Development of a Risk-based Framework for Assessing and Managing Dredge Underwater Sounds

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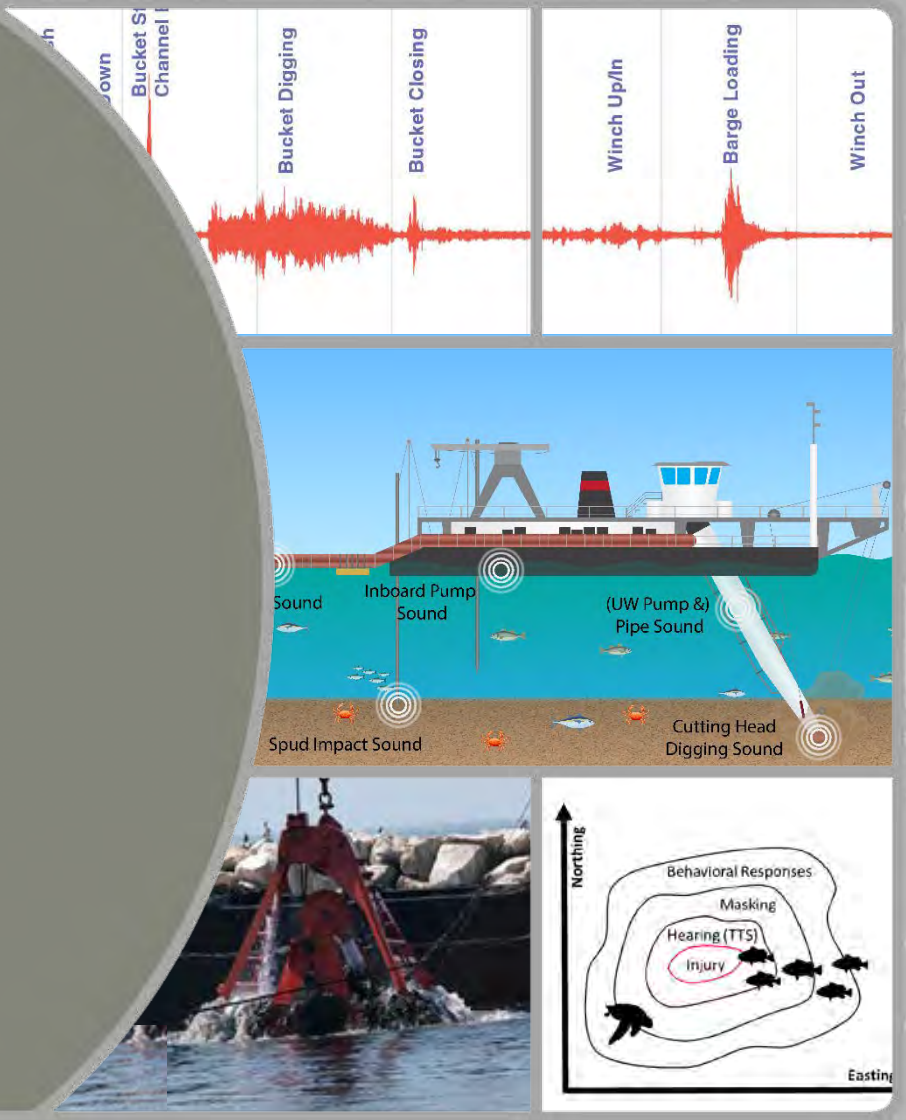
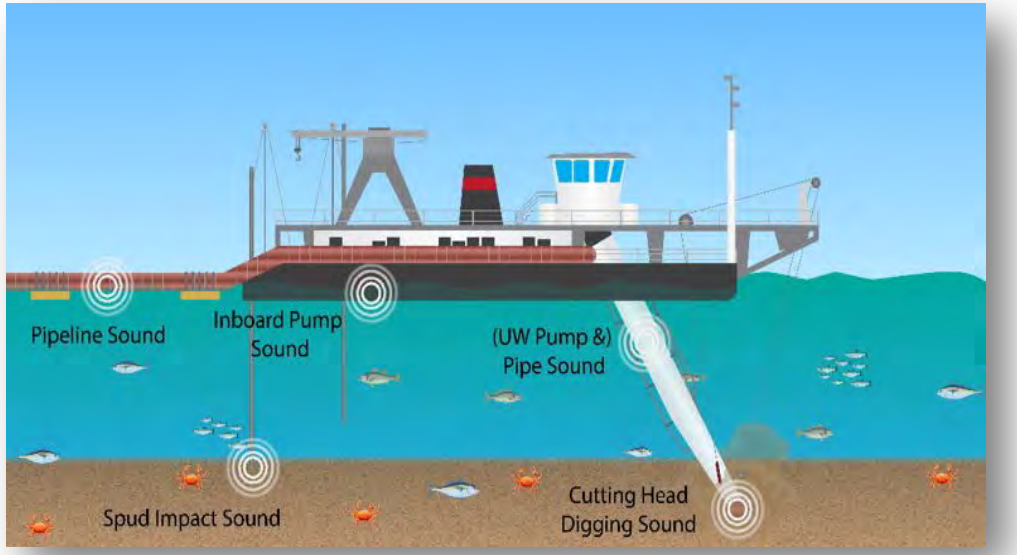
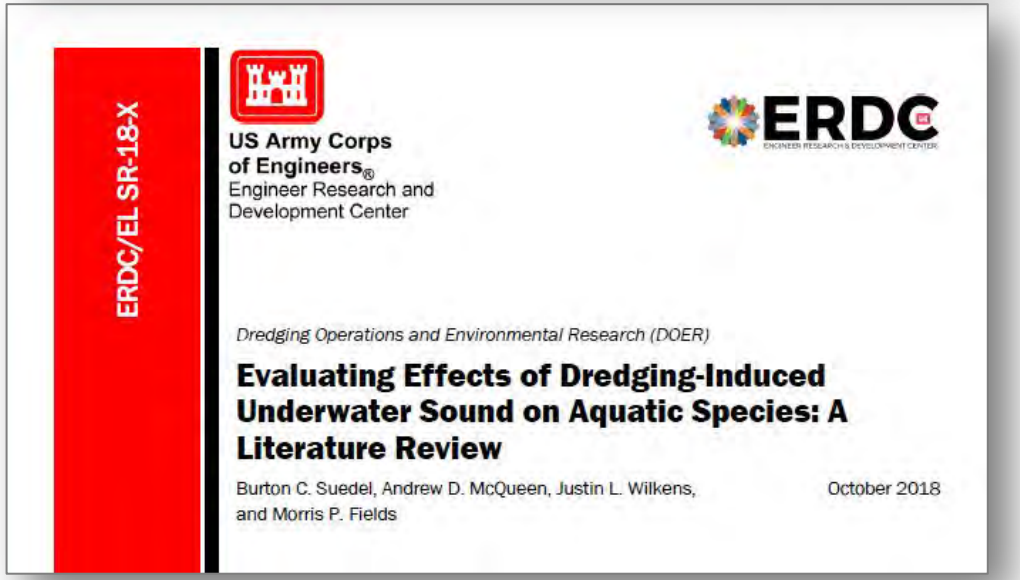


