Smith Mountain Lake Sediment Management:

Similar Challenges for Unique Lake Systems

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Sedimentation Working Group
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Team Introduction

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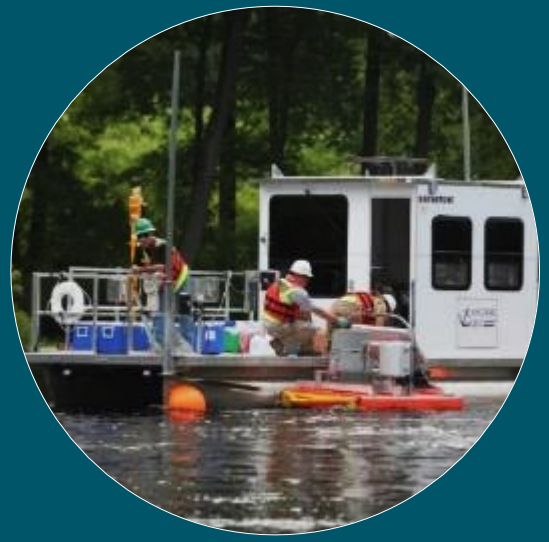
1500+
Clients
550+
Employees
28
Offices

Strengths and Expertise

Engineering



Environmental Science

Planning and Restoration

Technology and Innovation

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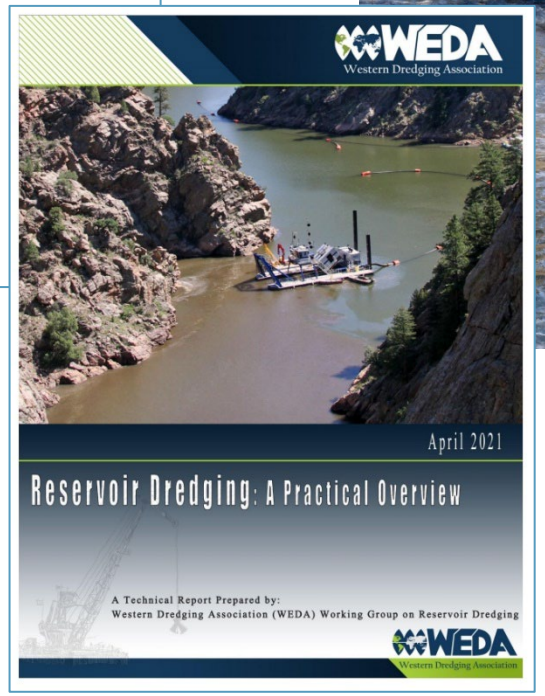
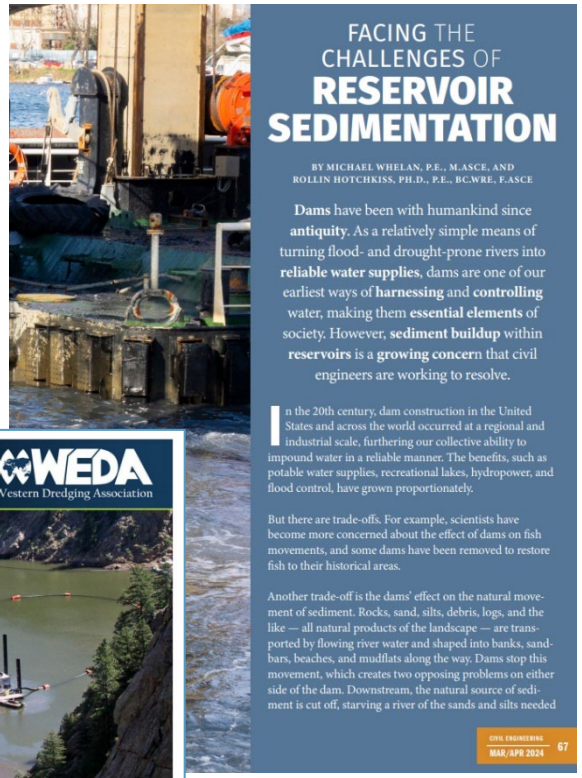
Anchor QEA Contributions to Published Industry Guidance

- National Reservoir Sediment Sustainability Team (NRSST)
  - Consortium of federal agencies and university researchers
- Reservoir dredging work groups
  - North America: Western Dredging Association (WEDA)
  - International: World Dredging Association (WODA)
- Popular publications
  - ASCE Civil Engineering magazine

NRSST publication



WEDA publication



ASCE *Civil Engineering* magazine March/April 2024 issue

Agenda

01 Regional Understanding

02 Sediment Management Process

03 Watershed Management Process

04 Strategic Planning and Design

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Regional Understanding

Regional Understanding

- Tri-County Lakes Administrative Commission
  - Administrative department for the four Virginia counties surrounding Smith Mountain Lake and Leesville Lake
- Smith Mountain Lake
  - 20,000 acres and 500-mile shoreline
  - Three counties—Bedford, Franklin, and Pittsylvania
- Leeville Lake
  - 3,400 acres and 110-mile shoreline
  - Three counties —Bedford, Campbell, and Pittsylvania
- Upper Roanoke Watershed

Current Challenges

- Sedimentation within lakes
  - Creating unfavorable environmental conditions
  - Impacting residential homeowner access to the lake
  - Impacting recreational opportunities
- Watershed management
  - Upstream development and land management practices increasing sedimentation within lakes
- Shoreline management

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Typical Lake Management Approaches

