# Iona Island Wastewater Treatment Plant
## Project Definition Update


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Liquid Waste Committee, February 7, 2020

metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

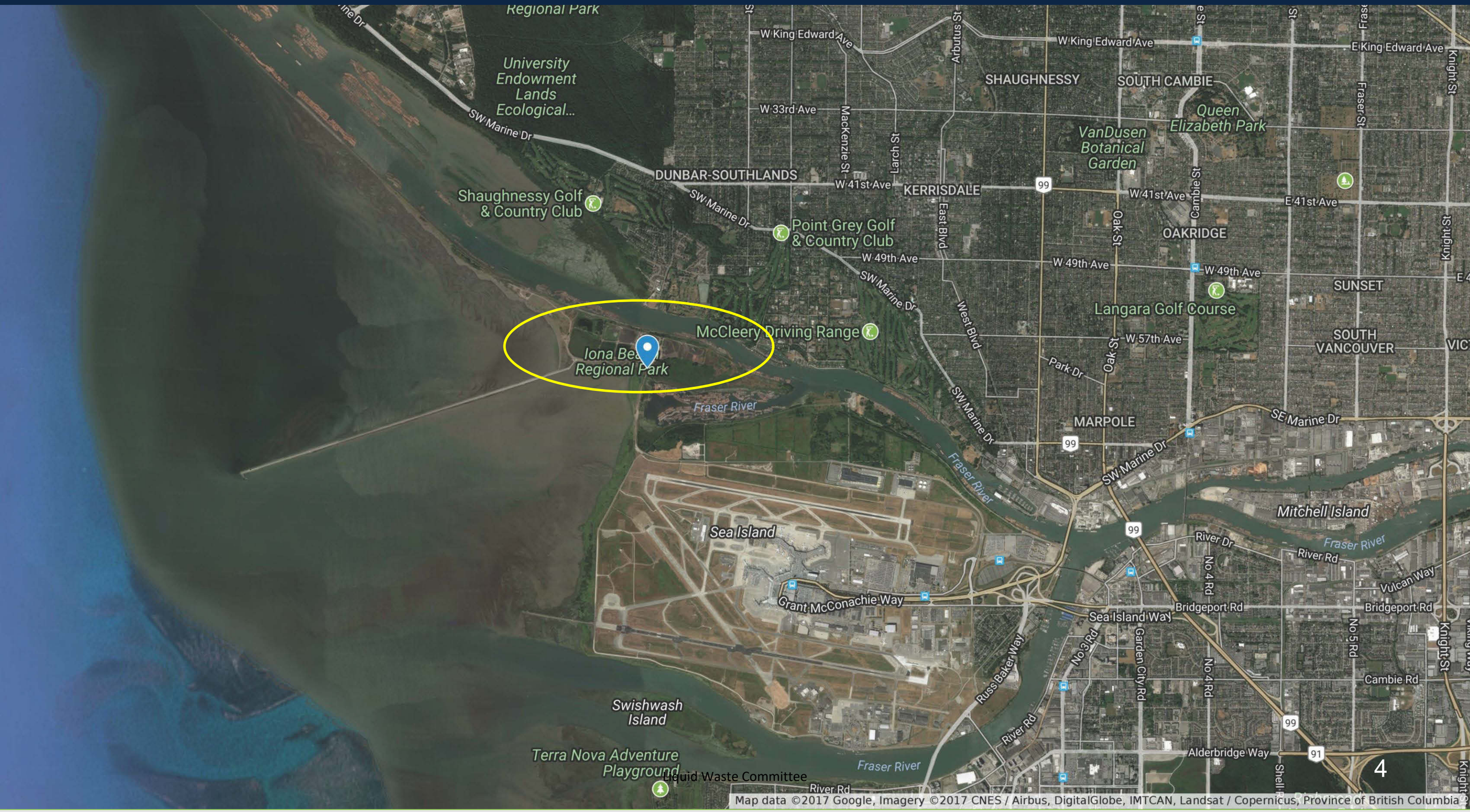
# Agenda

1. Project Definition Overview
2. Liquid and Solids Treatment Options
3. Overview of New Plant Layouts
4. Strategies for New Plant
5. Park Integration and Habitat Enhancement
6. Resource Recovery Opportunities
7. Community Engagement
8. Next Steps

# 1. PROJECT DEFINITION OVERVIEW

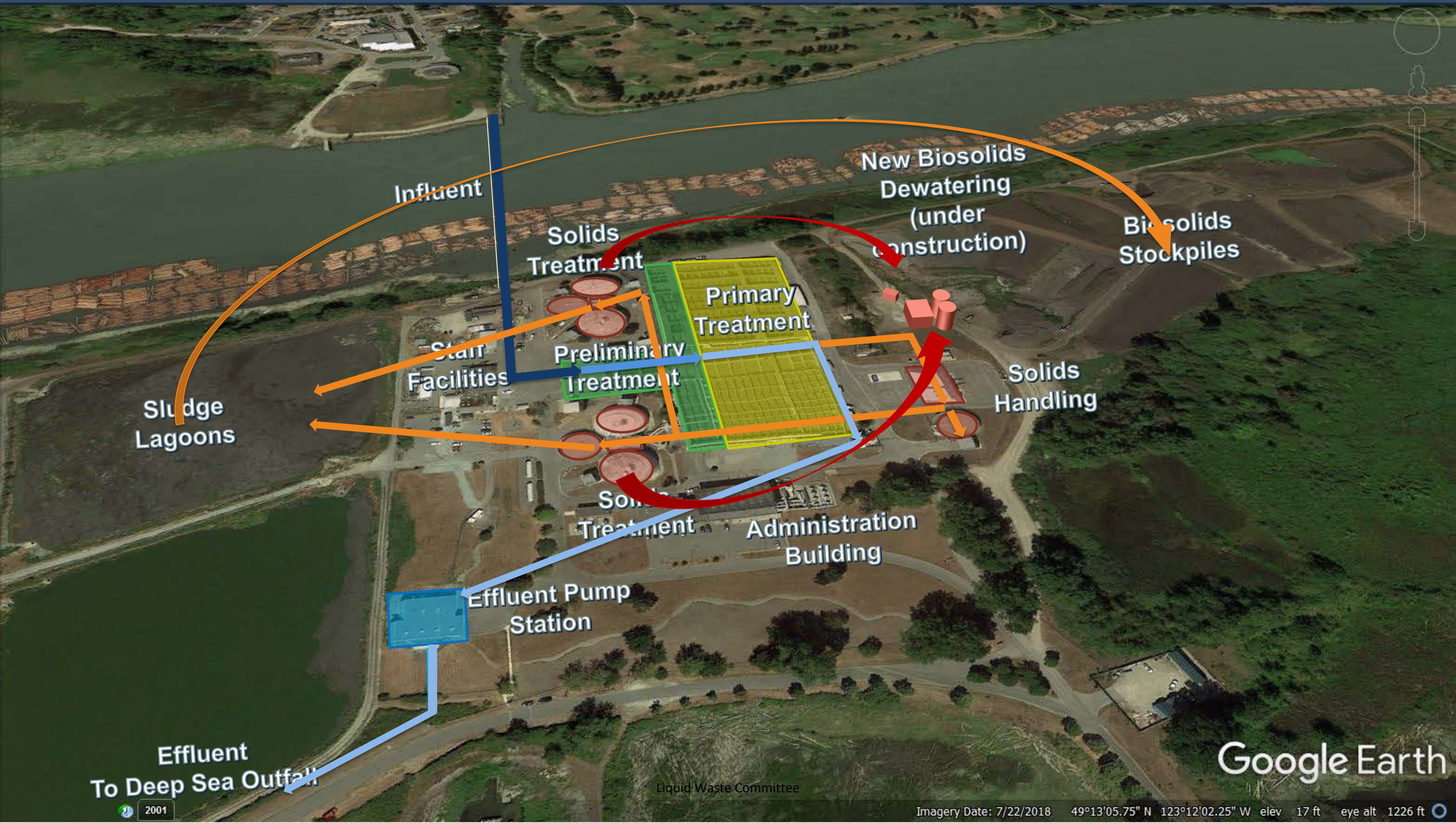
## Overall project timeline

# Plant Location



# Iona Island

# Existing Plant Layout



# Project Definition Goals

- Wastewater Treatment
- Community and Park Integration
- Resource Recovery

# Project Definition Design Considerations

**CLIMATE CHANGE RESPONSE**

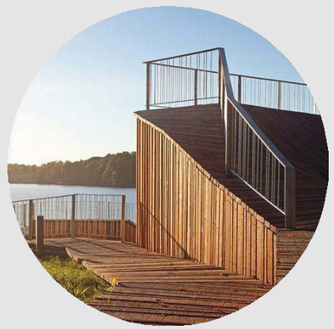
**EDUCATION**

**BIRDING**

**ADAPTABILITY + RESILIENCE**

**LEADERSHIP**

**COMMUNITY HEALTH**



**ARCHITECTURE**

**FACILITY INTEGRATION**

**STEWARDSHIP**

**DELIGHT**


**HISTORY + CULTURE**

**LIFE IN WATER**

**LIFE ON LAND**

**RECREATION**

# Evaluation Principles – Wastewater Treatment

- Effluent quality
- Flexibility for continuous improvement and innovation
- Ease of operation and maintenance
- Capital, operational and maintenance cost
- Adaptability and resiliency to climate change
- Staff safety and wellbeing

# Evaluation Principles – Community and Park Integration

- Ecosystem health of Salish Sea, the region and Fraser River
- Improve habitat for fish, birds and other wildlife
- Footprint, visibility and esthetics
- Air quality and odour emissions
- Light and noise pollution
- Recreational opportunities and improved access
- Cultural and traditional values
- Education, outreach and collaborative partnerships

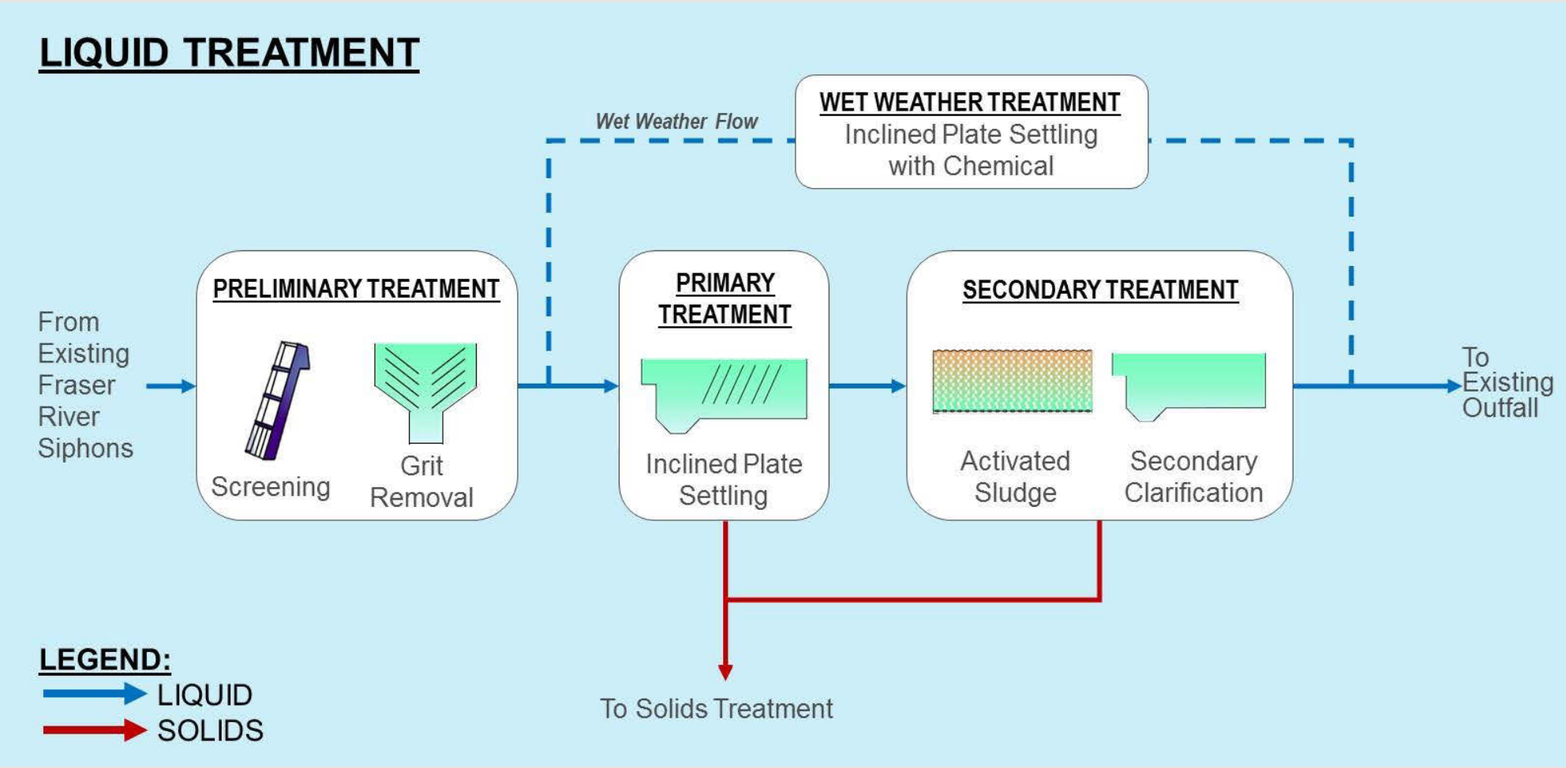
# Evaluation Principles – Resource Recovery

- Recovery and beneficial use of resources
- Circular economy benefits
- Partnerships and collaboration
- Energy generation
- Greenhouse gas emission reduction

