Appendix P– Drilling Fluids Data

BORE-GEL®

Boring Fluid System – U.S. Patent Number 5,723,416

Description

BORE-GEL® single-sack boring fluid system is specially formulated for use in horizontal directional drilling (HDD) applications. BORE-GEL fluid system is a proprietary blended product using high-quality Wyoming sodium bentonite. When BORE-GEL fluid system is mixed with fresh water, it develops an easy-to-pump slurry with desirable fluid properties for HDD.

Applications/Functions

The use of BORE-GEL fluid system promotes the following:

- Optimum gel strength for cuttings suspension and transport
- Pumpable slurry with minimal viscosity
- High reactive solids concentration for improved borehole stability in poorly consolidated/cemented sands and gravel formations
- Reduced filtration via a thin filter cake with low permeability
- Lubrication of pipe in microtunneling operations

Advantages

- Minimizes the number of boring fluid products required
- Easy to mix and fast to yield
- Low viscosity minimizes pump pressures
- Provides lubricity for pulling product line
- Can be used in Water Wells in unconsolidated formations or when additional gel strengths are required to compensate for low annular velocity
- NSF/ANSI Standard 60 certified

Typical Properties

Appearance	Tan to gray powder
pH (4% slurry or 15 lb/bbl)	10.2
Bulk density, lb/ft^3	68 to 72 (compacted)

Rev. 2/24/2011 · IDP 032

Recommended Treatment

Add slowly and uniformly through a high-shear, jet-type mixer over one or more cycles of the volume of slurry. Continue to circulate and agitate the slurry until all unyielded bentonite is dispersed.

Approximate amounts of BORE-GEL® fluid system added to fresh water		
Boring Application	**lb/100 gal**	**kg/m^3**
Normal boring conditions	25 – 35	30 – 42
Poorly consolidated sand/gravel	35 – 60	42 – 72
Lubrication fluid for microtunneling	50 – 60	60 – 72

Packaging

BORE-GEL boring fluid system is packaged in a 50-lb (23-kg) multiwall paper bag.

Availability

BORE-GEL boring fluid system can be purchased through any Baroid Industrial Drilling Products Retailer. To locate the Baroid IDP retailer nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

Baroid Industrial Drilling Products
Product Service Line, Halliburton
3000 N. Sam Houston Pkwy. E.
Houston, TX 77032

Customer Service	(800) 735-6075 Toll Free	(281) 871-4612
Technical Service	(877) 379-7412 Toll Free	(281) 871-4613

HALLIBURTON

MATERIAL SAFETY DATA SHEET

Product Trade Name: **BORE-GEL®**

Revision Date: 20-Mar-2015

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: BORE-GEL®
Synonyms: None
Chemical Family: Mineral
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 Stewardship
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

Substances	CAS Number	PERCENT (w/w)	ACGIH TLV-TWA	OSHA PEL-TWA
Bentonite	1302-78-9	60 - 100%	TWA: 1 mg/m^3	Not applicable
Crystalline silica, quartz	14808-60-7	1 - 5%	TWA: 0.025 mg/m^3	$\frac{10\ mg/m^3}{\%SiO2 + 2}$
Crystalline silica, cristobalite	14464-46-1	0.1 - 1%	TWA: 0.025 mg/m^3	1/2 x $\frac{10\ mg/m^3}{\%SiO2 + 2}$
Crystalline silica, tridymite	15468-32-3	0.1 - 1%	0.05 mg/m^3	1/2 x $\frac{10\ mg/m^3}{\%SiO2 + 2}$

3. HAZARDS IDENTIFICATION

Hazard Overview

CAUTION! - ACUTE HEALTH HAZARD
May cause eye and respiratory irritation.

DANGER! - CHRONIC HEALTH HAZARD
Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

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 exposures below recommended exposure limits. Wear a NIOSH certified, European Standard EN 149, AS/NZS 1715, or equivalent respirator when using this product. Review the Safety Data Sheet (SDS) for this product, which has been provided to your employer.

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 Treat symptomatically.

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 All standard firefighting media.

Special Exposure Hazards Not applicable.

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
HMIS Ratings: Health 0*, Flammability 0, Physical Hazard 0 , PPE: At

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	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.

7. HANDLING AND STORAGE

Handling Precautions	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.
Storage Information	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.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

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.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Powder
Color:	Light brown or Gray
Odor:	Mild earthy
pH:	8-10
Specific Gravity @ 20 C (Water=1):	2.5
Density @ 20 C (lbs./gallon):	Not Determined
Bulk Density @ 20 C (lbs/ft3):	53 - 80
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):	Slightly 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):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data: Stable

Hazardous Polymerization: Will Not Occur

Conditions to Avoid None anticipated

Incompatibility (Materials to Avoid) Hydrofluoric acid.

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

Additional Guidelines Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure Eye or skin contact, inhalation.

Sympotoms related to exposure

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 eye irritation.
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
Bentonite	1302-78-9	> 5000 mg/kg (Rat) > 2000 mg/kg (Rat)	No data available	> 5.27 mg/L (Rat)
Crystalline silica, quartz	14808-60-7	500 mg/kg (Rat) >15,000 mg/kg (Human)	No data available	No data available
Crystalline silica, cristobalite	14464-46-1	> 5000 mg/kg (Rat)	No data available	No data available
Crystalline silica, tridymite	15468-32-3	> 5000 mg/kg (Rat)	No data available	No data available

12. ECOLOGICAL INFORMATION

Ecotoxicological Information

Ecotoxicity Product

Acute Fish Toxicity: TLM96: 10000 ppm (Oncorhynchus mykiss)
Acute Crustaceans Toxicity: Not determined
Acute Algae Toxicity: Not determined

Ecotoxicity Substance

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Bentonite	1302-78-9	EC50(72h): > 100 mg/L (freshwater algae)	TLM96 10,000 ppm (Oncorhynchus mykiss) LC50 (96h) 16,000 - 19,000 mg/L (Oncorhynchus mykiss) LC50 (24h) 2800 – 3200 mg/L (black bass, warmouth bass, blue gill and sunfish)	No information available	EC50 (96h) 81.6 mg/L (Metacarcinus magister) EC50 (96h) 24.8 mg/L (Pandalus danae) EC50 (48h) > 100 mg/L (Daphnia magna)
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
Bentonite	1302-78-9	The methods for determining biodegradability are not applicable to inorganic substances.
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.
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
Bentonite	1302-78-9	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
No information available

12.5. Results of PBT and vPvB assessment
No information available.

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

12.6. Other adverse effects
No information available

13. DISPOSAL CONSIDERATIONS

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.

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

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

IMDG/IMO

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

IATA/ICAO

UN Number: Not restricted
UN Proper Shipping Name: Not restricted
Transport Hazard Class(es): Not applicable
Packing Group: 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	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Chronic Health Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity	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.
WHMIS Hazard Class	D2A Very Toxic Materials Crystalline silica

16. OTHER INFORMATION

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

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.

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*****

QUIK-GEL®

Viscosifier

Description

QUIK-GEL® viscosifier is an easy-to-mix, finely ground (200-mesh), premium-grade, high-yielding Wyoming sodium bentonite. QUIK-GEL viscosifier imparts viscosity, fluid loss control and gelling characteristics to freshwater-based drilling fluids.

Applications/Functions

The use of QUIK-GEL viscosifier promotes or assists the following:

- Mix with fresh water to form a low-solids drilling fluid for general drilling applications
- Viscosify water-based drilling fluids
- Reduce filtration by forming a thin filter cake with low permeability
- Improve hole-cleaning capability of drilling fluids
- Mix with foaming agents to make "gel/foam" drilling fluids for air/foam drilling applications

Advantages

- NSF/ANSI Standard 60 certified
- Single-sack product and cost effective
- Can provide lubricity for drilling fluids
- Can mix easily and quickly reaches maximum viscosity
- Can yield more than twice as much mud of the same viscosity as an equal weight of API oilfield grades of bentonite

Typical Properties

• Appearance	Grey to tan powder
• Bulk density, lb/ft^3	68 to 72 (compacted)
• pH (3% solution)	8.9

Recommended Treatment

Mix slowly through a jet mixer or sift slowly into the vortex of a high-speed stirrer.

Approximate Amounts of QUIK-GEL viscosifier Added to Freshwater			
Application/Desired Result	**lb/100 gal**	**lb/bbl**	**kg/m^3**
Normal Drilling Conditions	15-25	6-10	18-30
Unconsolidated Formations	35-50	15-21	42-60
Make-Up For Gel/Foam Systems	12-15	5-7	14-18

- 1 bbl = 42 U.S. gallons

Rev. 03/2011 · IDP 009

Additional Information

***Note*:**

- For optimum yield, pre-treat make-up water with 1-2 pounds of soda ash per 100 gallons of water (1.2-2.4 kg/m^3).

Packaging

QUIK-GEL viscosifier is packaged in 50-lb (22.7-kg) multiwall paper bags.

Availability

QUIK-GEL viscosifier can be purchased through any Baroid Industrial Products Retailer. To locate the Baroid IDP retailer nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

Baroid Industrial Drilling Products

Product Service Line, Halliburton

3000 N. Sam Houston Pkwy. E.

Houston, TX 77032

Customer Service	(800) 735-6075 Toll Free	(281) 871-4612
Technical Service	(877) 379-7412 Toll Free	(281) 871-4613

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SAFETY DATA SHEET

Product Trade Name: **QUIK-GEL®**

Revision Date: 14-Aug-2017 **Revision Number:** 20

1. Identification

1.1. Product Identifier

Product Trade Name: QUIK-GEL®
Synonyms None
Chemical Family: Mineral
Internal ID Code HM003747

1.2 Recommended use and restrictions on use

Application: Viscosifier
Uses advised against No information available

1.3 Manufacturer's Name and Contact Details

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

Halliburton Energy Services, Inc.
645 - 7th Ave SW Suite 1800
Calgary, AB
T2P 4G8
Canada

Prepared By Chemical Stewardship
Telephone: 1-281-871-6107
e-mail: fdunexchem@halliburton.com

1.4. Emergency telephone number:

Emergency Telephone Number 1-866-519-4752 or 1-760-476-3962
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazards Identification

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

Carcinogenicity	Category 1A - H350
Specific Target Organ Toxicity - (Repeated Exposure)	Category 1 - H372

2.2. Label Elements

Hazard Pictograms

Signal Word: Danger

Hazard Statements
H350 - May cause cancer by inhalation
H372 - Causes damage to organs through prolonged or repeated exposure if inhaled

Precautionary Statements

Prevention
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
P264 - Wash face, hands and any exposed skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P280 - Wear protective gloves/protective clothing/eye protection/face protection

Response
P308 + P313 - IF exposed or concerned: Get medical advice/attention
P314 - Get medical attention/advice if you feel unwell

Storage
P405 - Store locked up

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

2.3 Hazards not otherwise classified

This product contains Wyoming bentonite or other sorptive clays. Crystalline silica forms found in this particular clay are limited to quartz. Extreme temperatures that can generate cristobalite or tridymite are not expected to occur under realistic conditions. In addition, all quartz found in sorptive clays are considered "occluded", i.e., strongly coated with an amorphous silica surface. Occluded quartz has been experimentally-determined to be relatively non-toxic compared to unoccluded quartz. A lack of health effects found in several studies examining occupational exposure to sorptive clays also suggest that chronic inhalation of sorptive clays is not expected to result in silicosis or cancer. In light of these findings OSHA has recently exempted Wyoming bentonite and other sorptive clays from the crystalline silica PEL in §1910.1053(a)(1)(iii).

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Crystalline silica, quartz	14808-60-7	1 - 5%	Carc. 1A (H350) STOT RE 1 (H372)

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

4. First Aid Measures

4.1. Description of first aid measures

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

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

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

Ingestion Rinse mouth with water many times.

4.2 Most important symptoms/effects, 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.

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 in a fire

None anticipated

5.3 Special protective equipment and precautions for fire-fighters

Special protective equipment for firefighters

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. 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.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions

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. Use appropriate protective equipment.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Information

Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Keep from excessive heat. Do not reuse empty container. 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
Crystalline silica, quartz	14808-60-7	TWA: 50 µg/m³	TWA: 0.025 mg/m³

Exposures to crystalline silica that result from bentonite or other sorptive clays are exempt from the PEL in §1910.1053. The PEL in §1910.1000 Table Z–3 (i.e., the formula that is approximately equivalent to 100 µg/m³) applies to occupational exposures to respirable crystalline silica from sorptive clays.

8.2 Appropriate engineering controls

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

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 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.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Powder
Odor: Mild earthy
Color Various
Odor Threshold: No information available

Property Remarks/ - Method	Values
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	2.6
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

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).

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 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 None known.

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.

This product contains Wyoming bentonite or other sorptive clays. Crystalline silica forms found in this particular clay are limited to quartz. Extreme temperatures that can generate cristobalite or tridymite are not expected to occur under realistic conditions. In addition, all quartz found in sorptive clays are considered "occluded", i.e., strongly coated with an amorphous silica surface (Wendlandt et al., 2007; Hochella and Muryama, 2010; SMI, 2014). Occluded quartz has been experimentally-determined to be relatively non-toxic compared to unoccluded quartz (Geh et al., 2006; Creutzenberg et al., 2008). A lack of health effects found in several studies examining occupational exposure to sorptive clays also suggest that chronic inhalation of sorptive clays is not expected to result in silicosis or cancer (Waxweiler et al., 1988; ACGIH, 1991; USEPA, 1996; IARC, 2005). In light of these findings OSHA has recently exempted Wyoming bentonite and other sorptive clays from the crystalline silica PEL in §1910.1053(a)(1)(iii).

11.3 Toxicity data

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Crystalline silica, quartz	14808-60-7	> 15000 mg/kg (human)	No data available	No data available

Substances	CAS Number	Skin corrosion/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin

Substances	CAS Number	Serious eye damage/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the eye

Substances	CAS Number	Skin Sensitization
Crystalline silica, quartz	14808-60-7	No information available.

Substances	CAS Number	Respiratory Sensitization
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	Mutagenic Effects
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
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.

Substances	CAS Number	Reproductive toxicity
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	STOT - single exposure
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Crystalline silica, quartz	14808-60-7	Not applicable

12. Ecological Information

12.1. Toxicity

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Crystalline silica, quartz	14808-60-7	EC50 (72 h) =440 mg/L (Selenastrum capricornutum)(similar substance)	LL0 (96 h) =10000 mg/L (Danio rerio)(similar substance)	No information available	LL50 (24 h) >10000 mg/L (Daphnia magna)(similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Crystalline silica, quartz	14808-60-7	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Crystalline silica, quartz	14808-60-7	No information available

12.5 Other adverse effects

No information available

13. Disposal Considerations

13.1. Waste treatment methods

Disposal methods 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.

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

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.

TSCA Significant New Use Rules - S5A2

Substances	CAS Number	TSCA Significant New Use Rules - S5A2
Crystalline silica, quartz	14808-60-7	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Crystalline silica, quartz	14808-60-7	Not applicable

EPA SARA (311,312) Hazard Class
Chronic Health Hazard

EPA SARA (313) Chemicals

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Crystalline silica, quartz	14808-60-7	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Crystalline silica, quartz	14808-60-7	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

Substances	CAS Number	California Proposition 65
Crystalline silica, quartz	14808-60-7	carcinogen

U.S. State Right-to-Know Regulations

Substances	CAS Number	MA Right-to-Know Law	NJ Right-to-Know Law	PA Right-to-Know Law
Crystalline silica, quartz	14808-60-7	Carcinogen Extraordinarily hazardous	1660	Present

NFPA Ratings: Health 0, Flammability 0, Reactivity 0
HMIS Ratings: Health 0*, Flammability 0, Physical Hazard 0 , PPE: E

Canadian Regulations

Canadian Domestic Substances List (DSL) All components listed on inventory or are exempt.

16. Other information

Preparation Information

Prepared By
Chemical Stewardship
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Revision Date: 14-Aug-2017

Reason for Revision
SDS sections updated:
2
8
11

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 used in the safety data sheet
bw – body weight
CAS – Chemical Abstracts Service
d - day
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
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

Soda Ash

Alkalinity Agent

Description

Soda Ash alkalinity agent is a granular powder form of sodium carbonate primarily used to condition and soften make-up water and to raise pH.

Applications/Functions

- Treat out calcium hardness in make-up water
- Raise pH

Advantages

- Can eliminate calcium ions by converting to insoluble carbonate
- Can maximize the performance of bentonite and polymer products

Typical Properties

Appearance	Variable-colored powder (white to gray)
pH of 5% solution	11.5
Bulk density, lb/ft^3	57-65

Recommended Treatment

- Hardness and pH levels of make-up water should be checked prior to addition of Soda Ash.
- When treating make-up water, pH ranges should be maintained between 8.5 – 9.5
- Addition of Soda Ash should always be done prior to addition of bentonite or polymer to the fluid system.
- Soda Ash alkalinity agent should not be added at the same time as other drilling fluid components.

General Treatment:

- 1-2 pounds of Soda Ash alkalinity agent per 100 gallons of make-up water or 1.2-2.4 kilograms per cubic meter of make-up water.
- Use as required to remove calcium ions but do not add in excess as overtreatment can lead to detrimental effects and reduced performance of the drilling fluid components and/or system.
- Mix slowly through a jet mixer or sift slowly into the vortex of a high-speed stirrer.

Rev. 08/18/2011

Packaging	Soda Ash is packaged in 50-lb (22.7 kg) or 100-lb (45.4 kg) multiwall paper bags.
Availability	Soda Ash can be purchased through any Baroid Industrial Drilling Products Retailer. To locate the Baroid IDP retailer nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

Baroid Industrial Drilling Products
Product Service Line, Halliburton
3000 N. Sam Houston Pkwy. E.
Houston, TX 77032

Customer Service	(800) 735-6075 Toll Free	(281) 871-4612
Technical Service	(877) 379-7412 Toll Free	(281) 871-4613

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **SODA ASH**

Revision Date: 24-Apr-2017 **Revision Number:** 42

1. Identification

1.1. Product Identifier

Product Trade Name: SODA ASH
Synonyms None
Chemical Family: Carbonate
Internal ID Code HM001822

1.2 Recommended use and restrictions on use

Application: Buffer
Uses advised against No information available

1.3 Manufacturer's Name and Contact Details

Manufacturer/Supplier

Halliburton Energy Services, Inc.
P.O. Box 1431
Duncan, Oklahoma 73536-0431
Telephone: 1-281-871-6107

Halliburton Energy Services, Inc.
645 - 7th Ave SW Suite 1800
Calgary, AB
T2P 4G8
Canada

Prepared By Chemical Stewardship
Telephone: 1-281-871-6107
e-mail: fdunexchem@halliburton.com

1.4. Emergency telephone number

Emergency Telephone Number: 1-866-519-4752 or 1-760-476-3962
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazards Identification

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

Serious Eye Damage/Irritation	Category 2 - H319

2.2. Label Elements

Hazard Pictograms

Signal Word: Warning

Hazard Statements H319 - Causes serious eye irritation

Precautionary Statements

Prevention P264 - Wash face, hands and any exposed skin thoroughly after handling
P280 - Wear eye protection/face protection

Response P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P337 + P313 - If eye irritation persists: Get medical advice/attention

Storage None

Disposal None

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Sodium carbonate	497-19-8	60 - 100%	Eye Irrit. 2 (H319)

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

4. First Aid Measures

4.1. Description of first aid measures

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

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

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

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

4.2 Most important symptoms/effects, acute and delayed

Causes eye irritation

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 in a fire
Decomposition in fire may produce harmful gases.

5.3 Special protective equipment and precautions for fire-fighters

Special protective equipment for firefighters
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. Avoid contact with skin, eyes and clothing. Ensure adequate ventilation.
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. Ensure adequate ventilation. Wash hands after use. Launder contaminated clothing before reuse. Use appropriate protective equipment.
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 acids. Store in a cool, dry location. Product has a shelf life of 60 months.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

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

8.2 Appropriate engineering controls

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

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.

Hand Protection	Normal work gloves.
Skin Protection	Normal work coveralls.
Eye Protection	Dust proof goggles.
Other Precautions	None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Powder	**Color**	White
Odor:	Odorless	**Odor Threshold:**	No information available

Property Remarks/ - Method	Values
pH:	11.5
Freezing Point / Range	No data available
Melting Point / Range	851 °C
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

Molecular Weight	105.99 g/mole
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 acids.

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 Causes eye irritation.

Skin Contact Not irritating to skin in rabbits.

Ingestion Irritation of the mouth, throat, and stomach.

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
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

Substances	CAS Number	Skin corrosion/irritation
Sodium carbonate	497-19-8	Non-irritating to the skin

Substances	CAS Number	Serious eye damage/irritation
Sodium carbonate	497-19-8	Irritating to eyes

Substances	CAS Number	Skin Sensitization
Sodium carbonate	497-19-8	Not classified

Substances	CAS Number	Respiratory Sensitization
Sodium carbonate	497-19-8	No information available

Substances	CAS Number	Mutagenic Effects
Sodium carbonate	497-19-8	In vivo tests did not show mutagenic effects.

Substances	CAS Number	Carcinogenic Effects
Sodium carbonate	497-19-8	No information available

Substances	CAS Number	Reproductive toxicity
Sodium carbonate	497-19-8	Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Sodium carbonate	497-19-8	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.

Substances	CAS Number	Aspiration hazard
Sodium carbonate	497-19-8	Not applicable

12. Ecological Information

12.1. Toxicity

Substance Ecotoxicity Data

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.)

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.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Sodium carbonate	497-19-8	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Sodium carbonate	497-19-8	No information available

12.5 Other adverse effects

No information available

13. Disposal Considerations

13.1. Waste treatment methods

Disposal methods Bury in a licensed landfill according to 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

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.

TSCA Significant New Use Rules - S5A2

Substances	CAS Number	TSCA Significant New Use Rules - S5A2
Sodium carbonate	497-19-8	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Sodium carbonate	497-19-8	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
Sodium carbonate	497-19-8	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Sodium carbonate	497-19-8	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

Substances	CAS Number	California Proposition 65
Sodium carbonate	497-19-8	Not applicable

U.S. State Right-to-Know Regulations

Substances	CAS Number	MA Right-to-Know Law	NJ Right-to-Know Law	PA Right-to-Know Law
Sodium carbonate	497-19-8	Not applicable	Not applicable	Not applicable

NFPA Ratings: Health 2, Flammability 0, Reactivity 0
HMIS Ratings: Health 2, Flammability 0, Physical Hazard 0 , PPE: B

Canadian Regulations

Canadian Domestic Substances List (DSL) All components listed on inventory or are exempt.

16. Other information

Preparation Information

Prepared By
Chemical Stewardship
Telephone: 1-281-871-6107
e-mail: fdunexchem@halliburton.com

Revision Date: 24-Apr-2017

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 used in the safety data sheet
bw – body weight
CAS – Chemical Abstracts Service
d - day
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
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

Appendix Q– Diving Procedures and Safe Practices Manual

DIVING PROCEDURES & SAFE PRACTICES MANUAL

Caldwell Marine International

REVISION TABLE			
REV. #	**DESCRIPTION**	**DATE**	**APPROVED**
00	Creation	06/20/08	AB AG
01	Revised after review	10/17/17	LA DC
02	Revised after revew	12/17/21	LA EP DC
03	Revised after reveiw	05/18/22	LA EP DC
04	Revised after reveiw	06/17/22	LA EP

*This manual references the current 29 CFR 1910 standards for Commercial Diving Operations and the US Navy Diver's Handbook – Revision 7

1. General Information 6
1.1 Introduction 6
1.2. Diving Personnel Responsibilities 6
1.2.1 Diving Supervisor 6
1.2.2 Diver 8
1.2.3 Standby Diver 8
1.2.4 Tender 8
1.3 Medical Requirements 9
1.3.1 General 9
1.3.2 Physical Examination 9
1.3.3 Re-examination After Diving Injury or Illness 9
1.3.4 Physician's Written Report 10
1.3.5 Disqualifying Conditions 10
1.3.6 Withdrawal From Hyperbaric Conditions 11
1.3.7 Medical Record Keeping 11
1.4 Record Keeping 11
1.4.1 Diving Logs 11
1.4.2 Maintenance Logs 12
1.5 Limits/Prohibitions 13
1.5.1 General Limits 13
2. Operation Planning 14
2.1 General Planning Considerations 14
2.2 Define Project Objective 14
2.3 Information Gathering 14
2.3.1 Surface Conditions 15
2.3.2 Sea State 15
2.3.3 Tender Safety 15
2.3.4 Surface Visibility 15
2.3.5 Depth 16
2.3.6 River or Major Ocean Currents 16
2.3.7 Underwater Visibility 16
2.3.8 Type of Bottom 16
2.4 Logistics 16
2.5 Chart and Checklists 17
3. Safety 18
3.1 General 18
3.2 Emergency Services 18
3.3 Diving Operations 18
3.4 Responsibilities of the Diving Supervisor 19
3.5 Diving Personnel Responsibilities 19
3.6 Deck and General Safety 20
3.7 Deck Crew Directly Assisting the Divers 20
3.8 Crane Operators 20
3.9 Uses and Storage of Gas Cylinders 21
3.10 Oxygen Safety Precautions 21
3.11 Operation and use of equipment underwater 22

3.12 Underwater Cutting and Welding 22
3.12.1 Explosive Gases 22
3.12.2 Electricity Underwater 23
3.13 Hand tools 28
3.14 Explosives 28
3.15 Confined Space Entry/Tunnel Penetration 28
4. Equipment Requirements 30
4.1 General System Requirements 30
4.2 Diving Supervisor Responsibilities 30
4.3 Diver Worn Equipment 30
4.3.1 Helmets 31
4.3.2 Pre-dive Checks 31
4.3.3 Thermal Protection 31
4.3.4 Wet Suits 31
4.3.5 Variable Volume Dry Suits 32
4.3.6 Extreme Exposure Suits/Hot Water Suits 32
4.3.7 Pre-dive Checks and Maintenance 32
4.3.8 Safety Harness/Bailout bottle 32
4.3.9 Knife 33
4.3.10 Umbilical 33
4.4 Gas Hose Requirements 34
4.5 Breathing Gas Systems 34
4.5.1 Requirements for Air Supply 34
4.5.2 Air Supply Flow Requirements 34
4.5.3 Supply Pressure Requirements 35
4.5.4 Water Vapor Control 35
4.5.5 Air Compressors 35
4.5.6 Gas Purity Standards 35
4.5.7 Gas Cylinder Color Codes 36
4.6 Deck Chambers 36
4.6.1 Basic Requirements 36
4.6.2 Standard Features 36
4.6.3 Labeling 36
4.6.4 Inlet and Exhaust Ports 36
4.6.5 Pressure Gauges 36
4.6.6 Relief Valves 37
4.6.7 Communications System 37
4.6.8 Lighting Fixtures 37
4.6.9 State of Readiness 37
4.6.10 Post Dive Checklist 37
4.6.11 Diving Craft and Platforms 37
4.7 Miscellaneous equipment 38
4.7.1 Diving Ladders 38

4.7.2 Diving Stages 38
4.7.3 First Aid Equipment 38
4.8 Equipment Test Requirements 38
4.8.1 Chamber Maintenance 38
4.8.2 Gas Hose test 39
5. Surface-Supplied Air Diving 46
5.1 Limits 46
5.2 Minimum Personnel 46
5.3 General Surface Supplied Procedures 47
5.4 Minimum Equipment 48
5.4.1 Shallow Air (0 to 80 fsw, 60 fsw when live boating) 48
5.4.2 Deep Air (in excess of 80 fsw, 60 fsw when live boating) 48
5.5. Post-Dive Procedures 48
5.6 Recompression Capability 49
5.7 Record of Dive 49
5.8 Air Diving Procedures 50
5.8.1 Introduction 50
5.8.2 AIR Decompression Definition 51
5.8.3 Selection of Decompression Schedule 52
5.9 Rules During Ascent 52
5.9.1 Ascent Rate 53
5.9.2 Decompression Stop Time 53
5.10 Decompression Tables 53
5.10.1 The Unlimited/No-Decompression 53
5.10.2 U.S. Navy Standard Air Decompression Schedules 54
5.10.3 Repetitive Dives 54
5.10.4 Residual Nitrogen Timetable for Repetitive Air Dives 55
5.10.5 RNT Exception Rule 55
5.11 Surface Decompression 55
5.11.1 Surface Decompression Table Using Oxygen. 56
5.11.2 Loss of Oxygen Supply in the Chamber (40 fsw Chamber Stop) 56
5.11.3 CNS Oxygen Toxicity (40 fsw Chamber Stop) 57
5.11.4 Repetitive Dives 57
5.11.5 Surface Decompression Table Using Air 57
5.11.6 Repetitive Dives 58
5.12 Exceptional Exposure 58
5.12.1 Surface Decompression Procedures for Exceptional Exposure Dives 58
5.12.2 Oxygen System Failure (Chamber Stop) 59
5.13 Diving At High Altitudes 59
5.13.1 Flying After Diving 59
5.14 Emergency Procedures 61
6.1 Limits 64
6.2 Procedures 64

6.3 Termination of the dive 64
6.4 Minimum SCUBA Equipment 64
6.5 Buddy Diver Responsibilities 65
6.6 Working with Tools 65
6.7 Ascent Procedures 66
6.7.1 Emergency Free-Ascent Procedures 66
7. **Liveboating** 67
7.1 Limits 67
7.2 Minimum Personnel 67
7.3 Vessel 67
7.4 Dynamically Positioned Diving Support Vessels 67
7.4.1 Procedures 68
8. **Recompression Treatment** 69
8.1 OMITTED DECOMPRESSION 69
8.1.1 Ascent from 20 Feet or Shallower (Shallow Surfacing) with Decompression Stops Required 69
8.1.2 Ascent from 20 Feet or Shallower with No Decompression Stops Required. . 69
8.1.2Ascent from Deeper than 20 Feet (Uncontrolled Ascent) 69
8.1.4 Asymptomatic Uncontrolled Ascent 70
8.1.4 Development of Symptoms 70
8.1.5 In-Water Procedure 70
8.1.6 Symptomatic Uncontrolled Ascent 70
8.1.7 Transporting the Patient 71
8.1.8 Medical Treatment During Transport 71
8.1.9 Transport by Unpressurized Aircraft 71
8.1.10 Communications with Chamber 71
8.2 Treatment Tables 71
8.2.1 Treatment of Symptoms During Sur-D Surface Interval 72
8.2.2 Treating for Exceeded Sur-D Surface Interval 72
8.2.3 Recompression Treatments When Oxygen Is Not Available 72
8.2.3 Descent/Ascent Rates for Air Treatment Tables 72
8.2.4 Recompression Treatments When Oxygen Is Available 72
8.2.5 Treatment Table 5 72
8.2.6 Performance of Neurological Exam at 60 fsw 73
8.2.7 Extending Oxygen Breathing Periods on Treatment Table 5 73
8.2.7 When Use of Treatment Table 6 is Mandatory 73
8.2.8 Complete Relief after 10 Minutes 73
8.2.9 Musculoskeletal Pain Due to Orthopedic Injury 73
8.3 Treatment Table 6 73
8.3.1 Treating Arterial Gas Embolism 74
8.4 Treatment Table 6A 74
8.5 Treatment Table 4 74
8.6 Treatment Table 7 74

8.7 Treatment Table 8 75
10. **Definitions** 77

1. General Information

1.1 Introduction

The procedures and requirements outlined in this manual are founded on the regulations that have been established by the U. S. Coast Guard, the Association of Diving Contractors (ADC), and the Occupational Safety and Health Administration (OSHA), and the US Navy Diver's Handbook – Revision 7

When diving operations occur that are not covered in this manual, local regulations must be determined. Should differences between local regulations and this manual occur the more conservative guidance shall be used. If a direct conflict exists between this manual and local regulations, Caldwell Marine International *(CMI*) management must be consulted for guidance.

This manual applies to all types of diving operations conducted by *Caldwell Marine International* divers and contractors. It provides guidance and detailed procedures to be followed when conducting air diving, both surface supplied and SCUBA. As changes to regulations governing commercial diving occur this manual will be updated

1.2. Diving Personnel Responsibilities

Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner. All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent) and in the use of a manual bag-type resuscitator. Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology and fully understand emergency procedures.

1.2.1 Diving Supervisor

The Diving Supervisor is the on-scene-representative of *Caldwell Marine International* management and is directly responsible for the safe conduct of all phases of diving operations. The diving supervisor shall be designated in writing and given to the Person-in-Charge prior to any diving operation**. THE NUMBER ONE PRIORITY OF THE DIVING SUPERVISOR IS THE SAFETY OF THE DIVE TEAM UNDER THEIR AUTHORITY.** The Diving Supervisor has the final word concerning diving operations, shall exercise caution when dealing with matters not covered by company policy, and must understand and comply with all government regulations and company policies that apply to the diving operation.

The responsibilities of the Diving Supervisor include:

- The Supervisor shall be in immediate control of the diving operation and available to implement emergency procedures.
- The Supervisor is not permitted to dive unless there is another qualified supervisor designated in writing and is available to take over the divingoperation.
- The Diving Supervisor shall coordinate with the Person-in-Charge, Craft Masters, Customer Representative, all persons responsible for any thing that may affect the safety of the divers and the efficient completion of the divingoperation.
- Personally verify that all personnel in the dive team are qualified and physically able to perform tasks assigned. He must make an assessment of the physical condition of the divers prior to each dive to determine if any physical impairment is present which would be harmful to their health and safety ether in the water or in a chamber.
- The Diving Supervisor will perform Job Hazard Analysis (JHA) for each task undertaken.
- The supervisor will establish a dive plan ensuring that enough trained personnel, supplies, and proper equipment are available for the safe and timely completion of the diving operation.
- The Diving supervisor shall personally verify the emergency assistance checklist to ensure a two-way communication system is available to reach emergency assistance if required.
- The Diving supervisor shall ensure that diving operations are conducted from a safe dive platform.
- The Supervisor shall verify that the Safety Procedures Checklist, Equipment Procedures Checklist, and the Recompression Chamber Checklist, if chamber is on location, have been performed properly and ensure that all diving equipment designated for use is suitable for the planned operation and is in good working order.
- Ensure that all manuals, instructions, decompression and recompression tables and regulatory publications are available at the dive location. Provide the Customer Representative a copy of the dive manual and a dive plan outlining the diving operation.
- The Diving Supervisor shall brief the dive team on the details to the task, safety precautions and emergency procedures. After the dive he will assess the diver condition and instruct to report any physical problems that may occur as soon as possible.
- The Diving Supervisor will immediately activate emergency procedures at the first sign of a problem with the dive. As soon as the situation stabilizes he will inform the Person-in-Charge, and Customer Representative.
- Report all accidents or incidents required by law to the company. Insure that all reports required are promptly filled out sent to the proper authorities.

1.2.2 Diver

Assigned by the Diving Supervisor, the diver should be at least 18 years old, and medically certified "fit to dive". The diver shall be qualified to dive the equipment in use, and be in possession of an up to date diver's logbook. The Diver must have a current certification in First Aid and CPR.

- Understand and comply with company policies and this document.
- Follow safe diving practice at all times.
- Ensure diver-worn equipment is properly maintained, complete, and ready for use. Asrequired, assist in the maintenance and repair of all diving equipment.
- Immediately obey all commands or instructions form the diving supervisor to return the surface or first decompression stop.
- Act as standby diver when directed to do so.
- Act as a chamber operator as required.
- Report any recent medical treatment or illness to the diving supervisor.
- Report all symptoms after a dive to the diving supervisor immediately and as accurately as possible.
- Report all equipment problems to the diving supervisor.
- Know and observe the rules for flying after diving or traveling to altitudes higher than the dive site.
- Remain in the vicinity of the recompression chamber if required.
- Be ready to assume the responsibilities of the Diving Supervisor where one is not required.

1.2.3 Standby Diver

The Standby Diver is that individual possessing the required training and experience to enter the water at the diving station in order to render assistance to a stricken diver.

- The Standby's helmet or mask will be fitted to the standby umbilical in a wrench tight status. The flow to the helmet or mask will be verified, and a communications check will be conducted to ensure three-way communications between the standby diver, topside, and the stricken diver.
- The Standby will remain in the immediate vicinity of the diving control station, receives the same briefings and instructions as the working diver, monitors the progress of the dive, and be fully prepared to respond if called upon for assistance i.e.. Standby diver is at the dive station with his diving helmet, harness, bail-out bottle and weight belt and available to render immediate assistance when called apon.The standby diver shall also be equipped with an octopus rig.

1.2.4 Tender

The tender is assigned by the diving supervisor to continuously tend a diver. He must have a basic understanding of diving acquired through a special school or equivalent experience He shall not be assigned any other task while the diver is under the water. The Tender must have a current certification in First Aid and CPR. The Tender must:

- Set up and operate all equipment as directed by the lead tender, Diving supervisor.

Assist in topside work connected with the diving operations or other topside work as required or directed.

- Stay alert to what is going on with the dive. Be aware of the divers location and the

divers depth. Once the diver is in the water, the tender constantly tends the lines to eliminate excess slack or tension. The tender exchanges line-pull signals with the diver, keeps the Diving Supervisor informed of the line-pull signals and amount of diving hose/tending line over the side and remains alert for any signs of an emergency.

- Immediately report any conditions, which may be hazardous or unsafe.
- If qualified, operate the recompression chamber when directed by the diving supervisor.
- If qualified to act as an inside tender he must be medically certified, “fit to dive.”
- If acting as an inside tender he must be familiar with and alert for any symptoms of oxygen toxicity.

1.3 Medical Requirements

1.3.1 General

For persons engaged as divers or otherwise subjected to hyperbaric conditions the following medical examinations are required.

- An initial medical examination
- Periodic re-examination recommended annually but as minimum on an annual basis.

1. A re-examination is required after a diving related injury or illness to determine fitness to return to diving duty. For the purposes of these medical requirements all examinations are to be performed only by licensed physicians qualified to perform commercial diver medical examinations. Must have licensed physician signature to be legible and/or stamped, with their medigal designation clearly indicated. Non-physicians are not recognized by the ADCI as being qualified to perform commercial diver medical examinations

1.3.2 Physical Examination

The initial examination and subsequent periodic re-examination include the following:

- Work History
- The test required in table 1-1
- Any test deemed necessary to establish the presence of any disqualifying conditions
- Any test the physician needs to prepare the written report.

If with in one year the individual has had a comprehensive medical examination comparable to the initial diving physical and no disqualifying conditions are present, the examination can be use in place of the initial examination.

1.3.3 Re-examination After Diving Injury or Illness

Any person exposed to hyperbaric conditions who has a diving related injury or illness that requires hospitalization of more 72 hours or known AGE or decompression sickness with central nervous system dysfunction will require a re-examination and be released by a qualified physician before they can return to diving duty.
The examining physician should determine the scope of the examination in light of the nature of the diving injury or illness.

1.3.4 Physician's Written Report

With respect to the initial examination or any re-examination, the diver must obtain a written report from the examining physician that contains the following information:

- Results of the examination and tests given on accordance with this section.
- The physician's opinion as to the fitness of the person to perform as a diver based on his medical history and the results of the test required in table 1-1 in particular to the following:
- Stress to the pulmonary, muscular, cardiac and skeletal systems.
- Interference with effective external communication of the gas-containing organs of the body.
- Condition if the central and peripheral nervous system.
- Any other factor that indicates material impairment of the employee's health.
- The physician's opinion as to whether there exist any disqualifying conditions.
- Any recommended limitations placed on the persons activities as a diver or exposure to hyperbaric conditions.
- A statement by the examining physician the individual has been informed of the results of the physical any and conditions that require further examination or treatment.

1.3.5 Disqualifying Conditions

A person having any of the following conditions, as determined by a qualified physician shall be disqualified from engaging in diving or other hyperbaric activities:

- History of seizure disorders other than childhood febrile convulsions.
- Cystic or cavity disease of the lungs, significant obstructive or restrictive lung disease, or recurrent pneumothorax.
- Chronic inability to equalize sinus and middle ear cavities.
- Significant central peripheral nervous system disease.
- Significant cardiac abnormalities.
- Chronic alcoholism, drug abuse, or history of psychosis.
- Significant hemoglobinopathies.
- Significant malignancies.
- Grossly impaired hearing.
- Pregnancy.
- Chronic obstruction of the Eustachian tubes.
- Chronic gastrointestinal disease.
- Hernia
- Severe head injury, cranial surgery.

- Severe visual defects.
- Excessive obesity.
- Diabetes.
- Gross abnormality of the renal tract.
- Severe Stammering.
- Any acute condition while undergoing treatment for that condition

Below are the current Disqualifying Conditions Listed on the ADCI current edition:

- History of seizure disorder other than early childhood febrile conditions.
- Cystic, bullous or cavitary disease of the lungs, significant obstructive or restrictive lung disease and/or spontaneous pneumothorax.
- Chronic inability to equalize sinus and middle ear pressure.
- Significant central or peripheral nervous system disease or impairment.
- Chronic alcoholism, drug abuse or dependence or history of psychosis.
- Hemoglobinpathies associated with comorbidities.
- Any person engaged as a diver, or otherwise exposed to hyperbaric conditions, will have a medical evaluation following any non-diving injury or illness that requires any prescription medication, any surgical procedure or any hospitalization.
- Untreated or persistent/metastatic or other significant malignancies including those that require chemotherapy and/or radiation therapy unless five years after treatment with no evidence of recurrence.
- Hearing impairment in the better ear should be at least 40 dB average in the 500, 1000, and 2000 Hz frequencies.
- Justa-articular osteonecrosis is disqualifying. Chronic conditions requiring continuous control by medication that increases risks in diving.
- Pregnancy.

The above current list does not mean that all other conditions are acceptable such as excessive obesity. For example previously listed diabetes. Current gudielines suggest that DM with a stable HBA1c and no medications is not disqualifying.

1.3.6 Withdrawal from Hyperbaric Conditions

Withdrawal from hyperbaric conditions shall be determined by a physician examination whether a person's health will be at risk by continued hyperbaric exposure.

1.3.7 Medical Record Keeping

An accurate medical record for each person subject to the medical specifications of this section should be maintained. The record should include the employees current dive physical and be maintained for at least 5 years after the last hyperbaric exposure.

Medical Test for Diving			
Test	**Initial**	**Annual Per ADCI current table 2.3.4 tble 1**	**Comments**
History and Physical	X	X	Include predisposition to unconsciousness, vomiting cardiac arrest, impairment of oxygen transport, serious blood loss, or anything that in the opinion of the examining physician will interfere with effective underwater work.
Chest X-Ray	X	X	PA (Projection: 14" x 17" min.)
Bone and Joint X-Ray Survey	X		Required initially and as medically indicated.
EKG: Stress			Required only as medically indicated.
Pulmonary Function	X	X	Required initially and as medically indicated
Audiogram	X	X	Threshold audiogram by pure tone audiometry; bone conduction audiogram as medically indicated.
Visual Acuity	X	X	Required initially and as medically indicated.
Color Blindness	X		Required initially
Hematocrit, Hemoglobin, WBC Count	X	X	
EEG			Required only as medically indicated
Routine Urinalysis	X	X	
EKG Standard (12l)	X		Required initially to establish baseline, annually after age 35, and as medically indicated
Comprehensive Metabolic profile.	X	X	Optional including cholesteraol and triglucerides required for diversd over 40
Lipid Panel	X	X	Required annualy afterage 35
Framingham Risk Score	X	X	Required annualy after age of 35

1.4 Record Keeping

1.4.1 Diving Logs

During each diving operation, an operation log shall be maintained covering the entire operation. The Diving Supervisor will ensure that the master operations log is properly updated.

Operations logbook will be maintain at the dive control center. This logbook will be a chronological record of all events that directly affect the diving operation. The diving supervisor will sign all entries. The logbook shall include the following:

- Date, time, and location at the start and completion of each dive operation.
- Approximate underwater and surface conditions (weather, visibility, temperatures, and currents).
- Names of dive team members including diving supervisor.
- General nature of work performed.
- Repetitive dive designation or elapsed time since last hyperbaric exposure if less than 24 hours for each diver.
- Diving modes used.
- Maximum depth and bottom time for each diver.
- Name of person-in-charge
- For each dive outside the no-de-compression limits, deeper than 130 fsw, or using mixed-gas, the breathing gases and decompression table designations used.
- When decompression sickness or gas embolism is suspected or symptoms are evident:
- The name of the diver; and a description and results of treatment
- For each fatality or any diving related injury or illness that results in incapacitation of more than 72 hours or requires any dive team member to be hospitalized for more than 24 hours—The date, Time, Circumstances; and Extent of any injury or illness.
- The diving supervisor shall insure that the following is recorded in the logbook for each diving operation deviating from the requirements of this manual:
- A description of the circumstances leading to the situation.
- The deviations made.
- The corrective action taken, if appropriate, to reduce the possibility of recurrence.

1.4.2 Maintenance Logs

Caldwell Marine International shall insure that the equipment identified below will be maintained, inspected/tested, and tagged at the appropriate intervals and documented:

- The date and results of each check of the medical kits.
- The date and results of each test of the air compressor.
- The date and results of each check of breathing mixtures.
- The date and results of each check of each breathing supply system.
- The date, equipment cleaned, general cleaning procedure, and names of persons cleaning the diving equipment for oxygen service.
- The date and results of each test of the breathing supply hoses and sys-tem.

- The date and results of each inspection of the breathing gas supply system.
- The date and results of each test of depth gages and timekeeping de-vices.
- The date and results of each test and inspection of each PVHO.
- The date and results of each inspection of the diving equipment.
- The date and results of each test and inspection of pressure piping.
- The date and results of each test and inspection of volume tanks and cylinders. (see addendum 3-4)

1.5 Limits/Prohibitions

This section will establish limits for the use of the various types of diving equipment and breathing gases for *Caldwell Marine International* divers and contractors. These limits are in accordance with accepted safe diving practices. **THEY ARE CONSIDERED FIRM DO NOT EXCEED THEM WITHOUT EXPRESS PERMISSION FROM *Caldwell Marine International* MANAGEMENT**. The limits established in this section are to govern all diving operations regardless of the geographical location, unless they are in conflict with regulations established by the local government. In this case the limits that are more conservative shall be used, and the area of difference will be brought to the attention of *Caldwell Marine International* management.

1.5.1 General Limits

The limits presented in Table 1-2 are to govern all diving operations conducted by *Caldwell Marine International* divers and contractors.

Table 1-2 *Caldwell Marine International Diving* Limits

Depth: Feet	Meters	Type of Diving Activity
0 fsw	0 m	CMI requires a bail out bottle at all times regardless of depth. (USCG)
60 fsw	18.2 m	Recompression chamber required at the dive site for any dives deeper than this depth or any dives requiring decompression. (ADC)
130 fsw	39.6	Stage or open bell required for dives deeper than this depth or for any for any dives requiring decompression (USCG)
100 fsw	39.6	Maximum permissible depth for SCUBA (USCG)
170 fsw	51.8	Normal working limit for surface supplied air diving. Dives deeper than this depth will not be conducted without the permission of *Caldwell Marine International* management (*Caldwell Marine International*)
190 fsw	57.9 m	Air dives deeper than this depth will be limited to dives with a maximum bottom time of 30 minutes. (USCG)
220 fsw	67 m	Maximum limit for live boating. (USCG) – not permitted
220 fsw	67 m	Maximum limit for surface supplied air diving. Maximum bottom time – 30 minutes. (USCG)

2. Operation Planning

2.1 General Planning Considerations

Planning of a diving operation shall include a Job Hazard Analysis. A successful diving project is the direct outcome of careful, thorough planning. The nature of each operation determines the scope of the planning effort, but certain general considerations apply to every operation.

- **Bottom Time**: Bottom time is always at a premium. Developing measures to conserve bottom time or increase diver effectiveness is critical for success.
- **Preplanning:** An operation that is delayed due to unanticipated problems may fail. Preplanning the use of the time available to accomplish specific objectives is a prerequisite to success.
- **Equipment:** Selecting the correct equipment for the job is critical to success.
- **Environmental Conditions:** Diving operational planners must plan for safely mitigating extreme environmental conditions. Personnel and support facility safety shall be given the highest priority.
- **Diver Protection:** It is critical to protect divers from shipping hazards, temperature extremes, and dangerous pollution during all operations.
- **Emergency Assistance:** It is critical to coordinate emergency assistance from outside sources before the operation begins.
- **Weather:** Because diving operations are weather dependent, dive planning should factor in delays due to weather.

2.2 Define Project Objective

A clear and concise statement of the project objective shall be established. This includes an in-depth breakdown of all task required to complete the job, the location and the time frame in which it is to be accomplished. All parties involved in the project, diving and non-diving should work together to define the scope of work. Once the diving objectives have been outlined planning can begin.

2.3 Information Gathering

The size of the operation, the diving site location, bottom conditions, and the prevailing environmental conditions influence the extent and type of information that must be gathered when planning an operation. Some operations are of a recurring nature; so much of the required information is readily available. However, even for a standard operation, procedures may have been modified or special environmental conditions may exist, requiring a change in the plan or special tools. Potential changes in task requirements affecting work procedures should not be overlooked during planning. Areas, which should be considered when planning an operation, include government regulations affecting diving, resources, both logistical and emergency that are available locally to support the operation.

2.3.1 Surface Conditions

Surface conditions in the operating area affect both the divers and the topside team members. Surface conditions are influenced by location, time of year, wind, waves, tides, current, cloud cover, temperature, visibility, and the presence of other ships. Completing the Environmental Assessment Work-sheet can help ensure that environmental factors are not overlooked during planning. Weather reports and long-range weather forecasts shall be studied to determine if conditions will be acceptable for diving. Weather reports shall be continually monitored while an operation is in progress.

NOTE: Diving should be discontinued if sudden squalls, electrical storms, heavy seas, unusual tide or any other condition exists that, in the opinion of the Diving Supervisor, jeopardizes the safety of the divers or topside personnel.

2.3.2 Sea State

A significant factor is the sea state. Wave action can affect everything from the stability of the moor to the vulnerability of the crew to seasickness or injury. Unless properly moored, a ship or boat drifts or swings around an anchor, fouling lines and dragging divers. Wave action will cause the vessel to pitch and roll, resulting in a potentially hazardous surge on lines and hoses to the diver and equipment such as a jet sled or bell, on or near the bottom. Divers are not particularly affected by the action of surface waves unless operating in surf or shallow waters, or if the waves are exceptionally large. Surface waves may become a serious problem when the diver enters or leaves the water and during decompression stops near the surface.

2.3.3 Tender Safety

Effective dive planning shall provide for extreme temperatures that may be encountered on the surface. Normally, such conditions are a greater problem for tending personnel than for a diver. Any reduction in the effectiveness of the topside personnel may endanger the safety of a diver. Tending personnel shall guard against:

- Sunburn
- Windburn
- Hypothermia
- Frostbite
- Dehydration
- Heat exhaustion

2.3.4 Surface Visibility

Variations in surface visibility are important. Reduced visibility may seriously hinder or force postponement of diving operations. For operations to be conducted in a known fog belt, the diving schedule should allow for delays because of low visibility. Diver and support crew safety is the prime consideration when determining whether surface visibility is adequate. Proper flags signaling devices shall be use during the day and at the proper lighting shall be use to warn other vessels in the area.

2.3.5 Depth

Depth is a major factor in selecting both diving personnel and apparatus and influences the decompression profile for any dive. Depth must be carefully measured and plotted over the general area of the operation to get an accurate depth profile of the dive site. Operations in deep waters may also call for special support equipment such as underwater lights, cameras, ROV, etc.

2.3.6 River or Major Ocean Currents

The direction and velocity of normal river, ocean, and tidal currents will vary with time of the year, phase of the tide, con-figuration of the bottom, water depth, and weather. Tide and current tables show the conditions at the surface only and should be used with caution when planning diving operations. The direction and velocity of the current beneath the surface may be quite different than that observed on the surface.

2.3.7 Underwater Visibility

Underwater visibility varies with depth and turbidity. Visibility is poorest in harbor areas because of river silt, sewage, and industrial wastes flowing into the harbor. Agitation of the bottom caused by strong currents and the passage of large ships can also affect visibility. Divers are frequently required to dive at night or in an enclosed space where visibility very limited. Generally good visibility can be considered a luxury, and should be accounted for.

2.3.8 Type of Bottom

The type of bottom may have a significant effect upon a diver's ability to move and work efficiently and safely. Advance knowledge of bottom conditions is important in scheduling work, selecting dive technique and equipment, and anticipating possible hazards. The type of bottom is often noted on the chart for the area, but conditions can change within just a few feet.

2.4 Logistics

The initial task to be planned for is getting all equipment, supplies and personnel on site at the proper time. Once on the scene and operating the problem becomes one of maintaining an adequate supply required materials to meet anticipated requirements.

- Consultation with the Person-in-Charge of the platform from which operations are to be conducted is necessary. He must fully understand all of the demands that will be placed on his vessel so he has time to make the preparations required to ensure that his craft is ready on time. Arrangements must also be made for the placement of diving and support equipment on board in a manner that will not affect the stability and operability of the craft.
- Complying with regulations established by the government whose waters diving operations are being conducted is essential. It is not uncommon for a government to require written permission, submit copies of intended diving procedures, to have procedures that are more conservative than this manual. Governments may require environmental impact statements. The cost of not complying with governmental regulations can be enormous.

- Arrangements for personnel must not be over looked. This not only includes arranging for a sufficient quantity of qualified personnel at all levels, but also arranging backups in the event that personnel scheduled for a job are unable to make it, and making sure that personnel know when and where they are supposed to be, and any special equipment they are to bring.

2.5 Chart and Checklists

The charts and checklists are provided to assist the project planner complete the Job Hazard Analysis. (see addendum #1)

3. Safety

3.1 General

This section is intended to cover general safety rules and regulations relating to operations and equipment not dealt with in other sections. *Caldwell Marine International* divers and contractors should become intimately familiar with this section. **SAFETY IS A FULL-TIME JOB**. The more conscientious each employee becomes regarding safety, the safer and cost effective each job becomes.

- No standards will ever exist which can substitute for common sense, sound judgment, and a continuing concern for operation risk management.
- The procedures contained in this manual represent the minimum acceptable diving safety procedures to be employed in commercial diving operations.
- It is recommended that deviation from these procedures should only be undertaken when, in the opinion of the diving supervisor that a emergency situation exists and these procedures would do harm.
- Decompression procedures established in the US Navy Diving Manual Revision 6 will be used as a guideline and it will be the responsibility of all diving personnel to know and understand them so as to establish a safe and healthful working environment fir the diver.

3.2 Emergency Services

At all times while diving operations are being carried out, emergency services must be available and be able to proceed by the fastest means of transport to the location of the diving operations in the event of an life threatening emergency.

3.3 Diving Operations

- Water craft of any kind shall not come alongside a vessel from which diving operation are being conducted while a diver is in the water. The only exception to this rule is when the diver is working out of a stage or diving bell and the diving supervisor has giving his permission.
- Precaution shall be taken to ensure that the divers umbilical does not be come fowled in the propellers of the diving support vessel.
- Prior to lifting heavy objects from the bottom the diver should leave thewater.
- Appropriate signals, accordance with figure 3 –1, shall be displayed when

conducting diving operations. Adendum #XX

- Every precaution must be taken to prevent the divers umbilical from becoming fowled on hazards on the bottom.
- All efforts must be taken to isolate or shutdown any equipment/systems at the work site that present a potential hazard to the diver.
- Diver will not cut any lines until their purpose is known and permission is given from topside.
- The depth of the water, condition of the diver shall determine the length of the dive.
- No diver who shows apparent sings of intoxication, its after-effects (hangover), or is under the influence of drugs will be allowed on any dive station.
- Skylarking, horseplay, or carelessness will not be allowed on any diving station.
- All adjoining work activities shall be informed prior the commencement of diving operations.
- When a diver enters a pipeline, wreck, structure, tunnel, or any other restricted underwater area, another diver shall be available at the point of entry to tend the diver who has entered the enclosed space. **SCUBA DIVING IN ENCLOSED SPACES IS NOT PERMITTED.**
- All tools passed to the diver or recovered from the diver shall be turned off.
- If the diving supervisor does not feel that the divers fully understands all the safety aspects of the task, the diver shall not be used for the job.
- Divers should not dive with colds, sinus or lung congestion.
- The diver shall make sure that he fully understands the task the he is being asked to perform.
- Any diver who is taking medicine for any reason will inform the diving supervisor of the type of medicine and what for. All medicine must be cleared by a diving medical doctor prior to diving.

3.4 Responsibilities of the Diving Supervisor

The Diver Supervisor is on the frontline of this companies construction operation. He is responsible for the safe practices of all diving personnel and non-diving personnel working in his diving station. **SAFETY IS NEVER TO BE JEOPARDIZED TO ACHIEVE A TASK.** To realize this important responsibility the following items are considered the minimum standards.

- Enforce safety procedures and company policy
- Inform employees of safe practices
- See that all practical recommendations are carried out. If there is a conflict with set procedures bring it to the attention of management for the benefit of all employees.
- Ensure the all accidents are fully investigated and all reports are submitted in a timely manner, and that corrective measures are put in place to protect against the accident happing again.
- Stay up to date with new diving techniques, and assist in teaching the new methods to fellow employees.
- Stay current in US Navy techniques for treating Arterial Gas Embolism and Decompression Sickness.

- Maintain an open exchange of information between management and employees.
- Maintain accurate records.
- Establish dive plans with the safety of the dive team first in mind.

3.5 Diving Personnel Responsibilities

As an employee of Caldwell Marine International Group you are our most valued asset.

- Develop and utilize correct and safe working practices at all times.
- Use the proper tool for the task at han.
- If you notice damage on equipment for example, a crack weld or stuck valve bring it up to your supervisor so it can be fixed, more importantly so the equipment does not get put into service during a diving operation and fail while in use by a diver in the water or under pressure in a chamber.
- The proper PPE is worn at all times
- Report all injuries immediately and completely.
- Participate in daily JAG review and safety meetings.
- Correct hazards under your jurisdiction and report those outside your responsibility to your supervisor.
- Practice good house keeping in your work areas
- Only use tools that are cleaned for Oxygen use on an Oxygen system.

3.6 Deck and General Safety

All personnel:

- Stand clear of all lines, hoses, diving equipment, and high-pressure flasks and diver supply hoses.
- Deck Crew:
- Exercise care while loading materials around diving gear and diving equipment. If you should accidentally damage any diving gear or equipment bring it to the attention of the diving supervisor so a proper inspection can be accomplished.
- Do not move any diving equipment without permission of the diving supervisor and unless a member of the dive team is present.
- Do not touch any diving equipment especially do not change any valve configurations, line voltage that is connected as a primary or backup sourced for the diver, without permission of the diving supervisor.

3.7 Deck Crew Directly Assisting the Divers

- Be alert follow instructions carefully.
- Take order only from the diving supervisor.
- Do not wander off from your assigned station unless properly relieved by the diving supervisor.
- Know and be able to identify the meaning of diver line signals.
    - 1 Line Pull - All Stop
    - 2 Line Pulls - Provide Slack on the Divers Hose
    - 3 Line Pulls - Pick-up Slack on Divers Hose

- 4 Line Pull - Pick-up Slack – Diver Surfacing
- Repeated Line Pulls - Emergency, Bring the Diver Up ASAP

3.8 Crane Operators

- When it becomes necessary to move any diving equipment around have a dive team member assist in positioning.
- Should you accident bump into the diving equipment while moving a load notify the diving supervisor
- When assisting in diving operations maintain two-way radio communication with the diving supervisor. Under no circumstances accept any instructions or signals from anyone other than the diving supervisor.
- Understand the task being performed and all hand signals and radio communication expected to be used with the diving supervisor.

3.9 Uses and Storage of Gas Cylinders

NEVER

- Never use cylinders as rollers or supports even when they are empty.
- Never use valve protection caps for lifting cylinders.
- Never use a hammer or wrench to open cylinder valves.
- Never drop or allow any cylinder to fall especially oxygen.
- Never tamper with fuse plugs.

ALWAYS

- Always open cylinder valves slowly to allow the pressure in the system to come up gradually.
- Always keep cylinders far enough away from hot areas so that sparks, slag or flames will not reach them.
- Always store cylinders, both full and empty, so they can not be knocked over.
- Always soap test new connections.
- Always shut valves when finished with them even for a short time.
- Always use the proper “T” wrench to key to open valves on cylinders such acetylene.
- Always replace the cylinder valve cap when the regulator is removed.
- Always tie cylinders down.
- Always store cylinders in a ventilated area.
- Always mark empty cylinders.

3.10 Oxygen Safety Precautions

Oxygen is the most hazardous gas generally handled during diving operations. Oxygen lowers the ignition temperature of flammable substances and accelerates combustion. Hydrocarbons (oil grease ect.) can spontaneously combust in high Oxygen environments. The following rules apply when working with pure or high Oxygen percentages.

- Equipment used with oxygen must be designed for such use.
- Always use a clean oxygen regulator to get oxygen form a cylinder.
- **Never lubricate or allow oil or grease to come in contact with oxygen**

connections, or other oxygen equipment.

- Oxygen systems with pressures greater than 125 psig must have slow opening shut-off valves.
- All lubricants, gaskets, plastics, diaphragms, o-ring materials ect, use in oxygen systems must be O_2 compatible.
- All oxygen system must be assembled free of organic materials and loose particles. All valves, gauges, piping, used in oxygen systems must be Certified "Cleaned for Oxygen Service."
- The Recompression Chamber environment will be maintained at19 to 25 present. Chamber occupants will not be allowed flammable material in with them.
- Clothes, blankets, bedding and other materials used in recompression chamber must be made of fire retardant materials.
- Never use oxygen for compressed air or as a source of pressure.
- The minimum psig in an O_2 cylinder 25psi.

3.11 Operation and use of equipment underwater

Whether it is a screwdriver, specially designed tool, or welding torch, the diver will be thoroughly familiar with and experienced in use of what ever underwater tool is being used at the time.

- Never use a tool is not in good working condition.
- Do not overburden the work site.
- Arrange to have all required gear and tools readily available.
- Power tools shall be off when sent to a diver and when brought to the surface.
- If a hydraulic or pneumatic is available to perform the task required never use a electrically powered tool as a substitute.
- Never lower or drop tools or materials on divers or subsea assets. Always perform any driops next to the diver or assets.

3.12 Underwater Cutting and Welding

Underwater cutting and welding operations involve several hazards, including lethal electrical currents, oxygen and hydrogen rich gases that will explode in the presence of a spark and electrode tip, with temperatures in excess of 10,000°F. It is impossible to anticipate all possible situations that may arise in underwater cutting or welding operations. Consequently, it cannot be assumed that safe operating conditions will exist simply by blindly following the guidelines set forth in this manual. Nonetheless, with a thorough knowledge of cutting and welding fundamentals combined with the use of common sense and sound judgment, the procedures described in this manual can be performed in maximum safety.

3.12.1 Explosive Gases

A. Gases produced by underwater cutting are rich in oxygen and hydrogen and will explode if trapped and ignited. Gases from underwater cutting will collect in closed compartments, open tubular structural members, open piping systems, shaped structural

members and under such members as "H" beams. Before cutting, it is mandatory that provision be made to evacuate existing gases and eliminate the possibility of further gas entrapment. If the presence of trapped explosive gas mixtures is uncertain, it may be necessary to drill holes in suitable locations to allow the gases to escape. This will flood the compartment with seawater. An alternative would be to purge the compartment with a mixture of gases, which will not support combustion. Underwater cutting and welding processes generate explosive gases.

- When cutting with power on or welding, hydrogen and oxygen are dissociated from the water and will travel separately as bubbles. These bubbles can collect in a trapped or confined space overhead. As the hydrogen and oxygen gases combine they will ignite, causing a popping sound.
- Oxygen cutting is about 60 percent efficient, resulting in approximately 40 percent pure oxygen being released into the environment. This gas can become entrapped above the work area, and when combined with a fuel such as hydrocarbons, can easily be ignited by a hydrogen bubble or a spark trapped in the bubble. Any pop is a sign of explosive gases collecting above the underwater work area and is the point when cutting or welding must stop and the cause investigated.
- Prior to the start of any underwater cutting or welding, as built drawings and physical configuration of the work area must be studied to determine all these areas and voids that could contain or trap explosive gases. These areas and voids must be vented or made inert in accordance to prevent possible explosions.
- Care should also be taken when cutting or welding on enclosures that are on or above riverbeds, especially in mud, because trapped methane gas in the proper concentrations can explode.

B. Any one or a combination of the following may produce explosive gases:

- Petroleum products such as gasoline, fuel oil or greases;
- Paint mixing mediums, such as linseed oil or thinners;
- Epoxies, adhesives and solvents;
- Ammunition or bulk explosives;
- Decaying vegetable or animal matter; and
- Unburned gases from cutting torches.
- Every precaution must be taken to prevent an underwater explosion. To minimize the possibility of explosions from trapped gasses, the following procedures are recommended:
- Start cutting at the highest point and work downward.
- When cutting thick material, i.e., propeller shafting, cut from the outside and work around the circumference. By withdrawing the electrode every few seconds to allow water to enter the cut, exceedingly high temperatures can not build up inside the metal.
- Brushing or stroking action in the direction of the intended cut should be used.
- Gases may be vented to the surface with a vent tube (flexible hose) secured in place from the high point where gases would collect to a position above the waterline.

3.12.2 Electricity Underwater

A. Electricity Underwater

Electricity and water are incompatible by nature and the use of electrically powered equipment underwater presents a potential shock danger to both the diver and the tender. When using electrically powered equipment such as cutting, welding or underwater lighting, the diver and tender must be protected from electric shock. All personnel engaged in underwater cutting and welding should be thoroughly trained in CPR and first-aid so they can render immediate assistance in the event of an accident. There are many conditions that contribute to making underwater work difficult. These include adverse currents, unstable footing, poor visibility and low temperatures. A constant source of danger comes from the falling or rolling of cut-away pieces. This is especially true in salvage wrecking. These, combined with the dangers involved in operating an electric arc capable of producing fatal shock, severe burns and explosive gas pockets, create a situation where the diver must be extremely alert.

The following precautions must be observed:

- Careful examination should be made before starting the cut to learn how the cut-away pieces will fall and whether there are any projections, wires or other objects which may foul lines or cause a piece to swing around in an unexpectedmanner.

- Be extremely careful when cutting tightly-bound wire rope e.g., wire wrapped in a ship's propeller. When severed, the wire can backlash with spring-like force.
- Before cutting, ensure that umbilical and diving equipment will not be in the path of slag from the cutting operation.
- Avoid cutting overhead if possible, since the falling molten material will seriously damage the diving helmet, dress and umbilical.
- Never put down or carry an electrode holder while the power is on.
- Never change an electrode while the power is on.
- The diver must never allow any body part or equipment to come in contact with the grounded work when the safety switch is closed.
- Care should be taken with diver-carried large loose metallic items (i.e., wrenches and backpacks) to ensure no contact is made with a live electrode or the work.

B. Power Supply

The power supply used for underwater cutting or welding shall consist of only approved electric welding machines and shall be tested for proper working order prior to use. **Use only DC welding powe**r. Competent, experienced personnel in accordance with approved plans shall install electric welding equipment. This requirement is especially applicable to the installation of primary power lines and outlets intended to supply power to the electric welding machines. The equipment shall only be operated in accordance with the manufacturers recommended operating procedures and the safety precautions outlined in this manual. The following precautions are to be observed during set up and operation of arc cutting or welding equipment:

- Ensure that the welding machine frame and supporting structure are grounded before starting operations.
- Ensure that neither terminal of the welding machine is or becomes short-circuited to the machine frame before starting operations.

- Ensure that all electrical connections are securely made before starting operations.
- d. Stand on dry wood, rubber matting or similar insulating material and not on grounded metal.
- Wear dry rubber or rubberized-canvas gloves that are in good condition when handling energized holders, torches, cables or welding machines.
- Keep the welding machine commutators clean to prevent excessive flashing.
- Keep the welding machine clean and operable, free of oil and grease and (in electrical parts) free of metallic particles that can cause short circuits.

C. Electrode Holders and Cutting Torches

The following are electrode holder and cutting torch precautions that should be observed:

- Use only torches and electrode holders that have been specifically designed for under-water applications. They must have the capacity to handle the maximum rated current required by the electrode being used.
- Inspect the apparatus and ensure that all current-carrying parts are fully insulated with nonconducting material. This material should safely insulate against the maximum voltage encountered to ground. Remember, new does not necessarily

  mean ready for use. Extra insulation may be required, which will provide further diver protection and extend the life of the electrode holder.
- Standard holders designed for surface use shall not be used except in exceptional situations.
- Inspect the electrode holders for worn or damaged parts and insulating material and repair or replace any parts as necessary. Flashback arrestors and monel screens must always be in proper working order.
- Do not lower the welding or cutting torch before the ground clamp is securely attached near the work area.
- Before lowering or raising the electrode holder or ground clamp, ensure that the current is off and the knife switch is open.
- Never attempt to change or tighten an electrode with the current on.
- Never hold the holder so the electrode points toward the body. This can be likened to pointing a loaded pistol at oneself.
- Special care should be taken to avoid touching the metal parts of the diving equipment with the electrode or any uninsulated parts of the electrode holder.

D. Power Cable and Connector Safety

The following are power cable and connector safety precautions that should be observed:

- All parts of the cables that are intended to be submerged shall be fully insulated and watertight. This cannot be overstated.
- Inspect cables and cable connections for damaged insulation before starting operations. Defects in the cable must be repaired or the cable replaced before starting operations.
- All connections shall be made tight and thoroughly insulated by wrapping in rubber tape, applying a layer of scotch cote, then wrapping with electrical tape. This will prevent current loss at the connections. Cables that produce bubbles during

operation should be replaced. The bubbles indicate that current is being lost through the porous insulation.

- Use only welding cables that are a minimum of 2/0 extra flexible. An exception is the electrode holder lead, which can be 1/0. The 1/0 lead is more flexible and will aid the diver in maneuvering the electrode holder. The cable must conform to the applicable requirements of Military Specification MIL-C-915. Cables must be capable of handling the maximum current requirements of the intended work.
- Do not use excessive lengths of cable with large sections stored on deck. When working in deep water, a strain relief should be provided across the connections to support cable weight.
- When connecting lengths of cable, use connectors that have a current carrying capacity that is equivalent to the cable being used.
- Ensure that the 1/0 stinger lead between the electrode holder and the welding lead is defect-free. The cable connection coupling the stinger lead to the 2/0 welding lead should be thoroughly insulated with a layer of scotch cote, wrapped in rubber tape, insulated with an additional layer of scotch cote, then finally wrapped with electrical tape or heat-shrink tubing. This will afford added protection for the diver.

WARNING: The position of the ground in relation to the diver must be such that at no time does the diver or equipment become positioned between the ground and the electrode. The diver must avoid becoming part of the electrical circuit.

- Secure the ground clamp as close to the work-site as possible, preferably in the forward line of vision. The diver must face the ground when welding or cutting. A good rule-of-thumb to remember is: NEVER TURN YOUR BACK TO THE GROUND WHEN THE POWER IS ON.
- Keep additional power cables such as underwater light cables and welding leads separated.
- Cables should be strung overhead if they are to be run for long distances. If this is not practicable and they must be laid on deck, they must be protected and arranged to prevent interference with safe passage of personnel.
- When portable lighting is used, it should be clamped or fully secured in position and not hand held. The portable lighting power cords must be kept clear of the welding leads and work area. Additionally, a ground-fault detector/interrupter (GFD/I) must be incorporated in the circuit.
- Cables in storage should be kept dry and free of grease and oil, which cause premature breakdown of the insulation.

CAUTION: When AC power is required for underwater lighting or operation of hand tools, the AC equipment must be protected by ground-fault detection (GFD) and/or ground-fault interruption (GFI) devices.

D. Safety Switch

A positive-acting, infusible current interrupt switch, rated at 400 amperes must be in the welding circuit. This switch protects the diver by breaking the electric circuit, thereby

stopping the current supply to the electrode holder. The safety switch, more often referred to as a knife switch, is the most important safety item included in the underwater cutting or welding equipment inventory. The diver is fully isolated from electric current when the knife switch is open. The tender (phone talker) should only be instructed to close the switch when the electrode is poised for cutting or welding. It is extremely important to mount the switch correctly. The switch must be positively acting, rigidly mounted and located so that it cannot be accidentally knocked or vibrated closed. Should the switch fall, the circuit would be broken. Both double-pole and single-pole safety switches are authorized, however a double-pole is the most often used because both the working and ground lead are opened or closed simultaneously. To ensure safety switch effectiveness, the following guidelines must be followed:

- When using a single-pole knife switch, it should be located in the welding-lead side of the electric circuit and should be able to handle the maximum welding current.The safety switch must be mounted vertically on a non-conducting (wooden, plastic, etc.) stand. The switch has an open circuit potential of approximately 80 volts across the poles. To prevent accidents, the safety switch should be fitted with a non-conducting slotted cover.
- When reverse polarity is required, the safety switch must be placed in the cutting or welding lead side of the circuit.
- Never operate a knife switch in a combustible atmosphere.
- The knife switch must be in proper working order. Additionally, the switch contact surfaces should be periodically checked for verdigris accumulation.
- The current shall be off (knife switch open) at all times, except when poised for or actually cutting or welding.
- When a single-pole knife switch is used, special care must be taken to ensure that the safety switch is not shunted out between the switch and weldingmachine.
- Wet, bruised or worn cables can be shorted by rubbing against the welding machine frame, hatch combings or by lying on a steel deck. This creates a potential source of danger. Inspect the cable thoroughly and wrap any questionable spots in the insulation with rubber tape, followed by an additional layer of electrical tape or heat shrink.
- Periodic inspection should be made to ensure that the insulation is not damaged.
- The safety switch shall be located in such a position that enables the phone talker or designated tender to operate or oversee the operation of the switch during the entire time the diver is in the water. The switch shall not be closed unless specifically directed by the diver to do so. The phone talker shall confirm each change to the diver via the intercommunications system.

E. Fire and Explosion Prevention

The major causes of fire and explosion are listed as follows:

- Combustibles reached by the arc,
- Flying sparks,
- Hot slag,
- Misuse of compressed gases and cylinders and
- Short circuits.

- It is necessary for the diving supervisor be aware of topside work being conducted in the vicinity of the diving station. Do not allow welding or cutting in an area where there are combustibles. Sparks and slag can fly up to 35 feet. Keep equipment clean and operable, free of oil and grease and free of metallic particles (in electrical parts) that can cause short circuits.
- Hydrocarbons ignite almost spontaneously in the presence of oxygen. **Never allow oxygen-carrying components to come in contact with oil or grease.**

3.13 Hand tools

- Hand tools are often misused simply because the user has never been shown how to use the tool the proper way.
- Wrenches should be inspected frequently to eliminate worn or sprung jaws, broken cages, springs, and bent or cracked handles.
- Frequently inspect driving faces of hammers, chisels, drift pins, bars and similar tools to eliminate mushroomed heads, broken faces, cracked handles and other defects.
- Handles should be sound and securely wedged or fastened to the tools. Painting or taping of handles are prohibited for these practices may cover defects orcracks.
- Keep hand tools clean and in good working order.

3.14 Explosives

Prevention of explosive accidents depends on careful planning and faithful observance of proper blasting practices. The slightest abuse or misdirection of explosives may either kill or cause serious injury to yourself or others. Two general statements may be made about safety and the uses of explosives: (1) a blaster most important responsibility is safety; and (2) the safety of every blasting operation depends on itspeople.

The most important ingredients in a safety program are the quality of it people and the quality of their training. If explosives are to be used on a project a complete Explosive Safety Plan will be completed by the planner covering all aspects of safety and State, Federal, or Governmental regulations. The planner will ensure that the blasting crew is well trained in the blasting technique to be used, and that all safety precautions that can be taken are taken to protect personnel and equipment.

3.15 Confined Space Entry/Tunnel Penetration

Divers are often required to work in an enclosed or confined space. Enclosed space diving shall be supported by a surface-supplied air system.

NOTE Physically Confining Space is any space which would restrict the diver's ability to rotate head to toe, 180 degrees in any plane and/or when the diver has no direct access to the surface or bell for recovery of the diver from the water.

Enclosed Space Hazards: The interior of sunken ships, barges, pipelines, and cofferdams is hazardous due to limited access, poor visibility, and slippery surfaces. Enclosed spaces may be dry or flooded, and dry spaces may contain a contaminated atmosphere.

NOTE: When a diver is working in an enclosed or confined space an additional diver shall be stationed at the underwater point of diver ingress and immediately available to come to the assistance of the diver. In these conditions the dive team must include an additional Tender/Diver, ultimately, the number of tending divers deployed depends on the situation and the good judgment of the Diving Supervisor on the site.

Enclosed Space Safety Precautions:. Because of the hazards involved in enclosed space operations, divers must rigorously adhere to the following warnings.

WARNING: During enclosed space diving, all divers shall be outfitted with a surface supplied rig that includes a diver-to-diver and diver-to-topside communications system and a Bailout Bottle for the diver inside the space.

WARNING: For a dry penetration the divers shall not remove their diving equipment until the atmosphere tests confirm that the atmosphere is safe to breath the air will be tested constantly and the diver must be ready at all times to don his diving rig.

WARNING: If the diving equipment should fail, the diver shall immediately switch to the Bailout Bottle and abort the dive. The Bailout Bottle must have an adequate supply of air to support the diver from the deepest penetration point of the dive. The air requirem.ent for the Bail out Bottle shall be determined during the planning stages of the dive.

Working Around Corners: When working around corners where the umbilical is likely to become fouled or line-pull signals may be dissipated, a second diver (tending diver) may be sent down to tend the lines of the first diver at the obstruction and to pass along any line-pull signals. Line-pull signals are used when audio communications are lost, and are passed on the first diver's lines; the tending diver uses his own lines only for signals directly pertaining to his own situation.

Pre Entry Planning: A site specific HASP is required before entry into a confined space. The plan will cover all aspects of the planned operation; entry and egress form the confined space, health hazards physical chemical biological, emergency response plan. Additionally the HASP will include any permits required by local, state and federal governments.

Training of Personnel: A diving certification is not considered a certification to enter a confined space. The entire crew will be trained in confined space entry and rescue.

4. Equipment Requirements

In order to ensure the safety and wellbeing of the diver, the equipment used in diving operations must be designed to adequately perform the service required, properly maintained in accordance with Governmental regulations, and manufacturers specifications. This section will provide details of the requirements which equipment must meet prior to being used in diving operations conducted by *Caldwell Marine International* divers.

4.1 General System Requirements

To be considered complete, and safe for diving operations a diving system must include the following equipment:

- The equipment must be maintained and certified as per governmental regulations
- The equipment must be capable of supplying the correct gas mixer at the proper standard cubic feet (SCF) and pressure as required for depth.
- A Recompression Chamber is required for any dives deeper than 60 feet or for any dives requiring decompression, or when live-boating at anydepth.
- Voice communications between top side and all divers is required.
- An accurate depth-measuring device is required.
- First aid equipment
- Wet suit, dry suit or hot water suit system which will maintain the diver's body temperature
- A system, which will allow the diver to enter and safely exit the water, is required.

4.2 Diving Supervisor Responsibilities

Prior to the beginning of any diving operation, the diving Supervisor shall ensure that:

- That all equipment with the exception of mobile equipment required for the job is in place, ready for immediate use and secured firmly in place for the duration of the project.
- That the deck recompression chamber is readily accessible to divers returning from underwater operations.

At a minimum every 24 hours the diving Supervisor shall check:

- That all diving systems and equipment being used are in good working order.
- That all diving equipment has been leak tested.
- That all diving systems valve line up configurations have not been tampered with by non-diving personnel.

4.3 Diver Worn Equipment

For the proposes of this manual, diver worn equipment shall include all equipment required for the safety and the wellbeing of the diver, which is worn by or attached to the diver while he is in the water. When required by *Caldwell Marine International*, divers will use equipment specified and provided by *Caldwell Marine International*. No exceptions will be made without the permission of *Caldwell Marine International* management, except in the event of an emergency.

4.3.1 Helmets

The divers' helmet is the most important piece of equipment. Improperly maintained helmets put the diver at an extreme risk. Helmets/masks used by *Caldwell Marine International* divers will:

- Have a non-return check valve located at the attachment point of the umbilical to the helmet.

- Must have an exhaust valve.
- Have reliable two-way communications system

- Must supply the diver with a vent rate of 4.5 (acfm) at any depth the helmet is operated at.
- Dive Superintendent will check helmet certifications and do a visual inspection.

4.3.2 Pre-dive Checks

Immediately prior to each use, a helmet/mask will receive the following checks:

- Visual inspection for obvious signs of damage to the frame, faceplate, breathing system, neck dam, etc.
- Proper operation of the gas system including al regulators and valves.
- A vacuum test performed on the non-return valve.
- A communication check.

4.3.3 Thermal Protection

It is the responsibility of the diver to provide himself with and maintain a wet suit or dry suit, which will provide thermal protection

Suit Selection. Custom wet suits designed for cold-water diving, variable volume dry suits, and hot water suits have all been used effectively for diving in extremely cold water. Each has advantages and disadvantages that must be considered when planning a particular dive mission. All suits must be inspected before use to ensure they are in good condition with no seam separations or fabric cuts.

4.3.4 Wet Suits

Custom wet suits have the advantages of wide availability, simplicity and less danger of catastrophic failure than dry suits. Although the wet suit is not the equipment of choice, if used the following should be considered:

- The wet suit should be maintained in the best possible condition to reduce water flushing in and out of the suit.
- Wearing heavy insulating socks under the boots in a wet suit will help keep feet warm.

CAUTION In very cold water, the wet suit is only a marginally effective thermal protective measure, and its use exposes the diver to hypothermia and restricts available bottom time. The use of alternative thermal protective equipment should be considered in these circumstances.

4.3.5 Variable Volume Dry Suits

Variable volume dry suits provide superior thermal protection to the surface-supplied or scuba diver in the water and on the surface. They are constructed so the entry zipper or seal and all wrist and neck seals are waterproof, keeping the interior dry. They can be inflated orally or from a low-pressure air source via an inlet valve. Air can be exhausted from the

suit via a second valve, allowing excellent buoyancy control. The level of thermal protection can be varied through careful selection of the type and thickness of long underwear. However, too much underwear is bulky and can cause overheating, sweating, and subsequent chilling of the standby diver. Dry suit disadvantages are increased swimmer fatigue due to suit bulk, possible malfunction of inlet and exhaust valves, and the need for additional weights for neutral buoyancy. Further-more, if the diver is horizontal or deployed with the head below the rest of the body, air can migrate into the suit lower extremities, causing over inflation and loss of fins and buoyancy control. A parting seam or zipper could result in a dramatic loss of buoyancy control and thermal shock. Nevertheless, because of its superior thermal protection, the dry suit is an essential component of extremely cold water diving.

4.3.6 Extreme Exposure Suits/Hot Water Suits

Hot water suits provide excellent thermal protection. If their use can be supported logistically, they are an excellent choice whenever bottom times are lengthy. They are impractical for use by standby divers exposed on the surface. A hot water system failure can be catastrophic for a diver in very cold water since the hot water is a life support system under such conditions. Hot water temperature must be carefully monitored to ensure that the water is delivered at the proper temperature. Should dive conditions/durations require the use of a hot water suit system it will be provide by the company.

4.3.7 Pre-dive Checks and Maintenance

The flowing are checks that should be conducted prior to each use.

- Inspect the zipper slides.
- Check foam for gouges, rips or parting of the seams.
- Checks boots and gloves for damages.
- After each dive clean rinse, and dry the suit, boots and gloves with fresh clean water.
- Store in a dry location avoid folding for long periods.

4.3.8 Safety Harness/Bailout bottle

All divers must wear a safety harness. This harness will have a positive buckling device and an attachment ring for the umbilical that distributes the pulling force of the umbilical over the body of the diver, and prevent a direct strain form being placed on the diver helmet. The harness will also have a ring/loop to which a line can be attached for lifting the diver up and over the side in an emergency.

For all surface supplied dives, a bailout bottle will be used. It will be at a minimum equal to or greater than 19 cubic feet. It shall provide the total quantity of breathing mixture available for use by a diver until the standby diver reaches him and they can:

- Return to the surface and carry out the appropriate decompression procedures during the return
- Or standby diver provides the stricken diver with another source of air and than

abort the dive carrying out the appropriate decompression procedures during the return.

4.3.9 Knife

Several types of knives are available. Diving knives should have corrosion-resistant blades and a handle of plastic, hard rubber, or wood. Handles made of wood should be waterproofed with paint, wax, or linseed oil. Handles of cork or bone should be avoided, as these materials deteriorate rapidly when subjected to constant saltwater immersion. Cork may also float the knife away from the diver. Knives may have single-or-double- edged blades with chisel or pointed tips. The most useful knife has one sharp edge and one saw-toothed edge. All knives must be kept sharp. The knife must be carried in a suitable scabbard and worn on the diver's, harness, hip, thigh, or calf. The knife must be readily accessible, must not interfere with body movement, and must be positioned so that it will not become fouled while swimming or working. The scabbard should hold the knife with a positive but easily released lock. **The knife and scabbard must not be secured to the weight bel**t. If the weights are released in an emergency, the knife may be also dropped unintentionally.

4.3.10 Umbilical

The primary link to the divers is the umbilical. It carries breathing gas to the diver, a means of communications, and a method of measuring the diver depth. Also if the time duration and water temperature are a factor the umbilical carries hot water to the diver for thermal protection.

- A divers umbilical must be marked in the following manner: Every (10) foot from 10' to the 100' feet with one blue stripe; every (50) feet a red stripe will be added; and every (100) feet a yellow stripe will be added (USCG).
- It will consist of a least of the following:
  1. Gas hose.
  2. Communication cable.
  3. Pneumofathometer.
  4. Strength member.

4.4 Gas Hose Requirements

The air hose is the most important part of the umbilical. Failure of the air hose can put the diver at extreme risk of drowning. All breathing gas hoses use by Caldwell Marine International will meet the following minimum standards:

- Have a maximum working pressure that is equal to or exceeds the maximum working pressure of system being used, and the pressure equivalent of the maximum depth of the dive relative to the supply source plus 100 psig.
- Have a bursting pressure that is 4 times its maximum working pressure.
- Be made of kink-resistant material
- Have connectors which are corrosion resistant, are resistant accidental disengagement, and have a working pressure at least equal to the hose to which they are attached.

- Be tested in accordance with section 4.7.2

4.5 Breathing Gas Systems

Regardless of the source, the air must meet certain established standards of purity, must be supplied in an adequate volume for breathing, and must have a rate of flow that properly ventilates the helmet or mask. The air must also be provided at sufficient pressure to overcome the bottom water pressure and the pressure losses due to flow through the diving hose, fittings, and valves. The air supply requirements depend upon specific factors of each dive such as depth, duration, level of work, number of divers being supported, and type of diving system being used.

4.5.1 Requirements for Air Supply

All surface-supplied diving systems must include a primary and a secondary air supply. The primary supply must be able to support the airflow and pressure requirements for the diving equipment designated. The capacity of the primary supply must meet the consumption rate of the designated number of divers for the full duration of the dive (bottom time plus decompression time). The maximum depth of the dive, the number of divers, and the equipment to be used must be taken into account when sizing the supply. The secondary supply must be sized to be able to support recovery of all divers using the equipment and dive profile of the primary supply if the primary supply sustains a casualty at the worst-case time (for example, immediately prior to completion of planned bottom time of maximum dive depth, when decompression obligation is greatest). Primary and secondary supplies may be either high-pressure (HP) bank-supplied or compressor-supplied

4.5.2 Air Supply Flow Requirements

The required flow from an air supply depends upon the type of diving apparatus being used. The open-circuit air supply system must have a flow capacity (in acfm) that provides sufficient ventilation at depth to maintain acceptable carbon dioxide levels in the mask or helmet. Carbon dioxide levels must be kept within safe limits during normal work, heavy work, and emergencies. The flow requirements for respiration in a demand system are based upon the average rate of airflow demanded by the divers under normal working conditions. The maximum instantaneous (peak) rate of flow under severe work conditions is not a continuous requirement, but rather the highest rate of airflow attained during the inhalation part of the breathing cycle. The diver's requirement varies with the respiratory demands of the diver's work level.

4.5.3 Supply Pressure Requirements

In order to supply the diver with an adequate flow of air, the air source must deliver air at sufficient pressure to overcome the bottom seawater pressure and the pressure drop that is introduced as the air flows through the hoses and valves of the system.

4.5.4 Water Vapor Control

A properly operated air supply system should never permit the air supplied to the diver to

reach its dew point. Controlling the amount of water vapor (humidity) in the supplied air is normally accomplished by one or both of the following methods:

- Compression/Expansion. As high-pressure air expands across a pressure reducing valve, the partial pressure of the water vapor in the air is decreased. Since the expansion takes place at essentially a constant temperature (isothermal), the partial pressure of water vapor required to saturate the air remains unchanged. Therefore, the relative humidity of the air is reduced.