- Sediment Management Plan
  - Finite dredging event to address current sedimentation
  - Dredged Material Management plans
- Watershed Management Plan
  - Advance planning to reduce future sedimentation
    - Stream restoration, erosion controls, land use management strategies
  - Strategically plan maintenance dredging to control budget, schedule, and disturbed impact
  - Intentional, location-specific sedimentation—sediment traps, forebays

Sediment Management Process

Dredging Technology

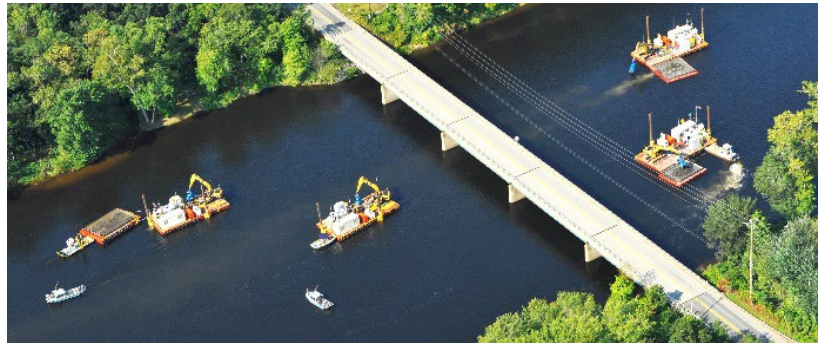
Dredged Material Management

Dredged Material Placement

Dredging Technology

Dredging Technologies

- Mechanical
  - Crane and cable (aka clamshell)
  - Hydraulic excavator
  - Specialized
- Hydraulic
  - Cutterhead
  - Dustpan/Horizontal Auger
  - Specialized
- Removal/excavation “in the dry”
  - Cofferdam
  - Temporary dams



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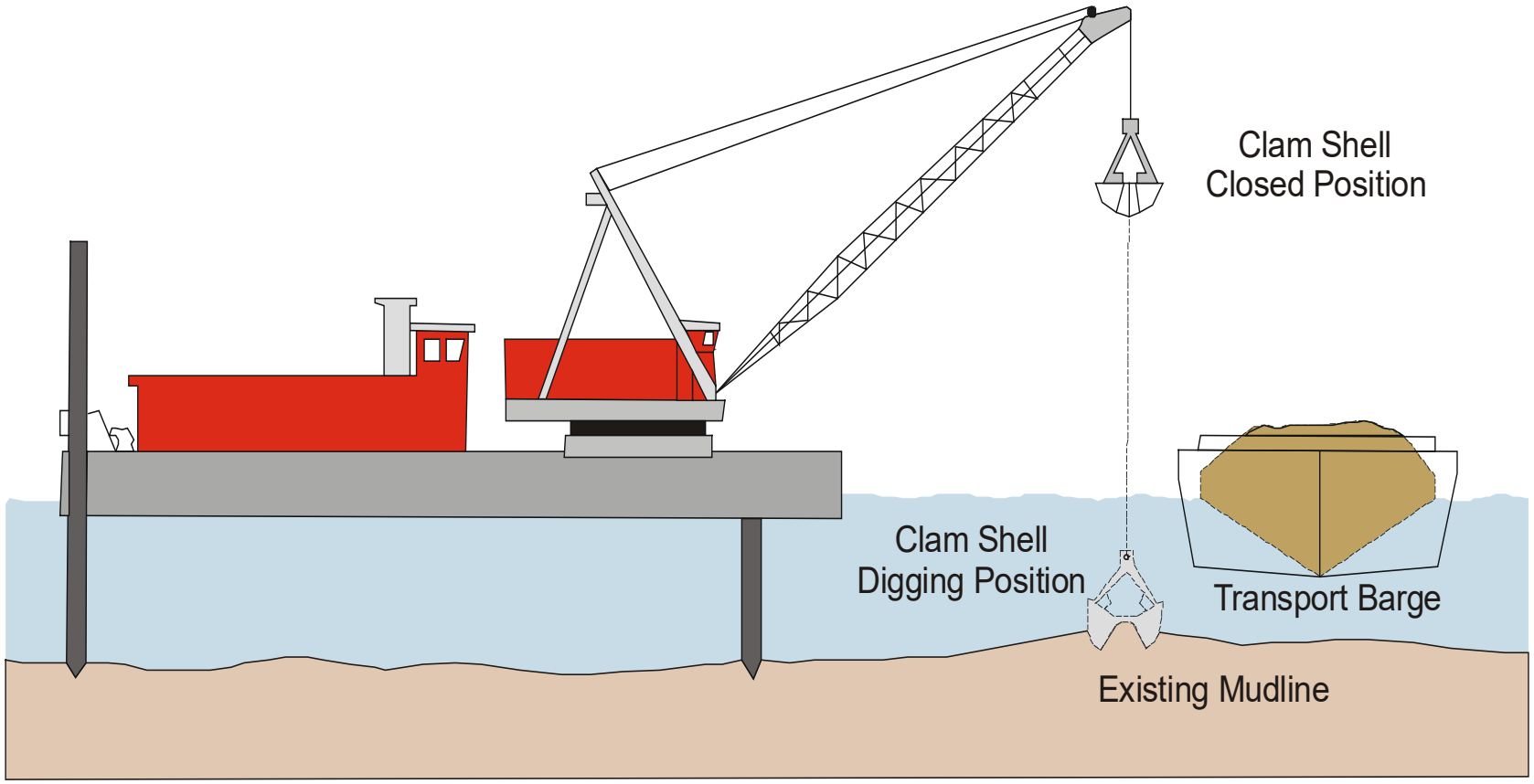
Dredging Methodology Determination

- Evaluate project conditions to determine dredging methodology
  - Comparison of hydraulic dredging, mechanical, and removal in the dry
- Various considerations for each case
  - Cost, production, water management, local impacts

Mechanical Dredging Technologies



Mechanical Dredging Technologies (cont.)

