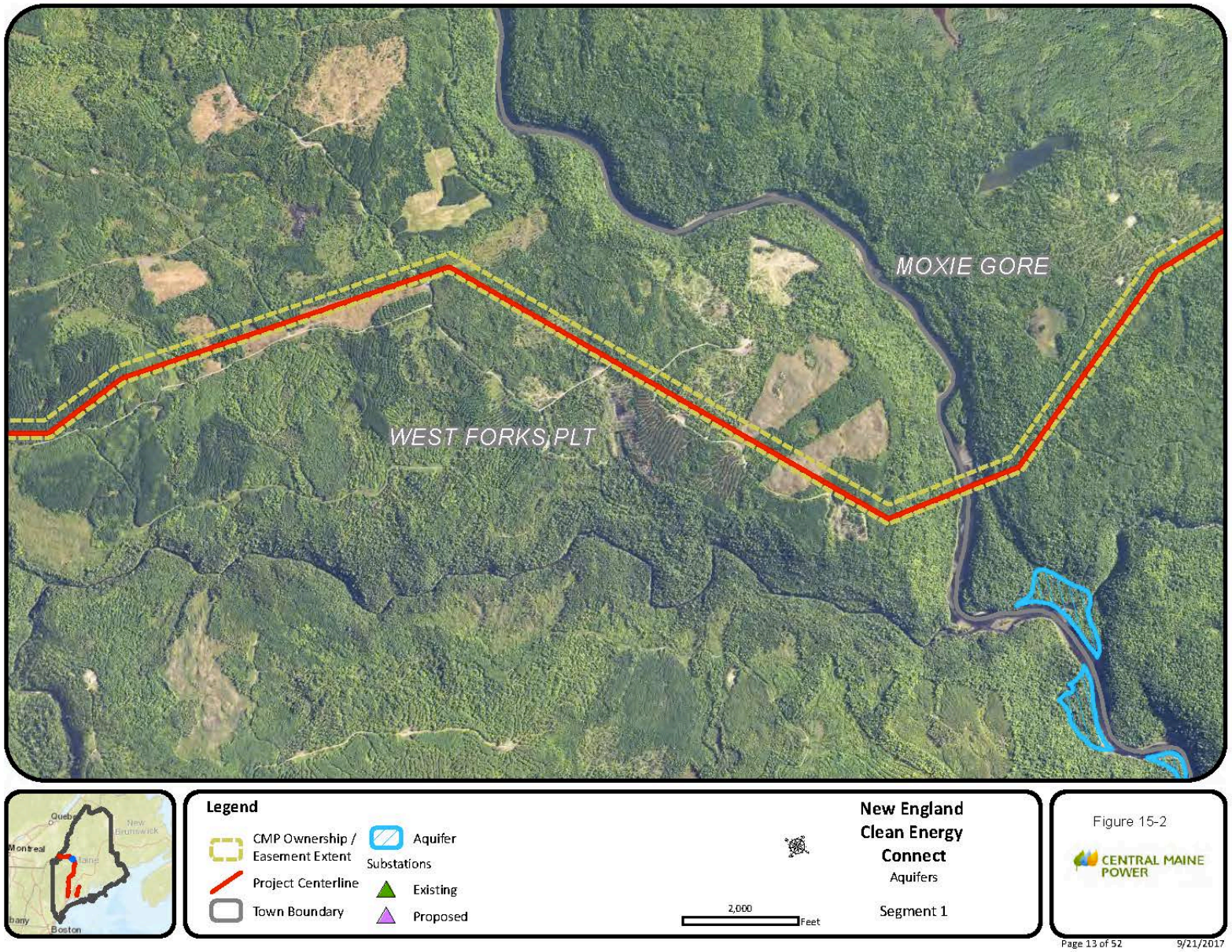
On land the drilling fluid shall be collected into a sump and removed by pumping or vacuuming. Repeated flushes with clean potable water shall be used to remove drilling fluid from vegetation. The Plan will outline the procedures necessary for stabilizing and restoring all disturbed areas to pre-existing conditions.

15.0 GROUNDWATER

The HDD development area does not traverse sole source or significant sand and gravel aquifers. However, an aquifer exists approximately 1,800 feet southwest of the HDD crossing (see Figure 15.1).

The HDD process will not require the use of groundwater from aquifers, so there will be no impact to groundwater quantity.

As referenced in Section 14.0 above, the HDD process uses a drilling fluid which is comprised of mostly water with the addition of naturally occurring clay called sodium montmorillonite (bentonite). Bentonite is a non-toxic, non-reactive, inert material that allows the HDD contractor to monitor and adjust the viscosity of the drilling fluid to achieve the desired carrying and lubricating properties. The HDD contractor will only use fluid with a composition which complies with all federal, state, and local environmental regulations. To further minimize the potential for adverse water quality impacts from the HDD process a licensed landfill or off-site facility will receive the cuttings, spoils, and excess drilling fluid. CMP will ensure that the disposal of all drilling fluids is done in a manner that is in compliance with all permits, and applicable federal, state, and local regulations. As a result, there will be no impact to groundwater quality resulting from the HDD installation of the transmission line.


MOXIE GORE
WEST FORKS PLT
Legend
CMP Ownership / Easement Extent
Project Centerline
Town Boundary
Aquifer
Substations
Existing
Proposed
2,000
Feet
New England Clean Energy Connect
Aquifers
Segment 1
Figure 15-2
CENTRAL MAINE POWER
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9/21/2017

16.0 WATER SUPPLY

300,000 to 400,000 gallons of water will be required to complete the proposed HDD bore. Over the course of a typical day of HDD operations, it is anticipated that 4,000 to 10,000 gallons of water will be required. Due to the elevation gain and distance from the river, it will not be practical to pump the necessary water out of the Kennebec River. The most effective means for obtaining water will be to pump the water out of another nearby body of water and haul it to the HDD work site. Typical small water tank trucks can haul between 2,000 and 4,000 gallons per trip, so it will be feasible to support the water needed by trucking. In accordance with MDEP regulations, for Class A, B, & C waters, there are no restrictions on withdrawal as long as water quality are flows are maintained (Chapter 587 (5 A-C)). For great ponds, water levels cannot be lowered by more than 1 foot between April and July, and by more than 2 feet between August and March (Chapter 587 (6A 1-3)). The HDD contractor will develop a detailed plan which will comply with these and all other regulatory requirements. The contractor's detailed plan will also address any reporting requirements, which vary depending on pumping method, quantity obtained, location of withdrawal, etc. See 38 M.R.S. § 470-B

17.0 WASTEWATER DISPOSAL

No wastewater facilities or wastewater holding tanks are proposed at the Moxie Gore and West Forks Termination Stations. Dewatering associated with the HDD installation will be completed as described in Section 14.0 Basic Standards Submissions.

18.0 SOLID WASTE

A system will be established to retain, process, and recirculate drilling fluids throughout HDD activities. Cuttings from the boring will be removed from the drilling fluid through gravity separation, cyclonic separation, or with a shaker table. The cuttings will be temporarily stored on site in a cutting pit, or a dumpster. The cuttings will be removed from site and disposed of at an approved location. About 1,000 cubic yards of drilling spoils will be generated for appropriate disposal. The State of Maine does not regulate uncontaminated soil, rock, or water.

However, the addition of bentonite results in the drill mud being classified as a solid waste material. Typically, the disposal of this inert material outside of a certified solid waste disposal facility is acceptable, however MDEP may require testing of the material to confirm it is not hazardous before removal from site can occur.

19.0 FLOODING

There are no Federal Emergency Management Agency ("FEMA") mapped 100-year flood zones within the HDD and termination station development areas. Additionally, according to the Land Use Planning Commission ("LUPC") zoning maps, the HDD drilling pad and termination stations on both the east and west sides of the river are not located in a Flood Prone Protection (P-FP) subdistrict. Therefore, the installation of transmission line structures will not directly impact or increase the risk of flooding along the proposed Project route.

20.0 BLASTING

Blasting, if required, will follow the requirements specified in Section 20.0 of CMP's September 27, 2017 Site Law application, further supplemented by CMP's September 6, 2018 response to the MDEP's review memorandum generated by John Hopeck, Ph.D (Division of Environmental Assessment) dated July 31, 2018.

21.0 AIR EMISSIONS

The termination stations will have no air emission producing equipment.

22.0 ODORS

The clearing, construction, maintenance, and operation of the NECEC Project will not result in or create significant odors. Limited and short-term odors may be caused as a result of tree harvesting and the operation of construction equipment.

23.0 WATER VAPOR

The HDD installation and the construction, operation, and maintenance of the termination stations will not generate water vapor. Therefore, the Project will not alter the existing cloud cover or rainfall characteristics of the area.

24.0 SUNLIGHT

The HDD installation and the construction of the termination stations will not block access to direct sunlight for any adjacent buildings that may utilize solar energy through active or passive solar systems. Based on the dispersed and minor nature of termination station equipment, there is no potential for shading of adjacent properties or structures.

25.0 LUPC CERTIFICATION

25.1 Introduction

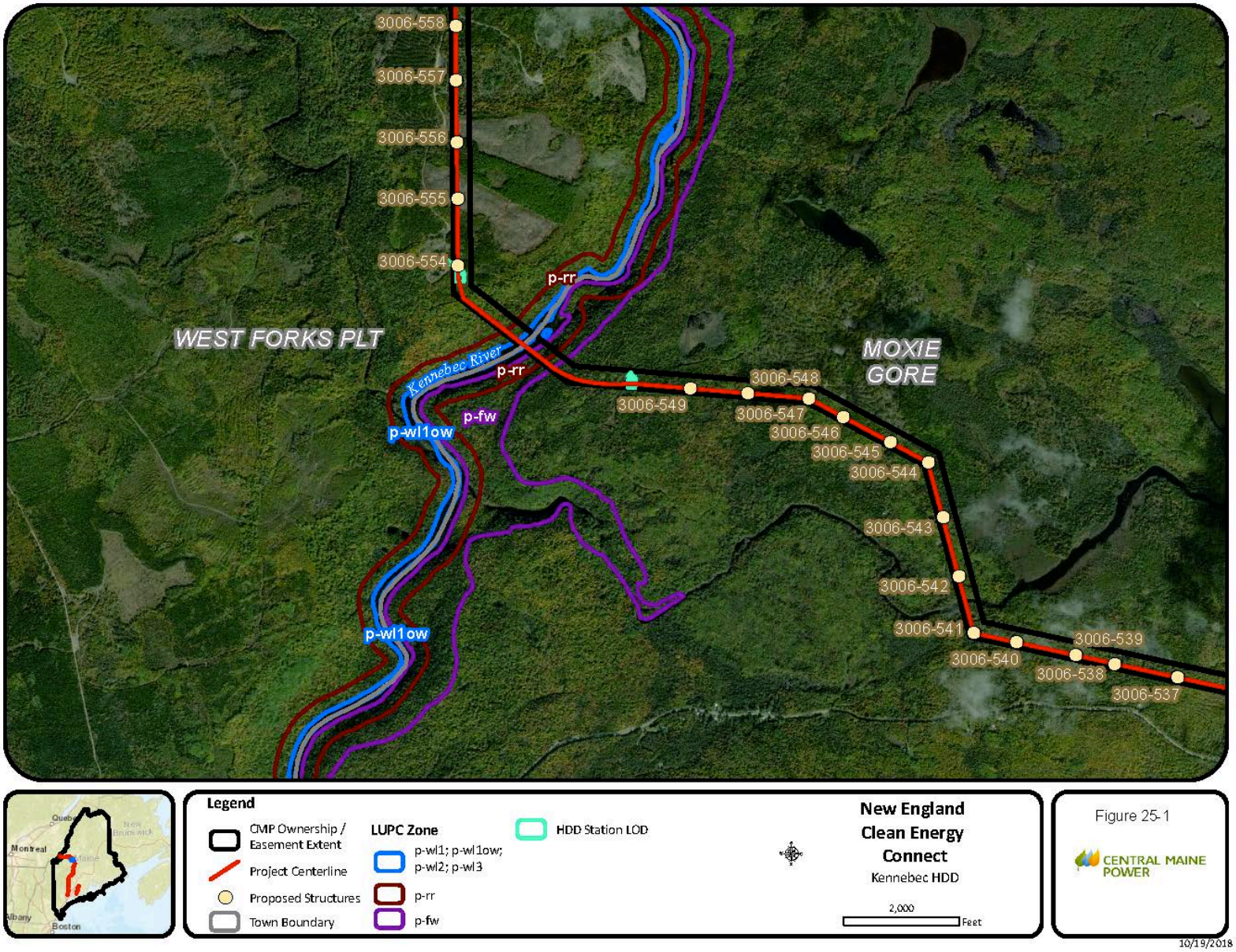
The LUPC Certification section of CMP's September 27, 2017 Site Law application demonstrated that the NECEC Project is an allowed use in the subdistricts for which it is proposed, and that the Project complies with all applicable LUPC land use standards not considered by MDEP in its review of the Project. CMP has now determined that an HDD underground crossing of the Kennebec River would avoid recreational and visual impacts, adverse or otherwise, and is financially practicable. The discussion provided herein is specific to the HDD installation beneath the Kennebec River and associated termination stations proposed on each side of the Upper Kennebec River in Moxie Gore and the West Forks Plt. The information provided below updates Section 25 of the September 27, 2017 Site Law application specific to the proposed underground crossing using HDD technology. Section 2.4.1 *et seq.* of the September 27, 2017 NRPA application, which references the information in Section 25 of the Site Law application, is being concurrently amended in the NRPA application amendment.

25.2 Project Description

Section 1.0 of this application amendment includes a detailed description of the HDD and termination station project modifications. Permanent access will be attained by using existing land management roads on both sides of the river. These roads will require modifications and upgrades to accommodate construction equipment and maintenance vehicles. A short section of permanent gravel road will be constructed at both termination stations, extending the existing land management roads by approximately 156 feet and 728 feet at the Moxie Gore and West Forks termination stations, respectively. See Section 25.4.3 for more information regarding vehicular access.

25.3 LUPC Zoning Compliance

The HDD drilling and receiving platforms and the termination station development areas on both the Moxie Gore and West Forks Plt sides of the river are located within CMP's 300-foot-wide corridor in the General Management (M-GN) subdistrict. As a result of the HDD bore, the HVDC transmission line will pass underground beneath the Fish and Wildlife Protection (P-FW), Wetland Protection (P-WL1), and Recreation Protection (P-RR) subdistricts at the Kennebec River (see Figure 25-1). Although the underground crossing will be below, and therefore not within, these subdistricts, the HDD crossing nonetheless will satisfy LUPC's special exception criteria, as discussed below.


3006-558
3006-557
3006-556
3006-555
3006-554
p-rr
WEST FORKS PLT
Kennebec River
p-rr
p-fw
p-wl1ow
MOXIE GORE
3006-548
3006-549
3006-547
3006-546
3006-545
3006-544
3006-543
3006-542
3006-541
3006-540
3006-539
3006-538
3006-537
p-wl1ow
Legend
CMP Ownership / Easement Extent
Project Centerline
Proposed Structures
Town Boundary
LUPC Zone
p-wl1; p-wl1ow; p-wl2; p-wl3
p-rr
p-fw
HDD Station LOD
New England Clean Energy Connect
Kennebec HDD
2,000
Feet
Figure 25-1
CENTRAL MAINE POWER
10/19/2018

Utility facilities such as the HVDC transmission line is an allowed use in each of these subdistricts, including those that require special exceptions for utility facilities, i.e., the P-RR and P-WL subdistricts. LUPC Ch. 10.23,I,3,d(8) and 10.23,N,3,d(9); *see also* LUPC Ch. 10.23,I,3,f and 10.23,N,3,f ("All uses not expressly allowed, with or without a permit or by special exception, shall be prohibited in P-RR subdistricts.").

The special exception criteria require the applicant to show that: a) there is no alternative site which is both suitable to the proposed use and reasonably available to the applicant; b) the use can be buffered from those other uses or resources within the subdistrict with which it is incompatible; and c) such other conditions are met that the Commission may reasonably impose in accordance with the policies of the Comprehensive Land Use Plan.

25.3.1 P-RR Subdistricts

P-RR subdistricts are those areas identified by the LUPC that provide or support unusually significant primitive recreation opportunities.

25.3.1.1 Upper Kennebec River

The Project corridor crosses the P-RR subdistrict associated with the Upper Kennebec River in West Forks Plt and Moxie Gore. The P-RR subdistrict extends 250 feet from the normal high-water mark on both sides of the river. The transmission line within an HDD crossing would be entirely underground as it passes below (and therefore not within) the P-RR subdistrict. The termination stations on either side of the river are located outside of the P-RR subdistrict. The purpose of the P-RR subdistrict is to provide protection from development and intensive recreational uses to those areas that currently support, or have opportunities for, unusually significant primitive recreation activities. The HDD installation and the development of the termination stations will not be visible from the P-RR subdistrict and therefore visual impacts to recreational users will be avoided. An underground crossing of the Upper Kennebec River would have no impact on the P-RR subdistrict or its intended purpose.

As discussed in CMP's September 27, 2017 application and as supplemented with this application amendment, there is no alternative site which is both suitable for the proposed (transmission line) use and reasonably available to the applicant. Further analysis of construction feasibility, operational and maintenance considerations, total project cost, and visual and recreational impact of the Underground Transmission Alternative described in the September 27, 2017 application have resulted in the conclusion that an HDD crossing beneath the Upper Kennebec River is both suitable and reasonably available to

CMP. Conversely, based on that analysis, the previous Preferred Alternative (an overhead transmission line), is no longer suitable for the crossing of the P-RR because it would have greater impacts than the HDD crossing. As described in the September 27, 2017 application, overhead conductors would be visible to rafters passing through or stopping in this portion of the river, and views of the transmission line structures would occur on the west side of the river with the overhead crossing. This will not occur with the HDD crossing.

Nor are the CMP Land Alternative or the Brookfield Alternative suitable or reasonably available, for the reasons stated in the September 27, 2017 application. Accordingly, no reasonable alternative to the HDD crossing exists which would have less adverse effect upon the natural and recreational features of this segment of the Kennebec River. 38 M.R.S. § 480-D(8).