- Cooling the air prior to expanding it raises its relative humidity, permitting some of the water to condense. The condensed liquid may then be drained from the system.

4.5.5 Air Compressors

Low pressure air compressors used in diving operations conducted by Caldwell Marine International personnel must have:

- A certified volume tank that meets required specifications.
- A check valve on the inlet side.
- A pressure gauge.
- A drain valve
- An intake, which is located away from areas containing exhaust, fumes from internal combustion engines or other harmful contaminates.
- An efficient filtration system.
- Slow opening relief valves when the system operating pressure exceeds 500 psi.

4.5.6 Gas Purity Standards

Gas used in diving operations conducted by Caldwell Marine International divers will meet the following standards for purity:

- Oxygen Federal Specification BB-O-925a, and be type 1 (gaseous) grade A or B.
- Nitrogen Federal Specification BB-N-411c, and be of type 1 (gaseous) class 1 (oil-free) and of grade A, B, or C.
- Helium grades A, B, or C produced by the U.S. Federal Government, or Equivalent Grade D is oil pumped and will not be used.
- Compressed Air must contain:

Constituent	**Specification**
Oxygen	(percent by volume) 20-22%
Carbon dioxide	(by volume) 1,000 ppm (max)
Carbon monoxide	(by volume) 20 ppm (max)
Total hydrocarbons	(by volume) 25 ppm (max)
Oil, mist, particulates	5 mg/m3 (max)
Odor and taste	not objectionable

4.5.7 Gas Cylinder Color Codes

Color coding systems are not standards and can very significantly. To determine what gas is contained in a cylinder the making on the cylinder must be used not the color the cylinder.

4.6 Deck Chambers

Recompression chambers are used for the treatment of decompression sickness, and for surface decompression procedures. Diving operations to depths greater than 60 fsw, live-boating operations, and any dives requiring decompression, must have a chamber be available at the dive site.

4.6.1 Basic Requirements

Double-lock chambers are used because they permit tending personnel and supplies to enter and leave the chamber during treatment.

4.6.2 Standard Features

Recompression chambers must be equipped with a means for delivering breathing oxygen to the personnel in the chamber. The inner lock should be provided with connections for demand-type oxygen inhalators. Oxygen can be furnished through a high- pressure manifold connected with supply cylinders outside the chamber.

4.6.3 Labeling

All lines should be identified and labeled to indicate function, content and direction of flow.

4.6.4 Inlet and Exhaust Ports

Optimum chamber ventilation requires separation of the inlet and exhaust ports within the chamber. Exhaust ports must be provided with a guard device to prevent accidental injury when they are open.

4.6.5 Pressure Gauges

Chambers must be fitted with appropriate pressure gauges. These gauges, marked to read in feet of seawater (fsw), must be calibrated to ensure accuracy.

4.6.6 Relief Valves

Recompression chambers should be equipped with pressure relief valves in each manned lock. Chambers that do not have latches (dogs) on the doors are not required to have a relief valve on the outer lock. In addition, all chambers shall be equipped with a gag valve, located between the chamber pressure hull and each relief valve. This gag valve shall be a quick acting, ball-type valve, sized to be compatible with the relief valve and its' supply piping. The gag valve shall be safety wired in the openposition

4.6.7 Communications System

Chamber communications are provided through a diver's intercommunication system, with the dual microphone/speaker unit in the chamber and the surface unit outside. The communication system should be arranged so that personnel inside the chamber need not interrupt their activities to operate the system. The backup communications system may be

provided by a set of standard sound-powered telephones. The press-to-talk button on the set inside the chamber can be taped down, thus keeping the circuit open.

4.6.8 Lighting Fixtures

Consideration should be given to installation of a low-level lighting fixture (on a separate circuit), which can be used to relieve the patient of the heat and glare of the main lights. Emergency lights for both locks and an external control station are mandatory.

4.6.9 State of Readiness

Since a recompression chamber is emergency equipment, it must be kept in a state of readiness. The chamber shall be well maintained and equipped with all necessary accessory equipment. A chamber is not to be used as a storage compartment. The chamber and the air and oxygen supply systems shall be checked prior to each use with the Predive Checklist provided at the end of this section. All diving personnel shall be trained in the operation of the recompression chamber equipment and should be able to perform any task required during treatment.

4.6.10 Post dive Checklist

To ensure equipment receives proper post dive maintenance and is returned to operational readiness, perform the equipment checks listed in the Recompression Chamber Post dive Checklist provided at the end of this section.

4.6.11 Diving Craft and Platforms

Regardless of the technique being supported, craft used for diving operations shall:

- Be seaworthy
- Include required lifesaving and other safety gear
- Have a reliable engine (unless it is a moored platform or barge)
- Provide ample room for the divers to dress
- Provide adequate shelter and working area for the support crew
- Be able to carry safely all equipment required for the operation
- Have a well-trained crew

Other support equipment—including barges, tugs, floating cranes or vessels may be needed, depending on the type of operation. The need for additional equipment should be anticipated as far in advance as possible.

4.7 Miscellaneous equipment

4.7.1 Diving Ladders

Diving ladders should be constructed of corrosion resistant material or preserved so as to prevent corrosion. It should be able to support the weight of two divers. It must extend at least 1meter below the surface. The ladder must be fixed firmly in place and have two hand rails extending above the deck of the support craft.

4.7.2 Diving Stages

Diving stages should be constructed of corrosion resistant material or preserved so as to prevent corrosion. It should be able to support the weight of two divers. It must have a open grating platform. A diving stage must be certified for man use.

4.7.3 First Aid Equipment

Each diving operation must have at the dive location and ready for immediate use:

- The Med kits are the responsibility of the diving supervisors when he has custody of the kits of them, but Company safety department will stock maintain the kits.

A medical kit approved by a physician that contains basic and advanced medical supplies necessary for the treatment of illness, minor first aid and trauma related injuries resulting from hyperbaric exposure and non-diving related illness and injuries. The Med kit will be inventoried before and after each job and at six- month intervals:

- Copies of a current emergency first aid handbook
- A bag-type manual resuscitator with mask and tubing.
- A two-way communications system for emergencies.
- A capability to assist an injured diver into the deck recompression chamber.

4.8 Equipment Test Requirements

This section is provided to outline the test requirements for diving system and equipment used by Caldwell Marine International divers.

4.8.1 Chamber Maintenance

Scheduled Maintenance.

Proper care of a recompression chamber requires both routine and periodic maintenance. Every recompression chamber (shall be pressure tested upon installation, at 2-year intervals thereafter, after a major overhaul or repair, and each time it is moved. This test shall be conducted in accordance with the pressure test for recompression chambers contained at the end of this section. The completed test form shall be retained until retest is conducted. Chamber relief valves shall be tested to verify setting. Each tested relief valve shall be tagged to indicate the valve set pressure, date of test, and testing activity. After every use or once a month, whichever comes first, the chamber shall receive routine maintenance in accordance with the Post dive Checklist. At this time, minor repairs shall be made and used supplies shall be restocked.

Inspections. At the discretion of the diving maintenance supervisor, but at least once a year, the chambers shall be inspected, both inside and outside. Any deposits of grease, dust, or other dirt shall be removed and, on steel chambers, the affected areas repainted.

Corrosion. Corrosion is removed best by hand sandpaper or by using a scraper, being careful not to gouge or otherwise damage the base metal. The corroded area and a small

area around it should then be cleaned to remove any remaining paint and/or corrosion and the surface repainted.

4.8.2 Gas Hose test

- Each breathing gas supply hose will be tested initially and every 12 months thereafter, to 1.5 times the maximum working pressure.
- Each breathing gas supply hose will be internally cleaned of hydrocarbons and particulates initially and every 18 months thereafter.
- Divers umbilical will have a coupling pullout test initially and every 12 months.

RECOMPRESSION CHAMBER PREDIVE CHECKLIST	
Equipment	**Initials**
Chamber	
Cleared of all extraneous equipment	
Clear of noxious odors	
Doors and seals undamaged, seals lubricated	
Remove floor Plates	
Visually inspect chamber interior for oily or volatile deposits of any kind	
Replace floor plates	
Inspect view ports for cracks clouding or pitting	
Shut outer hatch and pressurize chamber to 75 psi	
Inspect all hull penetrations and snoop for leaks	
Pressure gauges calibrated/compared	
Release pressure open outer hatch	
Air Supply System	
Primary and secondary air supply adequate	
One-valve supply: Valve closed	
Equalization valve closed, if applicable	
Supply regulator set at 250 psig or other appropriate pressure	
Fittings tight, filters clean, compressors fueled	
Exhaust System	
Valve closed and calibrated for ventilation	
Oxygen Supply System	
Cylinders full, marked as BREATHING OXYGEN, cylinder valves open	
Replacement cylinders on hand	
Built in breathing system (BIBS) masks installed inspected for damage and tested. Clean all BIBS mask with Non-Ionic soap	
Supply regulator set in accordance with OPs	
Fittings tight, gauges calibrated	
Oxygen manifold valves closed	
BIBS dump functioning	

RECOMPRESSION CHAMBER PREDIVE CHECKLIST	
Equipment	**Initials**
Electrical System	
Lights	
Oxygen analyzer calibrated	
Direct Current (DC) power supply	
Communication System	
Primary system tested	
Secondary system tested	
Fire Prevention System	
Fire-retardant clothing worn by all chamber occupants	
Fire-resistant mattresses and blankets in chamber	
Means of extinguishing a fire	
Miscellaneous	
Urinal	
Primary medical kit	
Ear protection, sound attenuators/aural protectors (1 set per person) Must have a 1/16” hole drilled to allow for equalization.	
Stopwatches for recompression treatment time, decompression time, personnel leaving chamber time, and cumulative time.	
U.S. Navy Diving Manual Revision 6	
Ventilation bill	
Chamber log	
Operating Procedures (OPs) and Emergency Procedures (EPs)	
Bedpan (to be locked in as required)	

RECOMPRESSION CHAMBER POSTDIVE CHECKLIST	
Equipment	**Initials**
Air Supply	
All valves closed	
Compressors fueled and maintained per technical manual/PMS requirements	
View Ports and Doors	
View-ports checked for damage; replaced as necessary	
Door seals checked, replaced as necessary	
Door seals lightly lubricated with approved lubricant	
Door dogs and dogging mechanism checked for proper operation and shaft seals for tight-ness	
Chamber	
Inside wiped clean with Nonionic Detergent (NID) and warm fresh water	
All but necessary support items removed from chamber	
Blankets cleaned and replaced	
All flammable material in chamber encased in fire-resistant containers	
Primary medical kit restocked as required	
Chamber aired out	
Outer door closed	
Deckplates lifted, area below Deckplates cleaned, Deckplates reinstalled	
Support Items	
*U.S. Navy Diving Manua*l, Operating Procedures (OPs), Emergency Procedures (EPs), ventilation bill and pencil available at control desk	
Secondary medical kit restocked as required and stowed	
Clothing cleaned and stowed	
All entries made in chamber log book	
Chamber log book stowed	
Oxygen Supply	
BIBS mask removed, cleaned per current PMS procedures, reinstalled	
All valves closed	
System bled	
Breathing oxygen cylinders fully pressurized	
Spare cylinders available	
System free of contamination	
Exhaust System	
Exhaust: valves closed	

PRESSURE TEST FOR *Caldwell Marine International* RECOMPRESSION CHAMBERS

NOTE: All Caldwell Marine International recompression chambers are restricted to a maximum working pressure of 100 psig (225 fsw), regardless of design pressure rating.

A pressure test shall be conducted on every recompression chamber:

- When initially installed
- When moved and reinstalled
- After repairs/overhaul
- At two-year intervals at a given location

Performance of the test and the test results are recorded on a Chamber Air Pressure and Leak Test form (attached).

The test is conducted as follows:

1. Pressurize the innermost lock to 100 fsw (45 psig). Using soapy water or an equivalent solution, leak test all shell penetration fittings, view-ports, dog seals, door dogs (where applicable), valve connections, pipe joints, and shell weldments.
2. Mark all leaks. Depressurize the lock and adjust, repair, or replace components as necessary to eliminate leaks.

   a. View-Port Leaks. Remove the view-port gasket (replace if necessary), wipe clean.

CAUTION
Acrylic view-ports should not be lubricated or come in contact with any lubricant. Acrylic view-ports should not come in contact with any volatile detergent or leak detector (non- ionic detergent is to be used for leak test). When reinstalling view-port, take up retaining ringbolts until the gasket just compresses evenly about the view-port. Do not over compress the gasket.

   b. Weldment Leaks. Contact appropriate technical authority for guidance on corrective action.

3. Repeat steps 1 and 2 until all the leaks have been eliminated.
4. Pressurize lock to 225 fsw (100 psig) and hold for 5 minutes.
5. Depressurize the lock to 165 fsw (73.4 psig). Hold for 1 hour. If pressure drops below 145 fsw (65 psig), locate and mark leaks. Depressurize chamber and repair leaks in accordance with Step 2 above and repeat this procedure until final pressure is at least145
fsw (65 psig).
6. Repeat Steps 1 through 5 leaving the inner door open and outer door closed. Leak test only those portions of the chamber not previously tested.

RECOMPRESSION CHAMBER

AIR PRESSURE AND LEAK TEST
(Sheet 2 of 3)
Facility test is conducted _____

NAME PLATE DATA

Manufacturer _____

Date of Manufacture _____

Contract/Drawing No. _____

Maximum Working Pressure _____

Date of Last Pressure Test _____

Test Conducted by _____

1. Conduct visual inspection of chamber to determine if ready for test

Chamber Satisfactory_____Initials of Test Conductor

Discrepancies from visual inspection of chamber:

_____

_____

2. Close inner door lock. With outer lock door open pressure inner lock to 100 fsw (45psig) and verify that the following components do not leak:

Inner lock leak checks Initials of Test Conductor.

A. Shell penetrations and fittings	___Satisfactory
B. View Ports	___Satisfactory
C. Door Seals	___Satisfactory
D. Door Dog Shaft Seals	___Satisfactory
E. Valve Connections and Stems	___Satisfactory
F. Pipe Joints	___Satisfactory
G. Shell Welds	___Satisfactory

3. Increase inner lock pressure to 225 fsw (100 psig) and hold for 5 minutes.

Record Test Pressure_____Satisfactory (Note: Disregard small leaks at this pressure).

RECOMPRESSION CHAMBER
AIR PRESSURE AND LEAK TEST
(Sheet 3 of 3)

4. Depressurize lock slowly to 165 fsw (73.4 psig). Secure all supply and exhaust valves and hold for one hour.

Start Time_____Pressure 165 fsw

End Time_____Pressure_____fsw

If pressure drops below 145 fsw (65 psig) locate and mark leaks. Depressurize, repair, and retest inner lock.
Inner Lock Pressure drop test passed _____ Satisfactory Initials of Test Conductor.

5. Depressurize inner lock and open inner lock door. Secure in open position. Close outer door and secure.

6. Repeat tests of sections 2, 3, and 4 above when set up in accordance with section Leak test only those portions of the chamber not tested in sections 2, 3, and 4.

7. Outer Lock Checks Initials of Test Conductor

A. Shell penetrations and fittings	___Satisfactory
B. View Ports	___Satisfactory
C. Door Seals	___Satisfactory
D. Door Dog Shaft Seals	___Satisfactory
E. Valve Connections and Stems	___Satisfactory
F. Pipe Joints	___Satisfactory
G. Shell Welds	___Satisfactory

8. Maximum Chamber Operating Pressure (100 psig) Test (5 minute hold)

Satisfactory_____Initials of Test Conductor

9. Inner and Outer Lock Chamber Drop Test
   Start Time_____Pressure 165 fsw
   End Time_____Pressure_____fsw
10. All above tests have been satisfactorily completed.

_____	_____	_____
Test Conductor Date	Diving Supervisor Date	Maintenance Supervisor Date

5. Surface-Supplied Air Diving

5.1 Limits

- Surface-supplied air diving shall not be conducted at depths deeper than 190 fsw, except dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw.
- A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 60 fsw. A decompression chamber is required for dives deeper than 60 fsw when live boating.
- A bell shall be used for dives with an in water decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces.

5.2 Minimum Personnel

The minimum number of personnel comprising a dive team must take into consideration not only the direct requirements of work to be performed, but also any additional factors either known or suspected that would require more personnel to support the diving operation. Question: Looking at the ADCI Operational Guidelines Pgs 51-55 Below Ranges 0-80, 80-130 , 130-220 are different ranges and requirements than the ADCI manual. As this is not my area of exoertise, I would not be able to advise you on the above ranges but would suggest consider following current ADCI Operational gudielines

Surface Supplied Air Diving 0 – 80 fsw with no decompression:

- 1 – Diving Supervisor
- 1 – Diver
- 1 – Tender/Standby Diver

Surface Supplied Air Diving 80 – 130 fsw, or less than 80 fsw when decompression is required:

- 1 – Diving Supervisor
- 1 – Diver
- 1 – Standby Diver
- 1 – Tender

Surface Supplied Air Diving 130 – 220 fsw:

- 1 – non Diving Supervisor
- 1 – Diver
- 1 – Standby Diver
- 2 – Tenders

Working with large Crews in shallow water less than 130 fsw

- When working in shifts with 2 eight-man crew's a non-diving supervisor is required for each shift.
- When working with 2 four-man crews on the same shift at different locations on a single vessel or facility, a non-diving supervisor is required.
- When working with 2 four-man crews on different shifts on a single vessel or facility, a non-diving supervisor is not required.

5.3 General Surface Supplied Procedures

The following are minimum requirements for surface supplied air diving operations.

- Each diver shall be continuously tended while in the water.
- A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.
- Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.
- Diving depth limitations are based on secondary breathing gas availability. A dive-location secondary breathing gas supply shall be provided and be capable of supporting two divers and a standby for the duration of the required decompression during an emergency.
- For dives deeper than 100 fsw or outside the no-decompression limits:
- A separate dive team member shall tend each diver in the water;
- A standby diver shall be available while a diver is in the water;
- A diver-carried reserve breathing gas supply (bailout) shall be provided for each diver when diving at all times regardless of depth, when direct ascent to the surface is not available, except when heavy gear is worn.
- For heavy-gear diving deeper than 100 fsw or outside the no-decompression limits an extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.
- A separate safety harness with a positive buckling device shall be worn. The harness shall prevent any strain from being placed on the diver's mask or helmet.
- In the event that diving operations require in-closed space diving a diver shall be stationed at the underwater point of entry.
- An operational two-way voice communication system shall be used between:
- Each surface-supplied air diver and a dive team member at the dive location or bell (when provided or required);
- An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.
- Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.
- A depth-time profile shall be maintained for each diver during the dive including decompression.
- A means capable of supporting the diver shall be provided for entering and exiting the water.
- The means provided for exiting the water shall extend below the water surface for a minimum of three feet and be adequate to facilitate rescue of injured personnel.
- Dive team members shall be briefed on the tasks to be undertaken, safety procedures for the diving mode being used and emergency procedures.

5.4 Minimum Equipment

5.4.1 Shallow Air (0 to 80 fsw, 60 fsw when live boating)

- Adequate air source and volume tank to support two (2) divers;
- Dive location emergency air source
- Two (2)-diver umbilicals each consisting of air hose, strength member, communications cable, and pneumofathometer hose.
- 1 Set of the U.S. Navy No-decompression tables, Repetitive dive tables, and air decompression and treatment tables
- 1 Safe practices/Operations Manual;
- 1 Control station consisting of communication system and depth gauges;
- Safe means of getting a diver of the water;
- 1 Basic First Aid kit with First Aid Manual and Bag type Manual Resuscitator;
- Two Sets of diver's personal diving equipment consisting of helmet or mask, weight belt if appropriate, protective clothing, tools as required, safety harness, diver carried reserve breathing gas supply (bailout), sharp knife.
- Two time keeping devices;
- Log book and/or dive sheets

5.4.2 Deep Air (in excess of 80 fsw, 60 fsw when live boating)

- Two adequate air sources and volume tanks to support two (2) divers;
- 1 Double-lock recompression chamber;
- 1 Set air decompression and treatment tables;
- Dive location emergency air source;
- 1 Diving stage (all dives deeper than 100 fsw, outside no decompression limits, or with heavy diving gear;
- Two (2)-diver umbilicals each consisting of air hose, strength member, communications cable, and pneumofathometer hose.
- 1 Safe practices/Operations Manual;
- 1 Control station consisting of communication system and depth gauges;
- Safe means of getting a diver of the water;
- 1 Basic First Aid kit with First Aid Manual and Bag type Manual Resuscitator;
- Two sets of diver's personal diving equipment consisting of helmet or mask, weight belt if appropriate, diver carried reserve breathing gas supply (bail out), protective clothing, tools as required, safety harness, diver carried reserve breathing gas supply (bailout), sharp knife;
- Adequate supply of oxygen for recompression treatments;
- Spare parts as required;
- 2 Time keeping devices;
- Log book and/or dive sheets

5.5. Post-Dive Procedures

After the completion of any dive, the Dive Supervisor shall:

- Check the physical condition of the diver.
- Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness.
- Advise the diver of the location of a recompression chamber that is ready foruse
- Alert the diver to the potential hazards of flying after diving.
- For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas as a breathing mixture, the Dive Supervisor shall instruct the diver to remain awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate).

5.6 Recompression Capability

- A recompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:
- Surface-supplied air diving to depths deeper than 60 fsw and shallower than 220 fsw;
- Diving outside the no-decompression limits shallower than 220 fsw.
- Live boating deeper than 60 fsw .
- The recompression chamber shall be:
- Dual-lock;
- Multi-place.
- Located within 5 minutes of the dive location.
- The recompression chamber at a minimum shall be equipped with:
    - A pressure gauge for each pressurized compartment designed for human occupancy
    - A built-in-breathing-system with a minimum of one mask per occupant
    - A two-way voice communication system between occupants and a dive team member at the dive location
    - A view port for each lock
    - Illumination capability to light the interior of the chamber
    - Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the divelocation.
    - A dive team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided).

5.7 Record of Dive

The following information shall be recorded and maintained for each diving operation:

- Names of dive team members including designated person-in-charge
- Date, time, and location
- Diving modes used
- General nature of work performed
- Approximate underwater and surface conditions (visibility, water temperature and current); and

- Maximum depth and bottom time for each diver
- For each dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas, the following additional information shall be recorded and maintained
- Depth-time and breathing gas profiles
- Decompression table designation (including modification); and
- Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation for each diver
- 5.7.1 Recompression Procedure Assessment
- For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained
- Description of decompression sickness symptoms (including depth and time of onset); and
- Description and results of treatment
- The employer shall:
- Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility
- Take appropriate corrective action to reduce the probability of recurrence of decompression sickness
- Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness.

5.8 Air Diving Procedures

5.8.1 Introduction

When air is breathed under pressure, nitrogen diffuses into various tissues of the body. This nitrogen uptake by the body occurs at different rates for the various tissues. It continues as long as the partial pressure of the inspired nitrogen in the circulatory and respiratory system is higher than the partial pressure of the gas absorbed in the tissues. Nitrogen absorption increases as the partial pressure of the inspired nitrogen increases, such as with increased depth. Nitrogen absorption also increases as the duration of the exposure increases, until tissues become saturated.

As a diver ascends, the process is reversed. The partial pressure of nitrogen in the tissues comes to exceed that in the circulatory and respiratory systems. During ascent, the nitrogen diffuses from the tissues to the lungs. The rate of ascent must be carefully controlled to prevent the nitrogen pressure from exceeding the ambient pressure by too great of an amount. If the pressure gradient is uncontrolled, bubbles of nitrogen gas can form in tissues and blood, causing decompression sickness.

To reduce the possibility of decompression sickness, special decompression tables and schedules were developed. These schedules take into consideration the amount of nitrogen absorbed by the body at various depths and times. Other considerations are the allowable pressure gradients that can exist without excessive bubble formation and the different gas-

elimination rates associated with various body tissues. Because of its operational simplicity, staged decompressions used for air decompression. Staged decompression requires decompression stops in the water at various depths for specific periods of time.

5.8.2 AIR Decompression Definition

The following terms are frequently used when conducting diving operations and discussing the decompression tables.

- Descent Time. *Descent time* is the total elapsed time from when the divers leave the surface to the time they reach the bottom. Descent time is rounded up to the next whole minute.
- Bottom Time. *Bottom time* is the total elapsed time from when the divers leave the surface to the time they begin their ascent from the bottom. Bottom time is measured in minutes and is rounded up to the next whole minute.
- Decompression Table. A *decompression table* is a structured set of decompression schedules, or limits, usually organized in order of increasing bottom times and depths.
- Decompression Schedule. A *decompression schedule* is a specific decompression procedure for a given combination of depth and bottom time as listed in a decompression table. It is normally indicated as feet/minutes.
- Decompression Stop. A *decompression stop* is a specified depth where a diver must remain for a specified length of time (stop time).
- Depth. The following terms are used to indicate the depth of a dive:
- *Maximum depth* is the deepest depth attained by the diver plus the pneumofathometer correction factor (Table 5- 1). When conducting scuba operations, maximum depth is the deepest depth gauge reading.
- *Stage depth* is the pneumofathometer reading taken when the divers are on the stage just prior to leaving the bottom. Stage depth is used to compute the distance and travel time to the first stop, or to the surface if no stops are required.

Pneumofathometer Correction Factors.

Pneumofathometer Depth	Correction Factor
0-100 fsw	+1 fsw
101-200	+2 fsw
201-300	+4 fsw
301-400	+7 fsw

- Equivalent Single Dive Bottom Time. The *equivalent single dive bottom time* is the time used to select a schedule for a single repetitive dive. This time is expressed in minutes.
- Unlimited/No-Decompression (No "D") Limit. The maximum time that can be spent at a given depth that safe ascent can be made directly to the surface at a prescribed travel rate with no decompression stops is the *unlimited/no-decompression* or *No "D" limit*.
- Repetitive Dive. A *repetitive dive is* any dive conducted within 12 hours of a previous dive.
- Repetitive Group Designation. The *repetitive group designation* is a letter used to indicate the amount of residual nitrogen remaining in a diver's body following a previous dive.

- Residual Nitrogen. *Residual nitrogen* is the nitrogen gas still dissolved in a diver's tissues after surfacing.
- Residual Nitrogen Time. *Residual nitrogen time* is the time that must be added to the bottom time of a repetitive dive to compensate for the nitrogen still in solution in a diver's tissues from a previous dive. Residual nitrogen time is expressed in minutes.
- Single Dive. A *single dive* refers to any dive conducted more than 12 hours after a previous dive.
- Single Repetitive Dive. A *single repetitive dive* is a dive for which the bottom time used to select the decompression schedule is the sum of the residual nitrogen time and the actual bottom time of the dive.
- Surface Interval. The *surface interval is* the time a diver has spent on the surface following a dive. It begins as soon as the diver surfaces and ends as soon as he starts his next descent.

5.8.3 Selection of Decompression Schedule

The decompression schedules of all the
tables are usually given in 10-foot depth increments and 10-minute bottom time increments. Depth and bottom time combinations from dives, however, rarely match the decompression schedules exactly. To ensure that the selected decom-pression schedule is always conservative, always select the schedule depth equal to or next greater than the maximum depth of the dive and always select the schedule bottom time equal to or next longer than the bottom time of the dive.
For example, to use the Standard Air Decompression Table to select the correct schedule for a dive to 97 fsw for 31 minutes, decompression would be selected for 100 fsw and carried out per the 100 fsw for 40 minutes (100/40) schedule.

CAUTION: Never attempt to interpolate between decompression schedules.

When planning for surface-supplied dives where the diver will be exceptionally cold or the workload is expected to be relatively strenuous, Surface Decompression should be considered. In such case, conduct decompression from the normal schedule in the water and then surface decompress using the chamber stop time(s) from the next longer schedule. When conducting dives using Standard Air Decompression Tables, select the next longer decompression schedule than the one that would normally be selected.
If the divers are exceptionally cold during the dive or if the workload is relatively strenuous, select the next longer decompression schedule than the one that would normally be selected. If the diver's depth cannot be maintained at a decompression stop, the Diving Supervisor may select the next deeper decompression table.

NOTE: Take into consideration the physical condition of the diver when deter-mining what is strenuous.

5.9 Rules During Ascent

After selecting the applicable decompression schedule, it is imperative that it be followed as closely as possible. Unless a Diving Medical Officer recommends a deviation and the

Commanding Officer concurs, decompression must be completed according to the schedule selected.

5.9.1 Ascent Rate

Always ascend at a rate of 30 fpm (20 seconds per 10 fsw). Minor variations in the rate of travel between 20 and 40 fsw/minute are acceptable. Any variation in the rate of ascent must be corrected in accordance with the procedures in paragraph 5.9.3. However, a delay of up to one minute in reaching the first decompression stop can be ignored.

5.9.2 Decompression Stop Time

Decompression stop times, as specified in the decompression schedule, begin as soon as the divers reach the stop depth. Upon completion of the specified stop time, the divers ascend to the next stop or to the surface at the proper ascent rate. Ascent time is not included as part of stop time.

Variations in Rate of Ascent Delays

in Arriving at the First Stop
Delay greater than 1 minute, deeper than 50 fsw. Add the total delay time (rounded up to the next whole minute) to the bottom time, re-compute a new decompression schedule, and decompress accordingly.
Delay greater than 1 minute, shallower than 50 fsw. If the rate of ascent is less than 30 fpm, add the delay time to the diver's first decompression stop. If the delay is between stops, disregard the delay. The delay time is rounded up to the next whole minute.

Travel Rate Exceeded
On a Standard Air Dive, if the rate of ascent is greater than 30 fpm, STOP THE ASCENT, allow the watches to catch up, and then continue ascent. If the stop is arrived at early, start the stop time after the watches catch up.

5.10 Decompression Tables

5.10.1 The Unlimited/No-Decompression

The table serves three purposes. First, the table identifies that on a dive with the depth 20 fsw and shallower, unlimited bottom time may be achieved. Second, it summarizes all the depth and bottom time combinations for which no decompression is required. Third, it provides the repetitive group designation for each unlimited/no-decompression dive. Even though decompression is not required, there is still an amount of nitrogen remaining in the diver's tissues for up to 12 hours following a dive. If they dive again within a 12- hour period, divers must consider this residual nitrogen when calculating decompression from the repetitive dive. Any dive deeper than 25 fsw that has a bottom time greater than the no-decompression limit given in this table is a decompression dive and must be conducted per the Standard Air Decompression Table.
Each depth listed in the Unlimited/No-Decompression Table has a corresponding no-decompression limit listed in minutes. This limit is the maximum bottom time that divers

may spend at that depth without requiring decompression. Use the columns to the right of the no-decompression limits column to obtain the repetitive group designation. This designation must be assigned to a diver subsequent to every dive.

5.10.2 U.S. Navy Standard Air Decompression Schedules

This manual combines the Standard Air Decompression Schedules and Exceptional Exposure Air Schedules into one table. To clearly distinguish between the standard (normal) and exceptional exposure decompression schedules, the exceptional exposure schedules have been separated by a bold line.

NOTE: Never conduct planned exceptional exposure dives.

If the bottom time of a dive is less than the first bottom time listed for its depth, decompression is not required. The divers may ascend directly to the surface at a rate of 30 feet per minute (fpm). The repetitive group designation for a no-decompression dive is given in the Unlimited/No-Decompression Table. As noted in the Standard Air Decompression Table, there are no repetitive group designations for exceptional exposure dives. Repetitive dives are not permitted following an exceptional exposure dive.

5.10.3 Repetitive Dives

During the 12-hour period after an air dive, the quantity of residual nitrogen in divers' bodies will gradually be reduced to its normal level. If the divers are to make a second dive within this period (repetitive dive), they must consider their residual nitrogen level when planning for the dive.

Upon completing the first dive, the divers are assigned a repetitive group designation from either the Standard Air Decompression Table or the Unlimited/No-Decompression Table. This designation relates directly to the residual nitrogen level upon surfacing. As nitrogen passes out of the diver's tissues and blood, their repetitive group designation changes. By using the Residual Nitrogen Timetable (Table 9- 7), this designation may be determined at any time during the surface interval.

To determine the decompression schedule for a repetitive dive using either the unlimited/no-decompression, standard air, or surface decompression table:

- Determine the residual nitrogen level just prior to leaving the surface of the repetitive dive (based on the repetitive dive depth), using the Residual Nitrogen Timetable. This level is expressed as residual nitrogen time, in minutes.
- Add this time to the actual bottom time of the repetitive dive to get the Equivalent Single Dive Time (ESDT).
- Conduct decompression from the repetitive dive using the max depth (MD) and the equivalent single dive time to select the appropriate decompression schedule. Avoid equivalent single dives requiring the use of Exceptional Exposure decompression schedules. Always use a systematic Repetitive Dive Worksheet, when determining the decompression schedule for a repetitive dive.

5.10.4 Residual Nitrogen Timetable for Repetitive Air Dives

The quantity of residual nitrogen in a diver's body immediately after a dive is expressed by the repetitive group designation assigned from either the Standard Air Decompression Schedule or the Unlimited/No-Decompression Table. The upper portion of the Residual Nitrogen Timetable is composed of various intervals between 10 minutes and 12 hours. These are expressed in hours and minutes (2:21 = 2 hours, 21 minutes). Each interval has a minimum time (top limit) and a maximum time (bottom limit). Residual nitrogen times corresponding to the depth of the repetitive dive is given in the body of the lower portion of the table. To determine the residual nitrogen time for a repetitive dive:

- Locate the diver's repetitive group designation from the previous dive along the diagonal line above the table.
- Read horizontally to the interval where the diver's surface interval lies. The time spent on the surface must be between or equal to the limits of the selected interval.
- Read vertically down to the new repetitive group designation. This corresponds to the present quantity of residual nitrogen in the diver's body.
- Continue down in this same column to the row representing the depth of the repetitive dive. The time given at the intersection is the residual nitrogen time, in minutes, to be applied to the bottom time of the repetitive dive.

5.10.5 RNT Exception Rule

An exception to this table occurs when the repetitive dive is made to the same or greater depth than that of the previous dive. This is referred to as the RNT Exception Rule. In such cases, the residual nitrogen time may be longer than the bottom time of the previous dive. A diver's body cannot contain more residual nitrogen than it was originally exposed to. To obtain the equivalent single dive time, simply add the bottom time of the previous dive to that of the repetitive dive. (All of the residual nitrogen passes out of a diver's body after 12 hours, so a dive conducted after a 12-hour surface interval is not a repetitive dive.)

5.11 Surface Decompression

Surface decompression is a technique for fulfilling all or a portion of a diver's decompression obligation in a recompression chamber instead of in the water, significantly reducing the time that a diver must spend in the water. Also, breathing oxygen in the recompression chamber reduces the diver's total decompression time.

Surface decompression offers many advantages that enhance the divers' safety. Shorter exposure time in the water keeps divers from chilling to a dangerous level. Inside the recompression chamber, the divers can be maintained at a constant pressure, unaffected by surface conditions of the sea. Divers shall be observed constantly by either the inside tender or topside personnel, and monitored for decompression sickness and oxygen toxicity.

If an oxygen breathing system is installed in the recompression chamber, conduct surface decompression according to the Surface Decompression Table Using Oxygen. If air is the only breathing medium available, use the Surface Decompression Table Using Air.

Residual Nitrogen Timetables have not been developed for Surface Decompression Repetitive Dives. Repetitive surface decompression dives may be accomplished in accordance with 5.12.

5.11.1 Surface Decompression Table Using Oxygen.

Using the Surface Decompression Table Using Oxygen (referred to as Sur D O2) requires an approved double-lock recompression chamber with an oxygen breathing system. With Sur D O2, divers ascend at a constant rate of 30 fpm. The divers are decompressed to the first decompression stop (or to the surface if there are no water stops required) at an ascent rate of 30 fpm. The travel rate between stops and from 30 fsw to the surface is also 30 fpm (:20 per 10 fsw). Minor variations in the rate of travel between 20 and 40 fpm are acceptable. Once the divers are on the surface, the tenders have three and a half (:03:30) minutes to remove the breathing apparatus and diving dress and assist the divers into the recompression chamber.

Pressurizing the recompression chamber with air to 40 fsw should take approximately 30 seconds (descent rate not to exceed 80 fpm). The total elapsed time from when the divers leave the 30 foot stop (or 30 fsw if no water stops are required) to when they reach the 40 foot recompression chamber stop must not exceed 5 minutes.

During descent in the recompression chamber, if a diver cannot clear and the chamber is at a depth of at least 20 fsw, stop, then breathe oxygen at 20 fsw for twice the 40 fsw chamber stop time. Ascend to 10 fsw and breathe oxygen again for twice the 40 fsw chamber stop time. Then ascend to the surface. This “safe way out” procedure is not intended to be used in place of normal Sur D O 2 procedures.

If the prescribed surface interval is exceeded and the divers are asymptomatic, treat them as if they have Type I decompression sickness (Treatment Table 5,). If the divers are symptomatic, they are treated as if they have Type II decompression sickness (Treatment Table 6,), even if they are only displaying Type I symptoms. Symptoms occurring during the chamber stops are treated as recurrences

Upon arrival at 40 fsw in the recompression chamber, the divers are placed on the Built-in Breathing System (BIBS) mask breathing pure oxygen. The mask should not be strapped on unless there is an inside tender with the divers, the divers must hold the mask to their face and ensure a good oxygen seal.

The designated 40-foot stop time commences once the divers are breathing oxygen. The divers breathe oxygen throughout the 40 foot stop, interrupting oxygen breathing after each 30 minutes with a 5 minute period of breathing chamber air (referred to as an “air break”). Count the air breaks as “dead time” and not part of the oxygen stop time. If the air break interval falls on time to travel, remove oxygen and commence traveling to the surface at 30 fpm. This procedure simplifies time keeping and should be used whenever using the Surface Decompression Table Using Oxygen. Remove the O 2 mask prior to leaving the 40 fsw stop for the surface.

Warning: The interval from leaving 40 fsw in the water to arriving at 50 fsw in the chamber cannot exceed 5 minutes without incurring a penalty. This is new in the US NAVY Dive Manual revision 7.

5.11.2 Loss of Oxygen Supply in the Chamber (40 fsw Chamber Stop)

If the oxygen supply in the chamber is lost at the 40 fsw chamber stop, have the diver breathe chamber air.

- Temporary Loss. Return the diver to oxygen breathing. Consider any time on air as dead time.
- Permanent Loss. Multiply the remaining oxygen time by three to obtain the equivalent chamber decompression time on air. If 50% helium 50% oxygen or 50% nitrogen 50% oxygen is available, multiply the remaining oxygen time by two to obtain the equivalent chamber decompression time on 50/50. Allocate 10% of the equivalent air or 50/50 time to the 40-fsw stop, 20% to the 30 fsw stop, and 70% to the 20 fsw stop. Round the stop times up to the next whole minute. Surface upon completion of the 20 fsw stop.

5.11.3 CNS Oxygen Toxicity (40 fsw Chamber Stop)

At the first sign of CNS toxicity, the patient should be removed from oxygen and allowed to breathe chamber air. Fifteen minutes after all symptoms have completely subsided, resume oxygen breathing at the point of interruption. If symptoms of CNS oxygen toxicity develop again or if the first symptom is a convulsion, take the following action:

1. Remove the mask.
2. After all symptoms have completely subsided, decompress 10 feet at a rate of 1 fsw/min. For a convulsion, begin travel when the patient is fully relaxed and breathing normally.
3. Resume oxygen breathing at the shallower depth at the point of interruption.
4. If another oxygen symptom occurs, complete decompression time on air. Multiply
5. the remaining oxygen time by three to obtain the equivalent chamber decompression time on air. Allocate 30% of the equivalent air to the 30 fsw stop and 70% to the 20 fsw stop. Surface upon completion of the 20 fsw stop.

5.11.4 Repetitive Dives.

There are no repetitive diving tables or surface interval tables for surface decompression dives. If another surface decompression dive using oxygen is planned within a 12-hour period, select the appropriate decompression schedule by:

- Adding the bottom times of all dives made in the previous 12 hours to get an adjusted bottom time, and
- Using the maximum depth obtained in the previous 12 hours.
- The equivalent single dive shall not exceed 170/40 for Sur D O 2 or 190/60 for Sur D Air.

5.11.5 Surface Decompression Table Using Air

The Surface Decompression Table Using Air (referred to as Sur D Air) should be used for surface decompression following an air dive when a recompression chamber without an oxygen breathing system is all that is available.

The total ascent times of the Surface Decompression Table Using Air exceed those of the Standard Air Decompression Table; the only advantages surface decompression using air are getting the divers out of the water sooner and maintaining the divers in a controlled, closely observed environment during decompression.

When using the Sur D Air table, all ascents are made at 30 fpm. This includes the ascent

rate from the last water stop. The time spent on the surface should not exceed 3½ minutes and the rate of descent to the first recompression chamber stop should not exceed 60 fpm. The total elapsed time for these three procedures must not exceed 5 minutes.
If the prescribed surface interval is exceeded and the divers are asymptomatic, they are treated as if they had Type I Decompression Sickness (Treatment Table 5 or 1A). If the divers are symptomatic, they are treated as if they had Type II Decompression Sickness (Treatment Table 6 or 2A), even if they are only displaying Type I symptoms.

5.11.6 Repetitive Dives.

If a second surface decompression air dive is planned within a 12-hour period, the same rule applies as for making a second Sur D O 2 dive

5.12 Exceptional Exposure

Exceptional exposure dives are those dives in which the risk of decompression sickness, oxygen toxicity, and/or exposure to the elements is substantially greater than on normal working dives. Decompression schedules for exceptional exposure dives are contained in the Standard Air Decompression Table. These exceptional exposure schedules are only used in emergencies, such as diver entrapment. Exceptional exposure dives should not be planned in advance except under the most unusual operational circumstances.

5.12.1 Surface Decompression Procedures for Exceptional Exposure Dives.

The long decompressions times associated with exceptional exposure dives impose unusual demands on a diver's endurance. There is also limited assurance that the dive will be completed without decompression sickness. These two risks can be reduced by using surface decompression techniques rather than completing decompression entirely in the water.

- Complete the entire 20 fsw in the water.
- Ascend to the surface at 30 fpm. Minor variations in the rate of travel between 20 and 40 fpm are acceptable.
- Once on the surface, the tenders have three and a half (:03:30) minutes to remove the breathing apparatus and diving dress and assist the divers into the recompression chamber.
- Pressurize the recompression chamber with air to 20 fsw at a travel rate of 60 fpm.
- Upon arrival at 20 fsw in the recompression chamber, the divers are placed on the Built-in Breathing System (BIBS) mask breathing 100% oxygen.
- The 20 foot stop time commences once the divers are breathing oxygen. Repeat the 20 fsw in-water stop time.
- The divers breathe oxygen throughout the 20-foot stop, interrupting oxygen breathing after each 30 minutes with a 5 minute air break. The air breaks count as part of the stop time.
- Ascend to 10 fsw at 30 fpm. Complete the 10 fsw in-water stop time. The divers breathe oxygen throughout the 10-foot stop, interrupting oxygen breathing after each 30 minutes with a 5 minute air break. The air breaks count as part of the stop time.

- Ascent to the surface at 30 fpm.

5.12.2 Oxygen System Failure (Chamber Stop).

If the oxygen system fails during a chamber stop, complete the remaining decompression time on air.

5.13 Diving At High Altitudes

Because of the reduced atmospheric pressure, dives conducted at altitude require more decompression than identical dives conducted at sea level. Standard air decompression tables, therefore, cannot be used as written. Some organizations calculate specific decompression tables for use at each altitude. An alternative approach is to correct the altitude dive to obtain an equivalent sea level dive, then determine the decompression requirement using standard tables. This procedure is commonly known as the "Cross Correction" technique and always yields a sea level dive that is deeper than the actual dive at altitude. A deeper sea level equivalent dive provides the extra decompression needed to offset effects of diving at altitude. If diving at altitudes above 300 feet refer to the US Navy dive manual for guidance.

5.13.1 Flying After Diving

Leaving the dive site may require temporary ascent to a higher altitude. Ascent to altitude after diving increases the risk of decompression sickness because of the additional reduction in atmospheric pressure the higher the altitude, the greater the risk. Pressurized commercial airline flights are addressed in Note 3 of Table 5-2.)

Table 5-2 gives the surface interval (hours: minutes) required before making a further ascent to altitude. The surface interval depends on the planned increase in altitude and the highest repetitive group designator obtained in the previous 24-hour period. Enter the table with the highest repetitive group designator obtained in the previous 24-hour period. Read the required surface interval from the column for the planned change in altitude.

Required Surface Interval Before Ascent to Altitude After Diving.

Repetitive Group Designator

Increase in Altitude

	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
A	00:00	00:00	00:00	00:00	00:00	00:00	00:00	**00:00**	00:00	00:00
B	00:00	00:00	00:00	00:00	00:00	00:00	00:00	**00:00**	00:00	02:11
C	00:00	00:00	00:00	00:00	00:00	00:00	00:00	**00:00**	03:06	08:26
D	00:00	00:00	00:00	00:00	00:00	00:00	00:09	**03:28**	07:33	12:52
E	00:00	00:00	00:00	00:00	00:00	00:51	03:35	**06:54**	10:59	16:18
F	00:00	00:00	00:00	00:00	001:12	03:40	06:23	**09:43**	13:47	19:07
G	00:00	00:00	00:00	01:23	03:34	06:02	08:46	**12:05**	16:10	21:29
H	00:00	00:00	01:31	03:26	05:37	08:05	10:49	**14:09**	18:13	23:33
I	00:00	01:32	03:20	05:15	07:26	09:54	12:38	**15:58**	20:02	24:00
J	01:32	03:09	04:57	06:52	09:04	11:32	14:16	**17:35**	21:39	24:00
K	03:00	04:37	06:25	08:20	10:32	13:00	15:44	**19:03**	23:07	24:00
L	04:21	05:57	07:46	09:41	11: 52	14:20	17:04	**20:23**	24:00	24:00
M	05:35	07:11	09:00	10:55	13:06	15:34	18:18	**21:37**	24:00	24:00
N	06:43	08:20	10:08	12:03	14:14	16:42	19:26	**22:46**	24:00	24:00
O	07:47	09:24	11:12	13:07	15:18	17:46	20:30	**23:49**	24:00	24:00
Z	08:17	09:54	11:42	13:37	15:49	18:17	21:01	**24:00**	24:00	24:00

Exceptional Exposure Wait 48 hours before flying

NOTE 1: When using Table 5-2, use the highest repetitive group designator obtained in the previous 24-hour period.
NOTE 2: Table 5-2 may only be used when the maximum altitude achieved is 10,000 feet or less.
NOTE 3: The cabin pressure in commercial aircraft is maintained at a constant value regardless of the actual altitude of the flight. Though cabin pressure varies somewhat with aircraft type, the nominal value is 8,000 feet. For commercial flights, use a final altitude of 8000 feet to compute the required surface interval before flying.
NOTE 4: No surface interval is required before taking a commercial flight if the dive site is at 8000 feet or higher. In this case, flying results in an increase in atmospheric pressure rather than a decrease.
NOTE 5: No repetitive group is given for air dives with surface decompression on oxygen or air. For these surface decompression dives, enter the standard air table with the sea level equivalent depth and bottom time of the dive to obtain the appropriate repetitive group designator to be used.
NOTE 6: For ascent to altitude following a non-saturation helium-oxygen dive, wait 12 hours if the dive was a no-decompression dive. Wait 24 hours if the dive was a decompression dive.

5.14 Emergency Procedures

Diving and the performance of work underwater, places a man in a situation that has inherent and unavoidable dangers. Even when using the best equipment manned by properly trained personnel, the possibility of and emergency may exist. Emergencies are by nature unexpected and differ form a routine failure in that they require prompt correct action to recover and prevent further deterioration of the situation. The emergency procedures (EP's) that follow for surface supplied diving operations outline the steps required to recover from known possible emergencies.

The cardinal rule of emergency procedures is the most difficult to follow – DON'T PANIC. While it is much easier to say than do, a panicky response will more than likely be wrong, and result in the further complication of the situation. While actions taken in an emergency must be quick, they must also be correct, and correct decisions are not made if you do not have a complete grasp on the situation. If the diver finds himself in an emergency situation, he should take time to assess the situation determine the correct action and what he can do for himself.

The following emergency procedures that may affect the health and safety of personnel are offered as minimum guidelines to assist companies in developing their own specific detailed emergency procedures. The steps that are listed may not be in order of preference.
Each emergency will dictate its own priorities. In general, every emergency will cause the dive to be aborted until the cause has been fully remedied.

.Loss of Breathing Media
1. Re-establish breathing media supply by:
• Activate topside secondary breathing media supply, or
• Diver go on bailout bottle, or
• Put breathing media to diver's pneumo hose and have the diver insert pneumo hose into helmet/mask.
2. Alert standby diver.
3. Diver goes to bell/stage.
4. If required, send Standby Diver to diver's assistance.
5. Terminate dive.

Loss of Communications
1. Attempt to establish line-pull signals.
2. Put air to diver's pneumo.
3. Alert Standby Diver.
4. Diver proceeds to downline/bell stage (if bell, attempt to use bell communications).
5. Bring diver to first stop once line-pull signals are established.
6. If required (unable to establish any form of communications with diver), send Standby Diver to diver's assistance prior to bringing diver to his first stop.
7. Terminate dive.

Fouled or Entrapped Diver
1. Avoid panic and ensure diver does not ditch equipment.
2. Diver informs topside.
3. Alert standby diver.
4. Diver determines extent of entrapment.
5. Diver attempts to free himself.
6. If required, send Standby Diver to diver's assistance.
7. When diver is free, if unable or unwilling to continue the dive, or if Standby Diver was required to go to his assistance, terminate dive.

Injured Diver in Water
1. Diver informs topside and dive is aborted.
2. Alert Standby Diver.
3. Diver determines nature and extent of injury.
Consensus Standards for Commercial Diving and Underwater Operations 3-41
4. If required, send Standby Diver down to assist diver, administer first aid, and evaluate injury. Standby Diver should remain with diver.5. Standby Diver assists injured diver to surface, following proper decompression procedures, except when severity of injury indicates a greater risk than omitting decompression.
6. Request required medical assistance and emergency evacuation (if required).
7. Monitor breathing. If breathing stops, overpressure diver's regulator, if possible.

Severance of Diver's Umbilical - Gas Hose Only
1. Put breathing media to diver's pneumo hose.
2. Diver activates bailout bottle.
3. Alert Standby Diver.
4. If required, diver inserts pneumo hose inside helmet/mask.
5. Diver returns to bell/stage.
6. Diver activates and uses emergency breathing media on bell/stage.
7. Terminate dive and follow proper decompression procedure.
8. If required, send Standby Diver down with additional bailout bottle or hose.

Severance of Complete Umbilical
1. Diver activates bailout bottle.
2. Alert Standby Diver.
3. Diver returns to bell/stage.
4. Diver activates and uses emergency gas on bell/stage.
5. If umbilical severed on deck and the end of the umbilical is still on deck, send Standby Diver down umbilical with new hose/bailout bottle. Otherwise, send Standby Diver down downline or bell stage cable.
6. Terminate dive and follow proper decompression procedure.

Fire in Equipment
1. Extinguish fire; secure equipment.
2. Determine damage and effect on diver.
3. If required, terminate dive; commence decompression.

4. Each chamber must have a means of extinguishing a fire in the interior.

Equipment Failure - Diver in the Water
1. Evaluate effect on diver.
2. Inform diver of problem and action planned.
3. Alert Standby Diver.
4. Alert deck crew.
5. Diver informs topside of his readiness.
6. Activate plan, terminate dive.

Oxygen Toxicity in Water
1. Supervisor notes signs or diver reports symptoms to topside.
2. Reduce oxygen partial pressure (switch to air).
3. Continue decompression on appropriate table unless a 50/50 nitrox mix is available for in-water decompression use.

Oxygen Toxicity during Treatment
1. Diver reports to topside.
2. Instruct diver to remove oxygen mask for 15 minutes. After all symptoms disappear, then start oxygen again. Do not count time not on oxygen. Recommence decompression where oxygen stopped.
3. If oxygen toxicity symptoms occur for the second (2nd) time, repeat Procedure 2.
4. If oxygen toxicity symptoms occur for the third (3rd) time, discontinue oxygen and immediately request medical advice and assistance from designated point ofcontact.

Emergency Evacuation
1. Notify diver and all surrounding personnel of emergency and terminate dive.
2. Decompress diver according to proper decompression procedures. If not possible, follow omitted decompression procedures.
3. Evacuate all unnecessary personnel to safe platform.
4. Contact management and inform them of conditions as soon as possible.
Additional emergency procedures should be developed as needed, possibly including but not limited to:
• Loss of power supplies
• Loss of SDC (bell)
• Loss of ROV
• Adverse environmental conditions, including but not limited to:
- Weather
- Sea state
Consensus Standards for Commercial Diving and Underwater Operations 3-43
Dive emergencies such as bailout, bends, omitted decompression, embolism, etc.

6 **SCUBA Diving**:

International Telecom divers do not normally conduct SCUBA diving operations. When the task can be performed using surface supplied techniques they should be employed. However the case may arise where a task can be more efficiently performed using SCUBA. In this case the techniques to be used is up to the on scene diving supervisor.

6.1 Limits

- SCUBA diving shall not be conducted at depths deeper than 130 fsw.
- SCUBA diving at depths deeper than 60 fsw requires a recompression chamber that is ready for use and on the dive location.
- Planned Decompression dives in SCUBA are not permitted.
- SCUBA dives shall not be conducted against currents exceeding one (1) knot.
- SCUBA diving is not permitted in enclosed or physically confining spaces.

6.2 Procedures

- A standby diver shall be available while a diver is in the water.
- A single diver shall be line-tended from the surface.
- Divers will be line-tended from the surface if direct access to the surface is not possible.
- A diver-carried reserve breathing gas supply shall be provided for each diver consisting of a manual reserve (J valve); or an independent reserve cylinder with a separate regulator.
- The valve of the reserve breathing gas supply shall be in the closed position prior to the dive.
- Dive team members shall be briefed on:
- The tasks to be undertaken;
- Safety procedures for the diving mode;
- Emergency procedures.

6.3 Termination of the dive

The dive shall be terminated when the divers go on reserve or have 500 psi remaining in their scuba bottles as read on the divers cylinder gauge.
If a situation arises to change the safe working conditions of the dive, either under the water or on the support craft, the dive should be aborted until the problem can be corrected.

6.4 Minimum SCUBA Equipment

Each diver shall be equipped with the following equipment:

- DOT approved and certified compressed gas cylinder
- Sharp knife
- Diving wristwatch
- Depth gage

- Weight belt, independent of the cylinder harness
- Cylinder harness with quick release
- Personnel floatation device
- Set of the U.S. Navy No-decompression tables, Repetitive dive tables, and air decompression and treatment tables

6.5 Buddy Diver Responsibilities.

The greatest single safety practice in scuba operations is the use of the buddy system. Dive partners operating in pairs are responsible for both the assigned task and each other's safety. The basic rules for buddy diving are:

- Always maintain contact with the dive partner. In good visibility, keep the partner in sight. In poor visibility, use a buddy line.
- Know the meaning of all hand and line-pull signals.
- If a signal is given, it must be acknowledged immediately. Failure of a dive partner to respond to a signal must be considered an emergency.
- Monitor the actions and apparent condition of the dive partner. Know the symptoms of diving ailments. If at any time the dive partner appears to be in distress or is acting in an abnormal manner, determine the cause immediately and take appropriate action.
- Never leave a partner unless the partner has become trapped or entangled and cannot be freed without additional assistance. If surface assistance must be sought, mark the location of the distressed diver with a line and float or other locating device. Do not leave a partner if voice communications or line-pull signals are being used; contact the surface and await assistance or instructions.
- Establish a lost-diver plan for any dive. If partner contact is broken, follow the plan.

6.6 Working with Tools

The near-neutral buoyancy of a scuba diver poses certain problems when working with tools. A diver is at a disadvantage when applying leverage with tools. When applying force to a wrench, for example, the diver is pushed away and can apply very little torque. If both sides of the work are accessible, two wrenches—one on the nut and one on the bolt should be used. By pulling on one wrench and pushing on the other, the counter- force permits most of the effort to be transmitted to the work. When using any tool that requires leverage or force (including pneumatic power tools), the diver should be braced with feet, a free hand, or a shoulder.

NOTE: When using externally powered tools with scuba, the diver must have voice communications with the Diving Supervisor.

Any tools to be used should be organized in advance. The diver should carry as few items as possible. If many tools are required, a canvas tool bag should be used to lower them to the diver as needed.

6.7 Ascent Procedures

When it is time to return to the surface, either diver may signal the end of the dive. When the signal has been acknowledged, the divers shall ascend to the surface together at a rate not to exceed 30 feet per minute. For a normal ascent, the divers will breathe steadily and naturally. Divers must never hold their breath during ascent, because of the danger of an air embolism. While ascending, divers must keep an arm extended overhead to watch for obstructions and should spiral slowly while rising to obtain a full 360-degree scan of the water column.

6.7.1 Emergency Free-Ascent Procedures

If a diver is suddenly without air or if the scuba is entangled and the dive partner cannot be reached quickly, a free ascent must be made. Guidelines for a free ascent are:

- Drop any tools or objects being carried by hand.
- Abandon the weight belt.
- If the scuba has become entangled and must be abandoned, actuate the quick-release buckles on the waist, chest, shoulder, and crotch straps. Slip an arm out of one shoulder strap and roll the scuba off the other arm. An alternate method is to flip the scuba over the head and pull out from underneath. Ensure that the hoses do not wrap around or otherwise constrict the neck. The neck straps packed with some single-hose units can complicate the overhead procedure and should be disconnected from the unit and not used.
- If the reason for the emergency ascent is a loss of air, drop all tools and the weight belt and actuate the life preserver to surface immediately. Do not drop the scuba unless it is absolutely necessary.
- If a diver is incapacitated or unconscious and the dive partner anticipates ifficulty in trying to swim the injured diver to the surface, the partner should activate the life preserver or inflate the buoyancy compensator. The weight belt may have to be released also. However, the partner should not lose direct contact with the diver. Exhale continuously during ascent to let the expanding air in the lungs escape freely.

7. Live-boating

7.1 Limits

- Diving operations involving live boating shall not be conducted: With an in water decompression time of greater than 120 minutes;
- Using surface-supplied air at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;
- Using mixed gas at depths greater than 220 fsw;
- Live-boating is not allowed in seas which significantly impede the vessels station keeping capabilities, in periods of restricted visibility, or in other than daylight hours.

7.2 Minimum Personnel

Air Diving (0 to 60 fsw)
1 - Diving supervisor
2 Divers
2 Tenders

When crew size is eight or more at least one member will be a non-diving supervisor.
Air diving (60 to 220)
1 – non-Diving Supervisor
Divers
2 – Tenders

7.3 Vessel

The vessel shall be acceptable to the company and the diving supervisor.
A "Kill Switch" to shut the engines shall be in the vicinity of the operator of the boat.

7.4 Dynamically Positioned Diving Support Vessels

- No single fault should cause a catastrophic failure and move the vessel from its intended position.
- The operating requirements of the system shall never be allowed to exceed the vessels capabilities in any respect.
- Personnel shall be fully capable of performing the task entrusted to them.
- Minimum Equipment
- A third diving hose connected the manifold shall be available for emergency use.
- Regardless of depth, the diver will wear a bailout bottle.
- When in water decompression is required a free-floating decompression buoy or equivalent will be used.
- A device shall be used which minimizes the possibility of entanglement of the diver's hose in the propeller of the vessel.

7.4.1 Procedures

- The supervisor must be experienced in live-boating
- The vessel Captain should be experienced in live-boating to the satisfaction of the supervisor.
- The propeller of the vessel shall be stopped before the diver enters or exits the water.
- Two-way voice communication between the designated person-in-charge and the person controlling the vessel shall be available while the diver is in the water.
- A standby diver shall be available while a diver is in the water.
- A diver-carried reserve breathing gas supply shall be carried by each diver engaged in live-boating operations.
- The divers umbilical will always be in view of the tender and diving supervisor

8. Recompression Treatment

This section is a very basic overview of recompression procedures outlined in the US NAVY Dive Manual revision 7 It is the responsibility of International Telecom divers to read and understand the procedures outlined in the US NAVY Dive Manual revision 7 Volume 2

8.1 OMITTED DECOMPRESSION

Certain emergencies, such as uncontrolled ascents, an exhausted air supply, or bodily injury, may interrupt or prevent required decompression. If the diver shows symptoms of decompression sickness or arterial gas embolism, immediate treatment using the appropriate oxygen or air recompression treatment table is essential. Even if the diver shows no symptoms, omitted decompression must be addressed in some manner to avert later difficulty.

8.1.1 Ascent from 20 Feet or Shallower (Shallow Surfacing) with Decompression Stops Required

If the diver surfaced from 20 feet or shallower feels well, and can be returned to stop depth within 1 minute, the diver may complete normal decompression stops. The decompression stop from which ascent occurred is lengthened by 1 minute. If the diver cannot be returned to the depth of the stop within 1 minute and the diver remains asymptomatic, return the diver to the stop from which the diver ascended. Multiply each decompression stop time missed by 1.5. Alternatively, if the surface interval is less than 5 minutes, the diver may be placed in a recompression chamber and treated on a Treatment Table 5 (or 1A if no oxygen is available). If the surface interval is greater than 5 minutes, the diver may be placed in a recompression chamber and treated on Treatment Table 6 (or 2A if no oxygen is available). The diver should be observed for 1 hour after surfacing and/or completing treatment.

8.1.2 Ascent from 20 Feet or Shallower with No Decompression Stops Required

No recompression is required if the diver surfaces from 20 feet or shallower but was within no-decompression limits. The diver should be observed on the surface for 1 hour.

8.1.2Ascent from Deeper than 20 Feet (Uncontrolled Ascent)

Any unexpected surfacing of the diver from depths in excess of 20 feet is considered an uncontrolled ascent. If the diver is within no-decompression limits and asymptomatic, he should be observed for at least 1 hour on the surface. Recompression is not necessary unless symptoms develop.

8.1.4 Asymptomatic Uncontrolled Ascent

Asymptomatic divers who experience an uncontrolled ascent and who have missed decompression stops are treated by recompression based on the amount of decompression missed as follows:

- Oxygen Available. Immediately compress the diver to 60 feet in the recompression chamber. If less than 30 minutes of decompression (total ascent time from the tables) were missed, decompress from 60 feet on Treatment Table 5. If more than

30 minutes of decompression were missed, decompress from 60 feet on Treatment Table 6.

- Oxygen Not Available. Compress the diver to 100 feet in the recompression chamber and treat on Table 1A if less than 30 minutes of decompression were missed; compress to 165 feet and treat on Table 2A if more than 30 minutes were missed.

8.1.4 Development of Symptoms

As long as the diver shows no ill effects, decompress in accordance with the treatment table. Consider any decompression sickness that develops during or after this procedure to be a recurrence. Try to keep all surface intervals as short as possible (5 minutes or less). If an asymptomatic diver who has an uncontrolled ascent from a decompression dive has more than a 5-minute surface interval, recompress to 60 feet on Treatment Table 6 or treat on Table 2A, even if the missed decompression time was less than 30 minutes.

8.1.5 In-Water Procedure

When no recompression facility is available, use the following in-water procedure to make up omitted decompression in asymptomatic divers for ascents from depths below 20 feet. Recompress the diver in the water as soon as possible (preferably less than a 5- minute surface interval). Keep the diver at rest, provide a standby diver, and maintain good communication and depth control. Use the decompression schedule appropriate for the divers depth and bottom time. Follow the procedure below with 1 minute between stops:

- Return the diver to the depth of the first stop.
- Follow the schedule for stops 40-fsw and deeper.
- Multiply the 30-, 20-, and 10-fsw stops by 1.5.

8.1.6 Symptomatic Uncontrolled Ascent

If a diver has had an uncontrolled ascent and has any symptoms, he should be compressed immediately in a recompression chamber to 60 fsw. Conduct a rapid assessment of the patient, and treat accordingly. Treatment Table 5 is not an appropriate treatment for symptomatic uncontrolled ascent. If the diver surfaced from 60 fsw or shallower, compress to 60 fsw and begin Treatment Table 6. If the diver surfaced from a greater depth, compress to 60 fsw or depth where the symptoms are significantly improved, not to exceed 165 fsw, and begin Treatment Table 6A. Symptoms developing during the surface interval or during a period of observation on no-decompression dives are treated as Type II DCS. Consultation with a Diving Medical Doctor should be made as soon as possible. For uncontrolled ascent deeper than 165 feet, the diving supervisor may elect to use Treatment Table 8 at the depth of relief, not to exceed 225 fsw. Treatment of symptomatic divers who have surfaced unexpectedly is difficult when no recompression chamber is on site. Immediate transportation to a recompression facility is indicated if this is impossible.

8.1.7 Transporting the Patient

In certain instances, some delay may be unavoidable while the patient is transported to a recompression chamber. While moving the patient to a recompression chamber, the patient should be kept lying horizontally. Do not put the patient head-down. Additionally, the patient should be kept warm and monitored constantly for signs of blocked airway, cessation of breathing, cardiac arrest, or shock. Always keep in mind that a number of conditions may exist at the same time. For example, the victim may be suffering from both

decompression sickness and severe internal injuries.

8.1.8 Medical Treatment During Transport

Always have the patient breathe 100 percent oxygen during transport, if available. If symptoms of decompression sick-ness or arterial gas embolism are relieved or improve after breathing 100 percent oxygen, the patient should still be treated as if the original symptom(s) were still present. Always ensure the patient is adequately hydrated. Give fluids by mouth if the patient is able to take them. Otherwise, intravenous fluids should be started before transport. If the patient must be transported, initial arrangements should have been made well in advance of the actual diving operations. These arrangements, which would include an alert notification to the recompression chamber and determination of the most effective means of transportation, should be posted on the Job Site Emergency Assistant Checklist for instant referral.

8.1.9 Transport by Unpressurized Aircraft

If the patient is moved by helicopter or other unpressurized aircraft, the aircraft should be flown as low as safely possible, preferably less than 1,000 feet. Any unnecessary altitude means an additional reduction in external pressure and possible additional symptom severity or complications. If available, always use aircraft that can be pressurized to one atmosphere.

8.1.10 Communications with Chamber

Call ahead to ensure that the chamber will be ready and that qualified medical personnel will be standing by. If two-way communications can be established, consult with the doctor as the patient is being

8.2 Treatment Tables

Oxygen Treatment Tables are more effective and, therefore, preferable over Air Treatment Tables. Treatment Table 4 can be used with or without oxygen but should always be used with oxygen if it is available.

8.2.1 Treatment of Symptoms During Sur-D Surface Interval

If surface decompression procedures are used, symptoms of decompression sickness may occur during the surface interval. Because neurological symptoms cannot be ruled out during this short period, the symptomatic diver is treated as having Type II symptoms, even if the only complaint is pain.

8.2.2 Treating for Exceeded Sur-D Surface Interval

If the prescribed surface interval is exceeded but the diver remains asymptomatic, the diver is treated with Treatment Table 5, or Treatment Table 1A if no oxygen is available. If the diver becomes symptomatic, the diver is treated as if Type II symptoms were present. Any symptoms occurring during the chamber stops of Surface Decompression Tables are treated as recurrences.

8.2.3 Recompression Treatments When Oxygen Is Not Available

If no oxygen is available, select the appropriate Air Treatment Table in accordance with Use Table 1A if pain is relieved at a depth less than 66 feet. If pain is relieved at a depth greater than 66 feet, use Table 2A. Table 3 is used for treatment of serious symptoms where oxygen cannot be used. Use Table 3 if symptoms are relieved within 30 minutes at 165 feet. If symptoms are not relieved in less than 30 minutes at 165 feet, use Table 4.

8.2.3 Descent/Ascent Rates for Air Treatment Tables

The Air Treatment Tables (1A, 2A, 3, and 4 using air) are used when no oxygen is available. They are not as effective as the Oxygen Treatment Tables. The descent rate is 20 feet per minute the ascent rate is not to exceed 1 foot per minute.

8.2.4 Recompression Treatments When Oxygen Is Available

Use Oxygen Treatment Tables 5, 6, 6A, 4, or 7, the descent rate is 20 feet per minute. Upon reaching treatment depth not to exceed 60 fsw, place the patient on oxygen. For depth deeper than 60 fsw, use treatment gas if available. Additional guidelines for each treatment table are given below.

8.2.5 Treatment Table 5

Treatment Table 5 may be used for the following:
Type I (except for cutis-marmorata) symptoms when a complete neurological examination has revealed no abnormality.

- Asymptomatic omitted decompression of shallow surfacing (20 fsw or less) Asymptomatic omitted decompression of rapid ascent (from deeper than 20 fsw) if the missed decompression is less than 30 minutes

Asymptomatic divers who have exceeded surface interval limits following a Sur-D dive
Treatment of resolved symptoms following in-water recompression

- Follow-up treatments for residual symptoms
- Carbon monoxide poisoning

8.2.6 Performance of Neurological Exam at 60 fsw

After arrival at 60 fsw a neurological exam shall be performed to ensure that no overt neurological symptoms (e.g., weakness, numbness, incoordination) are present. If any abnormalities are found, the stricken diver should be treated using Treatment Table 6.

8.2.7 Extending Oxygen Breathing Periods on Treatment Table 5

Treatment Table 5 may be extended by two oxygen-breathing periods at 30 fsw. Air breaks are not required prior to an extension, between extensions, or prior to surfacing. In other words, the Diving Supervisor may have the patient breathe oxygen continuously for 60 minutes at 30 fsw and travel to the surface while breathing oxygen. If the Diving Supervisor elects to extend this treatment table, the tender does not require additional oxygen breathing than currently prescribed.

8.2.7 When Use of Treatment Table 6 is Mandatory

Treatment Table 6 is mandatory if:

- Type I pain is severe and immediate recompression must be instituted

before a neurological examination can be performed, or

- A complete neurological examination cannot be performed, or Any neurological symptom is present.
- These rules apply no matter how rapidly or completely the symptoms resolve once recompression begins.

8.2.8 Complete Relief after 10 Minutes

If complete relief of Type I symptoms is not obtained within 10 minutes at 60 feet, Table 6 is required.

8.2.9 Musculoskeletal Pain Due to Orthopedic Injury

Symptoms of musculoskeletal pain that have shown absolutely no change after the second oxygen breathing period at 60 feet may be due to orthopedic injury rather than decompression sick-ness. If, after reviewing the patient's history, the Diving Medical Officer feels that the pain can be related to specific orthopedic trauma or injury, Treatment Table 5 may be completed. If no Diving Medical Doctor is on site,TreatmentTable6 shall be used.

NOTE: Once recompression to 60 feet is done, Treatment Table 5 shall be used even if it was decided symptoms were probably not decompression sickness. Direct ascent to the surface is done only in emergencies.

8.3 Treatment Table 6

Treatment Table 6 is used for the following:

- Type I symptoms where relief is not complete within 10 minutes at 60 feet or where a neurological exam is not complete
- Type II symptoms Cutis marmorata
- Severe carbon monoxide poisoning, cyanide poisoning, or smoke inhalation
- Arterial gas embolism
- Symptomatic uncontrolled ascent
- Asymptomatic divers with omitted decompression greater than 30 minutes Treatment of unresolved symptoms following in-water treatment Recurrence of symptoms shallower than 60 fsw

8.3.1 Treating Arterial Gas Embolism

Arterial gas embolism is treated by initial compression to 60 fsw. If symptoms are improved within the first oxygen-breathing period, then treatment is continued using Treatment Table 6. Treatment Table 6 may be extended for two oxygen-breathing periods at 60 fsw (20 minutes on oxygen, then 5 minutes on air, then 20 minutes on oxygen) and two oxygen breathing periods at 30 fsw (15 minutes on air, then 60 minutes on oxygen, then 15 minutes on air, then 60 minutes on oxygen). If there has been more than one extension, the tenders' breathing period is extended 60 minutes at 30 feet.

8.4 Treatment Table 6A

Arterial gas embolism or severe decompression symptoms are treated by initial compression to 60 fsw. If symptoms improve, complete Treatment Table 6. If symptoms are unchanged or worsen, assess the patient upon descent and compress to depth of relief

(significant improvement), not to exceed 165 fsw. Once at the depth of relief, begin treatment gas (N 2 O 2 ,HeO 2) IAW Table 21-5 if available. Stay there for 30 minutes. A breathing period of 25 minutes on treatment gas, interrupted by 5 minutes of air, is recommended at depth to simplify time keeping. The patient may remain on treatment gas during ascent from treatment depth to 60 fsw since the PO 2 will continually decrease during ascent. Decompress to 60 fsw at a travel rate not to exceed 3 ft./min. Upon arrival at 60
fsw, complete Treatment Table 6. Consult with a Diving Medical Officer at the earliest opportunity. The Diving Medical Officer may recommend a Treatment Table 4. Treatment Table 6A may be extended for two oxygen breathing periods at 60 fsw and two oxygen breathing periods at 30 fsw. If deterioration is noted during ascent to 60 feet, treat as a recurrence of symptoms.

8.5 Treatment Table 4

If a shift from Treatment Table 6A to Treatment Table 4 is contemplated, a Diving Medical Doctor shall be consulted before the shift is made. Treatment Table 4 is used when it is determined that the patient would receive additional benefit at depth of significant relief, not to exceed 165 fsw. The time at depth shall be between 30 to 120 minutes, based on the patient's response.

8.6 Treatment Table 7

Treatment Table 7 is considered a heroic measure for treating non-responding severe gas embolism or life-threatening decompression sickness. Committing a patient to a Treatment Table 7 involves isolating the patient and having to minister to his medical needs in the recompression chamber for 48 hours or longer. Experienced diving medical personnel shall be on scene.

8.7 Treatment Table 8

Treatment Table 8 is an adaptation of a Royal Navy Treatment Table 65 mainly for treating deep uncontrolled ascents (see Volume 3) when more than 60 minutes of decompression have been missed. Compress symptomatic patient to depth of relief not to exceed 225 fsw. Initiate Treatment Table 8 from depth of relief. The Table 8 schedule from 60 feet is the same as Treatment Table 7.

9.0 Record Keeping Requirements:

The employer shall record the occurrence of any diving-related injury or illness, which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

9.1 Availability of Records

Upon the request of the Assistant Secretary of Labor for Occupational Safety and Health, or the Director, National Institute for Occupational Safety and Health, Department of Health and Human Services of their designees, the employer shall make available for inspection and copying any record or document required by this standard.

Records and documents required by this standard shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.20 (a)-(e) and (g)-

- Safe practices manuals (1910.420), depth-time profiles (1910.422), recordings of dives (1910.423), decompression procedure assessment evaluations (1910.423), and records of hospitalizations (1910.440) shall be provided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (1910.430) shall also be provided upon request to employees and their designated representatives.
- Records and documents required by this standard shall be retained by the employer for the following period:
- Dive team member medical records (physician's reports) (1910.411) - 5 years;
- Safe practices manual (1910.420) - current document only;
- Depth-time profile (1910.422) - until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;
- Recording of dive (1910.423) - 1 year, except 5 years where there has been an incident of decompression sickness;
- Decompression procedure assessment evaluations (1910.423) - 5 years;
- Equipment inspections and testing records (1910.430) - current entry or tag, or until equipment is withdrawn from service;
- Records of hospitalizations (1910.440) - 5 years.
- After the expiration of the retention period of any record required to be kept for five (5) years, the employer shall forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services. The employer shall also comply with any additional requirements set forth at 29 CFR 1910.20(h).

10. Definitions

"Acfm": Actual cubic feet per minute.
"ASME Code or equivalent": ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.
"ATA": Atmosphere absolute.
"Bell": An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.
"Bottom time": The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent.
"Bursting pressure": The pressure at which a pressure containment device would fail structurally.
"Cylinder": A pressure vessel for the storage of gases.
"Decompression chamber": A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.
"Decompression sickness": A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.

"Decompression table": A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.
"Dive location": A surface or vessel from which a diving operation is conducted.
"Dive-location reserve breathing gas": A supply system of air or mixed-gas (as appropriate) at the dive location, which is independent of the primary supply system and sufficient to support divers during the planned decompression.
"**Dive team":** Divers and support employees involved in a diving operation, including the designated person-in-charge.
"Diver": An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.
"Diver-carried reserve breathing gas": A diver-carried supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by a standby diver.
"Diving mode": A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed gas).
"Fsw": Feet of seawater (or equivalent static pressure head).
"Heavy gear": Diver-worn deep-sea dress including helmet, breastplate, dry suit, and weighted shoes.
"Hyperbaric conditions": Pressure conditions in excess of surface pressure.
"In-water stage": A suspended underwater platform which supports a diver in the water. **"Live-boating":** The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.
"Mixed-gas diving": A diving mode in which the diver is supplied in the water with a breathing gas other than air.

"No-decompression limits": The depth-time limits of the "no-decompression limits and repetitive dive group designation table for no-decompression air dives", U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.
"Psi(g)": Pounds per square inch (gauge).
"Scientific diving" means diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.
"SCUBA diving": A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.
"Standby diver": A diver at the dive location available to assist a diver in the water.
"Surface-supplied air diving": A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.
"Treatment table": A depth-time and breathing gas profile designed to treat decompression sickness.
"Umbilical": The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.
"Volume tank": A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

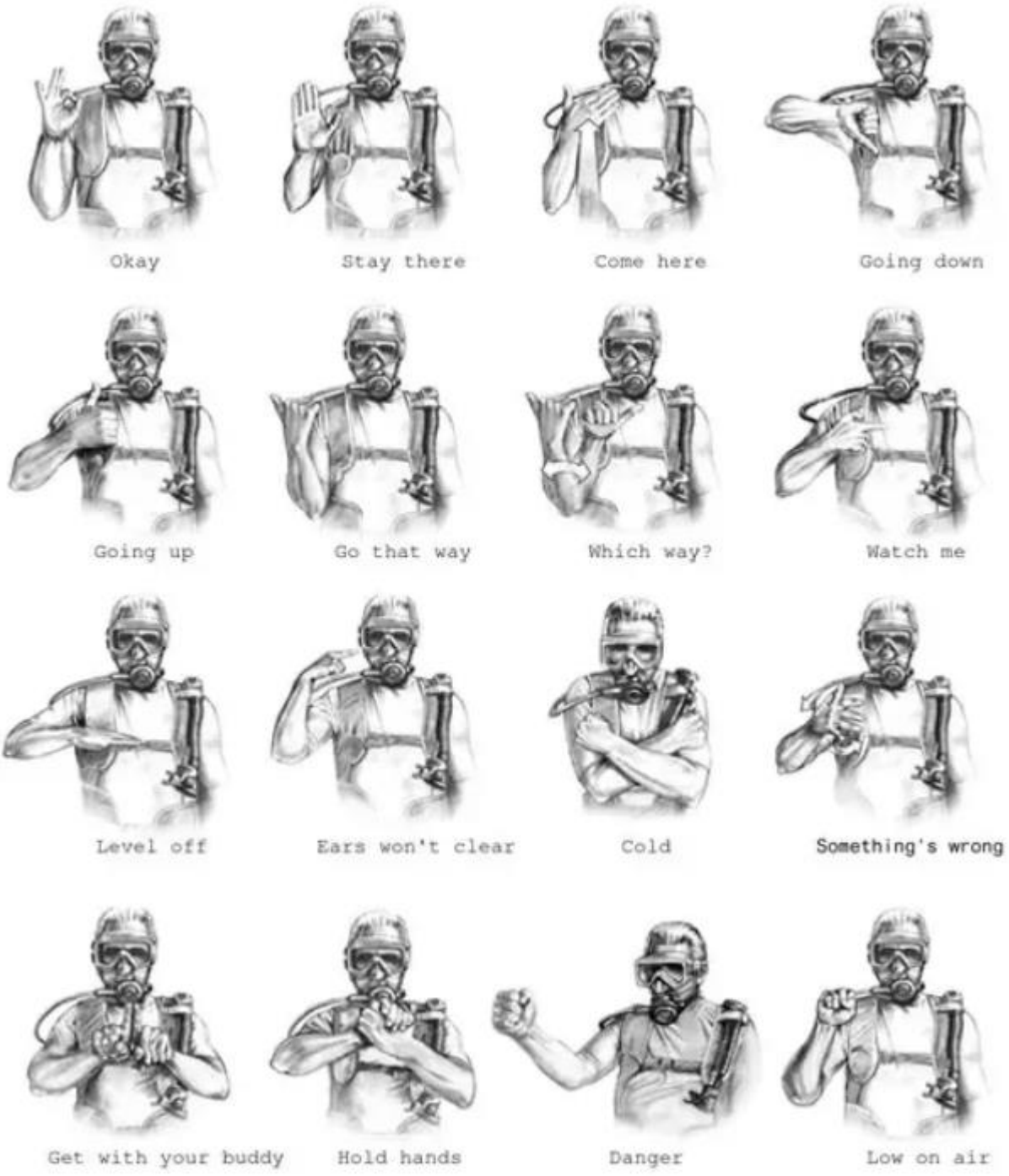
"Working pressure": The maximum pressure to which a pressure containment device may be exposed under standard operating conditions

SURFACE-SUPPLIED PREDIVE CHECKLIST

1. Verify	**Diving Supervisor**	
	Verify that a recompression chamber is available. For all decompression dives and dives deeper than 100 fsw a chamber is required on site. Check First Aid / Stretcher / O2	
	Verify that proper signals indicating underwater operations being conducted are displayed correctly.	
	Ensure that all personnel concerned, or in the vicinity, are informed of diving operations	
	Determine that all valves, switches, controls, and equipment components affecting diving operation are tagged-out to prevent accidental shut-down or activation.	
	Verify that the diver and standby diver are healthy and capable of performing the diving task.	
	Verify that the diving system is aligned properly and determine that sufficient fuel, coolant, lubricants, and antifreeze are available to service all components throughout the operation	
2. Activate the Air Supply	**Tender Perform the following**	
	Secondary Air – Open Air Cylinders verify proper pressure	
	Activate and ensure air through divers umbilical	
	Secure secondary air at divers console	
	Primary Air - Start the compressor check all petcocks, filler valves, filler caps, overflow points, bleed valves, and drain plugs for leakage or malfunction of any kind	
	Check that compressor intake is obtaining a free and pure suction without contamination	
3. Attach the Umbilical	**Tender Perform the following**	
	Blow down the umbilical. Ensure hoses are free of moisture, packing material, or chalk and attach it to the Non-Return Valve.	
4. Hat the Diver	**Tender / Diver Perform the following**	
	Ensure air is on to the hat. Don the hat connect the neckdam	
	Connect EGS to the hat. Ensure EGS cylinder valve is open. Verify EGS valve on hat is in the closed position	
5. Check Communications	**Diver Preform the following**	
	Check Com's	
6. Tender Check the Entire Rig	**Tender Perform the following**	
	a. Soap and leak check the Helmet gas fittings and connections including the EGS	
	b. Check Neck Yoke is properly attached to the helmet and all locking pins engaged	
	c. Check Safety Harness is properly adjusted and in good condition	
	d. Check Umbilical Strain Release	
	e. Check EGS Hose Quick Disconnect	
	f. Check Boots, gloves, knife, tools and other accessories	
	g. Check the hot water supply and connections	
	h. Check the dry suit Inflation Hose Connection. Ensure the dry suit Inflation Valve and Exhaust Valve function properly	

Dive Tender Signature:_____ Date:_____

ADDENDUM # 2


Okay
Stay there
Come here
Going down
Going up
Go that way
Which way?
Watch me
Level off
Ears won't clear
Cold
Something's wrong
Get with your buddy
Hold hands
Danger
Low on air

Caldwell
Marine International

DIVE EQUIPTMENT INSPECTION INTERVALS

Primary Equipment

Dive Spread #:

Description:	ID #	Inspection Frequency:	Responsible Party:	Inspection Performed By:	Inspection Date:
Master Cal. Gauge		6 Mo.	CMI		/ /
Pneumo Fathometer		6 Mo.	CMI		/ /
Volume Tank		5 Yr.	CMI		/ /
Volume Tank Gauge		6 Mo.	CMI		/ /
Dive Hoses			CMI		/ /
Dive Compressor (Air)		6 Mo.	CMI		/ /
Deck Whips		6 Mo.	CMI		/ /
Dive Compressor (Gauge)		6 Mo.	CMI		/ /
Diver Helmet		1 Yr.	Diver		/ /
Diver Bail-Out Bottle (Visual)		1 Yr.	Diver		/ /
Diver Bail-Out Bottle (Hydro)		5 Yr.	Diver		/ /
First Aid Kit					/ /
					/ /
					/ /
					/ /

Back-Up Equipment

Description:	ID #:	Inspection Frequency:	Responsible Party:	Inspection Performed By:	Inspection Date:
Dive Compressor (Air)		6 Mo.	CMI		/ /
Dive Compressor (Gauge)		6 mo.	CMI		/ /
					/ /
					/ /

It this Equipment in Safety Operation Condition? ☐ YES ☐ NO

Provide Detail(s) of any Item(s) of Concern:

Dive Supervisor Review: _____ Date: / /

CaldwellMarine INTERNATIONAL NORTHERN RESCO HUXTED TRENCHLESS

Caldwell
Marine International

Certificate of Calibration Verification

Reference Gauge			
Date:		Test Gauge Description:	
Accuracy Grade:		Calibrating Date:	

Tested Gauge					
Gauge Number:			Gauge Due Date:		
Model:			Accuracy Grade:		
Temperature:	°F	Test Units:	FSW ☐	PSI ☐	
Permissible Error % of span:	±1% ☐		(± 2%-±1%-2% ±) ☐	(± 3%-±2%-3% ±) ☐	

1st Cycle		
Reference Gauge Up-scale	Test Gauge Reading	In Range
Reference Gauge Down-Scale	Test Gauge Reading	In Range
2nd Cycle		
Reference Gauge Up-Scale	Test Gauge Reading	In Range
Reference Gauge Down-Scale	Test Gauge Reading	In Range

Dive Supervisor Review: _____ **Date:** ___/___/___

CaldwellMarine INTERNATIONAL NORTHEAST REMECO HUXTED TRENCHLESS

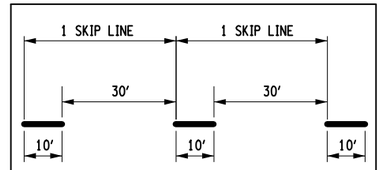
Appendix R– Maintenance and Protection of Traffic (MPT)

TABLE 011-01: PROTECTIVE VEHICLE REQUIREMENTS

CLOSURE TYPE	DURATION	MOBILE (WORK THAT MOVES INTERMITTENTLY OR CONTINUOUSLY, WHERE THE WORK AT ANY SPECIFIC LOCATION COMPLETES WITHIN 15 MINUTES) INCLUDES "STOP AND GO OPERATIONS OF 5 MINUTES OR LESS				SHORT DURATION (WORK THAT OCCUPIES A LOCATION FOR UP TO 1 HOUR)				SHORT TERM (DAYTIME WORK THAT OCCUPIES A LOCATION FOR MORE THAN 1 HOUR WITHIN A SINGLE DAYLIGHT PERIOD)				INTERMEDIATE TERM (WORK THAT OCCUPIES A LOCATION MORE THAN ONE DAYLIGHT PERIOD UP TO 3 CONSECUTIVE DAYS OR NIGHT TIME WORK LASTING MORE THAN 1 HOUR)				LONG TERM (WORK THAT OCCUPIES A LOCATION FOR MORE THAN 3 CONSECUTIVE DAYS)			
	ROAD TYPE & SPEED	FREEWAY	NON-FREEWAY			FREEWAY	NON-FREEWAY			FREEWAY	NON-FREEWAY			FREEWAY	NON-FREEWAY			FREEWAY	NON-FREEWAY		
			≥ 45 MPH	35 - 40 MPH	≤ 30 MPH		≥ 45 MPH	35 - 40 MPH	≤ 30 MPH		≥ 45 MPH	35 - 40 MPH	≤ 30 MPH		≥ 45 MPH	35 - 40 MPH	≤ 30 MPH		≥ 45 MPH	35 - 40 MPH	≤ 30 MPH
	EXPOSURE CONDITIONS[1]																				
LANE CLOSURE OR ENCROACHMENT	WORKERS ON FOOT OR VEHICLE EXPOSED TO TRAFFIC	P, TMIA	P, TMIA	P, TMIA	P	P, TMIA	P, TMIA	P, TMIA	P	P, TMIA	P, TMIA	P, TMIA	P	P, TMIA	P, TMIA	P, TMIA	SEE NOTE 2	P, TMIA	P, TMIA	P, TMIA	SEE NOTE 2
	OTHER HAZARDS NO WORKERS EXPOSED	NA	NA	NA	NA	P, TMIA	P, TMIA	P	P	P, TMIA	P, TMIA	P	SEE NOTE 2	P, TMIA	P, TMIA	SEE NOTE 2	SEE NOTE 2	P, TMIA	P, TMIA	SEE NOTE 2	SEE NOTE 2
SHOULDER CLOSURE OR ENCROACHMENT	WORKERS ON FOOT OR VEHICLE EXPOSED TO TRAFFIC	P, TMIA	P, TMIA	P	P	P, TMIA	P, TMIA	P	P	P, TMIA	P, TMIA	P	P	P, TMIA	P, TMIA	SEE NOTE 2	SEE NOTE 2	P, TMIA	P, TMIA	SEE NOTE 2	SEE NOTE 2
	OTHER HAZARDS NO WORKERS EXPOSED	NA	NA	NA	NA	P, TMIA	P, TMIA	P	P	P, TMIA	P, TMIA	P	SEE NOTE 2	P, TMIA	SEE NOTE 2	SEE NOTE 2	SEE NOTE 2	P, TMIA	SEE NOTE 2	SEE NOTE 2	SEE NOTE 2

LEGEND
P: PROTECTIVE VEHICLE REQUIRED FOR EACH CLOSED LANE & EACH CLOSED PAVED SHOULDER 8' OR WIDER, IF THE WORK SPACE MOVES WITHIN THE STATIONARY CLOSURE, THE PROTECTIVE VEHICLE SHALL BE REPOSITIONED ACCORDINGLY
TMIA: TRUCK/TRAILER MOUNTED IMPACT ATTENUATOR (TMIA) REQUIRED
NA: NOT APPLICABLE

NOTES
1. THE EXPOSURE CONDITIONS ASSUMES THERE IS NO POSITIVE PROTECTION PRESENT
2. EITHER A PROTECTIVE VEHICLE OR THE STANDARD BUFFER SPACE SHALL BE PROVIDED



DETAIL 011A - SKIP LINES

TABLE 011-02: TAPER LENGTHS & NUMBER OF CONES CHART

PRECONSTRUCTION POSTED SPEED LIMIT (MPH)	TAPER LENGTH: L (FT.)/ * OF SKIP LINES/ * OF CHANNELIZING DEVICES									SHOULDER TAPER LENGTH: L/3 (FT.)/ * OF SKIP LINES/ * OF CHANNELIZING DEVICES		
	LATERAL SHIFT OF TRAFFIC FLOW PATH (FT.)									FOR SHOULDER WIDTH		
	4	5	6	7	8	9	10	11	12	≤ 4 FT.	5 - 7 FT.	≥8 FT.
25	40/1/2	80/2/3	80/2/3	80/2/3	80/2/3	120/3/4	120/3/4	120/3/4	120/3/4	40/1/2	40/1/2	40/1/2
30	80/2/3	80/2/3	80/2/3	120/3/4	120/3/4	160/4/5	160/4/5	160/4/5	200/5/6	40/1/2	40/1/2	40/1/2
35	80/2/3	120/3/4	120/3/4	160/4/5	160/4/5	200/5/6	200/5/6	240/6/7	240/6/7	40/1/2	40/1/2	80/2/3
40	120/3/4	160/4/5	160/4/5	200/5/6	240/6/7	240/6/7	280/7/8	320/8/9	320/8/9	40/1/2	80/2/3	80/2/3
45	200/5/6	240/6/7	280/7/8	320/8/9	360/9/10	400/10/11	440/11/12	520/13/14	560/14/15	80/2/3	80/2/3	120/3/4
50	200/5/6	240/6/7	320/8/9	360/9/10	400/10/11	440/11/12	520/13/14	560/14/15	600/15/16	80/2/3	120/3/4	160/4/5
55	240/6/7	280/7/8	320/8/9	400/10/11	440/11/12	520/13/14	560/14/15	600/15/16	680/17/18	80/2/3	120/3/4	160/4/5
60	240/6/7	320/8/9	360/9/10	440/11/12	480/12/13	560/14/15	600/15/16	680/17/18	720/18/19	80/2/3	120/3/4	160/4/5
65	280/7/8	320/8/9	400/10/11	480/12/13	520/13/14	600/15/16	640/16/17	720/18/19	800/19/20	80/2/3	160/4/5	200/5/6

• THIS TABLE WAS CREATED WITH REFERENCE TO MUTCD TABLE 6H-4.
•• THE NUMBER OF CHANNELIZING DEVICES SHOWN IS CALCULATED BASED ON A 40FT DEVICE SPACING. THE NUMBER OF CHANNELIZING DEVICES CAN BE ADJUSTED AS NECESSARY.