Overview of Hydraulic Dredging and Dewatering Activities

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“In-the-Dry” Technologies

Cofferdam

Water Bladder Dam

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Community Awareness During Dredging

- **Noise:** complying with all noise ordinances during work hours; understanding when work will occur, especially on weekends
- **Traffic:** staging area will be constructed for the project; planning necessary to evaluate possible trucking routes for hauling sediment
- **Safety:** securing site and clearly marking water operations
- **Sediment:** contractor will be required to comply with permits for sediment control
  - Turbidity and water quality controls
  - Stabilization of sediment to prevent tracking on roads

Dredged Material Management

Managing Dredged Material

- Sediment transport
- Sediment screening
- Sediment dewatering
- Water treatment

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Sediment Transport Options

- Depends on several factors
  - Dredging areas (depends on dredge type and staging/processing)
    - Barge transport
    - Pipeline transport
    - Truck transport
  - Staging/processing (depends on disposal)
    - Trucks
    - Conveyors
- How much do you leave to a contractor?

Mechanical Dredge—Barge Transport

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Hydraulic Dredge—Pipeline Transport

Mechanical Debris Removal

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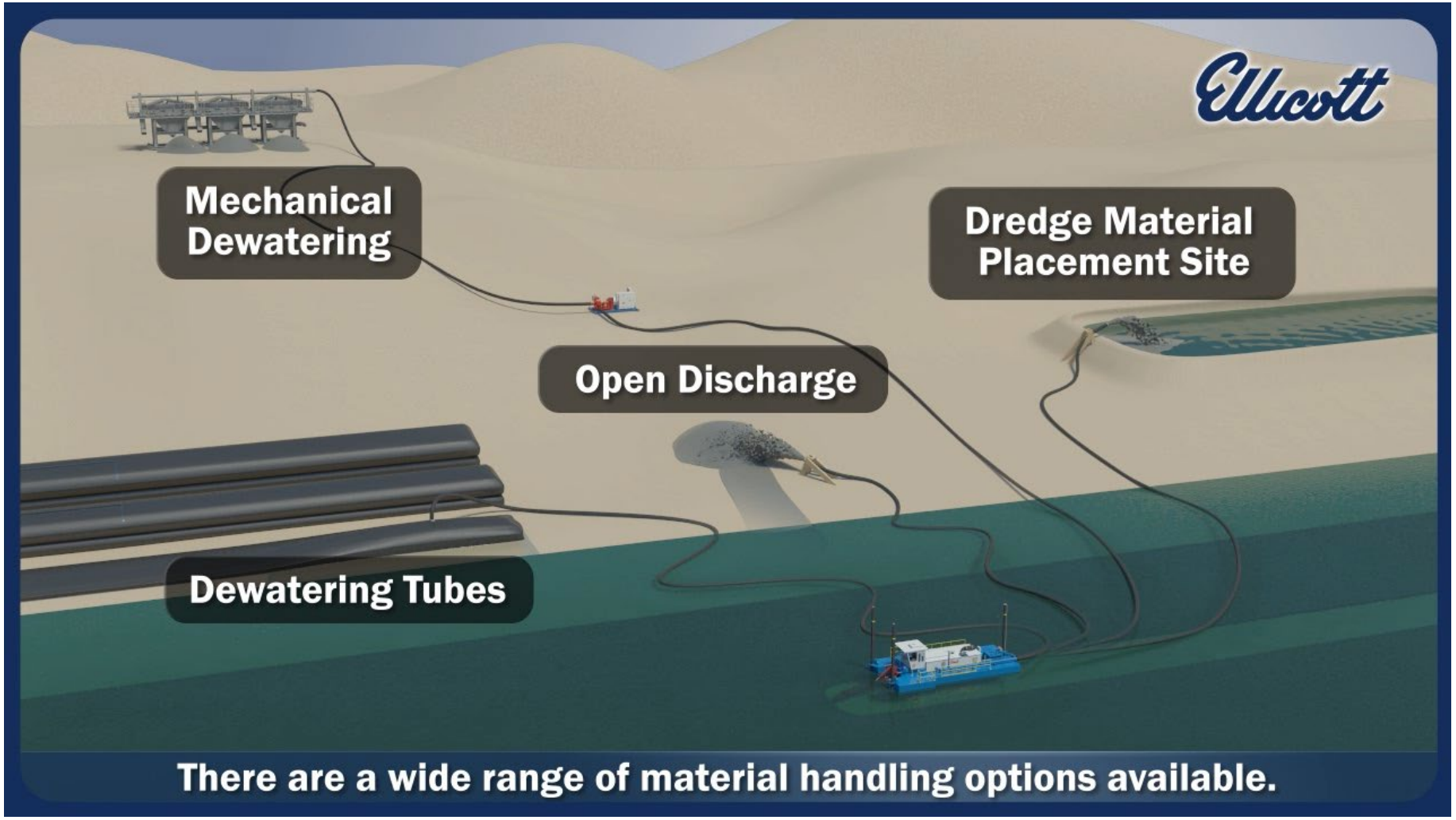
Sediment Dewatering



