Appendix 5-A: Methodology Statement for Submarine Cable Installation

METHODOLOGY STATEMENT

SUBMARINE CABLE INSTALLATION
LAKE CHAMPLAIN SEGMENT
CHPE DC CABLE SYSTEM

SUBMITTED TO:

NKT HV CABLES AB.

SUBMITTED BY:

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CALDWELL MARINE INTERNATIONAL LLC. 1333 Campus Parkway, Wall Township, New Jersey 07753 **PROJECT QUALITY ASSURANCE**	**Type:** Methodology Statement **Prepared By:** Peter Smith **Document #:** CHPE LAKE INSTALLATION METHODOLOGY-NKT-REV5.0-20240125.docx **Date**: 25 January 2024 **Revision No:** 5 0

DOCUMENT TITLE: Methodology Statement - Submarine Cable Installation – Lake Champlain Segment CHPE DC Cable System

APPROVALS:

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General Manager - Caldwell Marine International LLC.

_____
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LIST OF ACRONYMS

ABS	American Bureau of Shipping
AC	Alter Course
APP	Articulated Pipe Protection
AIS	Automatic Identification System
BAS	Burial Assessment Study
CHPE	Champlain Hudson Power Express
CME	Construction & Marine Equipment, Inc.
CMI	Caldwell Marine International, LLC
DA	Double Armor
DGPS	Differential Global Positioning System
DoL	Depth of Lowering (from ToC to adjacent lakebed grade level)
DoW	Depth of Water
DP	Dynamic Positioning
DTS	Distributed Temperature Sensing
DWT	Deadweight Tonnage
ECR	Equipment Calibration Record
EM&CP	Environmental Monitoring and Construction Plan
ERP	Emergency Response Plan
FO	Fiber Optic
HDD	Horizontal Directional Drill
HDPE	High Density Polyethylene
HP	Horsepower
HPU	Hydraulic Power Unit
IMO	International Maritime Organization
ITP	Inspection and Test Plan
KP	Kilometer Point (measured from origin, along planned cable route)
LBE	Linear Belt Engine
LCE	Linear Cable Engine
LLW	Lake Low Water ***NOTE:*** *NOAA charting is referenced to NGVD29 and uses a nominal Lake Low Water level of 93.0ft level NGVD*
MOP	Method of Procedure
MP	Mile (Statute) Post (measured from origin, along planned cable route)
NJ	New Jersey
NY	New York
OBC	Over Board Chute
OSI	Ocean Surveys Inc.
OTDR	Optical Time Domain Reflectometer
PIC	Person in Charge
PLC	Programmable Logic Controller
PLGR	Pre-Lay Grapnel Run
PPR	Plow Pre-Rip
QA	Quality Assurance
RC	Route Clearance
RLM	Running Line Monitor

LIST OF ACRONYMS

RPL	Route Position List
RTK	Real Time Kinematic
SA	Single Armor
SDO_2	Surface Decompression on Oxygen
SoW	Scope of Work
SWP	Sidewall Pressure
STA	Station
TBD	To Be Determined
ToC	Top of Cable
UPS	Uninterruptible Power Supply
USBL	Ultra-Short Baseline
USCG	United States Coast Guard
USCGD1	United States Coast Guard District 1
VBS	Virtual Base Station
VHF	Very High Frequency
VTS	Vessel Traffic Service
WAAS	Wide Area Augmentation System
XLPE	Cross-Linked Polyethylene

UNITS USED IN THIS DOCUMENT

This document uses primarily US Customary Units. The following table presents the units, abbreviations, and conversion factors to Metric units.

US Customary Unit		Metric Unit	Equivalent US Unit
Foot	ft	Meter	3.2803 ft
Inch	in	Centimeter	0.3937 in
Pound	lb	Kilogram	2.2046 lbs
Ton (short)	ton	Tonne	1.1023 ton
Mile (Statute)	mi	Kilometer	0.62137 mi
Pound force	lbf	KiloNewton	224.8089 lbf
Pounds/inch^2	psi	KiloPascal	0.145 psi

1 Introduction

Champlain Hudson Power Express, LLC and CHPE Properties, Inc. plan to construct, operate and maintain a new 1250 MW high-voltage direct current ("HVDC") underwater/underground electric transmission facility ("HVDC Transmission System") of clean hydro-electric power from Quebec, Canada to the New York City power market.

The CHPE route has been carefully designed to minimize its impact on the environment. Burying the cables keeps it out of sight and protects it from extreme weather. Within the US, the cable route will be comprised of both land and submarine cable segments. Two five-inch power cables and a smaller fiber optic cable will be installed underwater or underground and run approximately 339 miles from the U.S. – Canadian border, south through Lake Champlain, along and under the Hudson and Harlem Rivers to eventually terminate at a DC / AC electrical converter station that will be built in Astoria, Queens.

NKT HV Cables AB *(NKT)* have been selected as the cable supplier for the CHPE Project. *NKT* have subcontracted the following Project tasks to Caldwell Marine International LLC. (*CMI):*

1. **CIVIL INFRASTRUCTURE** [SEE NOTE 1]**:** Land-to-Water duct installation for:
    a. Lake Champlain Segment (southern landing only) *(Segment 17 EM&CP)*
    b. Upper Hudson River Segment (northern & southern landings) (*Segment 16 in EM&CP)*
    c. Lower Hudson River Segment (northern landing) (*Segment 16 in EM&CP)*
2. **SUBMARINE CABLE INSTALLATION:** Lake Champlain Segment and Harlem River Segment

This document details the methodologies that will be employed during CMI's installation of submarine cabling for the Lake Champlain Segment only. Methodology statements for CMI / Huxted civil infrastructure works and CMI's installation of submarine cabling for the Harlem River Segment will be provided under separate cover.

2 Executive Overview

The Lake Champlain Submarine Cable Segment will connect the southern end of the HQ Canadian project, Hertel-New York Interconnection Line Project, cable route to the northern end of the US land cable route at Putnam Station. The route will lie within New York State waters for its entire length.

CMI's cable installation activities will commence at the CAN / US border in the waters of the Richelieu River. The installation route proceeds southward under the Route 2 Road Bridge *(operational*), then passes through an engineered opening in the Rouses Point Railroad Bridge *(abandoned)* where it leaves the Richelieu River and enters the waters of Lake Champlain.

Continuing south, the route passes to the west of Isle La Motte, North Hero Island, & Grand Isle before passing under Chimney Point Road Bridge *(operational)*, to enter the narrower waters of the Lower Lake. Within Lower Lake waters, the route passes through the Ticonderoga Ferry Crossing, past Fort Ticonderoga, to the west, and Chipman Point Marina to the east, before terminating at the Putnam Station HDD landing area.

Figure 1 - Lake Champlain Submarine Cable Installation Segment

The following listing provide an overview of the installation parameters for the CHPE Lake Champlain Segment. See also ***Table 1*** **&** ***Table 2*** & ***Figure 2*****:**

Lake Champlain Route Origin Location:	US / Canada maritime border (MP0.0)
Lake Champlain Route Termination:	Putnam Station HDD *(at planned TJB location)* (MP96.7)
Lake Champlain Route Length (excl HDD):	~96.5 Statute Miles
Lake Champlain Route Water Depth Range:	0ft *(0m)* – ~400ft *(~122m)*
Installation Cable Bundle:	2xDC Power Cables (400kV) +1xFiber Optic Cable (48 fiber (24 pairs)
Cable Segment / Field Splice Count:	8 segments / 7 power field splice sites
Cable Bundle Protection Types:	
Upper Lake Water (CAN / US Border To Crown Point) DoW<150ft (45.7m):	~28.4 Statute Miles ((MP0.0 – MP21.3) + (MP65.9 – MP73)) Cables will be lowered below adjacent lakebed grade by means of Jet Plow (*primary*) *SEE NOTE 1/Diver lowering and/or Remedial Burial Equipment (*secondary*) – see ***Figure 2*****,** see ***Section 4.6.4*****.** Depth of cable product lowering per USACE requirements - see ***Table 1***
Upper Lake Water DoW>150ft (45.7m):	~44.6 Statute Miles (MP21.3 – MP65.9) Surface Lay with ROV touchdown monitoring
Lower Lake Water (Crown Point to Putnam Station) DoW<150ft (45.7m):	~23.5 Statute Miles (MP73 – MP96.5) Cables will be lowered below adjacent lakebed grade by means of Shear Plow (*primary*)*SEE NOTE 1/ Diver lowering and/or Remedial Burial Equipment (*secondary*) – see ***Figure 2*****,** see **S*ection 4.6.4***. Depth of cable product lowering per USACOE permit requirements – see ***Table 1***
Utility Crossings (All Lake Waters) DoW<150ft:	Concrete mattresses (Upper & Lower layers) **<u>or</u>** Articulated Pipe Protection (APP)0 such as Uraduct, UraGuard, Polyspace or a similar polyurethane protective duct to be utilized per CHPE Permits/Crossing Aggreement
Utility Crossings (All Lake Waters) DoW>150ft:	Uraduct, UraGuard, Polyspace, or a similar polyurethane protective duct to be utilized per CHPE Permits / Crossing Agreement
Putnam Station, NY HDD	Encasement in 2 x High Density Polyethylene (HDPE) ducts
Segment Route Utility Crossing Count:	Per finalized CHPE LLC. listings
Time of Year (ToY) Restrictions:	Upper Lake (CAN / US Border to Crown Point (MP 73)) – Submarine cable installation May 1st to August 31st Lower Lake (Crown Point (MP 73) to Putnam Station) – Submarine cable installation is permitted September 1st to December 31st. Extensions to theses windows has been

requested for 4-week overlap. (Upper Lake-May 1st to *September 30th*; Lowe Lake-*August 1st* to December 31st)

Canal Access to Lake Champlain: Canal opening ~May 15th
Canal closing October ~15th *See Note 2.*

***NOTE 1:** Use of Jet Plow vs Shear Plow is dictated by environmental permitting restrictions. CMI will operate our towed vehicle in 'Jet Plow' mode in Lake waters that lie North of Crown Point. South of this position, CMI will disable the pressurized water feed to the stinger and will operate our towed burial vehicle in 'Shear Plow' mode.*
***NOTE 2:** CMI will coordinate and confirm canal opening and closing dates with NYS Canal Corporation prior to transit.*

Burial Depth in feet	**Inside Shipping Channels or Narrows**		**Outside Shipping Channels or Narrows**	
USACE Permit Requirement	In rock	Elsewhere	In rock	Elsewhere
Lake Champlain (in less than 150 feet water depth	6	8	-	4

Table 1 – USACOE Depth of Lowering (DoL) Requirements

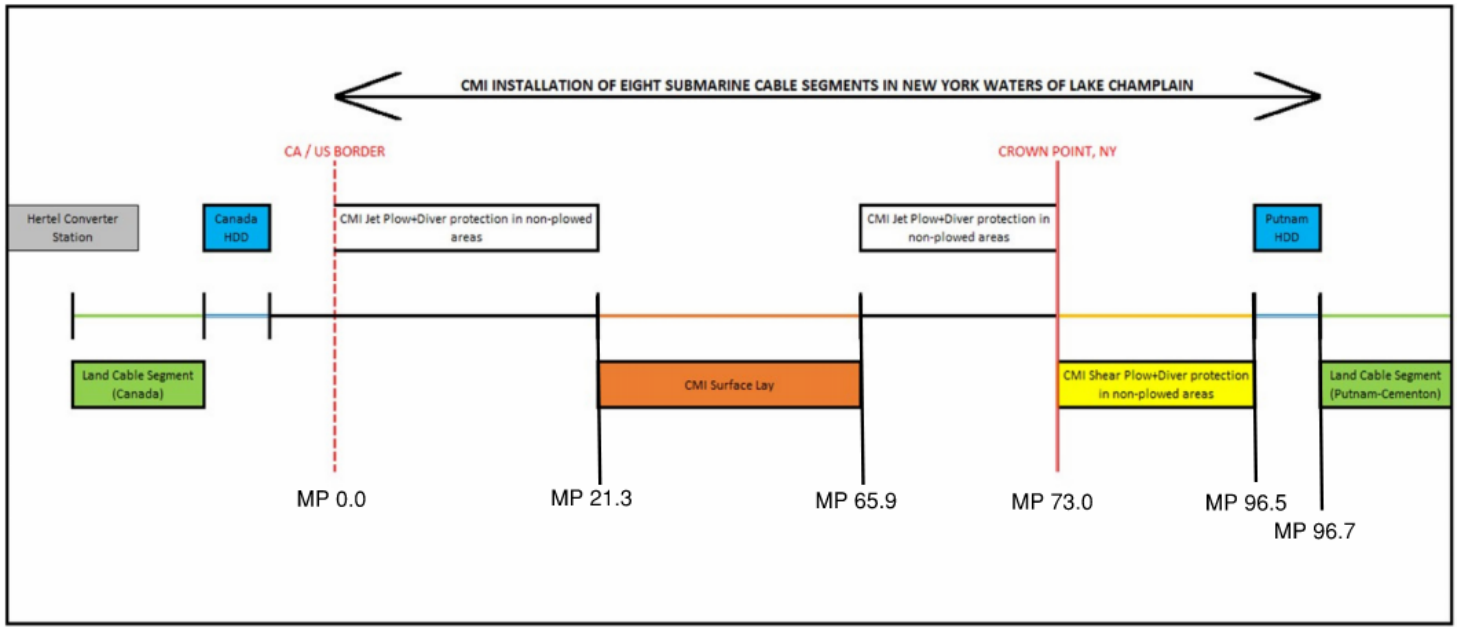

Figure 2 - Lake Champlain Submarine Cable Installation – Overview

Location (MP)	Lay Method	Protection
0.0 – 1.2	Surface Float-in	Post Diver and/or Remedial Burial Equipment
1.2 – 21.3	Direct Bury -ETA Plow Sled- Jet Mode	Plow burial
21.3 – 65.9	Surface Lay	None (Water Depths ≥ 150’)
65.9 – 73.0	Direct Bury -ETA Plow Sled – Jet Plow Mode	Plow Burial
73.0 – 96.5	Direct Bury - ETA Plow Sled – Shear Plow Mode	Plow Burial
96.5 – 96.7	Surface Float-in to HDD	Post Diver Burial / HDD

Table 2 – Cable Lay Method & Protection Summary

3 CMI Scope of Work

3.1 Submarine Cable Installation - Pre-Lay Works

3.1.1 Route Survey, Engineering & Consents

- Marine Route Survey 2022 (CAN / US maritime border in Richelieu River to Putnam Station HDD Landing Point) – field work *completed October 2022*
- Lake Champlain utility locate survey - *completed 2020 (based on 2013 route) and updated in 2022/2023 (based on RPL utilized in this Method Statement)*
- Burial Assessment Study (BAS) – *completed 2022 (based on 2013 route survey data)*
- Plow TSS Trials in Lake Champlain 2022 – *completed August / September 2022*
- Lake Champlain route engineering including determination of cable length values.
- Cable landing pull tension calculations (Putnam Station) – *CMI calculations provided for 'preliminary HDD design' only. Pull tensions will be recalculated when HDD 'as-built' drawings are available.*
- Execute installation of utility crossing protection measures in accordance to signed Crossing Agreements– *Segment 18A EM&CP -Pre-lay Mattress*
- Obtain documentation related to permits required to be obtained by the Contractor to execute the Works, such as, additional notifications, approvals, reports and pre-engineering.