Introduction

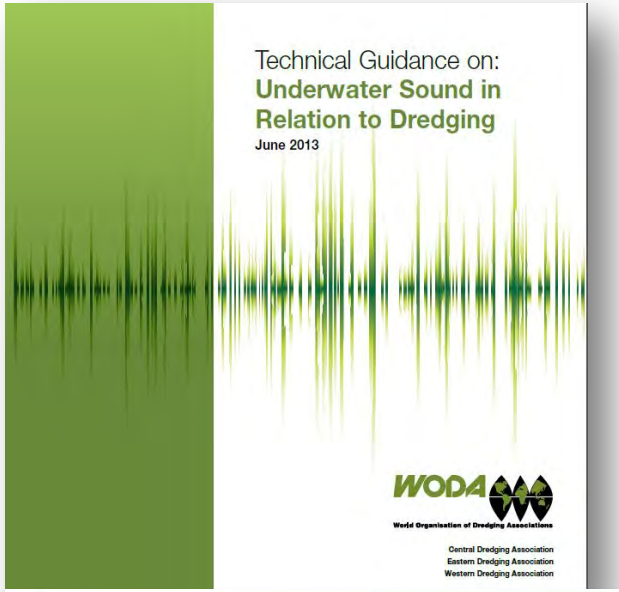
- Increasing national and international regulatory focus on adverse impacts from anthropogenic underwater sound
- NOAA NMFS (2018): Advisory Acoustic Thresholds for Marine Mammals
  - Non-impulsive Sounds – Shipping, Windfarms, Dredging?
- USACE reviewed the current state-of-the-science (Suedel et al. 2019)
  - **Study determined that a risk-based approach is needed to evaluate underwater sounds**



