Tunnels Meet Tides: Repurposing Infrastructure Byproducts for Salt Pond Restoration in San Francisco Bay

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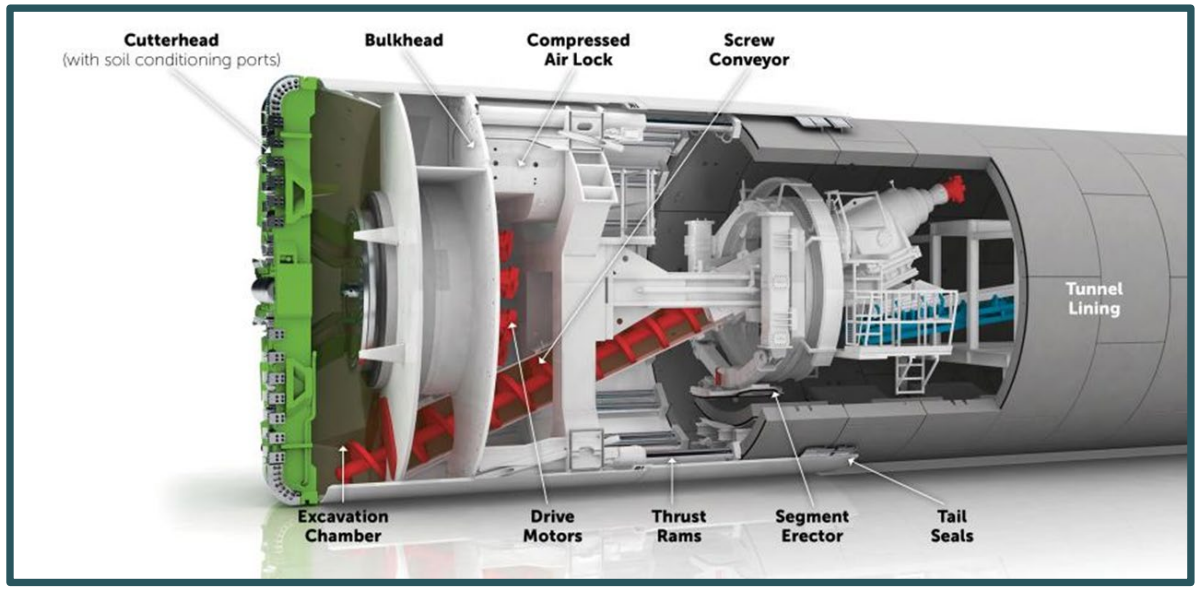
Agenda

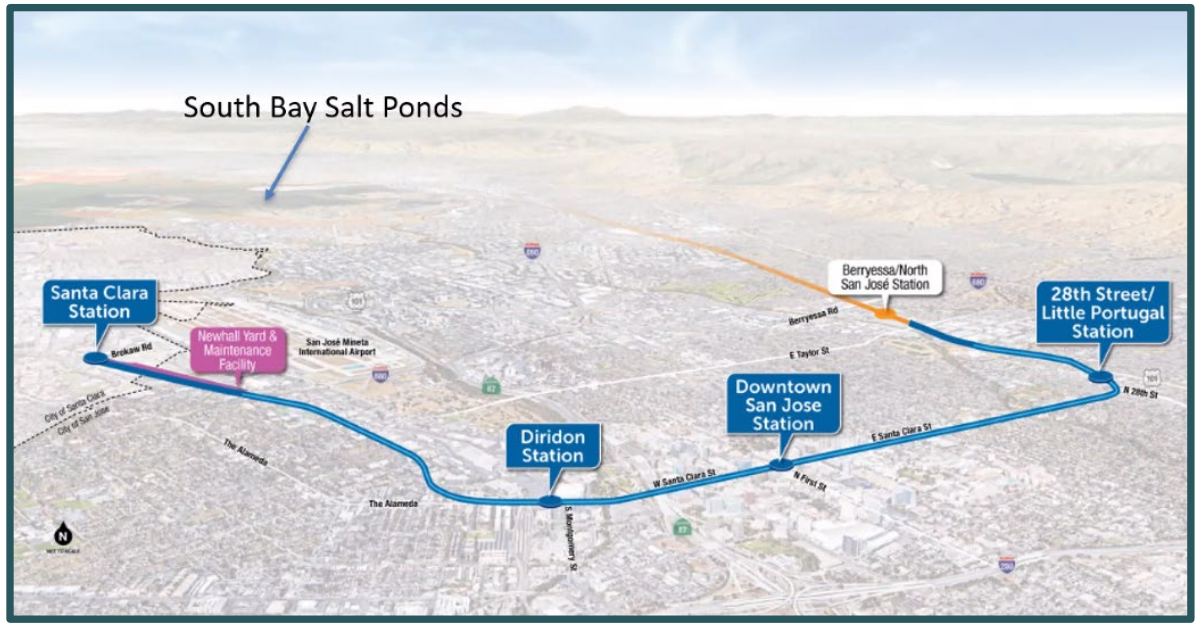
- Background
- Study Design
- Phase I Results
- Next Steps
- Q & A