# Questions?

# 2. LIQUID AND SOLIDS TREATMENT OPTIONS

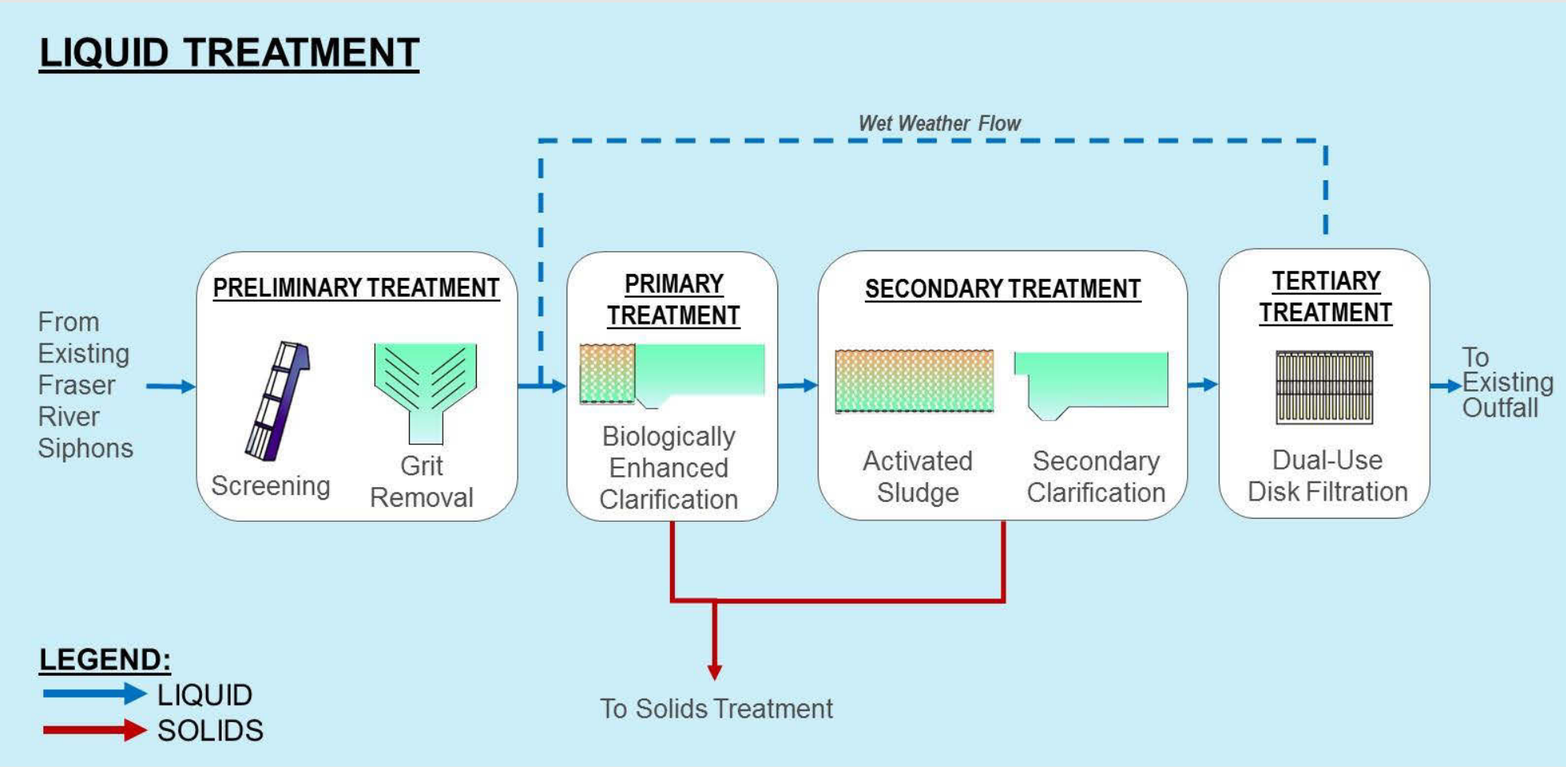
# Liquid Treatment 1 – Secondary Treatment




## Secondary Treatment

- Effluent quality meets regulatory requirements
- Low operational and maintenance intensity
- Provides flexibility for future innovation
- Split site layout and large footprint

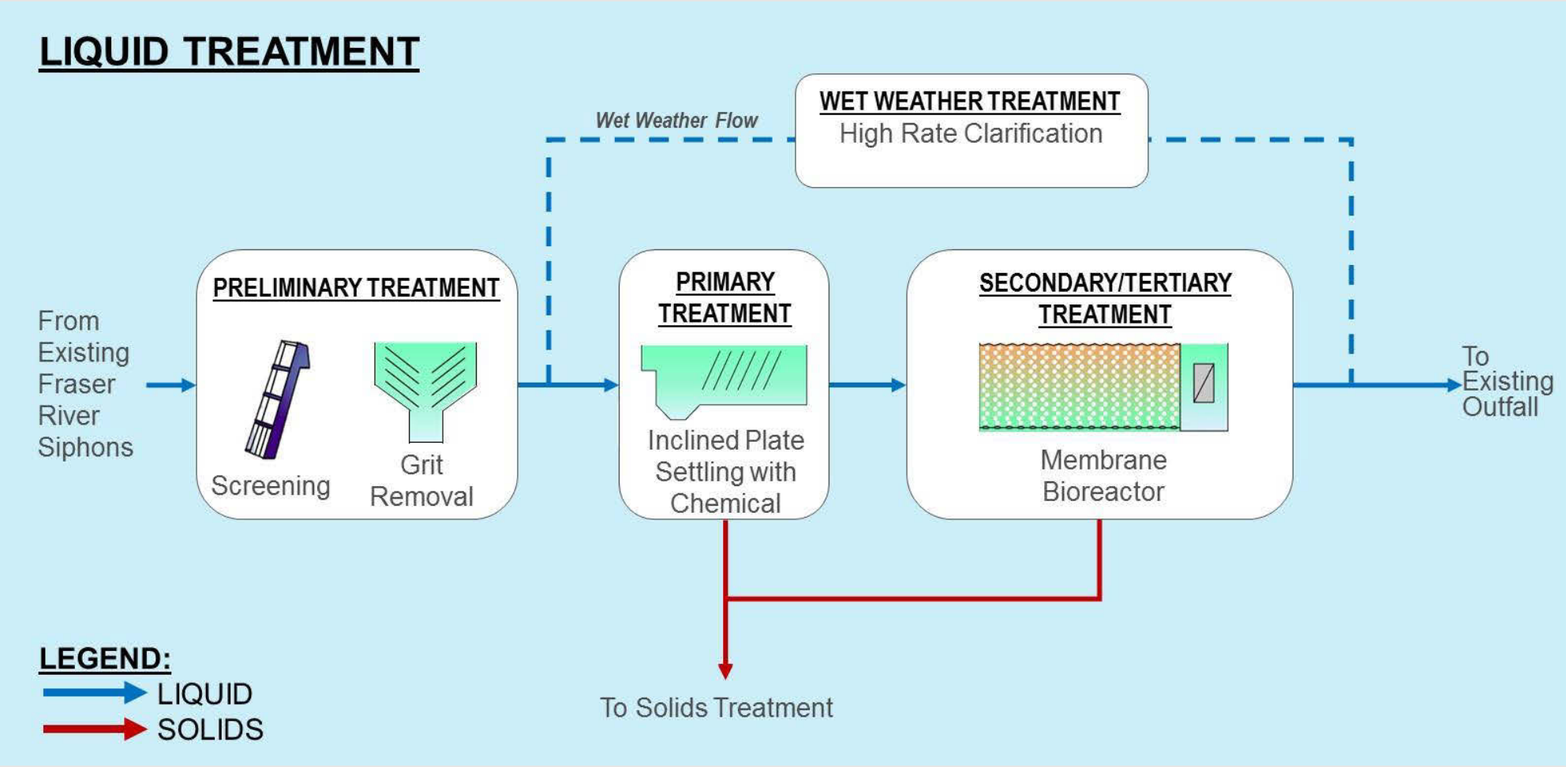
# Liquid Treatment 2 – Tertiary Filtration




## Tertiary Filtration

- Effluent quality meets regulatory requirements + tertiary filtration
- Innovative biological primary treatment
- Highest recovery of carbon for energy production
- Medium operational and maintenance intensity
- Consolidated site layout and medium footprint

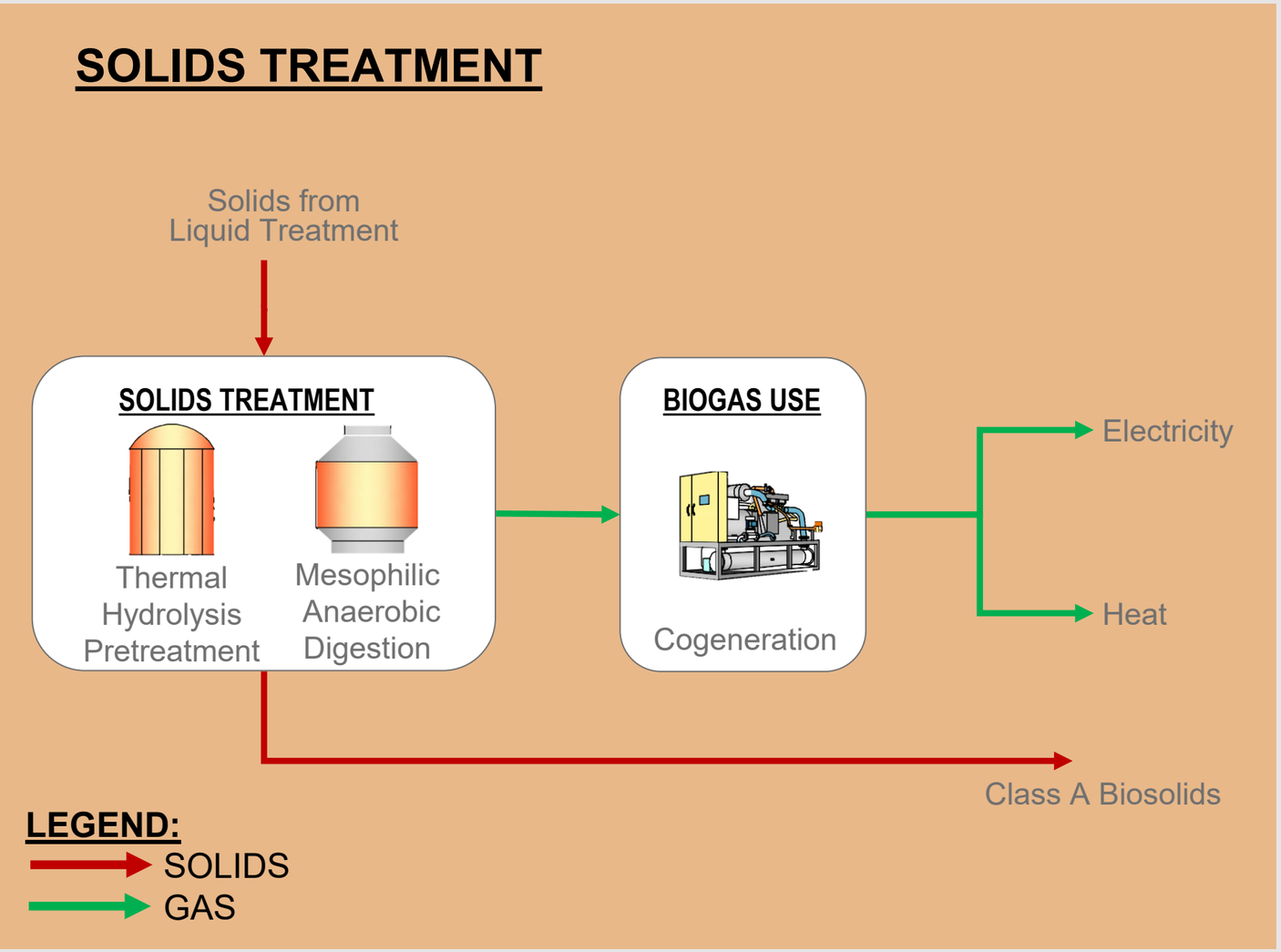
# Liquid Treatment 3
# – Tertiary Membrane Bioreactors (MBR)




## Tertiary MBR

- Tertiary effluent
- Consolidated site layout and smallest footprint
- High chemical use and energy consumption
- High operational and maintenance intensity

# Solids Treatment 1
## – Thermal Hydrolysis, Mesophilic Digestions & Cogeneration



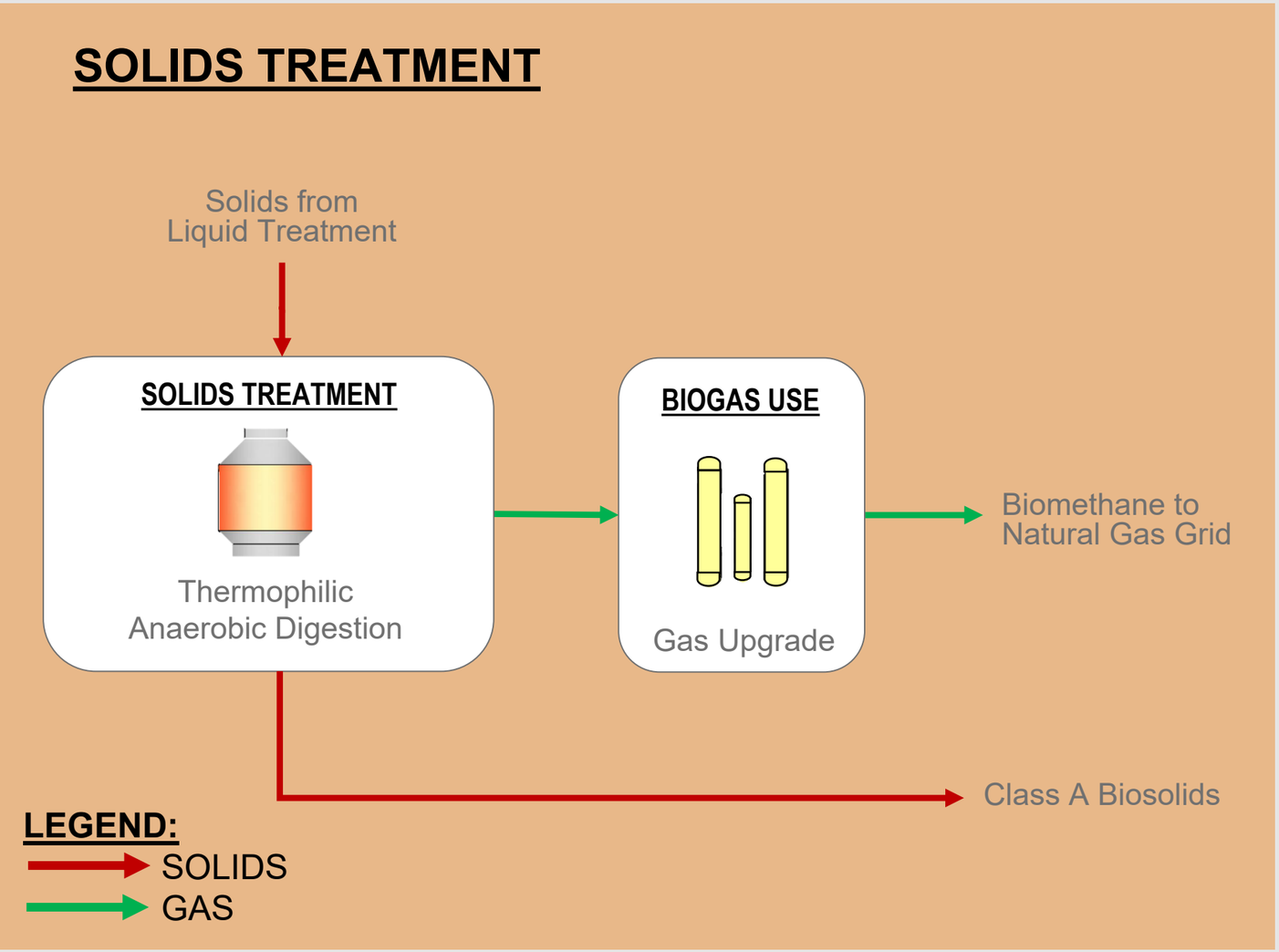

**Thermal Hydrolysis Pretreatment + Mesophilic Digestion**

- High temperature process
- Class A biosolids (land application)
- More biogas production and lower biosolids production
- Smaller digesters
- More equipment & higher operational and maintenance intensity

