



## Technical Memorandum

**To:** Tim Follensbee (VELCO)  
**From:** Jason Gorman  
**Date:** February 4, 2016  
**Re:** PV-20 Submarine Cable Replacement Project  
Inadvertent Return Contingency Plan  
CHA Project # 27406

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This technical memorandum describes procedures and contingency measures in the event of an inadvertent return during horizontal directional drilling (HDD) operations for the PV-20 Cable Replacement Project. These procedures and measures will be followed by the installation contractor to mitigate the inadvertent return of drilling fluids to Lake Champlain or adjacent lands.

### **Horizontal Directional Drilling Installation Considerations**

The most appropriate method to avoid an inadvertent return during drilling operations is through the careful design of the drill profile based on anticipated geologic conditions, drilling procedures, and monitoring of drilling progress. Additionally, fluid pressures will be monitored when drilling in soils. The contractor will also utilize environmentally responsible work practices and methods including the best management practices associated with spill prevention and containment and storm water pollution and prevention.

### **Design of Drill Profile**

Development of the design and geometry of the drilling plan and profile prior to commencement of drilling operations is essential to reduce the potential for an inadvertent return. The drill path can be optimized to ensure the boring is advanced through favorable geologic conditions and includes smooth and gradual vertical and horizontal bends. Based on geotechnical investigations performed at the proposed drill locations for this project, the HDD will principally be advanced through bedrock which will greatly reduce the potential for an inadvertent return.

## Drilling Procedures

Based on site conditions associated with this project and to minimize the risk of fluids being returned at the drill exit within the lake, this project will utilize a “Push Reaming” methodology. A drill rig will be assembled at the drill entry on land, with the primary motivation for the reaming process being provided by a powerful winch mounted on a barge securely anchored some distance from the planned exit in the water. When the pilot drill bit has exited the lake bed during boring of the pilot hole (initial bore), a diver will verify the exact exit location and a gravity cell (containment vessel similar in construction to a trench box) will be lowered to the bottom and placed over the exit point. Following the gravity cell placement, the drill assembly will be recovered to the support barge and a pad eye (metal loop) installed at the end of the drill assembly. The pad eye will be connected to a wire cable that is attached to a winch on the barge, at which time a reamer will be installed on the drill assembly on land. Drilling operations will resume with the reamer to enlarge the borehole by pushing the reamer from the land based drill rig and pulling from the winch on the barge. This method allows maintenance of mud circulation at the drill entry on land, preventing excessive volume of fluids from being returned at the drill exit. In the event of a return at the drill exist the drill fluid will be contained within the offshore gravity cell thereby significantly reducing the possibility of an offshore drill fluid loss. During reaming operations, the driller will stop the reamer before its breaks out into the gravity cell leaving an earthen plug in the bore hole. The drill string, reaming tool, and tail string will be returned back to the land based drill rig, where a larger reamer will be attached and the process repeated. This reaming process continues until the borehole reaches the desired diameter. When the final reamer is installed, it will be advanced through the earthen plug completing the boring and allowing for installation of the cable conduit.

Above the location of the gravity cell, a support barge with a frac tank and pump will remain moored during drilling operations. The pump will be placed in the gravity cell and connected to the frac-tanks on the barge via a large hose. It should be noted that any drill fluid that is inadvertently discharged from the drill exit will be contained at the bottom of the gravity cell (bentonite clay has a specific gravity greater than water). Drill operators in conjunction with divers and video cameras will monitor the gravity cell and if drill fluids are detected, divers will operate the pump to evacuate the drill fluid from the gravity cell and discharge the fluid into the frac tanks located on the support barge. Once complete the drilling fluid will be returned to shore for proper disposal.

## Monitoring of Drilling Progress

Drill operators will closely monitor penetration rates to ensure rates are within the applicable range required for the specific drill design and will use tracking equipment to guide the drill along the planned alignment. Drilling fluid pressures will also be monitored when advancing through soils. Additionally, during the boring process, drillers will adjust the thickness of the

drill fluid to match substrate conditions. These procedures will reduce the potential for an inadvertent return.

### **Inadvertent Return Contingency Plan**

HDD operations have the potential to release drilling fluids to the surface through inadvertent return caused by a blockage of the fluid return path that follow a path of least resistance. Because drilling fluids consist largely of a bentonite clay-water mixture, they are generally considered non-toxic. Drilling fluid to be used will be a mixture of bentonite clay, water, and drilling additives (which may include a water softener, viscosities, filtration control additives, biopolymer gel and torque reduce). Safety data sheets (SDS) for the fluid additives are attached to this memo. The following monitoring, detection, notification, and control and corrective procedures will be followed in the event of a release.

### **Inadvertent Release Monitoring and Detection**

To determine if an inadvertent return is occurring during drilling operations, drilling activities will be closely monitored by the installation contractor and environmental monitor. Monitoring and detection procedures will include, but are not limited to:

- 1) Regular visual observation along the drill path on land and within the water by divers,
- 2) Continuous analysis of drilling fluid volume of fluid returns and circulation and fluid pressure when drilling in soils,
- 3) Monitoring of drilling rate of penetration, fluid viscosity and alignment along the planned profile,
- 4) Detection of a fluid release to the surface will require the driller and monitor to initiate corrective actions and notification procedures.
- 5) The environmental monitor will take photos and prepare an observation report documenting the occurrence.

### **Notification Procedures**

Upon detection of a release, the installation contractor shall immediately begin control procedures (see below) at the same time that the environmental monitor will immediately notify responsible VELCO and/or New York Power Authority (NYPA) personnel.

VELCO and NYPA will coordinate to ensure that notification is sent to the appropriate agencies, included but not limited to, the following:

- 1) US Army Corps of Engineering (New England and Upstate New York districts) if a significant inadvertent return occurs within the lake and is not contained within short duration and per permit conditions,
- 2) VT DEC Lakes and Ponds Management and Protection Program if the release occurs within the lake and is not contained within short duration, and
- 3) VT DEC Watershed Management Division/ Storm Water Program if a significant inadvertent return occurs on land and migrates to the lake and/or beyond the permitted limits of disturbance and per permit conditions.

Prior to the start of drilling operations, a list of contacts with phone numbers, including those regulatory agencies listed above, will be circulated to all applicable personnel at the project site.

#### Control and Corrective Action Procedures

Immediately upon detection, the following measures are to be implemented to control, minimize and clean up the release of drilling fluid and the affected area.

- 1) Reduce or suspend drilling activities to determine the extent of the release and implement corrective actions,
- 2) Attempt to seal off the release to the surface from the borehole using approved loss circulation materials such as cotton seed hulls, newspaper, cedar fibers or corn cobs.
- 3) Pull back the drill string allowing the fluids in the fracture to solidify.
- 4) On land contain and cleanup the release and install erosion control devices around the disturbed area, if warranted.
- 5) Determine the cause of the release and implement measures to minimize reoccurrence, such as adjusting fluid viscosity.
- 6) If necessary, the borehole will be abandoned and the boring will be re-aligned. Abandonment procedures, including grouting the hole, using a mixture of cement and bentonite will be designed based on the depth and location of the bore hole.
- 7) In the event of a return to land and depending on the amount of fluid released the area may be swept, shoveled, or mixed with sand and temporarily left in place to dry prior to proper disposal of the material. Measures will be implemented to prevent drilling fluid from entering the lake with appropriate containment measures.
- 8) 8) In the event of an inadvertent return to the lake, the stand-by dive team will immediately be called on to assist in the cleanup effort. The cleanup effort will include recovering the drilling fluid to the surface containment tanks and where it will be stored until it is disposed of at an approved location. The area disturbed by the release and subsequent clean-up will be restored to preexisting condition to the extent possible.

The above outlined methods and procedures will ensure that water quality and terrestrial areas will not be adversely affected by an inadvertent return during HDD drilling operations for the PV-20 Cable Replacement project.

Attachment: SDS sheets for typical drill additives (Bore-Gel, Dinomul 2, No Sag, Quik-Trol Gold LV, Soda Ash)

## SAFETY DATA SHEET

according to Regulation (EC) No. 453/2010

### BORE-GEL®

Revision Date: 19-Jun-2015

Revision Number: 15

#### SECTION 1: Identification of the substance/mixture and of the company/undertaking

##### 1.1. Product Identifier

**Product Name** BORE-GEL®

##### 1.2. Relevant identified uses of the substance or mixture and uses advised against

<b>Recommended Use</b>	Viscosifier
<b>Sector of use</b>	SU2 - Mining, (including offshore industries)
<b>Product category</b>	PC20 - Products such as pH-regulators, flocculants, precipitants, neutralization agents, other unspecific
<b>Process categories</b>	PROC4 - Use in batch and other process (synthesis) where opportunity for exposure arises

##### 1.3. Details of the supplier of the safety data sheet

Halliburton Manufacturing Services, Ltd.  
Halliburton House, Howemoss Crescent  
Kirkhill Industrial Estate  
Dyce  
Aberdeen, AB21 0GN  
United Kingdom

Emergency Phone Number: +44 1224 795277 or +1 281 575 5000

[www.halliburton.com](http://www.halliburton.com)

For further information, please contact

**E-Mail address:** [fdunexchem@halliburton.com](mailto:fdunexchem@halliburton.com)

##### 1.4. Emergency telephone number

+44 1224 795277 or +1 281 575 5000

Emergency telephone - §45 - (EC)1272/2008	
<b>Europe</b>	<b>112</b>
<b>Croatia</b>	Centar za kontrolu otrovanja (CKO): (+385 1) 23-48-342 (Poison Control Center (PCC) - Institute for Medical Research and Occupational Health)
<b>Cyprus</b>	+210 7793777
<b>Denmark</b>	Poison Control Hotline (DK): +45 82 12 12 12
<b>France</b>	ORFILA (FR): + 01 45 42 59 59
<b>Germany</b>	Poison Center Berlin (DE): +49 030 30686 790
<b>Italy</b>	Poison Center, Milan (IT): +39 02 6610 1029
<b>Netherlands</b>	National Poisons Information Center (NL): +31 30 274 88 88 (NB: this service is only available to health professionals)
<b>Norway</b>	Poisons Information (NO): + 47 22 591300
<b>Poland</b>	Poison Control and Information Centre, Warsaw (PL): +48 22 619 66 54; +48 22 619 08 97
<b>Romania</b>	+40 21 318 36 06
<b>Spain</b>	Poison Information Service (ES): +34 91 562 04 20
<b>United Kingdom</b>	NHS Direct (UK): +44 0845 46 47

#### SECTION 2: Hazards Identification

##### 2.1. Classification of the substance or mixture

**REGULATION (EC) No 1272/2008**

Carcinogenicity	Category 1A - (H350)
Specific Target Organ Toxicity - (Repeated Exposure)	Category 2 - (H373)

**2.2. Label Elements****Hazard Pictograms****Signal Word****Danger****Hazard Statements**

H350i - May cause cancer by inhalation

H373 - May cause damage to organs through prolonged or repeated exposure if inhaled

**Precautionary Statements - EU (§28, 1272/2008)**

P201 - Obtain special instructions before use

P202 - Do not handle until all safety precautions have been read and understood

P260 - Do not breathe dust/fume/gas/mist/vapors/spray

P281 - Use personal protective equipment as required

P308 + P313 - IF exposed or concerned: Get medical advice/attention

P314 - Get medical attention/advice if you feel unwell

**Contains****Substances**

Sodium carbonate

Crystalline silica, quartz

Crystalline silica, cristobalite

Crystalline silica, tridymite

**CAS Number**

497-19-8

14808-60-7

14464-46-1

15468-32-3

**2.3. Other Hazards**

This substance is not considered to be persistent, bioaccumulating nor toxic (PBT)

This substance is not considered to be very persistent nor very bioaccumulating (vPvB).

**SECTION 3: Composition/information on Ingredients****3.1. Substances**

Substance

Substances	EINECS	CAS Number	PERCENT (w/w)	EU - CLP Substance Classification	REACH No.
Sodium carbonate	207-838-8	497-19-8	1 - 5%	Not applicable	01-2119485498-19
Crystalline silica, quartz	238-878-4	14808-60-7	1 - 5%	Carc. 1A (H350) STOT RE 1 (H372)	No data available
Crystalline silica, cristobalite	238-455-4	14464-46-1	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)	No data available
Crystalline silica, tridymite	239-487-1	15468-32-3	0.1 - 1%	Carc. 1A (H350) STOT RE 1 (H372)	No data available

For the full text of the H-phrases mentioned in this Section, see Section 16

**SECTION 4: First aid measures**

**4.1. Description of first aid measures**

<b>Inhalation</b>	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
<b>Eyes</b>	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
<b>Skin</b>	Wash with soap and water. Get medical attention if irritation persists.
<b>Ingestion</b>	Under normal conditions, first aid procedures are not required.

**4.2. Most Important symptoms and effects, both acute and delayed**

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

**4.3. Indication of any immediate medical attention and special treatment needed**

**Notes to Physician** Treat symptomatically

**SECTION 5: Firefighting Measures****5.1. Extinguishing media****Suitable Extinguishing Media**

All standard fire fighting media

**Extinguishing media which must not be used for safety reasons**

None known.

**5.2. Special hazards arising from the substance or mixture****Special Exposure Hazards**

Not applicable.

**5.3. Advice for firefighters****Special Protective Equipment for Fire-Fighters**

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

**SECTION 6: Accidental release measures****6.1. Personal precautions, protective equipment and emergency procedures**

Use appropriate protective equipment. Avoid creating and breathing dust. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.

See Section 8 for additional information

**6.2. Environmental precautions**

Prevent from entering sewers, waterways, or low areas.

**6.3. Methods and material for containment and cleaning up**

Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

**6.4. Reference to other sections**

See Section 8 and 13 for additional information.

**SECTION 7: Handling and Storage****7.1. Precautions for Safe Handling**

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet.

**Hygiene Measures**

Handle in accordance with good industrial hygiene and safety practice.

**7.2. Conditions for safe storage, including any incompatibilities**

Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Do not reuse empty container. Product has a shelf life of 12 months.

**7.3. Specific End Use(s)**

<b>Exposure Scenario</b>	No information available
<b>Other Guidelines</b>	No information available

## SECTION 8: Exposure Controls/Personal Protection

### 8.1. Control parameters

#### Exposure Limits

Substances	CAS Number	EU	UK	Netherlands	France
Sodium carbonate	497-19-8	Not applicable	10 mg/m <sup>3</sup>	Not applicable	Not applicable
Crystalline silica, quartz	14808-60-7	Not applicable	TWA: 0.1 mg/m <sup>3</sup>	TWA: 0.075 mg/m <sup>3</sup>	TWA: 0.1 mg/m <sup>3</sup>
Crystalline silica, cristobalite	14464-46-1	Not applicable	Not applicable	TWA: 0.075 mg/m <sup>3</sup>	TWA: 0.05 mg/m <sup>3</sup>
Crystalline silica, tridymite	15468-32-3	Not applicable	Not applicable	TWA: 0.075 mg/m <sup>3</sup>	TWA: 0.05 mg/m <sup>3</sup>

Substances	CAS Number	Germany	Spain	Portugal	Finland
Sodium carbonate	497-19-8	Not applicable	Not applicable	Not applicable	Not applicable
Crystalline silica, quartz	14808-60-7	Not applicable	TWA: 0.1 mg/m <sup>3</sup>	TWA: 0.025 mg/m <sup>3</sup>	TWA: 0.05 mg/m <sup>3</sup>
Crystalline silica, cristobalite	14464-46-1	Not applicable	TWA: 0.05 mg/m <sup>3</sup>	TWA: 0.025 mg/m <sup>3</sup>	TWA: 0.05 mg/m <sup>3</sup>
Crystalline silica, tridymite	15468-32-3	Not applicable	Not applicable	Not applicable	TWA: 0.05 mg/m <sup>3</sup>

Substances	CAS Number	Austria	Ireland	Switzerland	Norway
Sodium carbonate	497-19-8	Not applicable	Not applicable	Not applicable	Not applicable
Crystalline silica, quartz	14808-60-7	TWA: 0.15 mg/m <sup>3</sup>	0.1 mg/m <sup>3</sup> TWA (respirable dust) 0.3 mg/m <sup>3</sup> STEL (calculated, respirable dust)	TWA: 0.15 mg/m <sup>3</sup>	TWA: 0.3 mg/m <sup>3</sup> TWA: 0.1 mg/m <sup>3</sup> STEL: 0.9 mg/m <sup>3</sup> STEL: 0.3 mg/m <sup>3</sup>
Crystalline silica, cristobalite	14464-46-1	TWA: 0.15 mg/m <sup>3</sup>	0.1 mg/m <sup>3</sup> TWA (respirable dust) 0.3 mg/m <sup>3</sup> STEL (calculated, respirable dust)	TWA: 0.15 mg/m <sup>3</sup>	TWA: 0.15 mg/m <sup>3</sup> TWA: 0.05 mg/m <sup>3</sup> STEL: 0.45 mg/m <sup>3</sup> STEL: 0.15 mg/m <sup>3</sup>
Crystalline silica, tridymite	15468-32-3	TWA: 0.15 mg/m <sup>3</sup>	0.1 mg/m <sup>3</sup> TWA (respirable dust) 0.3 mg/m <sup>3</sup> STEL (calculated, respirable dust)	TWA: 0.15 mg/m <sup>3</sup>	TWA: 0.15 mg/m <sup>3</sup> TWA: 0.05 mg/m <sup>3</sup> STEL: 0.45 mg/m <sup>3</sup> STEL: 0.15 mg/m <sup>3</sup>

Substances	CAS Number	Italy	Poland	Hungary	Czech Republic
Sodium carbonate	497-19-8	Not applicable	Not applicable	Not applicable	TWA: 5 mg/m <sup>3</sup>
Crystalline silica, quartz	14808-60-7	Not applicable	TWA: 2 mg/m <sup>3</sup> TWA: 0.3 mg/m <sup>3</sup> TWA: 4.0 mg/m <sup>3</sup> TWA: 1.0 mg/m <sup>3</sup>	TWA: 0.15 mg/m <sup>3</sup>	TWA: 0.1 mg/m <sup>3</sup>
Crystalline silica, cristobalite	14464-46-1	Not applicable	TWA: 2 mg/m <sup>3</sup> TWA: 0.3 mg/m <sup>3</sup> TWA: 4.0 mg/m <sup>3</sup> TWA: 1.0 mg/m <sup>3</sup>	TWA: 0.15 mg/m <sup>3</sup>	TWA: 0.1 mg/m <sup>3</sup>
Crystalline silica, tridymite	15468-32-3	Not applicable	TWA: 2 mg/m <sup>3</sup> TWA: 0.3 mg/m <sup>3</sup> TWA: 4.0 mg/m <sup>3</sup> TWA: 1.0 mg/m <sup>3</sup>	TWA: 0.15 mg/m <sup>3</sup>	TWA: 0.1 mg/m <sup>3</sup>

Substances	CAS Number	Denmark	Romania	Croatia	Cyprus
Sodium carbonate	497-19-8	Not applicable	TWA: 1 mg/m <sup>3</sup> STEL: 3 mg/m <sup>3</sup>	Not applicable	Not applicable
Crystalline silica, quartz	14808-60-7	TWA: 0.3 mg/m <sup>3</sup> TWA: 0.1 mg/m <sup>3</sup>	TWA: 0.1 mg/m <sup>3</sup>	TWA: 0.1 mg/m <sup>3</sup>	Not applicable
Crystalline silica, cristobalite	14464-46-1	TWA: 0.15 mg/m <sup>3</sup> TWA: 0.05 mg/m <sup>3</sup>	TWA: 0.05 mg/m <sup>3</sup>	TWA: 0.05 mg/m <sup>3</sup>	Not applicable
Crystalline silica, tridymite	15468-32-3	TWA: 0.15 mg/m <sup>3</sup> TWA: 0.05 mg/m <sup>3</sup>	TWA: 0.05 mg/m <sup>3</sup>	TWA: 0.05 mg/m <sup>3</sup>	Not applicable

**Derived No Effect Level (DNEL)**  
**Worker**

No information available.



Substances	Long-term exposure - systemic effects, Inhalation	Acute / short term exposure - systemic effects, Inhalation	Long-term exposure - local effects, Inhalation	Acute / short term exposure - local effects, Inhalation	Long-term exposure - systemic effects, Dermal	Acute / short term exposure - systemic effects, Dermal	Long-term exposure - local effects, Dermal	Acute / short term exposure - local effects, Dermal	Hazards for the eyes - local effects
Sodium carbonate	Not available	Not available	10 mg/m <sup>3</sup>	Not available	Not available	Not available	Not available	Not available	Not available

**General Population**

Substances	Long-term exposure - systemic effects, Inhalation	Acute / short term exposure - systemic effects, Inhalation	Long-term exposure - local effects, Inhalation	Acute / short term exposure - local effects, Inhalation	Long-term exposure - systemic effects, Dermal	Acute / short term exposure - systemic effects, Dermal	Long-term exposure - local effects, Dermal	Acute / short term exposure - local effects, Dermal	Long-term exposure - systemic effects, Oral	Acute / short term exposure - local effects, Oral	Hazards for the eyes - local effects
Sodium carbonate	Not available	Not available	Not available	10 mg/m <sup>3</sup>	Not available	Not available	Not available	Not available	Not available	Not available	Not available

**Predicted No Effect Concentration (PNEC)**

No information available.

**8.2. Exposure controls**

**Engineering Controls**

Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

**Personal protective equipment**

If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

**Respiratory Protection**

Not normally needed. But if significant exposures are possible then the following respirator is recommended:

Dust/mist respirator. (N95, P2/P3)

**Hand Protection**

Normal work gloves.

**Skin Protection**

Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

**Eye Protection**

Wear safety glasses or goggles to protect against exposure.

**Other Precautions**

None known.

**Environmental Exposure Controls**

Do not allow material to contaminate ground water system

**SECTION 9: Physical and Chemical Properties**

**9.1. Information on basic physical and chemical properties**

**Physical State:** Powder

**Color:** Light brown or Gray

**Odor:** Mild earthy

**Odor Threshold:** No information available

Property

Values

Remarks/ - Method

**pH:**

8-10

**Freezing Point/Range**

No data available

**Melting Point/Range**

No data available

**Boiling Point/Range**

No data available

**Flash Point**

No data available

**Flammability (solid, gas)**

No data available

upper flammability limit

No data available

lower flammability limit

No data available

**Evaporation rate**

No data available

**Vapor Pressure**

No data available

**Vapor Density**

No data available

**Specific Gravity**

2.5

**Water Solubility**

Partly soluble

**Solubility in other solvents**

No data available

**Partition coefficient: n-octanol/water**

No data available

**Autoignition Temperature**

No data available

**Decomposition Temperature**

No data available

**Viscosity**

No data available

**Explosive Properties**

No information available

**Oxidizing Properties** No information available

**9.2. Other information**

**VOC Content (%)** No data available

## SECTION 10: Stability and Reactivity

**10.1. Reactivity**

Not expected to be reactive.

**10.2. Chemical Stability**

Stable

**10.3. Possibility of Hazardous Reactions**

Will Not Occur

**10.4. Conditions to Avoid**

None anticipated

**10.5. Incompatible Materials**

Hydrofluoric acid.

**10.6. Hazardous Decomposition Products**

Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

## SECTION 11: Toxicological Information

**11.1. Information on Toxicological Effects**

**Acute Toxicity**

**Inhalation**

Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).

**Eye Contact**

May cause mechanical irritation to eye.

**Skin Contact**

May cause mechanical skin irritation.

**Ingestion**

None known.

**Chronic Effects/Carcinogenicity**

**Silicosis:** Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

**Cancer Status:** The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

**Toxicology data for the components**

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Sodium carbonate	497-19-8	4090 mg/kg (Rat) 2800 mg/kg (Rat)	2210 mg/kg (Mouse) > 2000 mg/kg (Rabbit)	2.3 mg/L (Rat) 2h
Crystalline silica, quartz	14808-60-7	>15,000 mg/kg (Human)	No data available	No data available
Crystalline silica, cristobalite	14464-46-1	>15,000 mg/kg (Human)	No data available	No data available
Crystalline silica, tridymite	15468-32-3	>15,000 mg/kg (Human)	No data available	No data available

Substances	CAS Number	Skin corrosion/irritation
Sodium carbonate	497-19-8	Non-irritating to the skin
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin
Crystalline silica, cristobalite	14464-46-1	Non-irritating to the skin
Crystalline silica, tridymite	15468-32-3	Non-irritating to the skin

Substances	CAS Number	Eye damage/irritation
Sodium carbonate	497-19-8	Irritating to eyes.
Crystalline silica, quartz	14808-60-7	Mechanical irritation of the eyes is possible.
Crystalline silica, cristobalite	14464-46-1	Mechanical irritation of the eyes is possible.
Crystalline silica, tridymite	15468-32-3	Mechanical irritation of the eyes is possible.

Substances	CAS Number	Skin Sensitization
Sodium carbonate	497-19-8	Not classified
Crystalline silica, quartz	14808-60-7	No information available.
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	Respiratory Sensitization
Sodium carbonate	497-19-8	No information available
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	Mutagenic Effects
Sodium carbonate	497-19-8	In vivo tests did not show mutagenic effects.
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.
Crystalline silica, cristobalite	14464-46-1	Not regarded as mutagenic.
Crystalline silica, tridymite	15468-32-3	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
Sodium carbonate	497-19-8	No information available.
Crystalline silica, quartz	14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, cristobalite	14464-46-1	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.
Crystalline silica, tridymite	15468-32-3	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure. Based on available scientific evidence, this substance is a threshold carcinogen with a mode of action involving indirect genotoxicity secondary to lung injury.

Substances	CAS Number	Reproductive toxicity
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Sodium carbonate	497-19-8	Did not show teratogenic effects in animal experiments.
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

Substances	CAS Number	STOT - single exposure
Sodium carbonate	497-19-8	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, cristobalite	14464-46-1	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, tridymite	15468-32-3	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Sodium carbonate	497-19-8	No significant toxicity observed in animal studies at concentration requiring classification.
Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, cristobalite	14464-46-1	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)
Crystalline silica, tridymite	15468-32-3	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Sodium carbonate	497-19-8	Not applicable
Crystalline silica, quartz	14808-60-7	Not applicable
Crystalline silica, cristobalite	14464-46-1	Not applicable
Crystalline silica, tridymite	15468-32-3	Not applicable

## SECTION 12: Ecological Information

### 12.1. Toxicity Ecotoxicity Effects

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Sodium carbonate	497-19-8	EC50 242 mg/L (Nitzschia)	TLM24 385 mg/L (Lepomis macrochirus) LC50 310-1220 mg/L (Pimephales promelas) LC50 (96h) 300 mg/L (Lepomis macrochirus)	No information available	EC50 265 mg/L (Daphnia magna) EC50 (48h) 200 – 227 mg/L (Ceriodaphnia sp.)
Crystalline silica, quartz	14808-60-7	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, cristobalite	14464-46-1	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)
Crystalline silica, tridymite	15468-32-3	No information available	LL0 (96h) 10,000 mg/L (Danio rerio) (similar substance)	No information available	LL50 (24h) > 10,000 mg/L (Daphnia magna) (similar substance)

### 12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Sodium carbonate	497-19-8	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, tridymite	15468-32-3	The methods for determining biodegradability are not applicable to inorganic substances.

### 12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Sodium carbonate	497-19-8	No information available
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

#### 12.4. Mobility in soil

Substances	CAS Number	Mobility
Sodium carbonate	497-19-8	No information available
Crystalline silica, quartz	14808-60-7	No information available
Crystalline silica, cristobalite	14464-46-1	No information available
Crystalline silica, tridymite	15468-32-3	No information available

#### 12.5. Results of PBT and vPvB assessment

This substance is not considered to be persistent, bioaccumulating nor toxic (PBT). This substance is not considered to be very persistent nor very bioaccumulating (vPvB).

Substances	PBT and vPvB assessment
Crystalline silica, quartz	Not PBT/vPvB
Crystalline silica, cristobalite	No data available
Crystalline silica, tridymite	No data available

#### 12.6. Other adverse effects

##### Endocrine Disruptor Information

This product does not contain any known or suspected endocrine disruptors

### SECTION 13: Disposal Considerations

#### 13.1. Waste treatment methods

##### Disposal Method

If practical, recover and reclaim, recycle, or reuse by the guidelines of an approved local reuse program. Should contaminated product become a waste, dispose of in a licensed industrial landfill according to federal, state, and local regulations.

##### Contaminated Packaging

Follow all applicable national or local regulations.

### SECTION 14: Transport Information

#### IMDG/IMO

UN Number:	Not restricted
UN Proper Shipping Name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

#### RID

UN Number:	Not restricted
UN Proper Shipping Name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

#### ADR

UN Number:	Not restricted
UN Proper Shipping Name:	Not restricted
Transport Hazard Class(es):	Not applicable
Packing Group:	Not applicable
Environmental Hazards:	Not applicable

#### IATA/ICAO

UN Number:	Not restricted
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**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards:** Not applicable

**14.1. UN Number:** Not restricted

**14.2. UN Proper Shipping Name:** Not restricted

**14.3. Transport Hazard Class(es):** Not applicable

**14.4. Packing Group:** Not applicable

**14.5. Environmental Hazards:** Not applicable

**14.6. Special Precautions for User:** None

**14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:** Not applicable

## SECTION 15: Regulatory Information

### 15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

#### International Inventories

<b>EINECS Inventory</b>	This product, and all its components, complies with EINECS
<b>US TSCA Inventory</b>	All components listed on inventory or are exempt.
<b>Canadian DSL Inventory</b>	All components listed on inventory or are exempt.

#### Legend

**TSCA** - United States Toxic Substances Control Act Section 8(b) Inventory  
**EINECS/ELINCS** - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances  
**DSL/NDSL** - Canadian Domestic Substances List/Non-Domestic Substances List

**Germany, Water Endangering Classes (WGK)**      WGK 0: Generally not water endangering.

### 15.2. Chemical Safety Assessment

No information available

## SECTION 16: Other Information

### **Full text of H-Statements referred to under sections 2 and 3**

H350 - May cause cancer

H350i - May cause cancer by inhalation

H372 - Causes damage to organs through prolonged or repeated exposure if inhaled

H373 - May cause damage to organs through prolonged or repeated exposure if inhaled

**Key or legend to abbreviations and acronyms**

bw – body weight

CAS – Chemical Abstracts Service

CLP – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Classification, Labelling and Packaging of substances and mixtures

EC – European Commission

EC10 – Effective Concentration 10%

EC50 – Effective Concentration 50%

EEC – European Economic Community

ErC50 – Effective Concentration growth rate 50%

IBC Code – International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL0 – Lethal Loading 0%

LL50 – Lethal Loading 50%

MARPOL – International Convention for the Prevention of Pollution from Ships

mg/kg – milligram/kilogram

mg/L – milligram/liter

NIOSH – National Institute for Occupational Safety and Health

NOEC – No Observed Effect Concentration

NTP – National Toxicology Program

OEL – Occupational Exposure Limit

PBT – Persistent Bioaccumulative and Toxic

PC – Chemical Product category

PEL – Permissible Exposure Limit

ppm – parts per million

PROC – Process category

REACH – REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals

STEL – Short Term Exposure Limit

SU – Sector of Use category

**Key literature references and sources for data**

[www.ChemADVISOR.com/](http://www.ChemADVISOR.com/)

**Revision Date:** 19-Jun-2015

**Revision Note**

Update to Format SECTION: 2 3 4 6 7 8 10 12 16

**This safety data sheet complies with the requirements of Regulation (EC) No. 453/2010**

**Disclaimer Statement**

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

**End of Safety Data Sheet**

## SAFETY DATA SHEET

Product Trade Name: **DINOMUL™ 2**

Revision Date: 10-Jun-2015

Revision Number: 5

### 1. Identification

#### 1.1. Product Identifier

Product Trade Name: DINOMUL™ 2  
Synonyms: None  
Chemical Family: Aqueous Polymer Blend  
Internal ID Code: HM007522

#### 1.2 Recommended use and restrictions on use

Application: Wetting Agent / Lubricant  
Uses Advised Against: No information available

#### 1.3 Manufacturer's Name and Contact Details

Manufacturer/Supplier: Baroid Industrial Drilling Products  
Product Service Line of Halliburton  
P.O. Box 1675  
Houston, TX 77251  
Telephone: (281) 871-4613 or 1-877-379-7412  
Emergency Telephone: (281) 575-5000

Prepared By: Chemical Stewardship  
Telephone: 1-580-251-4335  
e-mail: fdunexchem@halliburton.com

#### 1.4. Emergency telephone number

Emergency Telephone Number: (281) 575-5000

### 2. Hazard(s) Identification

#### 2.1 Classification in accordance with paragraph (d) of §1910.1200

Serious Eye Damage / Eye Irritation	Category 2 - H319
Respiratory Sensitization	Category 1 - H334
Skin Sensitization	Category 1 - H317

#### 2.2. Label Elements

##### Hazard Pictograms



Signal Word: Danger

Hazard Statements: H317 - May cause an allergic skin reaction



H319 - Causes serious eye irritation  
 H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled

**Precautionary Statements**

**Prevention**

P261 - Avoid breathing dust/fume/gas/mist/vapors/spray  
 P264 - Wash face, hands and any exposed skin thoroughly after handling  
 P272 - Contaminated work clothing should not be allowed out of the workplace  
 P280 - Wear protective gloves/eye protection/face protection  
 P285 - In case of inadequate ventilation wear respiratory protection

**Response**

P302 + P352 - IF ON SKIN: Wash with plenty of soap and water  
 P333 + P313 - If skin irritation or rash occurs: Get medical advice/attention  
 P363 - Wash contaminated clothing before reuse  
 P304 + P340 - IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing  
 P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTRE or doctor/physician  
 P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing

**Storage**

None

**Disposal**

P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

**Contains**

**Substances**

Surfactant  
 Glutaraldehyde

**CAS Number**

Proprietary  
 111-30-8

**2.3 Hazards not otherwise classified**

None known

**3. Composition/information on Ingredients**

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Surfactant	Proprietary	5 - 10%	Skin Irrit. 2 (H315) Eye Corr. 1 (H318) Aquatic Acute 1 (H400) Aquatic Chronic 1 (H410)
Glutaraldehyde	111-30-8	0.1 - 1%	Acute Tox. 3 (H301) Acute Tox. 2 (H330) Skin Corr. 1B (H314) Eye Corr. 1 (H318) Resp. Sens. 1 (H334) Skin Sens. 1 (H317) STOT SE 3 (H335) Aquatic Acute 1 (H400) Aquatic Chronic 3 (H412)

The exact percentage (concentration) of the composition has been withheld as proprietary.

**4. First-Aid Measures**

**4.1. Description of first aid measures**

<b>Inhalation</b>	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
<b>Eyes</b>	In case of contact, or suspected contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention immediately after flushing.
<b>Skin</b>	Wash with soap and water. Get medical attention if irritation persists.
<b>Ingestion</b>	Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

#### **4.2 Most important symptoms/effects, acute and delayed**

Causes eye irritation May cause allergic skin reaction. May cause allergic respiratory reaction.

#### **4.3. Indication of any immediate medical attention and special treatment needed**

**Notes to Physician** Treat symptomatically.

### **5. Fire-fighting measures**

#### **5.1. Extinguishing media**

##### **Suitable Extinguishing Media**

All standard fire fighting media

##### **Extinguishing media which must not be used for safety reasons**

None known.

#### **5.2 Specific hazards arising from the substance or mixture**

##### **Special Exposure Hazards**

Decomposition in fire may produce harmful gases. Avoid spraying water directly into storage containers due to danger of boilover.

#### **5.3 Special protective equipment and precautions for fire-fighters**

##### **Special Protective Equipment for Fire-Fighters**

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

### **6. Accidental release measures**

#### **6.1. Personal precautions, protective equipment and emergency procedures**

Use appropriate protective equipment.

See Section 8 for additional information

#### **6.2. Environmental precautions**

Prevent from entering sewers, waterways, or low areas.

#### **6.3. Methods and material for containment and cleaning up**

Contain spill with sand or other inert materials. Isolate spill and stop leak where safe. Scoop up and remove.

### **7. Handling and storage**

#### **7.1. Precautions for Safe Handling**

##### **Handling Precautions**

Avoid contact with eyes, skin, or clothing. Wash hands after use. Avoid breathing mist. Avoid breathing vapors.

##### **Hygiene Measures**

Handle in accordance with good industrial hygiene and safety practice.

#### **7.2. Conditions for safe storage, including any incompatibilities**

##### **Storage Information**

Store in a cool well ventilated area. Store in a dry location. Keep from freezing. Product separates with storage and requires mixing before use. Product has a shelf life of 12 months.

**8. Exposure Controls/Personal Protection**

**8.1 Occupational Exposure Limits**

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Surfactant	Proprietary	Not applicable	Not applicable
Glutaraldehyde	111-30-8	Not applicable	0.05 ppm

**8.2 Appropriate engineering controls**

**Engineering Controls** None known.

**8.3 Individual protection measures, such as personal protective equipment**

**Personal Protective Equipment** If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

**Respiratory Protection** If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional.  
Not normally necessary.

**Hand Protection** Impervious rubber gloves.  
**Skin Protection** Normal work coveralls.  
**Eye Protection** Safety glasses.  
**Other Precautions** None known.

**9. Physical and Chemical Properties**

**9.1. Information on basic physical and chemical properties**

**Physical State:** Liquid  
**Color:** Amber  
**Odor:** Slight  
**Odor** No information available  
**Threshold:**

Property	Values
Remarks/ - Method	
<b>pH:</b>	9.2-10.2
<b>Freezing Point/Range</b>	No data available
<b>Melting Point/Range</b>	No data available
<b>Boiling Point/Range</b>	No data available
<b>Flash Point</b>	> 93 °C PMCC
<b>Flammability (solid, gas)</b>	No data available
upper flammability limit	No data available
lower flammability limit	No data available
<b>Evaporation rate</b>	No data available
<b>Vapor Pressure</b>	No data available
<b>Vapor Density</b>	No data available
<b>Specific Gravity</b>	1
<b>Water Solubility</b>	No data available
<b>Solubility in other solvents</b>	No data available
<b>Partition coefficient: n-octanol/water</b>	No data available
<b>Autoignition Temperature</b>	No data available
<b>Decomposition Temperature</b>	No data available
<b>Viscosity</b>	No data available
<b>Explosive Properties</b>	No information available
<b>Oxidizing Properties</b>	No information available

**9.2. Other information**

VOC Content (%)

No data available

**10. Stability and Reactivity****10.1. Reactivity**

Not expected to be reactive.

**10.2. Chemical Stability**

Stable

**10.3. Possibility of Hazardous Reactions**

Will Not Occur

**10.4. Conditions to Avoid**

None anticipated

**10.5. Incompatible Materials**

None known.

**10.6. Hazardous Decomposition Products**

Carbon monoxide and carbon dioxide.

**11. Toxicological Information****11.1 Information on likely routes of exposure**

Principle Route of Exposure Eye and skin contact.

**11.2 Symptoms related to the physical, chemical and toxicological characteristics****Acute Toxicity****Inhalation**

May cause allergic respiratory reaction.

**Eye Contact**

Causes eye irritation.

**Skin Contact**

May cause mild skin irritation. May cause an allergic skin reaction.

**Ingestion**

None known.

