



Soup to Nuts: An Overview of the Engineering Consultant's Dredge Design Process

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Outline

Purpose: An overview of the dredge design process by an environmental engineering consultant.



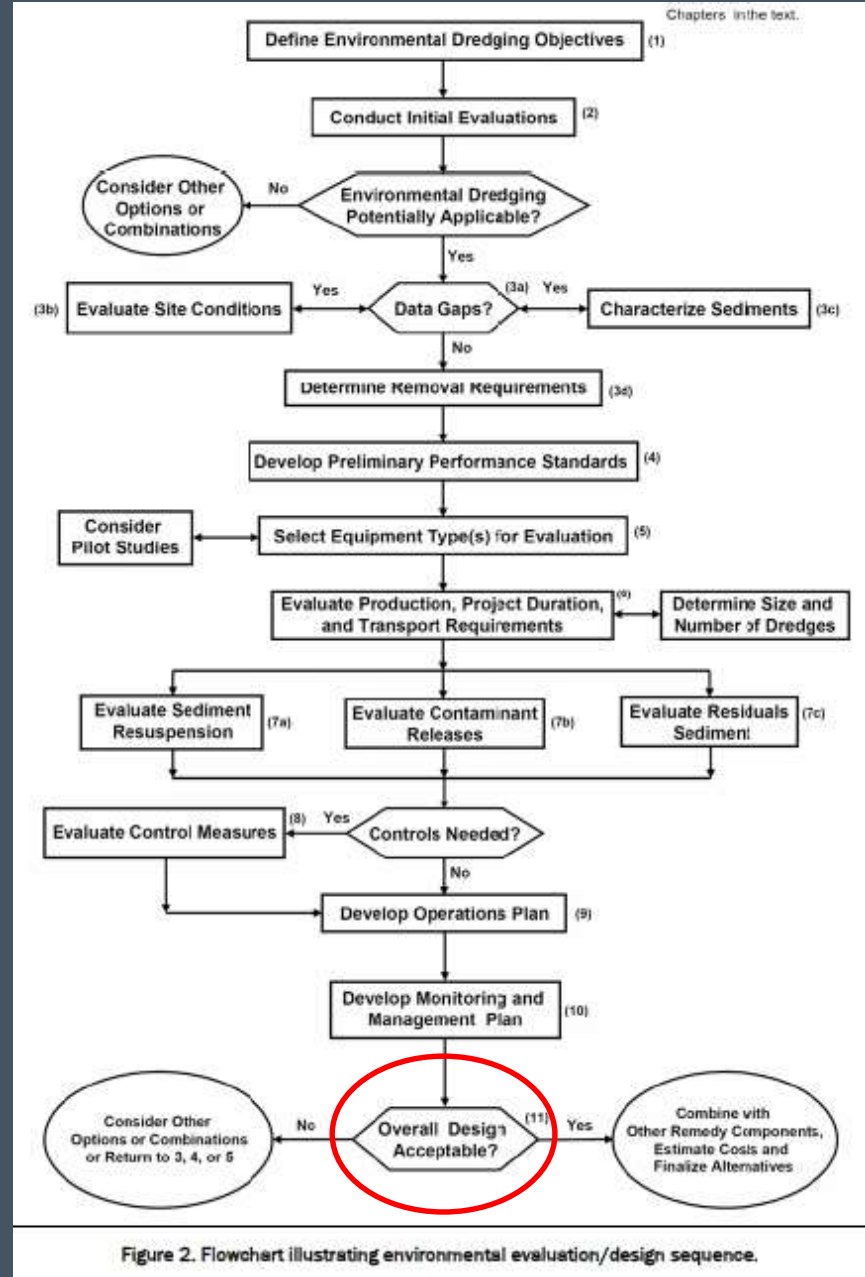
1. Overview
2. Typical Data Requirements
3. Dredge Plan Development
4. QA/QC and Constructability Review Process
5. Implementation

Overview

This presentation will focus on the engineering consultant's design process to create a dredge plan.

Assumes the overall design is acceptable.

How does a proposed dredge footprint go from paper to implementation?