In addition, the siting of the HDD installation and termination stations will result in maintained forest on both sides of the river and therefore will be buffered from those uses or resources within the subdistrict with which it is incompatible. The HDD crossing increases the forested buffers on both the east and west sides of the Upper Kennebec River beyond what was proposed for the overhead crossing, thereby avoiding visibility of the Project by recreational users on the river (see discussion in Section 6.0).

25.3.2 P-WL Subdistrict

P-WL subdistricts in the NECEC Project area are those areas contained within the normal high-water mark of flowing waters and bodies of standing water and freshwater wetlands. The purpose of the P-WL subdistrict is to conserve wetlands in essentially their natural state because of the indispensable biologic, hydrologic, and environmental functions they perform.

As discussed previously, the HDD installation will result in an underground crossing of the Upper Kennebec River. As a result, impacts to the P-WL subdistrict at the river will be avoided. There are no LUPC mapped P-WL subdistricts within the HDD installation work areas or the termination stations.

25.3.3 P-FW Subdistrict

Utility facilities are an allowed use in the P-FW subdistrict with a permit from the LUPC. Similar to the P-RR and P-WL subdistricts, the transmission line will pass beneath the P-FW subdistrict at the Upper Kennebec River crossing.

25.4 Applicable LUPC Land Use Standards

The LUPC established standards applicable to the Project, but not considered as part of MDEP's application review, include:

1. Land Division History, as required by the LUPC definition of subdivision, § 10.24,F
2. Dimensional Requirements, § 10.26
3. Vehicular Access, Circulation and Parking, § 10.24,B and § 10.25,D
4. Lighting, § 10.25,F
5. Activities in Flood Prone Areas, § 10.25,T
6. Vegetation Clearing, § 10.27,B
7. Signs, § 10.27,J

25.4.1 Land Division History

CMP has obtained title, right, or interest to all parcels required for the project in LUPC jurisdiction. The original application provided a 20-year land division history prepared by Curtis Thaxter, LLC, and associated maps demonstrating that none of the land divisions during that period created a subdivision.

25.4.2 Dimensional Requirements

The LUPC dimensional standards are contained in §10.26 of the Commission's Rules. Dimensional requirements for lot size (§10.26,A), shoreline frontage (§10.26,B), road frontage (§10.26,C), and lot coverage (§10.26,E) apply only to uses involving buildings. Infrastructure within the termination stations will include only electric components and overhead wires (see Attachment 1). There are no buildings or structures with floor area proposed within the termination stations, therefore the dimensional requirements for lot size, shoreline frontage, road frontage, and lot coverage do not apply to the development associated with HDD.

The dimensional requirements for minimum setbacks (§10.26,D) and maximum structure height (§10.26,F), applicable to the Project, are discussed below:

D. Minimum Setbacks: Section 10.26,D(2) states that the minimum setback for commercial or industrial development is 100 feet from minor flowing waters, P-WL1 wetlands, and waterbodies less than 10 acres. The setbacks from waterbodies greater than 10 acres and major flowing waters is 150 feet in all locations. Section 10.26,D(3) states that project components must be set back 75 feet from traveled portions of roads used by the public for access; and 25 feet from side and rear property boundary lines. The termination stations will be positioned outside of the setback requirements. In addition, an exception may be made to the shoreline, road, and/or property line setback requirements for structures where the

Commission finds that such structures must be located near to the shoreline, road, or property line due to the nature of their use. LUPC § 10.26,G(5).

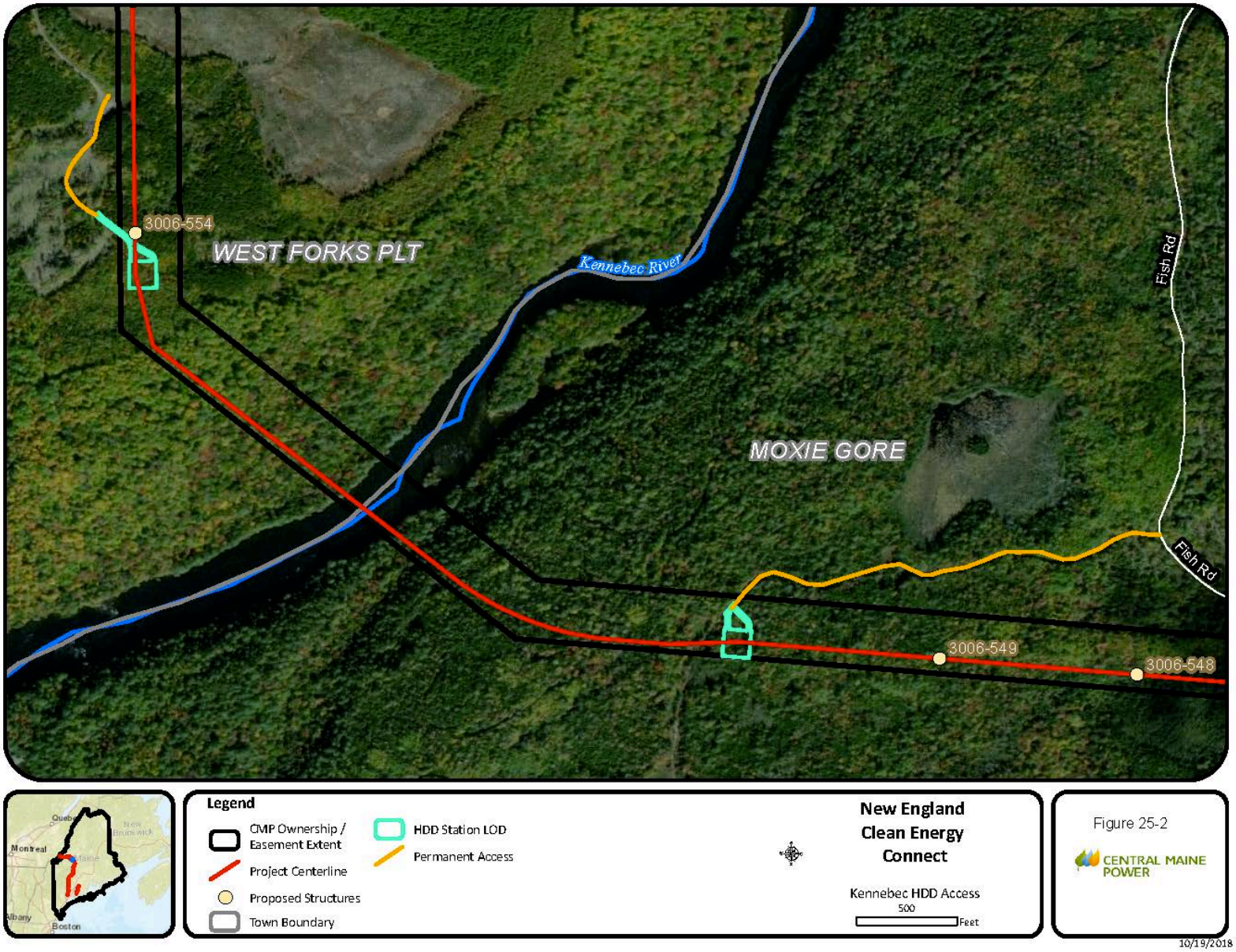
F. Maximum Structure Height: Section 10.26,F(2) states that the maximum structure height is 100 feet for commercial, industrial, and other non-residential uses involving one or more structures. Infrastructure within the termination stations will be no taller than 100 feet.

25.4.3 Vehicular Access, Circulation, and Parking

Section 10.24,B and Section 10.25,D pertain to the standards for vehicle access, parking, and general circulation. See also 12 M.R.S. § 685-B(4)(B).

Since the termination stations are unmanned, vehicular traffic would only be needed during construction (short-term) and maintenance (infrequent), and, as such, the operation of these facilities will not generate a significant amount of traffic. Existing land management roads (e.g., logging roads) will be upgraded and modified (e.g., widened) where needed and extended to the corridor. The existing land management road on the east and west sides of the river will need to be extended approximately 156 feet and 728 feet to gain access to the Moxie Gore and West Forks termination stations, respectively (see Figure 25-2).

Temporary access roads through sections of the new transmission line corridor will need to be established for the clearing and construction phases associated with the HDD and the construction of the termination stations. However, these access roads will be restored to pre-existing contours and revegetated once construction is complete and final restoration has been established. Project construction and maintenance related parking would primarily be in upland locations on the Project corridor or in existing developed areas. The termination stations are unmanned but will require operations visits on a bi-monthly inspection cycle, unless there is an emergency or if electrical switching is needed. Approximately 2-3 vehicles would be parked outside of the termination station during these visits. CMP will meet the vehicular circulation, access, and parking requirements of 10.25(D).


3006-554
WEST FORKS PLT
Kennebec River
Fish Rd
MOXIE GORE
Fish Rd
3006-549
3006-548
Legend
CMP Ownership / Easement Extent
Project Centerline
Proposed Structures
Town Boundary
HDD Station LOD
Permanent Access
New England Clean Energy Connect
Kennebec HDD Access
500
Feet
Figure 25-2
CENTRAL MAINE POWER
10/19/2018

25.4.4 Noise and Lighting

Section 10.25,F pertains to noise and lighting standards. Noise falls under MDEP jurisdiction, while lighting will be evaluated by LUPC.

There will be no station service or permanent lighting at the termination stations. Temporary nighttime lighting will be necessary throughout the HDD installation process. During operation and maintenance activities, work technicians will use portable lighting, as needed.

25.4.5 FEMA Standards

Section 10.25,T outlines the procedural requirements and development standards when conducting development activity in flood prone areas, including areas of special flood hazard, as identified by Flood Prone Protection (P-FP) subdistricts or Federal Emergency Management Agency ("FEMA") Flood Boundary and Floodway, Flood Hazard Boundary, or Flood Insurance Rate Maps ("FIRM").

Based on LUPC zoning maps, the HDD drilling and receiving platforms and termination stations on both the east and west sides of the river are located in the M-GN subdistrict. There are no P-FP subdistricts or FEMA identified flood hazards in the area. Therefore, the installation of transmission line structures will not impact or increase the risk of flooding along the proposed Project route.

25.4.6 Vegetation Clearing

Clearing widths within the 300-foot-wide corridor needed for the HDD installation of the underground conduit and termination stations vary; however, overall tree clearing as a result of the proposed modification will be reduced by approximately 7.16 acres. As a result, the vegetated buffers on the Upper Kennebec River will be expanded from 300 feet and 500 feet on the east and west sides to 1,450 feet and 1,160 feet, respectively.

Section 10.27,B pertains to the standards and requirements for vegetation clearing for any purpose other than road construction, wildlife management, forest management, agricultural management, and public trailered ramps or hand-carry launches. The MDEP applies clearing standards in NRPA resource areas and LUPC applies clearing standards in other areas.

Vegetation clearing activities not in conformance with the standards of Section 10.27,B may be allowed upon issuance of a permit from the Commission provided that such types of activities are allowed in the subdistrict involved. As stated previously, the Project is an allowed use in all subdistricts including those

allowed by special exception. Due to the nature of the Project, the buffer strips identified in LUPC Section 10.27,B will be retained but the Project cannot conform to the selective cutting requirements associated with the maintenance of vegetation (§10.27,B,2). The Project will maintain vegetative buffers in all scenarios but these buffers will not include capable vegetation that could grow to heights which would impede the conductor safety zone of the transmission line. Based on CMP's experience with its vegetation management plan, and based on the proposed compensation plan, vegetation clearing within the corridor will produce no undue adverse impact upon the resources and uses in the area.

25.4.7 Signs

Section 10.27, J pertains to the standards of any signs. Signage will be installed at the termination stations on the outside of the fence and gate panels in accordance with National Electric Safety Code requirements. The following signage will be required:

- A safety sign will be displayed at each entrance and on each side of the fenced enclosure.
- A standard "DANGER HIGH VOLTAGE" sign will be placed at each termination station main and secondary gate panel per gate location as well as within 10 feet from each side of each fence corner, and not more than 50 feet apart along the fence line.
- A standard "CAUTION ENERGIZED LINES OVERHEAD" sign will be placed at each termination station main and secondary gate panel.
- A standard "Substation Information" sign will be placed at each termination station main and secondary gate panel containing the Company's name, name of the termination station and emergency contact information.

This signage is consistent with the exemption for signs displayed for the direction, instruction, or convenience of the public, such as precautionary signs, and thus do not require a permit. Section 10.27,J(1)(e).

Traffic control signs and directional signs related to project construction will be limited and temporary; this signage does not require a permit from the LUPC, provided such signs are in conformance with the requirements of Section 10.27,J(1) and (2).

26.0 NOTICES

No public notices are required as a result of the submittal of application amendment materials. As required by DEP Ch. 3, Section 3(E), copies of this amendment application will be served on all parties and filed with the appropriate town or city clerks and with the county commissioners.

27.0 PROJECT PLANS

- Attachment 1- HDD and Termination Station Plans (attached)
- Attachment 2- Natural Resource Maps (Submitted with October 19, 2018 Supplemental Application Materials)
- Attachment 3- Aquifer Maps (no update necessary)
- Attachment 4- Floodplain and Soil Series Maps (no update necessary)
- Attachment 5- USGS Location Maps (no update necessary)
- Attachment 6- Significant Vernal Pool Location Maps (no update necessary)

REFERENCES

Clement, Christopher, Bertrand Pelletier, Jennifer Ort, and Jacob Freedman. 2018a. New England Clean Energy Connect Archaeological Reconnaissance Survey: Androscoggin, Cumberland, Franklin, Lincoln, Sagadahoc, Somerset, and Kennebec Counties, Maine. Report prepared for Central Maine Power Company, Augusta, ME.

Clement, Christopher, Robert Ingraham, Jacob Freedman, Jennifer Ort, Michael Hambacher, Bertrand Pelletier, Jessica Barnett, Kelly Hockersmith, and Meghan Mooney. 2018b. New England Clean Energy Connect Phase I Archaeological Survey: Androscoggin, Cumberland, Franklin, Lincoln, Sagadahoc, Somerset, and Kennebec Counties, Maine. Report prepared for Central Maine Power Company, Augusta, ME.

Dunham, Jenna, Maureen Bowman, Laurel Bartlett, Chad Blackwell, Liz Blackwell, Lauren Poche, Pamela Kendrick, Nick Linville, Tricia Peone, and Angelique Theriot. 2018. Revised Above Ground Historic Resources Identification Survey, NRHP Evaluation, and Finding of Effects Report New England Clean Energy Connect Androscoggin, Cumberland, Franklin, Lincoln, Sagadahoc, Somerset, and Kennebec Counties, Maine. Report prepared for Central Maine Power Company, Augusta, ME.

Freedman, Jacob A., Jenna Dunham, Jessica Fish, Tricia Peone, Robert Ingraham, Christopher Clement, and Jennifer Ort. 2017. New England Clean Energy Connect Cultural Resources Sensitivity Assessment and Scope of Work for Reconnaissance Surveys Androscoggin, Cumberland, Franklin, Lincoln, Sagadahoc, Somerset, and Kennebec Counties, Maine. Report prepared for Central Maine Power Company, Augusta, ME.

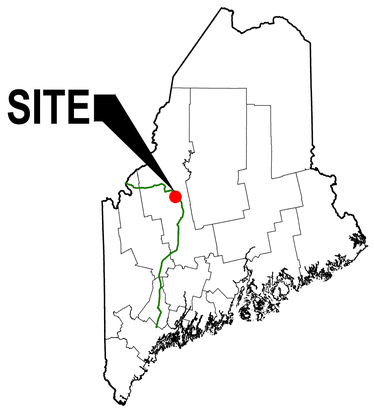
U.S. Fish & Wildlife Service (USFWS). Northern Long-eared Bat as Threatened Questions and Answers. Electronic document: https://www.fws.gov/midwest/endangered/mammals/nleb/FAQsFinalListNLEB.html. Accessed July 19, 2017.