**Chronic Effects/Carcinogenicity** No data available to indicate any components present at greater than 0.1% may present a carcinogenic hazard.**11.3 Toxicity data****Toxicology data for the components**

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Surfactant	Proprietary	1310 mg/kg (Rat) 2000 - 5000 mg/kg (Rat) (similar substance)	2 mL/kg (Rabbit)	No data available
Glutaraldehyde	111-30-8	100 mg/kg (Rat)	No data available	0.28-0.5 mg/L (Rat) 4h

Substances	CAS Number	Skin corrosion/irritation
Surfactant		May cause irritation. (Rabbit) (similar substances)
Glutaraldehyde	111-30-8	Causes severe skin irritation with tissue destruction. (Rabbit)

Substances	CAS Number	Eye damage/irritation
Surfactant		Causes eye irritation (Rabbit) (similar substances)
Glutaraldehyde	111-30-8	Causes severe eye irritation which may damage tissue. (Rabbit)

Substances	CAS Number	Skin Sensitization
Surfactant		Did not cause sensitization on laboratory animals (similar substances)

Glutaraldehyde	111-30-8	Skin sensitizer in guinea pig.
<b>Substances</b>	<b>CAS Number</b>	<b>Respiratory Sensitization</b>
Surfactant		No information available
Glutaraldehyde	111-30-8	May cause sensitization by inhalation
<b>Substances</b>	<b>CAS Number</b>	<b>Mutagenic Effects</b>
Surfactant		In vitro tests did not show mutagenic effects (similar substances)
Glutaraldehyde	111-30-8	In vivo tests did not show mutagenic effects.
<b>Substances</b>	<b>CAS Number</b>	<b>Carcinogenic Effects</b>
Surfactant		Did not show carcinogenic effects in animal experiments (similar substances)
Glutaraldehyde	111-30-8	Did not show carcinogenic effects in animal experiments
<b>Substances</b>	<b>CAS Number</b>	<b>Reproductive toxicity</b>
Surfactant		Not a confirmed teratogen or embryotoxin. (similar substances)
Glutaraldehyde	111-30-8	Not a confirmed teratogen or embryotoxin.
<b>Substances</b>	<b>CAS Number</b>	<b>STOT - single exposure</b>
Surfactant		No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)
Glutaraldehyde	111-30-8	May cause respiratory irritation.
<b>Substances</b>	<b>CAS Number</b>	<b>STOT - repeated exposure</b>
Surfactant		No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)
Glutaraldehyde	111-30-8	May cause disorder and damage to the Respiratory system
<b>Substances</b>	<b>CAS Number</b>	<b>Aspiration hazard</b>
Surfactant		Not applicable
Glutaraldehyde	111-30-8	Not applicable

## 12. Ecological Information

### 12.1. Toxicity Ecotoxicity Effects

#### Product Ecotoxicity Data

No data available

#### Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Surfactant	Proprietary	EC50 (72h) >3 mg/L (Pseudokirchnerella subcapitata) (similar substance)	LC50 (96h) 0.323 (Pimephales promelas) (similar substance)	No information available	LC50 (48h) 0.148 mg/L (Daphnia magna) (similar substance) NOEC (21d) 0.1 mg/L (Daphnia magna) (similar substance)
Glutaraldehyde	111-30-8	EC50 (72h) 0.6 mg/L (Desmodesmus subspicatus)	LC50 (96h) 10 mg/L (Lepomis macrochirus) NOEC (97d) 1.6 mg/L (Oncorhynchus mykiss)	EC50 (17h) 6.65 mg/L (Pseudomonas putida)	EC50 (48h) 0.35 mg/L (Daphnia magna) EC50 (48h) 0.7 mg/L (Acartia tonsa) NOEC (21d) 0.13 mg/L (Daphnia magna)

### 12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Surfactant	Proprietary	(58.7% @ 35d) (similar substance) (62% @ 28d) (similar substance)
Glutaraldehyde	111-30-8	Readily biodegradable (90-100% @ 28d)

**12.3. Bioaccumulative potential**

Substances	CAS Number	Log Pow
Surfactant	Proprietary	Log Pow = 5.39 (calculated) BAF = 37 (Barbus barbus) BAF = 23 (Cladophora glomerata) BAF = 10 (Potamogeton crispus) BAF = 3 (Fontinalis antipyretica) BAF = 0.8 (Salmo gairdneri)
Glutaraldehyde	111-30-8	-0.36

**12.4. Mobility in soil**

Substances	CAS Number	Mobility
Surfactant	Proprietary	No information available
Glutaraldehyde	111-30-8	KOC = >5.7 - <2070

**12.5 Other adverse effects**

No information available

**13. Disposal Considerations****13.1. Waste treatment methods**

**Disposal Method** Disposal should be made in accordance with federal, state, and local regulations.  
**Contaminated Packaging** Follow all applicable national or local regulations.

**14. Transport Information****US DOT**

**UN Number:** Not restricted  
**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards:** Not applicable

**US DOT Bulk**

**DOT (Bulk)** Not applicable

**Canadian TDG**

**UN Number:** Not restricted  
**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards:** Not applicable

**IMDG/IMO**

**UN Number:** Not restricted  
**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards:** Not applicable

**IATA/ICAO**

**UN Number:** Not restricted  
**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable

**Environmental Hazards:** Not applicable

**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:** Not applicable

**Special Precautions for User:** None

## 15. Regulatory Information

### US Regulations

**US TSCA Inventory** All components listed on inventory or are exempt.

#### EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Surfactant	Proprietary	Not applicable
Glutaraldehyde	111-30-8	Not applicable

#### EPA SARA (311,312) Hazard Class

Acute Health Hazard

#### EPA SARA (313) Chemicals

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Surfactant	Proprietary	Not applicable	Not applicable
Glutaraldehyde	111-30-8	Not applicable	Not applicable

#### EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Surfactant	Proprietary	Not applicable
Glutaraldehyde	111-30-8	Not applicable

#### EPA RCRA Hazardous Waste Classification

If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.

**California Proposition 65** The California Proposition 65 regulations apply to this product.

**MA Right-to-Know Law** One or more components listed.

**NJ Right-to-Know Law** One or more components listed.

**PA Right-to-Know Law** One or more components listed.

### Canadian Regulations

**Canadian DSL Inventory** All components listed on inventory or are exempt.

## 16. Other information

#### Preparation Information

**Prepared By** Chemical Stewardship  
Telephone: 1-580-251-4335  
e-mail: fdunexchem@halliburton.com

**Revision Date:** 10-Jun-2015

**Reason for Revision** SDS sections updated:

**Additional information**

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

**Key or legend to abbreviations and acronyms**

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

ErC50 – Effective Concentration growth rate 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NIOSH – National Institute for Occupational Safety and Health

NTP – National Toxicology Program

OEL – Occupational Exposure Limit

PEL – Permissible Exposure Limit

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

UN – United Nations

h - hour

mg/m<sup>3</sup> - milligram/cubic meter

mm - millimeter

mmHg - millimeter mercury

w/w - weight/weight

d - day

**Key literature references and sources for data**

[www.ChemADVISOR.com/](http://www.ChemADVISOR.com/)

**Disclaimer Statement**

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

**End of Safety Data Sheet**



## MATERIAL SAFETY DATA SHEET

Product Trade Name: **NO-SAG®**

Revision Date: 02-Jan-2013

### 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: NO-SAG®  
Synonyms: None  
Chemical Family: Carbohydrate  
Application: Viscosifier

Manufacturer/Supplier: Baroid Fluid Services  
Product Service Line of Halliburton  
P.O. Box 1675  
Houston, TX 77251  
Telephone: (281) 871-4000  
Emergency Telephone: (281) 575-5000

Prepared By: Chemical Compliance  
Telephone: 1-580-251-4335  
e-mail: fdunexchem@halliburton.com

### 2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Xanthan gum	11138-66-2	60 - 100%	10 mg/m <sup>3</sup>	15 mg/m <sup>3</sup>

### 3. HAZARDS IDENTIFICATION

Hazard Overview: May cause eye irritation. Airborne dust may be explosive.

### 4. FIRST AID MEASURES

**Inhalation**: If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

**Skin**: Wash with soap and water. Get medical attention if irritation persists.

**Eyes**: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

**Ingestion**: Under normal conditions, first aid procedures are not required.

**Notes to Physician**: Not Applicable

## 5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	400
Autoignition Temperature (C):	204
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

**Fire Extinguishing Media** Water fog, carbon dioxide, foam, dry chemical.

**Special Exposure Hazards** Organic dust in the presence of an ignition source can be explosive in high concentrations. Good housekeeping practices are required to minimize this potential. Decomposition in fire may produce toxic gases.

**Special Protective Equipment for Fire-Fighters** Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

**NFPA Ratings:** Health 0, Flammability 0, Reactivity 0  
**HMS Ratings:** Health 0, Flammability 0, Physical Hazard 0

## 6. ACCIDENTAL RELEASE MEASURES

**Personal Precautionary Measures** Use appropriate protective equipment. Avoid creating and breathing dust.

**Environmental Precautionary Measures** None known.

**Procedure for Cleaning / Absorption** Scoop up and remove.

## 7. HANDLING AND STORAGE

**Handling Precautions** Slippery when wet. Avoid creating or inhaling dust.

**Storage Information** Store away from oxidizers. Store in a cool, dry location.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**Engineering Controls** Use in a well ventilated area.

**Personal Protective Equipment** If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

**Respiratory Protection** Not normally needed. But if significant exposures are possible then the following respirator is recommended:  
Dust/mist respirator. (N95, P2/P3)

**Hand Protection** Normal work gloves.

**Skin Protection** Normal work coveralls.

**Eye Protection** Wear safety glasses or goggles to protect against exposure.

**Other Precautions** None known.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid
Color:	White to yellow
Odor:	Slight
pH:	7
Specific Gravity @ 20 C (Water=1):	1.5
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	35-55
Boiling Point/Range (F):	Not Determined
Boiling Point/Range (C):	Not Determined
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	1,000,000

## 10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	None anticipated
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

## 11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	May impede respiration.
Skin Contact	None known.
Eye Contact	May cause mild eye irritation.
Ingestion	None known
Aggravated Medical Conditions	None known.
Chronic Effects/Carcinogenicity	No data available to indicate product or components present at greater than 1% are chronic health hazards.
Other Information	None known.
Toxicity Tests	

<b>Oral Toxicity:</b>	LD50: > 5000 mg/kg (Rat)
<b>Dermal Toxicity:</b>	Not determined
<b>Inhalation Toxicity:</b>	Not determined
<b>Primary Irritation Effect:</b>	Not determined
<b>Carcinogenicity</b>	Not determined
<b>Genotoxicity:</b>	Not determined
<b>Reproductive / Developmental Toxicity:</b>	Not determined

## 12. ECOLOGICAL INFORMATION

<b>Mobility (Water/Soil/Air)</b>	Not determined
<b>Persistence/Degradability</b>	BOD(5 Day): 200 mg/g COD: 1600 mg/g
<b>Bio-accumulation</b>	Not determined

### Ecotoxicological Information

<b>Acute Fish Toxicity:</b>	Not determined
<b>Acute Crustaceans Toxicity:</b>	TLM96: > 75000 ppm (Mysidopsis bahia)
<b>Acute Algae Toxicity:</b>	Not determined

<b>Chemical Fate Information</b>	Not determined
<b>Other Information</b>	Not applicable

## 13. DISPOSAL CONSIDERATIONS

<b>Disposal Method</b>	Bury in a licensed landfill according to federal, state, and local regulations.
<b>Contaminated Packaging</b>	Follow all applicable national or local regulations.

## 14. TRANSPORT INFORMATION

### Land Transportation

**DOT**  
Not restricted

**Canadian TDG**  
Not restricted

**ADR**  
Not restricted

### Air Transportation

**ICAO/IATA**  
Not restricted

## Sea Transportation

### IMDG

Not restricted

## Other Transportation Information

Labels: None

## 15. REGULATORY INFORMATION

### US Regulations

<b>US TSCA Inventory</b>	All components listed on inventory or are exempt.
<b>EPA SARA Title III Extremely Hazardous Substances</b>	Not applicable
<b>EPA SARA (311,312) Hazard Class</b>	None
<b>EPA SARA (313) Chemicals</b>	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
<b>EPA CERCLA/Superfund Reportable Spill Quantity</b>	Not applicable.
<b>EPA RCRA Hazardous Waste Classification</b>	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
<b>California Proposition 65</b>	All components listed do not apply to the California Proposition 65 Regulation.
<b>MA Right-to-Know Law</b>	Does not apply.
<b>NJ Right-to-Know Law</b>	Does not apply.
<b>PA Right-to-Know Law</b>	Does not apply.

### Canadian Regulations

<b>Canadian DSL Inventory</b>	All components listed on inventory or are exempt.
<b>WHMIS Hazard Class</b>	Un-Controlled

## 16. OTHER INFORMATION

### The following sections have been revised since the last issue of this MSDS

Not applicable

**Additional Information** For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

**Disclaimer Statement**

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**\*\*\*END OF MSDS\*\*\***

## SAFETY DATA SHEET

### QUIK-TROL® GOLD LV

Product Trade Name:

Revision Date: 12-Jun-2015

Revision Number: 14

#### 1. Identification

##### 1.1. Product Identifier

**Product Trade Name:** QUIK-TROL® GOLD LV  
**Synonyms:** None  
**Chemical Family:** Carbohydrate  
**Internal ID Code** HM006782

##### 1.2 Recommended use and restrictions on use

**Application:** Viscosifier Filtrate Reducer  
**Uses Advised Against** No information available

##### 1.3 Manufacturer's Name and Contact Details

**Manufacturer/Supplier** Baroid Fluid Services  
Product Service Line of Halliburton  
P.O. Box 1675  
Houston, TX 77251  
Telephone: (281) 871-4000  
Emergency Telephone: (281) 575-5000

**Prepared By** Chemical Stewardship  
Telephone: 1-580-251-4335  
e-mail: fdunexchem@halliburton.com

##### 1.4. Emergency telephone number

**Emergency Telephone Number** (281) 575-5000

#### 2. Hazard(s) Identification

##### 2.1 Classification in accordance with paragraph (d) of §1910.1200

Combustible dust

Combustible dust

##### 2.2. Label Elements

**Hazard Pictograms**

**Signal Word** Warning

**Hazard Statements**

May form combustible dust concentrations in air.

**Precautionary Statements**

**Prevention** None

<b>Response</b>	None
<b>Storage</b>	None
<b>Disposal</b>	None

**Contains Substances**  
Polysaccharide

**CAS Number**  
Proprietary

**2.3 Hazards not otherwise classified**

None known

**3. Composition/information on Ingredients**

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Polysaccharide	Proprietary	60 - 100%	Combustible Dust

The specific chemical identity of the composition has been withheld as proprietary. The exact percentage (concentration) of the composition has been withheld as proprietary.

**4. First-Aid Measures**

**4.1. Description of first aid measures**

<b>Inhalation</b>	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
<b>Eyes</b>	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
<b>Skin</b>	Wash with soap and water. Get medical attention if irritation persists.
<b>Ingestion</b>	Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

**4.2 Most important symptoms/effects, acute and delayed**

No significant hazards expected.

**4.3. Indication of any immediate medical attention and special treatment needed**

**Notes to Physician** Treat symptomatically.

**5. Fire-fighting measures**

**5.1. Extinguishing media**

**Suitable Extinguishing Media**

Water fog, carbon dioxide, foam, dry chemical.

**Extinguishing media which must not be used for safety reasons**

None known.

**5.2 Specific hazards arising from the substance or mixture**

**Special Exposure Hazards**

Organic dust in the presence of an ignition source can be explosive in high concentrations. Good housekeeping practices are required to minimize this potential.

**5.3 Special protective equipment and precautions for fire-fighters**

**Special Protective Equipment for Fire-Fighters**

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.



**6. Accidental release measures**

**6.1. Personal precautions, protective equipment and emergency procedures**

Use appropriate protective equipment. Avoid creating and breathing dust. Slippery when wet. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.  
See Section 8 for additional information

**6.2. Environmental precautions**

Prevent from entering sewers, waterways, or low areas.

**6.3. Methods and material for containment and cleaning up**

Scoop up and remove.

**7. Handling and storage**

**7.1. Precautions for Safe Handling**

**Handling Precautions**

Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust. Avoid dust accumulations. Ensure adequate ventilation. Slippery when wet. Wash hands after use. Launder contaminated clothing before reuse. Do NOT consume food, drink, or tobacco in contaminated areas.

**Hygiene Measures**

Handle in accordance with good industrial hygiene and safety practice.

**7.2. Conditions for safe storage, including any incompatibilities**

**Storage Information**

Store away from oxidizers. Keep container closed when not in use. Store in a cool, dry location. Store away from direct sunlight. Keep from heat, sparks, and open flames. Store in a well ventilated area. Product has a shelf life of 36 months.

**8. Exposure Controls/Personal Protection**

**8.1 Occupational Exposure Limits**

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Polysaccharide	Proprietary	Not applicable	Not applicable

**8.2 Appropriate engineering controls**

**Engineering Controls**

A well ventilated area to control dust levels. Local exhaust ventilation should be used in areas without good cross ventilation.

**8.3 Individual protection measures, such as personal protective equipment**

**Personal Protective Equipment**

If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

**Respiratory Protection**

Not normally needed. But if significant exposures are possible then the following respirator is recommended:

Dust/mist respirator. (N95, P2/P3)

**Hand Protection**

Normal work gloves.

**Skin Protection**

Normal work coveralls.

**Eye Protection**

Wear safety glasses or goggles to protect against exposure.

**Other Precautions**

None known.

**9. Physical and Chemical Properties**

**9.1. Information on basic physical and chemical properties**

<b>Physical State:</b> Powder	<b>Color:</b> White to off white
<b>Odor:</b> Odorless	<b>Odor</b> No information available
	<b>Threshold:</b>

<u>Property</u> <u>Remarks/ - Method</u>	<u>Values</u>
<b>pH:</b>	5-9 (1%)
<b>Freezing Point/Range</b>	No data available
<b>Melting Point/Range</b>	No data available
<b>Boiling Point/Range</b>	No data available
<b>Flash Point</b>	No data available
<b>Flammability (solid, gas)</b>	No data available
upper flammability limit	No data available
lower flammability limit	No data available
<b>Evaporation rate</b>	No data available
<b>Vapor Pressure</b>	No data available
<b>Vapor Density</b>	No data available
<b>Specific Gravity</b>	No data available
<b>Water Solubility</b>	Soluble in water
<b>Solubility in other solvents</b>	No data available
<b>Partition coefficient: n-octanol/water</b>	No data available
<b>Autoignition Temperature</b>	No data available
<b>Decomposition Temperature</b>	No data available
<b>Viscosity</b>	No data available
<b>Explosive Properties</b>	No information available
<b>Oxidizing Properties</b>	No information available

**9.2. Other information**

**VOC Content (%)** No data available

**10. Stability and Reactivity**

**10.1. Reactivity**  
Not expected to be reactive.

**10.2. Chemical Stability**  
Stable

**10.3. Possibility of Hazardous Reactions**  
Will Not Occur

**10.4. Conditions to Avoid**  
None anticipated

**10.5. Incompatible Materials**  
Strong oxidizers.

**10.6. Hazardous Decomposition Products**  
Carbon monoxide and carbon dioxide.

**11. Toxicological Information**

**11.1 Information on likely routes of exposure**  
**Principle Route of Exposure** Eye or skin contact, inhalation.

**11.2 Symptoms related to the physical, chemical and toxicological characteristics**

**Acute Toxicity**

**Inhalation** May cause mild respiratory irritation.  
**Eye Contact** May cause mild eye irritation.  
**Skin Contact** May cause mild skin irritation.  
**Ingestion** None known.

**Chronic Effects/Carcinogenicity** No data available to indicate product or components present at greater than 0.1% are chronic health hazards.

**11.3 Toxicity data**

**Toxicology data for the components**

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Polysaccharide	Proprietary	27000 mg/kg (Rat)	2000 mg/kg (Rabbit)	5800 mg/m <sup>3</sup> (Rat) 4h

Substances	CAS Number	Skin corrosion/irritation
Polysaccharide		Not irritating to skin in rabbits.

Substances	CAS Number	Eye damage/irritation
Polysaccharide		Non-irritating to rabbit's eye

Substances	CAS Number	Skin Sensitization
Polysaccharide		Did not cause sensitization on laboratory animals

Substances	CAS Number	Respiratory Sensitization
Polysaccharide		No information available

Substances	CAS Number	Mutagenic Effects
Polysaccharide		In vitro tests did not show mutagenic effects In vivo tests did not show mutagenic effects. (similar substances)

Substances	CAS Number	Carcinogenic Effects
Polysaccharide		Did not show carcinogenic effects in animal experiments (similar substances)

Substances	CAS Number	Reproductive toxicity
Polysaccharide		Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Polysaccharide		No information available

Substances	CAS Number	STOT - repeated exposure
Polysaccharide		No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	Aspiration hazard
Polysaccharide		Not applicable

**12. Ecological Information**

**12.1. Toxicity**

**Ecotoxicity Effects**

**Product Ecotoxicity Data**

No data available

**Substance Ecotoxicity Data**

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Polysaccharide	Proprietary	No information available	TLM96: 10000 ppm (Oncorhynchus mykiss) LC50 (96h) 20000 mg/L (Oncorhynchus mykiss)	No information available	EC50 (48h) 1000-3300 mg/L (Crangon crangon)

**12.2. Persistence and degradability**

Readily biodegradable

Substances	CAS Number	Persistence and Degradability
Polysaccharide	Proprietary	No information available

**12.3. Bioaccumulative potential**

Does not bioaccumulate

Substances	CAS Number	Log Pow
Polysaccharide	Proprietary	No information available

**12.4. Mobility in soil**

Substances	CAS Number	Mobility
Polysaccharide	Proprietary	No information available

**12.5 Other adverse effects**

No information available

**13. Disposal Considerations**

**13.1. Waste treatment methods**

**Disposal Method** Disposal should be made in accordance with federal, state, and local regulations.  
**Contaminated Packaging** Follow all applicable national or local regulations.

**14. Transport Information**

**US DOT**

**UN Number:** Not restricted  
**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards:** Not applicable

**US DOT Bulk**

**DOT (Bulk)** Not applicable

**Canadian TDG**

**UN Number:** Not restricted  
**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards:** Not applicable

**IMDG/IMO**

**UN Number:** Not restricted  
**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards:** Not applicable

**IATA/ICAO**

**UN Number:** Not restricted  
**UN Proper Shipping Name:** Not restricted  
**Transport Hazard Class(es):** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards:** Not applicable

**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:** Not applicable

**Special Precautions for User:** None

**15. Regulatory Information**

**US Regulations**

<b>US TSCA Inventory</b>	All components listed on inventory or are exempt.
<b>EPA SARA Title III Extremely Hazardous Substances</b>	Not applicable
<b>EPA SARA (311,312) Hazard Class</b>	None
<b>EPA SARA (313) Chemicals</b>	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
<b>EPA CERCLA/Superfund Reportable Spill Quantity</b>	Not applicable.
<b>EPA RCRA Hazardous Waste Classification</b>	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
<b>California Proposition 65</b>	All components listed do not apply to the California Proposition 65 Regulation.
<b>MA Right-to-Know Law</b>	Does not apply.
<b>NJ Right-to-Know Law</b>	One or more components listed.
<b>PA Right-to-Know Law</b>	Does not apply.

**Canadian Regulations**

**Canadian DSL Inventory** All components listed on inventory or are exempt.

**16. Other information**

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**Preparation Information**

**Prepared By** Chemical Stewardship  
Telephone: 1-580-251-4335  
e-mail: fdunexchem@halliburton.com

**Revision Date:** 12-Jun-2015

**Reason for Revision** SDS sections updated:  
2

**Additional information**

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

**Key or legend to abbreviations and acronyms**

bw – body weight  
CAS – Chemical Abstracts Service  
EC50 – Effective Concentration 50%  
ErC50 – Effective Concentration growth rate 50%  
LC50 – Lethal Concentration 50%  
LD50 – Lethal Dose 50%  
LL50 – Lethal Loading 50%  
mg/kg – milligram/kilogram  
mg/L – milligram/liter  
NIOSH – National Institute for Occupational Safety and Health  
NTP – National Toxicology Program  
OEL – Occupational Exposure Limit  
PEL – Permissible Exposure Limit  
ppm – parts per million  
STEL – Short Term Exposure Limit  
TWA – Time-Weighted Average  
UN – United Nations  
h - hour  
mg/m<sup>3</sup> - milligram/cubic meter  
mm - millimeter  
mmHg - millimeter mercury  
w/w - weight/weight  
d - day

**Key literature references and sources for data**

[www.ChemADVISOR.com/](http://www.ChemADVISOR.com/)

**Disclaimer Statement**

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**End of Safety Data Sheet**

## MATERIAL SAFETY DATA SHEET

Product Trade Name: **SODA ASH**

Revision Date: 25-Oct-2012

### 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: SODA ASH  
Synonyms: None  
Chemical Family: Carbonate  
Application: Buffer

Manufacturer/Supplier: Halliburton Energy Services  
P.O. Box 1431  
Duncan, Oklahoma 73536-0431  
Emergency Telephone: (281) 575-5000

Prepared By: Chemical Compliance  
Telephone: 1-580-251-4335  
e-mail: fdunexchem@halliburton.com

### 2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Sodium carbonate	497-19-8	60 - 100%	Not applicable	Not applicable

### 3. HAZARDS IDENTIFICATION

Hazard Overview: May cause eye, skin, and respiratory irritation.

### 4. FIRST AID MEASURES

**Inhalation**: If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

**Skin**: Wash with soap and water. Get medical attention if irritation persists.

**Eyes**: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

**Ingestion**: Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.

**Notes to Physician**: Not Applicable

## 5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	Not Determined
Flash Point/Range (C):	Not Determined
Flash Point Method:	Not Determined
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	Not Determined
Flammability Limits in Air - Upper (%):	Not Determined

**Fire Extinguishing Media** Water fog, carbon dioxide, foam, dry chemical.

**Special Exposure Hazards** Decomposition in fire may produce toxic gases.

**Special Protective Equipment for Fire-Fighters** Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

**NFPA Ratings:** Health 2, Flammability 0, Reactivity 0  
**HMS Ratings:** Health 2, Flammability 0, Reactivity 0

## 6. ACCIDENTAL RELEASE MEASURES

**Personal Precautionary Measures** Use appropriate protective equipment. Avoid creating and breathing dust.

**Environmental Precautionary Measures** Prevent from entering sewers, waterways, or low areas.

**Procedure for Cleaning / Absorption** Scoop up and remove.

## 7. HANDLING AND STORAGE

**Handling Precautions** Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust.

**Storage Information** Store away from acids. Store in a cool, dry location. Product has a shelf life of 36 months.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

**Engineering Controls** Use in a well ventilated area. Localized ventilation should be used to control dust levels.

**Personal Protective Equipment** If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

**Respiratory Protection** Dust/mist respirator. (N95, P2/P3)

**Hand Protection** Normal work gloves.

**Skin Protection** Normal work coveralls.

**Eye Protection** Dust proof goggles.

**Other Precautions** Eyewash fountains and safety showers must be easily accessible.



## 9. PHYSICAL AND CHEMICAL PROPERTIES

<b>Physical State:</b>	Powder
<b>Color:</b>	White
<b>Odor:</b>	Odorless
<b>pH:</b>	11.5
<b>Specific Gravity @ 20 C (Water=1):</b>	2.5
<b>Density @ 20 C (lbs./gallon):</b>	Not Determined
<b>Bulk Density @ 20 C (lbs/ft3):</b>	48- 62
<b>Boiling Point/Range (F):</b>	Not Determined
<b>Boiling Point/Range (C):</b>	Not Determined
<b>Freezing Point/Range (F):</b>	Not Determined
<b>Freezing Point/Range (C):</b>	Not Determined
<b>Vapor Pressure @ 20 C (mmHg):</b>	Not Determined
<b>Vapor Density (Air=1):</b>	Not Determined
<b>Percent Volatiles:</b>	Not Determined
<b>Evaporation Rate (Butyl Acetate=1):</b>	Not Determined
<b>Solubility in Water (g/100ml):</b>	Partially soluble
<b>Solubility in Solvents (g/100ml):</b>	Not Determined
<b>VOCs (lbs./gallon):</b>	Not Determined
<b>Viscosity, Dynamic @ 20 C (centipoise):</b>	Not Determined
<b>Viscosity, Kinematic @ 20 C (centistokes):</b>	Not Determined
<b>Partition Coefficient/n-Octanol/Water:</b>	Not Determined
<b>Molecular Weight (g/mole):</b>	105.99

## 10. STABILITY AND REACTIVITY

<b>Stability Data:</b>	Stable
<b>Hazardous Polymerization:</b>	Will Not Occur
<b>Conditions to Avoid</b>	None anticipated
<b>Incompatibility (Materials to Avoid)</b>	Strong acids.
<b>Hazardous Decomposition Products</b>	Carbon monoxide and carbon dioxide.
<b>Additional Guidelines</b>	Not Applicable

## 11. TOXICOLOGICAL INFORMATION

<b>Principle Route of Exposure</b>	Eye or skin contact, inhalation.
<b>Inhalation</b>	May cause respiratory irritation.
<b>Skin Contact</b>	Prolonged or repeated contact may cause skin irritation.
<b>Eye Contact</b>	May cause eye irritation.
<b>Ingestion</b>	Irritation of the mouth, throat, and stomach.
<b>Aggravated Medical Conditions</b>	None known.
<b>Chronic Effects/Carcinogenicity</b>	No data available to indicate product or components present at greater than 1% are chronic health hazards.
<b>Other Information</b>	None known.

## Toxicity Tests

<b>Oral Toxicity:</b>	LD50: 4220 mg/kg (Rat)
<b>Dermal Toxicity:</b>	Not determined
<b>Inhalation Toxicity:</b>	Not determined
<b>Primary Irritation Effect:</b>	Not determined
<b>Carcinogenicity</b>	Not determined
<b>Genotoxicity:</b>	Not determined
<b>Reproductive / Developmental Toxicity:</b>	Not determined

## 12. ECOLOGICAL INFORMATION

<b>Mobility (Water/Soil/Air)</b>	Not determined
<b>Persistence/Degradability</b>	Not applicable
<b>Bio-accumulation</b>	Not determined

### Ecotoxicological Information

<b>Acute Fish Toxicity:</b>	TLM24: 385 mg/l (Lepomis macrochirus)
<b>Acute Crustaceans Toxicity:</b>	Not determined
<b>Acute Algae Toxicity:</b>	Not determined

<b>Chemical Fate Information</b>	Not determined
<b>Other Information</b>	Not applicable

## 13. DISPOSAL CONSIDERATIONS

<b>Disposal Method</b>	Bury in a licensed landfill according to federal, state, and local regulations.
<b>Contaminated Packaging</b>	Follow all applicable national or local regulations.

## 14. TRANSPORT INFORMATION

### Land Transportation

**DOT**  
Not restricted

**Canadian TDG**  
Not restricted

**ADR**  
Not restricted

### Air Transportation

ICAO/IATA  
Not restricted

## Sea Transportation

IMDG  
Not restricted

## Other Transportation Information

Labels: None

## 15. REGULATORY INFORMATION

### US Regulations

<b>US TSCA Inventory</b>	All components listed on inventory or are exempt.
<b>EPA SARA Title III Extremely Hazardous Substances</b>	Not applicable
<b>EPA SARA (311,312) Hazard Class</b>	Acute Health Hazard
<b>EPA SARA (313) Chemicals</b>	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
<b>EPA CERCLA/Superfund Reportable Spill Quantity</b>	Not applicable.
<b>EPA RCRA Hazardous Waste Classification</b>	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
<b>California Proposition 65</b>	All components listed do not apply to the California Proposition 65 Regulation.
<b>MA Right-to-Know Law</b>	Does not apply.
<b>NJ Right-to-Know Law</b>	Does not apply.
<b>PA Right-to-Know Law</b>	Does not apply.

### Canadian Regulations

<b>Canadian DSL Inventory</b>	All components listed on inventory or are exempt.
<b>WHMIS Hazard Class</b>	Un-Controlled

## 16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS  
Not applicable

**Additional Information** For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

**Disclaimer Statement**

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

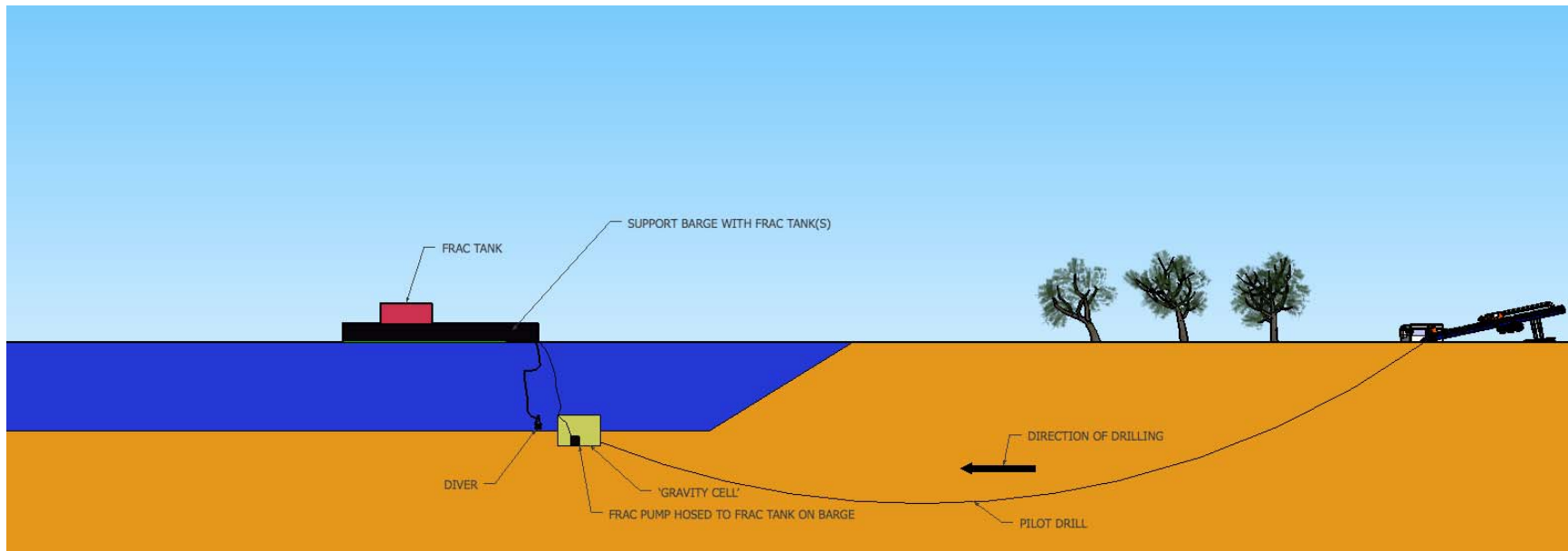
**\*\*\*END OF MSDS\*\*\***

## NYPA VELCO PV20 CABLE REPLACEMENT PROJECT

### PICTORIAL REPRESENTATION OF TYPICAL PUSH-REAMING PROCESS

#### 1. PILOT DRILL

- HDD drill rig provides primary motivation for drill bit.
- CMI Support Barge stationed on site in advance of punch-out.
- Gravity Cell placed at punch-out location with excavated sump (as conditions permit)

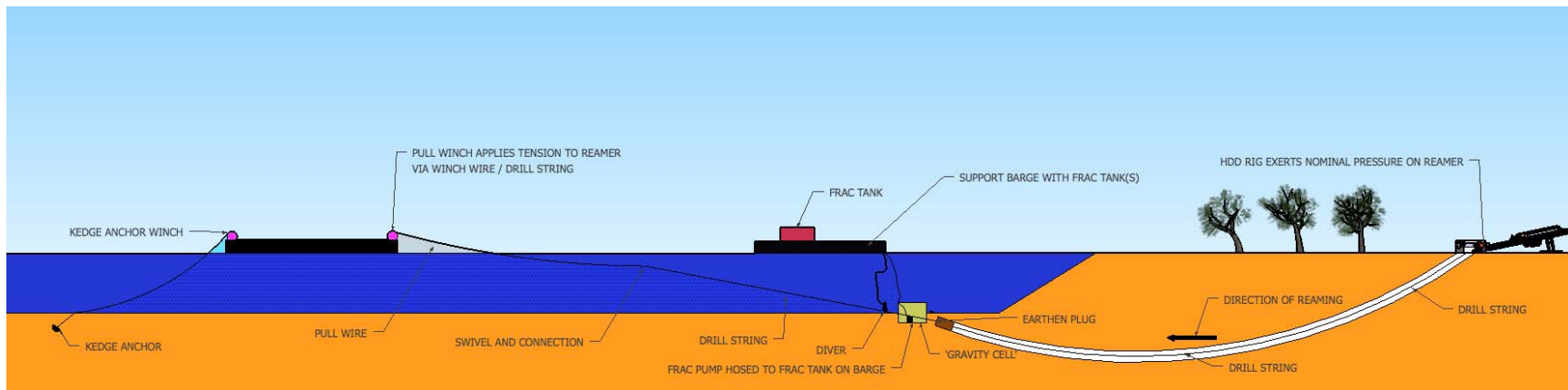


# Caldwell

Marine International, LLC

## 2. REAMING PROCESS

- Drill bit is removed from drill string after pilot drill punch-out. Drill string is connected via swivel to winch wire from CMI Support Barge moored offshore.
- Shore based HDD crew insert reamer into drill string line and commence reaming from land toward Lake
- HDD drill applies nominal pressure to reamer via drill string / CMI Support Barge applies tension to reamer via winch wire & drill string
- CMI Frac Tank Support Barge with dive team / pumping capability stationed adjacent to original pilot drill punch-out location monitoring for possible bentonite discharge.
- Gravity Cell in position at punch-out location as bentonite containment vessel.
- **NOTE: A single-pass reaming operation is planned for NYPA VELCO PV20 Project.....** if conditions should require additional reaming passes the first reaming pass will be suspended before punch-out leaving an earthen plug (see diagram). Reamer will be tripped back to HDD rig for removal / replacement with larger reamer and process repeated until hole size is adequate at which point final reamer will be allowed to punch-out

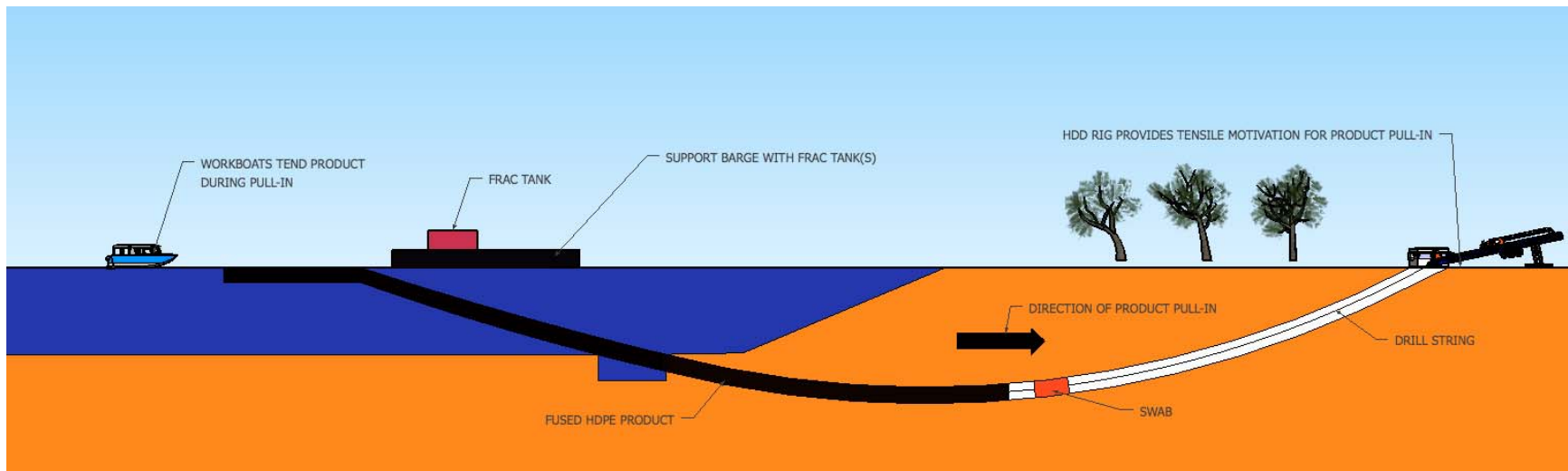


# Caldwell

Marine International, LLC

### 3. SWAB PASS / PRODUCT PULL-IN

- Reamer is removed from drill string by barge crew after reamer punch-out and is replaced by a sized swab. Swab is in turn connected to fused product line. NOTE HDPE pipe is fused close in advance of being required for pull-in. Product pipe is tended by CMI vessels during product pull-in.

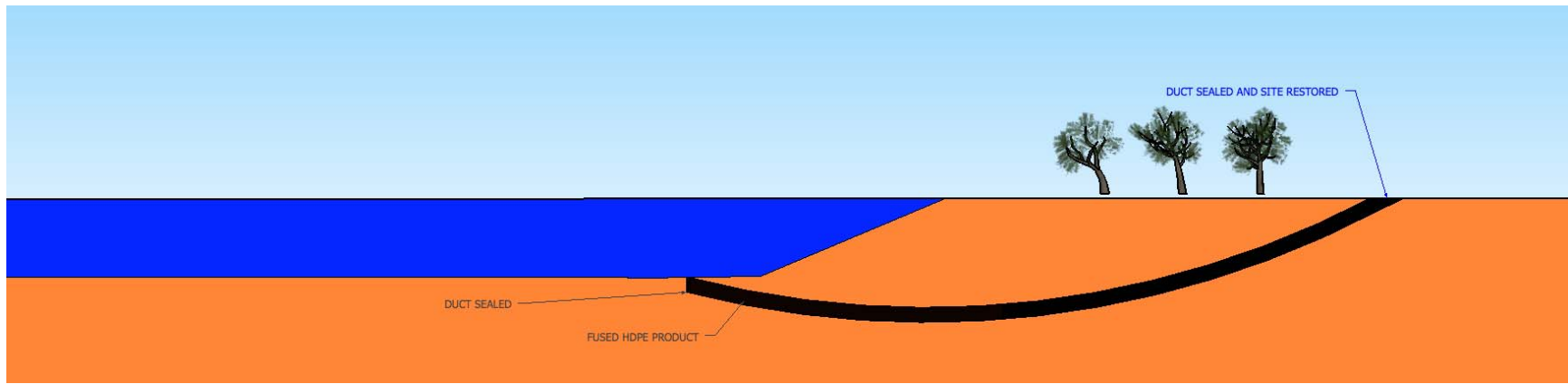


# *Caldwell*

Marine International, LLC

## 4. HDD PROCESS COMPLETED

- Ends of HDPE duct are temporarily sealed to prevent ingress of foreign materials.
- HDD lay-out area graded and cleaned in readiness for civil work.







