Effective Fill Management at the New Bedford, Massachusetts Lower Harbor CAD Cell

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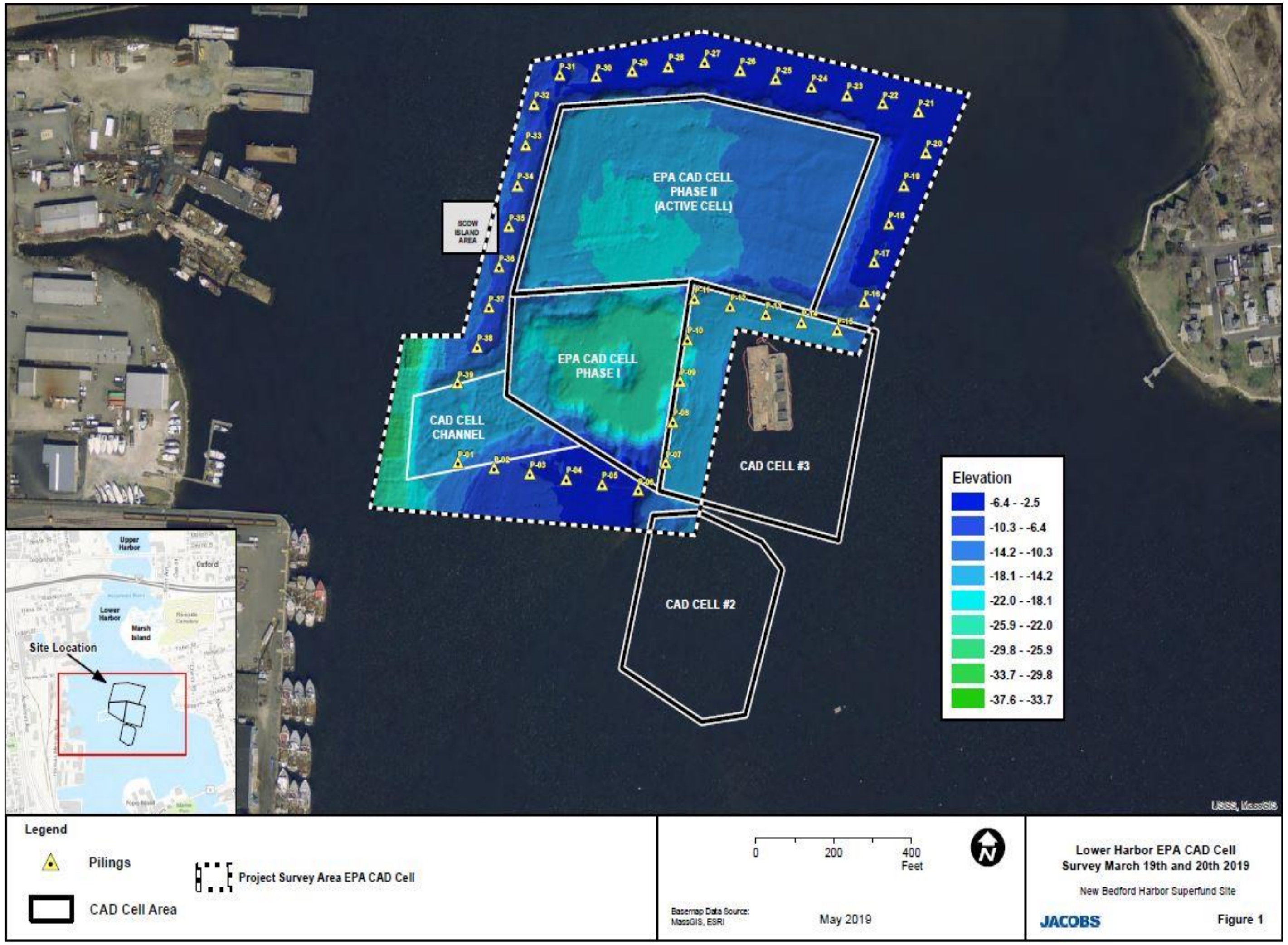
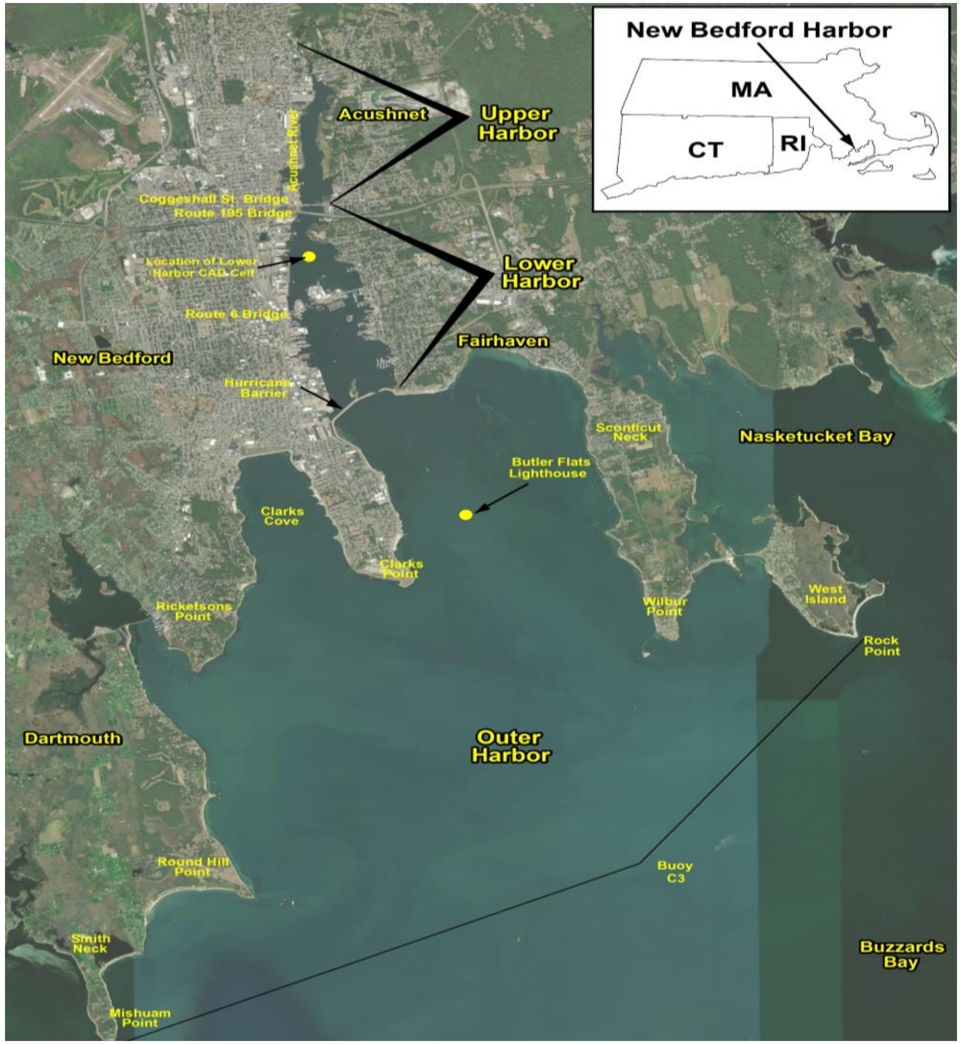
Presentation Overview

1. **Summary of New Bedford Subtidal Dredge Program and Lower Harbor CAD Cell (LHCC)**
2. **Dredge Prism Design for CAD Cell Operations**
3. **Mechanical Dredge Operations Management**
4. **LHCC Operations**
    1. Existing Conditions and Disposal Plan
    2. Winslow Pocket Scow and Disposal Operations
    3. Progress Monitoring
    4. Sill Construction along Phase I & II Interface
    5. Survey Challenges
    6. Final Conditions and Consolidation
5. **Conclusions**