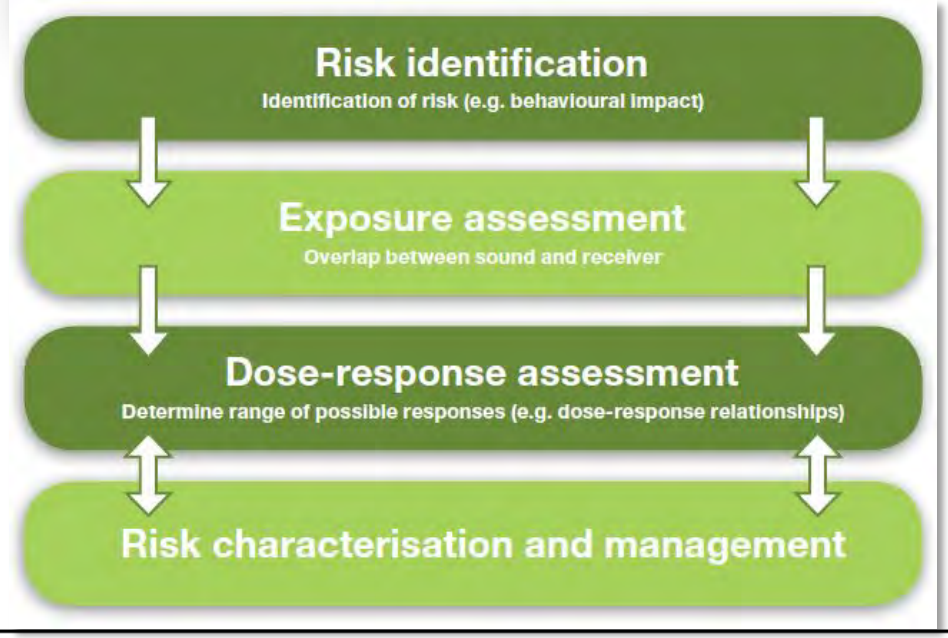


Introduction

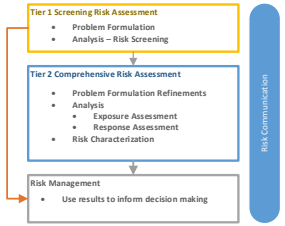
- Prior studies have advocated the use of a risk-based framework
  - WODA 2013
- This approach was met with interest among dredging community and regulatory agencies
- However, information still needed were:
  1. specific details of applying a risk framework
  2. demonstration of the approach
- Next logical steps…



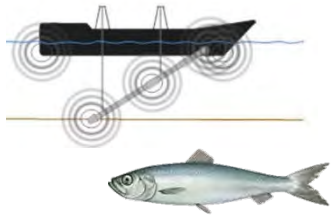
WODA 2013



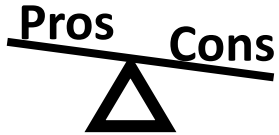
Objectives



1) Develop a tiered risk-based framework for assessing underwater sounds from dredge operations



2) Case study demonstration of the framework

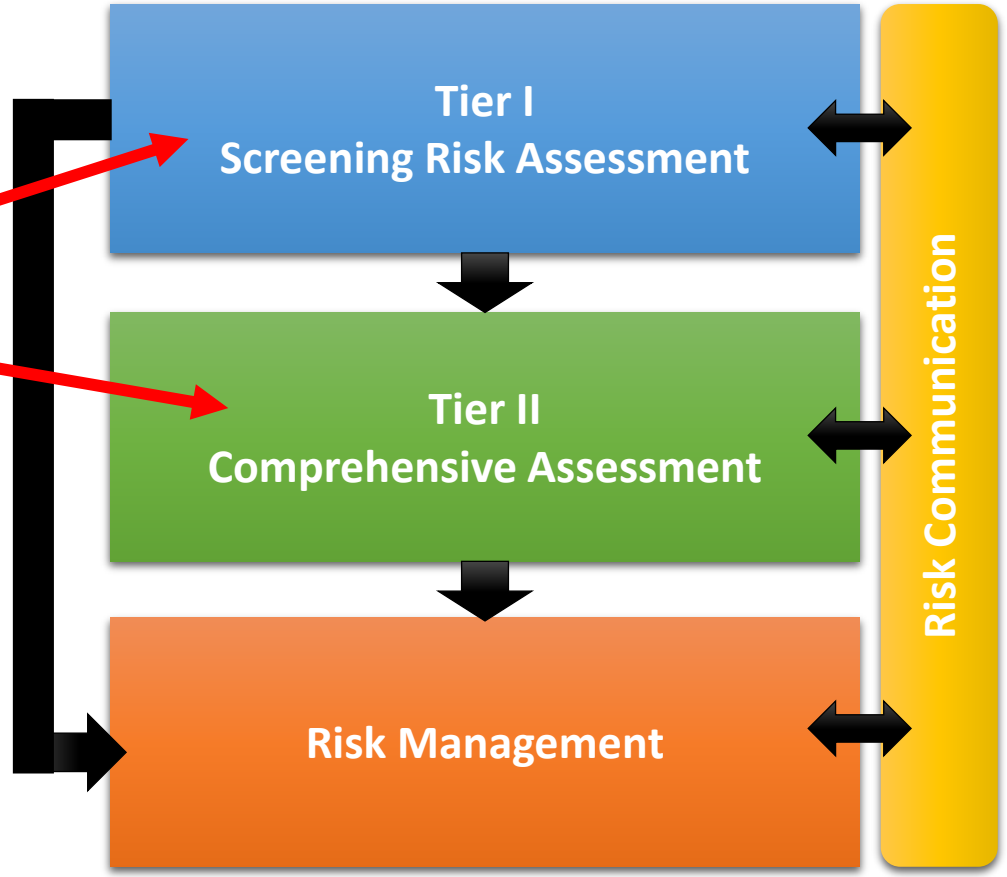


3) Identify strengths and limitations of the approach

Results: Risk Framework Development

Primary Components:

