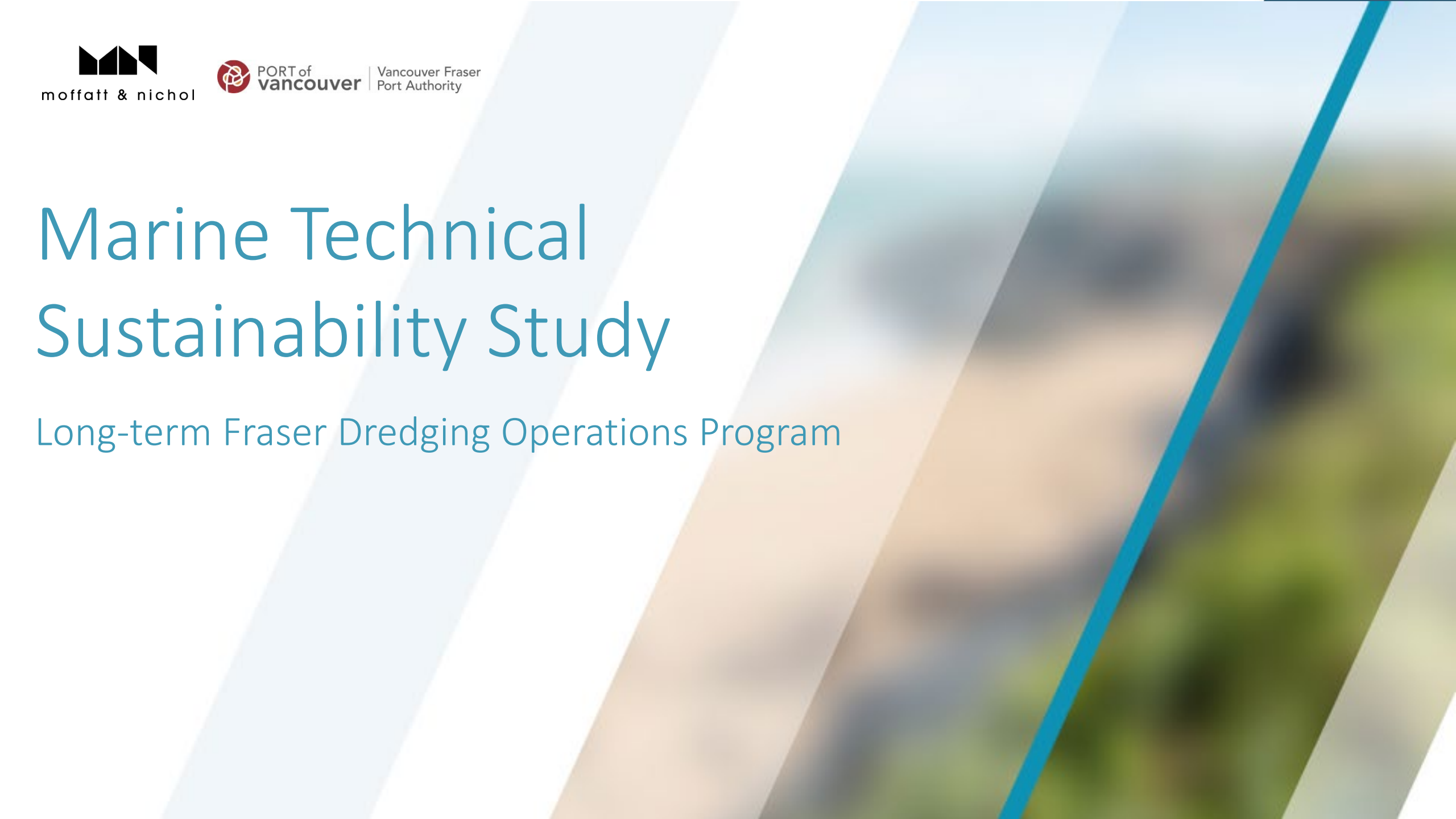
moffatt & nichol

PORT of vancouver | Vancouver Fraser Port Authority

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 the port authority and industry collaborators
- This discussion will not include final recommendations as to protect the competitive proposal process