3.1.2 Loading & Transport of Submarine Cables & NKT Jointing Equipment

3.1.2.1 Power Cables

- Mobilization & testing of six Cable Transport Barges with powered carousels
- Towed transit of Power Cable Transport Barge from Albany, NY to liaise with Cable Lay Barge in Lake Champlain, via Hudson River to NYSCC Champlain Canal System

3.1.2.2 Fiber Optic

- Fabrication of static storage tank on Lake Champlain Cable Lay Barge
- FO Transport Barge receipt of pre-loaded fiber optic transport basket at Port of Albany, NY.
- Towed transit of FO Transport Barge from Albany, NY to Plattsburgh, NY, via Hudson River to NYSCC Champlain Canal System.

3.1.3 Submarine Cable Route Preparation

- Route engineering.
- Engineer & execute PLGR / Route Clearance for Lake Champlain submarine cable installation route. *Please refer to PLGR Method Statement for further detail, included with this EM&CP submission.*
- Installation of pre-lay protection at listed Lake Champlain utility crossings in accordance with Project Permit & Utility Crossing Agreement requirements as referred in Segment 18A EM&CP Pre-Lay Mattress
- Reporting and documentation (as applicable) of all tasks listed above.

3.1.4 Land Site Preparation

- Putnam Station Landing
    - Mobilization & demobilization of Putnam Station cable landing assets
    - Site trials of Putnam Station cable landing assets
    - Cleaning, proofing, threading & preparation of pre-installed HDD landing ducts incl. marine exit points (Putnam Station)
    - Restoration of Putnam Station work site
- Plattsburgh Dock project site
    - Site set-up & restoration of Plattsburgh Dock area work site
    - Mobilization & demobilization of Cable Lay Barge in Lake Champlain waters (Plattsburgh Dock area)
    - Site trials of Cable Lay Barge in Lake Champlain waters
    - Mobilization & demobilization of Support Vessels
    - Site trials of all Support Vessels
    - Reporting and documentation (as applicable) of all tasks listed above.

3.2 Submarine Cable Installation

3.2.1 Vessel Mobilization

CMI will employ multiple barges and motorized vessels to perform the scope of work in Lake Champlain. Please refer to **Appendix 1** for further details of vessels.

- Cable Lay Barge (**Figure 15)**
    - DP2 controlled (4 x 500hp + 2 x 750hp thrusters)
    - Modular barge (300ft (~91.4m) x 90ft (~27.4m) x 7ft (~2.13m))
- Cable Transport Barge(s) (per **Figure 5**)
    - Six (6) newly fabricated project specific vessel
    - Utilized to transport cable from Port Albany to Lake Champlain
    - Turn Table Carousel installed to aid on cable lay operations
- Crane Support Barge
    - Modular Barge with Crane and Dive Equipment spread
    - Aid in initializing Plow Trials
    - Aid in initial float-out to US/CAN Border
    - Additional Use in PLGR, Pre/Post/Remedial Mattress install
- Anchor Support Barge
    - Modular Barge with A-frame
    - Used to Install Anchor Spread for CLB when required
        - Initial Cable Float-In at Rouses Point, US/CAN Border
        - Final Cable Float-In at Putnam Stations
        - Proposed Splice locations
    - Assist in initial/final cable pull-in
- Crew boat #1
    - ‘Alexis’ or similar (55ft x 16ft x 7ft 3 inches)
    - Transport Crew to/from marina to barge(s)
- Crew boat #2
    - Dimensions and details TBD
    - Transport Crew to/from marina to barge(s)

- Tug
    - Chartered vessel of opportunity (VOO)
    - Move Crane Support Barge, Anchor Support Barge to location
- Truckable Work Vessels
    - Adjust Crane Support Barge & Anchor Support Barge at location
    - Transfer and Transport Crew and light equipment
- Skiffs
    - Multiple vessels ~25' to assist in managing cable bundle during initial/final cable float-out

3.2.2 Cable Lay & Protection

- Lay & protection of Two (2) HVDC Power Cables + ONE Fiber Optic Cable from CAN/US maritime border in Richelieu River to transition splice pit (outer edge) at Putnam Station cable landing site including:
    - Float-in and Laydown of 'blind' capped cable ends in Canadian waters.
        - CMI/NKT to coordinate ~330 ft float-in to Canadian waters via NKT-Canada crew at CAN / US maritime border in Richelieu River.
    - Jet Plow cable installation to 4ft (~1.22m) Depth of Lowering in Upper Lake route areas that feature water depths ≤ 150ft (~45.7m) as referenced to NOAA Navigation Charts defined Lower Lake Level of 93ft in NGVD29 (equates to EL 92.5 ft NAVD88).
    - Surface lay cable installation in Upper Lake route areas that feature water depths > 150ft (~45.7m) as referenced to NOAA Navigations Charts defined Lower Lake Level of 93ft in NGVD29 (equates to EL 92.5 ft NAVD88).
    - Shear Plow cable installation to 4ft(~1.22m) Depth of Lowering in Lower Lake route areas (south of Crown Point) that feature water depths ≤ 150ft (~45.7m) as referenced to NOAA Navigation Charts defined Lower Lake Level of 93ft in NGVD29 (equates to EL 92.5 ft NAVD88).
    - OTDR monitoring of fiber optic cable during cable installation period.
    - Cable bundling
    - Marine transportation for field personnel to marine spreads during cable operations
    - Support of NKT submarine cable splicing operations aboard CMI Cable Lay Barge
    - Deployment of power cable splices
    - Remedial protection of non-plowed areas (splice locations)
    - Installation of Articulating Pipe Protection (APP) such as UraGuard or similar in deep water crossings (≥ 150 ft water depth) per approved Crossing Agreement(s).
    - Installation of Cable Protection System over submarine cable at Ticonderoga Ferry per approved Crossing Agreement.
    - Reporting and documentation (as applicable) of all lay tasks listed above.

3.2.3 Cable Float-in at US/Canada Border

- Initial Type Landing from Abandoned Trestle bridge to US/Canada Border ~1.2 Miles
    - Float in Cable A+FO & Cable B in bundle
    - Lowering Cable bundle to lake bed
    - Post Burial via Remedial Burial/ Diver Equipment from Border to Cable Lay Barge
    - OTDR Monitoring of fiber optic cable.
    - Reporting and documentation (as applicable) of all tasks listed above.

3.2.4 Cable Landing at Putnam Station

- 'Final' type landing at Putnam Station
    - Floated pull-in of cable A + FO cable into Duct 1A at Putnam Station
    - Floated pull-in of cable B into Duct 1B at Putnam Station
    - Remedial protection of non-plowed areas between "Plow Up" position & HDD exit
    - OTDR testing of installed Lake Champlain segment.
    - Await completion of NKT TDR testing of installed Lake Champlain power cabling
    - Reporting and documentation of tasks listed above.

3.3 Post-Lay Tasks

Please refer to Post-Lay and Remedial Mattress Placement Methodology Statement for detailed information included with this EM&CP submission.

- Installation of post-lay protection at listed Lake Champlain utility crossings in accordance with Project Permit & Utility Crossing Agreement requirements
- Remediation of project 'non-conformances' including remedial protection of areas where permitted / contracted cable protection standards were not achieved. Documented closeout of non-conformance 'punch-list'
- Preparation, review & issuance of 'As-Built' documentation using recorded Cable/Plow/ROV data

4 Task Methodologies

Documentation relating to CMI's CHPE civil works task is covered under Segment 17 EM&CP

4.1 Submarine Cable Installation - Pre-Lay Works

4.1.1 Lake Champlain Utility Locate Survey

CHPE has completed this survey in 2022/2023 to confirm Co-located Infrastructure to finalize Crossing Agreements.

4.1.2 Burial Equipment Water Quality Testing

4.1.2.1 Jet/Shear Plow

CMI completed Lake Champlain water quality testing in 2022 for the jet/shear plow. The trials were performed at test sites that had been selected as being representative of actual operational conditions. CMI performed plow trials that were monitored by an Owner appointed, independent body acting in accordance with Article VII Certificate conditions. Plow tests were designed to verify that the operation of the burial vehicle operates within the limits of water quality requirements while operating in either:

1. Jet plow mode (Upper Lake waters), or
2. Shear plow mode (Lower Lake waters)

Final field reporting indicated that recorded values were within permitted limits.

4.1.2.2 Remedial Burial Tools

Water quality testing will be performed as required under the Article VII Certificate to ensure Remedial Burial Equipment to be used adheres to required standards. These trials will be performed adjacent to the Cable Installation trials. CMI will perform the water quality testing trials with monitoring by an Owner appointed, independent body action in accordance with Article VII Certificate conditions. Equipment test is designed to verify that the operation of the burial vehicle operates within the limits of water quality requirements does during remedial burial operations. Results will be submitted, and acceptance of the tool confirmed prior to use for cable lay operations.

4.1.3 Cable Installation Trials

CMI will conduct cable installation site trials with actual cable product. The purpose of the trials is to demonstrate fitness-for-purpose of the cable handling and burial protection equipment under 'real world' conditions.

This task will be conducted as part of the post-mobilization CLB commissioning trials. A trial cable length of ~450m of submarine power cables aboard each of the Segment 1 Cable Transport Barge loads will be set aside for trials purposes. Fiber optic cable of similar length will be provided and installed during the trials as well.

Trials will be conducted around Route MP 9-10 between Chazy Landing to Trembleau Point. The trial will be conducted using the fully mobilized CLB installation spread. The jet plow will be deployed to verify its ability to safely lower the cable package to the permit required depth of lowering, or greater.

Figure 3 - Proposed Cable Install Trial Area

On completion of the trial, the installed test section will be recovered to enable inspection / testing. To minimize risk of damage to the cable product it may be necessary to employ diver jetting or use of the 'donut recovery tool' – see **Figure *4*** to release the cables from Lakebed prior to / during recovery by CLB. The ~450m test section of cable will then be discarded and not re-used as final product for cable lay.

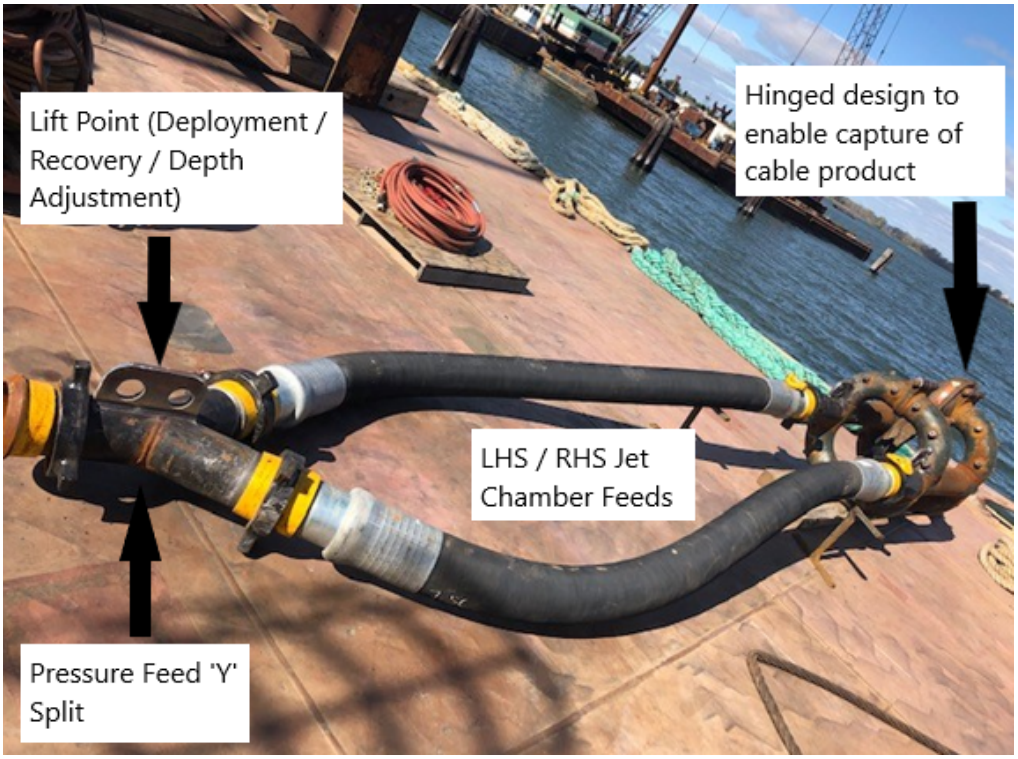

Figure 4 - CMI Cable Recovery 'Jetting Donut'

NOTE: *The jetting donut is lowered down the cable catenary to just above the Lakebed. Donut supply hosing is fed by pumps to pressurize donut nozzles thereby fluidizing the underlying soils. This unit is employed to reduce the requirement for diver intervention during the cable recovery process.*

4.1.4 Route Survey, Engineering & Consents

4.1.4.1 Marine Route Survey – Lake Champlain

In 2022, Ocean Surveys Inc. were subcontracted to survey the revised CHPE cable installation route for Lake Champlain waters.

OSI used the following reference datums for their survey operations:
Horizontal Datum: UTM Zone 18N, NAD83 with US feet as survey units
Vertical Datum: NAVD88 with soundings in Feet

Route development was conducted as required to avoid identified hazards and to optimize the route for cable installation and protection. Survey documentation & data will be used as follows:

- Utilized as reference for CMI route engineering, operational planning, & cable installation operations
- Inputted into CMI navigation computers during cable installation
- On completion of Lake Champlain cable installation, CMI will overlay recorded 'as-laid data onto 'Planning' charts to generate 'As-Built' charting.

4.1.4.2 Lake Champlain Route Engineering

AutoCAD Map 3D for route engineering. Information from the OSI 2022 survey charting (Plans and Profiles), NOAA navigational charts, Utility Crossing survey, and data from Lake Champlain Maritime Museum, have been considered and overlayed onto the proposed route. The route has been engineered to optimize cable installation whilst avoiding and mitigating obstacles and third-party property/assets.

