

**Land/Ocean Biogeochemical Observatories (LOBOs) for Water Quality Sampling in the St. Lucie Estuary and Indian River Lagoon
(DEP Agreement S0770)**

Site Selection & Installation Plan

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Introduction

FAU Harbor Branch was awarded funds from the 2014 State Legislative Budget through the Florida Department of Environmental Protection (DEP) for a real-time water quality monitoring network of Land/Ocean Biogeochemical Observatories (LOBOs) at five sites in the St. Lucie Estuary (SLE) and nearby Indian River Lagoon (IRL). LOBOs are designed to reduce biofouling, minimize operational and maintenance expenses, and provide real-time and retrospective high-accuracy and high-resolution data via a dedicated interactive website. The LOBO units have the flexibility to substitute or add different sensor instruments as new scientific needs are identified.

The objective of this project is to launch a LOBO estuarine observation network that will provide real-time, high-accuracy, and high-resolution water quality data through a dedicated interactive website. This network will provide a time series of critical environmental data that can be used by all parties to understand and address both short- and long-term issues in the SLE and the nearby IRL.

Specific Site Locations

The Indian River Lagoon Observatory Science and Technology Advisory Committee (IRLO-STAC) was established to provide a venue to share ideas and gather input on the LOBO monitoring network. The focus of the first meeting of IRLO-STAC on July 29, 2014, was to familiarize the committee with LOBO technology and gather feedback on IRLO's proposed sites for LOBO installations by Harbor Branch in the IRL and SLE. The STAC workshop report is available on the [project website](#).

The STAC discussion focused on determining the best locations for the LOBO units based on benefiting existing monitoring hot spots; reducing redundancy of similar sampling; and supporting management, agencies, and community needs. The STAC determined that the placement of the LOBO units will provide a broad look at the estuary system and will allow for continuation of monitoring to detect ecosystem change. Overall the consensus of the STAC for the general locations of the sites of the participants of this meeting was: North Fork, South Fork, and Middle Estuary near the Roosevelt Bridge in the SLE; in the IRL near the confluence with the SLE; and another IRL site north of that confluence, near Jensen Beach (Fig. 1). These sites are ecologically important because of the dynamic interface between freshwater inputs from river and canal discharges and oceanic water from the inlets. These sites are also important for other stakeholder ongoing and future activities.

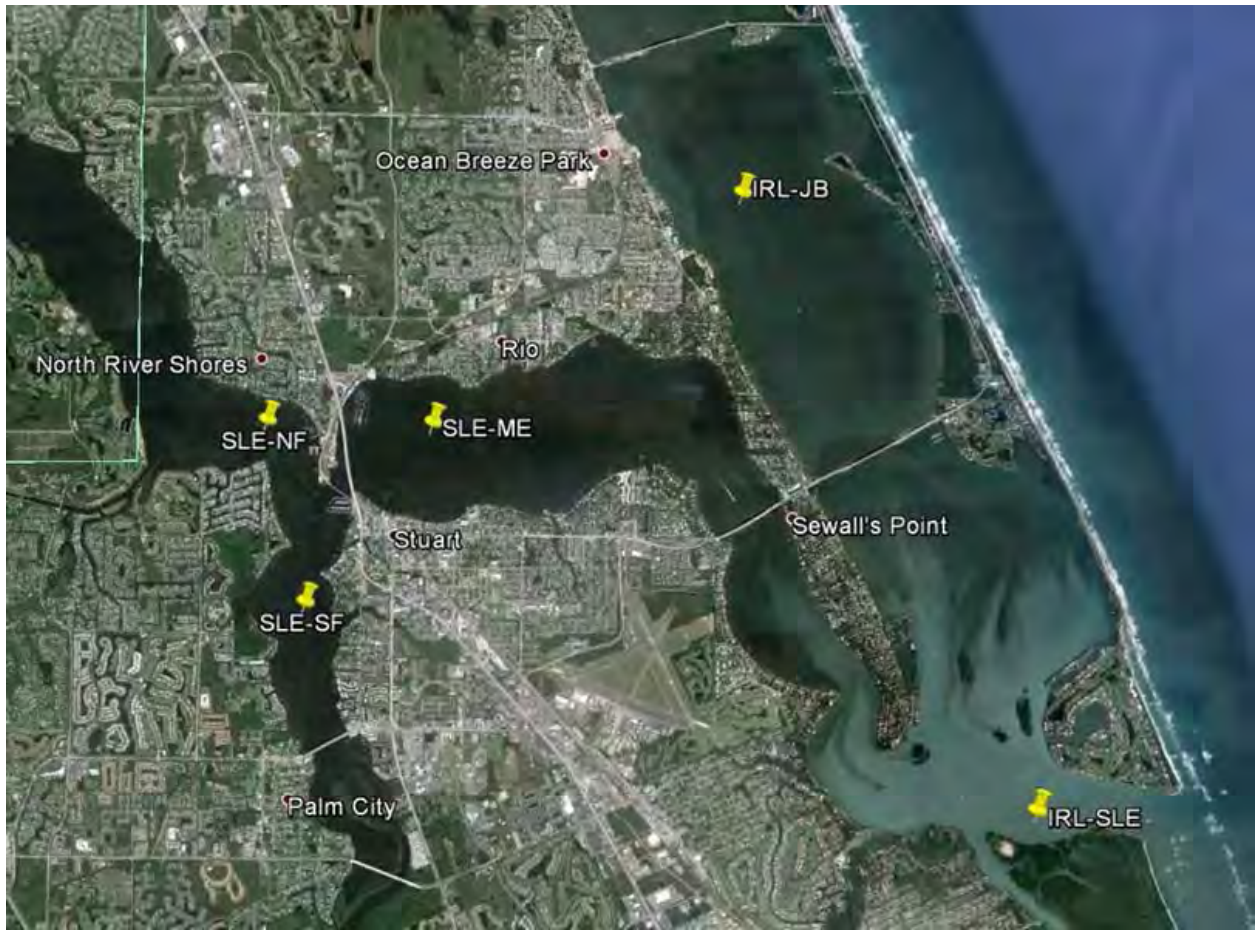


Figure 1. Sites for continuous LOBO monitoring in SLE and nearby IRL: SLE-NF (North Fork), SLE-SF (South Fork), SLE-ME (Middle Estuary), IRL-SLE (in the IRL near the confluence with the SLE), and IRL-JB (IRL near Jensen Beach).

The STAC recommended that final specific sites at these locations were to be selected by Harbor Branch, in consideration of any permits/permissions required from the Coast Guard and logistical constraints, with DEP concurrence. The consensus of the STAC was to deploy the LOBO a distance of ~1 m from the bottom, as the major concern is the relationships of water quality with key benthic organisms.

With the guidance and strategic locations provided by the STAC Workshop, field reconnaissance was made to locate specific sites for installation, focused on using existing navigation markers, as the only permission to use them for deployment is from the United States Coast Guard (USCG). The site information for the five specific sites selected for deployment is in Table 1.

Site ID	Description	Channel Marker	Latitude	Longitude
SLE-NF	North Fork	G "5"	27° 12' 33.10" N	80° 16' 10.14" W
SLE-SF	South Fork	G "25A"	27° 11' 18.97" N	80° 15' 52.53" W
SLE-ME	Middle Estuary	R "22A"	27° 12' 32.07" N	80° 14' 54.34" W
IRL-SLE	"Crossroads"	R "16"	27° 09' 53.81" N	80° 10' 18.64" W
IRL-JB	Jenson Beach	R "222"	27° 14' 06.13" N	80° 12' 32.48" W

Details of Station Configurations

HBOI will instrument the 5 sites and monitor continuously (hourly readings, 24 hours per day), for the following high-resolution measurements:

- physical parameters: temperature, salinity, depth, turbidity, and current speed and direction
- chemical parameters: chromophoric dissolved organic matter (water color), nitrate, orthophosphate, dissolved oxygen, and pH
- biological parameter: chlorophyll *a* fluorescence

A weather station integrated into each LOBO site will measure the following parameters concomitantly with the LOBO measurements: air temperature, barometric pressure, humidity, rain, PAR (= Photosynthetically Active Radiation = Light), wind direction, wind gust, and wind speed.

Permitting Requirements

HBOI is requesting USCG approval to install water quality monitoring instrumentation equipment on 5 existing ATON Day Beacons in the SLE. There are no other permitting requirements for these installations. HBOI has previously received USCG approval for, and currently has 2 similar systems installed on Aid To Navigation (ATON) Day Beacons (DB R "64" and DB R "158"), and 1 similar system installed on ATON Light Beacon (LT R "182") in the IRL, to the North of SLE (Fig.2). These systems and ATON installations have been working quite well, and have been providing valuable, publically available water quality data (<http://fau.loboviz.com>).

HBOI was granted permission to use USCG ATON pilings for the 3 existing IRL sites contingent on the following conditions, as will all new SLE site installations:

- Equipment must not hinder operational performance of ATON.
- Equipment must not impede CG personnel from servicing ATON.
- Equipment can be removed if ATON disestablished.

Existing Site Example, IRL-SB at ATON Day Beacon 64 (Planned vs. Installed)



Figure 2. Existing LOBO installation near Sebastian in the IRL, similar to plans for SLE sites.

Installation Needs

The LOBO units are designed to minimize operational and maintenance costs. We will utilize our previous installation experiences in the IRL on this project. Before deployment, the LOBOs will be wrapped with waterproof tape and painted with anti-fouling paint to reduce bio-fouling. The units will be placed in a test tank at HBOI to check that the apparatus and all sensors are functioning correctly and sending data. After the testing period, HBOI staff will transport and install the LOBO units in the field. HBOI will attach the LOBOs to pilings using an HBOI-designed and -built pulley I-beam system for raising and lowering the LOBOs into the water from an HBOI small boat. All HBOI equipment installations will:

- Be installed using an HBOI vessel and crew
- Be installed without modification to existing ATON structure (clamp-on)
- Not require any diving on scene

The planned typical SLE LOBO water quality instrumentation installation is depicted in Fig. 3 and its planned typical installation component weights are provided in Table 3.

Full design details for all SLE installations are provided in Appendix 1.

Planned Typical SLE Water Quality Instrumentation Installation

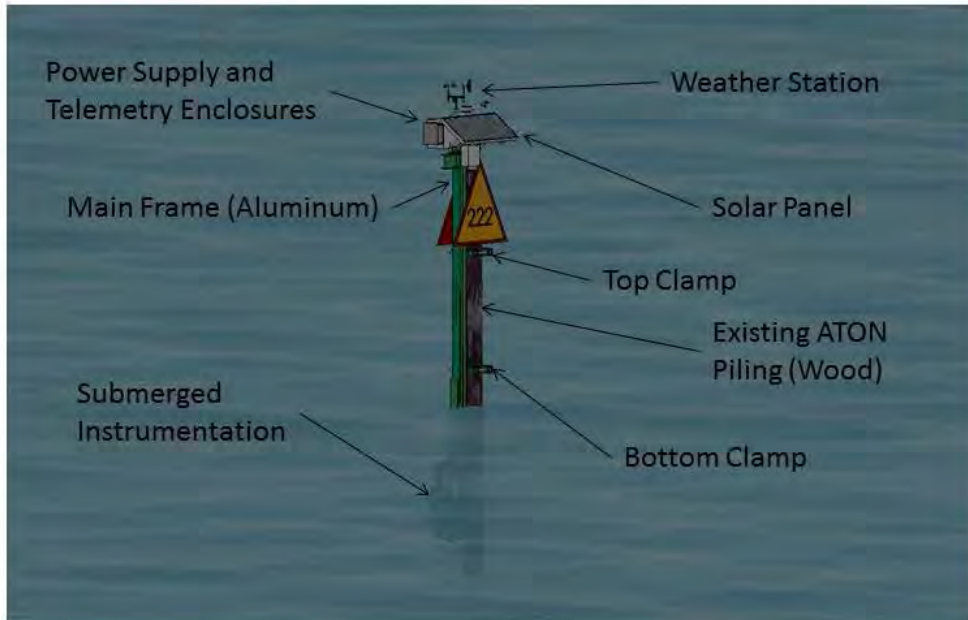


Figure 3. Planned typical SLE LOBO water quality Instrumentation installation.