Background & Approach

Background

- VFPA envisions becoming the world's most sustainable port as it

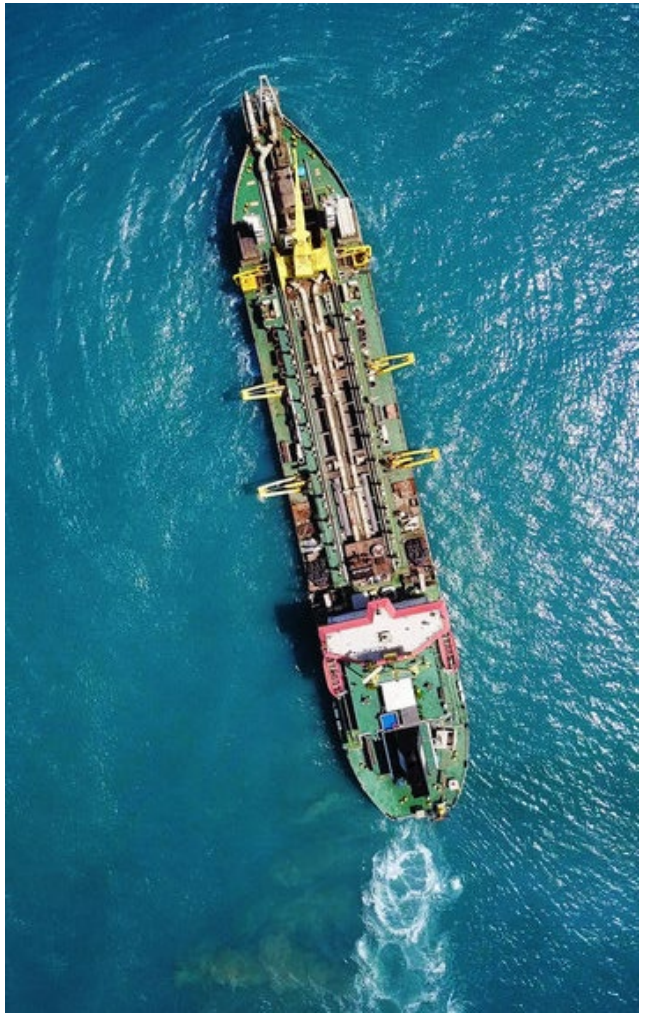
  "delivers economic prosperity through trade, maintains a healthy environment, and enables thriving communities through meaningful dialogue, shared aspirations and collective accountability"

- 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


VANCOUVER
COQUITLAM
SURREY
RICHMOND
Other
(km 35 to 42)
Annieville Channel
(km 30 to 35)
St. Mungo's
(km 27 to 30)
Purfleet Point
(km 24 to 27)
Gravesend Reach
(km 18 to 24)
No. 5 Reach
(km 16 to 18)
Woodwards Reach
(km 12 to 16)
Stevenson Bend
(km 5 to 7)
Stevenson Cut
(km 7 to 12)
Sandheads Reach
(km 1 to 5)
Sandheads
(km -1 to 1)

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

B.C. Low Carbon Fuel Standard

- Tailpipe Emissions Analysis

Natural Resources
Canada

Department
for Environment
Food & Rural Affairs

Data Collection – Industry Collaborators

Boskalis

Jan De Nul GROUP

OCEAN GO FULL FORCE

Van Oord Marine ingenuity

DEME Dredging, Environmental & Marine Engineering

DAMEN

FRPD Since 1911 FRASER RIVER PILE & DREDGE (GP) INC.