(Image title: Ravenswood XIII, 2021)

BART Silicon Valley Phase II (BSVII) Expansion

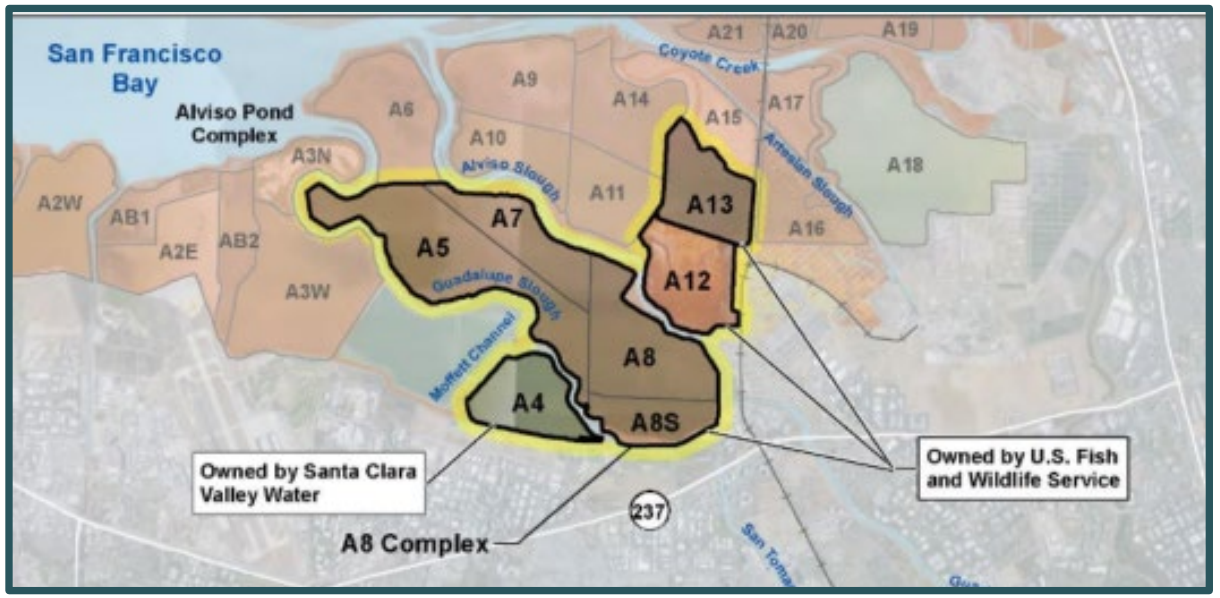
- 6-mile extension of the Bay Area Rapid Transit (BART) system that will include a 5-mile tunnel
- Tunnel Boring Machine (TBM) used in tunneling process
- Project will result in up to 3.5 million cubic yards of excavated material
- Once started tunneling will be continuous over the duration of the project
- Original plan was for disposal of TBM spoils at local landfill





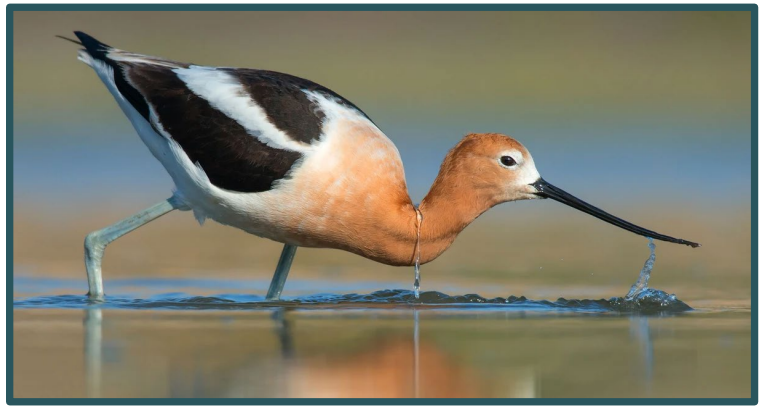
Alternative Disposal Option

- Valley Transportation Authority (VTA) partnered with the South Bay Salt Pond Restoration Project team to evaluate beneficial reuse of material
- Multiple salt ponds identified as possible receiving waterbodies of the excavated material
- Concerns of adverse impacts associated with soil conditioners