Project Location

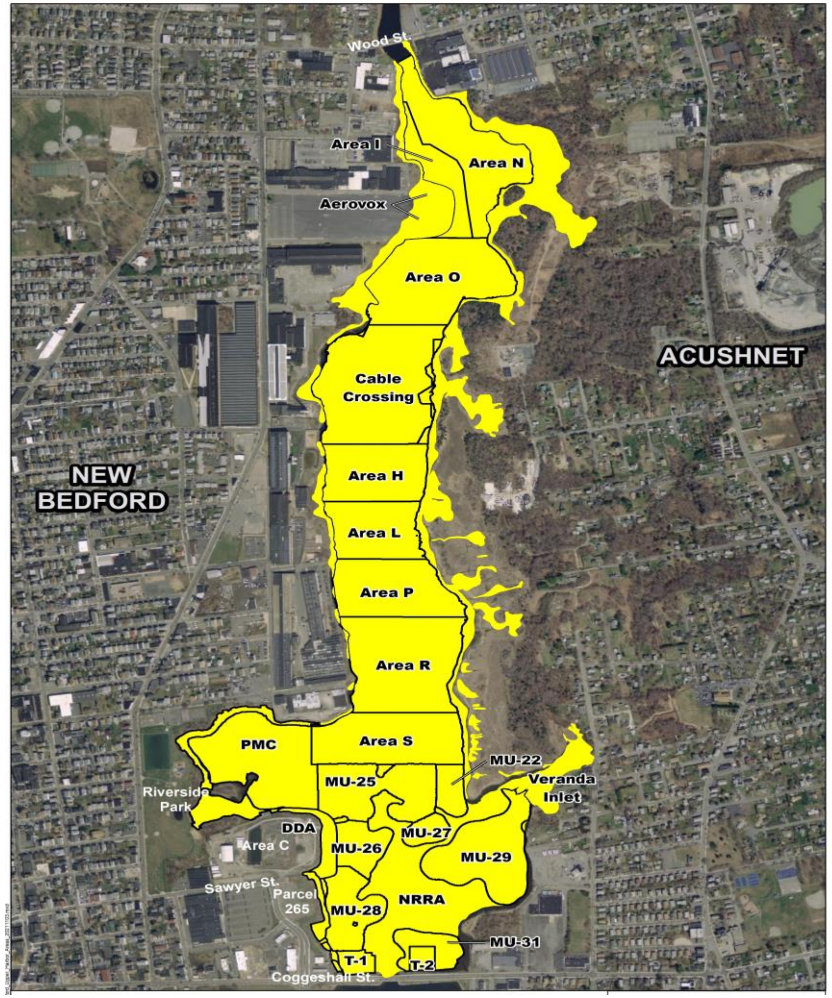




New Bedford Harbor Subtidal Dredge Program

- NPL 1983
- Hot Spot and Early Action Work 1990-2001
- Upper and Lower Harbor ROD 1998
- Upper Harbor Mass Removal and Offsite Disposal 2004-2016
- Lower Harbor mechanical dredging and CAD Cell Disposal 2016-2018
- Upper Harbor Cleanup Dredging and Offsite Disposal 2017-2020
  - Hybrid: mechanical dredging, hydraulic transport
- Upper Harbor mechanical dredging and CAD Cell Disposal 2019-2020
  - Southern Portion of the Upper Harbor
  - Approximately 68,000 cy and 1.5M SF dredged

Approximately 1M cy and 100 tons PCBs removed

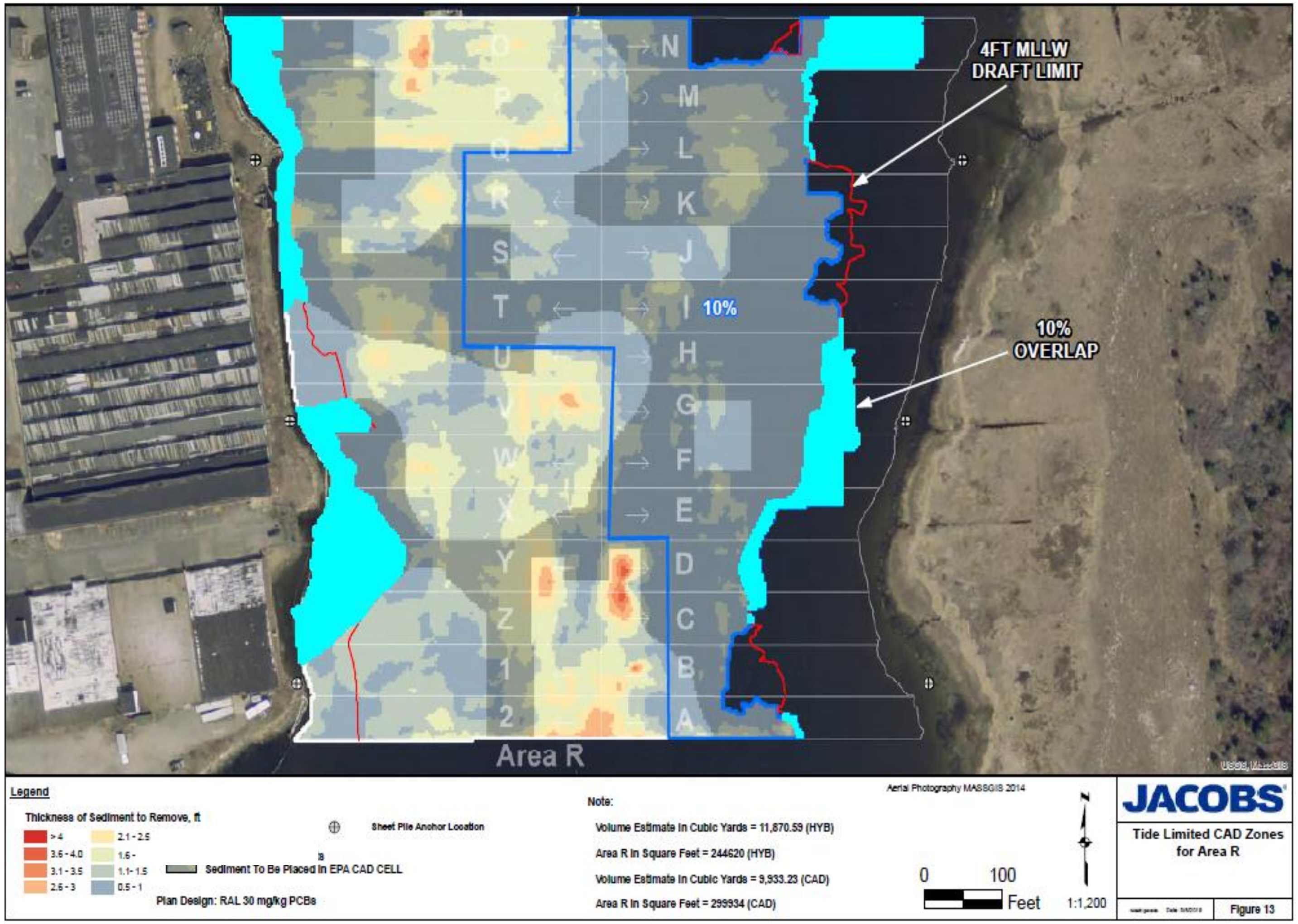


Upper Harbor

History of New Bedford Harbor Lower Harbor CAD Cell

- LHCC Phase I construction completed Jun 2014
- LHCC Phase II construction completed Dec 2015
- In 2017-2018, mechanical dredging and LHCC disposal of approximately 93,000 cy from Upper and Lower Harbors (Cashman Dredging and Marine)
- Sept 2019 - Mar 2020, mechanical dredging and LHCC disposal of approximately 68,000 cy from the Upper Harbor (Jacobs/SES team)
- Navigational dredging material also disposed in the LHCC under the State Enhanced Remedy process