TABLE 011-03 LONGITUDINAL BUFFER SPACE

PRECONSTRUCTION POSTED SPEED LIMIT (MPH)	DISTANCE (FT.)/ * OF SKIP LINES
25	155 / 4
30	200 / 5
35	250 / 6
40	305 / 8
45	360 / 9
50	425 / 11
55	495 / 13
65	645 / 16

• THIS TABLE IS THE SAME AS MUTCD TABLE 6C-2.

TABLE 011-04: ROLL AHEAD DISTANCE FOR PROTECTIVE VEHICLES

PRECONSTRUCTION POSTED SPEED LIMIT (MPH)	ROLL AHEAD DISTANCE (FT.)/* OF SKIP LINES FOR VEHICLES			
	MOVING OPERATION (BASED ON PROTECTIVE VEHICLE SPEED OF 15 MPH)		STATIONARY OPERATION	
	MIN	MAX	MIN	MAX
≥ 55	200/5	280/7	120/3	200/5
45 - 50	160/4	240/6	80/2	160/4
≤ 40	120/3	200/5	40/1	120/3

• THIS TABLE WAS CREATED WITH REFERENCE TO MUTCD TABLES NY-2 AND NY2-B.

TABLE 011-05 FLARE RATES FOR POSITIVE BARRIER

TYPE OF POSITIVE BARRIER	POSTED SPEED LIMIT				
	30 MPH	40 MPH	50 MPH	55 MPH	65 MPH
TEMPORARY POSITIVE BARRIER	8:1	11:1	14:1	16:1	20:1
BOX BEAM OR HEAVY POST CORRUGATED BEAM	7:1	9:1	11:1	12:1	15:1

TABLE 011-06 ADVANCE WARNING SIGN SPACING

ROAD TYPE	DISTANCE BETWEEN SIGNS			SIGN LEGEND	
	A (FT.)	B (FT.)	C (FT.)	XX	YY
URBAN (≤ 30 MPH•)	100	100	100	AHEAD	AHEAD
URBAN (35-40 MPH•)	200	200	200	AHEAD	AHEAD
URBAN (≥ 45 MPH•)	350	350	350	1000 FT.	AHEAD
RURAL	500	500	500	1500 FT.	1000 FT.
FREEWAY	1000	1500	2640	1 MILE	½ MILE

• PRECONSTRUCTION POSTED SPEED LIMIT.
•• THIS TABLE IS THE SAME AS MUTCD TABLE NY6H-3.

TABLE 011-07 TAPER LENGTH FOR TEMPORARY TRAFFIC CONTROL ZONES

TYPE OF TAPER	TAPER LENGTH (L)
MERGING TAPER	L
SHIFTING TAPER	L/2
SHOULDER TAPER	L/3
ONE-LANE, TWO-WAY TRAFFIC TAPER	50 FT. MIN -100 FT. MAX
DOWNSTREAM TAPER	50 FT. MIN -100 FT. MAX

• THIS TABLE IS THE SAME AS MUTCD TABLE 6C-3.

WORK ZONE TRAFFIC CONTROL LEGEND

SYMBOL	DESCRIPTION
	ARROW PANEL
	ARROW PANEL, CAUTION MODE
	ARROW PANEL TRAILER OR SUPPORT
	CHANGEABLE MESSAGE SIGN (PVMS)
	CHANNELIZING DEVICE
	CONE
	CRASH CUSHION/TEMPORARY IMPACT ATTENUATOR
	DIRECTION OF TEMPORARY TRAFFIC DETOUR
	DIRECTION OF TRAFFIC
	AUTOMATED FLAGGER ASSISTAMCE DEVICE WITH OPERATOR
	FLAGGER
	FLAG TREE
	LUMINAIRE
	MOWER
	PARKWAY GRASS SHOULDER
	PAVEMENT MARKINGS THAT SHALL BE REMOVED FOR A LONG TERM PROJECT
PVMS	PORTABLE VARIABLE MESSAGE SIGN
	ADVANCE WARNING SIGN WITH ORANGE FLAGS
	TRAILER FOR ARROW PANEL OR PORTABLE VARIABLE MESSAGE SIGN (PVMS)

WORK ZONE TRAFFIC CONTROL LEGEND

SYMBOL	DESCRIPTION
	SIGN, TEMPORARY
	SPOTTER
	TEMPORARY POSITIVE BARRIER
	TEMPORARY POSITIVE BARRIER WITH WARNING LIGHTS
	TEMPORARY TRAFFIC SIGNAL HEAD
	TYPE III BARRICADE
	WARNING LIGHTS
	WORK AREA
	WORK VEHICLE
	WORK VEHICLE (MULCHING/HERBICIDE OPERATION)
	WORK VEHICLE (PAVEMENT MARKING)
	WORK VEHICLE (SIGNAL WORK)
	24,000LB PROTECTIVE VEHICLE WITH TRUCK/TRAILER MOUNTED ATTENUATOR (TMIA)
	24,000LB PROTECTIVE VEHICLE WITHOUT TRUCK/ TRAILER MOUNTED ATTENUATOR

NEW YORK STATE OF OPPORTUNITY. Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL GENERAL TABLES AND LEGEND

APPROVED DECEMBER 2, 2021
Robert Limoges
ROBERT LIMOGES, P.E.
DIRECTOR, OTSM

ISSUED UNDER EI 21-028
619-011

FILE NAME = 619-011.dgn
DATE/TIME = 23-DEC-2021 15:52
USER = woheron

GENERAL NOTES

1. THE TYPICAL DETAILS DEPICTED ON THE STANDARD SHEETS AND IN THE MUTCD, REFLECT THE MINIMUM REQUIREMENTS.

2. PROPOSED REVISIONS TO THE TRAFFIC CONTROL PLAN SHALL BE PROVIDED, IN WRITING, TO THE DOT ENGINEER FOR REVIEW AND APPROVAL BY THE REGIONAL DIRECTOR OR HIS/HER DESIGNEE FIVE (5) WORK DAYS PRIOR TO THE PLANNED IMPLEMENTATION OF SUCH PROPOSED REVISIONS, EXCEPT FOR CHANGES THAT ALTER THE SCOPE OF THE TRAFFIC CONTROL PLAN. SUCH CHANGES IN SCOPE MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL BY THE REGIONAL DIRECTOR OR HIS/HER DESIGNEE THIRTY (30) WORKING DAYS PRIOR TO IMPLEMENTATION OF SUCH REVISIONS.

3. THE NAMES, ADDRESSES, AND TELEPHONE NUMBERS OF STAFF WHO ARE AUTHORIZED TO SECURE LABOR, MATERIALS, AND EQUIPMENT FOR EMERGENCY REPAIRS OUTSIDE NORMAL WORKING HOURS SHALL BE PROVIDED, IN WRITING, TO THE DOT ENGINEER. THE ENGINEER WILL PROVIDE THE SUBMITTED INFORMATION TO REGIONAL MANAGEMENT, THE NEW YORK STATE POLICE, THE RESIDENT ENGINEER, AND THE LOCAL POLICE.

4. STANDARD SHEET 619-503 MAY BE USED FOR AN OFFSITE DETOUR SETUP FOR BOTH LONG TERM AND SHORT TERM WORK DURATIONS.

5. FOLLOW REGIONAL HIGH-VOLUME RESTRICTIONS. CONSULT WITH DOT ENGINEER IF EXCEPTION NEEDED.

6. PLAN AHEAD TO AVOID CONFLICTING WORK ZONES. CHECK FOR CONSTRUCTION PROJECTS, CLOSURES, & RESTRICTIONS AT WWW.511NY.ORG, WWW.DOT.NY.GOV/PROJECTS, AND WITH DOT ENGINEER.

7. DOCUMENT AND REPORT WORK ZONE INCIDENTS USING EITHER THE DEPARTMENT'S WORK ZONE INCIDENT FORM, OR THE CONSTRUCTION INCIDENT REPORTING SYSTEM, AS APPROPRIATE.

8. CONSIDER CLOSURE WIDTH & CLEAR WIDTH FOR WIDE VEHICLES ON WIDE LOAD ROUTES.

ACTIVITY AREA

1. A 500' MINIMUM LONGITUDINAL DISTANCE SHALL BE MAINTAINED BETWEEN CONSTRUCTION OPERATIONS ON ALTERNATE SIDES OF THE ROADWAY, UNLESS OTHERWISE APPROVED BY THE ENGINEER.

2. WHEN TWO OR MORE AREAS ARE ADJACENT, OVERLAP, OR ARE IN CLOSE PROXIMITY, THE CONTRACTOR SHALL ENSURE THERE ARE NO CONFLICTING SIGNS AND THAT LANE CONTINUITY IS MAINTAINED THROUGHOUT ALL WORK AREAS.

SIGNS

1. THE LOCATIONS OF THE SIGNS SHOWN ON THE WORK ZONE TRAFFIC CONTROL PLANS AND DETAILS MAY BE ADJUSTED BASED ON SIGHT DISTANCE AND OTHER CONSIDERATIONS. THE FINAL LOCATIONS OF SIGNS ARE SUBJECT TO APPROVAL OF THE ENGINEER.

2. FOR LONG TERM WORK DURATIONS, ANY EXISTING SIGNS, INCLUDING OVERHEAD SIGNS, WHICH CONFLICT WITH THE TEMPORARY TRAFFIC CONTROL SIGN LAYOUT SHALL BE COVERED, REMOVED, STORED OR RESET, AS APPROVED BY THE ENGINEER. ALL APPROPRIATE EXISTING SIGNS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION AND/OR LOCATION UNLESS OTHERWISE REPLACED IN THIS CONTRACT.

3. SIGNS AT OR NEAR INTERSECTIONS SHALL BE PLACED SO THAT THEY DO NOT OBSTRUCT A MOTORIST'S LINE OF SIGHT.

4. SIGNS MOUNTED ON THE MEDIAN OF DIVIDED HIGHWAYS WHERE MEDIAN BARRIER IS IN PLACE MAY BE MOUNTED ON THE BARRIER WITH A SADDLE TYPE BRACKET OR OMMITED WITH THE APPROVAL OF THE DOT ENGINEER. LAYING THE SIGN DOWN IN A HORIZONTAL POSITION IS NOT PERMITTED.

5. THE DIMENSIONS OF WORK ZONE TRAFFIC CONTROL SIGNS ARE DESCRIBED IN THE MUTCD. ANY CHANGES TO THE DIMENSIONS SHALL BE APPROVED BY THE REGIONAL DIRECTOR OR BY HIS/HER DESIGNEE.

6. NYR9-12 SHALL BE USED IN PLACE OF NYR9-11 WHEN A REDUCED REGULATORY SPEED LIMIT SIGN IS AUTHORIZED.

7. RIGID AND FLEXIBLE "ROLL-UP" SIGNS MAY BE USED FOR MOBILE, SHORT DURATION AND SHORT-TERM STATIONARY WORK. RIGID SIGNS MUST BE MOUNTED AT LEAST 5 FEET ABOVE GRADE (7 FEET WHERE THERE ARE PEDESTRIANS OR PARKED CARS). FLEXIBLE SIGNS SHALL BE MOUNTED AT LEAST ONE FOOT ABOVE GRADE. MESH SIGNS SHALL NOT BE USED. USE RETRO REFLECTORIZED RIGID SIGNS FOR NIGHTTIME WORK.

CHANNELIZING DEVICES

1. WHERE POSSIBLE ALL CHANNELIZING AND GUIDING DEVICES ARE TO BE PLACED SO AS TO PROVIDE A MINIMUM 2' LATERAL CLEARANCE TO THE TRAVELED WAY.

PUBLIC ACCESS

1. PROPERTY OWNERS WHOSE DRIVEWAYS WILL BE MADE INACCESSIBLE SHALL BE NOTIFIED AT LEAST 24 HOURS PRIOR TO RESTRICTING USE OF THE DRIVEWAY. FOR MULTIPLE ACCESS PROPERTIES, AT LEAST ONE DRIVEWAY SHALL BE OPEN AT ALL TIMES. ACCESS SHALL BE RESTORED TO ALL DRIVEWAYS AS SOON AS POSSIBLE.

2. SUITABLE RAMPS SHALL BE INSTALLED TO MAINTAIN SMOOTH TRANSITIONS FROM RESIDENTIAL AND COMMERCIAL DRIVEWAYS TO AND FROM THE WORK AREA.

LANE CLOSURES

1. LANE CLOSURES SHALL BE LOCATED TO PROVIDE OPTIMUM VISIBILITY, I.E. BEFORE CURVES AND CRESTS, TO THE EXTENT CONDITIONS PERMIT.

2. THE ENGINEER MAY REQUIRE THAT ALL LANES BE RE-OPENED AT ANY TIME IF THE ROUTE IS NEEDED FOR EMERGENCY PURPOSES. THIS COULD INCLUDE INCIDENTS AT LOCATIONS OUTSIDE THE CONTRACT LIMITS.

3. ARROW PANELS SHALL BE LEGIBLE CONTINUOUSLY FROM ANY POINT WITHIN THE ROADWAY (INCLUSIVE OF SHOULDERS) FROM 1,500 FEET IN ADVANCE OF THE LANE CLOSURE TAPER TO THE BEGINNING OF THE LANE CLOSURE TAPER.

LANE WIDTHS

1. UNLESS AUTHORIZED BY THE ENGINEER, THE MINIMUM LANE WIDTHS FOR WORK ZONE TRAVEL LANES SHALL BE AS FOLLOWS: FREEWAYS AND/OR EXPRESSWAYS IS 11'. THE MINIMUM LANE WIDTH FOR ALL OTHER TYPES OF ROADWAYS IS 10'.

2. A WRITTEN NOTE SHALL BE PROVIDED TO THE ENGINEER, A MINIMUM OF 21 CALENDAR DAYS IN ADVANCE OF PERFORMING ANY WORK THAT RESULTS IN THE REDUCED WIDTH OF AN EXISTING ROADWAY, SO THAT THE ENGINEER MAY NOTIFY THE REGIONAL PERMIT ENGINEER IN A TIMELY MANNER.

PROTECTIVE VEHICLES

1. A PROTECTIVE VEHICLE IS A LARGE DUMP TRUCK, A LARGE RACK TRUCK OR OTHER VEHICLE HAVING A GROSS WEIGHT OF AT LEAST 24,000 POUNDS. IF THE PROTECTIVE VEHICLE ENCROACHES INTO THE TRAVEL LANE, OR IF IT REMAINS ENTIRELY ON THE SHOULDER OF ANY HIGH SPEED ROAD (45 MPH OR HIGHER), IT SHALL BE EQUIPPED WITH A DEPLOYED TRUCK/TRAILER MOUNTED IMPACT ATTENUATOR (TMIA, SEE TABLE 011-01 ON SHEET 619-11). PROTECTIVE VEHICLES MAY BE LOADED WITH SAND, GRAVEL, OR FINE AGGREGATE AS BALLAST TO ENHANCE THE VEHICLE'S GROSS WEIGHT. ANY BALLAST ADDED TO ENHANCE THE VEHICLE'S GROSS WEIGHT SHALL BE SECURED AS NOT TO BECOME DISLODGED IF IMPACTED.

2. A PROTECTIVE VEHICLE USED IN A MOVING OPERATION IS REFERRED TO AS A SHADOW VEHICLE.

3. A PROTECTIVE VEHICLE USED IN A STATIONARY OPERATION IS REFERRED TO AS A BARRIER VEHICLE.

4. IN A MOVING OPERATION OR A STATIONARY OPERATION THAT OCCUPIES A LOCATION FOR UP TO 1 HOUR, THE OPERATOR SHALL REMAIN IN THE PROTECTIVE VEHICLE WITH THE SAFETY BELT AND HEADREST PROPERLY ADJUSTED, MAINTAIN VEHICLE SPACING, AND KEEP THE WHEELS ALIGNED WITH THE LANE STRIPING. TWO-WAY RADIOS SHOULD BE USED TO COMMUNICATE BETWEEN THE OPERATOR AND THE WORK CREW.

5. IN A STATIONARY OPERATION THAT OCCUPIES A LOCATION FOR MORE THAN 1 HOUR, ONCE THE PROTECTIVE VEHICLE HAS BEEN APPROPRIATELY PLACED, IT SHOULD BE UNOCCUPIED. UNOCCUPIED VEHICLE SHALL BE POSITIONED PARALLEL TO TRAFFIC, PARKING BRAKE SET, PLACED IN 2ND GEAR (MANUAL TRANSMISSIONS /ENGINE OFF) OR PARK / NEUTRAL (AUTOMATIC TRANSMISSIONS) AND HAVE THE FRONT WHEELS ALIGNED WITH THE LANE STRIPING AND LANE TO MAINTAIN LANE DISCIPLINE AND TO STAY IN LANE IF STRUCK.

6. WHEN A PROTECTIVE VEHICLE IS USED IN ADVANCE OF EITHER MOVING OR STATIONARY OPERATIONS TO DISPLAY SIGN MESSAGES, IT IS REFERRED TO AS AN ADVANCE WARNING VEHICLE. ADVANCED WARNING VEHICLES MAY BE OCCUPIED OR UNOCCUPIED. WHEN SIGNS ARE MOUNTED ON AN ADVANCED WARNING VEHICLE, THEY SHALL NOT OBSTRUCT VISIBILITY OF ANY LIGHTS (TAILLIGHTS OR WARNING LIGHTS) OR SIDE-VIEW MIRRORS ON THE VEHICLE.

7. NO WORK ACTIVITY, EQUIPMENT, VEHICLES AND/OR MATERIALS SHALL BE LOCATED BETWEEN THE PROTECTIVE VEHICLE AND THE ACTIVE WORK AREA (ROLL AHEAD DISTANCE).

8. PROTECTIVE VEHICLES MAY BE REQUIRED IN CONJUNCTION WITH POLICE PRESENCE IN THE WORK ZONE, TO BE INCLUDED IN THE UNIT BID PRICE FOR BASIC WORK ZONE TRAFFIC CONTROL, FOR CAPITOL CONSTRUCTION PROJECTS.

9. DIRECT VERBAL COMMUNICATION BETWEEN THE PROTECTIVE VEHICLES AND THE WORK VEHICLE(S) / EQUIPMENT SHALL BE UTILIZED WHERE AVAILABLE.

WORK DURATION DEFINITIONS

1. THERE ARE MAINLY FIVE WORK DURATIONS:

   A. LONG-TERM IS STATIONARY WORK THAT OCCUPIES A LOCATION MORE THAN 3 CONSECUTIVE DAYS.

   B. INTERMEDIATE-TERM IS STATIONARY WORK THAT OCCUPIES A LOCATION MORE THAN ONE DAYLIGHT PERIOD UP TO 3 CONSECUTIVE DAYS, OR NIGHTTIME WORK LASTING MORE THAN 1 HOUR.

   C. SHORT-TERM IS STATIONARY DAYTIME WORK THAT OCCUPIES A LOCATION FOR MORE THAN 1 HOUR WITHIN A SINGLE DAYLIGHT PERIOD.

   D. SHORT DURATION IS WORK THAT OCCUPIES A LOCATION UP TO 1 HOUR. IT CAN BE PERFORMED DURING THE DAYTIME OR AT NIGHT IN ACCORDANCE WITH NOTES N1 TO N10 NOTES ON NIGHTTIME WORK.

   E. MOBILE IS WORK THAT MOVES INTERMITTENTLY OR CONTINUOUSLY WHERE THE WORK AT ANY SPECIFIC LOCATION COMPLETES WITHIN 15 MINUTES. IT IS USED FOR VEHICLE BASED OPERATIONS AND DOES NOT INVOLVE WORKERS ON FOOT. IT CAN BE PERFORMED DURING THE DAYTIME OR AT NIGHT IN ACCORDANCE WITH NOTES N1 TO N10 NOTES ON NIGHTTIME WORK.

2. SPECIAL OPERATIONS ARE WORK OPERATIONS THAT DO NOT FIT INTO ONE OF THE ABOVE FIVE CATEGORIES. SPECIAL OPERATIONS INCLUDE:

   A. STOP AND GO OPERATIONS - WORK THAT COMPLETES WITHIN 5 MINUTES AND ALLOWS WORKERS ON FOOT.

   B. OTHER OPERATIONS INCLUDING MOWING, MULCHING/HERBICIDE OPERATIONS, TEMPORARY ROAD/INTERSECTION CLOSURES, ETC.

ROADWAY TYPE DEFINITIONS

1. FREEWAY:

   A. INTERSTATE: INTERREGIONAL HIGH-SPEED, HIGH-VOLUME, DIVIDED FACILITIES WITH COMPLETE CONTROL OF ACCESS.

   B. PARKWAY: DIVIDED HIGHWAYS FOR NON-COMMERCIAL TRAFFIC WITH FULL CONTROL OF ACCESS, GRADE PARKWAY SEPARATIONS, INTERCHANGES, AND OCCASIONAL AT-GRADE INTERSECTIONS. PARKWAYS ARE DESIGNATED BY LAW.

ROADWAY TYPE DEFINITIONS (CONTINUED)

2. EXPRESSWAY: DIVIDED HIGHWAYS FOR THROUGH TRAFFIC WITH FULL OR PARTIAL CONTROL OF ACCESS AND GENERALLY WITH GRADE SEPARATIONS AT MAJOR CROSSROADS. ALL FREEWAY STANDARD SHEETS ARE APPLICABLE TO EXPRESSWAY.

3. NON-FREEWAY:

   A. MULTILANE DIVIDED HIGHWAY

   B. MULTILANE UNDIVIDED HIGHWAY

   C. TWO-LANE TWO-WAY ROADWAY

ALL NON-FREEWAYS CAN BE EITHER URBAN OR RURAL:

URBAN: (MEETS MORE THAN 1 OF THE FOLLOWING CRITERIA)
- •HIGH DENSITY DEVELOPMENT
- •ON-STREET PARKING
- •VARIED BUILDING SETBACKS
- •MULTI-STORY AND LOW-TO MEDIUM-RISE STRUCTURES FOR RESIDENTIAL
- •COMMERCIAL, AND EDUCATIONAL USES, STRUCTURES THAT ACCOMMODATE MIXED USES: COMMERCIAL, RESIDENTIAL, AND PARKING
- •LIGHT INDUSTRIAL, AND SOMETIMES HEAVY INDUSTRIAL, LAND USE
- •PROMINENT DESTINATIONS WITH SPECIALIZED STRUCTURES, E.G., LARGE THEATERS, SPORTS FACILITIES OR CONFERENCE CENTERS
- •HIGH LEVELS OF PEDESTRIAN AND BICYCLIST ACTIVITY, WITH NEARLY CONTINUOUS SIDEWALKS AND MARKED CROSSWALKS
- •HIGHER DENSITY OF TRANSIT STOPS AND ROUTES
- •DRIVEWAY DENSITIES GREATER THAN 25 DRIVEWAYS/MILE ON EACH SIDE OF THE ROAD
- •MINOR COMMERCIAL DRIVEWAY DENSITIES OF 10 DRIVEWAYS/MILE OR GREATER
- •MAJOR COMMERCIAL DRIVEWAYS
- •HIGH DENSITY OF CROSS STREETS

RURAL: DOES NOT MEET MORE THAN ONE OF THE ABOVE CRITERIA.

NOTES FOR NIGHTTIME OPERATIONS:

N1. WORK OCCURRING AFTER SUNSET AND BEFORE SUNRISE WILL BE CONSIDERED NIGHTTIME OPERATIONS.

N2. ALL SIGNS, STOP/SLOW PADDLES AND RED FLAGS USED TO WARN/ALERT/CONTROL TRAFFIC SHALL BE RETROREFLECTIVE.

N3. ALL WORKERS INVOLVED SHALL WEAR PROTECTIVE HELMETS AND NIGHTTIME APPAREL IN ACCORDANCE WITH §107-05A. HIGH VISIBILITY APPAREL AT ALL TIMES.

N4. VEHICLES OPERATING ON THE PAVEMENT OF A CLOSED ROADWAY OR TRAVEL LANE SHALL DISPLAY ROTATING AMBER BEACONS OR FLASHING LED BEACONS AT ALL TIMES.

N5. LEVEL I ILLUMINATION SHALL BE PROVIDED NEAR THE BEGINNING OF LANE CLOSURE TAPERS AND AT ROAD CLOSURES, INCLUDING THE SETUP AND REMOVAL OF THE CLOSURE TAPERS.

N6. LEVEL II ILLUMINATION SHALL BE PROVIDED FOR FLAGGING STATIONS, ASPHALT PAVING, MILLING, AND CONCRETE PLACEMENT AND/OR REMOVAL OPERATIONS, INCLUDING BRIDGE DECKS, 50 FEET AHEAD OF AND 100 FEET BEHIND A PAVING OR MILLING MACHINE.

N7. LEVEL III ILLUMINATION SHALL BE PROVIDED FOR PAVEMENT OR STRUCTURAL CRACK FILLING, JOINT REPAIR, PAVEMENT PATCHING AND REPAIRS, INSTALLATION OF SIGNAL EQUIPMENT OR OTHER ELECTRICAL/MECHANICAL EQUIPMENT, AND OTHER TASKS INVOLVING FINE DETAILS OR INTRICATE PARTS AND EQUIPMENT.

N8. ALL LIGHTING SHALL BE DESIGNED, INSTALLED, AND OPERATED TO AVOID GLARE THAT AFFECTS TRAFFIC ON THE ROADWAY OR THAT CAUSES ANNOYANCE OR DISCOMFORT FOR RESIDENCES ADJOINING THE ROADWAY.

N9. PRIOR TO THE START OF NIGHTTIME OPERATIONS, A WRITTEN NIGHTTIME OPERATIONS AND LIGHTING PLAN IS REQUIRED FOR APPROVAL FROM THE DOT ENGINEER.

N10. SEE STANDARD SPECIFICATIONS §619 FOR ADDITIONAL REQUIREMENTS AND CONSIDERATIONS.

N11. FLAGGERS SHALL USE A FLASHLIGHT WITH RED GLOW CONE/RED LED BATON FOR FLAGGING IN NON-ILLUMINATED FLAGGER STATIONS DURING NIGHTTIME OPERATIONS.

NEW YORK STATE OF OPPORTUNITY. Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL GENERAL NOTES

APPROVED APRIL 8, 2022	ISSUED UNDER EI 22-008
Robert Limoges ROBERT LIMOGES, P.E. DIRECTOR, OTSM	619-010

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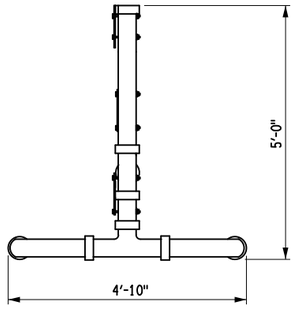

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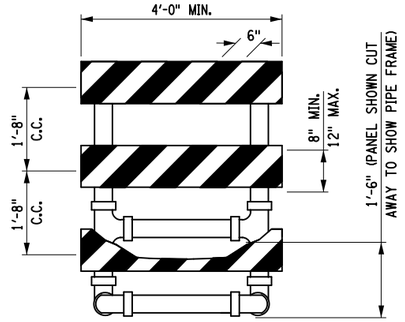

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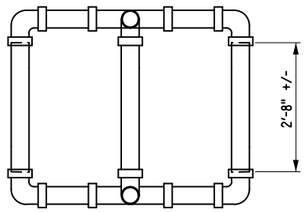
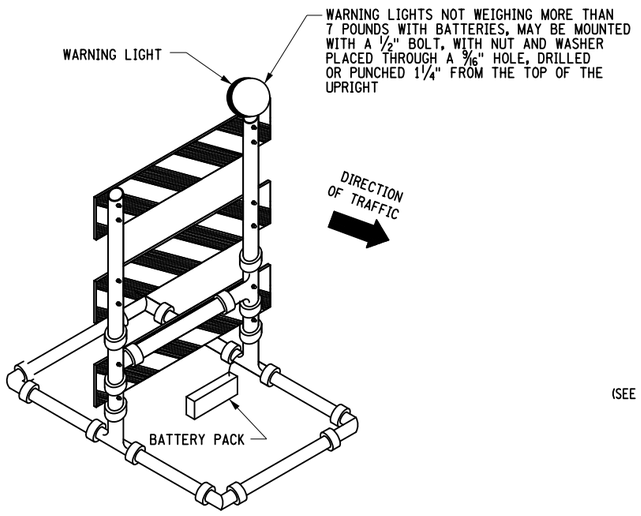


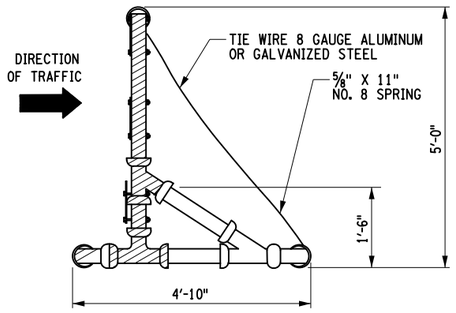
TYPE III CONSTRUCTION BARRICADE
ALTERNATE "A"

NOTES:

1. THE DETAILS AND MATERIALS FOR TYPE III CONSTRUCTION BARRICADES ARE NCHRP 350 APPROVED. IF THE CONTRACTOR ELECTS TO USE AN ALTERNATE DESIGN OR MATERIALS, THE ALTERNATIVE SHALL BE NCHRP 350 APPROVED.
2. THE ALTERNATES SHOWN ON THIS SHEET ARE EQUALLY ACCEPTABLE AND THE CONTRACTOR MAY USE ANY ONE OR A MIXTURE OF TYPES.
3. PANELS SHALL HAVE 6" WIDE REFLECTORIZED ORANGE AND WHITE DIAGONAL STRIPES OF TYPE I OR TYPE III SHEETING SLOPING AT AN ANGLE OF 45° IN ACCORDANCE WITH §729-08, TYPE III CONSTRUCTION BARRICADES. THE STRIPES SHALL SLOPE DOWNWARD TOWARD THE SIDE ON WHICH TRAFFIC IS TO PASS.
4. BALLAST MAY BE PLACED ON THE BASE MEMBERS OF THE BARRICADE. BALLAST SHALL NOT EXTEND INTO THE ACCESSIBLE PASSAGE WIDTH OF 5' WHERE BARRICADES ARE USED TO CHANNELIZE PEDESTRIANS.
5. PANELS FOR BARRICADES MAY BE WOOD, PLASTIC, OR ALUMINUM. PIPE FOR BARRICADES SHALL USE SDR SIZES 21 TO 32.5.
6. WHEN THE BATTERY AND LIGHT WEIGH MORE THAN 7 LBS, THE BATTERY SHALL BE MOUNTED ON THE BOTTOM OF THE BARRICADE.
7. ALL PIPES SHALL BE WHITE. WHITE FITTINGS ARE PREFERRED, BLACK MAY BE USED. ALL JOINTS IN ALTERNATE "A" SHALL BE GLUED WITH A SOLVENT CEMENT COMPATIBLE WITH THE P.V.C. PIPE.
8. ALL JOINTS IN ALTERNATE "B" SHALL BE FREE TO SEPARATE UPON VEHICLE IMPACT. SHADED PIPES AND FITTINGS SHALL BE TIED TOGETHER WITH A MINIMUM $\frac{3}{16}$" DIA. NYLON, OR EQUIVALENT ROPE THREADED INTO THE PIPE AND FITTING INTERIOR.
9. IF BARRICADES ARE USED TO TEMPORARILY CHANNELIZE PEDESTRIANS, THERE SHALL BE A CONTINUOUS DETECTABLE BOTTOM AND TOP RAILS WITH NO GAP BETWEEN INDIVIDUAL BARRICADES TO BE DETECTABLE TO BLIND OR VISUALLY IMPAIRED USERS OF LONG CANES. THE BOTTOM OF THE BOTTOM RAIL SHALL BE NO HIGHER THAN 2" ABOVE THE GROUND AND THE TOP OF THE TOP RAIL SHALL BE NO LOWER THAN 3' ABOVE THE GROUND.



DETAILS FOR FASTENING LIGHTS ON TOP OF BARRICADE



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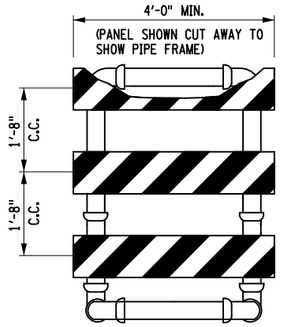

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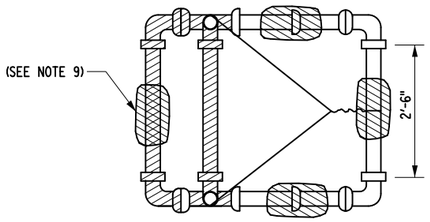

TYPE III CONSTRUCTION BARRICADE
ALTERNATE "B"

NEW YORK STATE OF OPPORTUNITY. **Department of Transportation**

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL
TYPE III CONSTRUCTION BARRICADES
(SHEET 1 OF 2)

APPROVED DECEMBER 2, 2021

Robert Limoges

ROBERT LIMOGES, P.E.
DIRECTOR, OTSM

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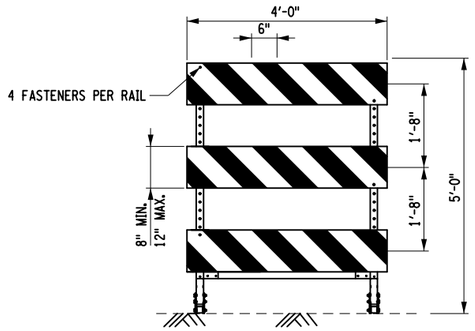

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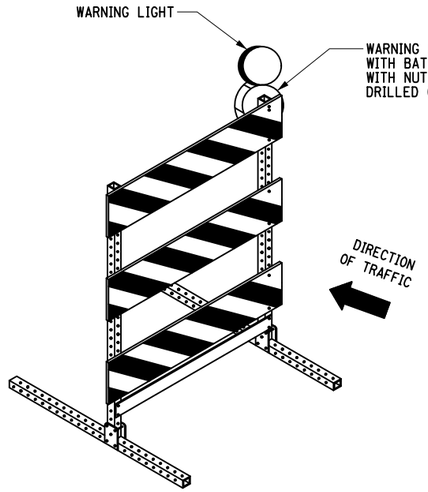


WARNING LIGHTS WEIGHING NOT MORE THAN 7 POUNDS WITH BATTERIES, MAY BE MOUNTED WITH A ½" BOLT, WITH NUT & WASHER, PLACED THROUGH A 9/16" HOLE DRILLED OR PUNCHED 1¼" FROM THE TOP OF THE UPRIGHT.

DETAIL FOR FASTENING LIGHT ON TOP OF BARRICADE

NOTES:

1. THE DETAILS AND MATERIALS FOR TYPE III CONSTRUCTION BARRICADES ARE NCHRP 350 APPROVED. IF THE CONTRACTOR ELECTS TO USE AN ALTERNATE DESIGN OR MATERIALS, THE ALTERNATIVE SHALL BE NCHRP 350 APPROVED.

2. THE ALTERNATES SHOWN ON THIS SHEET ARE EQUALLY ACCEPTABLE AND THE CONTRACTOR MAY USE ANY ONE OR A MIXTURE OF TYPES.

3. PANELS SHALL HAVE 6" WIDE REFLECTORIZED ORANGE AND WHITE DIAGONAL STRIPES OF TYPE I OR TYPE III SHEETING SLOPING AT AN ANGLE OF 45°, IN ACCORDANCE WITH §729-08. THE STRIPES SHALL SLOPE DOWNWARD TOWARD THE SIDE ON WHICH TRAFFIC IS TO PASS.

4. BALLAST MAY BE PLACED ON THE BASE MEMBERS OF THE BARRICADE. BALLAST SHALL NOT EXTEND INTO THE ACCESSIBLE PASSAGE WIDTH OF 5' WHERE BARRICADES ARE USED TO CHANNELIZE PEDESTRIANS.

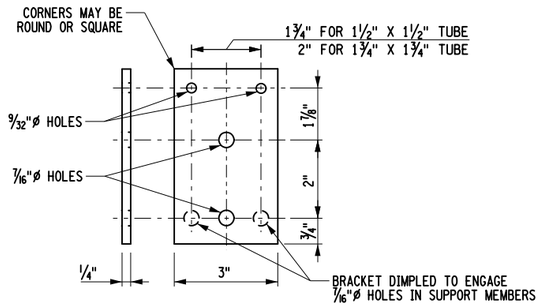
5. PANELS FOR BARRICADES MAY BE WOOD, PLASTIC, OR ALUMINUM.

6. WHEN THE BATTERY AND LIGHT WEIGH MORE THAN 7 LBS, THE BATTERY SHALL BE MOUNTED AT THE BOTTOM OF THE BARRICADE.

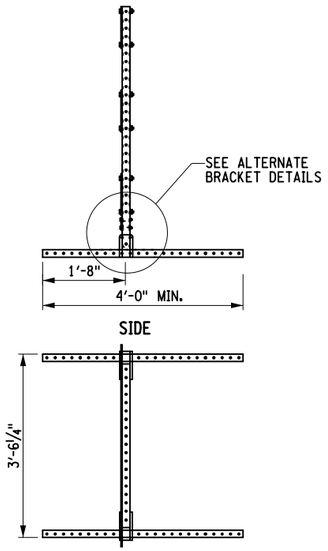
7. ALTERNATE "M" BARRICADES SHALL BE EXTENDED WITH INTERNAL SPLICE MEMBERS. THE INTERNAL SPLICE MEMBERS SHALL BE ONE 1 FOOT LENGTHS OF SQUARE STEEL TUBING INSERTED 6" INTO EACH UPRIGHT. THE EXTENSION SHALL THEN BE PLACED OVER THE TOP OF THE INTERNAL SPLICE MEMBER. THE EXTENSION AND INTERNAL SPLICE MEMBER SHALL BE HELD IN PLACE WITH ⅜" BOLTS WITH NUTS AND WASHERS PLACED 4"(±1") ABOVE AND BELOW THE JOINT FORMED BY THE EXTENSION. THE INTERNAL SPLICE MEMBERS SHALL BE ONE OF THE FOLLOWING SIZES DEPENDING UPON THE TUBING USED TO FABRICATE THE BARRICADE. GAUGES FOR SQUARE TUBES SHALL BE UNITED STATES STANDARD GAUGE.

BARRICADE MEMBERS	INTERNAL SPLICE MEMBERS
12 GAUGE 1¾" X 1¾"	12 GAUGE 1½" X 1½"
14 GAUGE 1¾" X 1¾"	14 GAUGE 1½" X 1½"
12 GAUGE 1½" X 1½"	12 GAUGE 1¼" X 1¼"

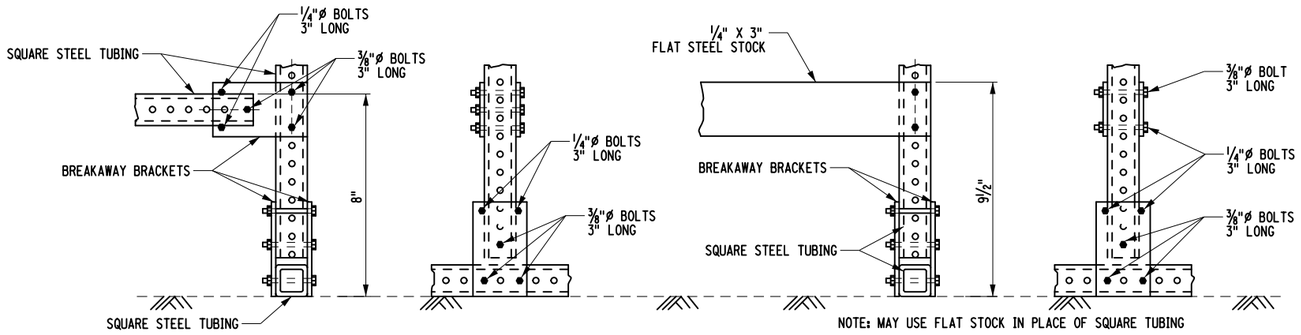
8. IF BARRICADES ARE USE TO TEMPORALLY CHANNELIZE PEDESTRIANS, THERE SHALL BE CONTINUOUS DETECTABLE BOTTOM AND TOP RAILS WITH NO GAP BETWEEN INDIVIDUAL BARRICADES, TO BE DETECTABLE TO BLIND OR VISUALLY IMPAIRED USERS OF LONG CANES. THE BOTTOM OF THE BOTTOM RAIL SHALL BE NO LOWER THAN 2" ABOVE THE GROUND SURFACE. THE TOP OF THE TOP RAIL SHALL BE NO LOWER THAN 3' ABOVE THE GROUND SURFACE.



BRACKET DETAIL



TYPE III CONSTRUCTION BARRICADE ALTERNATE "M"



ALTERNATE BRACKET DETAIL

NOTE: MAY USE FLAT STOCK IN PLACE OF SQUARE TUBING

NOTE: SQUARE STEEL TUBING SHALL MEET ONE OF THE FOLLOWING MATERIAL REQUIREMENTS:

12 GAUGE 1¾" X 1¾", ASTM A653
12 GAUGE 1½" X 1½", ASTM A653
14 GAUGE 1¾" X 1¾", ASTM A1011
ALL BOLTS ARE A325 OR EQUIVALENT BOLTS

NEW YORK STATE OF OPPORTUNITY. **Department of Transportation**

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL TYPE III CONSTRUCTION BARRICADES (SHEET 2 OF 2)

APPROVED DECEMBER 2, 2021

Robert Limoges
ROBERT LIMOGES, P.E.
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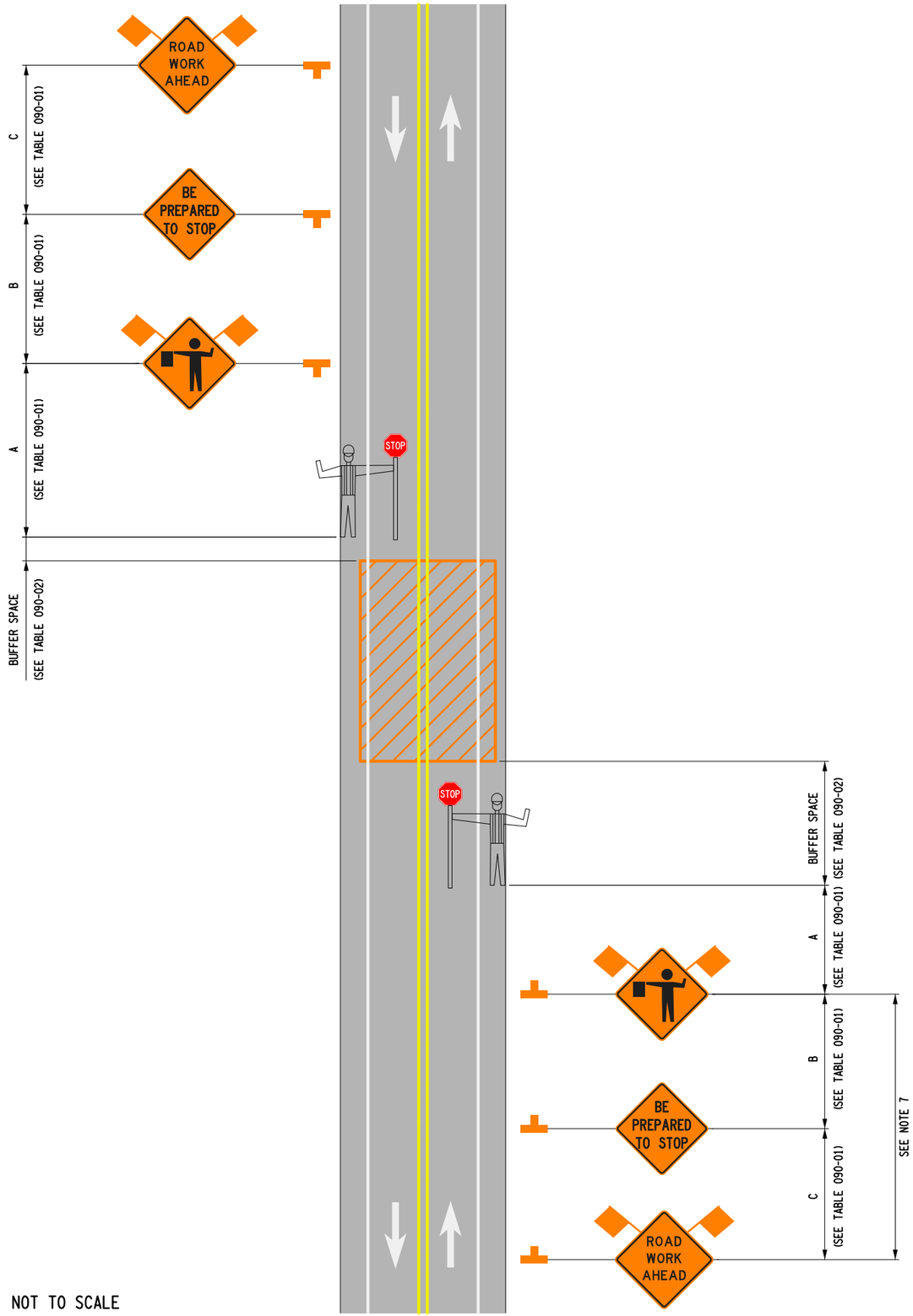

NOT TO SCALE

TABLE 090-01: ADVANCE WARNING SIGN SPACING

ROAD TYPE	DISTANCE BETWEEN SIGNS			SIGN LEGEND	
	A (FT.)	B (FT.)	C (FT.)	XX	YY
URBAN (≤ 30 MPH*)	100	100	100	AHEAD	AHEAD
URBAN (35-40 MPH*)	200	200	200	AHEAD	AHEAD
URBAN (≥ 45 MPH*)	350	350	350	1000 FT.	AHEAD
RURAL	500	500	500	1500 FT.	1000 FT.

* PRECONSTRUCTION POSTED SPEED LIMIT

TABLE 090-02: LONGITUDINAL BUFFER SPACE

PRECONSTRUCTION POSTED SPEED LIMIT (MPH)	DISTANCE (FT.)/ * OF SKIP LINES
25	155/4
30	200/5
35	250/6
40	305/8
45	360/9
50	425/11
55	495/13

TABLE 090-03: REQUIRED SIGN SIZE*

SIGN	NON-FREEWAY	FREEWAY
W3-4	36x36	48x48
W20-1	36x36	48x48
W20-7	36x36	48x48
WARNING FLAG	18x18	18x18

*FREEWAY SIZES MAY BE USED ON NON-FREEWAY, IF SPACE CONSTRAINTS DO NOT EXIST.

NOTES:

1. DURATION OF THE CLOSURE SHALL NOT EXCEED 5 MINUTES.
2. IN URBAN CONDITIONS, ADVANCE WARNING SIGN SPACINGS MAY BE ADJUSTED IN ORDER TO ACCOMMODATE SIDE STREETS AND DRIVEWAYS. IF THERE IS A CONFLICT, MOVE THE SIGN UPSTREAM.
3. FLAGGER SYMBOL SIGN (W20-7) AND "BE PREPARED TO STOP" (W3-4) SHALL BE REMOVED, COVERED OR TURNED AWAY FROM ROAD USERS WHEN FLAGGING OPERATIONS ARE NOT OCCURING.
4. FOR MULTI LANE ROADWAYS, A SITE SPECIFIC PLAN IS REQUIRED ILLUSTRATING PROPOSED STRATEGIES / SIGNAGE TO REDUCE THE ROAD TO A SINGLE LANE ON EACH APPROACH TO THE WORK AREA.
5. TRAFFIC IN BOTH DIRECTIONS WILL BE STOPPED FOR THE ENTIRE DURATION OF THE WORK. THE WORK SHALL BE SUSPENDED DURING PERIODS OF POOR VISIBILITY AND DURING PEAK HOURS.
6. WORK SHOULD BE SCHEDULED DURING NON-PEAK HOURS.
7. PRIOR TO PLACING THE ADVANCE WARNING SIGNS, CONSIDERATION NEEDS TO BE GIVEN TO THE EXPECTED VOLUME OF TRAFFIC THAT NEEDS TO BE HELD AND DISTANCES B AND C INCREASED IF NEEDED.

W3-4

WORK AREA

W20-7

W20-1

FLAGGER

NEW YORK STATE OF OPPORTUNITY. Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL TWO-LANE TWO-WAY ROADWAY TEMPORARY ROAD CLOSURE

APPROVED DECEMBER 2, 2021

Robert Limoges

ROBERT LIMOGES, P.E.
DIRECTOR, OTSM

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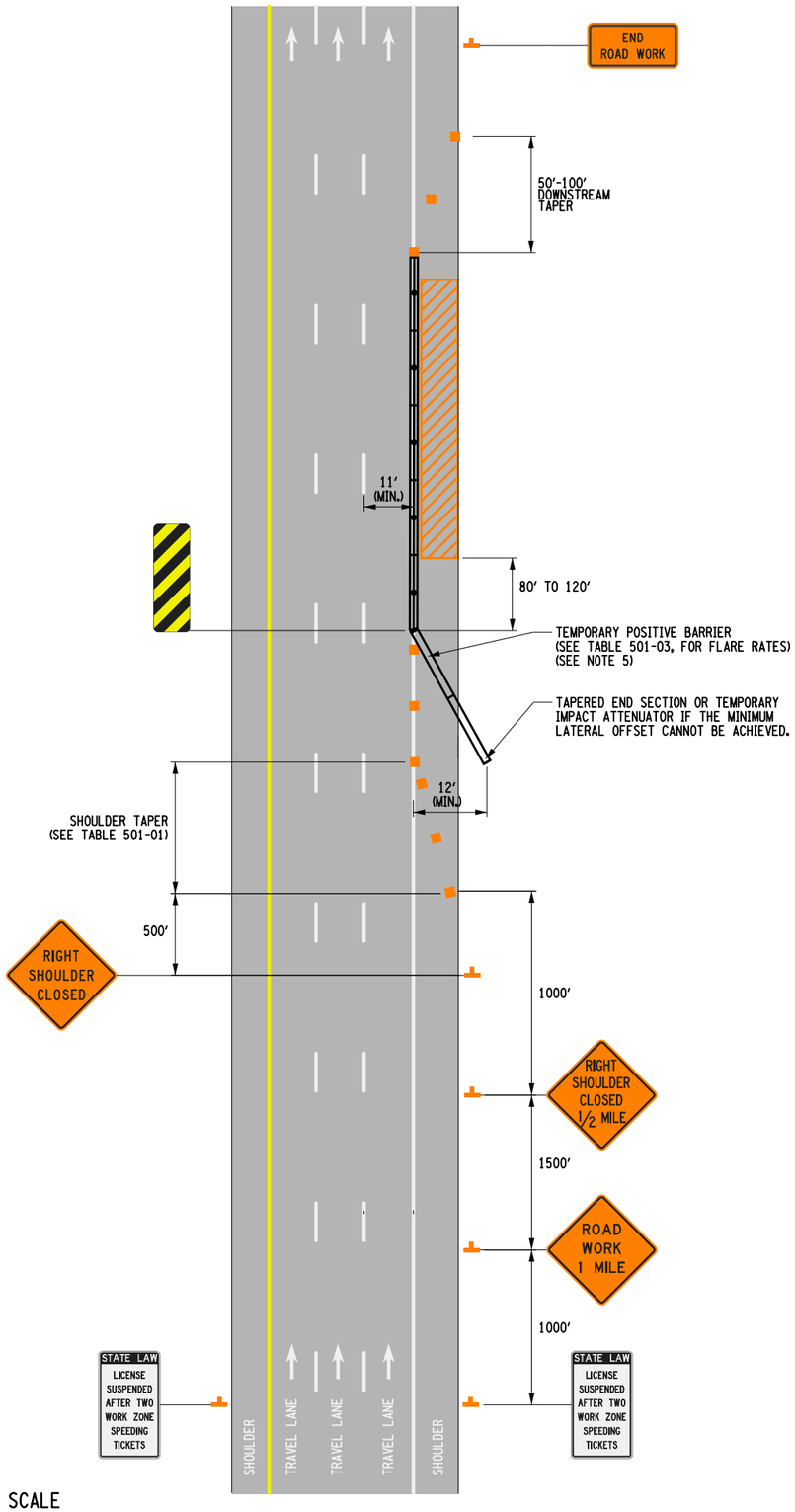

NOT TO SCALE

NOTES:

1. LONG-TERM IS STATIONARY WORK THAT OCCUPIES A LOCATION MORE THAN 3 CONSECUTIVE DAYS.

2. LEFT SHOULDER CLOSURES ARE SYMMETRICAL. SUBSTITUTE LEFT SHOULDER CLOSED SIGNS (W21-5bL AND W21-5aL), AND OBJECT MARKER (OM3-L) FOR RIGHT SHOULDER CLOSED SIGNS (W21-5bR AND W21-5aR), AND OBJECT MARKER (OM3-R).

3. XX IS THE EXPECTED OVERALL LENGTH OF THE OPERATION TO BE COMPLETED WITHIN THE WORK DAY. A SUPPLEMENTAL DISTANCE PLAQUE W7-3a SHALL BE USED WITH SIGN W20-1 WHEN THE DISTANCE BETWEEN THE ADVANCE WARNING SIGNS AND WORK MAY BECOME GREATER THAN 2 MILES AS A RESULT OF THE FOLLOWING SITUATIONS:
   - •MULTIPLE WORK LOCATIONS ARE ANTICIPATED WITHIN XX MILES FROM W20-1 SIGN
   - •WORK AREA WILL BE RELOCATED DURING THE DURATION OF THE WORK WITHIN XX MILES FROM THE W20-1 SIGN

THE SUPPLEMENT SIGN W7-3a SHALL INDICATE THE MAXIMUM ANTICIPATED DISTANCE BETWEEN THE W20-1 SIGN AND THE FARTHEST WORK LOCATION.

4. WHEN MULTIPLE WORK LOCATIONS EXIST WITHIN XX MILES FROM THE W20-1 SIGN. A G20-1 SIGN SHALL BE PLACED EVERY TWO MILES INDICATING THE DISTANCE FROM THE SIGN TO THE FARTHEST WORK LOCATION.

5. THE TEMPORARY POSITIVE BARRIER SHALL NOT BE PLACED ALONG THE MERGING TAPER. THE SHOULDER SHALL BE CLOSED USING CHANNELIZING DEVICES.

NOTES ON NIGHTTIME WORK:

N1. WORK OCCURRING AFTER SUNSET AND BEFORE SUNRISE WILL BE CONSIDERED NIGHTTIME OPERATIONS.

N2. ALL SIGNS, STOP/SLOW PADDLES AND RED FLAGS USED TO WARN/ALERT/CONTROL TRAFFIC SHALL BE RETROREFLECTIVE.

N3. ALL WORKERS INVOLVED SHALL WEAR PROTECTIVE HELMETS AND NIGHTTIME APPAREL IN ACCORDANCE WITH §107-05A. HIGH VISIBILITY APPAREL AT ALL TIMES.

N4. VEHICLES OPERATING ON THE PAVEMENT OF A CLOSED ROADWAY OR TRAVEL LANE SHALL DISPLAY ROTATING AMBER BEACONS OR FLASHING LED BEACONS AT ALL TIMES.

N5. LEVEL I ILLUMINATION SHALL BE PROVIDED NEAR THE BEGINNING OF LANE CLOSURE TAPERS AND AT ROAD CLOSURES, INCLUDING THE SETUP AND REMOVAL OF THE CLOSURE TAPERS.

N6. LEVEL II ILLUMINATION SHALL BE PROVIDED FOR FLAGGING STATIONS, ASPHALT PAVING, MILLING, AND CONCRETE PLACEMENT AND/OR REMOVAL OPERATIONS, INCLUDING BRIDGE DECKS, 50 FEET AHEAD OF AND 100 FEET BEHIND A PAVING OR MILLING MACHINE.

N7. LEVEL III ILLUMINATION SHALL BE PROVIDED FOR PAVEMENT OR STRUCTURAL CRACK FILLING, JOINT REPAIR, PAVEMENT PATCHING AND REPAIRS, INSTALLATION OF SIGNAL EQUIPMENT OR OTHER ELECTRICAL/MECHANICAL EQUIPMENT, AND OTHER TASKS INVOLVING FINE DETAILS OR INTRICATE PARTS AND EQUIPMENT.

N8. ALL LIGHTING SHALL BE DESIGNED, INSTALLED, AND OPERATED TO AVOID GLARE THAT AFFECTS TRAFFIC ON THE ROADWAY OR THAT CAUSES ANNOYANCE OR DISCOMFORT FOR RESIDENCES ADJOINING THE ROADWAY.

N9. PRIOR TO THE START OF NIGHTTIME OPERATIONS, A WRITTEN NIGHTTIME OPERATIONS AND LIGHTING PLAN IS REQUIRED FOR APPROVAL.

N10. SEE NIGHTTIME SAFETY BULLETIN, HDM §16.5.7, & STANDARD SPECIFICATIONS §619 FOR ADDITIONAL REQUIREMENTS AND CONSIDERATIONS.

OM3-R
(TYPE 3 OBJECT MARKER
RECOMMENDED)

RIGHT SHOULDER CLOSED — W21-5aR

RIGHT SHOULDER CLOSED 1/2 MILE — W21-5bR

STATE LAW: LICENSE SUSPENDED AFTER TWO WORK ZONE SPEEDING TICKETS — NYR9-11

ROAD WORK NEXT XX MILES — G20-1 (SEE NOTE 4)

TEMPORARY POSITIVE BARRIER WITH WARNING LIGHTS

END ROAD WORK — G20-2
THIS SIGN SHALL BE LOCATED A MINIMUM DISTANCE OF 80 FT. AND MAXIMUM OF 400 FT. PAST THE END OF THE DOWNSTREAM TAPER

ROAD WORK 1 MILE — W20-1

NEXT XX MILES — W7-3a (SEE NOTE 3)

WORK AREA

CHANNELIZING DEVICE (SEE TABLE 501-02)

REFER TO SHEET 2 OF 2 FOR ALL TABLES

NEW YORK STATE OF OPPORTUNITY. Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL FREEWAY - SHOULDER ≥ 8 FOOT RIGHT SHOULDER CLOSURE LONG TERM OPERATION (SHEET 1 OF 2)

APPROVED DECEMBER 2, 2021
Robert Limoges
ROBERT LIMOGES, P.E.
DIRECTOR, OTSM

ISSUED UNDER EI 21-028

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TABLE 501-01: LONGITUDINAL BUFFER SPACE AND TAPER LENGTHS

PRECONSTRUCTION POSTED SPEED LIMIT (MPH)	LONGITUDINAL BUFFER SPACE DISTANCE (FT.)/ * OF SKIP LINES	TAPER LENGTH: L (FT.)/ * OF SKIP LINES/ * OF CHANNELIZING DEVICES			SHOULDER TAPER LENGTH: L/3 (FT.)/ * OF SKIP LINES/ * OF CHANNELIZING DEVICES		
		FOR LANE WIDTH IN FT. (LATERAL SHIFT OF TRAFFIC FLOW PATH)			FOR SHOULDER WIDTH		
		10	11	12	≤ 4 FT.	5 - 7 FT.	≥ 8 FT.
45	360/9	440/11/12	520/13/14	560/14/15	80/2/3	80/2/3	120/3/4
50	425/11	520/13/14	560/14/15	600/15/16	80/2/3	120/3/4	160/4/5
55	495/13	560/14/15	600/15/16	680/17/18	80/2/3	120/3/4	160/4/5
65	645/16	640/16/17	720/18/19	800/20/21	80/2/3	160/4/5	200/5/6

TABLE 501-02: CHANNELIZING DEVICE APPLICATION FOR LONG-TERM STATIONARY WORK ZONES

WORK ZONE PROVISIONS	MAXIMUM DEVICE SPACING (CENTER TO CENTER)	MUTCD COMPLIANT CHANNELIZING DEVICE								
LONG-TERM STATIONARY WORK ZONES INVOLVE WORK THAT OCCUPIES A LOCATION FOR MORE THAN 3 CONSECUTIVE DAYS		DRUMS	STANDARD CONES	TALL CONES	EXTRA TALL CONES	TEMPORARY TUBULAR MARKERS	INTERIM TUBULAR MARKERS	VERTICAL PANELS	OVERSIZED VERTICAL PANELS	TYPE III BARRICADES
SHOULDER/MERGING/ SHIFTING TAPERS	20 FT.	X							X	
	40 FT.	X							X	
REMOVAL OF EXISTING GUIDE RAIL	80 FT.	X		X	X	X		X	X	O
	40 FT.									

NOTES: X= ALLOWED, BLANK = NOT ALLOWED, O = OPTIONAL
1. - A TYPE 1 OBJECT MARKER MAY BE USED IN LIEU OF CHANNELIZING DEVICE.
2. - CHANNELIZING DEVICES SHALL BE EQUIPPED WITH A FLASHING WARNING LIGHT.

TABLE 501-03: FLARE RATES FOR POSITIVE BARRIER

TYPE OF POSITIVE BARRIER	POSTED SPEED LIMIT		
	50 MPH	55 MPH	65 MPH
TEMPORARY POSITIVE BARRIER	14:1	16:1	20:1
BOX BEAM OR HEAVY POST CORRUGATED BEAM	11:1	12:1	15:1

TABLE 501-04: REQUIRED SIGN SIZES•

SIGN	NON-FREEWAY	FREEWAY
G20-1	36x18	48x24
G20-2	36x18	48x24
NYR9-11	24x42	48x48
W7-3a	24x18	36x30
W20-1	36x36	48x48
W21-5aR	36x36	48x48
W21-5bR	36x36	48x48
WARNING FLAG	18x18	18x18

•FREEWAY SIZES MAY BE USED ON NON-FREEWAY, IF SPACE CONSTRAINTS DO NOT EXIST.

NEW YORK STATE OF OPPORTUNITY. Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL FREEWAY - SHOULDER ≥ 8 FOOT RIGHT SHOULDER CLOSURE LONG TERM OPERATION (SHEET 2 OF 2)

APPROVED APRIL 8, 2022

Robert Limoges

ROBERT LIMOGES, P.E.
DIRECTOR, OTSM

ISSUED UNDER EI 22-008

619-501

FILE NAME = 619-501-2.dgn
DATE/TIME = 13-APR-2022 14:50
USER = oboatwright

Appendix S – Site Specific Health and Safety Plan

Caldwell

Marine International, LLC.

SEGMENT 1 EM&CP
HORIZONTAL DIRECTIONAL DRILLS
AT SHORELINE CROSSINGS

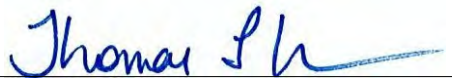
ON THE
CHAMPLAIN HUDSON POWER EXPRESS
SUBMARINE CABLE SYSTEM

Site Specific Health and Safety Plan

REVISION TABLE			
REV. #	**DESCRIPTION**	**DATE**	**APPROVED**
00	Creation	02/17/22	LA
01	Revised after NKT review	05/26/22	LA
02	Revised to Reflect all four (4) HDD EAPs	07/14/22	LA

February 17, 2022

SITE HEALTH & SAFETY PLAN APPROVAL



3/14/2022

Thomas F. Ulisse, Project Executive *Date*
Caldwell Marine

5/14/22

Br t Bailey, Pro1ect Manager *Date*
Caldwell Marine

03/14/22

Lucky Abernathy, EHS Director *Date*
Caldwell Marine

3-11-2022

Kevin J. McMahon, CIH, Prepared By *Date*

1 PROJECT IDENTIFICATION 5

1.1 GENERAL SCOPE OF WORK 5

2 INTRODUCTION 6

2.1. SCOPE & APPLICATION OF SSHASP 6
2.2. APPLICABILITY TO VISITORS & INSPECTORS 7
2.3. IMPLEMENTATION OF CHANGES TO SSHASP 7
2.4 SAFETY TRAINING & EDUCATION 7

3 IDENTIFICATION OF KEY PERSONNEL AND MANAGEMENT 9

3.1 KEY SITE PERSONNEL CONTACTS 9
3.2 ROLES AND RESPONSIBILITIES 9
3.3 SUBCONTRACTOR RESPONSIBILITIES 10

4 JOB HAZARD ANALYSIS 10

4.1 TOXIC SUBSTANCES/**HAZARD COMMUNICATION PROGRAM** 10
4.2 PHYSICAL AND SAFETY HAZARDS 16

5 SAFETY TRAINING AND EDUCATION 38

5.1. OSHA TRAINING. 38
5.2. TOOLBOX SAFETY MEETINGS 39

6. PERSONAL PROTECTIVE EQUIPMENT 39

7 EMERGENCY ACTION PLAN & PROCEDURES 41

7.1 PRE-EMERGENCY PLANNING 41
7.2 PERSONNEL ROLES AND LINES OF COMMUNICATION 41
7.3 EMERGENCY CONTACTS & NOTIFICATION SYSTEMS 41
7.4 EMERGENCY EQUIPMENT AND FACILITIES 42
7.5 DIRECTIONS TO HOSPITAL 43
7.6 FIRST AID AND MEDICAL ATTENTION 44

8 FIRE PROTECTIONPREVENTION 44

8.1 GENERAL REQUIREMENTS 44
8.2 FLAMMABLE AND COMBUSTIBLE LIQUIDS 46

9 ILLUMINATION AND HOUSEKEEPING 49

9.1 ILLUMINATION 49

9.2 HOUSEKEEPING & SANITATION 50

10 INSPECTION PROGRAM 50

11 TRAFFIC CONTROL 51

12 MATERIAL HANDLING, STORAGE, USE AND DISPOSAL 51

13 SIGNS, SIGNALS AND BARRICADES 53

13.1 ACCIDENT PREVENTION SIGNS AND TAGS 53
13.2 SIGNALING 56
13.3 BARRICADES 56

14 PANDEMIC REPONSE PLAN 58

Attachments

1. SSHASP Sign-Off Form
2. Job Safety Analyses
3. Safety Data Sheets
4. Directions to Hospital
5. Incident Report
6. CALDWELL MARINE. Corp. Health & Safety Policies and Procedures Manual
7. Confined Space Entry Permit
8. Hot Work Permit
9. Safety Inspection Form
10. Emergency Action Plans
11. Monthly EHS Report
12. Site Specific Safety Orientation Form
13. Lightning Safety Procedures
14. Pandemic Response Plan

PROJECT IDENTIFICATION

Client: NKT

Project Name: CHAMPLAIN HUDSON POWER EXPRESS
Site Location: Stoney Point, NY Congers,
NY Contractor: CALDWELL MARINE.
CALDWELL MARINE. Project Manager:
CALDWELL MARINE. Project Engineer:
CALDWELL MARINE. Site Superintendent:
CALDWELL MARINE. Site Safety Officer:

1.1 GENERAL SCOPE OF WORK

The work to be undertaken is associated with State of New York Public Service Commission Case 10-T-0139 for the Champlain Hudson Power Express project for the construction of a 1250 MW high voltage direct current circuit from the Canadian Border to New York City. The cable route extends approximately 330 miles over land and marine pathways.

For informational purposes the EM&CP process for this project will be divided into multiple segments to allow for approvals of work supporting the overall project schedule for completion.

Caldwell Marine International, LLC (CMI) will utilize a variety of heavy equipment including excavators/loaders, barges, crew boats, HDD rig, mud mixing equipment, separation plant, etc. and other equipment and hand tools during this project.

The drilling aspect of the operation will be performed by Huxted Trenchless, LLC (HUX). Caldwell Marine International, LLC (CMI) will provide marine support, permanent materials, supervision, and management of the operation.

2 INTRODUCTION

2.1. SCOPE & APPLICATION OF SSHASP

The purpose of this Site-Specific Health and Safety Plan (SSHASP) is to define the requirements and designate protocols to be followed by CALDWELL MARINE during construction activities on the **Horizontal Directional Drilling at Shoreline Crossings - Segment One EM&CP.**

Applicability extends to CALDWELL MARINE personnel, subcontractors, governmental authorities/officials, and visitors that enter the site while construction activities are occurring. For the purposes of this SSHASP, the term "site" will be used to identify construction areas associated with and around the CALDWELL MARINE work areas.

All site personnel, on-site contractors and subcontractors included (hereafter referred to as "project personnel"), will be provided with a site orientation including the site emergency response procedures and any potential fire, explosion, health, or safety and environmental hazards associated with the operations. The Site Specific Orientation form in *Attachment 12* will be completed for each orientation given. This SSHASP summarizes those hazards, and defines protective measures planned for the site. In the event that other potential hazards arise or are recognized after the project begins, the SSHASP will be updated accordingly as discussed in Section 2.3.

This plan must be reviewed by all project personnel, and an agreement to comply with the requirements contained herein must be signed by all project personnel and visitors who may enter the work areas prior to commencement of work. See *Attachment 1*.

During development of this plan, consideration was given to current safety standards as defined by OSHA; primarily in the Construction Industry Standards, 29 CFR 1926 and General Industry Standards, 29 CFR 1910, as applicable.

In addition to this SSHASP, CALDWELL MARINE. has established a comprehensive Corporate Health & Safety Manual based on past experience, sound engineering practices, employee training and enforcement of Safety and Health regulations, to prevent incidents and injuries. A copy of the Health & Safety Manual will be available on site.

2.2 Key EHS Performance Indicators

Measuring Key Performance Indicators (KPIs) is an important part of ensuring the effectiveness and efficiency of an EHS Management System. These KPIs allow EHS professionals and company leaders to collect data and communicate trends, which can then be used to identify where further improvements are needed.

A key performance indicator is a metric that is tied to a predetermined target and represents how far it exceeds or falls below that target. KPIs provide the company with objective data about their EHS performance, ensuring adequate feedback on the effectiveness of safety initiatives and policies.

KPIs should include leading and lagging indicators of performance to be most effective. KPIs will be developed for this project which include measures of safety performance, e.g., total recordable incident rate, lost time incident rate, number of restricted and days away from work; safety inspections and action items completed; safety training and meetings completed.

The Monthly EHS Report in *Attachment 11* will be completed for each month the project is in the field.

2.3 APPLICABILITY TO VISITORS & AUTHORITIES

In addition to this Site-Specific Health & Safety Plan, visitors to the site will be expected to comply with all Federal and State requirements. All project personnel, visitors, and authorities will provide and care for their own protective equipment or arrange to acquire PPE from their employer.

In the event that any project personnel, visitor, or authority does not adhere to the provisions of the SSHASP, he/she will be requested to leave the work site or area. All non-conformance incidents will be recorded in the log by Site Supervision, or his and will be reported to CALDWELL MARINE management immediately.

2.2. IMPLEMENTATION OF CHANGES TO SSHASP

If the project team determines changes to the SSHASP are required, the SSHASP Revision Form, provided as *Attachment 1*, will be completed. The proposed revision will be reviewed by the CALDWELL MARINE Project Manager and Site Safety Officer (SSO). If the revision is acceptable, it will be signed by the key project personnel and included in the control copy of the SSHASP as maintained by the SSO. In addition, approved SSHASP revisions will be discussed during the next daily safety tailgate meeting by the SSO.

2.4 SAFETY TRAINING & EDUCATION

Training is essential to assure employees or subcontractors recognize the hazards inherent in their work and understand the means and methods used to eliminate or control hazards, including engineering methods, administrative and work practices, warning systems, and personal protective equipment. Training will also be provided

to assure that employees or subcontractors understand the proper use of work equipment and tools and how to maintain the equipment to assure continued safety.

Training will be provided before employees or subcontractors are assigned to new or different work activities and periodically to re-enforce their awareness. Where required, annual refresher training will be provided. Management is responsible for assuring safety training is made available to all employees or subcontractors as required by their specific work activities. It is the responsibility of Site Superintendent (SS) to assure that employees or subcontractors have the required training to perform their work safely.

All employees and supervision will be required to attend New Hire/ Supervisor Training. This will include HSE induction and specific HSE training appropriate to the work being performed.

Employees or subcontractors will be required to have attended an initial OSHA 10-Hour class. Proof of training must be available in the form of an OSHA 10-hour "wallet" card, or a certificate of attendance submitted by the company providing the training (they must be an OSHA accepted trainer). Note: At the discretion of SSO, company employees who do not possess an OSHA 10hr card with be provided a reasonable amount of time to meet this requirement.

Initial and periodic refresher training will include at a minimum the following topics:

- Employee conduct
- Inspection of safety devices and protective equipment
- Exposure to hazardous substances
- Clothing
- Personal protective equipment
- Injuries and incident reporting
- Emergency information
- Housekeeping
- Smoking Policy
- Grounding
- Fall protection
- Excavation Safety
- Ladder Safety
- Welding, burning, cutting (i.e., Hot Work)

Weekly "toolbox" talks will be held to discuss safety requirements for current work and to "refresh" awareness of general safety topics. The Site Superintendent in conjunction with safety personnel will select the most appropriate topics to review during the "toolbox" talks. Attendance at these meetings mandatory. Attendance will be taken and records maintained.

3 IDENTIFICATION OF KEY PERSONNEL AND MANAGEMENT

3.1 KEY SITE PERSONNEL CONTACTS

Title	Person	Contact Phone Numbers
CALDWELL MARINE Project Executive (PE)	*Thomas F. Ulisse*	(732) 620-3470
CALDWELL MARINE Project Manager (PM)	*Brett Bailey*	(732) 620-8197
(CALDWELL MARINE.) Site Superintendent(s) (SS)	*Paul Larrabee - Water Side* *Brett Bryant - Land Side*	(732) 620-3938 (732) 620-4214
(CALDWELL MARINE.) Site Safety Officer(s) (SSO)	*Lucky Abernathy* (TBD)	(908) 433-3755 (TBD)

3.2 ROLES AND RESPONSIBILITIES

The Site Superintendent (SS) has overall responsibility for ensuring that the project is implemented according to specifications. As the representative of the general contractor, the Project Superintendent has the responsibility to follow this SSHASP and implement the steps necessary to protect the health and safety of workers on site, including review of subcontractors' safety performance. The SS will establish and ensure compliance with site control areas and procedures and coordinate these responsibilities with the Site Safety Officer. The SS has responsibility for all field activities and reviews safe work practices. The SS also assures the safety of visitors who enter the site. The SS maintains communication with the project manager, site owner representatives and other client representative(s) as required.

The SSO and SS constitute the Safety Team and are responsible for day-to-day implementation of the SSHASP and have full authority regarding health and safety issues. The SSO will make recommendations to protect the health and safety of site personnel.

It is the responsibility of all employees for the recognition, evaluation and control of potential hazards that may exist at the site during the scope of the project covered by this SSHASP. As part of these responsibilities, the Health and Safety team is responsible for day-to-day implementation of health and safety activities. The daily activities include, but are not limited to, the following:

- Implementing this SSHASP
- Completing daily safety observations

- Record keeping related to worker/visitor qualifications, medical surveillance, training and exposure/air monitoring
- Selection, use and modifications to personal protective equipment
- Communication of new hazards and appropriate controls

No activities are to take place on site without the knowledge of the SSO. In the event that the SSO is unavailable, the Site Superintendent will temporarily perform the duties of the SSO.

3.3 Subcontractor Responsibilities

OSHA Rules of Construction (29 CFR 1926.16)

Subcontractors will be pre-qualified to assure they meet the safety performance criteria, have policies and procedures for the tasks undertaken, and meet the training requirements for this project. All of the subcontractor's documentation will be reviewed and approved prior to being allowed to start their work.

Subcontractors are expected to follow all requirements of this SSHASP, their own SSHASP, as appropriate, and all Federal, State, and local health and safety requirements. If non-compliance or unsafe conditions or practices are observed, the work will be stopped. The subcontractor representative will be notified and corrective action will be required. Work will not be allowed to continue until satisfactory mitigations have been implemented. The subcontractor will determine and implement necessary controls and corrective actions and provide documentation that corrective actions were taken within necessary timeframes. If repeat non-compliance/unsafe conditions are observed, the subcontractor will be required to stop affected work until adequate corrective measures are implemented.

4 HAZARD ANALYSIS/RISK ASSEMENT

OSHA Recommended Practices for Safety and Health Programs

Work activities on this project have the potential to present hazards which can result in serious risks for injuries and/or illnesses to workers. This section reviews the potential hazardous materials and physical hazards that may be encountered when performing activities on this project and the measures to be taken to reduce the risks. Individual Job Hazard Analyses for each of the major tasks are provided in *Attachment 3*.

4.1.1 Hazardous Substances

As with any construction site, potentially hazardous materials can be generated by typical worksite activities. Some common types may include:

- Carbon monoxide from vehicle and generator exhaust
- Fuel and lubricants (e.g., gasoline, diesel fuel, hydraulic oil)
- Miscellaneous hazardous materials, e.g., solvents, cleaning agents, pesticides, etc.)
- Silica from concrete cutting, breaking and demolition operations.

Exposures will be evaluated, and controls implemented to assure that site personnel are not exposed above allowable exposure limits to any hazardous materials used or generated on site. Engineering, administrative and personal protective equipment will be used to assure site personnel are protected. Respiratory protection will be provided, if deemed necessary, in accordance with 29 CFR 1926.134 and Section 73 of the CALDWELL MARINE.'S Corporate Health & Safety Manual, (See *Attachment 6*).

Harmful silica dust may be generated from concrete cutting, breaking, demolition or other activities with materials containing crystalline silica and can cause lung damage and long-term illness. Exposure to silica containing materials, if applicable, will be assessed and controlled to avoid exposure. Wet techniques, and isolation barriers, if feasible, will be used to reduce generation of dust. Site personnel involved in these activities will be provided with adequate respiratory protection, e.g., N-95 or filtering face piece respirators with P-100 cartridges.

As this site may utilize various contractors/subcontractors, CALDWELL MARINE will coordinate among its contractors/subcontractors to assure that all contractors receive information about the hazardous materials that may be used on this project. All contractors/subcontractors will be required to submit Safety Data Sheets (SDSs) to CALDWELL MARINE for the chemicals they use on the site so the information may be communicated to all who may be affected. A complete inventory list of chemicals, including quantities of such chemicals that will be on site at all times.

4.1.2 Hazard Communication Program

OSHA Hazard Communication (29 CFR 1926.59)

A Safety Data Sheet (SDS) is required for all hazardous materials brought on site pursuant to 29 CFR 1926.59. The SSO will maintain a central file on site, accessible to all workers, which will contain an inventory of materials and SDSs for hazardous materials on site. See *Attachment 3*.

All site personnel working with hazardous materials will be trained, before first assignment, in accordance with 29 CFR 1926.59.

Each contractor and subcontractor will ensure that initial (at the time of assignment), and periodic, Hazard Communication Training will be provided to all employees or subcontractors regarding the hazardous chemicals in their work area. Whenever a chemical that poses a new or different type of hazard enters the work area it is the responsibility of each supervisor to ensure employees or subcontractors are trained. This training will include (but is not limited to) requirements of this program and a review of the SDS for that product for the following information:

a) Methods of detection and monitoring of the compound (including monitoring devices, appearance and odor).
b) Each physical and health hazard that the material presents.

c) Personal protective equipment, work practices, and emergency procedures (i.e., fire, first aid, chemical spill, etc.) to be followed while handling.
d) The labeling system for hazardous materials will be legible and in English, but for non-English speaking employees or subcontractors the information will be presented in their language, as it relates to the material.
e) Location of the hazard communication program, listing of hazardous materials present, SDS's and host employees or subcontractors can obtain from the Site Safety Officer (SSO) and be uses to review the appropriate hazard information.

A. Task specific procedures for informing employees or subcontractors of the hazards of non-routine tasks, such as equipment maintenance or trailer pesticide application, etc., will be implemented whenever that task involves a hazardous chemical. Each Superintendent is responsible for either training each employee or scheduling such training with a responsible person prior to performing any non-routine task.

B. Training for non-routine tasks will include:

a) Items (a) through (d) above.
b) Special precautions for the non-routine task; and
c) Other company safety procedures which are relevant to the operation, such as Lockout/Tagout and Hot Work Permits, etc.

C. It is the responsibility of the Superintendent to ensure that all employees or subcontractors working on site are informed of any hazardous chemicals that they may be exposed to while working on the project. This information will include:

a) Existing hazardous chemicals
b) Hazardous chemical emissions for processes involved in the work
c) Precautions and personal protective equipment which must be worn in the area
d) Where and how to safely store

D. The Project Manager will be responsible for all actions of the prime contractor employees or subcontractors and will ensure that the subcontractor employees or subcontractors follow all safety precautions that would be used by CALDWELL MARINE employees or subcontractors.

Documentation of Training

Training must include labeling and SDS format including:

- Type of information the employee would expect to see on the new labels, including the Product identifier: how the hazardous chemical is identified. This can be (but is not limited to) the chemical name, code number or batch number. The manufacturer, importer or distributor can decide the appropriate product identifier. The same product identifier must be both on the label and in Section 1 of the SDS (Identification).

- Signal word: used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. There are only two signal words, "Danger" and "Warning." Within a specific hazard class, "Danger" is used for the more severe hazards and "Warning" is used for the less severe hazards. There will only be one signal word on the label no matter how many hazards a chemical may have. If one of the hazards warrants a "Danger" signal word and another warrants the signal word "Warning," then only "Danger" should appear on the label.

- Pictogram: OSHA's required pictograms must be in the shape of a square set at a point and include a black hazard symbol on a white background with a red frame sufficiently wide enough to be clearly visible. A square red frame set at a point without a hazard symbol is not a pictogram and is not permitted on the label. OSHA has designated eight pictograms under this standard for application to a hazard category.

- Hazard statement(s): describe the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard. For example: "Causes damage to kidneys through prolonged or repeated exposure when absorbed through the skin." All of the applicable hazard statements must appear on the label. Hazard statements may be combined where appropriate to reduce redundancies and improve readability. The hazard statements are specific to the hazard classification categories, and chemical users should always see the same statement for the same hazards, no matter what the chemical is or who produces it.

- Precautionary statement(s): means a phrase that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical or improper storage or handling.

- Name, address and phone number of the chemical manufacturer, distributor, or importer. How an employee might use the labels in the workplace.

- Explain how information on the label can be used to ensure proper storage of hazardous chemicals.

- Explain how the information on the label might be used to quickly locate information on first aid when needed by employees or subcontractors or emergency personnel.

- General understanding of how the elements work together on a label.

- Explain that where a chemical has multiple hazards, different pictograms are used to identify the various hazards. The employee should expect to see the appropriate pictogram for the corresponding hazard class.

- Explain that when there are similar precautionary statements, the one providing the most protective information will be included on the label.

- Training on the format of the SDS must include information on: standardized 16-section format, including the type of information found in the various sections

- For example, the employee should be instructed that with the new format, Section 8 (Exposure Controls/Personal Protection) will always contain information about exposure limits, engineering controls and ways to protect yourself, including personal protective equipment.

- How the information on the label is related to the SDS

- For example, explain that the precautionary statements would be the same on the label and on the SDS.

  Whenever training is provided to employees or subcontractors or contractors in accordance with this policy, the individual(s) responsible for providing this training will collect the names (printed), signatures and Social Security numbers of all attending individuals, and the dates and times of the training. Utilize the training roster located at the end of this program. Note that OSHA requires the employee's SSN.

  Equipment operators, general laborers, Superintendents and management, etc., must be trained prior to being allowed to participate in or supervise field activities. The training should cover the use of personal protective equipment. The training should also cover work practices which minimize hazardous risks and safe use of engineering controls & equipment.

  Upon completion of training, forward a copy of the training roster and copies of any additional training material used to the Safety Director. Certificates of training and/or wallet cards will be produced and sent back to the location where the training was performed. These should be presented to the employees or

subcontractors for their personal records. Documentation of all training performed will be submitted to human resources for inclusion into the individual's personnel records. Maintain a copy of all training records and certificates at the facility or job site, as a record that training was performed as required by OSHA.

Labeling

It is the responsibility of each employee to ensure that, prior to use, all containers of potentially hazardous chemicals used are labeled, tagged, or marked with:

a) The identity of the hazardous material, i.e., common and/or chemical name, and Chemical Abstract Service (CAS) Registry Number, including the name that appears on the SDS, and;
b) An appropriate hazard warning, which gives an immediate warning and summary of the more important information from the SDS. In those cases where non-English speaking employees or subcontractors are working at jobsites information will be presented in their language also.
c) **Note:** Chemical materials supplied to outside contractors by CALDWELL MARINE must be labeled, tagged, or marked as identified above.