4.1.4.3 Utility Crossing Protection Methods

Utility crossing protection designs for each site are subject to:

1. Permit requirements pertaining to depth of water at subject location
2. Compliance with site specific Crossing Agreements that have been negotiated between CHPE, LLC & respective utility owners / operators.
3. Use of Pre, Post, & Remedial articulating Concrete Mattresses in shallow water depths (≤150 ft)
4. Use of Articulated Pipe Protection (APP) - Uraduct, UraGuard, Polyspace, or a similar polyurethane protective duct will be installed on the cable bundle in deep water depths (≥150 ft)

4.2 Transport of Submarine Cables

4.2.1 Power Cables

The weight and volume of power cables precludes the use of road transportation to the Lake Champlain. Therefore, the cables used for Lake Champlain installation will be shipped to Albany and then transported to Lake Champlain via 6 purpose-built Cable Transport Barges. Cable transportation will be performed by water with vessel access to Lake Champlain afforded by the Champlain Canal System. The Cable Transport Barge will be stored, empty or loaded, at Wilcox Dock as required between cable lay operations and trans-spooling operations.

The canal is managed by The New York State Canal Corporation who impose the restrictions on transiting vessels with respect to canal operating season, vessel length, draft, air draft, and beam. Coordination of the lock(s) status with NYS Canal Corporation performed prior to transit. Planning is founded on the following canal restriction criteria:

1. Canal Operating Period:
    - Canal opening date for vessel traffic: May 1st (each year)
    - Canal closing date for vessel traffic: Oct 15th (each year)
2. Canal Transit Navigation Constraints:
    - Vertical clearance of 17 feet;
    - Controlling depth of 9.5 feet; and
    - Usable width of 44.5 feet with vessels limited to 43.5 feet beam.

CHPE, LLC has addressed canal transportation challenges by commissioning the construction of:

1. Six new-build Transport Barges (**Figure 5)**:
    - Length Overall (LOA: 187ft (~57m)
    - Maximum Beam: 43ft 6 inches (~13.26m)
    - Light draft: 1ft 10 inches (~0.56m)
    - Loaded draft: 8'-4"ft (~2.54m)
    - Loaded air draft: 1ft (~0.3m) clearance from canal overhead
2. Six 1500MT capacity powered carousels (**Figure 5):**
    - Basket OD: 42ft 8inches (~13m)
    - Basket ID: 41ft 8inches (~127m)
    - Spool OD: 14ft (~4.27m)

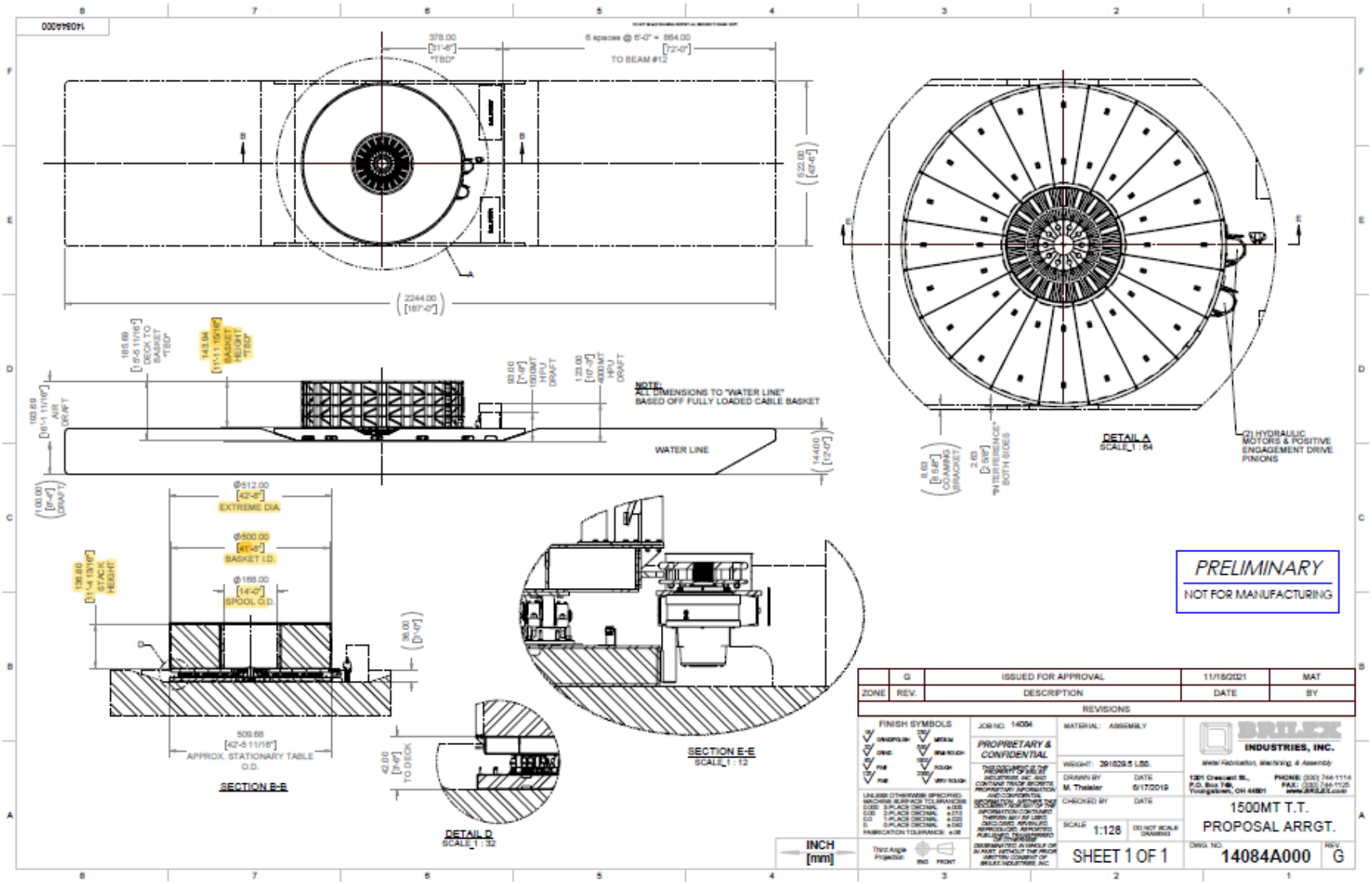

Figure 5 - CHPE Transport Barge & Carousel Design

4.2.2 FO Cable

Transportation of CHPE FO cables will be delivered for the Lake Champlain segment in one continuous length. A liftable basket with adequate capacity will be shipped and offloaded directly to a canal barge for transit to Lake Champlain. After arrival at Wilcox Dock, Plattsburgh, NY base the FO Transport Barge will set-up for transfer of the FO cable to the FO tank constructed on CLB.

4.3 Pre-Lay Grapnel Runs (PLGR)

Pre-Lay Grapnel Runs *(PLGR)* will only be performed in the planned burial sections of the Lake Champlain Route. The purpose of this task is to remove shallow buried and surficial debris (jetsam etc.) which might potentially impede the safe progress of the plow installation vehicle. Please refer to PLGR Methodology Statement for further information.

4.4 Utility Crossing Protection Methods

Actual protection design(s) will be dictated by signed crossing agreements

4.4.1 Concrete Mattress Protection

Utility Crossings that require Pre-Lay Mattress installation has been covered in Segment 18A Pre-Lay Mattress EM&CP. For post cable protection per signed Crossing Agreements and where permit required burial depths are not met and, details are included within Method Statement for Post-Lay and Remedial Mattress included in the Segment 18B Cable Lay EM&CP.

4.4.2 Utility Crossings using Articulated Pipe Protection (APP)

During surface lay operations in water depths of ≥ 150 feet, articulated pipe protection such as Uraduct, UraGuard, Polyspace, or a similar polyurethane protective duct may be installed in the cable bundle and placed per CHPE Permits / Crossing Agreement.

At each crossing during surface lay operations, the CLB will come to controlled stop. The APP will be installed onto the cable bundle on the CLB deck. It will then be offloaded via overboard chute as the CLB resumes forward progress along cable route.

4.4.3 Additional Crossings

Additional Crossings have been identified along the route that require safeguarding between the submarine cable bundle and the existing feature.

- Ticonderoga Ferry line – Protection to be installed per Co-located Infrastructure Crossing Agreement. Proposed installation methodology to be submitted at later date.

4.5 Land Site Mobilization & Preparation

4.5.1 Wilcox Dock (Plattsburgh, NY)

CMI will utilized Wilcox Dock, Plattsburgh, NY as an operational base. This location has served as CMI's operational base for previous Lake Champlain projects. CMI will mobilize equipment to Wilcox Dock in the early phases of the CHPE Project. The base will serve multiple support functions including:

- Mobilization and support of Lake Champlain CLB
- Mobilization of & support of CMI operational vessels for PLGR / RC / Utility Crossing Protection, ROV support
- Fiber Optic Cable Transfer (FO Transport Barge to Lake Champlain CLB)
- Personnel transfer staging point (primary)
- Emergency personnel transfer point.
- Exchange / clean-out service point for sanitation equipment (Porta-Pottis, Construction Waste, etc.)

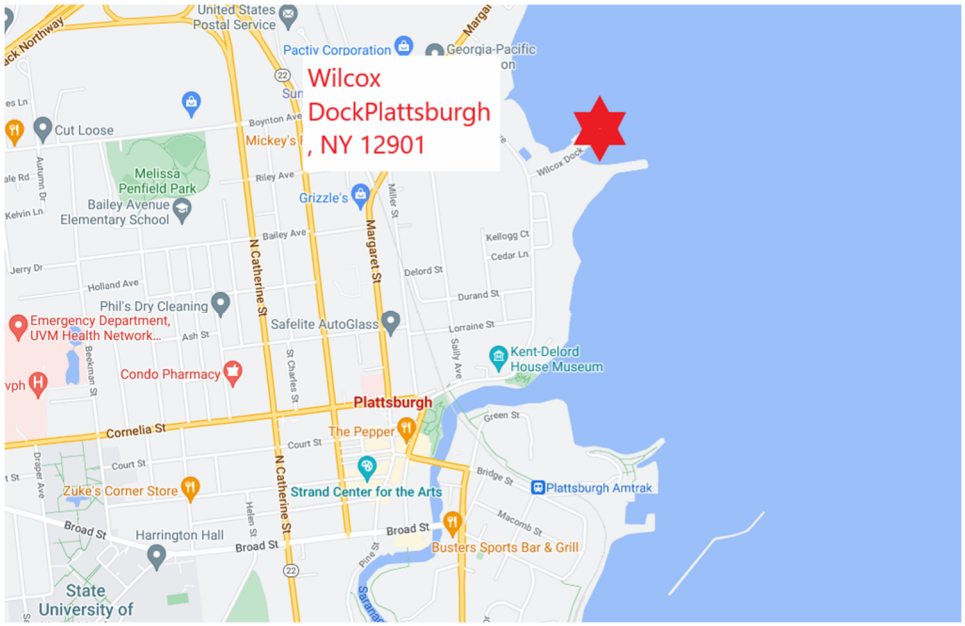

Figure 6 - Wilcox Dock, Plattsburgh, New York

Additional marinas will be used as crew and small equipment/materials transfer. CMI will privately arrange and secure the locations and review to ensure fit for purpose. Please see **Appendix 8** for identified locations.

Figure 7- Wilcox Dock Yard Layout Schematic, Plattsburgh, New York

4.5.2 Putnam Station Cable Landing Point

The landing site is located at Putnam Station which lies at the southern end of the Lake Champlain installation route. It will be conducted as a 'Final' type landing at the conclusion of CMI's cable lay tasks. Project cables (2 x Power + 1 x FO) will be landed to shore via two pre-installed HDPE ducts

Project tasks at Putnam Station include:

a. Establish Putnam Station work site compound
b. Mobilization of cable landing assets
c. Duct proving / cleaning.
   NOTE 1: *Ducts will be proven and cleaned on completion of the HDD and repeated prior to cable landing, to confirm readiness of this infrastructure*
   NOTE: *This task will require marine assistance. Barge equipment details are provided accordingly*
d. Cable landings – Please see **Figure 8** below.

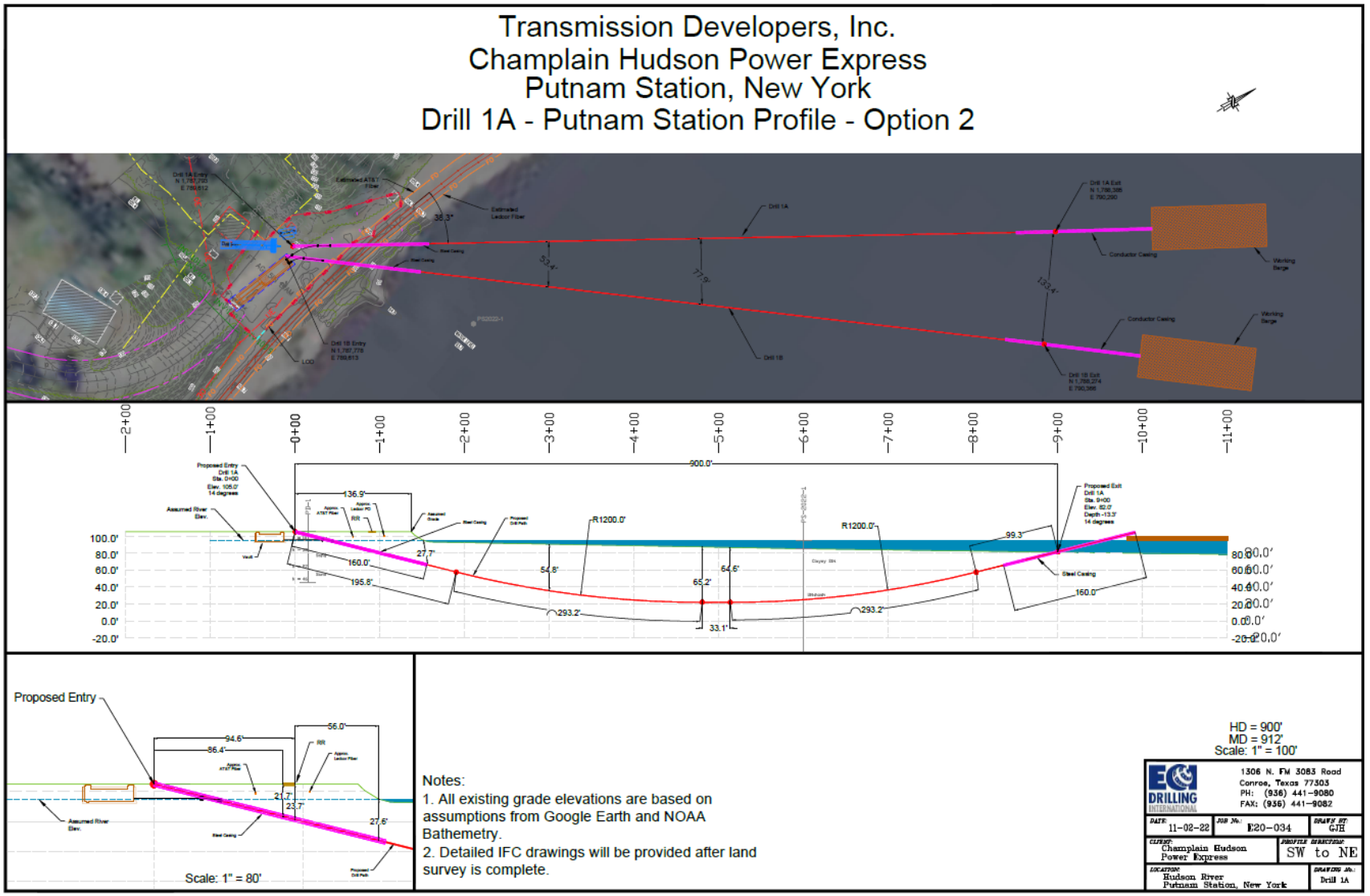

Figure 8 - Putnam Station Drill Path Design

4.5.2.1 Putnam Station HDD Duct Proving / Cleaning

On completion of cleaning / proving, the ducts will be left:

1. Threaded end-to-end with adequate length of messenger wire to reach the working deck of the support barge
2. Capped temporary caps to minimize the risk of subsequent duct contamination with foreign materials.