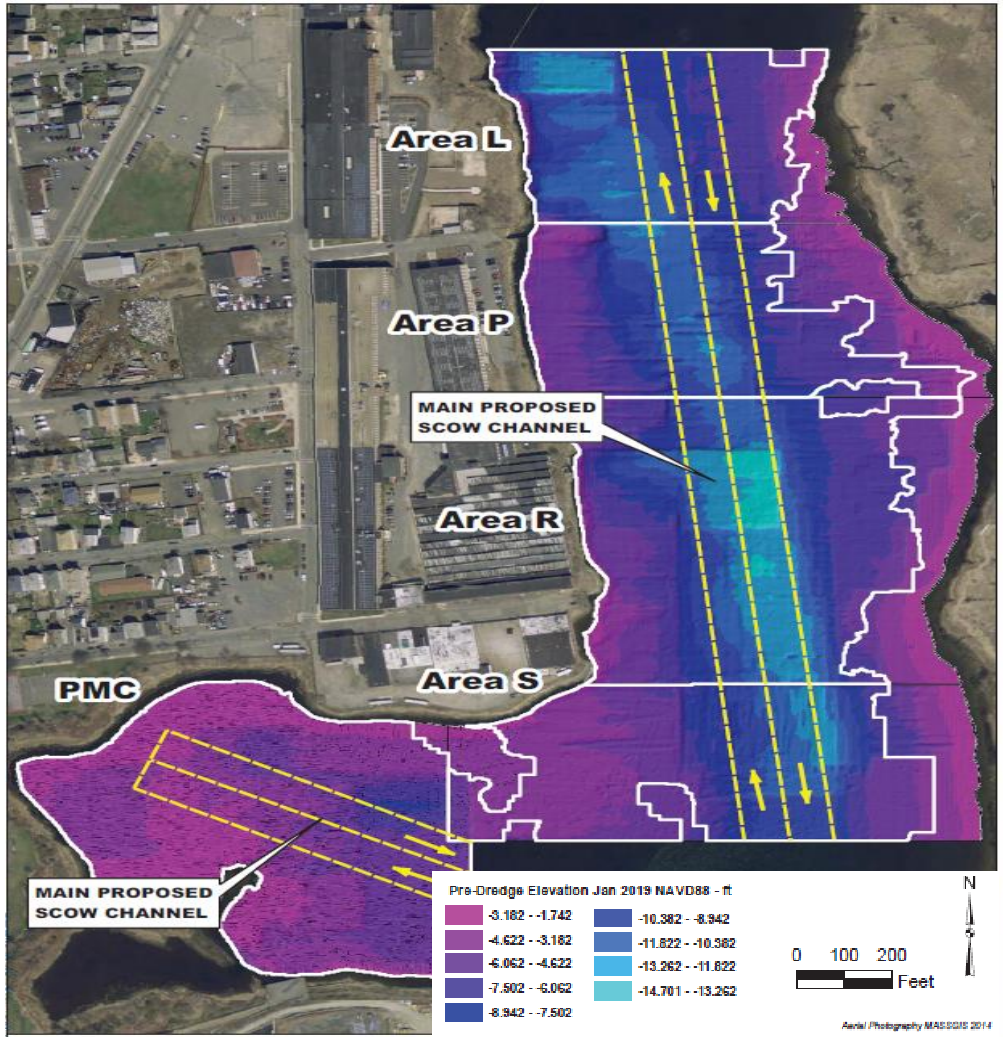
Dredge Prism Design for CAD Cell



- Developed a PCB distribution model to identify dredged material suitable for CAD cell disposal
- Conducted sediment geotechnical characterization to optimize placement location in CAD cell
  - Range from organic silt (OL), more consolidated silty clay (CL), sand and some shoreline debris
- Shallower cut depths compared to hybrid operations
- Most shoreline areas were designated for CAD cell so tide sequencing was critical for maintaining production rates
- Bucket overlap extended 5 ft into previously dredged hybrid area to manage residuals and potential sloughing

Dredge Operations Management

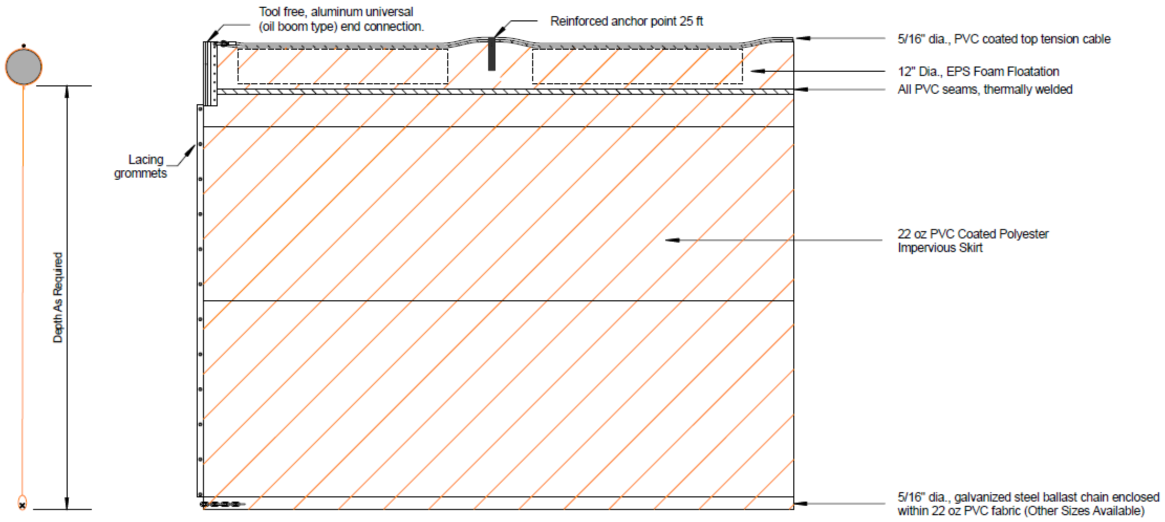
- Completed after hybrid operations so the more elevated PCB levels were already removed
- Prop wash analysis was conducted to ensure push boat operations did not move material in previously dredged hybrid area – scows loaded to approximately 75% to minimize draft material spillage
- Eight 100-cy hopper scows in rotation - approximate 1.5-mile ferry from dredge area to LHCC transload location
- Tide management important as push boats were slightly limited by peak high tides from bridge clearance
- CAD Cell Operations Average Production Rate – 702 cy/day
  - Main delay attributed to waiting for scows within rotation
  - Removed front two spuds to allow scow placement on either side of barge platform
- Hybrid Operations Average Production Rate – 565 cy/day
  - Includes re-dig operations
  - Delay time associated with clearing the grizzly screen and sediment processing



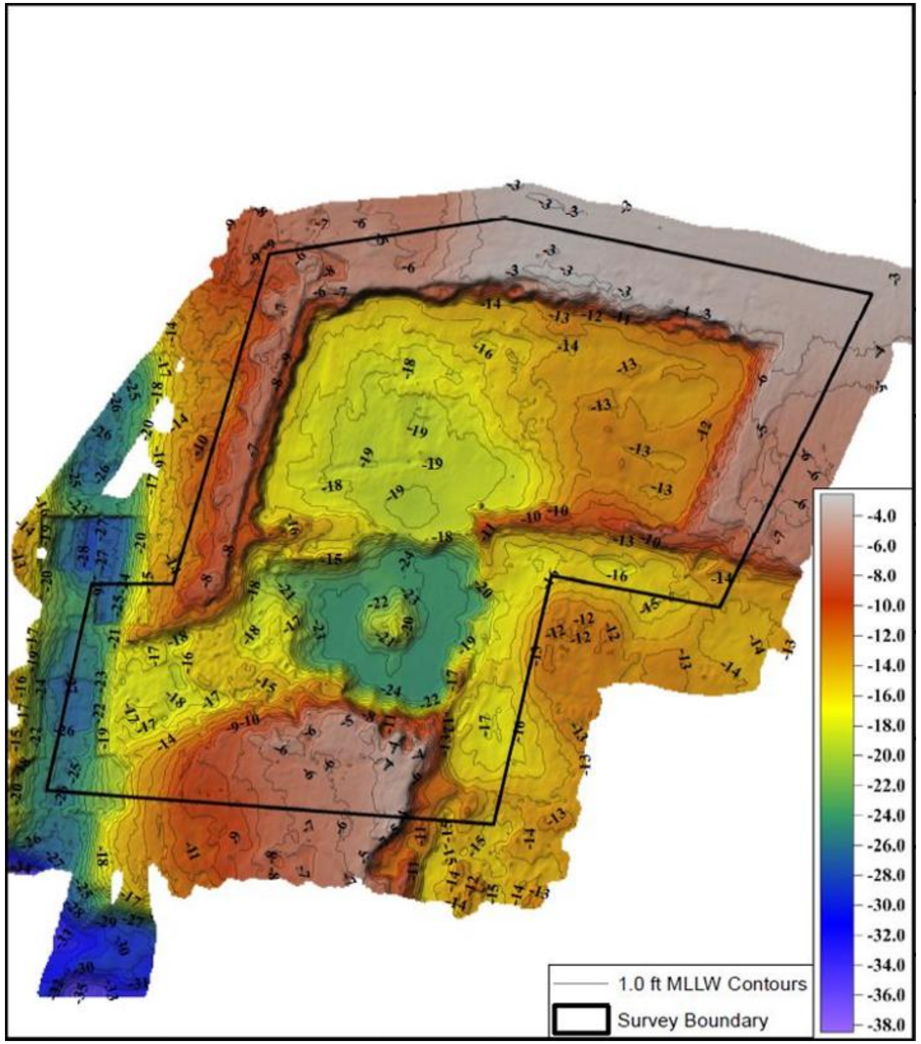
Dredge Equipment

Existing Conditions

- Phase II Max Design Fill Elevation of -10 ft MLLW
  - Total volume of 65,155 cy to -10 ft MLLW
- Phase I Max Design Fill Elevation of -17 ft MLLW
  - Total Volume of 19,730 cy to -17 ft MLLW
- Filling approach: begin in deeper western portion of CAD cell to assess placement behavior before filling in the shallower eastern zone
- CAD cell lined with silt curtains (detail below)