ATTACHMENT 1: HDD and Termination Station Plans

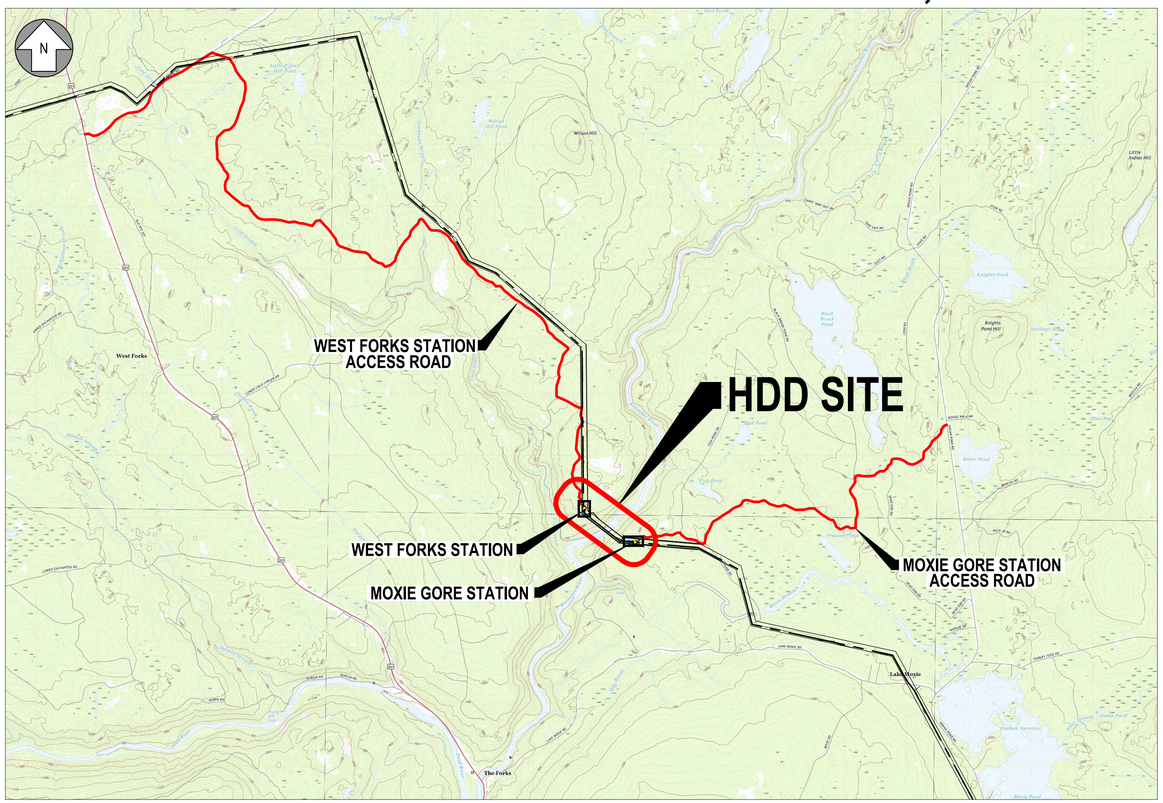
PERMITTING PLAN SET

NECEC KENNEBEC RIVER UNDERGROUND CABLE & HDD

SOMERSET COUNTY
WEST FORKS PLANTATION & MOXIE GORE, MAINE



STATE OF MAINE



LOCATION MAP
SCALE: 1"=4000'

DRAWING INDEX

G-1	COVER SHEET & DRAWING INDEX
G-2	GENERAL NOTES, LEGEND & VICINITY MAP
C-1	HDD CROSSING (STA 0+00 TO 20+50) PLAN & PROFILE
C-2	HDD CROSSING (STA 20+50 TO 36+00) PLAN & PROFILE
C-3	GRADING & RESTORATION PLAN – MOXIE GORE
C-4	GRADING & RESTORATION PLAN – WEST FORKS
C-5	CROSS SECTIONS AND HDD DETAILS 1
C-6	CROSS SECTIONS AND HDD DETAILS 2
C-7	EROSION CONTROL NOTES & DETAILS 1
C-8	EROSION CONTROL NOTES & DETAILS 2
SW-1	PRE-DEVELOPMENT WATERSHED PLAN - WEST FORKS
SW-2	POST-DEVELOPMENT WATERSHED PLAN - WEST FORKS
SW-3	PRE-DEVELOPMENT WATERSHED PLAN - MOXIE GORE
SW-4	POST-DEVELOPMENT WATERSHED PLAN - MOXIE GORE

PREPARED FOR:

AVANGRID

CENTRAL MAINE POWER CO.

83 EDISON DRIVE
AUGUSTA, ME 04336

PREPARED BY:

TRC

249 WESTERN AVENUE
AUGUSTA, ME 04330

811 DigSafe MA·ME·NH·RI·VT

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

IFP - ISSUED FOR PERMITTING
10/17/2018

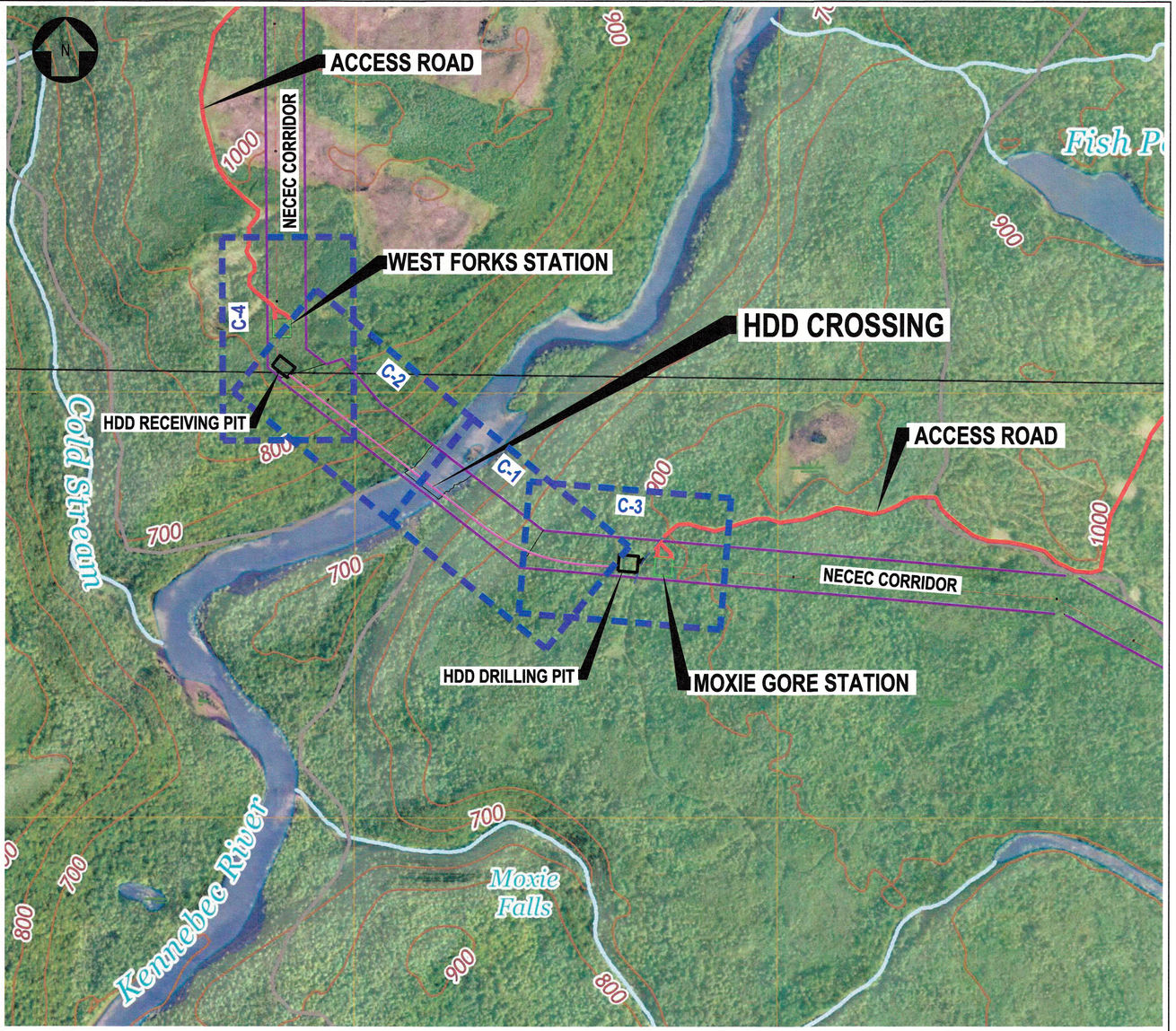
315641-G-1

GENERAL NOTES

1. SURVEY BOUNDARY DATA PROVIDED BY:
   SGC ENGINEERING, INC – "KENNEBEC RIVER GORGE" DATED 9-23-10
   DIRIGO PARTNERS, LTD – "WEYCO SURVEY" DATED 12-06-16
2. TOPOGRAPHIC LIDAR DATA PROVIDED BY CMP DATED SEPTEMBER 2018.
3. PROJECT PROJECTION: NAD83 UTM ZONE – 19 U.S FEET.
4. VERTICAL DATUM: NAVD 88 MEASURED IN U.S. FEET.
5. MEDIUM INTENSITY SOILS INFORMATION OBTAINED FROM WEB SOIL SURVEY OF SOMERSET COUNTY, ME.

LEGEND

EXISTING		PROPOSED
	PROPERTY/ROW LINE	
	SETBACK LINE	
	EASEMENT LINE	
	CENTERLINE	
	EDGE OF PAVEMENT	
	CURBING	
	EDGE OF GRAVEL	
	EDGE OF CONCRETE	
	SUBSTATION YARD	
	SUBSTATION BASELINE	
122	CONTOUR	122
	BUILDING	
	STONEWALL	
	TREELINE	
	CHAIN LINK FENCE	
	STOCKADE FENCE	
	BARB WIRE FENCE	
	RETAINING WALL	
	GUARDRAIL	
S	SEWER	S
FM	SEWER FORCE MAIN	FM
G	GAS	G
W	WATER	W
SD	STORM DRAIN	SD
UD	UNDERDRAIN	UD
12" CMP	CULVERT	12" CMP
UGE	UNDERGROUND ELECTRIC	UGE
	OVERHEAD TRANSMISSION	
○	IRON PIPE/REBAR	●
□	MONUMENT	■
△	SURVEY CONTROL POINT	
x124.6	SPOT ELEVATION	x122.50
Ⓢ	SEWER MANHOLE	●
Ⓓ	DRAINAGE MANHOLE	●
▥	CATCH BASIN	■
Ⓔ	ELECTRIC MANHOLE	●
⋈	SHUTOFF VALVE	⋈
⊹	HYDRANT	⊹
○	UTILITY POLE	●
☼	LIGHT POLE	✶
	MATCHLINE	
	LIMIT OF WORK	
	SILT FENCE	SF
	RIPRAP	
	EDGE OF WATER	
	STREAM	
	EDGE OF WETLANDS	
	WETLANDS	
	DRAINAGE FLOW	
	DRAINAGE SWALE	
	SIGN	
	SOIL BORING	



VICINITY MAP & SITE PLAN DRAWING INDEX
SCALE: 1"=500'

811 DigSafe MA·ME·NH·RI·VT

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	KAV	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

PE STAMP: STATE OF MAINE, TICKY A. YOUNG, No. 15422, LICENSED PROFESSIONAL ENGINEER, October 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

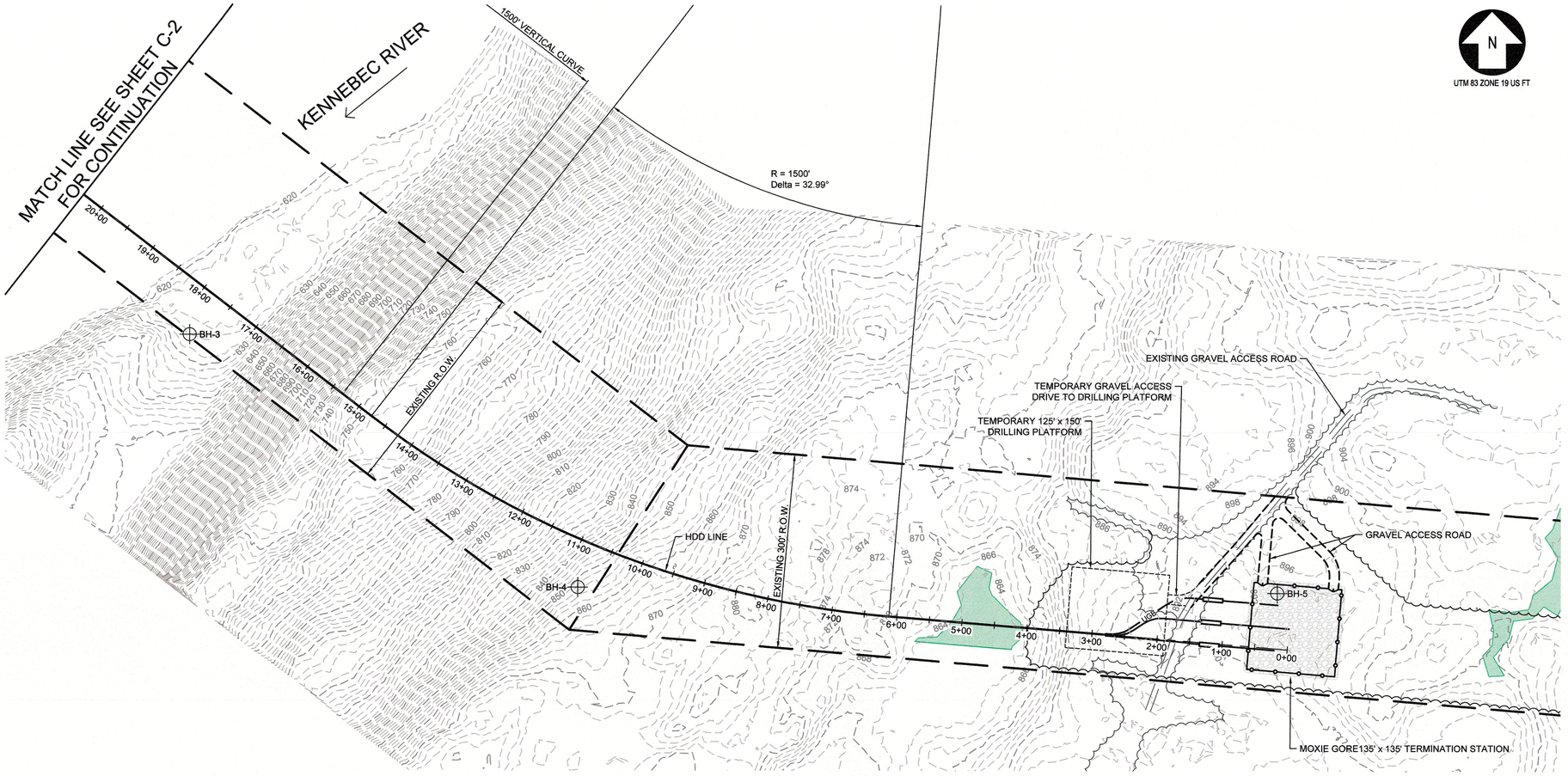
CMP AVANGRID

GENERAL NOTES, LEGEND & VICINITY MAP

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

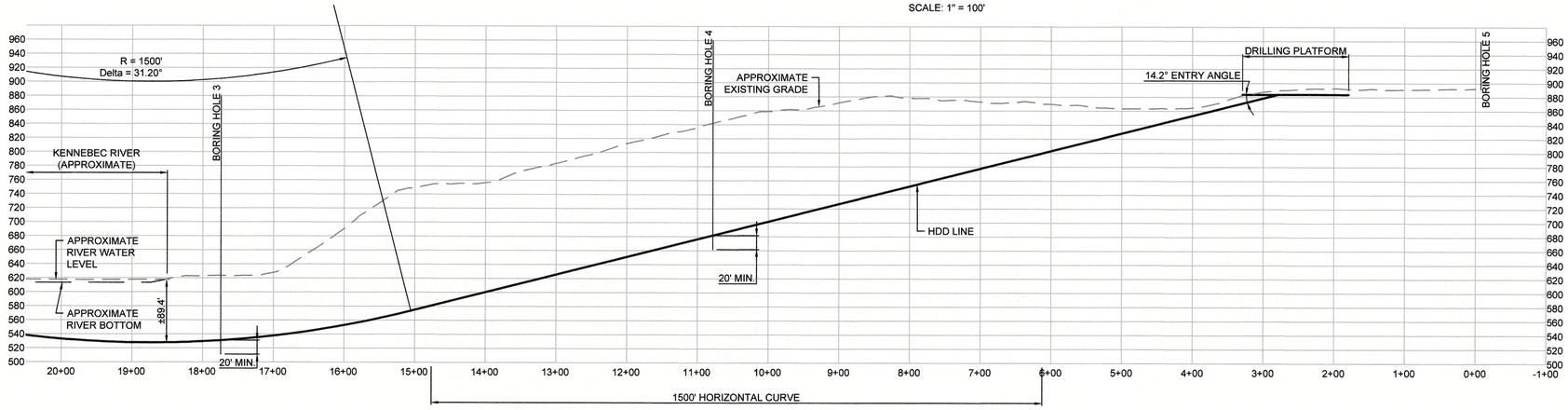
BY	KAV/TRC	SCALE: AS NOTED	FILE: 315641-G-2.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641-G-2	0-0B
DATE	10/05/2018		

LOGO: TRC — PROJECT NO:315641
INFO: TRC, 249 WESTERN AVENUE, AUGUSTA, MAINE, 207-621-7000
ANSI D 10/17/2018



PLAN

SCALE: 1" = 100'



PROFILE

SCALE: HORZ. 1" = 100'
VERT. 1" = 100'

100 0 100 200 FT

SCALE: 1" = 100'

UTM 83 ZONE 19 US FT

SYMBOL LEGEND

SYMBOL	DESCRIPTION
	HDD LINE
UGE	UNDERGROUND ELECTRIC LINE
	TERMINATION STATION FENCE
	ACCESS ROAD
	UNDERGROUND ELECTRIC VAULT
	TEMPORARY WORK PLATFORM
	TEMPORARY ACCESS ROAD
	EXISTING RIGHT OF WAY LINE
	WETLANDS
	STONE PAD
	EXISTING TREE LINE
	LIMIT OF CLEARING
BH-0	PROPOSED BORE HOLE LOCATION

REV	DESCRIPTION	DATE	BY	CK	APP
B.	IFP: ISSUED FOR PERMITTING	10/1/2018	DED	PGT	SGL
A.	IFR: ISSUE FOR REVIEW	10/5/2018	KAV	PGT	SGL

TRC
249 WESTERN AVENUE
AUGUSTA, MAINE 04330
207-621-8000
PROJECT NO:315641

LOCO INFO

ANSI D 10/19/2018

PE STAMP
STATE OF MAINE
RICKY A. YOUNG
No. 6422
LICENSED PROFESSIONAL ENGINEER
Oct. 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
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CMP AVANGRID

INSTALL
HDD CROSSING (STA 0+00 TO 20+50) PLAN & PROFILE

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	DED/TRC	SCALE: AS NOTED	FILE: 315641 HDD Plan And Profile.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 C-1	0-0B
DATE	10/05/2018		