Table 3 Planned Typical SLE Water Quality Instrumentation Installation Component Weights

Components	Weight (lbs)
Solar Panel and mounting bracket	34
Electronics Enclosures	73
Main Frame Weldment	150-175 (site dependent)
Submerged Instrumentation	160 in air (100 lb est. in water)
Weather Station	20
Misc.	15
TOTAL	452-477 (in air)

Appendix 1 – Installation Details

Land/Ocean Biogeochemical Observatories (LOBOs) for Water Quality Sampling in the St. Lucie Estuary and Indian River Lagoon

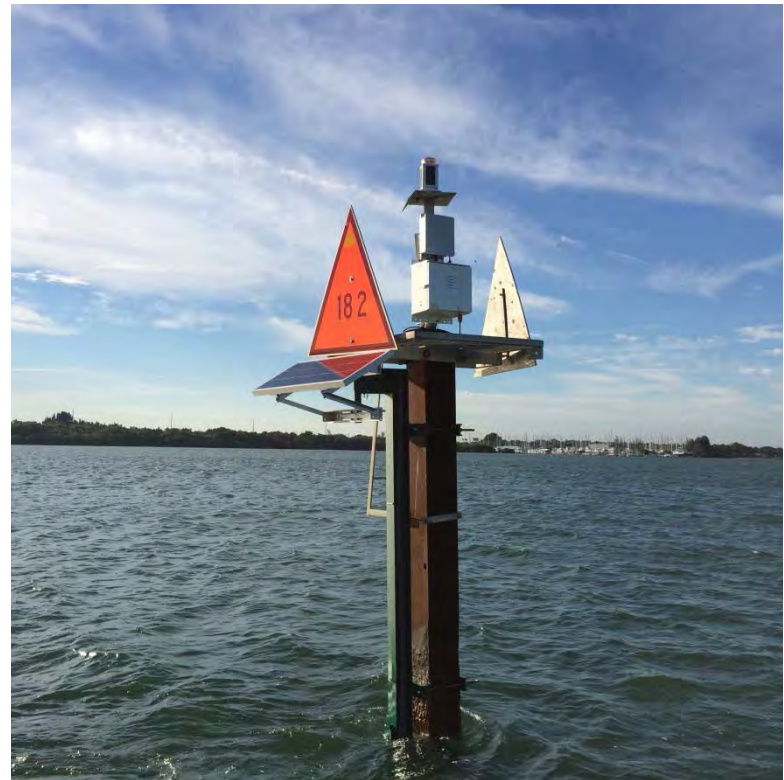
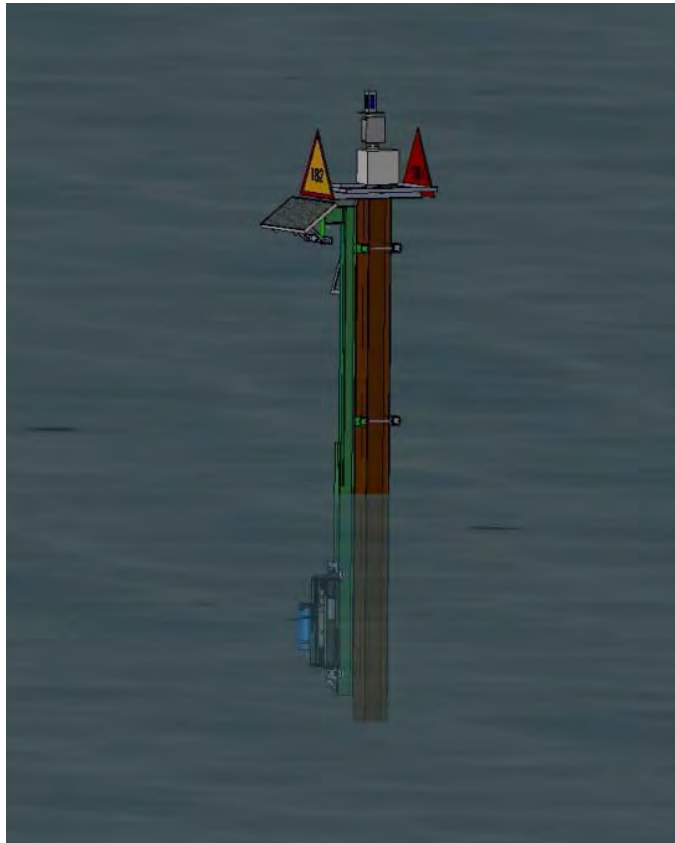
Appendix 1 – Installation Details

Land/Ocean Biogeochemical Observatories (LOBOs) for Water Quality Sampling in the St. Lucie Estuary and Indian River Lagoon)

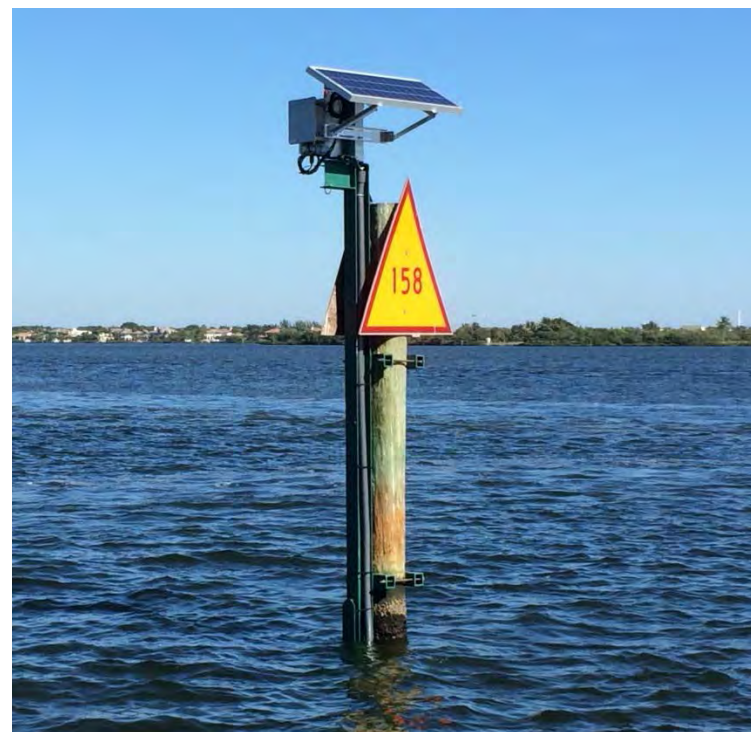
Proposed Site Summary

- Harbor Branch Oceanographic Institute (HBOI) at Florida Atlantic University (FAU) is requesting United States Coast Guard (USCG) approval to install water quality monitoring instrumentation equipment on 6 existing ATON Day Beacons in the Saint Lucie Estuary (SLE) in the coming months.
- HBOI had previously received USCG approval for, and currently has 2 similar systems installed on Aid To Navigation (ATON) Day Beacons (DB R “64” and DB R “158”), and 1 similar system installed on ATON Light Beacon (LT R “182”) in the IRL, to the North of SLE. These systems and ATON installations have been working quite well, and have been providing valuable, publically available water quality data (<http://fau.loboviz.com/>).

Existing Site Example, IRL-FP at ATON Light 182 (Planned vs. Installed)



Existing Site Example, IRL-VB at ATON Day Beacon 158 (Planned vs. Installed)



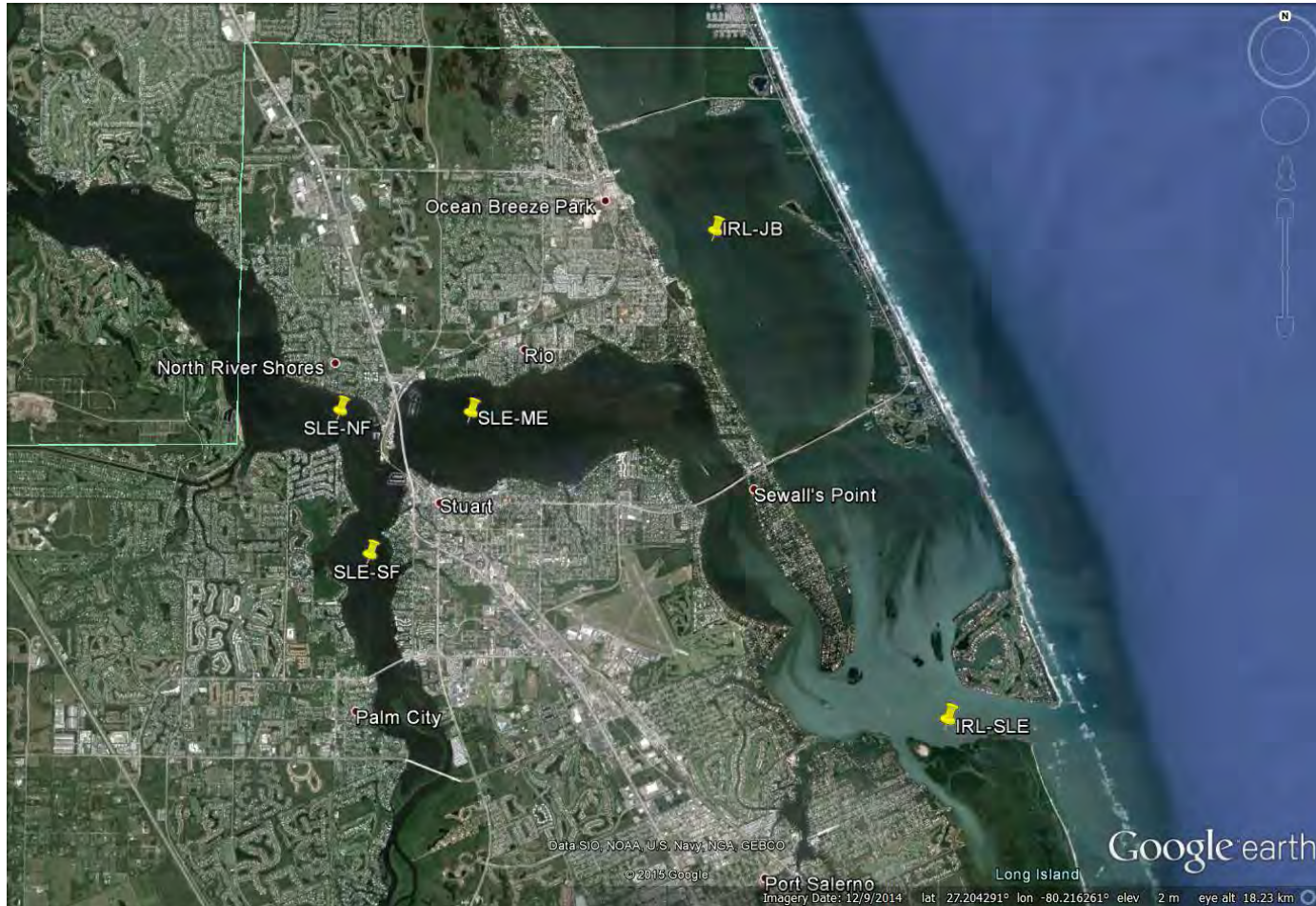
Existing Site Example, IRL-SB at ATON Day Beacon 64 (Planned vs. Installed)



Proposed New SLE Site Summary

SiteID	Description	Channel Marker	Latitude	Longitude
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SLE-SF	South Fork	G "25A"	N 27° 11' 18.97"	W 80° 15' 52.53"
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IRL-SLE	"Crossroads"	R "16"	N 27° 09' 53.81"	W 80° 10' 18.64"
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Proposed New SLE Site Locations