Royal IHC

seaspan

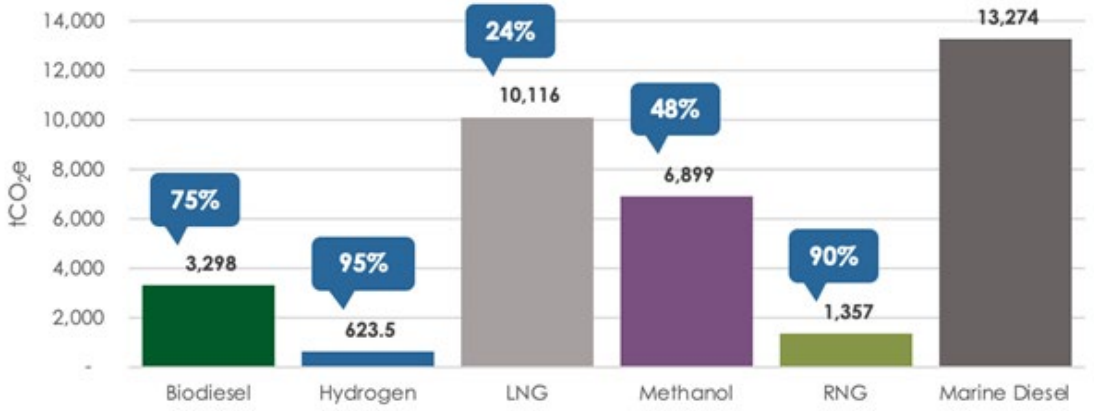
Emerging Technologies

Emerging Fuel Technologies

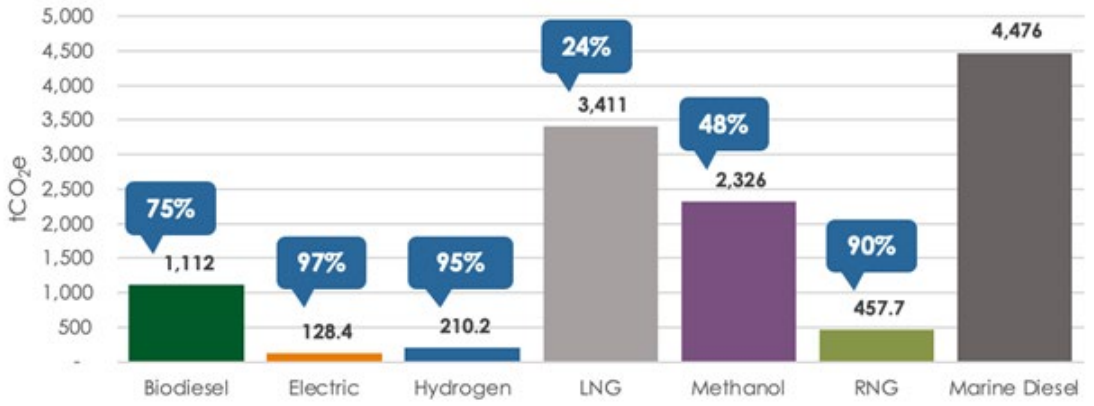
Biodiesel	LNG	RNG	Blue Hydrogen	Green Hydrogen
Organic Biomass – Canola, Corn, Soybeans, Spent Cooking Oil	Decomposition of organic matter into natural gas cooled to ~-260° F	Biofuel that has been refined to higher purity standards	A derivative of natural gas through SMR, CO_2 capture for disposal or beneficial use	Generated through the electrolysis of water
Commercially available in Vancouver	**Commercially available in Vancouver**	Commercially available in Vancouver	**NOT** Commercially Available in Vancouver	**NOT Commercially Available in Vancouver**
Typical Dredge Equipment	Dual Fuel TSHD	Dual Fuel TSHD		IHC Royal Low Energy Adaptive Fuel (LEAF) Dredge
Challenges	Infrastructure Development		~2.5x less energy dense than LNG Must be stored at ~ -250° C	

