

# Westside Select Committee

## Interim Findings

### *Option Sets Costing Analysis*

September 29, 2015



# Background

- >20 Sites and 9 Option Sets
  - *Examine 4 Plant & 1 Plant Option Sets*
  - *Insights on 2 Plant Option*
- Deeper Study in Feasibility and Costing
  - *Wastewater, Residual Solids Treatment, Sites*
  - *Target Market Resource Recovery*
  - *Order of Magnitude Costing*

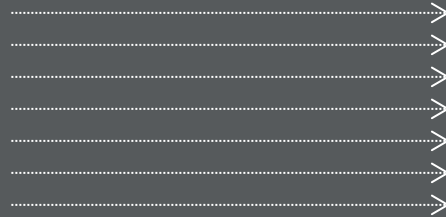
# Background

- Test the preliminary criteria and receive direction on how to enhance
- Compare costing, technology options and option set evaluations to confirm project outcomes

# Feasibility and Costing Elements

## Design Criteria

- Public Input & Levels of Service
- Regulations + Standards



Wastewater  
Treatment  
(Liquids)

Residual  
Solids  
Treatment

Suitable Technologies &  
Option Sets

## Life-Cycle Costing

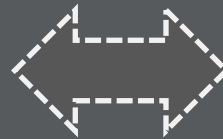
- Option Sets
- Capital + Operating
- Revenues



Resource Recovery

## Target Markets

- Customers + End Use
- Growth and Partnerships



Resource Recovery

## Target Markets

- *Customers + End Use*
- *Growth and Partnerships*

- *Long-term Demands & Revenues*
- *Technology Footprint*
- *Energy Balance*
- *Ability to Support community Amenities*
- *Scope of Infrastructure Needs*
- *Synergy with Public Services*

# Target Markets



## Water Reuse

- Park Irrigation
- Indirect Potable Reuse e.g. Toilet
- Aquifer Recharge
- New Markets: Streams, Greenhouses



## Solids and Heat Recovery

- Historic: Land Apply, Landfill
- Industrial Partnership e.g. fuel, kiln, fertilizer
- Thermal e.g. gasification
- Incinerate
- Low-Grade Heat



