

A photograph of a green boat with a cabin, marked '7887 EP', in a flooded forest. A person in a high-visibility vest and waders is standing in the water next to the boat. The water is a muddy brown color, and the trees are bare, suggesting a winter or late autumn setting.

Lessons Learned in Quantification of Dredge Volumes

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Quick Personal Bio



- Live in Green Bay, Wisconsin
- Licensed P.E.
- Certified Hydrographer #258: American Congress on Surveying and Mapping (ACSM), merged into National Society of Professional Surveyors (NSPS)
- Performed 200+ hydrographic surveys
- 15+ years of waterfront/marine design and survey experience

Sunrise



Sunset









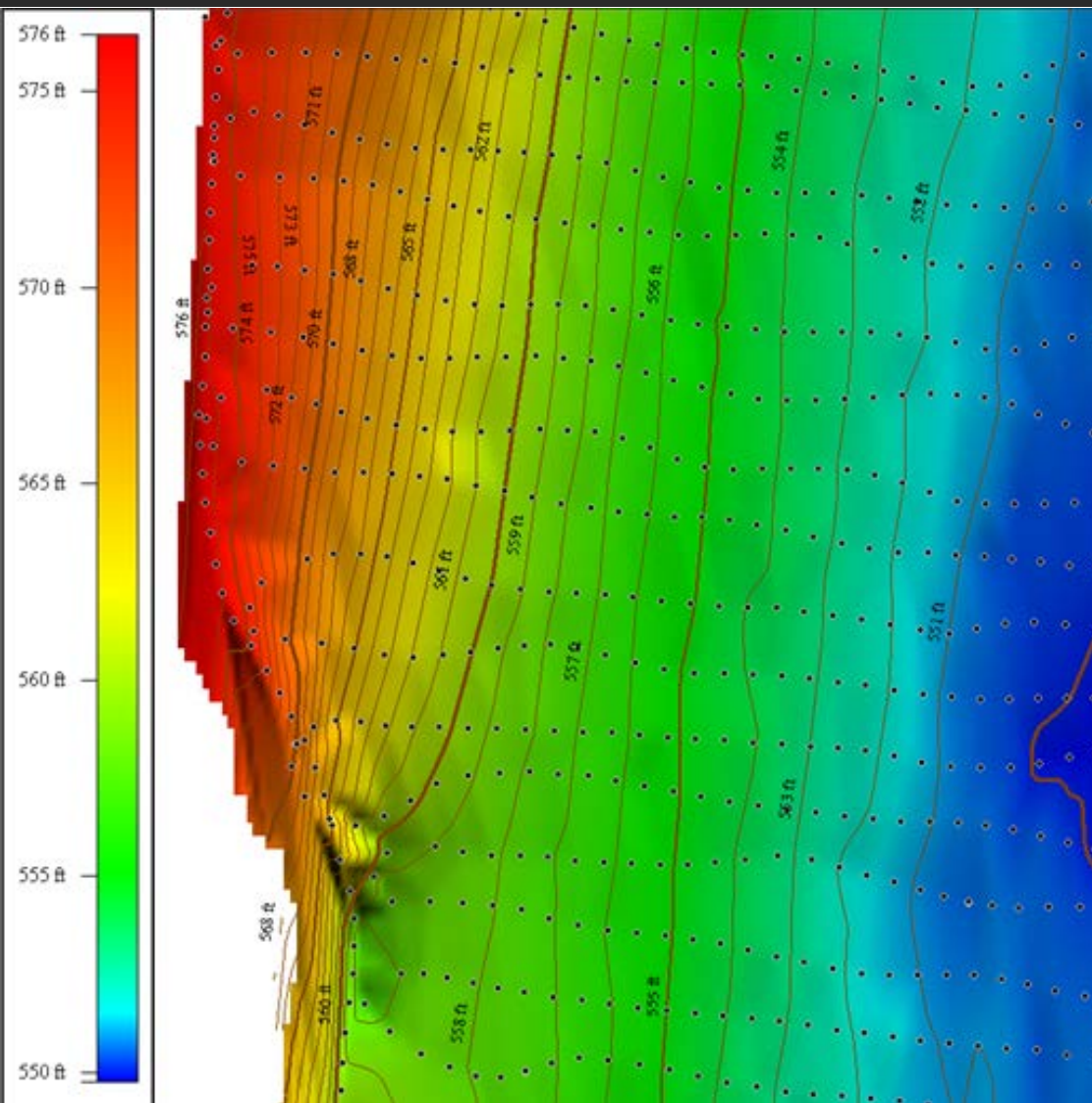
American History



Historic American Engineering



Transcontinental Connections
(Union Pacific Causeway, Great Salt Lake, Utah)



- Pre-dredge “Before” Survey A
- Post-dredge “After” Survey B
- Always = the same Cubic Yardage, right?
- Let’s review some basic aspects of surveys and how they impact your dredge payment volume.
- Planning and Bidding
- Execution: Dredging and Disposal
- Completion: Post-process and Payment