Emerging Fuel Technologies

LIFECYCLE GHG EMISSIONS BY FUEL TYPE FOR THE TSHD



LIFECYCLE GHG EMISSIONS BY FUEL TYPE FOR THE CSD



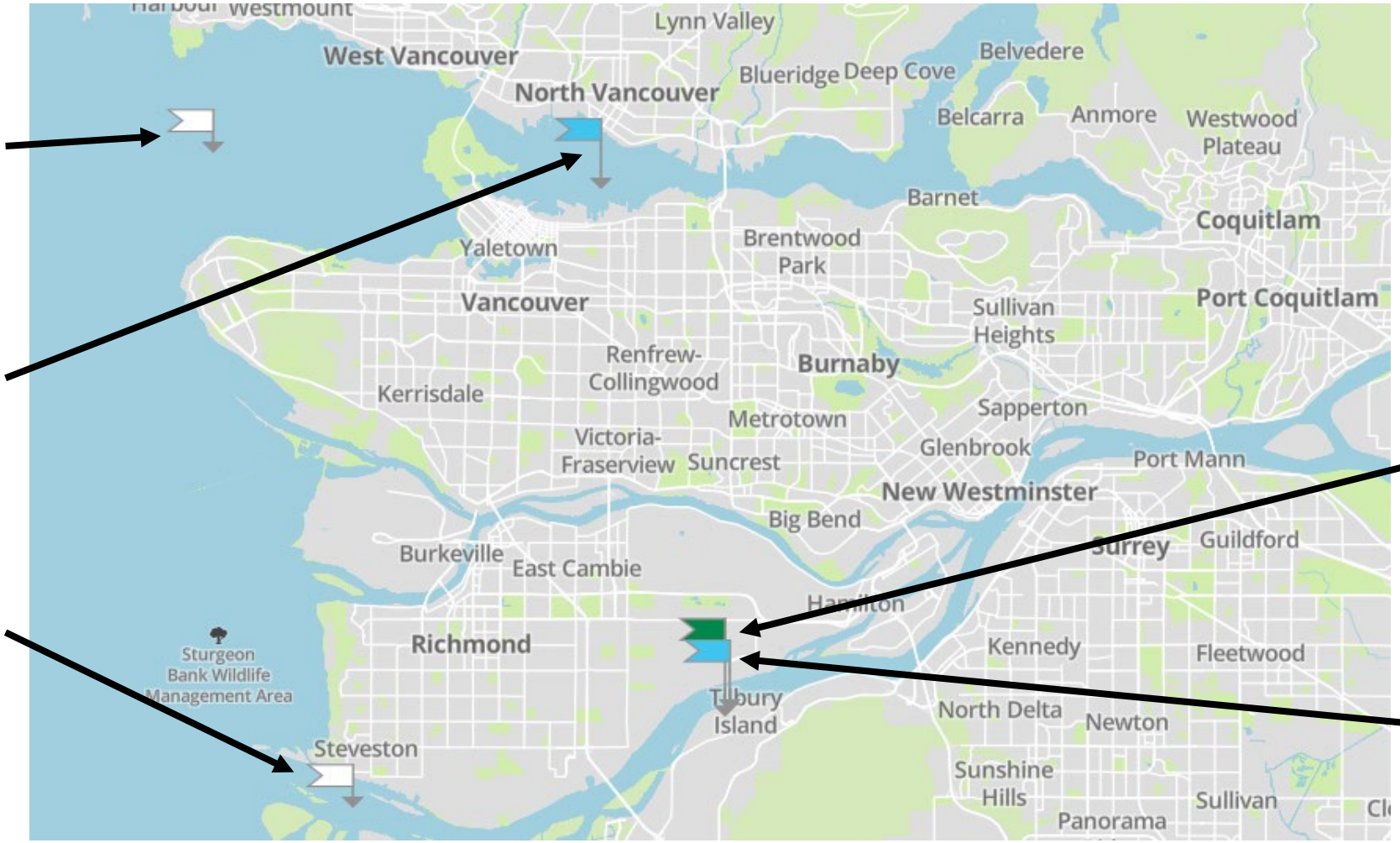
- Lifecycle analysis accounts for emissions produced at every step of production chain through transportation and combustion
- All alterative fuel options result in reduction in emissions over total lifecycle
- Electric power not considered for TSHD

Emerging Fuel Technologies

Ship-to-Ship Bunker
Operator: Cryopeak LNG Solutions
Start Date: 2023

Ship-to-Ship + Shore-to-Ship Bunker
Operator: Seaspan
Start Date: TBD

Ship-to-Ship Bunker
Operator: Seaspan
Start Date: 2023



Tilbury LNG Liquification Facility
Operator: Fortis BC
Start Date: Currently Operational