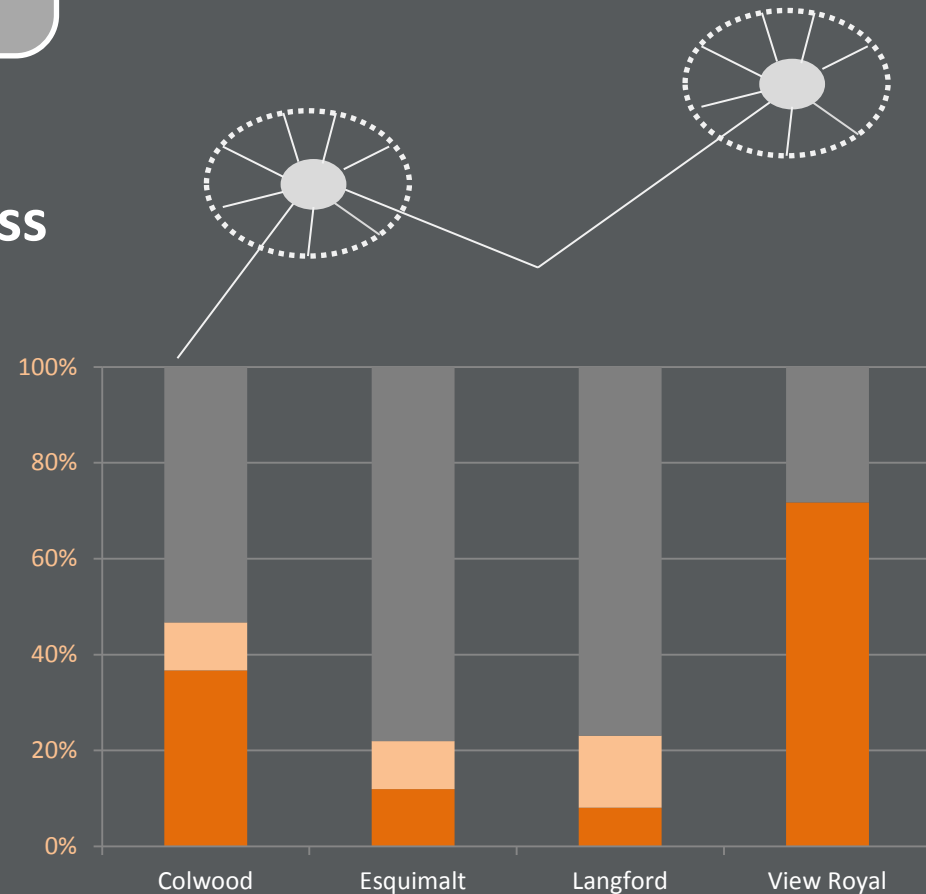
## Water Reuse

- Park Irrigation
- Indirect Potable Reuse e.g. Toilet
- Aquifer Recharge
- New Markets: Streams, Greenhouses

## Ingredients for Service Effectiveness

- *Clustered customers with high demand*
- *Clear policy or incentives for use*
- *Irrigation provides high-demand, ease of application (local challenges)*
- *Aquifer recharge feasibility*
- *Toilets (indoor substitution) @ Growth*
- *Potential for new markets – synergy with regional/local needs e.g. agriculture*
- *Stream augmentation challenges*

# Target Markets





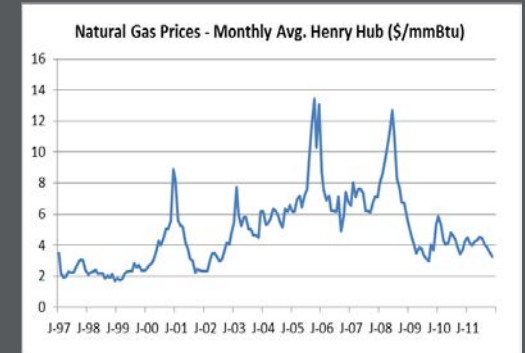
## Solids and Heat Recovery

- Historic: Land Apply, Landfill
- Industrial Partnership e.g. fuel, kiln, fertilizer
- Thermal e.g. gasification
- Incinerate
- Low-Grade Heat

# Target Markets

## Ingredients for Service Effectiveness

- *Committed customer(s) with specified product quality*
- *Value of biogas depends on fuel it is offsetting*
- *Energy Utilization Technologies Must Balance Energy Uses and Cost*
- *Synergies/Partnerships with other services*
- *Integrate with other waste to leverage energy resources*



## Design Criteria

- *Public Input & Levels of Service*
- *Regulations + Standards*

# Design Criteria

- *Design Criteria translate the goals and objectives of this project into node/site applications*
- *Connect public input into engineering outcomes*
- *Four types of applications across the Westside*
- *Criteria narrow the range of technologies*



## Design Criteria

- *Public Input & Levels of Service*
- *Regulations + Standards*

# Design Criteria

## Guiding Technical Criteria

- *Leverage existing infrastructure and minimize operating costs*
- *Look for long-term revenues and resource demands*
- *Look to integrate with other public services and community building e.g. waste streams*
- *Include capacity phasing*
- *Site, system and technology resiliency*
- *Carbon, energy and footprint considerations*
- *Provide for positive and safe public interaction*

**Establishes the framework for more detailed, instructive engineering criteria.**

## Design Criteria

- *Public Input & Levels of Service*
- *Regulations + Standards*

# Design Criteria

## 1 Plant Option (Westside)

- >50 MLD in non-residential setting
- Sidestream tertiary (market needs) + meet effluent regulations
- Large-scale solids and energy recovery

## Large Distributed Plant (Westside)

- 30-50 MLD in residential-commerce center
- Sidestream tertiary (market needs) + meet effluent regulations
- Convey solids to regional facility
- Potential co-gen opportunities

## Medium Plant

## Small Plant

- Medium @ 10-30 MLD and Small @ <10 MLD in residential setting
- Full tertiary for reuse and livability criteria
- Liquids focus while solids conveyed to larger facility
- Scale, look and experience of facility to suit neighborhood