To: VELCO PV-20 Project

Date: March 10, 2016  
Project #: 57660.00

Memorandum

From: Lydia Lee, PG  
Jason Gorman, PE, CHA

Re: PV-20 Submarine Cable Replacement Project - Installation  
Spill Prevention, Containment, and Contingency Plan

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## **Introduction**

The proposed PV-20 Project is to replace a segment of the existing 115 kV K20 circuit that extends west-to-east in Lake Champlain, between NYPA's Cumberland Head transition station in Plattsburgh, New York and VELCO's Grand Isle transition station in Grand Isle, Vermont (the "Project", see Figure 1: Site Location Map and Figure 2: EPSC Site Plan, Attached). This segment of the existing circuit, which is designated by NYPA and VELCO as the PV-20 line, currently consists of seven oil-filled cables that are buried along the land portions and within the shallows of Lake Champlain (the "Lake") and directly laid along the bottom in the deeper portions of the Lake.

In general, the Project consists of four components: installation of four new extruded dielectric (oil-free) cables, construction of a new transition station, removal of the existing cables, and decommissioning the existing transition station. The use of oil and hazardous materials ("OHM") will be limited to the use of fuel and fluids to power and operate equipment. Oil will also be purged from the existing cables prior to removal. This Spill Prevention, Containment, and Contingency Plan ("Spill Plan") describes the spill prevention and contingency methods and procedures to be utilized for the installation portion of the Project. Spill prevention methods for the removal portion are provided under separate cover.

## **Site Description**

The existing VELCO Grand Isle transition station is located on the western shore of Grand Isle, with a 911 address of 4A Champlain Landing, Grand Isle, Vermont. The proposed new transition station will be located on the adjoining parcel to the north (see Figure 2). The Project area elevation is approximately 120 feet above mean sea level, and the surrounding land generally slopes to the west toward the Lake, which is approximately 170 feet from the fence line of the existing terminal station. The new terminal station will be located approximately 325 feet from the Lake. Temporary stockpiling and staging areas will be located approximately 315 feet from the Lake and horizontal directional drilling ("HDD") launch pits will be located 270 feet from the Lake.

## **OHM Storage and Use**

### Installation and New Construction

Installation methods will include:

- Open trenching from the proposed new transition station to the proposed HDD Launch Area;
- HDD for the land to water transition; drilling will be completed from a land-based launch site and pull back area positioned approximately 270 feet from the Lake using a horizontal directional drill;
- Jet sledding for the installation of the cable in water depths of approximately 30 to 100 feet, with anticipated burial to 4 feet below the Lake bottom. The jet sled involves a skid-mounted jet sled which is towed by a barge; and



- Direct laying on the lake bottom using a linear cable engine on a dynamically positioned barge to control the cable tension and placement.

#### Refueling

Construction of the new transition station will involve typical construction machinery and equipment, such as excavators, backhoes, and cranes that will be fueled by gasoline and diesel fuel. The barges, support boats, and support vessels will require periodic refueling. The contractor shall take all usual and reasonable precautions during refueling and maintenance activities to prevent an accidental spill. These precautions include the use of secondary containment devices and/or the use of containment booms and absorbent pads. Additionally, spill response kits shall be readily available within the work area depicted on Figure 2.

Bulk Fuel Delivery Procedures are as Follows:

- No bulk deliveries shall take place without contractor supervision and approval.
- Check all gauges and volumes prior to fuel transfer.
- The delivery truck wheels shall be chocked as soon as the truck is parked in the fuel transfer position.
- Before fueling, flexible transfer hoses shall be inspected for cuts, abrasion, and damaged ends.
- All fuel transfers shall be monitored.
- Tanks shall not be filled to overflow capacity.
- Final inspection of the tank truck and tank feed lines shall be conducted to assure that all valves and ports are closed and that no leaks have occurred.

#### Storage

When not in use, all OHM used and stored on site, including fuels, lubricants, and hydraulic oil, will be located within secondary containment in a secure, designated OHM storage area within the Work Zone Area depicted on Figure 2. The contractor will use discretion to designate an appropriate area for OHM storage, which shall be located on flat, dry land at least 100 feet from the mean water level of 95.5 feet in elevation.

Anticipated OHM types, volumes, quantities, and storage protocols for installation procedures are summarized in the Table 1 below. Contractor shall provide Safety Data Sheets ("SDSs") for all OHM used and stored on-site, and SDSs shall be maintained with this Spill Plan.



**Table 1: Installation OHM Summary**

<b>Product</b>	<b>Purpose</b>	<b>Approximate Quantity</b>	<b>Storage and Spill Prevention</b>
Diesel Fuel	To fuel the D-2 Modular Cable Installation Barge	This vessel will be outfitted with an approved IMO Tank with adequate capacity (including contingency) to conduct an individual cable installation. The need for at sea refueling is therefore not envisaged.	When fuel is required the IMO Tank will be replenished alongside at a marine facility from shore-based tanks or fuel transport trucks. Fuel transfer operations will be completed by trained personnel. Refueling operations will be monitored at all times by the contractor. Fuel lines will be inspected before use and connection will be secure before fueling begins. The barge will be moored or stabilized as much as possible before fueling begins.
Diesel Fuel	To fuel support vessels (inboard powered crewboats, tugs, etc.)	These vessels will be refueled alongside at local marine facilities from shore-based tanks or fuel transport trucks.	Fuel transfer operations will be completed by trained personnel. Refueling operations will be monitored at all times by the contractor. Fuel lines will be inspected before use and connection will be secure before fueling begins. The vessel will be moored or stabilized as much as possible before fueling begins.
Diesel Fuel/Gasoline	To fuel support boats (outboard powered skiffs, etc.)	These vessels, when fitted with integral fuel tanks, will be refueled alongside at local marine facilities. If the vessels are outfitted with portable tanks the tanks may simply be refueled at local marine facilities or the sealed tanks may be transported to local gas stations for replenishment.	
Diesel Fuel	To fuel horizontal directional drill rig motors and heater.	Limited quantities of fuel will be stored on-site in containers with capacities less than 55 gallons. Otherwise, fuel will be transported to the site by approved bulk trucks.	Supplied in approved containers and stored in secondary containment on-site. Refueling operations will be monitored by the contractor.



**Table 1: Installation OHM Summary**

<b>Product</b>	<b>Purpose</b>	<b>Approximate Quantity</b>	<b>Storage and Spill Prevention</b>
Gasoline	To fuel remote water pump engines, including other support pumps and/or generators.	Limited quantities of fuel will be stored on-site in containers with capacities less than 55 gallons	Supplied in approved containers and stored in secondary containment on-site. The transfer of gas from approved containers to engines will be carried out over a containment area or absorbent pads with pumps, nozzles, or funnels designed to fit solidly into the container opening.
Lubricating Petroleum based Products	To maintain oil levels and oil changes for all engines.	Limited quantities will be supplied in approved containers with capacities less than 55 gallons	New oil will be stored in secondary containment. Used oil will be collected by containers designed to fit and be situated below equipment drain opening. The used oil will be placed in an approved container which can be sealed, and then placed into secondary containment until removed from the site and disposed of in an approved manner. To avoid excessive accumulation of used oil on-site, full containers will be routinely disposed of off-site in accordance with local, state and federal regulations.
Hydraulic Oil	To maintain the drill rig's and other equipment's hydraulic systems.	Limited quantities will be available on-site and will be transported to the site in sealed containers or barrels with capacities of 55 gallons or less.	All hydraulic hoses and fittings will be in good working order. All hydraulic pump bearing seals will be checked for leaks and repaired as necessary. Absorbent pads or small secondary containment containers will be placed beneath areas susceptible to drips or spills during the use of hydraulic oil.

Existing Transition Station Decommissioning

OHM use and handling related to decommissioning the existing transition station is limited to the purging and disposal of the conservatory tanks and associated MODF, and use of fuel (diesel and gasoline) to power typical construction machinery.

**Training**

Pursuant to 29 CFR 1910.120, the person(s) responsible for hazardous materials handling and spill prevention planning shall have a minimum of 40 hours of initial health and safety training for hazardous waste site operations (OSHA



HAZWOPER). Contractors shall also have OSHA 10 hour Construction Safety training per NYPA and VELCO requirements. All oil handling personnel will be trained in the operation and maintenance of equipment to prevent discharges, discharge procedures protocols, applicable pollution control laws, rules, and regulations, generally site operations, and the contents of this Spill Plan.

Prior to commencement of field activities, all personnel assigned to the Project will be provided training that will specifically address the activities, procedures, monitoring, and equipment for the site operations. It will include site and facility layout, hazards, and emergency services at the site, and will highlight all provisions contained within the Contractor's Work Plan. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Personnel shall respond to incidents in a manner consistent with the level and type of training received.

### **Spill Prevention and Containment**

When not in use, all OHM containers shall be stored in the designated OHM storage area in a secondary containment structure with compatible materials, as described in Table 1. All designated OHM storage areas shall be inspected and secured daily, and inspection checklists shall be filled out weekly, at a minimum. The purpose of this inspection program is to detect any condition or malfunction of containers and equipment that could result in the release of hazardous materials, petroleum or oil to the environment. The Project Spill Response Coordinator shall maintain records of all inspections, and be made available to VELCO upon request. An example inspection form is provided on page 3 of the Attachment.

During the inspections, all OHM storage containers, motive power containers (i.e. equipment fuel tank), and equipment lines/hoses will be examined for signs of damage or leakage. Indications of leaks are required to be reported immediately to the Project Spill Response Coordinator. If the Spill Response Coordinator identifies a condition causing or contributing to a leak or potential release, the Coordinator shall ensure that the condition is corrected as soon as reasonably possible.

Spill prevention measures specific to the use of OHM, such as refueling, are summarized in Table 1.

### **Emergency Information**

Prior to start of construction, VELCO and VELCO's contractor shall notify local police, fire, hospitals, and ENPRO (emergency spill response contractor) to make arrangements and coordinate local emergency response services.

If there is an immediate threat to life, health, or property (such as from fire, explosion, or toxic vapors) from the spilled material, VELCO personnel and VELCO contractors will first evacuate the immediate area, and remove or extinguish potential ignition sources to prevent fire and/or explosion.

Contractor shall maintain basic first aid kits, fire extinguishers, spill kits, and appropriate personal protective equipment (ear plugs, hard hats, etc.) at the Project site at all times. All personnel entering the work area shall be



notified of the storage location of such equipment. Spill kits shall be provided where oil or hazardous materials are stored, and shall be accessible at all times by trained personnel. Spill kits shall contain the following:

1. Personal Safety Wear: Tyvek suit, aprons, shoe booties, chemical goggles, solvent resistant gloves
2. Absorbents: granular sorbent, sorbent booms, sorbent static resistant pads
3. Clean Up Equipment: repair putty, 55 gallon steel Drum and hazardous waste label, drum liner, solvent resistant booms, non-spark and solvent resistant shovel, residue bags (50 each)

The closest hospital is the University of Vermont (“UVM”) Medical Center located at 111 Colchester Avenue, Burlington, VT 04501. Their phone number is 802-847-0000. A map with directions to the hospital from the Project site is attached.

**Contact Information and Notification Procedures**

VELCO contractors discovering an oil spill or discharge (“Discoverer”) shall immediately notify one of the Key Contractor Personnel listed in Table 2, who will notify VELCO’s Spill Response Coordinators, in the order listed in Table 3. In the event the Discoverer cannot contact Contractor Personnel, Discoverer shall notify VELCO’s Spill Response Coordinators directly. Communication will occur via cellular telephones.

<b>Table 2: Contractor Spill Notification List</b>		
<b>Company/Position</b>	<b>Person</b>	<b>Contact Numbers</b>
Project Manager	Peter Smith	(732) 557-6100 (CMI Head Office) (732) 239-7086 (Emergency)
ECI Drilling LLC. – Lead Driller	Jerry McVay	(936) 441-9080 (ECI Head Office)
Northline Utilities	TBD	(518) 647-8198 (Office)

<b>Table 3: VELCO Spill Notification List</b>		
<b>Department</b>	<b>Person</b>	<b>Contact Numbers</b>
1 <sup>st</sup> Spill Response Coordinator	Tim Follensbee	(802) 770-6423 (work) (802) 342-6267 (cell) (802) 742-2509 (pager)
2 <sup>nd</sup> Spill Response Coordinator	Brian Connaughton	(802) 770-6227 (work) (802) 343-4323 (cell)
VELCO System Operator	VELCO Control Center if Tim or Brian cannot be reached	(802) 770-6261
VELCO Emergency Line	Use for emergency situations only	(802) 770-6260



The following information shall be relayed to VELCO as soon as possible:

1. Person making the notification
2. Contact information for follow-up coordination
3. Location of release
4. Date and time of release
5. Material released
6. Estimated volume of release
7. Source of release
8. Cause of release
9. Any damages or injuries caused by the release
10. Media affected by the release
11. Actions being implemented to stop or control the release
12. Any other pertinent information (access restrictions, current weather conditions, etc.)

VELCO's Spill Response Coordinator will contact the appropriate regulatory agencies as outlined in the table below. The agency to be contacted will depend on the nature and amount of the spilled material and the location of the spill as defined in Table 4 below.

<b>Table 4: External Spill Notification List</b>		
<b>Agency</b>	<b>Criteria for Notification</b>	<b>Contact Numbers</b>
National Response Center	Any release that: (1) creates a sheen on surface water; or (2) causes deposition of sludge or emulsions beneath the surface or along the adjoining shoreline, or (3) is greater than or equal to 1,000 gallons of oil; or (4) discharges equal to or greater than 42 gallons that occur more than twice in a 12 month period; or. (5) causes a violation of the water quality standards.	(800) 424-8802
VT DEC Spills Hotline	Any release that: (1) A discharge of hazardous waste, or release of hazardous material that exceeds 2 gallons; (2) A discharge of hazardous waste, or release of hazardous material that is less than or equal to 2 gallons and poses a potential or actual threat to human health or the environment; or	(800) 641-5505 (802) 241-3888
Local Fire Department	Risk of fire or danger to public	911
U.S. Coast Guard	Risk of fire or danger to public	(802) 862-0376



<b>Table 4: External Spill Notification List</b>		
<b>Agency</b>	<b>Criteria for Notification</b>	<b>Contact Numbers</b>
Spill Response Contractor: ENPRO	<p>Cases where VELCO personnel or the Project Contractor alone cannot accomplish cleanup, or where additional material or equipment is necessary.</p> <p>ENPRO is located in Burlington, VT and maintains the capability of immediately responding to and correcting a potential spill resulting from the installation project.</p>	(800) 966-1102

**Spill Response Actions and Clean Up Procedures**

All clean up actions are subject to the Notification Procedures listed above. Additionally, VELCO personnel and VELCO contractors shall respond to incidents in a manner consistent with the level and type of training received. Removal and disposal of the oil and/or impacted media would be conducted in accordance with VT DEC regulations.

Small Spills on Impervious Surfaces (Less Than 2 gallons)

Wherever possible, any spilled materials should be collected with absorbents, transferred to DOT drums and properly labeled. Sufficient sorbent materials are available in the spill kits, which will be available during construction operations. If floor drains or trench drains near the spill are present, these features should be tightly sealed before commencing cleanup operations.

Small Spills on Pervious Areas (Less Than 2 gallons)

Spills on pervious areas could result in contamination to soils and possibly groundwater. Contaminated soil should be excavated and placed in DOT drums and properly labeled. The removal and disposal of the oil and/or impacted media would be conducted in accordance with VT DEC regulations. If necessary, spills should be contained with absorbent materials, trenching, or berming.

Large Spills (Any Spill Greater than 2 gallons)

Trained VELCO personnel and/or their contractors would attempt to control or slow a larger spill using normal spill response procedures if there is no immediate threat to life or health. In cases where VELCO personnel or the Project Contractor alone cannot accomplish the necessary cleanup actions, or where additional material or equipment is necessary, an Emergency Spill Response Contractor will be called in for assistance. VELCO maintains an on-call contract with ENPRO.

A large spill must be handled in a manner that prevents fire and explosion hazards. The following steps shall be taken for large spills:

1. If there is an immediate threat to life, health or property (such as from fire, explosion, or toxic vapors) from the spilled material:





- Evacuate the immediate area.
  - Remove or extinguish potential ignition sources.
2. Notify the VELCO Spill Response Coordinator as per the Notification Procedures listed above. The VELCO Spill Response Coordinator will notify the proper agencies as per the Notification Procedures listed above.
  3. Assess the magnitude of the release and direction of flow.
  4. Secure the site to prevent unauthorized access.
  5. If qualified and if not posing a danger to personnel, take action to minimize the spread of contamination.
  6. Contain the spill with absorbent materials (pads, booms, etc.), or by trenching, berming, or by securing drains, basins and sumps or by whatever other means that are necessary.
  7. Eliminate all sources of ignition near the spill. Only qualified technicians should trip switches if necessary. Also, do not plug in or unplug electrical cords in the endangered area. Absolutely no smoking is allowed in the endangered area in the event of a spill.
  8. The VELCO Spill Response Coordinator will contact an Emergency Spill Response Contractor (ENPRO, refer to Table 3 for contact information) if the spill cannot be contained by VELCO personnel.
  9. In the event of very large spills, the area should be evacuated, and any nearby buildings should be alerted of possible fire or explosion hazards, and requested to evacuate the buildings, if necessary.

#### Onshore Spills Potentially Affecting Surface Water

Moderate to large spills near water bodies may contaminate surface waters directly by overland flow, or indirectly by infiltrating through porous soils to the water table, then traveling along the water table until reaching the water body. The following additional procedures to those described above should be followed for onshore spills affecting or potentially affecting surface water:

1. The excavation of ditches and berms for containing spills to prevent overland flow of oil or fuel into surface waters.
2. If the spill has reached surface water, directly or indirectly, sorbent booms should be deployed to contain floating sheens or product.
3. Contaminated soils near the stream or waterbody must be excavated and stockpiled on and covered with plastic away from the spill site as soon as possible.



### Offshore Spills Affecting Surface Waters

Moderate to large spills within water bodies typically float atop waters and may migrate via wave or wind action. The following additional procedures to those described above should be followed for offshore spills affecting or potentially affecting surface water:

1. Immediately take steps to stem the flow of oil or hazardous materials to the surface water.
2. Deploy sorbent booms to contain floating sheens or product. If the spill is large, several booms may be used to prevent the spread of oil.
3. Dewater contaminated liquids, if necessary.
4. If offshore spills are close to shorelines, then sediments and soils must be assessed to determine if they have been impacted and if excavation would be a proper course of remedial action (this would be determined in cooperation with the appropriate agencies). If material is excavated, it will be containerized or stockpiled on and covered with plastic away from the spill site as soon as possible.

### **Disposal**

After a spill incident, removal of contaminated soils, liquids and absorbent debris may be necessary as part of site remediation activities. These materials may be classified as contaminated media and debris, and therefore they would become subject to the packaging, record keeping, transportation, treatment, and disposal requirements of the VT DEC and Vermont Hazardous Waste Management Regulations. Prior approval from the Vermont Agency of Natural Resources, Waste Management and Prevention Division, is required before contaminated media may be transported off-site. An approved contractor would transport the contaminated media with the appropriate shipping documentation to an approved off-site treatment or disposal facility.

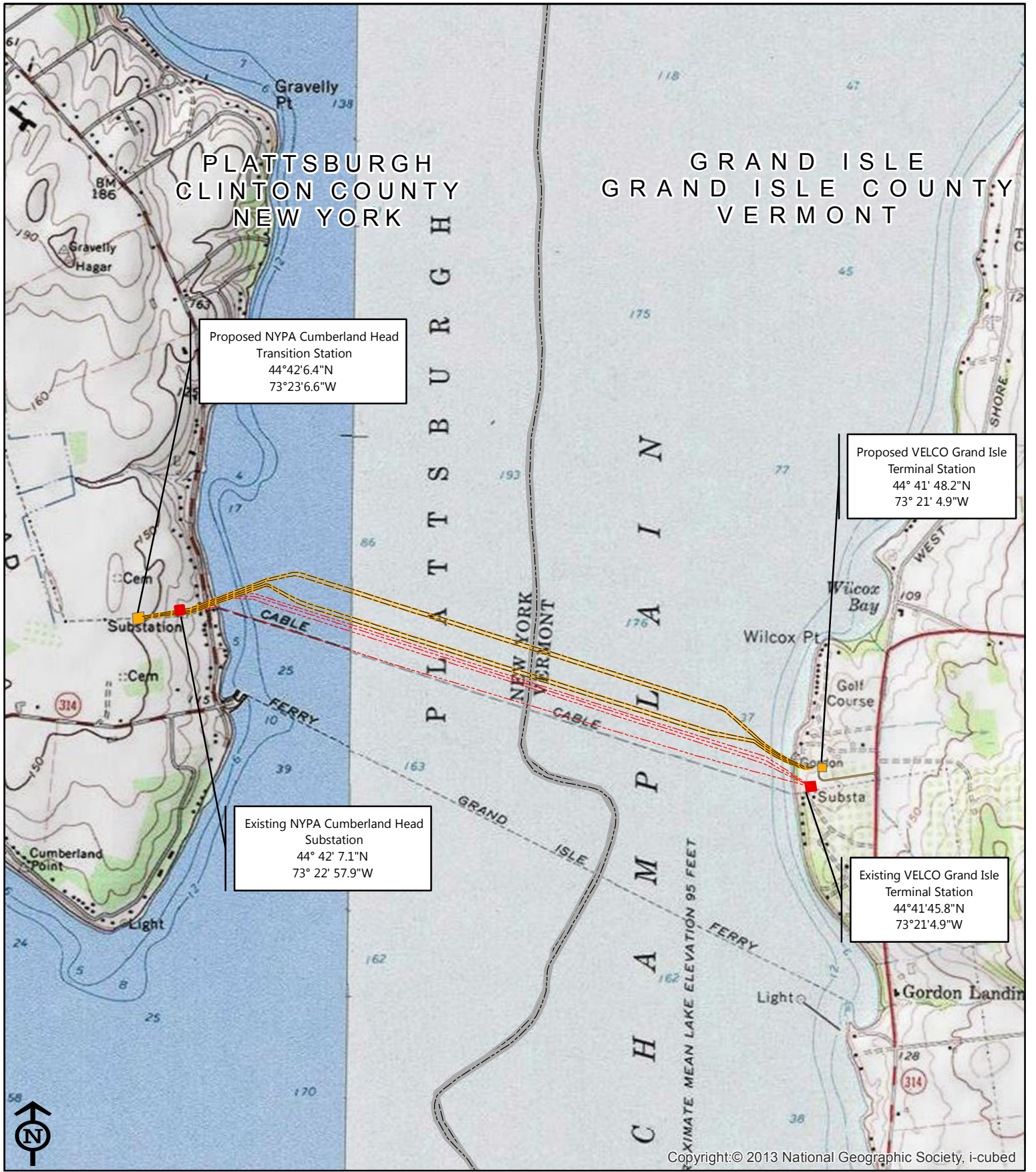
### **Summary**

On behalf of VELCO, VHB has prepared this Spill Plan to outline procedures to be implemented in the event of a spill during Project installation activities. The goal of this Spill Plan is to avoid the risk of a release of OHM to Lake Champlain, soils, or groundwater; and to have response actions in place in the event of a release. This goal is attainable with proper training, careful planning, and adherence to this Spill Plan.

### **Attachments**

- Figure 1: Site Location Map (page 1)
- Figure 2: EPSC Plan Sheet Showing Work Area (page 2)
- Weekly Inspection Checklist (page 3)
- Directions to UVM Medical Center (pages 4 through 6)

# ATTACHMENT



Proposed NYPA Cumberland Head  
Transition Station  
44°42'6.4"N  
73°23'6.6"W

Proposed VELCO Grand Isle  
Terminal Station  
44° 41' 48.2"N  
73° 21' 4.9"W

Existing NYPA Cumberland Head  
Substation  
44° 42' 7.1"N  
73° 22' 57.9"W

Existing VELCO Grand Isle  
Terminal Station  
44°41'45.8"N  
73°21'4.9"W

**Legend**

- - - Existing Cables (Approx.)
- Proposed Replacement Cable Locations (Approx.)
- Proposed Terminal Station
- Existing Terminal Station
- State Boundary

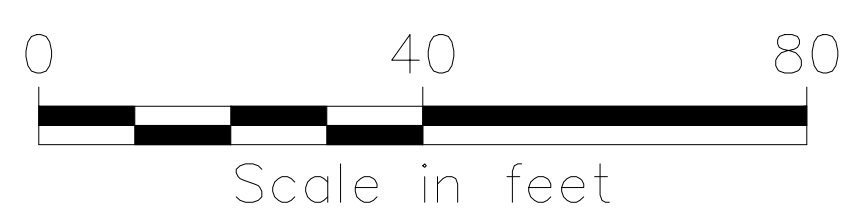
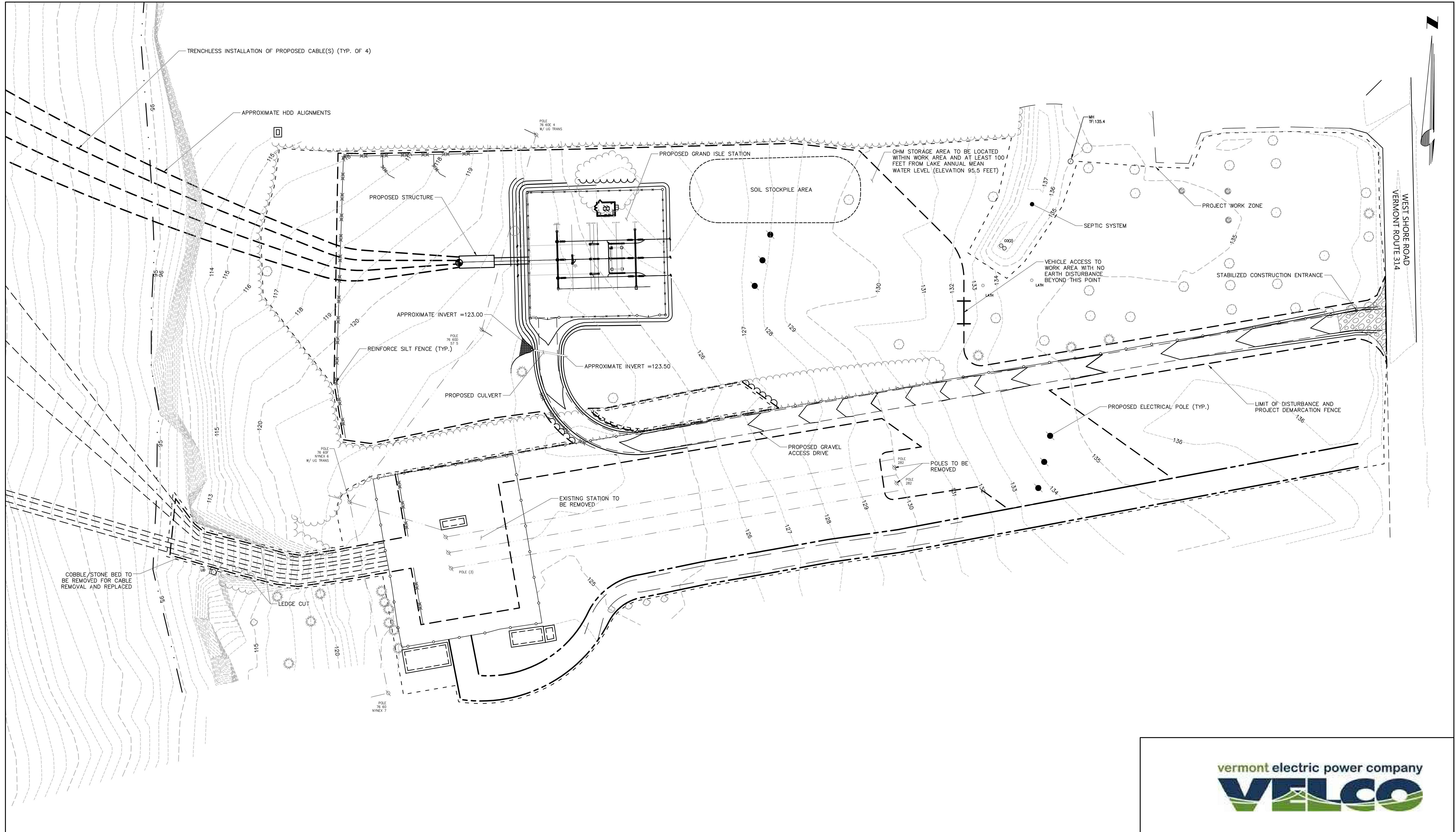
**VELCO and NYPA  
PV-20 Submarine Cable Replacement Project  
Grand Isle, VT and Plattsburgh, NY  
Figure 1: Site Location Map  
December 11, 2015**

2,000    1,000    0    2,000

Feet

Sources: USGS Topo Quads from ESRI (2015); State and Town Boundaries from VCGI (2010); Approximate Replacement Cable Locations, Existing and Proposed Terminal Station Locations from CHA (2015); Approximate Existing Cable Locations Digitized from Plans Provided by CHA (2015).

File: \\V:\DATA\PROJECTS\57660.00\NPA\_PV-20\CAD\PLANSET\EROSION\_PV-20\PERMITS\57660.00-LD-EROSION\_Sheet: 2/25/2016 1:41:37 PM Plotted: 2/25/2016 1:43:37 PM User: Shedd, Tyr Lutz\swb\kfr



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**CHA**  
 111 Winners Circle, PO Box 5269  
 Albany, NY 12205-0269  
 518.453.4500 • www.chacompanies.com

EROSION PREVENTION AND SEDIMENT CONTROL PLAN  
 PV-20 CABLE REPLACEMENT PROJECT  
 VT TRANSCO

PROJECT NO.  
57660.00  
 DATE: 02/08/16  
 FIGURE # 2

**PV-20 SUBMARINE CABLE REPLACEMENT PROJECT  
OHM STORAGE WEEKLY INSPECTION CHECKLIST**

(make multiple copies as necessary)

Inspector's Name: \_\_\_\_\_

Inspector's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Completed forms must be retained by the Contractor and provided to VELCO upon their request.**

**NOTE:** Check **yes** or **no** for each item. If no, indicate corrective action.

ITEMS	YES	NO	IF NO, CORRECTIVE ACTION
<b>OHM DRUM AND CONTAINER STORAGE</b>			
<b>OHM CONTAINERS IN SECONDARY CONTAINMENT</b>			
1. Are the drum/container surfaces in good condition and free of stains?			
2. Is the floor surrounding the drums and dikes/basins free of signs of spills?			
3. Are all OHM containers from the site located in the designated storage area at the end of the day?			
<b>OPERATIONAL EQUIPMENT</b>			
<b>EQUIPMENT AND MACHINERY</b>			
1. Are equipment and machinery surfaces in good condition and free of fuel stains?			
2. Is the area around the equipment and machinery free of stains?			
3. Is a spill kit accessible and does it have a complete supply of absorbent pads/booms and other emergency spill containment and cleanup equipment?			
Additional Notes/Observations:			

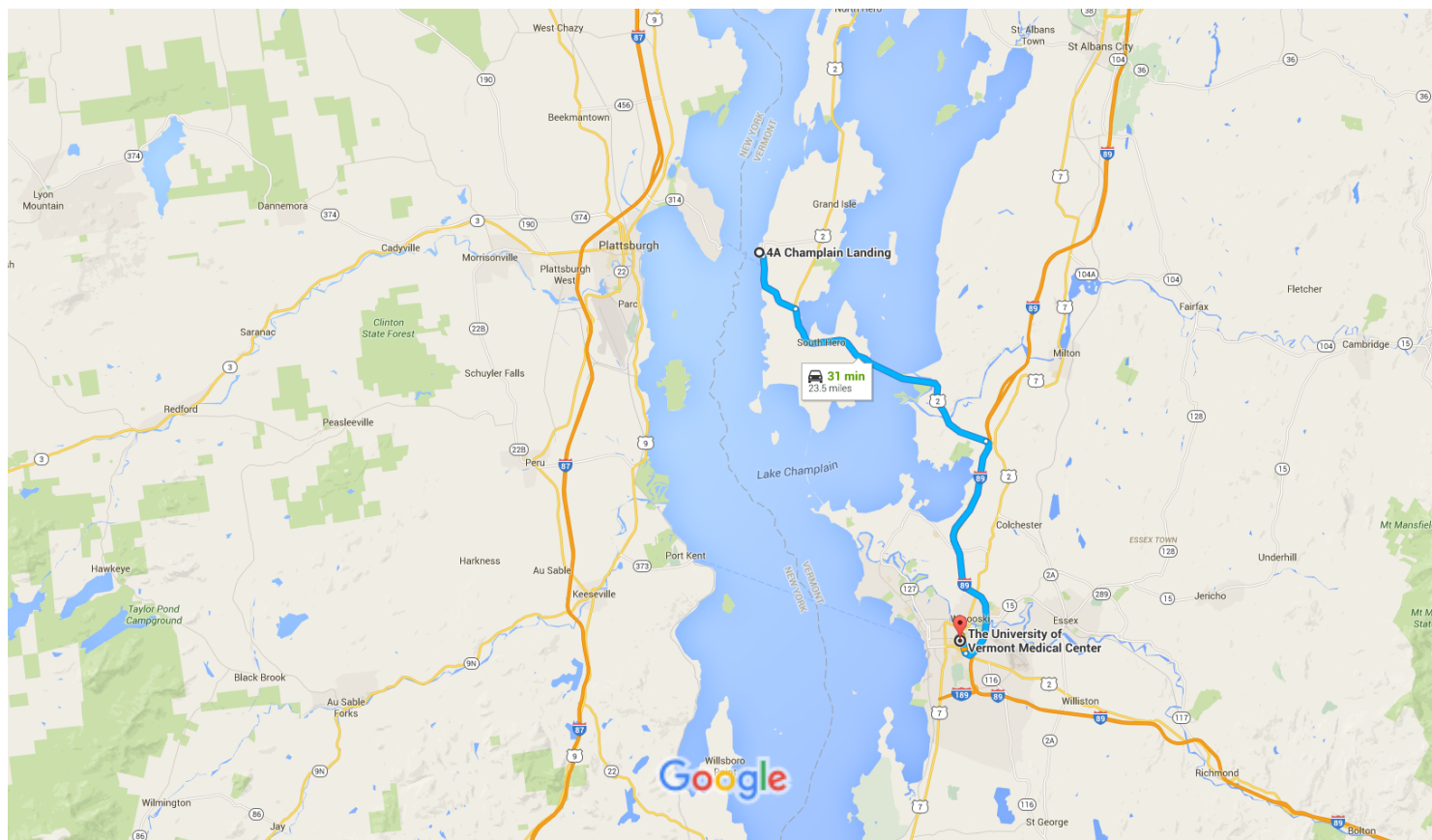
Supervisor's Signature: \_\_\_\_\_ Date: \_\_\_\_\_



# 4A Champlain Landing, Grand Isle, VT 05458 to The University of Vermont Medical Center

Drive 23.5 miles, 31 min

VELCO PV-20 Emergency Planning. Medical Center's Phone Number: 802-847-0000. Call 911 in an emergency.



Map data ©2016 Google 2 mi

## 4A Champlain Landing

Grand Isle, VT 05458

### Follow VT-314 S to US-2 E in South Hero

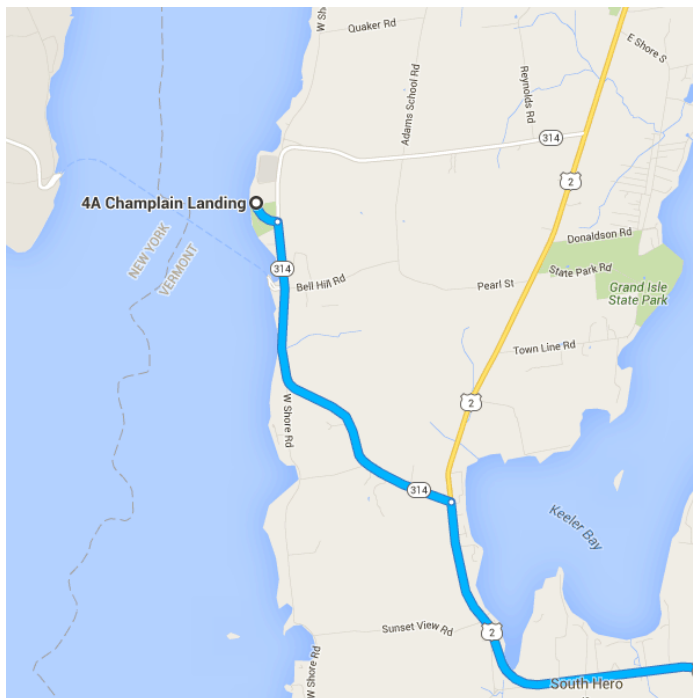
6 min (2.9 mi)

- ↑ 1. Head south on Champlain Landing toward Silent Cedars Cir

0.2 mi

- ↘ 2. Turn right onto VT-314 S

2.7 mi



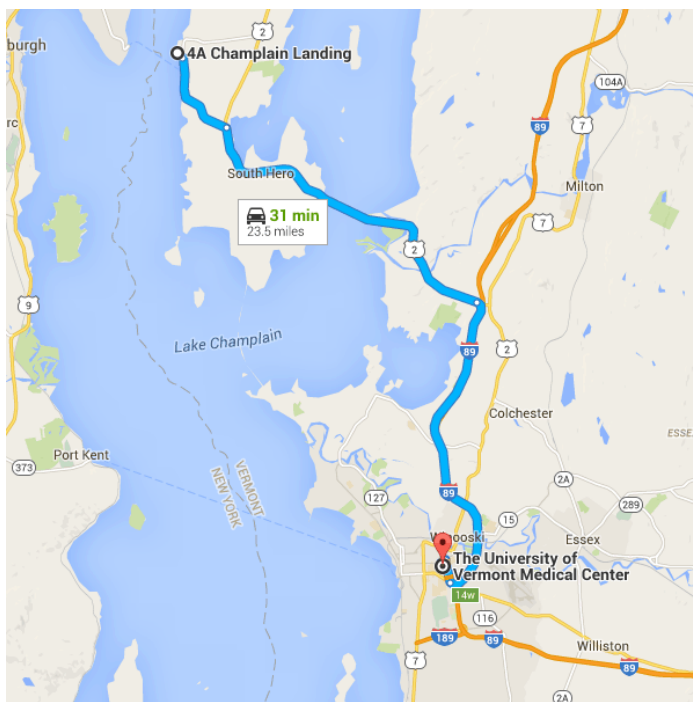
**Follow US-2 E and I-89 S to East Ave in South Burlington**

- 23 min (19.7 mi)

3. Turn right onto US-2 E
- 10.1 mi

4. Use the right lane to take the ramp onto I-89 S
- 9.0 mi

5. Take exit 14w to merge onto US-2 W/Main St toward Burlington
- 0.6 mi




**Continue on East Ave. Drive to Colchester Ave in Burlington**

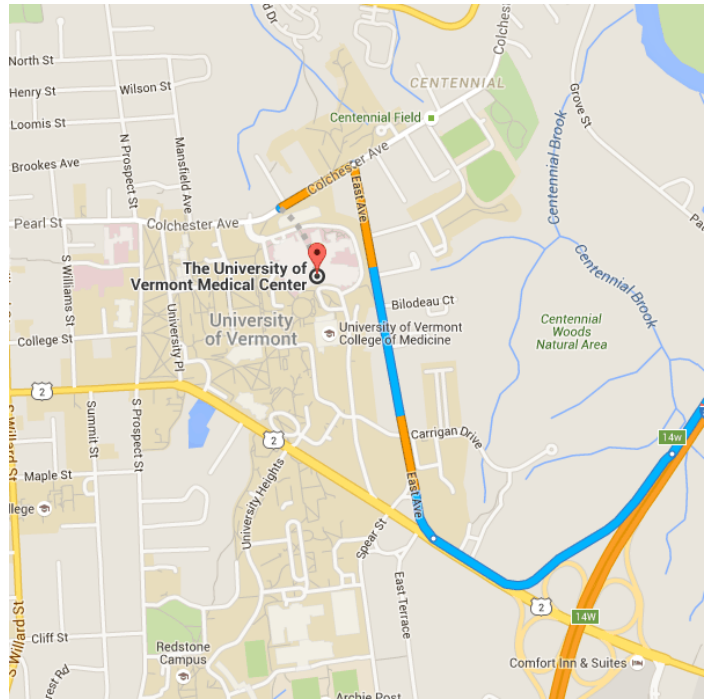
- 3 min (0.9 mi)

6. Use the right 2 lanes to turn right onto East Ave
- 0.7 mi



- 7. Turn left onto Colchester Ave
-  Destination will be on the left

0.2 mi



## The University of Vermont Medical Center

111 Colchester Avenue, Burlington, VT 05401

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.