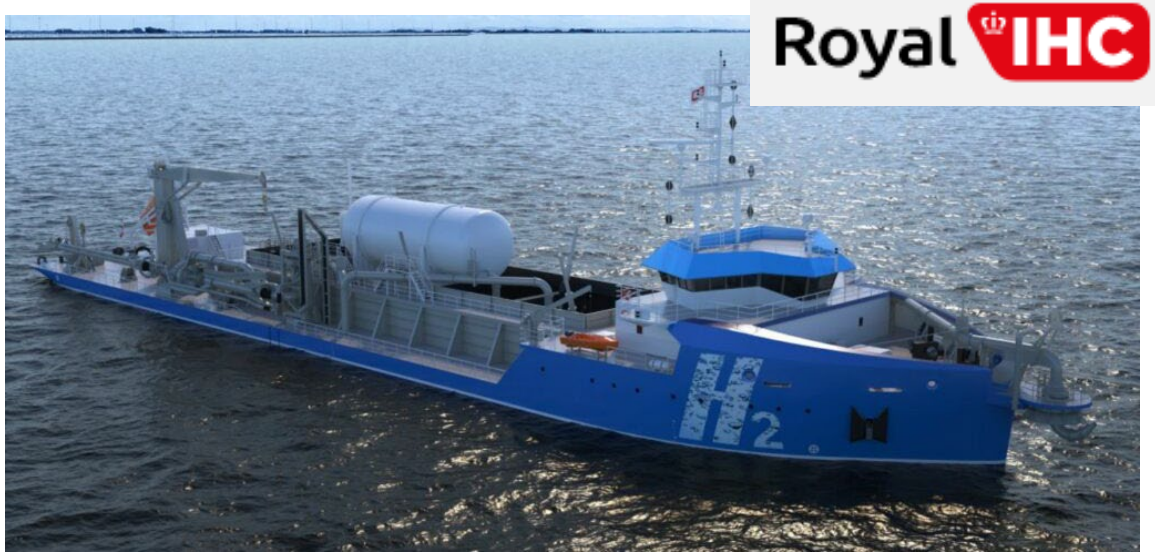
Truck-to-Ship Bunker
Operator: Fortis BC
Start Date: Currently Operational

Emerging Fuel Technologies

Low Energy Adaptive Fuel (LEAF) dredge

- Small format developmental hopper dredge
- Powered by green hydrogen
- Designed for littoral maintenance dredging of the Dutch coastline
- Development started 2019, received AIP 2021
- Expected completion 2024

Royal IHC



Dual-fuel TSHD in production/operation for:

DEME
Dredging, Environmental & Marine Engineering

DAMEN

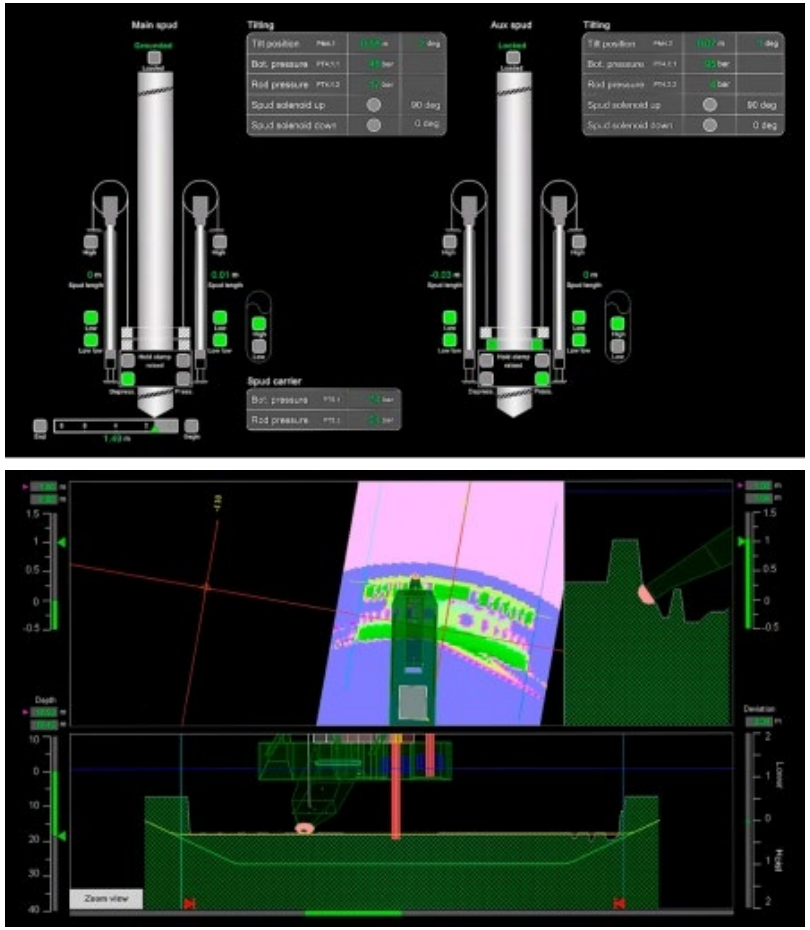
Van Oord
Marine ingenuity

Environmental Impact

- Water Quality
  - Draghead Selection
    - Draghead selection based on riverine, maintenance characteristics
  - Overflow Valves
    - Butterfly (“Green”) Valves
    - IHC Royal Plumigator