## Life-Cycle

### Costing

- *Option Sets*
- *Capital + Operating*
- *Revenues*

# Costing Factors

- *Order of magnitude suits level of detail and saves room for optimization*

## Cost Breakdown

- *Recent US and Canadian Projects*
- *Operating Costs to come*
- *Revenues to be developed*
- *Factors involved:*
  - ✓ *Contingency for design and construction risks*
  - ✓ *US currency conversion*
  - ✓ *Contractor profit*
  - ✓ *Inflation and further escalation*
  - ✓ *Service administration*

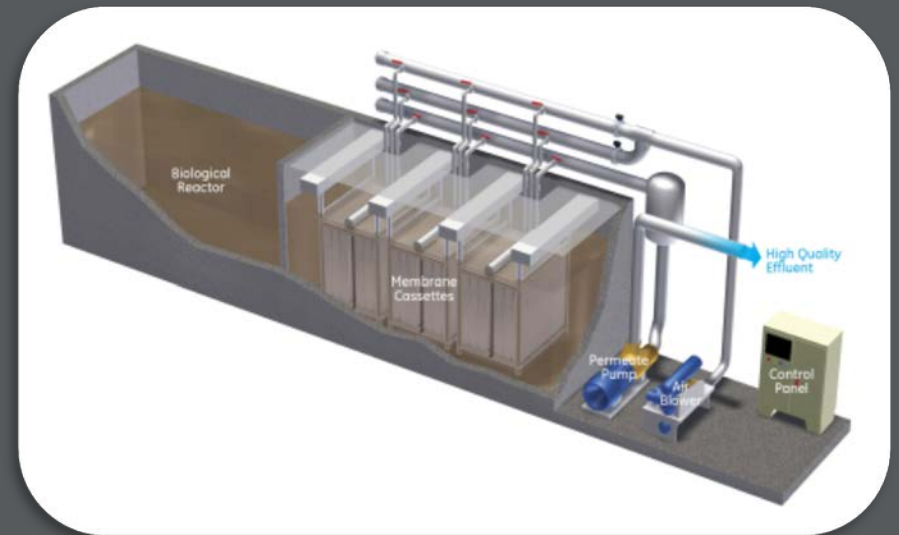
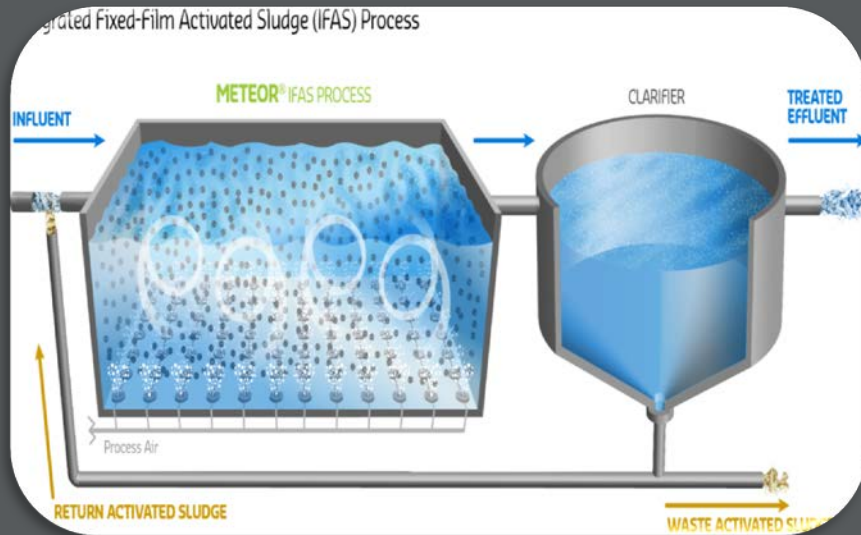
## Escalation Considerations

- *Happens in every industry*
- *Changes in NA economy 2010-2015*
- *Us Currency Exchange*
- *Labor Rate trends*
- *Different sites and infrastructure needs*
- *Supply-demand trends for wide variety of materials and products*