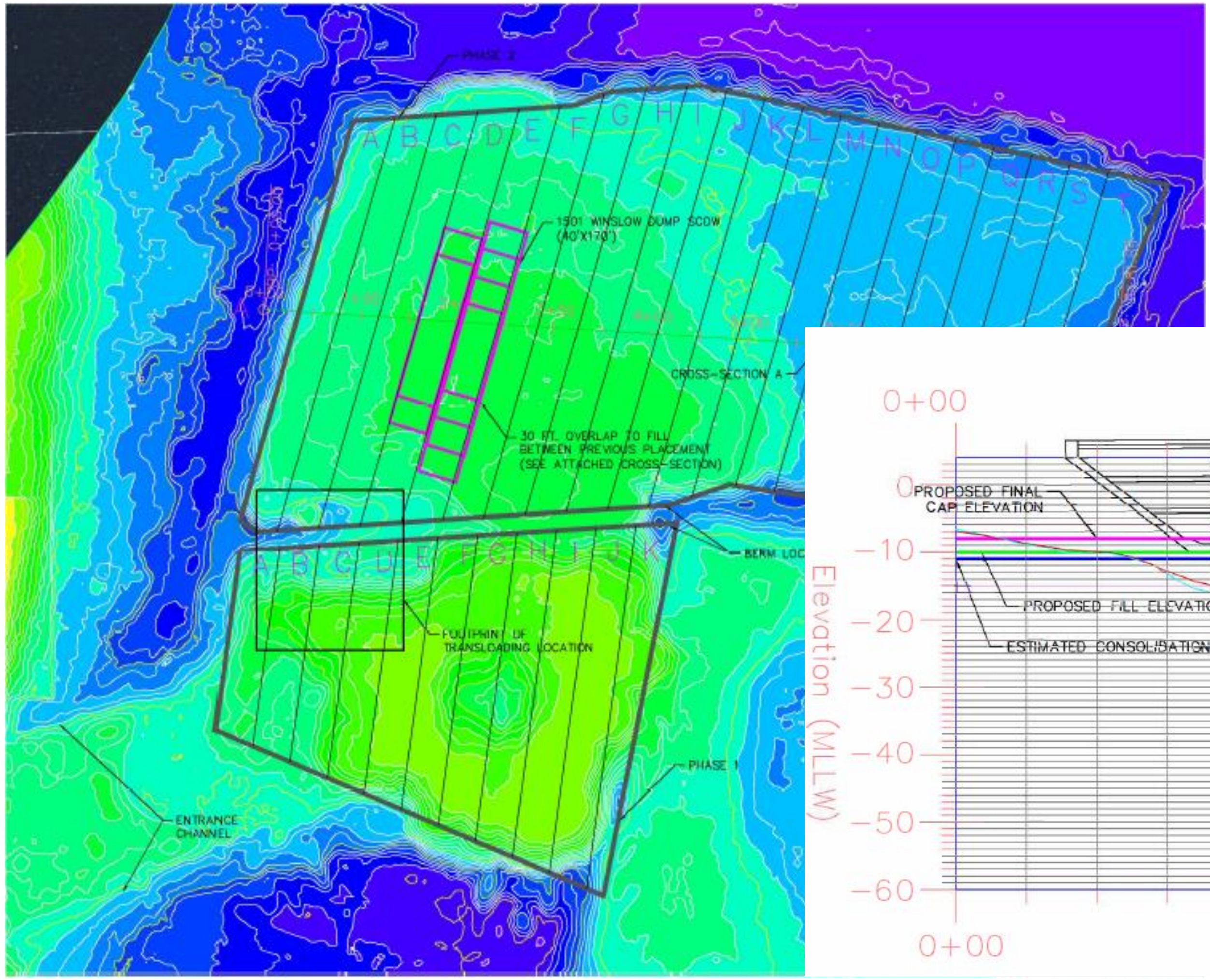


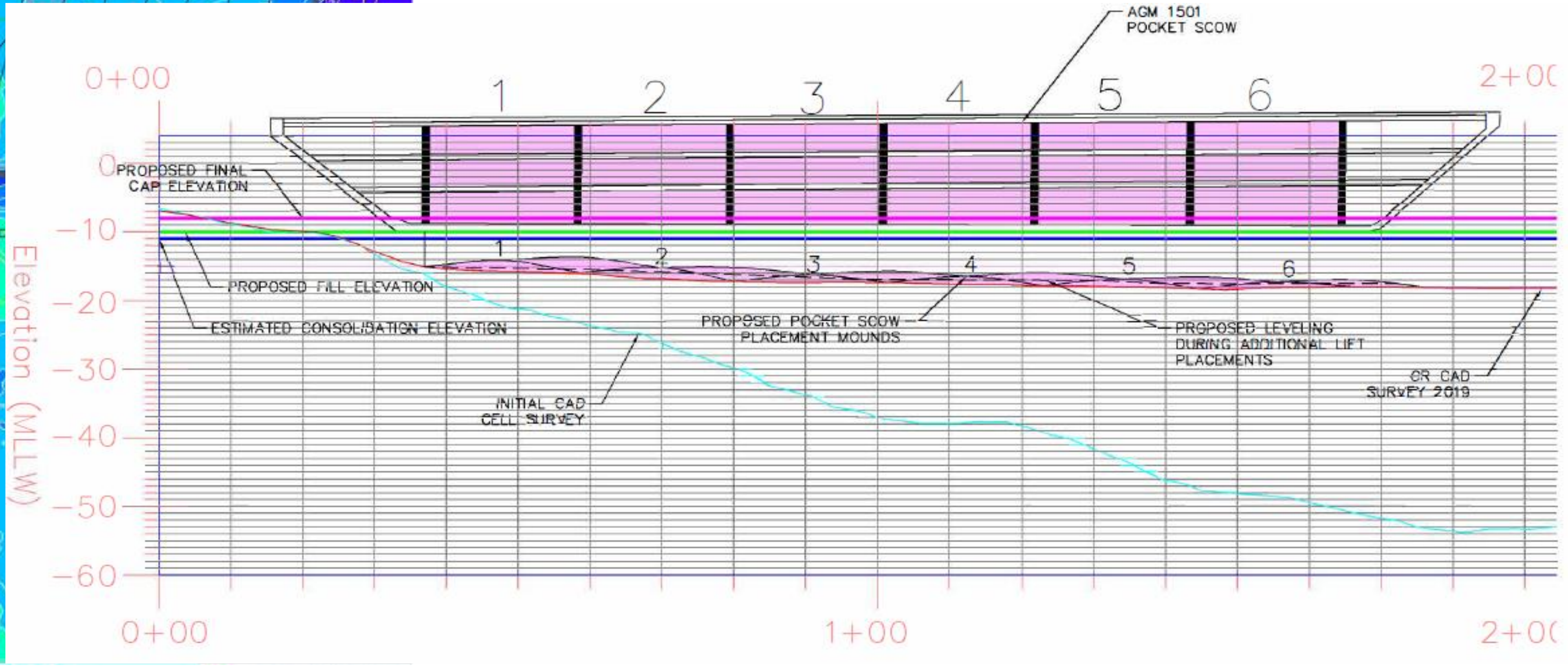
IMPERMEABLE HD
TURBIDTY BARRIER DETAIL
N.T.S.



CAD Cell Disposal Plan

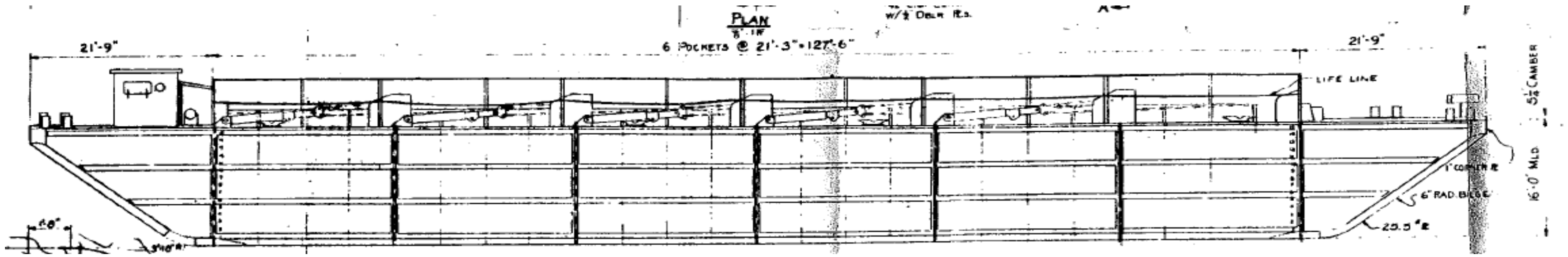
- Divided the CAD cell into ~40 ft lanes to help control placements
- Cross section for anticipated placement approach to achieve near-flat final surface for the final cap design
- Placement goals – maximize volume in Phase II CAD cell while achieving a nearly level final surface





AGM 1501 Winslow Pocket Scow

- 1,500 cy Capacity Pocket Scow (Six 250-cy pockets)
- Hydraulic ram release – each set of doors can be independently opened allowing for spot disposal if required
- Scow automation setup includes
  - Trimble SPS MSK Antennas (2)
  - Trimble SPS 461 Base RTK GNSS (1)
  - Laptop with DredgePACK
  - Toggle switches (6)
- Toggle switches were set up in Hypack hardware settings to mark when switched to on position and were each assigned to one of the six pockets
  - Tug operator completed this during placements