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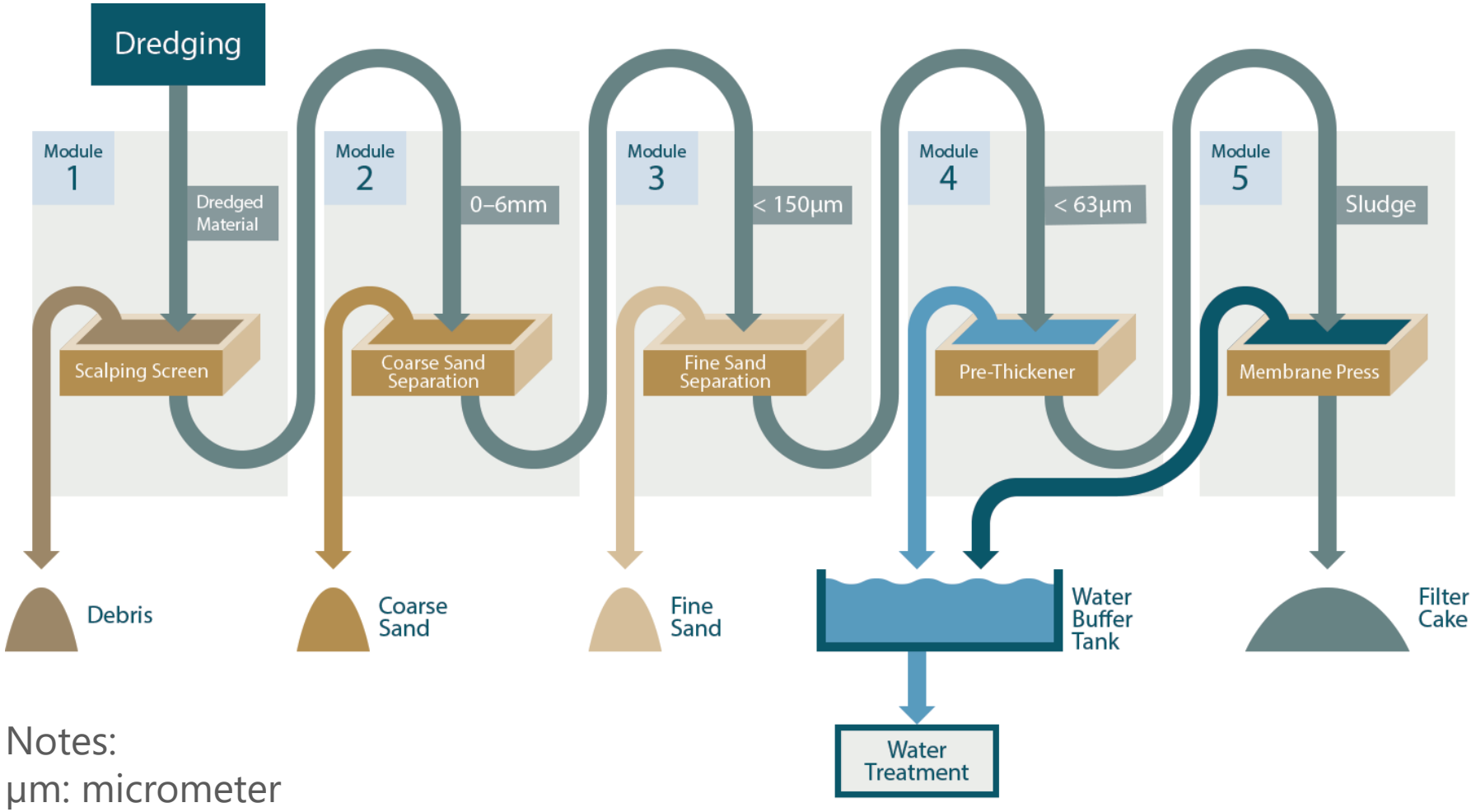
Sediment Dewatering

- Need and extent based on dredging type and disposal
- Simple gravity dewatering
  - Piles, barge (mechanical)
  - Confined disposal facility (mechanical or hydraulic)
- Geotubes
  - Low-cost option
  - Usage has been increasing
  - Need space and time
- Mechanical
  - Screening, hydrocyclones, presses
  - Incorporates sand/gravel separation
  - Higher cost but faster turnaround, drier material

Dewatering System Process Flow Diagram



Notes:
µm: micrometer
mm: millimeter

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Water Treatment

- Remaining suspended sediments removed from collected water
  - Flocculants and polymers used to settle out fine particles
  - Series of clarifiers, weir tanks, and V-bottom collection tanks used to collect remaining solids
- Clear water discharged back to the lake
  - Discharge monitored for compliance with permit requirements
- Additional systems can be added to treat contaminants if needed

Dredged Material Placement

Disposal and Placement Options

- Beneficial use
- Upland stockpiling
- Upland placement
- Commercial landfill

Beneficial Use

- Landfill cover and cap
- Soil and fill material
- Habitat restoration
- Shoreline stabilization

Upland Stockpiling

- Dewatered sediment transported using standard dump trucks
  - Sealed tailgates
  - Standard triaxle sizing
- Stockpile areas managed to control erosion
  - Silt fence, hay bales, and other controls
- Final stockpiles graded/seeded for storage of material