**Wastewater  
Treatment  
(Liquids)**

*Residual  
Solids  
Treatment*

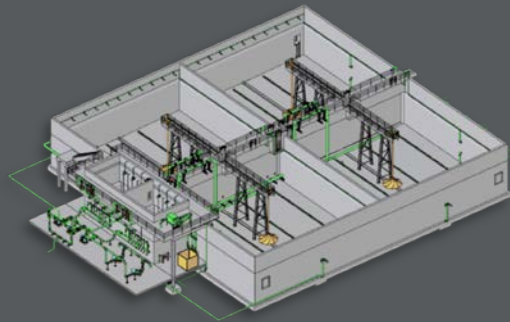
# Wastewater Technologies





# Solids Recovery Technologies

**Aerobic**



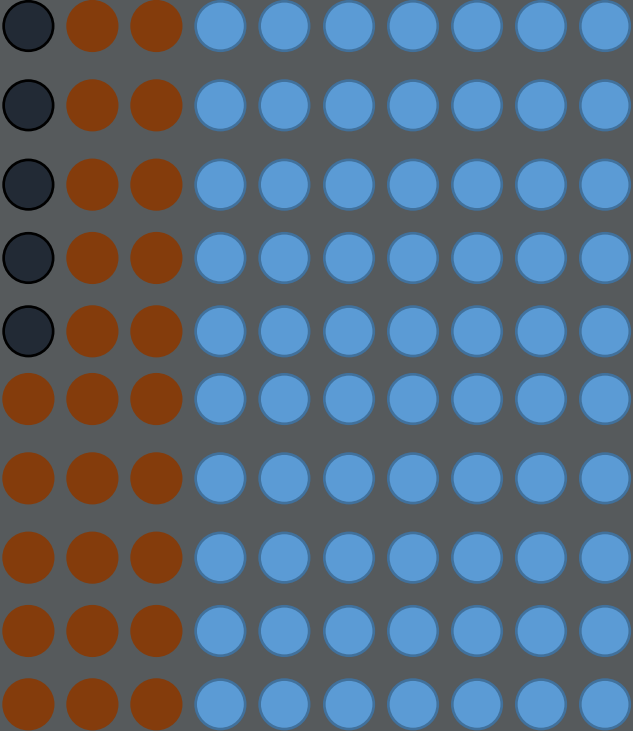
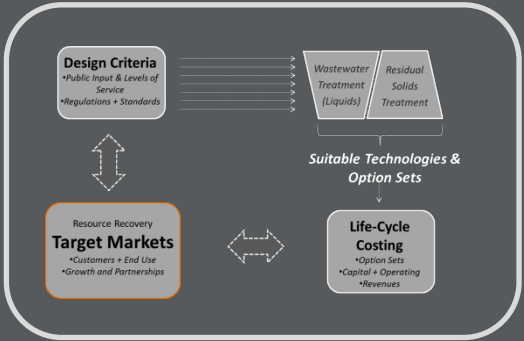
**Anaerobic**



**Gasification**



# Water + Energy Balance



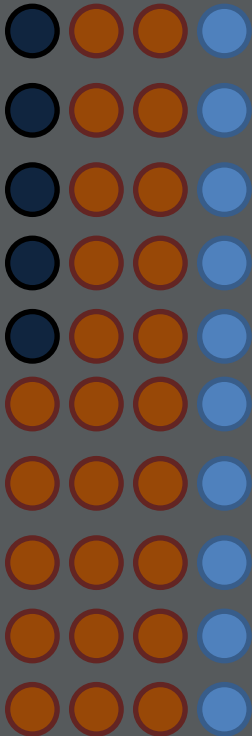
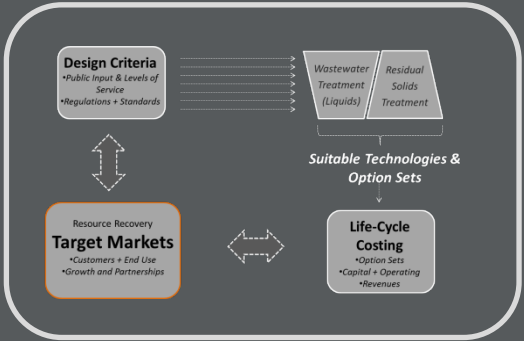
25% Dry Solids      4,000 Kcal/kg  
 75% Water          -1,800 Kcal/kg