Planning and Bidding

Essential #1: Know your specification



W912P4-14-B-0004

**US Army Corps
of Engineers**

Buffalo District

BUILDING STRONG

BARCELONA HARBOR

FY 14 MAINTENANCE DREDGING

BARCELONA, NY

PLANS & SPECIFICATIONS

CERTIFIED FINAL - RTA

11 MARCH 2014

- Unit of Measurement
- CDF/Landfill Fees and Requirements
- Dewatering/Discharge Permits

Essential #3: Confirm Coordinate System

SPC Zones - 2004

Essential #4: Confirm Distance Units

U.S. Feet

636,320.57' N

26,906,602.26' E

International Feet

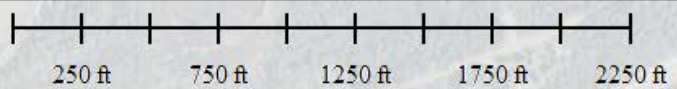
636,321.85' N

26,906,656.07' E



U.S. Feet versus
International Feet

1 intl foot =
0.99999803149994 U.S.
Survey feet



Essential #5: Confirm Vertical Datum



- National Geodetic Vertical Datum of 1929 (NGVD29)
- North American Vertical Datum of 1988 (NAVD88)
- Mean Sea Level (MSL)
- International Great Lakes Datum of 1988 (IGLD88)
- Low Water Datum (LWD)

Essential #6: Confirm Existing Benchmarks

FY14 Barcelona Harbor Maintenance Dredging
FY14BARDREDGEFW

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utility lines, vegetation, structures, equipment or improvements shall be protected from damage, and if damaged, shall be repaired by the Contractor at his own expense.

1.3.6 Condition of Channels

The channels are dredged totally, or in part, annually depending upon sediment build-up over the year. Drawings showing the depths for the most recent survey are available on the web at <http://www.lrb.usace.army.mil/Library/MapsandCharts.aspx>. For surveys older than those shown on the website, contact the Survey Section at (716) 879-4429. Previous surveys are to be considered for information only, and should not be considered representative of current conditions.

1.3.7 Temporary Lights, Signals and Buoys Required by the Coast Guard

All temporary lights, signals and buoys required by the U.S. Coast Guard must be displayed during the project work. Information regarding required signals, lights, buoys and other requirements may be obtained from the Commander (OAN), U.S. Coast Guard, Shore Maintenance Detachment, ATTENTION: Aids to Navigation Branch, 1240 East Ninth Street, Cleveland, Ohio 44199-2060, Telephone (216) 522-3990.

1.3.8 Datums and Benchmarks

The plane of reference of low water datum as used in these specifications is that determined by the following bench marks:

A. C 471 (PID NC0856), ELEVATION - 580.93 (feet), in Barcelona, along First street, on the property of the Barcelona Harbor House restaurant, 12.80 meters (42.0 ft) northwest of the center of First street, 3.90 meters (12.7 ft) north of the east corner of the restaurant, 2.13 meters (7.0 ft) southeast of the southeast face of the building. The mark is above level with street.

B. EAST (PID NC0864), ELEVATION - 575.18 (feet) - In Barcelona, at the northeast corner of the city pier at the Barcelona Harbor, 1.43 meters (4.7 ft) south of the north edge of the pier, 1.40 meters (4.6 ft) west of the east edge of the pier. The mark is above level with pier.

C. BARCELONA ECO (PID NC0865), ELEVATION - 575.14 (feet), In Barcelona, at the northeast corner of the city pier, at the Barcelona Harbor, 0.97 meter (3.2 ft) south of the north edge of the pier, 1.16 meters (3.8 ft) west of the east edge of the pier. The mark is a standard brass disk above level with pier.

D. 906 3032 MONROE A USLS (PID NC0857), ELEVATION 586.92 (feet) In Barcelona, set vertically in the block building (covered with a wood siding) of the Westfield Fisheries, 8252 1st St, Westfield, NY 14787, 0.18 Meter (0.6 Ft) northwest of the east corner of the building. The mark is 1.20 M above ground. There is a cut out circle that can be removed at time of need.

The plane of low water datum is 569.2 feet above mean level at Rimouski, Quebec (IGLD-1985) (International Great Lakes Datum 1985).

