Monitoring and Adaptive Management

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RISK FRAMEWORK

RISK ASSESSMENT PARADIGM

Problem Formulation

Exposure Assessment

Risk Characterization

Effects Assessment

Risk = / (Exposure + Effect)

Economic Analysis, Socio-Political, Engineering Feasibility

Risk Management
Topics

• Uncertainty and the Role of Monitoring
• Compliance Monitoring and Adaptive Management
• Development of a Monitoring Plan
• Monitoring Considerations
• Monitoring Components
• Adaptive Management
• Adaptive Management Components
• Example Case Study
Roles of Monitoring

• Traditionally
  - To assure compliance with regulatory requirements
  - Water and air sampling at points of compliance for comparison with water and air quality standards

• Adaptively
  - To support the risk paradigm
  - To address uncertainties in exposure data and source strength
  - To address uncertainties in effects data
  - To learn from the project and provide data for future assessments
  - To support adaptive risk management alternatives
  - To assure effectiveness of control measures
  - To assure compliance with risk goals and regulatory requirements
Development of a Monitoring Plan

- What? Parameters to be Monitored
- Where? Locations
- When? Frequency
- How? Techniques
- Who? Resources: budget, equipment, time and skills
- Why? Data Calibration, Processing and Analysis and Reporting
- OK? Does it satisfy the objectives?
Monitoring Considerations

• Unsteady Source
  ➢ Dredging is intermittent, processes are cyclic

• Moving Source
  ➢ Hopper dredge travels more than 5 miles in a 60-minute cycle
  ➢ Cutterhead swings over a width of 22 - 250 ft at a rate of 0.5 - 1 ft/sec
  ➢ Auger dredges advances about 500 ft/hr

• Multiple Sources
  ➢ Dredgehead, overflow, props, anchors, etc.
  ➢ Bottom and surface

• Unsteady Flow
  ➢ Tides
  ➢ Wind

• Exposure Pathway for Receptors of Concern
Stressors and Components

• Turbidity and TSS
  - Discrete samples from multiple depths and locations
  - Continuous discrete locations – OBS grid
  - Periodic transects – ADCP
  - Calibration samples to estimate TSS from OBS and ADCP

• Total Mass Loss and Loss Rate
  - TSS (requires background sampling as well)
  - Flow
    - ADCP
    - Gages
    - Current meter transects
    - Models
Stressors and Components

- Deposition
  - TSS
  - Settling characteristics
  - Shear stress characteristics
  - Sediment traps
  - Modeling

- Total Contaminant Mass Loss and Loss Rate
  - Discrete samples from multiple depths and locations analyzed for TSS, dissolved and total contaminant concentration
  - TSS
  - Flow
  - Sediment density, volume and bulk sediment contaminant concentrations
Adaptive Management

• Traditional Approach
  ➢ Implement controls
  ➢ Monitor to ensure risk goals are being attained

• Adaptive approach
  ➢ Implement initial controls
  ➢ Monitor
  ➢ Assess impact/efficiency of controls
  ➢ Adapt controls and possibly increase or reduce controls
Adaptive Management

• Adaptive management should be used when:
  ➢ High degree of uncertainty in the risk characterization
  ➢ High degree of uncertainty in the effectiveness risk management controls
  ➢ High costs of risk management

• Adaptive management leads to:
  ➢ Learning and a better explanation/understanding of the system
  ➢ Increase effectiveness of risk management
  ➢ Lower costs
  ➢ Better decisions
Adaptive Management Approach

• Develop short-term and long-term control alternatives
  ➢ Turbidity and TSS concentrations
  ➢ Contaminants concentrations
  ➢ Flux (flow augmentation)
  ➢ Total loss

• Establish action triggers for the risk management
  ➢ Effects-based criteria
  ➢ Exposure modeling
  ➢ Risk characterization

• Develop a control plan and implement

• Establish an active compliance monitoring plan and implement
Adaptive Management Approach

- Establish a response plan for triggers
  - Implement short-term control measures (such as stop overflowing or pause dredging)
  - Assess impacts
  - Analyze event data – cause and effect -- learn
  - Determine need for long-term controls
  - Implement long-term controls (such as slow production, install silt curtain, restrict overflow or seasonal restriction)
  - Assess impacts

- Update control, monitoring and response plans
- Perform ecological response monitoring of environmental resources to ensure that effects-based triggers are effective at achieving risk goals
Toddistan Adaptive Management

- **Risk Characterization Results**
  - Low impact to juvenile salmonids
  - Potential shading and burial of SAVs
  - No exposure pathway to corals

- **Risk Management Control Options**
  - 15 minutes of overflow
  - No overflow in certain reaches of the channel
  - No overflow
  - Seasonal restriction / environmental window

- **Action Triggers**
  - Turbidity greater than 10 NTU above background midway between channel and SAVs and between channel and corals
  - Turbidity greater than 100 NTU in upper 15 ft of channel bottleneck
Toddistan Adaptive Management

- **Initial Controls**
  - 15 minutes of overflow

- **Monitoring plan**
  - Six ADCP transects daily midway between channel and SAVs and midway between channel and corals for first 3 days throughout range of tidal cycle
  - TSS calibration sampling
  - Three transects twice a week thereafter during appropriate portion of tidal cycle
  - Additional transects if change in currents and wind
  - Surficial turbidity/TSS sampling in channel bottleneck
Toddistan Adaptive Management

• Response Plan
  - If turbidity is less than 25% of triggers, change control to 30 minute overflow.
  - If turbidity is greater trigger, change control to no overflow in adjacent reaches.
  - If turbidity is greater than 300% of triggers, change control to no overflow.

• Update controls, monitoring and response plan
  - If turbidity is still less than 25% of triggers, eliminate controls.
  - If turbidity is still greater than triggers without overflow, stop dredging and impose environmental window.
Questions?