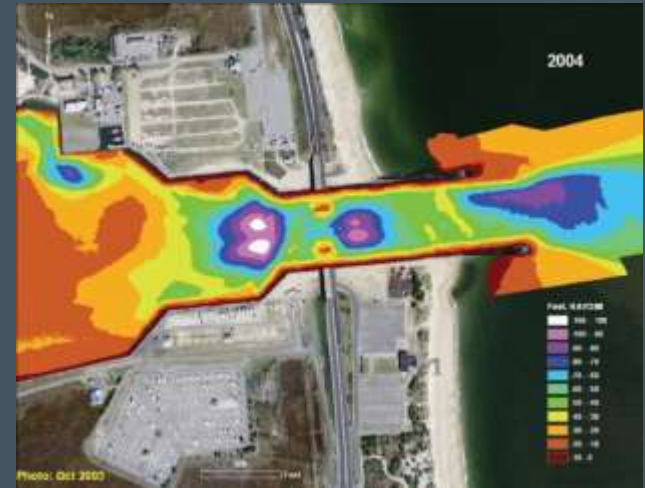


ERDC/EL TR-08-29.

Typical Data Requirements

Existing Conditions

1. Existing Bathymetry
 - Hydrographic survey
 - Supplemental topography
2. Current or flow data
3. Map of infrastructure
 - Bridges, docks, piles, utilities, etc.
4. High subgrade areas defined



Delaware Dept. of Transportation, 2013



Typical Data Requirements

Regulatory or Project Requirements

1. Engineering Constraints

- Steepness of side slopes
- Over dredge allowance
- Utilities or Infrastructure

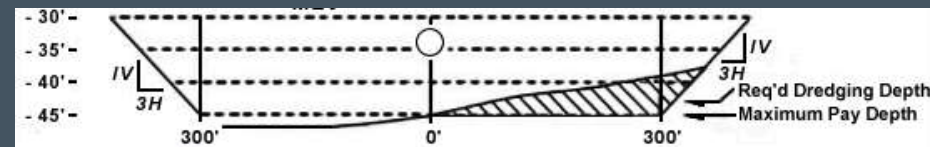
2. High Subgrade

3. Navigation channel or basin requirements

4. Riparian requirements



Port of Los Angeles, 2013

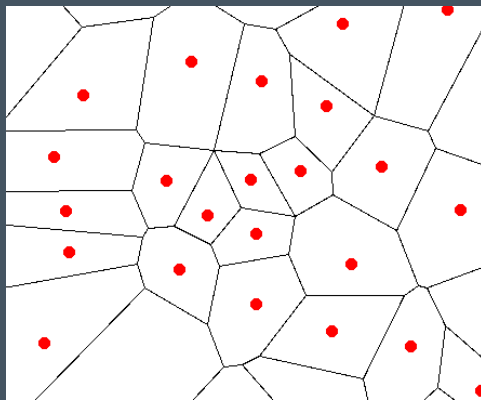


<http://education.usace.army.mil/navigation/>, 2013

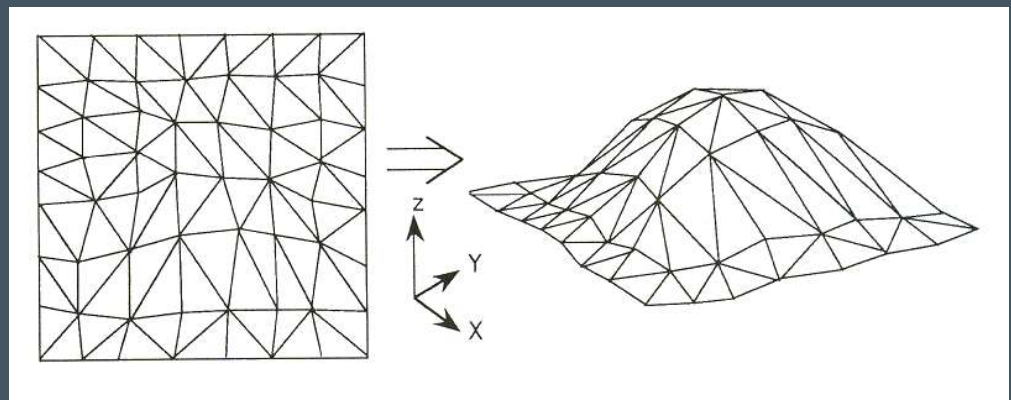
Typical Data Requirements

Basis of Design

1. Data density, in part, determines the basis of the actual dredge plan surface
 - Geostatistical model
 - Manual engineering (e.g., Thiessen Polygons)