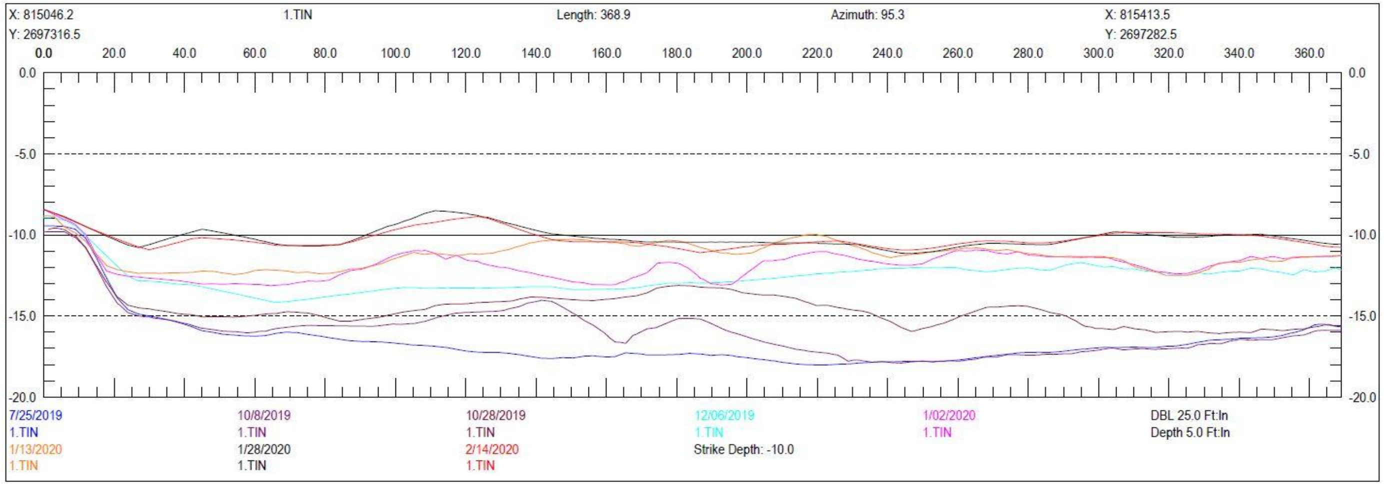


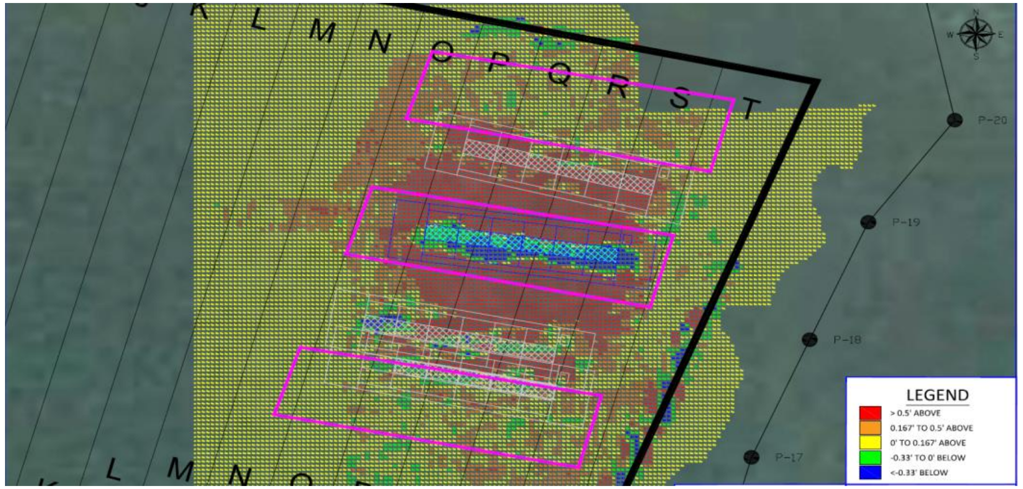
CAD Cell Operations

- Transload equipment - Sennebogen 860 Material Handler with 3 cy open top bucket
- Communication between dredge plant and LHCC to monitor and report changes in dredge material type and water content
- Total placement time was approximately 45 minutes (weather dependent)

CAD Cell Operations

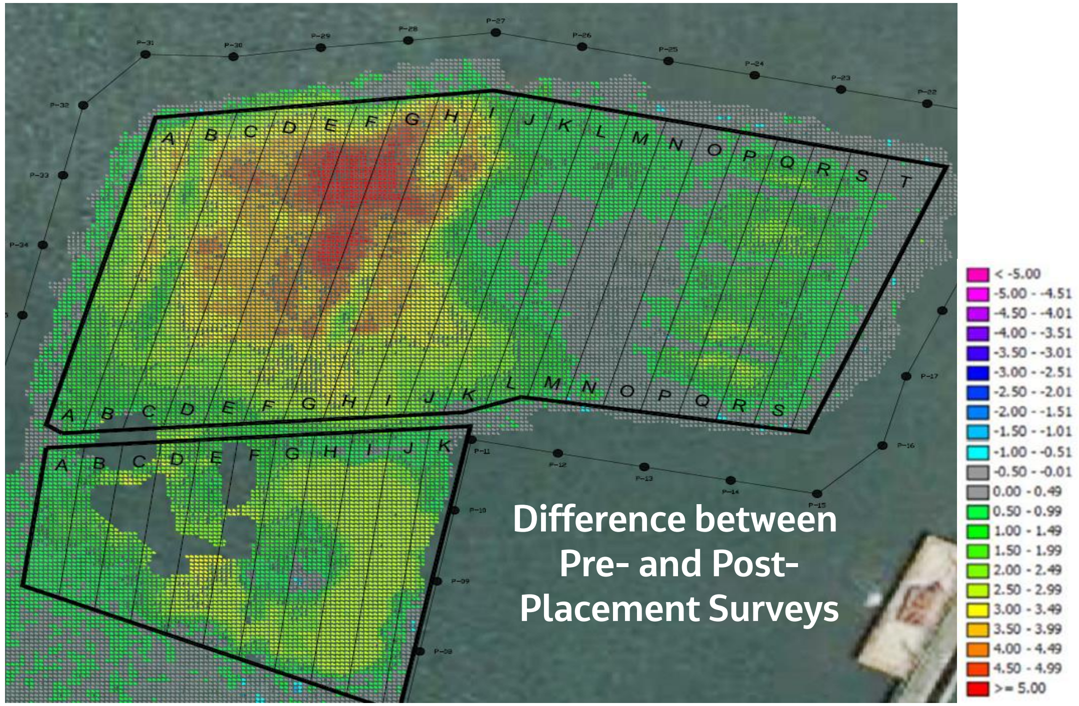
- Survey data showed ‘craters’ from allowing consolidated material to fall from pocket scow
- Hydraulic Stops were installed to better control door openings – cracking doors allowed for more controlled and uniform placement (cross section)
- Propwash analysis results showed that stable particle size is cobbles/gravel for 10% applied HP
- Approach was to apply BMPs to minimize scour
  - Tug faced away from CAD Cell edges for nearly all scow placements
  - Applied HP 25% or less when moving around CAD
  - Final cap will be placed partly on CAD cell edges to cover any potentially mobilized sediment