**Cogeneration**

- Cogeneration to produce electricity and heat for onsite use

# Solids Treatment 2
# – Thermophilic Digestion & Biogas Upgrade



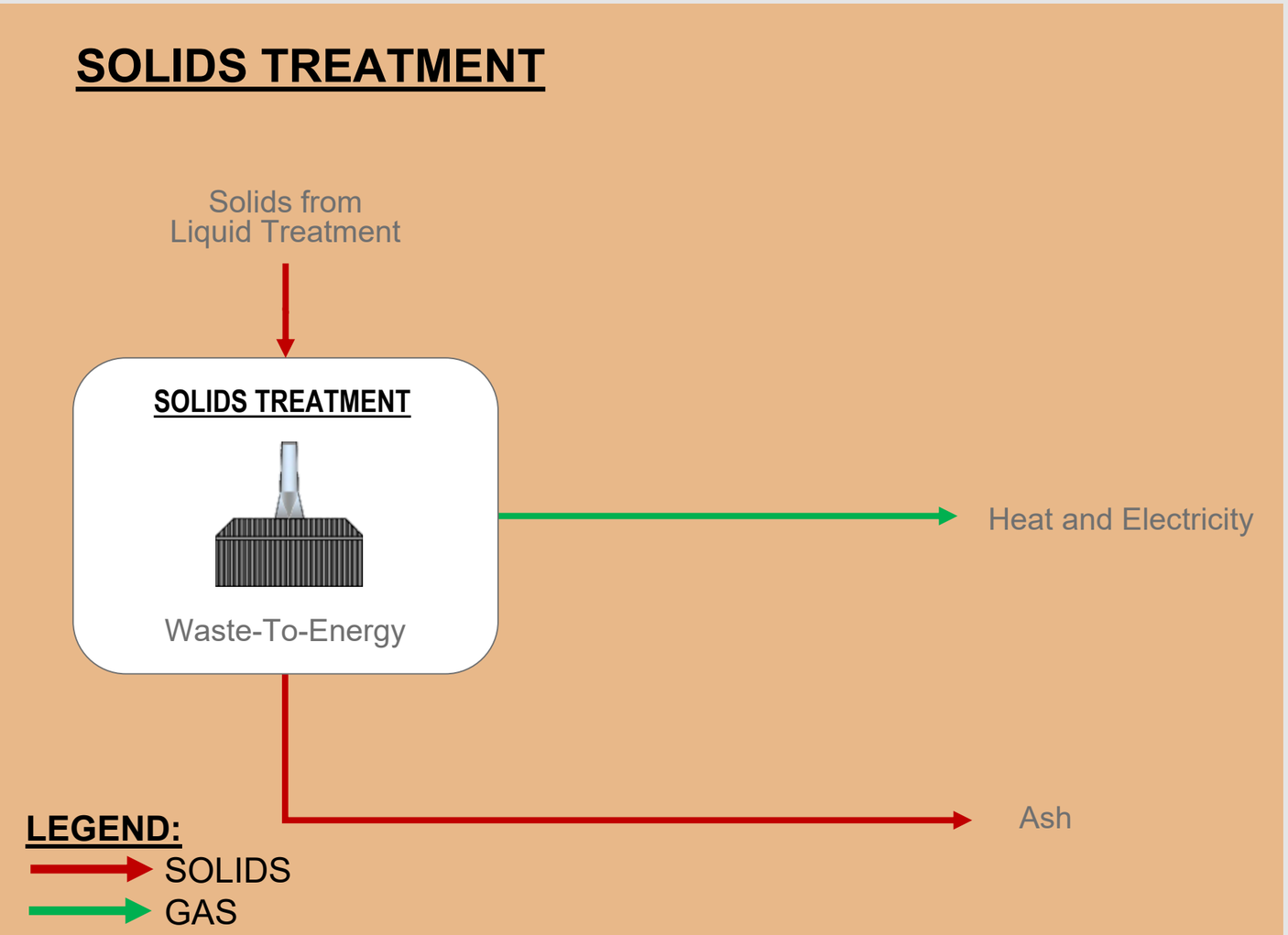

## Thermophilic Digestion

- Class A biosolids (land application)
- Biogas production

## Biogas Upgrade

- Biogas upgraded to produce biomethane for injection to natural gas grid and offsite use

# Solids Treatment 3 – Waste-to-Energy



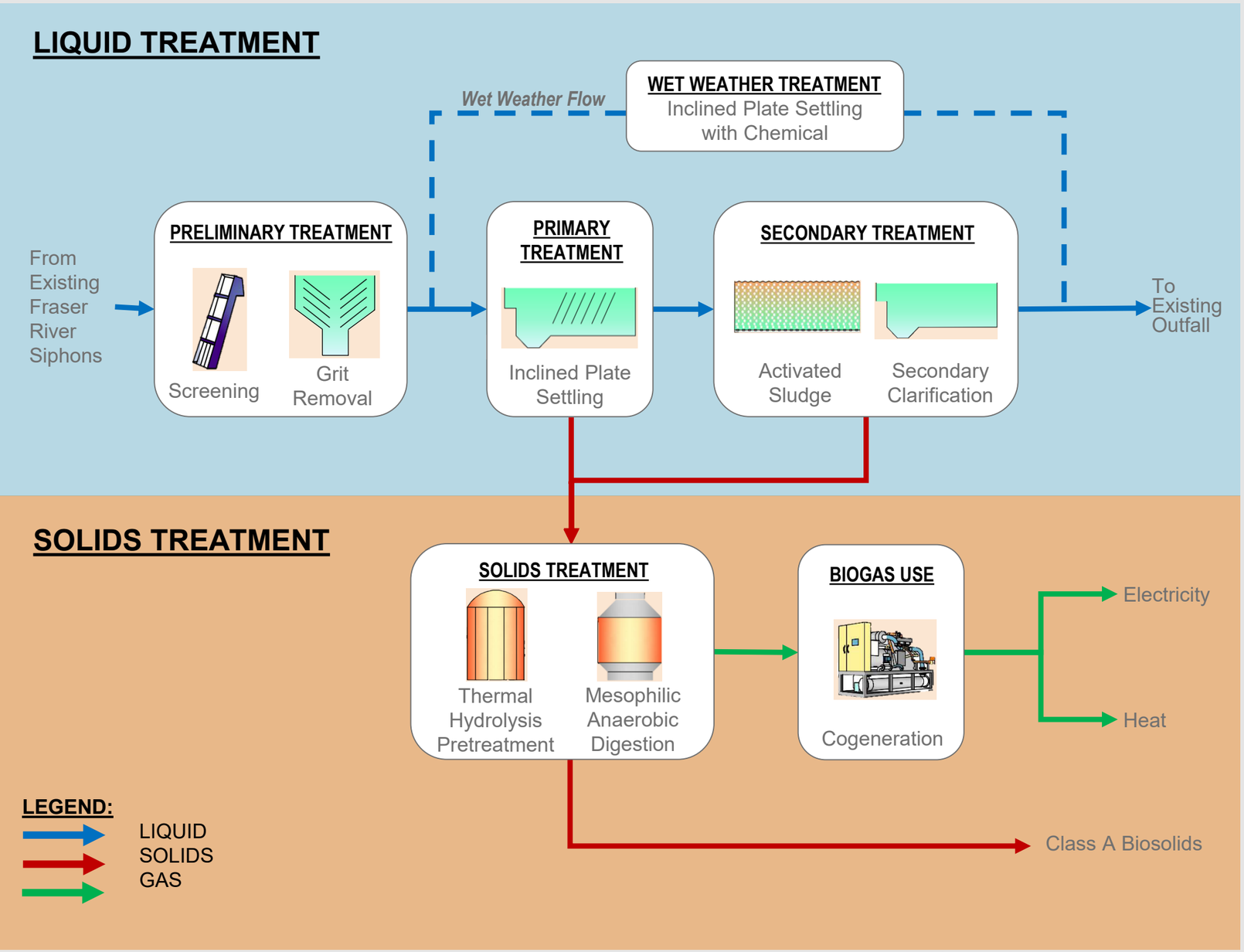

## Waste-to-Energy

- No biogas production
- No dewatered biosolids
- Ash production with potential beneficial use
- Heat and electricity production for onsite use
- Maintenance intensive

# Questions?

# 3. OVERVIEW OF NEW PLANT LAYOUTS

# Concept 1- Secondary Treatment



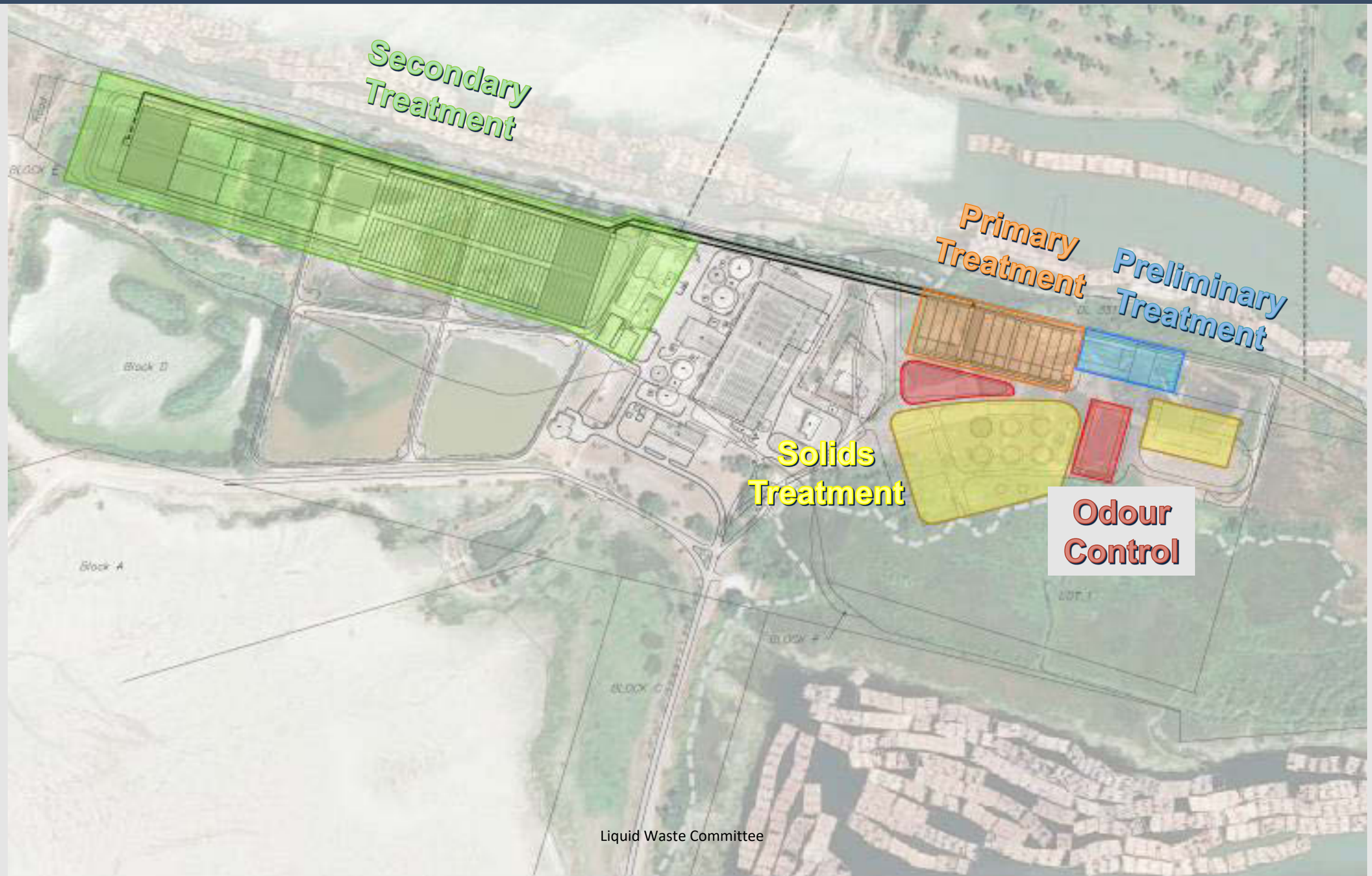

## Key Features

- Secondary clarification
- Smaller digesters with THP
- Secondary effluent that meets regulatory requirements