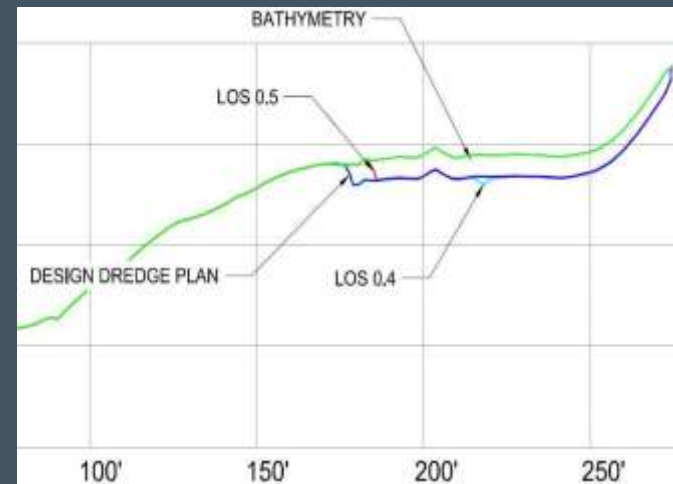
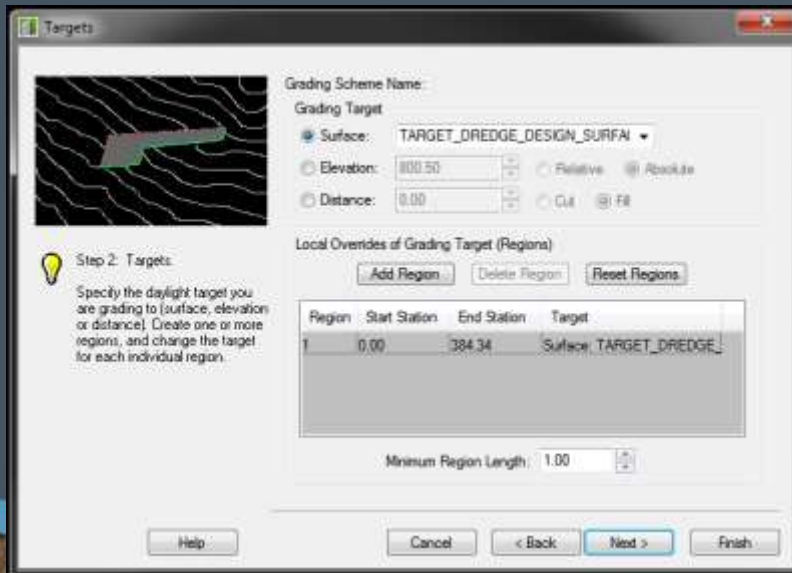
Narod.ru, 2013



Atlab.iis.u-tokyo.ac.jp, 2013

Dredge Plan Development

- Development of the dredge plan is completed using 3-D software
 - (AutoCAD: Land Desktop, Civil 3D, etc.)
- 3-D dredge plan is constructed, reviewed, and refined in real-time