Upland Placement Facility

- Confined Placement
- Liabilities and risks
  - Owner vs. landfill vs. shared
  - Long-term management
- Contaminant stability
- Location selection
  - Siting
  - Foundation conditions
  - Geometry and capacity
  - Berm and spillway design
  - Hydraulic efficiency
  - Transport distance
  - Management and drying

Commercial Landfill

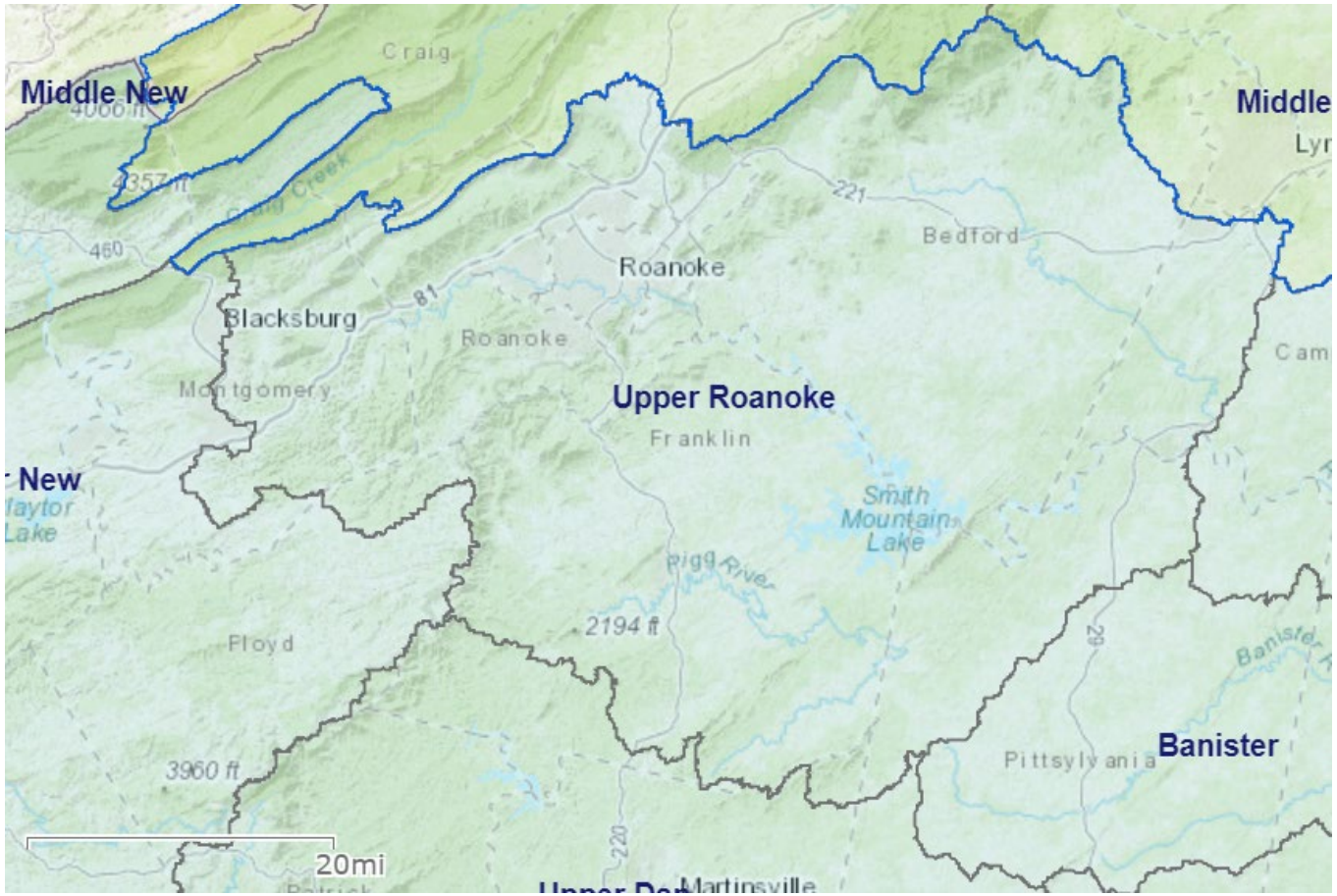
- Transport modes
- Processing for transport
- Measurement and payment
  - Truck scale
  - Barge displacement
  - In situ
- Liabilities and risks
  - Owner vs. landfill
- Highest cost option

Questions on dredging and dredged material management?

Watershed Management Process

What is a Watershed?

- Watersheds, or drainage basins, are areas of land that drain into rivers or bodies of water. Every waterbody in Virginia, ranging from small creeks to large rivers, has a watershed, and every resident in Virginia lives in a local watershed