Automation

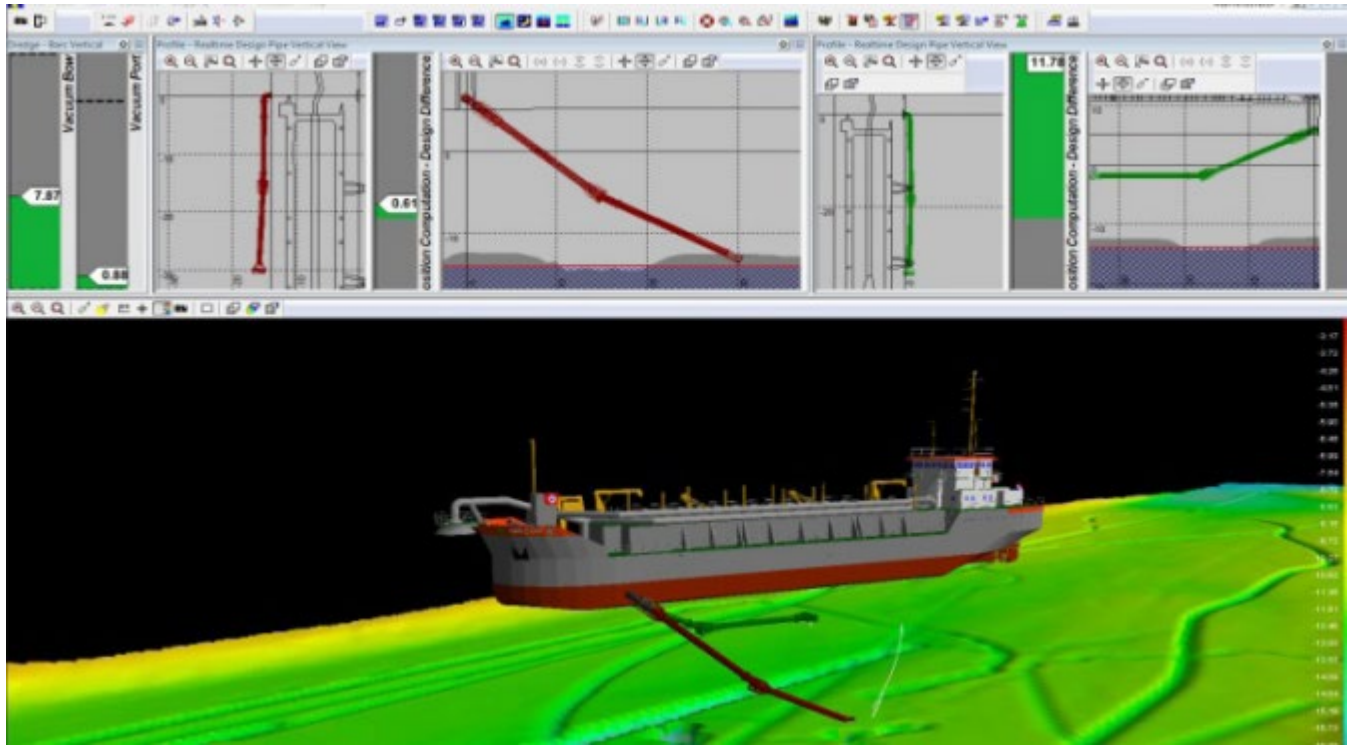
- Installed on new or existing dredges
- TSHD Automation platforms optimize dredge performance efficiency by monitoring and modifying:
  - Intake material density
  - Flow speed
  - Volume of solids in hopper
  - Pipeline wear
  - Draft
  - Draghead position
  - Visor control
  - Suction strength
  -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



Examples of DCS automation retrieved from IHC Royal

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



Example of PDS visualization retrieved from Teledyne

Specifications Assessment

Conclusion

- Recommendations made to the port authority 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 port authority objectives
  - Support port authority in its initiatives to become the World's most sustainable port

Thank you!

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