San Francisco Bay Salt Pond Restoration Project

- Restoration of existing salt ponds to tidal pools and marsh lands
- Largest wetland restoration project on western coast of United States
- Goals
  - Enhanced wildlife habitat
  - Increased water quality
  - Flood protection
- Salt pond restoration project identified several receptors that may be impacted by the placement of materials



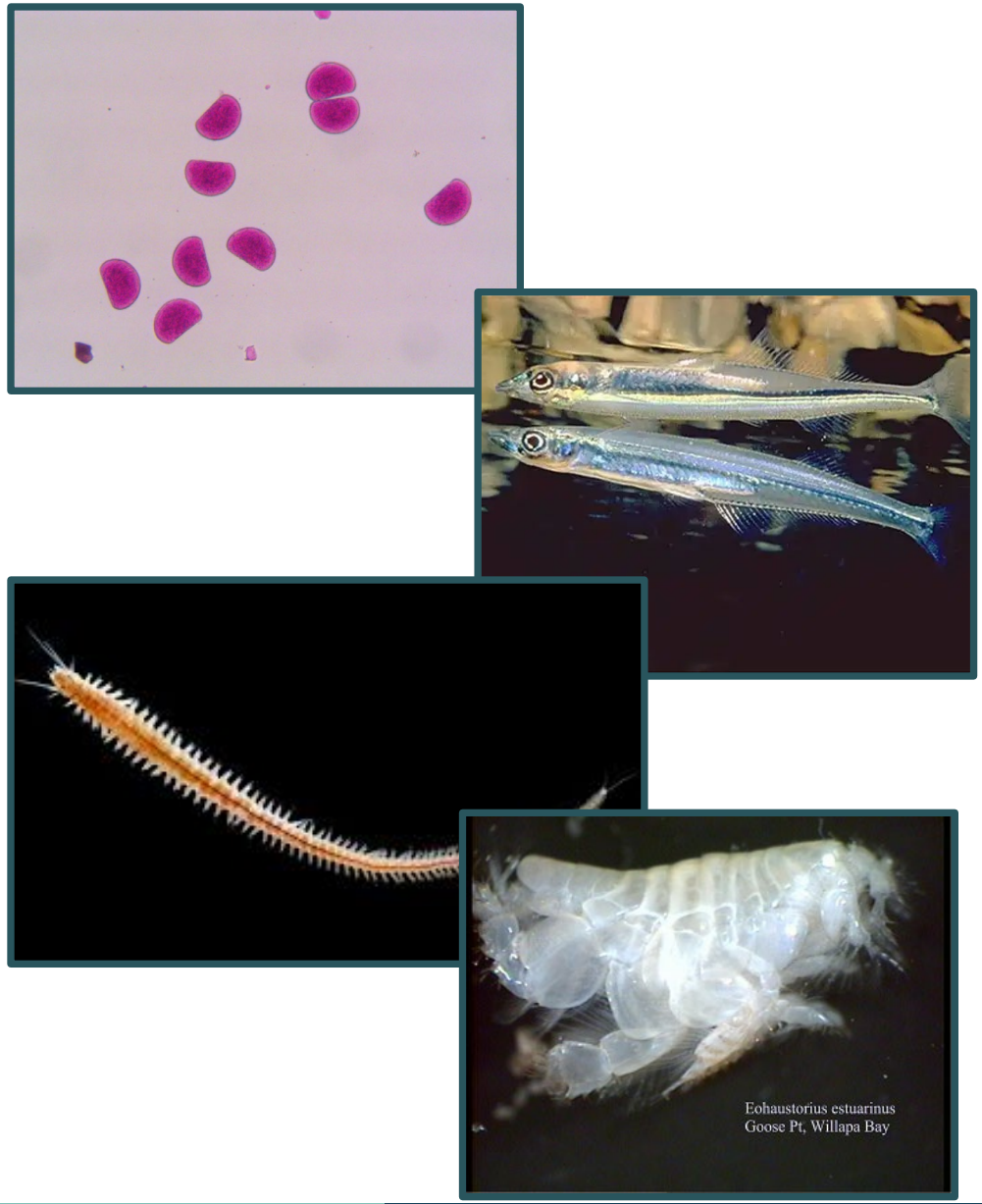
American avocet
(*Recurvirostra americana*)