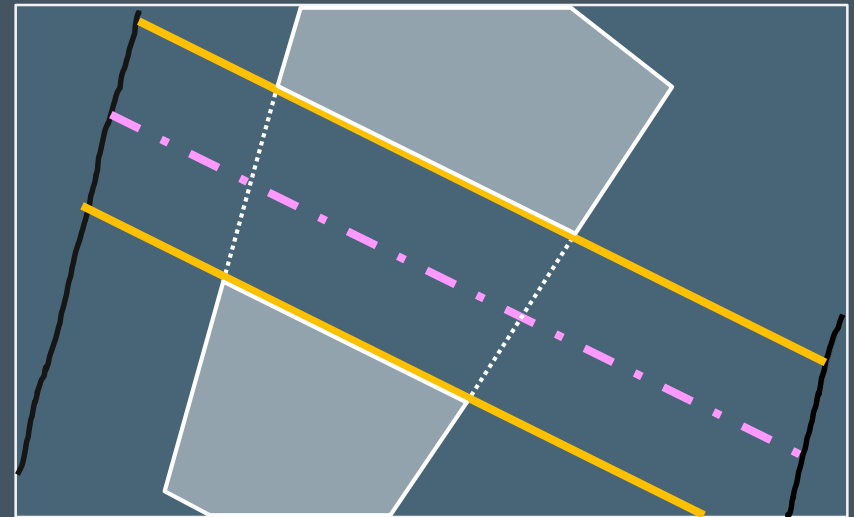
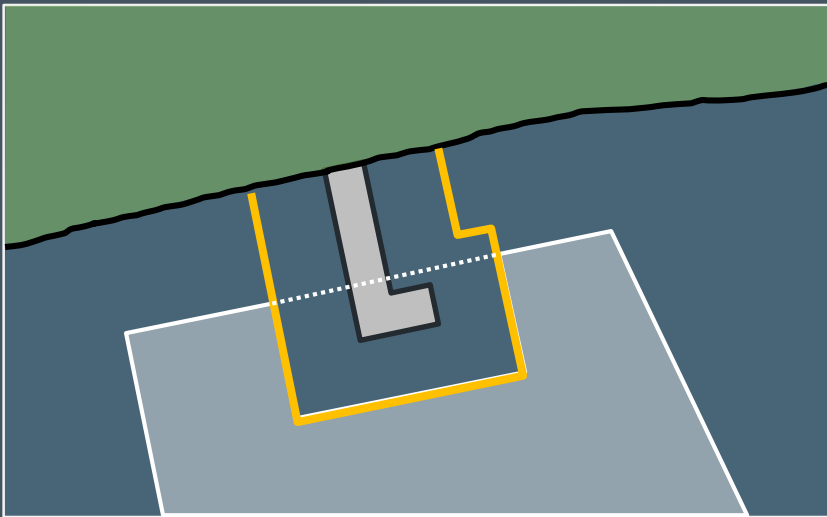


Anchor QEA, 2013

Dredge Plan Development

Plan View Design Components

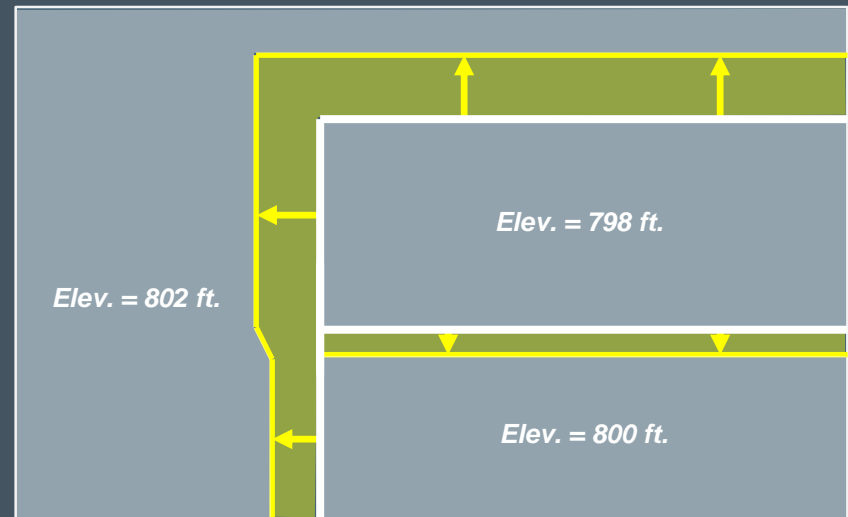
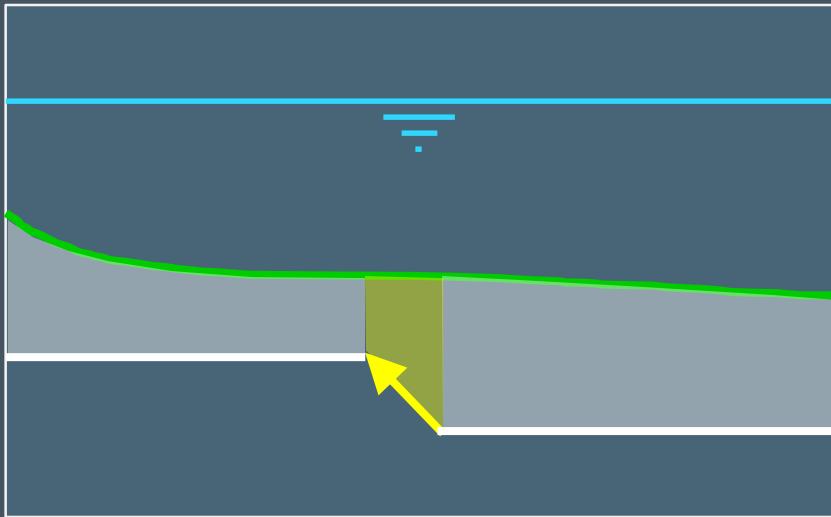
- Incorporate infrastructure offsets
- High Subgrade