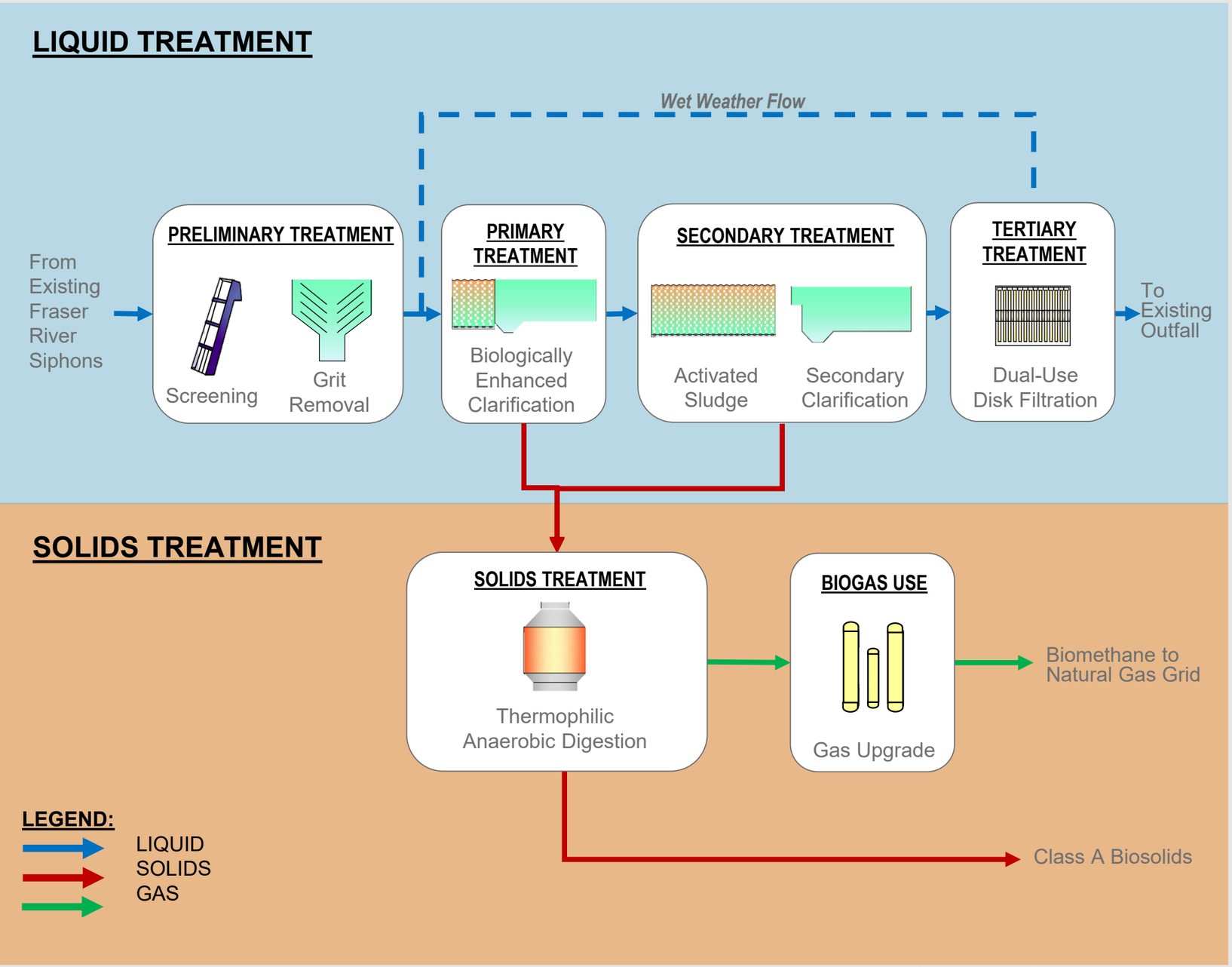
## Resource Recovery Opportunities

- Reclaimed water
- Effluent heat recovery
- Biogas → Electricity and heat
- Class A biosolids

# Concept 1 - Site Layout



# Concept 2 – Tertiary Filtration



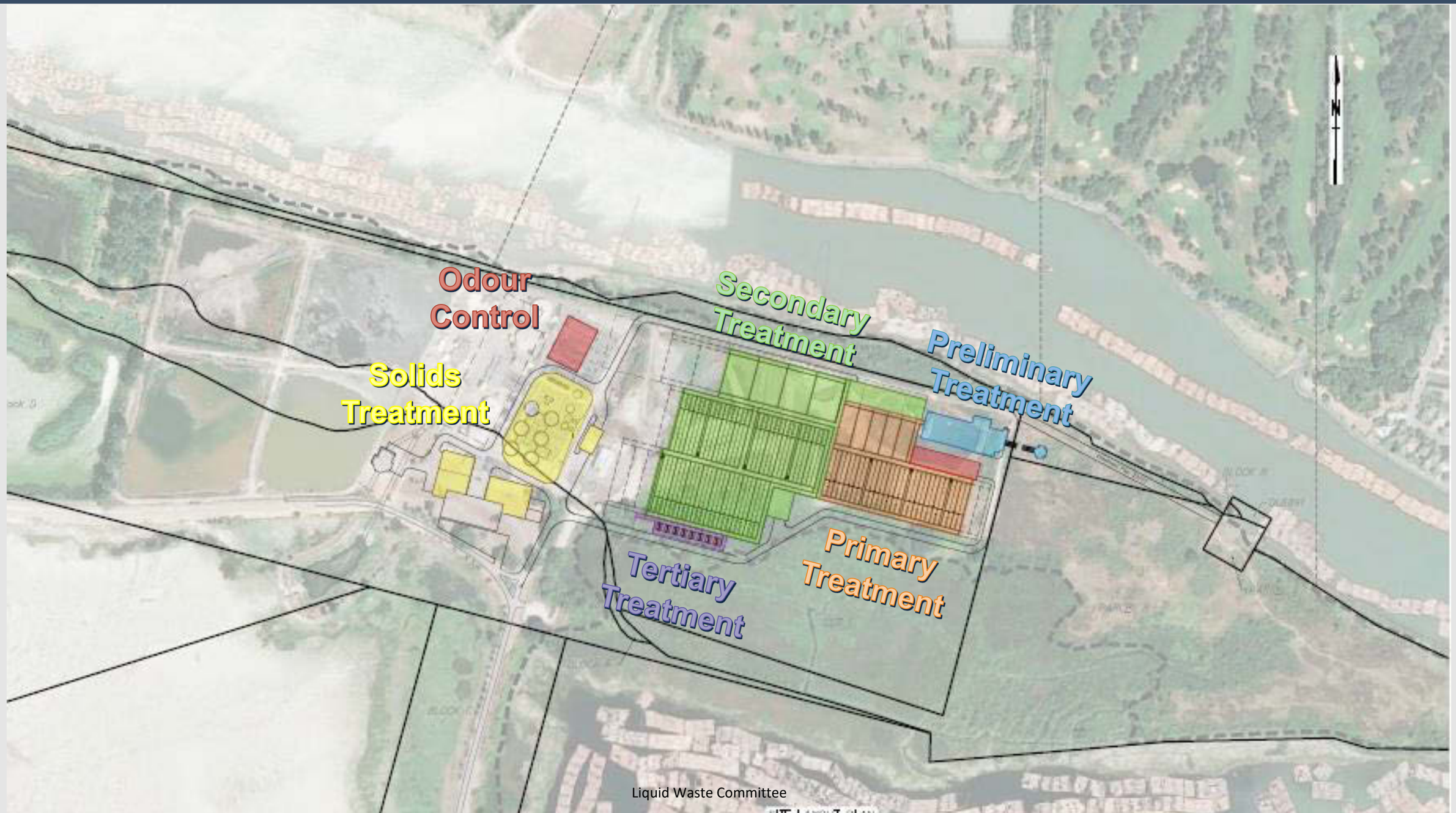

## Key Features

- Enhanced primary followed by secondary clarification
- Tertiary effluent
- Opportunities for effluent reuse
- Biogas upgraded to biomethane
- Higher energy recovery
- Smaller secondary tanks

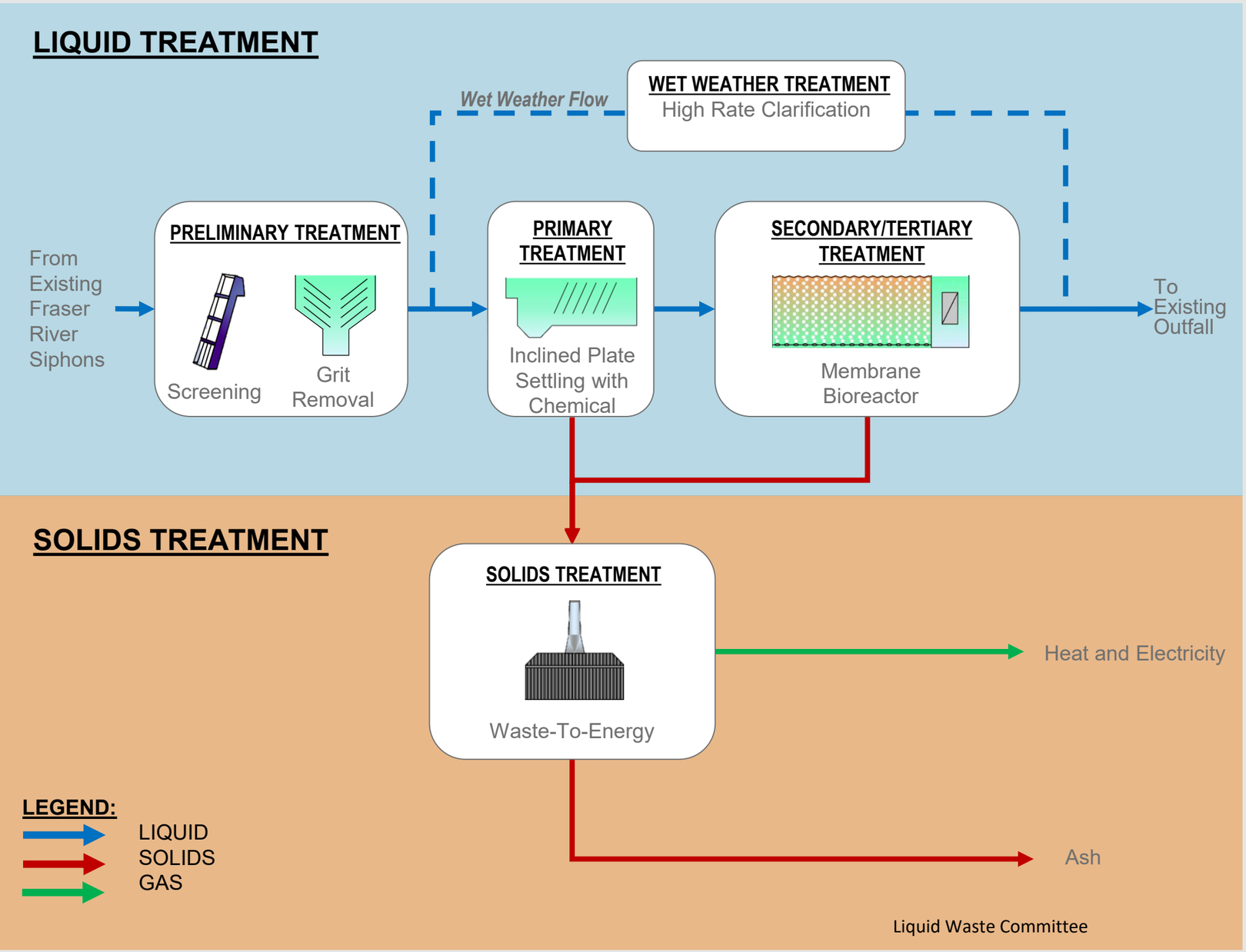
## Resource Recovery Opportunities

- Reclaimed water
- Effluent heat recovery
- Biogas → biomethane → grid
- Class A biosolids

# Concept 2 - Site Layout



# Concept 3 – Tertiary Membrane Bioreactor (MBR)



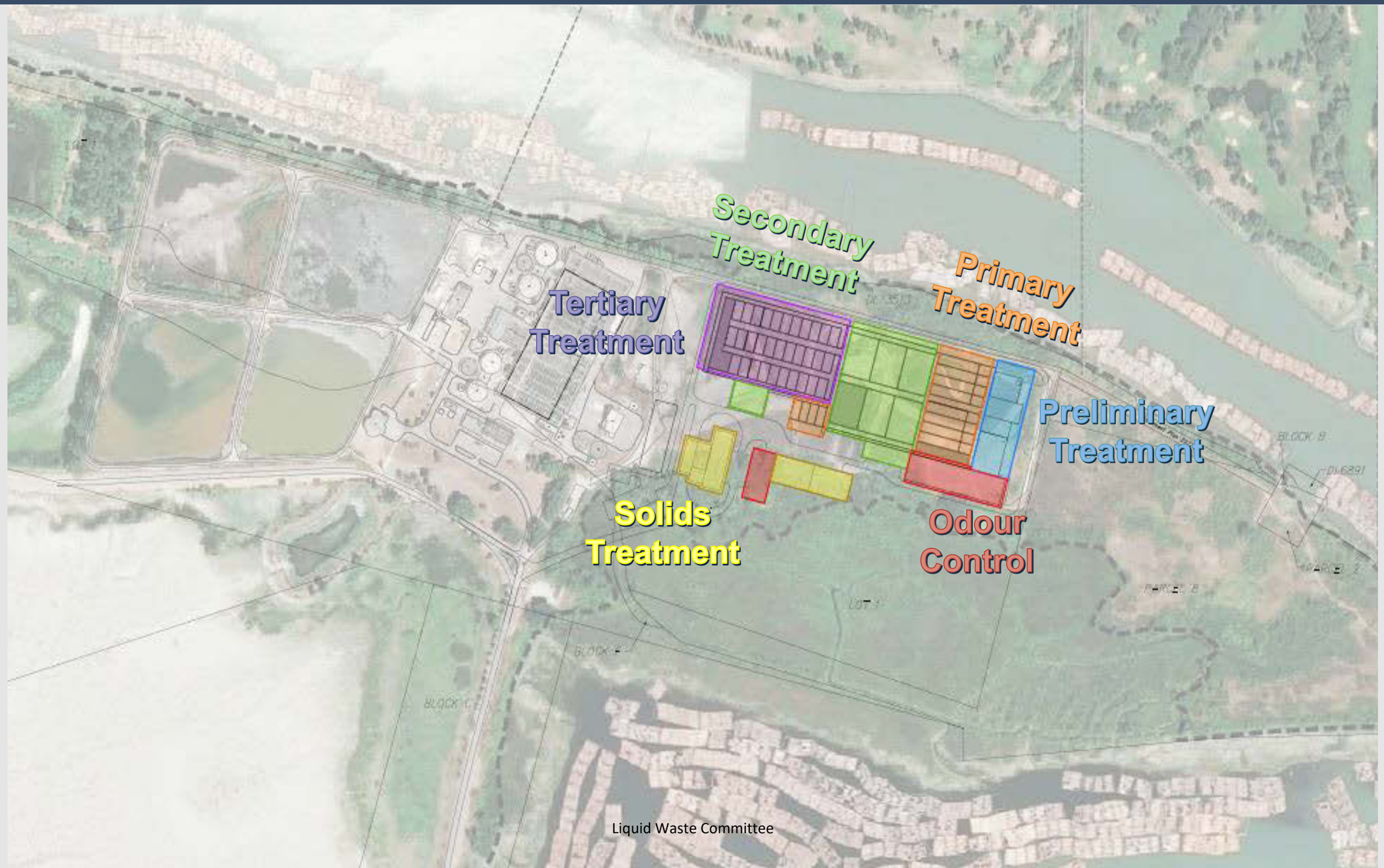

## Key Features

- Secondary and Tertiary level treatment achieved within small footprint
- Opportunities for effluent reuse
- Ash management in lieu of biosolids