NOTE: *These tasks are described in CMI's Civil Works documentation.*

Prior to cable landing operations, the ducts are proven and cleaned again. This work will require the use of both land-based, and marine-based assets.

4.6 Submarine Cable Installation

4.6.1 Operating Hours

CMI expects to be working extended hours, including nights, weekends, and state/federal holidays to maintain and complete the project operations on time per the following:

- CLB Mobilization – (1) 12-hour shift per day, 7 days per week
- Sea Trials – (1) 12-hour shift per day, 7 days per week
- Cable Lay & Protection – 24 hours per day ((2)-12 hour shifts), 7 days per week

Please refer to PLGR and Post & Remedial Mattress Lay Method Statements submitted within this EM&CP for operating hours.

4.6.2 Lake Weather Conditions / Operational Weather Limits

Lake Weather Conditions

The following meteorological factors apply to Lake Champlain waters:

Location:	Lake waters are categorized as 'inland'. ***NOTE:*** *The Lake does feature some comparatively large expanses of open water where wave heights may be elevated due to wind 'fetch'*
Tidal effect:	No observable tidal effect, however, Lake water levels are subject to seasonal variation
Current strength / Direction:	Under normal conditions, Lake waters flow from south (Whitehall) to North (Richelieu River entrance). This 'general direction of flow can be temporarily affected, or even reversed, by wind effect.
Ice:	Lake water is fresh not salt. Meteorological records indicate that Lake Champlain waters are subject to freezing during colder winters

Monitoring of Site Weather Conditions & Forecasts

During the operational periods for the Barge, the Barge Superintendent / appointed alternate will monitor the current and forecast weather conditions for operational work sites and vessel transit routes. The Barge Superintendent will notify the attending NKT Representative if a temporary suspension of project activities is required due to weather (actual, or forecast).

The Barge Superintendent's primary weather forecast resource will be NOAA Marine Weather.com (Governmental).

The Barge Superintendent will typically also review web-based, non-governmental resources which may include:

- https://www.windy.com
- https://www.buoyweather.com/
- https://www.windalert.com
- https://climeradar.com

Recording of Site Weather Conditions

Site weather conditions will be recorded in a dedicated section of the Barge Daily Report. Recorded values will either be derived from:

a. Local observation, or
b. Download from a local registered NOAA weather observation station (airport or similar)

Operational Weather Limits

Wind:	OSHA safety rules for crane operations dictate a maximum wind strength 25mph.
Current Strength:	Maximum current strength 2 knots. As noted above, Lake waters are non-tidal, current strengths no expected to approach this limit
Sea / Swell Height:	**Cable Lay Operations:** Work may be deferred / suspended at the discretion of Barge Superintendent & Dive Supervisor.

4.6.3 Cable Lay Barge (CLB) Marine Mobilization / Site Trials

4.6.3.1 CLB Mobilization

Access constraints to Lake Champlain dictate that the Cable Lay Barge (CLB) will be of modular design and assembled in Lake waters. CLB mobilization will be conducted at CMI's operational base at Wilcox Dock, Plattsburgh – ***Para 4.5.1*** refers.

The completed dimensions of the CLB will be approximate Length 300ft (~91.44m) x Beam 90ft (~27.68m). The vessel will be constructed from modular units with a uniform height of 7ft (~2.13m).

The principal method of propulsion for the CLB will be six fully azimuthing thrusters (4 x 500hp + 2 x 750hp). Thrusters force magnitude and direction will be controlled by a DP2 (Dynamic Positioning Class 2) system – see **Figure 13**. The vessel will also carry a multi-point anchor spread and spuds for use in waters that are too shallow to utilize powered thrusters.

CLB Equipment List (Provisional)

- Regulatory Compliance Measures of Regulation navigation lighting
    - Regulation Life Saving Equipment *(LSE)*
    - Regulation Fire Fighting Equipment
    - Regulation First Aid supplies
    - Spill kits
    - Temporary storage for waste materials
    - Porta-Potti's / Portable wash facilities
    - Safe access ladders
- Barge Propulsion: ***NOTE:*** *The Lake Champlain Segment route features both shallow and deep water lay areas. CLB will be outfitted with both DP2 and anchor propulsion to enable performance in all anticipated site conditions:*
    - Dynamic Positioning Class 2 (DP2) Controls & sensors
    - 2 x 750hp + 4 x 500hp 'Thrustmaster' thrusters – fully retractable, 360-degree azimuthing thruster power packs, hosing & cabling
    - Double-walled fuel storage and transfer system
- Anchor Propulsion:
    - Operator cabin with pneumatic controls
    - Winches & wires
    - Deck turning & over-boarding sheaves
    - Anchors (size & design suited for site conditions and loads)
    - Recovery pennant wires
    - Recovery buoys with marker lights
- Operational Equipment:
    - Deck crane(s) – rated for anticipated loads & working radius

- Hardwire communications (sound-powered phones)
- Generators rated for service loads + emergency back-up
- Generators for jointing
- Compressor(s) & hosing – rated for demand + emergency back-up
- Fuel storage (double-walled) + equipment refueling system
- Cutting / Burning equipment & supplies

- Cable Equipment - Fiber Optic Cable
  - MBR compliant static holding tank sized for 100% Lake Champlain FO cable capacity
  - MBR conformant FO cable highway
  - Linear Belt Engine for FO cable loading / recovery
  - Cable sealing supplies & equipment
  - Sized & rated Kellems Grips
  - OTDR monitoring equipment
- Cable Equipment - DC Power Cables ***NOTE:*** *Power Cable storage will be on the adjacent Cable Transport Barges with line feeds to the CLB cable installation machinery*
  - MBR conformant loading arm feeds from CTB's + power cable highways - **see Figure 9:**
    - Loading arms with powered luff / slew
    - 3-ton LCE's (integral to loading arm assemblies)
  - 2 x Linear Cable Engines (LCE's) – for DC Power Cable (rated for required max holdback) – See **Figure 10.**
  - Instrumented (4.0m) cable overboard chute – see **Figure 11.**
  - Cable sealing supplies & equipment (*Owner supply*)
  - Sized & rated Kellems Grips
  - Swivel & low-profile connections
  - Cable stoppers & misc. rigging
  - Cable floats
  - Emergency abandonment supplies:
    - Cable cutter + spare blades / abrasive wheels (as applicable)
    - Shrink caps
    - Kellems grips
    - Clump weights (e.g. mushroom anchors)
    - Laydown rigging
    - Pennant recovery line
    - Recovery buoy + lighting
- Barge Navigation
  - Fixed DGPS with back-up – Primary & secondary positioning systems
  - Portable RTK DGPS for localized, high accuracy positioning
  - USBL – For tracking of underwater vehicles Plow / ROV
  - Cable Lay Software
  - Navigation Software
  - Wired network for distribution of nav / lay data to key barge stations

- Touchdown Monitoring (TDM) - Surface Lay Operations
  - Follow-up ROV – Electric propelled, Large Observational Class / Light Work Class - Falcon or similar (**Figure 12)**
  - Control system
  - USBL tracking beacons

- Umbilical
- Launch & Recovery System (LARS)
- Operational spares

- Cable Protection Equipment (Plow / Diver):
  - ETA Plow **(Appendix 2):**
    - 'Stinger' custom-built for cable products, Depth of Lowering (DoL) requirements, & work site soil conditions ***NOTE:*** *For operations in 'Upper Lake' (North of ~MP73) the vehicle will be operated as a Jet Plow. For operations in Lower Lake (South of ~MP73) water hose supplies will be disconnected & stinger jets plugged and the vehicle will be operated in shear plow mode*
    - Launch & Recovery System (LARS) and/or rated crane
    - Umbilical 'wet mate-able'
    - OSBIT vehicle control system & monitoring software
    - Plow winch & tow wire + controls
  - Water pumps & hosing (Jet Plow operations only) Diver protection
    - Dive Station Control hut
    - System Monitoring Gauges (calibrated)
    - Surface / Diver communication system
    - Video display + recording
    - Umbilicals
    - Hyperbaric chamber
    - Compressors + pressurized bottles (back-up supply)
    - Hot water machines
    - Pressure compensated water jetting nozzles
    - Water-Lift (venturi)
    - Airlift (venturi)
    - Pumps & hosing
- Containerized Hut Listings:
  - Barge Navigation / Plow Control / DP Control.
  - Winch Control Hut(s)
  - Office(s)
    - Owner / NKT Office(s)
    - CMI
  - Crew Messroom
  - Operator Messroom
  - Diver Changing Room
  - Tool Hut
  - Spares Hut
  - OTDR monitoring hut
    - EXFO OTDR monitoring equipment + splice on test leads
    - Fusion splicer + supplies
    - FO cable termination tools
  - Modular Splicing Environment (NKT)

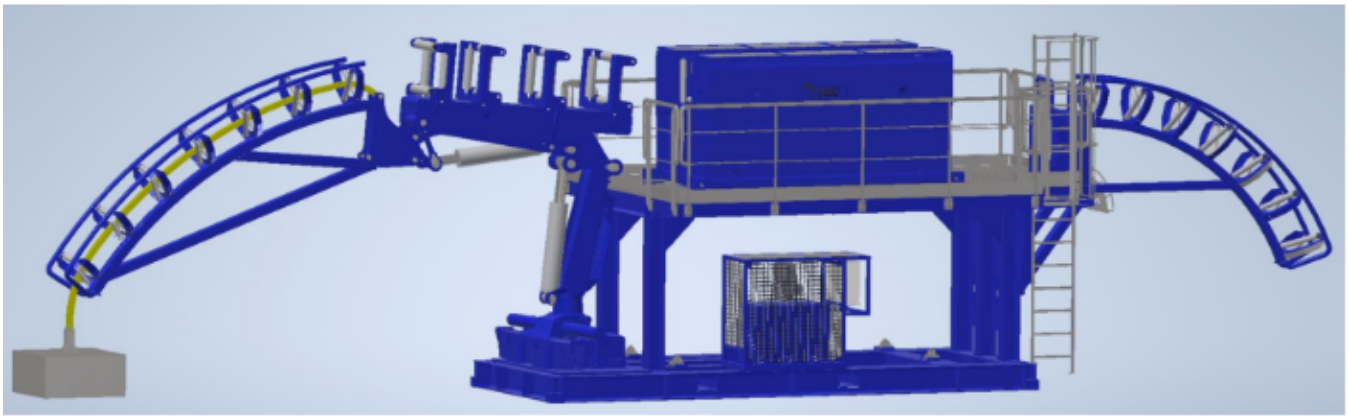

Figure 9 - Loading Arm Assembly

Figure 10 – Linear Cable Engine -typical (LCE)

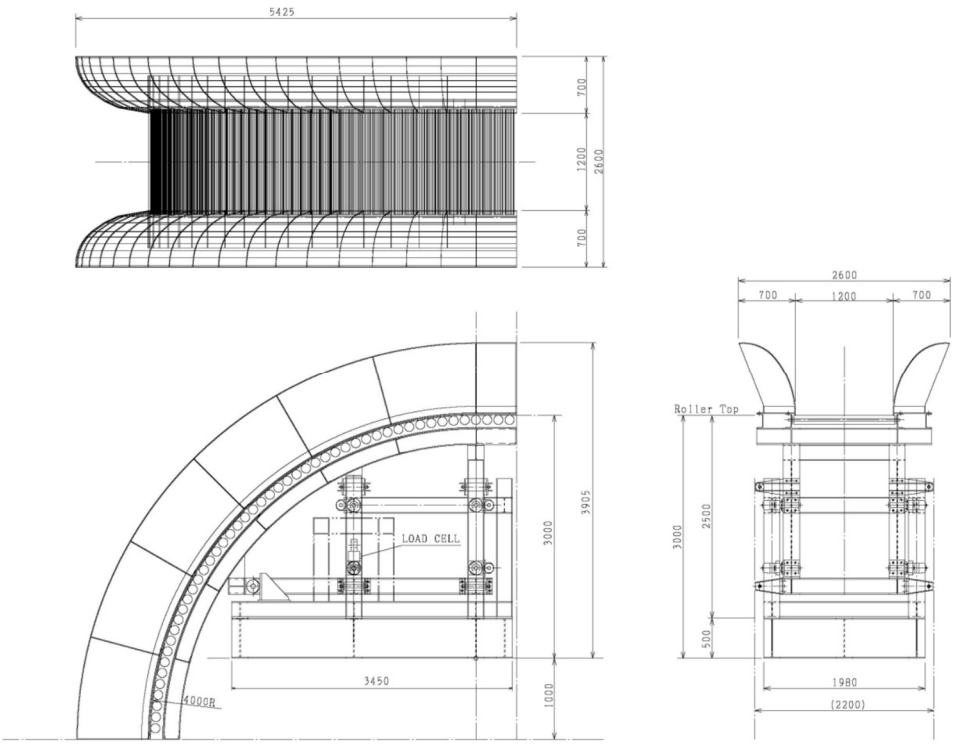

Figure 11- Instrumented Overboard Chute (OBC)

Figure 12 - Typical TDM ROV – Large Observational Class

4.6.3.2 Sea Trials

The CLB mobilization will be subject to a stiff regimen of inspections, tests, and trials to verify the full operational readiness of the vessel and her operational systems:

1. Navigation & positioning
    a. Primary, and secondary positioning systems + respective correction services. – Accuracy will be checked against an established survey monument reference point
    b. Handheld RTK GPS + correction service - Accuracy will be checked against an established survey monument reference point
    c. Compass heading (hemisphere / gyro) – verify accurate alignment
    d. Echo-sounder – vertical offsets & input sound velocity to be inputted before accuracy check
    e. Offset values for aerials & selected vessel reference points – check reference points positional values against local RTK reading, swing vessel heading and repeat.
    f. USBL system & beacons – patch test / self-calibrate (as applicable)
    g. Cable lay software – verify all cable parameters are correct & check feedbacks from all calibrated sensors.
    h. Data logging systems – hard / soft copy

2. Propulsion DP2 / Anchor

    Dynamic Positioning Class 2 (DP2). The primary components of the CLB DP2 system are:

    a. Six fully azimuthing retractable thrusters (4 x 500hp + 2 x 750hp)
    b. DP2 Control system with user interface, environmental & positioning sensors, thruster feedback loops. ***NOTE:*** *In accordance with DP2 Class designation, the system incorporates a level of equipment redundancy* – see **Figure 13**.