# **MILLER ENVIRONMENTAL GROUP, INC.**

**CPR 460: PV-20 SUBMARINE CABLE REPLACEMENT  
SUBMARINE TRANSMISSION LINE DECOMMISSIONING  
PLATTSBURGH, NEW YORK  
GRAND ISLE, VERMONT**

**SPILL PREVENTION, CONTAINMENT AND CONTINGENCY PLAN**

**APRIL 2015**

***REVISED MARCH 2016***

**Prepared For:**

**New York Power Authority  
123 Main Street  
White Plains, New York 10601**

**Prepared By:**

**Miller Environmental Group, Inc.  
538 Edwards Avenue  
Calverton, New York 11933**

**Website: <http://www.MillerEnv.com>**



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4. LAKE CHAMPLAIN SITE PLAN

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- A. DISCHARGE NOTIFICATION PROCEDURE
- B. DISCHARGE PREVENTION BRIEFING LOG



## INTRODUCTION

The purpose of this Spill Prevention, Containment and Contingency (SPCC) plan is to describe measures to be implemented by Miller Environmental Group, Inc. (MEG) to prevent oil discharges from occurring, and to prepare all affected personnel to be able to respond in a safe, effective, and timely manner to mitigate the impacts of a discharge at the designated work zones.

## MANAGEMENT APPROVAL

MEG is committed to maintaining the highest standards for preventing discharges of oil to navigable waters and the environment through the implementation of this SPCC Plan. This SPCC Plan has the full approval of the MEG management and MEG has committed the necessary resources to implement the measures described in this Plan.

**Slade McFadden** is the MEG Designated Person Accountable for Oil Spill Prevention during the field operations associated with the PV-20 Submarine Cable Replacement and has the authority to commit the necessary resources to implement the Plan as described. At the start of the project the MEG Designated Person will conduct a Discharge Prevention Briefing to all crews working on the project. The briefing will discuss the details of this plan and any task specific items that may apply.

**TABLE 0-1 MEG CONTACT INFORMATION**

Spill Coordinator:	Slade McFadden: 631.208.6443 (cell)
Alternate Spill Coordinator:	To be Determined
Alternate Spill Coordinator	To be Determined



# MILLER ENVIRONMENTAL GROUP, INC.

## PART I – GENERAL FACILITY INFORMATION

### 1. NYPA CUMBERLAND HEAD – SUBMARINE CABLE – GRAND ISLAND TRANSITION STATION

#### a. SITE INFORMATION:

Facility Name: Cumberland Head’s Substation  
 Type of Facility: Electric Transmission System  
 Facility’s Latitude/Longitude: N44.7020° W73.3827 °  
 Year of Initial Facility Operation: 1958  
 Maximum Cable Storage Capacity: 1,257-gallons  
 Maximum Tank Storage Capacity: 230-gallons

#### b. CONTACT INFORMATION

The Designated Person Accountable for overall oil spill prevention and response at the facility, also referred to as the site’s “Spill Response Coordinator” (SRC), is the Spill Coordinator, 24-hour contact information is provided in Table 1.1.

**TABLE 1-1 FACILITY CONTACT INFORMATION**

Spill Response Coordinator:	Jon Mayette: 315.764.6850 (office) 315.323.2042 (cell) 315.388.5309 (home)
Alternate Spill Response Coordinator:	John Norwicki: 315.764.6854 (office) 315.322.1391 (cell) 315.262.2877 (home)
Transmission Spill Coordinator	Joseph Robertaccio: 315.792.8268 (office) 315.617.2559 (cell) 315.733.1916 (home)



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## 2. VELCO GRAND ISLE TRANSMISSION SUBSTATION

### a. SITE INFORMATION:

Facility Name: VELCO Substation  
 Type of Facility: Electric Transmission System  
 Facility’s Address: 4A Champlain Landing  
 Year of Initial Facility Operation: 1958  
 Maximum Cable Storage Capacity: 1,257-gallons  
 Maximum Tank Storage Capacity: 230-gallons

### b. CONTACT INFORMATION

The Designated Person Accountable for overall oil spill prevention and response at the facility, is the Spill Response Coordinator (SRC), 24-hour contact information needs to be provided by VELCO prior to start of field operations.

**TABLE 1-2 FACILITY CONTACT INFORMATION**

1 <sup>st</sup> Spill Response Coordinator:	Tim Follensbee	802-770-6423 (work) 802-342-6267 (cell) 802-742-2509 (pager)
2 <sup>nd</sup> Spill Response Coordinator:	Brian Conaughton	802-770-6227 (work) 802-343-4323 (cell)
VELCO System Operator	VELCO Control Center, if Tim or Brian cannot be reached	802-770-6261
VELCO Emergency Line	Use for emergency situations only	802-770-6260

## 3. FACILITY / SITE DIAGRAMS

The following figures are attached at the end of this plan: Figure 1- General Work Site Location Map; Figure 2 - NYPA-Cumberland Head Site Plan; Figure 3 - VELCO Grand Isle Site Plan; and Figure 4 – Lake Champlain Site Plan



**4. Oil Storage CONTAINERS**

**a. NYPA CUMBERLAND HEAD SUBSTATION**

Table 1-3 identifies the conservator tanks associated with the NYPA Cumberland Head Substation

**TABLE 1-3: CHARACTERISTICS OF OIL CONTAINERS AT CUMBERLAND HEAD SUBSTATION**

Item	Type	Construction	Primary Contents	Location	Capacity (gallons)
1	AST	Plain steel, single wall	Dielectric oil	Tank Containment	20
2	AST	Plain steel single wall	Dielectric oil	Tank Containment	20
3	AST	Plain steel	Dielectric oil	Tank Containment	20
4	AST	Plain steel	Dielectric oil	Tank Containment	20
5	AST	Plain steel	Dielectric oil	Tank Containment	20
6	AST	Plain steel	Dielectric oil	Tank Containment	20
7	AST	Plain steel	Dielectric oil	Tank Containment	15
8	AST	Plain steel	Dielectric oil	Tank Containment	15
9	AST	Plain steel	Dielectric oil	Tank Containment	20
10	AST	Plain steel	Dielectric oil	Tank Containment	20
11	AST	Plain steel	Dielectric oil	Tank Containment	20
12	AST	Plain steel	Dielectric oil	Tank Containment	20
				Total	230



**b. VELCO SUBSTATION**

Table 1-4 identifies the conservator tanks associated with the VELCO Grand Isle Substation

**TABLE 1-4: CHARACTERISTICS OF OIL CONTAINERS AT VELCO GRAND ISLE SUBSTATION**

Item	Type	Construction	Primary Contents	Location	Capacity (gallons)
1	AST	Plain steel, single wall	Dielectric oil	Tank Containment	20
2	AST	Plain steel single wall	Dielectric oil	Tank Containment	20
3	AST	Plain steel	Dielectric oil	Tank Containment	20
4	AST	Plain steel	Dielectric oil	Tank Containment	20
5	AST	Plain steel	Dielectric oil	Tank Containment	15
6	AST	Plain steel	Dielectric oil	Tank Containment	15
7	AST	Plain steel	Dielectric oil	Tank Containment	15
8	AST	Plain steel	Dielectric oil	Tank Containment	15
9	AST	Plain steel	Dielectric oil	Tank Containment	15
10	AST	Plain steel	Dielectric oil	Tank Containment	15
11	AST	Plain steel	Dielectric oil	Tank Containment	15
12	AST	Plain steel	Dielectric oil	Tank Containment	15
				Total	200





## 5. REMOVAL OF OIL FROM CONSERVATOR TANKS AND SUBMARINE CABLES

The following procedures are followed during the decommissioning of the conservator tanks at the Cumberland Head Substation.

- a. Prior to commencement of decommissioning, the NYPA/VELCO facility operator and the MEG Project Manager will verify that all equipment has been de-energized and that all lock out/tag out procedures have been implemented.
- b. Prior to initiating draining / purging activities, MEG will inventory all quantities of the conservatory tanks and associated equipment at the substation
- c. No smoking is allowed on site at any time.
- d. Personnel responsible for the draining/purging operations are to remain at their designated locations during draining/purging operations.
- e. During the first stage of purging operations there will be two (2) people at each substation involved with the operation. One person will be stationed at the tank (within the elevated tank containment) and the second person will be at ground level (stationed either at the Vac-truck or air compressor).
- f. Throughout the process each person must be alert, have an unobstructed view of the equipment for which they are responsible and be in visual communication with the teammate.
- g. A containment pad will be constructed within each of the two (2) substations, adjacent to the elevated tanks (see Figures 2 & 3 for approximate containment locations). The pad is capable of containing a total of 3,949-gallons. The maximum estimated volume is expected to be no more than 728.3-gallons. The containment provides approximately 542% of maximum expected capacity.
- h. The drain valve on the tank is to be closed, and the unloading line is to be drained back to the vac-truck tank before disconnecting.
- i. The tanker truck driver will gauge the tank and record the volume within the tank.
- j. The lower most drain, and all outlets are to be closely examined for leakage, and if necessary, tightened, adjusted or replaced to prevent any liquid leakage.



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- k. Immediately report any leakage or spillage, including quantity to the MEG Designated Person (631) 208-6443. The MEG Designated person shall immediately notify the NYPA and/or VELCO Spill Coordinator.

A spill kit is located adjacent to the Containment Pad. The spill kit can be utilized to capture/contain and clean-up any minor discharges occurring during transfer operations.

## **6. CUTTING OF CABLES IN PLACE (PRIOR TO REMOVAL OF CABLES FROM THE GROUND)**

- a. Prior to the cutting of any cable, MEG will place spill containment beneath the cable to be cut. The containment will be designed to hold (at a minimum) approximately 25 gallons.
- b. A spill kit will be placed within 25 feet of the cutting operations. The spill kit can be utilized to capture/contain and clean-up any minor discharges occurring during cutting operations
- c. Any liquids captured into the containment pad will be recovered with the use of absorbents and containerized within DOT approved 55-gallon drums.
- d. The drums will be placed within the Waste Management Zone (location and layout of the Waste Management Zone to be determined prior to start of operations) pending offsite disposal.

## **7. CLEANING OF CONSERVATOR TANKS**

- a. After the tanks have been emptied they will be tripled rinsed prior to removal.
- b. All generated liquids will be containerized within DOT approved 55-gallon drums and stored within the Waste Management Area pending analysis and disposal.

## **8. RECOVERY OF CABLES (DURING BOTH LAND AND MARINE OPERATIONS)**

- a. No oil discharge is expected during cable recovery operations.
- b. A spill kit will be maintained on the operating barge and its tender.
- c. A spill kit will be maintained on the fast response boat.
- d. In the event that a discharge to the environment does occur, MEG crews will apply absorbents (and/or containment boom) as needed to capture and contain the release.



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- e. All impacted absorbents will be containerized within DOT approved 55-gallon drums and stored within the Waste Management Area pending analysis and disposal.

## 9. CUTTING OF CABLES ON REELS

- a. The barge will be brought in to the bulkhead (this location will be determined prior to start of field operations)
- b. The cable cutter and a 20 yard lined roll off container will be staged within a containment berm (12'x44'x1')
- c. Polyethylene sheeting will be laid out from the cable spool to the containment berm
- d. The cable will be fed from the spool into the cable cutter
- e. The cable cutter will unspool the cable, cut it into 4' sections and discharge it into the 20 yard container.
- f. When full the 20-yard container will be removed from the containment berm and taken to an approved facility for recycling or disposal.

## 10. SECURITY

Both the New York and Vermont sites are restricted access areas with only authorized personnel permitted entry to either site.

## 11. PROXIMITY TO NAVIGABLE WATERS

Both the New York and Vermont facilities adjacent to Lake Champlain and the cable removal will consist of work being done on the lake proper.

MEG will take all necessary steps to minimize any potential release to the lake during its operations.

During all operations that take place on or adjacent to the water, MEG will have a response boat in the water equipped with absorbent booms and sweep should the need arise.

## 12. CONFORMANCE WITH APPLICABLE STATE AND LOCAL REGULATIONS



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All discharge notifications are made in conformance with all federal, state and local regulations (as outlined within Part II of this report).



## **PART II – SPILL RESPONSE AND REPORTING**

### **1. DISCHARGE DISCOVERY AND REPORTING**

Several individuals and organizations must be contacted in the event of an oil discharge. The MEG Designated Person is responsible for ensuring that all required discharge notifications have been made. All discharges should be reported to the MEG Designated Person. The summary table included in **APPENDIX A** of this SPCC Plan provides a list of agencies to be contacted under different circumstances. The Form included in **APPENDIX A** of this Plan summarizes the information that must be provided when reporting a discharge, including contact lists and phone numbers.

### **2. VERBAL NOTIFICATION REQUIREMENTS (LOCAL, STATE AND)**

In the event of a discharge that threatens to result in an emergency condition the MEG Designated Person will notify the NYPA and VELCO Spill Coordinators as necessary.

For any discharge that reaches navigable waters, or threatens to reach navigable waters, immediate notification must be made to the National Response Center Hotline (800-424-8802) and to the USEPA.

In the event of a discharge that threatens to result in an emergency condition which has or threatens to pollute the lands or waters of the State of New York, including groundwater, facility personnel must verbally notify the New York State Department of Environmental Conservation (NYSDEC) spills hot line at (800-457-7362) or (518-475-7362) immediately, and in no case later than two (2) hours of the discovery of the discharge.

In the event of a discharge that threatens to result in an emergency condition which has or threatens to pollute the lands or waters of the State of Vermont, including groundwater, facility personnel must verbally notify the Grand Isle Consolidated Water District (802-372-8830), the VT DEC Spill Response Team (800-641-5005) and the Vermont DEC Water Supply Division (802-241-3400) immediately, and in no case later than two (2) hours of the discovery of the discharge.



### **3. WRITTEN NOTIFICATION REQUIREMENTS (STATE AND FEDERAL)**

A written notification will be made to the USEPA for any single discharge of oil to a navigable waters or adjoining shoreline waterway of more than 1,000-gallon, or two discharges of 42-gallons of oil to a waterway within any 12-month period. This written notification must be made within 60 days of the qualify discharge, and a copy will be sent to the NYSDEC and/or VTDEC, which are the state agencies in charge of oil pollution control activities. This reporting requirement is separate and in addition to reporting under 40 CFR part 110 discussed above.

### **4. SPILL MITIGATION PROCEDURES**

The following is a summary of actions that must be taken in the event of a discharge. It summarizes the distribution of responsibilities among individuals and describes procedures to follow in the event of a discharge.

In the event of a discharge, MEG personnel and the Spill Coordinator shall be responsible for the following.

### **5. SHUT-OFF IGNITION SOURCES**

MEG personnel must shut off all ignition sources, including motors, electrical circuits, and open flames.

### **6. Stop Oil Flow**

MEG personnel should determine the source of the discharge, and if safe to do so, immediately shut off the source of the discharge.

### **7. STOP THE SPREAD OF OIL AND CALL THE SPILL COORDINATOR**

If safe to do so, MEG personnel must use resources available at the site (Spill Response Equipment is located at a designated location at each site, and on each vessel in operation) to stop the spilled material from spreading. Measures that may be implemented, depending on the location and size of the discharge include placing sorbent material or other barriers in the path of the discharge. If a catch basin is located within the vicinity of the discharge, place a petroleum absorbent boom (found in the Spill Kit) around the catch basin to prevent any additional material from entering the drainage system.



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In the event of a significant discharge, facility personnel must immediately contact the Spill Coordinator, who may obtain assistance from authorized company contractors and direct the response and cleanup activities.

## **8. GATHER SPILL INFORMATION**

The Spill Coordinator will ensure that the Discharge Notification Form is filled out and that notifications have been made to the appropriate authorities. The Spill Coordinator may ask for assistance in gathering the spill information on the Discharge Notification Form (**APPENDIX B**) of this Plan.

- a. Reporter's name
- b. Exact location of the spill
- c. Date and time of spill discovery
- d. Material spilled (e.g. diesel, glycol)
- e. Total Volume spilled and total volume reaching or threatening navigable waters or adjoining shorelines
- f. Weather conditions (if spill occurred outdoors)
- g. Source of spill
- h. Actions being taken to stop, remove, and mitigate the effects of the discharge
- i. Whether an evacuation may be needed
- j. Spill impacts (injuries; damage; environmental media, e.g., air, waterway, groundwater, sewer)
- k. Names of individuals and/or organizations who have also been contacted

## **9. NOTIFY AGENCIES VERBALLY**

Some notifications must be completed immediately upon discovering the discharge. It is important to immediately contact the Spill Coordinator so that timely notifications can be made. If the Spill Coordinator is not available, or the Spill Coordinator requests it, facility personnel must designate one person to begin notifications. Section 2.1 of this Plan describes the required notifications to government agencies. The Notification List is included in **APPENDIX A** of this SPCC Plan. The Spill Coordinator must also ensure that written notifications, if needed are submitted to the appropriate agencies.



## **10. DISPOSAL PLAN**

The cleanup contractor will handle the disposal of any recovered product, contaminated soil, contaminated materials and equipment, decontamination solutions, sorbents, and spent chemicals collected during a response to a discharge incident.

The Spill Coordinator will characterize the waste and arrange for the use of certified waste containers. All waste will be temporarily stored within the Waste Containment Area pending waste characterization and off site disposal.





## PART III – SPILL PREVENTION, CONTAINMENT AND CONTINGENCY PROVISIONS

### 1. POTENTIAL DISCHARGE VOLUME AND DIRECTION OF FLOW

Tables 3-1 to 3-3, below, summarizes potential oil discharge scenarios. If unimpeded, oil would follow local topography.

**TABLE 3-1: NYPA POTENTIAL DISCHARGE VOLUME AND DIRECTION OF FLOW**

Source	Type of Failure	Maximum Volume (Gallons)	Maximum Discharge Rate (gal/min)	Direction of Flow	Containment
Conservator tanks	Rupture of single interior tank	20	20	NA	Secondary Containment
	Rupture of all interior tanks	230	230	NA	Secondary Containment
	Rupture of all interior tanks and secondary containment	230	230	Southeast	None

**TABLE 3-2: VELCO POTENTIAL DISCHARGE VOLUME AND DIRECTION OF FLOW**

Source	Type of Failure	Maximum Volume (Gallons)	Maximum Discharge Rate (gal/min)	Direction of Flow	Containment
Conservator tanks	Rupture of single interior tank	20	20	NA	Secondary Containment
	Rupture of all interior tanks	200	200	NA	Secondary Containment
	Rupture of all interior tanks and secondary containment	200	200	Northwest	None



**TABLE 3-3: CABLE PURGING POTENTIAL DISCHARGE VOLUME AND DIRECTION OF FLOW**

Source	Type of Failure	Maximum Volume (Gallons)	Maximum Discharge Rate (gal/min)	Direction of Flow	Containment
Submarine Cables	Failure of line At Vac-truck	171.1	171.1	NA	Secondary Containment

**2. PERSONNEL, TRAINING, AND DISCHARGE PREVENTION PROCEDURES**

The MEG Designated Person has been designated as the point of contact for all oil discharge prevention and responses during the field operations of the submarine cable decommissioning project.

All MEG personnel who handle, or may come into direct contact with the products covered by this Plan, receive training on the proper handling of oil products and procedures to respond to an oil discharge prior to entering those areas wherein the use, storage or transfer of bulk oil/petroleum. The training ensures that all designated facility personnel understand the procedures described in this SPCC Plan and are informed of the requirements under applicable pollution control laws, rules and regulations. All training records are maintained for each employee by MEG and are available upon request.

MEG ensures that all sub-contractor personnel are familiar with the facility operations, safety procedures, and spill prevention and control procedures described in this Plan prior to entering the work zone.

**3. SPILL PREVENTION BRIEFING**

The MEG Designated Person, or his designated representative, conducts Spill Prevention Briefings prior to the start of work to ensure adequate understanding and effective implementation of this SPCC Plan. These briefings highlight and describe known spill events or failures, malfunctioning components, and any recently developed precautionary measures. The briefings are conducted in conjunction with the MEG safety meetings. Sign-in sheets, which include the topics of discussion at each meeting, are maintained with this Plan. A Discharge Prevention Briefing Log form is provided in **APPENDIX B** to this Plan and is used to document the briefings. The briefing includes a review of the policies and procedures relating to spill prevention, control, cleanup, and reporting; procedures for routine handling of products (e.g. loading, unloading, transfers); spill prevention



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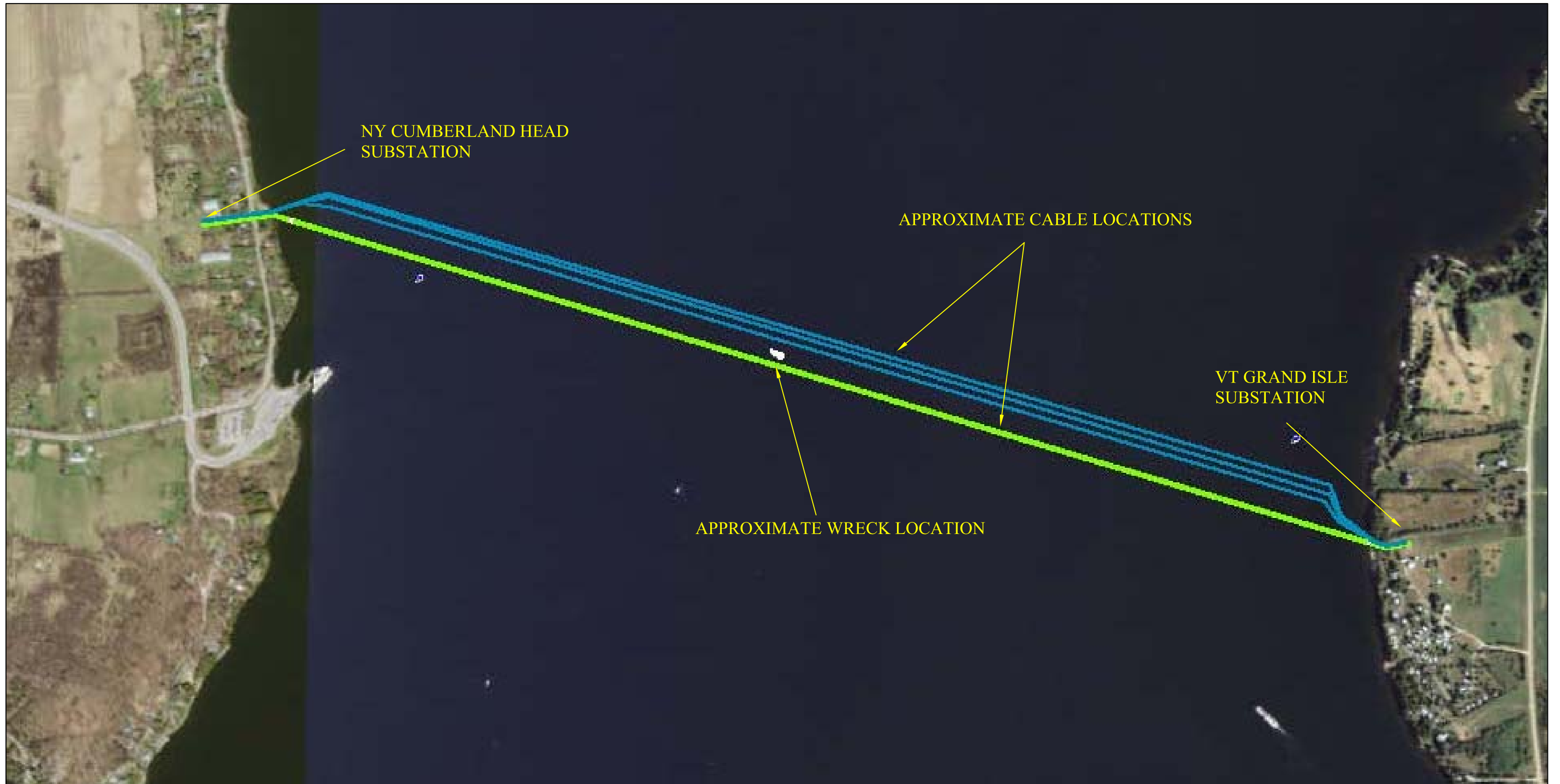
procedures; spill reporting procedures; spill response; and recovery, disposal and treatment of spilled material. MEG personnel have an opportunity during the briefings to share recommendations concerning health, safety, and environmental issues encountered during facility operations.

- a. The general outline of the briefings is as follows:
  - i. Responsibilities of personnel and Designated Person Accountable for Spill Prevention
  - ii. Spill prevention regulations and requirements
  - iii. Spill prevention procedures
  - iv. Spill reporting and cleanup procedures
  - v. Equipment failures and operational issues
  - vi. Recently developed measures/procedures



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**FIGURES**

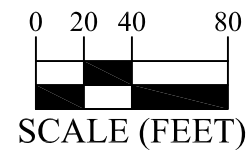
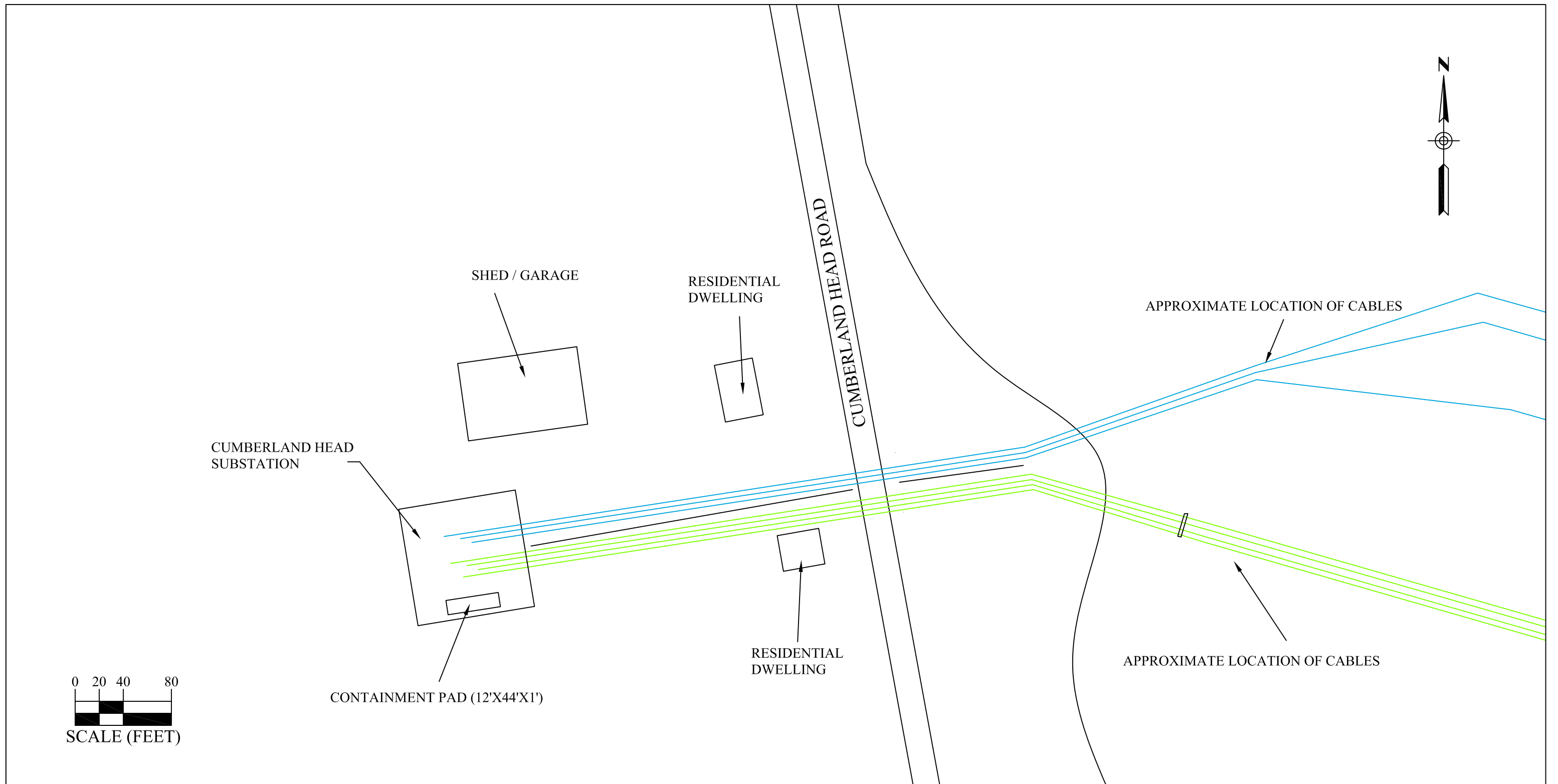


NO.	COMMENT	DATE	INIT
4.			
3.			
2.			
1.			

**REVISIONS**




 <p><b>MILLER ENVIRONMENTAL GROUP, INC.</b>          1300 SHAMES DR., WESTBURY, NY 11590          PHONE: 516.876.7940 - FAX: 516.876.7946</p>	<p><b>FIGURE 1</b></p> <p>GENERAL WORK SITE LOCATION MAP</p> <p>CUMBERLAND HEAD, NY          GRAND ISLE, VT</p>
	<p>DRAWN BY: RJF          DATE: 04/02/15          SCALE: NTS</p> <p>CLIENT:          NYPA / VELCO</p> <p>MEG #:</p>



NO.	COMMENT	DATE	INIT
4.			
3.			
2.			
1.	ADD CONTAINMENT PAD LOCATION	03/02/16	RJF

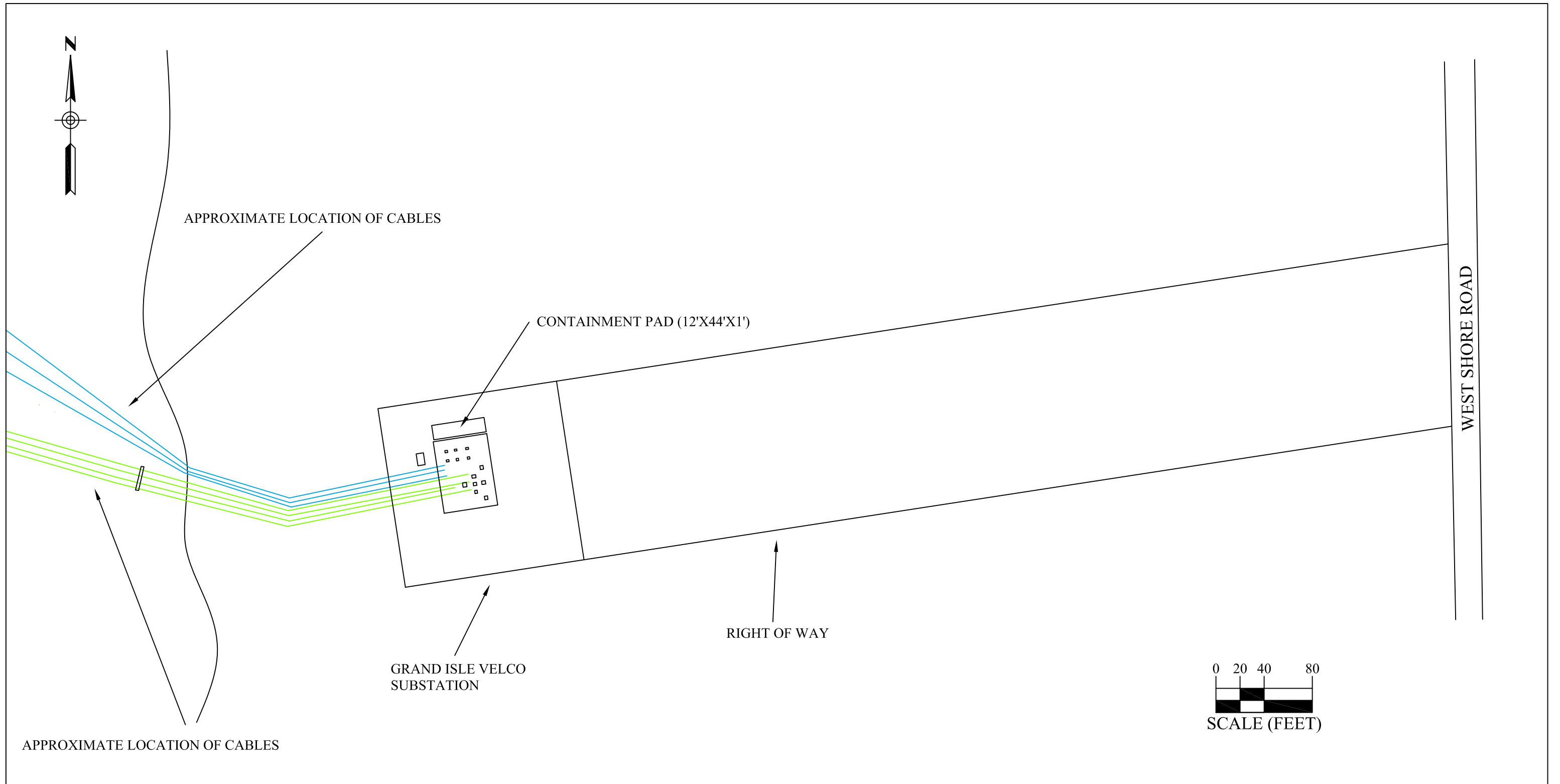
REVISIONS



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 1300 SHAMES DR., WESTBURY, NY 11590  
 PHONE: 516.876.7940 - FAX: 516.876.7946


**FIGURE 2**  
 NY WORK AREA  
 CUMBERLAND HEAD, NY  
 GRAND ISLE, VT

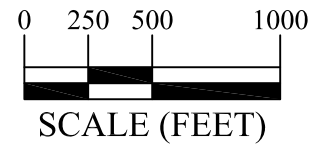
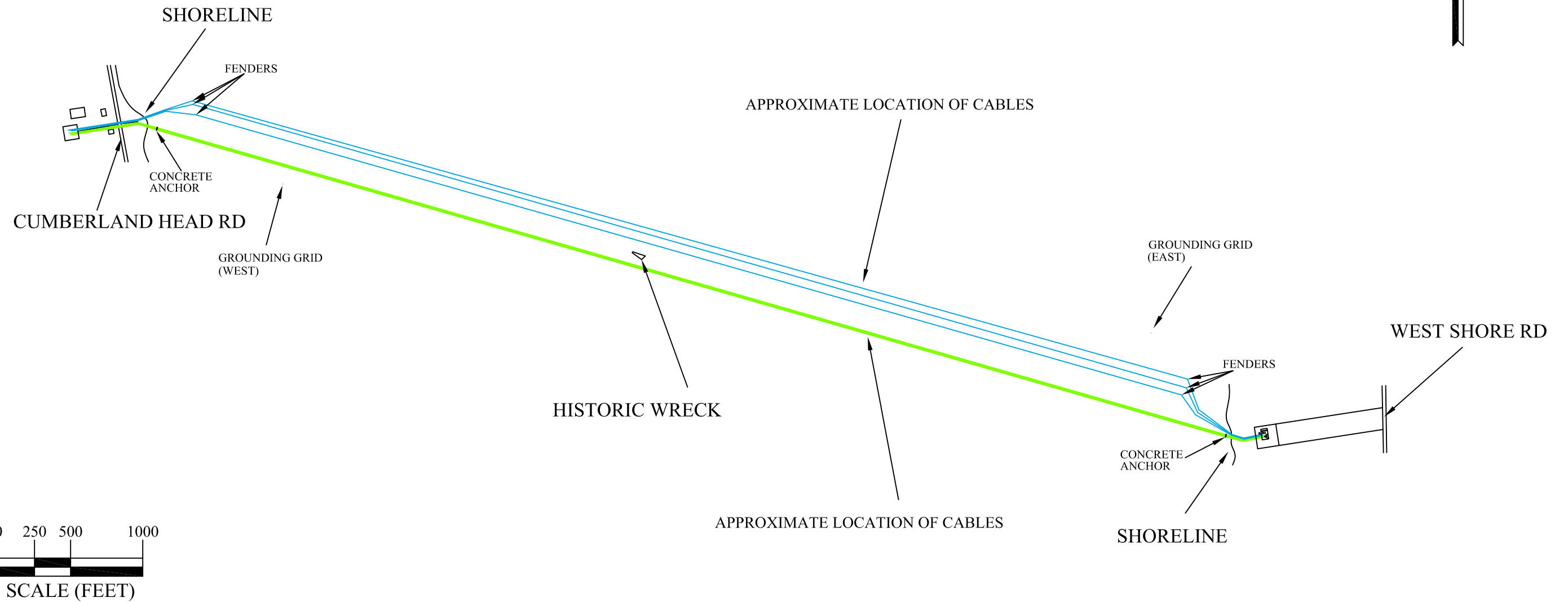
DRAWN BY: RJF
DATE: 04/02/15
SCALE: 1:80
CLIENT: NYP&A / VELCO
MEG #:




NO.	COMMENT	DATE	INIT
4.			
3.			
2.			
1.	ADD CONTAINMENT PAD LOCATION	03/02/16	RJF

REVISIONS

 <p><b>MILLER ENVIRONMENTAL GROUP, INC.</b>          1300 SHAMES DR., WESTBURY, NY 11590          PHONE: 516.876.7940 - FAX: 516.876.7946</p>	DRAWN BY: RJF DATE: 04/02/15 SCALE: 1:80
	CLIENT: NYPA / VELCO MEG #:
<p><b>FIGURE 3</b>  <b>VT WORK AREA</b>  <b>CUMBERLAND HEAD, NY</b>  <b>GRAND ISLE, VT</b></p>	



NO.	COMMENT	DATE	INIT
4.			
3.			
2.			
1.			
<b>REVISIONS</b>			

 <p><b>MILLER ENVIRONMENTAL GROUP, INC.</b> 1300 SHAMES DR., WESTBURY, NY 11590 PHONE: 516.876.7940 - FAX: 516.876.7946</p>	<p><b>FIGURE 4</b> <b>LAKE CHAMPLIAN SITE PLAN</b> <b>CUMBERLAND HEAD, NY</b> <b>GRAND ISLE, VT</b></p>		<p>DRAWN BY: RJF DATE: 04/02/15 SCALE: 1:750</p>
	<p>CLIENT: NYP&amp;A / VELCO</p>		<p>MEG #:</p>





**MILLER ENVIRONMENTAL GROUP, INC.**

**APPENDIX A**  
**DISCHARGE NOTIFICATION PROCEDURES**



# MILLER ENVIRONMENTAL GROUP, INC.

## APPENDIX A – DISCHARGE NOTIFICATION PROCEDURES

Circumstances, instructions, and phone numbers for reporting a discharge to the National Response Center and other federal, state, and local agencies, and to other affected parties, are provided below.