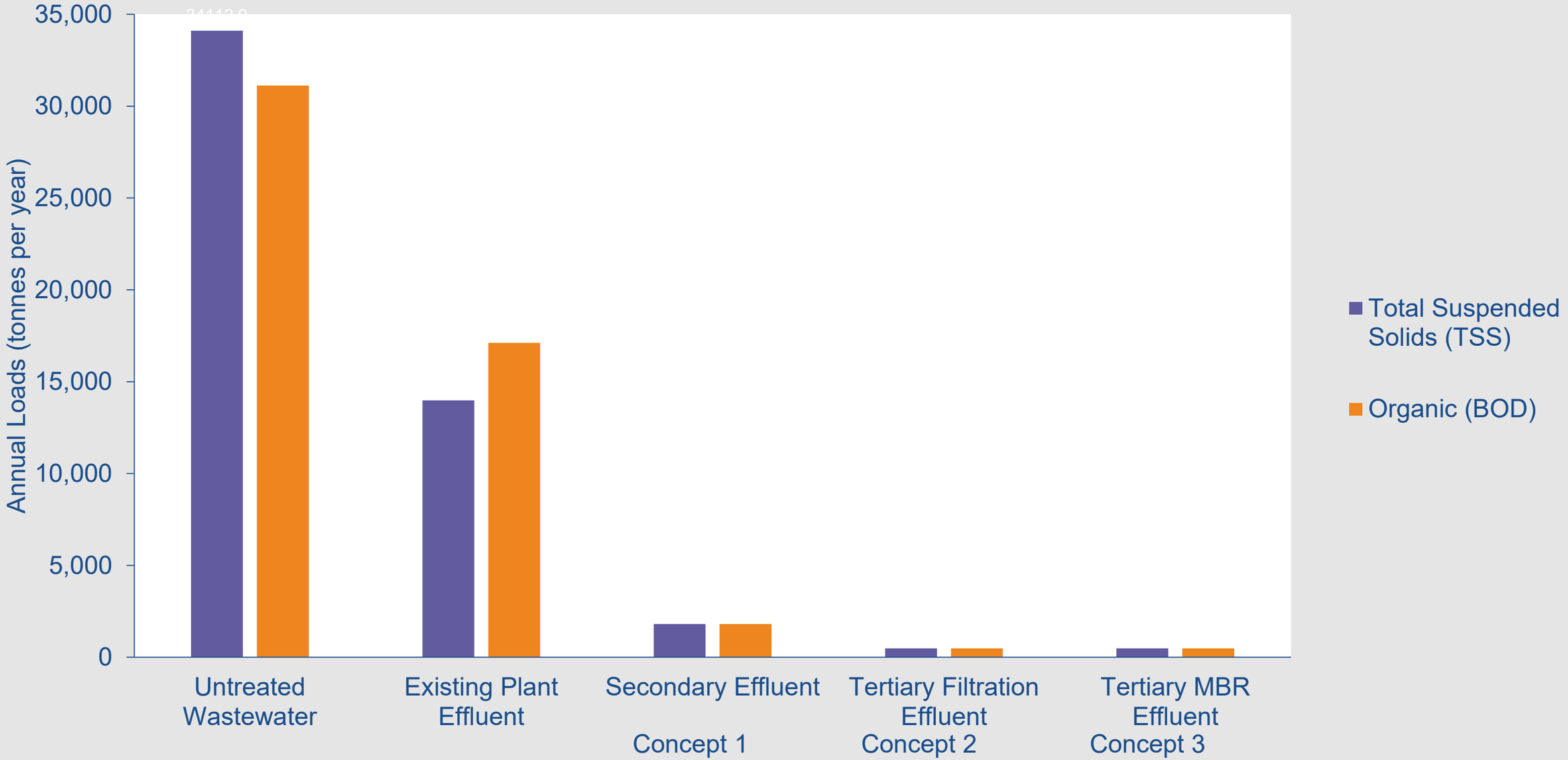
## Resource Recovery Opportunities

- Reclaimed water
- Effluent heat recovery
- Heat and electricity recovery
- Beneficial use of ash

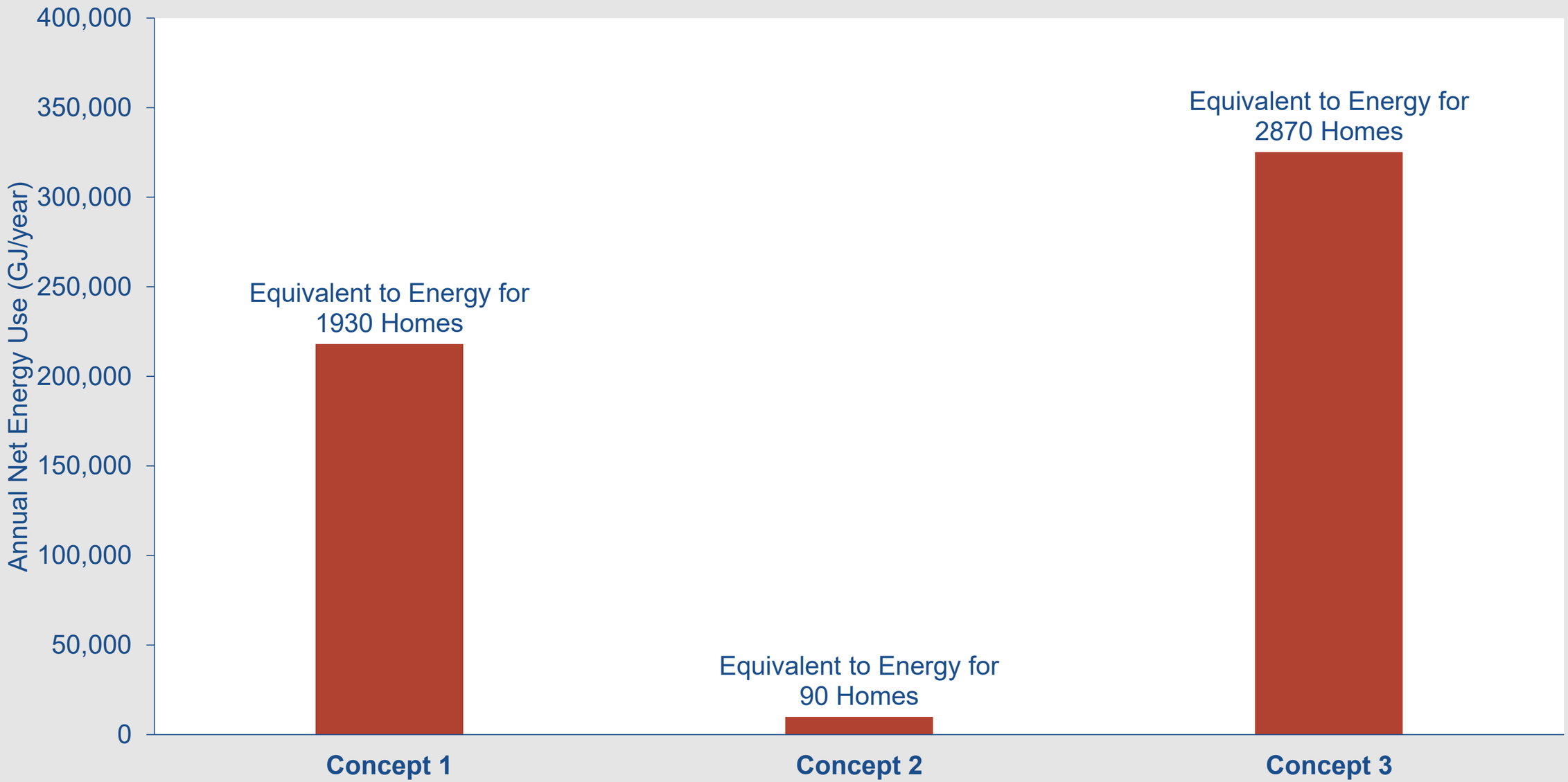
# Concept 3 - Site Layout



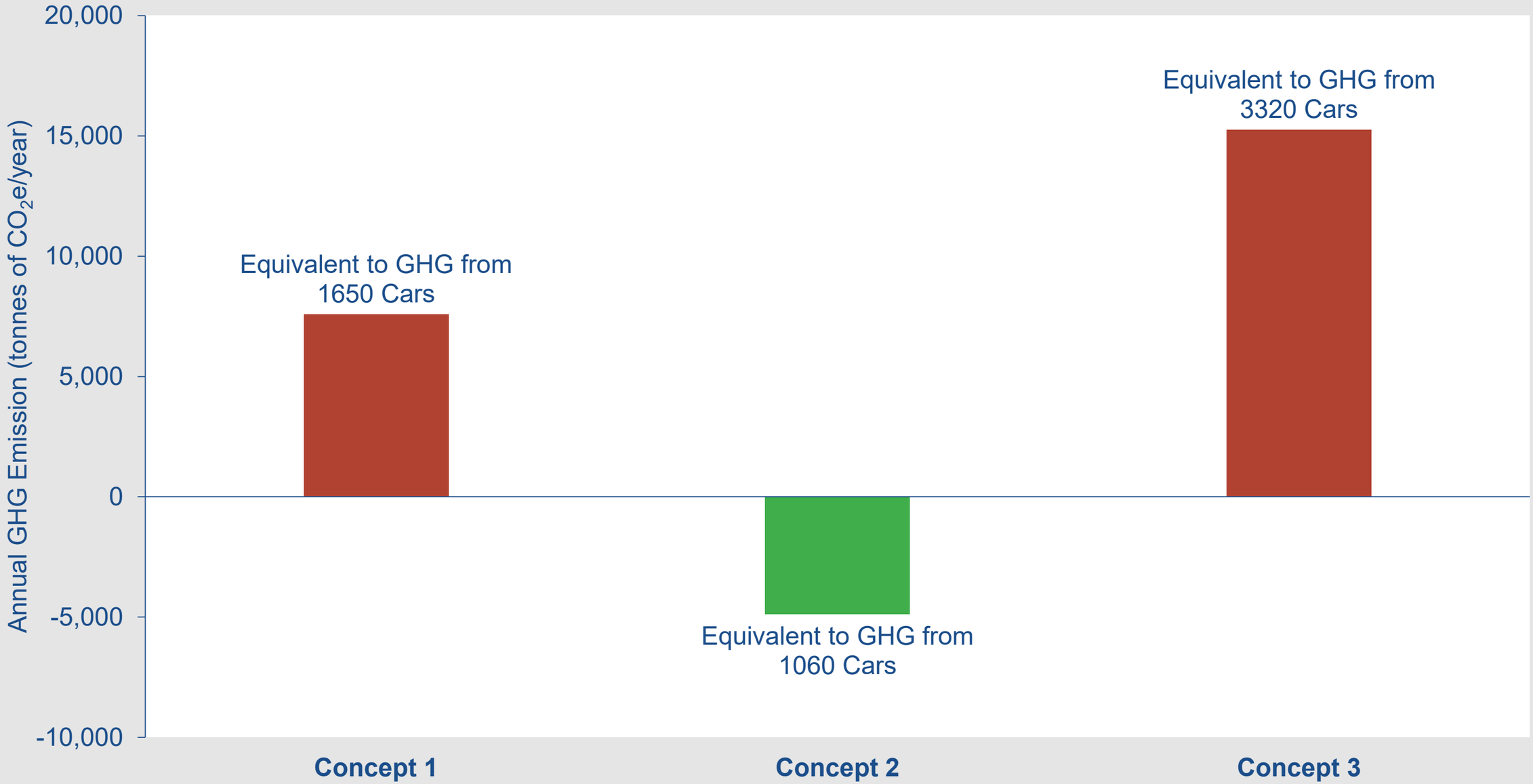
# Comparing Annual Solids and Organics Discharge



# Net Energy Use



# Greenhouse Gas Emissions



# Comparison of Options

| Criteria | Concept 1<br>Base Secondary | Concept 2<br>Tertiary Filtration | Concept 3<br>Tertiary MBR |
|---|---|---|---|
| Operational Complexity | Medium | Low | High |
| Maintenance Requirements | High | Low | High |
| Health and Safety Risks | High | Low | High |
| Odour Release Risks | High | Medium | Low |
| Footprint | Large | Medium | Small |
| Ability to Adopt Future Technological Innovations | Medium | High | Low |
| Capital Cost (2020 Dollars) | Highest | Lowest | Medium |
| Annual Operating Cost | Medium | Lowest | Highest |

# Summary of Analysis

**<u>Concept 2</u> provides:**

- Tertiary filtered effluent that surpasses secondary treatment standards
- Lowest energy consumption
- Highest potential for energy production
- Lowest greenhouse gas emissions
- Simplest operation and maintenance
- Lowest health and safety risks
- Lowest capital and O&M costs
- Highest flexibility for future adaptation

# Questions?

# 4. STRATEGIES FOR NEW PLANT

# Existing Plant

- 60 years old (built from 1959 to 1963)
- Additional stages added in 1973, 1978, 1981 and 1985
- Effluent pump station & deep outfall 32 years old (built 1988)


Liquid Waste Committee

# Recent Upgrades to Solids Treatment

Recent upgrades:

- Digester retrofits and mixing upgrades
- Biogas piping upgrades
- Solids handling building
- Biosolids dewatering facility (2021)