Proposed New SLE Site and Installation Conditions

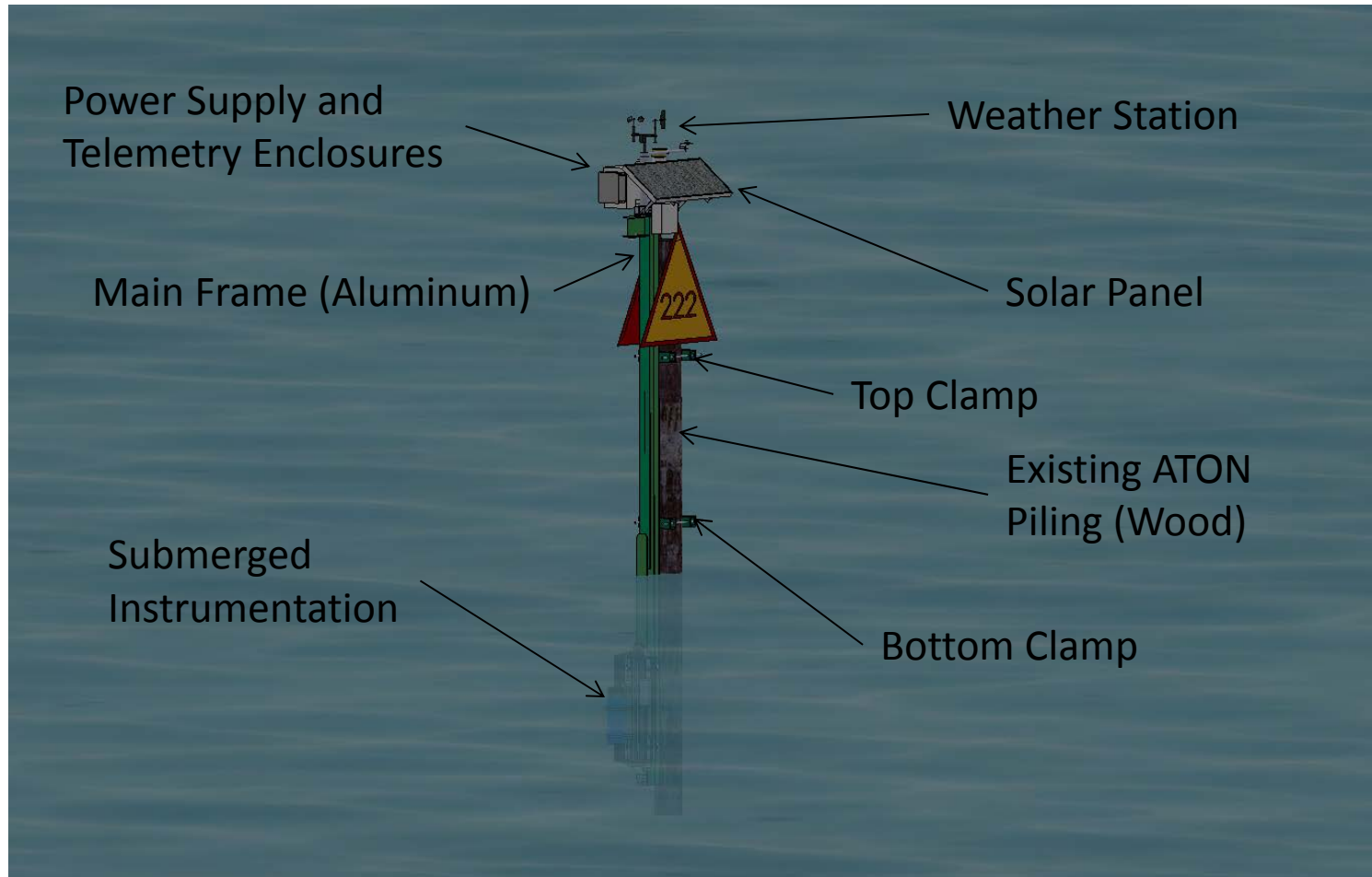
HBOI was granted permission to use USCG ATON pilings for the 3 existing sites contingent on the following conditions. All new SLE Site Installations will also follow these.

- Equipment must not hinder operational performance of ATON
- Equipment must not impede CG personnel from servicing ATON
- Equipment can be removed if ATON disestablished

All HBOI equipment installation will:

- Be installed using an HBOI Vessel and Crew
- Be installed without modification to existing ATON structure (clamp-on)
- Not require any diving on scene

Planned Typical SLE Water Quality Instrumentation Installation



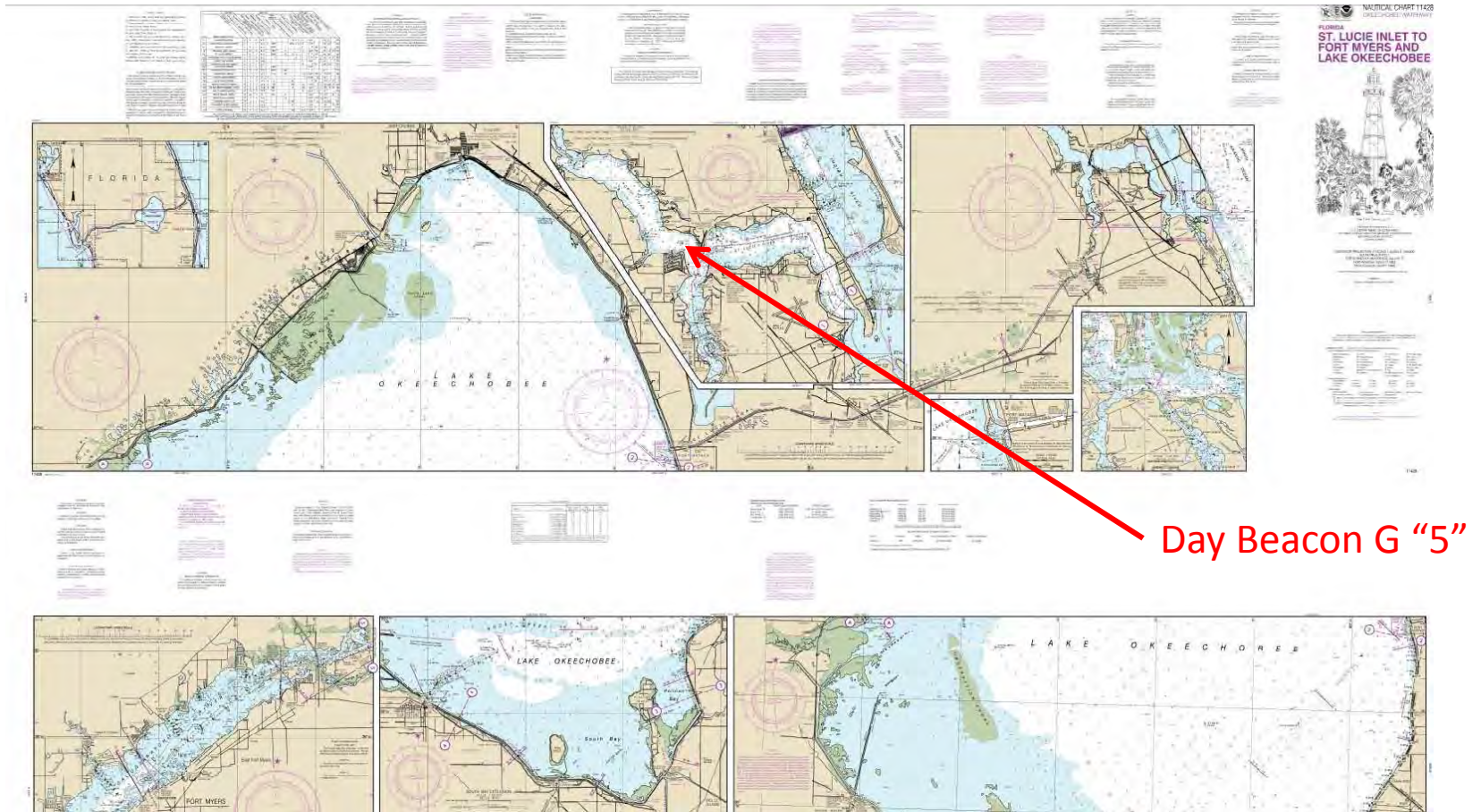
**Table 3 Planned Typical SLE Water Quality
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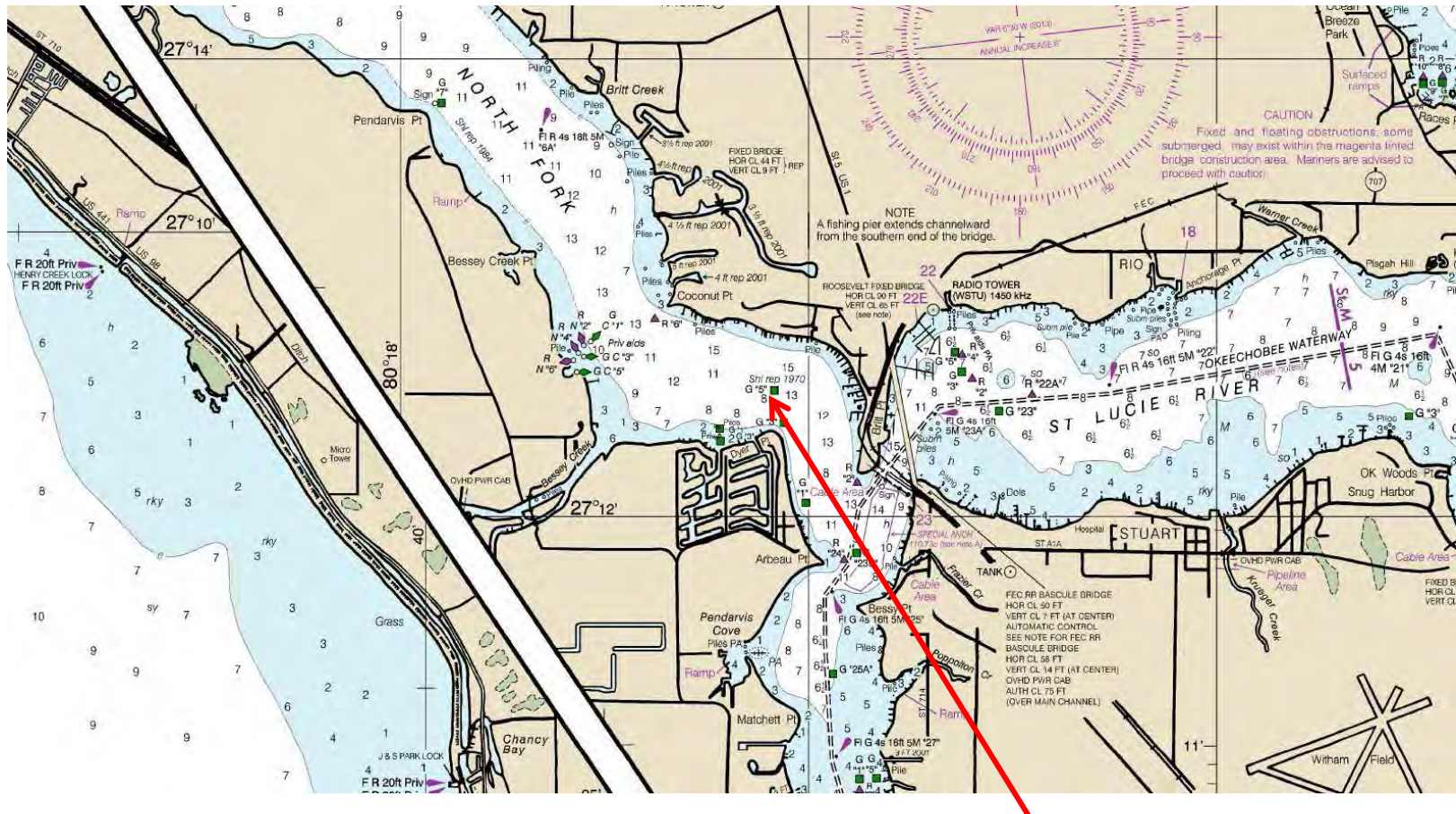
Proposed HBOI Water Quality Instrumentation (**SLE-NF**)

At ATON Day Beacon G “5”

Proposed HBOI Water Quality Instrumentation (SLE-NF) on ATON DB 5 NOAA Chart 11428



Proposed HBOI Water Quality Instrumentation (SLE-NF) on ATON DB 5
NOAA Chart 11428 ZOOM INSET 1 SIDE A