Spill Coordinator: Slade McFadden: (24 hours) (631) 208-6443 (Cell)  
 FIRE: 911  
 POLICE: 911  
 RESCUE: 911

Agency/Organization	Agency Contact	Circumstances	When to Notify
Federal Agencies National Response Center	1-800-424-8802	Discharge reaching navigable waters	Immediately (verbal)
USEPA Region 2 Regional Administrator Chris Jimenez	1-732-906-6847	Discharge 1,000 gallons or more; or second discharge of 42 gallons or more over a 12-month period.	Immediately (verbal)
State Agencies NYSDEC Spill Hotline	1-800-457-7362	Discharge of petroleum, which may impact; air, water, soil or groundwater	Within 2 hours of discovery
VTDEC Spill Response Team	1-800-641-5005	Discharge of petroleum, which may impact; air, water, soil or groundwater	Within 2 hours of discovery
VTDEC Water Supply Division	1-802-241-3400	Discharge of petroleum, which may impact; air, water, soil or groundwater	Within 2 hours of discovery
Grand Isle Consolidated Water District	1-802-372-8830	Discharge of petroleum, which may impact; air, water, soil or groundwater	Within 2 hours of discovery



# MILLER ENVIRONMENTAL GROUP, INC.

Agency/Organization	Agency Contact	Circumstances	When to Notify
VELCO – 1 <sup>st</sup> SRC	802-770-6423	Discharge of petroleum, which may impact; air, water, soil or groundwater	Additional #'s are listed in Table 1-2 Above
VELCO – 2 <sup>nd</sup> SRC	802-770-6227	Discharge of petroleum, which may impact; air, water, soil or groundwater	Additional #'s are listed in Table 1-2 Above
VELCO System Operator	802-770-6261	In the event that VELCO 1 <sup>st</sup> and 2 <sup>nd</sup> SRC cannot be reached	
VELCO Emergency Line	802-770-6260	For Emergency Situations only	
NYPA SRC	315-764-6850	Discharge of petroleum, which may impact; air, water, soil or groundwater	Additional #'s are listed in Table 1-1 Above
NYPA Alternate SRC	315-764-6854	Discharge of petroleum, which may impact; air, water, soil or groundwater	Additional #'s are listed in Table 1-1 Above
NYPA Transmission Spill Coordinator	315.792.8268	Discharge of petroleum, which may impact; air, water, soil or groundwater	Additional #'s are listed in Table 1-1 Above
Other Cleanup Contractors	Miller Environmental Group 631-369.4900	Any discharge that exceeds the capacity of facility personnel to respond and cleanup	As needed



# MILLER ENVIRONMENTAL GROUP, INC.

The person reporting the discharge must provide the following information:

- Name, location, organization and telephone number;
- Name and address of the owner/operator;
- Date and time of the incident;
- Location of the incident;
- Source and cause of discharge;
- Types of material(s) discharged;
- Total quantity of materials discharged;
- Quantity discharged in harmful quantity (to navigable waters of adjoining shorelines);
- Danger or threat posed by the release or discharge;
- Description of all affected media (e.g., water, soil);
- Number and types of injuries (if any) and damaged caused;
- Weather conditions (if discharge occurred outdoors);
- Actions used to stop, remove, and mitigate effects of the discharge;
- Whether an evacuation is needed;
- Name of individuals and/or organizations contacted; and
- Any other information that may help emergency personnel respond to the incident.



## MILLER ENVIRONMENTAL GROUP, INC.

Whenever the facility discharges more than 1,000 gallons of oil in a single event, or discharges more than 42-gallons of oil in each of two (2) discharge incidents within a 12-month period, the Spill Coordinator must provide the following information to the US Environmental Protection Agency' Regional Administrator within 60 days:

- Name of the facility;
- Name of the owner or operator;
- Location of the facility;
- Maximum storage or handling capacity and normal daily throughput;
- Corrective actions and countermeasures taken, including a description of equipment repairs and replacements;
- Description of facility, including maps, flow diagrams and topographic maps;
- Cause of the discharge(s) to navigable waters, including a failure analysis of the system and sub-systems in which the failure occurred;
- Additional preventive measures taken or contemplated to minimize possibility of recurrence; and
- Other pertinent information requested by the Regional Administrator.



# MILLER ENVIRONMENTAL GROUP, INC.

## DISCHARGE NOTIFICATION FORM

\*\*\* Notification must not be delayed if information or individuals are not available.

Facility:

DESCRIPTION OF DISCHARGE		
Date/time	Release Date: Release Time: Duration:	Discovery date: Discovery time:
Reporting Individual	Name: Tel. #:	
Location of Discharge	Latitude: Longitude:	Description:
Equipment Source	Conservator Tank Transmission Cable 55-gallon drum Tanker Truck	Description:
Product	Dielectric Oil Gasoline Diesel Motor Oil Other*	* Describe other:
Appearance and description		
Environmental conditions	Wind direction: Wind speed	Rainfall: Current:



# MILLER ENVIRONMENTAL GROUP, INC.

<b>IMPACTS</b>		
Quantity	Released:	Recovered:
Receiving medium	Water Land Other (describe)	Release confined to facility property Release outside facility property ** if water, indicate extent and body of water
Describe circumstances of the release		
Assessment of impacts and remedial actions		
Disposal method for recovered material		
Action taken to prevent incident from reoccurring		
Safety Issues	Injuries Fatalities Evacuation	



# MILLER ENVIRONMENTAL GROUP, INC.

Agency	Name	Date/time reported & Comments
VELCO Facility Spill Spill Coordinator 802-770-6423		
NYPA Facility Spill Coordinator 315-764-6850		
National Response Center 1-800-424-8802		
USEPA Region 2 Chris Jimenez 1-732-906-6847		
NYSDEC Spill Hotline 1-800-457-7362		
VTDEC Spill Response Team 1-800-641-5005		
VTDEC Water Supply Division 1-802-241-3400		
Grand Isle Consolidated Water District 1-802-372-8830		
Environmental Spill Cleanup Contractor (631) 369-4900		





**MILLER ENVIRONMENTAL GROUP, INC.**

**APPENDIX B**  
**DISCHARGE PREVENTION BRIEFING LOG**



**VELCO**  
***PV-20 Cable Replacement Project***

**Grand Isle, Vermont**

---

Prepared for **VELCO**  
366 Pinnacle Ridge Road  
Rutland, VT 05701

Prepared by **VHB**  
40 IDX Drive, Building 100  
Suite 200  
South Burlington, VT 05403

**March 10, 2016**





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## 1.0 Purpose and Background

On behalf of Vermont Transco LLC and Vermont Electric Power Company Inc. (hereinafter collectively referred to as "VELCO"), VHB has prepared this Turbidity Monitoring Plan ("TMP") for turbidity monitoring during select in-Lake construction activities for the proposed PV-20 Cable Replacement Project ("Project"). The Project proposes to replace a segment of the existing 115 kV K20 circuit that extends west-to-east between the New York Power Authority ("NYPA") Cumberland Head Substation in Plattsburgh, New York and VELCO's Grand Isle terminal station in Grand Isle, Vermont (refer to the Site Location Map on page 1 of the Attachment). This segment of the existing circuit currently consists of six oil-filled electrical transmission cables still in operation and one abandoned cable that failed in 1969. These seven cables are buried along the land portions and within the shallows of Lake Champlain (the "Lake") and directly laid along the bottom in the deeper portions of the Lake.

The Project involves the installation of four new, extruded dielectric (oil-free) submarine cables within an approximate 500-foot-wide corridor starting approximately 30 feet north of the northernmost existing cable and extending northward within the Lake. Cable installation methods starting from the east at the terminal station to the west at the Vermont/New York state line within the Lake will include open trenching, horizontal directional drilling ("HDD"), jet sledding, and direct laying. The cable installations will occur one at a time, with an anticipated jet sled duration of approximately 2 hours per cable. Although installation work within the Lake is scheduled to occur between June 1 and October 1 of the construction year (with the exception of horizontal direction drill activities), it is currently anticipated that all four cables will be installed over a period of 16 non-consecutive days. This means that there will be a period of time between installations in the Vermont side of the Lake, allowing resuspended sediment to settle prior to the installation of the next cable in the same area of the Lake. Thus, turbidity increases in the water column are not anticipated to accumulate as a result of subsequent installations. In addition, the anticipated monitoring period will be approximately 16 days, more or less, depending on prevailing conditions that affect the speed of installation. VELCO intends to also monitor background conditions for up to two weeks prior to start of the in-lake installation activities.

Once the new cables are installed, tested, and commissioned into service, the seven existing oil-filled cables will be removed, one at a time. Prior to removal of the existing cables, the free-phase oil will be drained and purged with water, air or another innocuous material, to remove oil from within the cables. The land portions of the cables will be removed via open trench methods. Within shallow portions of the Lake (less than 20 feet water depth), the cables were placed under a layer of rip-rap that will likely require mechanical removal methods. The rip-rap will be side cast or placed on a barge deck and replaced once the cable is retrieved. Within deeper portions of the Lake, the cable would be removed utilizing a barge and hoisting system which will lift the cable off the lake bottom onto the barge deck for disposal or recycling. After the rip-rap is removed and the route has been confirmed clear, actual removal of the cables via barge and hoist is anticipated to take 1 day per cable, with removal of all cables completed over a period of 24 days. The 24



days could be non-consecutive depending on unanticipated delays, challenges, etc. The removal work period will take place between June 1 and September 30 of the construction season to allow for mobilization, preparation, cable purging, potential problem solving, and demobilization. Therefore, it is anticipated that the actual turbidity monitoring period will be consistent with actual removal activity duration, and VELCO intends to monitor background conditions for up to two weeks prior to start of the removal activities.

The turbidity monitoring presented herein is proposed to take place during Project activities in the Vermont side of the Lake that are expected to result in the short term resuspension of sediment and thus a short term increase in total suspended solids ("TSS") within the Lake, specifically during cable installation via jet sledding and cable removal activities. Previous modeling and research completed for the proposed Project (VHB, 2015) indicates that the majority of resuspended sediment would extend no more than 200 feet from the work area, would settle within four hours of cable installation via jet sledding, and would not prevent the full support of uses of the Lake, described below in Section 3.1. Installation via HDD and direct lay will result in minimal, disturbance of Lake bottom sediments. Based on available data the existing cables are believed to be covered in varying amounts of sediment. The evidence suggests that the cables are covered with a "dusting" up to 4 feet of lakebed sediments. The proposed removal activities are anticipated to result in minor resuspension of lakebed sediments; however given the nature of the work it is not anticipated to exceed the modeling results associated with the jet sled installation.

For the PV-20 Project, VELCO is proposing to monitor turbidity because TSS needs to be analyzed by a laboratory in which results are not available for a minimum of 24 hours. Given the short duration of each cable's installation via jet sledding and each cable removal for the PV-20 Project, measuring TSS as a means of assessing the Project's real time impact is not appropriate. Rather, VELCO proposes to monitor turbidity, which can be measured in real-time with an in-situ sensor (as described herein) to monitor the Project's impact to water quality.

### **1.1 Study Purpose and Objectives**

Although modeling results indicate that the PV-20 Project installation and removal will comply with the Vermont Water Quality Standards ("VWQS", 2014) for TSS and other water quality parameters (VHB, 2015; HDR, 2014), this turbidity monitoring plan ("TMP") has been established for verification by monitoring real time conditions during construction activities, and to establish water quality action thresholds for the maintenance of VWQS criteria. Further, the TMP has been designed with specific consideration of the Grand Isle Consolidated Water District's ("GICWD's") deep water intake ("Deep Intake"), which is located 3,900 feet to the south of the Project corridor and used to supply water to the VT Fish and Wildlife Department's ("FWD's") Ed Weed Fish Hatchery ("Fish Hatchery") as well as to supply potable water to the GICWD. The Fish Hatchery is sensitive to the amount of turbidity in the water, and although water quality impacts are not expected to be measureable at this distance from the Project, this Plan incorporates turbidity monitoring locations between the Project corridor and the Deep Intake to provide an extra measure of assurance. The TMP has also been designed with consideration of the GICWD Shallow Intake, which is also used to supply potable municipal water.



The data quality objectives for the project are to quantitatively and qualitatively monitor turbidity concentrations within Lake Champlain during new cable installation via jet sledding and the existing cable removal activities. To ensure that the data quality objectives are met, all sampling will occur in accordance with the specifications presented in this TMP.

## **1.2 Project Organization**

The monitoring plan will consist of the following components:

- Real-time in-situ turbidity monitoring approximately 2 weeks prior to and during jet sled installation activities in the Vermont side of the Lake (approximately 14 days of pre-construction monitoring and 16 days of construction monitoring, depending on prevailing conditions)
- Real-time in-situ turbidity monitoring approximately 2 weeks prior to and during cable removal activities in the Vermont side of the Lake (approximately 14 days of pre-construction monitoring and 24 days of construction monitoring, depending on prevailing conditions)
- Visual water surface monitoring during all in-Lake construction activities in the Vermont side of the Lake, including HDD and direct lay.

General TMP coordination is being performed by VELCO and VELCO's qualified consultant (Project's Compliance Team). Monitoring equipment will be supplied by Fondriest Environmental (or similar company). Access and navigation will be coordinated by VELCO and its contractor in consultation with the US Army Corps of Engineers and the US Coast Guard. The roles and responsibilities associated with the equipment supplier and the Compliance Team are summarized below.

### **1.2.1 VELCO and Qualified Consultant**

VELCO and its qualified consultant will be responsible for the following:

- overall project coordination, oversight, and assessment
- field equipment deployment, calibration, and collection
- field analysis and assessment
- sampling quality control
- data processing, data processing quality control, data quality review, and data evaluation (if applicable)
- submit monitoring reports to the Vermont Department of Environmental Conservation ("VT DEC") as described in Section 6.0

Technical Project Manager: VELCO, Timothy Follensbee II, Environmental Manager, 802-770-6423

Quality Assurance Personnel: Qualified Consultant or VELCO Personnel, to be determined ("TBD")

Field Operations Manager: Qualified Consultant or VELCO Personnel, TBD



### **1.2.2 Fondriest Environmental (or similar company)**

Fondriest Environmental (or similar company) will be responsible for the following:

- Equipment factory calibration
- Real-time communication set up
- Web data center host
- Equipment support and troubleshooting

### **1.3 Documents and Records**

Field data and records of calibration of field equipment provided by VELCO's Qualified Consultant will be digitally scanned from the field notebook(s) and stored in the electronic project file. Digital photographs collected from the Project's Monitoring Team will also be stored in the electronic project file. All turbidity measurements collected in real-time will be available to the Project's Monitoring Team in an on-line web center. During active construction, the Project's Compliance Team will actively monitor the turbidity data and all data will be downloaded for backup on a weekly basis.

Work completed will be recorded by the construction crew and relayed to the Project's Compliance Team daily. The Project's Compliance Team will be responsible for recording daily visual observations. Observations will be reported to the Project's Compliance Team more frequently if either visual or turbidity sensor monitoring indicates a potential issue.

All project files will be maintained for a minimum of three years.

---

## **2.0 Monitoring Plan**

In general, real-time, in-situ turbidity monitoring will be conducted during jet sledding cable installation and during cable removal activities within the Vermont side of the Lake. Data buoys with turbidity sensors and data loggers will be installed in the water to the north and south of the Project corridor in order to continuously monitor turbidity conditions up-current and down-current of the Project. Current meters/profilers will also be installed on two of the buoys to monitor flow direction for determining up-current and down-current locations.

Buoys and instruments will be installed up to two weeks prior to the anticipated date of jet sledding and cable removal. Turbidity sensors and current meters (select buoys) will be secured approximately 15 feet off the Lake bottom. Data will be evaluated to assess natural turbidity levels and fluctuations prior to construction activities.

### **2.1 Monitoring Locations**

Installation: During jet sled installation, data buoys will be installed with the goal of monitoring turbidity conditions that may affect general water quality and the Deep Intake. During cable





installation, the greatest sediment disturbance will be during installation of the cables via jet sled, therefore the installation monitoring network has been designed accordingly, as follows (refer to the Turbidity monitoring plan Map for visual representation of the buoy locations and Table 1 for a summary of the locations):

- I-1: Data buoy I-1 will be installed approximately 500 feet to the north of the northernmost proposed cable, laterally located in the approximate center of the jet sled area (estimated water depth of 65 feet). In conditions where the current is flowing to the south, this location will serve as the up-current/ background station.
- I-2: Data buoy I-2 will be installed approximately 500 feet to the south of the southernmost existing cable, laterally located in the approximate center of the jet sled area (estimated water depth of 65 feet). A current meter will be placed on this buoy at the approximate same depth as the turbidity meter to monitor current flow direction. In conditions where the current is flowing the north, this location will serve as the up-current background station. This location also serves to monitor conditions between the project and points located south of the Project area, including, the Shallow Intake.
- I-3: Data buoy I-3 will be installed in a water depth of approximately 180 feet, located approximately 500 feet to the south of the southernmost existing cable. A current meter will also be placed on this buoy to monitor current flow direction at this depth. This location serves to monitor turbidity conditions near the Project at the same depth contour as the Deep Intake.
- I-4: Data buoy I-4 will be installed approximately 2,200 feet to the south of the southernmost existing cable (approximately 870 feet to the north of the Deep Intake) at an approximate water depth of 180 feet. This location serves to monitor turbidity conditions in close proximity to and along the depth contour of the Deep Intake. In the event that elevated turbidity conditions are observed at I-2 and/or I-3, and are determined to be caused by the Project, this point will serve to monitor conditions closer to the Deep Intake. Based on discussions with the Agency of Natural Resources (“ANR”), it possible that the VT Fish and Wildlife Department (“FWD”) may install a turbidity monitoring system to monitor water from the Deep Intake prior to the filtration system. If this is accomplished prior to the initiation of in Lake work for the PV-20 Project, VELCO will work with the ANR representatives and determine if buoy I-4 remains necessary or warranted, given the real-time monitoring within the Ed Weed Fish Culture facility. If it is determined that buoy I-4 is no longer necessary or warranted, then this buoy may be eliminated from the monitoring plan and data from this general location would be supplemented with the data collected from the FWD’s turbidity monitoring of water from the Deep Intake.

<b>Table 1: Summary of Installation Monitoring Network</b>				
<b>Monitoring Location</b>	<b>Water Depth (ft below water surface)</b>	<b>Turbidity Sensor Depth (ft below water surface)</b>	<b>Current Profiler?</b>	<b>Location Purpose</b>
I-1	65	50	No	Overall Project Monitoring;



<b>Table 1: Summary of Installation Monitoring Network</b>				
<b>Monitoring Location</b>	<b>Water Depth (ft below water surface)</b>	<b>Turbidity Sensor Depth (ft below water surface)</b>	<b>Current Profiler?</b>	<b>Location Purpose</b>
				Up-current or down-current station
I-2	65	50	Yes	Overall Project Monitoring; Up-current or down-current station
I-3	180	165	Yes	Deep Intake depth contour close to Project
I-4	180	165	No	Deep Intake depth contour close to Deep Intake

Cable Removal: During the existing cable removal, four data buoys will be installed similarly to the installation layout but R-1 will be shifted to deeper water to distribute the monitoring location to the north more evenly along the entire removal corridor. Removal monitoring locations are described below and summarized in Table 2.

- R-1: Data buoy R-1 will be installed approximately 500 feet to the north of the northernmost proposed cable at an estimated water depth of 180 feet. This location serves to monitor conditions at the same depth contour as the Deep Intake. In conditions where the current is flowing to the south, this location will serve as the up-current background station.
- R-2: Data buoy R-2 will be installed at a water depth of approximately 65 feet, located approximately 500 feet to the south of the southernmost existing cable. A current meter will also be placed on this buoy at approximately the same depth as the turbidity meter to monitor current flow direction. This location serves to monitor turbidity conditions between the Project and points located south of the Project area, including the Shallow Intake.
- R-3: Data buoy R-3 will be installed approximately 500 feet to the south of the southernmost existing cable (estimated water depth of 180 feet). This location serves to monitor turbidity conditions near the Project and at the same depth contour as the Deep Intake. A current meter will also be placed on this buoy at the same depth as the turbidity meter to monitor current flow direction. In conditions where the current is flowing the north, this location will serve as the up-current background station.
- R-4: Data buoy R-4 will be installed approximately 2,200 feet to the south of the southernmost existing cable (approximately 870 feet to the north of the Deep Intake) at an approximate water depth of 180 feet. This location serves to monitor turbidity conditions in close proximity to and at the same depth contour as the Deep Intake. In the event that elevated turbidity conditions are observed at R-2 and/or R-3, and are determined to be caused by the Project, this point will serve to monitor conditions closer to the Deep Intake. As stated above, if the FWD installs a turbidity monitoring system for the Deep Intake prior the PV-20 removal activities and it is determined that this buoy is no longer necessary or



warranted, then it may be removed from this monitoring plan and supplemented with data from the FWD’s turbidity monitoring system.

<b>Table 2: Summary of Removal Monitoring Network</b>				
<b>Monitoring Location</b>	<b>Water Depth (ft below water surface)</b>	<b>Turbidity Sensor Depth (ft below water surface)</b>	<b>Current Profiler?</b>	<b>Location Purpose</b>
R-1	180	165	No	Overall Project Monitoring; Up-current or down-current station
R-2	65	50	Yes	Overall Project Monitoring; between Project and Shallow Intake
R-3	180	165	Yes	Deep Intake depth contour close to Project
R-4	180	165	No	Deep Intake depth contour close to Deep Intake

The distance from the project corridor and water depths may be adjusted based on safety considerations during relevant project activities. The approximate proposed monitoring locations are depicted on the attached Turbidity monitoring plan map, located on page 2 of the Attachment.

The turbidity sensors will be placed approximately 15 feet above the surface of the Lake bottom. Placement closer to the Lake bottom could result in erroneous readings during wave actions.

**2.2 Monitoring Methods and Equipment**

The following equipment specification is based on the rental or purchase of currently-available apparatus from Fondriest Environmental. VELCO may acquire the same or equivalent equipment from a different vendor. Specification sheets, a monitoring system typical diagram, and a monitoring guide from Fondriest Environmental are provided on pages 3 through 20 of the Attachment.

Real-time turbidity data will be achieved through the use of a YSI 6136 turbidity sensor or equivalent. A specification sheet is provided on pages 7 through 8 of the Attachment. The turbidity sensor will be capable of in situ turbidity monitoring and will be self-cleaning for long-term deployment. The sensor will be programmed to record turbidity readings every 10 minutes during the pre-construction monitoring period and during active construction.

Current flow data will be recorded using an Acoustic Doppler Current meter (“ADC” meter, Aquadopp© Current Meter or equivalent). The ADC meter will be mounted on two buoys located to the south of the Project at two different depth intervals to determine the bottom current flow



direction across the Project Corridor, as well as at different depth contours. Readings will be collected every 10 minutes and transferred remotely similarly to the turbidity data.

A data buoy will be used to suspend the turbidity sensors and ACD meters approximately 15 feet above the surface of the lakebed (refer to the Data Buoy Dimensional View, page 3 of the Attachment). The suspension cable will be weighted but not anchored so as to prevent sediment disturbance within the vicinity of the sample location. The data buoy will be secured by two anchor lines with marker buoys to separate the data cable from the anchor lines (refer to the Typical Turbidity Monitoring System diagram, page 4 of the Attachment).

### **2.3 Visual Monitoring**

VELCO and its qualified contractor/consultant will visually monitor water surface conditions within the Project corridor and vicinity during all in-Lake construction activities, including HDD and direct lay, for the presence of potential turbidity issues. Visual observations will be recorded if visibly discolored water is observed by the compliance monitor, either from Project activities or elsewhere, or if turbidity levels at the buoy monitoring locations indicate a potential issue. If visibly discolored water is identified, observations will be recorded based on initial identification and any subsequent turbidity changes during Project activities. In the event significantly discolored water is observed, the monitor may take individual turbidity monitoring samples at the surface or other depths to determine the levels and extent of the turbidity, if warranted, and will record all such data. These observations will be recorded regularly (at least daily) during active Project in-Lake construction, and will be used to supplement or confirm the quantitative real-time data from the buoy mounted monitors (for jet sledding and cable removal).

---

## **3.0 Regulatory Compliance**

This section includes a discussion of applicable regulatory guidance, the establishment of turbidity level action thresholds, and VELCO's response procedures if the action thresholds are observed during in-Lake construction. As previously described, VELCO intends to monitor turbidity during in-Lake construction activities rather than TSS due to the short duration of the proposed Project activities and the time delay associated with collecting and obtaining TSS results. Because the VWQS do not stipulate specific, quantitative turbidity values for such Projects (as discussed below in Section 3.1), VELCO proposes to work with DEC and the FWD to develop acceptable turbidity thresholds for the Project in context of the VWQSs, and specifically, for the protection of the Fish Hatchery. VELCO will coordinate communication with DEC, FWD, GICWD, and other applicable agencies during in-Lake activities.

### **3.1 Vermont Water Quality Standards**

In order to comply with the Project's anticipated Lake Encroachment Permit and §401 Water Quality Certification, VELCO must demonstrate that the Project will comply with the VWQS, and that the



Project will not prevent the full support of uses of the Lake. The VWQS designate the uses of the Lake as follows:

- 1. Aquatic Biota, Wildlife, and Aquatic Habitat** - aquatic biota and wildlife sustained by high quality aquatic habitat with additional protection in those waters where these uses were sustainable at a higher level based on Water Management Type designation.
- 2. Aesthetics** - water character, flows, water level, bed and channel characteristics, exhibiting good aesthetic value and, where attainable, excellent aesthetic value based on Water Management Type designation.
- 3. Public water supply** - Suitable for use as a source for a public water supply with filtration and disinfection.
- 4. Irrigation of crops and other agricultural uses** - suitable, without treatment, for irrigation of crops used for human consumption without cooking and suitable for other agricultural uses.
- 5. Swimming and other primary contact recreation** - suitable for swimming and other forms of water based recreation where sustained direct contact with the water occurs and, where attainable, suitable for these uses at very low risk of illness based on Water Management Type designation.
- 6. Boating, fishing and other recreational uses** - Suitable for these uses with additional protection in those waters where these uses are sustainable at a higher level based on Water Management Type designation.

Additionally, the VWQS (2014) stipulate that for Class B Warm Water Fish Habitat waters (as this section of the Lake is), turbidity shall be “none in such amounts or concentrations that would prevent the full support of uses, and not to exceed 25 NTU (nephelometric turbidity units) as an annual average under dry weather base-flow conditions.” Since a portion of the Project is located in close proximity to the source protection area associated with the GICWD water supply intakes, the turbidity standard for the management of Class A(2) Public Water Supplies has also been considered, which is defined as follows: “none in such amounts or concentrations that would prevent the full support of uses, and not to exceed 10 NTU (nephelometric turbidity units) as an annual average under dry weather base-flow conditions.” Note that these standards are based on annual averages and during dry weather base flow conditions, making these absolute values inappropriate for use in establishing action thresholds. Further, the VWQS establish the TSS standard for these waters as “none in such concentrations or combinations that would prevent the full support of uses.”

### **3.2 Background Turbidity Levels - Deep Intake**

VHB reviewed turbidity data reported on the Vermont Monthly Water System Operations Report for the GICWD (WSID #20614)<sup>1</sup> from June 2015 through September 2015 (representative timeframe for in-Lake work). Based on this dataset, the average turbidity at the deep water intake is 2.4, with a range

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<sup>1</sup> The reports do not indicate which intake the results are from, but DEC staff indicated the reports provided are for the deep intake based on temperature data.



from 0.4 to 9.1. These values do not represent an action threshold, but rather provide an indication of the background range of turbidity variation at the 180-foot depth for one specific 3 month period.

### 3.3 Proposed Action Levels

Given that the FWD currently does not have historical data related to turbidity and/or its impacts on the Ed Weed Fish Culture Station's filtration system, VELCO proposes to work with DEC and FWD to establish turbidity thresholds which would trigger the need to evaluate and/or alter the Project activities. VELCO proposes the following trigger thresholds, with numerical values to be developed in consultation with DEC and FWD:

- Level 1: A certain value, in NTU, above background (up-current location) at a down-current monitoring location located within 500 feet from the Project corridor (dependent upon current flow). The Level 1 trigger would alert the Project team that elevated turbidity levels may be more widespread than predicted by the model, and Level 1 response would be initiated (described below).
- Level 2: A certain value, in NTU, above the background (up-current location) at the monitoring location closest to (or at) the Deep Intake, but only if currents are shown to be flowing from the Project Area to the Deep Intake. The Level 2 trigger, which would presumably be reached after Level 1, would alert the Project Team that elevated turbidity levels caused by the Project could reach the Deep Intake, and Level 2 response would be initiated.
- Level 3: The ultimate threshold, in NTU, determined likely to overwhelm the Ed Weed Fish Culture Station filtration system, regardless of background levels, is observed at southernmost monitoring location (I-4 or R-4, or at the FWD Station). This threshold would only apply if it is determined that the Project is causing the elevated turbidity conditions, which will be determined based on current flow direction and monitoring data closer to the Project.

If these action levels are observed during the active in-Lake Project construction (jet sledding or cable removal) VELCO will initiate Level 1, 2, and 3 response procedures as indicated above and described as follows:

1. Level 1 - Initial Response: VELCO will obtain a collection of manual measurements near the buoys to confirm the results or to determine if sensor calibration is needed. If turbidity levels are verified, VELCO will determine if the Project is causing the elevated turbidity conditions, based on current flow direction and monitoring data closer to the Project; for example, if the current is flowing south and down-current locations closer to the Project indicate relatively higher turbidity levels compared to up-current locations. The compliance monitor will make the decision based on their professional judgment, whether Level 2 response should be initiated, based on the following:
  - a. If the manual measurements indicate there is no turbidity problem resulting from the Project, the compliance monitor will correct the issue, and collect manual measurements to confirm the issue has been resolved. No further action is required.



- b. If the manual measurements indicate a potential problem, the compliance monitor will track the plume in the direction of the current, and initiate Level 2 response if necessary.
2. Level 2 – Notification: If manual measurements confirm the action levels have been reached at the southernmost monitoring location, VELCO will implement Level 2 response by notifying the DEC and other applicable agencies of the turbidity levels and extent. VELCO will concurrently discuss with the contractor and implement changes to the installation or removal methods, such as reducing the water pressure of the jets or altering the speed of jet sled or cable removal. Provided the ultimate threshold determined likely to overwhelm the Ed Weed Fish Culture Station filtration system is not reached at the Deep Intake monitoring location, VELCO may proceed with installation or removal activities, provided VELCO and their contractors are implementing corrective actions to limit water quality impacts and continue to monitor the situation for subsequent changes. VELCO would require the contractor to implement potential corrective actions as soon as feasible, however given the relatively short period of time for each cable installation and/or removal, VELCO assumes that any permanent adjustments to the work activities would need to be made on the subsequent installation or cable removal efforts.
3. Level 3 – Project Evaluation/Agency Coordination: If it is determined that project modifications do not resolve the turbidity issues and the Deep Intake is being overwhelmed as a result of the Project, VELCO would work with FWD, DEC and the Project contractors to evaluate all options to limit impacts to water quality and the intake.

---

## 4.0 Quality Control

### 4.1 Instrument/Equipment Testing, Inspection, Maintenance, and Calibration

Self-wiping, logging optical turbidity sondes (YSI 600 OMS) will be used for field measurements of the in-situ turbidity levels. Maintenance, testing, and calibration of the sensors will be performed by the manufacturer prior to shipment, and by the monitoring team prior to deployment in accordance with manufacturer's specifications as presented in the operations manual for the instrument. The instrument will have a range of 0 to 1,000 NTU with a resolution of 0.1 NTU and accuracy of 2% of the reading. A specification sheet is included on pages 7 and 8 of the Attachment.

### 4.2 Data Management

Water quality data will be managed by VELCO's qualified personnel or consultant. Field data will be collected remotely, downloaded, and stored in the electronic project file at least weekly, and more frequently during sediment resuspension activities. All data will be entered into a Microsoft® Excel



spreadsheet maintained for the project. Within the spreadsheet, one page will be dedicated to each specific sampling location.

#### **4.3 Assessment and Oversight**

It is not anticipated that an intensive assessment and oversight program will be necessary to achieve the required data quality and goals of this project. However, at the discretion of VELCO or their qualified consultant, field sampling instrumentation, data quality, and project management systems could be reviewed at any time during the monitoring program. Any reviews will help ensure that the data collection and analysis methods presented in this Turbidity Monitoring Plan resulted in the collection of water quality data necessary to achieve the goals of the project.

---

### **5.0 Data Validation and Usability**

#### **5.1 Data Review, Verification, and Validation**

Upon inspection of the field-collected data, the data will be accepted for the monitoring program unless there is a noted occurrence of field instrumentation malfunction. These conditions will be clearly noted within field data collection notes and reports submitted to ANR (refer to Section 6.0 for Reporting requirements).

#### **5.2 Verification and Validation Methods**

A specification sheet of the turbidity sensor is attached (pages 7 and 8) which describes the accuracy and validation of the instrument.

---

### **6.0 Reporting**

As stated in Section 3.0, if data indicates that the established turbidity threshold is reached, then VELCO will verbally notify the ANR within 24 hours of the occurrence. A written report with applicable data will be provided within one week of the initial detection.

Final summary reports and all data will be submitted within 90 days of completion of the jet sled installation and within 90 days of the completion of cable removal.



---

## 7.0 Summary

VELCO proposes to conduct turbidity monitoring during in-Lake Project activities (Vermont side of the Lake), specifically cable installation via jet sledding and cable removal, that are expected to result in the short term resuspension of sediment and thus a short term increase in TSS (and resultantly turbidity) within the Lake. The monitoring plan has been designed to monitor the Project's overall turbidity impact and specific monitoring is proposed to ensure the Project does not result in adverse effects to the GICWD intakes, specifically the Deep Intake, which also serves the Ed Weed Fish Culture Station. Refer to Tables 1 and 2 in Section 2.1 for Table summaries of the monitoring network.

VELCO proposes to work with DEC and FWD to establish turbidity thresholds which would trigger the need to evaluate or alter the Project's activities. VELCO proposes two thresholds, with numerical values to be agreed upon as described in section 3.3 above. If these action levels are observed during the active in-Lake Project construction (jet sledding or cable removal) and are verified to be a result of the Project activities, then VELCO will initiate Level 1, 2, and 3 response procedures as outlined above in section 3.3.

In conclusion, by implementing this proposed TMP, VELCO will demonstrate the Project's compliance with the VWQSs and will provide adequate protection for the Grand Isle Consolidated Water District Intakes and Ed Weed Fish Culture Station.



---

## References

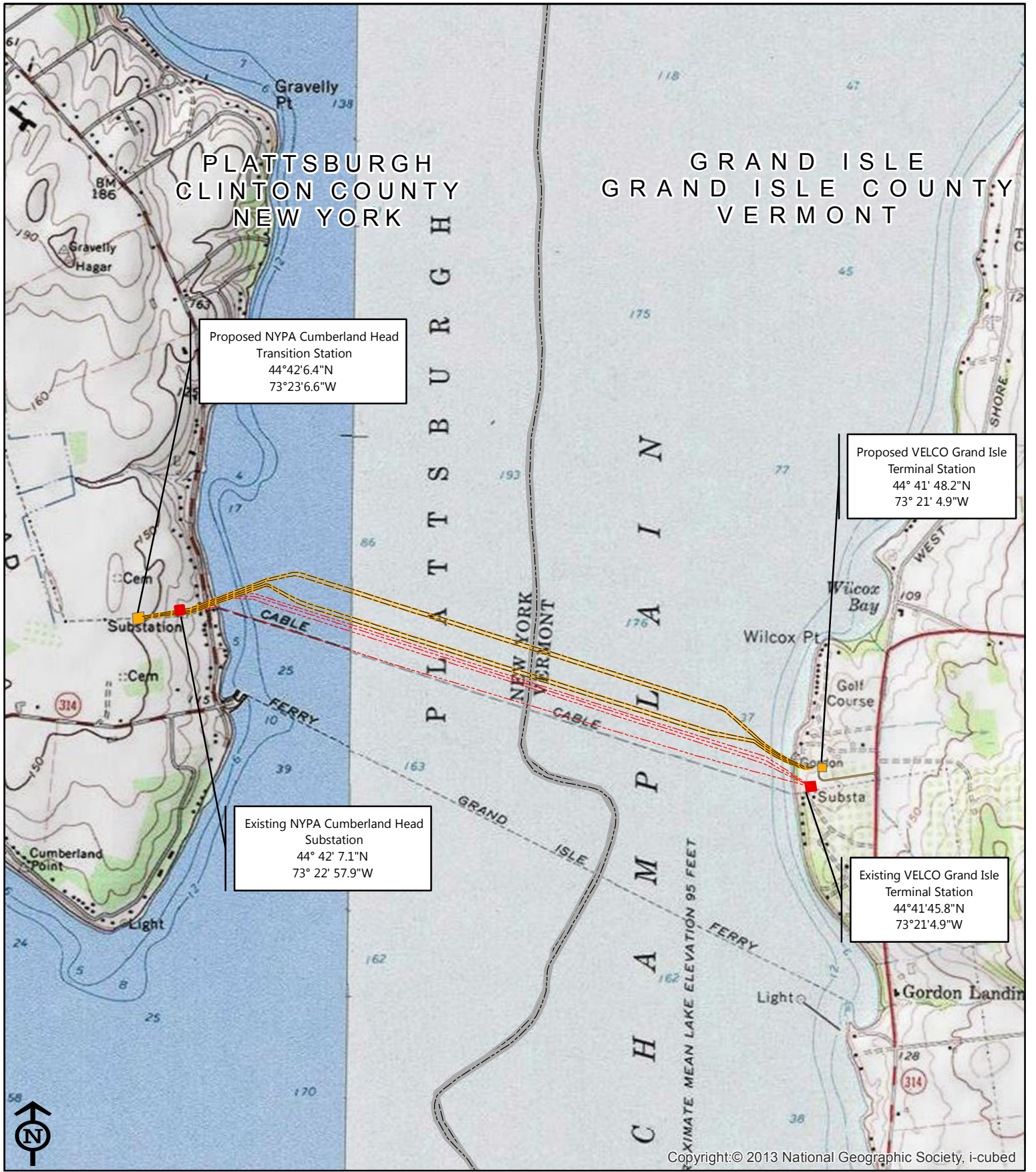
HDR, 2014. Lake Champlain Water Quality Monitoring Report. New England Clean Power Link. December 2014. Exh. TDI-AT-2 of PSB Docket 8400.

Vermont Agency Of Natural Resources, Department of Environmental Conservation, 2014. "Vermont Water Quality Standards, Environmental Protection Rule Chapter 29(a)." Effective October 30, 2014.

VHB, 2015. VELCO PV-20 Lake Champlain Crossing Water Quality Assessment Memorandum. July 13, 2015.

\\vtfnfdata\projects\57660.00 NYPA PV-20\reports\Water Quality Monitoring Plan\VELCO Turbidity Monitoring Plan final.docx

# ATTACHMENT



Proposed NYPA Cumberland Head  
Transition Station  
44°42'6.4"N  
73°23'6.6"W

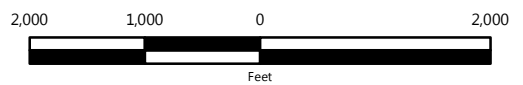
Proposed VELCO Grand Isle  
Terminal Station  
44° 41' 48.2"N  
73° 21' 4.9"W

Existing NYPA Cumberland Head  
Substation  
44° 42' 7.1"N  
73° 22' 57.9"W

Existing VELCO Grand Isle  
Terminal Station  
44°41'45.8"N  
73°21'4.9"W

- Legend**
- - - Existing Cables (Approx.)
  - Proposed Replacment Cable Locations (Approx.)
  - Proposed Terminal Station
  - Existing Terminal Station
  - State Boundary

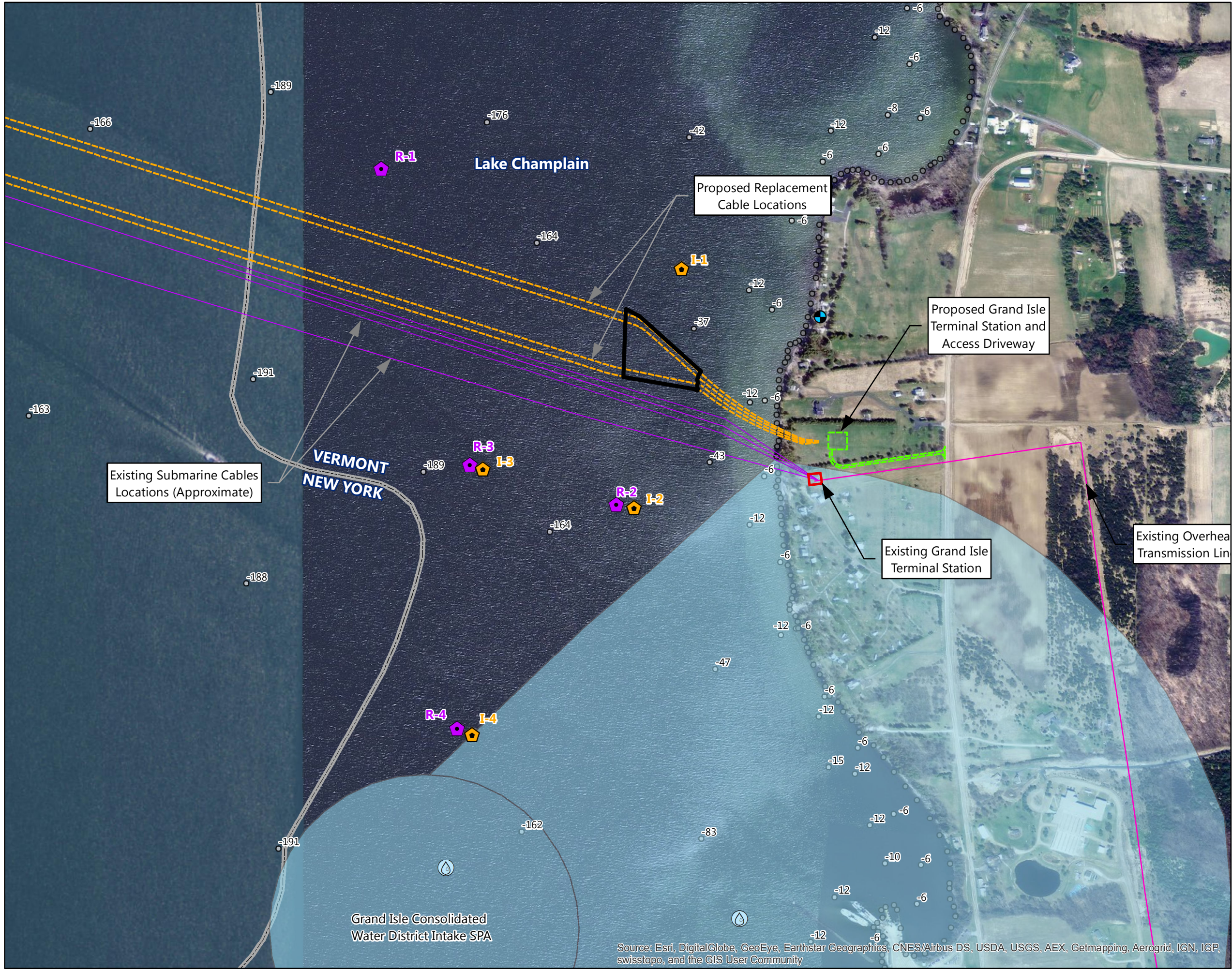
**VELCO and NYPA  
PV-20 Submarine Cable Replacement Project  
Grand Isle, VT and Plattsburgh, NY  
Site Location Map  
December 11, 2015**



Sources: USGS Topo Quads from ESRI (2015); State and Town Boundaries from VCGI (2010); Approximate Replacment Cable Locations, Existing and Proposed Terminal Station Locations from CHA (2015); Approximate Existing Cable Locaitons Digitized from Plans Provided by CHA (2015).