    The DP2 control system will be fully commissioned and tested as a new install by the system manufacturer. Vessel performance will be tested and documented in accordance with applicable US regulatory standards for DP2 commissioning trials.

    The six Thrustmaster thrusters, HPU's & feedback systems will be fully tested as an integral part of the DP2 trials. In addition, the ability to deploy / retract thrusters will be confirmed.

    Anchor Propulsion System. The primary components of the CLB anchor propulsion system are:

    a. Anchor winches – These units typically feature their own diesel prime mover and have double drums with adequate capacity to hold the required scope lengths of wire.
    b. Anchor winch operator station with navigation screen – verify correct function of all controls and gauges
    c. Deck turning sheaves and fairleads – check that they are free-running and in correct alignment
    d. Anchors – verify anchors have sufficient weight and suitable design to provide adequate holding capability in anticipated Lake conditions
    e. Anchor handling tug / barge deploy & recovery – field trials to verify functionality
    f. Anchor handling tug radio data connection – verify aerial placement on tug and CLB minimizes potential communication blind spots
    g. Anchor pennant buoys – conduct pressure checks to verify watertight integrity. Check that paint condition provides adequate visibility
    h. Anchor pennant buoy lighting - verify proper operation, battery condition and availability of spare lights & batteries

3. Cable handling:
    a. CLB cable gooseneck arms – check entire system for free running rollers. Remove any sharp points / edges
    b. Cable highway – check entire system for free running rollers. Remove any sharp points / edges
    c. Linear Cable Engines (LCE's) – Check squeeze pressure against cable specs. Verify track open / close function /Check pay-in / pay-out function and speeds / Verify track form is compatible with product in use / Verify holdback capability
    d. Cable counters – bi-directional calibration using known length product
    e. Instrumented Overboard Chute (OBC) – apply known loads and check against readout values apply corrections as required & recheck
    f. Cable departure angle sensor – verify accuracy of readout values against digital spirit level

4. Cable Protection
    a. Plow – Jet Plow & Shear Plow modes – elevate vehicle on 2 containers, calibrate readout values for share angle & depth of lowering against measured values through entire range of travel.
    b. Remedial burial tools – Calibrate readout values for jeting angle, speed, Dol, TSS monitoring
    c. Launch / load & unload / recover operability – sea trial performance
    d. Plow & Remedial burial tooling - software + logging, as applicable
    e. Plow & Remedial burial tooling - water feed pumps & hosing – check pressure gauge values against calibrated gauge, as applicable

5. Dive spread
    a. Equipment calibration – check all certification is in date
    b. Umbilicals / hoses – check condition, replace as necessary
    c. Video & communications systems including record function – field checks
    d. Safe water ingress / egress - verify condition of ladders
    e. Emergency diver recovery – Verify functionality and satisfactory condition of emergency recovery winch
    f. Standby diver systems – check as per primary systems
    g. Compressors / storage bottles & back-up systems – verify pressures and bottle dates
    h. Diver certifications – check certifications of all divers

6. ROV
    a. Check spares inventory
    b. Check general condition of vehicle + ancillary equipment
    c. Perform deck checks
    d. Verify function of LARS
    e. Perform dive to depth to verify watertight integrity of electrical connections etc. – correct any ground fault errors
    f. Verify all manipulator functions
    g. Check TX/ RX on all USBL beacons and track with CRB
    h. Verify nav / video / communications feeds between ROV control hut & Nav Control (if separate)

7. OTDR Monitoring equipment + auto alarm notification system
    a. EXFO equipment - checks per equipment manufacturer instructions
    b. Fusion Splicer - checks per equipment manufacturer instructions
    c. Verify FO stripping tool inventory

8. Communications systems (voice / data) – verify transmit receive function of all stations / verify availability of spare units & batteries

9. Crane & materials handling equipment
    a. Equipment certification & general condition – complete standard crane checklist every shift
    b. Operator certifications - check certifications of all operators
    c. Rigging – check certification & perform visual inspection at least every shift and prior to usage
    d. Complete lift plan for all major lift operations

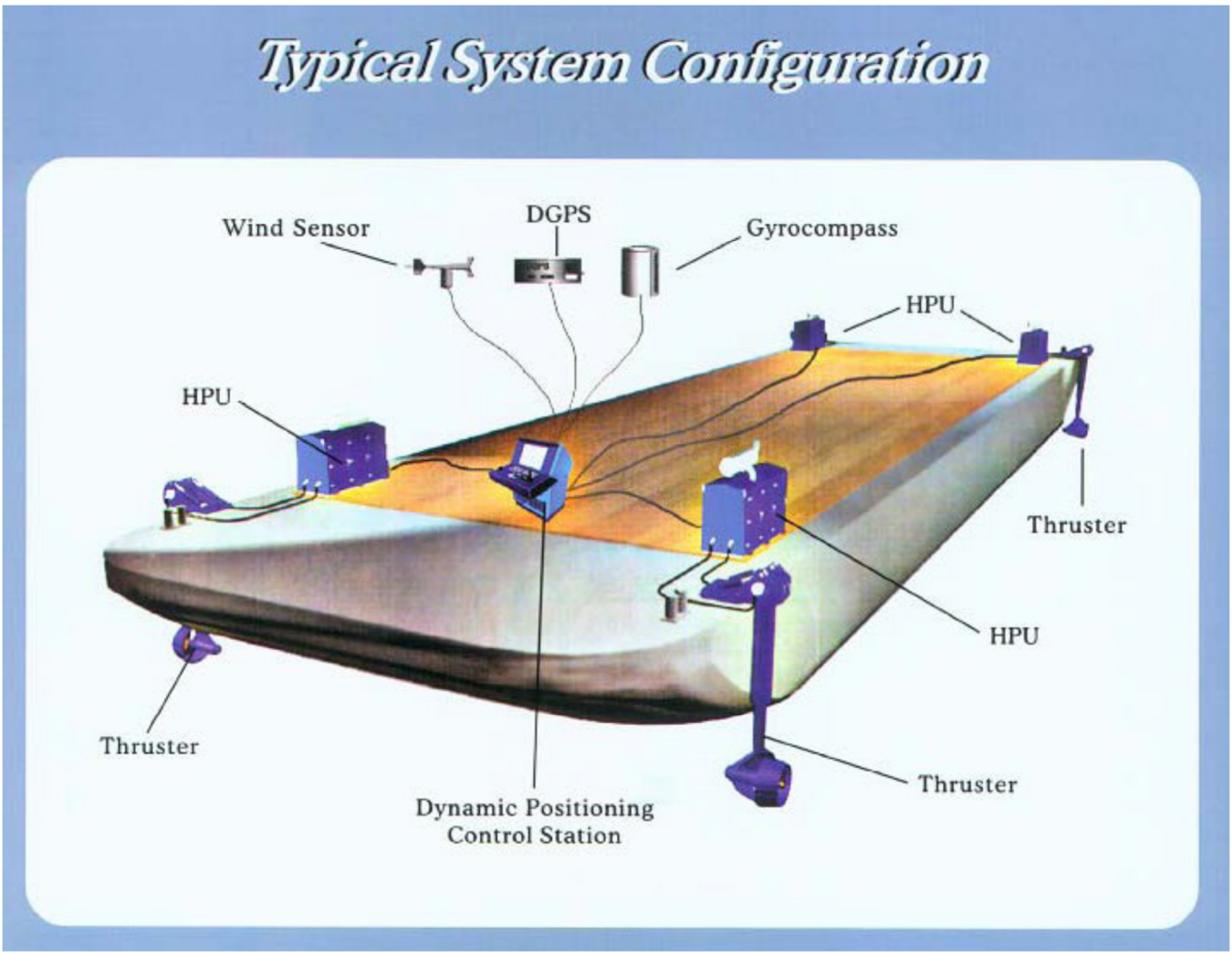

Figure 13 - DP system schematic

NOTE: *Diagram shows 4 thruster set-up. CMI's Lake Champlain CLB will be equipped with 6 thrusters (4 x 500HP & 2 x 750HP)*

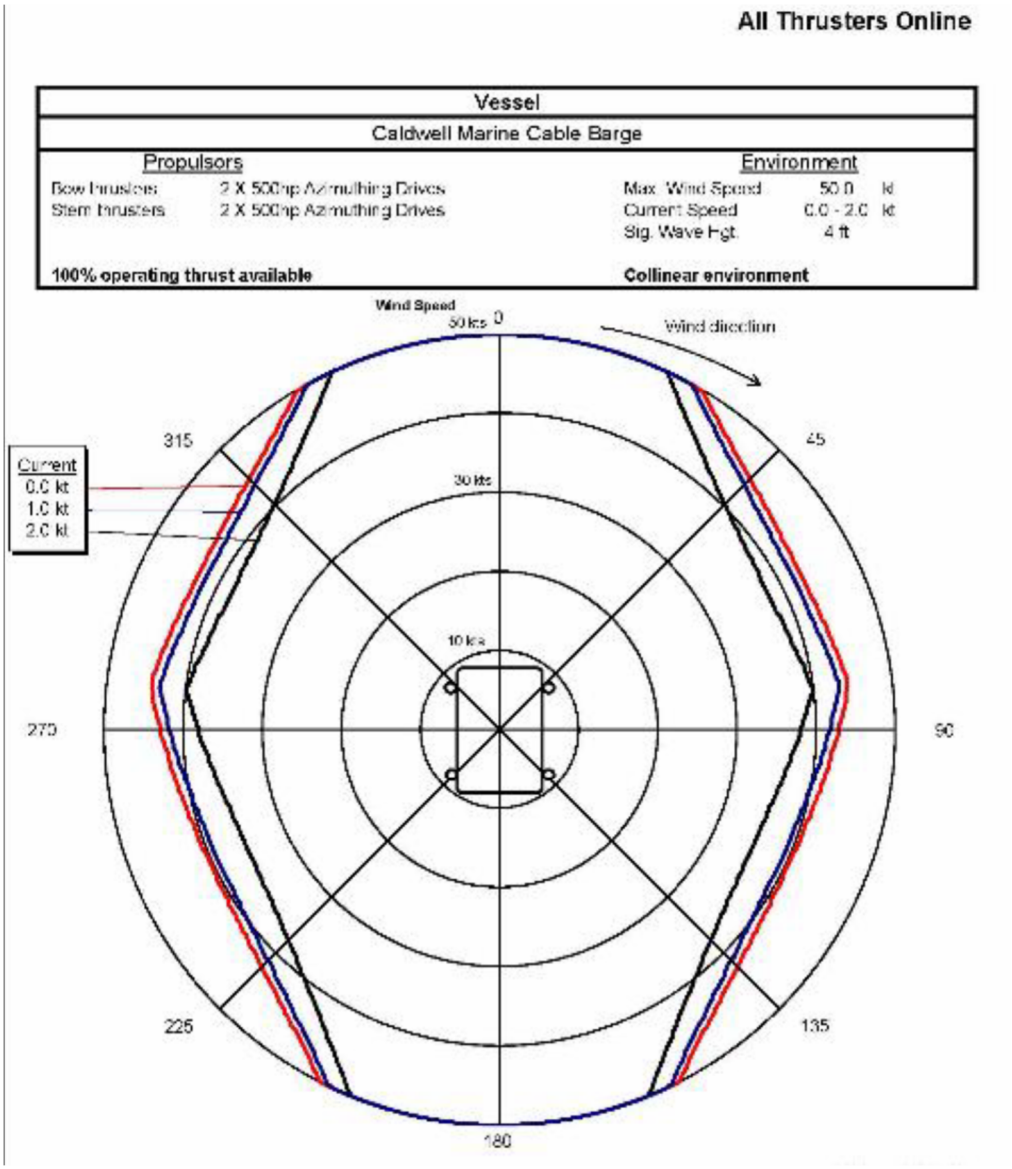

Figure 14 - Sample DP Holding Analysis Diagram

Instructions for interpreting the sample plot:

1. *Select sea current velocity curve for worst anticipated site conditions*
2. *The environment direction (direction that the weather arises from, relative to the vessel's bow), is read around the outer ring of the plot. The maximum wind speed that can be sustained with the DP system is indicated by where the curve crosses a radius from the center to the selected environment direction.*

***Example:** - Using the diagram: For a sea current velocity of 2 knots and a relative wind direction of 315^0 the subject vessel may be expected to maintain position in winds speeds of up to 40 knots*

NOTE: The diagram in Figure 13 has been provided as an example only. Results for the CHPE Lake Champlain Cable Lay Barge will differ from those shown.