Typical Sources of Sedimentation

- Shoreline erosion
- Runoff
- Organic material

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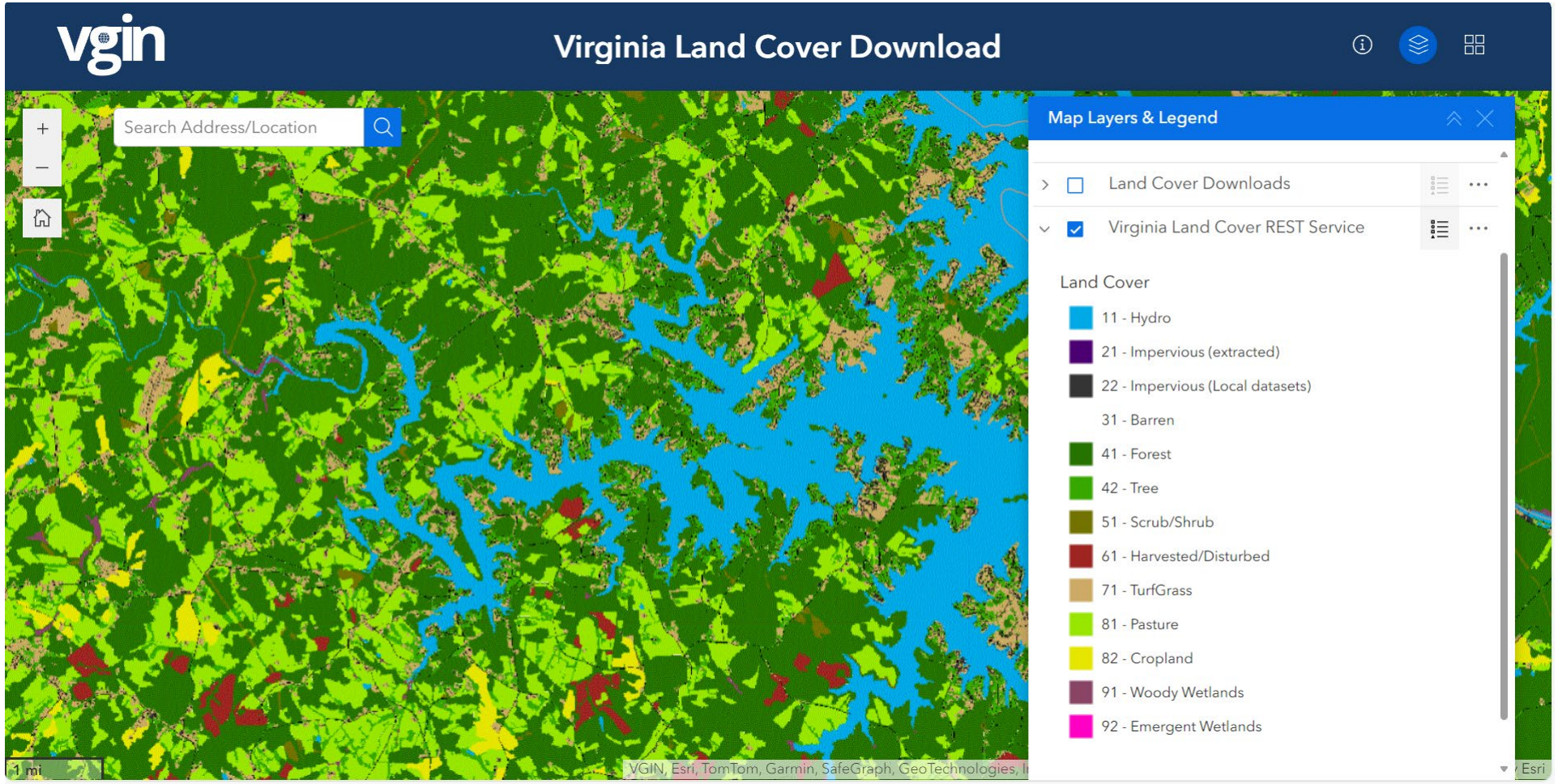
Methods to Manage Sedimentation

- Prevent/slow sedimentation
  - Land use practices to minimize sediment disturbance
  - Stream/bank stabilization
- Create areas for sediment to accumulate
  - Maintenance dredging
  - Forebays

Land Use Planning



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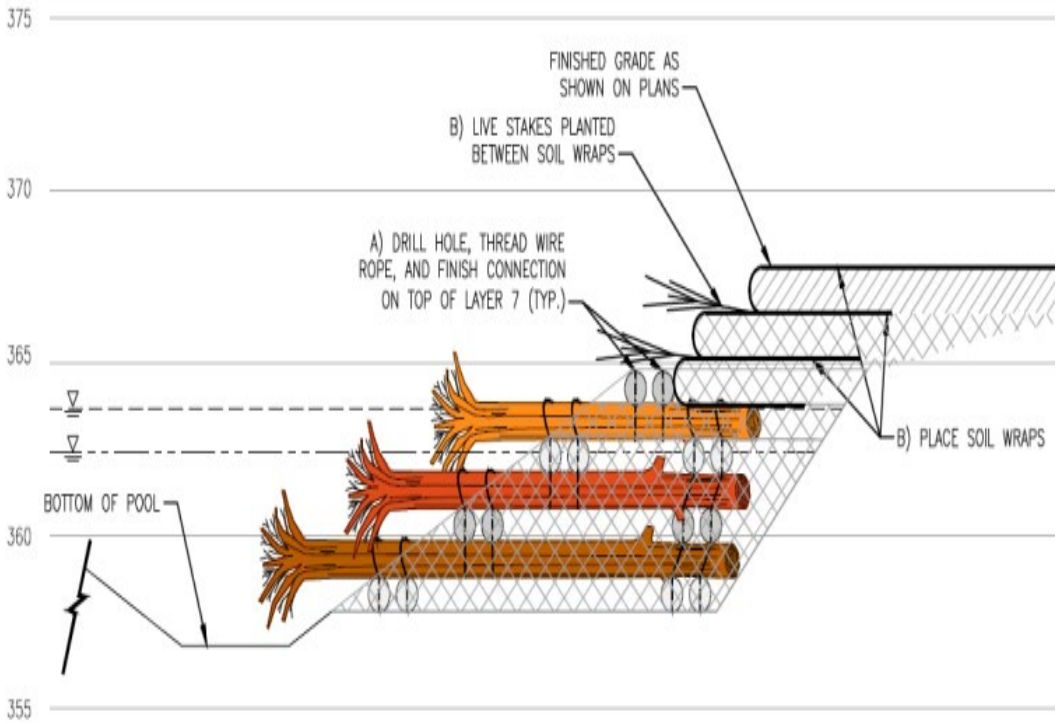
Stream and Bank Stabilization