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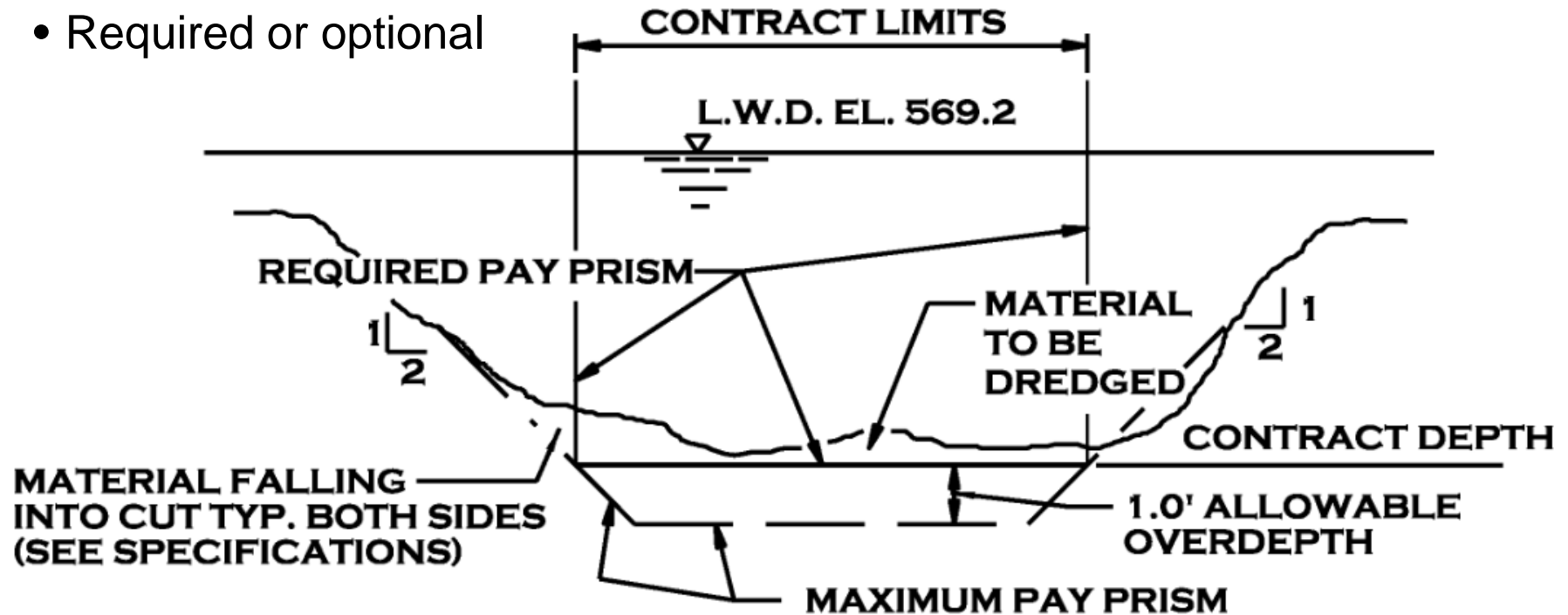
02/21/14

Where are they?



Essential #7: Confirm Over-Depth or Over-Dredge Allowance

- Channel
- Sideslopes
- Required or optional

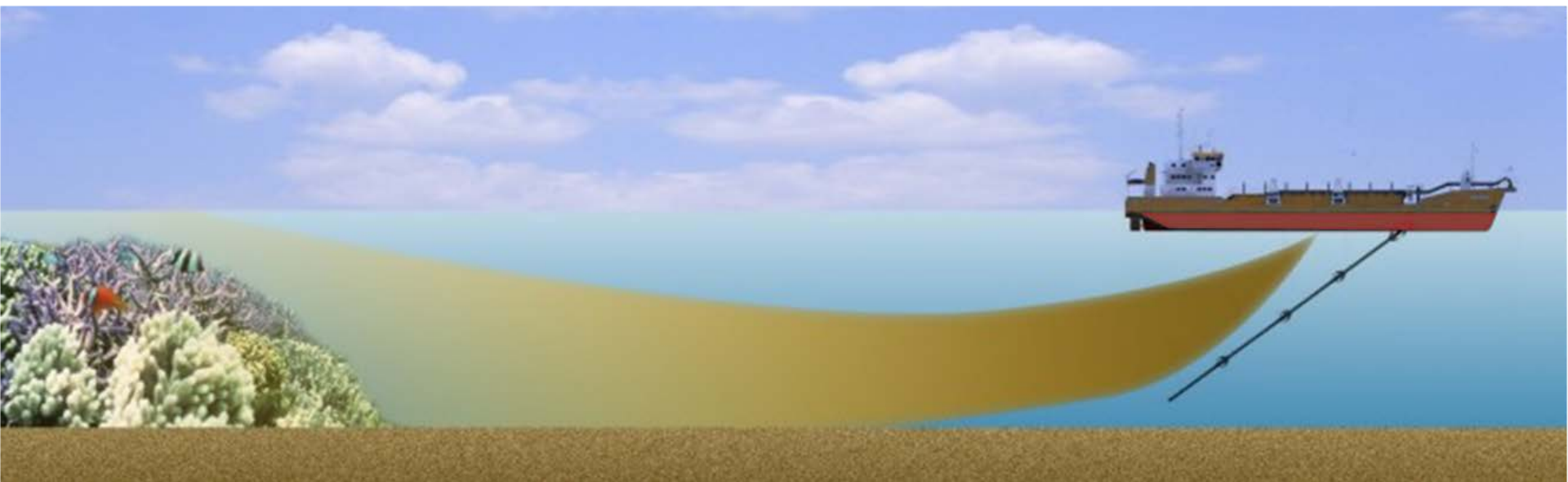


TYPICAL SUBMERGED SECTION

NOT TO SCALE

Essential #8: Confirm Allowable Method of Dewatering

- Navigational projects
- Environmental projects
- Sealed Barge or Drain off barge allowed
- Pre-discharge treatment



Essential #9: Confirm if Hard Material Removal is Required



- Is hard material defined? How?
- Separate pay rate?
- Who determines quantity? Contractor or Engineer?