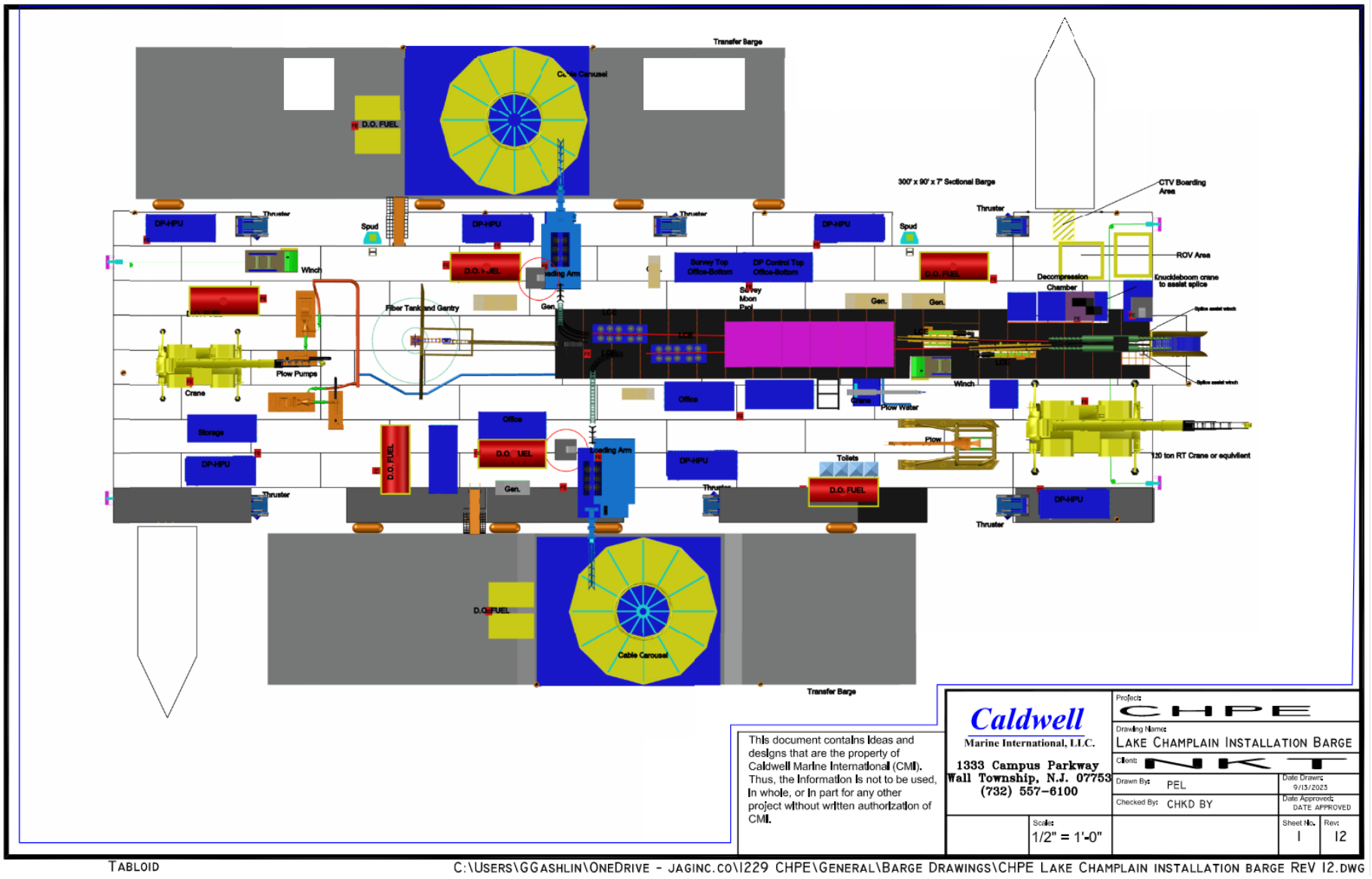

Figure 15 - Lake Champlain CLB Deck Layout

4.6.4 Cable Lay & Protection

4.6.4.1 Initialize Cable Feed CTB's to CLB

Cable storage capacity on the Lake Champlain CLB is limited to a single FO static tank. Power cable product will be fed to the CLB lay line from two CTB's that will be securely moored & fendered on each side of the CLB. The mooring position of both CTB's will be adjusted so that their carousels are centered under the CLB 'gooseneck' loading arms.

4.6.4.2 Commencement of Lake Champlain Lay

CMI's designated start of lay is at the US / CAN border. Access to this lay start position is hampered by a narrow aperture on the Rouses Point Railway Bridge (derelict) & Rt2 Road Bridge.

CMI review of this site has identified 2 benefits (sheltered waters & minimal current). In view of these favorable factors, CMI has elected to perform a float-in of the ~1.2-mile route length between the railway bridge and the US / Can border. Canadian marine team will take the floating submarine cable bundle at the US/Can border to ~330 ft (~100m) into Canadian waters.
NOTE: *This operation will preclude use of the jet plow for protection of the float in route section. This area will require post lay burial protection by diver and/or equipment.*

The CLB will hold position, just south of the railway bridge aperture. A support barge with pull winch will be setup at the border to pull the cable northward. Please see **Figure 16.**

CMI will utilize 'SeaFlex Sea Serpent' Model 3000-2-7 flotation or similar – Please see **Appendix 10.** The flotation product will provide reserve buoyancy. The floatation will be added to the cable bundle as it is paid out from CLB toward the US/CAN Border. Support vessels will keep the floated cable in alignment. The cable bundle will then be handed off to the Canadian Team at the border. Once cable bundle in proposed position, the floatation will be deflated, and cable bundle lowered to lakebed. The cable bundle position can be adjusted as required using divers, floatation devices (sea serpent, lift back, etc.) and surface support vessels to ensure the cable is within permitted route tolerances.

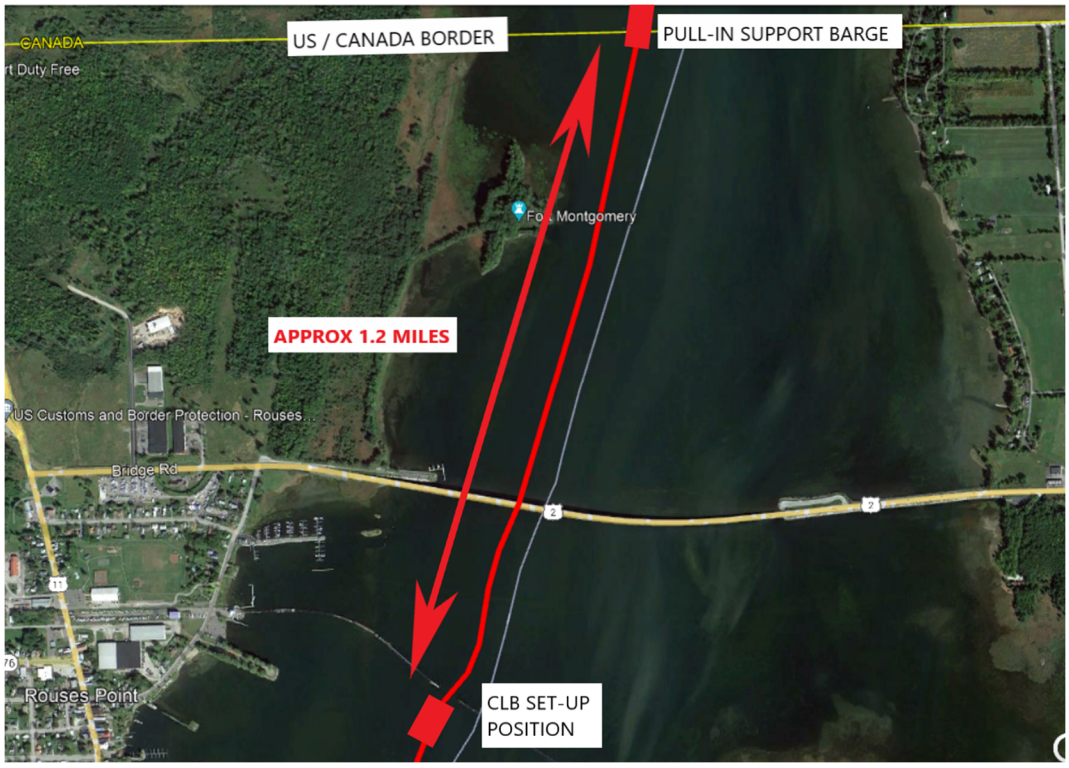

Figure 16 - Start of Lay (Rouses Point)

In accordance with Project permitting, in route areas featuring water depths of ≤150ft (~45.7m) the CHPE cables are to be lowered to a depth of ≥4ft (~1.22m) below adjacent lakebed / riverbed grade. CMI may elect to utilize the following, but not limited to, post-lay cable protection vehicles and/or equipment, and diver lowering methods to accomplish cable lowering in the North Lake cable float-in route section.

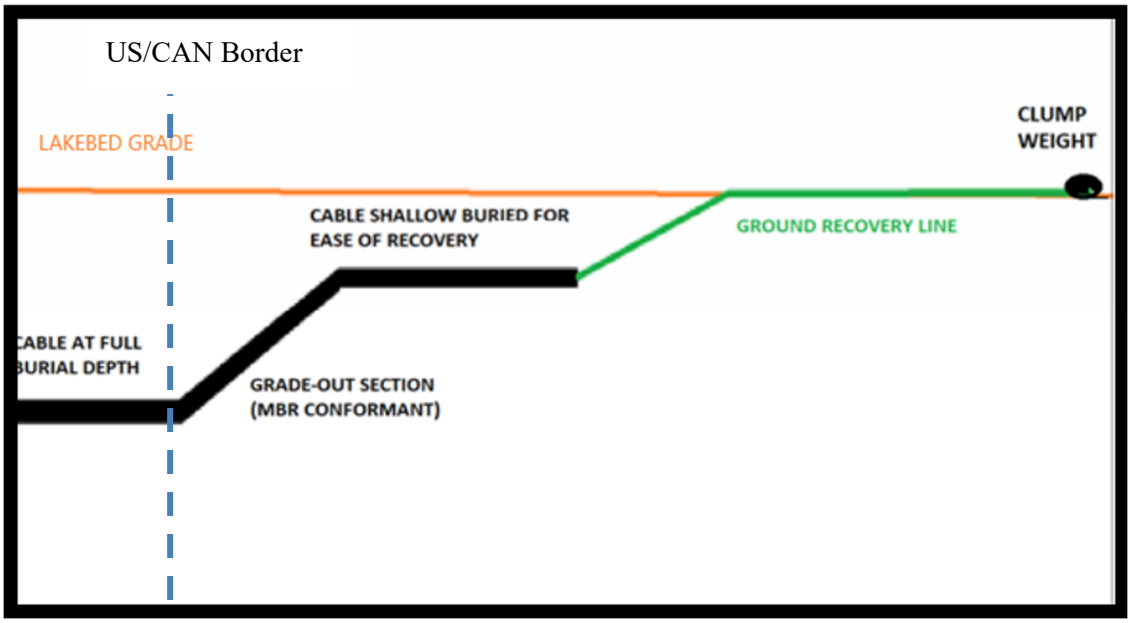

Figure 17- Grade-out for recovery by HQ Shore End Team

CMI has procured post-lay protection vehicles or remedial burial tools and equipment that are capable of the requisite cable protection tasks:

1. **CMI PREFERRED VEHICLE:** Remotely Operated Tracked Jetter or similar – Please see **Figure 18** & **Appendix 11**

***Figure 18* - Post-Lay Protection – Jetter Vehicle (Typical)**

The tracked jetter vehicle has the following operational benefits:

- Motivation by powered tracks – *Vehicle production reliability and rate should be improved*
- Option to fit the jetting swords with a positive depressor – *This will enable instrumented real-time recording of DoL*
- Jetting sword width of 450mm – *will easily accommodate CHPE cable bundle*

The tracked jetter is CMI's preferred tool for cable lowering in the Richelieu River area.

NOTE: *Tracked Jetter or similar equipment used is subject to applicable required approvals and trials*.

2. **'Diver Operated' jetting vehicle**. See **Figure 19 & Appendix 12** for additional information.

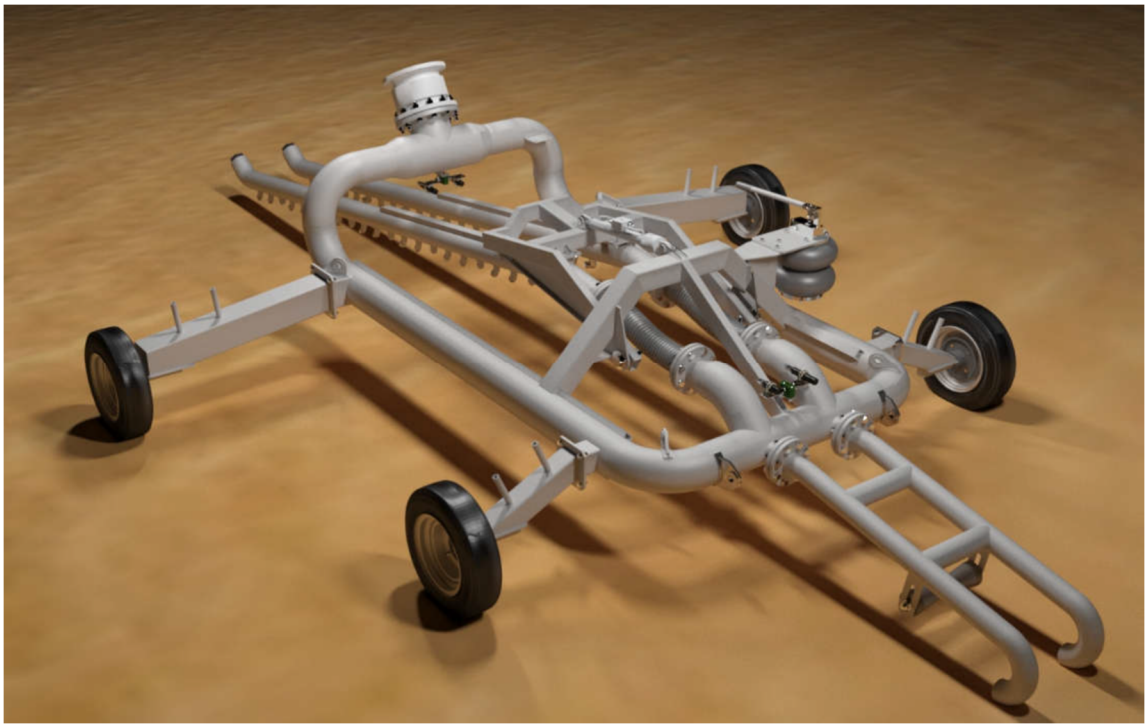

Figure 19- Diver Operated Vehicle (typical)

The diver operated jetting vehicle features a simple operational design.