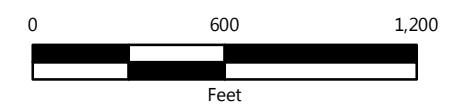


Vermont Transco, LLC  
 PV-20  
 Submarine Cable Replacement Project  
 Grand Isle, Vermont  
 Water Quality Monitoring  
 Plan Map  
 January 8, 2016



**Legend**

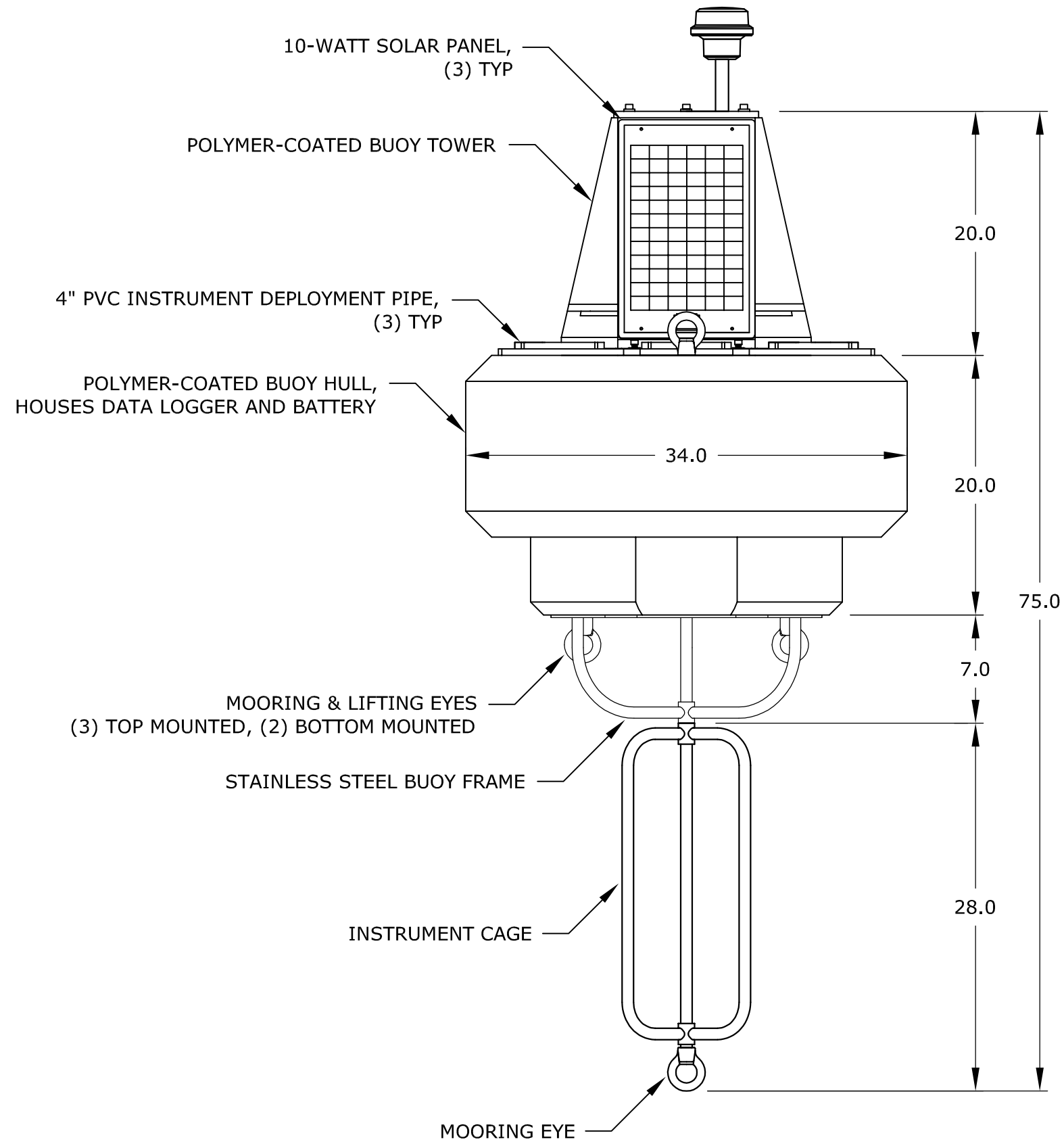
- Data Buoy for Removal Monitoring
- Data Buoy for Installation Monitoring
- Jet Sled Zone
- Existing Infrastructure**
- Transition Station
- Submarine Cables (Approximate Location)
- Overhead Transmission Line
- Proposed Infrastructure**
- Proposed Replacement Cables
- Proposed Transition Station and Access Driveway
- Public Water Source**
- Surface Water Intake
- Groundwater Supply Source
- Surface Water Protection Area (VT ANR)
- 10 ft. Contour (VCGI)
- Bathymetric Depth
- Shore (0 ft)
- State Boundary (ESRI)



Sources: Background Orthophoto by VMP (2012);  
 Surface Water Protection Area by VT ANR  
 and downloaded from VCGI (2012); State boundaries  
 from ESRI (2013); Existing and Proposed Project  
 Infrastructure digitized from CHA Plans (2015).  
 Bathymetry from VCGI (DEM).



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



### CB-450 DATA BUOY DIMENSIONAL VIEW

SCALE: 1:10



DRAWN BY: MHD

DATE: 8/12/14

SHEET: 1 of 1

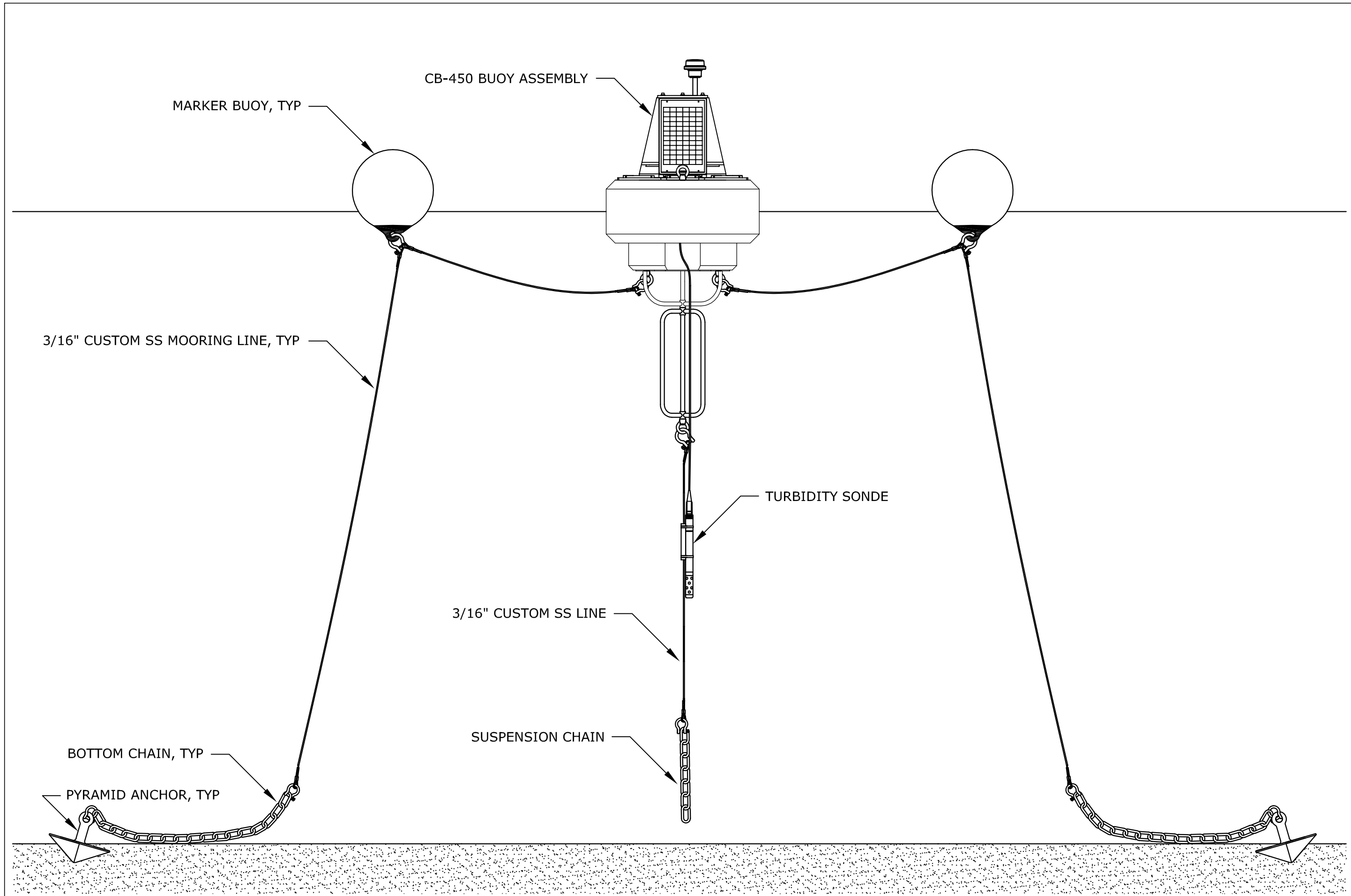
ITEM: NEXSENS CB-450 COASTAL DATA BUOY

SHEET TITLE: DATA BUOY DIMENSIONAL VIEW

DRAWING NUMBER: NEX198

REV: 01

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**TYPICAL TURBIDITY MONITORING SYSTEM**

SCALE: 1:20



ITEM:	NEXSENS CB-450 COASTAL DATA BUOY		
	DRAWN BY:	MHD	
SHEET TITLE:	DATE:	8/12/14	
	SHEET:	1 of 1	
DRAWING NUMBER:	NEX199	REV:	01
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# CB-450

## DATA BUOY

- Self-powered data logging buoy
- Wi-Fi, radio, cellular or satellite telemetry
- Supports a variety of environmental sensors
- Accommodates most environmental data loggers
- Rugged polymer-coated foam hull



The NexSens **CB-450** Data Buoy is designed for deployment in lakes, rivers, coastal waters, harbors, estuaries and other freshwater or marine environments. The floating platform supports both topside and subsurface environmental monitoring sensors including weather stations, wave sensors, thermistor strings, multi-parameter sondes, Doppler current profilers and other monitoring instruments.

The buoy is constructed of an inner core of cross-linked polyethylene foam with a tough polyurea skin. A topside 20" tall stainless steel tower includes three 10-watt 12 VDC unbreakable solar panels, and a center 10" ID x 18" tall instrument well accommodates batteries, data loggers, sensors, and more. Three 4" pass-through holes with female NPT bottom threads allow for quick connection of instrument deployment pipes and custom sensor mounts. The stainless steel frame supports both single point and multi-point moorings.

The **CB-450** Data Buoy is optimized for use with NexSens data loggers. Wireless telemetry options include Wi-Fi, spread spectrum radio, cellular and Iridium satellite. Compatible digital and analog sensor interfaces include RS-232, RS-485, SDI-12, VDC, mA, and pulse count. The top of the instrument well includes 8 pass-through ports for power and sensor interface. Each port offers a UW receptacle with double O-ring seal for a reliable waterproof connection.

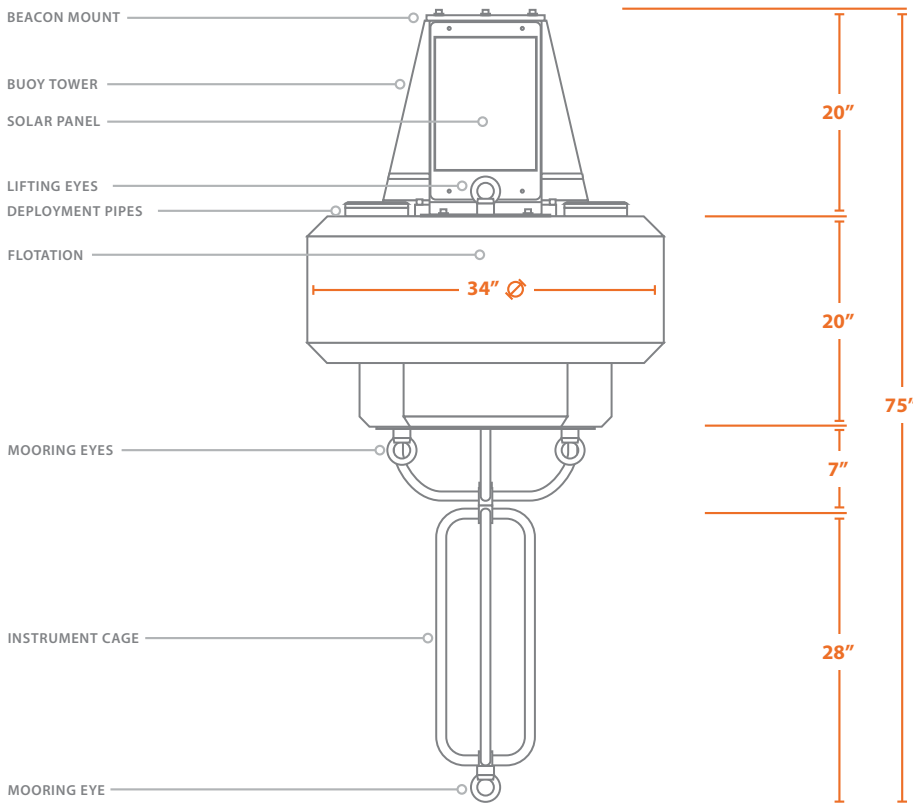


# CB-450

DATA BUOY

## specifications

Hull Dimensions	34" (86.36cm) outside diameter; 20" (50.80cm) tall
Tower Dimensions	20" (50.80cm) tall, triangular
Data Well Dimensions	10" (25.40cm) inside diameter; 18" (45.72cm) tall
Weight	130 lbs.
Buoyancy	450 lbs.
Hull Material	Cross-linked polyethylene foam with polyurea coating & stainless steel deck
Hardware Material	304 stainless steel
Mooring Attachments	1 or 2 point, 3/4" eyenut
Solar Power	(3) 10-watt 12 VDC solar panels



## parts list

Part #	Description
CB-450	Data buoy with polymer-coated foam hull & (3) 10-watt solar panels, 450 lb. buoyancy
CB-A05-1	Battery harness with integrated solar regulator & (1) 28 A-Hr battery
CB-A05-2	Battery harness with integrated solar regulator & (2) 28 A-Hr batteries
iSIC-CB	iSIC data logger housed in CB-Series buoy lid enclosure
RTU-R	Spread spectrum radio & antenna kit
RTU-C	Cellular modem & antenna kit
RTU-I	Iridium satellite modem & antenna kit
M550-P-Y	Solar marine light with pole mount & 1-3 nautical mile range, 15 flashes per minute, yellow
914M	Deployment pipe assembly with eye bolt & threaded male adapter, 4" schedule 80 PVC, 32" length
CB-WS-M	Lufft WS-Series weather sensor mount for CB-Series data buoys
CB-WX-M	Airmar WX-Series weather sensor mounth for CB-Series data buoys



tel: **937.426.2703**  
8am to 7pm EST, Monday-Friday

fax: **937.426.1125**

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Fairborn, OH 45324  
info@nexsens.com

[nexsens.com](http://nexsens.com)



## YSI 6136 Turbidity Sensor

### *Accurate, in situ turbidity measurements*

The 6136 is a fouling-resistant, wiped sensor designed to seamlessly integrate – using no external interface hardware – with all YSI sondes that contain an optical port. It provides accurate, *in situ* measurement of turbidity in fresh, brackish, and sea water, and features an improved mechanical self-wiping capability for long-term monitoring, which helps ensure proper turbidity measurements.



YSI 6136 Optical Turbidity Sensor

- *In situ* monitoring
- Self-cleaning sensor for long-term deployment
- Field-replaceable

### *Take Advantage of YSI's New V2 Sondes*

Expand your optical monitoring capability and upgrade your 6820, 6920, or 6600. V2 upgrades increase the number of optical ports on your sonde, allowing for measurement of additional optical sensors including:

- Turbidity
- Blue-Green Algae - Phycocyanin (for freshwater applications)
- Blue-Green Algae - Phycoerythrin (for marine applications)
- ROX™ Optical Dissolved Oxygen
- Chlorophyll
- Rhodamine

Upgrades are available from YSI Authorized Service Centers. Contact YSI for details.

Pure  
Data for a  
Healthy  
Planet.®

Accurate, *in situ* turbidity  
measurement

### **Sensor performance verified\***

The performance of the YSI 6136 Turbidity Sensor was verified through the US EPA's Environmental Technology Verification Program (ETV).





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**ISO 14001**  
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Printed in USA 0109 E56-03

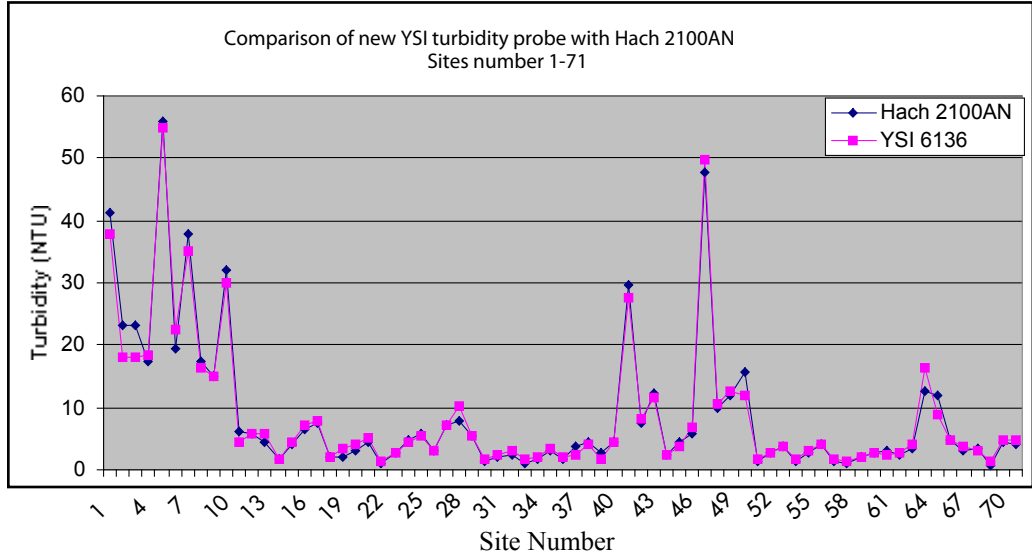


\*Sensors with listed with the ETV logo were submitted to the ETV program on the YSI 6600EDS. Information on the performance characteristics of YSI water quality sensors can be found at www.epa.gov/etv, or call YSI for the ETV verification report. Use of the ETV name or logo does not imply approval or certification of this product nor does it make any explicit or implied warranties or guarantees as to product performance.

YSI incorporated  
Who's Minding the Planet?®

## Excellent agreement with the industry standard

Extensive empirical field and laboratory tests performed by YSI and independent agencies in Alpha and Beta studies document close agreement between *in situ* measurements made with the YSI 6136 turbidity sensor and data from the Hach® 2100AN, a laboratory instrument recognized as the standard for turbidity measurement.



Comparison of turbidity measurements made with the YSI 6136 Turbidity Sensor and Hach® 2100AN at 70 different riverine and lacustrine sites exhibiting widely varying (lower) turbidity ranges.

## YSI 6136 Sensor Specifications

	Range	Resolution	Accuracy
Turbidity* 6136 Sensor*	0 to 1,000 NTU	0.1 NTU	±2% of reading or 0.3 NTU, whichever is greater**

\* Maximum depth rating for all standard optical sensors is 200 feet, 61 m. Turbidity is also available in a Deep Depth option (0 to 200 m).

\*\*In YSI AMCO-AEPA Polymer Standards.

## Applications include:

- Dredging
- Storm water
- Construction site monitoring
- Vertical profiling
- Long-term studies
- Surface water evaluations
- Circulation in lakes, reservoirs, bays, and estuaries

# MONITORING TURBIDITY AT DREDGING SITES

A GUIDE TO UNDERSTANDING AND ESTABLISHING TURBIDITY AS A REAL-TIME MONITORING SOLUTION



**FONDRIEST**  
ENVIRONMENTAL

## WHAT'S INSIDE

- 01 Environmental Dredging: Overview of USACE Guidelines
- 02 A Real-Time Solution
- 04 Turbidity Technology
- 06 Typical Turbidity Monitoring System
- 08 Points of Compliance
- 10 Data Management
- 12 Quality Assurance
- 14 Recommended Equipment
- 16 Purchase or Rent?
- 17 About Fondriest Environmental
- 18 System Configuration Tool

# WHY MONITORING MATTERS

Dredging is a common and economically viable solution for the removal and subsequent treatment of contaminated sediment. If executed properly, dredging can yield positive environmental results without harming water quality conditions. Dredging operations should aim to remove sediment as efficiently as possible while diminishing short-term environmental impacts, most notably the re-suspension of potentially contaminated sediments.

To minimize sediment re-suspension and contaminant release, a monitoring system should be established. Sediment can easily be dislodged by dredging and dispersed into the water column. This re-suspension may damage water quality both in the immediate vicinity as well as downstream as it travels with the current. Additionally, if the suspended sediment is contaminated, it can release toxins into the water and air. Effective monitoring of re-suspended sediments for the duration of dredging operations is crucial to maintaining acceptable water quality levels for both wildlife and humans.

For this reason, the U.S. Army Corps of Engineers (USACE) and Environmental Protection Agency (EPA) offer extensive guidelines for estimating the environmental consequences of a dredge. The guides also emphasize the need to monitor these effects as the dredging operation occurs in order to keep any re-suspension and transport under control. These monitoring efforts allow project managers to respond if re-suspended sediment levels exceed pre-established parameters by slowing down or altering the dredging.

For the complete USACE's Technical Guidelines for Environmental Dredging of Contaminated Sediments, visit:  
<http://el.erdc.usace.army.mil/elpubs/pdf/trel08-29.pdf>

For the complete EPA's Contaminated Sediment Remediation Guidance for Hazardous Waste Sites, visit:  
<http://www.epa.gov/superfund/health/conmedia/sediment/pdfs/guidance.pdf>

**FONDRIEST**  
ENVIRONMENTAL

## ENVIRONMENTAL DREDGING

### Overview of USACE Guidelines

Environmental dredging is defined as: "the removal of contaminated sediments from a water body for purposes of sediment remediation" (USACE). While there are several approaches to dealing with contaminated sediment, dredging is frequently the cleanup method of choice for projects under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the "Superfund" program.

As no two projects are identical, the specific environmental limits set for a dredging project will vary. Several influencing factors include location, sediment composition, acting regulatory agencies and environmental laws. To assist with this effort, the U.S. Army Corps of Engineers (USACE) has generated a comprehensive set of guidelines to evaluate environmental dredging as a solution for sediment remediation projects. While the EPA's remediation guide addresses all possible steps and alternatives for dealing with contaminated sediment, the USACE's guide focuses specifically on the dredging component.

These guidelines provide detailed steps regarding the establishment of a dredging operation, from the preliminary evaluation to the process, methods and control procedures. In doing so, this guide establishes a hierarchy of objectives regarding the technical aspects of a remedial dredging operation. These objectives aim not only to minimize sediment re-suspension, release and residuals, but also to maintain a cost-effective strategy in both the short and long term.

Both of these guidelines stress the importance of implementing a monitoring strategy that provides rapid feedback, allowing dredge operators to respond to high re-suspension levels before they become problematic. Established limits for sediment re-suspension (maximum allowable levels for water quality and released contaminants), may be a part of dredging regulations established in consultation with stakeholders, or by federal acts and regulatory agencies.

The USACE recommends drafting a comprehensive monitoring plan that includes equipment and techniques to use, protocols for sampling, where to place sampling devices and details about how to interpret the monitoring data. Furthermore, the guidelines suggest creating a management plan that describes the specific actions to be taken based on the results of the monitoring. This may include increasing monitoring locations/sampling frequency to further assess impacts, implementing operational controls (i.e., stopping or slowing down dredge work), altering debris management or changing equipment. To this end, the USACE technical guidelines advise incorporating real-time feedback on re-suspension into the monitoring plan to make early identification of problems possible. The most rapid and efficient management responses are achievable with this real-time data.



# A REAL-TIME SOLUTION

Measuring total suspended solids (TSS) directly is the best method for evaluating sediment concentrations. However, it is not feasible for real-time applications such as monitoring sediment re-suspension during dredging operations. At present, TSS can only be accurately measured by collecting water samples and conducting laboratory tests, which require filtering the sediment from the water, drying and weighing it. This procedure is too time-consuming for monitoring dredge sites, considering the quick feedback required to allow timely control measures. This is particularly true in cases when the dredged sediment contains contaminants that pose an added risk to wildlife and people. To achieve this real-time monitoring, turbidity, a measure of water clarity, is substituted for TSS.

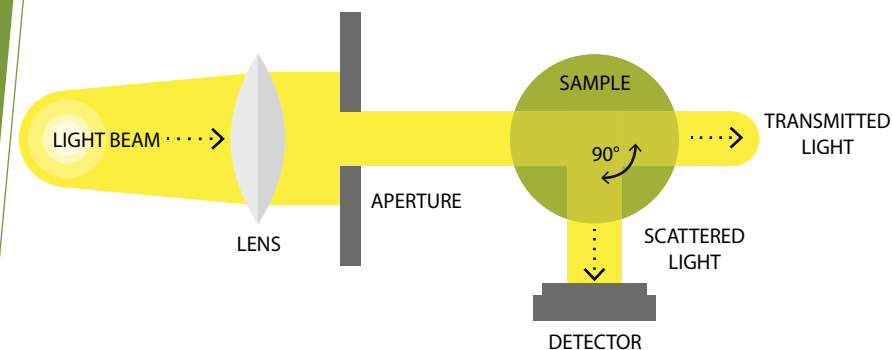
## Measuring Turbidity

Turbidity data can be substituted for total suspended solids because it is an indirect measure of the particle density in the water. When monitoring dredging operations, turbidity readings can approximate levels of re-suspension and indicate the likelihood of released contaminants in real time. As an optical measurement, turbidity monitoring requires a light source and a photodetector.

The light source in the instrument generates an incident light beam, which is scattered in all directions by particles in the water. The more particles present in the water, the more the light will scatter. A photodetector is set up to measure the amount of light scattered at a specified angle. Most turbidity instruments use nephelometry, which requires a 90-degree angle for measurement. This is considered the most accurate method and is approved by both the Environmental Protection Agency (EPA) and International Organization for Standardization (ISO) quality design standards. Other detector angles, such as backscatter, can provide useful data but they are not considered approved methods.

Real-time turbidity data are achieved with the use of a dynamic turbidity instrument, also known as a turbidity sensor. These sensors are submerged in a body of water for continuous turbidity monitoring. Turbidity meters, on the other hand, use a water sample instead of measuring in the water directly. This means they cannot be used in-situ for real-time data. While turbidity meters can be used to check data quality, they are not recommended as primary monitoring sources for dredging applications.

Most turbidity sensors are connected to a buoy-based sonde or a data logger for recording data. This is the preferred turbidity monitoring method by the U. S. Geological Survey, as in-situ measurements more accurately represent surface water conditions than sampling methods. In addition, the real-time availability of data from submersible sensors improves control measure response times when turbidity levels change.



Turbidity sensors can use nephelometric (90 degree) or backscatter (>90 degree) technology to measure the amount of light scattered by particles in water. The sensor is designed with two optical windows, generally located on the same flat surface of the sensor. The light source and the photodetector are located below the optical windows, and are tilted to achieve the desired scattered-light angle. The single flat surface means that a turbidity sensor can be wiped, or cleaned remotely, during a deployment. Regularly wiping the sensor windows prevents fouling (attachment of inorganic material such as silt or biological material such as algae or barnacles). Wipers can be built into the sensor, or attached to a separate brushing mechanism. Fouling on the sensor windows can yield artificially high turbidity readings as the material can block light from entering the water or from returning to the detector.



## Turbidity Units and Reporting

Thanks to the multitude of instrument designs, turbidity reporting can quickly become confusing. There is also a large amount of misinformation regarding approved standard compliance and which turbidity units should be used in reporting. Turbidity units are only useful and accurate if they are reported correctly – with correspondence to a specific instrument design. On their own, turbidity units (including NTU and FNU) have no inherent value, physical or otherwise. They are a qualitative, rather than a quantitative, measurement.

Turbidity, and thus particle density, is a function of the amount of light that is scattered at specific angles. However, the physical properties of these particles – shape, color and distribution – can affect the measurement. This means that two water samples with the same level of suspended solids but with varying particle compositions could result in different turbidity readings. In addition, longer and shorter light wavelengths interact with and reflect off of particles in different ways. This means that two instruments with different light sources may not measure the same level of turbidity in the same water sample. Finally, the measurement angle within an instrument is only accurate within a specific turbidity range. Some angles are accurate for lower turbidity levels, while others are intended for very high measurements.

The solution to all of these variables is in the turbidity unit. The USGS and ASTM have developed a list of ten different turbidity units, each intended for use with a specific instrument design. As turbidity instrument designs vary by light source and measurement angle, these factors will determine which units should be used. If the light source or the angle changes, so will the recommended unit. Three of these units are commonly used in dredge turbidity monitoring, listed at the bottom of this page.

Each instrument design has its own designated unit, and the misappropriation of turbidity units, particularly NTU, diminishes their accuracy and usefulness. Unfortunately, most turbidity data in the U.S. have been reported in NTUs over the past two decades, regardless of their light source or detector geometry. The USGS's revised turbidity protocol (2004) is working to improve the comparability of turbidity data by requiring that reported units match the instrument design.

As mentioned earlier, the U.S. Environmental Protection Agency (USEPA) and the International Organization for Standardization (ISO) have established specific requirements for turbidity instrument designs. The quality design standards are known as EPA Method 180.1 and ISO 7027. As the EPA Method 180.1 requires a tungsten lamp light source and a 90-degree measurement angle, it falls under the nephelometric, white-light turbidimeter category. Thus, instruments in compliance with EPA Method 180.1 report in NTU: Nephelometric Turbidity Units.

ISO 7027 requires a near-infrared LED light source and a nephelometric measurement angle, so instruments in compliance with this design report in FNU: Formazin Nephelometric Units. Formazin is the recommended calibration standard for many of these instruments. The third well-known design is not compliant with any approved design standards. Instruments that follow the backscatter, near-IR turbidimeter design should report in FBU: Formazin Backscatter Units.

Most submersible turbidity sensors use a near-infrared LED light source due to the low power draw, and thus should report in FNU or FBU. Turbidity meters (used for data quality assurance) may contain a white light (400-680) instead of a near infrared light. These instruments report in NTU.

Common Turbidity Monitoring Instrument Design	Unit
Nephelometric white-light turbidimeter	NTU
Nephelometric near-IR turbidimeter	FNU
Backscatter, near-IR turbidimeter	FBU

# TURBIDITY TECHNOLOGY

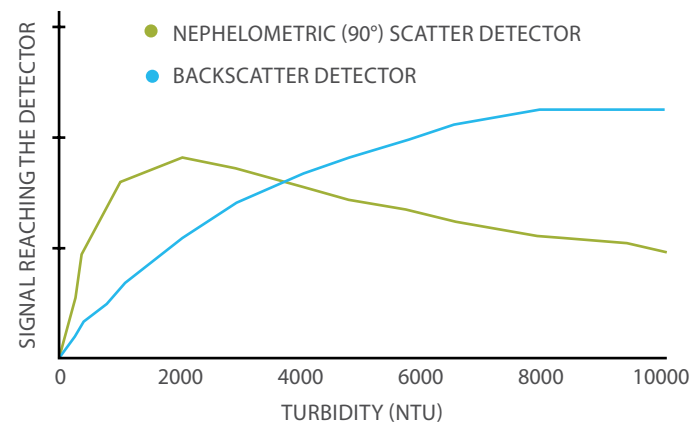
The most commonly used turbidity monitoring systems will use a submersible sensor to monitor for sediment re-suspension. These turbidity sensors can use nephelometry or backscatter technology to measure the amount of light scattered by particles in the water.

Regardless of the sensor chosen, it is important to use the same sensor model throughout a project for internally consistent data. While inter-instrument relationship models can be developed, data from different instrument designs are not directly comparable. Each sensor will read varying amounts of light scatter from suspended particles due to the differences in light source and measurement angle. In turn, the sensors will output varying results despite measuring the same water sample. In addition to cost considerations, sensor choice should be based on expected or potential turbidity readings (low, high or a wide range), and whether or not compliant and comparable data would be useful.

## Nephelometry

Nephelometry is a measurement method with a light source and a photodetector set at a 90-degree angle from each other. This is the angle that is most sensitive to light scatter as it is not affected by particle size.

Most nephelometric turbidity sensors comply with ISO 7027 guidelines. While other sensor designs exist, compliance with ISO 7027 ensures accurate and comparable turbidity readings. In addition to the high sensitivity, the relationship between nephelometric light scatter and particle density is fairly linear. However, it becomes non-linear above 40 NTU and inaccurate at higher turbidities. To account for this, some sensors offer a secondary algorithm for measurements over 1000 NTU. This yields less precise readings, but the accuracy is improved over non-adjusted nephelometric sensors.



## Backscatter

A backscatter sensor uses a photodetector centered past the 90-degree angle (90-180 degrees from the transmitted light). Backscatter sensors have several advantages: 1) a wide measurement range; 2) improved accuracy at higher turbidities (over 1000 NTU); 3) a tolerance for a varying particle sizes. Between 1000-4000 NTU, backscatter technology is nearly perfectly linear. However, during periods of low turbidity, a backscatter sensor will not be as accurate as a nephelometric instrument. Backscatter sensors are also more prone to color interference due to particle darkness value (the ability to reflect near-IR bands).

The largest disadvantage for backscatter sensors, however, is the lack of comparability. The USGS and several backscatter sensor manufacturers have attempted to define appropriate backscatter angles (e.g. 135-180 degrees

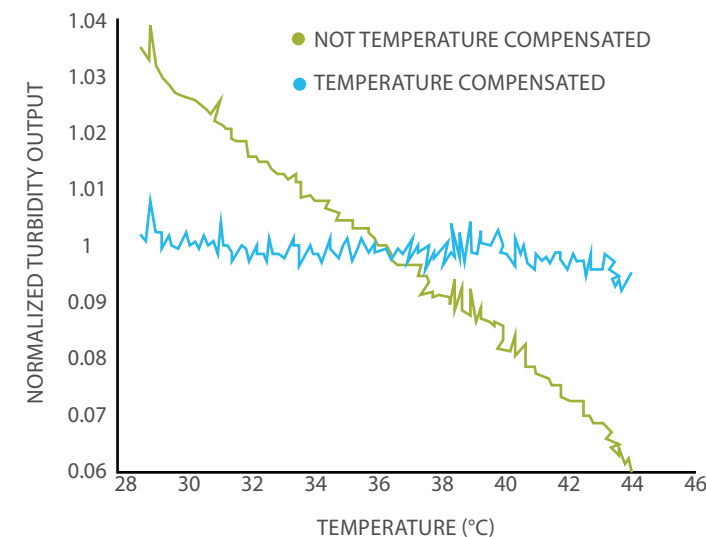
from the incident light). At this time, no current design standard has been set for these sensors. As such, any scattered light detection centered between 90-180 degrees from the transmitted light can be accepted as a backscatter sensor. Without a standardized quality guide for these instruments, any data received are not comparable to any other instrument.

## Method Compliance

Many turbidity monitoring projects want data to be EPA compliant. However, no true, EPA 180.1 compliant submersible turbidity sensors exist. For in-situ monitoring, the USGS instead recommends ISO 7027 compliant sensors.

The requirement of a tungsten lamp light source makes any dynamic EPA Method 180.1 instrumentation impractical. Tungsten lamps have a high power draw, require warm-up time and have an energy output that deteriorates with age. This means that instruments in compliance with this method will require frequent calibrations and bulb replacements. While this is simple enough with a handheld meter, it becomes impractical in a submersible sensor.

On the other hand, LED light sources are compact and have a smaller power draw. LEDs also have a longer lifetime than tungsten lamps, no warm-up period and they can be modulated to reject ambient light. Modulating, or rapidly pulsing, a light source reduces errors due to ambient light. This makes LED light sources ideal for long-term deployments. However, sensors with an LED light source should be compensated for temperature. While turbidity itself is not affected by temperature, the LED is. Changes in the internal temperature will affect the optical power output of the LED. As temperature increases, output intensity (brightness) will decrease, which in turn affects the measured turbidity reading. Some turbidity sensors include an



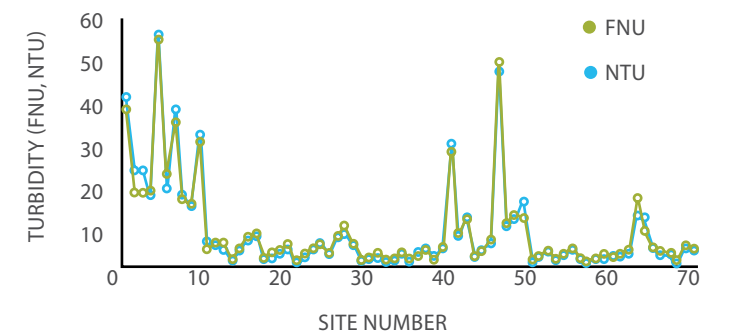
internal thermistor to compensate for these effects, while others offer the ability to make adjustments in the software. For sensors that do not compensate for temperature, a minor drift can be seen in the turbidity readings as the temperature of the LED rises.

In addition to the longevity and stability of an LED light source, near-infrared LEDs (780-900 nm) offer further advantages by reducing color interference. Near-infrared wavelengths are less likely to be absorbed by particles in the water, and thus will have a lower error value than broadband light (which can be partially absorbed). This means that colored dissolved material in the water, such as a dye or humic stain, will not affect ISO 7027 compliant sensors. White/Broadband light instruments however, (including EPA Method 180.1 turbidity meters) will be affected if color is present.

Due to the advantages of a near-infrared LED, most nephelometric turbidity sensors follow ISO 7027 guidelines. While other designs, including backscatter, also use a near-infrared LED, ISO 7027 compliance ensures accurate and comparable turbidity data.

## NTU and mg/L: Unit Conversions

For relation to an EPA-approved method (measurements in NTU), an EPA-approved turbidity meter can be used to spot sample at regular intervals for quality assurance of the sensor data. These data can then be used to establish a correlation between the sensor data and the EPA-approved data. However, a calculated model between data sets is only valid for the location where measurements were taken. At other locations, suspended particles may vary in size, material and distribution, and any constructed conversion will no longer be accurate.