1. Project Formulation
2. Exposure and Response Analysis
3. Risk Management
4. Communication

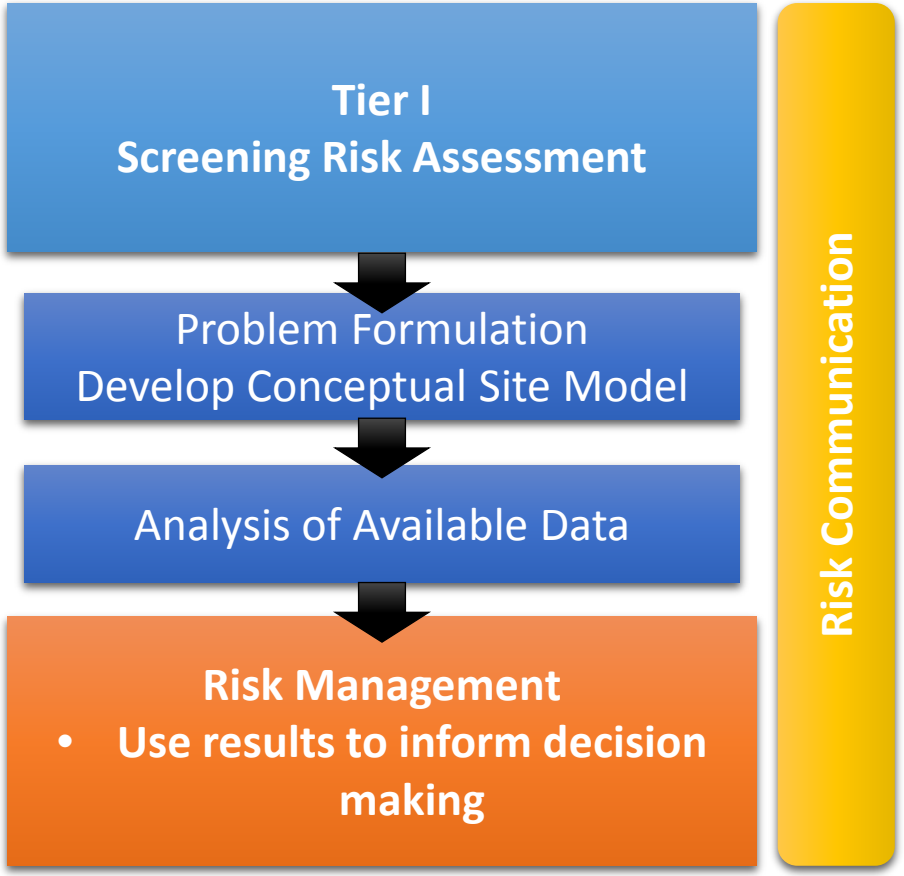


Results: Risk Framework

Tier 1: Screening Assessment

- Problem Formulation
  - Identify sources of sound
  - Species of concern
  - Develop conceptual site model
  - Compile existing data and other information
- Analysis
  - Evaluate exposure and effects data to estimate risks of species of concern
  - Identify sources of uncertainty

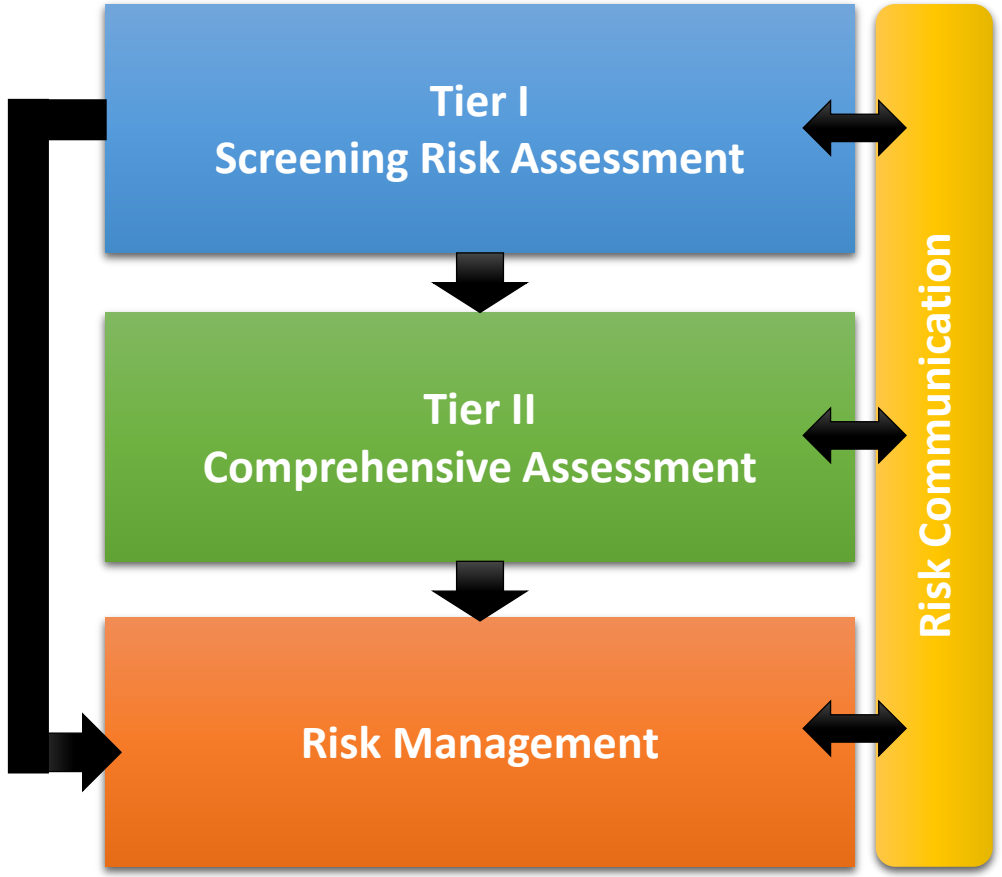
Key benefits: Eliminate species early from further consideration