Dredge Plan Development

Three Dimensional Design Components

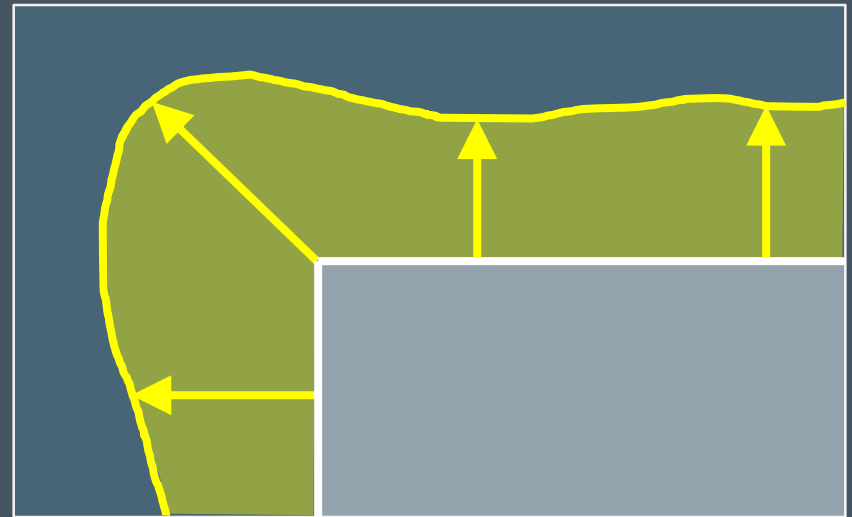
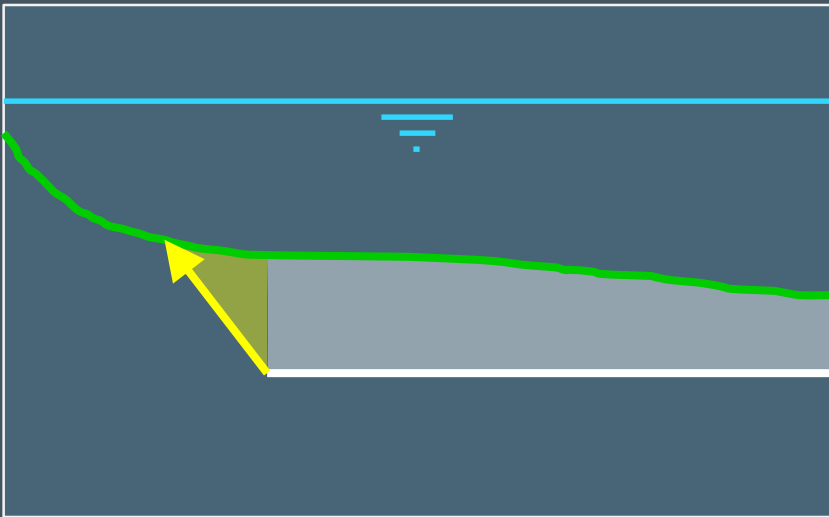
- Grading interior side slopes
- Varying elevation/depth prisms