Likewise, models can be created to calculate total suspended solids from turbidity. TSS samples will need to be collected and measured to establish a relationship between turbidity and suspended solids. In most situations, a relationship is derived through a single or multiple linear regression model. Once a regression model has been approved, it can be used to predict TSS concentrations.

# TYPICAL TURBIDITY MONITORING SYSTEM

When dredging, it is necessary to monitor sediment re-suspension levels to prevent damage to the local ecosystem and minimize the spread of contaminants. This is usually done with a turbidity monitoring station upstream (for background data) and two stations downstream (at locations affected by the dredging).

To be effective, measurement data should be provided in real time. The easiest and most efficient way to do this is with a buoy-based turbidity monitoring system. A data buoy can house sensors at multiple depths in the deepest part of the waterway, providing more comprehensive data than a shore-based system. This system can then securely transmit the data to the Internet in real time for access from any computer.

Buoy systems are flexible and customizable based on the dredging project requirements. They can house as many sensors as needed, and all equipment is powered via a marine battery and recharging solar panel system. With multiple telemetry options to choose from, continuous real-time data are available from any computer. This ensures that the dredging operations progress smoothly, and any control measures can be implemented immediately if parameter limits are exceeded.

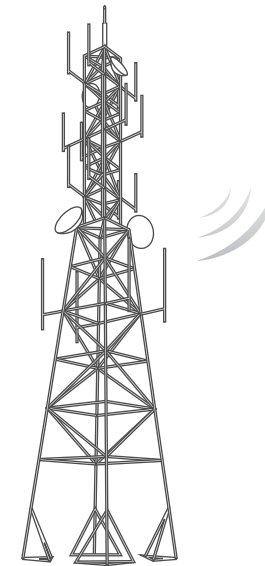


## Dredge

Dredges are excavators used to remove contaminated sediment from the water. They can be hydraulic, mechanical or a hybrid. Most are mounted on a spud barge. An additional barge may be needed for sediment disposal.

## Telemetry

Telemetry provides access to data in real time. The wireless communication can be radio-to-shore, cellular or satellite based.



## Data Buoy

A data buoy is a floating platform that supports real-time monitoring instruments such as sensors and data loggers. In addition to housing the monitoring equipment, the buoy supplies all power and can transmit sensor data in real time.

## Turbidity Sensor

Turbidity data are substituted for TSS as it can be measured instantaneously. Most turbidity sensors are compliant with ISO 7027 and have a wiper to prevent fouling. Sensors can hang at multiple levels in the water column, alone or in a multi-parameter sonde.

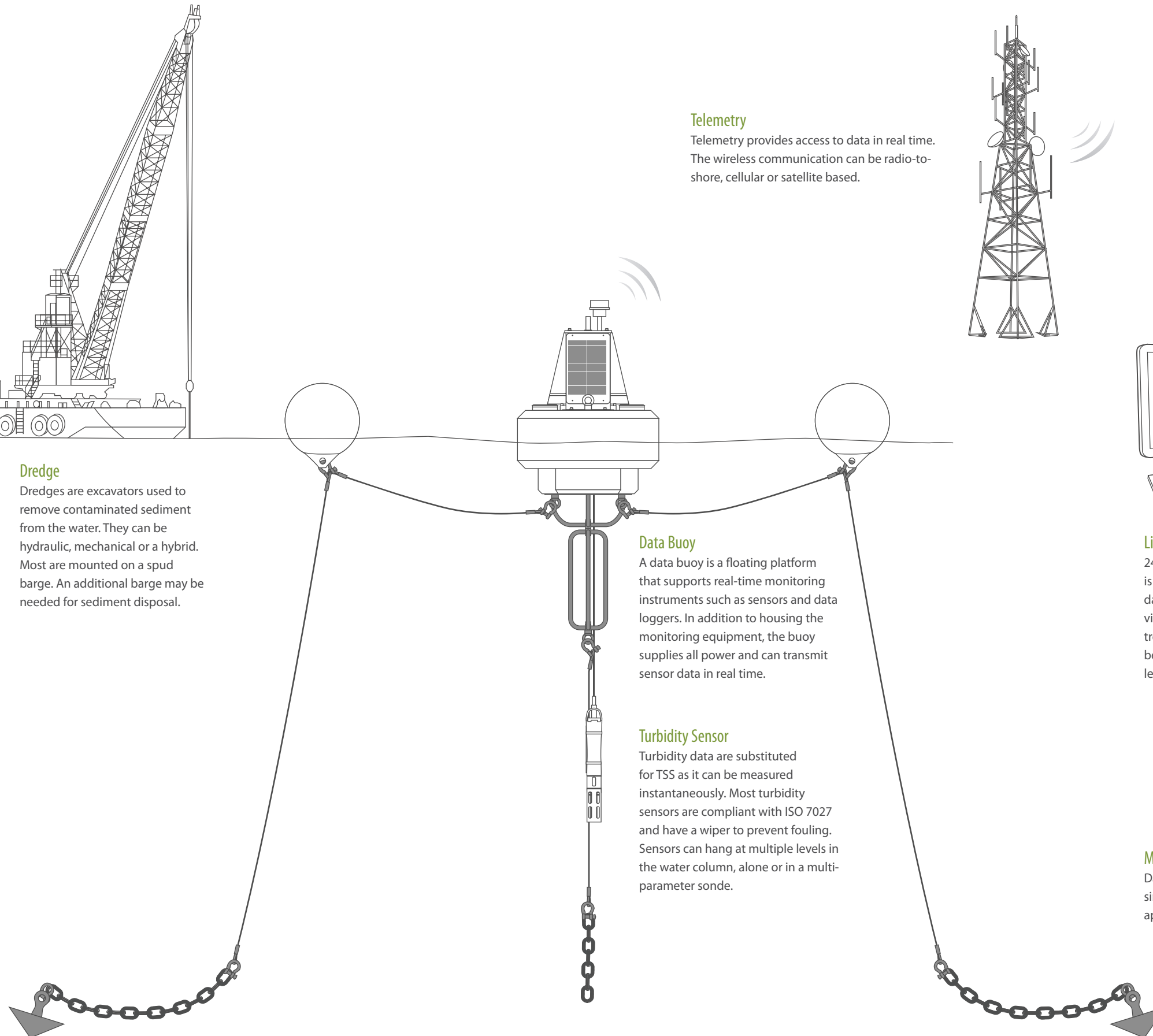


## Live Data

24/7 instant access to project data is available through a cloud-based datacenter. Monitoring data can be viewed in real time, or as a graph to see trends. Real-time automated alerts can be sent via text or email when turbidity levels exceed pre-defined limits.

## Mooring Hardware

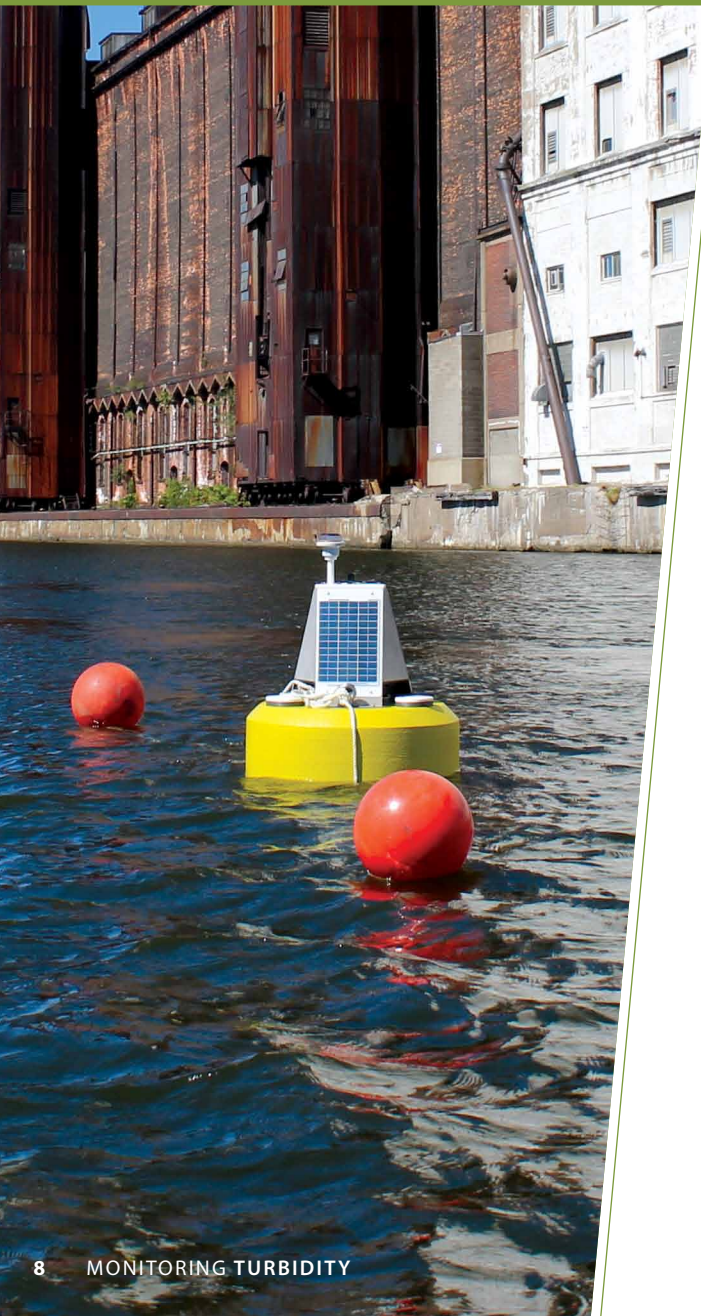
Data buoys can be anchored with a single or two-point mooring based on application requirements.





# POINTS OF COMPLIANCE

Where turbidity monitoring systems should be located will depend largely on the site conditions of the dredging project. The number of monitoring locations required for a dredging operation can vary, but a common monitoring setup relies on three measurement locations. The chosen measurement locations are known as points of compliance. At these points, the USACE suggests using stationary or towed turbidity sensors in conjunction with water column sampling.



## Selecting the Location

As suggested by the name, stationary systems are set at fixed locations. These systems can be placed on structure or on an anchored buoy in the water. Seawalls are a common example of a structure that can be used, as turbidity monitoring sensors can be mounted in a perforated PVC pipe along the seawall. However, site conditions often make it difficult or impractical to mount the monitoring equipment along the shore. In addition, relying solely on shoreline solutions may not accurately represent re-suspension levels and sediment transport due to the nature of water currents. For these reasons, buoy-based systems offer the most comprehensive and cost-effective solution. Data buoys provide a stable platform for turbidity monitoring, with the ability to house multiple sensors at different depths in the water column. In addition, they can carry a data logger, solar-powered battery pack, and telemetry (wireless communications) systems for extended deployments.

Anchored buoys are usually located both up and downstream of the dredging operation. The downstream buoy(s) measure re-suspended sediment and sediment transport in areas at risk, while the upstream (and off-site) buoy serves as a control for suitable turbidity levels. These buoys can come in different sizes based on the environmental conditions and the number of sensors suspended from the buoy. Data buoys with 150- to 450-lb. net buoyancy are generally adequate for monitoring projects on rivers, inland lakes and protected waters. Larger platforms may be required in coastal and Great Lakes deployments that are subject to more extreme conditions and wave action.

Towed sensors are known as “floating” points of compliance, as they move with the dredging operation. While these can be attached directly to the dredging equipment, they can also be deployed on a buoy system a set distance away from the dredge location. The buoy systems then move with the dredge as the project progresses, remaining the same distance away from the active dredging site.

## Pre-Deployment

For accurate data, all sensors should be calibrated shortly before the project begins. If using a buoy-based system, the platforms should be fully assembled on shore prior to deployment. This includes attaching any sensors, towers, solar panels and additional ballast weights if needed. Furthermore, the complete turbidity monitoring system (sensors, data logger, telemetry, software) should be tested before the buoy is put in the water. While this process ensures that all equipment is functioning within specifications, it also gives everyone the chance to familiarize themselves with the system prior to deployment. Issues are always easier to deal with before the buoy platform is deployed in the water.

## Buoy Mooring

A buoy-based system must be moored to ensure that it remains stationary. The buoy is usually moored via a stainless steel mooring line, bottom chain and anchor. It is recommended to moor the buoy in the deepest part of the waterway to ensure the most inclusive measurements. This allows for multiple measurement depths and will best reflect the characteristics of the water body as a whole.

Buoy-based systems are typically moored as either a single-point or two-point mooring, based on environmental and application-specific factors.

## Single-Point Mooring

Single-point moorings are not common, but they require the least amount of mooring equipment. This setup can be deployed in very calm waters with minimal instruments. A single-point mooring should only be used when all sensors and equipment are housed within an instrument cage or deployment pipe. Hanging sensors risk getting damaged or entangled with the anchor line. A cage or pipe protects the instruments from entanglement, subsurface debris and currents without affecting sensor readings.

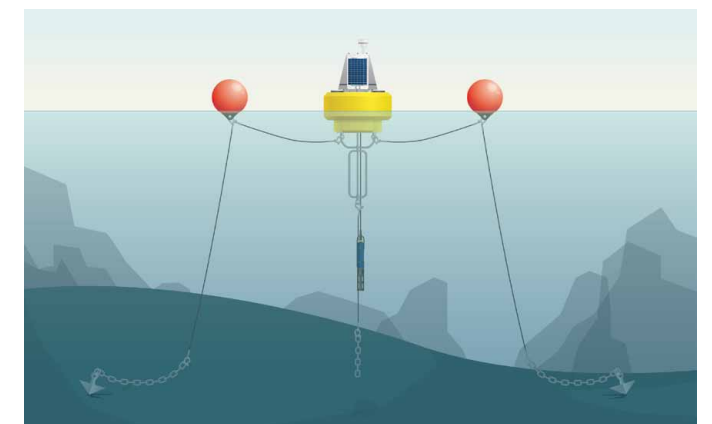
In a single-point configuration, a mooring line connects the buoy directly to a bottom chain and anchor. The sensors are typically housed within a central deployment pipe or attached to a rigid instrument cage. The anchor, bottom chain and mooring line are assembled and attached to the buoy prior to deploying the system.



## Two-Point Mooring

Two-point moorings are the most common deployment configuration. This is the recommended setup if sensors will be hanging at multiple depths in the water column. In a two-point setup, the mooring lines are pulled away from the data buoy by two smaller marker buoys. This configuration leaves the water column below the buoy available for sensors, without risk of entanglement with anchor lines. It also offers greater stability if there are currents or wave action at the location.

A two-point mooring requires a larger deployment area than a single-point mooring, as the marker buoys are typically set about ten feet away from the data buoy. Additional mooring lines run from the marker buoys to bottom chains and anchors at the seafloor. The increased system stability from the two anchor setup is well worth the extra equipment, as is the expanded area for hanging sensors. If there is significant subsurface debris or other risks present, deployment pipes or instrument cages can still be used.



# DATA MANAGEMENT

A major part of any monitoring project is collecting and accessing the data. While it is possible to simply record measurements onsite, the ability to log, send and view monitoring data in real time is far more efficient.



## Data Logger

As the name implies, a data logger is an instrument that stores data. In environmental monitoring applications, data loggers can be used not only to collect data from sensors and sondes, but to control sampling rates and transmit data to a central location in real time.

While sondes often have the ability to log their own data, a separate, dedicated data logger can gather data from any and all attached sensors, while ensuring that no data are lost. If telemetry (wireless communication) is available, the logger can remotely control sensor sampling rates and transmit collected data to a central project computer. Data loggers with telemetry technology can provide real-time turbidity data and remote access via a cellular modem, radio transmission or satellite modem.

When housed in a data buoy, a data logger is charged by the buoy's solar power system. If a solar panel system or external battery is not available, the logger can be self-powered using alkaline batteries. Data loggers can be configured with a number of sensor ports for connection to industry-standard digital and analog interfaces, including RS-485, SDI-12 or 0-2.5 VDC. Turbidity sensors can connect to a logger directly or through a multi-parameter sonde. A data logger can also handle additional water quality sensors, temperature strings or Doppler velocity meters if they are required for the dredging application.

## Telemetry

Telemetry, or wireless communication, is a useful tool for monitoring turbidity in real time. Common telemetry options are cellular and radio, though satellite telemetry can be used in more remote locations. The deciding factor when determining the most cost-effective telemetry option should be the local site conditions and proximity to a project computer. All three of these options permit real-time updates regarding water quality during a dredging operation.

Radio telemetry is recommended when all equipment is in close proximity. If equipped with a license-free spread-spectrum radio, a data logger can communicate with a shore-side radio base station. This range may vary depending on the logger and base station used. Spread-spectrum radio technology may allow a range as far as five miles (line-of-sight) or a few hundred feet (non-line-of-sight). The radio base station serves as a central hub for any buoy-based data logger in range, with the ability to send the collected data to a project computer.

Cellular telemetry offers more geographic flexibility than radio, though it does require a cellular data plan. This small, additional cost permits data transmissions from anywhere that receives a cellular signal. With cellular

telemetry, monitoring stations do not need to be in close proximity, nor is a shore-side base station required. Instead, all the data can be accessed wirelessly via the Internet. Data loggers may be equipped with cellular modems from different providers, including AT&T, Verizon and Sprint.

For remote applications where radio and cellular telemetry are not feasible, satellite telemetry can be used. The Iridium communications network maintains a dynamic, cross-linked constellation of Low Earth Orbiting (LEO) satellites, providing coverage all over the world. This means that data loggers with an Iridium satellite modem can transmit data in real time from anywhere on Earth. As with cellular networks, the data are sent to a central gateway, which then transfers the data over the Internet to any project computer or cell phone.

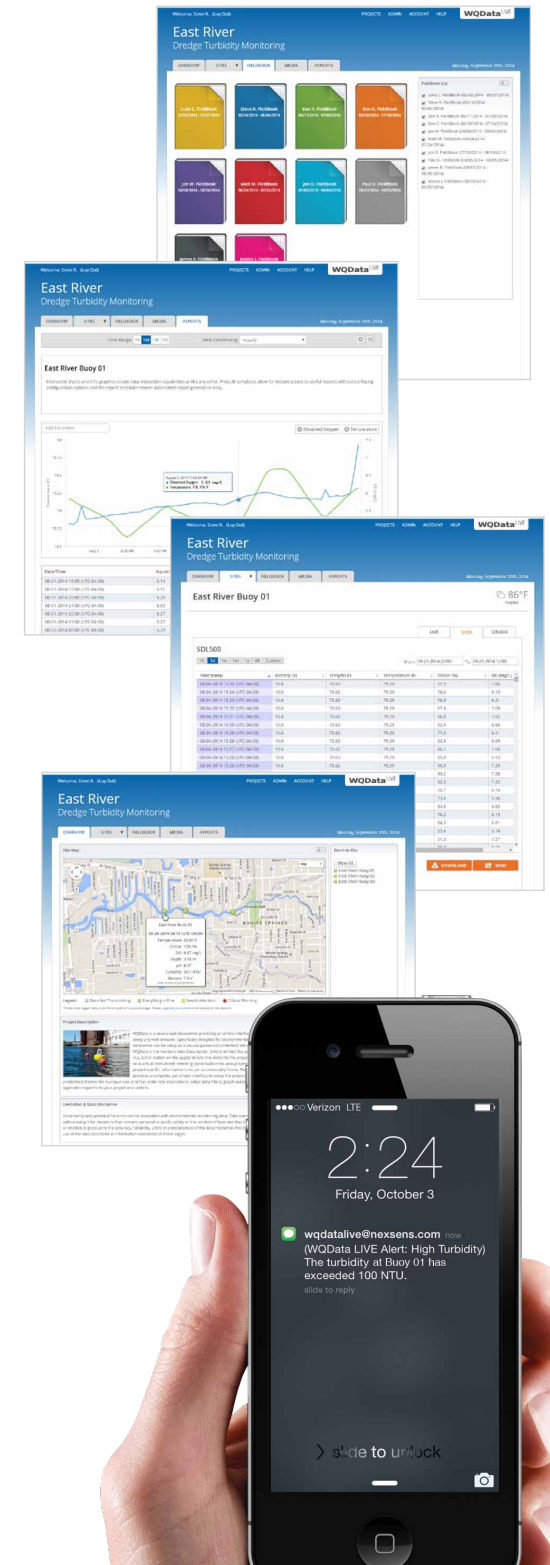
## Real-Time Online Datacenter

The easiest way to share and view turbidity monitoring data is through a web-based datacenter. An online datacenter offers 24/7 instant access to project data via any web browser. Turbidity monitoring and other data can be exported into the datacenter directly from the data logger, or through the project software.

This project management service can be password protected or public, and allows users access to the collected data in real time. In addition to any dredging-specific information, the online interface can provide dynamic area maps, overlaid with weather information, recent and historical data, time series graphs and statistical summaries. Visitors can interact with the project maps and view real-time monitoring data or turbidity level trends over time.

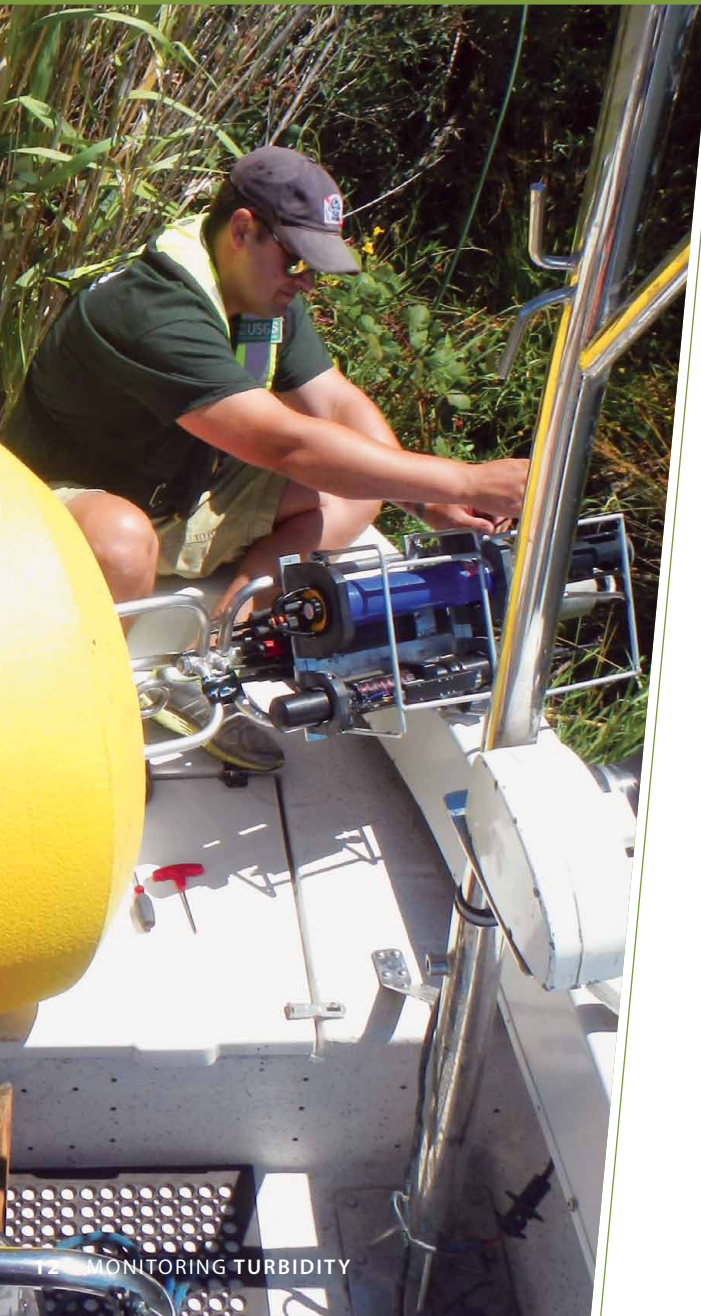
But these cloud-based datacenters are more than just a pretty face. Many can be programmed to send out automated alarm notifications when turbidity levels exceed pre-defined limits. These limits are determined by collecting background data prior to dredging using spot-sampling equipment. Once an allowable turbidity range has been set, the data are entered into the online database. If turbidity levels exceed this recommended range during dredging operations, the datacenter will immediately issue an alert (text and/or email) to the appropriate project manager or operator.

With the availability of real-time data and the datacenter's auto-alert system, dredge operators can be notified immediately when turbidity levels rise. This means that timely control procedures can be implemented to slow down, alter or stop the dredging operation until levels fall below the maximum allowable limit. The online datacenter can also transmit this alert back to the data logger in order to respond to the exceeded turbidity range. Automated responses may include taking more frequent readings during high turbidity periods, then resuming regular log intervals when levels return to normal.



# QUALITY ASSURANCE

Accurate data ensure that dredging operations remain in compliance with set regulations. To maintain that accuracy and keep equipment functioning within specifications, best practice recommends cleaning and calibrating the instruments at regular intervals. It is also recommended to cross-check sensor accuracy against a separate instrument. This cross-checked data can then be used to show compliance against an EPA approved method, if needed.



## System Maintenance

Regardless of the turbidity equipment chosen to monitor a dredging site, periodic maintenance and calibration is required. Instrument maintenance includes cleaning the instruments (especially if a sensor is not self-wiping), and replacing any deteriorating o-rings to prevent water ingress. If using additional parameter sensors (such as conductivity), further field servicing may be required. Maintenance intervals are largely dependent on site conditions and other variables, such as the potential for biofouling. Common calibration and maintenance intervals are on a weekly or bi-weekly basis.

Turbidity sensors usually require a two-point calibration — one at 0 NTU/FNU and another at a higher turbidity value (often 126 NTU/124 FNU). The 0 NTU value can be obtained using de-ionized water, though 0 NTU/FNU standard solutions do exist. The high range calibration should use an approved standard such as a commercial or prepared Formazin, or commercial AMCO-AEPA standards. For greater accuracy and a wider range, turbidity sensors can follow a three-point calibration (e.g. 0 NTU, 100 NTU and 1000 NTU). Regardless of the number of points used, it is important to always include 0 NTU/FNU as the first point. For best results, use only freshly prepared or purchased turbidity standard, as they degrade over time. Any diluted standard should only be used on the day it is made.

In case of sensor failure or damage, it is useful to have spare sensors or sondes on hand. These can be field swapped during calibration or routine maintenance checks. Having a spare turbidity sensor available will reduce downtime due to unforeseen sensor failure, which could cause critical and costly interruptions to safe dredging operations.

For greater details regarding maintenance requirements and sensor calibration, the manufacturer's user manual should be referenced.

## Performance Verification

In addition to keeping turbidity equipment calibrated, it's important to periodically verify that the sensors are providing accurate turbidity data. The best way to achieve this is by checking turbidity in the same area using a separate, portable monitoring system. This is also known as spot sampling.

There are two portable turbidity measurement methods available for spot sampling. The first method uses a sensor (much like the one used in the buoy-based monitoring system) and a handheld display. The turbidity sensor can be attached directly to a handheld display or through a sonde to the display to show real-time data. Sondes are useful instruments if other parameters, such as pH, dissolved oxygen or conductivity should be recorded as well. The sonde or sensor can be lowered into the water column to a depth that matches the in-place sensors. While it is at that depth, a turbidity measurement can be taken. The data from this portable system can then be compared to the in-place monitoring system and checked for discrepancies. As with the buoy-based system, this method reports in FNU or FBU based on the sensor used. While FNU readings are approved by ISO 7027, neither option is approved by the EPA.

The second method uses a handheld turbidity meter. This method requires taking a water sample, and then inserting it into the meter for a reading. As this method uses a sample instead of an in-situ measurement, it is often not representative of the surface water as a whole. This is especially a hindrance



when quality checking monitoring systems that measure turbidity at multiple depths along the water column. While handheld meters are not submersible, many styles are compliant with EPA method 180.1. This means that the long-term data can be cross-checked against an EPA-approved method. However, while correlations can be made between data sets, care should be taken when comparing data between the meter and the buoy-based monitoring system. Turbidity instruments are inherently not comparable, and comparative models are only accurate for the specific sample location.



# RECOMMENDED EQUIPMENT

While there are plenty of turbidity monitoring instruments on the market, some stand out above the rest. Fondriest Environmental has selected these products as the best in their field for their quality, reliability and value. Together, they provide an advanced and powerful real-time turbidity monitoring system. For a sensor or sonde, accuracy is of utmost importance and the YSI EXO2 does not disappoint. The rugged NexSens CB-450 offers long-term durability with 30 W of solar power, 450 pounds of buoyancy and a choice of instrument mounts for multiple sensors. Alone, real-time data are good, but with remote data collection, 24/7 access from any computer, instant alarm notifications and trend tracking, the intuitive WQData Live takes real-time data to the next level.



## YSI EXO2 Multi-Parameter Sonde

The YSI EXO represents the next generation of water quality instruments from YSI. The advanced sonde platform offers a wide range of capabilities to those dedicated to monitoring natural aquatic environments such as oceans, estuaries, rivers, lakes and groundwater. With a highly efficient power management platform, robust construction and chemistry free anti-fouling system, EXO allows accurate data collection for up to 90 days between service intervals.

The EXO2 sonde includes six sensor ports and a central anti-fouling wiper option. Sensor parameters include temperature, conductivity, depth, dissolved oxygen, pH, ORP, total algae (phycocyanin and chlorophyll), turbidity and fluorescent dissolved organic matter (fDOM). The sonde can also output 4 calculated parameters including salinity, specific conductance, total dissolved solids (TDS) and total suspended solids (TSS).

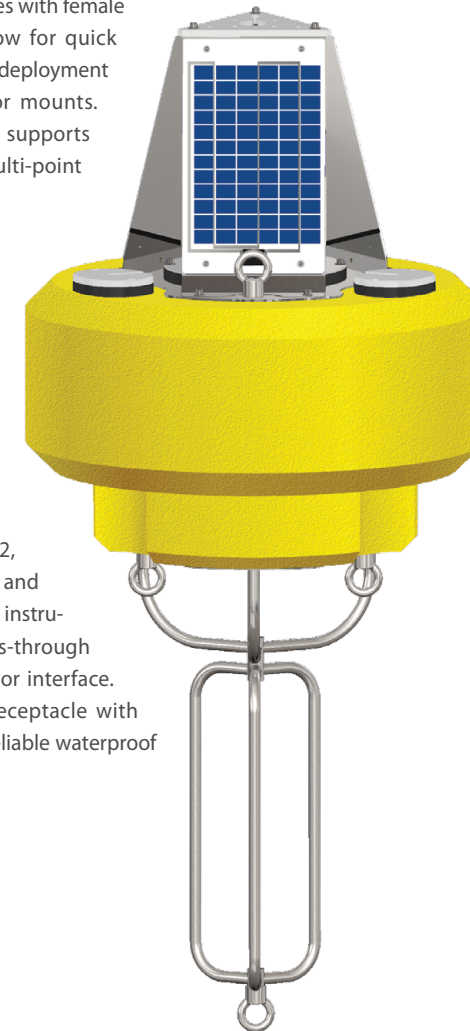
All EXO sensors are digital sensors with onboard signal processing and memory. Built-in sensor diagnostic and calibration data allow users to calibrate multiple sensors in one sonde and distribute to various other sondes in the field. Wet-mateable connectors allow for swaps in wet conditions, while active port monitoring automatically detects each sensor and verifies operation.

## NexSens CB-450 Data Buoy

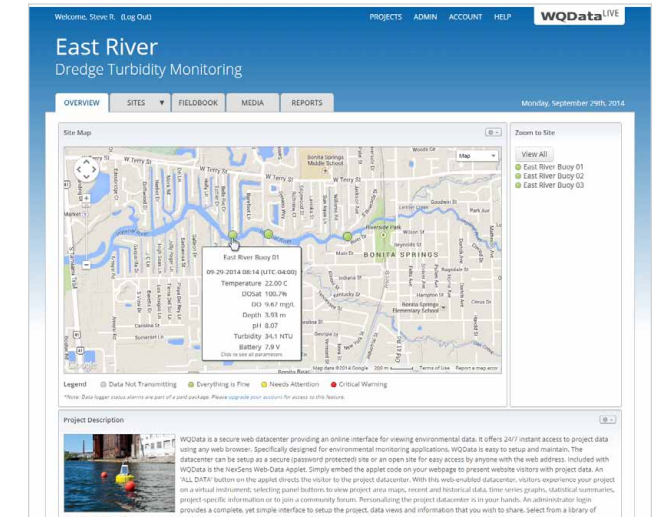
The NexSens CB-450 Data Buoy is designed for deployment in lakes, rivers, coastal waters, harbors, estuaries and other freshwater or marine environments. The floating platform supports both topside and subsurface environmental monitoring sensors including weather stations, wave sensors, thermistor strings, multi-parameter sondes, Doppler current profilers and other monitoring instruments.

The buoy is constructed of an inner core of cross-linked polyethylene foam with a tough polyurea skin. A topside 20" tall stainless steel tower includes three 10-watt 12VDC unbreakable solar panels, and a center 10" ID x 18" tall instrument well accommodates batteries, data loggers, sensors and more. Three 4" pass-through holes with female NPT bottom threads allow for quick connection of instrument deployment pipes and custom sensor mounts. The stainless steel frame supports both single-point and multi-point moorings.

The CB-450 Data Buoy is optimized for use with NexSens data loggers. Wireless telemetry options include Wi-Fi, spread spectrum radio, cellular and Iridium satellite. Compatible digital and analog sensor interfaces include RS-232, RS-485, SDI-12, VDC, mA and pulse count. The top of the instrument well includes 8 pass-through ports for power and sensor interface. Each port offers a UW receptacle with double O-ring seal for a reliable waterproof connection.



## NexSens WQData LIVE Web Datacenter



WQData LIVE is a web-based project management service that allows users 24/7 instant access to data collected from NexSens remote environmental data logging & telemetry systems. More than just an online database, WQData LIVE offers the ability to generate automated reports, configure alarms to notify project personnel when data values exceed threshold limits, create FieldBooks to store calibration forms, notes and media and much more. Projects are password protected with the ability to configure a public portal or presentation view to share data with the general public. Project Administrators have the ability to edit project descriptions and information, while users given Collaborator access are limited to data viewing and form entry.

The Google Maps view shows all project sites on a map with zoom, scroll and drag capability. Mousing over a site on the map displays the most recent data values, and clicking on the site navigates to a display showing the last reading or tabular data that can be downloaded to Excel and sent via email or FTP. FieldBooks can be created to store notes recorded during field visits, including forms to store calibration data, which can be submitted from the WQData LIVE mobile app. This eliminates the need for conventional fieldbooks while keeping critical project information in a single, easy-to-access location. Site photos can even be placed onto FieldBook pages or uploaded into the project's Media page.

The WQData LIVE report feature allows data to be shown both graphically and in a tabular format. Report templates can be saved so that specific information can quickly be referenced. Project alarms send email or text messages to project staff for immediate notification of critical conditions. With this unique set of features, WQData LIVE provides everything needed to effectively manage an environmental monitoring application.

# PURCHASE OR RENT?

When managing a large or long-term dredging project, purchasing several turbidity monitoring systems is often the most economical option. However, for short-term dredging projects on a tight budget, it may not be practical to purchase the necessary turbidity monitoring equipment. In these situations, it is much more prudent to rent real-time monitoring systems. With several lease duration and extension options available, the flexibility of renting turbidity monitoring systems may still be cost-effective for the larger dredging applications as well.

Turbidity monitoring equipment can be rented instrument by instrument, or as an entire system, calibrated and ready to deploy on arrival. Rental equipment can include sensors, sondes, handheld displays, data buoys and web-based datacenter access. Real-time telemetry via radio-to-shore, cellular and satellite can also be incorporated. A large rental pool also means that most turbidity monitoring equipment can be shipped same-day for quick deployment and emergency situations.

Just as with Fondriest purchases, rental projects have access to a knowledgeable support staff who will provide personalized service before, during and after the project.

Fondriest Environmental, Inc.  
2091 Exchange Court  
Fairborn, OH 45324

tel: 888.426.2151  
fax: 937.426.1125  
customer@fondriest.com

# ABOUT FONDRIEST

## Company

Located in the Lower Great Lakes and Ohio River Valley region, Fondriest Environmental is a leading distributor and integrator of equipment for natural resource professionals and outdoor enthusiasts. Our team of specialists can help customers understand the products they are buying and make the correct decisions out in the field. We seek to understand project needs, devise a comprehensive solution, provide the equipment and know-how to implement it and then offer long-term project support for whatever needs arise.

## Capabilities

We work closely with NexSens Technology, a company that specializes in the design and manufacture of real-time environmental measurement systems. A variety of sensor, platform and telemetry options are available to fit the unique needs of each project. We can provide complete integrated solutions and support projects from conception to completion. An extensive fleet of rental equipment is also available for short-term project needs.

## Certifications

Fondriest Environmental is a Certified Repair Center for YSI, NexSens & FishSens, offering quick turnaround, affordable labor rates and personalized service. Our knowledgeable technicians are available for phone, email and onsite support when the need arises.

## Publications

We cover many customer projects in our Environmental Monitor magazine, which is updated daily online and printed quarterly. We also produce Lake Scientist, an interactive online resource providing research articles and news on lake ecology. Informational pages on environmental parameters and applications are available in the Measurement Sciences section of our website. And FishSens Magazine, available online, provides anglers, boaters and fisheries professionals with the latest fish science news.

## Commitment

A commitment to integrity and longstanding customer relations are the standard, rather than the exception, at Fondriest Environmental. We support professionals, educators and researchers who continuously work to monitor and protect our global resources by providing them with the products and services needed to face today's environmental challenges. Our team of solution-driven experts has years of field experience and a keen eye for finding the best equipment for each application.

## Contact Information

To reach an application specialist, please call (888) 426.2151 or email [customer@fondriest.com](mailto:customer@fondriest.com)



## SYSTEM CONFIGURATION TOOL

Fondriest application specialists will assist with tailoring buoy configuration and equipment choices on a site-by-site basis to ensure reliability and proper data management. The questionnaire below can help you get started. Once completed, this form can be faxed to (937) 426.1125 or, if completed digitally, emailed to [customercare@fondriest.com](mailto:customercare@fondriest.com).

### Contact Information

Name: \_\_\_\_\_

Organization: \_\_\_\_\_

Telephone: \_\_\_\_\_

Email: \_\_\_\_\_

### Site Conditions

Describe the site conditions in a paragraph or two. Please include details regarding levels of wind, waves and boat traffic experienced in the area.

\_\_\_\_\_

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\_\_\_\_\_

### Site Location

The location of a monitoring system can affect what buoy configuration best suits the conditions. Please select in what type of water body the system will reside.

Lake  River  Coastal  Other Please Specify \_\_\_\_\_

### Approximate Depth

The mooring hardware and cable lengths used for a deployment depends on the distance to the sea floor. An application specialist can develop the best mooring plan to accommodate the approximate water depth.

< 5 ft.  Between 5 and 25 ft.  Between 25 and 50 ft.  Between 50 and 100 ft.  > 100 ft.

### Water Column Measurements

Measuring turbidity at a single mid-level depth is often sufficient for dredge monitoring. In some cases, however, regulatory agencies may require readings at multiple depths.

Single Depth  Multiple Depths Please Specify \_\_\_\_\_

### Telemetry

License-free spread-spectrum radio telemetry allows communication with a shore-side NexSens radio base station as far as five miles line-of-sight from the monitoring site. Cellular telemetry allows greater geographic flexibility and is able to transmit from almost anywhere in the U.S., but it includes the cost of a cellular data plan. Satellite telemetry can be used nearly anywhere in the world, but it tends to have the highest data cost compared with cellular telemetry.

Cellular  Radio  Satellite  None

### Quality Assurance

A multi-parameter sonde with turbidity sensor connected to a handheld display is an ideal way to verify the accuracy of a turbidity monitoring system and uses the ISO 7027 method. Alternatively, there are portable turbidimeters that can measure using the EPA-approved 180.1 method.

Multi-parameter sonde & handheld display (ISO 7027 Method)  Portable turbidimeter (EPA 180.1 Method)

### Project Length (Rental vs. Purchase)

Although it often makes sense to purchase systems outright, many short-term dredging projects make it cost-prohibitive. Fondriest Environmental offers real-time turbidity monitoring systems with weekly and monthly rental rates to accommodate these operations. An application specialist can make recommendations on what choice is most cost-effective.