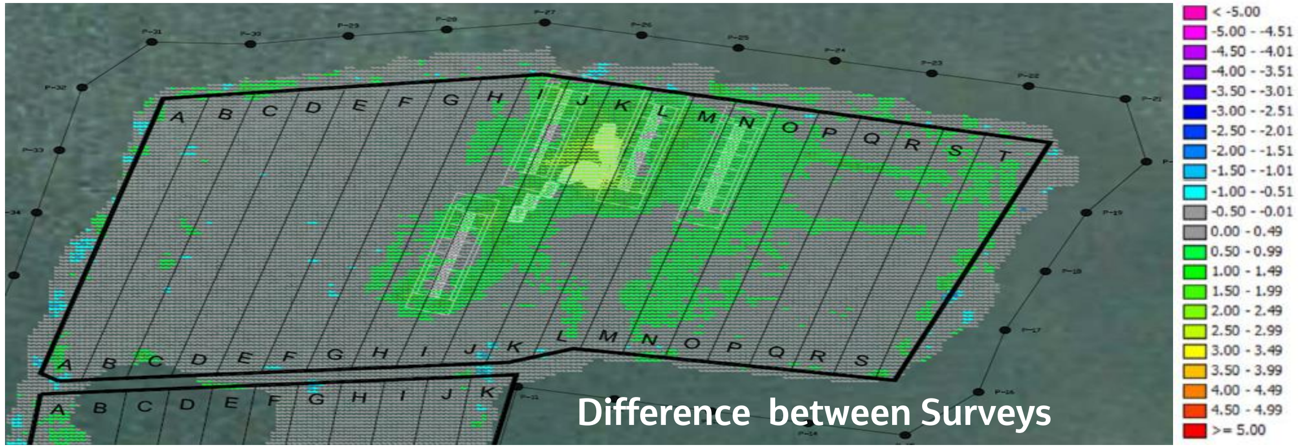


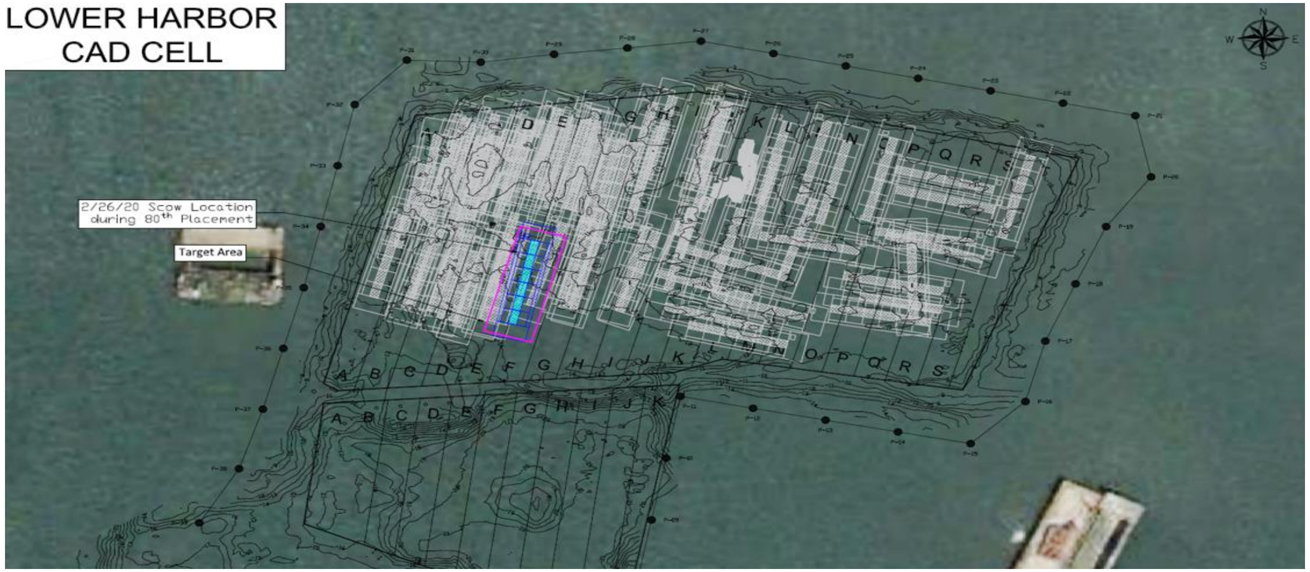


Progress Monitoring

- Daily progress monitoring included scow tracks for placement and survey updates tracking dredged and CAD cell volumes
- Results showed the fluidity of material flowing both within Phase II and into Phase I

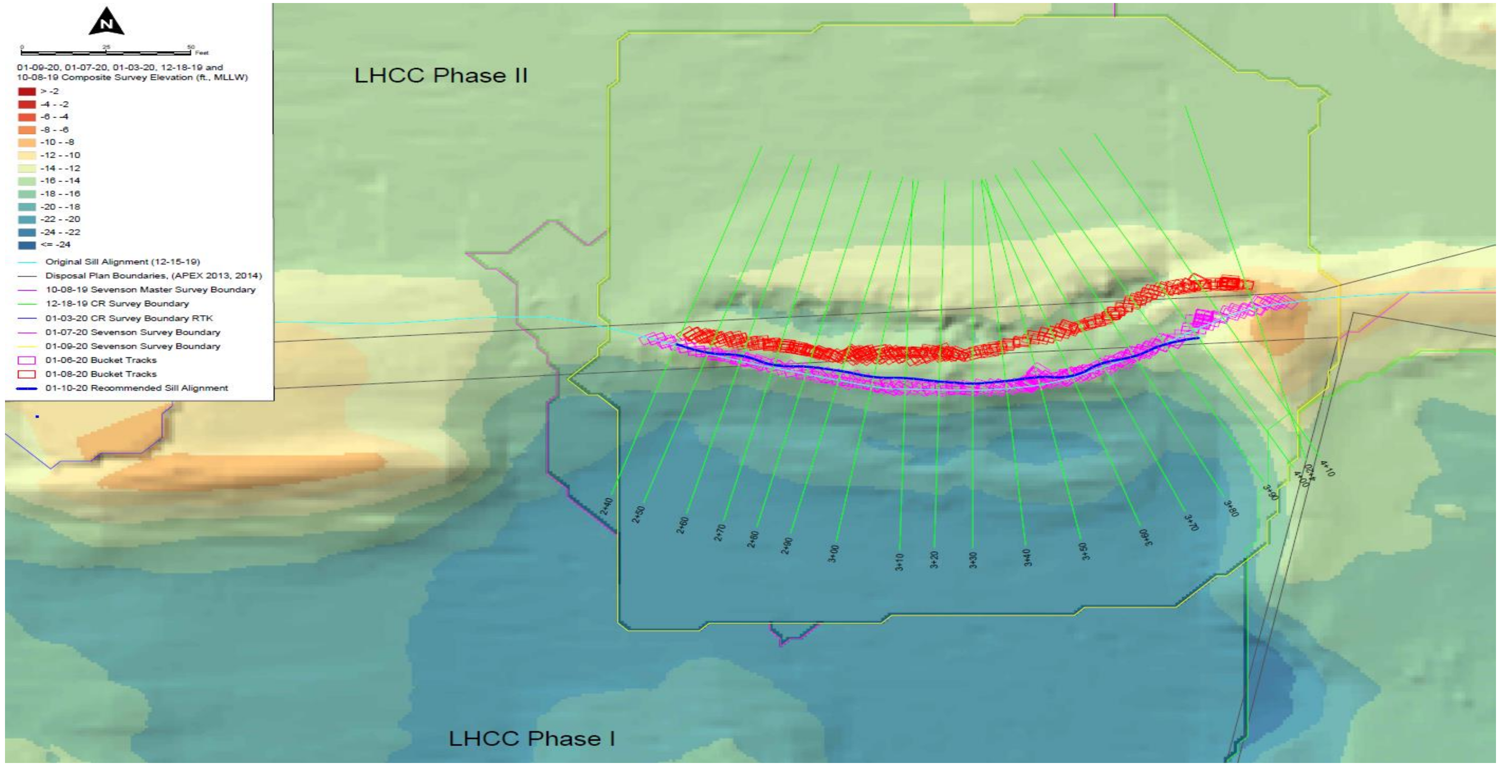


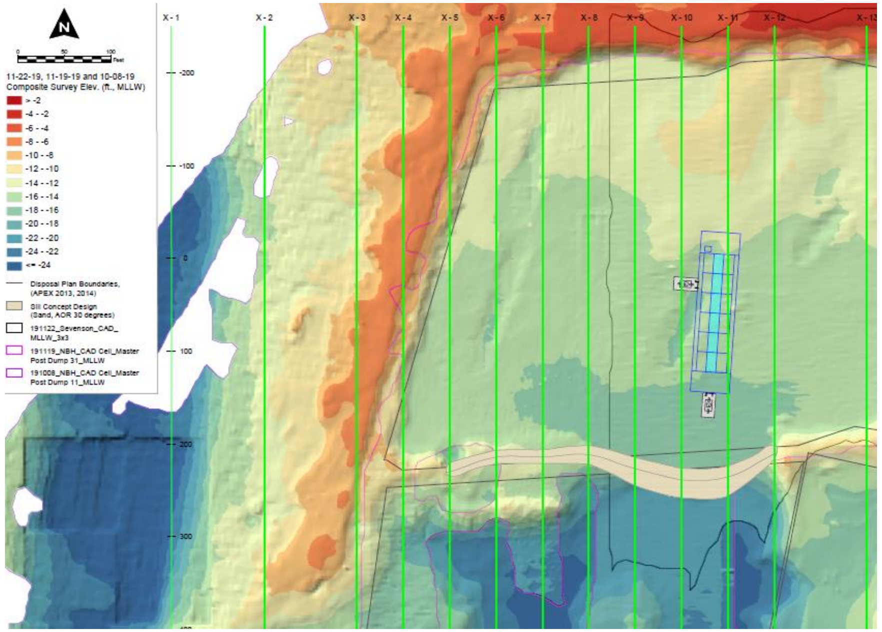


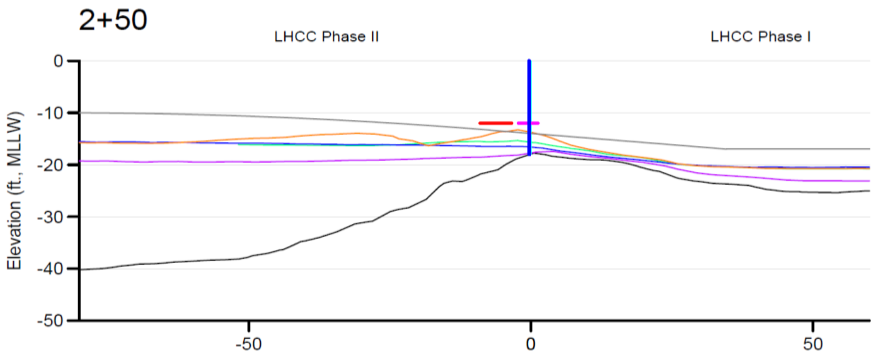


CAD Cell Sill Construction

- Sill constructed along the interface between Phase II and Phase I to prevent material flow into Phase I
- Utilized Sennebogen 860 Excavator on barge platform with conventional 1 cy bucket
- Approximately 1,500 cy of sand material was placed to target design elevation of -11 ft MLLW