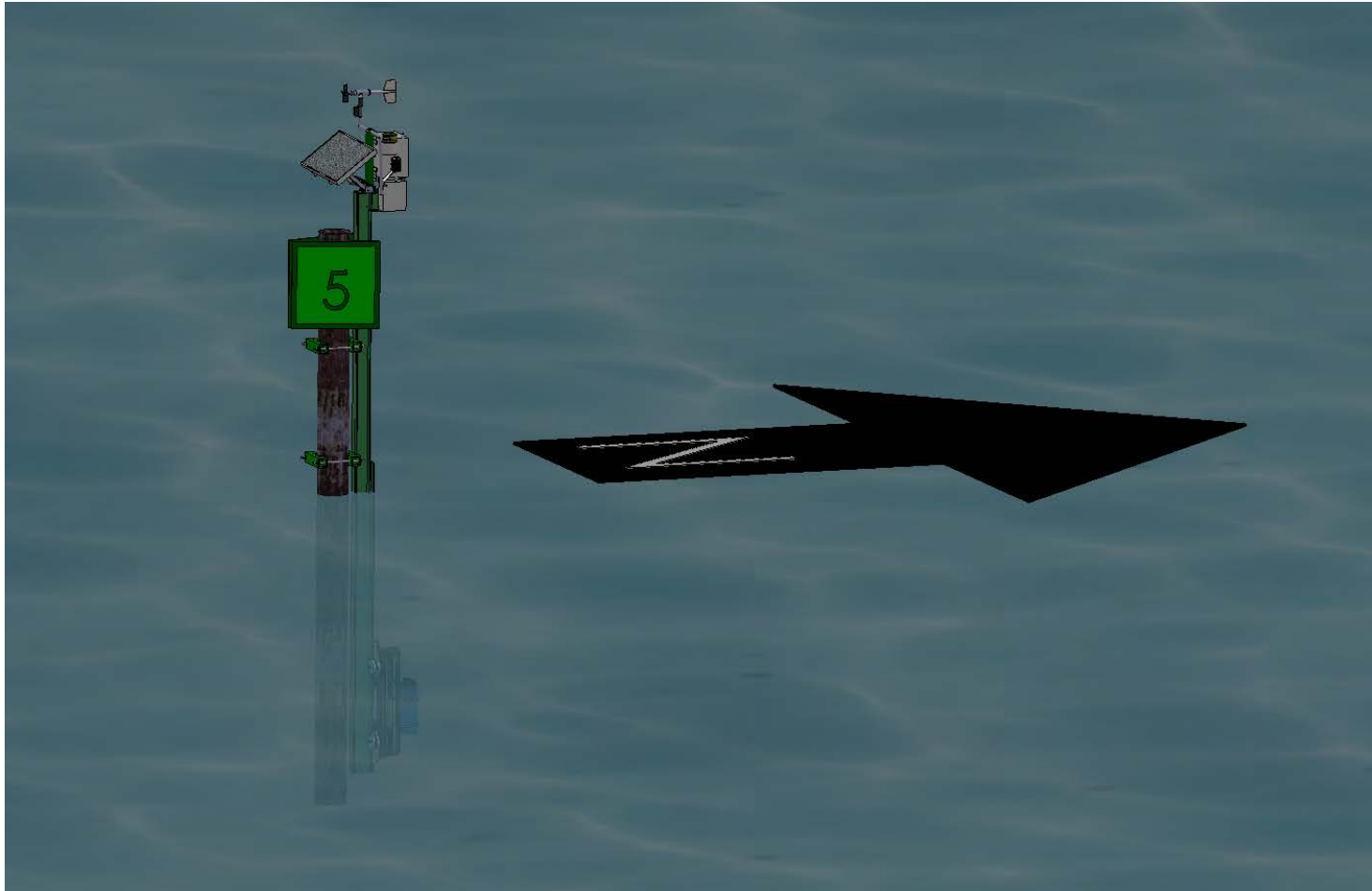


Day Beacon G "5"

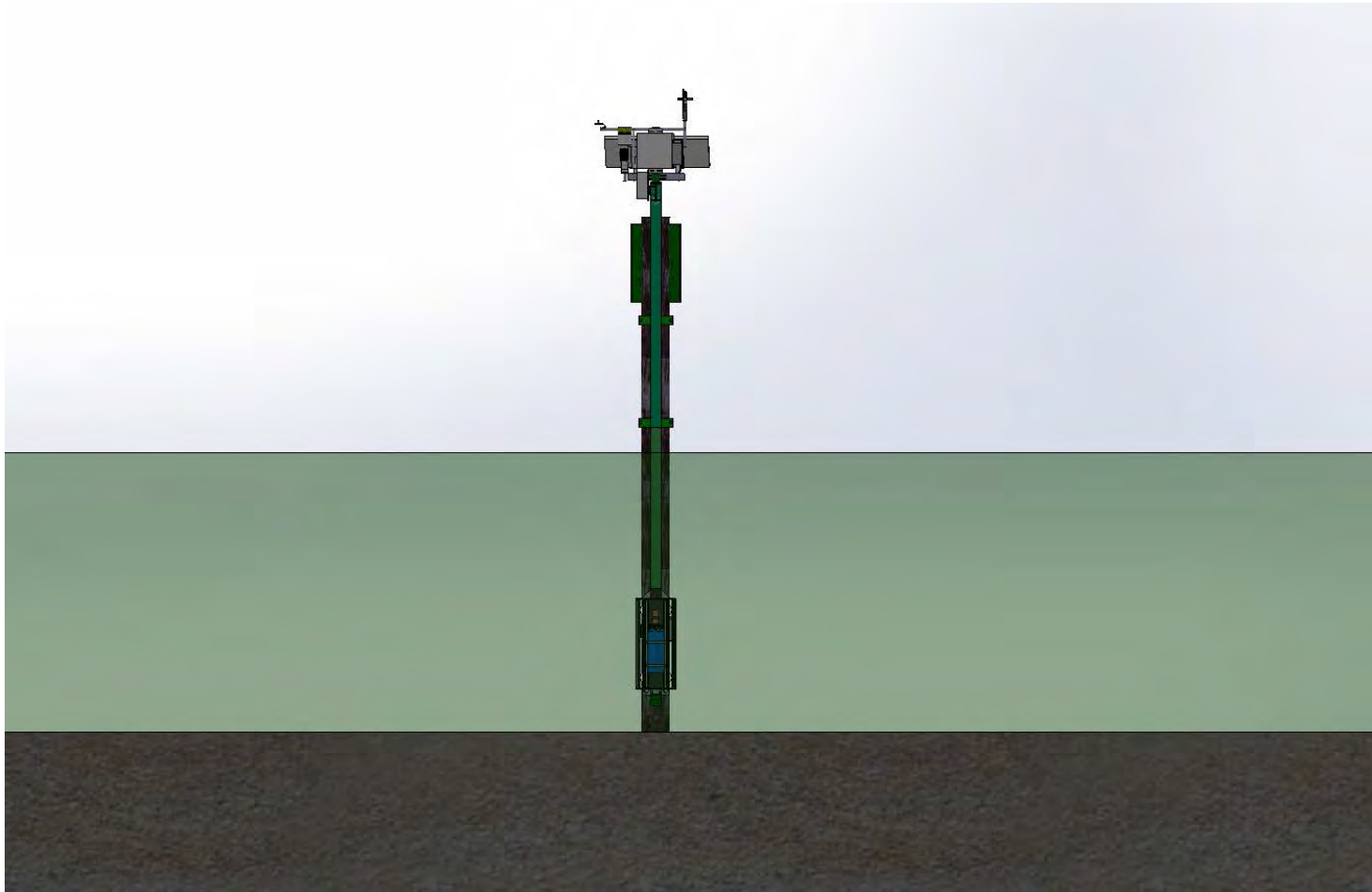
Proposed HBOI Water Quality Instrumentation (**SLE-NF**) on **ATON DB 5**
NOAA Chart 11428
Existing ATON Day Beacon



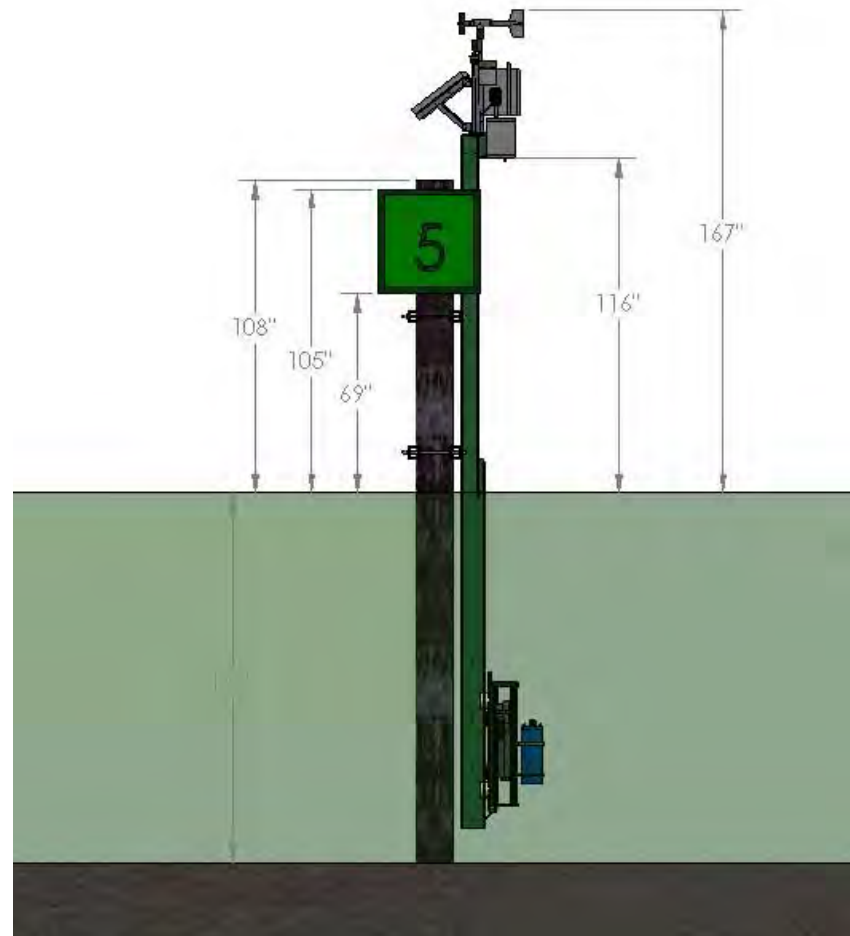
Proposed HBOI Water Quality Instrumentation (**SLE-NF**) on **ATON DB 5**
NOAA Chart 11428
Sketch of Proposed Equipment Installed



Proposed HBOI Water Quality Instrumentation (**SLE-NF**) on **ATON DB 5**
NOAA Chart 11428
Sketch of Proposed Equipment Installed (View From North)



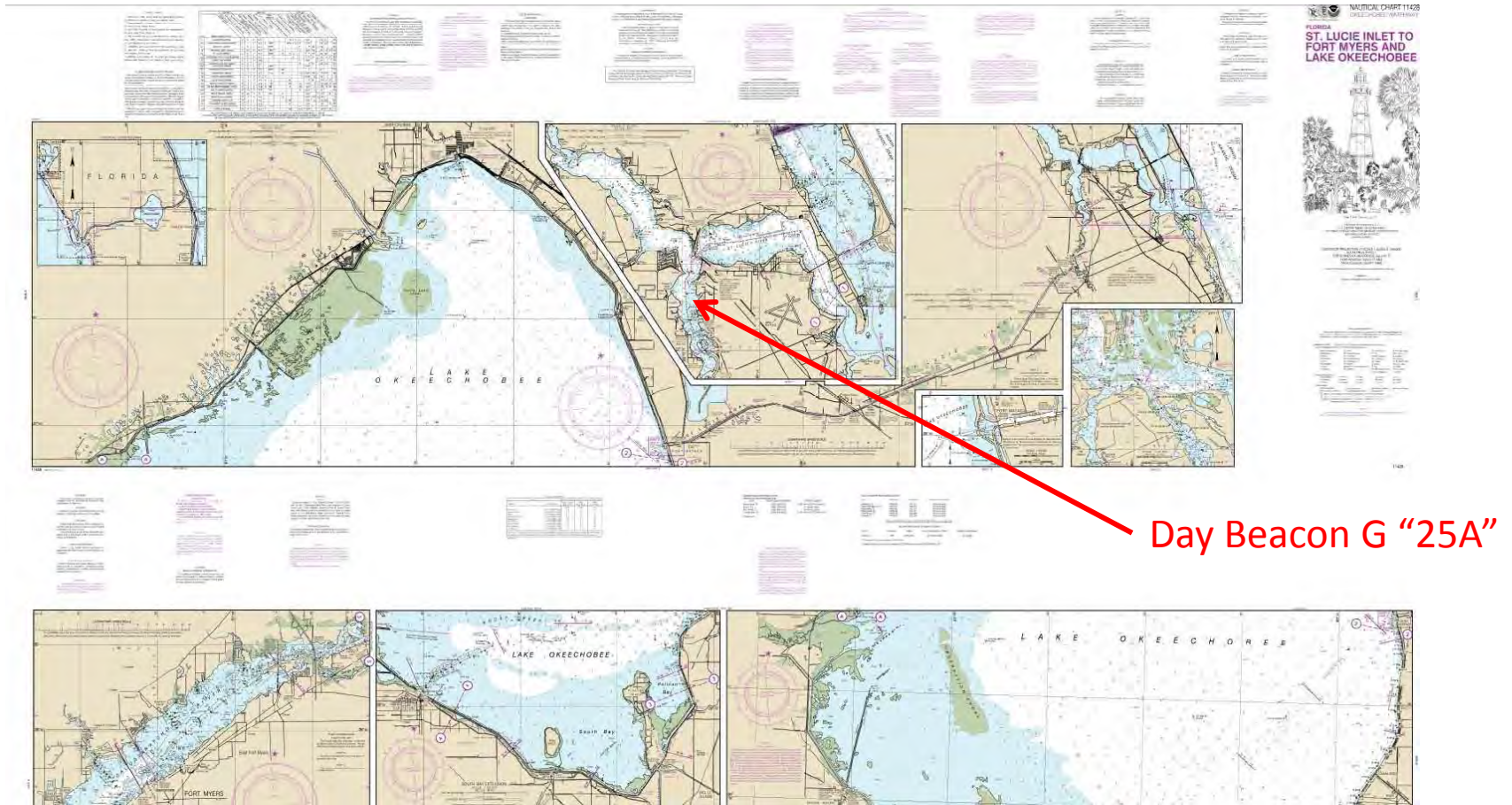
Proposed HBOI Water Quality Instrumentation (**SLE-NF**) on **ATON DB 5**
NOAA Chart 11428
Sketch of Proposed Equipment Installed (View From East)