Execution: Dredging and Disposal Phase

Essential #10: Confirm Specification of Pre-dredge Survey

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FY14BARDREDGEPM

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required under this contract, within 500 feet of the acceptance section, has been completed, or to a point where, in the judgment of the Contracting Officer, further dredging in the contract area will not cause shoaling or damage to the acceptance section. Unless specifically designated in the Section 01 35 13 "SPECIAL PROJECT REQUIREMENTS", paragraph "Acceptance Section Lengths", acceptance section lengths for hydraulic dredges with a cutterhead and mechanical dredges will be a minimum of 2,500 feet. Acceptance lengths for hopper dredges will be a minimum of 5,000 feet. The acceptance section lengths will be determined by the Contracting Officer prior to the commencement of dredging.

1.3.4 Quantity Determination

Before and After dredge surveys shall be performed by the Government for purposes of acceptance and determination of quantities dredged. The Government will conduct surveys in accordance with EM 1110-2-1003, "Hydrographic Surveying", using one of the following methods: (1) multibeam, (2) single beam, or (3) lead line, whichever is deemed appropriate by the Government for the harbor/channel being dredged. The quantity calculation method utilized will be in HYPACK software utilizing either the TIN method or the Standard HYPACK method. The surveying method and quantity calculation method utilized will be determined solely by the Government and is entirely at its discretion. Upon request, the Contractor will be advised of the surveying method and quantity calculation methods to be used prior to the commencement of dredging.

1.3.4 Quantity Determination

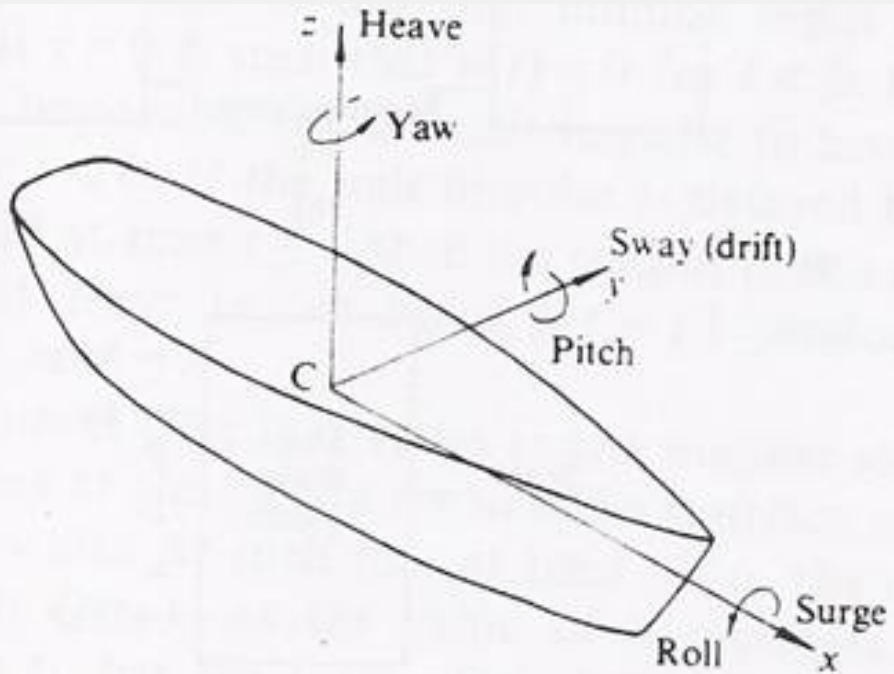
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02/21/14

- Who performs?
- When can it be performed?
- Timing of approval
- Handling of volume changes