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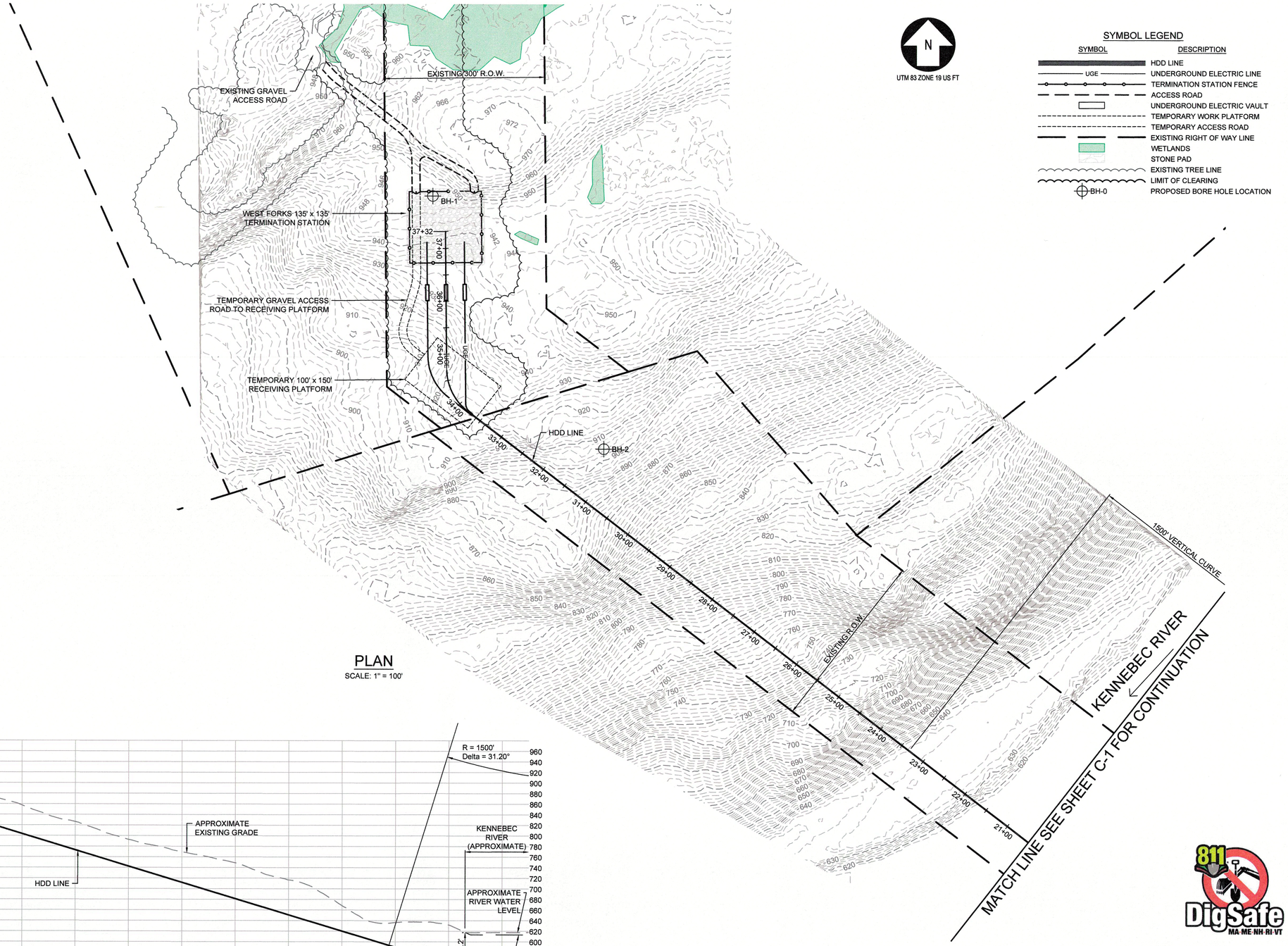
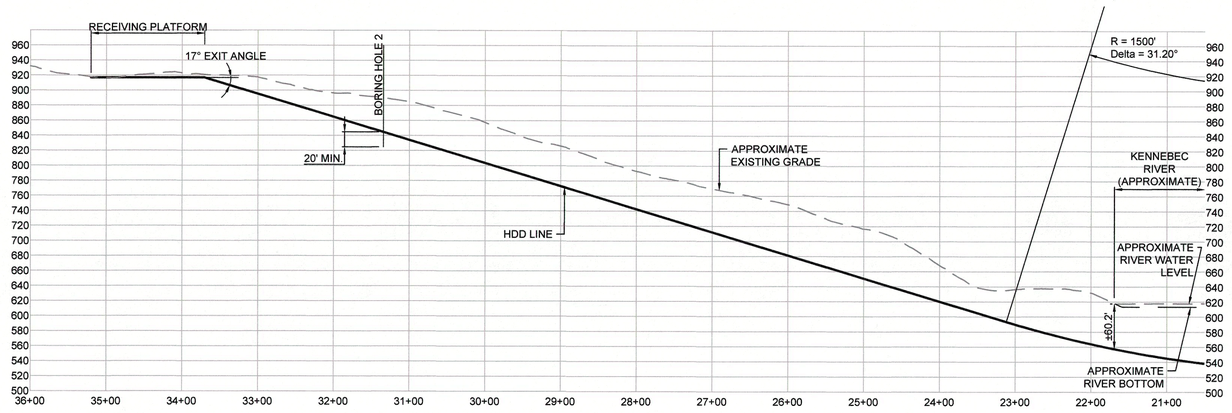
ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION



PLAN

SCALE: 1" = 100'



PROFILE

SCALE: HORZ. 1" = 100'
VERT. 1" = 100'

100 0 100 200 FT

SCALE: 1" = 100'

REV	DESCRIPTION	DATE	DED	PGT	SGL
B	IFP - ISSUED FOR PERMITTING	10/17/2015	DED	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL
REV	DESCRIPTION	DATE	BY	CK	APP

INFO
LOGO
TRC
249 WESTERN AVENUE
AUGUSTA, ME 04330
207-621-7600
PROJECT NO.315441
ANSI D 10/19/2018

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ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP
STATE OF MAINE
RICKY A. YOUNG
No. 6422
LICENSED PROFESSIONAL ENGINEER
OCT. 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
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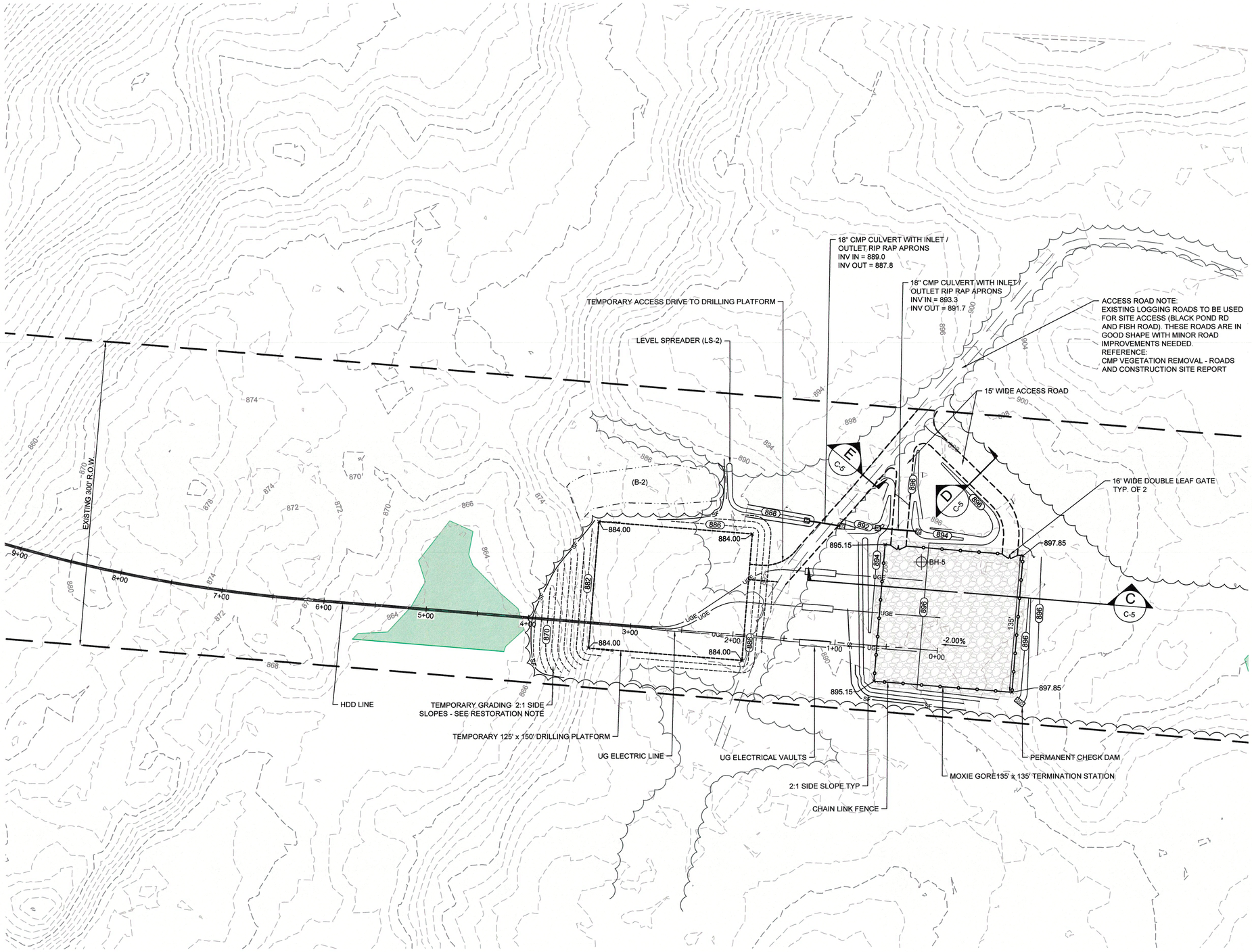
REV	DESCRIPTION	DATE	BY	CK	APP

HDD CROSSING (STA 20+50 TO 36+00)
PLAN & PROFILE

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	DED/TRC	SCALE: AS NOTED	FILE: 315641 HDD Plan And Profile.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 C-2	0-OB
DATE	10/05/2018		



REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	DED	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	CK

LOGO
TRC
249 WESTERN AVENUE
AUGUSTA, ME 04330
207-621-7000
PROJECT NO.315941
INFO
ANSI D 10/19/2018

50 0 50 100 FT
SCALE: 1" = 50'

ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP
STATE OF MAINE
Patricia G. Crowley
No. 6422
LICENSED PROFESSIONAL ENGINEER
10/19/2018

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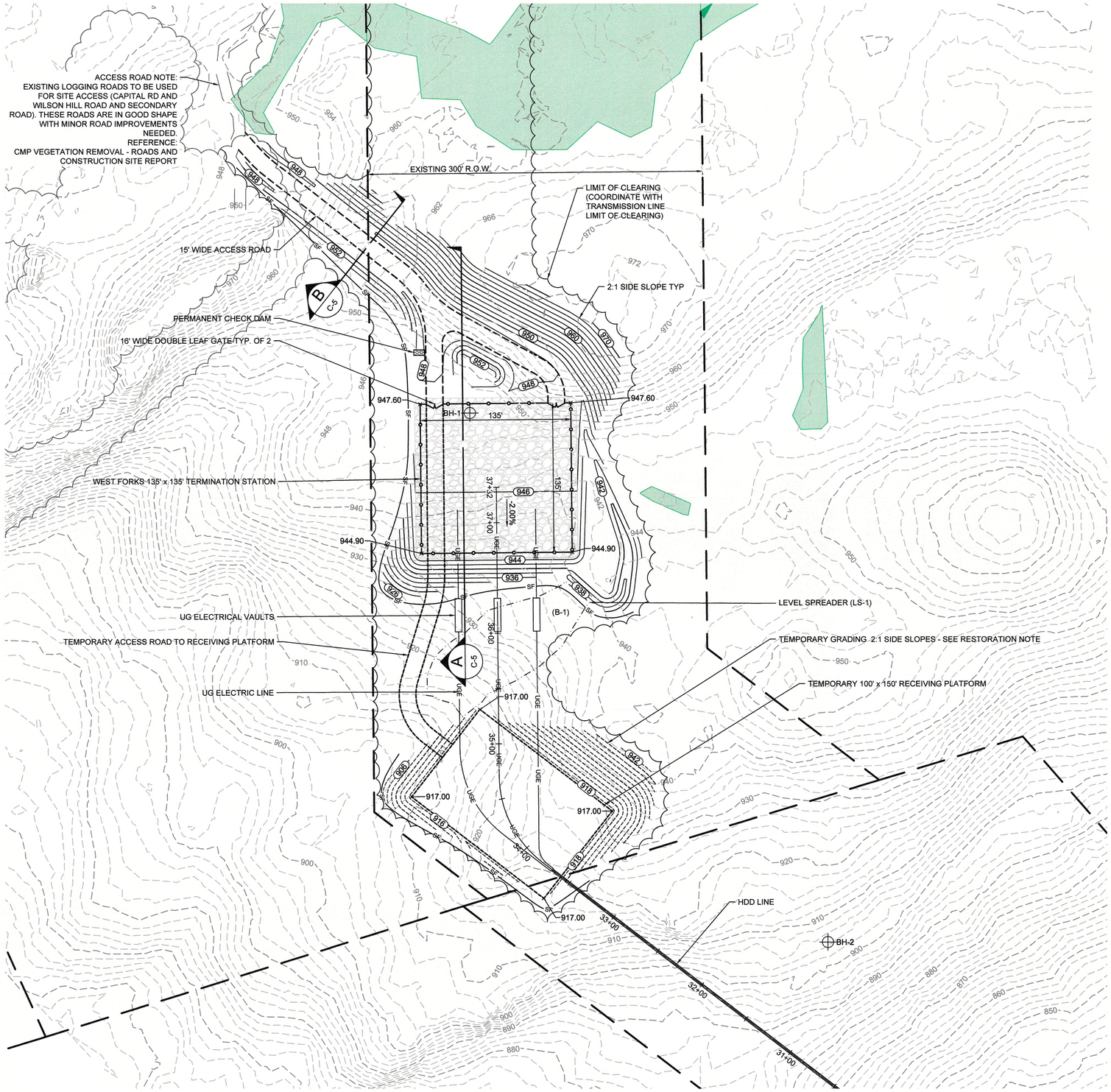
GRADING & RESTORATION PLAN MOXIE GORE

NECEC HDVC LINE — MOXIE GORE & WEST FORKS, ME

BY	DED/TRC	SCALE: AS NOTED	FILE: 315641 Base.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 C-3	0-0B
DATE	10/05/2018		



N

UTM 83 ZONE 19 US FT

SYMBOL LEGEND

SYMBOL	DESCRIPTION
	HDD LINE
UGE	UNDERGROUND ELECTRIC LINE
	TERMINATION STATION FENCE
	ACCESS ROAD
	UNDERGROUND ELECTRIC VAULT
	TEMPORARY WORK PLATFORM
	TEMPORARY ACCESS ROAD
	RIGHT OF WAY LINE
	WETLANDS
	YARD SURFACING
	EXISTING TREE LINE
	LIMIT OF CLEARING
SF	SILT FENCE
850	EXISTING CONTOUR
850	PROPOSED CONTOUR
850	TEMPORARY CONTOUR (SEE RESTORATION NOTE)
BH-0	PROPOSED BORE HOLE LOCATION

RESTORATION NOTE:

PRIOR TO INITIAL SITE GRADING, TOPSOIL WILL BE REMOVED STOCKPILED AND STABILIZED FOR THE DURATION OF CONSTRUCTION. UPON COMPLETION OF CONSTRUCTION THE SITE WILL BE GRADED TO APPROXIMATE PRECONSTRUCTION CONTOURS AND TOPSOIL WILL BE REPLACED. A CONSERVATION SEED MIX (APRIL 16-OCTOBER 31) WILL BE APPLIED AT A RATE SPECIFIED BY THE MANUFACTURER. AN ANNUAL SEED MIXTURE WILL BE APPLIED BASED ON 3X THE MANUFACTURER'S SPECIFIED RATE (NOV 1-APRIL 15). ALL EXPOSED SOIL AND SEEDED AREAS WILL BE COVERED WITH HAY MULCH. MULCH WILL BE APPLIED AT A RATE OF 2 BALES (APRIL 16-OCTOBER 31) AND 5 BALES (NOV 1-APRIL 15) PER 1,000 SQUARE FEET.