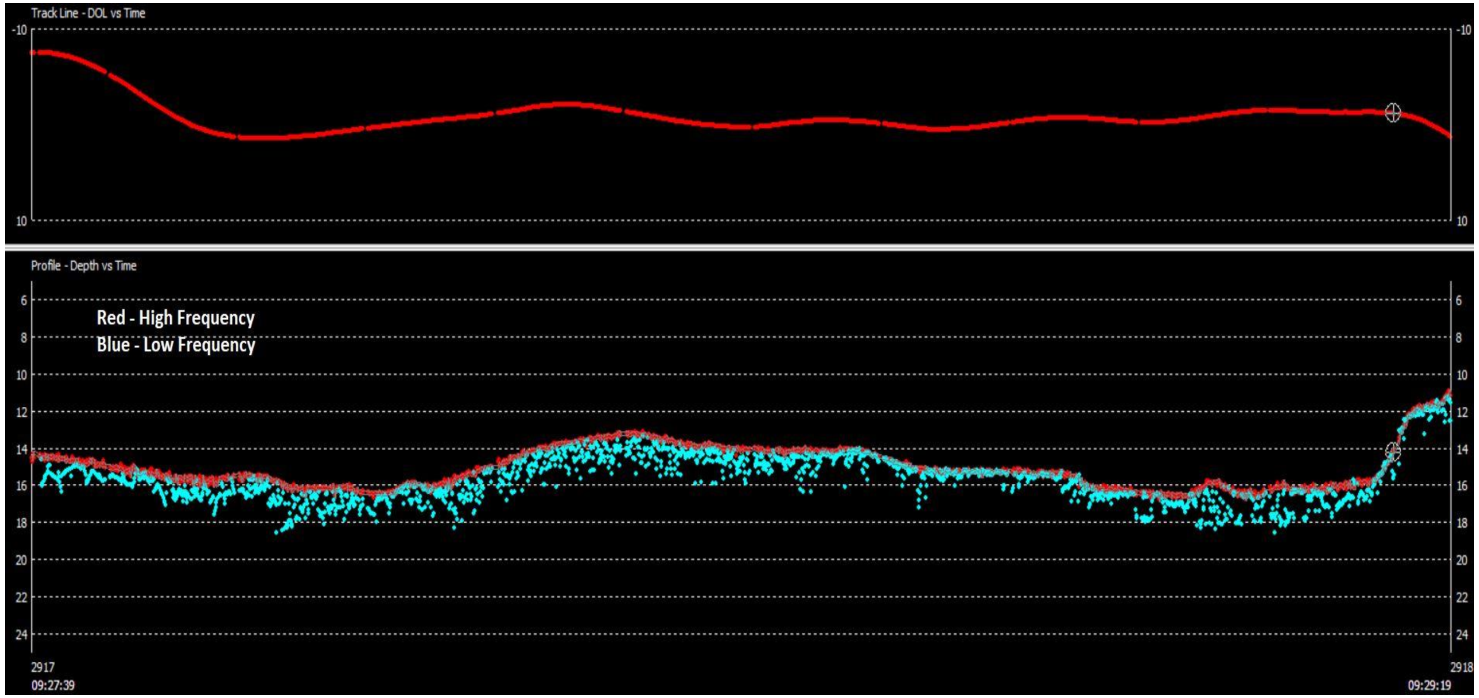


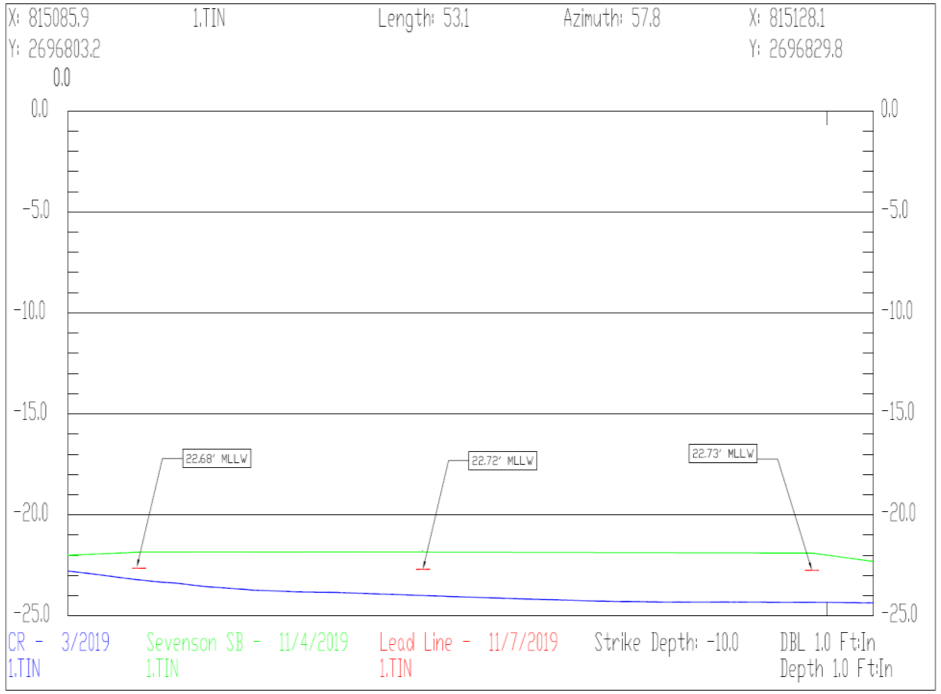




Bathymetric Survey Challenges

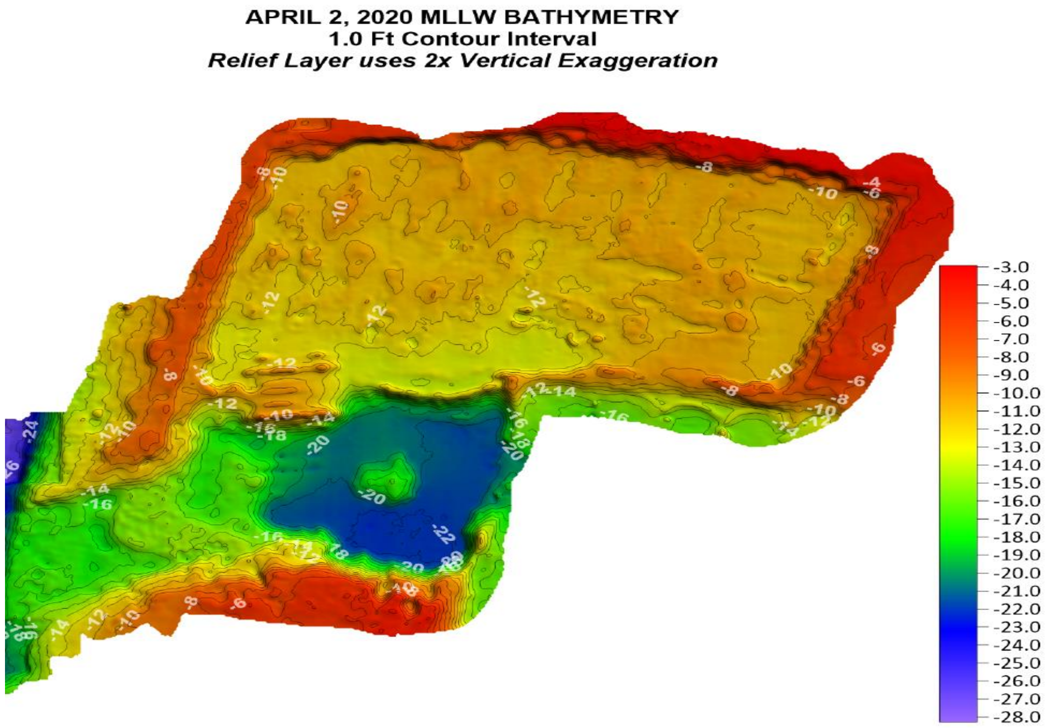
- Timing the survey to not impact production, but allow time for material to settle
- Survey data picked up a fluff layer as the organic sediment settled from water column
- Survey data initially checked with lead lines
- Dual frequency approach to determining the thickness of fluff layer (EM-1110-2-1003)

