



Marine Technical Sustainability Study

Long-term Fraser Dredging Operations Program

Disclaimer

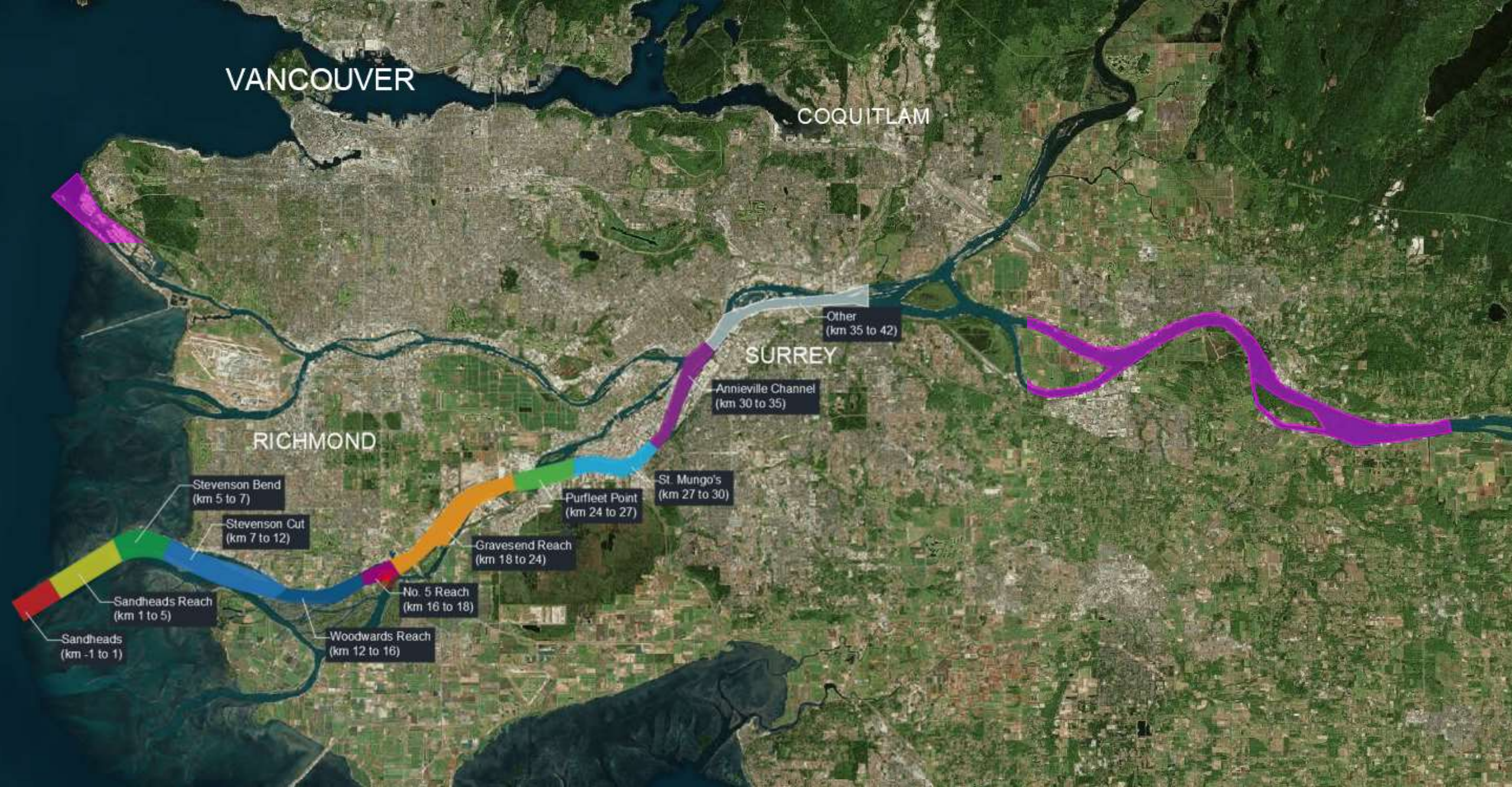
- Research and recommendations included in the sustainability study may be included in upcoming contract documents for future procurement efforts
- Presentation of information in this discussion will protect proprietary information provided by VFPA and its industry partners
- This discussion will not include final recommendations so as to protect the competitive proposal process