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	DED	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KVV	PGT	SGL

LOGO: TRC — PROJECT NO.315641
INFO: TRC, 249 WESTERN AVENUE, AUGUSTA, ME 04330, 207-621-7000
ANSI D 10/19/2018

811 DigSafe MA ME NH RI VT

ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP: STATE OF MAINE — RICKY A. YOUNG — LICENSED PROFESSIONAL ENGINEER — October 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

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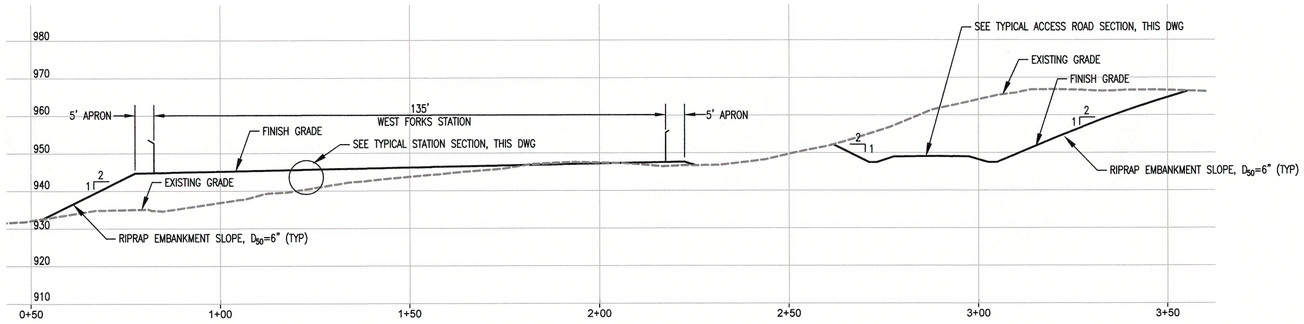
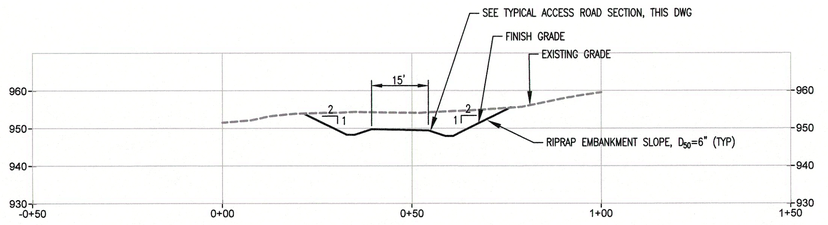
GRADING & RESTORATION PLAN WEST FORKS

NECEC HDVC LINE — MOXIE GORE & WEST FORKS, ME

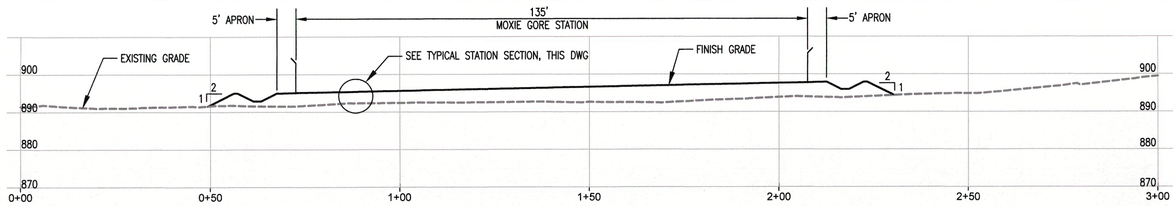
BY	DED/TRC	SCALE: AS NOTED	FILE: 315641 Base.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 C-4	0-0B
DATE	10/05/2018		



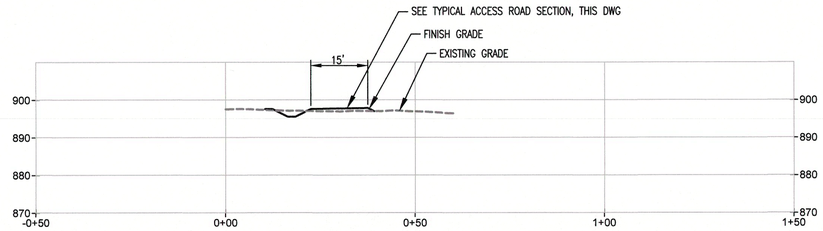
A C-4 WEST FORKS STATION CROSS-SECTION
NOT TO SCALE



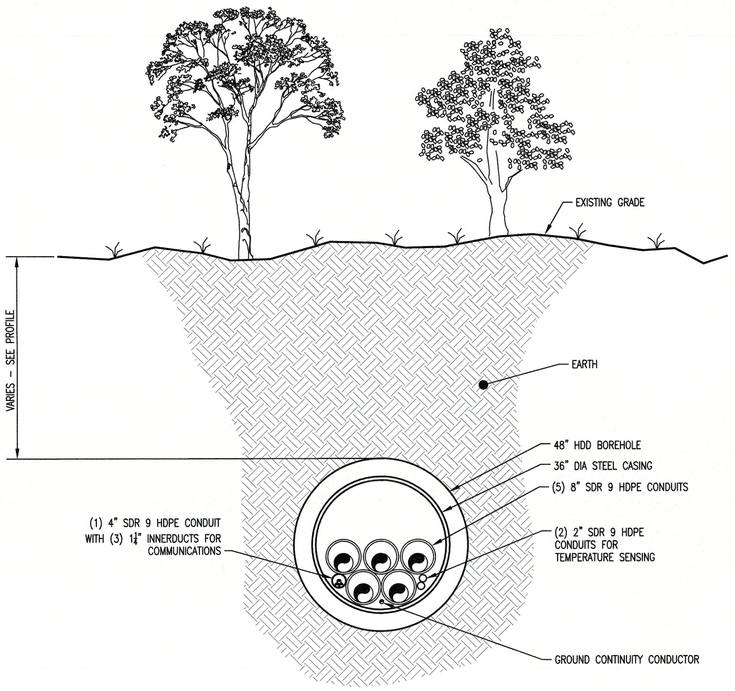
B C-4 WEST FORKS STATION CROSS-SECTION
NOT TO SCALE



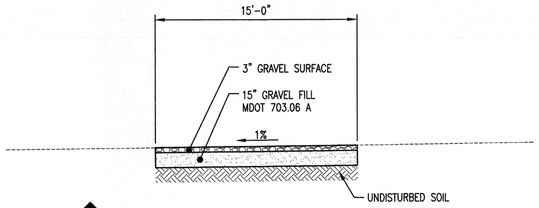
C C-3 MOXIE GORE STATION CROSS-SECTION
NOT TO SCALE



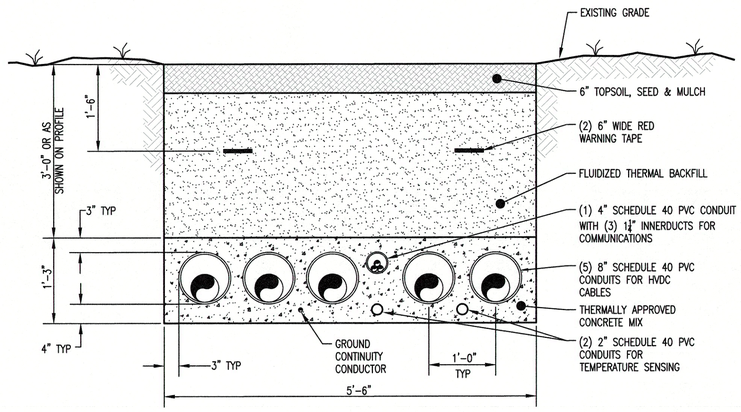
D C-3 MOXIE GORE STATION CROSS-SECTION
NOT TO SCALE



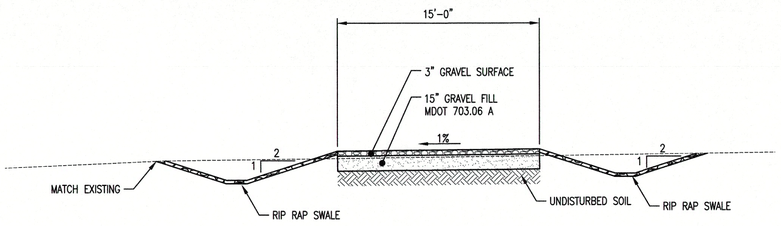
TYPICAL HVDC HDD BORE DETAIL
NOT TO SCALE



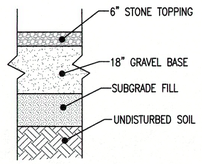
E C-3 TYPICAL ACCESS ROAD RESTORATION DETAIL
NOT TO SCALE



TYPICAL HVDC TRENCH DETAIL
NOT TO SCALE



TYPICAL ACCESS ROAD SECTION
NOT TO SCALE



TYPICAL STATION SECTION
NOT TO SCALE

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ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP
STATE OF MAINE
RICKY A. YOUNG
No. 8422
LICENSED PROFESSIONAL ENGINEER
OCTOBER 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

CMP AVANGRID

CROSS-SECTIONS & HDD DETAILS 1

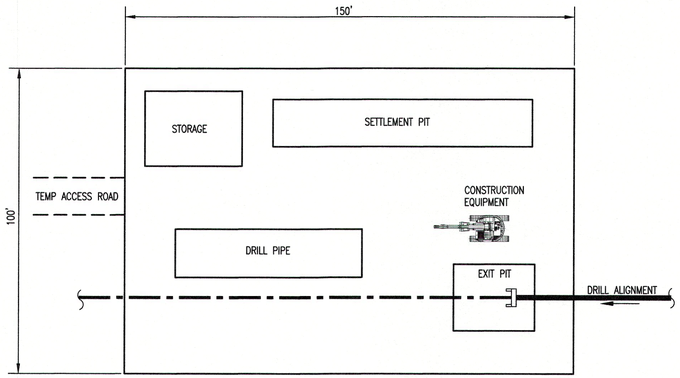
NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	KAV	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

BY	KAV/TRC
CK	PGT/TRC
APP	SGL/TRC
DATE	10/5/2018
SCALE:	AS NOTED
FILE:	315641-C-5.dwg
NO.	315641-C-5
REV	0-0B

TRC
249 WESTERN AVENUE
AUGUSTA, ME 04330
207-621-7000
PROJECT NO.315641

LOGO
INFO
ANSI D 10/19/2018

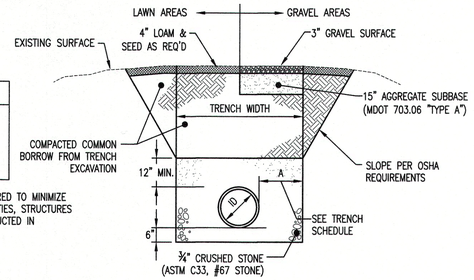


HDD RECEIVING SITE SETUP SCHEMATIC (WEST FORKS)

NOT TO SCALE

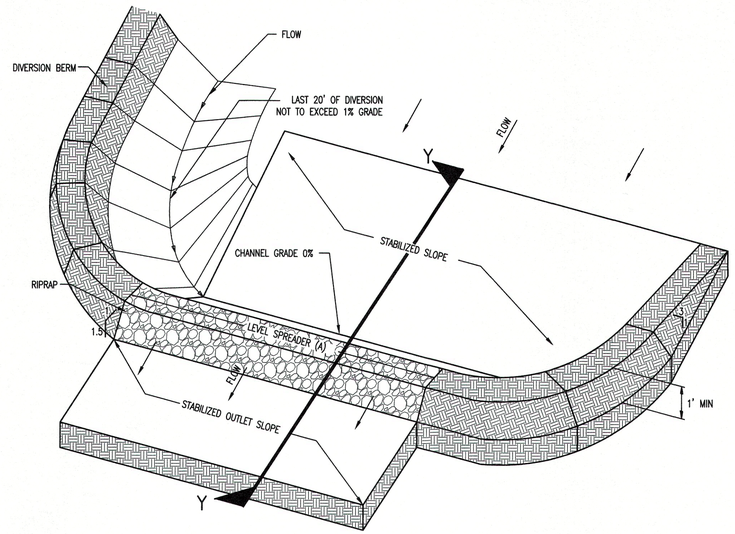
TRENCH SCHEDULE	
ID	A (MIN.)
4"–12"	0'–10"
15"	0'–10"
18"	0'–10"
24"	0'–6"
30"	0'–6"
36"	0'–6"

NOTE: SHORE TRENCH EXCAVATION AS REQUIRED TO MINIMIZE EXCAVATION AND IMPACTS TO ADJACENT UTILITIES, STRUCTURES OR PAVEMENT. TRENCHES SHALL BE CONSTRUCTED IN ACCORDANCE WITH OSHA REQUIREMENTS.

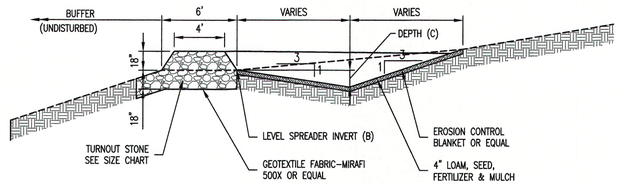


TYPICAL CULVERT TRENCH DETAIL

NOT TO SCALE



TURNOUT STONE SIZE	
SIEVE DESIGNATION	% PASSING BY WEIGHT
12 IN.	100
6 IN.	84–100
3 IN.	68–83
1 IN.	42–55
No. 4	8–12

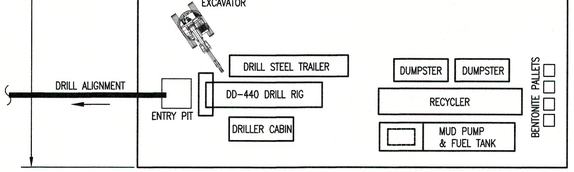


SECTION Y–Y

LEVEL SPREADER CHART				
SITE	ID	LENGTH (A)	INVERT (B)	DEPTH (C)
WEST FORKS	LS–1	30'	941.0	2.5'
MOXIE GORE	LS–2	30'	889.0	1.7'

LEVEL LIP SPREADER DETAIL

NOT TO SCALE



DRILL OPERATION SITE SETUP SCHEMATIC (MOXIE GORE)

NOT TO SCALE

REV	DESCRIPTION	DATE	BY	CK	APP
A	FR: ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL
B	IFP: ISSUED FOR PERMITTING	10/17/2018	KAV	PGT	SGL

INFO
TRC
240 WESTERN AVENUE
AUGUSTA, ME 04330
207-621-1000

LOGO
TRC
PROJECT NO: 315641

ANSI D 10/17/2018

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ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP
STATE OF MAINE
RICKY A YOUNG
No. 5402
LICENSED PROFESSIONAL ENGINEER
10/17/2018

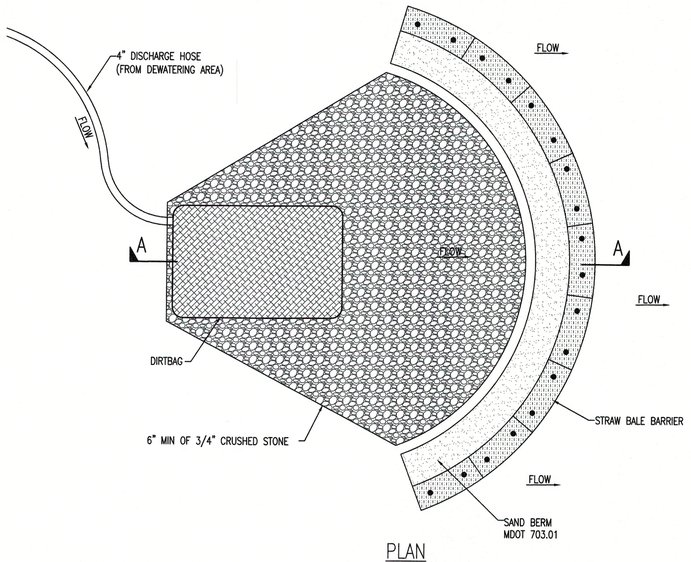
AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

CMP AVANGRID

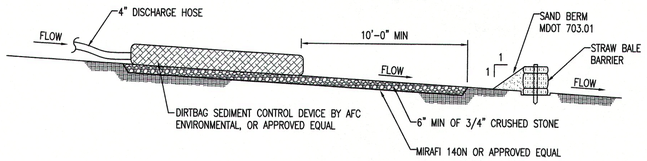
CROSS-SECTIONS & HDD DETAILS 2

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	KAV/TRC	SCALE: AS NOTED	FILE: 315641-C-6.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641-C-6	0-0B
DATE	10/05/2018		



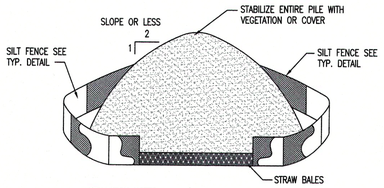
PLAN



SECTION A–A

DEWATERING SYSTEM DETAIL

NOT TO SCALE



INSTALLATION NOTES:

1. AREA CHOSEN FOR STOCKPILING OPERATIONS SHALL BE DRY AND STABLE. STOCKPILES SHALL NOT BE LOCATED:
   A. IN AREAS OF CONCENTRATED FLOW
   B. WITHIN 75' OF A WETLAND OR STREAM
   C. ON A SLOPE GREATER THAN 3%
2. MAXIMUM SLOPE OF STOCKPILE SHALL BE 2H:1V.
3. UPON COMPLETION OF SOIL STOCKPILING, EACH PILE SHALL BE SURROUNDED WITH EITHER SILT FENCING OR STRAW BALES, THEN STABILIZED WITH VEGETATION OR COVERED.

TYPICAL SOIL STOCKPILE

NOT TO SCALE

DEWATERING NOTES

1. THE CONTRACTOR SHALL INSTALL, MAINTAIN, AND OPERATE ALL CHANNELS, SUMPS, AND ALL OTHER TEMPORARY DIVERSION AND PROTECTIVE WORKS NEEDED TO DIVERT STREAM FLOW AND OTHER SURFACE WATER THROUGH OR AROUND THE CONSTRUCTION SITE. CONTROL OF SURFACE WATER SHALL BE CONTINUOUS DURING THE PERIOD THAT DAMAGE TO CONSTRUCTION WORK COULD OCCUR.

2. OPEN EXCAVATIONS SHALL BE DEWATERED AND KEPT FREE OF STANDING WATER AND MUDDY CONDITIONS AS NECESSARY FOR THE PROPER EXECUTION OF THE WORK. THE CONTRACTOR SHALL FURNISH, INSTALL, OPERATE, AND MAINTAIN ALL DRAINS, SUMPS AND ALL OTHER EQUIPMENT REQUIRED TO PROPERLY DEWATER THE SITE. DEWATERING SYSTEMS THAT CAUSE A LOSS OF SOIL FINES FROM THE FOUNDATION AREAS WILL NOT BE PERMITTED.

3. INSTALL DIVERSION DITCHES OR BERMS IF NECESSARY TO MINIMIZE THE AMOUNT OF CLEAN STORMWATER RUNOFF ALLOWED INTO THE EXCAVATED AREA.

4. REMOVAL OF WATER FROM THE CONSTRUCTION SITE SHALL BE ACCOMPLISHED SO THAT EROSION AND THE TRANSPORTING OF SEDIMENT AND OTHER POLLUTANTS ARE MINIMIZED.

5. DISCHARGE DEWATERING EFFLUENT TO AREAS AS INDICATED ON THE SITE GRADING PLAN. DISCHARGE SHALL BE IN SHEET FLOW.

6. DEWATERING IN PERIODS OF INTENSE, HEAVY RAIN, WHEN THE INFILTRATIVE CAPACITY OF THE SOIL IS EXCEEDED, SHALL BE AVOIDED.

7. FLOW TO THE SEDIMENT REMOVAL STRUCTURE MAY NOT EXCEED THE STRUCTURE'S CAPACITY TO SETTLE AND FILTER FLOW OR THE STRUCTURE'S VOLUME CAPACITY.