The outside shipping container label may contain the same information as the immediate chemical container unless that label conflicts with the label(s) required by the Department of Transportation (DOT) for the transportation of hazardous materials.

An employee may transfer or place a hazardous chemical into another "secondary use". That "secondary use" container must be labeled immediately to reflect the by the employee who transfers the product.

The contents of a chemical container that is not labeled appropriately may not be used or put into service, unless it is relabeled appropriately, or the user is given specific approval from a responsible person. Labels already on any chemical container at any location, and used for any purpose, may not be removed, or defaced unless the contents of the container changes.

Signs, placards, standard operating procedures (SOP's), or similar written material may be used instead of placing a label on stationary containers, as long as the written document conveys the same information as is required on a label and is readily accessible to each applicable employee during their normal working shift. This alternate labeling procedure will only be used after review by the Safety Director

for each individual situation. Labels will be legible, in English. However, for non-English-speaking employees or subcontractors, information may be presented in their language as well.

4.2 Physical Safety Hazards

OSHA General Duty Clause, OSH Act of 1970, Section 5 (a)(1)

Construction sites may also present numerous potential physical safety hazards. As such, workers must be aware of these hazards and exercise caution at all times. All unsafe conditions must be reported immediately to the SSO. While it is important to identify and be aware of potential physical hazards and the means by which to reduce their risks, not all hazards can be predicted. Although a task-by-task analysis of potential hazards is included in the sections below, the recognition, evaluation, and control of site activities associated with the potential hazards is best accomplished by the development, use, and implementation of standard operating procedures and guidelines, as well as ongoing review of applicable standards and regulations. This Site-Specific Health & Safety Plan, as well as CALDWELL MARINE's Corporate Health and Safety Manual (*Attachment 6*), provide safe operating procedures for activities covered by the scope of work for this project.

This section assesses the physical safety hazards that may be encountered on this project. These include, but are not limited to:

- O Excavations, holes, ditches, trenches and other subsurface work
- O Sharp objects, such as nails, metal piping and shards, and broken glass
- O Slips/Trips/Falls
- O Working near heavy equipment (backhoes, cranes, dump trucks and other material handling equipment), vehicular traffic
- O Lightning
- O Electrical
- O Material handling
- O Hand and power tools
- O Noise
- O Heat and cold stress
- O Fire
- O Confined Space
- O Hot Work

Safety/physical hazards associated with work on this project are presented in detail below.

4.2.1. Electrical

OSHA Electrical (29 CFR 1926, Subpart K)

OSHA Electrical, Wiring design and protection (29 CFR 1926.404)

Overhead power lines, downed electrical wires, and buried cables all pose a danger of shock or electrocution if contacted or severed during site operations. A minimum distance of 10 feet will be present between overhead wires and equipment. This distance will vary according to voltage; the greater the voltage, the greater the clearance between any part of the equipment and the power line Refer to ***Table 4 - Minimum Clearance From Energized Overhead Electrical Lines***. When required, a spotter will be utilized to maintain a safe distance between equipment and overhead wires. The basic rule is "Don't locate equipment in a position where it can come in contact with overhead power lines." Maintain the required distance from the lines. Overhead electrical power lines will be considered energized unless the person owning such line or operating officials of the electric utility supplying the line assures that it is not energized, and it has been visibly grounded.

Table 1 - Minimum Clearance from Energized Overhead Electrical Lines	
Nominal System Voltage	Minimum Rated Clearance
0 to 50 kV	10 Feet (3 m)
50 to 200 kV	15 Feet (4.5 m)
200 to 350 kV	20 Feet (6 m)
350 to 500 kV	25 Feet
500 to 750 kV	35 Feet
751 to 1000 kV	45 Feet
>1000 kV	(as established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution).

There are various means of insulating the wires, as well as barriers and alarms that may be available to reduce the risk of injury to workers, but the use of such devices does not change the requirements of any other applicable standards or laws. In addition, these and other measures (such as grounding the equipment itself) may not be fully effective but may create a false sense of security. Only the utility company is authorized to de- energize, insulate, or handle the lines. No one else may attempt these operations.

Electrically powered equipment and tools may also pose a hazard. Whenever possible, workers will use low-voltage equipment with ground-fault circuit interrupters (GFCIs) and watertight, corrosion-resistant connecting cables to help minimize this hazard.

No employee will be permitted to work in the proximity of any part of an electrical power circuit unless the person is protected against electric shock by de-energizing the circuit and grounding it, or it has been locked and tagged out.

4.2.2. Heavy Equipment/Vehicle Traffic

OSHA Equipment (29 CFR 1926.600)
OSHA Operator Training, Certification, and Evaluation (29 CFR 1926.1427)

Considerations for controlling the movement of personnel and equipment in a construction area are vitally important to any project, as injuries may occur while working with or adjacent to such equipment. This category includes all operations that utilize moving heavy equipment: excavators, loaders, graders, dozers, and delivery/supply trucks. Site workers will take every precaution necessary to ensure the

safety of the public and the on-site personnel during traffic movement operations.

Site workers will adhere to all applicable standards and regulations while operating heavy equipment at the site. Operators will be trained and experienced in the use and maintenance of the equipment they are operating. Equipment will be inspected on a daily basis to identify any worn parts, and/or unsafe conditions. Any unsafe equipment will be removed from service until safety defects can be corrected. Equipment operators will not leave their machine unattended while it is running. Keys will be removed when equipment is not in use. All equipment will have electronic backup alarms. Each piece of equipment will be equipped with a minimum 5 lb. ABC fire extinguisher. No vehicles or equipment will be operated in a careless or unsafe manner. Personnel will wear high visibility reflective vests when working around equipment/vehicles. All personnel will stay a minimum of 4 ft clear of the operational area of the equipment.

During construction activities, it is often necessary to have a worker direct the operator. In these cases, close communication between the operator and the laborer is of critical importance. One designated person will give signals to the operator of both equipment and vehicles in the work area. Workers should not take any action unless they have made eye contact with the operator and clearly communicated their intentions. In addition, all machines will be equipped with back-up alarms, which are checked daily and repaired immediately. Truck traffic will be controlled by a competent flagger/spotter, as required.

4.2.3. Material Handling

OSHA Reference 29 CFR 1926.251
OSHA Electrical, Wiring design and protection (29 CFR 1926.404)

Various materials and equipment may be handled manually during project operations. Care should be taken when lifting and handling heavy or bulky items to avoid back and other joint injuries. At induction the following fundamentals will addressed in regard to the proper lifting techniques that are essential in preventing back injuries:

- The size, shape, and weight of the object to be lifted must first be considered. Multiple employees or subcontractors or the use of mechanical lifting devices are required for heavy objects.
- The anticipated path to be taken by the lifter should be considered for the presence of slip, trip, and fall hazards.
- The feet will be placed far enough apart for good balance and stability (typically

shoulder width).

- The worker will get as close to the load as possible. The legs will be bent at the knees.
- The back will be kept as straight as possible and abdominal muscles should be tightened.
- Twisting motions should be avoided when performing manual lifts.
- To lift the object, the legs are straightened from their bending position.
- A worker will never carry a load that cannot be seen over or around.

When placing an object down, the stance and position are identical to that for lifting. The legs are bent at the knees and the object lowered. When two or more workers are required to handle the same object, workers will coordinate the effort so that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each worker, if possible, will face the direction in which the object is being carried. In handling bulky or heavy items, the following guidelines will be followed to avoid injury to the hands and fingers:

- A firm grip on the object is essential; leather work gloves will be used unless it is a sharp object. If sharp, cut resistant gloves will be used.
- The hands and object will be free of oil, grease, and water which might prevent a firm grip, and the fingers will be kept away from any points that could cause them to be pinched or crushed, especially when setting the object down.
- The item will be inspected for metal slivers, jagged edges, burrs, and rough or slippery surfaces prior to being lifted.

4.2.4 Hand and Power Tools

Hand and power tools will be used for various site activities. Procedures for using hand and power tools are as follows:

- Persons using power tools will be trained in their use.
- Ground Faults must be present on all electrical tools.
- Only tools in good condition will be used.
- Tools will be kept clean.
- Guards and shields will be kept on all tools.
- Air couplings will be secured with pins or tie-wire.
- Non-sparking tools will be used in hazardous areas, i.e., where flammables may be present.
- Task specific eye protection is critical when using power tools. At a minimum, safety glasses will be required during site operations. If projectiles are possible, full-face shields will be utilized in addition to the glasses.

4.2.5 Noise Exposure

OSHA Electrical, Wiring design and protection (29 CFR 1926.404)

Noise is generated during construction activities in such operations as transportation of materials, operation of heavy construction equipment and other construction equipment, e.g., compressors. Noise has been defined as unwanted sounds. The human ear can tolerate a certain amount of sound without any harmful effects. The OSHA standard allows 90 dB (A) for a full 8 hours and for a lesser time when the levels exceed 90 dB (A). It is usually safe to assume that if you need to shout to be heard at arms-length, the noise level is at 90 dB (A) or above. Hearing protection will be utilized by personnel operating or working around construction equipment or power tools or in marked and designated areas.

4.2.6 Excavation Safety/Protection of Underground Facilities

OSHA Specific Excavation Requirements (29 CFR 1926.651)
OSHA Requirements for Protective Systems (29 CFR 1926.652)
Pipeline Awareness Color Code Chart

This section outlines the basic hazards associated with excavation. Section 13 of CALDWELL MARINE's Corporate Health & Safety Manual, incorporated by reference in *Attachment 6* of this SSHASP, provides detailed procedures for excavation and trenching safety.

A competent person will be assigned for each excavation. The competent person will be trained and capable of identifying existing and predictable hazards in the surroundings or working conditions, which are unsanitary, hazardous, or dangerous to employees or subcontractors. The competent person will have the ability and authority to take prompt corrective measures to eliminate these conditions. The competent person will perform the following:

1. Have a complete understanding of the applicable safety standards and any other data provided.
2. Assure the proper locations of underground installations or utilities, and that the proper utility companies have been contacted.
3. Conduct soil classification tests and reclassify soil after any condition changes.
4. Determine adequate protective systems (sloping, shoring, or shielding systems) for employee protection.
5. Conduct all air monitoring for potential hazardous atmospheres if anticipated. Conduct daily and periodic inspections of excavations and trenches. Approve design of structural ramps, if used.

Prior to beginning any excavation work with mechanical equipment, the site must be marked out by the facility owner in compliance with NYS Industrial Code 753. The Site Superintendent will call in for marks At least **2 to 10 working days prior** to any mechanized work (does not include the date of the call) notice must be provided to the One-Call Notification System, which will transmit the project information to involved members so that they can mark the location of any facilities at the excavation site. Call for remarks every 10 days thereafter. The One Call Number inside New York State is

811 or 800-962-7962. Notification of cancellations must be made no later than the day of the scheduled work and no earlier than 24 hours before the scheduled work date. Confirmation numbers will be kept by the Project Manager in the main office on a running log. Dig Safely New York currently allows excavators to submit Survey and Design Requests via Exactix or by calling the operations center at 1-800-962-7962.

Callers must still contact the affected companies directly; however, Dig Safely New York will identify those affected companies and inform them of the design request, and provide the caller with a contact number for those affected companies. These contacts are often engineering departments that may be able to supply "as-built" maps and charts, which are more accurate.

Utility installations, such as sewer, telephone, fuel, electric or water line, etc. that may be encountered during excavation work must be delineated prior to opening an excavation and protected, supported, removed, or relocated as per standards, as directed by the on- site Representative, and as necessary to safeguard workers while the excavation is open.

The primary hazard encountered during soil excavation is the cave in of excavation sides with possible burial or crushing of workers. Causes of cave-ins may include: (a) absence of shoring, (b) misjudgment of stability, (c) defective shoring, and (d) undercut sides. Other potential hazards include: falling during access/egress, while monitoring or dismounting equipment, or stumbling into excavation. An overhead hazard can result from material, tools, rock, and/or soil falling into the excavation. When applicable, adequate shoring or sloping of sides of the excavation will be provided. Excavation/trenches will be inspected daily for changing conditions.

Excavation spoils will be kept at least 2 feet from the sides of trenches. Excavation/trenches will be protected to avoid the possibility of someone falling into them. The use of raised berms, caution signs and caution tape will be instituted to protect both the public and other personnel on the site. The excavation area will be delineated with caution tape during operations and barricaded/secured with safety fence at the end of each workday. Adequate means of exit, such as ladders, steps, ramps, or other safe means of egress, will be provided and be within 25 feet of lateral travel.

Where personnel are required to enter excavations over 4 ft in depth, sufficient stairs, ramps, or ladders will be provided to require no more than 25 ft. of lateral travel. At least two means of exit will be provided for personnel working in excavations. Where the width of the excavation exceeds 100 ft. two or more means of exit will be provided on each side of the excavation.

Adequate precautions will be taken to avoid creating hazards due to accumulating water. Surface water will be diverted to prevent it from entering the excavation. Site personnel will not be allowed to work in excavations with accumulating water unless specific measure is taken to correct conditions. The competent person will monitor conditions and assure adequate measures are taken.

Support systems such as shoring, bracing, or underpinning will be used to assure the

stability of adjacent structures, sidewalks, and pavements to protect site personnel.

Barricades, guardrail systems, fences or similar equipment will be used to guard open excavations that are over 6 feet in depth to protect site personnel from falls.

Not expected for this project, however, for trenches over 20 feet in depth a shop drawing and design calculations, certified by a Professional Engineer, will be provided.

4.2.7 Slips/Trips/Falls

OSHA Walking-Working Surfaces (29 CFR 1910.28)
OSHA Fall Protection (29 CFR 1926, Subpart M)

Slip/trip/hit/fall injuries are among the most frequent of all injuries to workers. They occur for a wide variety of reasons, but all injuries can be prevented by the following prudent practices:

- Spot-check the work area to identify hazards.
- Establish and utilize a pathway, which is most free of slip and trip hazards.
- Beware of trip hazards such as wet floors, slippery floors, and uneven surfaces or terrain.
- Carry only loads, that you can see over.
- Keep work areas clean and free of clutter, especially in storage rooms and walkways.
- Communicate hazards to on-site personnel
- Secure all loose clothing, ties, and remove jewelry while around machinery.
- Report and/or remove hazards.
- Keep a safe buffer zone between workers using equipment and tools

Fall protection is required at elevations of **6 ft. or greater**. Examples of areas where employees or subcontractors may have to be protected include but are not limited to the following:

- Leading edges
- Hoist areas
- Holes in walk surface
- Framework and reinforcing steel
- Ramps, runways, and other walkways
- Excavations
- Working over dangerous equipment/water
- Roofing work on low or steep sloped roofs
- Precast concrete construction
- Wall openings
- Scaffolds
- Aerial lifts

4.2.8 Confined Spaces

OSHA Confined Spaces in Construction (29 CFR 1926, Subpart AA)

A Confined Space is a space that is large enough and so configured that an employee can

bodily enter and perform assigned work and has limited or restricted means for entry or exit (i.e., tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry/egress) and is not designed for continuous employee occupancy. Entry means the action by which a person passes through an opening into a confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon **as any part of the entrant's body breaks the plane of an opening into the space.**

Concrete vaults, RPZ drains, and basins are potential confined spaces. In the event that site personnel are required to enter a confined space, the confined space procedures in Section 12 of CALDWELL MARINE.'S Corporate Health & Safety Manual will be followed. Procedures include hazard assessment and control, permitting, training for personnel working on confined space entries, pre-job briefing, atmospheric testing and ventilation, personal protective equipment, rescue equipment and plans. A Confined Space Entry Permit form is provided in *Attachment 7*.

Copies of personnel training records, rescue equipment/procedures and proof of rescue arrangements will be submitted to CALDWELL MARINE's SSO prior to all confined space entries.

The following personnel and roles will be assigned to each confined space entry.

1) **Entry Superintendent:** CALDWELL MARINE employees or subcontractors or contractors assigned to entry Superintendent duties must be trained and qualified in CALDWELL MARINE confined space procedures. Certification of training in hazardous atmosphere testing equipment must be obtained.
2) **Attendant (Safety Observer):** The attendant (safety observer) must be trained, qualified, and designated by to perform the duties of an entry attendant. Note: One attendant is typically required for each specific confined space; attendants are not authorized to attend multiple confined space entries unless specific provisions are made prior to entry.
3) **Authorized Entrants:** Entrants into confined space must be trained, qualified, and authorized.

Duties of Entry Superintendent:

1) The Entry Superintendent must know the hazards faced during entry, including information on the mode, signs, and symptoms and consequences of exposure. An SDS or similar written material must be kept at the work site for any material to which the authorized entrant may be exposed.
2) The Entry Superintendent must verify that the appropriate entries have

been made on the confined space entry permit and that all specified tests have been conducted.

3) Verifies, by checking, that all procedures and equipment specified by the permit are in place, before signing the permit and allowing entry.
4) Terminates the entry and cancels the permit if the confined space hazard or conditions outside the confined space pose a hazard to the entrants.
5) Verifies that rescue services are available and that the communication with rescue services is readily available.
6) Removes unauthorized individuals who enter or who attempt to enter the confined space.
7) Reviews the confined space operation at intervals dictated by the hazard and the operation to insure compliance with this policy.
8) Determines when responsibility for a permit space entry operation is transferred.
9) Reviews the Permit-Required Confined Space work, prior to commencement with the attendant, and entrants.
10) Designates qualified individuals to act as entrants and attendants.
11) Monitor the space and inform the entrants of the potential hazards and results; they must participate in the permit review and signing. Ventilation must be used & testing must be conducted before entry & during work.

Duties of Attendant:

1) The attendant must know the hazards that may be faced during entry, including information on the mode, signs, symptoms, and consequences of exposure.
2) An attendant must be on duty outside the confined space for the duration of entry operations.
4) The attendant must be aware of possible behavioral effects of hazard exposure in authorized entrants.

5) The attendant must maintain an accurate count of authorized entrants in the permit space and ensure that the entrants are properly identified and authorized on the permit.
6) The attendant must insure, by head count, that all authorized entrants have departed the confined space prior to closing out the permit or departing the confined space.
7) The attendant will contact emergency responders utilizing 9-1-1 if the attendant feels the entrants may need assistance to escape from hazards or may have displayed the effects of the hazards of the confined space.
8) The attendant will prevent unauthorized entry to the confined space.
9) The attendant will not attempt to rescue by entry into the confined space. Non-entry rescue attempt only is allowed.
10) The attendant will not vacate the area, for any reason, or perform any duty, which would prevent or inhibit the ability to communicate with the entrants.
11) The attendant will evacuate the confined space if:

a) The attendants detects a condition outside (i.e. an alarm, leak, etc.) which may endanger the entrants or any alarm condition on continuous monitoring equipment
b) The attendant detects a behavioral or symptomatic change in the entrant(s).
c) The attendant must leave the site or cannot comply with all the duties listed in this section.
d) The attendant cannot effectively communicate with the entrants.
e) The attendant is advised to vacate the confined space by a client representative or CALDWELL MARINE Superintendent.
f) The attendant determines that the entrant (s) is (are) not complying with personal protective equipment practices or safe work practices.

Duties of the Authorized Entrant:

1) The authorized entrant must know the hazards that may be faced during entry, including information on the mode, signs and symptoms and consequences of the exposure.
2) Properly use protective equipment and monitoring devices as specified.
3) Establish and maintain open communications with the attendant.
4) Alert the attendant if the entrant detects a prohibited or hazardous condition.
5) Alert the attendant and other entrants if the entrant notices any warning sign or change in behavior or symptom of exposure in any other entrant. The entrant will notify the entry Superintendent of the condition changes. The Superintendent will then cancel the existing permit and re-evaluate the space.
6) The entrant will immediately take action to evacuate the confined space if the entrant:
   a) Is directed to do so by the attendant, entry Superintendent or designated client representative.
   b) Detects a failure to comply with personal protective equipment requirements.
   c) Is unable to maintain effective communication with the attendant.
   d) Detects any alarm on continuous monitoring equipment.

A Confined Space Entry Permit (*Attachment 7*) will be completed as needed.

4.2.8.1 PERMIT REQUIRED CONFINED SPACE PREPARATION FOR ENTRY:

A. **Isolation:** The confined space must be removed from service and completely protected against the release of energy and material into the space.

B. All energy sources must be locked out.

C. All lines, pipes, hoses, intake vents, ducts, etc., leading to or from the confined space must be broken away in a manner which would prevent intake or through put of hazardous materials or energy: blanked, blinded, or sections removed.

D. Rotating equipment must be de-energized and locked out.

E. The confined space must be purged, flushed, ventilated, cleaned or inert to eliminate or control the hazardous atmosphere (**Note**: Inert Atmospheres create a hazard by displacing oxygen with an inert. Special care and ventilation prior to testing and entry must be exercised prior to entry. A SDS must also be provided and kept at the site for chemical-cleaning agents used in confined spaces. Confined spaces purged with steam or cleaned with hot water must be allowed time to cool to acceptable levels prior to the onset of entry).

F. Barriers to prevent pedestrian or vehicle entry, which could pose a hazard to entrants, must be erected.

G. Determine if the cover (if any) can be safely removed by the following:

1) Conduct exterior visual examination for existence of hazards, i.e. liquid, etc.
2) Test the atmosphere around the cover to determine the presence of hydrocarbons or toxic vapors.
3) Slowly open the cover to insure no existence of pressure, fluids, etc. If possible, atmospheric testing should be conducted.
4) Remove cover and visually inspect from the outside for the presence of hazards.
5) Conduct atmospheric testing in this exact manner
   (Note: Ventilation systems must be off for a minimum of 30 minutes prior to testing**):**
   a) Test atmosphere outside of confined space for oxygen content.
   b) Test atmosphere inside of confined space for oxygen content.
   c) Compare reading, a difference of –1% oxygen content inside of the confined space may represent 10,000 PPM or a toxic material.
   d) Oxygen content must be above 19.5% and below 23.5% for entry.
   e) Test for combustible gases must be below 2% LFL for entry.
   f) Test for toxic gases or vapors must read 0 Parts Per Million (PPM).

g) If testing falls outside of the parameters established above, a permit cannot be issued without elimination of hazard and retest.

h) Entrants or their representatives are to be given an opportunity to review and participate in the review and calibration of air monitoring data before entering.

i) Entrants must also be given the opportunity to participate in the permit review and signing.

H. Designate attendant and entrants as described in this procedure.

I. Provide all personal protective equipment.

J. Provide ventilation, (Refer to Section on Welding and Burning).

K. All lighting and electrical tools used in confined spaces must be connected to GFCI or reduced to 12 volts

L. All air-operated tools must be connected to breathing air quality air sources.

M. Discuss job requirements, emergency procedures and hazards with entrants, attendants and client-designated representatives. Secure / issue proper confined space entry permit and appropriate work permit for confined space work (if required by client). Note: In spaces where multi employers are working in the same space, all of the above information will be discussed with those individuals entering the space and information gathered/discussed as to their purpose of entering the space. If for any reason it would increase the hazards to employees or subcontractors entering the space an effort to schedule different entry periods will be made.

N. Post copies of the permits; permit required confined space entry procedure, SDS and emergency procedures plan at the work site.

O. A permit required confined space may be declared and certified as a non-permit required confined space by following the procedures outlined in the Non-Permit Required Confined Space Procedure.

P. Periodic hazardous atmosphere monitoring will be conducted and logged on the confined space entry permit form.

Q. If the confined space is vacated, unattended, or recovered, visual inspection and re-testing of the space for hazardous atmosphere must be conducted.

R. Caution:

1) Hazards, such as welding fumes, electrical shock, flammable and toxic vapors, may be introduced to the confined space by work in the confined space.
2) Welding and cutting torches may not be left on and unattended. The source must be isolated prior to departing the confined space.
3) Adequate ventilation must be provided for welding, cutting, and burning work inside of confined spaces.

Employees or subcontractors or their representatives are entitled to request additional monitoring at any time.

Rescue Equipment/Procedures:

CALDWELL MARINE uses a tripod retrieval device in which the employee entering the space is "tied in" with a harness and lanyard system. The individual can be retrieved from the space by cranking the retrieval arm, therefore, hoisting the individual from the space. Under no circumstances is an individual to go inside the space to retrieve an individual. Typically, the space can be illuminated with flashlights carried by the occupying party. If not possible, other lighting arrangements will be made.

It should be noted that every time the individual leaves the confined space, testing procedures for the reentry must take place before the individual re-enters the space. These occurrences are to be documented as part of the entry permit and times including atmospheric readings are to be recorded.

The following equipment is to be provided to the crew:

- Testing and monitoring equipment including multi-gas detector (minimum: LEL/O2/CO/H2S) needed to determine if hazardous condition exist.
- Ventilation equipment to maintain gas and particulates below occupational exposure limits.
- Communication between personnel involved in the entry operation.
- Personal protective equipment insofar as feasible engineering and work practice controls does not adequately protect employees or subcontractors.
- Lighting equipment needed to enable employees or subcontractors to see well enough to work safely and to exit the space quickly in an emergency. Barriers and shields as required protecting the workers from

pedestrian and vehicular traffic.

- Ladders, needed for safe ingress and egress by authorized entrants.
- Rescue, Retrieval and Emergency equipment needed to extract or treat injured personnel, except to the extent that the equipment and or service are provided by rescue services that are immediately amiable.
- Any other equipment necessary for safe entry into and rescue from permitted spaces at our facility.
- Other equipment: Air Compressor (as required); Air Purifying Respirators (as required); Body Harness; Emergency escape breathing apparatus (as needed); Escape ladders for depths of 4 ft. or below; Extraction cable and lanyards; eye protection equipment; first aid kits; hand tools; head protection equipment; hearing protection equipment; Intrinsically safe lighting equipment (if in potential flammable/combustible atmosphere); lock out/tag out equipment (as required); Personal Protective clothing.

Arrangements will be made with public or private rescue services prior to beginning any permit required confined space work.

4.2.8.2 NON-PERMIT REQUIRED CONFINED SPACE ENTRY PROCEDURE

Determination of Permit-Required or Non-Permit Required Confined Space:
For permit-required confined spaces, CALDWELL MARINE must ensure that all exposed employees or subcontractors are made aware by posting signs or by any other effective means, of the existence and location of the danger posed by the permit-required space.

CALDWELL MARINE employees or subcontractors must consider all confined spaces meeting the definition of a confined space as a permit-required confined space, until a determination has been made by a trained, competent entry Superintendent or CALDWELL MARINE SSO.

CALDWELL MARINE employees or subcontractors will not enter the confined space until a determination has been made. Certification of non-permit required confined space determination will be provided to the CALDWELL MARINE, employees or subcontractors assigned to enter and must be kept at the job site.

Under no circumstances will CALDWELL MARINE, employees or subcontractors enter a Permit-Required Confined Space without a properly issued permit for entry. Work will not begin in the permit-required confined space until additional permits, e.g., hot work, have been issued.

B. The following steps must be taken, and the attached form be completed in determining the status of the confined space by the CALDWELL MARINE Entry Superintendent.

1) Entry covers must be safely removed.

2) A visual inspection, if possible, without entry must be performed to establish the absence of recognized hazards.

3) Install proper railing or temporary barrier that will prevent accidental fall through the opening.

4) Test internal atmosphere with a calibrated direct reading instrument for the following conditions.

5) ***NOTE: AIR MOVERS MUST BE TURNED OFF DURING ATMOSPHERIC TESTING AND THE TESTING MUST BE ACCOMPLISHED IN THE EXACT ORDER PRESENTED BELOW.***

a) Oxygen content – must be above 19.5% and below 23.5%.
b) Test for flammable gases and vapors – must be below 10% flammable limit (LFL).
c) Visually ascertain that no airborne combustible dust is present.
d) Test for the presence of H2S or other toxic contaminants.
e) **IF YOU ARE IN DOUBT OF RESULTS, CONTACT CALDWELL MARINE SSO FOR FURTHER INSTRUCTIONS**

C. The CALDWELL MARINE Entry Superintendent must complete the attached form and leave the form at the work site. In the event that multiple sites are involved, each site must be tested, and the results posted on the attached forms.

D. Ladders must be provided for egress and entry.

E. Coordinating entry operations for multi employers so that employees or subcontractors of one employer do not endanger the employees or subcontractors of any other employer.

F. A safety observer (attendant) must be assigned with clear communications capability with the non-permit confined space entrants. **THE ATTENDANT WILL NOT ATTEMPT TO RESCUE ENTRANTS WITHIN THE CONFINED SPACE BY ENTERING INTO THE CONFINED SPACE**.

G. The attendant must be knowledgeable of how to summon emergency response personnel.

H. Non-Permit Required Confined Spaces that are vacated for a period of 1 hour, suspended for any purpose, or suspected to have any change in atmosphere or condition, must be re-tested and the results annotated on the attached form.

I. Non-Permit Required Confined Spaces must be periodically monitored for changes in conditions by the Entry Superintendent.

J. Reviews of the permit space program, using the canceled permits retained for at least one year after each entry and revise the program as necessary, to ensure that employees or subcontractors are protected.

K. Failure of any re-test or changes in condition requires reclassification of the confined space as a Permit-Required Confined Space and must be noted on the attached form.

4.2.9 Welding and Cutting

OSHA 1926 Subpart J - 1926.350 Gas Welding and Cutting
OSHA 1926 Subpart J - 1926.351 ARC Welding and Cutting
OSHA 1926 Subpart J - 1926.352 Fire Prevention
OSHA 1926 Subpart J - 1926.353 Ventilation & Protection in Welding, Cutting and Heating
OSHA 1926 Subpart J - 1926.354 Welding, Cutting and Heating in Way of Preservative Coatings

Welding and cutting may be performed during the course of the project. When performed, the following requirements will be followed:

A. **Fire Prevention:**

1. Objects to be welded, cut, burned or heated should be moved to a designated safe location when practical.
2. First aid equipment will be available at all times.
3. If the object to be welded or cut cannot be moved and if all the fire hazards cannot be removed, then guards shields, fire blankets, etc. will be used to confine the heat, sparks and slag and to protect the immovable fire hazards. Welding, cutting, burning or heating operations must not be performed where the application of

4. flammable paints, compounds or heavy dust accumulation will present a hazard.
5. The proper fire extinguishing equipment and fire watch must be in place prior to the onset of work.
6. Gas supplies to torches must be shut off at a point, (preferably the source) outside of confined spaces.
7. Torches and hoses must not be left in confined spaces and excavations overnight.
8. Welding and cutting on used drums is prohibited unless the drums have been properly cleaned and purged of hazardous materials.
9. Hollow spaces, cavities and containers must be vented and purged with an inert gas before preheating, welding or cutting.
10. In areas where either a flammable atmosphere or combustible materials may be present fire watch will be designated and will remain at the operation, plus a ½ hour after completion The fire watch is required during the following:
    a) Locations where other than a minor fire might develop.
    b) Combustible materials closer than 35ft. (10.7M) to the point of operation.
    c) Combustibles that are 35ft. (10.7M) or more away but are easily ignited.
    d) Wall or floor openings within 35ft. (10.7M) radius expose combustible materials.
    e) Combustible materials are adjacent to the opposite side of metal partitions, ceilings or roofs.

    Note: 1. All persons performing fire watch duties will be trained in the proper use of fire extinguishing equipment and general fire watch duties.

    Note: 2. If the area has the potential for a flammable or explosive atmosphere LEL readings will be continuously monitored with a pre-calibrated instrument for that purpose.

    Note: 3 If fire hazards cannot be moved or guarded, welding and cutting operations will NOT be performed.

11. Hot work permits (*Attachment 8*) will be required for all burning, cutting, and welding operations by the Superintendent or designated SSO. A copy of the permit is attached to the end of this section.

B. Gas Welding, Cutting And Burning.

1. When transporting gas cylinders, they must be secured on a cradle,

sling board or pallet. Choker sling or electric magnets must not be used.

2. The cylinders must be secured and transported in a vertical position with the valve protective caps in place.
3. Unless cylinders are firmly secured on a special carrier intended for the purpose, regulators must be removed and protective caps must be in place prior to movement.
4. An approved cylinder truck or chain must be sued to steady the cylinders while in use or storage.
5. The cylinder valve may be opened only when work is being performed.
6. All gas cylinders must be kept away from the actual welding or cutting operation and protected from sparks, hot slag or flames.
7. Cylinders may not be placed where they may become a part of an electrical circuit.
8. Oxygen cylinders must be stored in an upright position, with regulators removed and safety caps installed.
9. Oxygen cylinders must be separated from fuel cylinders by a minimum of 20 feet.
10. All cylinders must be properly labeled with content and hazard warnings.
11. Cylinders must have fixed had wheels, keys, handles or a non-adjustable wrench on the valve stem.
12. Acetylene cylinders must never be opened more than 1 and 1/2 turns of the spindle
13. Before connecting a regulator to a cylinder valve, crack the valve open slightly and close to insure tight stop and no leakage. Do not stand in front of the valve when opening.
14. Fuel gas hose and oxygen hose must be easily distinguishable from each other. (Red hose for fuel gases, green hoses for oxygen and non-combustible gases black hose for inert gas and air).
15. All regulators, hoses, and valves must be kept free and clear of oil and other materials.
16. Parallel sections of oxygen and fuel hose that have been taped together must be taped with not more than 4 inches of tape each 12 inches.
17. Hoses in with noticeable or suspected defect must not be used.
18. All hoses, cables and other equipment must be kept clear of walkways and roadways.
19. Torches must be inspected each day for leaking shut off valves, hose couplings and tip connections.
20. Torches may be lit by friction lighters only.
21. All gauges, valves and pressure regulators must be in proper working order.

22. Cutting, welding and burning may not be performed on surfaces with protective coatings applied without proper breathing zone ventilation or appropriate respiratory protection.
23. Proper protective equipment must be worn when performing welding, cutting or burning.
24. Hoses must not be wrapped around an individual's body.
25. Workers in charge of oxygen or fuel-gas supply equipment (including distribution piping systems and generators) must be instructed and judged competent for such work.

C. **Arc Welding and Cutting.**

1. Employees or subcontractors assigned to operate arc welding equipment must be properly instructed and qualified to operate such equipment.
2. SDS for welding rods must be available in the CALDWELL MARINE. HAZCOM program.
2. Positive ventilation must be provided when welding and cutting are performed in a confined space, or respiratory protection must be provided. Proper ventilation or respiratory protection procedures must be used when evolution of hazardous fumes, gases, or dust is possible.
3. All ground connections will be inspected to insure that they are mechanically sound and properly rated for the required current.
4. A ground return cable must have a safe current carrying capacity equal to or exceeding the specified maximum output of the arc-welding unit.
5. The frames of all arc welding machines must be grounded either through a third wire in the cable containing the circuit conductor or through a separate wire that is grounded at the source of the current.
6. Gasoline or propane fueled portable welding machines and auxiliary generators must have a positive ground before placing them in service.
7. Arc welding and cutting operations with must be screened with non-combustible or flameproof screens wherever possible.
8. Use only manual electrode holders specifically designed for arc welding and cutting.
9. All current carrying parts must be fully insulated against the maximum voltage encountered to ground.
10. All arc welding cables must be capable of handling the maximum current requirements of the work being accomplished.
11. Cables must be equipped with standard insulated connectors of a capacity at least equivalent to that of the cable.
12. Proper eye and face protection must be used when performing arc welding or cutting.

Note: 1. All employees or subcontractors assigned arc welding and cutting duties must be familiar with 29 CFR 1910.254, 29 CFR 252 (a), (b) and (c), and with fire prevention and protection, health protection and ventilation, and protection of personnel.

Note: 2. Operators of equipment should report any equipment defect or safety hazards and discontinue use of equipment until its safety has been assured. Repairs will be made only by qualified personnel.

Note: 3. Burners, welders and fire watch personnel should be licensed in accordance with jurisdiction of authority.

4.2.8 Weather & Lightning

OSHA Emergency Action Plans 1926 Subpart C 1926.35
OSHA Emergency Preparedness
OSHA Lightning Safety
OSHA Tornado Preparedness and Response

The procedures provided below will be used to protect site personnel from weather and lightning related injuries.

CALDWELL MARINE will consult the publicly available weather forecasts on a daily basis for the operation. Estimated operational limits for specific phases are shown in Table 7-1 of the Installation Manual. Lightening Safety Procedures are provided in *Attachment 13*.

Training

A tailgate safety meeting will be conducted to increase awareness to the hazards and prevention of weather and lightning related incidents.

Detection of Lightning

The Site Superintendent will be proactive in monitoring conditions that may produce thunderstorms and lightning. The weather forecast will be tracked and communicated to site personnel as often as necessary. When signs of impending storms, i.e., increasing wind, darkening skies, or lightening appear, local weather monitoring will be increased. The National Weather Service (www.nws.noaa.gov/) should be consulted frequently. Personnel will be notified when thunderstorms may impact the site.

The "flash/bang" (f/b) technique of measuring the distance to lightning will be reviewed with all personnel. The f/b technique is defined as: for each five seconds from the time of observing the lightning flash to hearing the associated thunder, the lightning is approximately one mile away.

Suspension/Resumption of Activities

All outside activities will be suspended when a lightning flash is immediately in the area or a f/b of 20 seconds (4 miles away) is noted. Personnel may continue indoor work activities. Outdoor activities will resume when 30 minutes have passed since the last observable f/b is 20 seconds or greater.

Lightning Protection

When notification is given, all outside work activities will stop and personnel will gather in the support area for a head count and further instructions. Indoor work will continue, except for the use of electrical equipment, telephones and computers. When a safe location is not present and personnel are caught by a sudden lightning event, employees or subcontractors should seek the lowest possible area, away from large objects which might attract lightning or fall over, e.g., trees, utility poles. The employee should assume a crouching position with their head lowered and hands over their ears. AVOID: WATER, HIGH GROUNDS, HEAVY EQUIPMENT AND TALL, ISOLATED OBJECTS.

First Aid

An employee that is struck by lightning needs immediate medical assistance (call 911). The body will not carry an electrical charge, but receives a severe electrical shock and may be burned. Personnel certified in first aid/CPR should inspect for shock and burns around fingers, toes, buckles and jewelry. Stay with the injured employee until medical help arrives.

4.2.9 Fires

If required, the SSO will establish areas approved for welding, cutting, and other hot work. Hot work must comply with the following Hot Work Procedures. A Hot Work Permit will be obtained from the SSO, if required. All personnel will be protected from welding radiation, flashes, sparks, molten metal, and slag. All welding, burning, and cutting equipment will be inspected daily by the operator. Defective equipment will be tagged and removed from service, replaced, or repaired, and re-inspected before being placed back in service. All welders will be properly trained in the safe operation of their equipment, safe welding/cutting practices, and welding/cutting respiratory and fire protection.

Where practical, all combustible material will be relocated at least 35 feet away from the hot work site. Where relocation is impractical, combustibles will be protected with flame proofed covers or otherwise shielded. At a minimum, two fully charged and operable fire extinguishers, appropriate for the type of possible fire (e.g., 10 lb. ABC), will be available at the work area. A fire watch will be required whenever hot work is performed and a minimum of 30 minutes after hot work is complete.

A hot work permit will be completed by the SSO, reviewed with personnel who will perform the hot work, and posted near the work area. The hot work permit is good only for the date issued and is valid only for the eight-hour shift for which it is issued. If at

any time during the hot work operation a change in conditions at the work site is suspected, such as a release of flammable gases or vapors in the work area, work will be stopped immediately and the SSO will be notified. Such work stoppage invalidates the hot work permit, and a new permit will be completed after inspections and tests have been performed by the SSO. .

4.2.10 Dust Control

Control measures will be implemented for all operations where dust is likely to be generated. Careful planning and implementation of controls will reduce potential dust emissions. There are a number of possible construction practices which will reduce levels of airborne particulates. These include:

- Providing for a misting spray during excavation activities.
- Applying water on and sweeping haul roads.
- Spraying mist on buckets during material handling and dumping.
- Hauling materials in properly tarped or watertight containers.
- Reducing the active work area surface and limiting the number of concurrent operations.
- Avoiding dry sweeping.

4.2.11 Noise Control

Noise levels will be controlled to meet applicable OSHA standards for workers. Applicable noise ordinances will be observed nearby residents and off-site community.

5 SAFETY TRAINING AND EDUCATION

5.1. OSHA TRAINING

All site personnel will have the required OSHA training pertaining to the work they are conducting. Copies of training certificates will be available upon request. The CALDWELL MARINE. Site Superintendent will have a minimum of the OSHA 30 Hour Construction training. All laborers will have a minimum of the OSHA 10 Hour Construction training.

Content for new hire and periodic training is outlined in Section 2.4 of this Plan.
All contractors and visitors at this site are expected to comply with all applicable government safety, health, and environmental regulations, as well as company policies. Worker protection standards include, but are not limited to:

OSHA Construction Standards (29 CFR 1926), such as -

- Subpart C - General Health & Safety Provisions
- Subpart D - Occupational Noise Exposure (1926.52)
- Subpart E - Personal Protective and Life Saving Equipment
- Subpart F - Fire Protection

-
- Subpart G - Signs, Signals and Barricades
- Subpart J - Welding & Cutting
- Subpart M - Fall Protection

Should there be a conflict between this plan and any of the above mentioned standards, the more stringent provisions will be followed until a proper evaluation can be made to determine the appropriate course of action.

5.2. Site Safety Orientation

All site personnel and visitors will be provided with a Site Safety Orientation when they arrive on site and before they enter a work zone. The Site Safety Orientation will be conducted by the SSO or designee and will be documented on the form in *Attachment 8.* The Site Safety Orientation will generally include an overview of the project, current activities, emergency procedures/evacuation routes, assembly areas and notification, PPE requirements, and general site rules.

5.2. TOOLBOX SAFETY MEETINGS

Site Safety Meetings, also called Toolbox Safety Meetings, will be presented to all site personnel just prior to the onset of each initial work activity and performed at least weekly. It will be the responsibility of the SSO or designated representative to conduct these meetings. Toolbox Safety Meetings are mandatory for all project personnel. At the conclusion of the meeting, each individual will be required to sign the Field Safety Meeting attendance log.

The SSO and SS will determine the topics based on activities to be conducted and any incidents or items identified during previous days. These topics will include, but are not limited to, PPE requirements, chemical hazards, physical hazards, emergency procedures, weather concerns (if applicable), injury/incidents and trends, and any other special considerations.

6. PERSONAL PROTECTIVE EQUIPMENT

OSHA Personal Protective Equipment

The SSO will assure personal protective equipment is regularly inspected by the user (e.g., before each use) and in accordance with manufacturers' recommendations. Equipment that fails inspection will be removed from service immediately and replaced with equivalent equipment.

Site personnel wearing protective equipment will be trained in the proper use, inspection, and maintenance of the equipment.

Activities on this project have been assessed for PPE requirements. Minimum personal PPE on this site includes eye protection, work boots, hard hat, and reflective vest at all times. Specific requirements include:

- Hard hat
- Safety glasses with side shields
- Face shield (when exposed to projectiles)
- Safety work boots (e.g., composite toe)
- High visibility reflective warning vest
- Hearing protection (working around heavy/noisy equipment)
- Work gloves

The need for respirators will be assessed prior to exposure to dust producing materials, e.g., concrete/silica. Workers requiring use of respirators will be evaluated to assure they are medically cleared to wear respirators and fit tested to assure an effective seal. N-95 filtering facepiece respirators, where appropriate, will be used to minimize exposure. Respirators will be maintained, and filters will be changed as necessary to assure they remain effective in protecting site personnel.

Fall protection is required at elevations of **6 ft. or greater**. Requirements for fall protection are listed in Section 4.2.7.

The SSO will ensure that each worker who is exposed to the hazards of flames (hot work) or electric arcs does not wear clothing that could increase the extent of injury. Flame retardant/resistant clothing will be designed and maintained in accordance with ASTM 1506 or NFPA 1975 requirements. Clothing made from the following types of fabrics, either alone or in blends, are prohibited: acetate, nylon, polyester, rayon. Proper inspection of PPE requires several steps depending upon specific type of PPE and its frequency of use. The different steps of inspection are as follows:

- Inspection and operational testing of equipment received from the factory or distributor.
- Inspection of equipment as it is issued to workers.
- Inspection before each use
- Inspection after use or training and prior to maintenance.
- Periodic inspection of stored equipment.
- Periodic inspection when a question arises concerning the appropriateness of the selected equipment, or when problems with similar equipment arise.
- Inspection for tears and punctures.

7 EMERGENCY ACTION PLAN & PROCEDURES

OSHA Emergency Action Plans (29 CFR 1910.38)

This section describes contingencies and emergency planning procedures to be implemented at the site. *Attachment 10* of this plan includes Emergency Action Plans for the project.

Directions to the hospital will be posted on site when this SSHASP is in effect.
Emergency procedures will be posted and covered in daily site briefings.

7.1 PRE-EMERGENCY PLANNING

The Site Superintendent will ensure that the appropriate lines of communications have been established with local hospitals, government agencies and other emergency response organizations prior to site activities. Site workers and visitors will be notified of the emergency response plan, communication systems, and evacuation routes during orientation.

7.2 PERSONNEL ROLES AND LINES OF AUTHORITY

The Site Superintendent and SSO have primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measure to ensure the safety of site personnel and the public. Possible actions may involve evacuation of adjacent personnel. Additionally, they are responsible for ensuring that corrective measures have been implemented, appropriate authorities notified, and follow up investigation reports completed. All incidents involving injury to site personnel (beyond first aid) or the public and significant property damage will be reported to CALDWELL MARINE management and Engineer in Charge within 8 hours of occurrence. Major incidents involving hospitalization or fatality will be reported immediately.

7.3 EMERGENCY CONTACTS & NOTIFICATION SYSTEMS

The following table provides names and telephone numbers for emergency contact personnel. It will be posted where the nearest phones are located. In the event of any emergency situation Emergency Services will be notified so the appropriate response personnel can be activated.

All incidents involving injury to site personnel (beyond first aid) or the public and significant property damage will be reported to CALDWELL MARINE management and Engineer in Charge within 8 hours of occurrence. Major incidents involving hospitalization or fatality will be reported immediately. Initial Incident Investigation reports will be completed within 24 hours.

Organization/ Responsibility	Contact	Telephone
Police		911
Fire		911
Hospital (see Attachment 4)	Attachment 4	Attachment 4
US Coast Guard	VHF-FM Channel 16 (15 .8 MHz), dial 911 Northern New England -Lake C mplain Emergency: (207) 767-0303 Sector New Y rk - Hudson River Emergency: (71	
(CALDWELL MARINE) Project Manager	See Page 9	See Page 9
(CALDWELL MARINE) Site Superintendent	See Page 9	See Page 9
(CALDWELL MARINE.) Site Safety Officer	See Page 9	See Page 9
Engineer in Charge	See Page 9	See Page 9

7.4 EMERGENCY EQUIPMENT & FACILITIES

The following emergency equipment will be available:

- First aid kit
- Fire extinguishers near areas of welding and torch burning; outside flammable liquid storage areas
- Portable eye wash near any areas of chemical use or splashing
- Mobile phone and/or two-way radio
- Oil absorbing spill pads and booms

Successful communications between personnel on site is essential. The following communications systems may be used to communicate in the event of an emergency.

. Two way radios H Channel (. H
(ther radio channels could be designated in the e ent o excess communication tra ic rom other users
. Air horns (see below)
. Cellular phone or hardwired phone

Air Horn Alerts

Signal	Definition
One long blast	Attention
Two long Blasts	Leave when possible
Three long Blasts	Leave area IMMEDIATELY (EMERGENCY Situation)
Repeated Short Blasts	Send Backup Support

Fire and Emergency Events

When a fire or emergency event is discovered:

Activate the nearest fire alarm (if installed) or sound the emergency signal on the project by **three long blasts** of the air horn.
Notify the local Fire Department by calling 9-1-1
Notify your Superintendent immediately.

Fight the fire ONLY if:

The Fire Department has been notified.
The fire is small and is not spreading to other areas.
Escaping the area is possible by backing up to the nearest exit.
The fire extinguisher is in working condition and personnel have been trained to use it.

Upon being notified about the emergency, site personnel must:

Leave the affected area using the designated evacuation routes. Assemble in the designated area established in advance. Remain outside the affected area until the Superintendent and or designated authority announces that it is safe to reenter. The Superintendent or foreman will account for all employees or subcontractors using the project's employee roster or attendance record to ensure all employees or subcontractors evacuated the area. In the event an employee is unaccounted for, the emergency response agency will be notified of the missing employee.

7.5 Directions to Hospital

A map with directions to the nearest hospital is displayed in *Attachment 4.* Copies of the

map will be posted in the site trailer. The SSO or designated alternative will drive the hospital route before field activities begin to verify that the route is acceptable and unobstructed by other construction activities.

7.6 First Aid and Medical Attention

Medical personnel will be made available for advice and consultation on matters of occupational health and provisions will be made prior to beginning the project for prompt medical attention in case of serious injury.

First aid supplies will be available at the project trailer and made available as needed. The contents of the first aid kit will be in a weatherproof container with individual sealed packages for each type of item, and will be checked before being sent out to the job site and at least weekly to ensure that the expended items are replaced.

A telephone for contacting necessary ambulance service will be provided.

A portable eye wash will be maintained in any area where employees or subcontractors may be exposed to corrosive materials or materials which could injure the eyes.

8 FIRE PROTECTION & PREVENTION

OSHA 1926 Subpart J - 1926.352 Fire Prevention

8.1 General Requirements

A fire protection program will be maintained throughout all phases of the project. Access to all available firefighting equipment will be maintained at all times and will be conspicuously located. All firefighting equipment will be periodically inspected and maintained in operating condition. Defective equipment will be immediately replaced.

A "No Smoking On-Site" policy is in effect on this site for all personnel. Failure to comply with this policy will result in action to assure that future non-conformances will not occur.

8.1.2 Fire Extinguishers

A fire extinguisher, rated not less than 10B, will be provided within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the jobsite. This requirement does not apply to the integral fuel tanks of motor vehicles. Travel distance from any point of the protected area to the nearest fire extinguisher will not exceed 100 feet and will be protected from freezing.

Portable fire extinguishers will be inspected periodically and maintained in accordance with *Maintenance and Use of Portable Fire Extinguishers*, NFPA No.

10 and OSHA 1926.150. Fire extinguishers which have been listed or approved by a nationally recognized testing laboratory (e.g., UL, FM Global), will be used.

The Site Superintendent or designee will conduct a visual inspection of fire extinguishers on at least a monthly basis.

8.1.3 Fire Alarm Devices

An alarm system, e.g., cell phone, will be established on the site so the local fire department can be alerted for an emergency. Site personnel will be alerted via 3 long blasts on an air horn. The alarm code and reporting instructions will be conspicuously posted at phones and at employee entrances.

8.1.4 Ignition Hazards

Electrical wiring and equipment for light, heat, or power purposes will be installed in compliance with the requirements of OSHA 1910.26, Subpart K, *Electrical*.

Internal combustion engine powered equipment will be located so that the exhausts are well away from combustible materials.

Smoking will be prohibited at or in the vicinity of operations which constitute a fire hazard, and will be conspicuously posted: "No Smoking or Open Flame."

Portable battery powered lighting equipment, used in connection with the storage, handling, or use of flammable gases or liquids, will be of the type approved for the hazardous location.

8.1.5 Open Yard Storage

Combustible materials will be kept stable and no higher than 20 feet. Method of piling will be solid wherever possible and in orderly and regular piles. No combustible material will be stored outdoors within 10 feet of a building or structure.

Driveways between and around combustible storage piles will be at least 15 feet wide and maintained free from accumulation of rubbish, equipment, or other articles or materials. Driveways will be so spaced that a maximum grid system unit of 50 feet by 150 feet is produced.

The entire storage site will be kept free from accumulation of unnecessary combustible materials. Weeds and grass will be kept down, and a regular procedure provided for the periodic cleanup of the entire area. When there is a

danger of an underground fire, that land will not be used for combustible or flammable storage.

Portable fire extinguishing equipment, suitable for the fire hazard involved, will be provided at convenient, conspicuously accessible locations in the yard area. Portable fire extinguishers, rated not less than 2A, will be placed so that maximum travel distance to the nearest unit will not exceed 100 feet.

8.2 Flammable and Combustible Liquids

8.2.1 General Requirements

Only approved containers and portable tanks will be used for storage and handling of flammable and combustible liquids. Approved metal safety (e.g., UL, FM Global) cans will be used for the handling and use of flammable liquids in quantities greater than one gallon, except that this will not apply to those flammable liquid materials which are highly viscid (extremely hard to pour), which may be used and handled in original shipping containers. For quantities of one gallon or less, only the original container or approved metal safety cans will

be used for storage, use, and handling of flammable liquids.

Flammable or combustible liquids will not be stored in areas used for exits, stairways, or normally used for the safe passage of people.

8.2.2 Storage Outside Buildings

Storage of containers (not more than 60 gallons each) will not exceed 1,100 gallons in any one pile or area. Piles or groups of containers will be separated by a 5-foot clearance. Piles or groups of containers will not be nearer than 20 feet to a building.

Within 200 feet of each pile of containers, there will be a 12-foot-wide access way to permit approach of fire control apparatus.

The storage area will be graded in a manner to divert possible spills away from buildings or other exposures, or will be surrounded by a curb or earth dike at least 12 inches high. When curbs or dikes are used, provisions will be made for draining off accumulations of ground or rainwater, or spills of flammable or combustible liquids. Drains will terminate at a safe location and will be accessible to operation under fire conditions.

Outdoor portable tank storage:

i. Portable tanks will not be nearer than 20 feet from any building. Two or more portable tanks, grouped together, having a combined capacity in excess of 2,200 gallons, will be separated by a 5-foot-clear area. Individual portable tanks exceeding 1,100 gallons will be separated by a 5-foot-clear area.
ii. Within 200 feet of each portable tank, there will be a 12-foot-wide access way to permit approach of fire control apparatus.

Storage areas will be kept free of weeds, debris, and other combustible material not necessary to the storage.

Portable tanks, not exceeding 660 gallons, will be provided with emergency venting and other devices, as required by chapters III and IV of NFPA 30-2018, *The Flammable and Combustible Liquids Code*.

Portable tanks, in excess of 660 gallons, will have emergency venting and other devices, as required by chapters II and III of *The Flammable and Combustible Liquids Code*, NFPA 30-2018.

At least one portable fire extinguisher having a rating of not less than 20-B units will be located not less than 25 feet, nor more than 75 feet, from any flammable liquid storage area located outside.

At least one portable fire extinguisher having a rating of not less than 20-B:C units will be provided on all tank trucks or other vehicles used for transporting and/or dispensing flammable or combustible liquids.

8.2.3 Dispensing Liquids

Areas in which flammable or combustible liquids are transferred at one time, in quantities greater than 5 gallons from one tank or container to another tank or container, will be separated from other operations by 25-feet distance or by construction having a fire resistance of at least 1 hour. Drainage or other means will be provided to control spills. Adequate natural or mechanical ventilation will be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.

Transfer of flammable liquids from one container to another will be done only when containers are electrically interconnected (bonded).

Flammable or combustible liquids will be drawn from or transferred into vessels, containers, or tanks within a building or outside only through a closed piping system, from safety cans, by means of a device drawing through the top, or from a container, or portable tanks, by gravity or pump, through an approved self-

closing valve. Transferring by means of air pressure on the container or portable tanks is prohibited.

The dispensing units will be protected against collision damage. Dispensing devices and nozzles for flammable liquids will be of an approved type.

8.2.4 Handling Liquids at Point of Final Use

Flammable liquids will be kept in closed containers when not actually in use.

Leakage or spillage of flammable or combustible liquids will be disposed of promptly and safely.

Flammable liquids may be used only where there are no open flames or other sources of ignition within 50 feet of the operation, unless conditions warrant greater clearance.

8.2.5 Service and Refueling Areas

Flammable or combustible liquids will be stored in approved closed containers, in tanks located underground, or in aboveground portable tanks.

The tank trucks will comply with the requirements covered in the *Standard for Tank Vehicles for Flammable and Combustible Liquids*, NFPA No. 385-2022.

The dispensing hose will be an approved type, and the dispensing nozzle will be an approved automatic-closing type without a latch-open device.

Clearly identified and easily accessible switch(es) will be provided at a location remote from dispensing devices to shut off the power to all dispensing devices in the event of an emergency.

Heating equipment of an approved type may be installed in the lubrication or service area where there is no dispensing or transferring of flammable liquids, provided the bottom of the heating unit is at least 18 inches above the floor and is protected from physical damage.

Heating equipment installed in lubrication or service areas, where flammable liquids are dispensed, will be of an approved type for garages, and will be installed at least 8 feet above the floor.

There will be no smoking or open flames in the areas used for fueling, servicing fuel systems for internal combustion engines, receiving or dispensing of flammable or combustible liquids. Conspicuous and legible signs prohibiting

smoking will be posted.

The motors of all equipment being fueled will be shut off during the fueling operation.

Each service or fueling area will be provided with at least one fire extinguisher having a rating of not less than 20-B:C located so that an extinguisher will be within 75 feet of each pump, dispenser, underground fill pipe opening, and lubrication or service area

9 SECURITY, ILLUMINATION and HOUSEKEEPING

OSHA General Duty Clause

9.1 ILLUMINATION

Site operations will cease in time to permit personnel to exit the work area and secure the site prior to dusk. Conversely, operations will not begin until lighting is adequate at dawn. If work schedules require work outside of these parameters then portable light plants sufficient to provide adequate lighting will be provided. (Headlights from vehicles and equipment generally do not provide sufficient illumination to conduct work safely.)

Construction areas, ramps, runways, corridors, offices, shops, and storage areas will be lighted to not less than the minimum illumination intensities listed in the Table below.

MINIMUM ILLUMINATION INTENSITIES IN FOOT-CANDLES

Foot-Candles	Area of Operation
5	General construction area lighting.
3	General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas.
5	Indoors: warehouses, corridors, hallways, and exit ways.
5	Tunnels, shafts, and general underground work areas: (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights will be acceptable for use in the tunnel heading)

10	General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active store rooms, mess halls, and indoor toilets and workrooms.)
30	First aid stations, infirmaries, and offices.

For areas or operations not covered above, refer to the American National Standard A11.1-1965, R1970, or latest edition, *Practice for Industrial Lighting*, for recommended values of illumination.

9.2 HOUSEKEEPING & SANITATION

To minimize potential accidents the site will be maintained in a generally clean condition. Waste materials will be disposed of in approved waste containers or roll-offs.

The site will be set up so as to be reasonably free from significant safety hazards. Wires and hoses will be positioned so they do not obstruct or present a safety hazard in walkways and evacuation routes.

An adequate supply of potable water will be provided. Portable containers used to dispense drinking water will be capable of being tightly closed, and equipped with a tap. Any container used to distribute drinking water will be clearly marked as to the nature of its contents and not used for any other purpose. Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups will be provided.

Toilets will be provided for employees or subcontractors according to the following table:

Number of employees or subcontractors	**Number of Toilets**
20 or less	1
20 or more	1 toilet seat and 1 urinal per 40 workers.
200 or more	1 toilet seat and 1 urinal per 50 workers.

Under temporary field conditions, provisions will be made to assure not less than one toilet facility is available. The requirements for sanitation facilities will not apply to mobile crews having transportation readily available to nearby toilet facilities. Washing facilities will be maintained in a sanitary condition with adequate soap or hand sanitizer.

10 INSPECTION PROGRAM

Work areas will be inspected on a periodic basis. The SSO or alternate will utilize a checklist when performing these inspections. Inspections will be performed at least weekly and kept available for inspection with the SSO records. A Construction Safety Inspection Checklist form is included in *Attachment 9.*

11 TRAFFIC CONTROL

Manual on Uniform Traffic Control Devices (MUTCD)

Protection of the public and site personnel working on roadways during this project are of the highest concern. Minimizing impacts to traffic is also a primary concern. Objectives for maintaining safety and reducing traffic concerns include:

1. Providing a high level of safety for workers, motorists, pedestrians, bicyclists and persons with disabilities in the highway work zone
2. Minimizing congestion and community impacts by maintaining acceptable levels of service as close as possible to preconstruction levels.
3. Providing a feasible design of highway traffic control during highway operations.
4. Providing contractors with access to the roadway that is adequate to complete the work efficiently while meeting the quality requirements of the contract.
5. Keeping the cost as low as possible, consistent with safety and an appropriate degree of convenience for the public.

11.1 Flagger Training

New York State Department of Transportation requires that all flaggers be adequately trained in flagging operations by recognized training programs, including the American Traffic Safety Services Association, the National Safety Council, unions, or construction industry associations, or by an individual who holds a current certification as a flagger training instructor from such a program. Prior to the start of flagging operations, CALDWELL MARINE or its subcontractors will provide to a list of certified flaggers to be used in the operation, identifying the source of flagger training for each individual. When requested, flaggers will demonstrate their competency in flagging procedures. Flaggers not competent in flagging procedures will be retrained or replaced at once.

12 MATERIAL HANDLING, STORAGE, USE AND WASTE DISPOSAL

EPA Land, Waste and Cleanup Topics

The following procedures provide a process for waste management planning and promote the development of more coherent and appropriate waste management. It is the responsibility of each individual on site to follow CALDWELL MARINE. policies and procedures for managing waste.

1. CALDWELL MARINE will estimate the waste that will be generated prior to work being performed so that the need for containers and waste removal can be determined. Trash and scrap materials will be considered waste.

2. Waste materials will be properly stored and handled to minimize the potential for a spill or impact to the environment. During outdoor activities, receptacles will be covered with a tarp to prevent dispersion of waste materials and to control the potential for run-off.

3. CALDWELL MARINE will properly segregate waste materials to ensure opportunities for reuse or recycling.

4. All site personnel will be instructed on the proper disposal method for wastes. This will include general instruction on disposal of non-hazardous wastes, trash, scrap materials, and waste oils. If wastes generated are classified as hazardous, employees or subcontractors will be trained to ensure proper disposal. This training will be conducted during the site orientation and conducted by the Site Superintendent or his designee.

5. Waste management planning will be continuously reviewed and revised to assure site safety and to meet regulatory requirements.

Section 8 of this SSHASP outlines storage and handling requirements for potentially flammable and combustible materials to prevent the possibility of fires.

General materials storage and disposal requirements for this project include the following:

1. All materials stored in tiers must be stacked, racked, blocked, interlocked or otherwise secured to prevent sliding, falling or collapse.
2. When a difference in road or working levels exist, means such as ramps, blocking or grading will be used to ensure safe movement of vehicles between two levels.
3. Non-compatible materials will be segregated in storage.
4. All bagged materials will be stacked by stepping back the layers and cross keying the bags at least every 10 bags high.
5. All used lumber will have all nails withdrawn before stacking.
6. All structural steel, poles, pipe, bar stock and other cylindrical materials, unless racked, will be stacked and blocked to prevent spreading or tilting.
7. All scrap lumber, waste materials and rubbish will be removed from the immediate work area, as the work progresses.

8. Disposal of waste material and debris by burning is forbidden.
9. Storage areas will be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion, or pest harborage. Vegetation control will be exercised when necessary.

The work area will be surrounded by a silt fence.

Specific procedures for handling of spoil piles, HDD cuttings, and Drilling Fluids are provided in the CALDWELL MARINE project Installation Manual.

Section 74 of CALDWELL MARINE's Corporate Health & Safety Manual (*Attachment 6)* provides detailed procedures for rigging and hoisting of materials. All such procedures will be closely adhered.

13 SIGNS, SIGNALS AND BARRICADES

OSHA Specifications for accident prevention signs and tags (29 CFR 1910.145)

Signs, signals, and barricades are important, if not critical, to the safety of the construction workers. Several important definitions are applicable to this subpart:

Barricade means an obstruction to deter the passage of persons or vehicles.

Signs are the warnings of hazard, temporarily or permanently affixed or placed, at locations where hazards exist.

Signals are moving signs, provided by workers, such as flagmen, or by devices, such as flashing lights, to warn of possible or existing hazards.

Tags are temporary signs, usually attached to a piece of equipment or part of a structure, to warn of existing or immediate hazards.

13.1 Accident Prevention Signs and Tags

13.1.1 General

Signs and symbols will be visible at times when work is being performed, and will be removed or covered promptly when the hazards no longer exist.

13.1.2 Danger Signs

Danger signs will be used only where an immediate hazard exists.

Danger signs will have red as the predominating color for the upper panel; black outline on the borders; and a white lower panel for additional sign wording (see accompanying figure).

13.1.3 Caution Signs

Caution signs will be used only to warn against potential hazards or to caution against unsafe practices.

Caution signs will have yellow as the predominating color; black upper panel and borders; yellow lettering of "caution" on the black panel; and the lower yellow panel for additional sign wording. Black lettering will be used for additional wording.

Standard color of the background will be yellow; and the panel, black with yellow letters. Any letters used against the yellow background will be black. The colors will be those of opaque glossy samples as specified in Table 1 of American National Standard ANSI Z53.1-1967 (see accompanying figure).

13.1.4 Exit Signs

Exit signs, when required, will be lettered in legible red letters, not less than 6 inches high, on a white field and the principal stroke of the letters will be at least three-fourths inch in width.

13.1.5 Safety Instruction Signs

Safety instruction signs, when used, will be white with green upper panel with white letters to convey the principal message. Any additional wording on the sign will be black letters on the white background (see accompanying figure).

13.1.6 Directional Signs

Directional signs, other than automotive traffic signs specified in the paragraph below, will be white with a black panel and a white directional symbol. Any additional wording on the sign will be black letters on the white background.

13.1.7 Traffic Signs

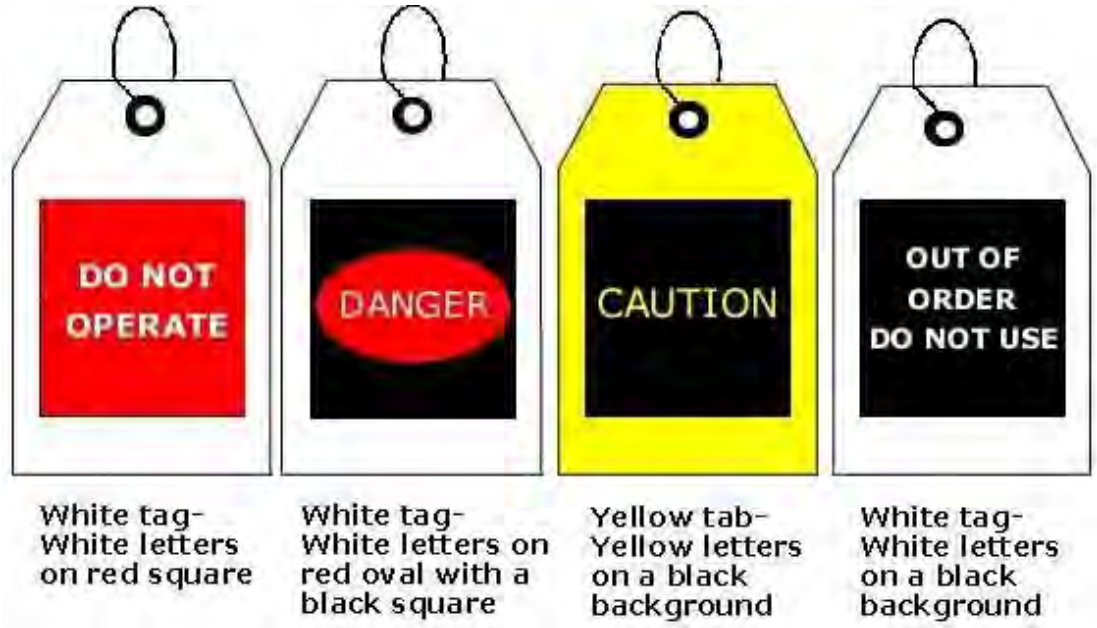
Construction areas will be posted with legible traffic signs at points of hazard.

All traffic control signs or devices used for protection of construction workers will conform to AASHTO MUTCD 2010 Edition, *Manual on Uniform Traffic Control Devices.*

13.1.8 Accident Prevention Tags

Accident prevention tags will be used as a temporary means of warning employees or subcontractors of an existing hazard, such as defective tools, equipment, etc. They will not be used in place of, or as a substitute for, accident prevention signs.

Specifications for accident prevention tags similar to those shown below will apply.



Basic Stock (Background)	Safety Colors (Ink)	Copy Specification (Letters)
White	Red	Do Not Operate
White	Black and Red	Danger
Yellow	Black	Caution
White	Black	Out of Order Do Not Use

13.1.9 Additional Rules

American National Standards Institute ANSI Z35.1-1968, *Specifications for Accident Prevention Signs*, and ANSI Z35.2-1968, *Specifications for Accident Prevention Tags*, contain rules which are additional to the rules prescribed in this section. The employer will comply with these ANSI standards with respect to rules not specifically prescribed in this subpart.

13.2 SIGNALING

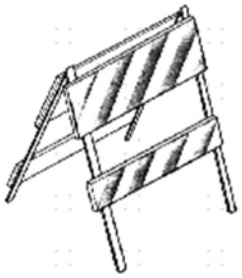
13.2.1 Flagmen

When operations are such that signs, signals, and barricades do not provide the necessary protection on or adjacent to a highway or street, flagmen or other appropriate traffic controls will be provided.

Signaling directions by flagmen will conform to AASHTO MUTCD 2010 Edition, *Manual on Uniform Traffic Control Devices.*

Hand signaling by flagmen will be by use of red flags at least 18 inches square or sign paddles, and in periods of darkness, red lights.

Flagmen will be provided with and will wear a red or orange warning garment while flagging. Warning garments worn at night will be of reflectorized material.



13.2.2 Crane and Hoist Signals

Regulations for crane and hoist signaling will be found in applicable American National Standards Institute standards and CALDWELL MARINE Safety Manual.

13.3 BARRICADES

Barricades for protection of employees or subcontractors will conform to AASHTO MUTCD 2010 Edition, *Manual on Uniform Traffic Control Devices,* portions relating to barricades. Pedestrian barricades will be of the type pictured below or equivalent.

Pedestrian Barricade

ATTACHMENT 1

Plan Acknowledgement & Revision Forms

ATTACHMENT 1

The following individuals acknowledge that they have read and understand this Site-Specific Health and Safety Plan:

Print Name	Signature	Company	Date

Site Specific Health & Safety Plan
Revision Form

Project Name: _____ **Project No.** _____

Amendment No. _____ **Date:** _____

Amendment Revises: Page:_____ **Section:** _____

Task(s) Amendment Affects*:

_____

_____

*(*Attach new/revised Job Safety Analyses*)

Reason For Amendment:

_____

_____

_____

_____

Amendment:
(Attach separate sheet(s) as necessary)

_____

_____

_____

_____

_____

_____

_____

_____

_____

Completed by: _____ **Approved by:** _____

_____ _____

ATTACHMENT 2

JOB SAFET ANALYSES

JOB SAFETY ANALYSIS FOR HANDING DRILL STEM – LOAD/UNLOAD				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Loading/Unloading HDD Drill Stem	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects	Hard hats, safety glasses, hearing protection, cut resistant/work gloves, safety shoes/boots; high visible vest for all tasks in this JSA	
	Strains/Sprains Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment to move large, awkward loads	Cut Resistant or Leather gloves	
	High Noise Levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) • Assess noise level with sound level meter if possibility exists that level may exceed 85dBA 8 HR TWA	Hearing Protection	
	Slips, Trips, Falls	• Clear walkways, work areas of equipment, vegetation, excavated material, tools, and debris • Mark, identify, or barricade other obstructions		
	Caught In/ Between Moving Parts	• Identify and understand parts of equipment which may cause crushing, pinching, rotating or similar injuries • Assure guards are in place to protect from these parts of equipment during operation • Provide and wear proper work gloves when the possibility of crush, pinch, or other injury may be caused by moving/stationary edges or objects • Maintain all equipment in a safe condition • Keep all guards in place during use • De-energize and lock-out machinery before maintenance or service		
Powered Industrial	Struck	• Personnel will know transport route and how		

JOB SAFETY ANALYSIS FOR HANDING DRILL STEM – LOAD/UNLOAD				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Trucks (for lifting materials)	By/Struck Against Overhead Hazards	equipment will be transported prior to the move; the pathway will be made clear of any obstacles. • Trained/certified personnel will operate the forklift. Training verfication will be on site and a copy or certification will be available. • Forklifts will be inspected by the operator prior to use and transport of equipment. • Slings and shackles will be adequately rated for lifting and transporting materials and equipment • Rigging equipment (i.e. slings,schackles, etc..) will be inspected prior to and during use by the compentent person. • Loads will be slightly lifted off the ground to test rigging & detect any shift before lifting load. • Spotters/Flaggers will be utilized when equipment is transported. Spotter will observe for any overhead hazards when transporting equipment. • Areas where forklifts will be in operation will be free from excess materials and a clear path will be in place. • Personnel will stay clear of forklift during transport. ~		

JOB SAFETY ANALYSIS FOR CONFINED SPACE ENTRY – FRAK TANK/BARGE				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Confined Space Entry	Slips, Trips, Falls	• Clear walkways, work areas of equipment, vegetation, excavated material, tools, and debris around space • Mark, identify, or barricade other obstructions • Evaluate fall hazards above 4 ft.; use fall protection equipment (harness/lanyard), standard guardrails or other fall protection systems when working on elevated platforms above 6 ft. • Use 'heavy duty industrial' (type IA) fiber glass ladders • Secure straight/extension ladders	Hard hats, safety glasses, hearing protection, work gloves, safety shoe/boots; high visible vest (applies to all tasks for this JSA unless otherwise noted)	
	Fire/ Explosion	• Eliminate sources of ignition from the work area • Prohibit smoking • Provide ABC (or equivalent) fire extinguishers in all work, flammable storage areas and with fuel powered generators and compressors • Store flammable liquids in well ventilated areas • Prohibit storage, transfer of flammable liquids in plastic containers • Post "NO SMOKING" signs • Store combustible materials away from flammables • Store all compressed gas cylinders upright, caps in place when not in use • Separate Flammables and Oxidizers by 20 feet minimum	Portable fire extinguisher	LEL/O_2 Meter
	Flammable, Toxic, Oxygen deficient Atmospheres	• Test confined space atmosphere for flammable/toxic vapors, and oxygen deficiency • Obtain Confined Space Entry Permit signed by Supervisor/Safety Officer • De-energize, lock-out and tag all energized equipment • Establish rescue plan and resources • Review emergency procedures before work commences • Review hazardous properties of possible contaminants with entrants and attendant	Portable ABC fire extinguisher	LEL/O_2/CO/ H2S meter

JOB SAFETY ANALYSIS FOR CONFINED SPACE ENTRY – FRAK TANK/BARGE				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		• Provide attendant outside space • Wear proper level of PPE for the type of atmospheric contaminants • Use body harness, safety belt with tripod winch for possible rescue		
	Inhalation and Contact with Hazardous Substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of possible contaminants with workers before operations begin • Monitor breathing zone air to determine levels of contaminants	Tyvek coveralls, nitrile gloves, latex or neoprene boots (see Section 5.0 HASP)	LEL/O_2/CO/ H2S meter
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all hand and power tools in a safe condition • Keep guards in place during use	Leather or cut resistant gloves	
	High/Low Ambient Temperature	• Monitor for Heat/Cold stress • Provide fluids to prevent worker dehydration • Follow work/rest schedule in the safety plan	Insulated Clothing (subject to ambient temperature)	Meteorological Equipment

JOB SAFETY ANALYSIS FOR CRANES / HOISTING / RIGGING ACTIVITIES				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Rigging Activities	Overhead Utilities	• Identify all utilities around the site before work commences • Utility clearance shall conform with 29 CFR 1926.955 Guard or de-energize electrical sources before crane operations begin	Hard hats, safety glasses, hearing protection, work gloves, safety shoe/boots; high visible vest for all tasks in this JSA	
	Rigging Equipment	• Identify the proper rigging equipment for the type of lift • Inspect rigging devices to verify slings, chains, straps are free from defects and rated for the lift weight • Prohibit use of equipment with missing documentation tags, or defective equipment • Ensure tag-lines are free of knots and defects • Review rigging techniques, positioning of load, tag lines with workers involved in rigging activities • Use qualified riggers. Training verification will be kept onsite. • Loads will be slightly lifted off the ground to test rigging & detect any shift before lifting load.	Cut Resistant or Leather gloves	
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects	Cut Resistant or Leather gloves	
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	Cut Resistant or Leather gloves	
Hoisting and Lifting Crane Operation Inspections		• Verify the crane annual inspection and maintenance log • Perform required daily crane inspections, of wire ropes sheaves, drums, rigging hardware and attachments	Cut Resistant or Leather gloves	

JOB SAFETY ANALYSIS FOR CRANES / HOISTING / RIGGING ACTIVITIES				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		• Perform daily inspection of mechanical, hydraulic operations crane • Use manufacture's inspection checklist		
Hoisting and Lifting Pre-lift Meeting		• Hold mandatory pre-lift meeting and complete lift worksheet • Determine if the lift is a critical lift • Assign lift or critical lift supervisor and a signaler for the lift • Calculate lift / load capacities using crane operations manuals and load capacity charts • Review lift hand signals with operator, signaler, supervisor, and work crew		
Crane Operation	Struck By/ Against Heavy Equipment	• Wear reflective warning vests when exposed to vehicular traffic • Isolate crane swing areas • Make eye contact with operators before approaching equipment • Prohibit all personnel from work activities in the blind swing areas of the crane • Test lift objects if center of gravity or similar critical factors are uncertain • Never lift any object if weights are unknown • Never stand under a suspended load	Warning vests, hard hat, safety glasses; safety shoes/boots	
Tag Lines	Cut/Lacerations	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by tag lines • Prohibit looping / winding tag lines around hands or body • Prohibit positioning, moving load using tag lines	Cut Resistant or Leather gloves	
	High Noise Levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) • Assess noise level with sound level meter if possibility exists that level may exceed 85dBA 8 HR	Hearing Protection	

JOB SAFETY ANALYSIS FOR CRANES / HOISTING / RIGGING ACTIVITIES				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		TWA		
	Slips, Trips, Falls	• Clear walkways, work areas of equipment, vegetation, excavated material, tools, and debris • Mark, identify, or barricade other obstructions		
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	Cut Resistant or Leather gloves	
	Struck By/Struck Against Overhead Hazards	• Provide detailed lift plans along with this JHA; lift plan will contain a cut sheet of the crane being used, copy of annual inspections, copy of current crane operator license, weights of loads, and percentage of crane capcity being used during the lift) prior to crane coming on site. • The weight of lifts will not exceed 75% of the crane's capacity. • Spill kit will accompany crane while on site. • Barricade swing radius using caution tape and safety cones. • Complete Safe Work Permits (e.g., Crane Lift) • Use certified crane operators. • Use qualified and competent persons to conduct all assembly/disassembly of crane components. • Place poly boards under crane outriggers. • Outriggers fully extended. • Inspect each crane prior to use by the operator. • Use a qualified signal person for all lifts. Training verification will be onsite. • Restrict location of boom so that it is not within 20 ft of overhead lines.		

JOB SAFETY ANALYSIS FOR CRANES / HOISTING / RIGGING ACTIVITIES				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		• Use two-way radios for communication during each lift. • Stay clear of load. Nobody shall place any part of their body under a suspended load. • Use tag lines to control loads. • Suspend the lift if wind exceeds 25 MPH or at first sign of lightening		

JOB SAFETY ANALYSIS FOR DIVING OPERATIONS		
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**
Diving Operations	Drowning Respiratory and circulatory problems; lack of air Decompression sickness (DCS, the "bends") Nitrogen narcosis Hypothermia	• Follow all requirements in OSHA's Commercial Diving standards (29 CFR Part 1910, Subpart T) • Perform a site-specific risk assessment with the involvement of the diving crew before each dive. • Each dive team member will have the experience or training necessary to perform assigned tasks in a safe and healthful manner. Divers will be medically qualified. • All dive team members will be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent). A properly stocked First Aid kit and AED will be immediately available. Emergency and rescue plans will be available before each dive. • Have appropriate breathing air gas mixtures. Routine periodical inspection nand testing of cylinders. Analysis of oxygen fraction of gas before use, particularly if cylinder has been stored for a long time. Periodic air quality testing of compressors. • Divers must follow strict decompression procedures. • A DPIC will be at the dive location in charge of all aspects of the diving operation. • Diving with two (2) divers in the water requires a minimum of four (4) dive team members as follows: designated person-in-charge (DPIC), a standby diver, and two (2) divers • Two (2) divers must be in continuous visual contact of each other or connected by a buddy line. The two (2) divers do not require a tending line to the surface unless they are required to work against a current exceeding one (1) knot. • When required or deemed necessary, one (1) tending line to the surface is sufficient when the two (2) divers are connected by a buddy line.. • The standby diver can be the DPIC provided that he/she is a qualified diver, and that the fourth dive team member is trained and capable of performing all necessary functions of the DPIC while the DPIC is in the water as the standby diver. • The standby diver can also be the tender provided that he/she is a qualified diver; in this case the DPIC would assume tending duties when the standby diver is in the water. • De-energize, lockout, tagout all equipment being serviced or repaired. Equipment Specific LOTO procedure and A Safe Work Permit will be used.

JOB SAFETY ANALYSIS FOR EXCAVATION LOADER/MUD PIT/SAETY FENCE				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Excavation/Mud Pit/Safety Fence/Backfilling	Underground/ Overhead Utilities	• Identify all utilities around the site before work begins • Cease work immediately if unknown utility markers are uncovered • Use manual excavation within 2 feet of known utilities • Utility clearance shall conform with 29 CFR 1926.955 (high voltage >700 kv) 15 feet phase to ground clearance; 31 feet phase to phase clearance	Hard hats, safety glasses, hearing protection, work gloves, safety shoe/boots; high visible vest (applies to all tasks for this JSA unless otherwise noted)	
	Excavation Wall Collapse	• Construct diversion ditches or dikes to prevent surface water from entering excavation • Provide good drainage of area adjacent to excavation • Collect ground water/rainwater from excavation and dispose of properly • Store excavated material at least 2 feet from the edge of the excavation; prevent excessive loading of the excavation face • Provide sufficient stairs, ladders, or ramps when workers enter excavations over 4 feet in depth • Place ladders no more than 25 feet apart laterally • Treat excavations over 4 feet deep as potential confined spaces if located in area of potential contaminants • Monitor atmosphere for flammable/toxic vapors, and oxygen deficiency if contamination possible • Slope, bench, shore, or sheet excavations over 5 feet deep if worker entry is required • Assign a competent person to inspect, decide soil classification, proper sloping, correct shoring, or sheeting • Inspect excavations (when personnel entry is required) daily, whenever conditions change		LEL/O2 meter (if potential contaminants)

JOB SAFETY ANALYSIS FOR EXCAVATION LOADER/MUD PIT/SAETY FENCE				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
	Struck By/ Against Heavy Equipment	• Wear reflective warning vests when exposed to vehicular traffic • Isolate equipment swing areas		
		• Make eye contact with operators before approaching equipment • Understand and review hand signals		
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads		
	Slips, Trips, Falls	• Clear walkways, work areas of equipment, vegetation, excavated material, tools, and debris • Mark, identify, or barricade other obstructions • Use heavy duty industrial (type IA) ladders • Secure straignt/extension ladders		
	Caught In/ Between Moving Parts	• Identify and understand parts of equipment which may cause crushing, pinching, rotating or similar injuries • Assure guards are in place to protect from these parts of equipment during operation • Provide and use proper work gloves when the possibility of crush, pinch, or other injury may be caused by moving/stationary edges or objects • Maintain all equipment in a safe condition • Keep all guards in place during use • De-energize and lock-out machinery before maintenance or service		
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all hand and power tools in a safe condition • Keep guards in place during use	Cut resistant gloves	

JOB SAFETY ANALYSIS FOR EXCAVATION LOADER/MUD PIT/SAETY FENCE				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
	High Noise Levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) • Assess noise level with sound level meter if possibility exists that level may exceed 85dBA 8 HrTWA	Ear plugs	Sound Level Meter
	High/Low Ambient Temperature	• Monitor for Heat/Cold stress in accordance with Safety Plan • Provide fluids to prevent worker dehydration • Follow work/rest schedule in Safety Plan	Insulated Clothing (subject to ambient temperature)	Meteorological Equipment or Weather App

JOB SAFETY ANALYSIS FOR RECEIVING EQUIPMENT/MATERIALS				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Rigging Activities	Overhead Utilities	• Identify all utilities around the site before work commences • Utility clearance shall conform with 29 CFR 1926.955 Guard or de-energize electrical sources before crane operations begin	Hard hats, safety glasses, hearing protection, work gloves, safety shoe/boots; high visible vest (for all tasks in this JSA; additional PPE noted as need)	
	Rigging Equipment	• Identify the proper rigging equipment for the type of lift • Inspect rigging devices to verify slings, chains, straps are free from defects and rated for the lift weight • Prohibit use of equipment with missing documentation tags, or defective equipment • Ensure tag-lines are free of knots and defects • Review rigging techniques, positioning of load, tag lines with workers involved in rigging activities • Use qualified riggers. Training verification will be kept onsite. • Loads will be slightly lifted off the ground to test rigging & detect any shift before lifting load.	Cut Resistant or Leather gloves	
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects	Cut Resistant or Leather gloves	
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	Cut Resistant or Leather gloves	
Crane Operation	Struck By/ Against Heavy Equipment	• Wear reflective warning vests when exposed to vehicular traffic • Isolate crane swing areas • Make eye contact with operators before approaching equipment		

JOB SAFETY ANALYSIS FOR RECEIVING EQUIPMENT/MATERIALS				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		• Prohibit all personnel from work activities in the blind swing areas of the crane • Test lift objects if center of gravity or similar critical factors are uncertain • Never lift any object if weights are unknown • Never stand under a suspended load		
	Cut/Lacerations	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by tag lines • Prohibit looping / winding tag lines around hands or body • Prohibit positioning, moving load using tag lines	Cut Resistant or Leather gloves	
	High Noise Levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) • Assess noise level with sound level meter if possibility exists that level may exceed 85dBA 8 HR TWA	Hearing Protection	
	Slips, Trips, Falls	• Clear walkways, work areas of equipment, vegetation, excavated material, tools, and debris • Mark, identify, or barricade other obstructions		
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	Cut Resistant or Leather gloves	
	Struck By/Struck Against Overhead Hazards	• Provide detailed lift plans along with this JHA; lift plan will contain a cut sheet of the crane being used, copy of annual inspections, copy of current crane operator license, weights of loads, and percentage of crane capcity being used during the lift) prior to crane coming on site.		

JOB SAFETY ANALYSIS FOR RECEIVING EQUIPMENT/MATERIALS				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		• The weight of lifts will not exceed 75% of the crane's capacity. • Spill kit will accompany crane while on site. • Barricade swing radius using caution tape and safety cones. • Complete Safe Work Permits (e.g., Crane Lift) • Use certified crane operators. • Use qualified and competent persons to conduct all assembly/disassembly of crane components. • Place poly boards under crane outriggers. • Outriggers fully extended. • Inspect each crane prior to use by the operator. • Use a qualified signal person for all lifts. Training verification will be onsite. • Restrict location of boom so that it is not within 20 ft of overhead lines. • Use two-way radios for communication during each lift. • Stay clear of load. Nobody shall place any part of their body under a suspended load. • Use tag lines to control loads. • Suspend the lift if wind exceeds 25 MPH or at first sign of lightening		
Forklift Operation	Struck By/Struck Against Overhead Hazards	• Personnel will know transport route and how equipment will be transported prior to the move; the pathway will be made clear of any obstacles. • Trained/certified personnel will operate the forklift. Training verfication will be on site and a copy or certification will be available. • Forklifts will be inspected by the operator prior to use and transport of equipment. • Slings and shackles will be adequately rated for lifting and transporting materials and equipment		

JOB SAFETY ANALYSIS FOR RECEIVING EQUIPMENT/MATERIALS				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		• Rigging equipment (i.e. slings,schackles, etc..) will be inspected prior to and during use by the compentent person. • Loads will be slightly lifted off the ground to test rigging & detect any shift before lifting load. • Spotters/Flaggers will be utilized when equipment is transported. Spotter will observe for any overhead hazards when transporting equipment. • Areas where forklifts will be in operation will be free from excess materials and a clear path will be in place. • Personnel will stay clear of forklift during transport.		