Background & Approach

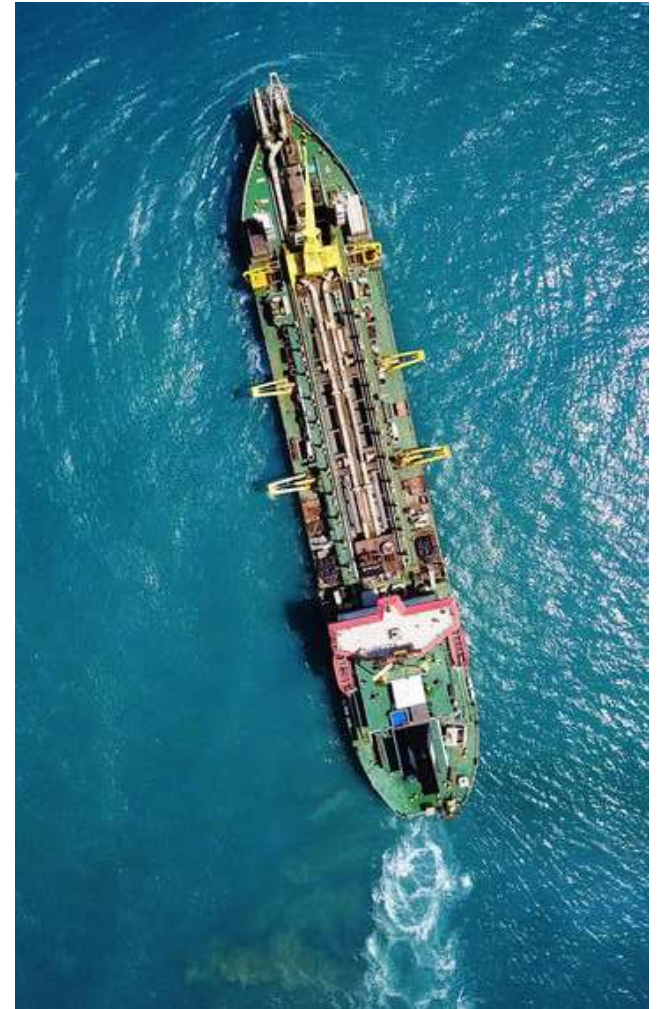
Background

- VFPA envisions becoming the world's most sustainable port as it
“delivers economic prosperity through trade, maintains a healthy environment, and enables thriving communities through meaningful dialogue, shared aspirations and collective accountability”
- VFPA has joined the Northwest Sea Alliance (NWSA) in marine cargo partnership with the Ports of Seattle and Tacoma
- The voluntary commitment includes reduction of maritime emissions to zero by 2050



Approach

- Set baseline of dredge emissions, water quality, and in-water noise
- Research and recommend emerging technologies
- Research and recommend operational efficiency improvements to:
 - Reduce environmental impacts
 - Determine optimized dredge size
 - Utilize emerging technologies
 - Utilize alternative fuel sources



Data Collection - Synergy

- Current Air Emissions Regulations



- Tailpipe Emissions Analysis



Data Collection – Moffatt & Nichol





Emerging Technologies

Emerging Fuel Technologies

Biodiesel	LNG	RNG	Blue Hydrogen	Green Hydrogen
Organic Biomass – Canola, Corn, Soybeans, Spent Cooking Oil	Decomposition of organic matter into natural gas cooled to ~-260° F	Biofuel that has been refined to higher purity standards	A derivative of natural gas through SMR, CO ₂ capture for disposal or beneficial use	Generated through the electrolysis of water
Commercially available in Vancouver	Commercially available in Vancouver	Commercially available in Vancouver	<u>NOT</u> Commercially Available in Vancouver	<u>NOT</u> Commercially Available in Vancouver
Typical Dredge Equipment	Dual Fuel TSHD	Dual Fuel TSHD		IHC Royal Low Energy Adaptive Fuel (LEAF) Dredge
Challenges of infrastructure development to allow ship to ship or shore to ship transfer			Challenges of reduced energy density and storage of increased volume	

Environmental Impact

- Water Quality

- Draghead Selection

- Draghead selection based on riverine, maintenance characteristics
 - Survey of available dragheads included IHC Royal, Vosta LMG, Hi-Sea, HollandMT, and MOTAS

- Overflow Valves

- Butterfly (“Green”) Valves
 - IHC Royal Plumigator



Environmental Impact

- Green Passport

- IMO Guidelines on Ship Recycling, Resolution A.962(23)
- Travels with the ship throughout its lifetime
- Inventory Inspections for amount/location of hazardous materials:
 - At time of construction
 - Periodically over lifetime
 - Prior to recycling