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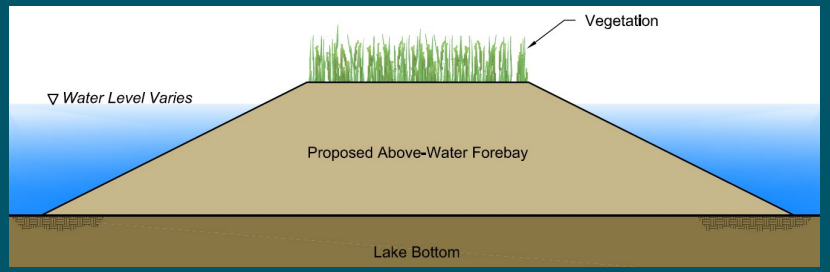
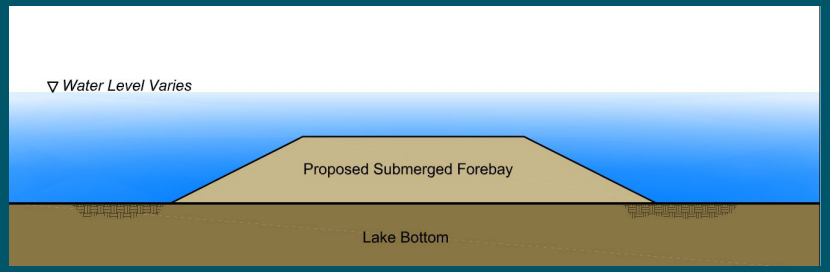
Sediment Traps and Forebays

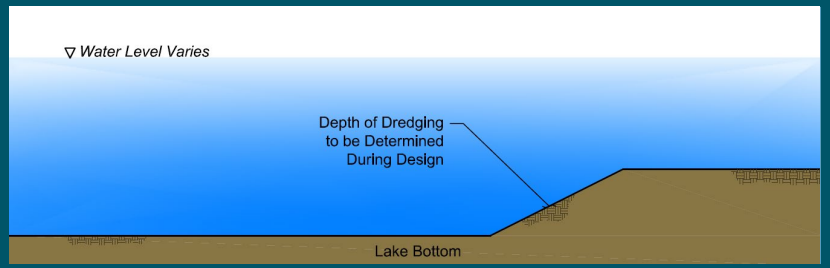
- Creation of intentional areas for sediment to settle
- Planned location and access to simplify future maintenance needs
- Ideally make maintenance dredging operations less expensive but possibly more frequent



Sand berm above water surface



Submerged sand berm



Forebay creation by dredging

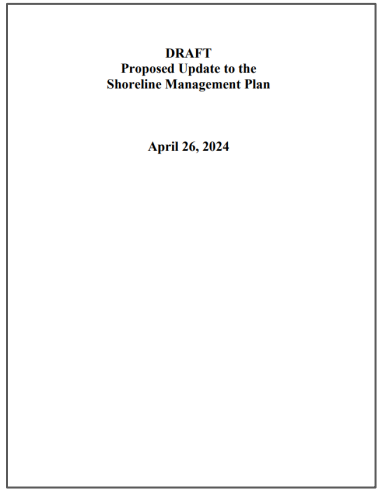
Strategic Planning and Design

Approach

- Identify immediate and long-term challenges
- Develop sediment management strategy for short-term solutions
- Develop watershed management strategy for long term solutions

Available Watershed Management Resources

- Sedimentation Monitoring Plan
- Erosion Monitoring Plan
- Habitat Management Plan
- Recreation Management Plan
- Shoreline Management Plan
- Save Our Streams Annual Surveys
- Smith Mountain Lake Citizen Action Group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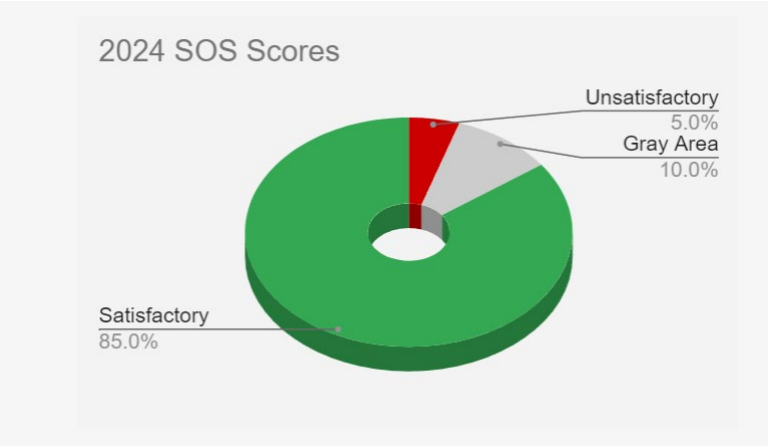
Proposed Update to the
Shoreline Management Plan