JOB SAFETY ANALYSIS FOR SITE PREP/MARK OUTS/GRADING/SILT FENCE		
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**
Site preparation, mark outs, grading, silt fence	Struck by/ Against Heavy Equipment & Materials, Vehicular Traffic	• Wear hard hat, safety glasses, safety shoes, work gloves, high visibility vest, hearing protection • Isolate equipment swing areas • Make eye contact with operators before approaching equipment • Understand and review hand signals for signaling operators
	Slips, Trips, Falls	• Clear walkways and work areas of equipment, tools, debris, vegetation and other materials • Mark, identify, or barricade other obstructions
	Handling Heavy Objects	• Plan movement of materials to take shortest route • Use mechanical lifting equipment (e.g., backhoe/loader; trucks) to move large, awkward loads • Observe proper lifting techniques • Obey sensible lifting limits (e.g., 60 lb. per person for manual lifting)
	Underground/ Overhead Utilities	• Identify all utilities around the site before work commences • Cease work immediately if unknown utility markers are uncovered • Use manual excavation within 2 feet of known utilities • Utility clearance shall conform with 29 CFR 1926.955
	Excavation Hazards	• Follow all excavation/trenching safety practices if excavation is over 4 feet deep. • Store excavated material at least 2 feet from the edge of the excavation; prevent excessive loading of the excavation face • Assign a competent person to inspect, decide soil classification, proper sloping, the correct shoring, or sheeting • Inspect excavations (when personnel entry is required) daily, any time conditions change
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all hand and power tools in a safe condition • Keep guards in place during use of power tools

JOB SAFETY ANALYSIS FOR CHAIN SAW/CHOP SAW		
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**
Survey work area/objects to be cut	• Slip, Trip & Fall • Struck by vehicles and other mobile equipment	• Wear hard hat, safety glasses, safety shoes, work gloves, high visibility vest • Walk cautiously and observe pathway. Walk around, step over or clear pathway of obstacles, defects, and obstructions. • Identify objects to be cut and proper saw for the task
Check and fill fluid levels in saw; inspect saw for damages and leaks	• Splash or spilling of gas/oil mixture • Saw could stall-out while cutting causing a kick-back when re-started in cut • Fire could occur if fuel mixture leaked	• Wear hard hat, safety glasses, safety shoes, work gloves, high visibility vest • Replace and close fluid tank caps on both saw and supply containers after use • Maintain fluid level and right mixture (in accordance with manufacturer specification) to avoid stalling-out during the cut • Do not use saw if leak is detected. Take saw out of service and have repaired before re-using
Check cutting blade/chain for proper type, wear/tear & wear pattern, installed properly for direction of rotation and secured	• Cuts/Lacerations	• Wear hard hat, safety glasses, safety shoes, high visibility vest • Wear gloves if handling blade/chain to inspect it • Make sure blade is straight and tight and correct for type of material being cut. Check manufacturer's requirements for type of blade to use • Check blade/chain for defects; know what to look for to determine if defective; check manufacturer's manual; replace blade/wheel/chain when defects are detected
Ensure blade guard is properly in place	• Struck by particles of metal and other debris • Cuts/Lacerations	• Adjust guard so that rear section is flush with the work piece and spatter and sparks from object being cut will be led away from the user • Never remove or pin back guards during operation
Start-up saw	• Cuts/Laceration - Lose control of saw	• Wear hard hat, safety glasses, safety shoes, high visibility vest; hearing protection • Wear chain saw chaps when operating chain saw • Place saw on firm ground, ensure blade/wheel/chain is clear

JOB SAFETY ANALYSIS FOR CHAIN SAW/CHOP SAW		
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**
		of obstructions. Secure saw with hand using firm grip on front handle and placing foot on base handle (if saw equipped with base handle).
Cutting operation	• Strain, sprain • Struck by debris • Cuts/lacerations and other injuries from saw kickback/flying debris • Hearing loss • Carbon Monoxide exposure	• Avoid bending at the waist by squatting, using a wide stance, and/or using support by resting arm on knee. Face forward to avoid twisting. Keep the work close to avoid reaching. • Wear safety hard hat, safety shoes, safety glasses or goggles, and a face shield. Keep body away from path of sparks • Let the saw do the work • Support object being cut to prevent it from moving and pinching the blade • Review the saw manual for proper cutting technique • Never start to cut with the upper quadrant (12 o'clock to 3 o'clock position) of the blade (kickback zone) • Hold the machine with firm grip using 2 hands and stand off to side of saw while cutting • Keep good balance and firm foothold • Always cut at maximum speed • Stand at comfortable distance from the work piece • Never cut above shoulder height • Be alert to movement of the object which could cause the cut to close and pinch the blade • To prevent kickback avoid removing blade and re-entering to make cut • Do not wear any loose clothing, jewelry or other articles which could become entangled in the saw • Wear hearing protection (plugs or muffs) • Only use gas powered saw in a well ventilated area to avoid overexposure to carbon monoxide. Use mechanical ventilation (blowers), in poorly ventilated areas.

JOB SAFETY ANALYSIS FOR WELDING/BURNING/CUTTING				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Welding, cutting, burning	Fire or Explosion Struck by/Against	• Complete Hot work permit. • Conduct air monitoring if in any area with flammable/combustible materils. • Do not weld near flammable material. Move flammables at least 35 feet away or protect them withflame-proof covers. • Do not weld on drums, tanks, or any closed containers unless a qualified person has tested it and declared it or prepared it to be safe. • Store acetylene and oxygen cylinders at least 20 feet apart when stored; or five foot high fire barrier when on cart together • Keep valve caps in place when not in use/stored. Do not lift cylinders by valve caps.	Hard hats, safety glasses, hearing protection, work gloves, safety shoes/boots; high visible vest (applies to all tasks for this JSA; additional PPE as noted)	LEL/O2 meter
	Inhalation of fumes	• Use enough forced ventilation or local exhaust at the arc to remove fumes from breathing area. • Use welding helmet that has fresh air supply. • Keep your head out of the fumes and do not breathe fumes.	Welding helmet; respirator if fumes are not controlled	
	Sparks could burn eyes, hands, clothes	• Wear welder's cap, eye protection, face shield, gloves, apron • If welding outside with breeze, use wind break and line of sight barrier to protect passers-by.	Leather/flame resistant gloves	
	Eye burns	• Use welding helmet with correct shade of filter.	Welding helmet	

JOB SAFETY ANALYSIS FOR WELDING/BURNING/CUTTING				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		• Use welding curtain to shield other employees and visitors from arc rays.		

JOB SAFETY ANALYSIS FOR RIGGING UP DRILL/EQUIPMENT HANDLING/HOSE MANAGEMENT				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Rigging Activities	Overhead Utilities	• Identify all utilities around the site before work commences • Utility clearance shall conform with 29 CFR 1926.955 Guard or de-energize electrical sources before crane operations begin	Hard hats, safety glasses, hearing protection, work gloves, safety shoe/boots; high visible vest for all tasks in this JSA; additional PPE as noted	
	Rigging Equipment	• Identify the proper rigging equipment for the type of lift • Inspect rigging devices to verify slings, chains, straps are free from defects and rated for the lift weight • Prohibit use of equipment with missing documentation tags, or defective equipment • Ensure tag-lines are free of knots and defects • Review rigging techniques, positioning of load, tag lines with workers involved in rigging activities • Use qualified riggers. Training verification will be kept onsite. • Loads will be slightly lifted off the ground to test rigging & detect any shift before lifting load.	Cut Resistant or Leather gloves	
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects	Cut Resistant or Leather gloves	
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	Cut Resistant or Leather gloves	
Hoisting and Lifting, Crane Operation Inspections		• Verify the crane annual inspection and maintenance log • Perform required daily crane inspections, of wire ropes sheaves, drums, rigging hardware and attachments	Cut Resistant or Leather gloves	

JOB SAFETY ANALYSIS FOR RIGGING UP DRILL/EQUIPMENT HANDLING/HOSE MANAGEMENT				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		• Perform daily inspection of mechanical, hydraulic operations crane • Use manufacture's inspection checklist		
Hoisting and Lifting Pre-lift Meeting		• Hold mandatory pre-lift meeting and complete lift worksheet • Determine if the lift is a critical lift • Assign lift or critical lift supervisor and a signaler for the lift • Calculate lift / load capacities using crane operations manuals and load capacity charts • Review lift hand signals with operator, signaler, supervisor, and work crew		
Crane Operation	Struck By/ Against Heavy Equipment	• Wear reflective warning vests when exposed to vehicular traffic • Isolate crane swing areas • Make eye contact with operators before approaching equipment • Prohibit all personnel from work activities in the blind swing areas of the crane • Test lift objects if center of gravity or similar critical factors are uncertain • Never lift any object if weights are unknown • Never stand under a suspended load		
Tag Lines	Cut/Lacerations	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by tag lines • Prohibit looping / winding tag lines around hands or body • Prohibit positioning, moving load using tag lines	Cut Resistant or Leather gloves	
	High Noise Levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) • Assess noise level with sound level meter if possibility exists that level may exceed 85dBA 8 HR	Hearing Protection	

JOB SAFETY ANALYSIS FOR RIGGING UP DRILL/EQUIPMENT HANDLING/HOSE MANAGEMENT				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		TWA		
	Slips, Trips, Falls	• Clear walkways, work areas of equipment, vegetation, excavated material, tools, and debris • Mark, identify, or barricade other obstructions		
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	Cut Resistant or Leather gloves	
	Struck By/Struck Against Overhead Hazards	• Provide detailed lift plans along with this JHA; lift plan will contain a cut sheet of the crane being used, copy of annual inspections, copy of current crane operator license, weights of loads, and percentage of crane capcity being used during the lift) prior to crane coming on site. • The weight of lifts will not exceed 75% of the crane's capacity. • Spill kit will accompany crane while on site. • Barricade swing radius using caution tape and safety cones. • Complete Safe Work Permits (e.g., Crane Lift) • Use certified crane operators. • Use qualified and competent persons to conduct all assembly/disassembly of crane components. • Place poly boards under crane outriggers. • Outriggers fully extended. • Inspect each crane prior to use by the operator. • Use a qualified signal person for all lifts. Training verification will be onsite. • Restrict location of boom so that it is not within 20 ft of overhead lines.		

JOB SAFETY ANALYSIS FOR RIGGING UP DRILL/EQUIPMENT HANDLING/HOSE MANAGEMENT				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		• Use two-way radios for communication during each lift. • Stay clear of load. Nobody shall place any part of their body under a suspended load. • Use tag lines to control loads. • Suspend the lift if wind exceeds 25 MPH or at first sign of lightening		
Equipment Handling, Hose Management	Struck by/ Against Heavy Equipment & Materials Vehicular Traffic	• Isolate equipment swing areas • Make eye contact with operators before approaching equipment • Understand and review hand signals for signaling operators		
	Slips, Trips, Falls	• Clear walkways and work areas of equipment, tools, debris, vegetation and other materials • Mark, identify, or barricade other obstructions		
	Falls from Elevated Heights	• Use standard guardrails when working on elevated platforms or PFAS (harness/lanyard); anchorage points for fall arrest systems must support each worker. • Use heavy duty industrial (type IA) ladders; tie-off all straight/extension ladders. • Install/inspect scaffolds according to manufacturer's requirements. • Train operators using aerial lifts		
	Handling Heavy Objects	• Plan movement of materials to take shortest route • Use mechanical lifting equipment (e.g., backhoe/loader; trucks) to move large, awkward loads • Observe proper lifting techniques • Obey sensible lifting limits (e.g., 60 lb. per person for manual lifting)		
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects	Cut Resistant or Leather Work Gloves	

JOB SAFETY ANALYSIS FOR RIGGING UP DRILL/EQUIPMENT HANDLING/HOSE MANAGEMENT				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
		• Maintain all hand and power tools in a safe condition • Keep guards in place during use of power tools		
	High Noise Levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) • Assess noise level with sound level meter if possibility exists that level may exceed 85dBA 8 HR TWA		

ATTACHMENT 3

Safety Data Sheets

(Added as Brought to the Project)

ATTACHMENT 4

Directions to Hospital

(See Emergency Action Plans – Attachment 10)

ATTACHMENT 5

Incident Investigation Report

INJURY REPORT – FORM # 1

(Completed by Investigating Supervisor)

Report Only ☐

Complete Within 8 Hours or Before End of Shift
email to: safety@jaginc.co

Investigation #	
Work Comp#	

Location: _____

Date of Incident:	**Time of Incident:** ☐ AM ☐ PM
Date Reported:	**Shift:** ☐ 1 ☐ 2 ☐ 3 ☐ OTHER
Location of Incident:	**Length of Shift:** ☐ 8 ☐ 10 ☐ 12 ☐ OTHER

Type of Incident: ☐ Injury ☐ Illness ☐ Near Miss ☐ Other: _____

Incident Description:

PERSON INVOLVED

1. **Name of Person involved:**
2. **Employment Status:** ☐ Employee ☐ Sub-Contractor ☐ General Public
3. **Date of Hire/Assignment:**
4. **Job Title/Craft/Position:**
5. **Department:**
6. **Manager/Supervisor:**
7. **Gender:** ☐ Male ☐ Female
8. **How long in Current Position:** Yrs. Months
9. **List the possible witnesses of the incident – Attach witness statement (Form #2):** ☐ ☐
10. **Photographs taken** ☐ Yes ☐ No **(PICTURE MUST BE TAKEN WHENEVER POSSIBLE)**
11. **Is the employee involved employed anywhere other than Prestige Industries?** ☐ Yes ☐ No
    If yes, where and what does s/he do?
12. **What day of the week did the incident occur?** ☐ M ☐ Tu ☐ W ☐ Th ☐ F ☐ Sa ☐ Su
13. **What consecutive day of the employee's work week was it?** ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7
14. **Was the employee working overtime at the time of the incident?** ☐ Yes ☐ No
15. **Was the employee doing their regularly assigned/scheduled job duties?** ☐ Yes ☐ No
    If "NO", then please explain

NOTE: Multiple Injuries – If more than one person is injured in an incident, a separate incident form will need to be completed for each person. Keep all the information for these incidents together and submit as one package.

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INJURY / ILLNESS

1. What type of injury / illness occurred?

☐ Abrasion ☐ Amputation ☐ Bruise ☐ Concussion ☐ Dislocation
☐ Fracture ☐ Foreign Body ☐ Laceration ☐ Sprain/Strain ☐ Loss of Consciousness
☐ Other:

2. To what part (s) of the body? ☐ Right ☐ Left ☐ Both

☐ Right ☐ Left ☐ Both

3. What was the initial type of treatment was provided? ☐ First Aid ☐ Medical Clinic ☐ Hospital
☐ None - Not Needed or Requested at Time of Incident

Name and Location of treating facility: _____

4. Was the injury/illness reported in a timely manner? ☐ Yes ☐ No

If not, why?

5. Onset of condition ☐ Gradual ☐ Sudden

6. Has the employee experienced a similar injury, pain, or discomfort previously?

☐ Yes ☐ No ☐ Unknown

If "Yes" explain

7. Did the incident result in a lost time accident? ☐ Yes ☐ No ☐ Unknown

If Yes, what was the date of the last day worked?

8. Has the person to been assigned light duty or job transfer? ☐ Yes ☐ No ☐ Unknown

9. When the employee was sent for post incident drug & alcohol test? ☐ Yes ☐ No

Supervisor (print):	Signature:	Date:
Time of this Report: ☐ AM ☐ PM		

INCIDENT INVESTIGATION FORM REPORTING PROCEDURES

FORM(s) TO COMPLETE	BY WHOM	BY WHEN
Incident Report– Form # 1	Investigating Supervisor	Within 8 hour or End of shift
Incident Statement –Form # 2	Person Involved in Incident	Within 24 hours
Incident Investigation-Form #3	Witness / Description - Extension for Form 1 or 2	Within 24 hours

SCAN and SEND FORMS VIA EMAIL TO: Safety@jaginc.co

Call EH&S Director ASAP with Details of the Incident - Lucky Abernathy at (908) 433-3755

NOTE: Initial report within 8hrs and a complete report with Incident Statement(s) within 24hrs

INCIDENT STATEMENT – FORM# 2

Complete within 24 email to: Safety@jaginc.co

STATEMENT FORM

Company: _____ **email to: Safetey@jaginc.co**

Statement By:	☐ Person/Employee Involved ☐ Employee Witness ☐ Manager/Supervisor ☐ Witness ☐ Contractor ☐ Temporary ☐ Visitor
Name:	**Date of Incident:** ***Time of Incident:***

STATEMENT

Print Name:	**Signature:**	**Date:**
Supervisors Review:	**Date:**	

INCIDENT INVESTIGATION FORM # 3

(Completed by Investigating Supervisor)

Complete within 24 Hours or before end of shift
email to: Safety@jaginc.co

Investigation #

Company: _____ **Work Comp#**

Date of Incident: **Time of Incident:** ☐ AM ☐ PM

Type of Incident: ☐ Injury ☐ Illness ☐ Property Damage ☐ Other:
☐ Fire ☐ Near Miss ☐ Equipment Damage

Incident Description: _____

PERSON INVOLVED

1. **Name of Person(s) involved**
2. **Employment Status** ☐ Employee ☐ Temporary ☐ Sub-Contractor ☐ Visitor
4. **Job Title/Position**
5. **Department**
6. **Manager/Supervisor**

ROOT CAUSE ANALYSIS

1. **What unsafe acts and or conditions contributed to the incident?**

☐ Failure to Lockout/tagout ☐ Not wearing PPE ☐ Defective tool / equipment
☐ Lack of training or knowledge ☐ Wearing unsafe clothing ☐ Willful disregard of safety policy
☐ Improper guarding ☐ Inattentiveness / distraction ☐ Failed to recognize hazard
☐ Poor housekeeping ☐ Over exertion / pushing / pulling ☐ Other:

Other – please explain:

2. **What is the root causes(s) of the incident?**
(Please list or describe) _____

3. **Did the person(s) involved violate a Company safety rule/regulation?** ☐ **Yes** ☐ **No**

If so, which one and describe? _____

Name: **DOI:**

EQUIPMENT / MATERIAL ANALYSIS N/A ☐

1. **Was the equipment/machine/tool involved suited for the purpose?** ☐ **Yes** ☐ **No**

If No, please explain

2. **Was the equipment/machine/tool involved in good condition?** ☐ **Yes** ☐ **No**

If No, please explain

3. **Were the safeguards in place?** ☐ **Yes** ☐ **No**

If No, please explain

ENVIRONMENT ☐ ☐ N/A

1. **Was the area where the incident occurred well lit?** **Yes** **No**

☐ ☐

If No, please explain

2. **Walking/Working Surface:** ☐ Slippery ☐ Wet ☐ Dry ☐ Level ☐ Not level ☐ Cracked ☐ N/A

Other:

CORRECTIVE ACTIONS N/A

1.

2.

3.

Supervisor (print)		**Signature**		**Date**	

INCIDENT INVESTIGATION FORM REPORTING PROCEDURES		
FORM(s) TO COMPLETE	**BY WHOM**	**BY WHEN**
1. Incident Report	Investigating Supervisor	Within 8 hour or end of shift
2. Incident Statement	Person involved in incident	Within 24 hours
3. Incident Statement	Witness or description extension for Form 1 or 2	Within 24 hours

SCAN and SEND FORMS VIA EMAIL TO: Safety@jaginc.co

NOTE: Initial report within – 8hrs and a complete report with Incident Statement(s) within 24hr.

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FIRST AID LOG – FORM # 4 Week of / /

Submit to Safety@jaginc.co Monthly

THIS FIRST AID LOG IS TO BE COMPLETED FOR ANY INJURY REPORTED TO A SUPERVISOR OR ANY FIRST-AID TREATEMENT PROVODED BY THE SUPERVISOR

Employee Name: *Jose Nunes* **Date:** *11/11/11* **Time:** *10:30* **X AM** ☐ **PM**

Type of Injury: *Cut right hand* **Description of Injury:** *Jose was opening a can with a screwdriver and cut his hand. The palm of his had was cut about ½" across*

Treatment Given: *Cleaned the cut and put on a band-aid. Told Jose to check in with me in the morning.*

Person Treating: *John Smith*

1) Employee Name: _____ **Date:** _____ **Time:** _____ ☐ **AM** ☐ **PM**

Type of Injury: _____ **Description of Injury:** _____

Treatment Given: _____

Person Treating:

2) Employee Name: _____ **Date:** _____ **Time:** _____ ☐ **AM** ☐ **PM**

Type of Injury: _____ **Description of Injury:** _____

Treatment Given: _____

Person Treating:

3) Employee Name: _____ **Date:** _____ **Time:** _____ ☐ **AM** ☐ **PM**

Type of Injury: _____ **Description of Injury:** _____

Treatment Given:

Person Treating:

4) Employee Name: _____ **Date:** _____ **Time:** _____ ☐ **AM** ☐ **PM**

Type of Injury: _____ **Description of Injury:** _____

Treatment Given:

Person Treating:

5) Employee Name: **Date:** **Time:** ☐ **AM** ☐ **PM**

Type of Injury: _____ **Description of Injury:** _____

Treatment Given:

Person Treating:

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EQUIP/GL INCIDENT REPORT # 5

Complete Within 8 hours or before the End of Shift
email to: Safety@jaginc.co

Report Only	☐
Investigation #	

Company:		**Vehicle # :**
Date of Incident:	**Time of Incident:**	☐ AM ☐ PM
Date Reported:		**Shift:** ☐ 1 ☐ 2 ☐ 3 ☐ OTHER
Incident Location:		**Length of Shift:** ☐ 8 ☐ 10 ☐ 12 ☐ OTHER
City:	**State:**	

What day of the week did the incident occur : ☐ Mon ☐ Tue ☐ Wed ☐ Thur ☐ Fri ☐ Sat ☐ Sun

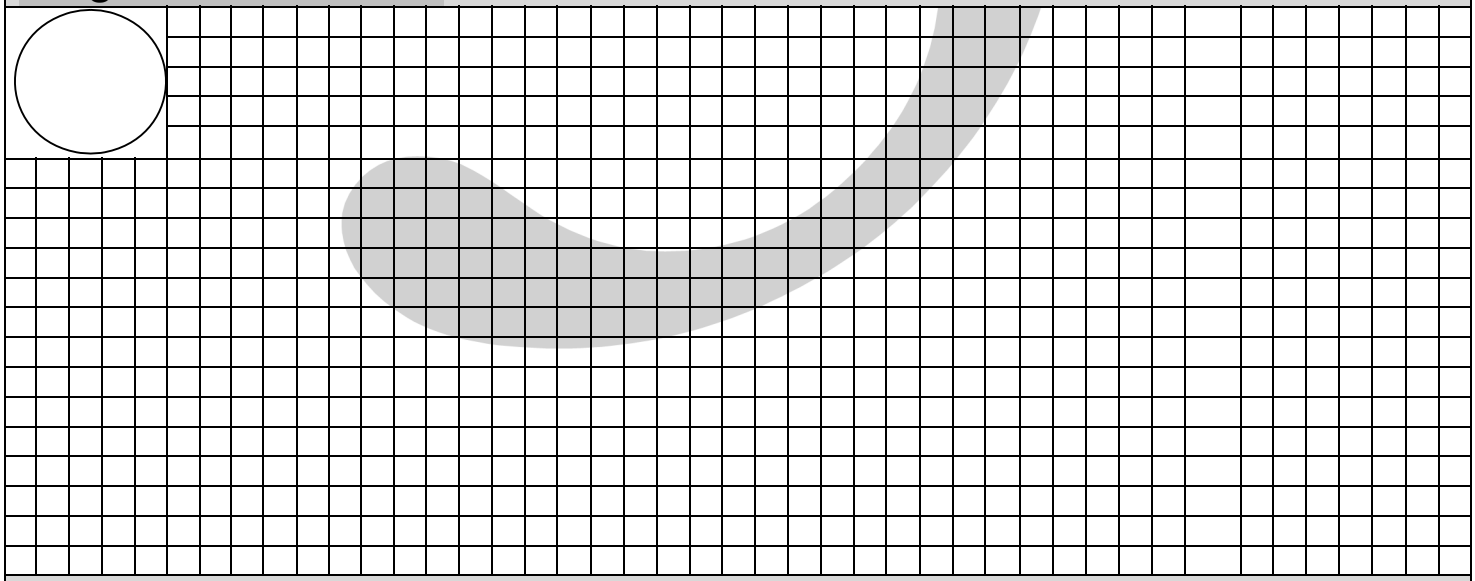
Type of Incident: ☐ Motor Vehicle Accident ☐ Equipment Damage ☐ Property Damage ☐ Theft ☐ Fire ☐ Near Miss ☐ Unsafe Condition ☐ Other:

Incident Description:

Accident / Incident Description

Driver/Operator Name:	**How long in Current Position:** Yrs. months
Employment Status: ☐ Employee ☐ Temporary ☐ Contractor ☐ Owner Operator	
Any Injuries: ☐ Yes ☐ No * ☐ Fatality If so, Who:	**Was anyone removed from the scene by ambulance?** * ☐ Yes ☐ No If so, Who:
Was any vehicle towed: * ☐ Yes ☐ No	**Which vehicle:** ☐ Yours ☐ Other driver ☐ Both
Was a police report made: ☐ Yes ☐ No	**Report # :** **Was Driver ticketed:** * ☐ Yes ☐ No
Other Driver's Insurance Information	**: Name:** **Insurance:** **Unavailable:** ☐
Other Vehicle Make:	**Model:** **Ins. Carrier :** **Policy #**
List the possible witnesses of the incident:	**1)** **2)** **3)**
Photographs taken: ☐ Yes ☐ No **(PICTURES MUST BE TAKEN!!!!)**	**If not, why:**

Diagram of Incident :



Provide a drawing of the roadway configuration and all vehicles or objects that were invoilved in the incident.

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Accident / Incident Description - Continued

Incident Occurred during:	☐ Loading ☐ Unloading ☐ In route (driving) ☐ Backing up ☐ Moving Forward ☐ Excessive Speed ☐ Unexpected Movement ☐ Unsafe Operation ☐ Turning ☐ Other :
Vehicle Type:	☐ Forklift ____Ton ☐ Tractor ☐ Trailer ☐ Straight Truck (26,000 or below) ☐ Auto ☐ Other
Weather Conditions:	☐ Clear ☐ Rain ☐ Snow ☐ Wind ☐ N/A (In-side) ☐ Sun Glare ☐ Other
Road Conditions:	☐ Dry ☐ Wet ☐ Snow covered ☐ Icy ☐ Dark ☐ Other
Damage to:	☐ Tire/wheels ☐ Cab ☐ Body _____(Location) ☐ R ☐ L ☐ Windshield ☐ N/A ☐ Drive Train ☐ Frame/Suspension ☐ Bumper - ☐ Front ☐ Rear ☐ Other

Note: If the DOT driver received a ticket or answered yes to two (2) or more of the questions above with an asterisk (*) by it, then the driver must report for a Post-Accident Drug/ Alcohol Testing directly!!!

When was the Post Incident Drug & Alcohol Test done:

DOT D & A Test: ☐	NON- DOT D & A Test: ☐	If a test was not performed, Why?
Date:	Time: ☐ AM ☐ PM	Location: State:

Reminders for the Drivers:

☐ Completer drivers report of accident
☐ Protect the vehicle and cargo
☐ Set warning devices and move to A Safe location
☐ Discuss the incident with ONLY proper authorities
☐ Obtain information i.e. Other vehicle info/witness names and numbers etc.
☐ Pictures, Pictures, Pictures

Driver/Operator (print):	**Signature:**	**Date:**
Supervisor (print):	**Signature:**	**Date:**

INCIDENT INVESTIGATION FORM REPORTING PROCEDURES		
FORM(s) TO COMPLETE	**BY WHOM**	**BY WHEN**
Equipment Incident Report– Form # 5	Investigating Supervisor	Within 8 hour or End of shift
Incident Report – Form # 1	Supervisor (If Employee Injury Involved)	Within 8 hour or End of shift
Incident Statement –Form # 2	Person involved in incident	Within 24 hours
Incident Investigation-Form #3	Witness / Description extension for Parts 1 or 2	Within 24 hours

SCAN and SEND FORMS VIA EMAIL TO: Safety@jaginc.co

NOTE: Initial report within 8hrs/end of shift and a complete report with Incident Statement(s) etc. within 24hrs.

Attachment 6

CALDWELL MARINE
Corporate Health & Safety Policies and Procedures Manual

(Incorporated by Reference)

Attachment 7

Confined Space Entry Forms

Caldwell
Marine International

CONFINED SPACE ENTRY PERMIT

LOCATION and DESCRIPTION of Confined Space:

PURPOSE of Entry:

DEPARTMENT:

SUPERVISOR:

Permit Type: **Specific Entry** **Duration of Job** **Annual** **Special/Hot Work**

Hazards: **O_2** **Flammability** **Toxic Chemical (specify)-**
Other (specify)-

KEY PERSONEL (Initialed by Individual)

Authorized Entrants	Attendant(s)	Rescue Personnel
	1st -	
	2nd -	

ENTRY CHECKLIST

Item	YES	N/A	Item	YES	N/A
Lockout - De-energize/electrical			Lifelines		
Lockout - Mechanical/valves			Fire Extinguisher(s)		
Purge - Flush and Vent			Rescue Personnel Available		
Positive Ventilation			Lighting		
Secure Area, Barriers in Place			Protective Clothing		
Emergency SCBA at Site			Oxygen Meter		
Escape Harness			Combustible Gas Meter		
Tripod Emergency Escape Unit			Chemical Detector		

Special Precautions & Equipment:

Air Monitoring

Test Parameter	Permitted Condition	Perform Test		Initial Results	2	3	4	5
		YES	NO		Time	Time	Time	Time
% Oxygen	19.5 - 23%							
% of LEL	< 10 %							
% of CO	< 25 %							
Hydrogen Sulfide	< 10 %							

[QUALIFIED PERSON] has verified that all of the above conditions have been satisfied and authorizes work to proceed as specified:

Name: _____ **Title:** _____ **Date:** _____

Attachment 8

Hot Work Permit

HOT WORK PERMIT

Date: _____ Time: _____

Location: _____

Issued To: _____

Site Safety Officer (if applicable): _____

Supervisor: _____

Do not cut or use open-flame or spark producing equipment until the following precautions have been taken.

Protective Equipment to be used: _____

Fire Watch Assigned: _____

(Initial Each Of The Following)

_____ The location where the work is to be done has been personally examined.

_____ Any available fire protection systems are in service.

_____ There are no flammable dusts, vapors, liquids or unpurged tanks (empty) in the area.

_____ Explosive meter reading <10%. 1st Reading: _____ 2nd Reading: _____ Additional readings: _____

_____ All combustibles have been moved away from the operation, or otherwise protected with fire curtains or equivalent.

_____ Ample portable fire extinguishing equipment has been provided.

_____ Arrangements have been made to patrol the area for at least 30 minutes after the work has been completed.

_____ The phone number for the local Fire Department is: _____

NOTE: This form is to be filled out in its entirety by the responsible person performing the "HOT WORK". It must be approved by the Health and Safety Officer and the client prior to beginning the project.
This permit expires 24 hours after the designated "start time." If work is to continue another permit must be issued.

Company:	Date:
Responsible Person:	Start Time:
Work to be performed:	End Time:
Location (area, room, etc.):	Equipment:
Is it possible to perform this work in the shop? Yes No	Other:

Place a checkmark if the following items have been completed.

Flame or spark-producing equipment to be used has been inspected and found in good repair.	
Sprinklers, where provided, are in commission and will not be taken out of service while this work is being done.	
There are no combustible fibers, dusts, vapors, gases, or liquids in the area. Tanks and equipment previously containing such materials have been purged. The absence of gases or vapors has been verified by a combustible gas detection instrument. If there is a possibility of a leak developing in nearby piping, equipment, or tanks, this area is to be continuously monitored. Call Site Safety if assistance is needed to test area at (specify phone #):_____	
Fire alarms will not be taken out of service while work is being performed. If alarm system must be inactivated during work, then client will be contacted prior to taking alarm out of service so that a suitable "Fire Watch" can be coordinated. *Under no circumstances will fire alarms be taken out of service without contacting client.*	
The work will be confined to the area or equipment specified on this permit.	
Surrounding floors have been swept clean and, if combustible, wet down.	
Contractor has ample portable fire extinguishers available and trained personnel to use them.	
All combustibles have been relocated 35 feet from the operation and the remainder protected with metal guards or flame-proofed curtains or covers (not ordinary tarpaulins).	
All floor and wall openings within 35 feet of the operations have been tightly covered.	
Responsible personnel have been assigned to provide a "Fire Watch" for dangerous sparks in the work area, as well as on floors above and below while work is being performed.	
Arrangements have been made to provide a "Fire Watch" to patrol the area, including floors above and below, during any lunch or rest period and for at least one-half hour after the work has been completed.	

I attest that the above precautions have been taken:	
Name of Person Responsible for performing Hot Work:	
Site HSO Approval (name):	
Date:	

Attachment 9

Safety Inspection Form

Inspected By: _____ Date: _____

Worksite Information	Yes	No	N/A
Posting of OSHA and other work-site warning posters?			
First aid equipment properly stocked?			
Work site injury records being kept?			
Emergency telephone numbers conspicuously posted?			
Emergency Information (evacuation, muster points, etc.) posted?			
Safety Meetings conducted periodically? When was last meeting?			

Describe violation, location, and corrective actions taken:

_____

_____

_____

Housekeeping and Sanitation	Yes	No	N/A
Are emergency lights fully operational?			
Regular disposal of waste and trash?			
Passageways and walkways clear?			
Waste containers provided and used?			
Sanitary facilities adequate and clean?			
Adequate supply of water?			
Adequate lighting?			
Trash receptacle for drinking cups?			
Are handrails and stair treads in good repair?			
Is smoking restricted to certain locations?			
Are electrical cords and plugs in good condition?			
Is a clearance of 3’ maintained around hot water heaters, electric breaker panels, heating units, and fire sprinkler riser?			
Are electric circuit breakers free of obstructions?			
General neatness of working areas:			

Describe violation, location, and corrective actions taken:

_____

_____

_____

Fire Prevention	Yes	No	N/A
Fire instruction to personnel?			
Fire extinguishers identified, accessible, and fully charged?			
"No Smoking" signs posted and enforced where needed?			
Good housekeeping?			
Storage use and handling of flammable liquids properly done?			
Fire hazards checked?			
Is gasoline contained only in UL listed containers?			

Describe violation, location, and corrective actions taken:

_____

_____

_____

Handling and Storage of Materials	Yes	No	N/A
Are materials properly stored and stacked?			
Are passageways clear?			
Shelves in stockrooms in good repair and properly anchored.			
Stacks on firm footing, not too high?			
Are employees lifting loads correctly?			
Are materials protected from weather conditions?			
Flammable liquids not stored in areas used for exits or stairways?			

Describe violation, location, and corrective actions taken:

_____

_____

_____

Hand Tools	Yes	No	N/A
Proper tool being used for each job?			
Neat storage, safe carrying?			
Inspection and maintenance?			
Electric tools are grounded?			

Describe violation, location, and corrective actions taken:

_____

_____

_____

Personal Protective Equipment	Yes	No	N/A
Eye protection?			
Respirators and mask?			
Helmets, hoods, head protection?			
Gloves, aprons, sleeves?			
Hearing protection?			
Safety harnesses and lifelines?			
Shirts are to be worn?			
Back support belts?			

Describe violation, location, and corrective actions taken:

_____

_____

_____

Hazardous Materials	Yes	No	N/A
Is a binder containing SDS for supplies containing hazardous chemicals available to employees before using?			
Are "Safety Data Sheets" are available on request signs posted in conspicuous locations?			
Is the hazardous waste inventory log maintained?			
Are hazardous waste storage areas inspected weekly?			
Is the hazardous material dispositioning log maintained?			
All containers clearly identified?			
Proper storage practices observed?			
Proper storage temperatures and protection?			
Proper type and number of extinguishers nearby?			
Are there any visible dust or fumes that could be of a concern?			

Describe violation, location, and corrective actions taken:

_____

_____

_____

Unsafe acts and/or practices observed:

_____

_____

_____

Site Supervisor_____Date: _____

Safety Inspector _____Date: _____

Attachment 10
Emergency Action Plans

JOB EMERGENCY ACTION PLAN

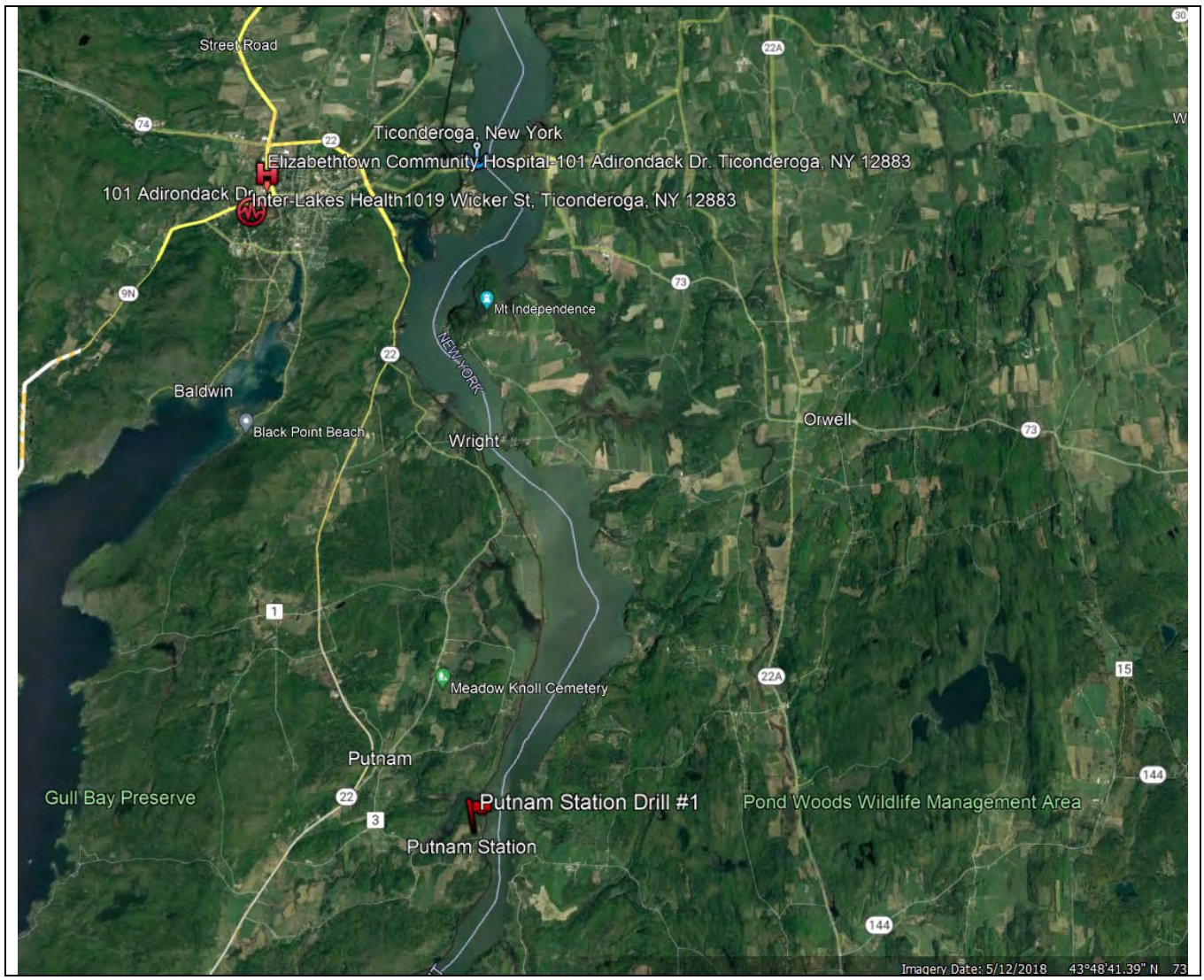
JOBSITE DETAILS			
Date: 07/12/22	**Project Owner:** CHPE, LLC	**Contractor:** CMI/ECI	
Project Name: CHPE HDD			**Job No:** 1229
Project Address: Putnam Station Drill #1 - 523 Co Rd 3 100 Alpha Blvd Catskill, NY 12414			
PM: Thomas Ulisse	**Cell:** 732 620 3470	**Supt:** Brett Bryant	**Cell:** 732 620 4214

EMERGENCY CALLING INFORMATION – 911 (*Local numbers are required, even if 911 is used.*)		
Department	***Name***	***Telephone Number***
POLICE	**Putnam Valley Sheriff's Department**	**845 225 4300/911**
FIRE DEPARTMENT	**Putnam Volunteer Fire Dept.**	**518 547 9982/911**
FIRST AID / NON-EMERGENCY	**Rockland Urgent Care**	**845 429 4000**
HOSPITAL / EMERGENCY	**Montefiore Nyack Hospital**	**845 348 2000**
POISON CONTROL	**NY Poison Control**	**800 222 1222**
SPILL RESONSE	**Clean Harbors**	**800 645 8265**
OSHA	**** Corporate Safety Director will Initiate Any/All Contact with OSHA****	
DIVE HOSPITAL	**Jacobi Medical Center 234 East 149th St. Bronx, NY**	**718 579 5000**
Other:		

OWNER / CONTRACTOR CALLING INFORMATION		
Role	***Name- Address***	***Telephone***
OWNER: CHPE, LLC		
OWNER'S ENGINEER:		
GENERAL CONTRACTOR: NKT INC.	**Fredrik Hallsten**	**919-836-3522**
SUBCONTRACTOR: ECI DRILLING, LLC	**John Langford**	**(936) 5224-0852**
SITE SAFETY REPRESENTATIVE:	**Lucky Abernathy**	**(908) 433-3755**

JOB EMERGENCY ACTION PLAN

EVACUATION POINT(s)



JOB EMERGENCY ACTION PLAN

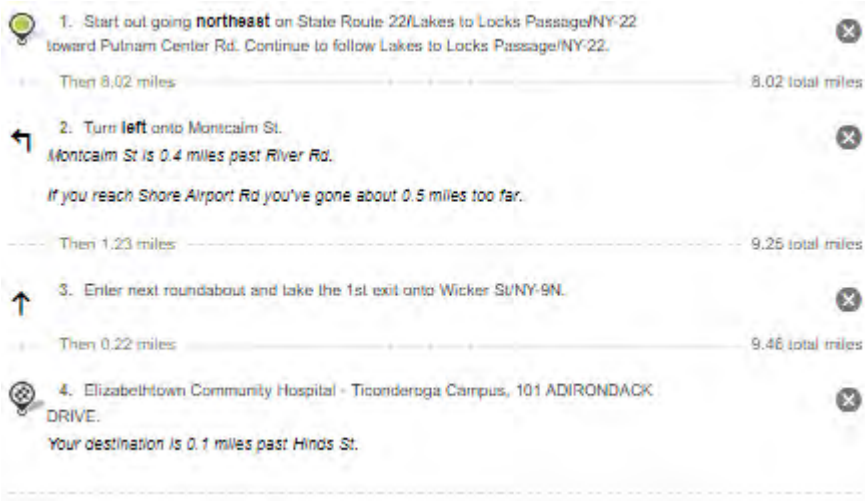
HOSPITAL - Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance beyond first aid should obtain immediate attention at the address provided herein:

Transport to the nearest Emergency Room

Elizabethtown Community Hospital
101 Adirondack Dr.
Ticonderoga, NY 12883
845-348-2000



After emergency care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

JOB EMERGENCY ACTION PLAN

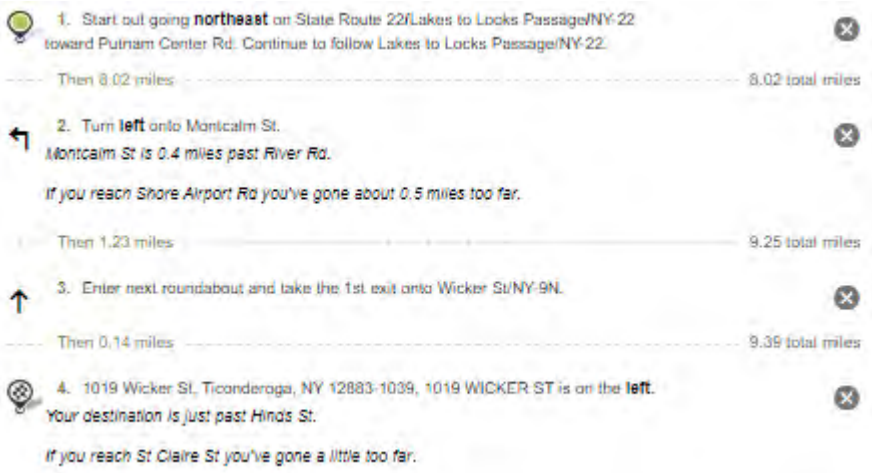
OC DOCTOR – Non Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance above and beyond first aid should obtain immediate attention at the address provided herein:

Transport to the Occupational Medical Provider

Inter-Lakes Health
1019 Wicker St,
Ticonderoga, NY 12883
845-429-4000



After medical care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

JOB EMERGENCY ACTION PLAN

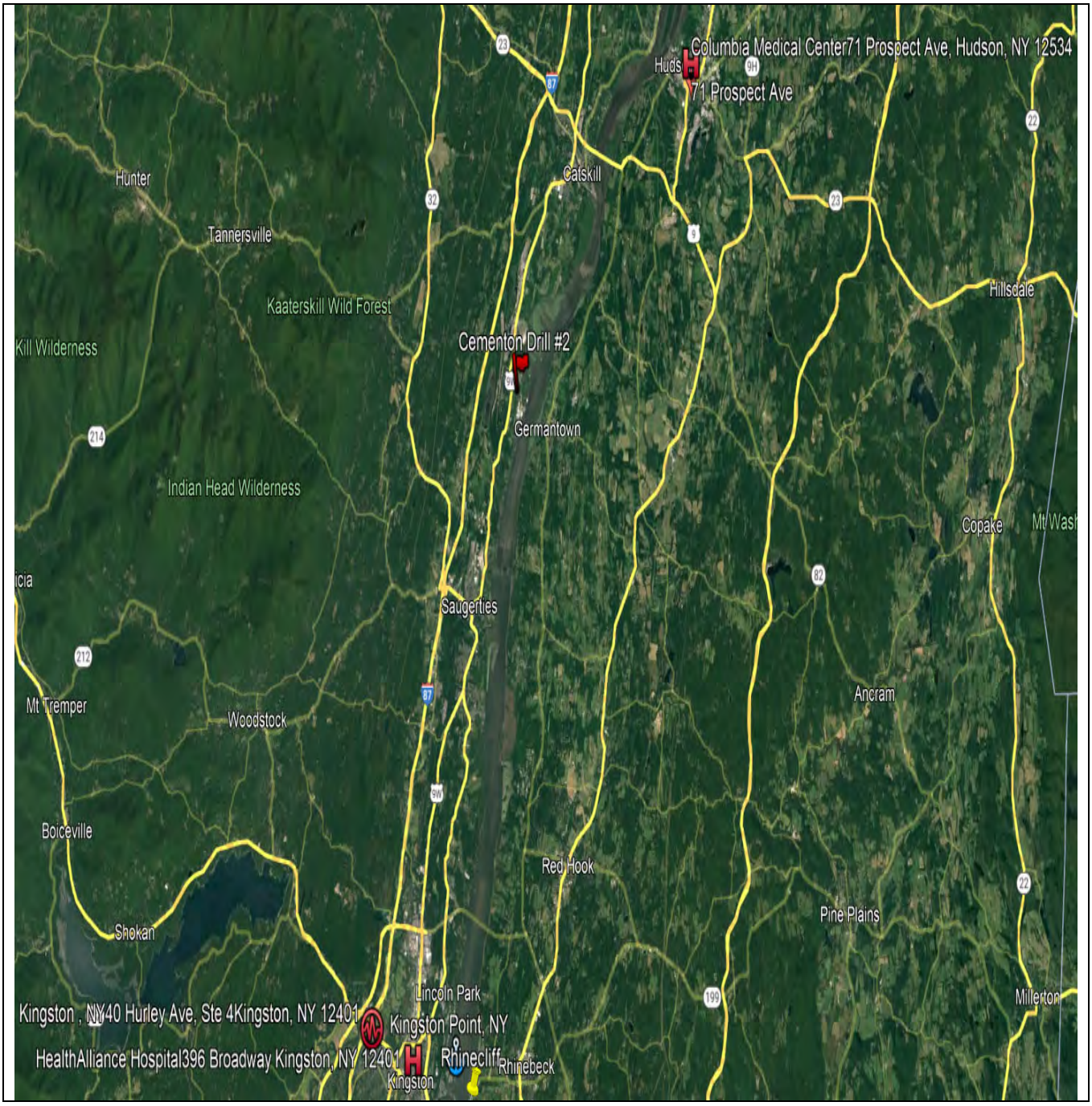
JOBSITE DETAILS			
Date: 07/12/22	**Project Owner:** CHPE, LLC	**Contractor:** CMI/ECI	
Project Name: CHPE HDD			**Job No:** 1229
Project Address: Cementon Drill #2- 523 Co Rd 3 Putnam Station, NY 12861			
PM: Thomas Ulisse	**Cell:** 732 620 3470	**Supt:** Brett Bryant	**Cell:** 732 620 4214

EMERGENCY CALLING INFORMATION – 911 (*Lcal numbers are required, even if 911 is used.*)		
Department	***Name***	***Telephone Number***
POLICE	**Catskill Village Police**	**518 943 2244/911**
FIRE DEPARTMENT	**Malden West Camp Station**	**845 246 3287/911**
FIRST AID/ NON-EMERGENCY	**Emergency One-Kingston, NY**	**845 331 3131**
HOSPITAL / EMERGENCY	**COLUMBIA MEMORIAL HEALTH**	**518 828 760171**
POISON CONTROL	**NY Poison Control**	**800 222 1222**
SPILL RESONSE	**Clean Harbors**	**800 645 8265**
OSHA	**** Corporate Safety Director will Initiate Any/All Contact with OSHA****	
DIVE HOSPITAL	**Jacobi Medical Center 234 East 149th St. Bronx, NY**	**1-718-579-5000**
Other:		

OWNER / CONTRACTOR CALLING INFORMATION		
Role	***Name- Address***	***Telephone***
OWNER: CHPE,LLC		
OWNER'S ENGINEER:		
GENERAL CONTRACTOR: NKT INC.	**Fredrik Hallsten**	**919-836-3522**
SUBCONTRACTOR: ECI DRILLING, LLC	**John Langford**	**(936) 5224-0852**
SITE SAFETY REPRESENTATIVE:	**Lucky Abernathy**	**(908) 433-3755**

JOB EMERGENCY ACTION PLAN

EVACUATION POINT(s)



JOB EMERGENCY ACTION PLAN

HOSPITAL - Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance beyond first aid should obtain immediate attention at the address provided herein:

Transport to the nearest Emergency Room

Prospect Ave
Hudson, NY 12534
818 828 7601

1. Start out going **north** toward Lehigh Rd.
Then 0.42 miles — 0.42 total miles
2. Take the 1st **left** onto Lehigh Rd.
Then 0.18 miles — 0.60 total miles
3. Turn **left**.
Then 0.16 miles — 0.76 total miles
4. Take the 1st **right** onto US Highway 9W/US-9W N.
If you are on US Highway 9W and reach Alpha Rd you've gone about 0.3 miles too far.
Then 4.78 miles — 5.54 total miles
5. Turn **right** onto W Bridge St/US-9W N.
Then 0.56 miles — 6.09 total miles
6. Turn **slight right** onto W Bridge St/NY-385.
W Bridge St is just past Grandview Plz.
Then 0.88 miles — 6.97 total miles
7. Turn **left** onto Spring St/NY-385.
Spring St is just past Liberty St.
If you reach Prospect Ave you've gone a little too far.
Then 0.56 miles — 7.53 total miles
8. Turn **right** onto Rip Van Winkle Bridge/NY-23 (Portions toll).
Rip Van Winkle Bridge is just past Gardiner St.
Then 1.57 miles — 9.10 total miles
9. Enter next roundabout and take the 2nd exit onto Rhinebeck-Hudson Rd/NY-23/NY-9G.
Then 0.47 miles — 9.56 total miles
10. Turn **left** onto NY-9G/NY-23B.
If you are on State Route 23 and reach Conway Rd you've gone about 0.3 miles too far.
Then 2.79 miles — 12.35 total miles
11. Turn **right** onto Warren St.
Warren St is just past Cherry Aly.
If you are on N 3rd St and reach Prison Aly you've gone a little too far.
Then 0.78 miles — 13.13 total miles
12. Turn **left** onto Prospect Ave.
Prospect Ave is just past 5th St.
If you reach Worth Aly you've gone about 0.2 miles too far.
Then 0.24 miles — 13.37 total miles
13. 71 Prospect Ave, Hudson, NY 12534-2907, 71 PROSPECT AVE is on the **left**.
Your destination is 0.1 miles past Rossman Ave.

After emergency care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

Caldwell Marine International, LLC

HUXTED TUNNELING

DRILLING INTERNATIONAL

JOB EMERGENCY ACTION PLAN

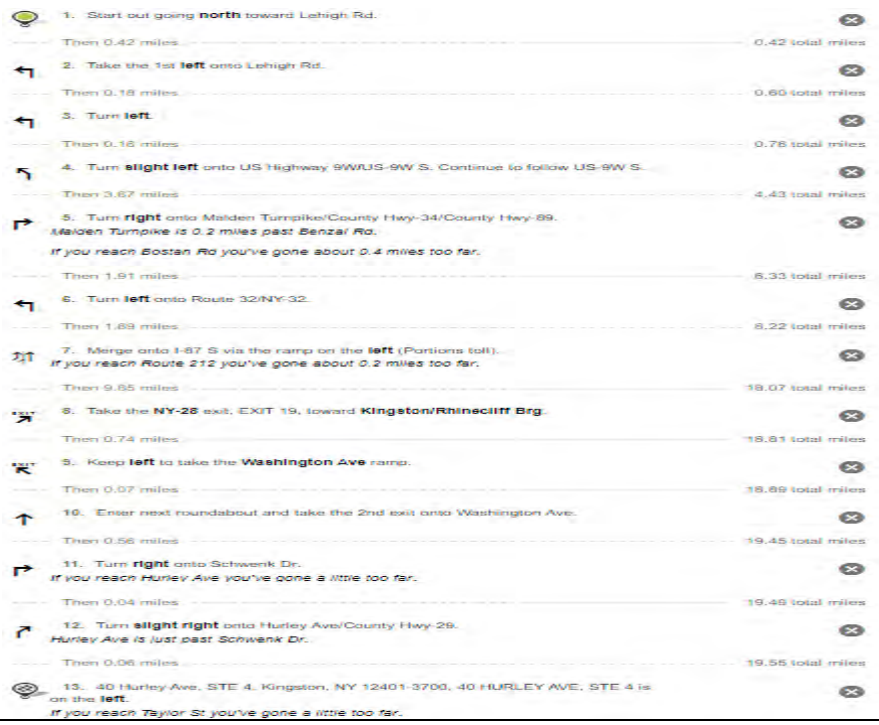
OC DOCTOR – Non Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance above and beyond first aid should obtain immediate attention at the address provided herein:

Transport to the Occupational Medical Provider

Emergency One, Kingston, NY
40 Hurley Ave, Ste 4
Kingston, NY 12401
(845) 338-5600



After medical care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

Caldwell Marine International, LLC
HUXTED TUNNELING
DRILLING INTERNATIONAL

JOB EMERGENCY ACTION PLAN

JOBSITE DETAILS			
Date: 03/04/22	**Project Owner:** CHPE,LLC	**Contractor:** CMI/ECI	
Project Name: CHPE HDD			**Job No:** 1229
Project Address: Drill #3 - Stony Point – 1 Elm Ave, Tompkins Cove, NY			
PM: Thomas Ulisse	**Cell:** 732 620 3470	**Supt:** Brett Bryant	**Cell:** 732 620 4214

EMERGENCY CALLING INFORMATION – 911		*(Local numbers are required, even if 911 is used.)*
Department	***Name***	***Telephone Number***
POLICE	**Stony Point Police Dept.**	**845-786-2422/911**
FIRE DEPARTMENT	**West Haverstraw Fire Dept.**	**845-947-2800/911**
FIRST AID / NON-EMERGENCY	**Rockland Urgent Care**	**845-429-4000**
HOSPITAL / EMERGENCY	**Montefiore Nyack Hospital**	**845-348-2000**
POISON CONTROL	**NY Poison Control**	**1-800-222-1222**
SPILL RESONSE	**Clean Harbors**	**1-800-645-8265**
OSHA	**** Corporate Safety Director will Initiate Any/All Contact with OSHA****	
DIVE HOSPITAL	**Jacobi Medical Center 234 East 149th St. Bronx, NY**	**1-718-579-5000**
Other:		

OWNER / CONTRACTOR CALLING INFORMATION		
Role	***Name- Address***	***Telephone***
OWNER: CHPE,LLC		
OWNER'S ENGINEER:		
GENERAL CONTRACTOR: NKT INC.	**Fredrik Hallsten**	**919-836-3522**
SUBCONTRACTOR: ECI DRILLING, LLC	**John Langford**	**(936) 5224-0852**
SITE SAFETY REPRESENTATIVE:	**Lucky Abernathy**	**(908) 433-3755**

JOB EMERGENCY ACTION PLAN

EVACUATION POINT(s)

JOB EMERGENCY ACTION PLAN

HOSPITAL - Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance beyond first aid should obtain immediate attention at the address provided herein:

Transport to the nearest Emergency Room

Montefiore Nyack Hospital
160 N Midland Avenue
Nyack, NY 10960
845-348-2000

Head south on Elm Ave	
Turn left onto N Liberty Dr	167 ft
Turn right onto Wayne Ave	0.3 mi
Turn slightly right onto W Main St	1.4 mi
Turn right onto Route 210	0.2 mi
Turn left onto Palisades Interstate Pkwy	1.5 mi
Keep right and leave the freeway at exit 9E towards I-87 South/I-287 East/New York City	9.9 mi
Enter the freeway I-287 E/I-87 S from the right	0.5 mi
Keep right and leave the freeway at exit 11 towards South Nyack/US-9W/Nyack	2.8 mi
Turn left onto Route 59	0.2 mi
Turn left onto N Highland Ave	0.4 mi
Turn right onto 5th Ave	0.4 mi
Turn right onto N Midland Ave	0.1 mi
Turn right	344 ft
Turn left	82 ft
Your destination is in front of you	157 ft

After emergency care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

Caldwell Marine International, LLC HUXTED TUNNELING DRILLING INTERNATIONAL

JOB EMERGENCY ACTION PLAN

OC DOCTOR – Non Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance above and beyond first aid should obtain immediate attention at the address provided herein:

Transport to the Occupational Medical Provider

Rockland Urgent Care
89 South Route 9W
West Haverstraw, NY 10993
845-429-4000

After medical care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

Caldwell Marine International, LLC HUXTED TUNNELING DRILLING INTERNATIONAL

JOB EMERGENCY ACTION PLAN

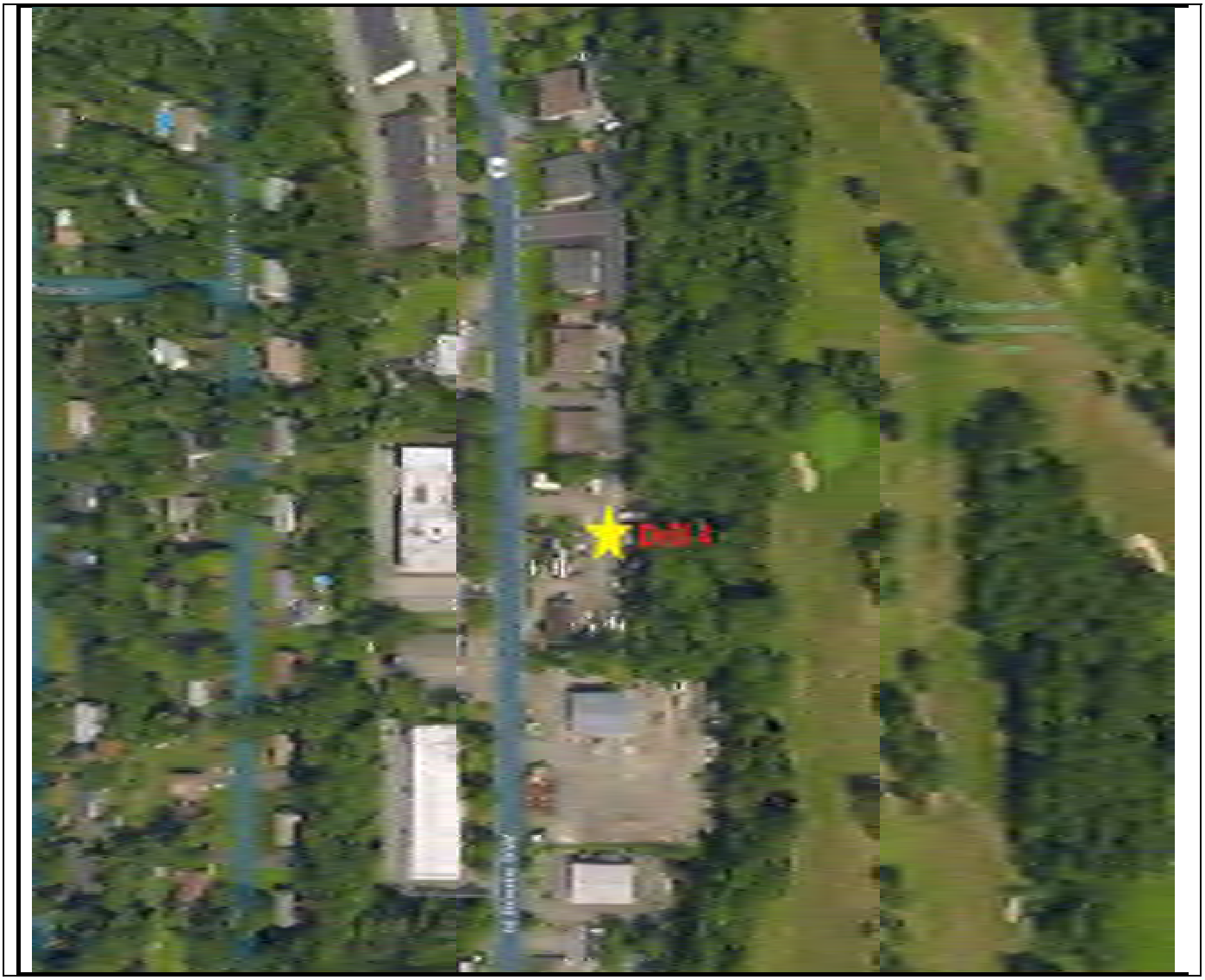
JOBSITE DETAILS			
Date: 03/04/22	**Project Owner:** CHPE, LLC	**Contractor:** CMI/ECI	
Project Name: CHPE HDD			**Job No:** 1229
Project Address: Drill #4 Congers – 152 Rte. 9W Congers, NY			
PM: Thomas Ulisse	**Cell:** 732 620 3470	**Supt:** Brett Bryant	**Cell:** 732 620 4214

EMERGENCY CALLING INFORMATION – 911		*(Local numbers are required, even if 911 is used.)*
Department	***Name***	***Telephone Number***
POLICE	**Rockland Lake Police**	**845-268-6200/911**
FIRE DEPARTMENT	**Congers Fire Dept.**	**845-268-6562/911**
FIRST AID / NON-EMERGENCY	**Walk-in Medical Urgent Care**	**845-678-3434**
HOSPITAL / EMERGENCY	**Montefiore Nyack Hospital**	**845-348-2000**
POISON CONTROL	**NY Poison Control**	**1-800-222-1222**
SPILL RESONSE	**Clean Harbors**	**1-800-645-8265**
OSHA	**** Corporate Safety Director will Initiate Any/All Contact with OSHA****	
DIVE HOSPITAL	**Jacobi Medical Center 234 East 149th St. Bronx, NY**	**1-718-579-5000**
Other:		

OWNER / CONTRACTOR CALLING INFORMATION		
Role	***Name- Address***	***Telephone***
OWNER: CHPE,LLC		
OWNER'S ENGINEER:		
GENERAL CONTRACTOR: NKT INC.	**Fredrik Hallsten**	**919-836-3522**
SUBCONTRACTOR: ECI DRILLING, LLC	**John Langford**	**(936) 5224-0852**
SITE SAFETY REPRESENTATIVE:	**Lucky Abernathy**	**(908) 433-3755**

JOB EMERGENCY ACTION PLAN

EVACUATION POINT(s)



Caldwell Marine International, LLC

HUXTED TUNNELING

DRILLING INTERNATIONAL

JOB EMERGENCY ACTION PLAN

HOSPITAL - Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance beyond first aid should obtain immediate attention at the address provided herein:

Transport to the nearest Emergency Room

Montefiore Nyack Hospital
160 N Midland Avenue
Nyack, NY 10960
845-348-2000

Head south on Elm Ave	
Turn left onto N Liberty Dr	167 ft
Turn right onto Wayne Ave	0.3 mi
Turn slightly right onto W Main St	1.4 mi
Turn right onto Route 210	0.2 mi
Turn left onto Palisades Interstate Pkwy	1.5 mi
Keep right and leave the freeway at exit 9E towards I-87 South/I-287 East/New York City	9.9 mi
Enter the freeway I-287 E/I-87 S from the right	0.5 mi
Keep right and leave the freeway at exit 11 towards South Nyack/US-9W/Nyack	2.8 mi
Turn left onto Route 59	0.2 mi
Turn left onto N Highland Ave	0.4 mi
Turn right onto 5th Ave	0.4 mi
Turn right onto N Midland Ave	0.1 mi
Turn right	344 ft
Turn left	82 ft
Your destination is in front of you	157 ft

After emergency care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

Caldwell Marine International, LLC HUXTED TUNNELING DRILLING INTERNATIONAL

JOB EMERGENCY ACTION PLAN

OC DOCTOR – Non-Emergency

Work Related Incidents/Accidents:

Any injured employee requiring assistance above and beyond first aid should obtain immediate attention at the address provided herein:

Transport to the Occupational Medical Provider

Walk-In Medical Urgent Care

236 South Main Street
New City, NY 10906
845-678-3434

After medical care has been given to an injured employee, notify the Safety Director ASAP @ (908) 433-3755.

A written incident report must be submitted within 24 hours of the occurrence to Safety@Jaginc.co

Caldwell Marine International, LLC

HUXTED TUNNELING

DRILLING INTERNATIONAL

Attachment 11
HSE Monthly Report

HEALTH, SAFETY & ENVIRONMENT – MONTHLY REPORT

Project:			
Project Number:			**Month:**
Man-hours	Total Carried:	Current Month:	Project Total:
Employee/Visitor On-Boarding	Total Carried:	Current Month:	Project Total:
Daily JAGs (Job Action Guide)	Total Carried:	Current Month:	Project Total:
Weekly Toolbox Topics	Total Carried:	Current Month:	Project Total:
Safety Inspection Performed	Total Carried:	Current Month:	Project Total:
Safety Stand-Down/Time-Outs	Total Carried:	Current Month:	Project Total:
Near Miss	Total Carried:	Current Month:	Project Total:
First Aid	Total Carried:	Current Month:	Project Total:
Medical Treatment (Off-Site)	Total Carried:	Current Month:	Project Total:
Restricted Duty	Total Carried:	Current Month:	Project Total:
Lost Time	Total Carried:	Current Month:	Project Total:
Environmental Incidents	Total Carried:	Current Month:	Project Total:
Asset/Equipment Damage	Total Carried:	Current Month:	Project Total:
Management Of Change	Total Carried:	Current Month:	Project Total:

Incident Status Up-Date

Date:	Location:	Incident #:	Title:	Category:	Status: Open/ Close

Prepared By:	**Signature:**	**Date:**

Attachment 12

Site Specific Safety Orientation Form

SITE SPECIFIC SAFETY ORIENTATION

Contractor / Subcontractor:	Project Number:
I have attended the site orientation and understand and furthermore I accept the site rules and regulations presented.	
Printed Name:	**Trade:**
Address:	**Telephone Number:**
Emergency Contact Person & Telephone Number:	**Driver's License Number:**

MEDICAL QUESTIONS – This information is medical and is considered confidential.
All questions are voluntarily requested to assist in the event of an emergency.

1. **Do you have any known allergies?** ☐ No ☐ Yes If yes, describe: _____
2. **Are you on any medications?** ☐ No ☐ Yes If yes, describe: _____
3. **Do you have first aid training?** ☐ No ☐ Yes If yes, exp. date: _____

SAFETY RULES AND REGULATIONS

☐ Review of Federal Regulations & Requirements	☐ Work Permit
☐ Emergency Response / Alarms	☐ Scaffolding / Tag System
☐ First Aid Station / Location / Training	☐ Ladders
☐ Reporting ACC / INC / Injuries / Hazards	☐ Riggers – Responsibilities
☐ Worker Responsibilities	☐ Preventive Maintenance Program
☐ Foreman Responsibilities	☐ Excavations
☐ Management Responsibilities	☐ Barricades
☐ Worker Right to Know	☐ Signage / Flagging
☐ Site Hazards	☐ Welders Responsibilities / Work Protection, etc.
☐ HNIS / MSDS – Training / Locations	☐ Fire Extinguishers / Locations / Inspections
☐ Communication Systems	☐ Torches / Cutting Equipment / Safeguards / Flash Arrestors
☐ Traffic Patterns / Parking / Security	☐ Proper Storage / Transporting Cylinders
☐ Safety Meetings	☐ Inspection of Hoses / Coupling etc.
☐ Smoking / Alcohol / Drugs	☐ Equipment Safeguards
☐ Zero Tolerance Rules	☐ Grinders / Disc Rated
☐ Equipment Inspection / Certification	☐ Electrical Cords / Connectors / Overhead Lines
☐ Equipment Hazards	☐ Hand Tools / Power Tools
☐ Lockout Program	☐ Rowdiness / Horseplay
☐ P.P.E. Eyes / Ears / Head / Hands / Feet	☐ Good Housekeeping / Sanitation
☐ Safety Harness / Lanyards	☐ Other:
☐ Confines Space / Training	☐ Other:

Attendee's Signature:	**Date:**
Instructor's Signature:	**Date:**

Attachment 13
Lightning Safety Procedures

Lightning Safety Procedures

Overview

The purpose of this document is to provide a guide for personal safety during thunderstorms.
A brief review of common medical problems encountered with a lightning strike and appropriate first aid treatment is also included.

References

OSHA Emergency Action Plans 29CFR 1926.35

Hazards

Direct strike - statistics show that death resulted in over 70 % of cases.
Side flash - e.g. standing near a tree - this can be as serious as a direct strike.
Contact potential - physical contact with struck object has similar consequences to direct strike.
Step voltage - lightning impulse traveling through/on ground and may pass through one limb/part and out another. Injuries include burns and paralysis but these are usually temporary.
Surge propagation - person close to or in contact with an electrical appliance or power/communication line. Serious injury is not common but a number of deaths have resulted from telephone usage.

Key Responsibilities

Managers and Supervisors

- Review project Emergency Action Plan (EAP), as outlined in 29 CFR 1926.35
- Review written lightning safety protocol with all outdoor workers
- Regularly monitor weather conditions and local weather forecasts prior to scheduled activities
- Monitor SkyScan EWS-PRO 2 Portable Lightning Detector and Early Warning Device
- Notify all employees about lightning safety warnings and instruct workers seek safe shelter inside.
- Suspend outdoor work activities when lightning is detected within 3-8 miles
- Inform all workers to take action after hearing thunder, seeing lightning, or perceiving any other warning signs of approaching thunderstorms.
- Do not allow the resumption of outdoor work activities until 30min after the last lightning strike.

Employees

- Follow all directions and instruction of your supervisor
- When instructed, seek safe shelter ASAP
- Do not return to work until instructed to do so by supervisor.
- Employees should safely secure any work tasks being performed at the time of lightning notification and seek safe shelter inside ASAP.

Procedure/Practices

General

Lightning safety awareness should be a priority at every outdoor facility and operation, where education is the single most important means to achieving this goal.

The number one rule is that workers need to always consider their own situational safety, and those who may find themselves exposed to the risk should always recognize and anticipate their exposure to a changing or high-risk situation, and where appropriate move to a lower-risk location.

The following steps are suggested:

1. Regularly monitor weather conditions and local weather forecasts prior to scheduled activities.
2. Suspension and resumption of work activities should be planned in advance, in conjunction with this Lightning Risk Policy
3. Understanding of SAFE shelters is essential. SAFE evacuation sites include:
    - Grounder Barge offices/lunchroom/tool containers
    - Fully enclosed metal vehicles with windows up
    - Substantial buildings
    - Low ground
4. UNSAFE SHELTER AREAS include all outdoor metal objects, like power poles, fences and gates, high mast light poles, electrical equipment, mowing and road machinery.
    - AVOID solitary trees.
    - AVOID water.
    - AVOID open fields.
    - AVOID high ground and caves.
5. If you feel your hair standing on end, and/or hear "crackling noises," you are in lightning's electric field. If caught outside during close lightning activity, immediately remove metal objects (including baseball cap, jewelry, belts, car keys etc.), place your feet together, duck your head, and crouch down low with hands on knees.
6. Wait a minimum of 30 minutes from the last observed lightning or thunder before resuming activities. Be extra cautious during this phase as the storm may not be over.
7. People who have been struck by lightning do not carry an electrical charge and are safe to handle. Apply first aid immediately if you are qualified to do so. Get emergency help promptly.
9. Suspend activities, allowing sufficient time to get to shelter. Of course, different distances to safety will determine different times to suspend activities.
10. Be aware of your surroundings and the nearest safe area.

SkyScan EWS-PRO 2 Features:

Accurate digital microprocessor with patented dual antenna receiving system

- Built-in 12 volt rechargeable power source, operating for 7+ days on a single charge
- Loud 95dB alert horn, with adjustable range setting
- Rugged weather-resistant case
- Low battery indicator on the weather detector
- Severe thunderstorm alert that warns of large storm cell approaching
- False signal filtering feature to warn against any possible location interference
- Accurate identification software that eliminates alerts to harmless cloud-to-cloud lightning activity
- Battery management intelligent battery recharging system.
- Case designed with battery recharger storage compartment

Attachment 14
Pandemic Response Plan

JAG Companies

Pandemic Pathogen Response Plan

VERSION 1.5 | November 1, 2020

Authored by: Rolando E. Acosta

JAG Companies Pandemic Pathogen Response Plan

Note: The following plan provides a general framework that any Northeast Remsco Construction, Caldwell Marine International, Huxted Tunneling, and ECI Drilling International facility/project should follow during a pandemic event. The plan is based on Federal guidelines; however, State/Local Governments, Project Owners, or specific circumstances may require a different standard of response. The Plan, in coordination with the Emergency Response Team, may be altered to support additional requirements requested/required from State/Local Governments or Project Owners or to respond to particular conditions.

1. Purpose & Goal

a. The purpose of implementing the JAG Companies Pandemic Pathogen Response Plan (the "plan") is to:
    i. (1) protect the health of our employees and their families
    ii. (2) to ensure business continuity and maintain mission-critical operations and services during a pandemic event
b. Maintaining essential business functions during a pandemic event is a challenge and the response requires flexibility based on available credible information from government agencies (federal, state, & local) and medical professionals.
c. The plan allows JAG Co. to respond to any pandemic, outbreak, or health related event effectively and efficiently.
d. Leadership is key during a pandemic event. Employees will look to management to provide leadership for JAG Co. We are committed to lead as follows:
    i. *Anticipate*: We will attempt to predict what lies ahead without succumbing to panic.
    ii. *Navigate*: We will course correct as needed in real time.
    iii. *Communicate*: We will continually maintain clear, established lines of communication with our employees.
    iv. *Listen*: We will listen to the experts, our advisors, and our employees, including information we may not want to hear. We will attempt to avoid media hype and crowd hysteria.
    v. *Learn*: We will use what we learn from this experience as a lesson for future events.
    vi. *Lead*: We will improve ourselves and elevate those around us.
e. The plan will be reviewed annually or during the initial phases of a health event as needed. Reviewers will include certain JAG Co. management personnel.

2. Key Terms & Definitions

a. **Close Contact**: Being within 6 feet of an infected person for a cumulative total of 15 minutes or more over a 24-hour period regardless of whether cloth face covers or masks were in us.
    i. Anyone who has been exposed to COIVD-19 due to "close contact" is required to stay home for 14-days from the day of last exposure.
        1. During the 14 days, that person must maintain a distance of at least 6 fee from others at all times, self-monitor for symptoms, avoid contact with people at higher risk of illness, and follow CDC guidelines if they develop symptoms.
    ii. Brief interactions totaling 15 minutes over the course of 24-hours with:
        1. A person who is known to have COVID-19 (i.e., someone who has been

tested and confirmed to have COVID-19),
2. A person who developed symptoms consistent with COVID-19 two to three days after the interaction, or
3. A person currently experiencing symptoms of COVID-19.

iii. Factors to consider when evaluating close contact:
1. Proximity: closer distance increases exposure risk.
2. Duration: longer interactions increase exposure risk.
3. Symptoms: interactions with a person within two to three days of symptom onset increase your exposure risk.
4. Activity: interactions with persons coughing or shouting increase your exposure risk.
5. Location: interactions in an area that has less ventilation (indoors vs. outdoors) increase your exposure risk.

b. **Hand Hygiene**: Applies to the disinfecting of one's hands. This is usually done with soap and water, hand sanitizer, or hand wipes. It is recommended that you wash your hands for a minimum of 20 seconds with soap & water and 10 seconds with hand sanitizer/wipes.
c. **Human-to-Human Transmission:** Refers to the spread of a pathogen from one human to another by (including but not limited to): direct contact with the blood or body fluids (i.e., *saliva, urine, vomit, semen, and feces***)** of an infected person or contact with objects that have been contaminated with the blood or body fluids of an infected person.
i. The pathogen in the blood & body fluids can enter another person's body through broken skin or unprotected mucous membranes in the eyes, nose, or mouth.
ii. During outbreaks of pathogen, the disease can spread quickly and human-to-human contact must be avoided and/or eliminated.
iii. Proper disinfecting and disposal of objects is vital.
d. **Infection Control**: A broad term used to describe a number of measures designed to detect, prevent, and contain the spread of an infectious disease. Some measures include hand washing, respiratory etiquette, use of personal protective equipment (PPE), prophylaxis, isolation, and quarantine.
e. **Infectious Disease**: An infectious disease, or communicable disease, is caused by the entrance of organisms (e.g. viruses, bacteria, fungi) into the body that grow and multiply to cause illness. Infectious diseases can be transmitted by direct contact with an infected individual, their discharges (e.g. breath, cough, sneeze), or with an item touched by them.
f. **Isolation**: When sick people are asked to remain in one place (e.g. home, hospital), away from the public, until they are no longer infectious.
g. **Pandemic**: A disease epidemic that has spread across a large region, for instance multiple continents, or worldwide.
h. **Pathogen**: A bacterium, virus, or other microorganism that can cause disease.
i. **Personal Protective Equipment (PPE)**: PPE is specialized clothing or equipment worn to protect someone against a hazard including an infectious disease. It can range from a mask or a pair of gloves to a combination of gear that might cover some or all of the body.
j. **Prevention**: An action taken to reduce or eliminate the opportunities for transmission of the disease from one individual to another. We must all do our part to prevent the spread of the disease by following the procedures outlined in this process.
k. **Quarantine**: A quarantine is when people who have been in close proximity to an infected person, but appear healthy, are asked to remain in one place, away from the general public,

until it can be determined that they have not been infected.

l. **Respiratory Etiquette**: Respiratory etiquette, or good coughing and sneezing manners, is one way of minimizing the spread of pathogens which are passed from human-to-human in the tiny droplets of moisture that come out of the nose or mouth when coughing, sneezing, or talking. Healthy and sick people should cover their nose and mouth when sneezing, coughing, or blowing their nose and then put the used tissue in the trash to prevent the spread of germs.

m. **Social (Physical) Distancing**: An infection control strategy that includes methods of reducing the frequency and the closeness of contact between people to limit the spread of infectious diseases. Generally, social distancing refers to the avoidance of gatherings with many people.
    i. In the event **Social (Physical) Distancing** is not practical nor feasible during work activities, the employee will be supplied and required to wear the appropriate respiratory PPE.

n. **Work from Home (WFH)**: WFH is a consideration available for certain eligible employees as identified by the Emergency Response Team ("ERT") to work temporarily from home or a remote location. The WFH process will be followed by all identified employees:
    i. The ERT will identify employees that can or will work from home.
    ii. The ERT will notify the employee's manager and the manager will assign a virtual meeting group and meeting group leader.
    iii. Normal operating hours apply.
        1. A 30-minute lunch break will be accounted for during working hours.
    iv. OIT will coordinate and set-up the necessary technology for identified employees.
        1. OIT is available to provide all necessary support.

3. Responsibilities

a. Employer: All JAG Companies' operating companies.
    i. Create, distribute and implement a **"Self-Assessment Checklist."**
        1. The checklist does not supersede any daily assessment protocols that may already be in place as provided by the project owner.
        2. The checklist will be provided to employees as well as prominently displayed at all Company facilities (offices, jobsites, shops, etc.).
        3. If you reply **YES** to any of the checklist questions, **STAY HOME** and immediately contact your supervisor.
    ii. Educate workers about general precautions and regularly communicate plans to limit the spread of the pathogen.
    iii. Reinforce good hygiene practices and take steps to make it easy for workers to frequently wash their hands.
        1. Install hand-sanitizing stations throughout workplaces.
    iv. Implement policies that maintain physical distance between workers.
        1. Post social distancing signs as a reminder.
        2. Instruct employees to avoid direct physical contact.
    v. Identify, clean and sanitize high-risk transmission areas regularly.
    vi. Provide appropriate personal protective equipment (PPE)
    vii. Require sick workers to stay home and send sick workers home.

b. Employees: For the sake of clarity, we are ALL employees.
    i. Employees must complete a self-assessment as outlined in the **"Self-Assessment Checklist"** prior to the start of EVERY shift.
        1. The checklist does not supersede any daily assessment protocols that may already be in place as provided by the project owner.
        2. The checklist will be provided to employees as well as prominently displayed at all Company facilities (offices, jobsites, shops, etc.).
        3. If you reply **YES** to any of the checklist questions, **STAY HOME** and immediately contact your supervisor.
        4. Check your body temperature and know the symptoms that may indicate an infection, specifically COVID-19. Check for the following:
            - Fever or feeling feverish
            - General soreness
            - Fatigue
            - Headache
            - Sore Throat
            - Cough
            - Change or Loss of Appetite
            - Repeated shaking with chills
            - Shortness of breath
            - Muscle pain
            - Loss of taste
            - Loss of smell
            - Diarrhea.
    ii. Employees that are or feel ill must **NOT** report to work
        1. Employee should contact their manager to discuss next steps.
        2. Any employee that reports to work with any "sick symptoms" will be sent home immediately.
        3. The employee may not return to work without clearance or a return to work note from a medical professional or approval from ERT.
    iii. Maintain good workplace hygiene, including hand washing practices and cough/sneeze etiquette.
        1. **100%** use of a "**face cover**" on **ALL** company projects, regardless of geographic location.
        2. The Safety Team is available to discuss and suggest the appropriate face covering for your project activities: cloth covering/mask, surgical mask, KN95, N95, face shield, etc.
    iv. Maintain a distance of at least six feet from other workers and limit large group interactions. Follow these same practices on and off the job as well.
        1. In the event the minimum distance of six feet is not practical nor feasible during work activities, the employee will be supplied and required to wear the appropriate respiratory equipment.
    v. Cooperate with response measures instituted by employer and those recommended by health officials at the federal, state and local level.
    vi. Do not share other workers' phones, PPE or other work tools and equipment.
    vii. Receive recommended appropriate immunization or vaccination.
c. Office/Site Managers: Managers are responsible for implementing the protocol for

employees that are symptomatic and employees returning to work after being out sick.

i. If any employee exhibits symptoms that are indicative of the pandemic, office/site management must be notified immediately. The communication should be oral or telephone first, followed by an email.
    1. Isolate the employee to the best of your ability.
    2. Provide a mask to the employee and instruct them to put the mask on immediately. Masks and other PPE will be available onsite.
    3. The Corporate Safety Director ("CSD") will speak directly with the employee to avoid any misinformation or having pertinent information "lost in translation." The CSD will manage the communications with the employee and protect the identity of the employee to best of their ability.
    4. Instruct the employee to leave work. Ask the employee to avoid public transportation if possible.
    5. Advise the employee to seek medical attention.
    6. Have the employee's workstation, work area, vehicle, tools, etc. cleaned and disinfected immediately by a cleaning service.
    7. If the diagnosis from a medical professional is that the symptoms are unrelated to the pandemic, then the employee may to return to work following review by the ERT.
    8. If the diagnosis from a medical professional is that the employee has the illness causing the pandemic, then the employee must follow the Diagnosed Individual Protocol outlined in *Section 5d* below.
    9. Check on the employee during their absence from work and encourage a return to work once they feel better and are cleared by medical professional.

ii. **Temperature Screening**
    1. To protect your co-workers and families, the company will require temperature screening for all employees returning to their workplace after being sick or quarantined.
    2. Body temperatures will be taken in a manner that is consistent with infection control and social distancing policies (six-foot separation between individuals in line) and provides privacy for those individuals being screened.
    3. Screening information will be considered confidential and protected accordingly, even while acting on that information to protect the health and safety of others in the workplace.
    4. For the purpose of the Plan, a fever is defined as subjective fever (feeling feverish) or a measured temperature of 100.4 F (38 C) or higher.
    5. An employee with a body temperature of 100.4 F (38 C) or higher may be denied from returning to their workplace after being sick or quarantined.
        - Employees who screen positive for a fever will be rechecked a second time after 15 minutes.

iii. Any thermometer or other equipment used in the temperature screening process that touches an employee or is touched by an employee should be properly disinfected between uses.

d. Emergency Response Team ("ERT"): An ERT will be responsible for investigating all

pandemic events & emergency events and evaluating the impact such event will have on JAG Co. The ERT will be responsible for providing guidance in responding to the event. The ERT will consist of some or all of the following JAG Co. employees (*the ERT may also include other JAG Co. employees*):

i. Lucky Abernathy, Corporate Safety Director JAG Companies
ii. Roly Acosta, President/CEO JAG Companies
iii. Marcelo Afonso, CFO JAG Companies
iv. Dustin Brasher, VP/GM ECI Drilling International
v. Anna Camooso, HR Manager JAG Companies
vi. Greg Goett, Counsel JAG Companies
vii. John Gutierrez, VP/Equipment Manager JAG Companies
viii. Ray Post, VP/GM Huxted Tunneling
ix. Rob Ross, VP/GM Northeast Remsco Construction
x. Jim Yuille, VP/GM Caldwell Marine International

4. Communication

a. Good communication during a pandemic event is critical to the success of our response. The company will utilize various channels of communication to keep our employees informed including telephone calls, emails, text messages, emergency text message service, letters, handouts, website, social media accounts, etc.
b. The communicator may vary, but the message will have "one voice" for consistency, clear instructions & directions, and to avoid confusion.
c. Regular communication provides:
    i. Notification of any changes in our Tiered Response Plan (*detailed in this plan*).
    ii. Clarification to any Executive Orders from Federal, State, or Local governments.
    iii. Updates on the status of the pandemic from credible sources including the Center for Disease Control ("CDC"), the World Health Organization ("WHO"), & the Occupational Safety & Health Administration ("OSHA").
    iv. Changes to our Response Plan.
    v. Prompt notification of all employees of any known exposure to COVID-19 at the worksite.

5. Pandemic Pathogen Protocol

a. International Travelers: Any employees or project personnel, including subcontractors & vendors, returning from a CDC Level 2 or 3 country must disclose their travels to their manager or project management prior to returning to work. The traveler must remain out of work for the CDC (or equivalent government agency) designated quarantine period (beginning from the date returned to the United States) even if they are not directed to quarantine by government officials. https://wwwnc.cdc.gov/travel/notices/
    i. An employee might be permitted to follow WFH process if job duties allow.
b. Domestic Travelers: Any employees or project personnel, including subcontractors & vendors, returning from domestic travel must disclose their travels to their manager or project management prior to returning to work. Notification is required regardless of travel method (i.e., air, rail, ship, road, etc.) The ERT will provide guidance that may include a CDC (or equivalent government agency) designated quarantine period (beginning from the date returned to the United States) even if they are not directed to

quarantine by government officials.

i. An employee might be permitted to follow WFH process if job duties allow.

c. Individuals directed to Quarantine by Federal, State & Local Authorities: Employees, subcontractors or vendors who are directed to quarantine by federal, state or local authorities must remain out of work for the duration of the quarantine period.
    i. An employee might be permitted to follow WFH process if job duties allow.
d. Diagnosed Individuals: Employees, subcontractors or vendors who have been diagnosed with a pandemic pathogen must remain out of work for the CDC (or equivalent government agency) designated quarantine period starting from the date of the positive diagnosis. The individual cannot return to work unless they have been cleared by a medical professional and the ERT.
    i. An employee might be permitted to follow WFH process if job duties allow.
e. Others: Individuals who feel they are at risk for contracting a pandemic pathogen must provide a written statement to their manager explaining the reason for their concerns. Concerns might include shared residence with a diagnosed person, close contact with a diagnosed person, exposure to the pathogen in their personal life, etc. The ERT will review the statement and provide guidance that may include some period of quarantine.
    i. An employee might be permitted to follow WFH process if job duties allow.
f. These are intended as general guidelines; JAG Co. may modify or make exceptions following review and approval by the ERT.