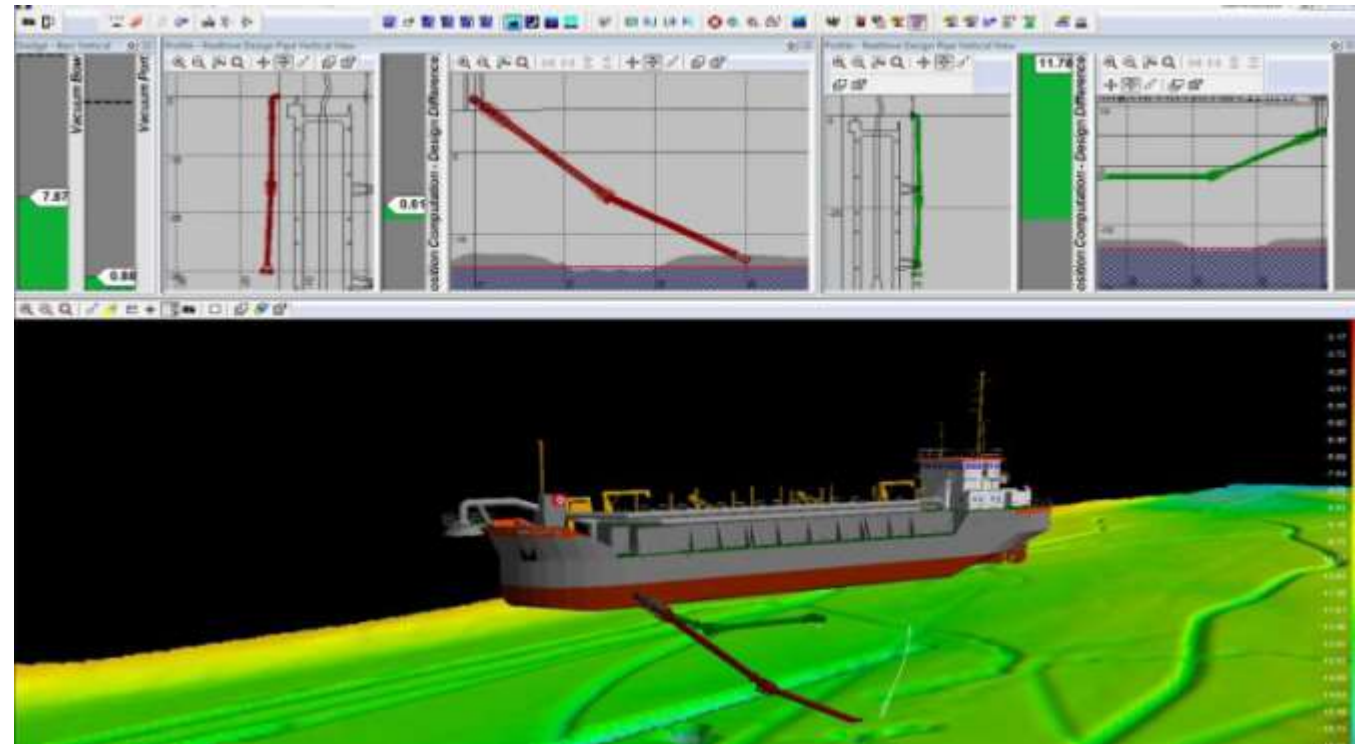
INTERNATIONAL
MARITIME
ORGANIZATION

Automation

- Installed on new or existing dredges
- TSHD Automation platforms optimize dredge performance efficiency by monitoring and modifying:
 - Intake material density
 - Flow speed
 - Volume of solids in hopper
 - Pipeline wear
 - Draft
 - Draghead position
 - Visor control
 - Suction strength
 - Gantry positioning
 - Swell compensation

Visualization

- Teledyne PSD
 - Integration of hydrographic survey equipment and sensors
 - Feeds data collected during active dredging to the operating matrix
 - PDS provides ability to target clean-up work or avoid obstructions without survey downtime





TSHD Sizing & Specifications Assessment

Dredge Sizing – 4,000 m³

- Smaller loads than current capacity (4,630 m³) but increased haul volume % per load
- Decreased load size allows for complete offload at smaller disp. sites without requiring light-loading
- Fewer draft and air-draft restrictions for future supplemental upland disposal areas



FRPD TSHD 309

Dredge Sizing – 6,000 m³

- Larger loads would increase operating time per load
- Increased production in June to September when shoaling rates are at their highest
- Additional float days available in the schedule
- Supply outside project sediment fill needs with clean sand



Specifications Recommendations

- ~50% of offshore disposal is sourced from farthest reach from disposal site
- New upland disposal site west of Mainland Sand & Gravel
 - ~300k m³ disposed east of MS&G vs ~900k m³ to the west
- Limit material rehandling
 - TSHD material placement at transfer pit, re-handled by CSD
 - Future use of a single dredge to pump directly to land
- Increase req. depth in areas of highest shoaling



Conclusion

- Recommendations made to VFPA are intended to:
 - Reduce air emissions, turbidity, and in-water noise
 - Introduce developmental alternative fuels
 - Integrate emerging technologies such as automation, new equipment, and visualization to increase efficiency
 - Identify optimal dredge size to meet VFPA objectives
 - Support VFPA in its initiatives to become the World's most sustainable port

Thank you!

Kristen Ewert

kewert@moffattnichol.com