Essential #11: Confirm if Heave-Pitch-Roll Sensor Required



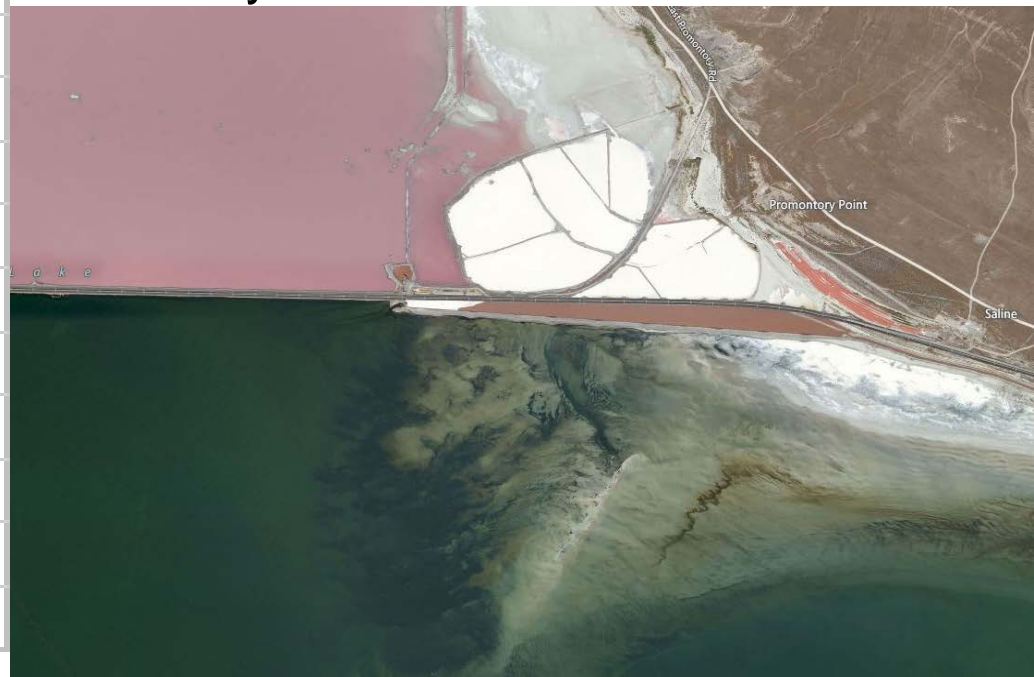
Or perform during calm seas



Essential #12: Equipment Calibration: Sound Velocity

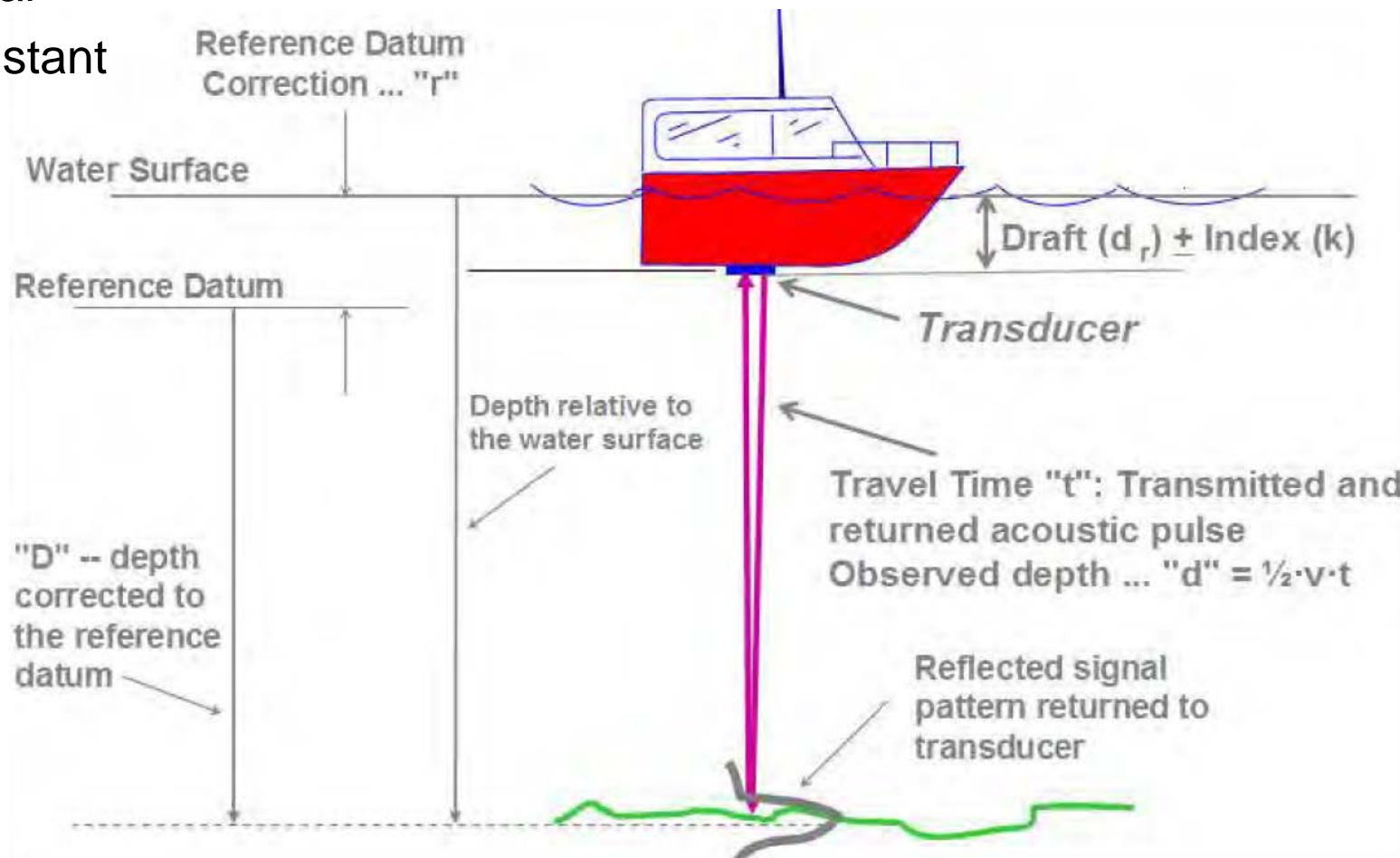
<u>Temperature</u> - t - (°F)	<u>Speed of Sound</u> - C - (ft/s)
32	4,603
40	4,672
50	4,748
60	4,814
70	4,871
80	4,919
90	4,960
100	4,995
120	5,049
140	5,091
160	5,101
180	5,095
200	5,089
212	5,062