Arrow goby
(*Clevelandia ios*)

Nereidid polychaete

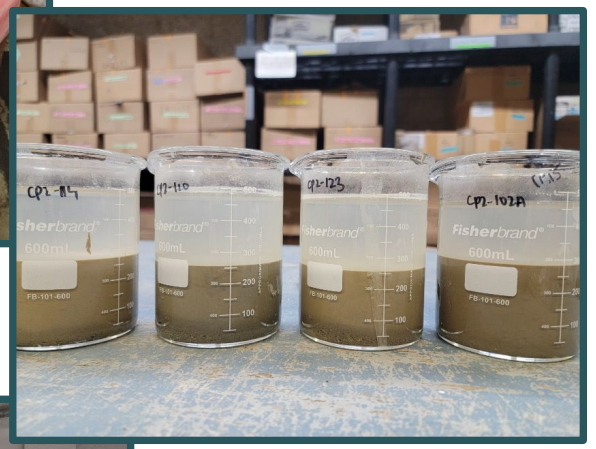
Bioassay Workplan

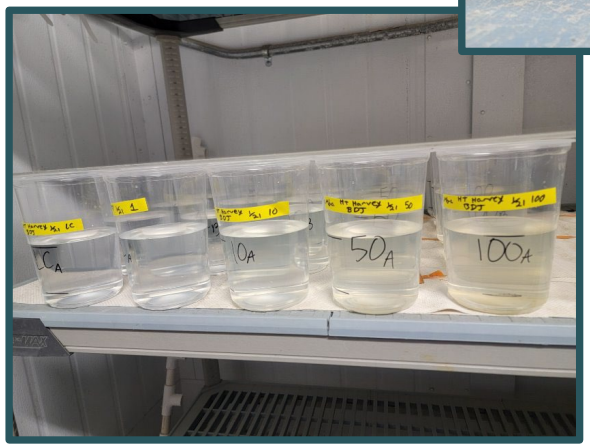
- Purpose: Assess the ecotoxicity of the BSVII Project's tunnel excavated materials with the added soil conditioners
- Due to accelerated timeline, off the shelf guidance was used as framework for development of the study
- Study evaluated impacts that soils, conditioners, and combination may have on ecological receptors
- Phase I: Aquatic elutriate bioassay test
- Phase II: Benthic bioassay test