8. WHEN TEMPORARY WORKS ARE NO LONGER NEEDED, THE CONTRACTOR SHALL REMOVE AND RETURN THE AREA TO A CONDITION SIMILAR TO THAT WHICH EXISTED BEFORE CONSTRUCTION. AREAS WHERE TEMPORARY WORKS WERE LOCATED SHALL BE GRADED FOR SIGHTLY APPEARANCE WITH NO OBSTRUCTION TO NATURAL SURFACE WATER FLOWS OR THE PROPER FUNCTIONING AND ACCESS TO THE WORKS OF IMPROVEMENT INSTALLED. THE CONTRACTOR SHALL EXERCISE EXTREME CARE DURING THE REMOVAL STAGES TO MINIMIZE THE LOSS OF SOIL SEDIMENT AND DEBRIS THAT WAS TRAPPED DURING CONSTRUCTION.

DEWATERING DETAIL NOTES:

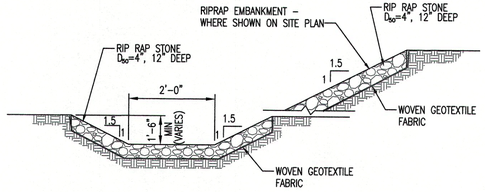
1. DIRT BAG MATERIAL BASED ON PARTICLE SIZE IN DIRTY WATER, I.E. FOR COARSE PARTICLES A WOVEN MATERIAL; FOR SILTS/CLAYS A NON-WOVEN MATERIAL.

2. DO NOT OVER PRESSURIZE DIRT BAG OR USE BEYOND CAPACITY.

3. LOCATE DISCHARGE SITE AS INDICATED ON SITE GRADING PLAN.

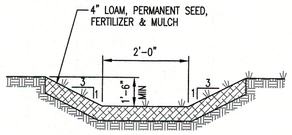
4. DOWNGRADIENT RECEIVING AREA MUST BE WELL VEGETATED OR OTHERWISE STABLE FROM EROSION, E.G. FOREST FLOOR OR COARSE GRAVEL/STONE.

5. DISCHARGE NOT PERMITTED WITHIN 100' OF A STREAM OR WETLAND.



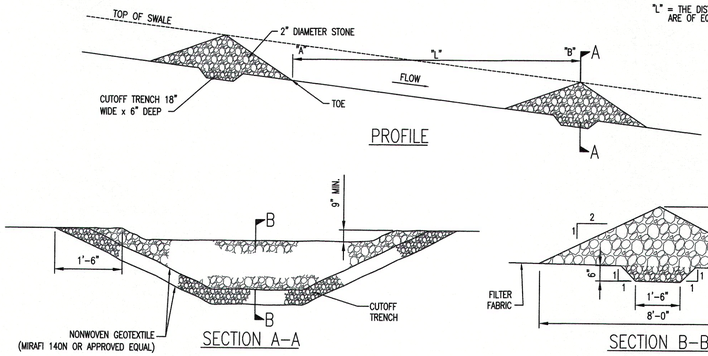
RIPRAP SWALE DETAIL (WEST FORKS STATION)

NOT TO SCALE



VEGETATED SWALE DETAIL (MOXIE GORE STATION)

NOT TO SCALE



"L" = THE DISTANCE SUCH THAT POINTS "A" AND "B" ARE OF EQUAL ELEVATION

SLOPE (FT/FT)	LENGTH (FT/FT)
0.020	100
0.030	66
0.040	50
0.050	40
0.080	25
0.100	20
0.120	17
0.150	13

NOTE: INSTALL WHERE INDICATED ON SITE GRADING PLAN AND AS NEEDED BY SPACING REQUIREMENTS.

CHECK DAM DETAILS

NOT TO SCALE

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	KAV	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

LOGO: TRC
PROJECT NO:315641
INFO: TRC 249 WESTERN AVENUE AUGUSTA, ME 04330 207-621-7500
ANSI D 10/17/2018

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

811 DigSafe MA ME NH RI VT

INSTALL

PE STAMP: STATE OF MAINE RICKY A. GOING No. 6422 PROFESSIONAL ENGINEER OCTOBER 5, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

CMP AVANGRID

EROSION CONTROL NOTES & DETAILS 1

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	KAV/TRC	SCALE: AS NOTED	FILE: 315641-C-7.dwg
CK	PGT/TRC	NO.	
APP	SGL/TRC		
DATE	10/05/2018		

315641-C-7 0-0B

CONSTRUCTION SEQUENCE

1. ESTABLISH CONSTRUCTION WORKSPACE LIMITS; IDENTIFY AND MARK SENSITIVE RESOURCES.

2. PERFORM ALL WORK IN ACCORDANCE WITH MAINE EROSION CONTROL AND SEDIMENT CONTROL HANDBOOK FOR CONSTRUCTION BEST MANAGEMENT PRACTICES (2003) AND MDEP WINTER CONSTRUCTION GUIDELINES (1999).

3. PRIOR TO USAGE, CONSTRUCT AND STABILIZE THE CONSTRUCTION ENTRANCE ON THE EXISTING PERMANENT ACCESS ROAD WITH A STONE PAD, MUD RACK, OR OTHER MATERIALS USED TO REDUCE THE TRACKING OR FLOWING OF SEDIMENT OFF THE SITE AND MAINTAIN UNTIL PAVING IS COMPLETED.

4. CLEAR TIMBER AND BRUSH; DO NOT GRUB UNTIL JUST PRIOR TO PRELIMINARY GRADING AND ESTABLISHMENT AND STABILIZATION OF TEMPORARY OR PERMANENT DRAINAGE COURSES.

5. INSTALL AND MAINTAIN SEDIMENT BARRIERS SUCH AS SILT FENCING AND/OR OTHER EROSION CONTROL BARRIERS ALONG THE DOWNHILL LIMIT OF WORK, AS SHOWN ON THE DRAWINGS. SEDIMENT BARRIER LOCATIONS MAY BE ADJUSTED IN THE FIELD BASED ON SITE CONDITIONS AS DETERMINED BY THE ENGINEERING INSPECTOR. WHERE SILT FENCE CANNOT BE TOED-IN PROPERLY DUE TO TREE ROOTS, ROCKS OR FROZEN GROUND, HAY BALES OR AN EROSION CONTROL MIX BERM MAY BE SUBSTITUTED. SILT FENCING WILL BE INSTALLED AFTER CLEARING BUT PRIOR TO GRUBBING AND GRADING ACTIVITIES. ANY EROSION ISSUES DEVELOPED DURING CLEARING WILL BE TEMPORARILY STABILIZED AS NECESSARY.

6. STABILIZE PERMANENT ACCESS ROAD SURFACE, PARKING AREAS AND EQUIPMENT STORAGE AND LAYDOWN AREAS WITH MATTING, CRUSHED STONE OR GRAVEL SUBBASE AS NECESSARY TO MINIMIZE RUTTING AND AVOID PONDING.

7. CONCURRENT WITH INITIATION OF SITE GRADING, CONSTRUCT AND STABILIZE TEMPORARY DRAINAGE SWALES, DIVERSION BERMS, CHECK DAMS, AND CULVERTS WITH TEMPORARY INLET AND OUTLET STRUCTURES TO MINIMIZE SEDIMENT IN SITE RUNOFF DURING THE CONSTRUCTION OF THE ROADWAY. DEWATER IN ACCORDANCE WITH DEWATERING NOTES BELOW.

8. INSTALL PROPERLY SPACED STONE CHECK DAMS IN ANY SECTION OF DITCH WITHIN 24 HOURS OF FORMING, SHAPING OR ROUGH GRADING THAT SECTION OF DITCH.

9. MINIMIZE THE AMOUNT OF DISTURBANCE AT ANY ONE TIME BY STAGING CONSTRUCTION AS MUCH AS PRACTICAL FOR EFFICIENT CONSTRUCTION OF THE FACILITY. NATURAL VEGETATIVE BUFFERS OR STRIPS SHOULD BE LEFT IN PLACE WHERE FEASIBLE TO AID IN SEDIMENT RETENTION AND REDUCE EROSION POTENTIAL.

10. STABILIZE ANY NEWLY GRADED SLOPE GREATER THAN EIGHT PERCENT AND ANY SECTION OF NEWLY CONSTRUCTED DITCH USING ANCHORED EROSION CONTROL BLANKETS OR OTHER APPROVED MULCHING TECHNIQUES WITHIN 24 HOURS. STABILIZE ANY SLOPE EXCEEDING EIGHT PERCENT AND BROUGHT TO FINAL GRADE WITHIN 24 HOURS USING THE APPROVED PERMANENT STABILIZATION MEASURES FOR SLOPES. STABILIZE ANY SECTION OF DITCH BROUGHT TO FINAL GRADE WITHIN 24 HOURS USING THE APPROVED PERMANENT STABILIZATION MEASURES FOR DITCHES.

11. DUST CONTROL METHODS WILL BE EMPLOYED AFTER GRADING AND PRIOR TO FINAL STABILIZATION TO PREVENT THE BLOWING AND MOVEMENT OF DUST THROUGH THE APPLICATION OF WATER AND/OR CALCIUM CHLORIDE TO REDUCE WIND EROSION. REPETITIVE TREATMENT WILL BE APPLIED AS NEEDED TO ACCOMPLISH CONTROL.

12. APPLY TEMPORARY SEED AND MULCH TO ANY EXPOSED AREAS WHERE ACTIVITY IS NOT ANTICIPATED FOR 30 DAYS OR MORE, OR WHERE ACTIVITY HAS NOT OCCURRED WITHIN 30 DAYS. TEMPORARILY MULCH ANY EXPOSED AREAS WITHIN 100 FEET OF A WETLAND WHERE ACTIVITY IS NOT ANTICIPATED OR HAS NOT OCCURRED IN 7 DAYS.

13. REMOVE EXCESS SPOILS FROM SITE THAT WILL NOT BE USED FOR THE FINAL DESIGN AND STABILIZATION. STOCKPILED SOILS THAT REMAIN IN PLACE FOR 48 HOURS OR MORE WILL BE CONTAINED WITH SEDIMENT BARRIERS SUCH AS SILT FENCE, HAY BALES OR EQUIVALENT. THE SEDIMENT BARRIERS SHALL BE ADEQUATELY LOCATED AND REINFORCED TO HANDLE A SIGNIFICANT RAIN EVENT AND THE POTENTIAL SLUMPING OF THE PILE. BETWEEN APRIL 15 AND OCTOBER 1, APPLY TEMPORARY SEED AND MULCH TO A STOCKPILE THAT IS NOT EXPECTED TO BE DISTURBED WITHIN 30 DAYS. APPLY ANCHORED MULCH DAILY, AS NEEDED, DURING WINTER CONSTRUCTION.

14. INSPECT AND REPAIR EROSION CONTROL MEASURES DAILY IN AREAS OF ACTIVE CONSTRUCTION; OTHERWISE WEEKLY AND AFTER RAINFALL OF ½ INCH OR GREATER WITHIN A 24-HOUR PERIOD. REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES 1/3 THE HEIGHT OF THE BARRIER.

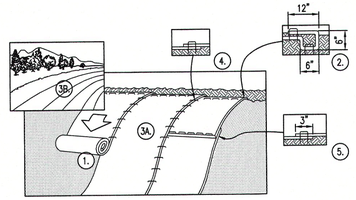
15. MONITOR PUBLIC ROADS FOR SIGNS OF TRACKING OR SPILLING OF SPOIL MATERIAL AND CLEANUP AS NEEDED.

16. COMPLETE FINAL GRADING AND STABILIZATION OF EARTHEN STRUCTURES SUCH AS DIVERSION BERMS, LEVEL SPREADERS AND SWALES THAT WILL CONTROL RUNOFF.

17. FINISH GRADE AND REPLACE TOPSOIL OR LOAM IN DISTURBED AREAS. SEED AND MULCH DISTURBED AREAS WITHIN 6 DAYS OF FINAL GRADING.

18. MAINTAIN ALL TEMPORARY EROSION CONTROLS AND SEDIMENT BARRIERS UNTIL VEGETATION HAS BEEN ESTABLISHED OVER 85-90% OF THE AREA TO BE REVEGETATED. RESEED SPARSELY VEGETATED AREAS.

19. REMOVE ALL TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES ONCE THE SITE IS PERMANENTLY STABILIZED.



1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL-O-SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.

2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF BLANKET EXTEDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.

3. ROLL THE BLANKETS (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING OPTIONAL DOT SYSTEM, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.

4. THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH APPROXIMATELY 2"-5" OVERLAP DEPENDING ON BLANKET TYPE. TO ENSURE PROPER SEAM ALIGNMENT, PLACE THE EDGE OF THE OVERLAPPING BLANKET (BLANKET BEING INSTALLED ON TOP) EVEN WITH THE COLORED SEAM STITCH ON THE PREVIOUSLY INSTALLED BLANKET.

5. CONSECUTIVE BLANKETS SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART ACROSS ENTIRE BLANKET WIDTH.

NOTE:
*IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY SECURE THE BLANKETS.

EROSION CONTROL BLANKET INSTALLATION

NOT TO SCALE

MULCH AND SEEDING SPECIFICATIONS

SUMMARY OF TEMPORARY AND PERMANENT MULCH APPLICATION REQUIREMENTS

CONDITION	TIMING	MULCH TYPE[1,2]	APPLICATION RATES
TEMPORARY			
	IF NO ACTIVITY IN EXPOSED AREAS FOR 7 DAYS, OR PRIOR TO A STORM EVENT	STRAW MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 2000 LB./ACRES
ALL DISTRIBUTED AREAS OF THE CONSTRUCTION WORKSPACE	APPLY MULCH TO ALL EXPOSED AREAS IF NO ACTIVITY OCCURS WITHIN 30 DAYS. APPLY MULCH AND TEMPORARY SEEDING SOONER WHEN IT CAN BE ANTICIPATED THAT ACTIVITY IS NOT GOING TO OCCUR WITHIN 30 DAYS.	STRAW MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 2000 LB./ACRES [3]
ALL WORK AREAS EXPOSED ARE TO BE MULCHED DAILY EACH TIME SOIL IS DISTURBED	NOVEMBER 1 – APRIL 15	STRAW MULCH OR WOOD FIBER MULCH	3 TONS/ACRES 2000 LB./ACRES
PERMANENT			
ON ALL EXPOSED AREAS AFTER SEEDING TO STABILIZE THE SOIL SURFACE	PERMANENT GRASS AND/OR LEGUME SEEDING COVERED BY HAY OR STRAW MULCH ON ALL AREAS THAT HAVE BEEN RESTORED TO FINAL GRADE. THIS DOES NOT APPLY TO AREAS STABILIZED BY OTHER MEANS SUCH AS JUTE MATTING OR PERMANENT EROSION CONTROL MIX.	CRIMPED STRAW MULCH OR PAPER MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 1500 LB./ACRES [4] 2000 LB./ACRES
WOOD CHIP APPLICATION AREAS	PERMANENT GRASS AND/OR LEGUME SEEDING COVERED BY HAY OR STRAW MULCH ON ALL AREAS THAT HAVE BEEN RESTORED TO FINAL GRADE. THIS DOES NOT APPLY TO AREAS STABILIZED BY OTHER MEANS SUCH AS JUTE MATTING OR PERMANENT EROSION CONTROL MIX.	CRIMPED STRAW MULCH OR PAPER MULCH OR WOOD FIBER MULCH	2 TONS/ACRES 1500 LB./ACRES [4] 2000 LB./ACRES

NOTES:
1. STRAW AND HAY MULCH MAY BE USED INTERCHANGEABLY, EXCEPT IN WETLAND AREAS WHERE STRAW MULCH WILL BE REQUIRED.
2. DOUBLE RATE OF WOOD FIBER MULCH WHEN USED IN CRITICAL AREAS.
3. STRAW, HAY, OR HYDROMULCH (WOOD FIBER OR PAPER MULCH AS APPROPRIATE) WILL PROVIDE 90 PERCENT GROUND COVERAGE
4. PAPER MULCH IS ACCEPTABLE FOR USE DURING THE GROWING SEASON. ON SLOPES >30 PERCENT AND IN AREAS WHERE VEGETATION HAS NOT ESTABLISHED WELL, ADDITIONAL HAY MULCH WILL BE ADDED AS A WINTERIZING MEASURE.

MULCH ANCHORING REQUIREMENTS

ON SLOPES GREATER THAN 3 PERCENT, HAY OR STRAW MULCH WILL BE FIRMLY ANCHORED INTO THE SOIL UTILIZING ONE OF THE FOLLOWING METHODS:
-CRIMPING WITH A STRAIGHT OR NOTCHED MULCH CRIMPING TOOL (FARM DISCS WILL NOT BE ALLOWED);
-TRACK WALKING WITH DEEP-CLEATED EQUIPMENT OPERATING UP AND DOWN THE SLOPE (MULCH CRIMPED PERPENDICULAR TO THE SLOPE) ON SLOPES <25 PERCENT;
-APPLICATION OF MULCH NETTING;
-APPLICATION OF 500 LB./ACRE OF WOOD FIBER MULCH OVER STRAW/HAY MULCH; AND
-COMMERCIALLY AVAILABLE TACKIFIERS (EXCEPT WITHIN 100 FEET OF WATERBODIES OR WETLANDS).