- Acoustic velocimeter
- Water temperature
- Barometric pressure
- Salinity

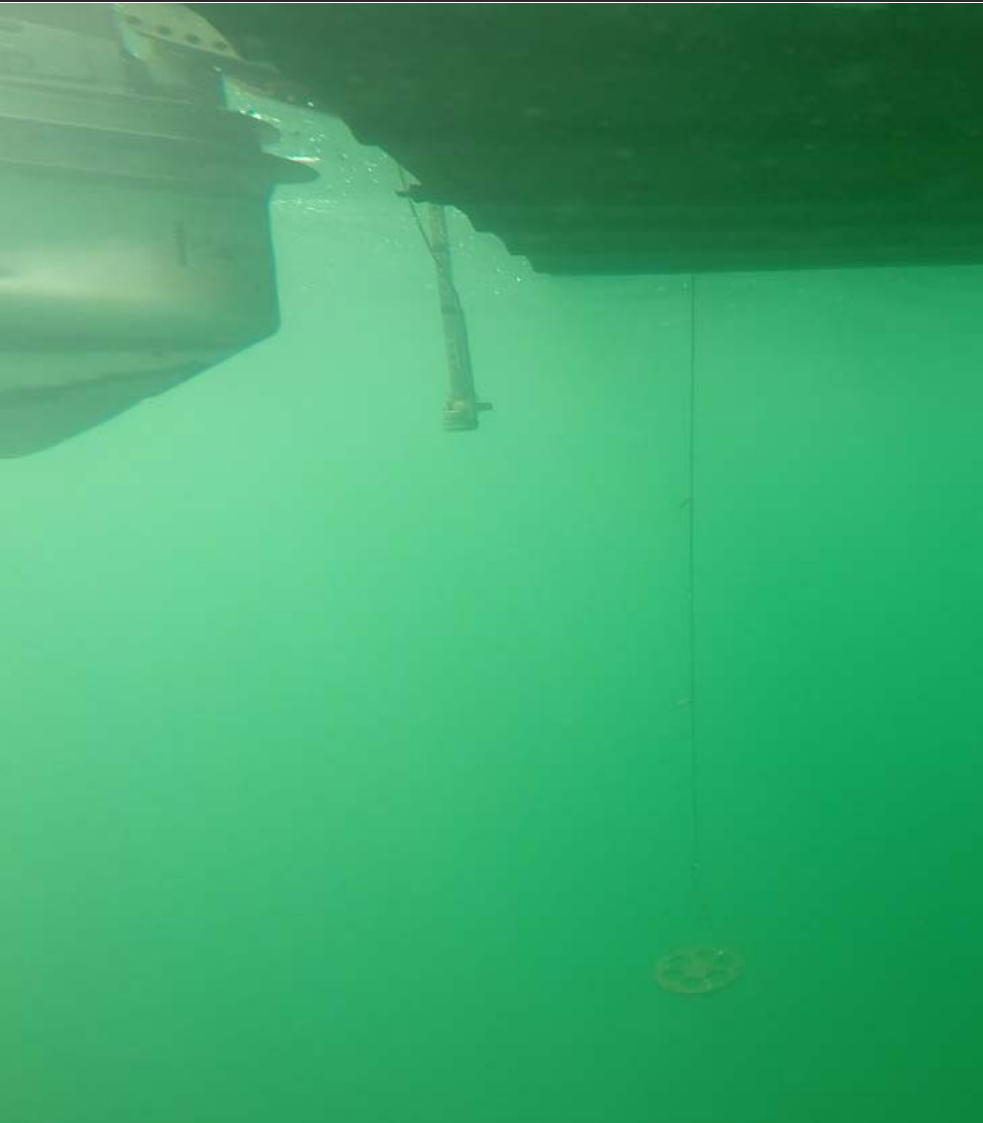


Essential #13: Equipment Calibration: Bar Check

- Deep Bar
- Shallow Bar
- Index Constant
- Draft



Essential #14: Determine Dynamic Draft