Phase I – Sample Creation

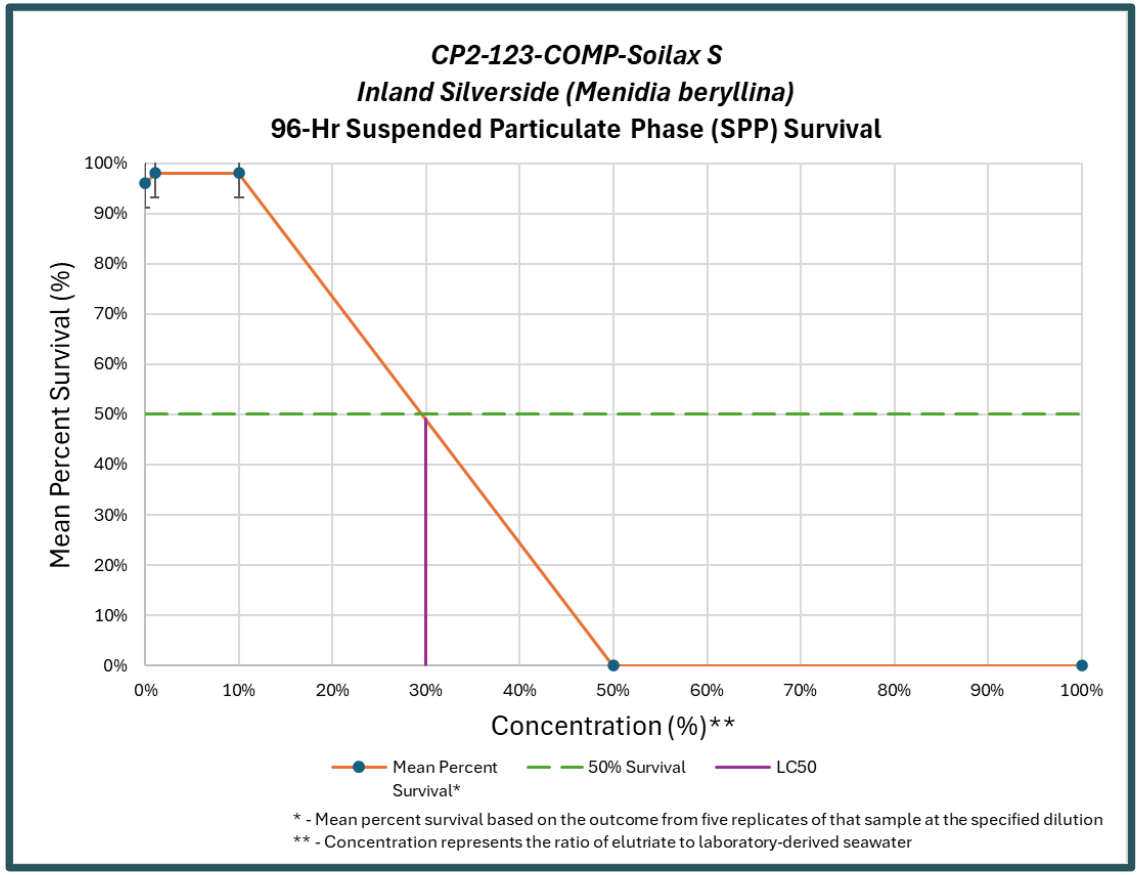
- Project challenges
  - Procurement of sample material
  - Sample conditions
- Material homogenized and hydrated to create composite sediment samples
- Conditioners were added to sample media based on assumed concentration that would be used during tunneling
- Conditioners were evaluated independently through an elutriate dilution series (1%, 10%, 50%, and 100%) following federal and regional guidelines





Phase I – Elutriate Tests

- Two test species
  - Inland silverside (96-hour)
  - Blue mussel (48-hour)
- Bioassay test meant to determine if material suitable for unconfined aquatic disposal (SUAD)
- Test endpoints
  - Survival
  - D-shell development (bivalve only)
- Three toxicity threshold measurements
  - No Observable Effect Concentrations (NOECs),
  - 50% Lethal Concentrations (LC50s), and
  - 50% Effective Concentrations (EC50s) (bivalve only)



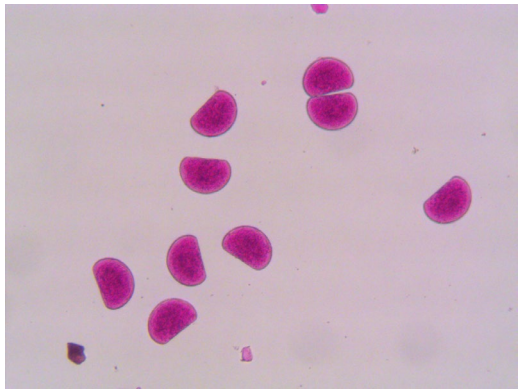
Phase I Results – Inland Silverside

- Inland Silverside
  - Untreated soils did not impact test species
  - LC50s for combinations of sample and conditioners ranged from 26% to 30%

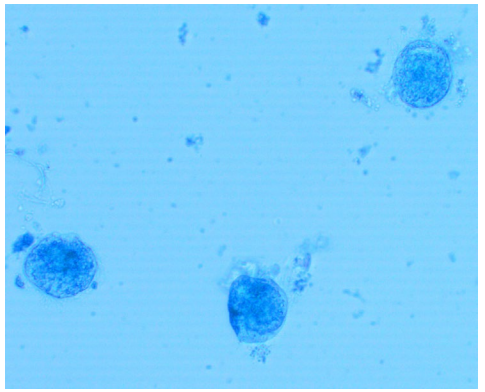
Composite Sample	CP2-123	CP2-110	CP2-114	CP2-102A
Conditioner	LC_{50} (%)	LC_{50} (%)	LC_{50} (%)	LC_{50} (%)
Untreated	>100	>100	>100	>100
Soilax-S	30	26.9	29.8	28.4
Bert's Drillin' Juice	30	29.1	29.6	28.2
Soilax-AC	26.7	29.3	29.4	29.6