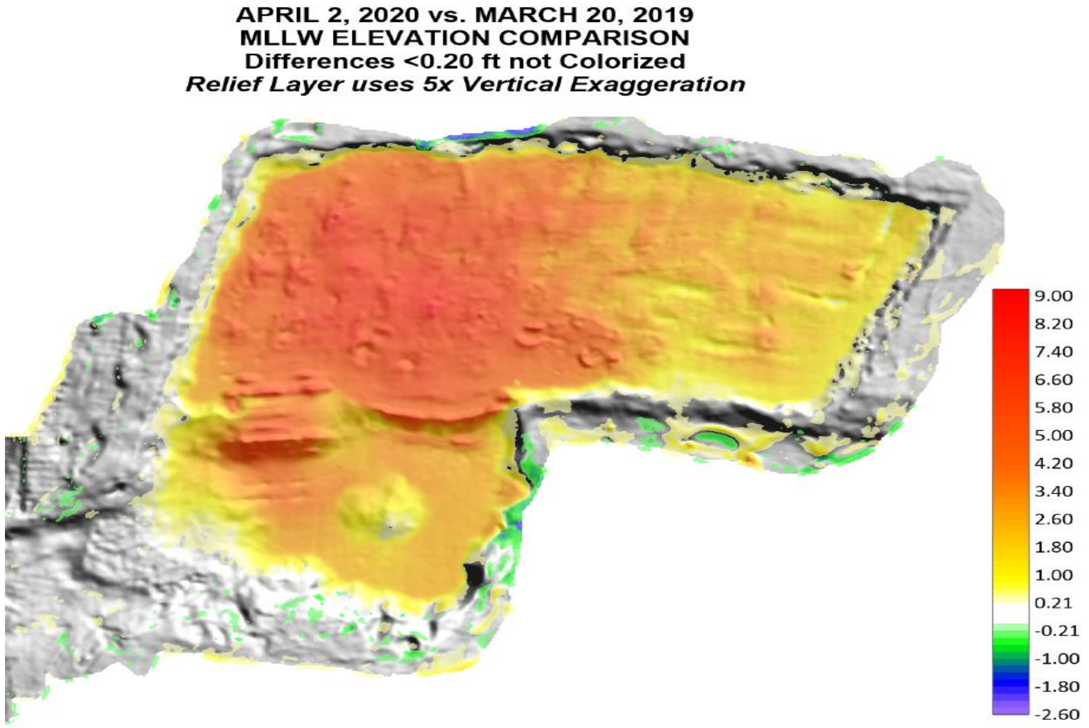




Final Conditions

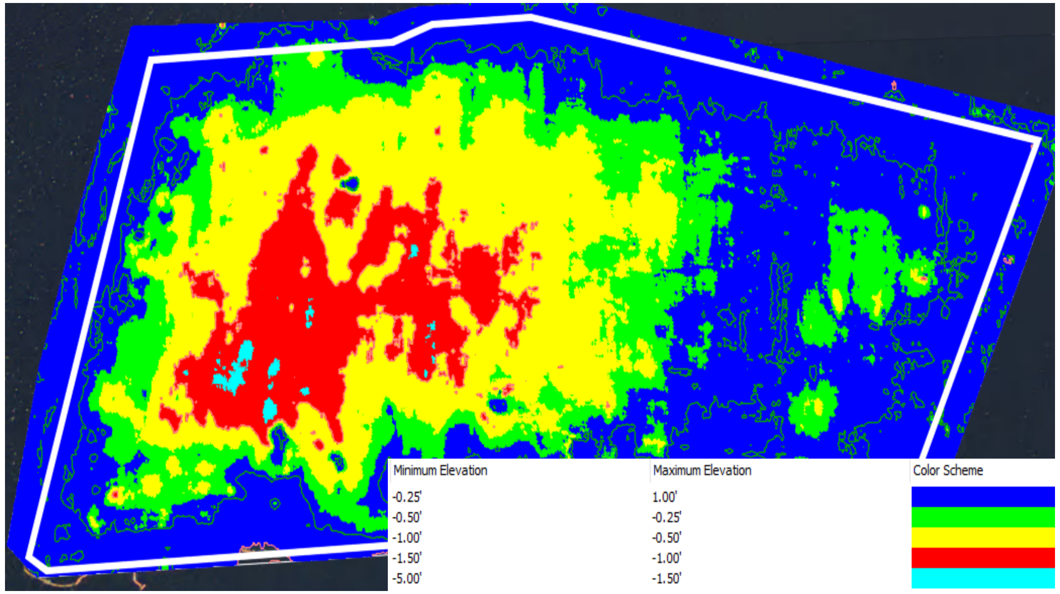
- Total surveyed volumes include:
  - Phase II – 50,276 cy
  - Phase I – 11,107 cy
  - Total combined volume – 61,383 cy
- Total in situ dredge volume – 68,057 cy

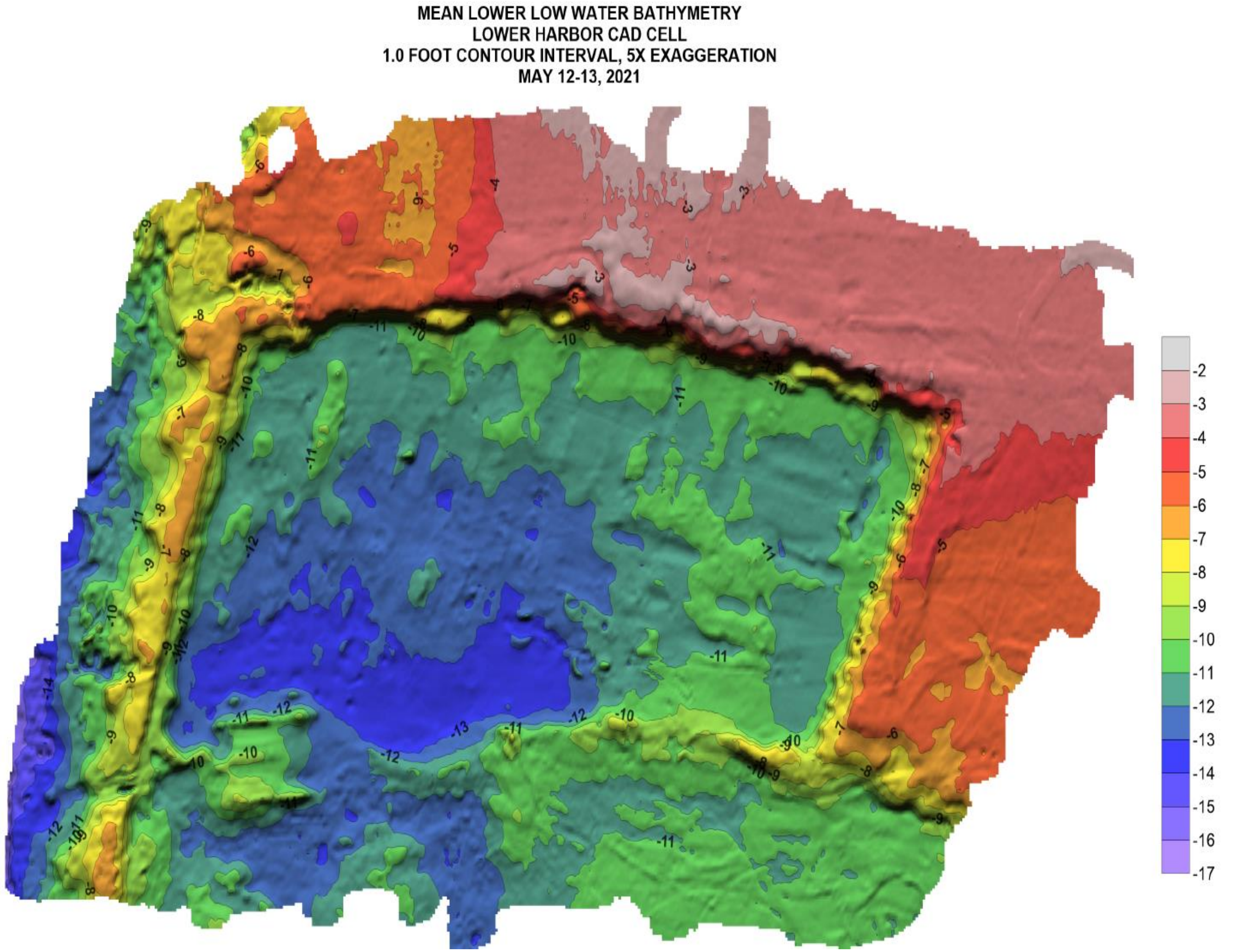




Consolidation

- Compared final post-placement surveys (04/20) and (05/21) for Phase II exclusively
  - Total average consolidation 0.4 ft
  - Maximum consolidation of 1.5 ft in thicker western zone
- Relatively level final surface was achieved to support the final 3 ft cap layer





Conclusions

- Upfront planning of dredge prisms were important to optimize capacity within CAD Cell
- Communication between dredge and CAD cell operations was critical to optimize production
- Disposal work plan development was a helpful start in operations management strategy
- Unexpected conditions of placed material behavior an adaptive management response became critical to achieving project goals
  - Modification to Pocket Scow doors to allow material to be placed in more controlled manner
  - Sill Construction to keep material within Phase II
  - Coordinate and calibrate bathymetric surveys to allow for accurate progress monitoring to optimize placements
- Overall, project achieved goals of disposing 68,000 cy of in situ material from Upper Harbor dredge areas to the effective fill elevation, while leaving required capacity for future operations for City of New Bedford
  - A total of 387,000 cy of material has been placed in LHCC to date

Thank You!

Jacobs

Challenging today.
Reinventing tomorrow.