Dredge Plan Development

Three Dimensional Design Components

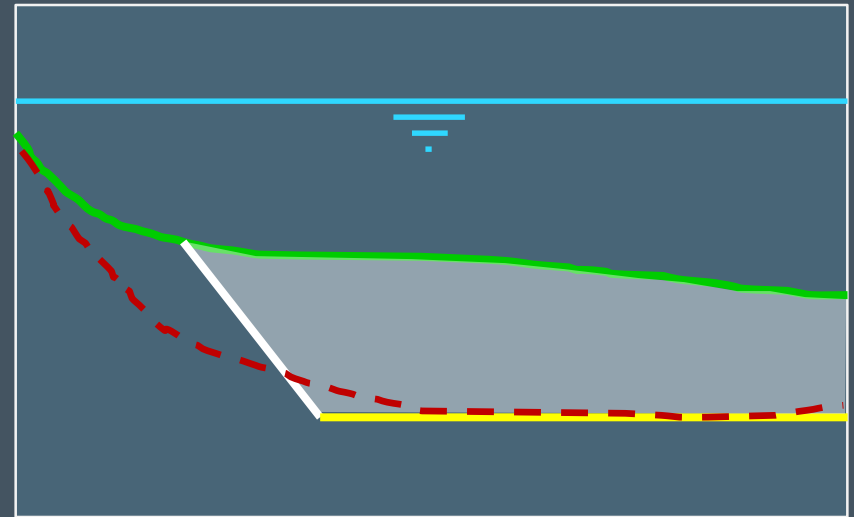
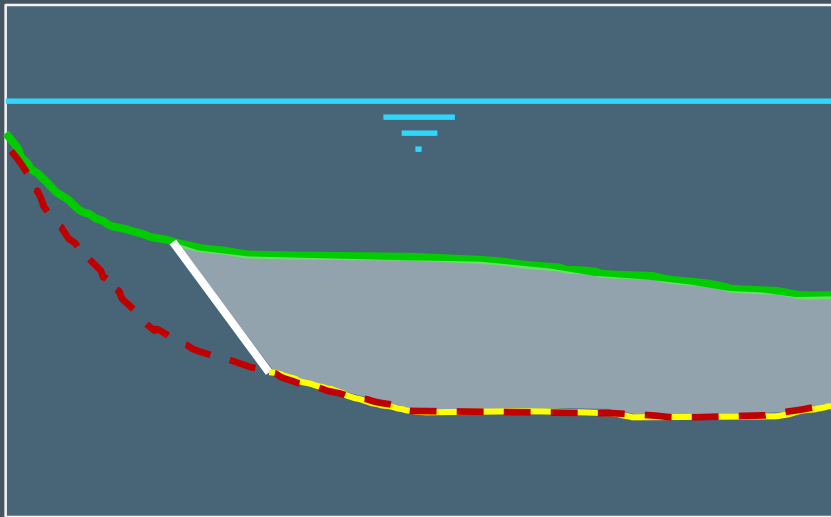
- Grading exterior side slopes
- Daylighted to bathymetry
 - Grading “up” or “down”



Dredge Plan Development

Three Dimensional Design Components

- Interior “infill” surface
 - Geostatistical model surface or flat elevation or depth prisms



Dredge Plan Development

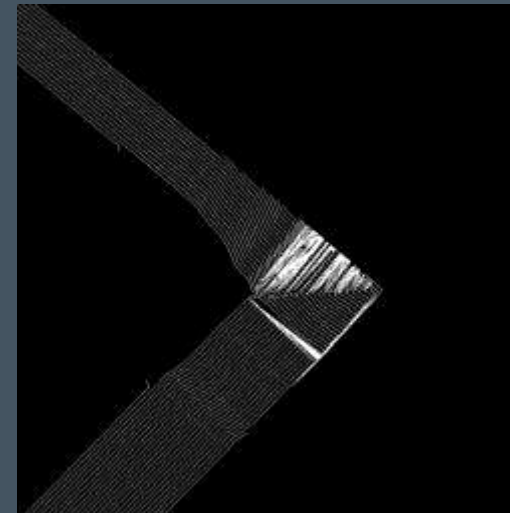
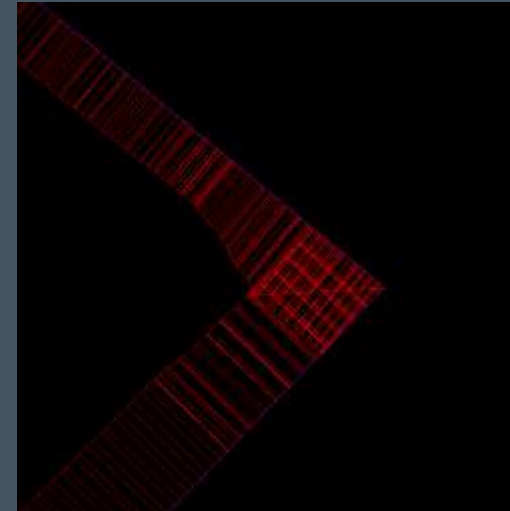
Typical Deliverables