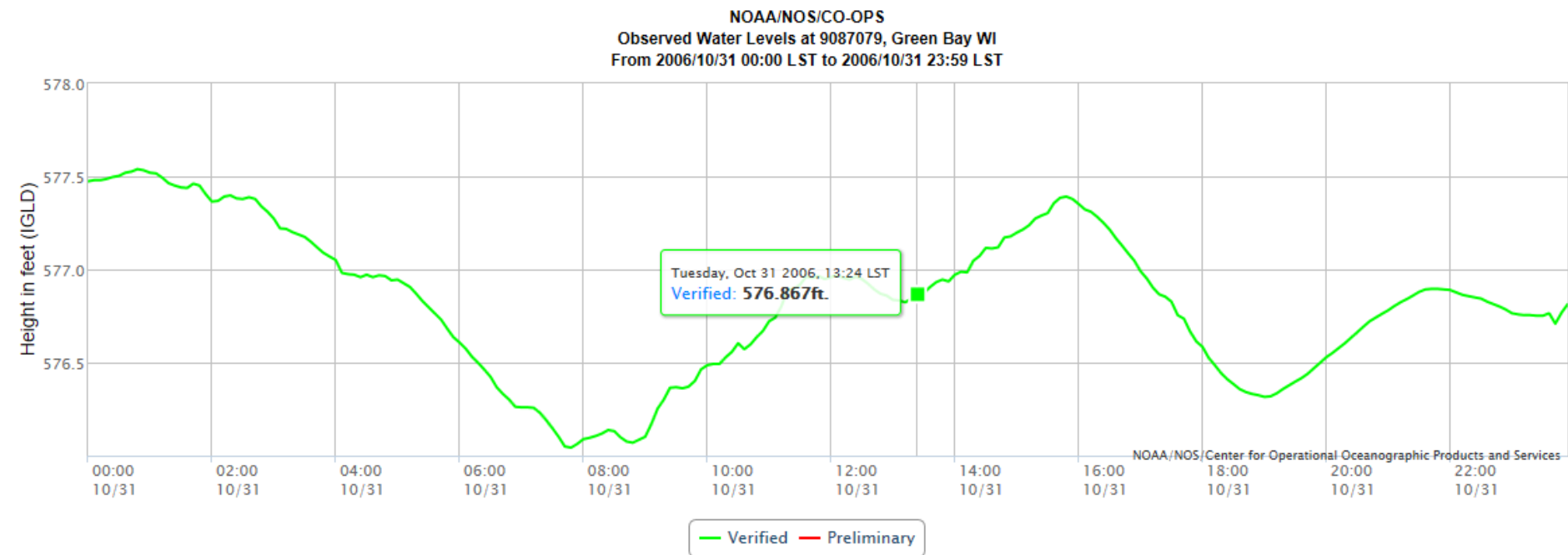


- Bar Check while dead in water
- Level from shore
- Pressure transducer
- Drift then Motor
- Squat/Settlement: Required to compensate for differential displacement at varied speeds. (Less-so for RTK Tides)