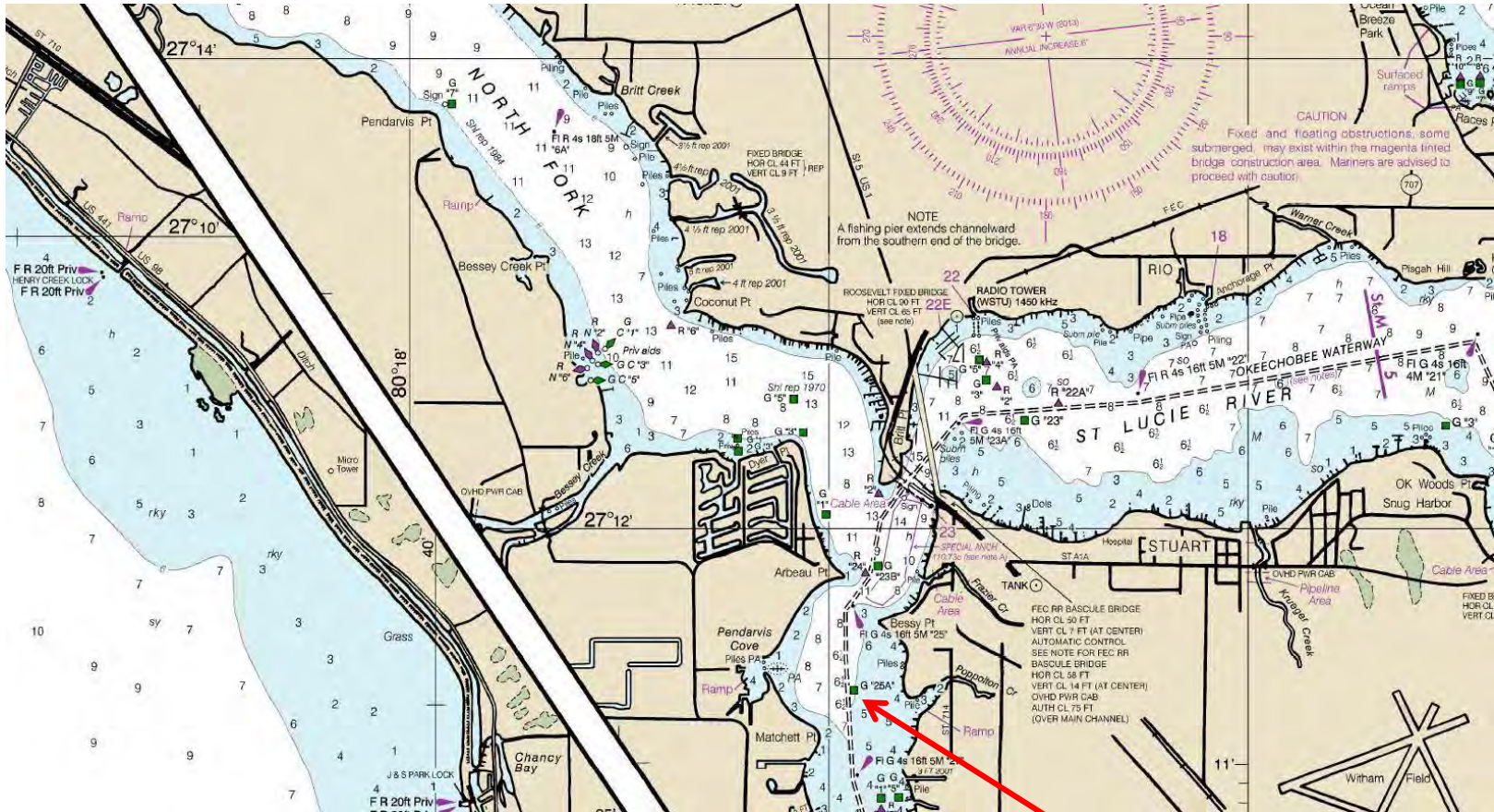
Proposed HBOI Water Quality Instrumentation (**SLE-SF**)

At ATON Day Beacon G “25A”

Proposed HBOI Water Quality Instrumentation (SLE-SF) on ATON DB G "25A"
NOAA Chart 11428



Proposed HBOI Water Quality Instrumentation (SLE-SF) on ATON DB G "25A"
NOAA Chart 11428 ZOOM INSET 1 SIDE A



Day Beacon G "25A"

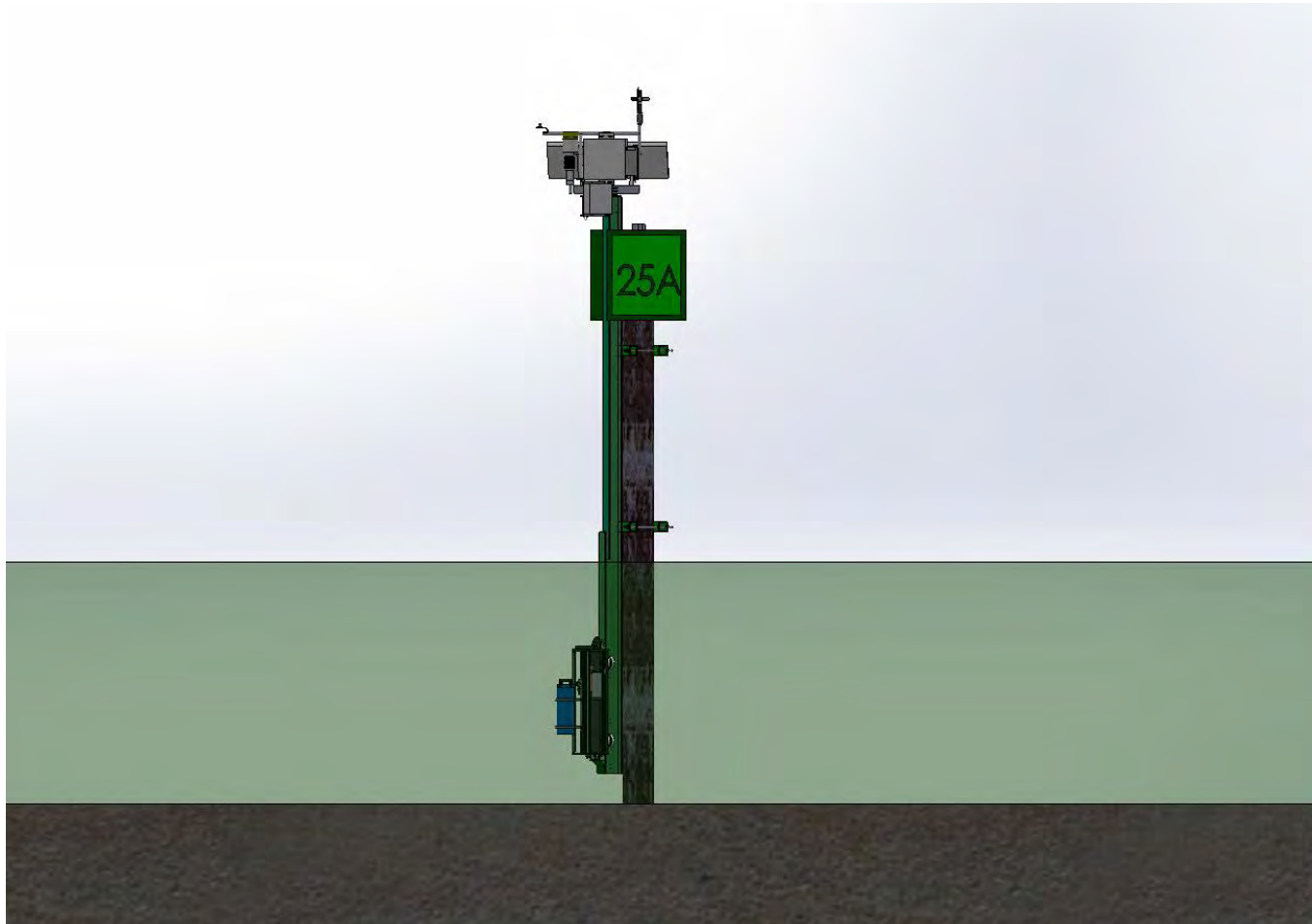
Proposed HBOI Water Quality Instrumentation (**SLE-SF**) on **ATON DB G “25A”**
NOAA Chart 11428
Existing ATON Day Beacon



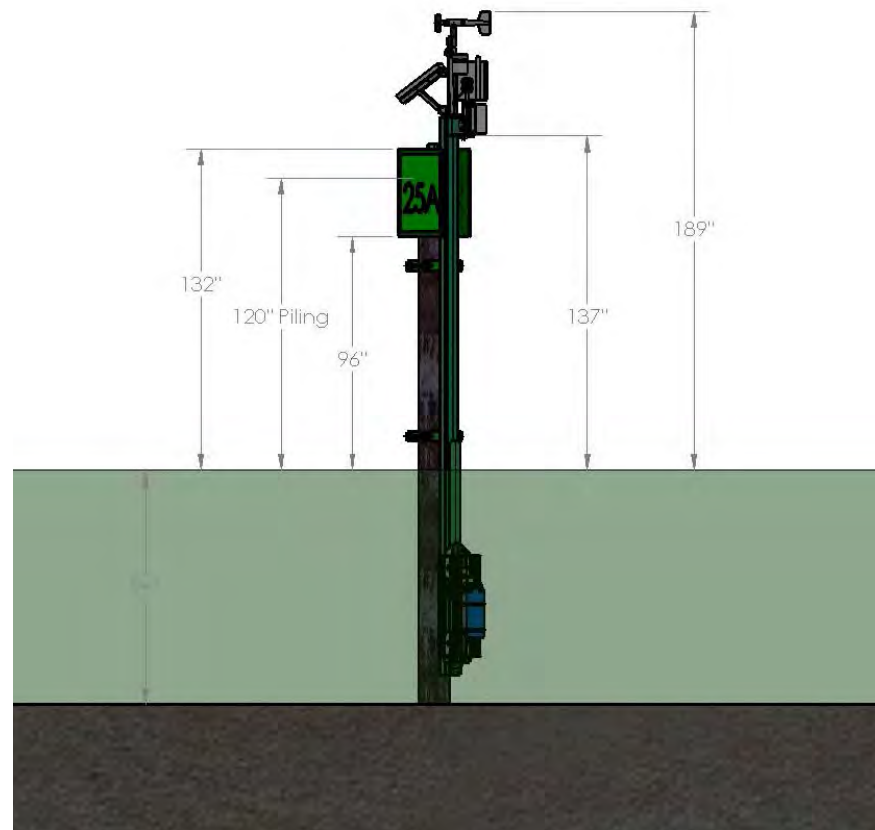
Proposed HBOI Water Quality Instrumentation (**SLE-SF**) on **ATON DB G “25A”**
NOAA Chart 11428
Sketch of Proposed Equipment Installed



Proposed HBOI Water Quality Instrumentation (**SLE-SF**) on **ATON DB G "25A"**
NOAA Chart 11428
Sketch of Proposed Equipment Installed (View From North)



Proposed HBOI Water Quality Instrumentation (SLE-SF) on ATON DB G "25A"
NOAA Chart 11428
Sketch of Proposed Equipment Installed (View From East)