6. COVID-19 Risk Assessment

a. The Company will conduct periodic assessments of risk levels following OSHA and CDC guidance to keep employees safe on a continuous basis.
b. OSHA classifies occupational risk to COVID-19 infections as:
    i. ***Lower Exposure Risk***: Activities that do not require contact between people know to be, or suspected of being, infective with COVID-19 nor frequent contact with (within 6 feet of) the general public.
    ii. ***Medium Exposure Risk***: Activities that require frequent and/or close contact with (within 6 feet of) people who may be infected with COVID-19, but who are not known or suspected to be infected with COVID-19.
    iii. ***High Exposure Risk***: Activities with high potential for exposure to known or suspected sources of COVID-19.
    iv. ***Very High Exposure Risk***: Activities with high potential for exposure to known or suspected sources of COVID-19 during specific medical, postmortem, or laboratory procedures.

7. JAG Companies Face Cover PPE Protocol

a. During a pandemic, company protocol is **100%** use of a "**face cover**" on **ALL** company property (office, project, shops, etc).
b. **General Information**
    i. A face covering is a personal protective device that is worn on the face or head and covers at least the nose and mouth. A face covering is used to reduce the wearer's risk of inhaling hazardous airborne particles (including infectious agents), gases or vapors.
    ii. Information indicates that covering your nose and mouth can slow the spread of

a pathogen, including COVID-19.

iii. Lowering the covering from your nose and mouth while talking defeats the purpose of wearing the face covering since you can spread virus while you talk.
iv. Employees may be unable to wear every available face covering due to certain medical conditions.
    1. Employees should consult with the Safety Department prior to utilizing a face covering that they are unfamiliar with or uncertain of wearing.
v. An employee experiencing difficulty breathing while wearing a face covering should social distance immediate and discontinue use. The employee must report the issue to their supervisor as soon as possible.

c. **Cloth Face Covers**
    i. A cloth face cover is a material that covers the nose and mouth.
    ii. It can be secured to the head with ties or straps or simply wrapped around the lower face. It can be made of a variety of materials, such as cotton, silk, or linen.
    iii. A cloth face covering may be factory-made or sewn by hand or can be improvised from household items such as scarfs, T-shirts, sweatshirts, or towels.
    iv. Employees may provide their own cloth face covering or request a company issued cloth face cover.
    v. It is recommended that you wash your cloth face covering frequently, ideally after each use, or at least daily.
    vi. Use a bag or bin to store cloth face coverings until they can be laundered with detergent and hot water and dried on a hot cycle.
    vii. If you must re-wear your cloth face covering before washing, wash your hands immediately after putting it back on and avoid touching your face.
    viii. Do NOT share cloth face coverings nor any other PPE.
    ix. Discard cloth face coverings that:
        1. No longer cover the nose and mouth
        2. Have stretched out or damaged ties or straps
        3. Cannot stay on the face
        4. Have holes or tears in the fabric

d. **Surgical Masks**
    i. A surgical mask is a loose-fitting, disposable device that creates a physical barrier between the mouth and nose of the wearer and potential contaminants in the immediate environment.
    ii. Surgical masks are made in different thicknesses and with different ability to protect you from contact with liquids. These properties may also affect how easily you can breathe through the facemask.
    iii. If worn properly, a surgical mask is meant to help block large-particle droplets, splashes, sprays, or splatter that may contain germs (viruses and bacteria), keeping it from reaching your mouth and nose. Surgical masks may also help reduce exposure of your saliva and respiratory secretions to others.
    iv. Employees should minimize the demand for surgical masks respirators by undertaking preventative actions on the job site. That is our first line of defense.
    v. Surgical masks will be provided to employees when required.
    vi. Do NOT share surgical masks nor any other PPE.
    vii. Surgical masks are not intended to be used more than once. If your mask is damaged or soiled, or if breathing through the mask becomes difficult, you

should remove the face mask, discard it safely, and replace it with a new one.

viii. To safely discard your mask, place it in a secure waste receptacle. Wash your hands after handling the used mask.

e. **N95 Respirator Masks** (KN95 Masks are a suitable alternative under certain emergency circumstances)
   i. A N95 is a type of respirator which removes particles from the air that are breathed through it. These respirators filter out at least 95% of very small (0.3 micron) particles. N95's are capable of filtering out all types of particles, including bacteria and viruses.
   ii. Achieving an adequate seal to the face is essential. When properly fitted and worn, minimal leakage occurs around edges of the respirator when the user inhales. This means almost all of the air is directed through the filter media.
   iii. The CDC does not recommend that the general public wear N95 respirators to protect themselves from respiratory diseases, including coronavirus. Everyday preventative action prevents the spread of respiratory viruses.
   iv. To ensure N95 respirators are available when needed, employees should minimize the demand for N95 respirators by undertaking preventative actions on the job site. That is our first line of defense.
   v. N95 respirators will be provided to employees when required. An employee will be issued one (1) N95 respirator per week (or as needed) when required.
   vi. Do NOT share N95 respirators nor any other PPE.
   vii. During times of supply shortages, the CDC allows for the re-use of N95 respirators assuming it is not clogged with particulates.
   viii. The respirator should be carefully stored between uses:
      1. In a receptacle that allows for some breathability: a paper bag, a plastic container with holes in the top, a closable plastic bag with holes in it.
      2. Label respirators with the user's name before use to prevent reuse by another individual
   ix. The wearer should wash his or her hands before & after handling the respirator.
   x. Respirator users should not attempt to disinfect N95 respirators. It may create a health hazard for the user and it may render the respirator ineffective in providing respiratory protection.
   xi. As the N95 mask gets clogged, it becomes more difficult to breathe. When this occurs, throw it out and request a new one.
   xii. Discard the mask if it is wet, dirty, deformed, or if the filter is torn.
   xiii. To safely discard your mask, place it in a secure waste receptacle.

8. Tiered Response Plan

a. The JAG CO. Tiered Response Plan outlines our temporary approach to a pandemic event to keep our employees & their families safe and maintain mission-critical operations and business continuity.

Office Response Plan

The following shall be applied to each JAG office location as may be required:

TIER ZERO ("0")

- Office open with minimal restrictions.
- Follow the CDC Five:
    - Hands: Wash Them Often
    - Elbow: Cough Into It
    - Face: Don't Touch It
    - Feet: Stay More Than 6ft Apart
    - Feel: Sick? Stay Home

TIER ONE ("1")

- Office open with some restrictions.
- Certain eligible employees might be offered the opportunity to work temporarily from home or remote location ("home").
    - Job description must allow for productive work from home.
    - Manager approval required
    - Follow "Work from Home" Process.
- Request that all meetings be conducted via teleconference or virtual platform.
- Limit personal interactions with co-workers.
- Limit visitors to the office (vendors, subcontractors, spouse, children, etc.)
- Practice social distancing, hand hygiene, and respiratory etiquette.
- Restrict occupancy in common areas such as break or lunch areas.
- Eliminate water coolers and other shared resources (high-touch areas).
- Increase cleaning / wipe down of personal work areas, common areas and facilities.
- Nonessential business related travel suspended.
- Use of a face covering outside of your personal workspace and where 6' of distance cannot be maintained with other employees.

TIER TWO ("2")

- Office open with further restrictions.
- Office restricted to essential personnel and activities as well as employees where telecommunicating poses a hardship.
    - The ERT will identify essential personnel & activities as required.
- All eligible non-essential employees might be offered the opportunity to work temporarily from home.
    - Job description must allow for productive work from home.
    - ERT approval required.
    - Follow "Work from Home" Process.
- All meetings must be conducted via teleconference or virtual platform.
- Limit interactions with co-workers.
- No visitors to the office.
- Practice social distancing, hand hygiene, and respiratory etiquette.
- Restrict occupancy in common areas such as break/lunch areas to accommodate 6' social distance.
- Increase cleaning / wipe down of personal work areas, common areas and facilities.
- All business travel is suspended.
- Use of a face covering outside of your personal workspace and where 6' of distance cannot be maintained with other employees.

TIER THREE ("3")

- Office Closed.
- All eligible essential & non-essential employees might be offered the opportunity to work temporarily from home.
    - Job description must allow for productive work from home.
    - Follow "Work from Home" Process.
- All meetings must be conducted via teleconference or virtual platform.

Field/Shop/Non-Office Locations Response Plan

The following shall be applied to each JAG Companies operating location as may be required:

TIER ZERO ("0")

- Location is operational with minimal restrictions.
- Follow the CDC Five:
    - Hands: Wash Them Often
    - Elbow: Cough Into It
    - Face: Don't Touch It
    - Feet: Stay More Than 6ft Apart
    - Feel: Sick? Stay Home

TIER ONE ("1")

- Location is operational with some restrictions.
- Certain eligible employees might be offered the opportunity to work temporarily from home or remote location ("home").
    - Job description must allow for productive work from home.
    - ERT approval required
    - Follow "Work from Home" Process.
- Request that all meetings be conducted via teleconference or virtual platform.
- Limit personal interactions with co-workers.
- Limit visitors to essential project personnel (owner, engineer, vendors, suppliers, subcontractors, etc.)
- Practice social distancing, hand hygiene, and respiratory etiquette.
- Eliminate water coolers and other shared resources (high-touch areas).
- Increase cleaning / wipe down of personal work areas, common areas and facilities.
- Hold separate "Tool Box Talks" or other job meetings with the various crews.
- Eat lunch separately to the extent possible.
- Reduce choke points (i.e., project entrances, portable toilet facilities, etc.).
- Use of a face covering outside of your personal workspace and where 6' of distance cannot be maintained with other employees.

TIER TWO ("2")

- Location is operational with further restrictions.
- Location restricted to essential personnel and activities.
    - The ERT will identify essential personnel & activities as required.

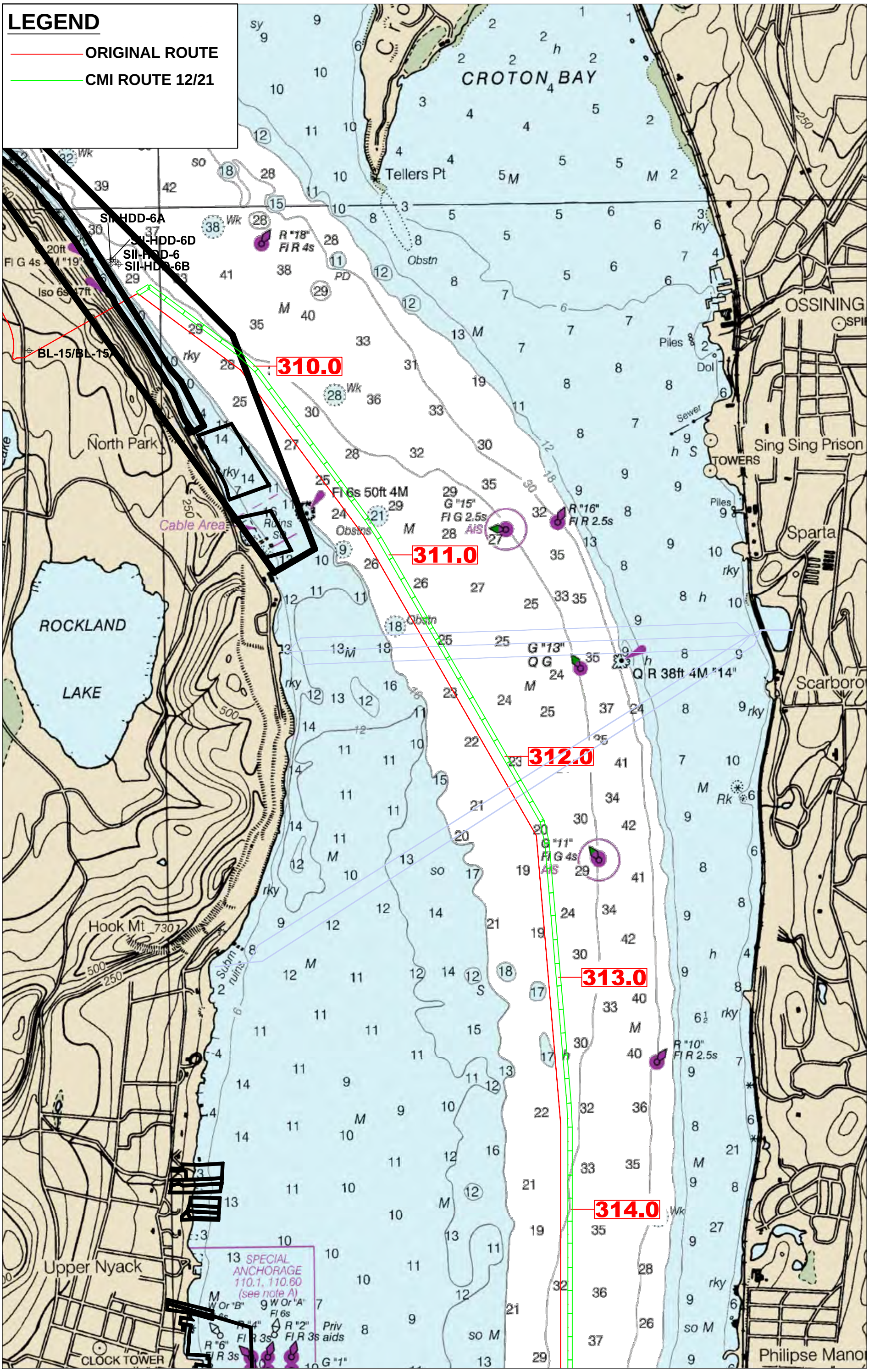
- All eligible non-essential employees might be offered the opportunity to work temporarily from home.
    - Job description must allow for productive work from home.
    - ERT approval required.
    - Follow "Work from Home" Process.
- All meetings must be conducted via teleconference or virtual platform.
- No visitors to the location except for essential personnel.
- Limit interactions with co-workers. Eat lunch separately.
- Practice social distancing, hand hygiene, and respiratory etiquette.
- Increase cleaning / wipe down of personal work areas, common areas and facilities.
- Hold separate "Tool Box Talks" or other job meetings with the various crews.
- Use of a face covering outside of your personal workspace and where 6' of distance cannot be maintained with other employees.

TIER THREE ("3")

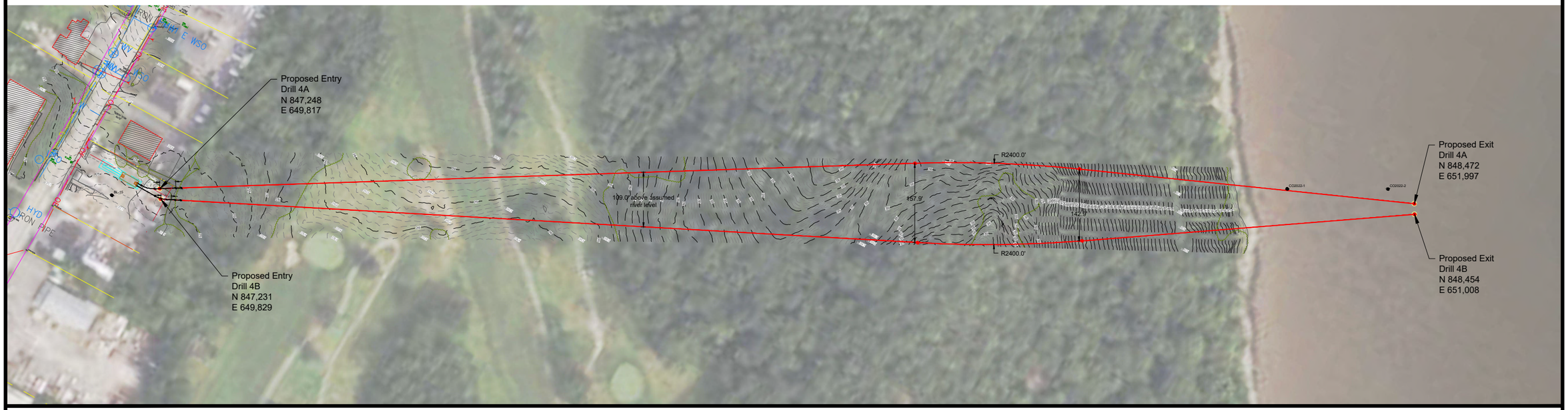
- Location is Closed.
- All eligible essential & non-essential employees might be offered the opportunity to work temporarily from home.
    - Job description must allow for productive work from home.
    - Follow "Work from Home" Process.
- All meetings must be conducted via teleconference or virtual platform.

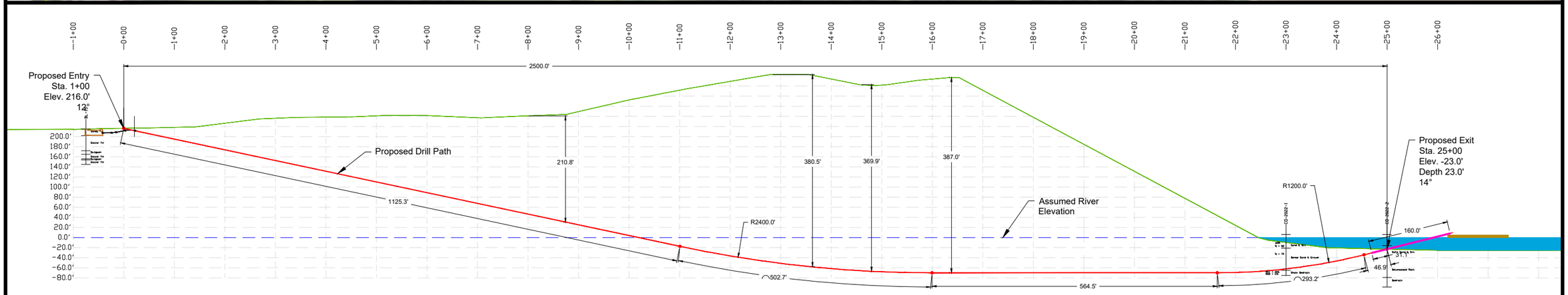
Appendix T – Geotechnical Borings Taken in 2022

CHPE - HUDSON RIVER CABLE ROUTE ADJUSTMENT



Transmission Developers, Inc.
Champlain Hudson Power Express
Drill 4 - Congers





HD = 2,500'
MD = 2,530'
Scale: 1" = 250'

Notes:
1. All existing grade elevations are based on assumptions from Google Earth and NOAA Bathemetry.
2. Detailed IFC drawings will be provided after land survey is complete.
3. Depth of drill profile is greater than horizontal separartion.

EC DRILLING INTERNATIONAL
1306 N. FM 3083 Road
Conroe, Texas 77303
PH: (936) 441-9080
FAX: (936) 441-9082

DATE:	JOB No.:	DRAWN BY:
10-26-22	E20-034	GJH

CLIENT:	PROFILE DIRECTION:
Champlain Hudson Power Express	SW to NE

LOCATION:	DRAWING No.:
Hudson River Congers, New York	Drill 4

Project: **CHPE**
Congers, New York
Date: 03/09/2022 to 03/14/2022
Contractor: Warren George, Inc.

Boring No.: CO-2022-1
Sheet: 1 of 2
Ground El: Barge Deck
Groundwater Depth: NA

Depth Feet	SAMPLES Number	Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
				Barge Deck Assumed 0.0 @ 8:30AM on 3/9/22 Assumed 0.0 is ±1.33ft above MLLW at Haverstraw Bay Position: 41°09' N 73°55' W	
5				Water Line	6'-0"
10					
15				Mud Line	15'-0"
	S-1	WOR-37-58-51		6" River Mud	
	S-2	12-12-14-14			
20	S-3	8-16-18-16	S	Dark gray coarse to fine Sand, and Silt	SM
	S-4	17-12-14-10			
	S-5	12-22-24-15			
25	S-6	17-22-27-25			27'-0"
30	S-7	47-100		Dark gray coarse to fine Gravel, little Silt, some coarse to fine Sand	GM
35	S-8	42-36-38-36			37'-0"
			G_T		
40					
45				Dense Sand & Gravel	GM
50					

Project: **CHPE**
Congers, New York
Date: 03/09/2022 to 03/14/2022
Contractor: Warren George, Inc.

Boring No.: CO-2022-1
Sheet: 2 of 2
Ground El: Barge Deck
Groundwater Depth: NA

Depth Feet	SAMPLES Number	Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
55					
60			G_T	Dense Sand & Gravel	GM
65		RUN =60" 66'-71' REC = 15% RQD = 0%		Gravel in Core Barrel	
70					71'-0"
		RUN =60" 71-76' REC = 60% RQD = 21%	R	Red brown Shale Bedrock (Stockton Formation):	
75					
		RUN =60" 76'-81' REC = 45% RQD = 11%			
80					81'-0"
				End of Boring	
85					
90					
95					
100	S-13	100/1"			

Project: **CHPE**
Congers, New York
Date: 03/14/2022 to 03/15/2022
Contractor: Warren George, Inc.

Boring No.: CO-2022-2
Sheet: 1 of 3
Ground El: Barge Deck
Groundwater Depth: NA

Depth Feet	SAMPLES Number	SAMPLES Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
				Barge Deck Assumed 0.0 @ 9:00AM on 3/14/22 Assumed 0.0 is ±3.34ft above MLLW at Haverstraw Bay Position: 41°09' N 73°55' W	
5				Water Line	6'-0"
10					
15					
20				Mud Line	22'-0"
25					
30					
35			S	Soft Sand & Silt	
40					
45					
50					

Project: **CHPE**
Congers, New York
Date: 03/14/2022 to 03/15/2022
Contractor: Warren George, Inc.

Boring No.: CO-2022-2
Sheet: 2 of 3
Ground El: Barge Deck
Groundwater Depth: NA

Depth Feet	SAMPLES Number	SAMPLES Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
			S	Soft Sand & Silt	53'-0"
55					
60					
65					
70			G_T	Dense Sand & Gravel	
75					
80					
85					85'-0"
90			D_R	Dense Soil and Rock Possible Decomposed Rock	
95					
100			R	Possible Bedrock	100'-0"

Project: **CHPE**
Congers, New York
Date: 03/14/2022 to 03/15/2022
Contractor: Warren George, Inc.

Boring No.: CO-2022-2
Sheet: 3 of 3
Ground El: Barge Deck
Groundwater Depth: NA

Depth Feet	SAMPLES Number	SAMPLES Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
			R	Possible Bedrock	104'-0"
105				End of Boring	
110					
115					
120					
125					
130					
135					
140					
145					
150					

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.9	8.8	10.7	25.3	34.4	10.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	90.1		
.375	85.8		
#4	81.3		
#10	70.6		
#20	60.1		
#40	45.3		
#60	27.6		
#140	13.7		
#200	10.9		

* (no specification provided)

Material Description

Dark gray-brown poorly graded sand with silt and gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 18.8751 D_{85}= 7.3284 D_{60}= 0.8462
D_{50}= 0.5021 D_{30}= 0.2706 D_{15}= 0.1223
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: CO-2022-1 **Depth:** 23-25 ft.
Sample Number: S-5 **Date:** 5-12-2022

SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

COMPRESSIVE STRENGTH OF INTACT ROCK CORE

Project: Warren George/Pillori Assoc. - Champlain Hudson Power Express
Job No.: 22-045
Location: Hudson Valley, NY

Tested by: ZM
Test Date: 5-5-2022
Boring: CO-2022-1 Core: R-2 Depth (ft.): 73.3

Test Condition: [ ] As-received [x] Laboratory air dry [ ] Oven dry [ ] Saturated/Soaked

Moist Unit Weight (pcf): 159.3
Dry Unit Weight (pcf): 157.6
Post-Test Moisture Content: 1.1%

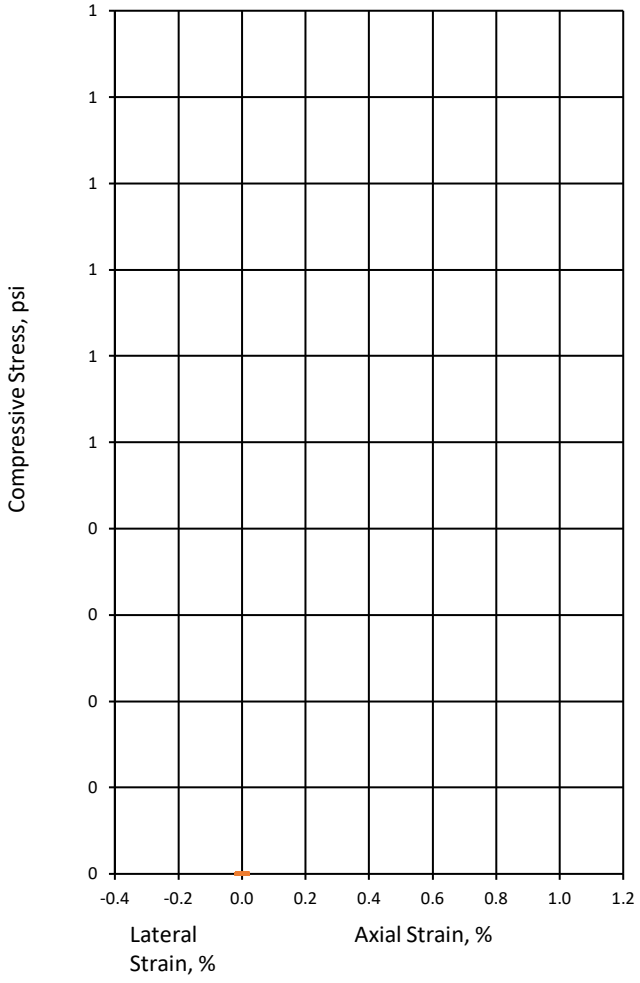
Test Method: ASTM D7012C
Stress rate, lbf/s: 80

Specimen Data

Ave. Diameter, in.: 1.979 Area (in.^{2}): 3.076
Ave. Length, in.: 4.049 L/D: 2.0

For any checked item(s) below, specimen not able to be prepared in accordance with ASTM D4543; results may differ from results obtained from a test specimen that met the requirement.

[ ] Side Straightness [x] End Flatness [x] End ⊥ [x] End ∥



Pre-Test

Post-Test

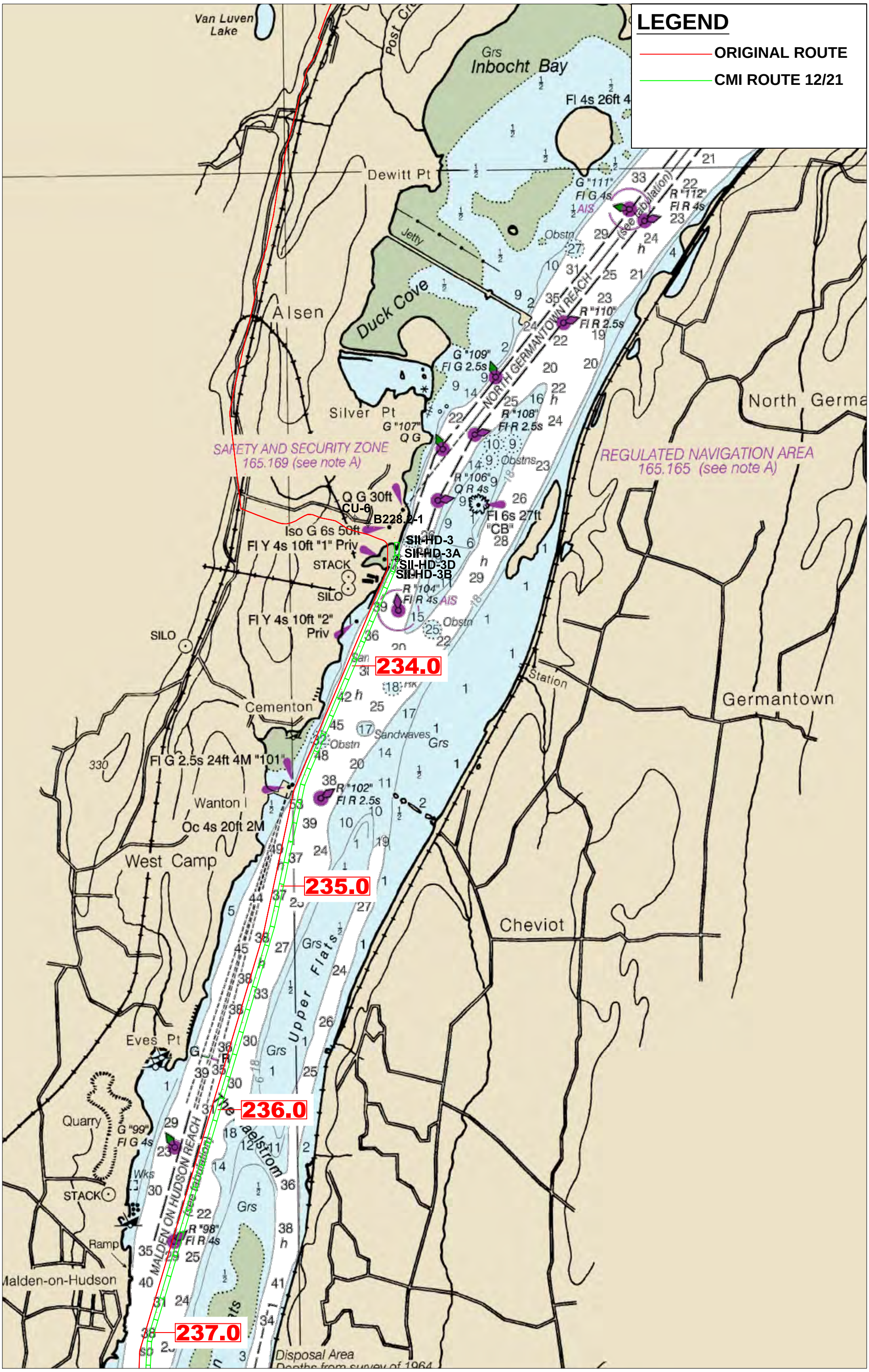
Unconfined Compressive Strength: 10,800 psi

E
Tan. Mod. at 50% UC Strength: NR
Ave. Mod. Along Linear Portion: NR

Remarks: Red f Sandstone

SKYLANDS TESTING, LLC

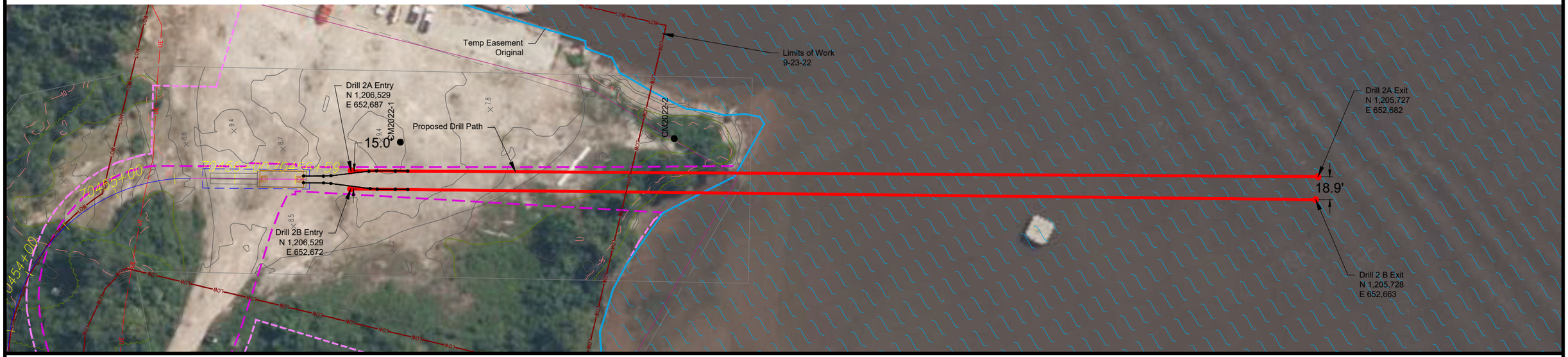
CHPE - HUDSON RIVER CABLE ROUTE ADJUSTMENT

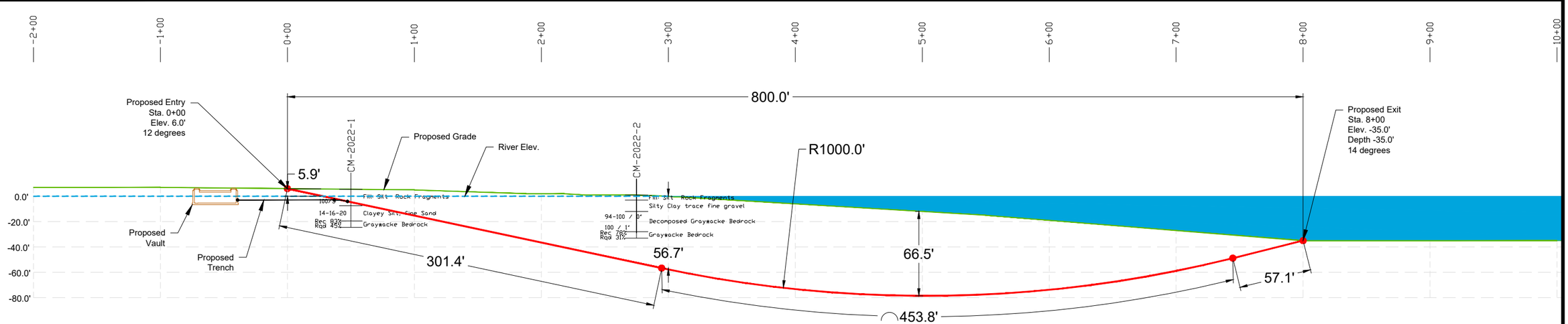


11/03/2021 R1 12/14/2021

SHEET 1 OF 16

Transmission Developers, Inc.
Champlain Hudson Power Express
Drill 2 - Cementon, New York





HD = 800'
MD = 812'
Scale: 1" = 80'

Notes:
1. All existing grade elevations are based on assumptions from Google Earth and NOAA Bathemetry.
2. Detailed IFC drawings will be provided after land survey is complete.

EC DRILLING INTERNATIONAL
1306 N. FM 3083 Road
Conroe, Texas 77303
PH: (936) 441-9080
FAX: (936) 441-9082

DATE:	JOB No.:	DRAWN BY:
10-19-22	E20-034	GJH

CLIENT:	PROFILE DIRECTION:
Champlain Hudson Power Express	N to S

LOCATION:	DRAWING No.:
Hudson River Cementon, New York	Drill 2

Project: **CHPE**
Cementon, New York
Date: 03/18/2022
Contractor: Warren George, Inc.

Boring No.: CM-2022-1
Sheet: 1 of 1
Ground El: NA
Groundwater Depth: NA

Depth Feet	SAMPLES Number	Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
	S-1	10-21-20-21	F	Fill: Gray brown coarse to fine Sand, little Silt, some coarse to fine Gravel	4'-0"
5	S-2	5-11-6-14	F	Fill: Brown Silty Clay, litle coarse to fine Sand, trace fine Gravel	FILL 8'-0"
10	S-3	80-100/3"	F	Fill: Silt & rock fragments	13'-0"
15	S-4	7-8-10-10	S	Dark gray Clayey Silt, trace fine Sand	ML
20	S-5	4-3-4-4	S		25'-0"
25		RUN =60" 25'-30' REC = 83% RQD = 45%	R	Dark gray Graywacke Bedrock:	30'-0"
30				End of Boring	
35					
40					
45					
50					

PILLORI ASSOCIATES, P.A. ***Geotechnical Engineering***

Project No.: 220103

Project: **CHPE**
Cementon, New York
Date: 03/18/2022
Contractor: Warren George, Inc.

Boring No.: CM-2022-2
Sheet: 1 of 1
Ground El: NA
Groundwater Depth: NA

Depth Feet	SAMPLES Number	Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
	S-1	12-11-12-12	F	Fill: Gray brown coarse to fine Sand, little Silt, some coarse to fine Gravel w/brick fragments	FILL 4'-0"
5	S-2	10-9-11-10	C	Brown Silty Clay, litle fine Sand, trace fine Gravel	CL 13'-0"
10	S-3	94-100/0"	D_R	Silt & rock fragments (decomposed bedrock)	
15	S-4	50/0"			
20	S-5	100/2"		Decomposed Graywacke Bedrock	
25	S-6	100/1"			29'-0"
30		RUN =60" 29'-34' REC = 78% RQD = 31%	R	Dark gray Graywack Bedrock:	34'-0"
35				End of Boring	
40					
45					
50					

PILLORI ASSOCIATES, P.A. ***Geotechnical Engineering***

Project No.: 220103

COMPRESSIVE STRENGTH OF INTACT ROCK CORE

Project: Warren George/Pillori Assoc. - Champlain Hudson Power Express
Job No.: 22-045
Location: Hudson Valley, NY

Tested by: ZM
Test Date: 5-5-2022
Boring: CM-2022-1 Core: R-1 Depth (ft.): 28.6

Test Condition: [ ] As-received [x] Laboratory air dry [ ] Oven dry [ ] Saturated/Soaked

Moist Unit Weight (pcf): 169.2
Dry Unit Weight (pcf): 168.0
Post-Test Moisture Content: 0.8%

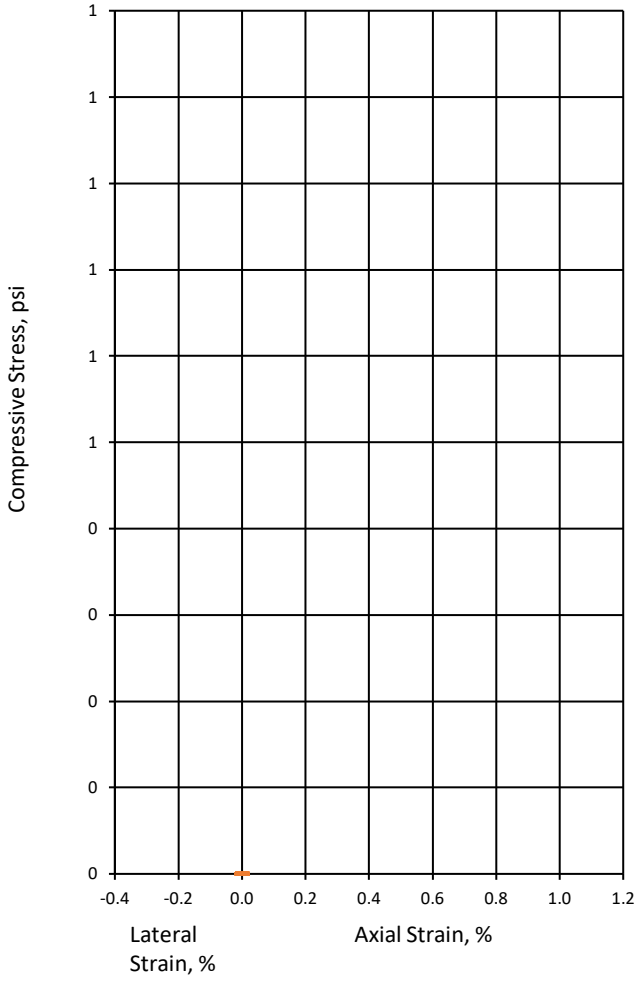
Test Method: ASTM D7012C
Stress rate, lbf/s: 100

Specimen Data			
Ave. Diameter, in.	1.987	Area (in.^{2})	3.100
Ave. Length, in.	3.741	L/D	1.9*

For any checked item(s) below, specimen not able to be prepared in accordance with ASTM D4543; results may differ from results obtained from a test specimen that met the requirement.

[ ] Side Straightness [x] End Flatness [x] End ⊥ [x] End ∥

* Specimen did not meet the minimum length requirement; results may differ from results obtained from a test specimen that met the requirement.



Pre-Test

Post-Test

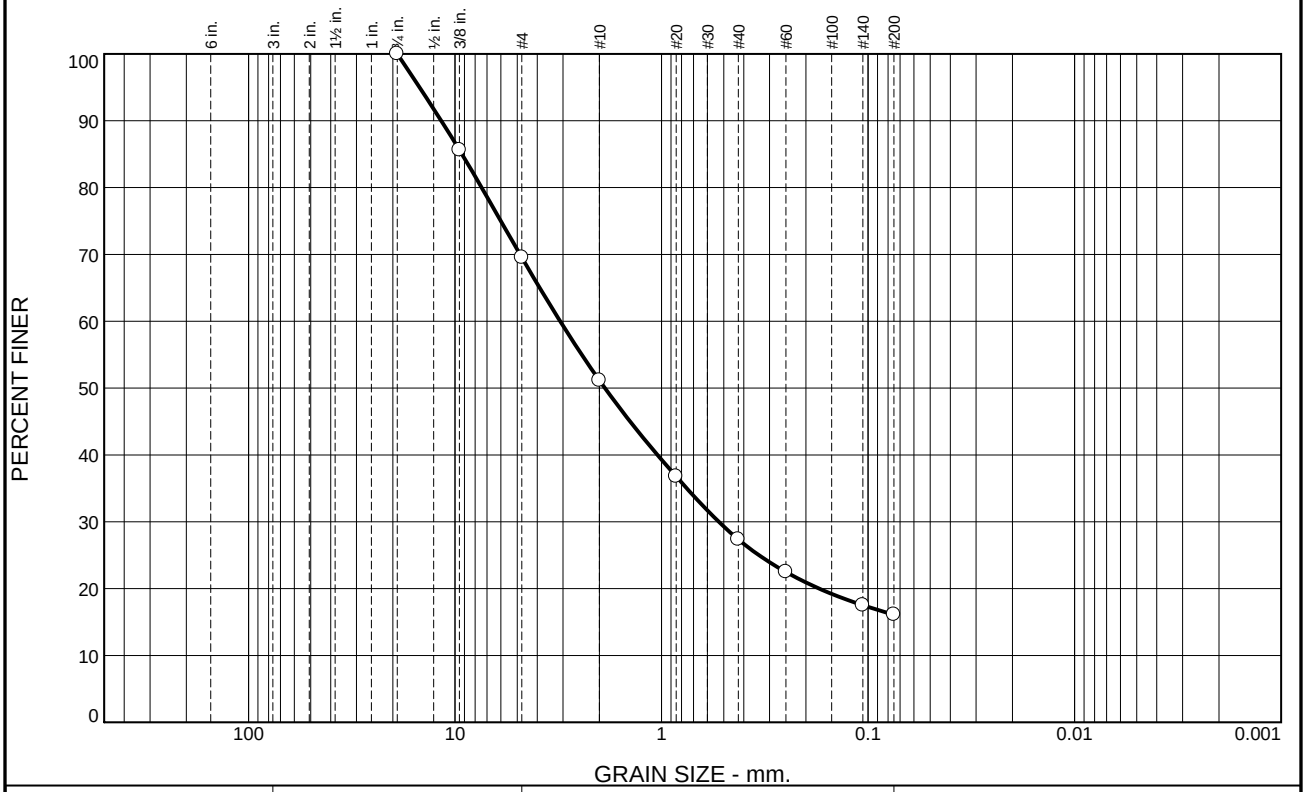
Unconfined Compressive Strength: 2,500 psi

E
Tan. Mod. at 50% UC Strength: NR
Ave. Mod. Along Linear Portion: NR

Remarks: Gray Shale/Graywacke
Longest piece available

SKYLANDS TESTING, LLC

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	30.5	18.3	23.8	11.3	16.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	85.6		
#4	69.5		
#10	51.2		
#20	36.8		
#40	27.4		
#60	22.5		
#140	17.5		
#200	16.1		

* (no specification provided)

Material Description

Gray silty sand with gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 11.6655 D_{85}= 9.2586 D_{60}= 3.0956
D_{50}= 1.8802 D_{30}= 0.5283 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: CM-2022-2 **Depth:** 20-22 & 25-27 ft.
Sample Number: S-5 & S-6 combined **Date:** 5-12-2022

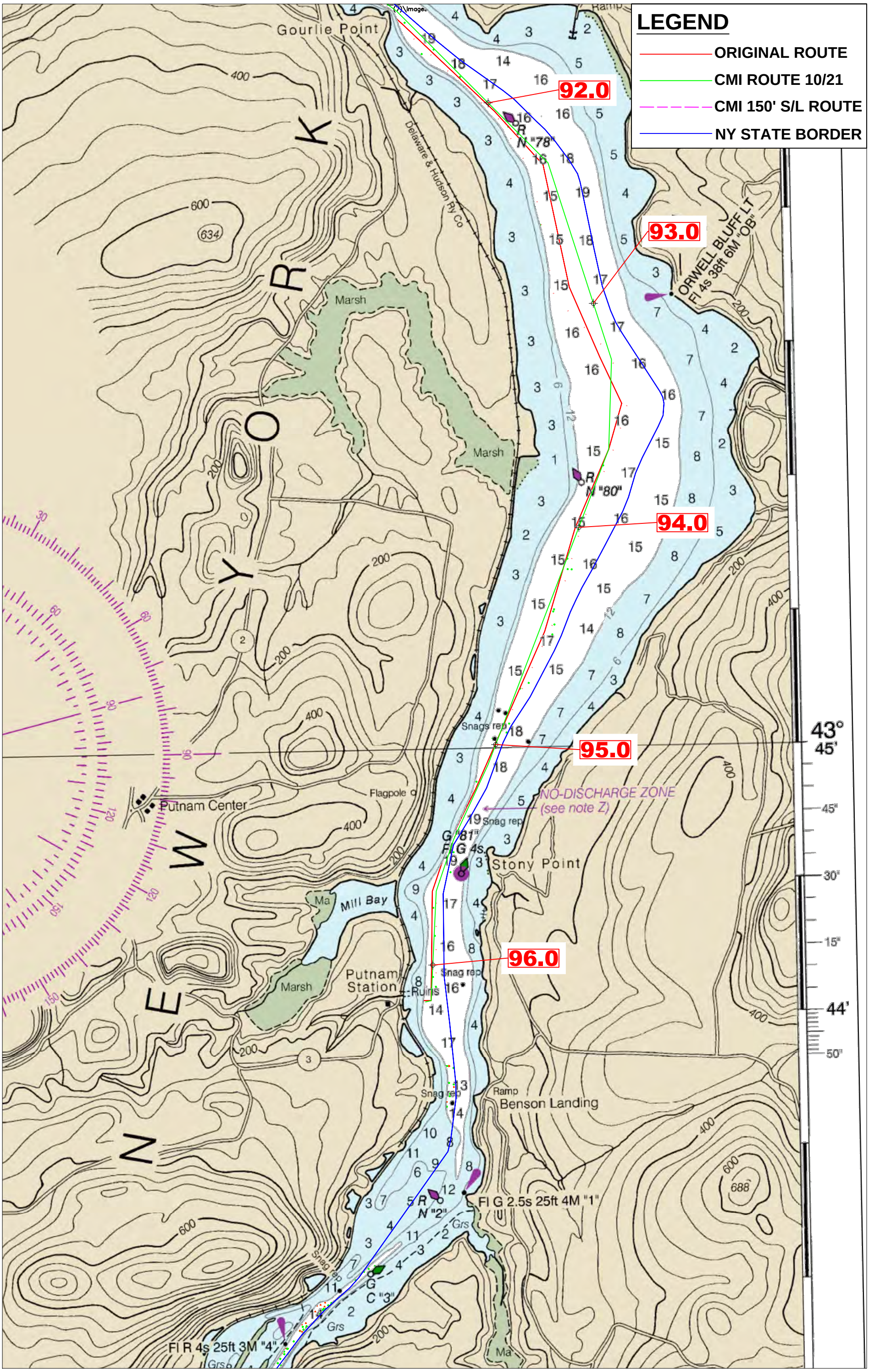
SKYLANDS TESTING, LLC

Sparta, NJ

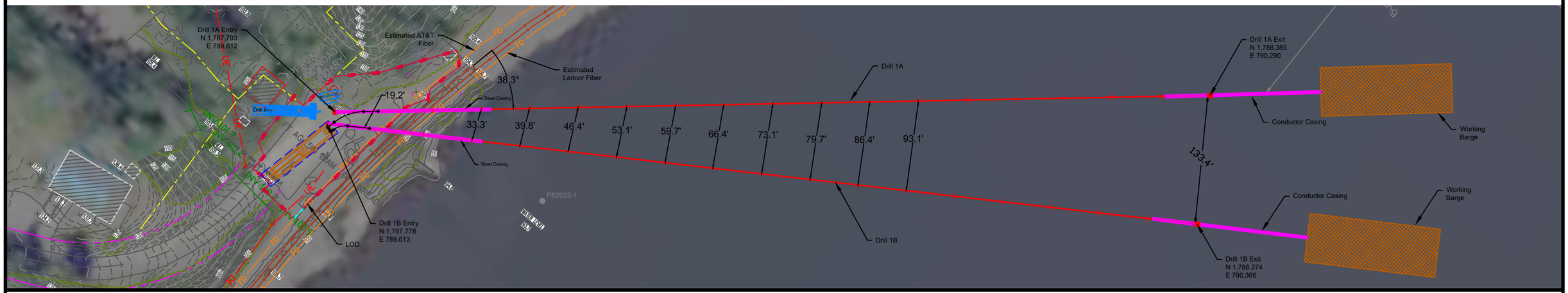
Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

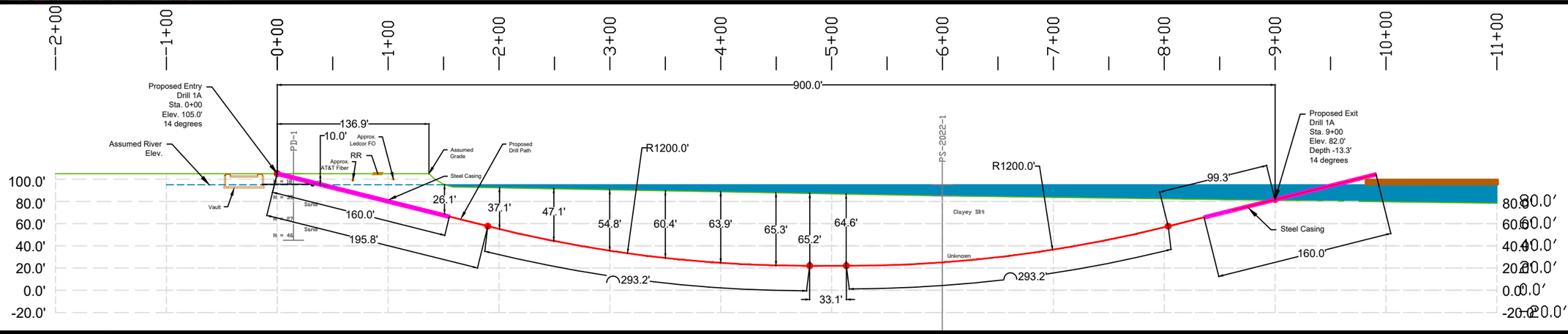
Tested By: RS **Checked By:** VRS

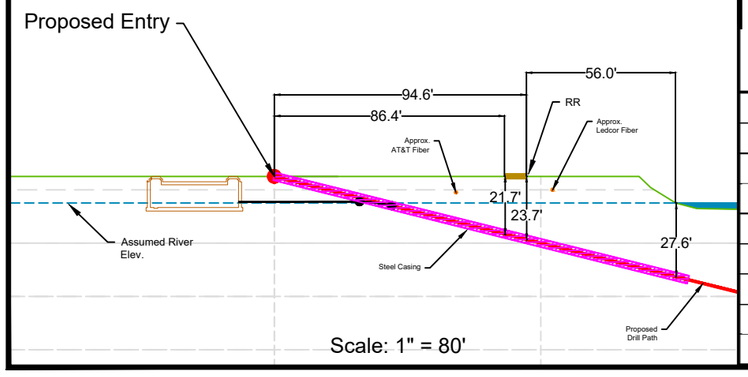
CHPE - LAKE CHAMPLAIN CABLE ROUTE ADJUSTMENT



Transmission Developers, Inc.
Champlain Hudson Power Express
Putnam Station, New York
Drill 1A - Putnam Station Profile - Option 2







Location	Horizontal Separation	Depth Below Mud Line	Difference
River Elev.	19.2	10.0	9.2
1+50	33.3	27.5	5.8
2+00	39.8	37.1	2.7
2+50	46.4	47.1	-0.7
3+00	53.1	54.8	-1.7
3+50	59.7	60.4	-0.7
4+00	66.4	63.9	2.5
4+50	73.1	65.3	7.8
5+00	79.7	64.8	14.9

Notes:
1. All existing grade elevations are based on assumptions from Google Earth and NOAA Bathemetry.
2. Detailed IFC drawings will be provided after land survey is complete.

HD = 900'
MD = 912'
Scale: 1" = 100'

E&I DRILLING INTERNATIONAL
1306 N. FM 3083 Road
Conroe, Texas 77303
PH: (936) 441-9080
FAX: (936) 441-9082

DATE:	JOB No.:	DRAWN BY:
11-02-22	E20-034	GJH

CLIENT:	PROFILE DIRECTION:
Champlain Hudson Power Express	SW to NE

LOCATION:	DRAWING No.:
Hudson River Putnam Station, New York	Drill 1A

Project: **CHPE**
Putnam, New York
Date: 05/24/2022- 05/25/2022
Contractor: Warren George, Inc.

Boring No.:PS-2022-1
Sheet: 1 of 2
Ground El: Barge Deck
Groundwater Depth: NA

Depth Feet	SAMPLES Number	Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
				Barge Deck/Water Line Assumed 0.0 @ 11:00 AM on 5/24/2022 Position: 43°44' N 73°22' W	8'-0"
10	S-1	WOH	S	Mud Line	
15	S-2	WOH		Gray Silt	ML
20	S-3	WOH			21'-0"
25	S-4	10-11-11-13	G_A	Gray fine Sand, trace Silt with wood fragments	SP
30	S-5	7-7-6-7			
35	S-6	10-11-14-15		Gray medium to fine Sand, trace Silt	
40	S-7	13-14-14-15			
45	S-8	15-20-25-26			
50	S-9	15-16-20-20		Gray fine Sand, trace Silt	

Project: **CHPE**
Putnam, New York
Date: 05/24/2022-05/25/2022
Contractor: Warren George, Inc.

Boring No.:PS-2022-1
Sheet: 2 of 2
Ground El: Barge Deck
Groundwater Depth: NA

Depth Feet	SAMPLES Number	Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
55	S-10	20-28-30-36		Gray fine Sand, trace Silt	
60	S-11	18-21-28-47			
			G_A		SP
65	S-12	30-30-31-32			
				Gray coarse to fine Sand, trace Silt	
70	S-13	30-36-35-33			
	S-14	40-54-55-61			
75					76'-0"
80					
85				Advanced Boring through Sand from 75 to 100ft. No Bedrock was encountered	
90					
95					
100					100'-0"
				End of Boring	

Project: **CHPE**
Putnam, New York
Date: 05/25/2022
Contractor: Warren George, Inc.

Boring No.:PS-2022-2
Sheet: 1 of 2
Ground El: Barge Deck
Groundwater Depth: NA

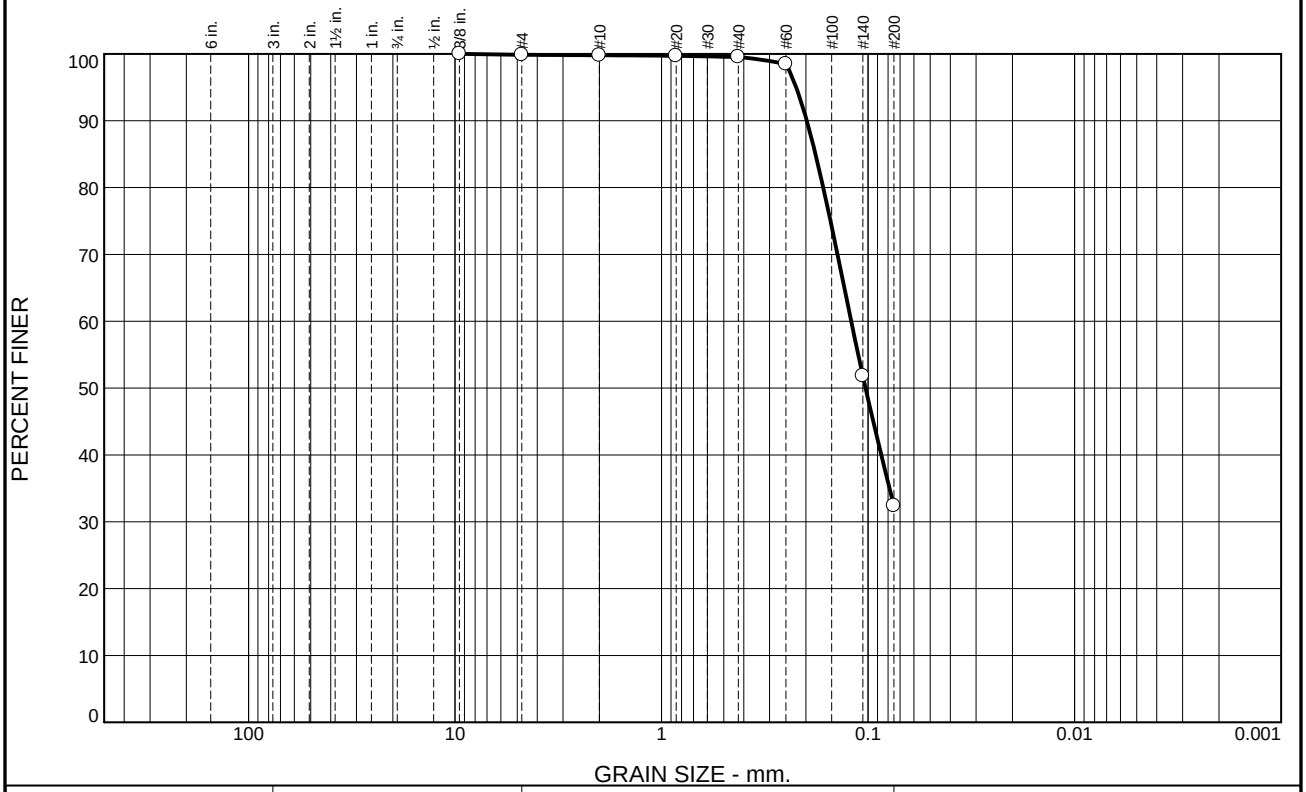
Depth Feet	SAMPLES Number	Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
				Barge Deck/Water Line	
5				Assumed 0.0 @ 10:00 AM on 5/25/2022 Position: 43°44' N 73°22' W	
10					
15					15'-0"
	S-1	WOR		Mud Line	
20					
25	S-2	WOR			
30					
			S	Gray Silt	ML
35	S-3	WOR			
40					
45	S-4	WOR			
50					

Project: **CHPE**
Putnam, New York
Date: 05/25/2022
Contractor: Warren George, Inc.

Boring No.:PS-2022-2
Sheet: 2 of 2
Ground El: Barge Deck
Groundwater Depth: NA

Depth Feet	SAMPLES Number	Blows / 6"	Strata	SOIL DESCRIPTION	Classification Depth Elevation
55	S-5	WOR			
60					
65	S-6	WOR			
70					
75	S-7	WOR	S	Gray Silt	ML
80					
85	S-8	WOR			
90					
95					
100	S-2	WOR			100'-0"
				End of Boring	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.1	0.3	67.1	32.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	99.8		
#20	99.7		
#40	99.5		
#60	98.5		
#140	51.8		
#200	32.4		

* (no specification provided)

Material Description

Dark gray silty sand; w/wood

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1980 D_{85}= 0.1798 D_{60}= 0.1207
D_{50}= 0.1029 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 23-25 ft.
Sample Number: S-4

Date: 7-21-2022

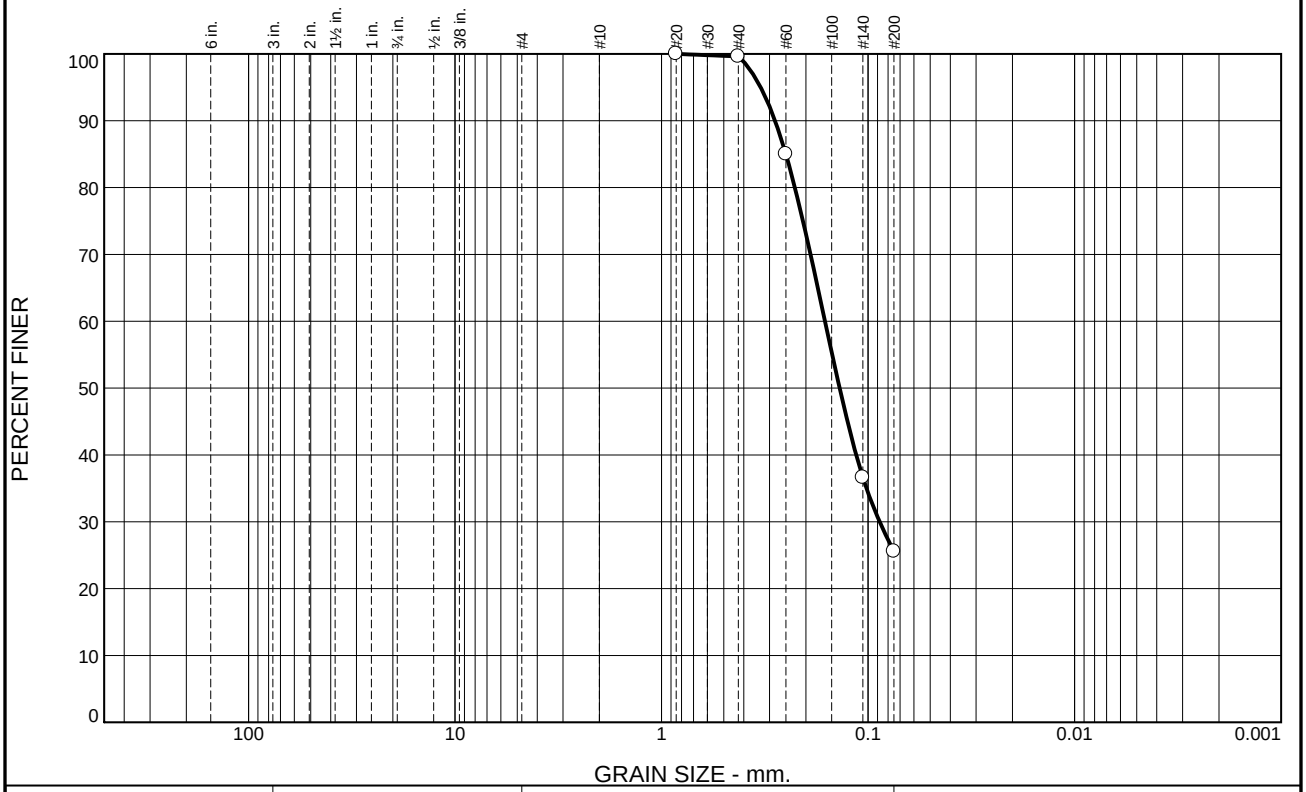
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.4	74.0	25.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#20	100.0		
#40	99.6		
#60	85.0		
#140	36.6		
#200	25.6		

* (no specification provided)

Material Description

Dark gray silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2821 D_{85}= 0.2500 D_{60}= 0.1617
D_{50}= 0.1373 D_{30}= 0.0879 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 28-30 ft.
Sample Number: S-5

Date: 7-21-2022

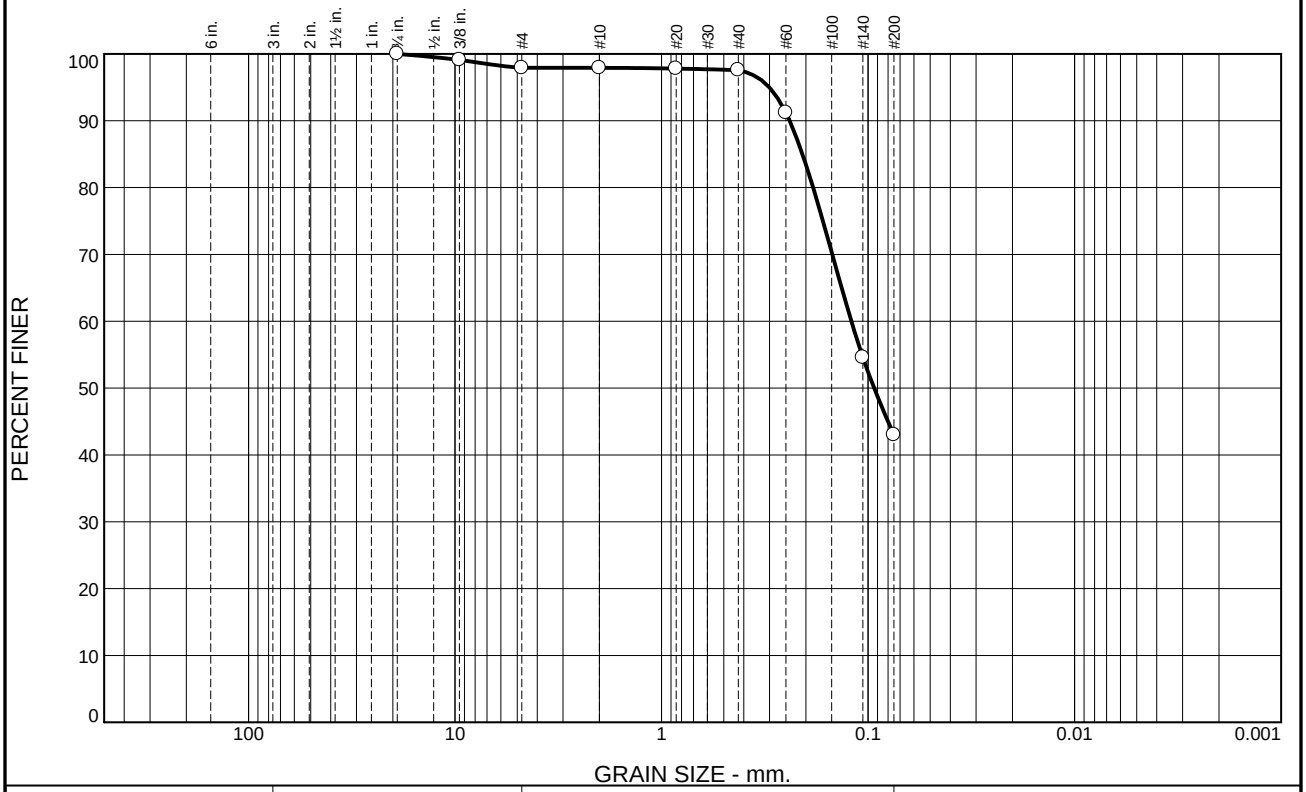
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.1	0.0	0.3	54.6	43.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	99.1		
#4	97.9		
#10	97.9		
#20	97.8		
#40	97.6		
#60	91.2		
#140	54.6		
#200	43.0		

* (no specification provided)

Material Description

Dark gray silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2397 D_{85}= 0.2079 D_{60}= 0.1205
D_{50}= 0.0935 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 33-35 ft.
Sample Number: S-6

Date: 7-21-2022

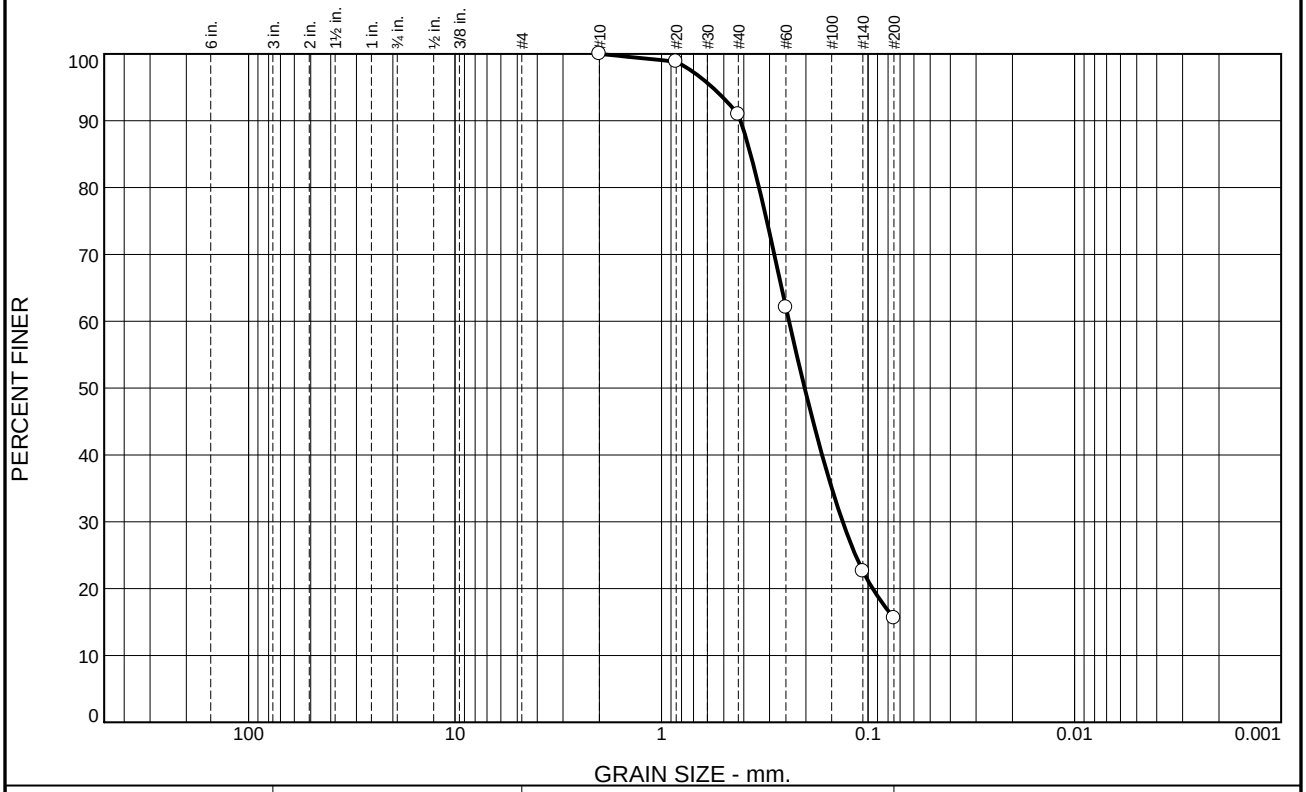
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	9.0	75.4	15.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	98.8		
#40	91.0		
#60	62.1		
#140	22.6		
#200	15.6		

* (no specification provided)

Material Description

Dark gray silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4145 D_{85}= 0.3706 D_{60}= 0.2414
D_{50}= 0.2028 D_{30}= 0.1327 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 38-40 ft.
Sample Number: S-7

Date: 7-21-2022

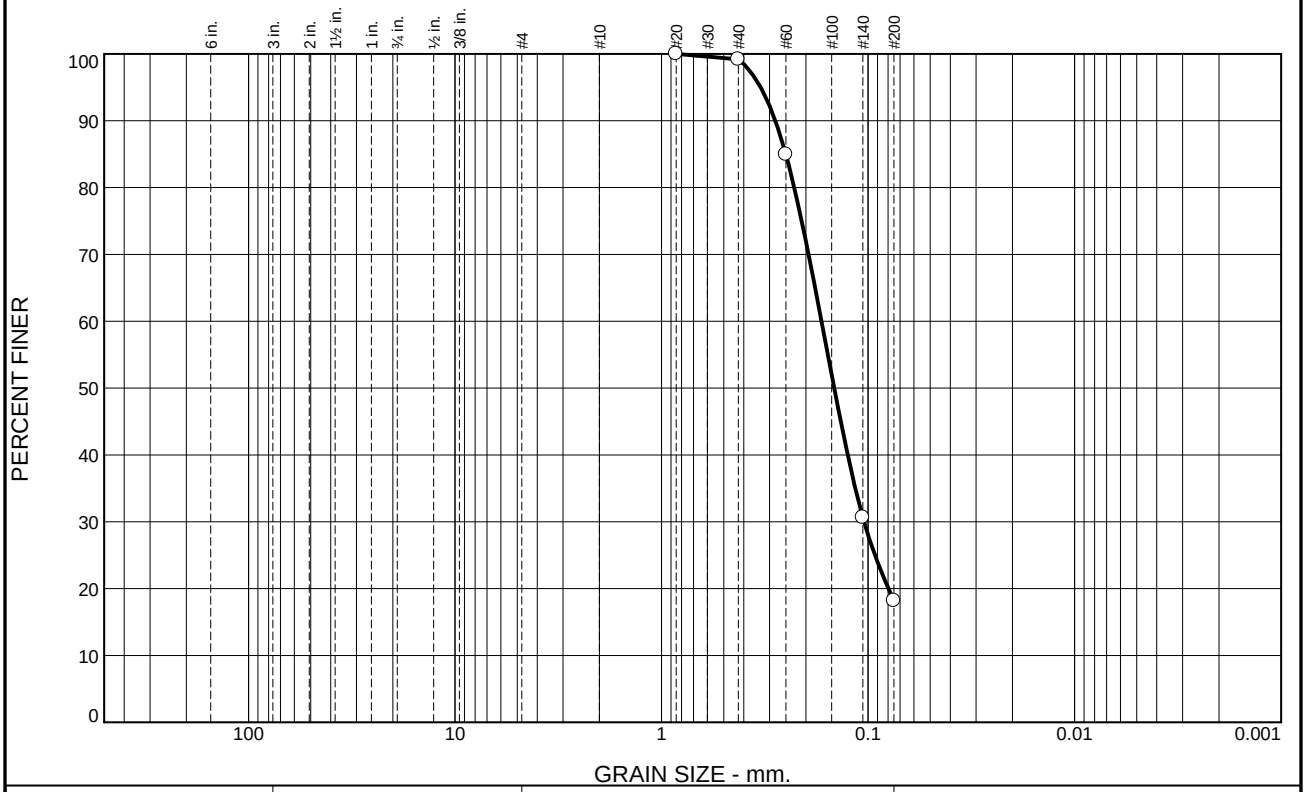
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.8	81.0	18.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#20	100.0		
#40	99.2		
#60	85.0		
#140	30.6		
#200	18.2		

* (no specification provided)

Material Description

Gray silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2812 D_{85}= 0.2502 D_{60}= 0.1681
D_{50}= 0.1459 D_{30}= 0.1046 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 43-45 ft.
Sample Number: S-8

Date: 7-21-2022

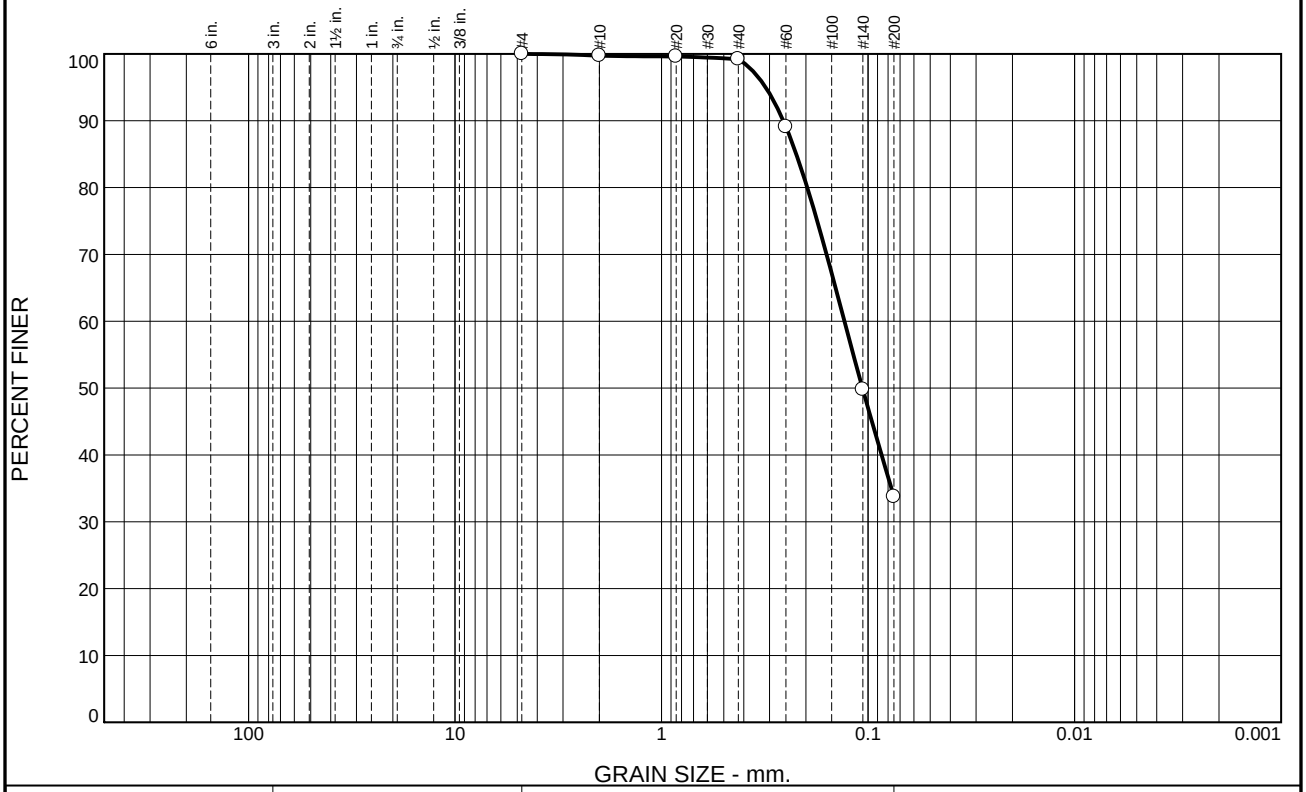
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.3	0.5	65.4	33.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	99.6		
#40	99.2		
#60	89.1		
#140	49.8		
#200	33.8		

* (no specification provided)

Material Description

Light gray-brown silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2573 D_{85}= 0.2226 D_{60}= 0.1301
D_{50}= 0.1065 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 48-50 ft.
Sample Number: S-9

Date: 7-21-2022

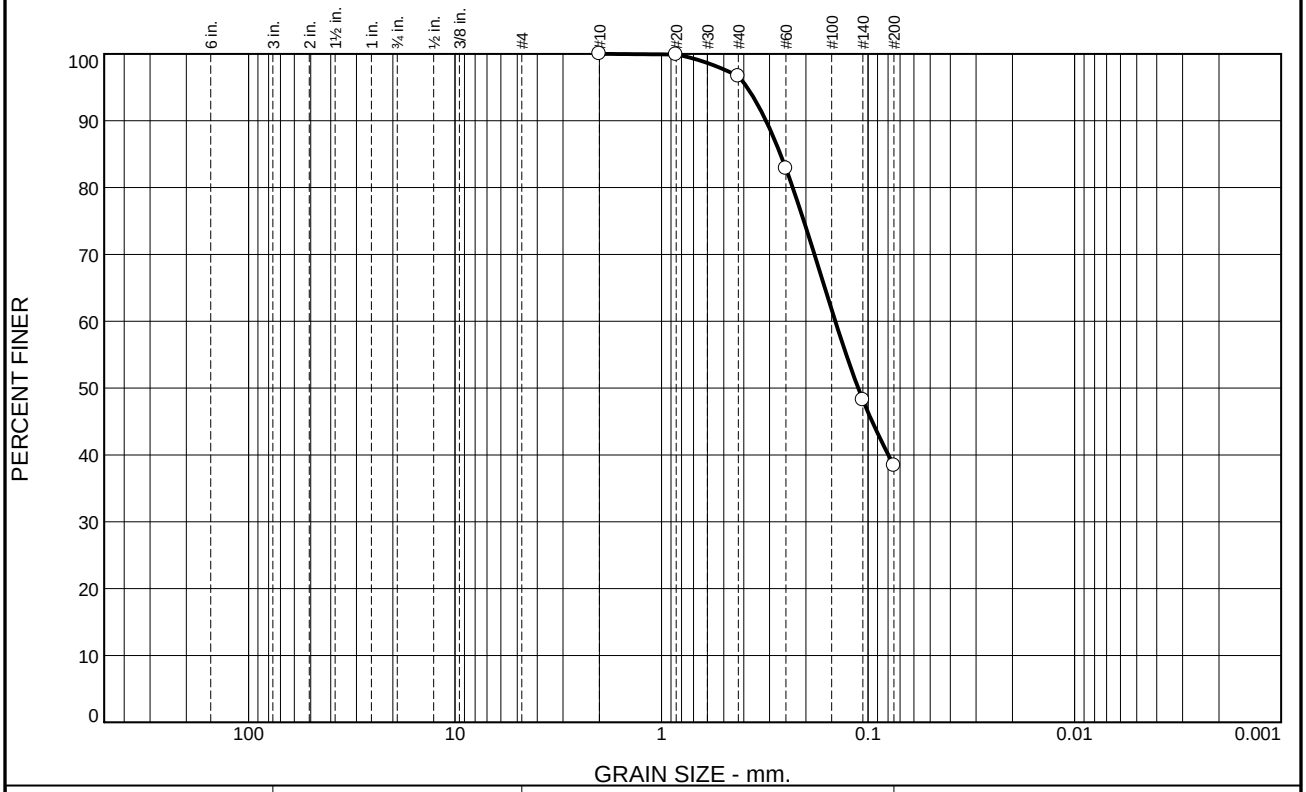
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.3	58.3	38.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	96.7		
#60	82.9		
#140	48.2		
#200	38.4		

* (no specification provided)

Material Description

Light gray-brown silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3120 D_{85}= 0.2657 D_{60}= 0.1441
D_{50}= 0.1116 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 53-55 ft.
Sample Number: S-10

Date: 7-21-2022

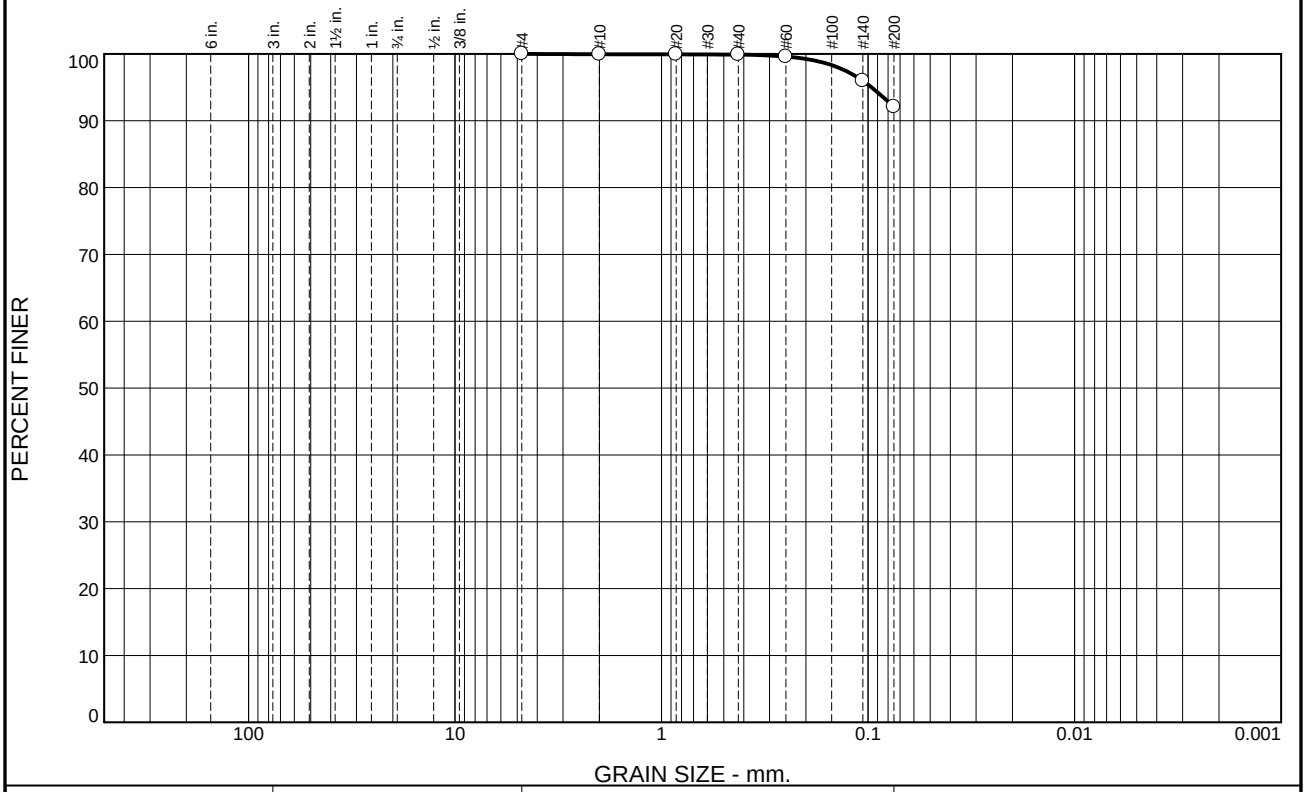
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.0	7.8	92.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.9		
#40	99.9		
#60	99.6		
#140	96.0		
#200	92.1		

* (no specification provided)

Material Description

Light gray-brown silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 58-60 ft.
Sample Number: S-11 **Date:** 7-21-2022

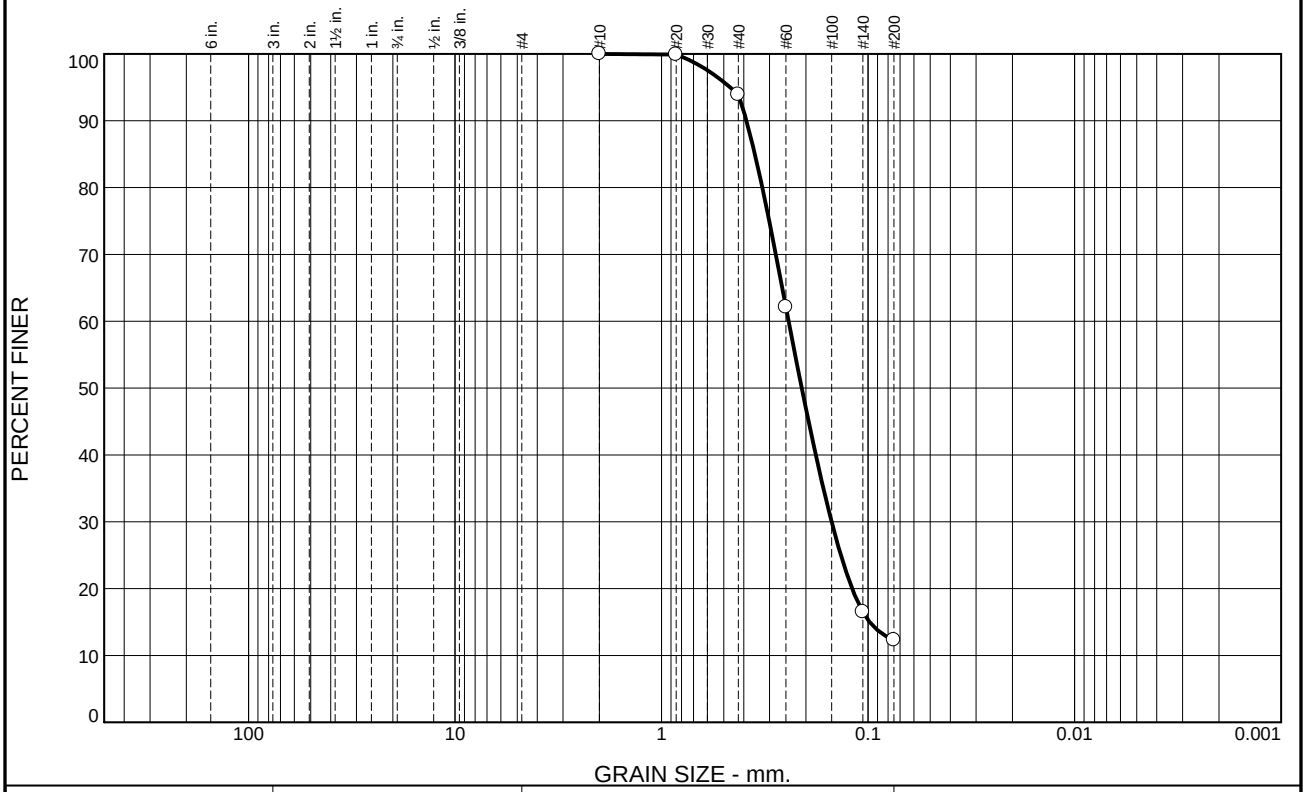
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	6.1	81.6	12.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	93.9		
#60	62.1		
#140	16.5		
#200	12.3		