Results: Risk Framework

Risk Management

- **If acceptable risks** – focus on communication with appropriate parties and discuss uncertainties
- **If unacceptable risks** – focus on operational and engineering controls to manage risks to an acceptable level
  - E.g., timing, sound mitigation
  - Controls weighed with economics, timeliness, and effectiveness



Case Study: Port of Rotterdam Expansion

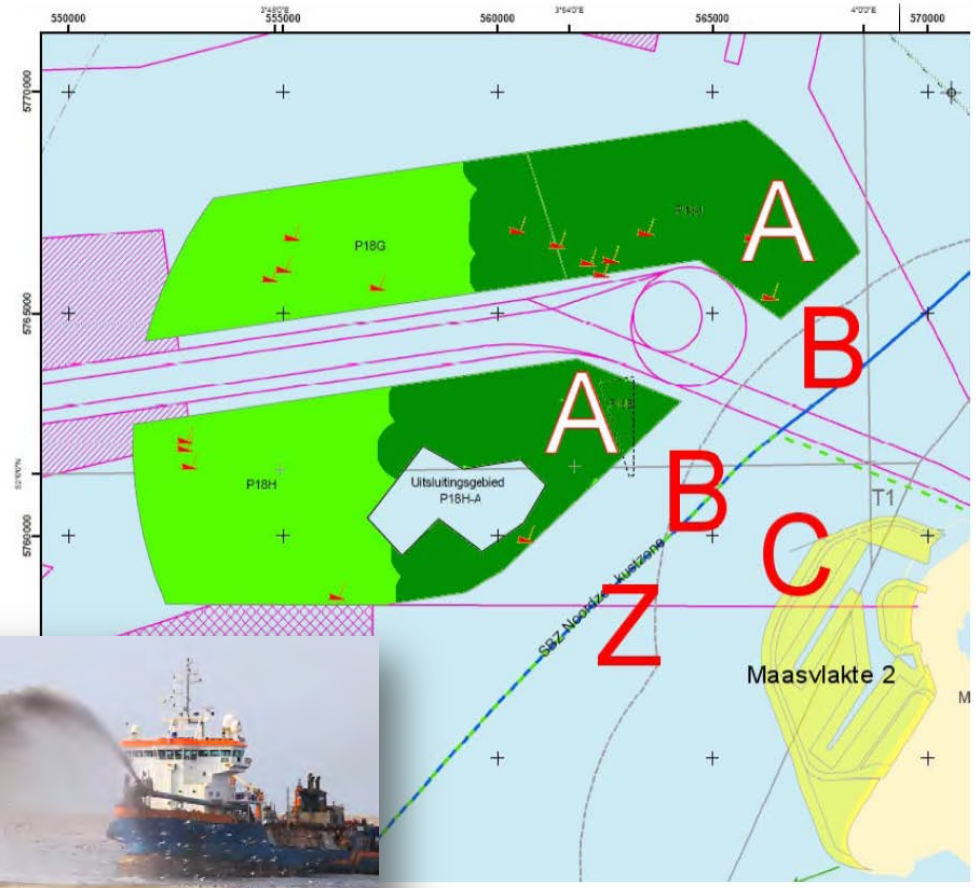
- Trailing suction hopper dredges transported 230 MCY of sediments