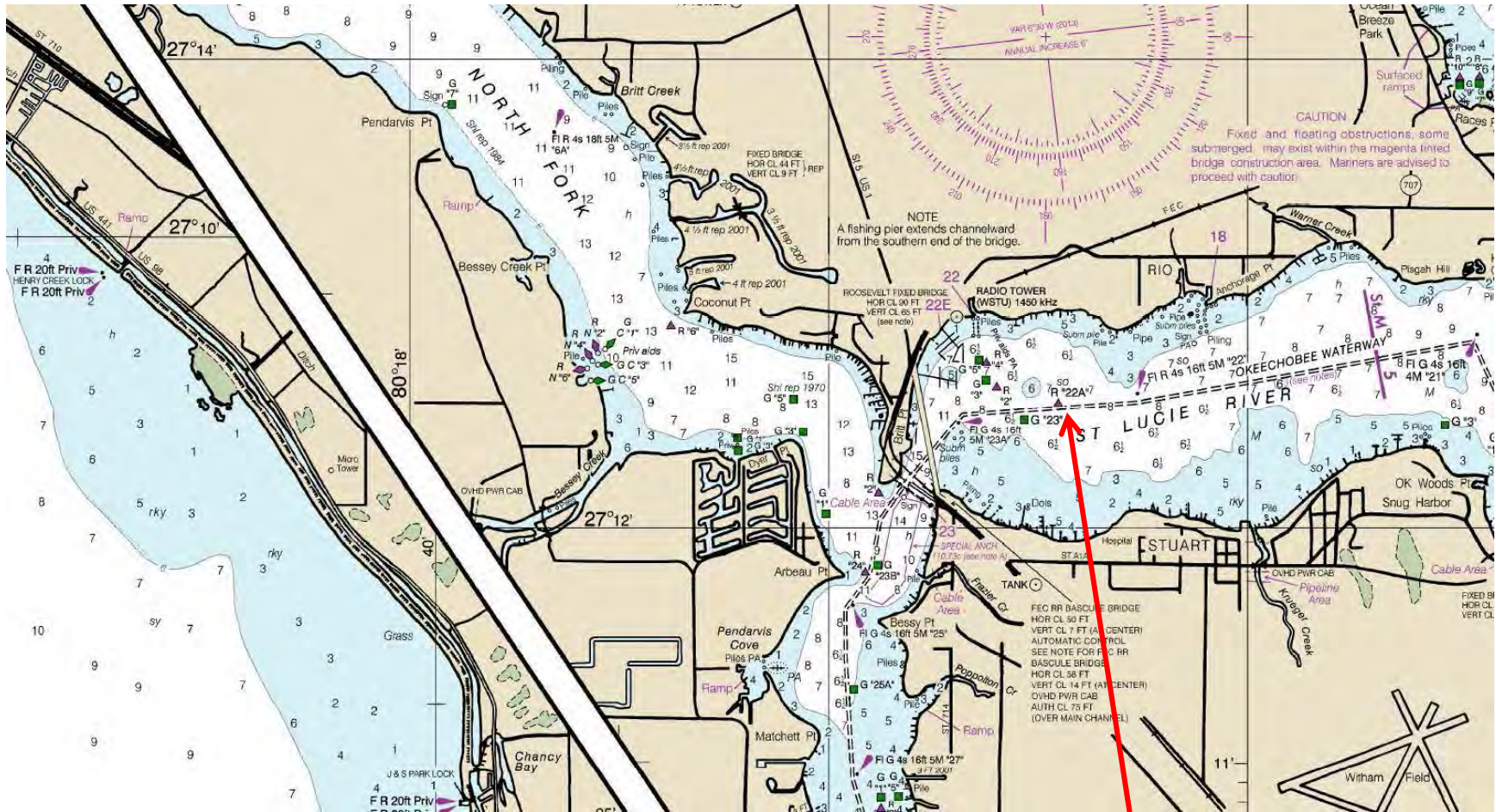
Proposed HBOI Water Quality Instrumentation (**SLE-ME**)

At ATON Day Beacon R “22A”

Proposed HBOI Water Quality Instrumentation (SLE-ME) on ATON DB R "22A" NOAA Chart 11428



Proposed HBOI Water Quality Instrumentation (SLE-ME) on ATON DB R "22A"
NOAA Chart 11428 ZOOM INSET 1 SIDE A



Day Beacon R "22A"

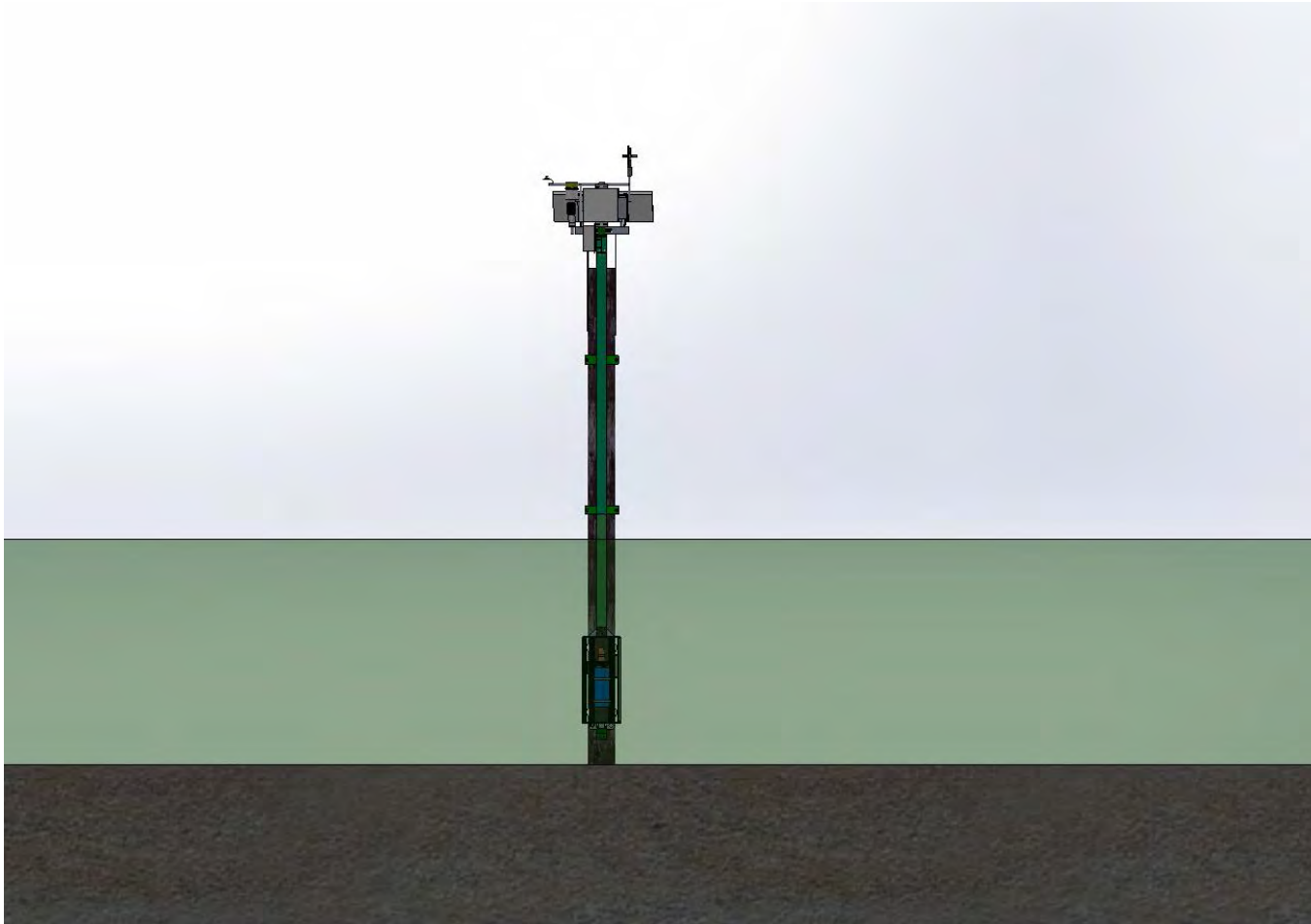
Proposed HBOI Water Quality Instrumentation (**SLE-ME**) on **ATON DB R “22A”**
NOAA Chart 11428
Existing ATON Day Beacon



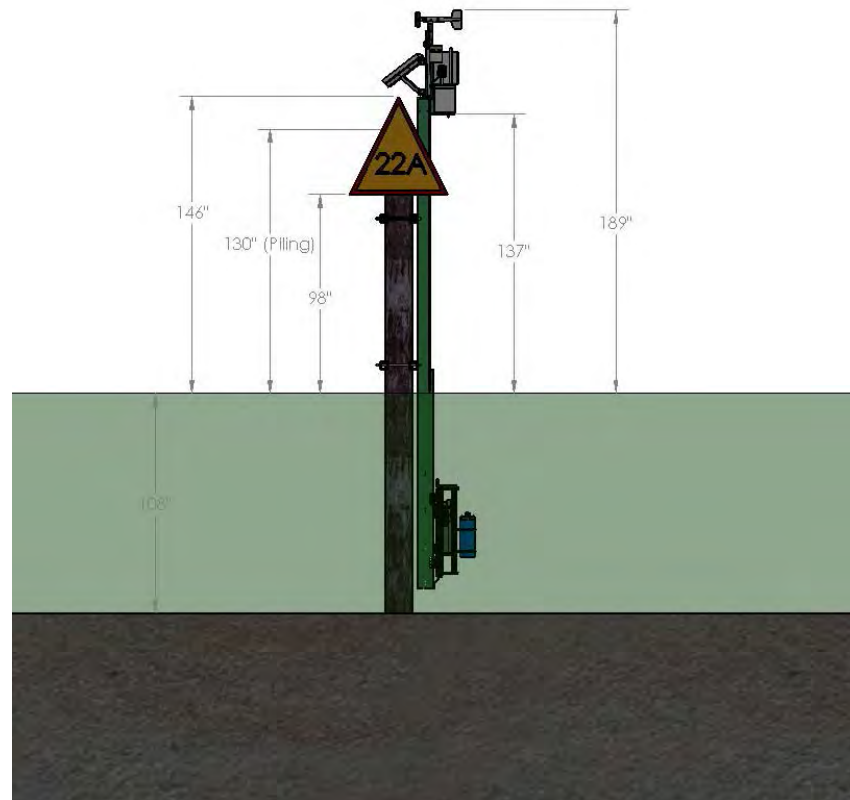
Proposed HBOI Water Quality Instrumentation (SLE-ME) on **ATON DB R "22A"**
NOAA Chart 11428
Sketch of Proposed Equipment Installed



Proposed HBOI Water Quality Instrumentation (**SLE-ME**) on **ATON DB R "22A"**
NOAA Chart 11428
Sketch of Proposed Equipment Installed (View From North)