1-3 Months  3-6 Months  6-12 Months  >1 Year Please Specify \_\_\_\_\_

# FONDRIEST ENVIRONMENTAL

Fondriest Environmental, Inc.  
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Fairborn, OH 45324

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demands  
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**TAKE YOUR PROJECT TO THE NEXT LEVEL.**  
CONTACT A FONDRIEST APPLICATION SPECIALIST  
888.426.2151



To: VELCO PV-20 Project

Date: March 9, 2016  
Project #: 57660.00

Memorandum

From: Patti B. Kallfelz-Werts VHB  
Jason Gorman, PE, CHA

Re: PV-20 Submarine Cable Replacement Project  
Aquatic Invasive Species Management Plan

---

## 1.0 Introduction

The PV-20 Cable Replacement Project proposes to replace a segment of the existing 115 kV K20 line circuit that extends west-to-east, between the New York Power Authority ("NYPA") Cumberland Head Substation in Plattsburgh, New York and Vermont Transco, LLC's ("VELCO") Grand Isle Terminal Station in Grand Isle, Vermont (refer to the Site Location Map Attachment 1). This segment of the existing circuit, which is designated by NYPA and VELCO as the "PV-20 line", currently consists of six oil-filled electrical transmission cables still in operation and one abandoned cable that failed in 1969, and will be replaced with four new extruded dielectric (oil free) submarine cables. The existing seven cables are buried along the land portions and within the shallows of Lake Champlain (the "Lake") and directly laid along the bottom in the deeper portions of the Lake.

This Aquatic Invasive Species Management ("AISM") Plan is intended to summarize planned construction activities associated with installation of new cables and removal of existing cables; and protocols to be followed during both the installation and removal phases of the project in order to limit the potential of transporting aquatic invasive species ("AIS") during Project activities, pursuant to 10 V.S.A. §1454 (transport of aquatic plants and aquatic nuisance species). Overall, the goal of the AISM Plan is to prevent further introduction and migration of AIS into Lake Champlain from vessels and equipment that may be transported from other water bodies to Lake Champlain in association with the PV-20 Project.

## 2.0 Project Overview

The primary project activities that will involve transport of equipment via waterways to Lake Champlain include: (1) installation of new cables via Horizontal Directional Drilling ("HDD") from an entry point on land to an exit point within Lake Champlain, (2) installation of the new submarine cables within Lake Champlain, and (3) removal of existing submarine cables from Lake Champlain. Large transport barges will carry equipment, including submarine cables, materials, and other construction-related supplies, which are anticipated to originate from Port Elizabeth, New Jersey or New York ports, through the Hudson River and Champlain Canal to Lake Champlain. It is anticipated that transporting supplies and equipment for Project construction can be accomplished in one trip from the port of origin, and will not require multiple round trips. Smaller vessels will be transported to Lake Champlain via truck, trailer, or barge. The following is an overview of the Project components which will require the use of vessels in Lake Champlain, and the anticipated types of vessels and their size classification (small or large) that will be transported to Lake Champlain for the purposes of this project:

### HDD Installation

- Deck barge for HDD installation (large, typically 140 feet by 40 feet)
- Gravity cell for fluid containment during HDD installation (small)
- Deck barge with pumping plant (large, typically 140 feet by 40 feet)
- Support tugs (large)





Memorandum

- Crew boats (small)
- Outboard powered support craft (small)

Submarine Cable Installation

- Sectional lay barge (small, transported in sections, typically 200 feet by 70 feet once assembled)
- Cable transport barge (large)
- Jet sled for trenching the cable (small)
- Support tugs (large)
- Crew boats (small)
- Outboard powered support craft (small)

Submarine Cable Removal

- Steel barge with spool (small, transported overland in sections, typically 40 feet by 30 feet once assembled)
- Steel barge and barge (large)tender
- Cable tender boat (large)
- Support tug (large)
- Crew/ dive support boat (small)
- Quick response boat (small)

**3.0 Aquatic Invasive Target Species of Concern**

The Vermont Department of Environmental Conservation (“VT DEC”) and the New York Department of Environmental Conservation (“NY DEC”) maintain a list of aquatic invasive species that may be present in Lake Champlain and are known to cause environmental and/or economic harm, or harm to human health (see Attachment 2). Although the lists of AIS are extensive, the following table (see Table 1) provides a subset of aquatic invasive species that are considered acceptable target species to address in managing the potential introduction and spread of other aquatic invasive species to or within Lake Champlain. Specifically, these target species are representative of the types of species that are included on the comprehensive AIS lists for both Vermont and New York. By monitoring and treating for this sub-set of species, it is anticipated that non-target AIS will be addressed as well.

<b>Table 1: Aquatic Invasive Animal and Plant Target Species of Concern</b>		
<b>Aquatic Invasive Animal Species</b>		<b>Aquatic Invasive Plant Species</b>
Zebra Mussel <i>(Dreissena polymorpha)</i>	Quagga Mussel <i>(Dreissena bugensis)</i>	Water Chestnut <i>(Trapa natans)</i>
Alewife <i>(Alosa pseudoharengus)</i>	Spiny Waterflea <i>(Bythotrephes cederstroemi)</i>	Eurasian Watermilfoil <i>(Myriophyllum spicatum)</i>
Rusty Crayfish <i>(Orconectes rusticus)</i>	Sea Lamprey <i>(Petromyzon marinus)</i>	Variable-leaved Watermilfoil <i>(Myriophyllum heterophyllum)</i>



#### **4.0 Aquatic Invasive Species Management Plan**

In an effort to prevent further introduction and migration of aquatic invasive species into Lake Champlain from vessels and equipment associated with the PV-20 Project, this AISM Plan has been prepared to provide guidance to project personnel and contractors, with regard to training, precautionary measures, and decontamination procedures to be implemented when transporting vessels to Lake Champlain. This AISM Plan has been formatted to address the following two categories of vessels that are expected to transport equipment, materials, and supplies to the PV-20 Project site (see Section 2.0 for more information):

- Large Vessels – unsuitable in size to remove from the water to conduct observation and mitigation measures
- Small Vessels – suitable in size to either be transported out of water via truck or on a larger barge or, if traveling in the water, removed from the water to conduct observation and mitigation measures

##### **4.1 Training**

Prior to work within Lake Champlain, all project personnel and contractors involved with in-lake work and monitoring will be provided training to review precautionary measures (see Section 4.2) and decontamination procedures (see Section 4.3), as well as Vermont and New York guidelines to prevent the spread of aquatic invasive species (see Attachment 3).

##### **4.2 Precautionary Measures and Decontamination Procedures**

The following guidance provides precautionary measures and decontamination procedures to be implemented when transporting large- and small-sized vessels to Lake Champlain. Precautionary measures are intended to serve as the first step in reducing potential for further introduction and migration of aquatic invasive species into Lake Champlain, with decontamination as a second step if determined to be necessary.

###### **4.2.1 Large Vessels**

For large vessels that will be transported to Lake Champlain via the Champlain Canal and are not feasible to remove from the water, the following precautionary measures shall be taken prior to entering Lake Champlain:

- Deploy divers to conduct a visual inspection of the barge exterior for potential aquatic invasive species and/or other foreign matter, using the guidelines provided by NY DEC and VT DEC (see Attachment 2). Particular attention to be given to: (1) cracks and crevices where animal and plant material may become trapped, and (2) areas on propellers that may harbor animal and plant material. Manually remove any observed materials.
- Drain or pump bilge water to a containment vessel or discharge bilge water prior to entering Lake Champlain.
- Sanitize all areas within the vessel where water not originating from Lake Champlain may have been stored.



## Memorandum

### **4.2.2 Small Vessels**

For small vessels (or boats) that will be transported to Lake Champlain via truck, trailer, or barge and can be observed while on land prior to entering the water, the following precautionary measures shall be taken prior to entering Lake Champlain:

- Conduct a visual inspection of all boats, motors, trailers, and related equipment for potential aquatic invasive species and/or other foreign matter, using the guidelines provide by NY DEC and VT DEC (see Attachment 3). Particular attention to be given to: (1) cracks and crevices where animal and plant material may become trapped, and (2) areas on propellers that may harbor animal and plant material. Manually remove any observed materials.
- Wash boat exterior with hot soapy water or other sanitizing measures, and rinse thoroughly. The wash and rinse water should not be allowed to drain to nearby surface waters.
- Remove all boats, motors, trailers, and equipment from all waterbodies for at least two (2) days prior to deployment to the lake.
- Drain bilge water and disinfect all areas that store water prior to deployment to the lake.

## **5.0 Attachments**

Attachment 1:

- PV-20 Site Location Map

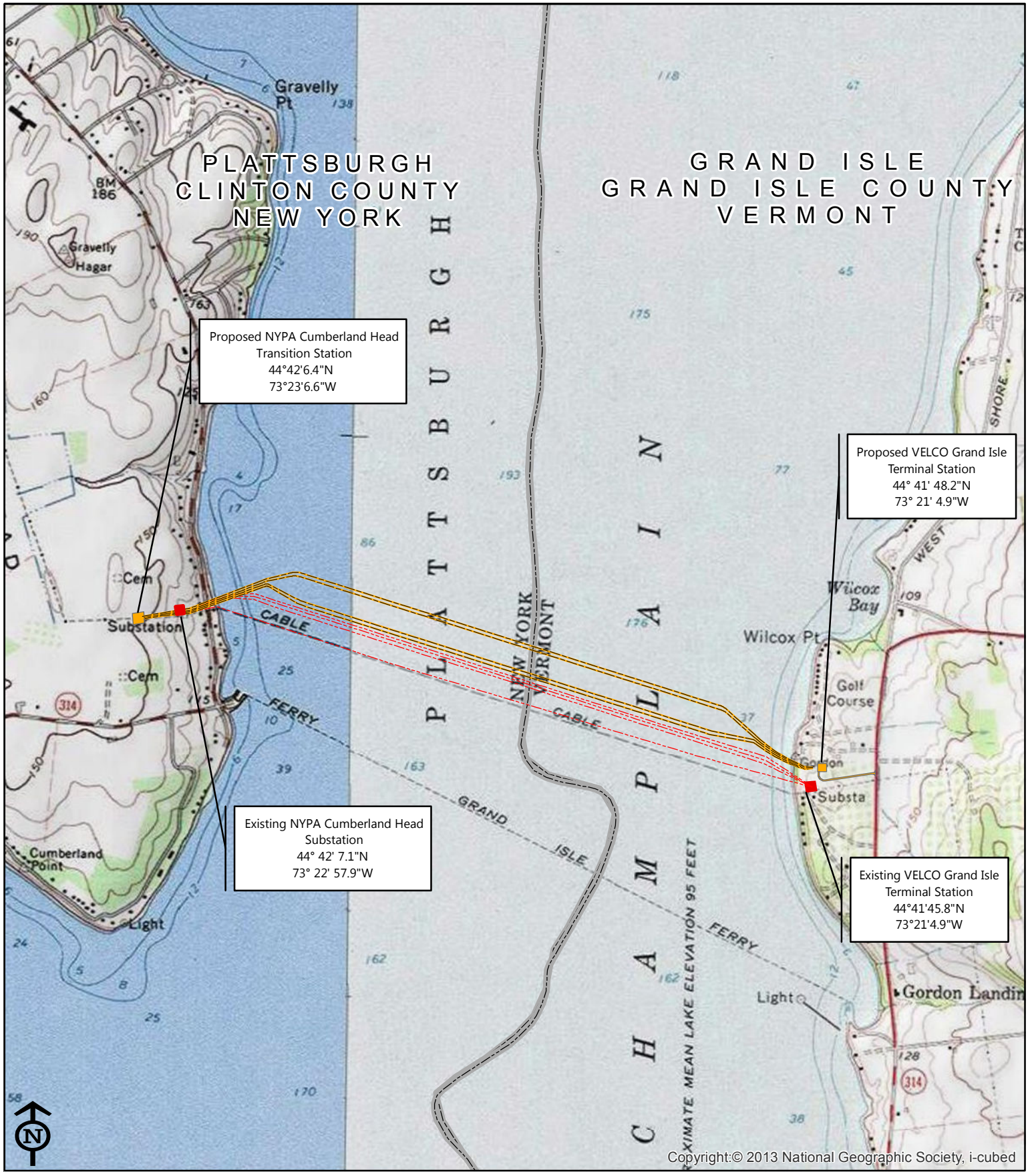
Attachment 2:

- Aquatic Invasive Species in Vermont
- Common Aquatic Invasive Species of New York

Attachment 3:

- Transport of Aquatic Plants and Aquatic Invasive Species in Vermont
- Prevent the Spread of Aquatic Invasive Species in New York

# ATTACHMENT 1



Proposed NYPA Cumberland Head  
Transition Station  
44°42'6.4"N  
73°23'6.6"W

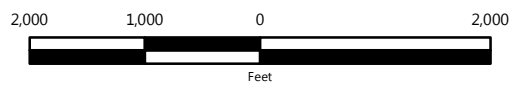
Proposed VELCO Grand Isle  
Terminal Station  
44° 41' 48.2"N  
73° 21' 4.9"W

Existing NYPA Cumberland Head  
Substation  
44° 42' 7.1"N  
73° 22' 57.9"W

Existing VELCO Grand Isle  
Terminal Station  
44°41'45.8"N  
73°21'4.9"W

- Legend**
- - - Existing Cables (Approx.)
  - Proposed Replacment Cable Locations (Approx.)
  - Proposed Terminal Station
  - Existing Terminal Station
  - State Boundary

**VELCO and NYPA  
PV-20 Submarine Cable Replacement Project  
Grand Isle, VT and Plattsburgh, NY  
Site Location Map  
December 11, 2015**



Sources: USGS Topo Quads from ESRI (2015); State and Town Boundaries from VCGI (2010); Approximate Replacment Cable Locations, Existing and Proposed Terminal Station Locations from CHA (2015); Approximate Existing Cable Locaitons Digitized from Plans Provided by CHA (2015).



## ATTACHMENT 2

# Watershed Management Division



- [Surface Water Management Strategy](#)
- [Ecosystem Restoration Program](#)
- [Lakes and Ponds](#)
- [Monitoring, Assessment & Planning](#)
- [Rivers Program](#)
- [Rulemaking](#)
- [Stormwater](#)
- [Wastewater](#)
- [Wetlands](#)
- [Inspection, Compliance and Enforcement](#)
- [Water Quality Certification \(401 Program\)](#)
- [Contacts](#)



[dec home](#) > [wsmd home](#) > [lakes & ponds](#) > aquatic invasive species

## Aquatic Invasive Species in Vermont

**To Report an Aquatic Invasive Species Sighting in Vermont  
Call 802-490-6120**

This Aquatic Invasive Species section of the Watershed Management Division web site presents information regarding aquatic invasive species, nonnative species whose introduction can cause environmental or economic harm or harm to human health, and nuisance species, native species that reach proportions of abundance that may cause economic harm or harm to human health. The Vermont Aquatic Invasive Species Program coordinates management activities associated with aquatic invasive and nuisance species. Priority species of concern at this time are listed below.



Click on an image for more information on each species.



**Water chestnut** (*Trapa natans*) is a glossy, green, triangular-leaved annual plant that can easily choke the waterbodies it invades, out-compete native plants, and reduce oxygen levels which can increase the potential for fish kills. Dense, nearly impenetrable water chestnut growth can make fishing, hunting, swimming, boating, and other recreational activities nearly impossible. Its sharply spined fruits wash ashore and can be hazardous to people who step on them.



**Eurasian watermilfoil** (*Myriophyllum spicatum*) is a rooted, submerged perennial plant that grows rapidly, producing dense stands. It aggressively competes with native plant communities reducing biodiversity. Dense mats clog propellers, impair swimming, restrict boating and fishing accesses, and affect water quality.



**Zebra mussels** (*Dreissena polymorpha*) are small barnacle-like mollusks. They have caused some serious economic and environmental problems in many areas. These mussels are highly prolific and able to form dense colonies out-competing native species. They feed by filtering plankton out of the water which impacts water clarity and alters the food web.



**Purple loosestrife** (*Lythrum salicaria*) is a wetland perennial plant able to out-compete native vegetation due to its high germination rate, and abundant and easily transported seed. Dense growth can eliminate food and shelter for wildlife including shallow water fish spawning grounds.



**Alewife** (*Alosa pseudoharengus*) is a marine fish from the herring family capable of surviving in freshwater. They reproduce quickly and can soon become the most dominant fish species in a lake. Alewife are very efficient feeders and consume huge quantities of zooplankton which enable them to out-compete other species.



**Variable-leaved watermilfoil** (*Myriophyllum heterophyllum*) is a rooted, submerged perennial plant that was first confirmed in a Vermont lake in 2008. Like its cousin Eurasian watermilfoil, variable-leaved watermilfoil is aggressive and grows rapidly, and dense growth can crowd out beneficial native aquatic plants reducing biodiversity. It can also impair recreational uses including swimming, boating and fishing.



**Rusty crayfish** (*Orconectes rusticus*) can be identified by their robust claws with black bands on the tips, and dark, rusty spots on each side of their body. They can out-compete native species, forcing native crayfish from daytime hiding areas and destroying aquatic plant beds. Rusty crayfish have likely been spread into numerous waterbodies in Vermont by anglers using them for bait.



**Didymo** (*Didymosphenia geminata*) is a nuisance algae (diatom) species capable of forming thick mats on river and stream bottoms with potentially significant impacts to fisheries and other habitat. (Picture at left from New Zealand)

### What is the State Doing?

- Vermonters and visitors to our state are learning about aquatic invasive species through a variety of **educational materials**: pamphlets and newsletters, slide shows, identification posters, metal boater warning signs, and public meetings.
- **Surveys** that assess the types and amounts of aquatic plants growing in a water body are conducted to monitor existing plant growth and to detect newly introduced invasive plant populations.
- A citizen-based, early detection program, the [Vermont Invasive Patrollers \(VIP\) Program](#), trains volunteers to search water bodies for new aquatic invasive species infestations.
- A net-work of trained [Public Access Greeters](#) (pdf, 577KB) offer visual inspections of boats and associated equipment to locate and remove any plant material or animals, and educate water users on the importance of

**Clean Boats Clean Waters**

**Before Launching AND Before Leaving**

<p><b>Clean</b> off any mud, plants, and animals from boats, trailers, and equipment.</p>	<p><b>Drain</b> your boat and equipment away from the water.</p>	<p><b>Dry</b> anything that comes into contact with the water.</p>
---	--	--

**Never** release plants, fish or animals into a body of water unless they came out of that body of water

**STOP AQUATIC HITCHHIKERS!**

Under Vermont Law, you may be fined up to \$1000 for transporting any aquatic plant or plant fragment, zebra mussels or



spread prevention and appropriate spread prevention techniques. [Clean Boats, Clean Waters](#) (pdf, 220KB) is a list and description of the workshops being offered in 2014.

- The Program keeps abreast of **current research** to learn of improved aquatic invasive species control methods and their applicability for use in Vermont.
- **Demonstration projects** have been implemented on a number of Vermont lakes to evaluate new control methods as well as to refine established techniques.
- **Technical assistance** on aquatic invasive and nuisance species control is provided to towns, water body associations, and others.
- [Financial assistance](#) is available through the Aquatic Nuisance Control Grant-in-Aid grant program in the form of grants to municipalities for qualified applicants to implement restoration, management, or protection projects.
- The overland movement of boats, personal watercraft, fishing gear, and other water-based equipment is a significant means by which aquatic invasive species “hitch a ride” between water bodies. [The transport of all aquatic plants, zebra mussels and quagga mussels is illegal in Vermont.](#)
- [Vermont Aquatic Invasive Species Program 2014 Update, November 2014](#) (pdf, 683 KB)



## You Can Help!

### Prevent the introduction and spread of aquatic invasive species.

- **Contact** the [Watershed Management Division](#) immediately if you think you have found a new occurrence of an aquatic invasive species.
- **Join the VIPs!** [Vermont Invasive Patrollers](#) help search for new infestations so we can respond immediately and prevent them from becoming established.
- **Start a public access greeter program** (pdf, 714KB) to help prevent the spread of aquatic invasive species.
- **Learn** to identify aquatic invasive species. Know which water bodies are infested. Review identification and distribution information on this website. The [Maine Center for Invasive Aquatic Plants - Virtual Herbarium website](#) also has identification information for many invasive aquatic plants found in the northeast, including a [Maine Field Guide to Invasive Aquatic Plants](#), and their common native look alikes.
- **Spread** the word, not aquatic species! Public participation is essential to the success of AIS spread prevention efforts.

### Before moving boats between waterbodies:

- **CLEAN** off any mud, plants, and animals from boat, trailer, motor and other equipment. **Discard** removed material in a trash receptacle or on high, dry ground where there is no danger of them washing into any water body.
- **DRAIN** all water from boat, boat engine, and other equipment away from the water.
- **DRY** anything that comes into contact with the water. Drying boat, trailer and equipment in the sun for at least five days is recommended if **rinsing** your boat, trailer parts and other equipment with hot, high pressure water is not an option.

## Resources

### Early Detection

- [Aquatic Plant Sample Submission Form](#) (pdf, 272 KB)

- [How to Conduct an Aquatic Plant Survey](#) (pdf, 86 KB)
- [Vermont Invasive Patrollers \(VIP\) Program](#)

#### Financial Assistance

- [Grant-in-Aid Program](#)
- [Report on the Vermont Aquatic Nuisance Control Grant-In-Aid Program, January 2006](#) (pdf, 684 KB)

#### Regulations

- [List of Prohibited Aquatic Plants](#) (pdf, 72 KB)
- [Noxious Weed Quarantine](#) (pdf, 105 KB)
- [Vermont Aquatic Nuisance Control Permit Program](#)
- [Vermont AIS Regulations](#)

#### Resources, Publications

- [Aquatic Invasive Species Resources/Publications \(Watershed Management Division\)](#)
- [Aquatic Plant Management Contractors List](#) (pdf, 174 KB)
- [Exotic Invasive Aquatic Plants of Concern in Vermont and Local Native Look-alikes](#) (pdf, 295 KB)
- [Infested Water bodies List](#) (pdf, 183 KB)
- [Lake Champlain Basin Aquatic Nuisance Species Management Plan](#) (pdf, 1.1 MB)
- [Links to Other Aquatic Invasive Species Sites](#)
- [Native Aquatic Plants](#) (pdf, 2MB)
- [Vermont AIS Highlights in Out of the Blue Newsletter](#)
- [Vermont Map of Major Aquatic Invasive Species](#) (pdf, 902 KB)
- [Vermont invasives website](#)

#### Threats

- [Aquatic Invasive Species Threatening Vermont](#) (pdf, 995KB)
- [Aquatic Invasive Species: Threats from Outside the Lake Champlain Basin](#)

#### Spread Prevention

- [Intercepting Aquatic Organisms](#) (pdf, 438 KB)
- [Public Access Greeter Program](#) (pdf, 714KB)
- [Spotlight on a Greeter Program](#) (pdf, 266KB)
- [Vermont Boat Access Greeter Program Training Manual](#) (pdf, 2.43 MB)
- [VTDEC Greeter Program Data Sheet](#) (pdf, 55KB)
- [VTDEC Intercept Report Sheet](#) (pdf, 24KB)
- [Greeter Program Summary Reporting Form](#) (pdf, 24KB)

Voluntary Guidelines to Prevent the Introduction and Spread of Aquatic Invasive Species: Recreational Activities:  
[http://www.anstaskforce.gov/Documents/AIS\\_Recreation\\_Guidelines\\_Final\\_8-29-13.pdf](http://www.anstaskforce.gov/Documents/AIS_Recreation_Guidelines_Final_8-29-13.pdf)

Voluntary Guidelines to Prevent the Introduction and Spread of Aquatic Invasive Species: Water Gardening:

[http://www.anstaskforce.gov/Documents/ANSTF\\_Water\\_garden\\_steps\\_FINAL\\_9\\_23\\_13.pdf](http://www.anstaskforce.gov/Documents/ANSTF_Water_garden_steps_FINAL_9_23_13.pdf)

Please share with anyone who may be interested. Thanks!

[www.watershedmanagement.vt.gov](http://www.watershedmanagement.vt.gov)

VT DEC • Watershed Management Division • 1 National Life Drive, Main 2 • Montpelier, VT 05620-3522 • Tele: 802-828-1535 • Fax: 802-828-1544

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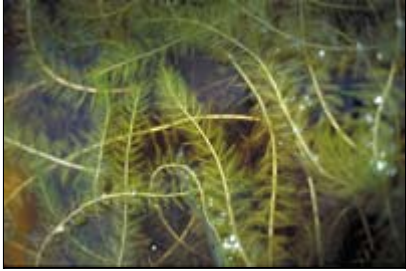


Department of  
Environmental  
Conservation





## Common Aquatic Invasive Species of NY




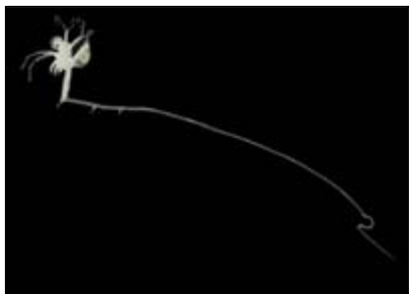
The following table contains some of the more common aquatic invasive species found in New York, the areas of the state they currently inhabit, and the control strategy recommended to ensure that they are not spread to new waters via boating and fishing equipment.





### Aquatic invasive plants and animals NY boaters need to be concerned about

Name	Description	Distribution	Cleaning Strategy
<p><b>Brazilian Elodea</b></p>  <p><i>B. Rice, sarracenia.com, Bugwood.org</i></p>	<p>Stems have numerous branches and can grow over 20 ft. in length. Is often confused with hydrilla and native elodea. Lance-shaped leaves are about 1/8 inches wide and 1.5 inches long and often have very minute teeth along the edges that may require magnification to see. Leaves are arranged in whorls around the stem with each whorl composed of 4 to 6 leaves. The number of leaves per whorls doubles or triples every 8 to 12 nodes. These "double nodes" are the only place where branches occur along the stem.</p>	<p>Found primarily on Long Island, but recently discovered in Westchester County.</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Brittle Naiad</b></p>  <p><i>G. Lovell, ADCNR, Bugwood.org</i></p>	<p>Leaves are opposite (in pairs along the stem), but sometimes appear to be in a whorl at the tip. Leaves are 1-2 inches long, toothed, stiff and pointed. Plant is very brittle and easily breaks into pieces.</p>	<p>Most abundant in the Hudson Valley and Central New York. It has also found its way into some Adirondack waters.</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Curly-leaf Pondweed</b></p> 	<p>Stems are branched and somewhat flattened. Leaves are reddish-brown in color, oblong and about 3 inches long. Leaves are usually stiff and crinkled and unlike other pondweeds have finely toothed edges.</p>	<p>Found throughout New York State</p>	<p>Visual Inspection/Hand Removal</p>




<i>L.J. Mehroff, Univ. of Ct., Bugwood.org</i>			
<p><b>European Frogbit</b></p>  <p><i>L.J. Mehroff, Univ. of Ct., Bugwood.org</i></p>	<p>Floating leaves are heart-shaped and 1-2 inches wide. They resemble the leaves of a miniature waterlily, veined on top and dark purplish red with a spongy coating on the underside. The plant has numerous roots up to 12 inches in length that float freely under the plant.</p>	<p>First documented in Lake Ontario, the St. Lawrence River and adjacent waters, but has since expanded to Oneida Lake and other inland waters. Has recently been detected in some waters within the Adirondack Park.</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Eurasian Watermilfoil</b></p>  <p><i>L.J. Mehroff, Univ. of Ct., Bugwood.org</i></p>	<p>Stems are usually 3 to 10 feet in length and can range from pale pink to reddish brown in color. Bright green feathery leaves are finely divided and occur in whorls (circles) around the stem. Each leaf has 12-21 leaflet pairs. Native northern watermilfoil which it can commonly be confused with has 5-10 leaflet pairs.</p>	<p>The most common and widely distributed aquatic invasive plant in New York State. It can be found in all watersheds, although still relatively rare on Long Island.</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Fanwort</b></p>  <p><i>L.J. Mehroff, Univ. of Ct., Bugwood.org</i></p>	<p>Stems are long and appear tubular. Leaves are fan-like with a short stem and are arranged opposite each other on the stem. Plants have white to light pink flowers that float on the surface.</p>	<p>Most common in southeastern NY, but also found in some southern Adirondack waters.</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Hydrilla</b></p>  <p><i>L.J. Mehroff, Univ. of Ct., Bugwood.org</i></p>	<p>Plants looks very similar to Brazilian elodea and other native Elodeas. Northern plants often lack the spiny underleaf and finely toothed leaves may be difficult to see. Best distinguishing characteristic is the turion or bulb connected to its roots that the other plants lack.</p>	<p>Most widespread on Long Island, but also recently identified in the inlet to Cayuga Lake and the Upper Niagara River.</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Variable Leaf Milfoil</b></p>	<p>Leaves are similar to Eurasian watermilfoil except each leaf has 5-14 leaflets. As the stem reaches the surface it changes its growth</p>		

	<p>pattern to become a stout emergent flower-spike carrying an entirely different type of leaf. These emergent leaves are stalkless, wedge-shaped, stiff, and pointed, with variably-toothed margins.</p>	<p>Found primarily in Lake Champlain and other Adirondack waters.</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Water Chestnut</b></p> 	<p>Stems are very flexible and can reach 12 to 15 ft. in length. On the waters surface the plant contains a circular cluster of saw-toothed edged, triangular floating leaves that are connected to an inflated petiole (bladder) that provides added floatation. Feather-like leaves can be found along the submerged stem. Fruit is a nut with four 1/2 inch barbed spines.</p>	<p>Found primarily in the Hudson Valley, southern Lake Champlain and Mohawk River. Recently found in some western New York waters.</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Parrot Feather</b></p> 	<p>Woody stems can grow over 5 feet in length, often extending outward onto the bank or shore. Emergent leaves are bright blue-green, rigid and deeply serrated. Leaves are arranged in whorls of 4-6 around the stem, with each leaf containing 10-18 segments. The leaves can extend 12" out of the water and look like miniature fir trees. The underwater leaves are red-brown in color and have 20-30 segments per leaf. They appear to be decaying and are often confused with Eurasian watermilfoil leaves.</p>	<p>Found in the Peconic River on Long Island.</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Creeping Water Primrose</b></p> 	<p>Leaves are willow-like and are alternately arranged on hollow red stems. Young leaves may be rounded. Has bright yellow flowers from spring - fall. Sprawling growth habit that forms dense mats.</p>	<p>Currently found in the Peconic River and Prospect Park Lake on Long Island.</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Asian Clam</b></p>	<p>Triangular or rounded triangular</p>	<p>Scattered distribution across state including many</p>	

	<p>shell. Light brown in color with numerous rings on outside of shell. Inside of shell light blue or light purple in color.</p>	<p>Long Island waters, Finger Lakes, Chautauqua Lake, Lake Erie and Lake George.</p>	<p>Dry or disinfect</p>
<p><b>Zebra Mussel</b></p>  <p><i>USGS Archive, USGS, Bugwood.org</i></p>	<p>Shell "D" shaped usually with dark and light colored stripes.</p>	<p>Widely distributed in New York State with the exception of Long Island, Lower Hudson Valley and the Adirondack region. Particularly abundant in the Great Lakes, Lake Champlain, Chautauqua Lake and many central NY waters.</p>	<p>Dry or disinfect</p>
<p><b>Quagga Mussel</b></p>  <p><i>A. Benson, USGS, Bugwood.org</i></p>	<p>Similar to the zebra mussel, but rounder in shape and has a paler color near the hinge.</p>	<p>Found mostly in western and central New York waters. Not as widely distributed as zebra mussels.</p>	<p>Dry or disinfect</p>
<p><b>Fishhook Waterflea</b></p>  <p><i>I. Grigorovich, Bugwood.org</i></p>	<p>Body size 1-3 mm without tail, 6-13 mm with tail. Tail has 3 pairs of barbs and a characteristic loop (fish hook) near the end.</p>	<p>Lake Ontario, Lake Erie, Finger Lakes and some adjoining waters.</p>	<p>Dry or disinfect</p>
<p><b>Spiny waterflea</b></p>	<p>Can reach 15mm in length, with the tail making up 70% of more of total length. Tail has numerous</p>	<p>Primarily found in the Great Lakes and adjacent waters, including the Finger Lakes. Also found in northeastern NY in</p>	

 <p>Minnesota DNR</p>	<p>spines along its length. When they collect on fishing line, they look like bristly gobs of jelly with black spots.</p>	<p>Great Sacandaga Lake, Stewarts Bridge Reservoir, Peck Lake, Lake Pleasant and Piseco Lake.</p>	<p>Dry or disinfect</p>
<p><b>Bloody Red Shrimp</b></p>  <p>OMNR Archive, Bugwood.org</p>	<p>A relative of the Great Lakes opossum shrimp. bloody red shrimp are generally less than 1/2 inches in length. They can be distinguished from the native opossum shrimp by the flat end to its tail.</p>	<p>Great Lakes, Oneida Lake and some Finger Lakes.</p>	<p>Dry or disinfect</p>
<p><b>Starry Stonewort</b></p> 	<p>Looks like a rooted plant, but is actually an algae related to the native Chara. Can form dense mats on the lake bottom. Has long uneven-length gelatinous branches that look angular at each joint. May have one cream colored bulb at the base of each branch cluster.</p>	<p>Great Lakes, St. Lawrence River, Oneida Lake</p>	<p>Visual Inspection/Hand Removal</p>
<p><b>Didymo</b></p> 	<p>An invasive algae species that can form thick mats on the bottom of streams. Typically tan, brown or white in color (not green). Does not fall apart when rubbed between fingers and feels like wet wool (not slimy).</p>	<p>Esopus Creek, Schoharie Creek, Delaware River, East Branch Delaware River, West Branch Delaware River, Battenkill</p>	<p>Dry or disinfect</p>
	<p>The alewife is native to the</p>		



<p><b>Alewife</b></p> 	<p>coastal waters of New York. Unfortunately, due to migrations from these waters and bait bucket introductions, this species has also become established in nuisance proportions in the Great Lakes and many inland waters in New York State, most recently in Lake Champlain. Alewives are silver in color with a blue-green metallic luster along the back, usually with a black spot behind the gill cover and a serrated belly. In freshwater, they usually grow to 3 to 6 inches in length; however, in saltwater they can attain lengths of a foot or more.</p>	<p>Coastal waters, tidal Hudson River and lower Mohawk River, Great Lakes, Finger Lakes and a few other scattered lakes across New York.</p>	<p>Do not release any fish or dump baitfish into a body of water that they did not come from.</p>
<p><b>Round Goby</b></p> 	<p>Round gobies are bottom-dwelling fish that were introduced to the Great Lakes from central Eurasia. Round gobies are usually 3 to 6 inches in length, but can reach 10 inches. Key identifying characteristics include a black spot on the rear of the upper dorsal fin, a raised frog-like eye, thick lips and a body mostly slate gray or black, mottled with black or brown spots.</p>	<p>Lake Erie, Upper and Lower Niagara River, Lake Ontario and the St. Lawrence River and their tributaries upstream to the first barrier impassible to fish.</p>	<p>Do not release any fish or dump baitfish into a body of water that they did not come from.</p>
<p><b>White Perch</b></p> 	<p>White perch are an anadromous species that live most of their life in marine waters, but spawn in freshwater. Although a valued sportfish in some coastal waters, this species can become a nuisance when accidentally or purposefully introduced into landlocked waters. White perch are silvery-gray in color, with a light belly. Unlike the white bass and striped bass, they lack striping. They can attain lengths of 12 inches or more in freshwater and even larger in marine waters, but in overabundant populations rarely exceed 6 inches in length.</p>	<p>Coastal waters, tidal Hudson River, Mohawk River, Oneida Lake, Onondaga Lake, Otisco Lake, Chautauqua Lake, Cassadaga Lakes, Erie Canal, Lake Ontario and scattered ponds and Reservoirs in the Hudson Valley and Long Island.</p>	<p>Do not release any fish or dump baitfish into a body of water that they did not come from.</p>

## ATTACHMENT 3

# Law Prohibits the Transport of Aquatic Plants and Aquatic Invasive Species in Vermont

Invasive species such as Eurasian watermilfoil and zebra mussels are typically spread by “hitchhiking” on boat trailers, propellers and fishing gear that isn’t cleaned, or in bilge water, bait buckets, or livewells that aren’t drained before moving to a different water body. It often takes only a tiny fragment of an invasive plant, sometimes less than an inch, to start a whole new infestation.

On July 1, 2010, Vermont’s 22-year old law prohibiting the transport of important aquatic invasive species changed. Previously, the law prohibited the transport of the invasive plants Eurasian watermilfoil and water chestnut. As of July 1, Vermont’s invasive species transport law now **prohibits the transport of all aquatic plants or aquatic plant parts** on the outside of a vehicle boat, personal watercraft, trailer or other equipment.

The law defines an aquatic plant as “...a plant that naturally grows in water, saturated soils or seasonally saturated soils, including algae and submerged, floating leafed, floating, or emergent plants.”



A poster titled "CLEAN BOATS CLEAN WATERS" with a green leafy border. It features a photo of a boat on a trailer. The text includes: "No More Free Rides", "Under Vermont Law, you may be fined up to \$1000 for transporting any aquatic plant or plant fragment, zebra mussels or quagga mussels.", "So carefully inspect and clean your boat and trailer every time you take them out of the water.", and "WATERCRAFT CHECK POINTS" with a diagram of a boat on a trailer. The diagram labels: Hitch, Live Well, Transom Well, Rollers, Axle, and Lower Unit/Propeller. Below the diagram, it says: "When you leave a body of water: Clean off any mud, plants (even small fragments), and animals from boats, trailers and equipment. If possible wash at home or at a car wash. Drain boat and equipment away from water. Dry anything that comes into contact with water. Never release plants, fish or animals into a body of water unless they came out of that body of water."

The law change means both the public and those who enforce the law will not have to know how to distinguish one type of aquatic plant from another.

Vermont’s invasive species transport law also will continue to prohibit the transport of two animal species, zebra mussels and quagga mussels.

The full law is available [here](#).

A person who violates this law may be subject to a penalty of up to \$1,000 per violation (Vermont Statutes Annotated Title 23, Chapter 29 § 3317. Penalties).

## More information

- Click [here](#) for the full text of Vermont’s aquatic invasive species transport law.
- For more information on aquatic invasive species, contact:



Vermont Watershed Management Division  
at 802-828-1535  
or visit their Web site at  
<http://www.vtwaterquality.org>

## NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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## Prevent the Spread of Aquatic Invasive Species

A grant is available for [aquatic invasive species \(AIS\) spread prevention](#). The deadline for submission of the grant application is January 29, 2016 at 2:00 PM.

Boats, trailers, waders and other fishing and boating equipment can spread [aquatic invasive species](#) from waterbody to waterbody unless properly cleaned, dried or disinfected after use. Although some invasive species such as water milfoil are readily visible to the human eye, many others are too small to be readily noticed. To avoid spreading invasive species please follow the guidelines in the following steps:

1. [Check](#)
2. [Clean](#)
3. [Drain](#)
4. [Dry](#)
5. [Disinfect](#)

### Check

**Check** your boating and fishing equipment for invasive species.





*Don't forget to also inspect all gear used during your fishing or boating trip*

If your boat has been used in a water containing zebra mussels, run your hand along the hull. If it feels like sandpaper, it likely has mussels attached.



*Photo courtesy of Utah DWR*

## Clean

**Clean** any visible mud, plants, fish or animals before transporting equipment.

Discard items in an upland area or in one of the invasive species disposal stations that have been installed at many boat launch sites for your convenience.



Zebra mussels can be difficult to remove from a boat hull. They first need to be killed by exposure to water or steam at least 140 degrees F and then removed by brush or pressure washer.



*Photo courtesy of Utah DWR*

## Drain

**Drain** all water holding compartments including live wells, bait wells and bilge areas.



*Drain your boat before you leave the access site!*



*Be sure to drain boat ballast tanks if your waterski or wakeboard has them.*



*Drain your livewell if you have one.*

## Dry

**Dry** boats, trailers and all equipment before use in another waterbody.



*Drying your boat takes at least 5-7 days in dry, warm weather.*

The most effective method to ensure that no invasive species or fish diseases are transported to a new body of water is to completely dry your boating and fishing equipment. The key is to make certain that equipment is COMPLETELY dry before using it in a new water body. Drying times vary significantly depending upon the type of equipment, air temperature and relative humidity. While the outside of a boat will dry relatively rapidly, bilge, live wells and other areas of a boat not reached by the sun or lacking good air circulation will take additional time to dry completely. A minimum of 5-7 days drying time in dry, warm conditions is recommended. [Drying times can be estimated](http://www.100thmeridian.org/Emersion.asp) at <http://www.100thmeridian.org/Emersion.asp> (leaving DEC website).

## Disinfect

**Disinfect** anything that came into contact with water, if it cannot be dried before reuse.





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