- Footprint
 - Shapes (.dxf) and/or Vertices (.xyz)
- Daylight line for Design and Overdredge Surfaces
 - Outer extents of dredging
- Design and Overdredge surface (.tin, .xml, or .xyz)

QA/QC and Constructability Review Process

QA/QC Steps Taken During the Initial Design Process

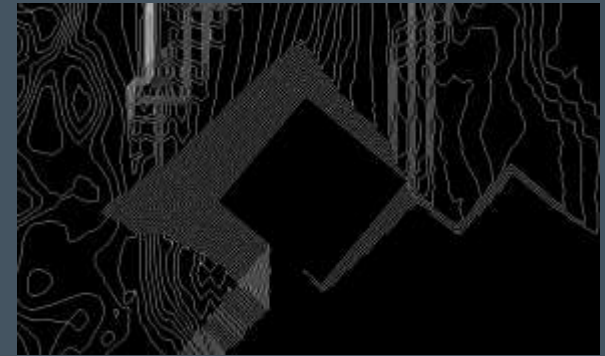
- Corners
 - Overlapping CAD lines
- Side Slopes
 - Angle and intersections
- Design versus Overdredge
- Dredge Surface versus Bathymetry
- Final Contours



QA/QC and Constructability Review Process

QA/QC Steps Taken Following the Initial Design Process

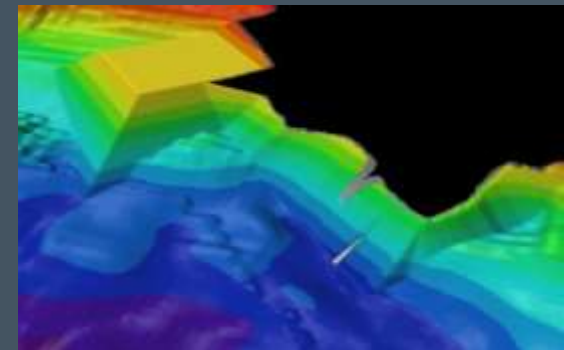
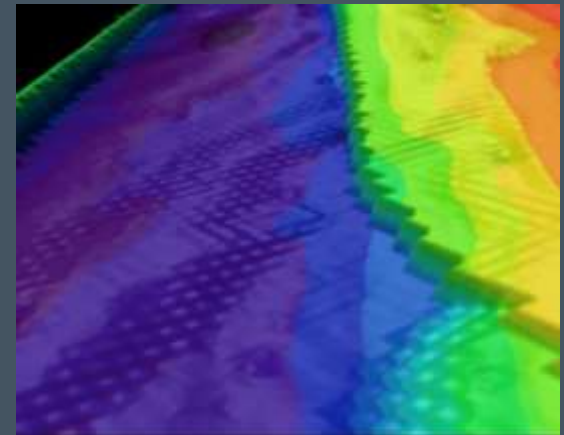
- Volumetric analysis
 - Comparison of bathymetry versus design
 - Comparison of design versus over-dredge surface
- P.E. Review
 - Constructability
 - Does the dredge plan meet the objectives?



QA/QC and Constructability Review Process

QA/QC Steps Taken Following the Initial Design Process

- Constructability review
 - Slope steepness
 - Dredge plan surface variability (smoothness)
 - Design versus Overdredge surface
- Typical review software: Hypack®, fledgermaus, AutoCAD



J.F. Brennan, 2013

QA/QC and Constructability Review Process

How to Help the Consultant During the Review Process

- If revisions are required, inform the consultant in writing, with example figures or images provided
- Provide enough time for the QA/QC process to cycle through again

Implementation

The Consultant's role During and Following Construction

- The consultant is prepared to make additional revisions as required by field conditions
- Document the as-built conditions (post-dredge survey) for re-dredge design or inclusion into design of adjacent areas
- Dredged sediment volume tracking

References

USACE Technical Guideline

Palermo, M., Schroeder, P., Estes, T., and Francingues, N. *Technical Guidelines for Environmental Dredging of Contaminated Sediments*. September, 2008. U.S. Army Corps of Engineers, Engineer Research and Development Center. ERDC/EL TR-08-29.