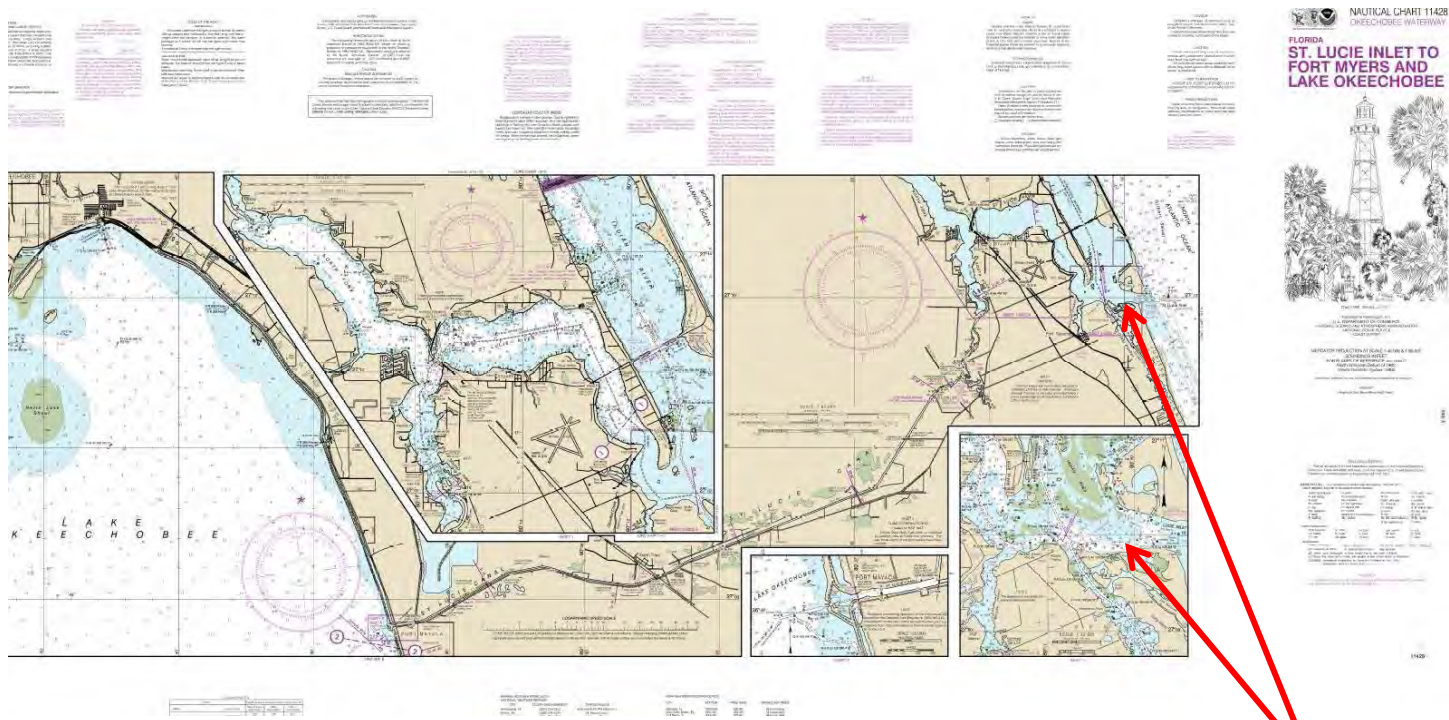
Proposed HBOI Water Quality Instrumentation (SLE-ME) on **ATON DB R "22A"**
NOAA Chart 11428
Sketch of Proposed Equipment Installed (View From East)



Proposed HBOI Water Quality Instrumentation (**IRL-SLE**)

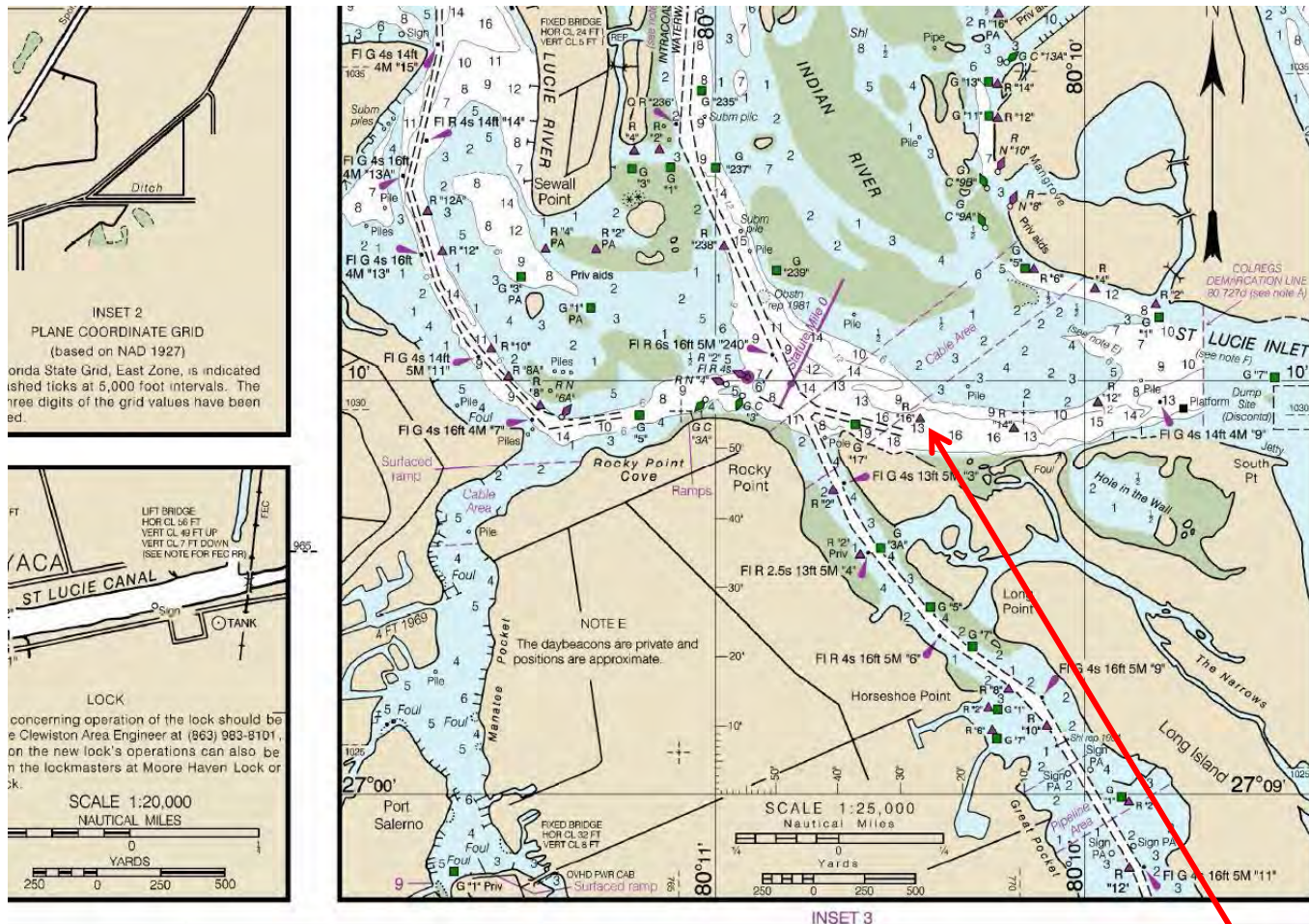
At ATON Day Beacon R “16”

Proposed HBOI Water Quality Instrumentation (IRL-SLE) on **ATON DB R "16"**
NOAA Chart 11428



Day Beacon R "16"

Proposed HBOI Water Quality Instrumentation (IRL-SLE) on ATON DB R "16"
 NOAA Chart 11428 ZOOM INSET 3 SIDE A



Day Beacon R "16"

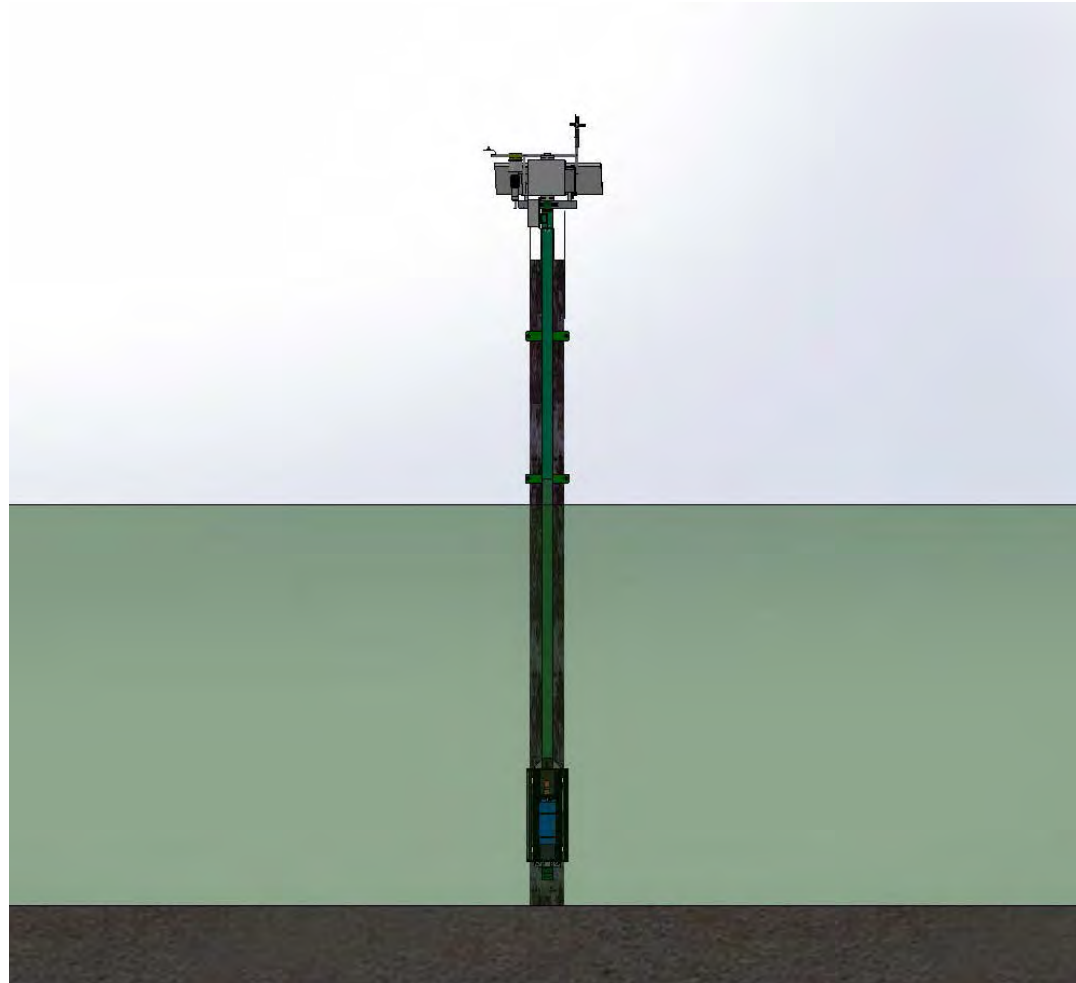
Proposed HBOI Water Quality Instrumentation (IRL-SLE) on **ATON DB R "16"**
NOAA Chart 11428
Existing ATON Day Beacon



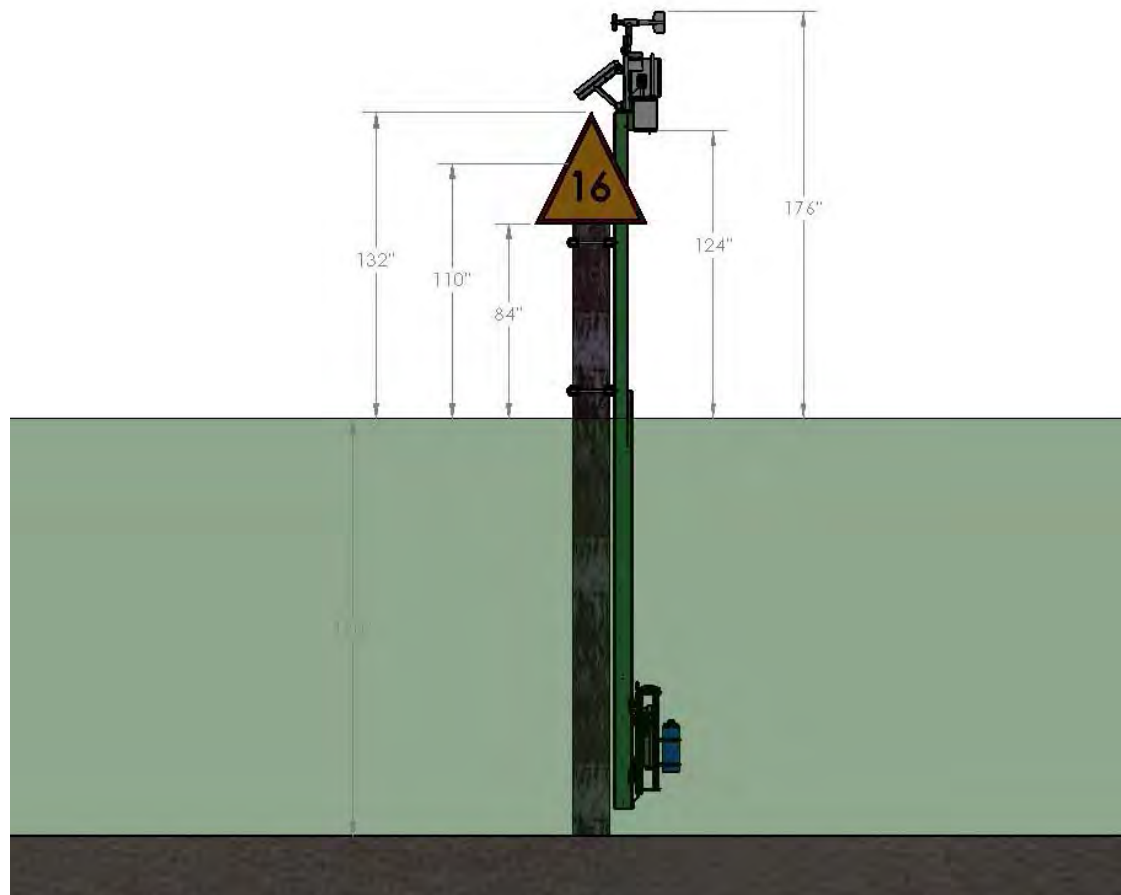
Proposed HBOI Water Quality Instrumentation (IRL-SLE) on **ATON DB R "16"**
NOAA Chart 11428
Sketch of Proposed Equipment Installed