Execution: Dredging and Disposal

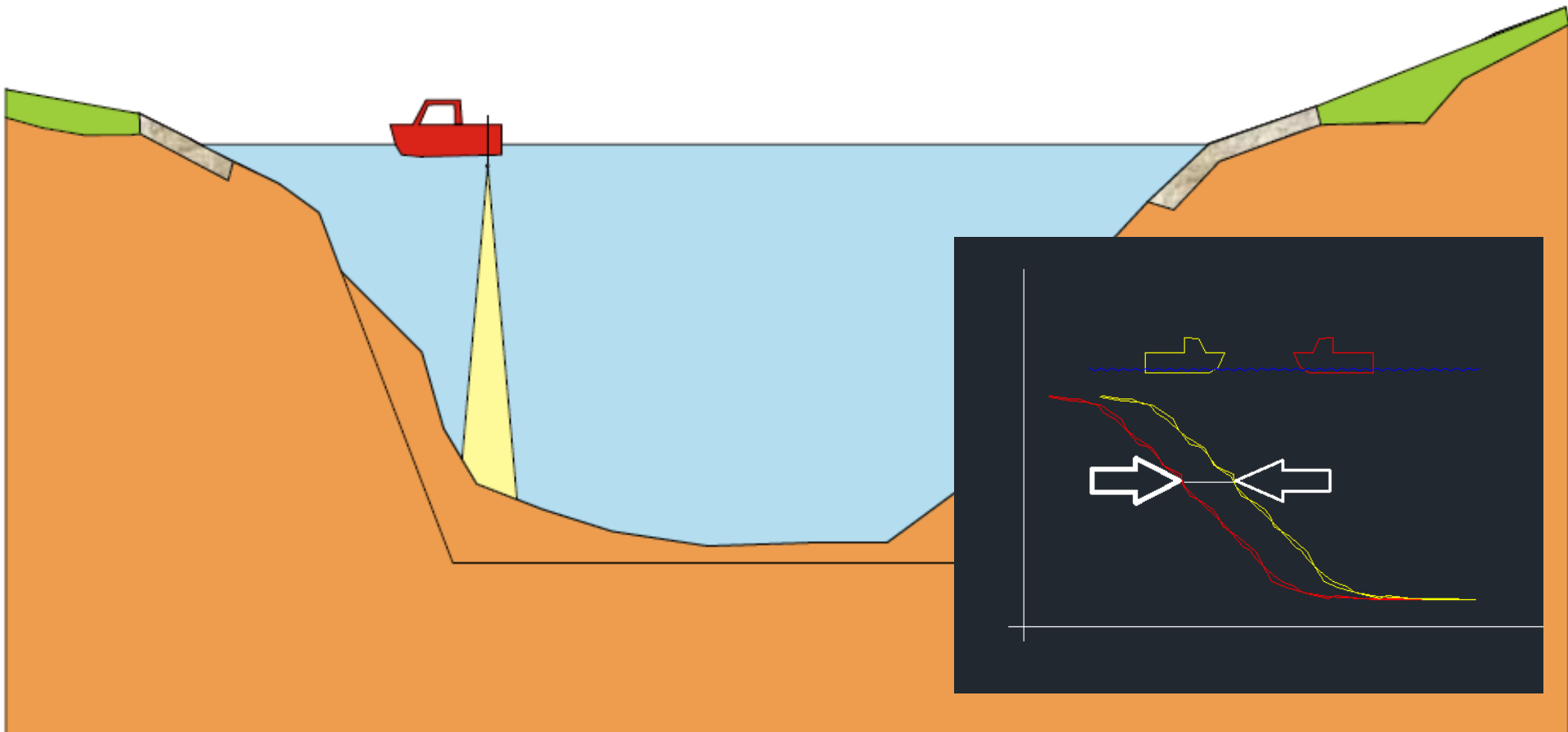
Essential #15: Tide Recording

- Staff gage near project
- Frequency of measurement
- Tide Recording: Establish frequency of Tide/Stage/Water Level Records – Check against vertical control



Essential #16: DGPS or RTK Position Latency

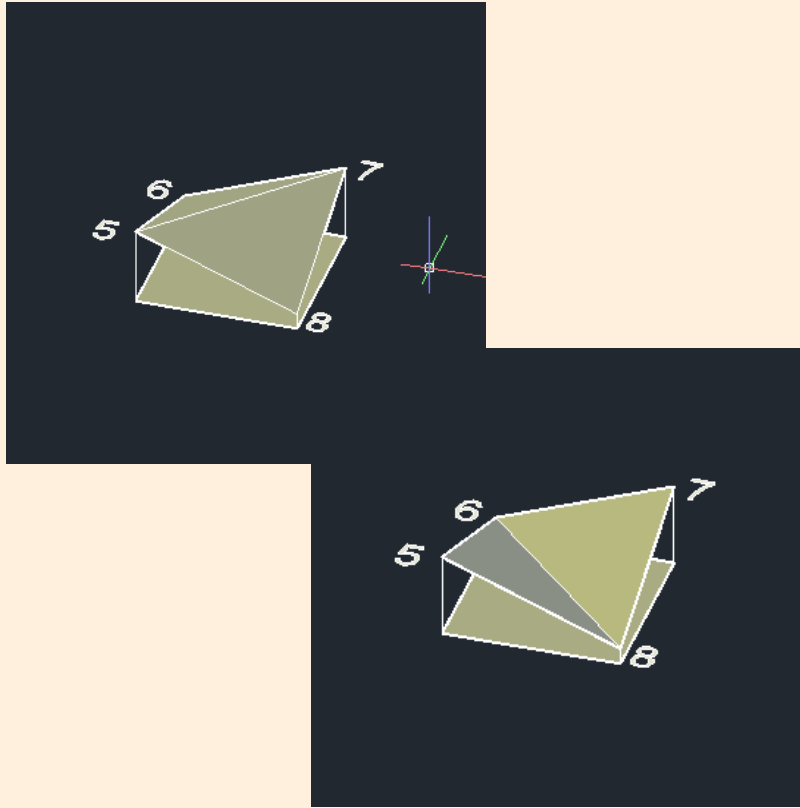
- Survey lines both directions over steep slope
- Symptom: Sawtooth contours



Essential #17: Quality Assurance

- Quality Assurance (Proactive)
 - Focus on Process
 - Different surveys by different vessels
 - Cross-Line Checks
 - Establish Check-Line Control Section outside project limits
 - Extend Cross Sections to undisturbed areas
 - Check for lack of repeatability
 - Identify biases
 - Check Statistical Differences

Completion: Post-Process and Payment Phase



- Read Specification Closely
- Two main methods:
 - Average End Area (AEA) or derivatives thereof
 - Triangulated Irregular Network (TIN)

Thank You!

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