- The vehicle does not require a dedicated LARS system and can easily be deployed by a deck crane using a rated 4-leg sling
- Vehicle propulsion is provided by rearward facing jets mounted at the front of the vehicle. Topside fed water supply is split on vehicle with control valves distributing flow as follows:
    a. Primary water feed goes to the jetting swords
    b. Secondary water feed is piped to rearward facing propulsion jets

    Control of vehicle travel speed is accomplished by diver adjustment of the onboard valve system to alter the relative distribution of water pressure between (a) & (b)
- The vehicle is fitted with cameras to enable topside viewing of seabed events
- Swords are 'open' design and have no depressor. Sword depth is instrumented, however due to 'open' sword design and absence of depressor the indicated sword depth provides only an indication of 'potential' depth of lowering (DoL). For field verification during operations, divers equipped with a graduated probe will be employed to measure DoL. The support vessel will track diver position by USBL to enable diver reported DoL values to be geo-referenced and logged.

The following suite of tools will be used, in addition to, for post-lay and remedial cable lowering:

- Diver jetting (fluidization of seabed material using water delivered via pressurized 'reactionless' nozzle) - Please see **Figure 20**
- Water-lifting (venturi educting device) – Please see **Figure 21**
- Airlifting (venturi educting device) – Please see **Figure 22**

Figure 20-'Navy type' reactionless jet nozzle (diver operated)

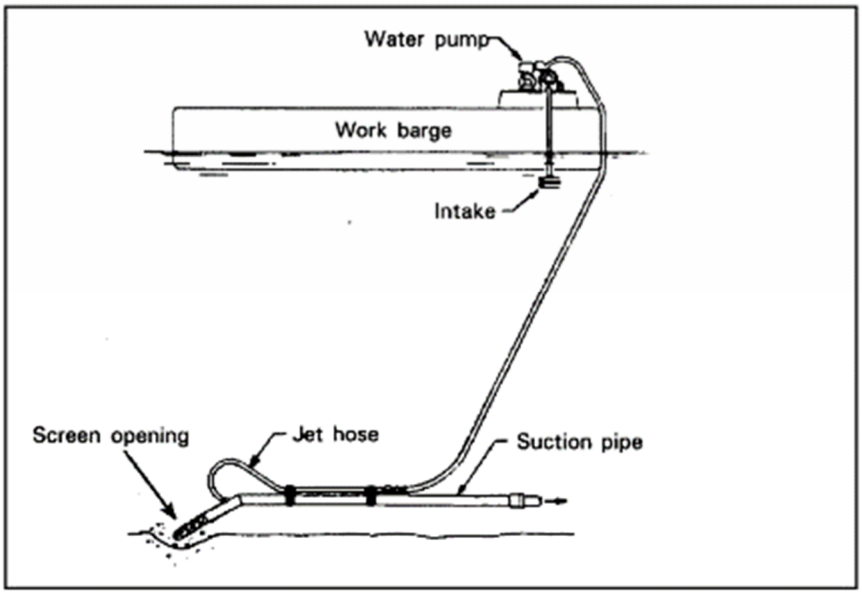

Figure 21 - Water-lift device (diver operated)

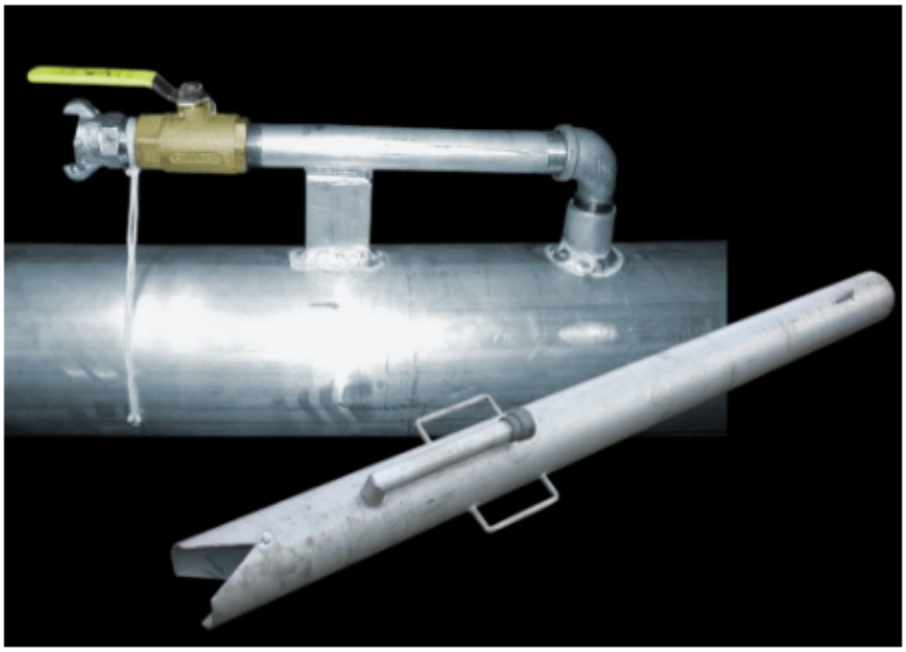

Figure 22 – Air-lift device (diver operated)

Field verification of depth of lowering in remedial burial areas will be achieved using typical marine survey methods.

4.6.4.3 Commence Lay & Plowing Operations

CMI's principal cable protection tool is a towed ETA Plow – Please see **Figure 23** & **Appendix 2.** For Lake Champlain operations, the plow will be operated in Jet Plow for northern Lake waters. In southern Lake waters, the vehicle will be modified and will be operated as a Shear Plow.

The plow bell mouth at the top of the blade features allows entry to the blade compartment. The cable bundle will travel through the bell mouth and plow blade and exit at the bottom rear to be installed at the target depth of lowering.

Figure 23 – ETA Jet/Shear Plow Sled (Typical)

4.6.4.4 Jet/Shear Plow

As the plow is towed forward, the water nozzles inject water to fluidize the substrate immediately ahead of the blade. The cable feed through the bell mouth and down to plow blade until it exits at the base. The plow continues its advance, leaving the cables embedded into the sea floor at the required depth of lowering. The recently fluidized seafloor material quickly precipitates out to fill the void astern of the vehicle. Subsequent inspection of the installation route will typically reveal very little evidence of recent burial activities.

The plow design incorporates custom sized blade to meet permit lowering requirements, as well as sled size and configuration in accordance with site specific conditions to allow for towage by the cable lay barge whilst simultaneously installing the submarine cable. The plow design includes lifting points that enable launch and recovery via a crane on the barge.

The CMI Shear/Jet Plow is tethered to the Cable Lay Barge by the following connections:

1. Tow wire – Tow wire pay-out / pay-in is controlled by a tow winch and is outfitted with a dynamometer that feeds tension data to CMI's lay computer. Deck operators can adjust vehicle layback distance in accordance with water depth and other prevailing conditions **Figure 24 & Figure 25.**
2. Water Hose(s) – Jet nozzle arrays on the vehicle are fed via, one or more, pressurized raw water hoses connected surface-supply pump(s). The number of hoses employed will be dictated by seabed conditions, depth of lowering requirements, and whether a high / low pressure combination is required. Topside pressure sensors enable operators to adjust pump output(s) to optimal level(s)
3. Cable product – Cable feed rate is controlled by barge mounted Linear Cable Engine(s) (LCE). Cable payout is adjusted as necessary to maintain an 'ideal catenary' in accordance with barge forward progress and changes in route bathymetry.
4. Umbilical – The vehicle is outfitted umbilical line allowing plow pod data to be transferred and recorded to cable lay barge.

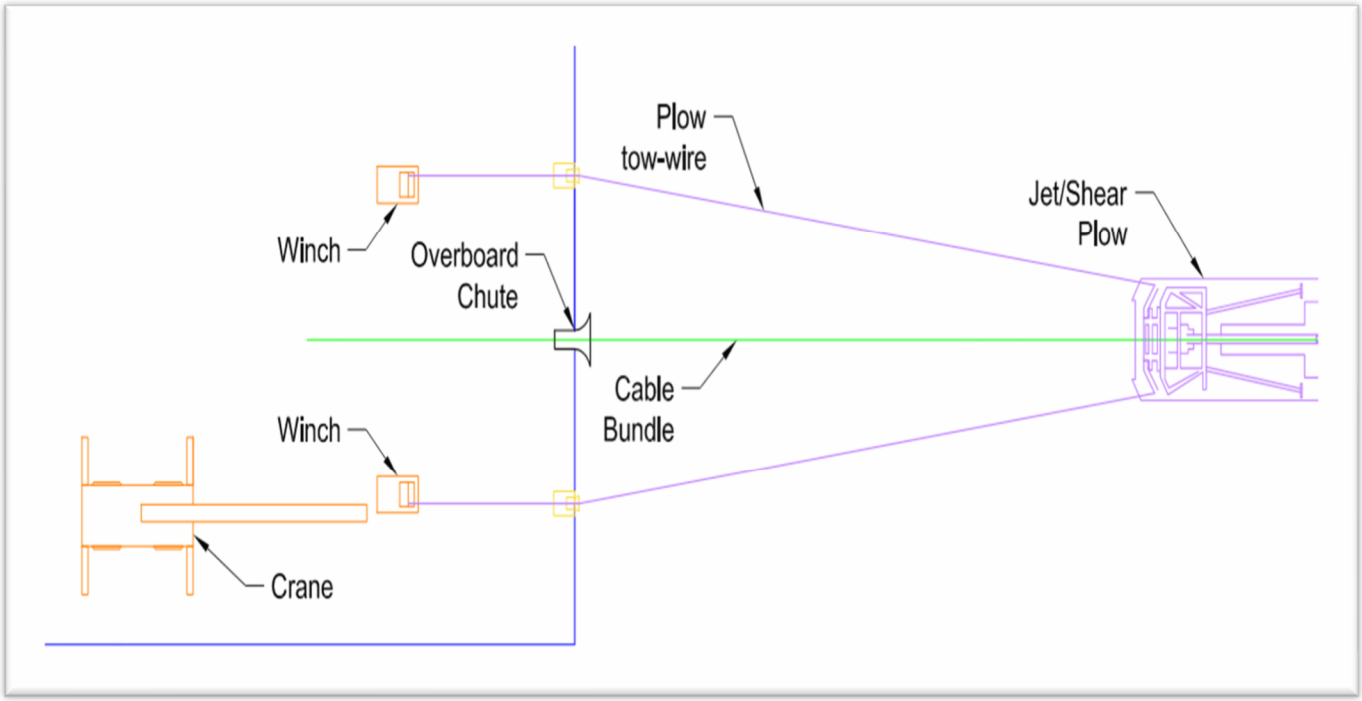

Figure 24 – Plow in Tow Schematic (Top view)

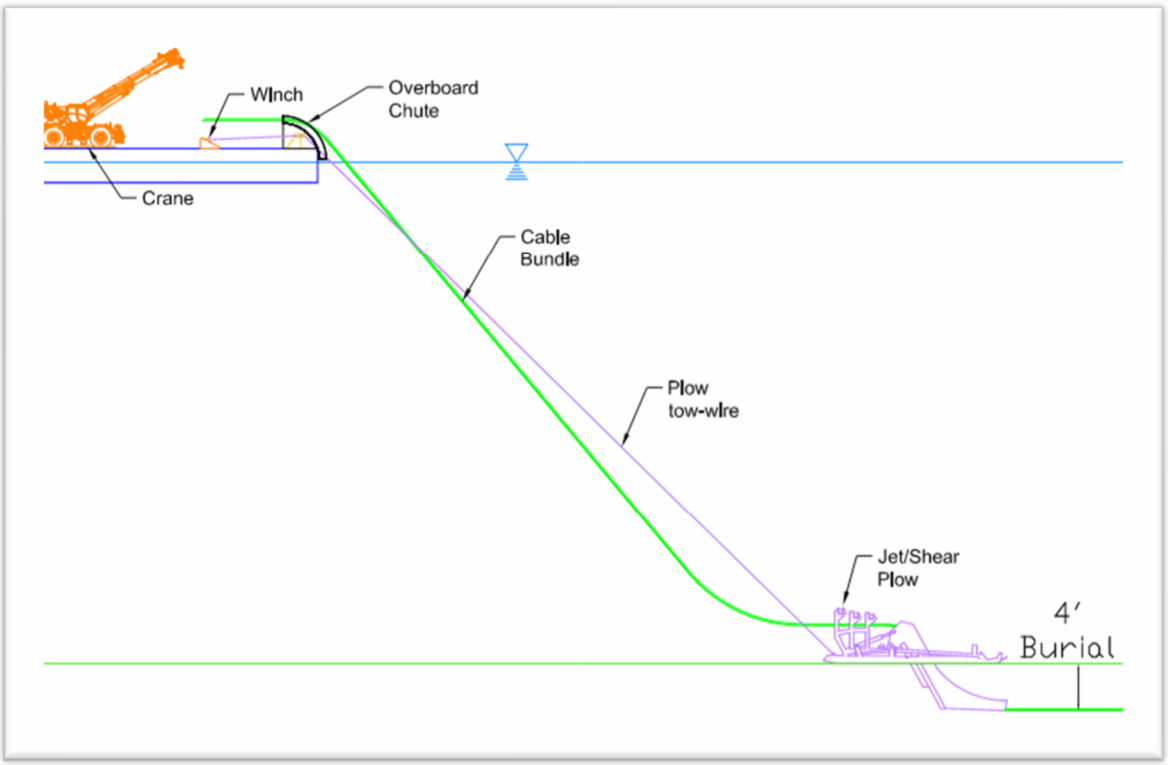

Figure 25 – Plow in Tow Schematic (Profile View)

4.6.4.5 Plow Loading

The plow design requires the vehicle to be 'diver loaded / unloaded.' The plow features hinged doors to facilitate this task. When divers load the plow, they will direct cables into the designated partition before closing the loading door and securing it with bolts.

4.6.4.6 Transition from Mooring to DP Propulsion

The CLB is equipment with an anchor spread setup as well as spuds (steel pipe) to maintain holding position. Spuds are expected to be used in constricted areas where sufficient lead on an anchor spread for proper anchor holding cannot be achieved, in ~60 ft or less of water depth.

The CLB DP response system is modelled for cable installation conditions and for both plow and surface lay operations. CLB commissioning trials will include a test of the vessel's ability to successfully and safely transition from stationary spud position or anchor spread and propulsion pattern to DP2 controlled mechanical thruster propulsion.

Performance of this transition will be conducted in strict adherence with operating instructions per DP control manufacturer.