# Staging Plant Implementation

Key considerations for construction of new plant:

- Useful life of existing assets
- Flexibility for future innovation
- Regional biosolids dryer potentially operational prior to 2030
- Reduce capital cost

Opportunity to stage implementation of Concept 2 by reusing solids treatment

# Risk of Reusing Solids Treatment

- Not designed to seismic standards
- Maintaining operations while retrofitting is challenging
- Concrete surfaces require refurbishment
- Constructed below future flood levels

# Staging Strategy for Concept 2

- New liquid treatment
- Upgrade existing solids treatment
- Utilize new solids handling and dewatering facilities
- Excess biosolids to new regional biosolids dryer
- Potential savings by deferring cost of new digesters
- Flexibility to adopt Hydrothermal Liquefaction technology in the future

# Questions?

# 5. PARK INTEGRATION and HABITAT ENHANCEMENT

# Iona Beach Regional Park

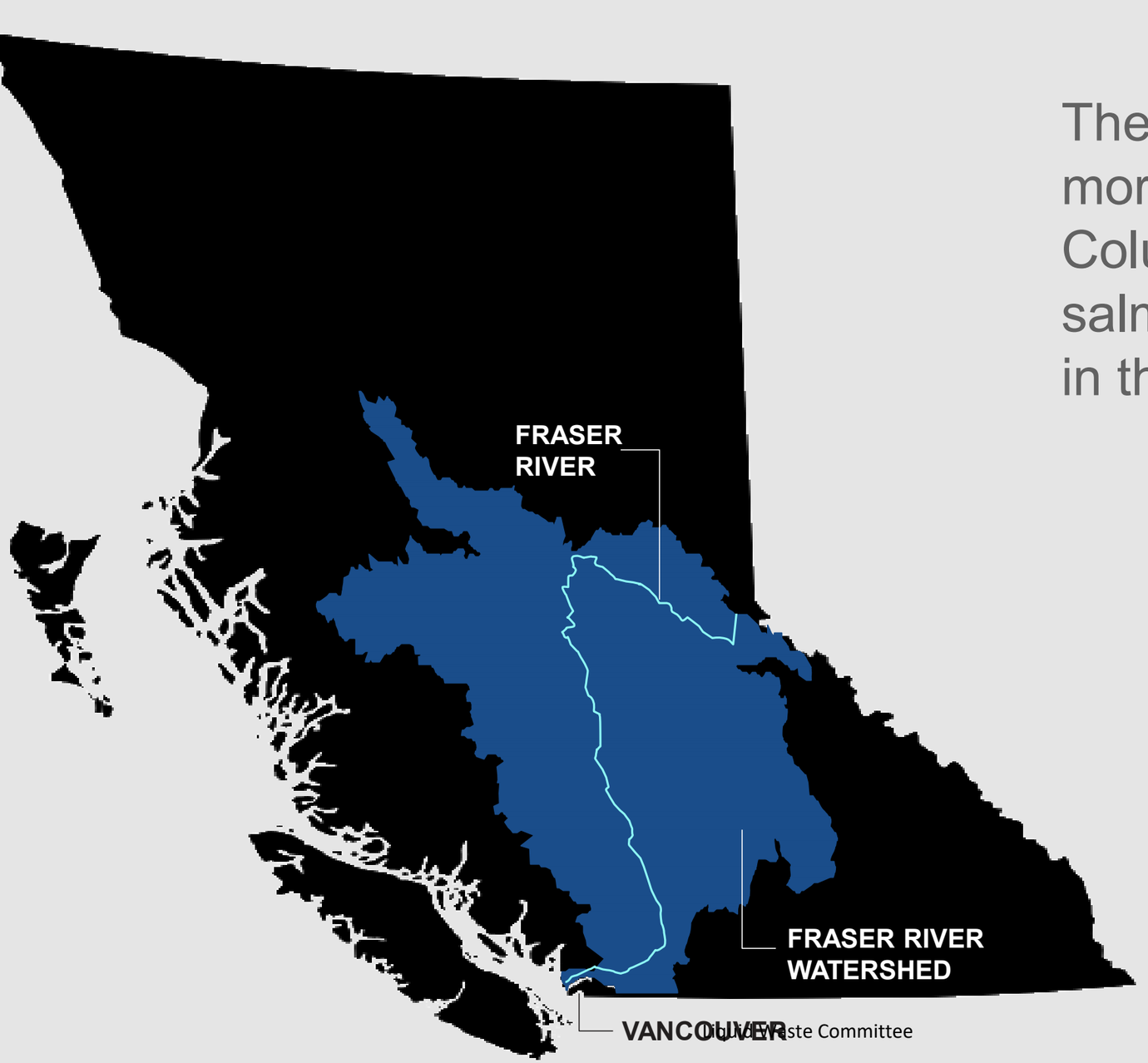
# Iona Beach Regional Park


Iona South Outfall Jetty


Interpretive Programs


Coastal Sand Ecosystem

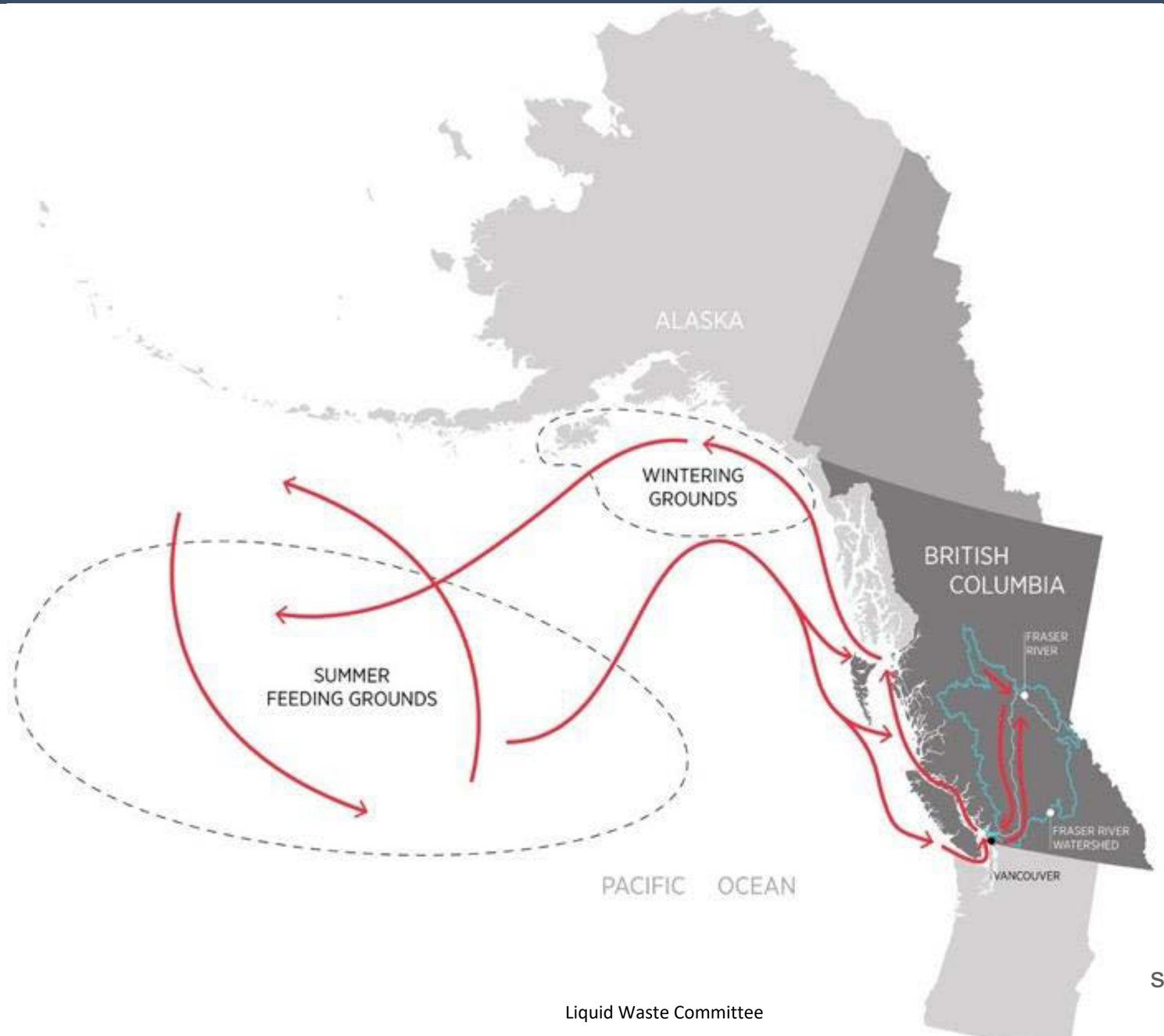
# The Fraser River Basin




The Fraser River Basin drains more  than a quarter of British Columbia, and supports more salmon runs than any other river in the world