* (no specification provided)

Material Description

Dark gray silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3881 D_{85}= 0.3531 D_{60}= 0.2425
D_{50}= 0.2095 D_{30}= 0.1502 D_{15}= 0.0983
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 63-65 ft.
Sample Number: S-12

Date: 7-21-2022

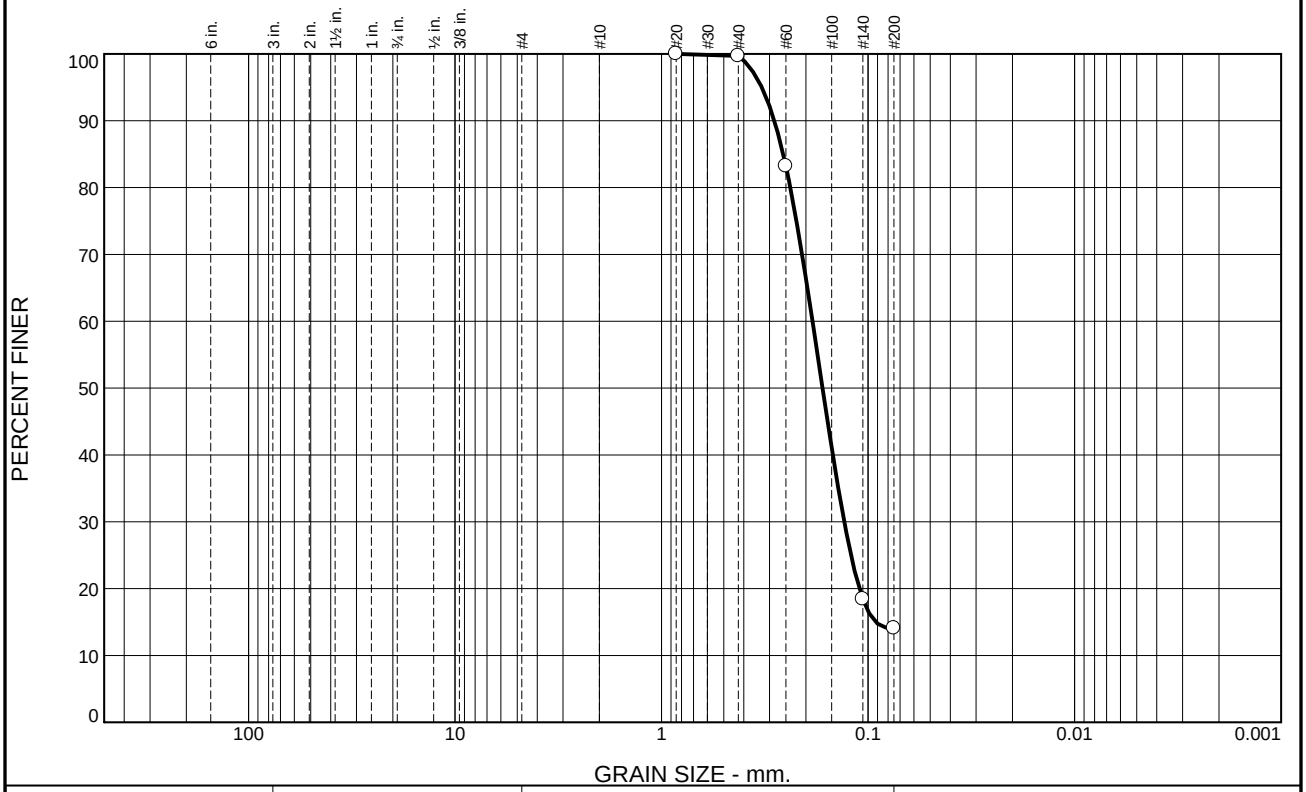
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.3	85.6	14.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#20	100.0		
#40	99.7		
#60	83.2		
#140	18.4		
#200	14.1		

* (no specification provided)

Material Description

Dark gray silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2843 D_{85}= 0.2575 D_{60}= 0.1859
D_{50}= 0.1662 D_{30}= 0.1304 D_{15}= 0.0919
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 68-70 ft.
Sample Number: S-13 **Date:** 7-21-2022

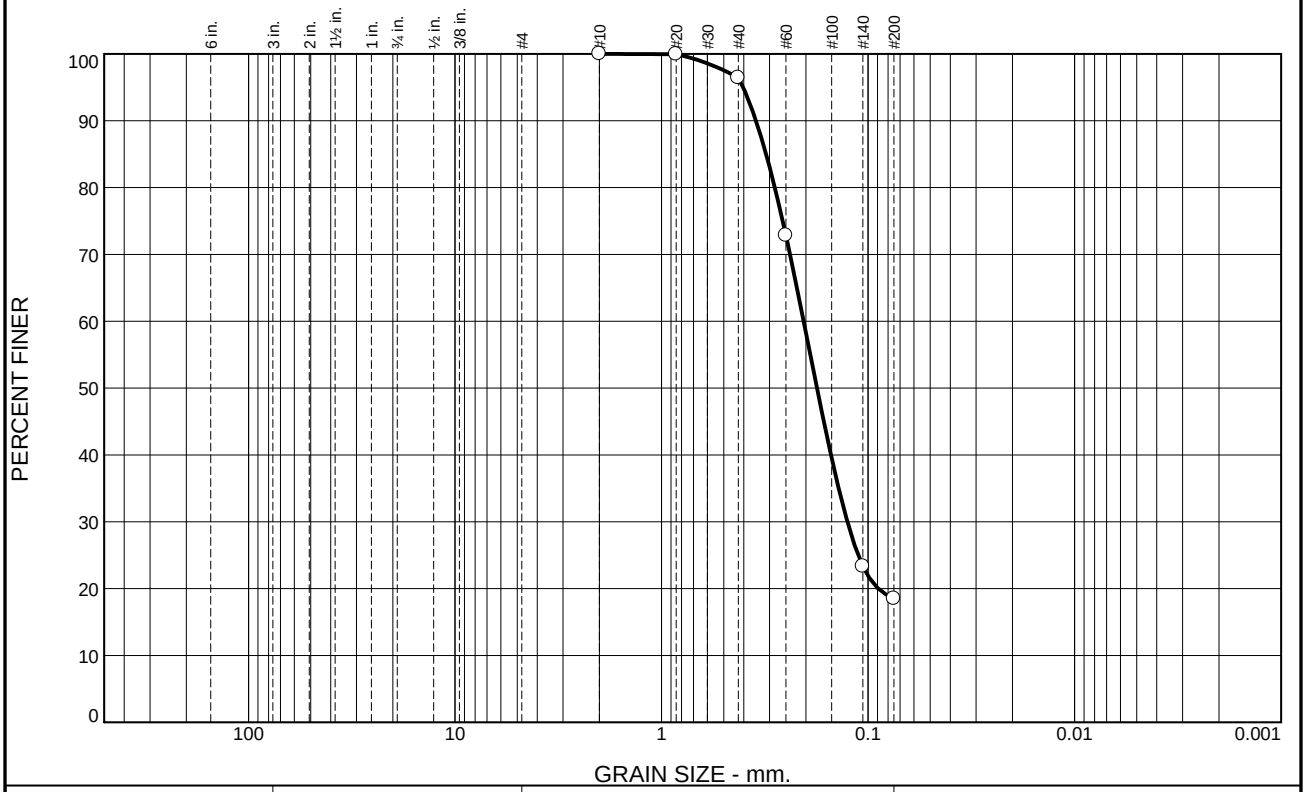
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.6	77.9	18.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	100.0		
#40	96.4		
#60	72.8		
#140	23.4		
#200	18.5		

* (no specification provided)

Material Description

Dark gray silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3488 D_{85}= 0.3117 D_{60}= 0.2051
D_{50}= 0.1768 D_{30}= 0.1259 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample washed on #200 sieve
USCS based on dilatancy & plasticity per ASTM D2488

Source of Sample: PS-2022-1 **Depth:** 73-75 ft.
Sample Number: S-14

Date: 7-21-2022

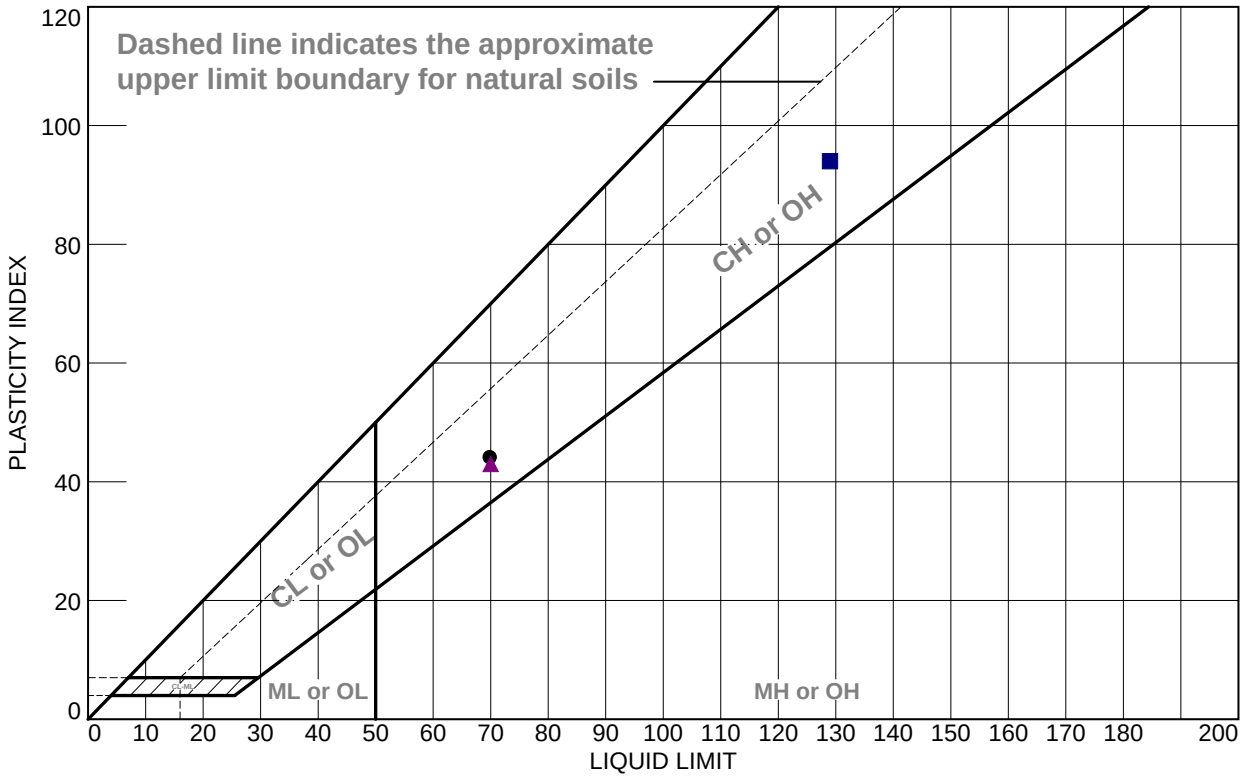
SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.
Project: Champlain Hudson Power Express
Hudson Valley, NY
Project No: 22-045 **Figure**

Tested By: RS **Checked By:** VRS

ATTERBERG LIMITS REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	PS-2022-1	S-1	8-10 ft.	106.5	26	70	44	1.8	
■	PS-2022-1	S-2	13-15 ft.	124.6	35	129	94	1.0	
▲	PS-2022-1	S-3	18-20 ft.	76.5	27	70	43	1.2	

SKYLANDS TESTING, LLC

Sparta, NJ

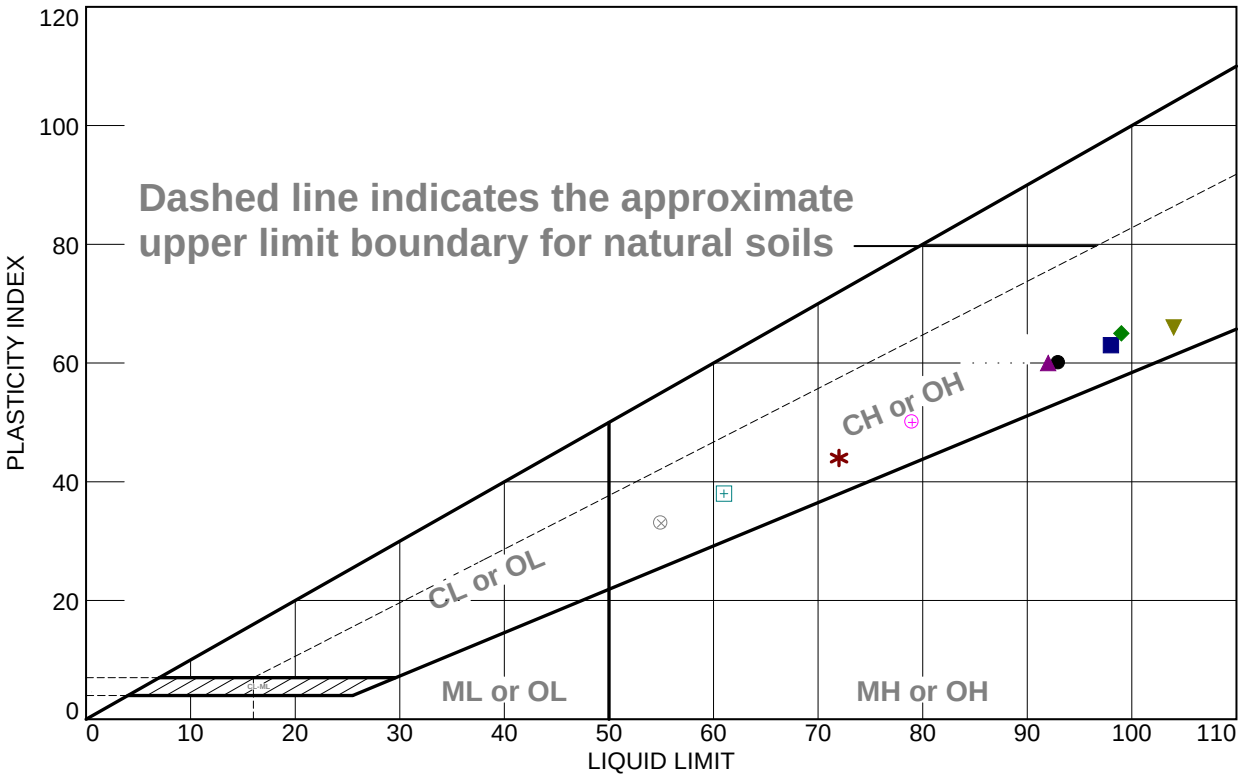
Client: Warren George/Pillori Assoc.

Project: Champlain Hudson Power Express
Hudson Valley, NY

Project No.: 22-045

Figure

ATTERBERG LIMITS REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	PS-2022-2	S-1	15-17 ft.	116.2	33	93	60	1.4	
■	PS-2022-2	S-2	25-27 ft.	88.6	35	98	63	0.9	
▲	PS-2022-2	S-3	35-37 ft.	80.5	32	92	60	0.8	
◆	PS-2022-2	S-4	45-47 ft,	85.2	34	99	65	0.8	
▼	PS-2022-2	S-5	55-57 ft.	97.0	38	104	66	0.9	
✱	PS-2022-2	S-6	65-67 ft.	71.8	28	72	44	1.0	
⊕	PS-2022-2	S-7	75-77 ft.	72.2	29	79	50	0.9	
⊞	PS-2022-2	S-8	85-87 ft.	51.6	23	61	38	0.8	
⊗	PS-2022-2	S-9	98-100 ft.	38.5	22	55	33	0.5	

SKYLANDS TESTING, LLC

Sparta, NJ

Client: Warren George/Pillori Assoc.

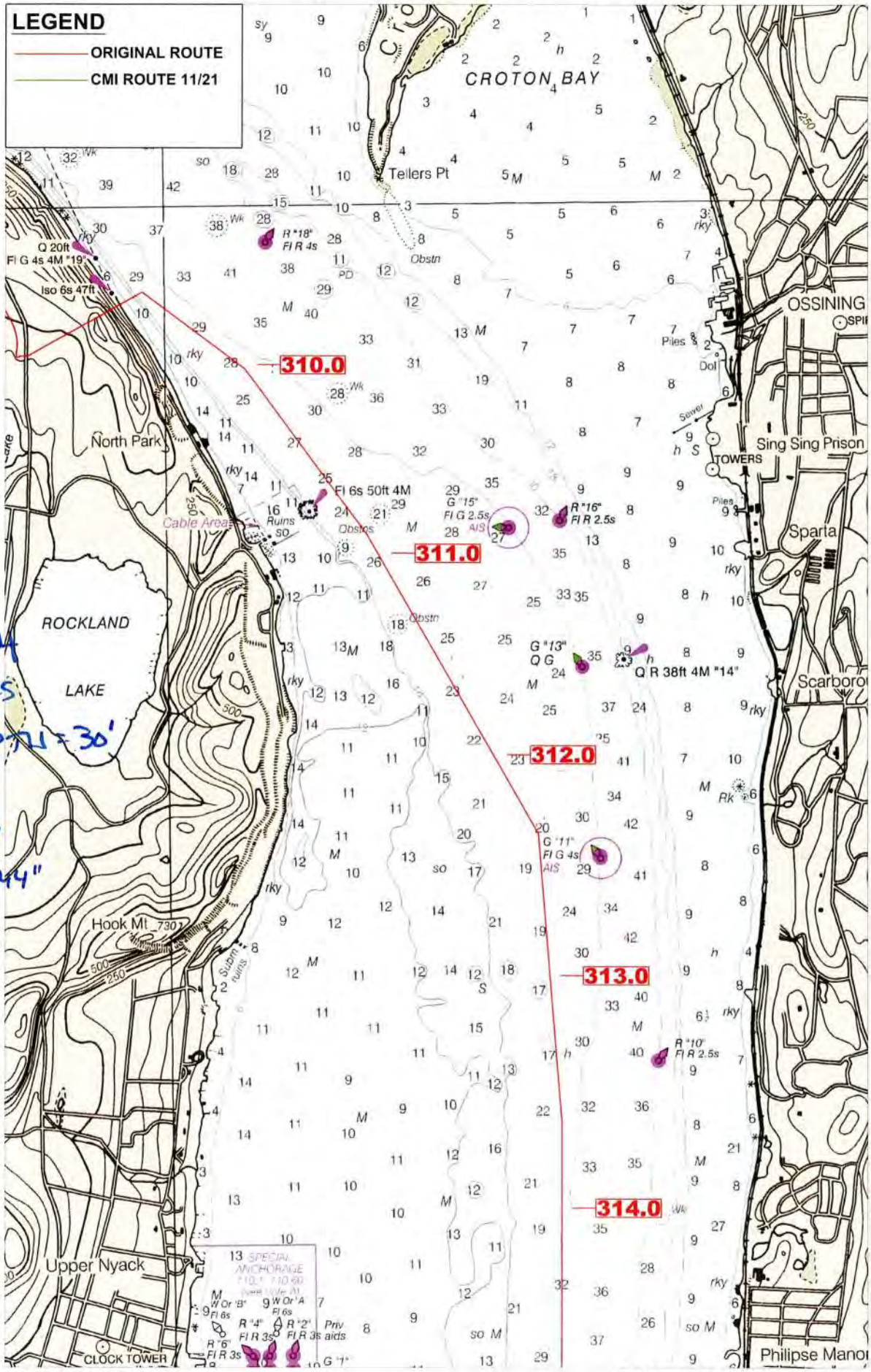
Project: Champlain Hudson Power Express
Hudson Valley, NY

Project No.: 22-045

Figure

Appendix U – Previous Geotechnical Borings

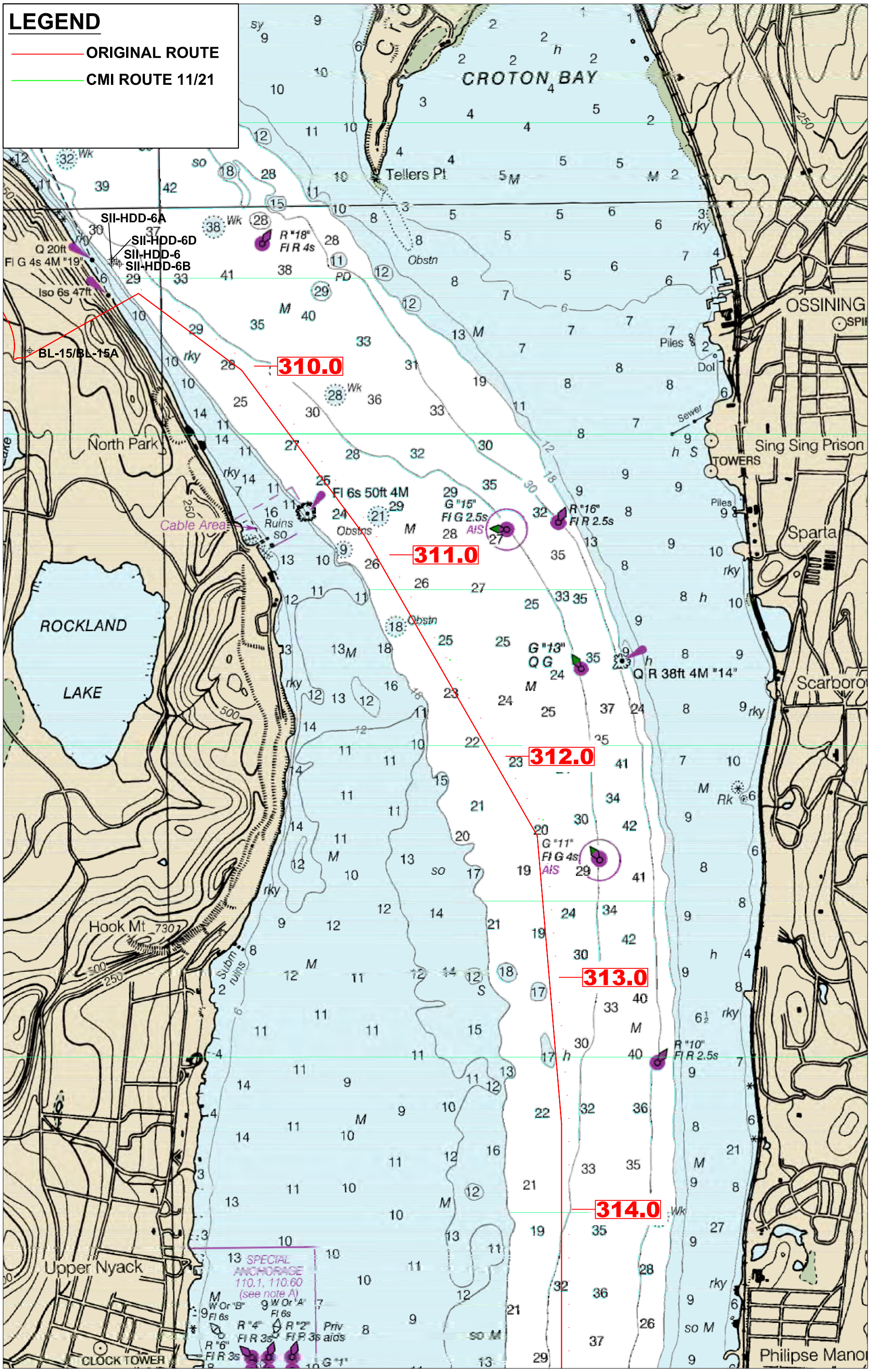
CHPE - HUDSON RIVER CABLE ROUTE ADJUSTMENT

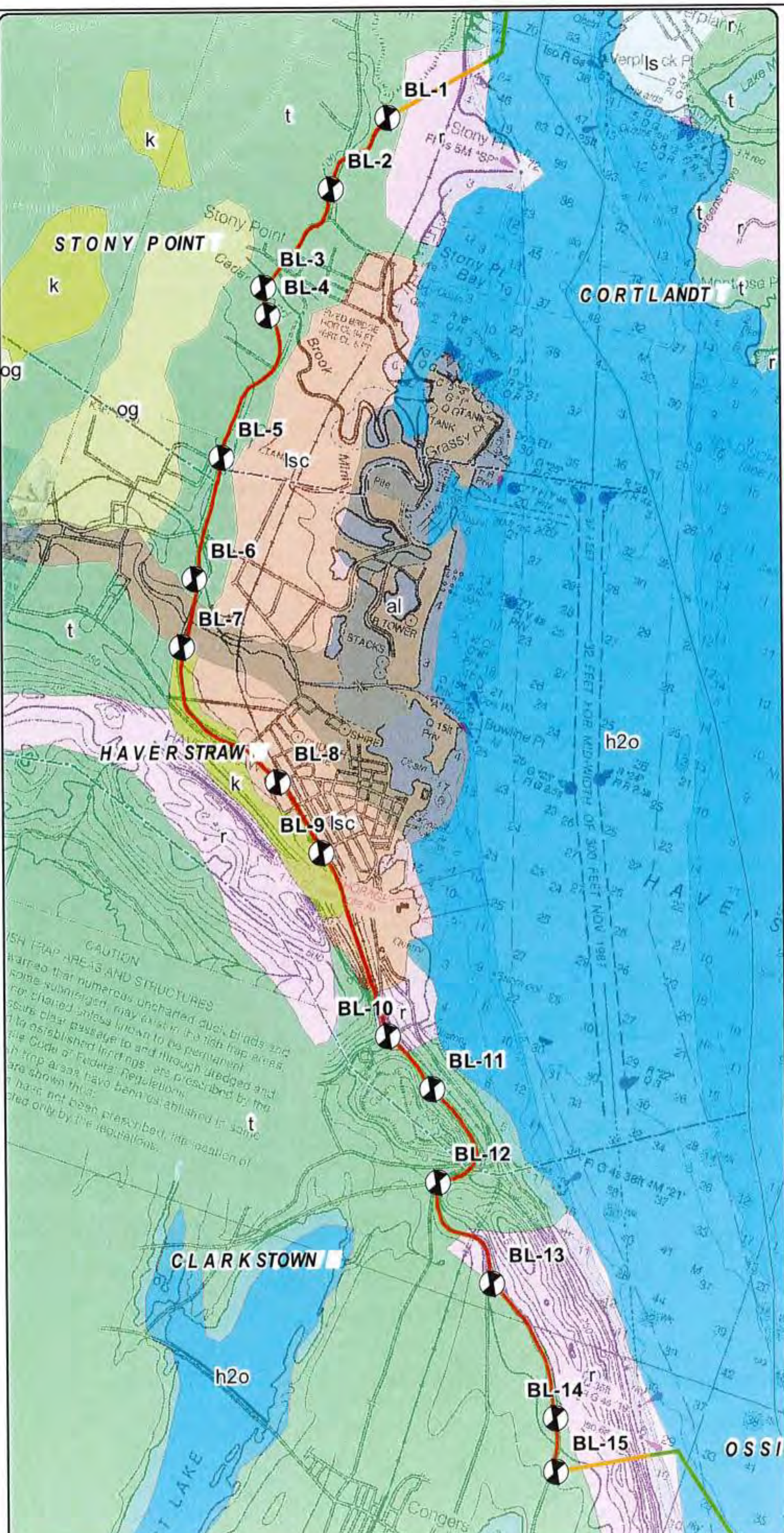


DRILL #4
CONCRETE
WATER DEPTH = 30'

N41°09'21.10"
W73°54'49.44"

CHPE - HUDSON RIVER CABLE ROUTE ADJUSTMENT





LEGEND

Approximate Boring Locations

- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location

Surficial Geology

- af- Artificial fill
- al- Recent alluvium, fine sand to gravel
- alf- Alluvial fan
- b- Beach, sand and gravel deposit at marine shorelines
- bi- Barier island, sand and gravel deposit as barrier islands
- h2o- Water
- k- Kame deposits, coarse to fine gravel and/or sand
- km- Kame moraine, variable texture from boulders to sand
- ld- Lacustrine delta, coarse to fine gravel and sand
- ls- Lacustrine sand, generally quartz sand, well sorted, stratified
- lsc, Lacustrine silt and clay, generally laminated silt and clay
- og- Outwash sand and gravel, coarse to fine gravel with sand
- pm- Swamp deposits, peat-muck, organic silt and sand in poorly drained area
- r- Bedrock, exposed or generally within 1 meter of surface
- t- Till, variable texture (boulders to silt)
- tm-Till moraine, variable texture (size and sorting)
- Town Boundary
- County Boundary

N

0.35 0.175 0 0.35 Miles

Transmission Developers Inc

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

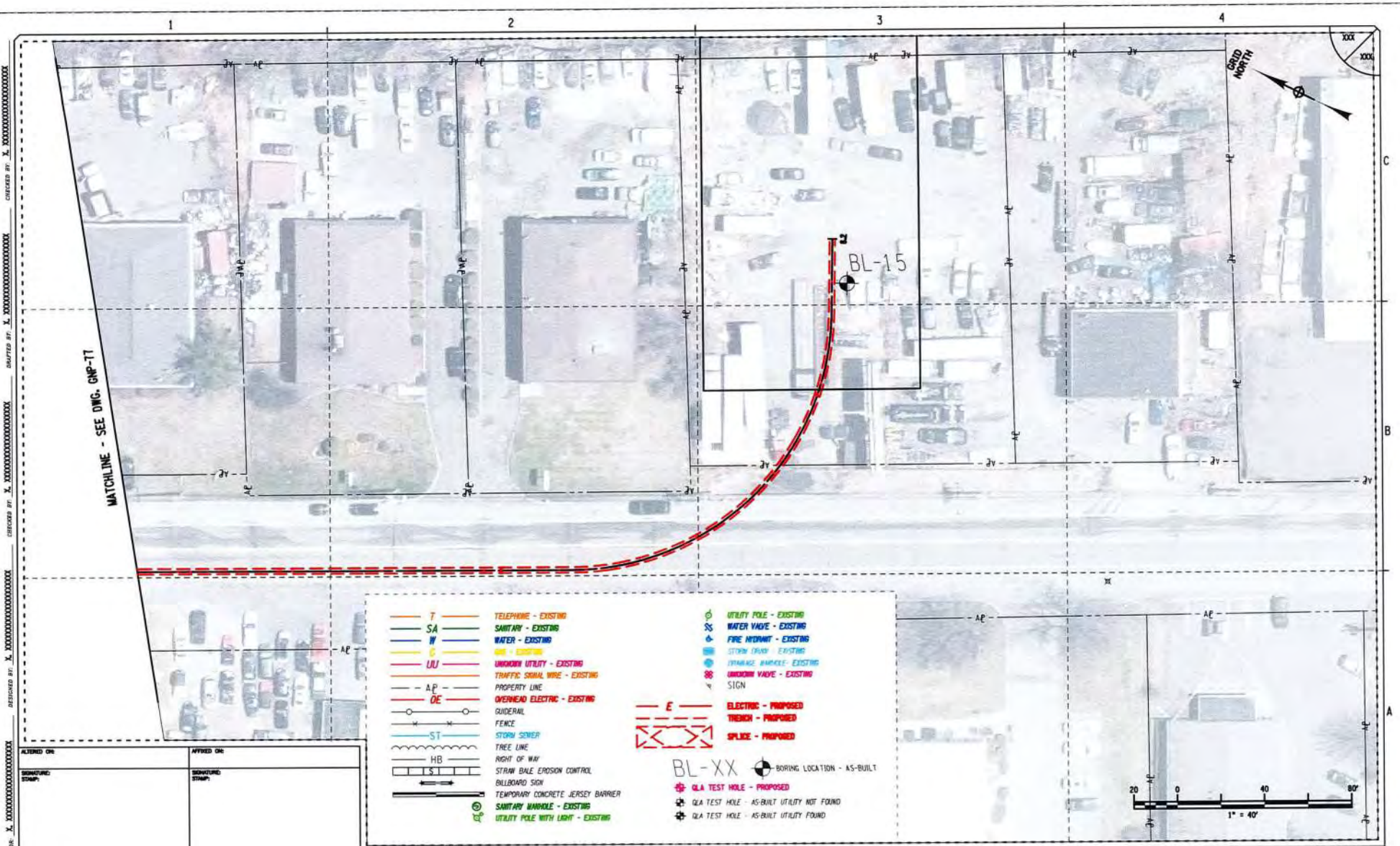
FIGURE 3

Surficial Geology and Geotechnical Borings

Prepared on 8/25/2020

by: AECOM

DATA SOURCES: ESRI, NYSDOT, NOAA, USACE, NYDOS, TDI, TRC



T — TELEPHONE - EXISTING
SA — SANITARY - EXISTING
W — WATER - EXISTING
G — GAS - EXISTING
UU — UNKNOWN UTILITY - EXISTING
TRAFFIC SIGNAL WIRE - EXISTING
PROPERTY LINE
OE — OVERHEAD ELECTRIC - EXISTING
GUIDERAIL
FENCE
ST — STORM SEWER
TREE LINE
HB — RIGHT OF WAY
STRAW BALE EROSION CONTROL
BILLBOARD SIGN
TEMPORARY CONCRETE JERSEY BARRIER
SANITARY MANHOLE - EXISTING
UTILITY POLE WITH LIGHT - EXISTING
UTILITY POLE - EXISTING
WATER VALVE - EXISTING
FIRE HYDRANT - EXISTING
STORM DRAIN - EXISTING
DRAINAGE MANHOLE - EXISTING
UNKNOWN VALVE - EXISTING
SIGN
E — ELECTRIC - PROPOSED
TRENCH - PROPOSED
SPLICE - PROPOSED
BL-XX — BORING LOCATION - AS-BUILT
QLA TEST HOLE - PROPOSED
QLA TEST HOLE - AS-BUILT UTILITY NOT FOUND
QLA TEST HOLE - AS-BUILT UTILITY FOUND

ALTERED ON:	APPROVED ON:
SIGNATURE: STAMP:	SIGNATURE: STAMP:

DESIGN SUPERVISOR: X. XXXXXXXXXXXXXXXXXX
DESIGNED BY: X. XXXXXXXXXXXXXXXXXX
CHECKED BY: X. XXXXXXXXXXXXXXXXXX
DRAFTED BY: X. XXXXXXXXXXXXXXXXXX
CHECKED BY: X. XXXXXXXXXXXXXXXXXX

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR, TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

REVISIONS

DATE	DESCRIPTION	BY	SYM.

TRANSMISSION DEVELOPERS, INC.
1301 AVENUE OF THE AMERICAS
NEW YORK, NY 10019-6022

AECOM

TITLE OF PROJECT: CHAMPLAIN HUDSON POWER EXPRESS
LOCATION OF PROJECT:
TITLE OF DRAWING: GENERAL PLANS
CONTRACT NUMBER: 60323056
DATED:
DRAWING NUMBER: GNP-78

Aquifer / AECOM #60323056
CHPE - Rockland County Borings
LABORATORY SOIL TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS								REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	SPECIFIC GRAVITY (-)	
BL-2	S-1b	7.2-8.0	22.1	28	19	9	CL	86	17		
BL-2	S-2	8-10	18.6	27	19	8	CL	75	13		
BL-3	S-1	6-8	12.5				ML	96.1	20		
BL-3	S-2	8-10	16.3				ML	93	14		
BL-3	S-3	10-10.7	12.4				ML	66	14		
BL-5	S-1	5-7	10.6				SM	40	8		
BL-5	S-3	9-11	7.0				SM	23	4	2.728	
BL-5	S-4	11-13	8.6				SM	24	4		
BL-5	S-6	15-17	8.2				SM	22	3		
BL-6	S-1	4-6	4.1				GW-GM	7	2		
BL-7	S-1	5-7	5.1				SP-SM	8	2		
BL-7	S-3	9-11	5.3				GW-GM	10	2		
BL-7	S-4	11-13	7.5				SM	25	4		
BL-7	S-6	15-17	6.0				SM	14	2		
BL-8	S-1	6-8	17.9	35	20	15	CL	51	11		
BL-8	S-3	10-12	10.2				SM	32	6		
BL-9	S-1	6-8	10.0				SP-SM	9	2		
BL-9	S-3	10-12	7.0				SM	14	3		
BL-9	S-5	14-16	4.9				SW-SM	11	3		
BL-11	S-4	11-13	10.1				SM	24	5		
BL-12	S-1	6-8	8.9				SM	24	6		
BL-13	S-1	4.5-6.5	9.3				SM	15	4	2.722	
BL-13	S-3	8.5-10.5	6.6				SM	13	3		
BL-13	S-4	10.5-12.5	9.9				SM	19	5		
BL-14	S-1	6-8	10.0				SM	27	6		
BL-14	S-2	8-10	8.1				SM	24	5		
BL-15	S-3	9-11	9.5				SM	32	8		
BL-15	S-9	21-23	7.9				SM	26	4		
BL-15	S-14	31-33	6.1				SM	33	4		
BL-15	S-17	45-47	11.9				SM	20	3		
BL-15	S-21	65-67	8.2				SP-SM	10	1		

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.

proposed procedure does not necessarily produce laboratory samples that match field densities, GeothermUSA believes it will provide reasonable results.

3. Because GeothermUSA personnel were not in the field to select representative samples for laboratory testing, AECOM collected and shipped extra samples for potential laboratory TR testing and provided GeothermUSA field test boring logs with geologic sample descriptions. In this way, GeothermUSA was able to review the samples and select ones most appropriate for TR testing, discarding the excess.
4. Because field TR testing was not performed, no information is available regarding the ambient temperature in the ground at sample locations. Nevertheless, GeothermUSA indicated that the TR values obtained from the enhanced field sampling and laboratory TR testing program would provide reasonable and useful results, suitable for determining recommended TR design values for use by NKT to evaluate heat dissipation in cable system design.

An overview of the TR lab testing performed by GeothermUSA is presented in Table 2. Detailed results of laboratory TR testing are summarized on Table 5, including GeothermUSA's suggested design TR values for each sample tested.

GeothermUSA's summary report is attached as Appendix E. The GeothermUSA report includes suggested design TR values for each boring location, corresponding to the anticipated cable depth. These are reproduced below:

Boring ID	Milepost	Boring Depth (ft)	Cable Depth (ft)	Suggested TR (°C-cm/W)
BL-1	N/A	60.0	3.5	45
BL-2	1.08	12.0	9.80	90
BL-3	1.67	10.7	8.95	110
BL-4	1.81	16.0	9.74	45
BL-5	2.58	17.0	9.41	90
BL-6	3.18	11.0	8.66	90
BL-7	3.51	17.0	9.29	90
BL-8	4.38	12.0	7.92	90
BL-9	4.77	16.0	7.89	110
BL-10 & BL-10A	5.69	4.0	8.04	45
BL-11	6.02	13.0	6.36	90
BL-12	6.63	12.0	6.15	90
BL-13	7.24	12.5	6.57	90
BL-14	7.96	12.0	5.88	90
BL-15 & BL-15A	N/A	87.6	varies	100 or 45 depending if its in silty sand or rock

2.6 Geotechnical Laboratory Testing

Geotechnical laboratory testing was performed by TerraSense LLC. This included index testing to characterize soil, and strength and hardness tests to characterize rock. A summary of the testing is presented in Table 3.

Table 1. Summary of Test Borings

Boring ID	Completion Date	Total Depth of Boring (ft)	Depth to Top of Bedrock (ft)	Northing (1)	Easting (1)	Top of Boring Elevation (2)
BL-1	7/6/2020	60	3.3	877579.553	634487.801	16.537
BL-2	7/7/2020	12	>12	875415.701	633752.651	88.970
BL-3	7/7/2020	10.7	10.7	872536.075	632999.287	113.426
BL-4	7/7/2020	16	4.8	871905.948	633323.295	108.145
BL-5	7/8/2020	17	>17	868175.528	633428.855	128.013
BL-6	7/8/2020	11	>11	865097.101	633816.627	102.228
BL-7	7/8/2020	17	>17	863383.514	634098.781	106.175
BL-8	7/9/2020	12	>12	861016.248	637485.511	113.886
BL-9	7/9/2020	16	>16	859720.742	639084.310	116.995
BL-10 & BL-10A	7/13/2020	4	>4	855972.062	642193.725	173.236
BL-11	7/10/2020	13	>13	855114.602	643665.967	192.660
BL-12	7/13/2020	12	>12	852960.555	644583.631	233.585
BL-13	7/10/2020	12.5	>12.5	851046.588	646695.547	264.744
BL-14	7/14/2020	12	>12	848431.817	649278.128	278.475
BL-15 & BL-15A	7/23/2020	87.6	77.1	847189.449	649740.851	213.397

Notes:
(1) Coordinates in New York State Plane, NAD83
(2) Elevations in NAVD88

Table 4. Summary of Rock Parameters from Field and Laboratory Testing

Rock Type	Age	RQD (%)	Dry Unit Weight (pcf)	Mohs Hardness	Compressive Strength (psi)	Thermal Resistivity (°C-cm/W)	
						Wet	Dry
Limestone	Middle Ordovician	0 - 84	174 - 176	3 - 6	8050 - 15070	33	51
Quartzite	Middle Ordovician	84	176	4 - 5	6280	--	--
Sandstone/ Siltstone	Upper Triassic	0 - 66	155 - 162	2 - 4	2081[1] - 7940	37 - 44	56 - 64
Diabase	Upper Triassic	N/A	179 - 182	5 - 6	21640 - 25120	42	58

Notes:
(1) Estimated value from point load test

Table 7. Summary of Geotechnical Laboratory Test Results of Rock Samples

Boring ID	Sample Type	Depth (ft)	Rock Type	Water Content (%)	Dry Unit Weight (pcf)	Mohs Hardness	Unconfined Compressive Strength Test			Point Load Test		
							Compressive Strength (psi)	Axial Strain (%)	Estimated Elastic Modulus (psi)	Sample Orientation	Strength Index (Is50) (psi)	Estimated Compressive Strength (psi)
BL-1	Core	19.2 – 20.2	Limestone	0.15	176	4-5	8760	0.20	4E+06	--	--	--
	Core	31.0 – 31.7	Limestone	0.11	175	5-6	8050	0.16	5E+06	--	--	--
	Core	48.2 – 48.9	Quartzite	0.08	176	4-5	6280	0.11	6E+06	--	--	--
	Core	54.0 – 55.0	Limestone	0.13	174	3-4	15070	0.19	9E+06	--	--	--
BL-4	Core	11.3 – 11.6	Sandstone/ Siltstone	1.00	--	2-3	--	--	--	Diametral	190.0	4393
										Axial	200	4405
	Core	12.2 – 12.5	Sandstone	1.18	--	2-3	--	--	--	Diametral	90	2081
										Axial	170	3464
BL-10	Core	Outcrop[1]	Diabase	1.08	179	5-6	23820	0.41	7E+06	--	--	--
	Core	Outcrop[1]	Diabase	0.67	179	5-6	21640	0.50	5E+06	--	--	--
	Core	Outcrop[1]	Diabase	0.71	182	5-6	25120	0.44	7E+06	--	--	--
BL-15A	Core	80.4 – 80.7	Sandstone	1.09	156	--	6830	0.51	1E+06	--	--	--
	Core	81.5 – 82.1	Sandstone	--	--	3-4	--	--	--	--	--	--

Boring ID	Sample Type	Depth (ft)	Rock Type	Water Content (%)	Dry Unit Weight (pcf)	Mohs Hardness	Unconfined Compressive Strength Test			Point Load Test		
							Compressive Strength (psi)	Axial Strain (%)	Estimated Elastic Modulus (psi)	Sample Orientation	Strength Index (Is50) (psi)	Estimated Compressive Strength (psi)
	Core	83.0 – 83.6	Sandstone	0.68	155	3-4	7940	0.45	2E+06	--	--	--

Notes:
(1) Outcrop block samples cored by the geotechnical laboratory prior to testing

BORING CONTRACTOR: ADT

DRILLER: Tim Van Ness

SOILS ENGINEER: Roberto Lucidi

LOCATION: 152 Route 9W, Congers, NY

AECOM

BORING LOG

SHEET 1 OF 3

PROJECT NAME: CHPE - Rockland Co. Borings

PROJECT NO.: 60323056

HOLE NO.: BL-15

START DATE: 7/14/2020

FINISH DATE: 7/17/2020

OFFSET: N/A

DRILL RIG: Geoprobe

BORING TYPE: SPT

BORING O.D.: 4.5"

SURFACE ELEV.: 213.397

NORTHING 847189.449

EASTING 649740.851

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL
3.5' below grade on 7/14/20 at 2 pm	TYPE	Flush joint Steel	SPLIT SPOON[1]	3-7/8" TRICONE	-
Artesian water at approx. 45' below grade	SIZE I.D.	4.0"	2.4"	-	-
(head >13.0' above grade) on 7/16/2020	SIZE O.D.	4.5"	3.0"	-	-
at 1:30 pm	HAMMER WT.	SPUN	140 lb	-	-
	HAMMER FALL	-	30"	-	-

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	SAMPLE TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.[2]	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
1.0												Sandy Fill	Gravel pavement
		Hand Cleared									SM		Brown, f-m SAND, some f-m-c gravel, some
2.0		0.0 - 5.0											silt, with cobbles and boulders, moist
3.0													
													TR[3]-1 (3.0'-5.0')
4.0													Water at 3.5'
													Brown, f-m SAND, some f-m-c gravel, some
5.0													silt, with cobbles and boulders, wet
6.0		5.0 - 7.0	S-1	24.0	8.0	15	16	12	11	18	SM		S-1: Brown, f-m SAND, some silt, little f-m
													gravel, wet, medium dense
7.0													
8.0		7.0 - 9.0	S-2	24.0	5	6	4	6	7	7	SM		S-2: Brown, f-m SAND, some silt, little f-m
													gravel, wet, loose
9.0													Casing installed at 9.0'
10.0		9.0 - 11.0	S-3	24.0	12.0	43	17	12	14	19	SM		S-3: Same as above, wet, medium dense
													TR-2 (10.5'-11.0')
11.0													
12.0		11.0 - 13.0	S-4	24.0	16.0	15	23	24	27	31	SM		S-4: Same as above, wet, dense
13.0													
14.0		13.0 - 15.0	S-5	15.0	8.0	20	40	65/3"	-	-	SM	Glacial Till	S-5: Brown, f-m SAND, some silt, trace f-m
													gravel, moist, very dense
15.0													Boulder from 14.3' to 15.0'
													Casing advanced to 15.0'
16.0		15.0 - 17.0	S-6	24.0	16.0	45	63	92	93	101	SM		S-6: Brown, f-m SAND, some silt, little f-m-c
													gravel, moist, very dense
17.0													TR-3 (16.0'-16.5')
18.0		17.0 - 19.0	S-7	24.0	14.0	36	56	66	58	79	SM		S-7: Brown, f-m SAND, some silt, trace fine
													gravel, moist, very dense
19.0													
20.0		19.0 - 21.0	S-8	18.0	15.0	78	104	102	50/0"	134	SM		S-8: Same as above, moist, very dense

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: $N_{corr}=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

(3) TR = sample for thermal resistivity testing.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

BORING CONTRACTOR: ADT

DRILLER: Tim Van Ness

SOILS ENGINEER: Roberto Lucidi

LOCATION: 152 Route 9W, Congers, NY

AECOM

BORING LOG

SHEET 2 OF 3

PROJECT NAME: CHPE - Rockland Co. Borings

PROJECT NO.: 60323056

HOLE NO.: BL-15

START DATE: 7/14/2020

FINISH DATE: 7/17/2020

OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
21.0													
22.0		21.0 - 23.0	S-9	24.0	20.0	3	48	67	66	75	SM		S-9: Brown, f-m SAND, some silt, little fine gravel, moist, very dense
23.0													
24.0		23.0 - 25.0	S-10	24.0	20.0	30	81	73	104	100	SM		S-10: Same as above, moist, very dense
25.0													
26.0		25.0 - 27.0	S-11	10.0	10.0	56	100/4"	-	-	-	SM		S-11: Same as above, moist, very dense
27.0													
28.0		27.0 - 29.0	S-12	24.0	9.0	40	91	60	69	98	SM		S-12: Brown, f-m SAND, little f-m-c gravel, little silt, moist, very dense TR-4 (28.5'-29.0') Casing advanced to 29.0'
29.0													
30.0		29.0 - 31.0	S-13	24.0	12.0	90	71	60	104	85	SM		S-13: Same as above, moist, very dense
31.0													
32.0		31.0 - 33.0	S-14	21.0	12.0	67	91	108	100/3"	129	SM	Glacial Till	S-14: Brown, f-m SAND, some silt, some f-m-c gravel, moist, very dense
33.0													
34.0													
35.0													
36.0		35.0 - 37.0	S-15	19.0	15.0	60	78	99	50/1"	115	SM		S-15: Brown, f-m SAND, some f-m-c gravel, some silt, moist, very dense
37.0													
38.0													
39.0													
40.0													
41.0		40.0 - 42.0	S-16	24.0	10.0	27	79	85	46	107	SM		S-16: Brown, f-m SAND, little f-m gravel, little silt, moist, very dense TR-5 (41.5'-42.0')
42.0													
43.0													
44.0												Outwash	
45.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

BORING CONTRACTOR: ADT

DRILLER: Tim Van Ness

SOILS ENGINEER: Roberto Lucidi

LOCATION: 152 Route 9W, Congers, NY

AECOM

BORING LOG

SHEET 3 OF 3

PROJECT NAME: CHPE - Rockland Co. Borings

PROJECT NO.: 60323056

HOLE NO.: BL-15

START DATE: 7/14/2020

FINISH DATE: 7/17/2020

OFFSET: N/A

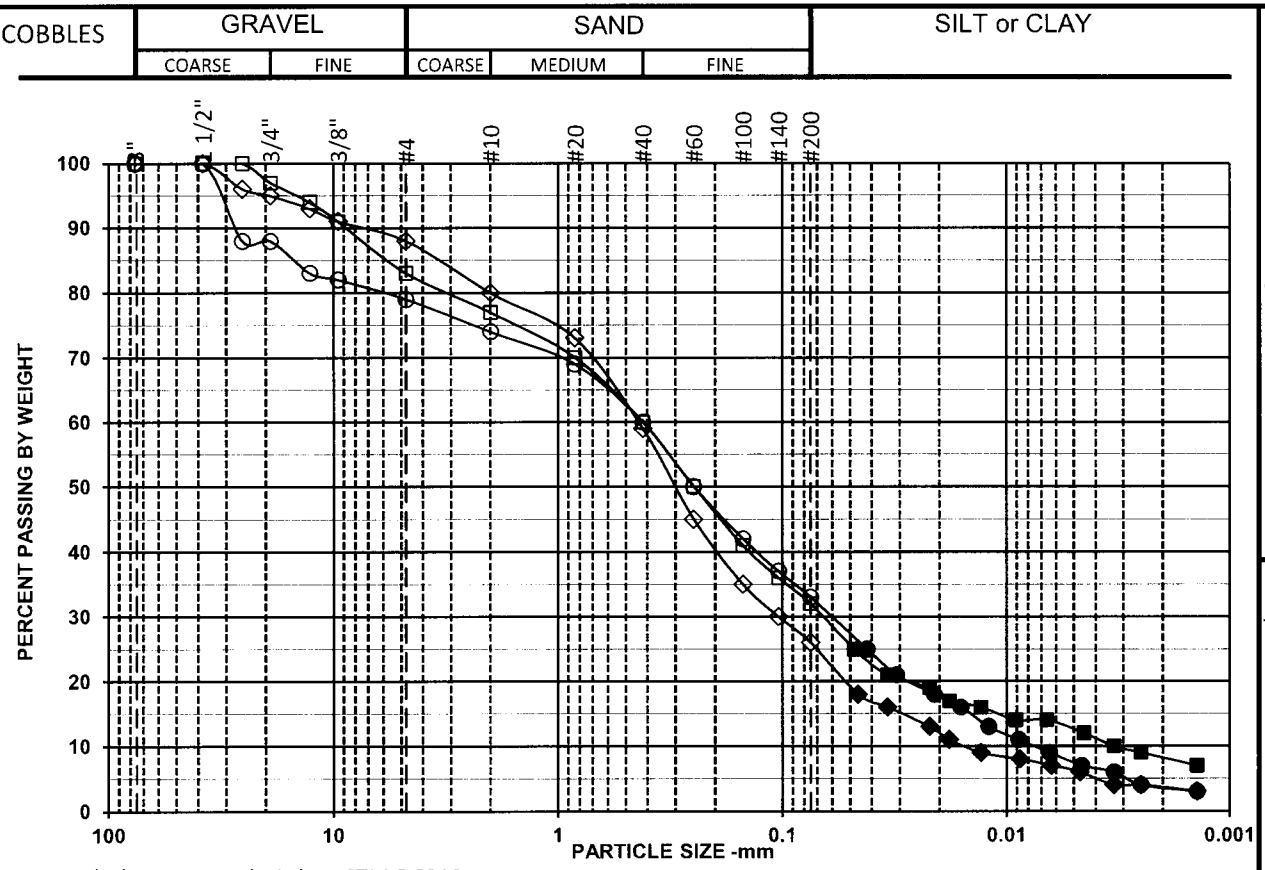
DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
46.0		45.0 - 47.0	S-17	24.0	18.0	19	43	54	48	63	SM	Outwash	S-17: Brown, f-m SAND, some silt, trace fine gravel, wet, very dense
47.0													
48.0													
49.0													
50.0													Casing advanced to 50.0'
51.0		50.0 - 52.0	S-18	9.0	5.0	49	80/3"	-	-	-	SM	Glacial Till	Artesian water flowing out from top of casing S-18: Brown, f-m SAND, some silt, little f-m gravel, moist, very dense
52.0													Casing advanced to 52.0'
53.0													Drilling mud used to advance borehole from 52.0'
54.0													Hard drilling from 50.0' to 55.0'
55.0													
56.0		55.0 - 57.0	S-19	4.0	4.0	150/4"	-	-	-	-	SM		S-19: Same as above, moist, extremely dense
57.0													
58.0													Hard drilling and rig chattering from 55.0' to 60.0'
59.0												Outwash	
60.0													
61.0		60.0 - 62.0	S-20	8.0	5.0	52	100/2"	-	-	-	SP		S-20a (60.0'-60.4'): Brown, f-m SAND, trace fine gravel, trace silt, wet, v. dense S-20b (60.4'-60.8'): Brown, f-m SAND, some f-m-c gravel, some silt, moist, extremely dense
62.0												Glacial Till	
63.0													Hard drilling from 60.0' to 65.0'
64.0													
65.0													
66.0		65.0 - 67.0	S-21	24.0	16.0	41	79	88	110	109	SP-SM	Outwash	S-21: Brown, f-m SAND, some fine gravel, little silt, wet, very dense TR-6 (66.0'-66.5') TR-7 (Composite: 35.0'-37.0', 40.0'-42.0', 50.0'-52.0', 60.0'-62.0') Artesian water flowing out from interface between casing and borehole Boring abandoned at 70.0' below grade Borehole grouted
67.0													
68.0													
69.0													
70.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

Symbol	□	◇	○
Boring	BL-15	BL-15	BL-15
Sample	S-3	S-9	S-14
Depth	9-11	21-23	31-33
% +3"	0	0	0
% Gravel	17	12	21
% SAND	51	62	46
%C SAND	6	8	5
%M SAND	17	21	14
%F SAND	28	33	27
% FINES	32	26	33
D_{100} (mm)	25.4	38.1	38.1
D_{60} (mm)	0.419	0.44	0.419
D_{30} (mm)	0.066	0.1	0.06
D_{10} (mm)	0.0033	0.015	0.0075
Cc	3.2	1.5	1.1
Cu	127	29.3	55.9

Sieve Size/ID #	Percent Finer Data		
6"	100	100	100
4"	100	100	100
3"	100	100	100
1 1/2"	100	100	100
1"	100	96	88
3/4"	97	95	88
1/2"	94	93	83
3/8"	91	91	82
#4	83	88	79
#10	77	80	74
#20	70	73	69
#40	60	59	60
#60	50	45	50
#100	41	35	42
#140	36	30	37
#200	32	26	33
5μ m	13	6	8
2μ m	8	4	4
1μ m	6	2	2

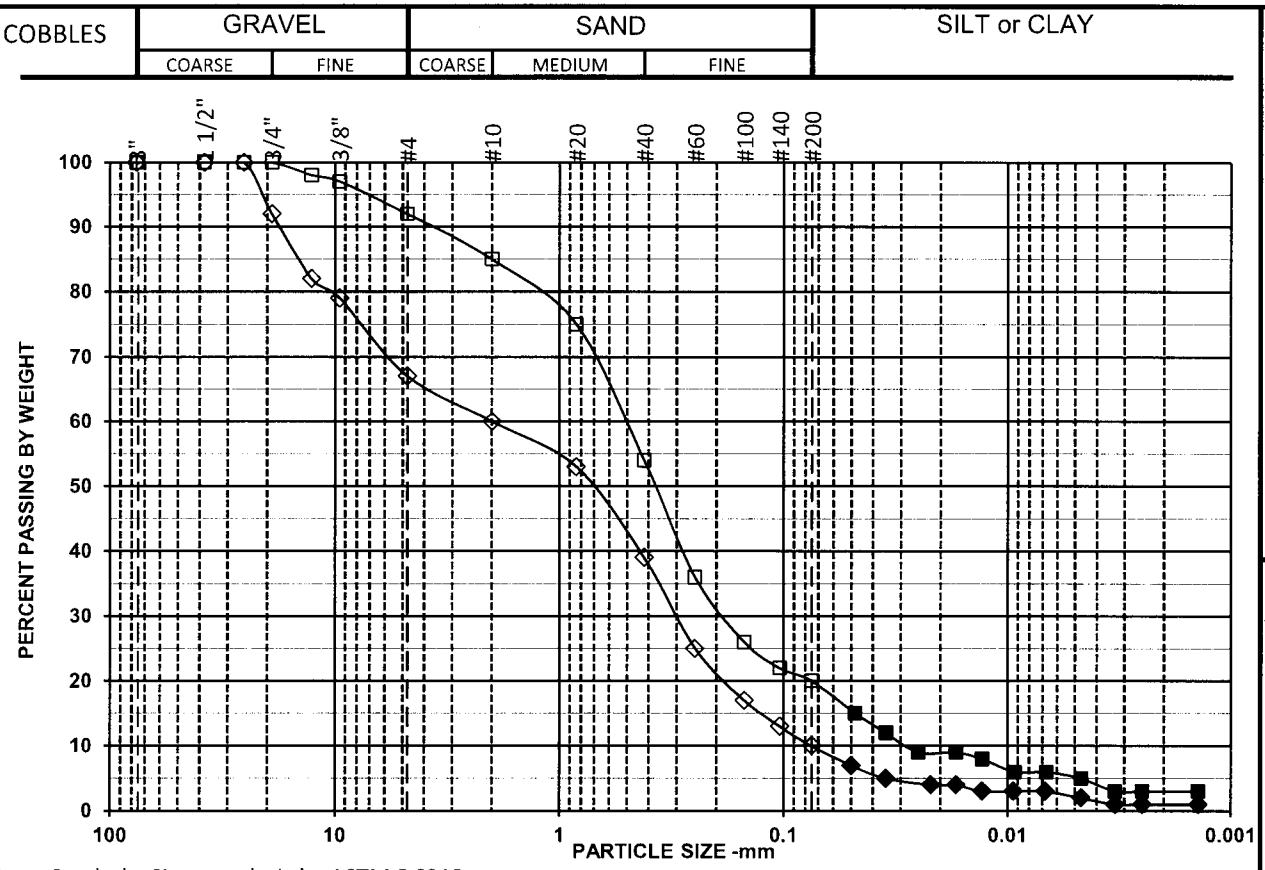
PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	9.5				SM		Brown, Silty sand with gravel	08/05/20
◇	7.9				SM		Brown, Silty sand	08/05/20
○	6.1				SM		Brown, Silty sand with gravel	08/05/20

Aquifer / AECOM #60323056

TerraSense, LLC #7853-20003

CHPE - Rockland County Borings



Open Symbols: Sieve analysis by ASTM D6913

Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	11.9				SM		Brown, Silty sand	08/10/20
◇	8.2				SP-SM		Brown, Poorly graded sand with silt and gravel	08/10/20
○								

Aquifer / AECOM #60323056

TerraSense, LLC #7853-20003

CHPE - Rockland County Borings

Symbol	□	◇	○
Boring	BL-15	BL-15	
Sample	S-17	S-21	
Depth	45-47	65-67	
% +3"	0	0	
% Gravel	8	33	
% SAND	72	57	
%C SAND	7	7	
%M SAND	31	21	
%F SAND	34	29	
% FINES	20	10	
D_{100} (mm)	19.1	25.4	
D_{60} (mm)	0.511	2	
D_{30} (mm)	0.18	0.3	
D_{10} (mm)	0.028	0.075	
Cc	2.3	0.6	
Cu	18.3	26.7	

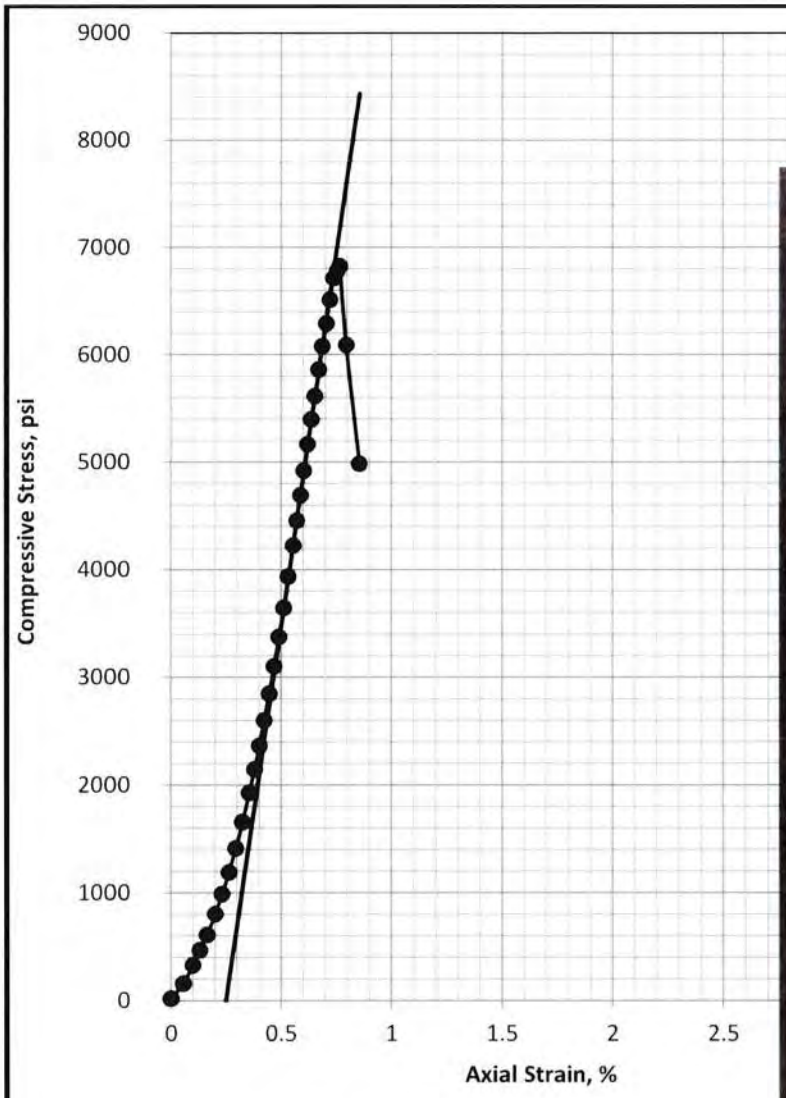
Sieve Size/ID #	Percent Finer Data		
6"	100	100	
4"	100	100	
3"	100	100	
1 1/2"	100	100	
1"	100	100	
3/4"	100	92	
1/2"	98	82	
3/8"	97	79	
#4	92	67	
#10	85	60	
#20	75	53	
#40	54	39	
#60	36	25	
#100	26	17	
#140	22	13	
#200	20	10	
5μ m	5	2	
2μ m	3	1	
1μ m	3	1	

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

Aquifer
CHPE - Rockland County Borings
SUMMARY OF ROCK TESTING

SAMPLE IDENTIFICATION			STATE PROPERTIES			ENGINEERING PROPERTY TESTS								REMARKS
Boring	Run/ Sample	Depth	WATER CONTENT (1)	TOTAL UNIT WGT.	DRY UNIT WGT.	TEST TYPE (2)	ORIENTATION	HARDNESS TESTS Mohs HARDNESS	POINT LOAD TEST (ASTM D5731)		UNCONFINED COMPRESSION TESTS (ASTM D7012)			
									STRENGTH INDEX Is(50)	ESTIMATED (4) COMPRESSIVE STRENGTH	COMPRESSIVE STRENGTH	AXIAL STRAIN @ FAILURE	ESTIMATED (5) ELASTIC MODULUS	
			(%)	(pcf)	(pcf)		(3)	(-)	(psi)	(psi)	(psi)	(%)	(psi)	
BL-1	R-3	19.2-20.2				M		4-5						
BL-1	R-3	19.3-19.7	0.15	176	176	UC					8760	0.20	4E+06	
BL-1	R-7	31.0-31.7				M		5-6						
BL-1	R-7	31.1-31.5	0.11	176	175	UC					8050	0.16	5E+06	
BL-1	R-10	48.2-48.9				M		4-5						
BL-1	R-10	48.3-48.7	0.08	177	176	UC					6280	0.11	6E+06	
BL-1	R-11	54-55				M		3-4						
BL-1	R-11	53.9-54.3	0.13	174	174	UC					15070	0.19	9E+06	
BL-4	R-1	11.3-11.6				M		2-3						
BL-4	R-1	11.3-11.6	1.00			PL	Diametral		190	4393				
BL-4	R-1	11.3-11.6				PL	Axial		200	4405				
BL-4	R-2	12.2-12.5				M		2-3						
BL-4	R-2	12.2-12.5	1.18			PL	Diametral		90	2081				
BL-4	R-2	12.2-12.5				PL	Axial		170	3464				
BL-10	Outcrop (A)	-				M		5-6						
BL-10	Outcrop (A)	-	1.08	181	179	UC					23820	0.41	7E+06	
BL-10	Outcrop (B)	-				M		5-6						
BL-10	Outcrop (B)	-	0.67	180	179	UC					21640	0.50	5E+06	
BL-10	Outcrop (C)	-				M		5-6						
BL-10	Outcrop (C)	-	0.71	183	182	UC					25120	0.44	7E+06	
BL-15	R-1 (A)	80.35-80.7	1.09	158	156	UC					6830	0.51	1E+06	
BL-15	R-1 (B)	83.2-83.55	0.68	156	155	UC					7940	0.45	2E+06	
BL-15A	R-1(A)	81.5-82.1				M		3-4						
BL-15A	R-1(B)	83.0-83.6				M		3-4						

Notes: (1) Water contents determined after trimming and shearing.
(2) Test Type Abbreviations: M: Mohs Hardness, PL: Point Load, UC: Unconfined Compression test with estimated elastic moduli determination
(3) Diametral orientation across core along bedding/foliation plane, axial perpendicular to bedding/foliation plane, as applicable.
(4) Compressive Strength determined using generalized "K" factor in ASTM D5731
(5) Modulus estimated based on corrected gross deformations.



FAILURE PHOTO

Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (inch)	Diameter (inch)
1.09	158	156	4.341	1.765

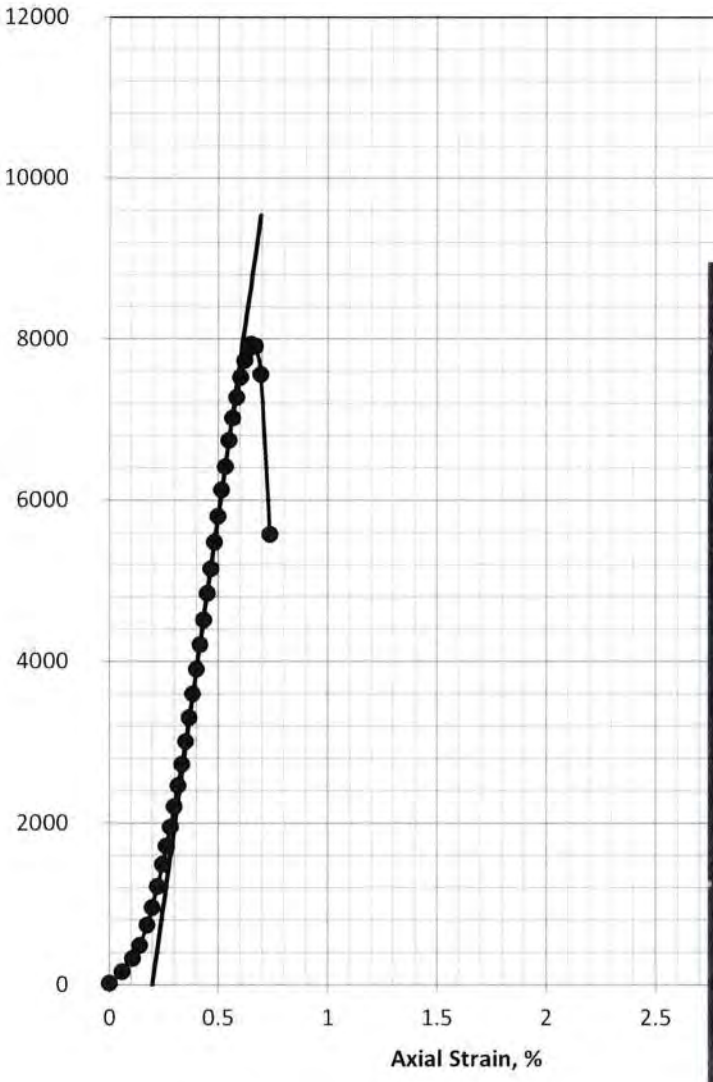
Specimen meets ASTM D4543 shape tolerances

Test Summary

Strain Rate (%/min)	Corrected Strain to Peak (%)	q_u (psi)	Estimated (shown) Elastic Modulus (psi)
0.14	0.51	6830	1E+06

Test by: DM
Test Date: Aug-17-20
Reviewed by: GET

Aquifer **Project # PO 309907**	**CHPE - Rockland County Borings**	**COMPRESSIVE STRESS VS STRAIN** **UNCONFINED COMPRESSIVE STRENGTH TEST**
TerraSense, LLC **Project # 7853-20003**		**Boring: BL-15 Run: R-1 (A)** **Depth 80.35-80.7 ft.**



FAILURE PHOTO

Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (inch)	Diameter (inch)
0.68	156	155	4.026	1.768

Specimen meets ASTM D4543 shape tolerances

Test Summary

Strain Rate (%/min)	Corrected Strain to Peak (%)	q_u (psi)	Estimated (shown) Elastic Modulus (psi)
0.14	0.45	7940	2E+06

Test by: DM
Test Date: Aug-17-20
Reviewed by: GET

Aquifer **Project # PO 309907**	**CHPE - Rockland County Borings**	**COMPRESSIVE STRESS VS STRAIN** **UNCONFINED COMPRESSIVE STRENGTH TEST**
TerraSense, LLC **Project # 7853-20003**		**Boring: BL-15 Run: R-1 (B)** **Depth 83.2-83.55 ft.**

BL-15A not shown on AECOM LOC MAPS. Coodinates shown on BL-15 A match BL-1 Coordinates. Street address shown on BL-15 A match BL-15 street address. It is unclear where BL-15A was performed.

BORING CONTRACTOR: ADT	AECOM	SHEET 1 OF 4
DRILLER: Tim Van Ness		PROJECT NAME: CHPE - Rockland Co. Borings
SOILS ENGINEER: Roberto Lucidi		PROJECT NO.: 60323056
		HOLE NO.: BL-15A
	BORING LOG	START DATE: 7/20/2020
		FINISH DATE: 7/23/2020
LOCATION: 152 Route 9W, Congers, NY		OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	
4.5' below grade on 7/20/2020 at 9 am	TYPE	Flush joint Steel	SPLIT SPOON(1)	3-7/8" TRICONE	NQ-3	DRILL RIG: Geoprobe
Artesian water at approx. 45' below grade	SIZE I.D.	6.0", 5.0", 4.0", 3.0"	2.4"	-	1.78	BORING TYPE: SPT
(head >13.0' above grade) on 7/22/2020	SIZE O.D.	6.5", 5.5", 4.5", 3.5"	3.0"	-	2.97	BORING O.D.: 4.5"
at 2:30 pm	HAMMER WT.	140 lb, Spun	140 lb	-	-	SURFACE ELEV.: 16.537
	HAMMER FALL	30"	30"	-	-	NORTHING 877579.553
						EASTING 634487.801

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	SAMPLE TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)	N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
1.0										Gravel pavement
		Hand Cleared						SM		Brown, f-m SAND, some f-c gravel, some silt, with cobbles and boulders, with asphalt fragments, moist
2.0		0.0 - 5.0								
3.0										
4.0										
5.0										Water at 4.5'
										Drilled continuously from 5.0' to 20.0' (no sampling)
6.0										Drilling mud used to advance borehole from 5.0'
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0									Sandy Fill	
14.0										Hard drilling from approximately 13.0'
15.0										6" Casing installed at 14.0'
16.0										
17.0										
18.0										
19.0									Glacial Till	
20.0										5" Casing installed at 19.0'

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: $N_{corr}=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT

DRILLER: Tim Van Ness

SOILS ENGINEER: Roberto Lucidi

LOCATION: 152 Route 9W, Congers, NY

AECOM

BORING LOG

SHEET 2 OF 4

PROJECT NAME: CHPE - Rockland Co. Borings

PROJECT NO.: 60323056

HOLE NO.: BL-15A

START DATE: 7/20/2020

FINISH DATE: 7/23/2020

OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)	N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
21.0										Drilled continuously from 20.0' to 45.0' (no sampling)
22.0										Rig chattering from 20.0' to 45.0'
23.0										
24.0										
25.0										
26.0										
27.0										
28.0										
29.0										
30.0										
31.0										
32.0										
33.0										
34.0										
35.0										
36.0										
37.0										
38.0										
39.0										
40.0										
41.0										
42.0										
43.0										
44.0										
45.0									Glacial Till	

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

BORING CONTRACTOR: ADT

DRILLER: Tim Van Ness

SOILS ENGINEER: Roberto Lucidi

LOCATION: 152 Route 9W, Congers, NY

AECOM

BORING LOG

SHEET 3 OF 4

PROJECT NAME: CHPE - Rockland Co. Borings

PROJECT NO.: 60323056

HOLE NO.: BL-15A

START DATE: 7/20/2020

FINISH DATE: 7/23/2020

OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)	N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
46.0										Drilled continuously from 45.0' to 70.0' (no sampling)
47.0										Rig chattering from 45.0' to 70.0'
48.0										
49.0										
50.0										Hard drilling from approximately 50.0'
51.0										
52.0										
53.0										
54.0										
55.0										
56.0										
57.0										Glacial Till
58.0										
59.0										
60.0										
61.0										
62.0										
63.0										
64.0										
65.0										
66.0										
67.0										
68.0										
69.0										
70.0										

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

BORING CONTRACTOR: ADT	AECOM		SHEET 4 OF 4
DRILLER: Tim Van Ness			PROJECT NAME: CHPE - Rockland Co. Borings
SOILS ENGINEER: Roberto Lucidi	**BORING LOG**		PROJECT NO.: 60323056
LOCATION: 152 Route 9W, Congers, NY			HOLE NO.: BL-15A
			START DATE: 7/20/2020
			FINISH DATE: 7/23/2020
			OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
71.0		70.0 - 72.0	S-1	5.0	5.0	100/5"	-	-	-	-	SM	Glacial Till	S-1: Brown, f-m SAND, some silt, trace fine gravel, moist, extremely dense
72.0													
73.0													
74.0													
75.0													
76.0												Decomposed Sandstone	Very hard drilling from 75.0'
77.0													Drilled to 77.0' to confirm that it is not a boulder
													Installed 4" casing to 77.0' and 5" casing to 77.5'
		77.0' - 77.1'	S-2	1.0	1.0	100/1"	-	-	-	-	SM		S-2: Red-brown, fine SAND, and silt, moist, very dense
78.0	6.0											Sandstone (Brunswick Fm.)	Started coring from 77.6'
		77.6 - 87.6	R-1	120.0	115.0	RQD =	79"/120"						From 77.6' to 81.1': Red-brown, SANDSTONE, fine grained, slightly weathered (II), medium strong (R3), highly fractured, thinly bedded. Drill spin over sub-horizontal fractures.
79.0	6.0				96%	=	66%						
80.0	2.5												From 81.1' to 87.6': Red-brown, SANDSTONE, medium-coarse grained, slightly weathered (II), strong (R4), moderately fractured, laminated (dip<1C°). Discontinuities: <10° slightly rough bedding 60° & sub-vertical, rough, undulating joints.
81.0	2.5												
82.0	3.0												TR(1)-1 (79.4'-79.8')
83.0	3.0												TR-2 (82.6'-83.0')
84.0	2.5												TR-3 (84.5'-85.0')
85.0	2.5												
86.0	2.5												
87.0	2.5												
88.0													End of boring at 87.6' below grade
89.0													Borehole grouted
90.0													
91.0													
92.0													
93.0													
94.0													
95.0													

NOTES:

(1) TR = sample for thermal resistivity testing.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

ROCK CORE PHOTOGRAPHIC LOG

AECOM Project No: **60323056**
Project Name: **Upland Segment, Rockland County, NY, Champlain-Hudson Power Express**
Location: **Rockland County, NY**

AECOM

Boring No.	Depth (ft.)	
BL-15A (dry)	77.6 to 87.6	
Boring No.	**Depth (ft.)**	
BL-15A (wet)	77.6 to 87.6	

Note: Black foam inserts represent core pieces that were removed for geotechnical and/or thermal resistivity laboratory testing

Note: Soundings are in feet.

0 1,000 2,000

Feet

Note for Lake Champlain (Maps 1-28): The depth soundings in the report were referenced to North American Vertical Datum 1988 and therefore required a depth adjustment using a water surface elevation of 95.5 feet based on the USGS average for Lake Champlain.