SEED MIX SPECIFICATIONS

SEED MIX NAME	SEED MIX COMPONENTS	LB./ACRE [1]
TEMPORARY SEED MIX	ANNUAL RYEGRASS	40
PERMANENT UPLAND SEED MIX	REDTOP CREEPING RED FESCUE TALL FESCUE BIRDSFOOT TREFOIL	4 40 40 16
WOODCHIP APPLICATION SEED MIX	CREEPING RED FESCUE REDTOP TALL FESCUE CROWNVETCH	20 4 30 30
WETLAND SEED MIX	ANNUAL RYEGRASS	40
SUPPLEMENTAL WINTER SEED MIX[2]	WINTER RYEGRASS	120

NOTES:
1. INCREASE SEEDING RATES 10% WHEN HYDROSEEDING
2. WINTER RYE WILL BE ADDED TO PERMANENT UPLAND MIX AT A RATE OF 120 LB./ACRE BETWEEN OCTOBER 1 AND APRIL 15

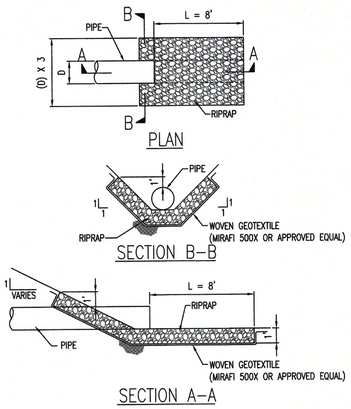
SUMMARY OF SEEDING REQUIREMENTS

CONDITION	TIMING[1,2]	SEED MIX
TEMPORARY SEEDING [3]	TEMPORARY SEED BETWEEN APRIL 15 AND OCTOBER 1 ONLY. DISTURBED AREAS OR SPOIL STOCKPILES WILL BE SEEDED IMMEDIATELY IF FURTHER DISTURBANCE IS NOT EXPECTED FOR 30 DAYS OR MORE.	ANNUAL RYEGRASS
PERMANENT SEEDING [3,4]		
UPLAND PORTIONS OF THE CONSTRUCTION AREA	DISTURBED AREA WILL BE SEEDED WITHIN 6 DAYS OF FINAL GRADING.	PERMANENT UPLAND MIX
SLOPES > 3:1	DISTURBED AREA WILL BE SEEDED IMMEDIATELY AFTER SEEDBED PREPARATION.	PERMANENT UPLAND MIX
WETLANDS	DISTURBED WETLANDS WILL BE SEEDED WITHIN 6 DAYS OF FINAL GRADING.	ANNUAL RYEGRASS
WOODCHIP APPLICATION AREAS	DISTURBED AREA WILL BE SEEDED WITHIN 6 DAYS OF FINAL GRADING.	WOODCHIP APPLICATION SEED MIX
WINTER DORMANT SEEDING	DORMANT SEED BETWEEN OCTOBER 1 AND APRIL 15 ONLY. NO SEEDING WILL OCCUR IF SNOW DEPTHS EXCEED 1 INCH.	PERMANENT UPLAND MIX PLUS WINTER RYEGRASS

NOTES:
1. WEATHER CONDITIONS PERMITTING.
2. AREAS THAT DO NOT SUCCESSFULLY REVEGETATE WITHIN APPROPRIATE PERIOD OF TIME WILL BE RESEEDED AS NECCESSARY.
3. LOOSEN COMPACTED SOIL TO A MINIMUM DEPTH OF 4 INCHES.
4. TOP DRESS WITH 6 INCHES LOAM, AS NEEDED.

FERTILIZER AND LIMESTONE REQUIREMENTS.

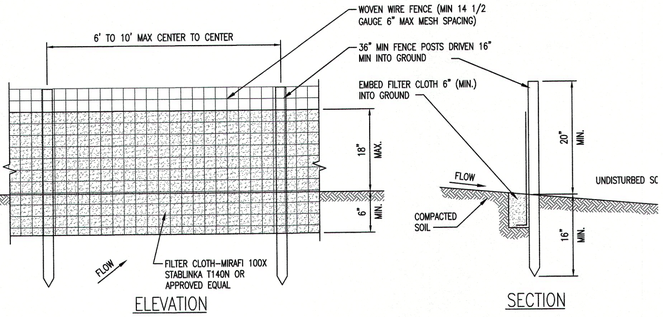
IN GENERAL, FERTILIZER AND LIME APPLICATION RATES WILL FOLLOW THE GUIDELINES IDENTIFIED BELOW UNLESS SITE SPECIFIC SOIL TESTS IDENTIFY THE NEED FOR ALTERNATIVE FERTILIZER/LIME APPLICATION RATES. FERTILIZER WILL BE APPLIED TO UPLAND AREAS PRIOR TO SEEDING AT A RATE OF 800 POUNDS PER ACRE USING 10-20-20 (N-P2O5-K2O) OR EQUIVALENT. GROUND LIMESTONE (EQUIVALENT TO 50 PERCENT CALCIUM PLUS MAGNESIUM OXIDE) WILL BE APPLIED AT A RATE OF 3 TONS PER ACRE. AN EQUIVALENT MIXTURE OF FERTILIZER AND LIME MAY BE APPLIED USING THE HYDROSEEDING METHOD. NO LIME OR FERTILIZER WILL BE APPLIED TO WETLANDS.



NOTES:
- D50=4", D100=6"
- THICKNESS=12"
- STONE FOR RIPRAP SHALL CONSIST OF SUB-ANGULAR FIELD STONE OR ROUGH UNHEWN QUARRY STONE OF APPROXIMATELY RECTANGULAR SHAPE. THE STONE SHALL BE HARD AND OF SUCH QUALITY THAT IT WILL NOT DISINTEGRATE ON EXPOSURE TO WATER OR WEATHERING, BE CHEMICALLY STABLE, AND IT SHALL BE SUITABLE IN ALL OTHER RESPECTS FOR THE PURPOSE INTENDED. THE BULK SPECIFIC GRAVITY (SATURATED SURFACE-DRY BASIS) OF THE INDIVIDUAL STONES SHALL BE AT LEAST 2.5.

CULVERT INLET/OUTLET PROTECTION

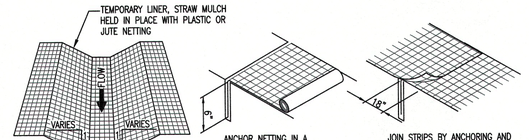
NOT TO SCALE



1. WOVEN WIRE FENCE TO BE FASTENED TO FENCE POSTS WITH WIRE TIES OR STAPLES.	POSTS: STEEL "T" OR "U" TYPE OR 2" HARDWOOD.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MIDSECTION.	FENCE: WOVEN WIRE. 14 1/2 GA 6" MAX MESH OPENING.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY 6" AND FOLDED.	FILTER CLOTH: FILTER X, MIRAFI 100X. STABLINKA T140N OR APPROVED EQUAL.
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN BUILD-UP REACHES 1/3 THE HEIGHT OF THE FENCE.	PREFABRICATED UNIT: ENVIROFENCE OR APPROVED EQUAL

SILT FENCE DETAILS

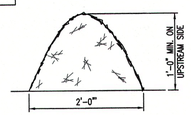
NOT TO SCALE



1. EXCAVATE THE CHANNEL AND SHAPE IT TO AN EVEN CROSS-SECTION AS SHOWN. WHEN STAKING INDICATE A 0.2' OVERCUT AROUND THE CHANNEL PERIMETER FOR SILTING AND BULKING.
2. GRADE SOIL AWAY FROM CHANNEL SO THAT SURFACE WATER MAY ENTER FREELY.
3. APPLY LIME, FERTILIZER AND SEED TO THE CHANNEL AND ADJOINING AREAS IN ACCORDANCE WITH THE EROSION CONTROL PLAN.
4. SPREAD HAY OR STRAW MULCH AT THE RATE OF 100LB/1000 SF.
5. HOLD MULCH IN PLACE IMMEDIATELY AFTER SPREADING WITH A PLASTIC NETTING INSTALLED AS SHOWN.
6. START LAYING THE NET FROM THE TOP OF THE UPSTREAM END OF THE CHANNEL AND UNROLL IT DOWN GRADE. DO NOT STRETCH THE NETTING.
7. BURY THE UP SLOPE END AND STAPLE THE NET EVERY 12" ACROSS THE TOP END, EVERY 3 FT AROUND THE EDGES AND ACROSS THE NET SO THAT THE STRAW IS HELD CLOSELY AGAINST THE SOIL. HOWEVER, DO NOT STRETCH THE NETTING WHEN STAPLING.
8. NETTING STRIPS SHOULD BE JOINED TOGETHER ALONG THE SIDES WITH A 3" OVERLAP AND STAPLED TOGETHER.
9. TO JOIN ENDS OF STRIPS, INSERT A NEW ROLL OF NET IN A TRENCH AS WITH THE UP SLOPE END AND OVERLAP IT 18" WITH THE PREVIOUSLY LAID UPPER ROLL. TURN UNDER 6" OF THE 18" OVERLAP AND STAPLE EVERY 12" ACROSS THE END.

GRASS LINED CHANNEL

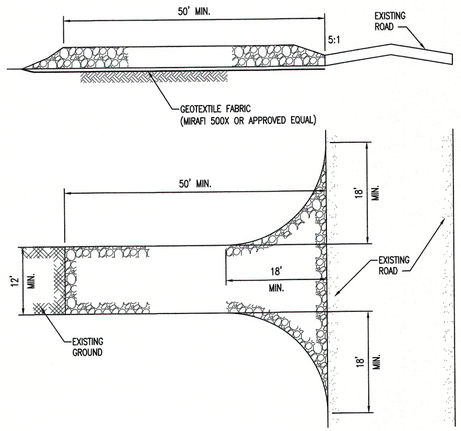
NOT TO SCALE



EROSION CONTROL SOIL/BARK MIX: SHALL CONSIST OF SHREDDED BARK, STUMP GRINDINGS, COMPOSTED BARK OR FLUME GRIT AND FRAGMENTED WOOD GENERATED FROM WATER-FLUME LOG HANDLING SYSTEMS. THE MIX SHALL CONFORM TO THE FOLLOWING:
1. pH – 5.0 TO 8.0.
2. SCREEN SIZE: 6" – 100% PASSING
   3/4" – 70% TO 85% PASSING
   MIX SHALL NOT CONTAIN LARGE PORTIONS OF SILTS, CLAYS OR FINE SANDS
3. ORGANIC MATERIAL 20% – 100% (DRY WEIGHT BASIS)
   ORGANIC PORTION MUST BE FIBROUS AND ELONGATED
4. SOLUBLE SALTS SHALL BE < 4.0 mmhos/cm

EROSION CONTROL BERM

NOT TO SCALE



1. STONE SIZE – USE 2" STONE.
2. LENGTH – NOT LESS THAN 50 FEET.
3. THICKNESS – NOT LESS THAN SIX (6) INCHES.
4. WIDTH – TWELVE (12) FOOT MIN. BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.
5. GEOTEXTILE FABRIC – WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING THE STONE.
6. SURFACE WATER – ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

STABILIZED CONSTRUCTION ENTRANCE

NOT TO SCALE

811 DigSafe MA ME NH RI VT

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

REV	DESCRIPTION	DATE	BY	CK	APP
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL
B	IFP - ISSUED FOR PERMITTING	10/17/2018	KAV	PGT	SGL

PE STAMP
STATE OF MAINE
RICKY A. YOUNG
No. 6424
LICENSED
PROFESSIONAL ENGINEER
10/17/2018

AVANGRID ENGINEERING
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CMP AVANGRID

EROSION CONTROL NOTES & DETAILS 2

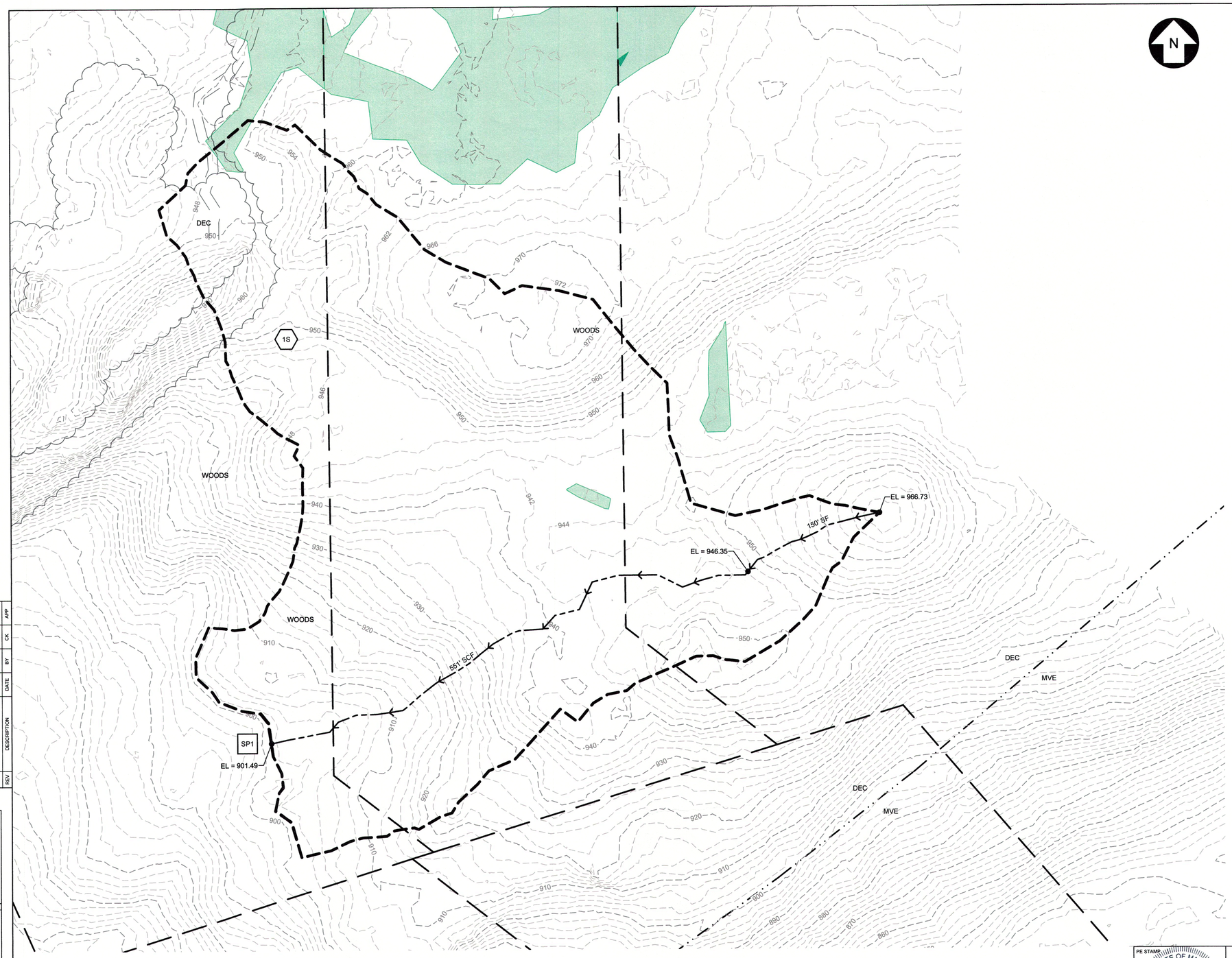
NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	KAV/TRC	SCALE: AS NOTED	FILE: 315641-C-8.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641-C-8	0-0B
DATE	10/05/2018		

INFO: TRC, 249 WESTERN AVENUE AUGUSTA, MAINE 04330, 207-621-7000

LOGO: TRC PROJECT NO.315641

ANSI D 10/17/2018



SOILS LEGEND		
MAP UNIT SYMBOL	MAP UNIT NAME	HSG RATING
DEC	DANFORTH-ELLIOTTSVILLE ASSOCIATION, 3 TO 15 PERCENT SLOPES	B
MOB	MONARDA-BURNHAM COMPLEX, 0 TO 3 PERCENT SLOPES, VERY STONY	D
MTB	MONARDA-TELOS COMPLEX, 0 TO 8 PERCENT SLOPES, VERY STONY	D
MVE	MONSON-ELLIOTTSVILLE-KNOB LOCK COMPLEX, 30 TO 60 PERCENT SLOPES, VERY ROCKY	D

WEST FORKS PRE-DEVELOPMENT LAND COVER COMPARISON SUMMARY (ACRES)		
COVER TYPE	CN	1S
ROOFS & FOUNDATIONS	98	0.00
STONE YARD SURFACE	55	0.00
GRAVEL ROAD, HSG B	96	0.00
BRUSH, HSG B	67	0.14
WOODS, HSG B	66	5.89
TOTAL AREA		6.03

LEGEND

- SUBCATCHMENTBOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- REACH
- 100' SF — SHEET FLOW
- 100' SCF — SHALLOW CONCENTRATED FLOW
- 100' CF — CHANNEL FLOW
- EL. 520.0± — SPOT ELEVATION
- 1R — REACH ID
- 1S — SUBCATCHMENT ID
- 1P — POND ID
- SP1 — STUDY POINT ID
- RIGHT OF WAY
- SOILS
- 100 — CONTOUR
- TREELINE
- WETLAND

811 DigSafe MA·ME·NH·RI·VT

ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	CMW	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	SGL