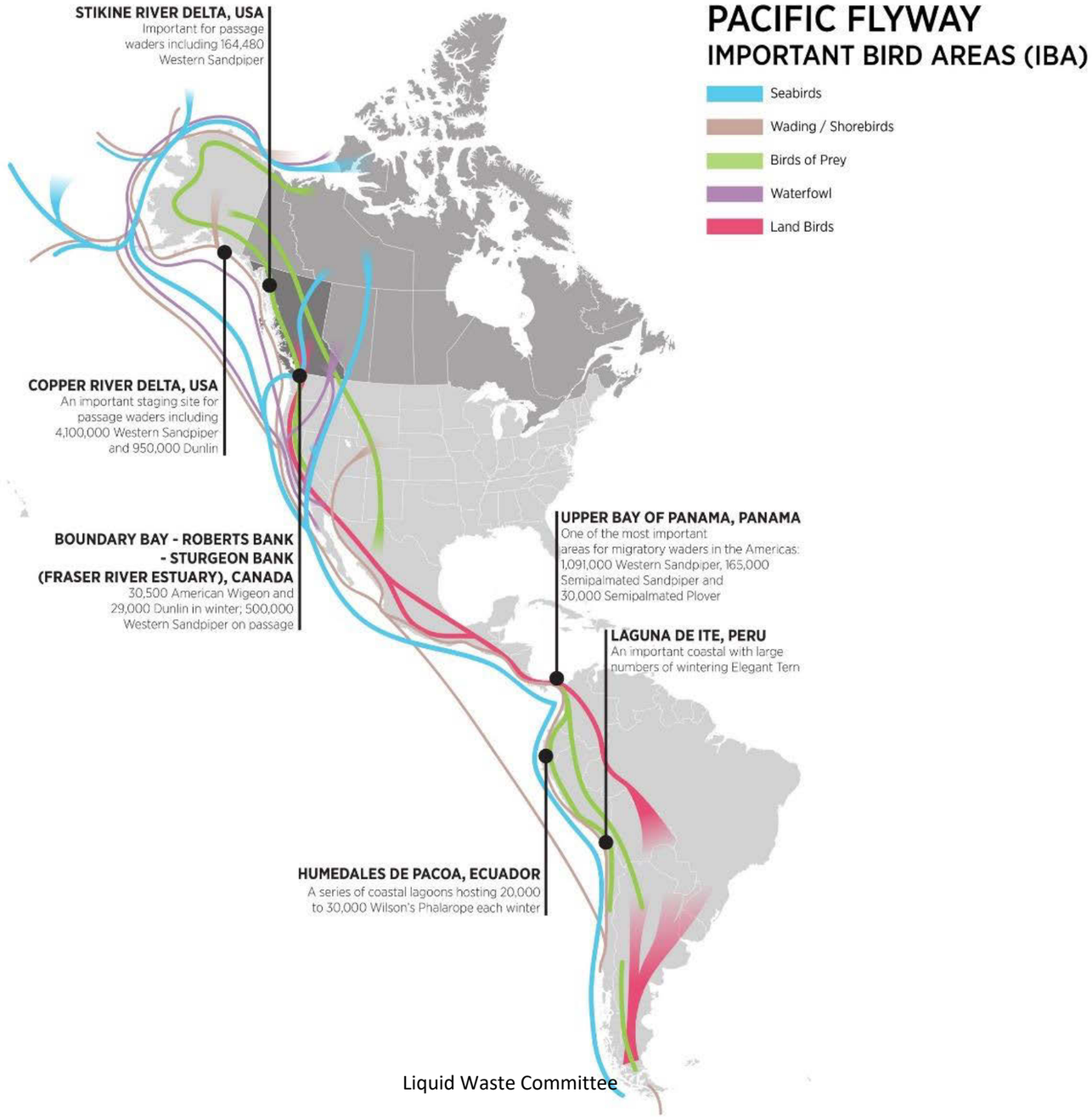
*source: Rivershed Society*

# Salmon Migration Routes




source: Cohen Commission

# Pacific Flyway





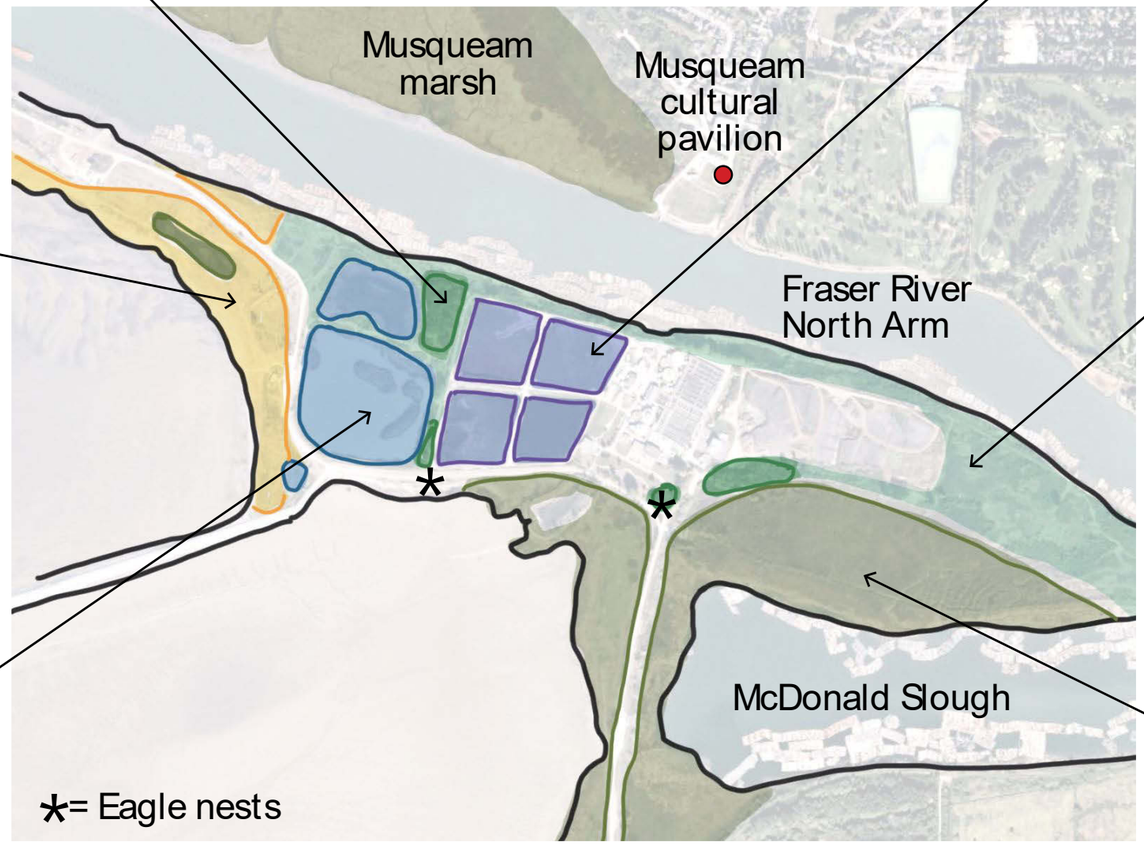

*source: National Geographic*

# Ecosystems of Iona Island

Riparian forest / swamp

Coastal sand ecosystem

Freshwater wetlands

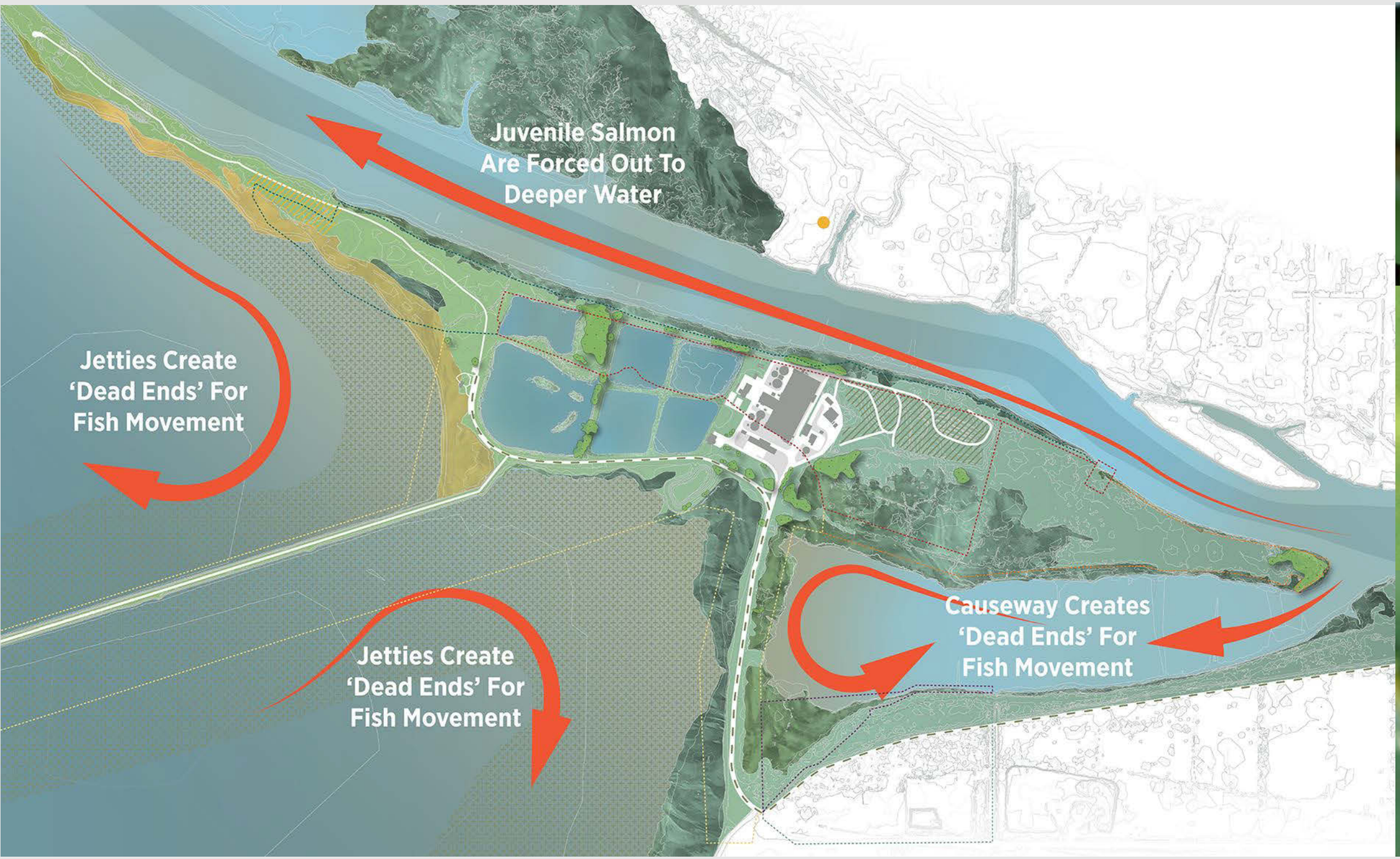



Sludge lagoons

Shrub grassland

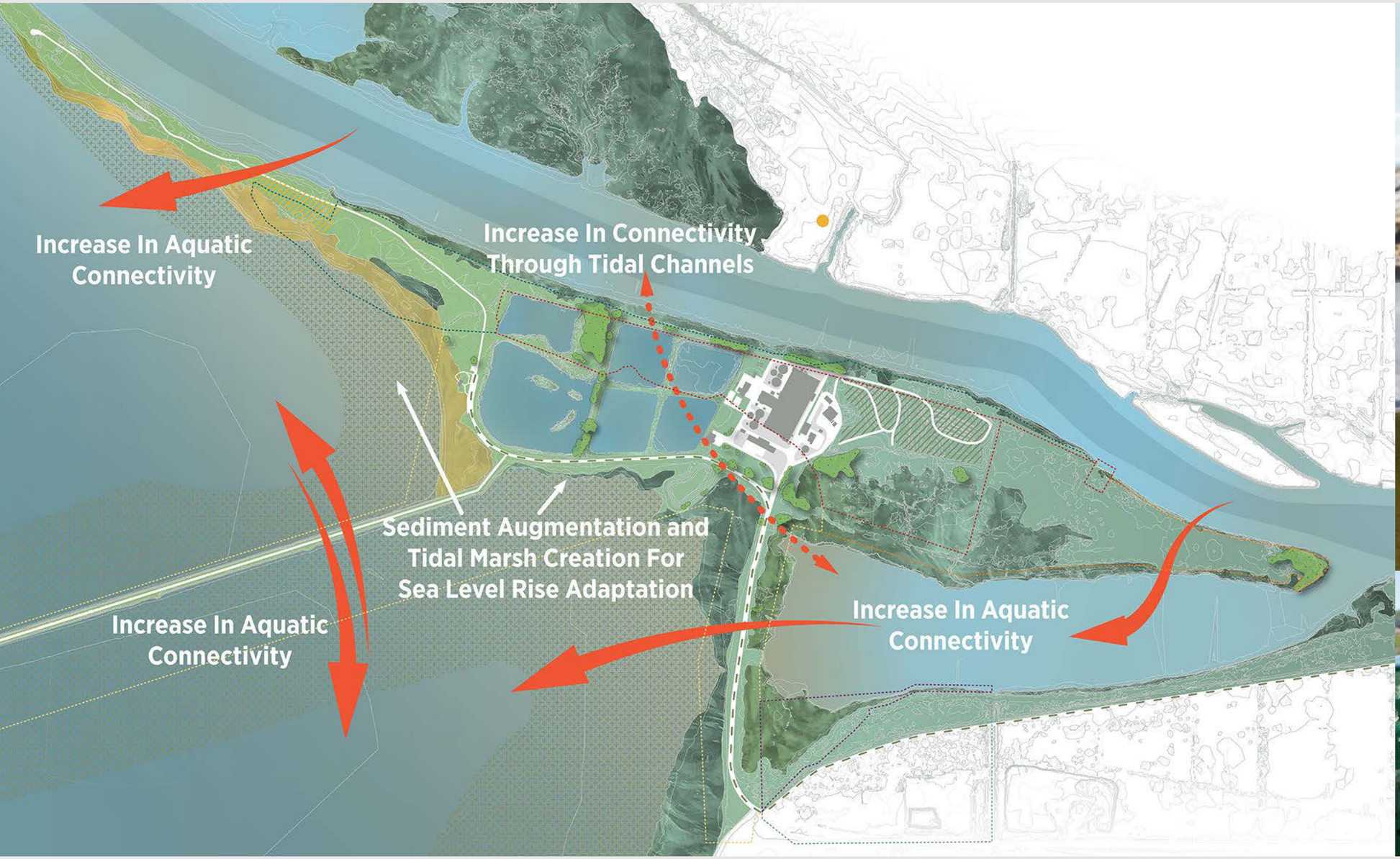
Tidal marsh

# Disconnected Salmon Migration






# Connected Salmon Migration

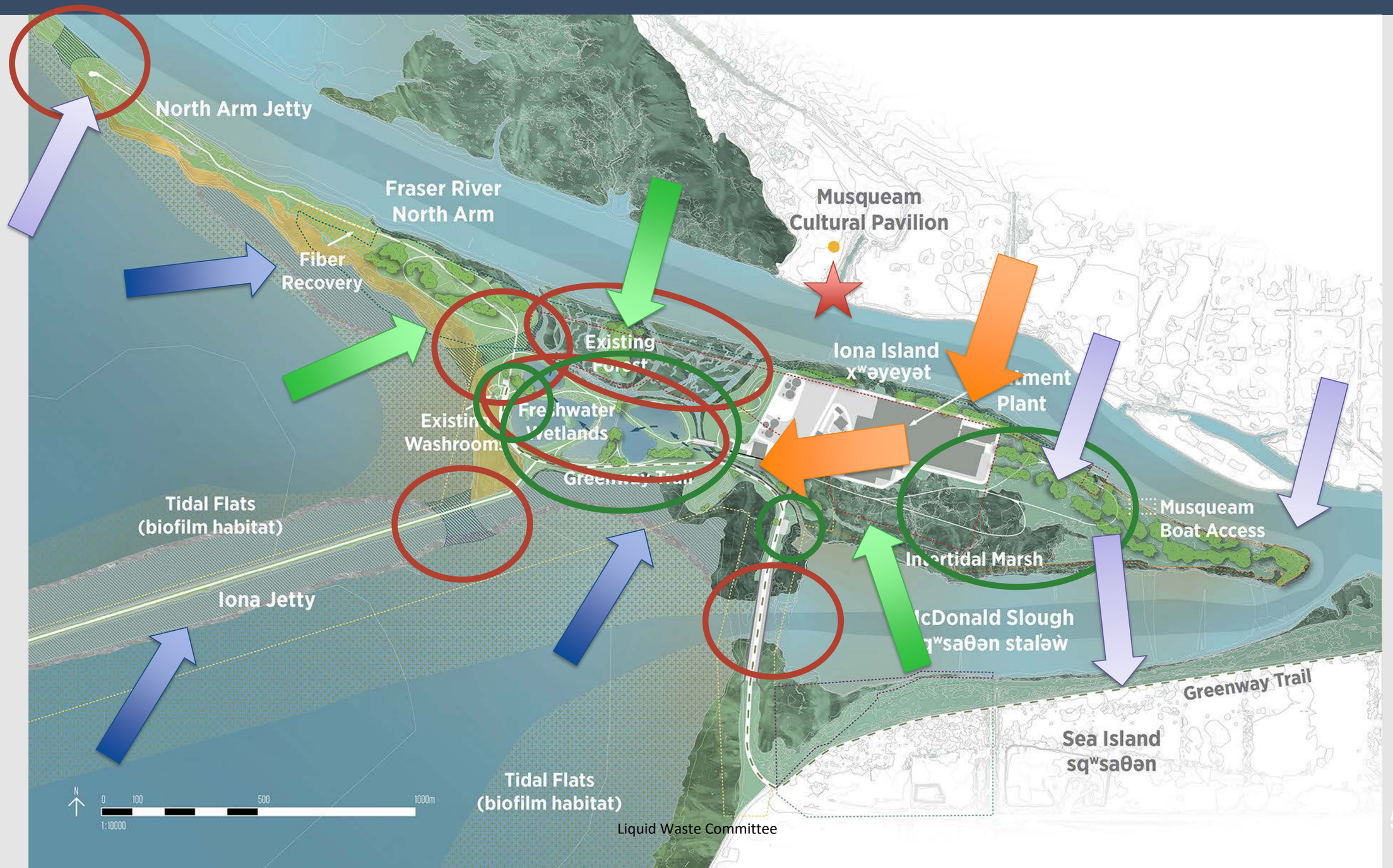



# ECOLOGICAL PRIORITIES

# PARK CONNECTION OPPORTUNITIES

1. Enhance park ecology
2. Improve circulation, connections and visitor experience
3. Opportunities for education, recreation programming
4. Park expansion (access to more area)
5. Sea level rise and climate change mitigation
6. New partnerships and community connections