(source: http://waterdata.usgs.gov/usa/nwis/uv?04279000)

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Appendix A

2012 MRS

Sheet 46 of 54

Prepared on 04/23/2013

CONGERS

Hole No. SII-HDD-6D

DRILLING LOG	DIVISION: HDR CHPE	INSTALLATION: MRS Phase 2 Cable Route Survey	SHEET 1 OF 1 SHEETS

1. PROJECT: CHPE
2. LOCATION (Coordinates or Station): Hudson River N 14,952,282.5 E 1,937,486.2
3. DRILLING AGENCY: ADT
4. HOLE NO. (As shown on drawing title and file number): SII-HDD-6D
5. NAME OF DRILLER: J. Philbin
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. Penetration, ft: 52.0
8. Recovery, ft: 52.0
9. Total Recovery, %: 100.0
10. SIZE AND TYPE OF BIT: Split Spoon
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 11; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. WATER DEPTH:
16. DATE HOLE: STARTED 11/18/2012; COMPLETED 11/18/2012
17. ELEVATION TOP OF HOLE: -29.4
18. TOTAL CORE RECOVERY FOR BORING: 100 %
19. GEOLOGIST: S. Miller

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
-29.4	0.0		Dark brown silt with trace shell fragments and trace wood fragments	100	SedBox6 0.0 2.0	WOR
-31.4	2.0		No Data			
-34.4	5.0					
-36.4	7.0		Dark brown, high-plasticity clay with a layer of brown coarse-grained sand at 6.8'	100	SedBox6 5.0 7.0	WOR
-39.4	10.0		No Data			
-41.4	12.0		Dark brown elastic silt	100	SedBox6 10.0 12.0	WOR
-44.4	15.0		No Data			
-46.4	17.0		Dark brown, high-plasticity clay with a layer of organic silt and wood fragments @16.9'	100	SedBox6 15.0 17.0	WOR
-49.4	20.0		No Data			
-51.4	22.0		Dark brown clayey-sand with wood fragments and shell layer near 21', and with coarse-grained sands below	100	SedBox6 20.0 22.0	WOR
-54.4	25.0		No Data			
			Dark brown, high-plasticity clay with trace shell fragments, sand lenses, and with a distinct layer of pebbles and cobbles at approximately 50'	100	SedBox6 25.0 27.0	WOR
				100	SedBox6 30.0 32.0	WOR
				100	SedBox6 35.0 37.0	WOR
				100	SedBox6 40.0 42.0	WOR
				100	SedBox6 45.0 47.0	WOR
-81.4	52.0			100	SedBox6 50.0 52.0	WOR

DRILLING LOG

DIVISION: HDR CHPE

INSTALLATION: MRS Phase 2 Cable Route Survey

SHEET 1 OF 1 SHEETS

1. PROJECT: CHPE
2. LOCATION (Coordinates or Station): HUDSON RIVER N 14,952,245.6 E 1,937,589.7
3. DRILLING AGENCY: AOSS
4. HOLE NO. *(As shown on drawing title and file number)*: SII-HDD-6
5. NAME OF DRILLER: M.Telesco
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. Penetration, ft: 9.3
8. Recovery, ft: 6.9
9. Total Recovery, %: 74.0
10. SIZE AND TYPE OF BIT: 3.5 in
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: NAVD88
12. MANUFACTURER'S DESIGNATION OF DRILL: Vibracore
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 1; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. WATER DEPTH: -29.9
16. DATE HOLE: STARTED 10/9/2012; COMPLETED 10/9/2012
17. ELEVATION TOP OF HOLE: -29.9
18. TOTAL CORE RECOVERY FOR BORING: 74.0 %
19. GEOLOGIST: M.Kwasek

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
-29.9	0.0		Grey elastic silt with black organic bands between 0.3' to 1.7'. Bivalve shell fragments found throughout.	100	BS1 0.0 6.9	Bagged Sample (0-6.9') @0.0' Tor=.03 T/sq.ft Pen=.05 T/sq.ft @1.0' Tor=.02 T/sq.ft Pen=.03 T/sq.ft @2.0' Tor=.02 T/sq.ft Pen=.03 T/sq.ft @3.0' Tor=.02 T/sq.ft Pen=.03 T/sq.ft @4.0' Tor=.02 T/sq.ft Pen=.01 T/sq.ft @5.0' Tor=.03 T/sq.ft Pen=.02 T/sq.ft @6.0' Tor=.02 T/sq.ft Pen=.03 T/sq.ft
-36.8	6.9					@7.0' Tor=.02 T/sq.ft Pen=.01 T/sq.ft

DRILLING LOG

DIVISION: HDR CHPE

INSTALLATION: MRS Phase 2 Cable Route Survey

SHEET 1 OF 1 SHEETS

1. PROJECT	CHPE
2. LOCATION (Coordinates or Station)	HUDSON RIVER N 14,952,177.8 E 1,937,480.9
3. DRILLING AGENCY	AOSS
4. HOLE NO. *(As shown on drawing title and file number)*	SII-HDD-6A
5. NAME OF DRILLER	M.Telesco
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. Penetration, ft	8.6
8. Recovery, ft	6.7
9. Total Recovery, %	77.7
10. SIZE AND TYPE OF BIT	3.5 in
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD88
12. MANUFACTURER'S DESIGNATION OF DRILL	Vibracore
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 1 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. WATER DEPTH	-28.2
16. DATE HOLE	STARTED 10/9/2012 / COMPLETED 10/9/2012
17. ELEVATION TOP OF HOLE	-28.2
18. TOTAL CORE RECOVERY FOR BORING	77.7 %
19. GEOLOGIST	D.Whitesell

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-28.2	0.0		Grey elastic silt Small bivalve shells throughout	100	BS1 0.0 6.7	Bagged Sample (0-6.7')
-34.9	6.7					

DRILLING LOG

DIVISION: HDR CHPE

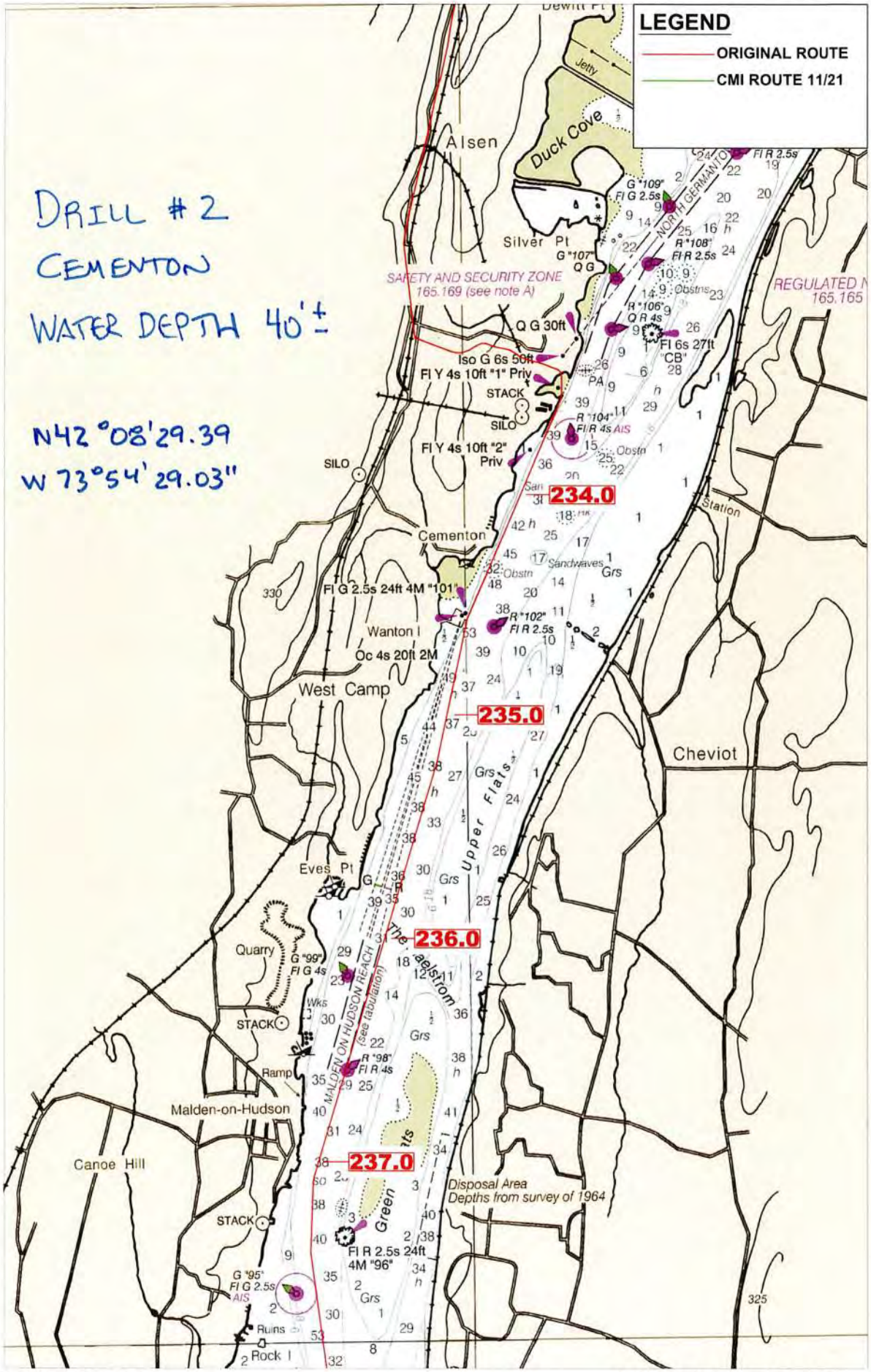
INSTALLATION: MRS Phase 2 Cable Route Survey

SHEET 1 OF 1 SHEETS

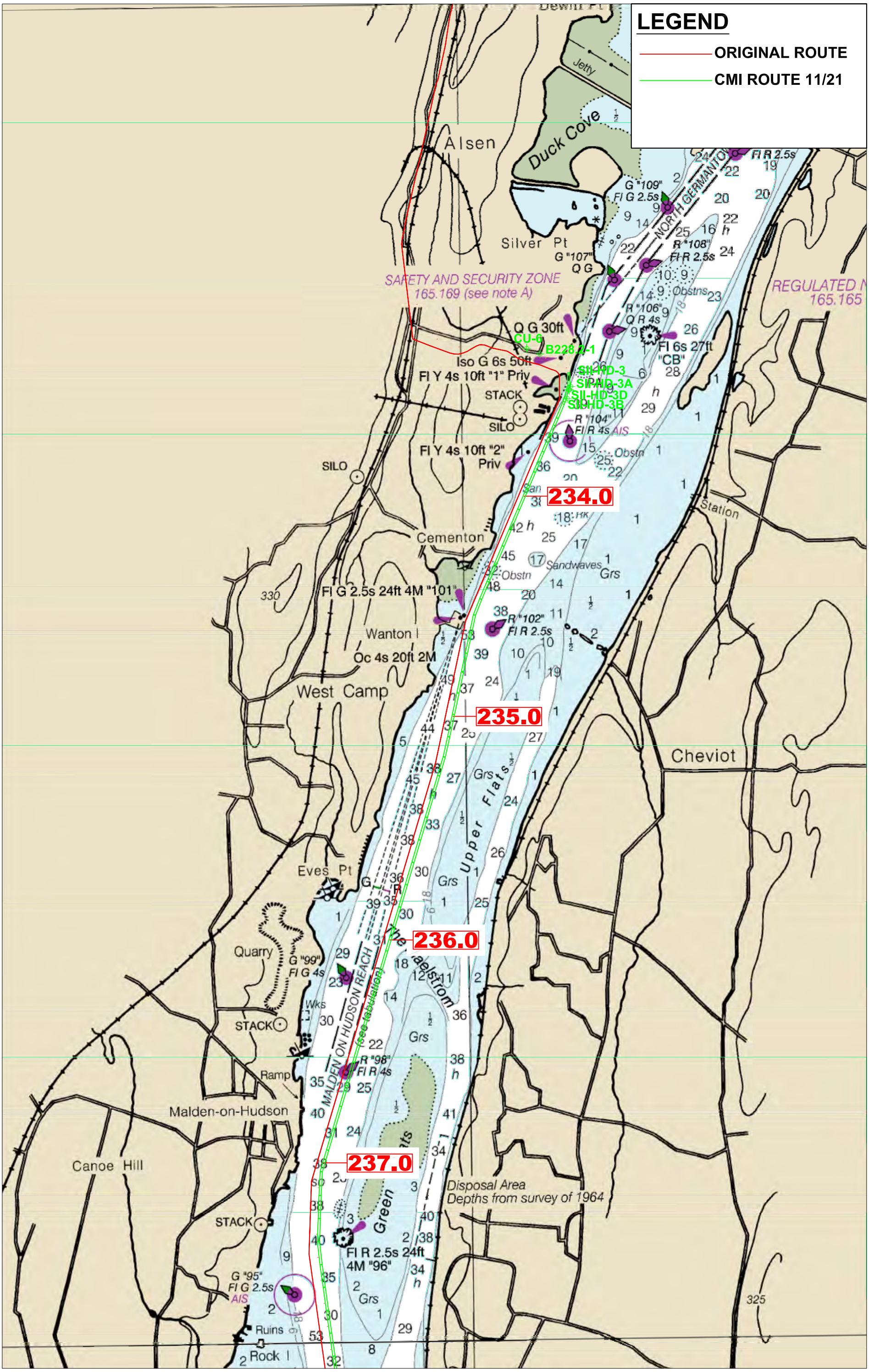
1. PROJECT: CHPE
2. LOCATION (Coordinates or Station): HUDSON RIVER N 14,952,174.2 E 1,937,661.9
3. DRILLING AGENCY: AOSS
4. HOLE NO. (As shown on drawing title and file number): SII-HDD-6B
5. NAME OF DRILLER: M. Telesco
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. Penetration, ft: 9.7
8. Recovery, ft: 8.1
9. Total Recovery, %: 82.9
10. SIZE AND TYPE OF BIT: 3.5 in
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURER'S DESIGNATION OF DRILL: Vibracore
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 1 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. WATER DEPTH: -30.6
16. DATE HOLE: STARTED 10/9/2012 COMPLETED 10/9/2012
17. ELEVATION TOP OF HOLE: -30.6
18. TOTAL CORE RECOVERY FOR BORING: 82.9 %
19. GEOLOGIST: D.Whitesell

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
-30.6	0.0		Dark grey, high-plasticity organic clay with common bands of black organic silt/clay	100	BS1 0.0 8.0	Bagged Sample (0-8.0')
						@0.0' Tor=.01 T/sq.ft Pen=.01 T/sq.ft
						@1.0' Tor=.01 T/sq.ft Pen=.02 T/sq.ft
						@2.0' Tor=.03 T/sq.ft Pen=.02 T/sq.ft
						@3.0' Tor=.03 T/sq.ft Pen=.03 T/sq.ft
						@4.0' Tor=.03 T/sq.ft Pen=.02 T/sq.ft
						@5.0' Tor=.03 T/sq.ft Pen=.02 T/sq.ft
						@6.0' Tor=.03 T/sq.ft Pen=.02 T/sq.ft
						@7.0' Tor=.04 T/sq.ft Pen=.03 T/sq.ft
-38.6	8.0					@8.0' Tor=.04 T/sq.ft Pen=.03 T/sq.ft

CHPE - HUDSON RIVER CABLE ROUTE ADJUSTMENT



CHPE - HUDSON RIVER CABLE ROUTE ADJUSTMENT



11/03/2021

SHEET 1 OF 16

LEGEND

- Certified Milepost - Tenths
- Certified Milepost
- Preferred Alternative Milepost - Tenths
- Preferred Alternative Milepost
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- 2021 Boring Location
- Previous (2013) Boring Location
- Streams/Ditches
- Railroad ROW
- Deviation Zone
- Deviation Zone Outside ROW
- Preferred Alternative Deviation Zone
- Preferred Alternative Deviation Zone Outside ROW
- Town Boundary
- Village Boundary
- State Park (OPRHP)

Parcel Ownership
TOWN NAME

Road Name

DATA SOURCES: ESRI, NETWORK MAPPING 2019, NYSDOT, OPRHP, TDI, TRC

Transmission

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

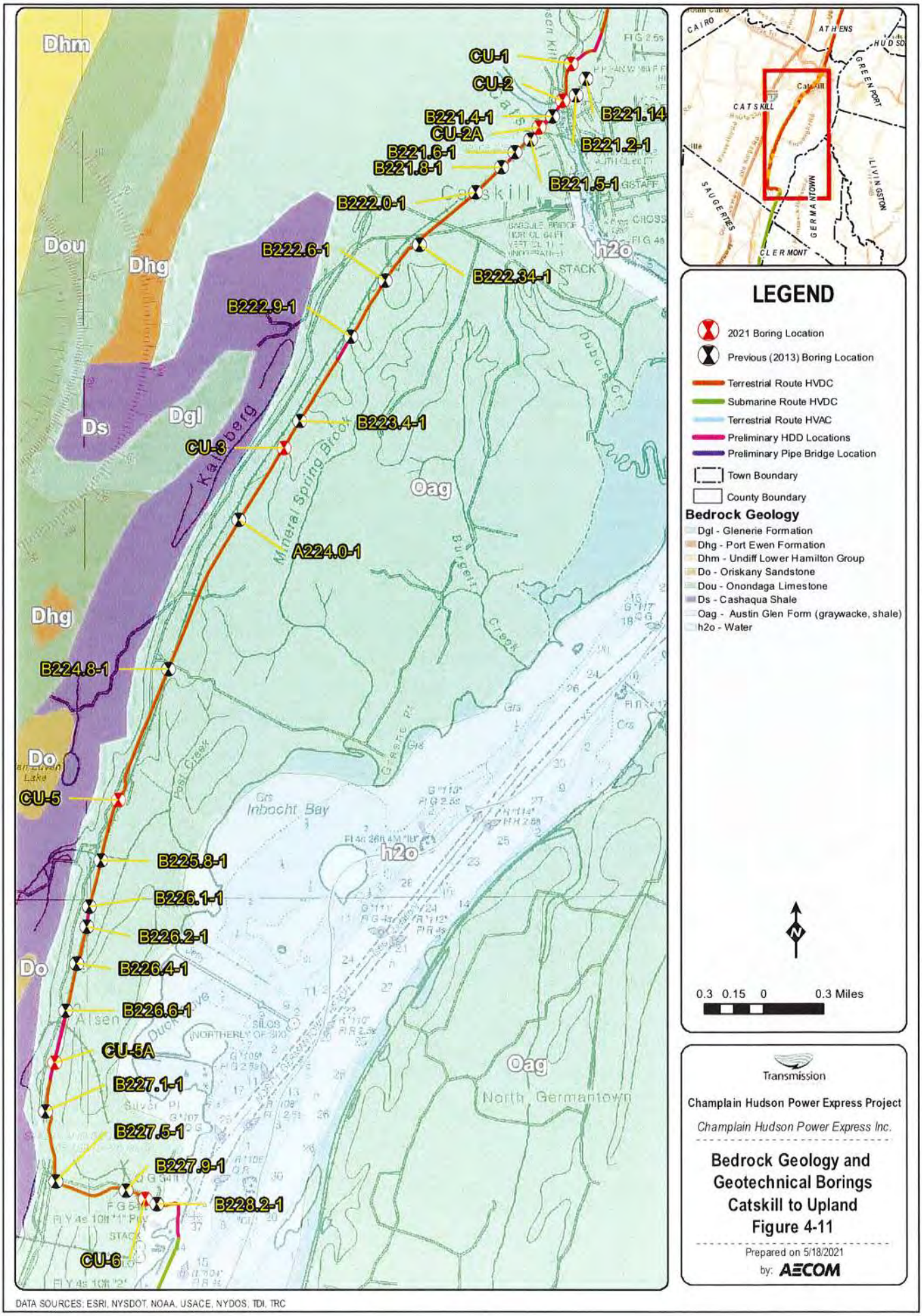
BORING LOCATION PLAN

Catskill to Upland

Figure A-11

Sheet 6 of 6

Prepared by: AECOM 5/20/2021



Transmission

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Bedrock Geology and Geotechnical Borings Catskill to Upland Figure 4-11

Prepared on 5/18/2021

by: AECOM

DATA SOURCES: ESRI, NYSDOT, NOAA, USACE, NYDOS, TDI, TRC

Table 1-11: Summary of Test Borings
Catskill - Upland Segment (CU)

Boring No.	Location	Approx. Mile Post	Total Depth of Boring (ft.)	Predominant Soil Type (0'-16')	Depth to Top of Bedrock (ft)	Type of Rock	Remarks	Depth to Water (ft.)	Northing (2)	Easting (2)	Top of Boring Elevation (1)
B226.6-1		226.65	25	SILTY CLAY	-	-	-	18.7	1211894.746	649689.666	-
CU-5A	CSXT ROW - East shoulder of rail siding	226.91	40	SILT & CLAY	-	-	-	25	1210523.689	649411.754	118.4
B227.1-1		227.16	30	CLAY, SILT & SAND	-	-	-	No water observed	1209233.087	649170.737	-
B227.5-1		227.53	30	CLAY, SILT & SAND	-	-	-	No water observed	1207372.399	649439.476	-
B227.9-1		227.93	25	SILTY SAND OVER SILTY CLAY	-	-	-	No water observed	1207125.886	651285.97	-
CU-6	South shoulder dirt private road	228.05	16	SAND, SILT, GRAVEL (WITH COBBLES?)	12.7	SILTSTONE	-	No water observed	1206902.296	651809.144	25.6
B228.2-1		228.1	60	SANDY GRAVEL (FILL)	-	-	-	No water observed	1206774.242	652109.492	-

Notes:
(1) Elevations refer to NAVD88
(2) Northing and Easting in NYS Plane East (ft.)
(3) Drilled by AECOM in 2021
(4) Drilled by TRC in 2013

BORING CONTRACTOR: ADT														SHEET 1 OF 1
DRILLER: Francisco M.														PROJECT NAME: CHPE -
SOILS ENGINEER/GEOLOGIST: Alexandra Golden														PROJECT NO.: 60323056
														HOLE NO.: **CU-6**
														START DATE: 2/16/21
														FINISH DATE: 2/16/21
LOCATION: MP - 228.05 Catskill, NY														OFFSET: N/A
GROUND WATER OBSERVATIONS					CASING		SAMPLER		DRILL BIT		CORE BARREL			DRILL RIG: Geoprobe 7822DT
No water observed			TYPE		Flush Joint Steel		California Modified		Tricone Roller Bit		NQ			BORING TYPE: SPT/Core
			SIZE I.D.		4"		2.5"		- -		1 7/8"			BORING O.D.: 4.5"/3"
			SIZE O.D.		4.5"		3"		3 7/8"		3"			SURFACE ELEV.:
			HAMMER WT.		140 lbs		140 lbs							LONGITUDE:
			HAMMER FALL		30"		30"							LATITUDE:
DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH		FIELD IDENTIFICATION OF SOILS
		0'-5'				Hand Cleared					SP			0.0'-3.0'; Brown medium-coarse SAND, little gravel, trace organics; loose, dry
1.0														
											SW			3.0'-5.0'; Dark brown fine-medium SAND, some silt, little gravel; medium stiff, dry
2.0														
3.0														
		3'-5'	S-1											TR-1; 3.0'-5.0'
4.0														
5.0														
		5'-7'	S-2	24"	24"	12	17	18	27	23	SW			Brown fine-medium SAND, some silt, some gravel, little subangular cobbles (3"); medium stiff, dry
6.0														TR-2; (5.5'-6.17')
7.0												Silty SAND		
		7'-9'	S-3	24"	24"	21	20	30	39	20	SW			SAA; moist
8.0														
9.0														
		9'-11'	S-4	24"	24"	45	40	48	50	57	SW			SAA
10.0														TR-3; (9.0'-9.5')
11.0														
		11'-'13'	S-5	19"	19"	9	25	33	50/3"	38	SW			SAA, moist
12.0														Rock encountered at 12.8', drill to 13'
13.0														
	3 min	13'-16'	R-1	36"	36"	RQD: 18" = 50%						SILTSTONE		Gray SILTSTONE, trace calcite veins, moderately weathered, 50 pieces
14.0														TR-4; (14'-14.5')
	2 min													
15.0														
	4 min													
16.0														
														CU-6 terminated at 16', backilled and grouted to surface
17.0														
18.0														
19.0														
20.0														

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: $N_{corr}=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

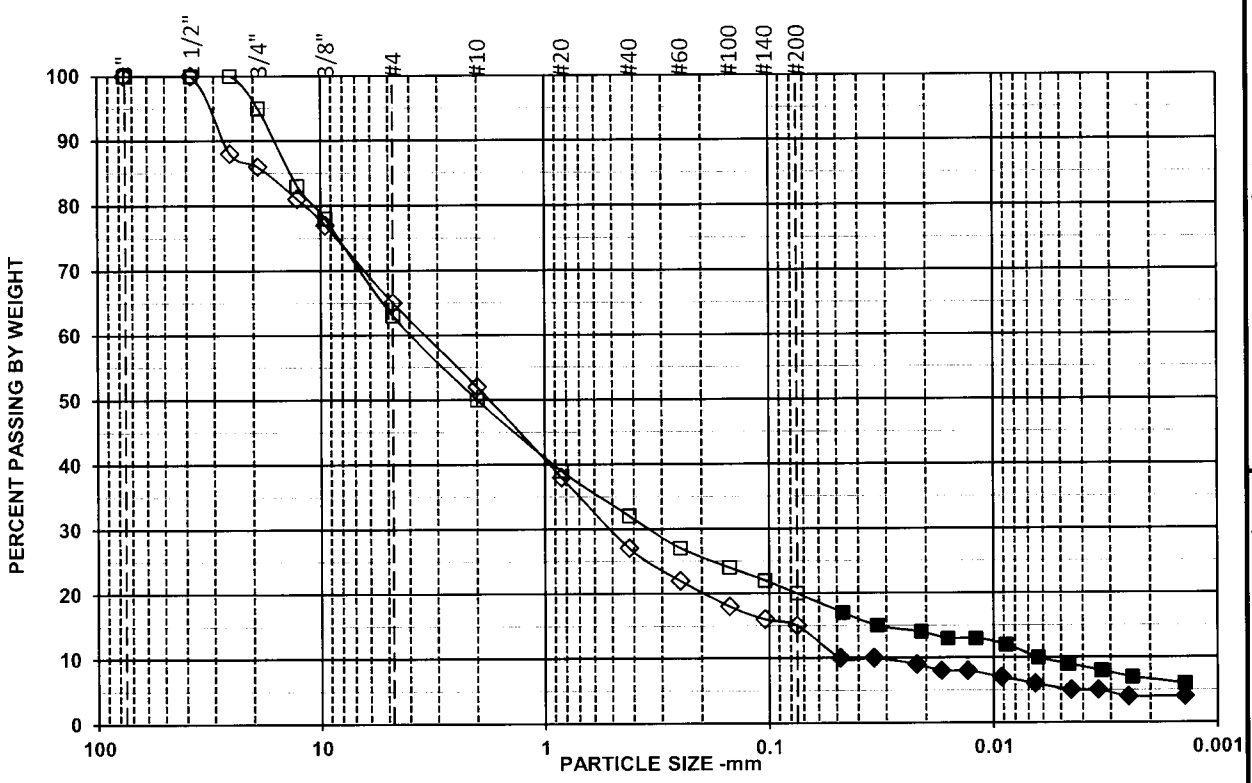
SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

Aquifer
CHPE - Catskill Upland Borings
LABORATORY SOIL TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS							REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 μm (%)	
CU-1	S-3	7-9	7.5				SM	33	9	
CU-1	S-6	13-15	9.0				SM	16	4	
CU-2	S-2	5-7	22.1				SM	14	3	
CU-2	S-6	13-15	20.6	34	20	14	SC	45	14	
CU-2	S-11	35-37	7.0				SM	23	5	
CU-2A	S-6	15-17	59.4	53	23	30	CH	99	87	
CU-2A	S-9	30-32	35.4	37	20	17	CL	99.6	46	
CU-2A	S-14	55-57	25.1	28	17	11	CL	85	28	
CU-4	S-2	5-7	28.9	60	26	34	CH	95.7	77	
CU-4	S-4	9-11	33.0				GC	31	22	
CU-5A	S-4	9-11	33.7	64	25	39	CH	99	90	
CU-5A	S-8	20-22	29.8	59	25	34	CH	99.4	58	
CU-5A	S-11	35-37	37.8	48	23	25	CL	100	68	
CU-6	S-2	5-5.5	9.4				SM	20	7	
CU-6	S-5	11-13	9.8				SM	15	4	

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	9.4				SM		Brown, Silty sand with gravel, Insufficient sample size	04/30/21
◇	9.8				SM		Brown, Silty sand with gravel, Insufficient sample size	04/30/21
○								

Aquifer

TerraSense, LLC #7853-21007

CHPE - Catskill Upland Borings

Symbol	□	◇	○
Boring	CU-6	CU-6	
Sample	S-2	S-5	
Depth	5-5.5	11-13	
% +3"	0	0	
% Gravel	37	35	
% SAND	43	50	
%C SAND	13	13	
%M SAND	18	25	
%F SAND	12	12	
% FINES	20	15	
D_{100} (mm)	25.4	38.1	
D_{60} (mm)	3.89	3.4	
D_{30} (mm)	0.34	0.51	
D_{10} (mm)	0.006	0.048	
Cc	4.7	1.6	
Cu	617.5	70.8	

Sieve Size/ID #	Percent Finer Data		
6"	100	100	
4"	100	100	
3"	100	100	
1 1/2"	100	100	
1"	100	88	
3/4"	95	86	
1/2"	83	81	
3/8"	78	77	
#4	63	65	
#10	50	52	
#20	39	38	
#40	32	27	
#60	27	22	
#100	24	18	
#140	22	16	
#200	20	15	
5μ m	9	5	
2μ m	7	4	
1μ m	5	4	

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

Aquifer
CHPE - Catskill Upland Borings
SUMMARY OF ROCK TESTING

SAMPLE IDENTIFICATION			STATE PROPERTIES			ENGINEERING PROPERTY TESTS					REMARKS
Boring	Run	Depth	WATER CONTENT (1) (%)	TOTAL UNIT WGT. (pcf)	DRY UNIT WGT. (pcf)	TEST TYPE (2)	Mohs HARDNESS (-)	UNCONFINED COMPRESSION TESTS (ASTM D7012)			
								COMPRESSIVE STRENGTH (psi)	AXIAL STRAIN @ FAILURE (%)	ESTIMATED (5) ELASTIC MODULUS (psi)	
CU-1	R-1	20.5-20.9				M	4				
CU-1	R-1	20.95-21.35	0.4	169	168	UC		21660	0.41	6E+06	
CU-1	R-3	32.4-32.6				M	3				
CU-1	R-3	32.7-33.1	0.6	169	168	UC		11100	0.30	4E+06	
CU-2	R-1	53				M	7				
CU-2	R-1	53.7-54.1	0.5	169	168	UC		8100	0.28	4E+06	
CU-6	R-1	13.6-13.9				M	5				
CU-6	R-1	13.1-13.5	0.3	169	168	UC		20750	0.36	6E+06	

(2) Test Type Abbreviations: M: Mohs Hardness, UC: UC Compression test with estimated elastic moduli

(3) Diametral orientation across core along bedding/foliation plane, axial perpendicular to bedding/foliation plane, as applicable.

(4) Compressive Strength determined using generalized "K" factor in ASTM D5731

(5) Modulus estimated based on corrected gross deformations.

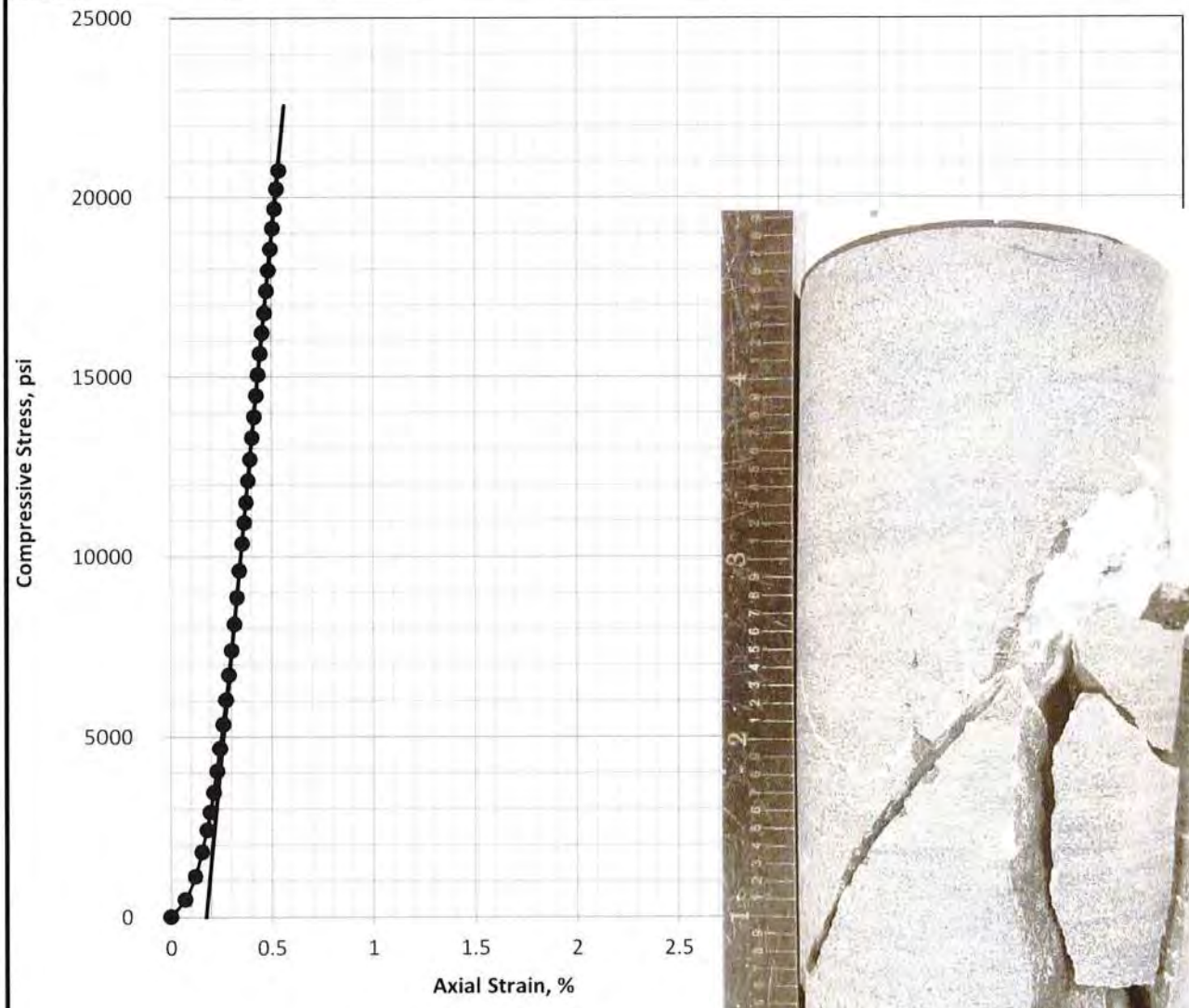
ROCK CORE PHOTOGRAPHIC LOG

AECOM Project No: **60323056**
Project Name: **CHPE – Upstate New York Upland Geotechnical Investigation**
Location: **Catskill - Upland Segment**

AECOM

Boring No.	Depth (ft.)	
CU-6	20.0-40.0	

Note: Black foam inserts represent core pieces that were removed for geotechnical and/or thermal resistivity laboratory testing



FAILURE PHOTO

Specimen Information

Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Length (inch)	Diameter (inch)
0.35	169	168	4.404	1.973

Specimen meets ASTM D4543 shape tolerances

Test Summary

Strain Rate (%/min)	Corrected Strain to Peak (%)	q_u (psi)	Estimated (shown) Elastic Modulus (psi)
0.09	0.36	20750	6E+06

Test by: DM
Test Date: Apr-07-21
Reviewed by: GET

Aquifer	**CHPE - Catskill Upland Borings**	**COMPRESSIVE STRESS VS STRAIN UNCONFINED COMPRESSIVE STRENGTH TEST**
TerraSense, LLC Project # 7853-21007		**Boring: CU-6 Run: R-1 Depth 13.1-13.5 ft.**

Table 6-11 Bedrock Conditions at HDD Locations						
Catskill - Upland Segment (CU)						
Approximate HDD MP		**Approximate Length (feet)**	**Boring No.**	**Boring Depth (feet)**	**Depth to Bedrock (feet)**	**Type of Rock**
Certified Route MP	**Alternative Route MP**					
221.2	0.1	430	CU-1	40	**19.7**	**LIMESTONE**
-	0.3	600	CU-2	60	**50.1**	**SHALE & SANDSTONE**
			B221.4-1	24.7	**13.6**	**GRAYWACKE**
-	0.45	388	CU-2A	60	>60	-
222.0	-	500	B222.0-1	25	>25	-
222.3	-	250	B222.34-1	25	>25	-
222.6	-	190	B222.6-1	30.5	>30.5	-
223.0	-	450	B222.9-1	30	>30	-
225.8	-	300	B225.8-1	30	>30	-
226.1	-	640	B226.1-1	30	>30	-
			B226.2-1	25	>25	-
226.7	-	1845	B226.6-1	30	>30	-
			CU-5A	40	>40	-
228.3	-	-	B228.2-1	60	>60	-

Note: This table represents AECOM's understanding of the HDD locations and lengths in this project Segment as of the start of the field investigation on December 10, 2020. HDD's that may have been added, or HDD locations or lengths that may have been modified since that date, as reflected in the Boring Location Plan (Appendix A) are not included.


Silver Pt
CATSKILL
G "107"
Q G
SAFETY AND SECURITY ZONE
65.169 (see note A)
Q G 30ft
F G 50ft
Fl Y 4s 10ft "1" Priv
SII-HDD-3B
SII-HDD-3
SII-HDD-3A
STACK
SILO
Fl Y 4s 10ft "2"
Priv
S76
HR343
Cementon
GERMANTOWN
Station
Proposed CRPE Routes
Terrestrial
Submarine
2012 MRS Corridor
2010 MRS Corridor
2012 MRS Core Locations
HDD Geotechnical Boring
Physical/Chemical
Physical/Chemical/Dioxin
2010 MRS Core Locations
Physical
Physical/Chemical
Physical/Chemical/Dioxin
Physical/Chemical/PCB
NYSDEC Protected Areas
NYSDEC SAV Bed
Significant Coastal Fish and Wildlife Boundaries
LCMM Cultural Resources*
LC1
Anomaly Index Number
Fed. Navigation Channel
Town Boundary

CEMENTON

Hole No. SII-HDD-3D

DRILLING LOG

DIVISION: HDR CHPE

INSTALLATION: MRS Phase 2 Cable Route Survey

SHEET 1 OF 1 SHEETS

1. PROJECT: CHPE
2. LOCATION (Coordinates or Station): Hudson River N 15,308,914.0 E 1,936,568.3
3. DRILLING AGENCY: ADT
4. HOLE NO. (As shown on drawing title and file number): SII-HDD-3D
5. NAME OF DRILLER: J. Philbin
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. Penetration, ft: 43.0
8. Recovery, ft: 43.0
9. Total Recovery, %: 100.0
10. SIZE AND TYPE OF BIT: Split Spoon/Rotary Drill
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 11; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 2
15. WATER DEPTH:
16. DATE HOLE: STARTED 11/14/2012; COMPLETED 11/15/2012
17. ELEVATION TOP OF HOLE: -44.1
18. TOTAL CORE RECOVERY FOR BORING: 100 %
19. GEOLOGIST: S. Miller

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
-44.1	0.0		Dark brown to black, fine to medium-grained, poorly-sorted sand with gravel	30	SedBox3 0.0 2.0	Blows 2-2-1-3
-49.1	5.0					
-49.3	5.2		Dark brown, medium-grained sand with shell hash; red rock/brick at 5.2'	100	SedBox3 5.0 7.0	Blows 1-1-3-6
-54.1	10.0		Dark brown, low-plasticity clay			
-55.1	11.0		Dark brown, fine to medium-grained sand with shell and brick fragments	30	SedBox3 10.0 12.0	Blows 5-6-10-10
-59.1	15.0		Dark brown silt with trace sand			
-59.9	15.8		Dark brown, medium to coarse-grained, silty-sand with pebbles and shell fragments; trace 1" rock	70	SedBox3 15.0 17.0	Blows 12-13-43-60
-61.1	17.0		Dark brown silty-sand	100	RockBox1 17.0 18.0	Drill Time 00:27:33 RQD=67%
			Gray to black low-grade metamorphic slate Diagonal fracturing	58	RockBox1 18.0 23.0	Drill Time 00:29:22 RQD=42%
				75	RockBox1 23.0 26.0	Drill Time 00:34:25 RQD=69%
				80	RockBox1 26.0 28.0	Drill Time 00:30:40 RQD=52%
-73.1	29.0			84	RockBox1 28.0 33.0	Drill Time 00:46:39 RQD=46%
			Low-grade metamorphosed sedimentary rocks (possibly slate or dense limestone) Diagonal and horizontal fracturing	98	RockBox1 33.0 38.0	Drill Time 00:24:35 RQD=93%
-84.1	40.0			94	RockBox2 38.0 43.0	Drill Time 00:28:19 RQD=86%

DRILLING LOG

DIVISION: HDR CHPE

INSTALLATION: MRS Phase 2 Cable Route Survey

SHEET 1 OF 1 SHEETS

1. PROJECT	CHPE
2. LOCATION (Coordinates or Station)	HUDSON RIVER N 15,308,900.2 E 1,936,575.0
3. DRILLING AGENCY	AOSS
4. HOLE NO. *(As shown on drawing title and file number)*	SII-HDD-3
5. NAME OF DRILLER	P.Morton
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. Penetration, ft	7.0
8. Recovery, ft	2.4
9. Total Recovery, %	34.5
10. SIZE AND TYPE OF BIT	3.5 in
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD88
12. MANUFACTURER'S DESIGNATION OF DRILL	Vibracore
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 1 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. WATER DEPTH	-47.5
16. DATE HOLE	STARTED 9/29/2012 / COMPLETED 9/29/2012
17. ELEVATION TOP OF HOLE	-47.5
18. TOTAL CORE RECOVERY FOR BORING	34.5 %
19. GEOLOGIST	P.Morton

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-47.5	0.0		Dark grey silty-sand with pieces of gravel (2" round) near the bottom of the unit	100	BS1 0.0 2.4	Bagged Sample (0-2.4')
-49.9	2.4					

DRILLING LOG

DIVISION: HDR CHPE

INSTALLATION: MRS Phase 2 Cable Route Survey

SHEET 1 OF 1 SHEETS

1. PROJECT: CHPE
2. LOCATION (Coordinates or Station): HUDSON RIVER N 15,308,983.5 E 1,936,602.6
3. DRILLING AGENCY: AOSS
4. HOLE NO. *(As shown on drawing title and file number)*: SII-HDD-3A
5. NAME OF DRILLER: P.Morton
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. Penetration, ft: 7.6
8. Recovery, ft: 6.7
9. Total Recovery, %: 88.5
10. SIZE AND TYPE OF BIT: 3.5 in
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: NAVD88
12. MANUFACTURER'S DESIGNATION OF DRILL: Vibracore
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: N/A
15. WATER DEPTH: -45.3
16. DATE HOLE: STARTED 10/30/2012; COMPLETED 10/30/2012
17. ELEVATION TOP OF HOLE: -45.3
18. TOTAL CORE RECOVERY FOR BORING: 88.5 %
19. GEOLOGIST: P.Morton

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-45.3	0.0		Dark brown grey silty-sand with gravel	100	BS1 0.0 3.2	Bagged Sample (0-3.2')
-48.5	3.2		Shell Layer (@ 3.2')			
			Dark grey, low-plasticity clay	100	BS2 3.2 6.7	Bagged Sample (3.2-6.7')
-52.0	6.7					

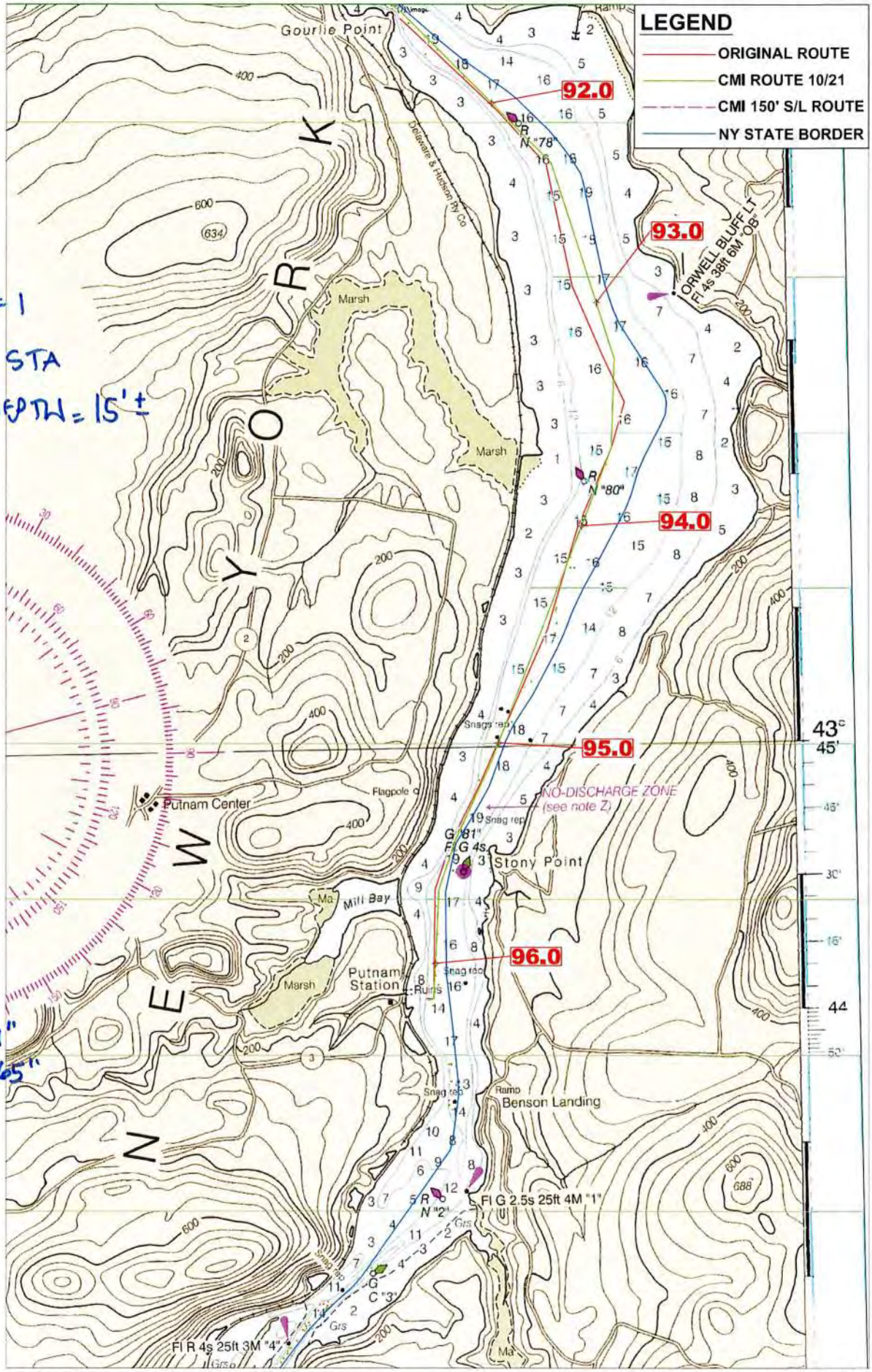
Hole No. SII-HDD-3B

DRILLING LOG	DIVISION: HDR CHPE	INSTALLATION: MRS Phase 2 Cable Route Survey	SHEET 1 OF 1 SHEETS

1. PROJECT	CHPE
2. LOCATION (Coordinates or Station)	HUDSON RIVER N 15,308,713.9 E 1,936,524.7
3. DRILLING AGENCY	AOSS
4. HOLE NO. *(As shown on drawing title and file number)*	SII-HDD-3B
5. NAME OF DRILLER	P.Morton
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.
7. Penetration, ft	6.4
8. Recovery, ft	3.4
9. Total Recovery, %	53.0
10. SIZE AND TYPE OF BIT	3.5 in
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD88
12. MANUFACTURER'S DESIGNATION OF DRILL	Vibracore
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 2 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. WATER DEPTH	-53.9
16. DATE HOLE	STARTED 9/29/2012 / COMPLETED 9/29/2012
17. ELEVATION TOP OF HOLE	-53.9
18. TOTAL CORE RECOVERY FOR BORING	53.0 %
19. GEOLOGIST	S.Ebersole

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
-53.9	0.0		Brown fine-grained to medium-grained silty-sands (tree fragments common)	100	BS1 0.0 1.0	Bagged Sample (0-1.0') @0.0' Tor=N/A Pen=N/A
-54.9	1.0					@1.0' Tor=.50 T/sq.ft Pen=.08 T/sq.ft
			Dark grey to black silty-sand (fine-grain to medium-grain) with common organics and high silt component (tree fragments common)	100	BS2 1.0 3.4	Bagged Sample (1.0-3.4')
						@2.0' Tor=.40 T/sq.ft Pen=1.25 T/sq.ft
						@3.0' Tor=.30 T/sq.ft Pen=1.00 T/sq.ft
-57.3	3.4					

CHPE - LAKE CHAMPLAIN CABLE ROUTE ADJUSTMENT



DRILL #1

PUTNAM STA

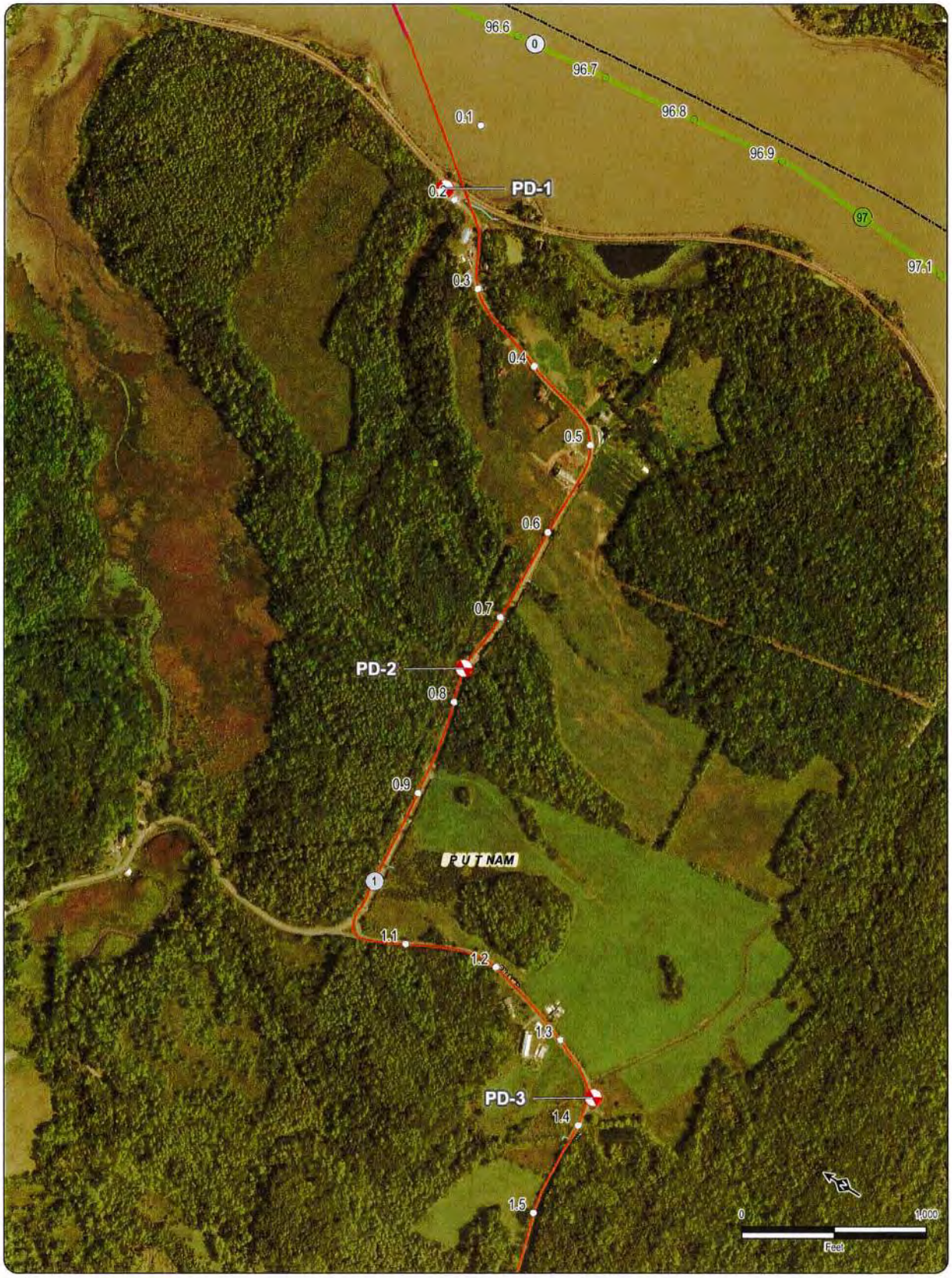
WATER DEPTH = 15' ±

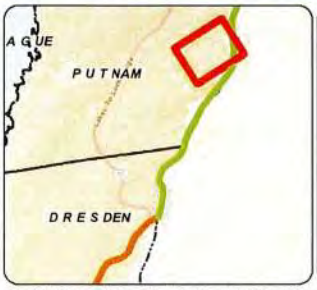
N43°44'12.51"

W 73°22'18.65"

10/19/2021 R10/26/2021

SHEET 17 OF 17





LEGEND

- Certified Milepost - Tenths
- Certified Milepost
- Preferred Alternative Milepost - Tenths
- Preferred Alternative Milepost
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- 2021 Boring Location
- Previous (2013) Boring Location
- Streams/Ditches
- Railroad ROW
- Deviation Zone
- Deviation Zone Outside ROW
- Preferred Alternative Deviation Zone
- Preferred Alternative Deviation Zone Outside ROW
- Town Boundary
- Village Boundary
- State Park (OPRHP)

Parcel Ownership

TOWN NAME

Road Name

Transmission

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Putnam to Dresden

Figure A-1

Sheet 1 of 6

Prepared by: AECOM 5/18/2021

DATA SOURCES: ESRI, NETWORK MAPPING 20'0, NYSDOT, OPRHP, TDI, TRC

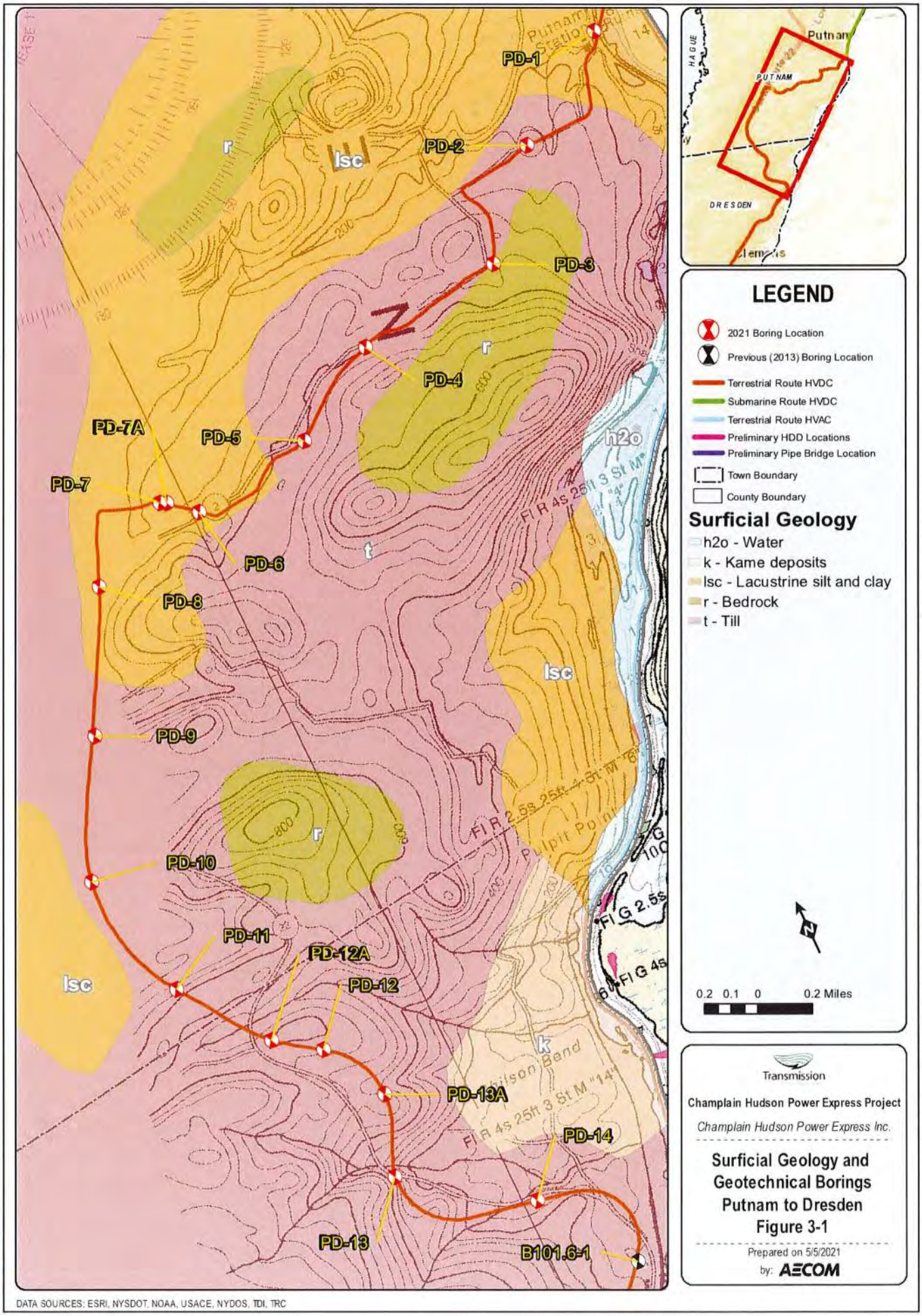

PD-1
PD-2
PD-3
PD-4
PD-5
PD-6
PD-7
PD-7A
PD-8
PD-9
PD-10
PD-11
PD-12A
PD-12
PD-13A
PD-14
PD-13
B101.6-1
r
lsc
t
k
h2o
Putnam
PUTNAM
DRESDEN
LEGEND
2021 Boring Location
Previous (2013) Boring Location
Terrestrial Route HVDC
Submarine Route HVDC
Terrestrial Route HVAC
Preliminary HDD Locations
Preliminary Pipe Bridge Location
Town Boundary
County Boundary
Surficial Geology
h2o - Water
k - Kame deposits
lsc - Lacustrine silt and clay
r - Bedrock
t - Till
N
0.2 0.1 0 0.2 Miles
Transmission
Champlain Hudson Power Express Project
Champlain Hudson Power Express Inc.
Surficial Geology and Geotechnical Borings
Putnam to Dresden
Figure 3-1
Prepared on 5/5/2021
by: AECOM
DATA SOURCES: ESRI, NYSDOT, NOAA, USACE, NYDOS, TDI, TRC

Table 1-1: Summary of Test Borings
Putnam to Dresden Segment (PD)

Boring No.	Approx. Mile Post	Total Depth of Boring (ft.)	Predominant Soil Type (0'-16')	Depth to Top of Bedrock (ft)	Type of Rock	Remarks	Depth to Water (ft.)	Northing (2)	Easting (2)	Top of Boring Elevation (1)
PD-1	0.19	60	FINE SAND	-	-	HDD to Lake Champlain	5	1787808.9	789619.3	105.7
PD-2	0.76	16.3	FINE SAND	6.3	SANDSTONE	-	2.5	1786326.7	787486.3	243.4
PD-3	1.37	17	CLAYEY SILT	-	-	-	No water observed	1784498.2	785906.2	335.1
PD-4	1.95	14.6	CLAY	14.6	SANDSTONE	-	No water observed	1784080.3	782956.5	365.7
PD-5	2.36	16	CLAYEY SILT	11	SANDSTONE	-	No water observed	1782925.2	781099.0	387.5
PD-6	2.87	17	SILTY CLAY	-	-	-	No water observed	1782539.0	778649.3	299.7
PD-7A	2.99	50	SILT & CLAY	-	-	HDD under Mill Creek	15	1782960.9	778149.9	269.5
PD-7	3.03	50	CLAYEY SILT	-	-		20	1783019.4	778020.6	266.4
PD-8	3.50	17	SILT & CLAY	-	-	-	No water observed	1782042.5	776254.4	286.1
PD-9	4.06	17	CLAY	-	-	-	No water observed	1779444.6	774945.9	301.5
PD-10	4.60	15.25	SAND & GRAVEL, WITH BOULDERS	-	-	-	No water observed	1776880.3	773692.7	428.9

BORING CONTRACTOR: ADT	**AECOM**		SHEET 1 OF 3
			PROJECT NAME: CHPE -
DRILLER: Chris Chaillou			PROJECT NO.: 60323056
			HOLE NO.: **PD-1**
SOILS ENGINEER/GEOLOGIST: Chris French			START DATE: 12/23/2020
	BORING LOG		FINISH DATE: 12/23/2020
LOCATION: MP 0.19 (Washington County Rt. 3)			OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	DRILL RIG: Geoprobe 7822 DT
Water at 5' (inferred)	TYPE	Flush Joint Steel	California Modified	Tricone Roller Bit		BORING TYPE: SPT
	SIZE I.D.	4"	2.5"	- -		BORING O.D.: 4.5"
	SIZE O.D.	4.5"	3"	3 7/8 "		SURFACE ELEV.:
	HAMMER WT.	140 lbs	140 lbs			LONGITUDE:
	HAMMER FALL	30"	30"			LATITUDE:

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.[2]	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		0'-5'									SP		0'-1.5'; Dark Brown fine-coarse SAND, little silt, little subangular-subrounded gravel,trace sub angular cobbles, organics (root materials), loose, moist
1.0		(Hand Cleared)											
2.0													
											SP		1.5'-5'; Lt Br fine SAND, some silt, trace sub rounded gravel, loose, moist
3.0		3'-5'	S-1										TR-1; (3.0'-5.0')
4.0													
5.0													
		5'-7'	S-2	24"	6"	WOH/3"	1/15"		2	-	SM		Light Brown fine SAND, some silt, very loose, saturated
6.0													
7.0													
		7'-9'	S-3	24"	18"	4	2	2	2	3	SM		Gray fine SAND, some silt, very loose, saturated, mild petroleum odor, TR-2; (8.0'-8.5')
8.0													
9.0													
		9'-11'	S-4	24"	16"	2	5	8	10	8	SP/SM		Gray Brown fine SAND, little silt, loose, moist
10.0												SAND	
11.0													
		11'-13'	S-5	24"	24"	10	10	17	17	18	SP		Brown fine SAND, trace silt, slight petroleum odor, medium dense, moist
12.0													
13.0													
		13'-15'	S-6	24"	24"	8	13	18	23	20	SP		SAA TR-3; (14.0'-14.5')
14.0													
15.0													
		15'-17'	S-7	24"	20"	19	32	22	18	35	SP		Brown fine SAND, trace silt, very slight petroleum odor, dense, moist
16.0													
17.0													
18.0													
19.0													
20.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: $Ncorr=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

BORING CONTRACTOR: ADT	AECOM		SHEET 2 OF 3
DRILLER: Chris Chaillou			PROJECT NAME: CHPE -
SOILS ENGINEER/Geologist: Chris French			PROJECT NO.: 60323056
	BORING LOG		HOLE NO.: **PD-1**
			START DATE: 12/23/2020
LOCATION: MP 0.19 (Washington County Rt. 3)			FINISH DATE: 12/23/2020
			OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'	S-8	24"	18"	16	27	25	16	34	SP		SAA TR-4; (21.0'-21.5')
21.0													
22.0													
23.0													
24.0													
25.0													
		25'-27'	S-9	24"	14"	12	15	12	18	18	SP/SM		Br f-m SAND, little silt, occasional silty clay lenses, medium dense, moist
26.0													
27.0													
28.0													
29.0													
30.0													
		30'-32'	S-10	24"	18"	7	18	19	19	24	SP/SM		Br fine SAND, little silt, medium dense, moist
31.0													
32.0													
33.0												SAND	
34.0													
35.0													
		35'-37'	S-11	24"	20"	20	21	20	19	27	SP/SM		SAA
36.0													
37.0													
38.0													
39.0													
40.0													
		40'-42'	S-12	24"	14"	14	17	20	21	24	SP/SM		Br f-m SAND, little silt, medium dense, moist-wet. TR-5; (41.0'-41.5')
41.0													
42.0													
43.0													
44.0													
45.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

BORING CONTRACTOR: ADT

DRILLER: Chris Chailtou

SOILS ENGINEER: Chris French

LOCATION: MP 0.19 (Washington County Rt. 3)

AECOM

BORING LOG

SHEET 3 OF 3

PROJECT NAME: CHPE -

PROJECT NO.: 60323056

HOLE NO.: **PD-1**

START DATE: 12/23/2020

FINISH DATE: 12/23/2020

OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		45'-47'	S-13	24"	16"	12	19	19	19	25	SP/SM		Br f-m SAND, little silt, medium dense, moist
46.0													
47.0													
48.0													
49.0													
50.0													
		50'-52'	S-14	24"	15"	14	21	20	23	27	SP/SM		Br fine SAND, little silt, medium dense, moist
51.0													
52.0													
53.0												SAND	
54.0													
55.0													
		55'-57'	S-15	24"	16"	14	20	25	25	29	SP/SM		Br f-m SAND, little silt, medium dense, moist
56.0													
57.0													
58.0													
		58'-60'	S-16	24"	18"	20	36	34	38	46	SP/SM		Br f-m SAND, little silt, dense, moist, TR-6; (59.0'-59.5')
59.0													
60.0													
													Boring terminated at 60' then grouted to surface.
61.0													
62.0													
63.0													
64.0													
65.0													
66.0													
67.0													
68.0													
69.0													
70.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against DMJM Harris AECOM if he finds that the actual conditions do not conform to those indicated by this log.

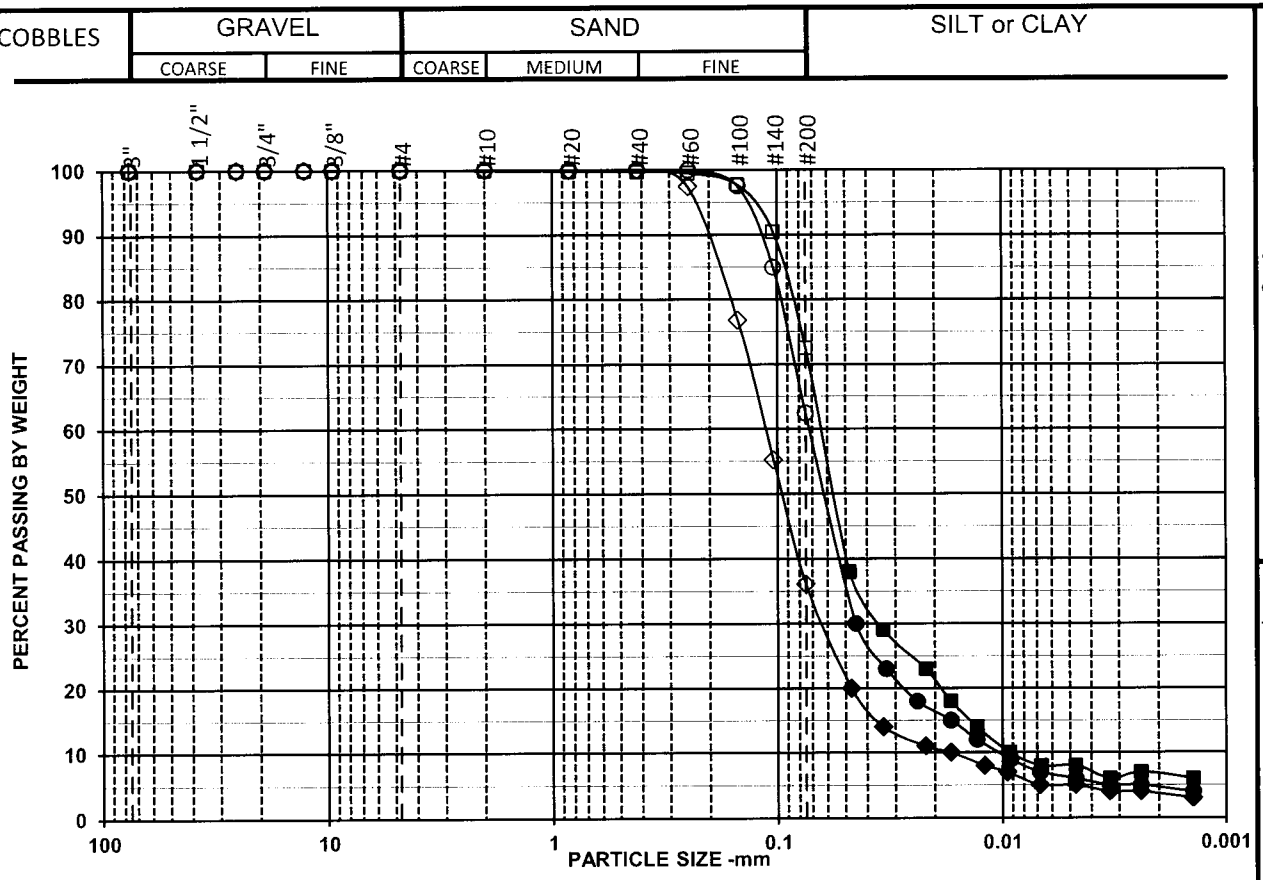
SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

Aquifer #602201207
CHPE - Putnam-Dresden Borings
LABORATORY SOIL TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS							REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 μm (%)	
PD-1	S-4	9-11	19.2				ML	72.5	7	
PD-1	S-8	20-22	18.8				SM	36.1	4	
PD-1	S-10	30-32	18.0				ML	62.4	5	
PD-1	S-12	40-42	18.6				SM	16.2	3	
PD-2	S-2	5-7	18.5				ML	97.7	15	
PD-4	S-2	5-7	42.2	81	30	51	CH	88	74	
PD-4	S-3	7-9	37.8	72	24	48	CH	94.3	75	
PD-4	S-5	11-13	33.1	60	21	39	CH	87	47	
PD-5	S-3	7-9	7.2	12	12	NP	SM	40	8	
PD-7	S-4	9-11	34.4	59	20	39	CH	99.7	55	
PD-7	S-8	20-22	68.4	50	19	31	OH	100	70	
PD-7	S-10	30-32	37.3	63	20	43	OH	100	70	
PD-7	S-12	40-42	61.7	70	22	48	OH	100	72	
PD-9	S-1	5-7	30.7	70	23	47	CH	99.9	80	
PD-9	S-3	9-11	44.0	66	23	43	CH	100	79	
PD-9	S-5	13-15	43.8	75	24	51	CH	100	92	
PD-10	S-1	6-8	8.5				GW	4	1	
PD-10	S-2	8-10	8.7				SM	38	5	
PD-13	S-1	5-7	4.2				SM	37	9	
PD-13	S-2	7-8	4.6				SM	36	9	
PD-14	S-1	5-7	24.1				ML	92.8	7	
PD-14	S-3	9-11	24.2				ML	77	5	
PD-14	S-5	13-15	22.7				ML	84.7	4	

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	19.2				ML		Brown, Silt with sand	3/15/2021
◇	18.8				SM		Brown, Silty sand	03/16/21
○	18.0				ML		Brown, Sandy silt	03/16/21

Aquifer #602201207

TerraSense, LLC #7853-21001

CHPE - Putnam-Dresden Borings

Symbol	□	◇	○
Boring	PD-1	PD-1	PD-1
Sample	S-4	S-8	S-10
Depth	9-11	20-22	30-32
% +3"	0	0	0
% Gravel	0	0	0
% SAND	27.5	63.9	37.6
%C SAND	0.1	0	0
%M SAND	0.2	0	0
%F SAND	27.2	63.9	37.6
% FINES	72.5	36.1	62.4
D_{100} (mm)	4.75	2	0.419
D_{60} (mm)	0.064	0.113	0.072
D_{30} (mm)	0.035	0.063	0.045
D_{10} (mm)	0.009	0.017	0.01
Cc	2.1	2.1	2.8
Cu	6.9	6.6	7.2

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	100.0
4"	100.0	100.0	100.0
3"	100.0	100.0	100.0
1 1/2"	100.0	100.0	100.0
1"	100.0	100.0	100.0
3/4"	100.0	100.0	100.0
1/2"	100.0	100.0	100.0
3/8"	100.0	100.0	100.0
#4	100.0	100.0	100.0
#10	99.9	100.0	100.0
#20	99.8	100.0	100.0
#40	99.7	100.0	100.0
#60	99.5	97.4	100.0
#100	97.7	76.8	97.5
#140	90.4	55.2	84.9
#200	72.5	36.1	62.4
5μ m	8	5	6
2μ m	7	4	5
1μ m	5	2	3

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

TerraSense Analysis File: GrainSizeV6Rev1a14

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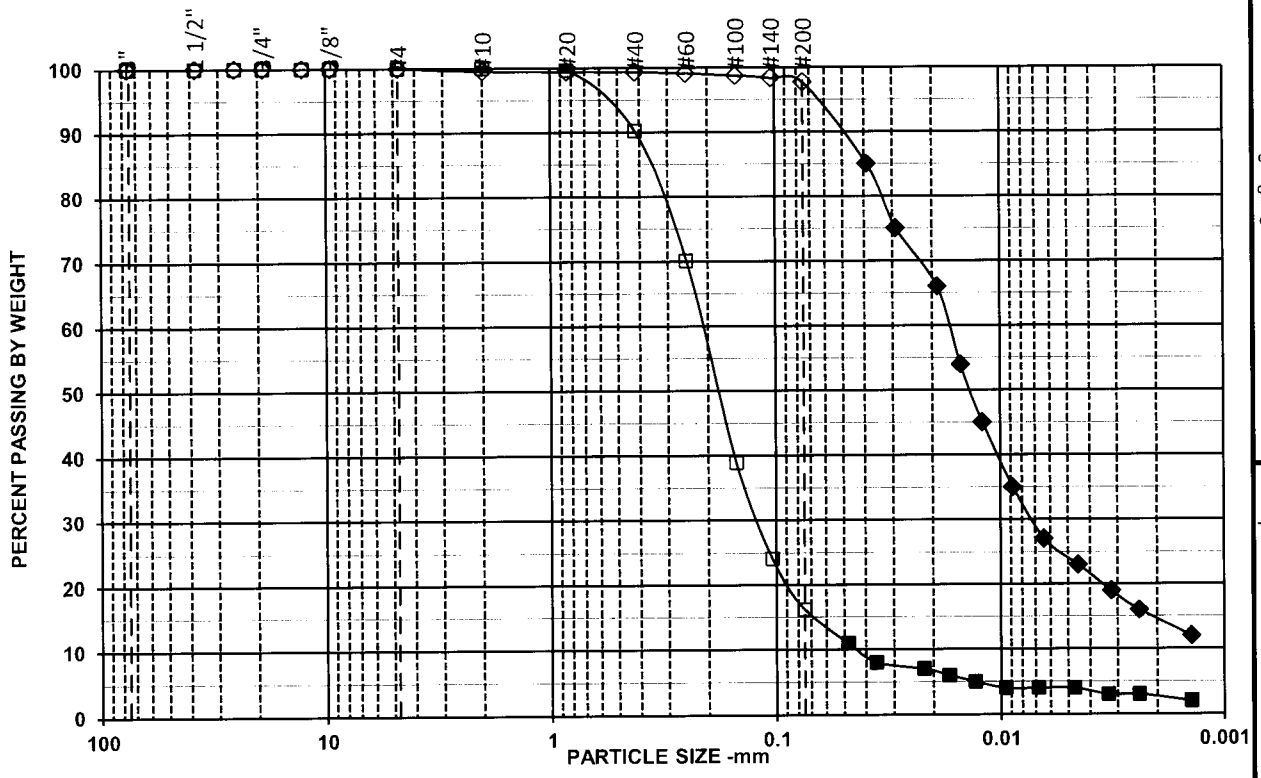

Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	18.6				SM		Brown, Silty sand	3/15/2021
◇	18.5				ML		Brown, Silt	03/15/21
○								

Symbol	□	◇	○
Boring	PD-1	PD-2	
Sample	S-12	S-2	
Depth	40-42	5-7	
% +3"	0	0	
% Gravel	0	0	
% SAND	83.8	2.3	
%C SAND	0	0.5	
%M SAND	9.8	0.2	
%F SAND	74	1.6	
% FINES	16.2	97.7	
D_{100} (mm)	2	4.75	
D_{60} (mm)	0.211	0.017	
D_{30} (mm)	0.12	0.007	
D_{10} (mm)	0.044		
Cc	1.6		
Cu	4.8		

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	100.0	100.0	
3/4"	100.0	100.0	
1/2"	100.0	100.0	
3/8"	100.0	100.0	
#4	100.0	100.0	
#10	100.0	99.5	
#20	99.6	99.4	
#40	90.2	99.3	
#60	70.1	99.1	
#100	38.9	98.7	
#140	24.1	98.3	
#200	16.2	97.7	
5μ m	4	24	
2μ m	3	15	
1μ m	1	10	

Aquifer #602201207

TerraSense, LLC #7853-21001

CHPE - Putnam-Dresden Borings

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

TerraSense Analysis File: GrainSizeV6Rev1a14

Siev1f.xlsx 4/5/2021

Appendix V – Time of Year Narrative for HDD

HDD: In-water work to establish steel conductor casing riser pipe

Condition 11 of the New York State Public Service Commission (NYSPSC) 401 Water Quality Certification (attached) states "The following in-water activities may be undertaken at any time: physical, biological, geotechnical and cultural resource sampling, surveying and testing, marine surveys, mobilization and demobilization of vessels and equipment used for cable installation and cofferdam construction; **cofferdam and steel casing rise pipe construction**; dredging of cofferdams provided that the walls of the cofferdam extend above mean high water during dredging; **HDD associated with either of the two foregoing items**; post-installation surveys and sampling; locating and marking utility crossings and work to effect utility crossings; and, with prior notice to the DPS, the New York State Department of Environmental Conservation ("NYSDEC"), and the New York State Department of Health ("NYSDOH") emergency maintenance work."

US Army Corps of Engineers Permit NAN-2009-01089 Special Condition R states "All regulated work shall be performed in accordance with dated permit drawings, the attached New York State-issued Section 401 of the Clean Water Act Water Quality Certificate dated 18 January 2013; and Special Conditions (A) through (OO) below which are all hereby made part of this permit."

Based on the above, steel casing rise pipe construction and the HDD associated with same can be undertaken at any time. This is consistent with Article VII BMP Section 26.2 which includes the statement "All in-water work will be conducted within the construction windows specified in the Certificate Conditions and the Water Quality Certificate."

CHPE Work in Water Window Permit Matrix

11/29/2022

Segment	Water Body	Mile Post (referenced to 2012 route)	HDD Site	Art VII CC93 Work in Water Window	Army Corps of Engineers Permit Work in Water Window	Planned Start of Construction	Planned Completion
Segment 7	Lower Lake Champlain	MP 73-101	Putnam Station	9/1 to 12/31	Null	4/29/2023	7/8/2023
Segment 9	Upper Hudson	MP 230-269	Cementon	8/1 to 10/15	7/1 to 1/14	6/11/2023*	9/5/2023
Segment 10	Mid-Upper Hudson	MP 269-296	Stony Point	9/15 to 11/30	7/1 to 1/14	7/8/2023	10/28/2023
Segment 11	Lower Hudson	MP 305-324	Congers	7/1 to 10/31	7/1 to 1/14	9/5/2023	12/23/2023

* Land work to commence. HDD not to cross water line until 7/1.

NEW YORK STATE PUBLIC SERVICE COMMISSION
401 WATER QUALITY CERTIFICATION

Pursuant to:	Section 401 of the Federal Water Pollution Control Act, 33 U.S.C. § 1341, and Article VII of the New York Public Service Law
Certification Issued to:	Champlain Hudson Power Express, Inc. CHPE Properties, Inc. Pieter Schuyler Bldg. 600 Broadway Albany, New York 12207

Location of Facility

Champlain Hudson Power Express, Inc. and CHPE Properties, Inc. (collectively, "CHPE") proposes to construct, operate, and maintain a new 1,000 megawatt ("MW") high-voltage direct current ("HVDC") underwater/underground electric transmission facility ("HVDC Transmission System"). The HVDC Transmission System will interconnect with the transmission system of Hydro Quebec and will run from the Canadian border east of the Town of Champlain, New York to Astoria, Queens, New York ("Astoria"). The approximately three hundred thirty two (332) mile HVDC Transmission System will connect with an HVDC converter station at Astoria to be owned by CHPE. From the converter station will be connected by an underground 345 kV HVAC circuit to a gas insulated switchgear substation owned or to be owned by the New York Power Authority on property owned by the Consolidated Edison Company of New York, Inc. at Astoria. A 345 kV HVAC circuit will extend from the GIS Substation to Con Edison's 345 kV Rainey Substation located on the corner of 36th Avenue and Vernon Boulevard in Queens, New York (the "Astoria-Rainey Cable"). The HVDC Transmission System and the Astoria-Rainey Cable are referred to collectively herein as the "Facility." The details and justification for the Facility are contained in the administrative record in Case 10-T-0139.

Facility Description

The record in the proceeding on CHPE's application, as supplemented, for a Certificate of Environmental Compatibility and Public Need under Article VII of the New York Public Service Law ("PSL") has fulfilled the requirements necessary to determine whether the Facility will qualify for issuance of a Water Quality Certification ("Certification") pursuant to § 401 of the Clean Water Act (33 U.S.C. §§ 1251-1387). The Facility cables will be located primarily underwater within the lake- and riverbeds of New York waterways, including Lake Champlain and the Hudson, Harlem and East Rivers, with some segments of the Facility route being sited overland. Overland Facility segments will consist primarily of cable installations buried along: (a) existing railroad rights-of-way; and (b) existing roadway rights-of-way. In addition, to cross the Hudson

River at Fort Edward, the Mohawk River at Schenectady and Catskill Creek, the cables will be located in conduits to be attached to existing railroad bridge structures.

For the overland segments of the Facility, the cables will be buried via excavated trenches or Horizontal Directional Drilling ("HDD") methods. For underwater cable installation, the primary methods for installation will be jet plowing and/or shear plowing. Underwater cable installation techniques will vary based on a number of factors, including, but not limited to, sediment type, bathymetry, and existing infrastructure crossings.

Where the overland segments of the Facility route encounter streams and/or wetlands, the following methods may be used to minimize impacts: (a) flume crossing; (b) dam and pump; (c) HDD or Jack and Bore ("J&B"); and (d) open cut. The waterbody crossing methods are further described in the Facility's Best Management Practices documentation, which is used in the preparation of the Environmental Management and Construction Plan ("EM&CP"). Adherence to the EM&CP, required to be filed for approval by the New York State Public Service Commission ("Commission") as a condition of the Public Service Law Article VII Certificate of Environmental Compatibility and Public Need ("Article VII Certificate") in Case 10-T-0139, will serve to protect these resources.

Construction of the Facility will be in accordance with the Article VII Certificate and approved EM&CP.

Certification

The Commission hereby certifies, pursuant to § 401 of the Clean Water Act (33 U.S.C. § 1341(a)(1)) and Article VII of the PSL, that the Facility, as conditioned herein, complies with applicable requirements of §§ 301, 302, 303, 306 and 307 of the Clean Water Act as amended, and applicable New York State water quality standards, limitations, criteria, and other requirements set forth in 6 NYCRR § 608.9(a) and Parts 701 through 704, provided that all of the conditions listed herein are met. This Certification is issued in conjunction with the Article VII Certificate sought by CHPE in, and based on the record of, Case 10-T-0139.

Conditions

1. No in-water work shall commence until all pre-construction conditions related to such work contained in the Article VII Certificate and any Order approving the EM&CP for each affected Segment EM&CP have been met to the satisfaction of the New York State Department of Public Service ("DPS").

2. Construction and operation of the Facility shall at all times be in conformance with: (a) the Application (as amended and supplemented) and Joint Proposal of Settlement filed in Case 10-T-0139 to the degree not superseded by the Article VII Certificate, (b) all conditions of approval contained in the Article VII

Certificate, (c) the EM&CP, and (d) all conditions incorporated in any Order approving the EM&CP in Case 10-T-0139, to the extent such documents referenced in (c) and (d) above pertain to CHPE's compliance with New York State Water Quality Standards necessary and appropriate for issuance of, and compliance with, this Certification.

3. CHPE shall provide a copy of this Certification to the United States Army Corps of Engineers ("USACE"), as well as a copy of the Application, Joint Proposal, Article VII Certificate (when issued) EM&CP and Order(s) approving the EM&CP (when issued) in Case 10-T-0139, so that the USACE will have a complete record of the conditions that apply hereto.

4. CHPE shall provide all construction contractors performing work on the Facility complete copies of this Certification, the Article VII Certificate, the approved EM&CP, and Orders(s) approving the EM&CP for each Facility segment.

Classified Streams and Wetland Crossings Installation

5. For overland installation, no site preparation work shall be undertaken until all required erosion control measures have been installed.

6. During overland cable installation in all waters of the State, including classified streams and wetlands, there shall be no visible increase in turbidity that causes a visible contrast to background conditions forty (40) feet downstream of the installed cable centerline.

7. CHPE shall employ measures sufficient to prevent contamination of the waters of the State by silt, sediment, fuels, drilling fluids, concrete, leachate or any other pollutant associated with the installation of the Facility.

8. All in-stream work, as well as any work that may result in the suspension of sediments, is prohibited in all streams designated as "C(T)" and "C(TS)" streams during the trout spawning and incubation period commencing October 1 and ending May 31st.

9. Any debris or excess materials caused by the construction of the Facility shall be immediately and completely removed from the bed and banks of all water areas and transported to an appropriate upland area for disposal.

Lake and River Installation

10. Underwater construction in Lake Champlain and the Hudson, Harlem and East Rivers (including jet-plow and shear-plow trials) and pre-installation route clearing activities (including pre-lay grapnel run and associated obstruction and debris removal) shall occur within the construction windows set forth in Table 1 in the Article VII Certificate.

11. The following in-water activities may be undertaken at any time: physical, biological, geotechnical and cultural resource sampling, surveying and testing; marine surveys, mobilization and demobilization of vessels and equipment used for cable installation and cofferdam construction; cofferdam and steel casing rise pipe construction; dredging of cofferdams provided that the walls of the cofferdam extend above mean high water during dredging; HDD associated with either of the two foregoing items; post-installation surveys and sampling; locating and marking utility crossings and work to effect utility crossings; and, with prior notice to the DPS, the New York State Department of Environmental Conservation ("NYSDEC"), and the New York State Department of Health ("NYSDOH") emergency maintenance work.

12. During the jet plow and shear plow trials and underwater cable installation, CHPE shall implement the Suspended Sediment/Water Quality Monitoring Plan (hereinafter the "Water Quality Monitoring Plan"), to be developed pursuant to the approved Suspended Sediment / Water Quality Monitoring Plan Scope of Study included as Attachment 1 to the Article VII Certificate . CHPE shall operate the jet plow and shear plow in accordance with the operating conditions determined through the jet plow and shear plow trials described in the Water Quality Monitoring Plan to minimize suspension of *in situ* sediment, subject to the limitation of Condition 14(c), below.

13. If the jet plow trials demonstrate that the preferred operating conditions result in real-time, total suspended solids ("TSS") concentrations, measured five hundred (500) feet down-current of the jet plow, exceeding the TSS concentrations at an up-current background station by more than two hundred (200) milligrams per liter ("mg/L"), CHPE shall report such conditions to the Aquatic Inspector and work with DPS and NYSDEC to evaluate and implement modifications to the plow operating conditions to further reduce *in-situ* sediment suspension associated with the single pass installation procedure. If the shear plow trials demonstrate that the preferred operating conditions result in real-time TSS concentrations, measured five hundred (500) feet down-current of the shear-plow in the southern portion of Lake Champlain (south of Crown Point), exceeding the TSS concentrations at an up-current background station by more than one hundred (100) mg/L, CHPE shall report such conditions to the Aquatic Inspector and work with DPS and NYSDEC to evaluate and implement modifications to the plow operating conditions to further reduce in-situ sediment suspension associated with the single pass installation procedure. CHPE shall not utilize the jet plow or shear plow until they have demonstrated to the satisfaction of DPS staff their ability to achieve the TSS standards established herein through test trials.

14. Water Quality

    a. During jet plow and shear plow cable installation, CHPE shall sample and

measure turbidity (in units of Nephelometric Turbidity Units ("NTU")), TSS, hardness, and the concentrations of the chemical constituents identified in the table provided in Condition 14(d) below, within the water column of Lake Champlain and the Hudson, Harlem and East Rivers outside the effects of the installation event (the up-current background station) and down-current of the operating jet plow and shear plow described in the Water Quality Monitoring Plan. Up-current samples shall be collected at a location five hundred (500) feet up-current of the cable installation outside the effect of the jet plowing and shear plowing. Down-current samples shall be collected five hundred (500) feet down-current of the jet plow and shear plow. Samples shall be collected at near-surface, mid-depth, and near-bottom at each sampling location. Measured levels of metals shall be reported both as totals and as dissolved fractions, except mercury, which shall be reported as total mercury.

b. Suspended sediment plume monitoring and water quality monitoring shall be conducted at the locations and frequency set forth in the Water Quality Monitoring Plan.

c. If, during underwater cable installation, TSS concentrations monitored or measured at five hundred (500) feet down-current of the installation exceed TSS concentrations at an up-current background station by more than two hundred (200) mg/L or more than one hundred (100) mg/L in the southern portion of Lake Champlain (south of Crown Point), the Aquatic Inspector shall be immediately notified. CHPE also must attempt to notify the NYSDEC and DPS within twenty four (24) hours of any such TSS exceedance. CHPE shall immediately employ one or more of the following environmental protection measures: changing the rate of advancement of the jet plow or shear plow, modifying hydraulic pressures, or implementing other reasonable operational controls that may reduce suspension of *in-situ sediments*. If CHPE proposes to employ mitigation measures not otherwise provided for in this paragraph, they must first consult with the DPS, NYSDEC, and the Aquatic Inspector. In the event that DPS determines that the mitigation techniques are unable to reduce TSS concentrations below the maximum allowable threshold, underwater cable installation shall be suspended and CHPE shall consult with DPS and NYSDEC regarding alternative cable installation techniques. Nothing in this subsection is intended to require that cable installation methods be modified to prevent burial of the cables in a single trench to the depths specified in the Article VII Certificate through a single installation pass.

d. During underwater cable installation, the concentrations of the chemical constituents listed below (Table 1), as measured in the samples collected five hundred (500) feet down-current of the cable installation activities, shall not exceed the greater of: (A) the levels set forth below or (B) 1.3 times the highest ambient background level measured during the prior twenty four

(24) -hour sampling period up-current of the installation at the same depth as the down-current sample.

Table 1. Underwater Cable Installation Water Quality Standards

Route Mile	Water Body Class	Contaminant	Standard	Unit	Method	Reporting Limit
0-73.5	AA	Dissolved Arsenic	340	ug/l	EPA 200.7	10
		Dissolved Copper	calculate using measured hardness and (0.96) exp(0.9422 [ln (ppm hardness)] - 1.7)	ug/l	EPA 200.7	2
		Dissolved Zinc	calculate using measured hardness and 0.978 exp(0.8473 [ln(ppm hardness)] + 0.884)	ug/l	EPA 200.7	2
73.5-101.7	B	Dissolved Arsenic	340	ug/l	EPA 200.7	10
		Dissolved Copper	calculate using measured hardness and (0.96) exp(0.9422 [ln (ppm hardness)] - 1.7)	ug/l	EPA 200.7	0.1*
		Dissolved Zinc	calculate using measured hardness and 0.978 exp(0.8473 [ln(ppm hardness)] + 0.884)	ug/l	EPA 200.7	2
228.5-272.3	A	Phenanthrene*	45	ug/l	EPA 8270C	0.02
		Dissolved Cadmium	5	ug/l	EPA 200.7	0.02*
		Dissolved Copper	200	ug/l	EPA 200.7	0.1*
		Dissolved Lead	50	ug/l	EPA 200.7	0.02*
		Total Mercury	0.7	ug/l	EPA 1669	0.001
		Total PCBs	0.09	ug/l	EPA 8082	0.005*
272.3-290.3	B	Dissolved Arsenic	340	ug/l	EPA 0.7	10
		Dissolved Cadmium	calculate using measured hardness and (0.85) exp(1.128 [ln (ppm hardness)] - 3.6867)	ug/l	EPA 200.7	0.02*
		Dissolved Copper	calculate based on measured hardness using (0.96) exp(0.9422 [ln (ppm hardness)] - 1.7)	ug/l	EPA 200.7	0.1*

		Dissolved Lead	calculate using measured hardness and {1.46203 - [ln (hardness) (0.145712)]} exp (1.273 [ln (hardness)] - 1.052)	ug/l		0.02*
		Phenanthrene*	45	ug/l	EPA 8270C	0.02
		Dissolved Mercury	1.4	ug/l	EPA 1669	0.001
		Total PCBs	0.2 per aroclor	ug/l	EPA 8082	0.005*
290.3-324.0	SB	Dissolved Arsenic	63	ug/l	EPA 200.7	10
		Dissolved Cadmium	7.7	ug/l	EPA 200.7	0.02*
		Dissolved Copper	7.9	ug/l	EPA 200.7	0.1*
		Dissolved Lead	204	ug/l	EPA 200.7	0.02*
		Phenanthrene*	14	ug/l	EPA 8270C	0.02
		Total Mercury	0.05***	ug/l	EPA 1669	0.001
		Total PCBs	0.2 per aroclor	ug/l	EPA 8082	0.005*
324.1-332.5	I	Dissolved Arsenic	36	ug/l	EPA 200.7	10
		Dissolved Cadmium	7.7	ug/l	EPA 200.7	0.02*
		Dissolved Copper	7.9	ug/l	EPA 200.7	0.1*
		Dissolved Lead	204	ug/l	EPA 200.7	0.02*
		Phenanthrene*	14	ug/l	EPA 8270C	0.02
		Total Mercury	0.05***	ug/l	EPA 1669	0.001
		Total PCBs	0.2 per aroclor	ug/l	EPA 8082	0.005*

* Assumes low level analysis, compared to standard level
** Phenanthrene will be used as an indicator for the total concentration of Polycyclic Aromatic Hydrocarbons (PAHs).
*** Standard based on General Level Currently Achievable described in TOGS 1.3.10.

e. All water quality laboratory analyses required in this Certification must be conducted by a laboratory certified by the NYSDOH.

f. If the compliance criteria described in clause 14(d) above are exceeded at any time during the installation, additional water quality sampling shall take place at the location of the exceedance as described in the Water Quality Monitoring Plan.

g. Hardness shall be measured in each water quality sample collected. The analytical results for hardness shall be applied to calculate the standards for dissolved copper, dissolved zinc, dissolved cadmium, and dissolved lead where necessary, as described in clause 14(d) above.

15. Changes in the Conditions of the Water Quality Certification, if proposed by the date on which the proposed Environmental Management and Construction Plan (EM&CP) is filed, shall be reviewed together with the proposed EM&CP. Changes in the Conditions of the Water Quality Certification shall be governed by Condition 158 of the Article VII Certificate governing changes to the approved EM&CP.

16. Nothing in this Certification shall limit either (i) the authority of the DEC to monitor the environmental and health impacts resulting from the construction and operation of the Facility and to enforce applicable provisions of the Environmental Conservation Law (including those which provide for summary abatement authority) and applicable implementing regulations governing the environmental and health impacts resulting from such construction and operation, or (ii) any defenses to such enforcement that CHPE may be able to assert under applicable law.

Certified by:

1-18-2013
Date

Floyd E. Barwig, Director
Office of Energy Efficiency and the Environment
New York State Department of Public Service
Three Empire State Plaza
Albany, New York 12223

NYSDEC, the EPC Contractor, and others as deemed appropriate to discuss and review these measures including the location of the flagging of lupine and nectar patches of potential and occupied butterfly habitat. The flagging shall be maintained until construction has been completed and all disturbed areas have been restored to their final grade.

91. Within six (6) months after the commencement of commercial operations of the Facility, the Certificate Holders shall provide a ROW maintenance plan for the Facility ROW from Route Mile 145**,** south of Scout Road in the Town of Wilton, New York to Route Mile 180, north of County Line Road in the Town of Rotterdam, New York. This plan shall include but not be limited to methods of maintenance, access routes to the ROW, seasonal construction windows, and the education of all company employees and contractors regarding all measures to avoid occupied habitat associated with Karner blue butterfly and frosted elfin butterfly. The plan shall also provide requirements for notification of the DPS Staff and NYSDEC of any planned maintenance or repair work within, or in the vicinity of occupied habitat that requires excavation or ground disturbance.

N. Underwater Cable Installation

92. All of the terms and conditions of the WQC are incorporated by reference into this Certificate as though fully set out herein. Any changes to the WQC shall be governed by the provisions of Condition 158 of this Certificate.

93. Construction within navigable waters and pre-installation route clearing activities (pre-lay grapnel run and associated obstruction and debris removal) shall occur within the construction time frames set forth in Table 1 below. After consultation with DPS Staff, the New York State Department of State ("NYSDOS"), and NYSDEC, the Certificate

Holders may seek an appropriate modification of the time frames, either in the proposed EM&CP or subject to the provisions of Condition 158 of this Certificate.

Table 1: Underwater Construction Windows in Lake Champlain, The Hudson, Harlem, and East Rivers

River Mile	Route Mile	Location	Construction Windows
	Lake Champlain		
	0 to 73	US/Canada Border to Crown Point	May 1 to August 31
	73 to 101	Crown Point to Dresden	September 1 to December 31
	Hudson River, Harlem River, East River		
107-68	229 to 269	Cementon – New Hamburg	Aug 1 - Oct 15
68-41	269 to 296	New Hamburg – Stony Point	Sep 15 - Nov 30
41-33	296 to 303	Stony Point - Rockland Lake State Park	OVERLAND
33-14	303 to 324	Rockland Lake State Park – Harlem River	Jul 1 - Oct 31
all	324 to 330	Harlem River – East River	May 15 - Nov 30

94. Commencement of in-river work within one (1) mile south of the designated Significant Coastal Fish and Wildlife Habitats ("SCFWHs") at Haverstraw Bay shall occur during the high, or flood, tide condition in order to avoid and/or minimize impacts from resuspended sediments to the SCFWH habitat of Haverstraw Bay.

95. The Certificate Holders shall use installation techniques for underwater cable installation activities that are appropriate for the prevailing substrate conditions.

a. Cable installation in the Hudson, Harlem, and East Rivers shall be designed and installed to meet the following criteria:

(i) Where the cables shall be located within the limits of the maintained