Phase I Results – Blue Mussel

- Blue Mussel
  - Untreated soils did not impact test species
  - LC50s for combinations of sample and conditioners ranged from 29% to 71%
  - EC50s for combinations of sample and conditioners ranged from 7% to 30%



Normal bivalve development

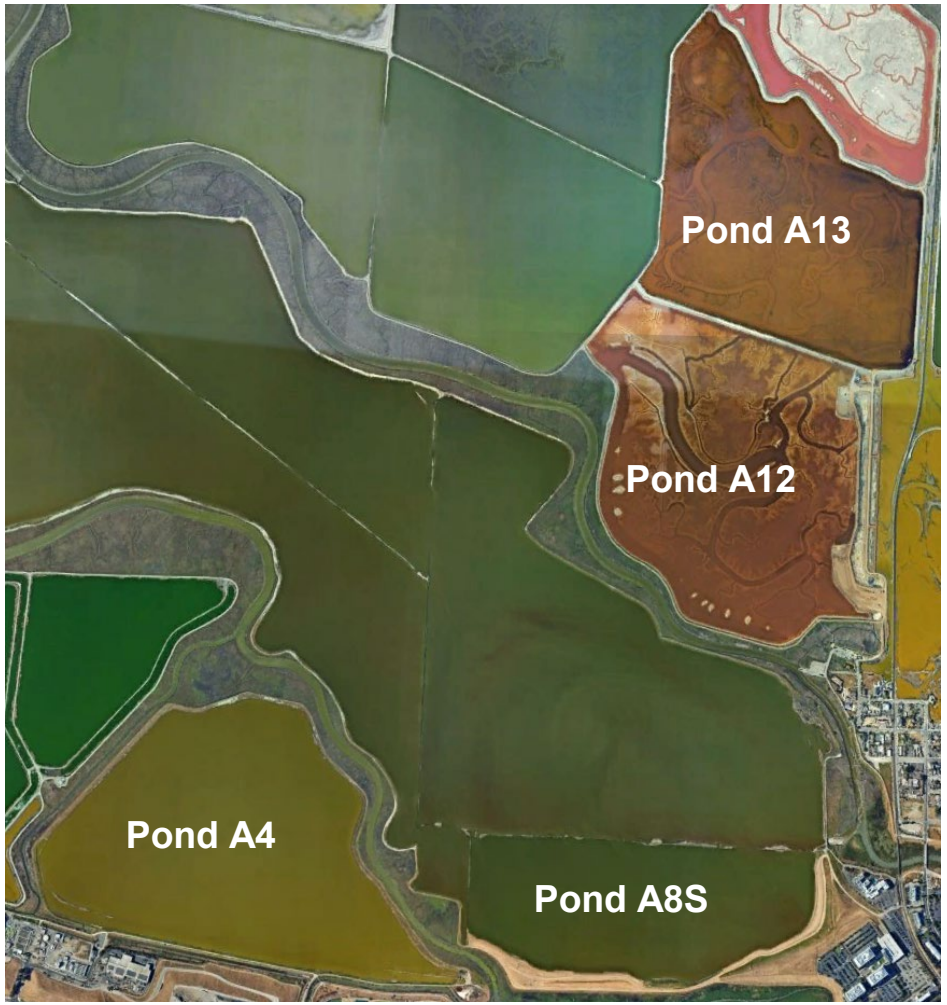


Abnormal bivalve development

Composite Sample	**CP2-123**		**CP2-110**		**CP2-114**		**CP2-102A**	
Conditioner	EC_{50} (%) Devel.	LC_{50} (%) Survival	EC_{50} (%) Devel.	LC_{50} (%) Survival	EC_{50} (%) Devel.	LC_{50} (%) Survival	EC_{50} (%) Devel.	LC_{50} (%) Survival
Untreated	>100	>100	>100	>100	>100	>100	>100	>100
Soilax-S	29.3	29.7	30	35.2	7.65	30	29.7	40.6
Bert's Drillin' Juice	30	29.4	29.6	47.7	28.7	29.2	30	71.3
Soilax-AC	27.4	31.1	29.8	46.9	28.8	30.2	8.19	31.5

Conclusions

- Adverse impacts for pelagic organisms may be mitigated through dilution during placement of material
- Management action or controls measures will be needed to prevent long term impacts to aquatic receptors in the ponds
- Control measures and material placement methodologies will need to be adjusted based on selected pond
- Implementation of Phase II currently in the planning stages to evaluate impact on benthic invertebrate community



Questions

Thank you!

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