# Habitat Enhancement and Park Integration



# Questions?

# 6. RESOURCE RECOVERY OPPORTUNITIES

## Inputs

Wastewater

Trucked Liquid Waste

Iona Island
Wastewater Treatment
Plant

## Potential Products

- Reclaimed Water
- Electricity
- Heat
- Biofuel
- Nutrients / Biosolids

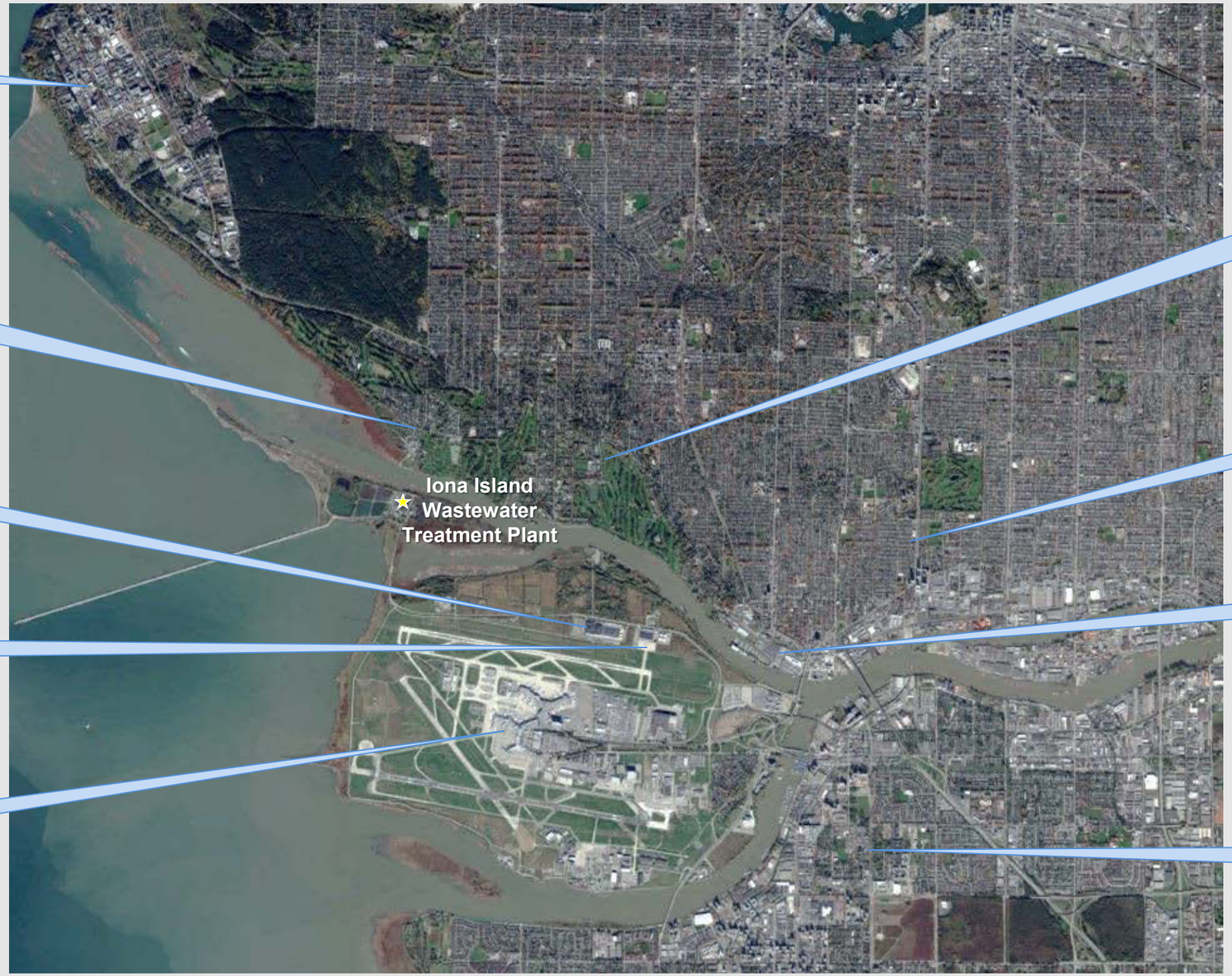
# Reclaimed Water

- Potential for 500 ML/day of reclaimed water
- Equivalent to 40% of Metro Vancouver drinking water supply

- Onsite use
  - Tank cleaning and wash down
  - Grey water in O&M building

- Offsite use
  - Irrigation (e.g. golf courses, parks)
  - Toilet flushing
  - Vehicle washing
  - Construction activities
  - Industrial uses

# Reclaimed Water – Potential Demand




UBC

Musqueam Indian Band

Canada Post

UPS

YVR

Golf Courses

City of Vancouver

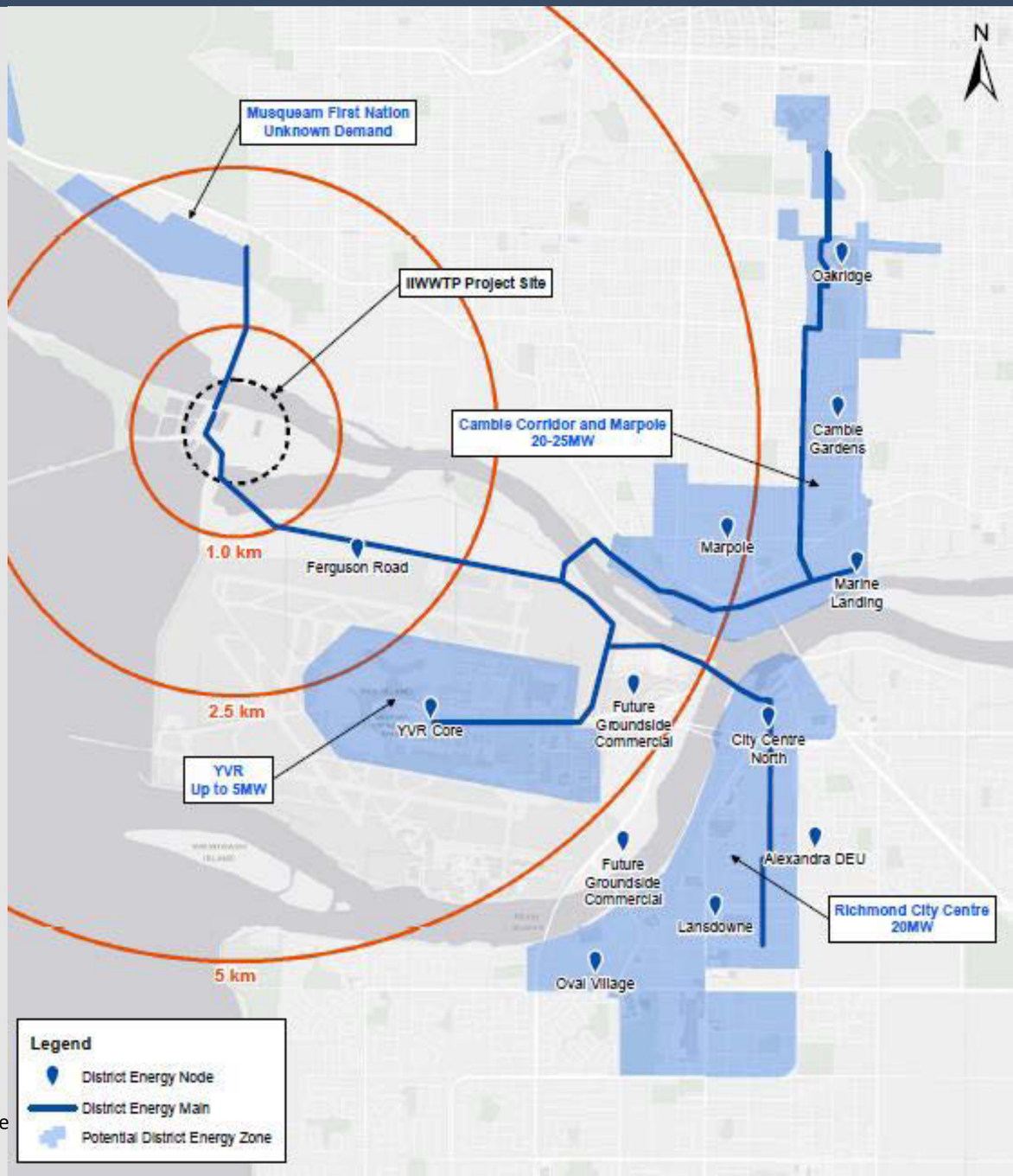
TransLink

City of Richmond

# Effluent Heat Recovery

Heat recovery from plant effluent

- Onsite heating and cooling needs
- Export to district energy system
- Equivalent to heating energy use of 50,000 apartment units



# Renewable Natural Gas

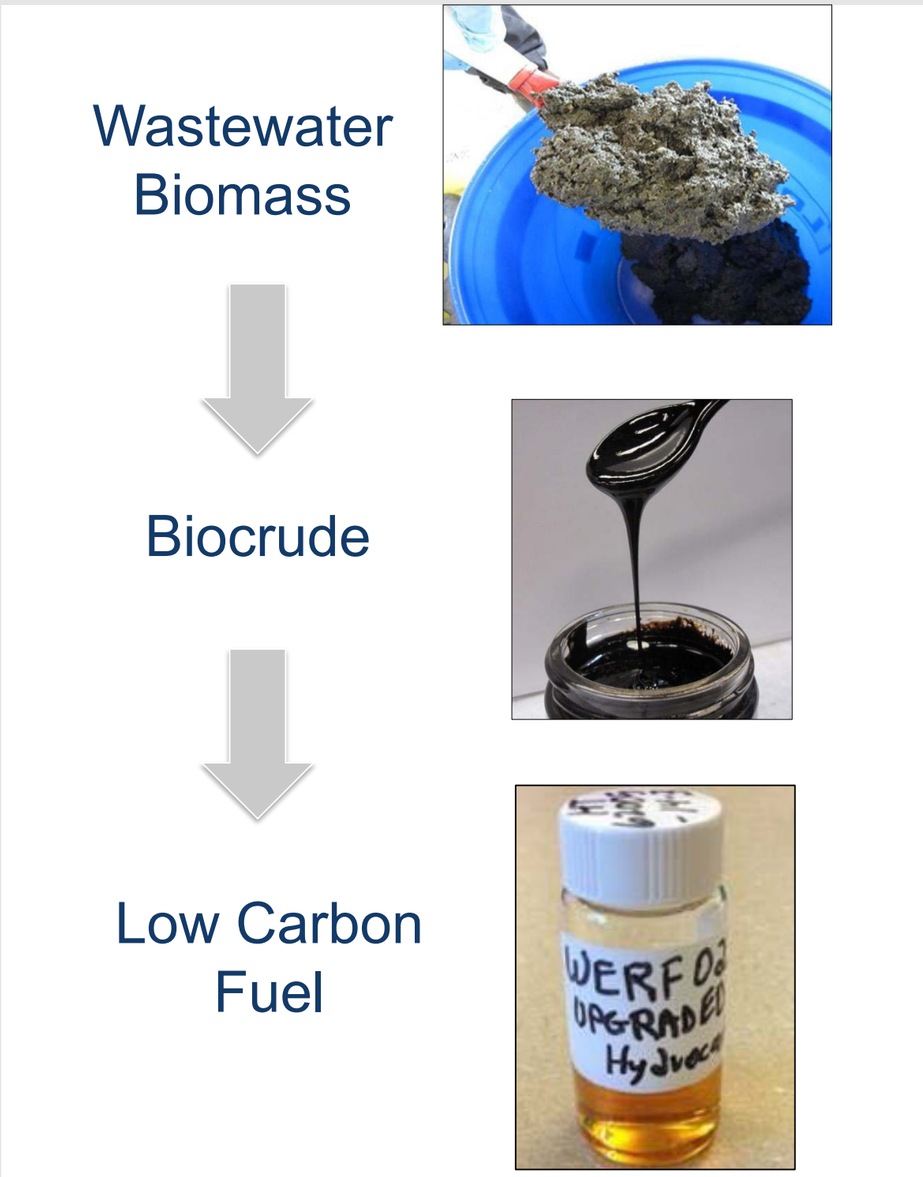
## Biofuels

- Biogas upgrade to biomethane/renewable natural gas (RNG) with injection to natural gas grid
- Equivalent to 3,500 household served
- 2,800 cars taken off the road
- Offset 85% of Corporate GHG emissions

*Biogas upgrade system at Surrey Biofuel Facility*

# Biocrude

- Pilot testing hydrothermal liquefaction (HTL) technology at Annacis Island WWTP
- Lower capital and O&M costs
- Revenue potential
- Equivalent of taking 3,500 cars off the road annually
- Displace 1,400 truck loads of biosolids annually



# Nutrients

- Biosolids for land application
- Nutrient recovery opportunities through struvite crystallization

# Questions?

# 7. COMMUNITY ENGAGEMENT

- GVS&DD Board (LWC, Regional Parks)
- VSA members
- Residents and businesses
- Special interests
- Musqueam Indian Band

*Technical Workshop 4, Musqueam Indian Band, July 24, 2019*

# What We've Heard

*Community Workshop 1, January 9, 2019, Richmond*

- Increase treatment level
- Reduce odour
- Reduce plant lighting
- Maintain access to park
- Replace and create new habitat
- Coordinate removal of existing lagoons with new habitat
- Maintain Musqueam views

# Engagement Activities (2020)

| Timeline | Meetings / Events |
|---|---|
| January 29 | Government agencies & NGOs re: fish migration opportunities |
| February to April | Community associations (Vancouver, Richmond, UBC & UEL) |
| February to April | Musqueam Indian Band: staff, Chief and Council, Community Meeting #2 |
| February 14 | Student Sustainability Conference (Vancouver/Richmond) |
| February 15 | Marpole-Oakridge Family Day event (Vancouver) |
| February/March | Vancouver Sewerage Area municipalities |
| March | Meeting with Vancouver Airport Authority |
| March 31 | Community Workshop #2 (Richmond) |
| April | NGOs: Georgia Strait Alliance, birders and naturalists |
| May 9 | Richmond Public Works Open House |
| June 21 | Burkeville Daze on Sea Island, Richmond |

# COMMITTEE & ENGAGEMENT OVERVIEW (2020)

| Timeline | Activity |
|---|---|
| February 7 | Liquid Waste Committee<br>Present design concepts. No decision sought. |
| February - April | Community Engagement<br>Design concepts |
| February 22 | Council of Councils<br>Design concepts |
| March 11 | Regional Parks Committee<br>Park integration and habitat enhancement |
| June | Liquid Waste Committee and GVS&DD Board<br>Recommend preferred concept, review input received.<br>Seek approval. |
| November | Liquid Waste Committee and GVS&DD Board<br>Present final Project Definition Report and Indicative Design.<br>Seek approval. |

# Questions?

# 8. NEXT STEPS

- Complete Indicative Design
- Planning for habitat enhancement projects
- Determine design and construction procurement options
- Pilot plant options for advanced wastewater treatment for micropollutant removal

# Final thoughts?

# COMMITTEE & ENGAGEMENT OVERVIEW (2020)

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