4.6.4.7 DP Control System

A dynamic positioning system is a computer-controlled propulsion system allowing the cable lay barge to maintain its position in open waters against wind, waves and current. The system consists of six (6) mounted thrusters controlled through a computer that calculates and controls the amount and direction of thrust necessary to counteract wind, wave, and current forces to prevent or correct deviation from the desired position and heading of the CLB. Position reference sensors, combined with wind sensors, current sensors and gyro compasses, provide information to the computer pertaining to the barge's position and the magnitude and direction of environmental forces affecting its position. The computer program contains a mathematical model of the vessel that includes information pertaining to the wind and current drag of the vessel and the location of the thrusters. This knowledge, combined with the sensor information, allows the computer to calculate the required steering angle and thruster output for each thruster. The permitted route will be uploaded to the system for navigation.

4.6.4.8 Cable Lay Survey, Navigation and Monitoring Systems

The survey, navigation, and plow/cable monitoring systems are used to guarantee that the cables are installed in the correct location and buried to the proper depth of lowering.

4.6.4.8.1 Route Navigation Setup

The permitted route will be uploaded to the navigation software and shared to both navigation team and DP operators. Data from route surveys, PLGR operations and Lake Champlain Maritime Museum will be plotted on screens. An offset will be placed with boundary alarm to notify navigation team when nearing location. Noteworthy items to be included, but not limited to:

- Permitted Route / Route Position List
- USA/Canadian Border
- NY/VT Border
- Cultural Resource(s) location and boundary
- Co-location infrastructure crossings
- As-built Pre-lay Mattress Locations w/ proposed Plow Grade-Out/Grade-in limits
- PLGR findings and confirmations
- Significant structures, such as Bridge Abutments, Sewer Outfalls, Water Intakes

4.6.4.8.2 Survey and Navigation Software

The navigation system consists primarily of a surface and sub-surface positioning system integrated in a navigation program that provides for vessel guidance and data recording via DGPS receiver(s), Gyro, USBL, etc. Data from these components are input to the navigation computer and processed using navigation software. The program integrates the surface and sub-surface systems and displays the vessel position at the navigation station and, on a separate screen, at the DP operator station.

The cable bundle position is calculated using the USBL system on the Plow/ROV to determine the position of either a transponder or responder on the Plow/ROV. When plowing, the second method uses the plow tow wire tension, tow wire length from the overboard chute, and plow depth to calculate the horizontal distance from the overboard chute to the plow. In Surface Lay operations, the second method uses calculated catenary length based on water depth, lay speed, etc., to determine the horizontal distance from the overboard chute to the cable touchdown point. A direct offset, using the barge heading, is then used to calculate the plow/ cable position. Both positions are recorded, the primary positioning method is USBL system.

Navigation data is recorded during all cable operations and at any time that the vessel is operating near existing cables, conduits, structures or in other critical areas.

4.6.4.8.3 Plow/Cable Monitoring Software & Sensors

The navigation and plow/cable monitoring system integrates the surface & subsurface navigation system, deck sensors, and plow instrumentation. This cable lay and plow system is used for installation of both surface laid cables and buried cables.

- **Deck Sensors for Plow/Cable Monitoring-**Deck sensors are used to monitor all parameters relevant to plow and cable operations.
- **Plow Instrumentation-**The plow is equipped with sensors and instrumentation to record display real-time plow conditions such as: Pitch & roll, Stinger angle, Depth transducer
    - The plow sensors are connected through underwater stainless-steel electronics housing or pod. The pod is connected to the lay barge via a neutrally buoyant umbilical cable. This information is connected and sent to be displayed on the plow computers.
- **Plow/Cable Monitoring Software** - The software allows for both numeric and graphical display of Plow/ROV, cable, and positioning data. The displays show cable tension and payout speed, as well as a graphic display cable paid out relative to cable remaining aboard.
    - Monitoring system consists of the following deck sensors, plow/ROV sensors and graphic display and data recording system.
    - Output from the sensors is relayed to the navigation and monitoring stations.
- **Navigation and Plow/Cable Data** - Essential data, such as lay barge position and Plow/ROV position and status, are recorded and time stamped. Time stamped data are typically recorded somewhere between a 5 second and 20 second interval, depending on project requirements. During the actual installation, the program records continuous distance-based data at dedicated intervals along the route.

4.6.4.9 Lay Operations at Utility Crossings

4.6.4.9.1 Burial Operations

Lay operations over utility crossing points are subject to the specific terms of the signed Crossing Agreement for the subject utility.

The following methodology assumes the following conditions:

a. Pre-lay mattress protection has been installed at the crossing point prior to the arrival of the CLB
b. Pre-lay mattress pattern is as per signed Crossing Agreements design.
c. Positional details of pre-lay mattress protection ‘as installed’ have been inputted into the CLB nav system
d. CLB is currently installing cable using Burial Equipment (Jet Plow, Track Trencher, ETA Diver Trencher)
e. Notifications have been submitted to owner / operators of subject utilities per requirements of Crossing Agreements

As the plow approaches the CI crossing, it will begin grade out as required. The plow will then be rigged to the crane onboard the CLB to be elevated into the water column to sufficiently clear the CI crossing and pre-lay mattresses. The cable will remain in the plow share and continue to feed out as the CLB makes forward progress. The plow will then be lowered to the lake bed at the appropriate distance away from the CI crossing. The plow will be disconnected from the crane, then grade-in to required depth of lowering as the CLB resumes forward progress. Position of grade-out, crossing and grade-in will be recorded for post lay mattress installation. Cable bundle position may be verified by Diver and/or ROV prior to post-lay mattress installation. Post-lay mattress protection operations to be scheduled after cable installation over the utility crossing.

4.6.4.9.2 Surface Lay Operations

Lay operations over utility crossing points in ≥ 150 ft water depths are subject to the specific terms of the signed Crossing Agreement for the subject utility.

The following methodology assumes the following conditions:

1. Positional 'as-found' details of existing Co-located Infrastructure have been inputted into CLB nav system.
2. Pre-lay protection (if required) per signed Crossing Agreements has been installed at the crossing point prior to the arrival of the CLB
3. Positional details of pre-lay protection 'as installed' have been inputted into the CLB nav system
4. CLB is currently installing cable in Surface Lay mode.
5. Cable Protection System (APP) to be installed per signed Crossing Agreements onto CHPE cable bundle
6. ROV verification of cable touchdown position at Co-located Infrastructure crossing location.
7. Notifications have been submitted to owner / operators of subject utilities per requirements of Crossing Agreements.

The CLB will slow progress as it comes to the CI location. The required APP will be installed onto the power cable. It will then be over boarded and lowered through the water cable as the CLB resumes cable pay-out and forward progress. ROV will confirm APP position and alignment over CI location.

4.6.4.10 Completion of Lay Segment / Set-up for Splicing

The CLB Team will closely monitor cable consumption and remaining stocks in each CTB. Installation speeds will be reduced prior to depletion of CTB cable stocks. CLB progress and cable payout will be suspended during the final turns of cable in the CTB carousels. Proposed splice locations will be reviewed to ensure following criteria is met:

- Post-burial of splice can be achieved in plowed sections in ≤ 150 ft water depths.
- Ensure splice location is adequate distance from and does not interfere with existing utility crossings and structures along entire route.

NOTE: *NKT field splices cannot pass through the plow. If plowing operations are being conducted, the plow will be graded-out and recovered at the splice area. Reloading of the plow will be performed after the field splices have been deployed to the Lakebed.*

The CLB will hold position at the required splice location. The cable bundle will be secured to the barge as required. The empty CTBs will be moved off the CLB and the CTBs with the next segment of cable will be rejoined and fed through the cable track system. Once cable lengths confirmed and in appropriate positions, splice operations will begin.

4.6.4.11 Deployment Of Power Cable Field Splices

Once splice operations are complete, the cable bundle with splices will be deployed with the assist of the CLB onboard crane. The onboard LCE system and winches will provide the required holdback tension as the system is lowered to the lakebed.

Power Cable splice body characteristics:

- Overall length of 13.8m (incl bend limiters)
- Weight in air of 2.7MT
- Weight in seawater of 2.0MT

- Weight in freshwater of 2.05MT

In water depths < 150', the splice section of the cable bundle, including grade-out/in length will be remedial buried and/or protected as required. The plow will then be re-deployed and reloaded as required to continue with cable installation operations via plow burial.

4.6.4.12 Cable Landing Operations at Putnam Station

Cables will be landed at Putnam Station via two HDPE ducts (installed under Segment 17 EM&CP). Cables will be landed to shore by means of a 'Final' type landing that will be performed at the end of Lake Champlain cable lay operations.

The CHPE submarine cables will be landed at Putnam Station as follows:

- Duct A: Power cable A (Single Stripe) + FO cable
- Duct B: Power cable B (Double Stripe)

Land Team & Dive Support Barge Team to conduct following operations prior to Cable Lay Barge arrival:

- Set-up shore winch & holdback
- Establish Dive Support Barge on spuds close to HDD exit while still providing unimpeded access for float-in operations
- Remove surficial overburden from HDD marine exit points
- Install flared extension piece onto HDD duct for 1st landing – see **Figure 26.**
- Thread winch wire into HDD duct that has been selected for 1st landing & mark with recovery riser / float
- Establish a mark on site at position where minimum acceptable amount of cable has been landed.
- Perform and confirm final duct cleaning and proofing

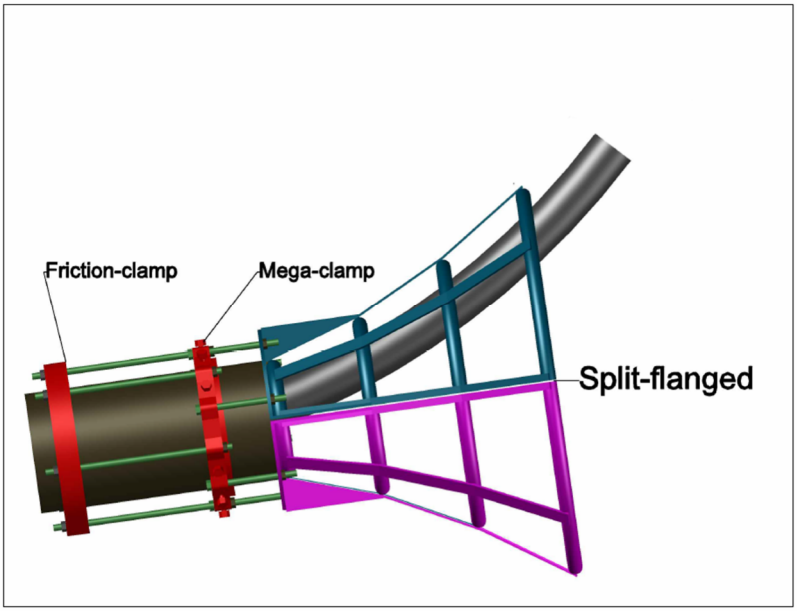

Figure 26 - Flared Extension Piece for HDD Duct

Once HDD duct preparation is complete, the CLB will setup in position to execute cable float in at Putnam Station. The CLB will attach floats to the individual cable as it pays out to the required pull-in length. The float out and pull-in operation will be performed with one cable at a time. The pull wire will be attached to the end of the cable. The land-based winch will begin cable pull-in with marine vessels managing the floated cable. Floats will be removed

from the cable prior to entering the HDD duct. The pull will be complete once the required cable length has been landed. The remaining floating cable will be lowered to the seabed bottom. The second cable length will repeat float-out and pull-in operations. Once all cables are lowered to the lake bed, diver lowering methods will be employed to achieve required depth of lowering from HDD duct to plow grade-out location. Divers will remove the split flange and seal offshore HDD prior to lowering.

4.7 Emergency and Contingency Planning

All CMI operations will be planned using weather forecasts received at regular intervals from multiple independent forecasters to ensure that conditions are within allowable parameters for the operation to be undertaken. This is to ensure the safe and effective installation of the cables throughout the Lake Champlain installation schedule.

In the event difficulties are experienced, such as with equipment, weather, etc., emergency procedures will be in place on all vessels to ensure the safety of crew, equipment, and environment.

All operations are planned in detail with the formation and discussion of a risk assessment to ensure that all potential hazards are accounted for and mitigated as far as possible.

4.7.1 Emergency Field Splice

In the unlikely event CMI must evacuate the project location, the cable will be cut, sealed, and lowered to the lake to be wet stored until cable lay operations can resume. Events such as extreme weather, essential equipment failure, etc. would result in suspending cable lay operations. Upon return to site, the cable will be recovered from the lake bed and an additional field splice will be installed.

5 Environmental Protection Measures

5.1 Oil Pollution Prevention

Please see dedicated SOPEP document in **Appendix 4** of this document.

An Emergency Notification Flowchart within the SOPEP document provides notification requirements and contact details in the event of emergency situations and incidents:

- The Cable Lay Barge will carry emergency ‘spill kit(s)’
- The Cable Lay Barge fuel stocks onboard will be kept to a practical minimum.
- The Cable Lay Barge fuel storage vessels will feature double-wall construction.
- As an emergency contingency measure CMI has pre-arranged that US Ecology, a US based Oil Spill Removal Organization (OSRO) will be available on ‘call-out’ basis to provide professional clean-up support. For further details, please see: https://www.usecology.com/.

5.2 Solid Waste Management

Disposal of waste into Lake waters is strictly prohibited by local, State & Federal law.

- Crews and contractors will be notified accordingly at the Project ‘Kick-Off Meeting’ and daily shift change / TBT meetings.
- New crew members/ contractors will be notified during the project and vessel familiarization processes.

The Cable Lay Barge will be mobilized with waste containment bins, these bins will feature closeable lids and heavy grade, disposable plastic liners. Bin liners will be replaced regularly and filled bags will be transported to shore for proper disposal at an approved facility.

5.3 Wastewater Management

- Disposal of untreated wastewater into Lake waters is strictly prohibited by local, State & Federal law.
- Crews and contractors will be notified accordingly at the Project 'Kick-Off Meeting'.
- New crew members/ contractors will be notified during the project and vessel familiarization processes.

The Cable Lay Barge will be equipped with portable toilet units that will be sourced from a local provider.

- Soiled / clean portable toilet units will be transferred by means of crew transfer vessel / work vessels.
- Portable toilet change-out / clean-out service will be performed by the local service provider at the operational base located at Wilcox Dock, Plattsburgh, NY.

Appendix 1 – Lake Champlain Vessels

Appendix 2 - CMI Shear / Jet Plow

Appendix 3 - Site Specific Health & Safety Plan - Lake Champlain Waters

Appendix 4 - Shipboard Oil Pollution Emergency Plan (SOPEP)

Appendix 5 - List of Marinas in Lake Champlain

Appendix 6 - Aquatic Invasive Species Management Plan

Appendix 7 – Cable Floatation

Appendix 8 – Remedial Burial Tool - RIHC Amphibious Tracked Jetter

Appendix 9 - ETA ST-4 Diver Operated Jetter