Proposed HBOI Water Quality Instrumentation (IRL-SLE) on **ATON DB R "16"**
NOAA Chart 11428
Sketch of Proposed Equipment Installed (View From North)



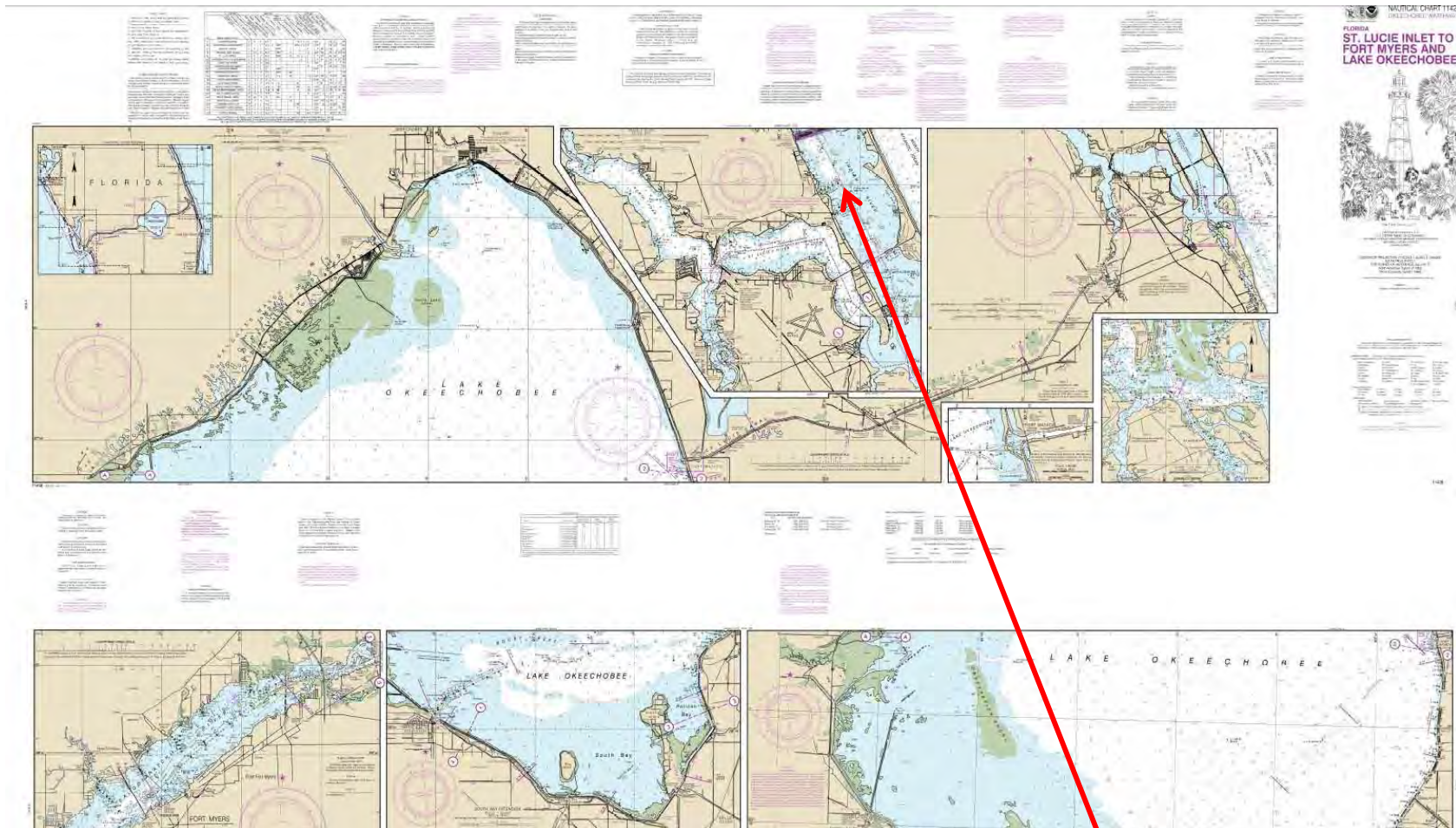
Proposed HBOI Water Quality Instrumentation (IRL-SLE) on **ATON DB R "16"**
NOAA Chart 11428
Sketch of Proposed Equipment Installed (View From East)



Proposed HBOI Water Quality Instrumentation (**IRL-JB**)

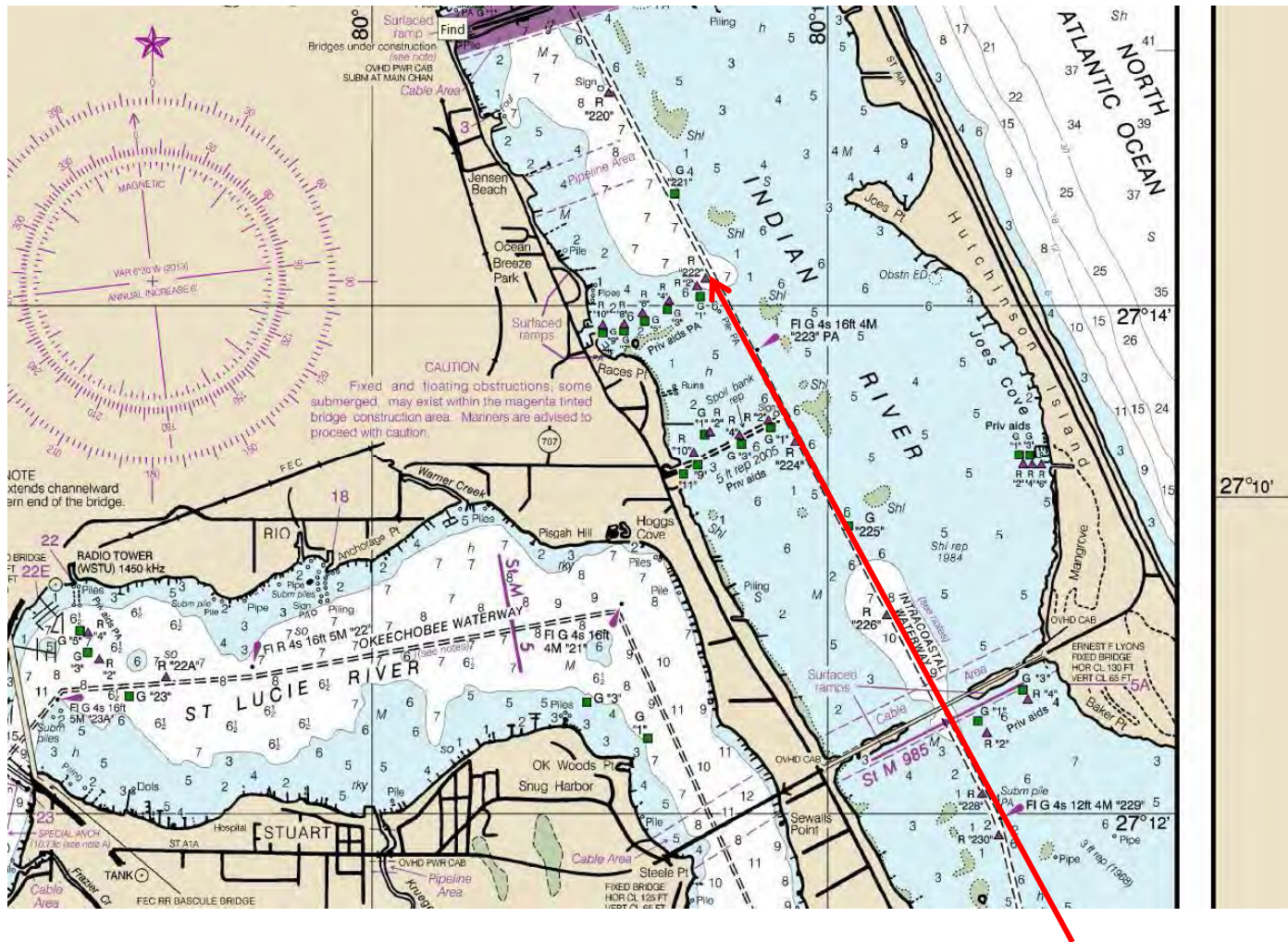
At ATON Day Beacon R “222”

Proposed HBOI Water Quality Instrumentation (IRL-JB) on ATON DB R "222" NOAA Chart 11428



Day Beacon R "222"

Proposed HBOI Water Quality Instrumentation (IRL-JB) on ATON DB R "222"
NOAA Chart 11428 ZOOM INSET 1 SIDE A



Day Beacon R "222"

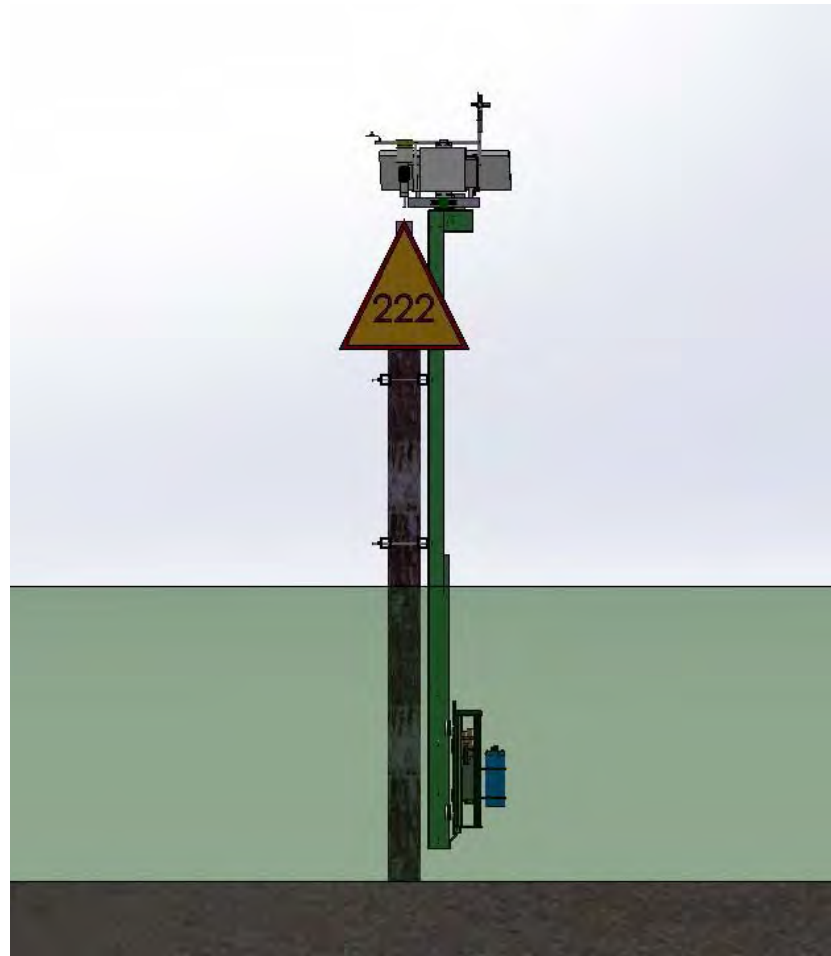
Proposed HBOI Water Quality Instrumentation (**IRL-JB**) on **ATON DB R “222”**
NOAA Chart 11428
Existing ATON Day Beacon



Proposed HBOI Water Quality Instrumentation (IRL-JB) on **ATON DB R "222"**
NOAA Chart 11428
Sketch of Proposed Equipment Installed



Proposed HBOI Water Quality Instrumentation (IRL-JB) on **ATON DB R "222"**
NOAA Chart 11428
Sketch of Proposed Equipment Installed (View From North)



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