INFO
TRC
249 WESTERN AVENUE
AUGUSTA, ME 04330
207-621-7000

LOGO
TRC
PROJECT NO.315641

ANSI D 10/17/2018

PE STAMP
STATE OF MAINE
RICKY A. GAGNON
LICENSED
PROFESSIONAL ENGINEER
OCT 19, 2018

AVANGRID ENGINEERING
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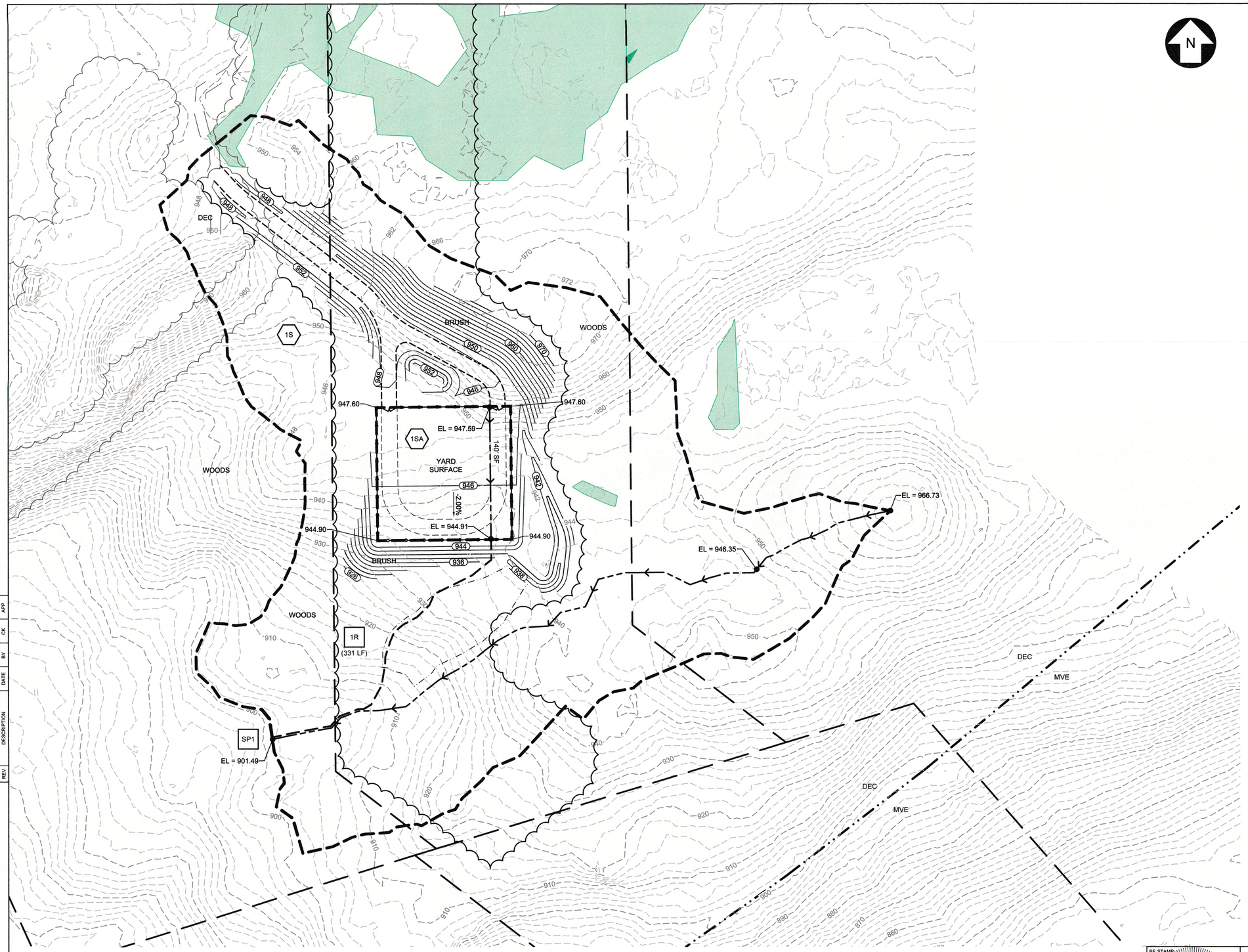
PRE-DEVELOPMENT WATERSHED PLAN

WEST FORKS STATION

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	PGT/TRC	SCALE: AS NOTED	FILE: 315641 Watershed.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 SW-1	0-0B
DATE	10/05/2018		



SOILS LEGEND		
MAP UNIT SYMBOL	MAP UNIT NAME	HSG RATING
DEC	DANFORTH-ELLIOTTSVILLE ASSOCIATION, 3 TO 15 PERCENT SLOPES	B
MOB	MONARDA-BURNHAM COMPLEX, 0 TO 3 PERCENT SLOPES, VERY STONY	D
MTB	MONARDA-TELOS COMPLEX, 0 TO 8 PERCENT SLOPES, VERY STONY	D
MVE	MONSON-ELLIOTTSVILLE-KNOB LOCK COMPLEX, 30 TO 60 PERCENT SLOPES, VERY ROCKY	D

WEST FORKS POST-DEVELOPMENT LAND COVER COMPARISON SUMMARY (ACRES)			
COVER TYPE	CN	1S	1SA
ROOFS & FOUNDATIONS	98	0.00	0.01
STONE YARD SURFACE	55	0.00	0.47
GRAVEL ROAD, HSG B	96	0.15	0.00
BRUSH, HSG B	67	0.48	0.00
WOODS, HSG B	66	4.92	0.00
TOTAL AREA		5.55	0.48

LEGEND

- SUBCATCHMENTBOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- REACH
- 100' SF — SHEET FLOW
- 100' SCF — SHALLOW CONCENTRATED FLOW
- 100' CF — CHANNEL FLOW
- EL. 520.0± — SPOT ELEVATION
- 1R — REACH ID
- 1S — SUBCATCHMENT ID
- 1P — POND ID
- SP1 — STUDY POINT ID
- RIGHT OF WAY
- SOILS
- 100 — EXISTING CONTOUR
- 100 — PROPOSED CONTOUR
- TREELINE
- WETLAND

811 DigSafe MA ME NH RI VT

ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

50 0 50 100 FT
SCALE: 1" = 50'

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/11/2018	CMW	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KAV	PGT	CK
					BY
					APP

LOGO: TRC
INFO: TRC, 249 WESTERN AVENUE AUGUSTA, MAINE 04330, 207-621-7000
PROJECT NO:315641
ANSI D 10/19/2018

PE STAMP: STATE OF MAINE, RICKY A. YOUNG, 12082, LICENSED PROFESSIONAL ENGINEER, Oct. 19, 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

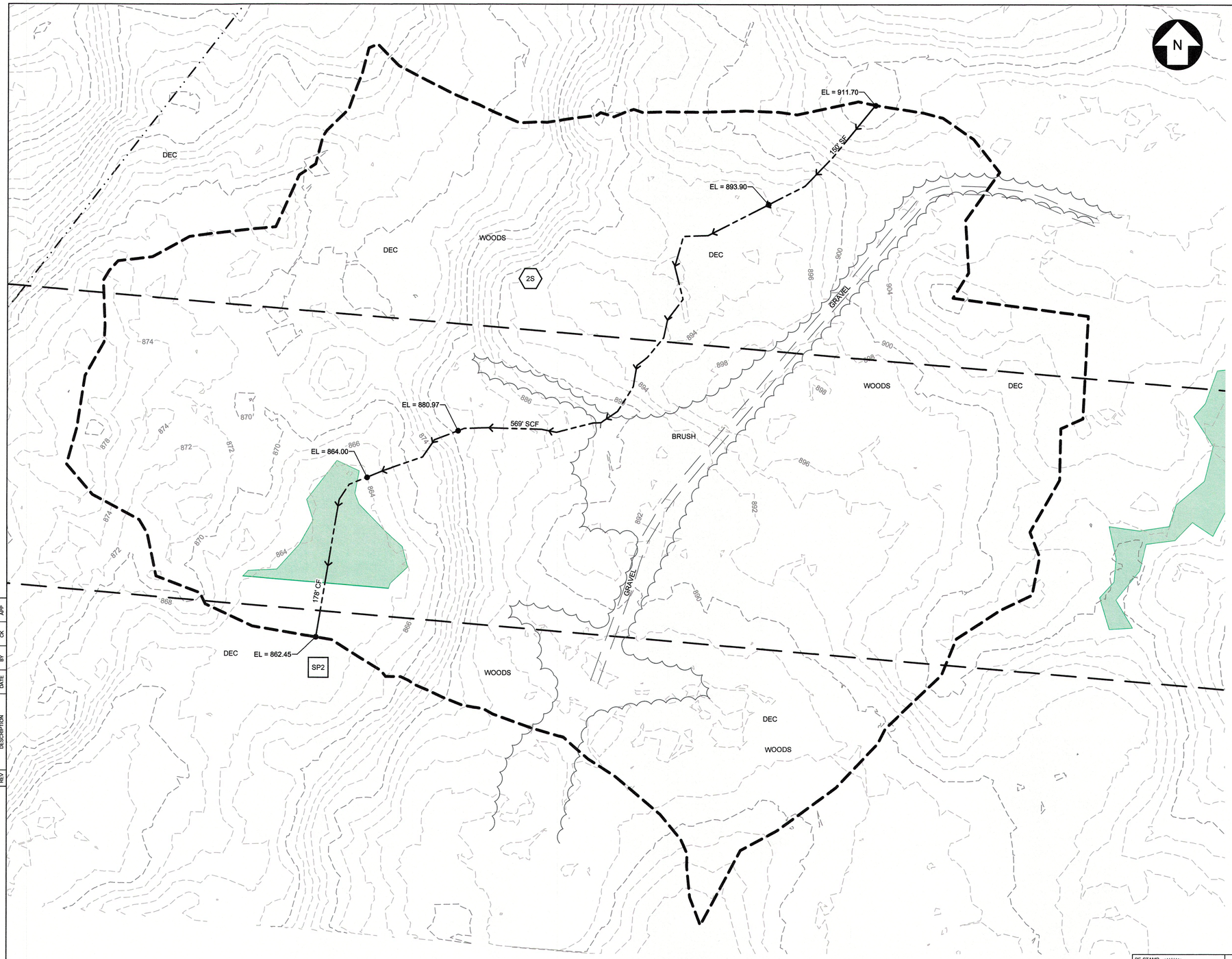
CMP AVANGRID

POST-DEVELOPMENT WATERSHED PLAN

WEST FORKS STATION

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	PGT/TRC	SCALE: AS NOTED	FILE: 315641 Watershed.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 SW-2	0-0B
DATE	10/05/2018		



SOILS LEGEND		
MAP UNIT SYMBOL	MAP UNIT NAME	HSG RATING
DEC	DANFORTH-ELLIOTTSVILLE ASSOCIATION, 3 TO 15 PERCENT SLOPES	B
MOB	MONARDA-BURNHAM COMPLEX, 0 TO 3 PERCENT SLOPES, VERY STONY	D
MTB	MONARDA-TELOS COMPLEX, 0 TO 8 PERCENT SLOPES, VERY STONY	D
MVE	MONSON-ELLIOTTSVILLE-KNOB LOCK COMPLEX, 30 TO 60 PERCENT SLOPES, VERY ROCKY	D

MOXIE GORE PRE-DEVELOPMENT LAND COVER COMPARISON SUMMARY (ACRES)		
COVER TYPE	HSG	2S
ROOFS & FOUNDATIONS	98	0.00
STONE YARD SURFACE	55	0.00
GRAVEL ROAD, HSG B	96	0.25
BRUSH, HSG B	67	0.58
WOODS, HSG B	66	11.57
TOTAL AREA		12.40

LEGEND

- SUBCATCHMENTBOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- REACH
- 100' SF — SHEET FLOW
- 100' SCF — SHALLOW CONCENTRATED FLOW
- 100' CF — CHANNEL FLOW
- EL. 520.0± — SPOT ELEVATION
- 1R — REACH ID
- 1S — SUBCATCHMENT ID
- 1P — POND ID
- SP1 — STUDY POINT ID
- RIGHT OF WAY
- SOILS
- 100 — CONTOUR
- TREELINE
- WETLAND

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUED FOR PERMITTING	10/17/2018	CMW	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	KVJ	PGT	SGL

50 0 50 100 FT
SCALE: 1" = 50'

ANSI D 10/18/2018

LOGO TRC PROJECT NO: 315641

INFO TRC 249 WESTERN AVENUE AUGUSTA, MAINE 207-621-7000

ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

PE STAMP: STATE OF MAINE — RICKY A YOUNG No. 6422 — LICENSED PROFESSIONAL ENGINEER — OCT. 19 2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

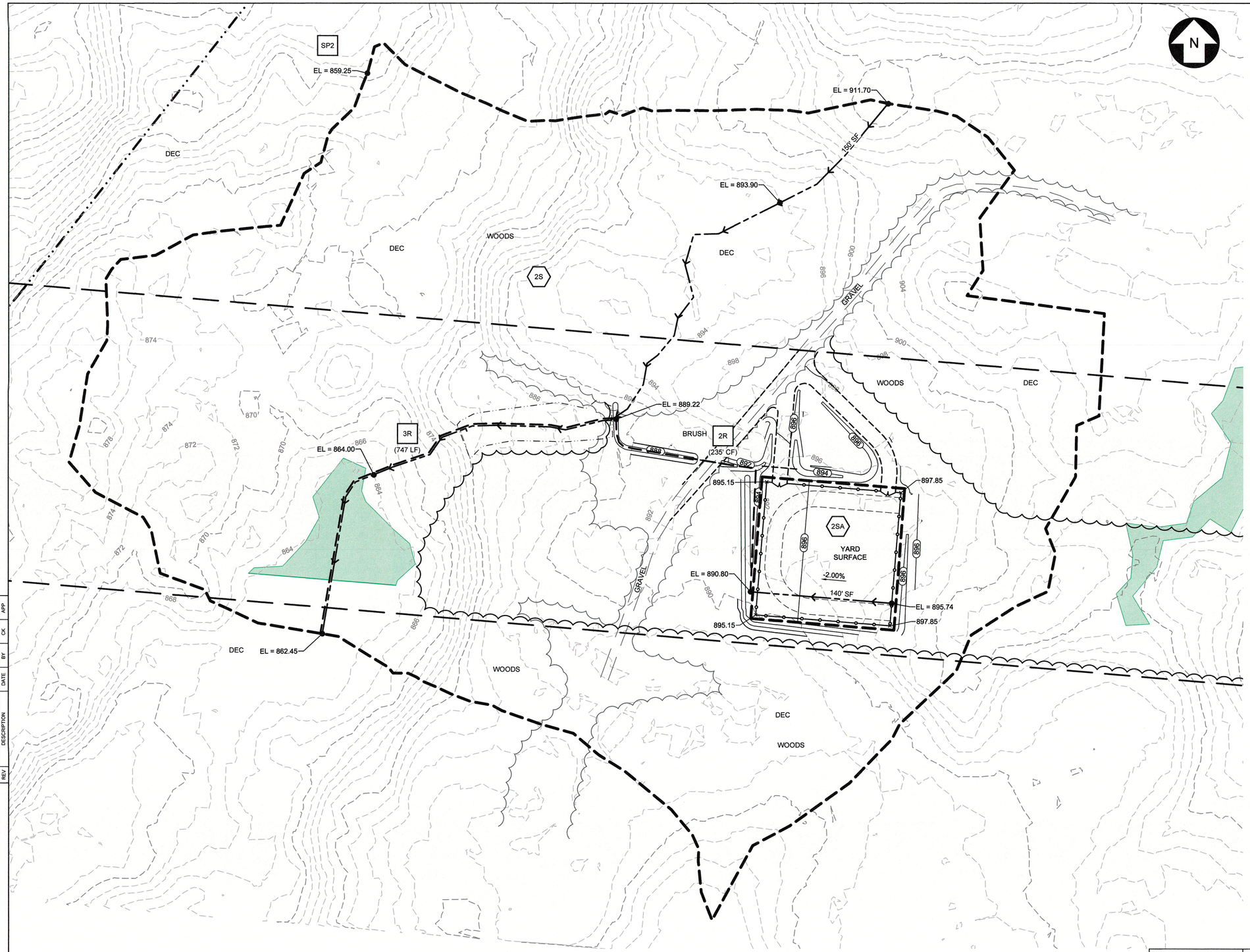
CMP AVANGRID

PRE-DEVELOPMENT WATERSHED PLAN

MOXIE GORE STATION

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY	PGT/TRC	SCALE: AS NOTED	FILE: 315641 Watershed.dwg
CK	PGT/TRC	NO.	REV
APP	SGL/TRC	315641 SW-3	0-0B
DATE	10/05/2018		



SOILS LEGEND		
MAP UNIT SYMBOL	MAP UNIT NAME	HSG RATING
DEC	DANFORTH-ELLIOTTSVILLE ASSOCIATION, 3 TO 15 PERCENT SLOPES	B
MOB	MONARDA-BURNHAM COMPLEX, 0 TO 3 PERCENT SLOPES, VERY STONY	D
MTB	MONARDA-TELOS COMPLEX, 0 TO 8 PERCENT SLOPES, VERY STONY	D
MVE	MONSON-ELLIOTTSVILLE-KNOB LOCK COMPLEX, 30 TO 60 PERCENT SLOPES, VERY ROCKY	D

MOXIE GORE POST-DEVELOPMENT LAND COVER COMPARISON SUMMARY (ACRES)			
COVER TYPE	HSG	2S	2SA
ROOFS & FOUNDATIONS	98	0.00	0.01
STONE YARD SURFACE	55	0.00	0.47
GRAVEL ROAD, HSG B	96	0.38	0.00
BRUSH, HSG B	67	0.83	0.00
WOODS, HSG B	66	10.71	0.00
TOTAL AREA		11.92	0.48

LEGEND

- SUBCATCHMENTBOUNDARY
- TIME OF CONCENTRATION FLOW LINE
- REACH
- 100' SF — SHEET FLOW
- 100' SCF — SHALLOW CONCENTRATED FLOW
- 100' CF — CHANNEL FLOW
- EL. 520.0± — SPOT ELEVATION
- 1R — REACH ID
- 1S — SUBCATCHMENT ID
- 1P — POND ID
- SP1 — STUDY POINT ID
- RIGHT OF WAY
- SOILS
- 100 — EXISTING CONTOUR
- 100 — PROPOSED CONTOUR
- TREELINE
- WETLAND

REV	DESCRIPTION	DATE	BY	CK	APP
B	IFP - ISSUE FOR PERMITTING	10/1/2018	DMV	PGT	SGL
A	IFR - ISSUE FOR REVIEW	10/05/2018	AAV	PGT	SGL

INFO
TRC
249 WESTERN AVENUE
AUGUSTA, ME 04330
207-621-7000

LOGO
TRC
PROJECT NO.315641

ANSI D 10/19/2018

50 0 50 100 FT
SCALE: 1" = 50'

PE STAMP
STATE OF MAINE
RICKY A. CYR
No. 9422
LICENSED PROFESSIONAL ENGINEER
10/19/2018

AVANGRID ENGINEERING
CONFIDENTIAL, PROPRIETARY and TRADE SECRET INFORMATION
Property of AVANGRID

CMP AVANGRID

811 DigSafe MA ME NH RI VT

ISSUE FOR PERMITTING
NOT FOR CONSTRUCTION

INSTALL

POST-DEVELOPMENT WATERSHED PLAN

MOXIE GORE STATION

NECEC HVDC LINE — MOXIE GORE & WEST FORKS, ME

BY PGT/TRC | SCALE: AS NOTED | FILE: 315641 Watershed.dwg
CK PGT/TRC | NO.
APP SGL/TRC | REV
DATE 10/05/2018 | 315641 SW-4 | 0-0B