<u>Risk Assessment goals:</u>

1. Characterize sound exposures
2. Evaluate potential affects to biota

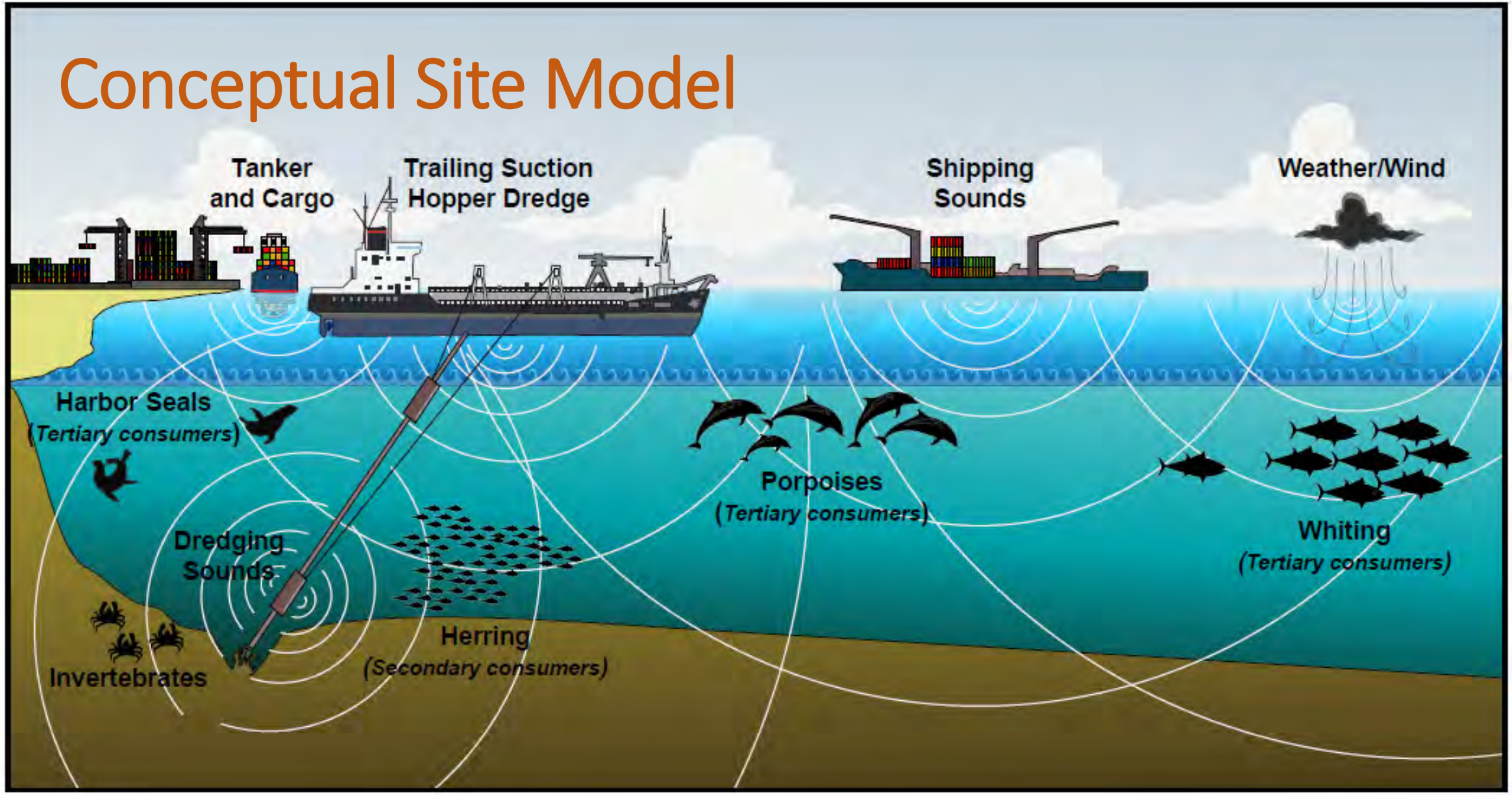
<u>Species of Concern</u>

- Harbor porpoises
- Harbor seals
- Fish (herring and whiting)



TNO (2013)

Conceptual Site Model



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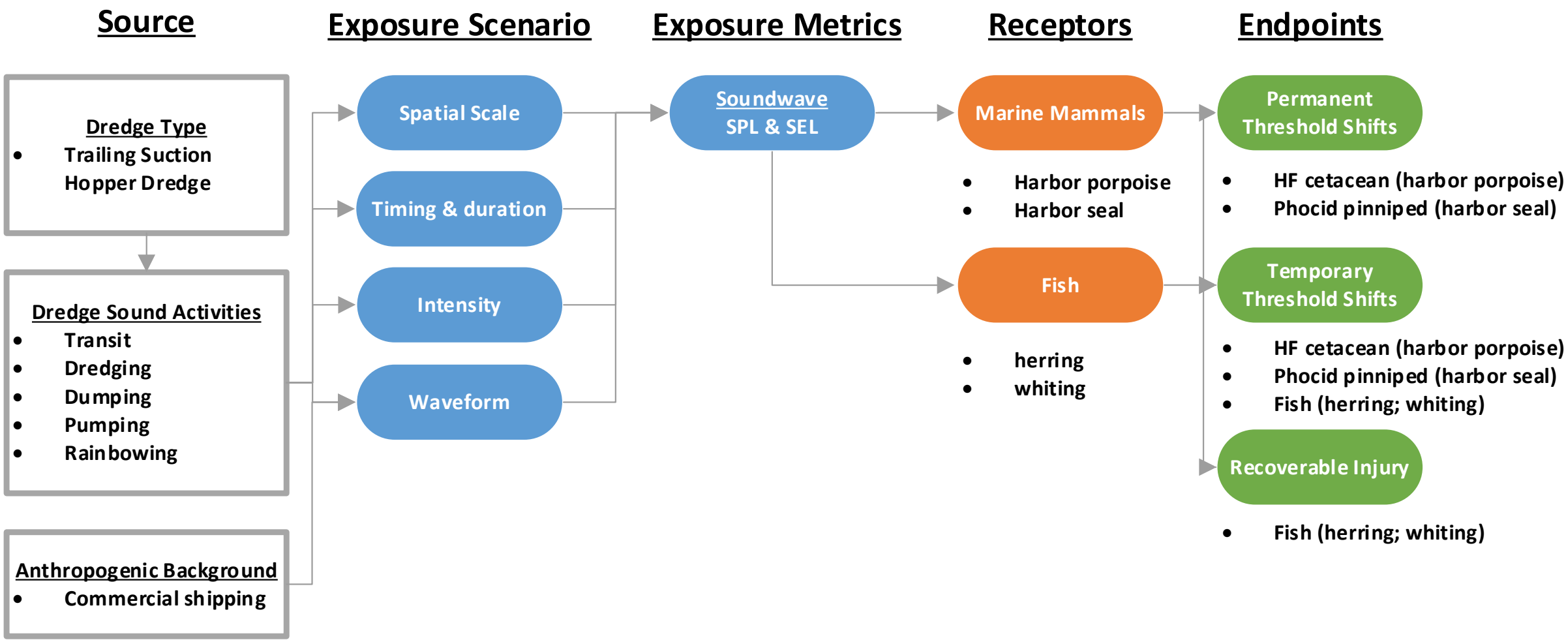
Conceptual Site Model