April 26, 2024



Planning

Conceptualize system and identify possible sites

Determine site needs and success criteria

Engage stakeholders

Set goals, quantify objectives, identify constraints

Conduct preliminary evaluation of sediment sources

Evaluate funding options

Adaptive Management

Baseline monitoring

Define success criteria and triggers for corrective action

Management responsibilities

Project performance monitoring

Future management actions

Design

Assess baseline and reference conditions

Prepare preliminary design

Evaluate sediment source in detail

Detailed design and permitting

Prepare final design

Develop specifications

Implementation

Bidding and contractor selection

Means and methods

Specialty equipment/requirements

Construction monitoring

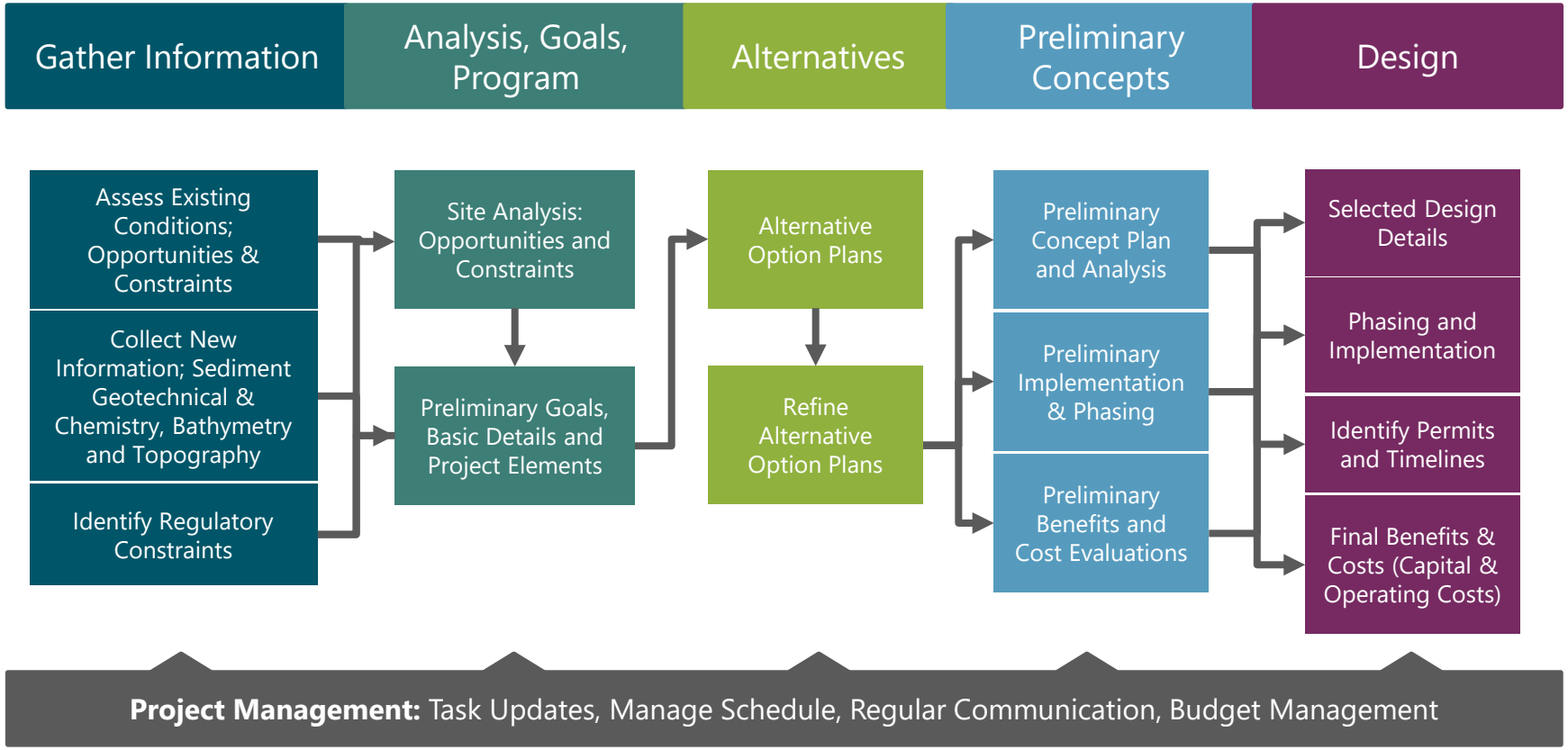
Construction quality assurance

Long-term monitoring

Project Development Needs

- Coordination
  - Dredging projects, staging areas, placement opportunities
- Dredged material characteristics
- Environmental assessments
- Alternatives analysis
- Stakeholder and regulatory engagement
- Permitting strategy
- Funding sources and budget

Alternatives Analysis Process



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Sediment Management Approach

- Identify primary areas of sedimentation
- Plan, design, permit, and fund
- Identify procurement strategy
- Remove accumulated sediments

Dredging to remove spits of accumulated sediments

Watershed Management Approach

- Identify primary sources of upstream sediment
- Develop strategy to remedy primary sources of sediment release
- Create sediment traps and forebays at sedimentation hot spots
- Monitor sedimentation rates
- Develop maintenance dredging cycles to plan for predictable budget and schedule management

Next Steps

Funding Sources

Additional Data Needs

Project Development

Thank you!

Questions?

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