Case Study: Screening-level Assessment

Source

Dredge Type
- Trailing Suction Hopper Dredge

Dredge Sound Activities
- Transit
- Dredging
- Dumping
- Pumping
- Rainbowing

Anthropogenic Background
- Commercial shipping

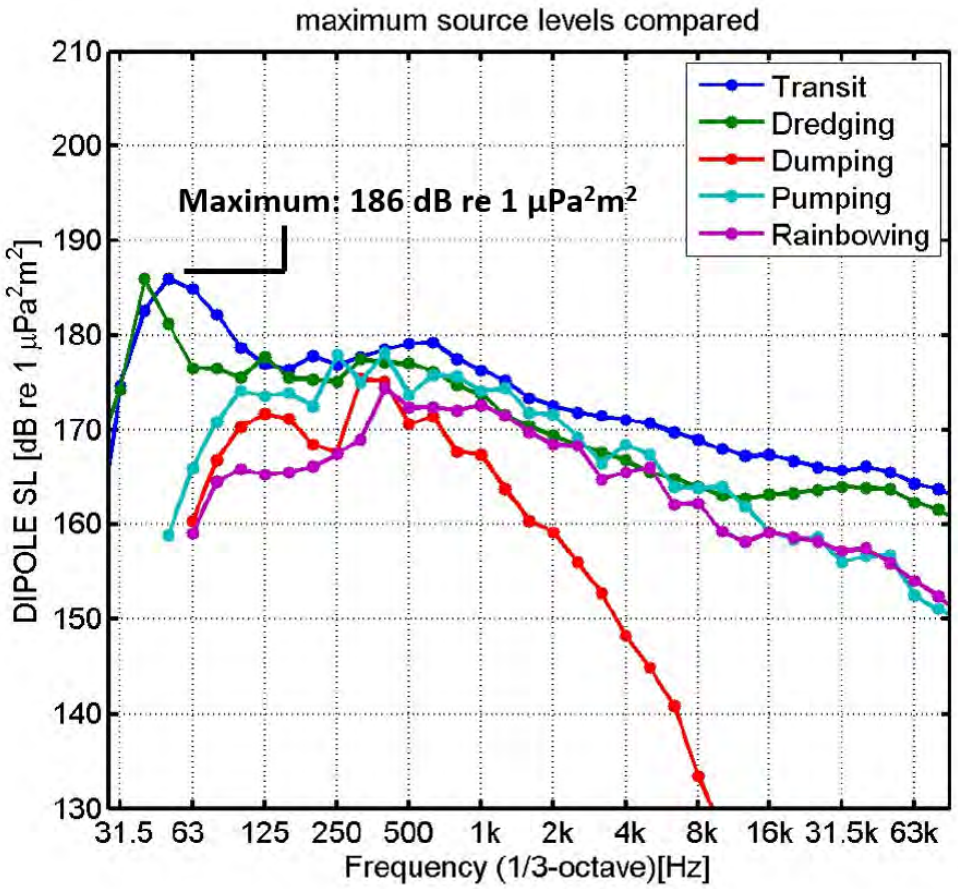
Exposure Scenario

- Spatial Scale
- Timing & duration
- Intensity
- Waveform

Exposure Metrics

- Soundwave SPL & SEL

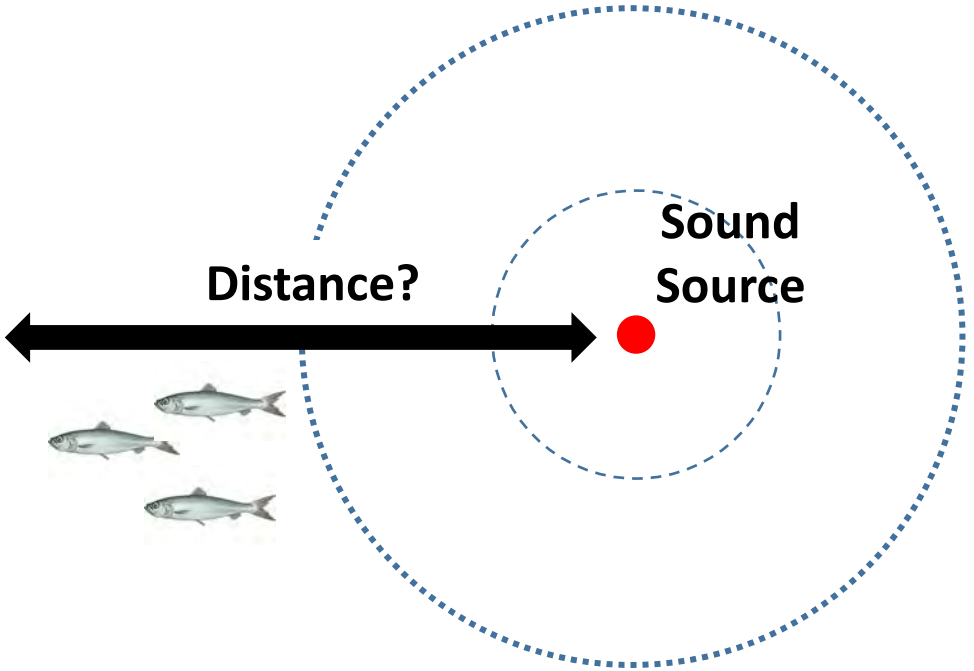
"Worst case" sound level = 186 dB at source



Case Study: Screening-level Assessment

Exposure assumptions:

- Maximum source level (dB)
- Stationary dredge/ Continuous operation
- Stationary receptor
- 24 hr duration
- 20 Log(R) propagation
- Frequency weighted (mammals; NMFS 2018)



Risk Thresholds

- High frequency cetaceans (porpoise); NMFS 2018
- Phocid pinniped (seal); NMFS 2018
- Fish; Popper et al. 2014

Case Study: Screening-level Assessment

Results: Estimated "exclusion zones"

Harbor porpoises:

- PTS: < 2 meters
- TTS: < 2 meters

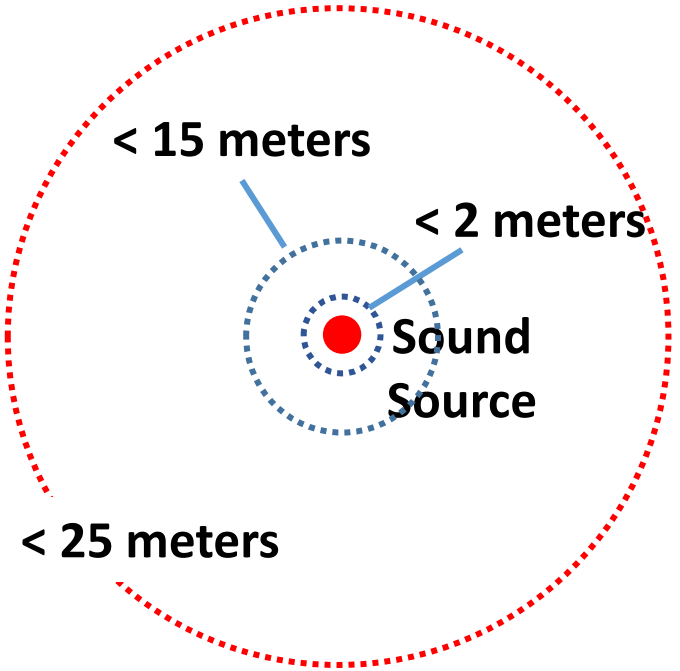
Harbor seals:

- PTS: < 2 meters
- TTS: < 15 meters

Fish (herring)

- "recoverable injury": <6 meters
- TTS: < 25 meters

Risk Threshold Isopleth



Carry Forward to Tier II Comprehensive Assessment

Strengths and Limitations

Strengths

- The screening-level approach allows receptors or scenarios to be eliminated from further consideration
- Flexible to be adapted as new information emerges

Limitations

- Lack of exposure-response data for low-frequency, non-impulsive sounds
- Current response data show high degree of uncertainty

Conclusions

Risk Framework Development

- Provides a mechanism to document and communicate risks and uncertainties to allow for a **transparent** and **repeatable process**
- Sufficiently **flexible** for wide ranging dredge scenarios

Case Study of Screening-level assessment

- Using “worst-case” scenarios were able to eliminate receptors from further consideration

THANK YOU!

QUESTIONS?

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