1 kg of solids      4 kg of sludge

1 kg dry solids      4,000 Kcal  
 3 kg of water      -5,400 Kcal

NET Energy          -1,400 Kcal

# Water + Energy Balance



85% Dry Solids      4,000 Kcal/kg  
 15% Water          -1,800 Kcal/kg

1 kg of solids          1.18 kg of sludge

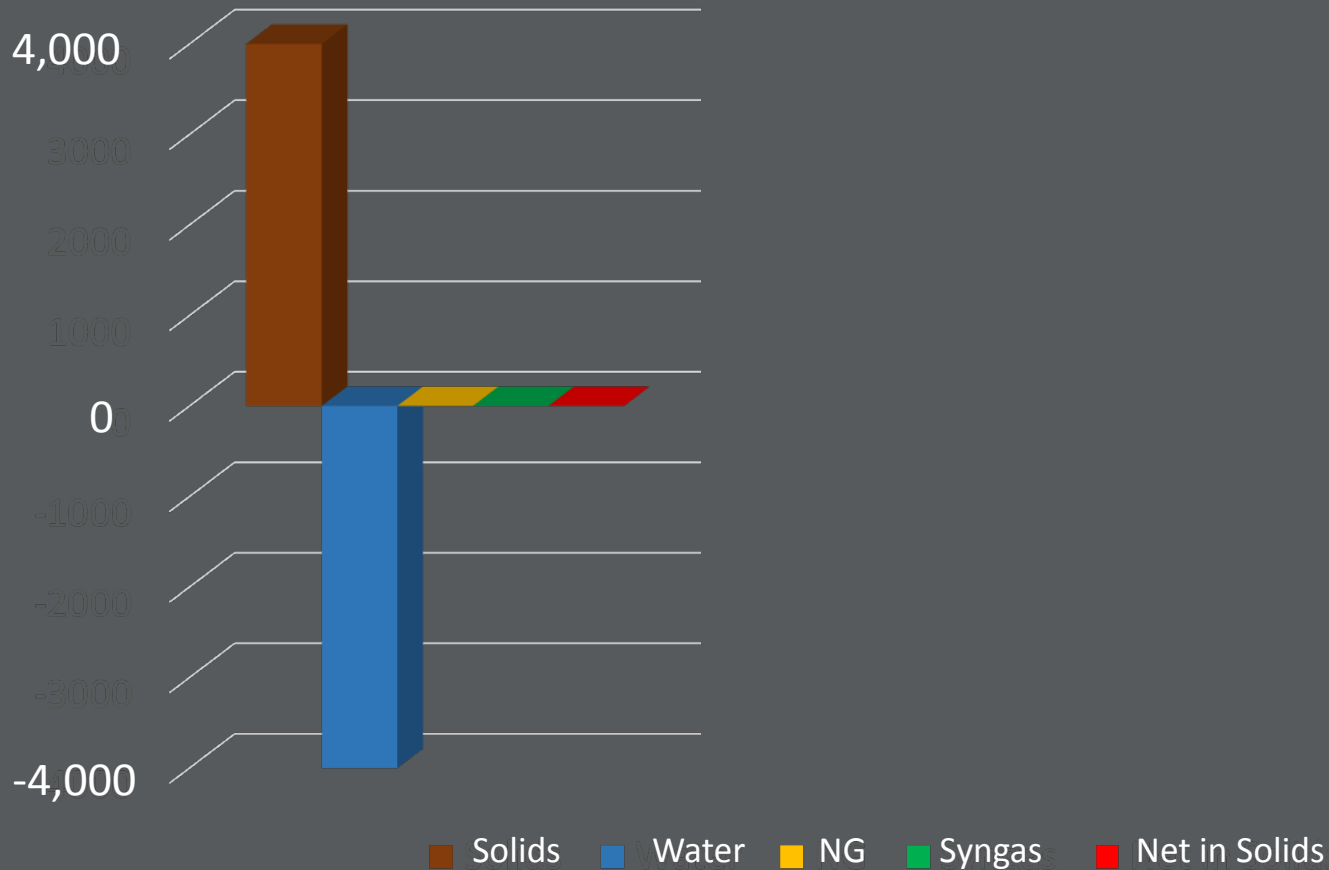
1 kg dry solids        4,000 Kcal  
 0.18 kg of water    -324 Kcal

NET Energy            3,676 Kcal

*“Tipping  
Points”*

# Water + Energy Balance

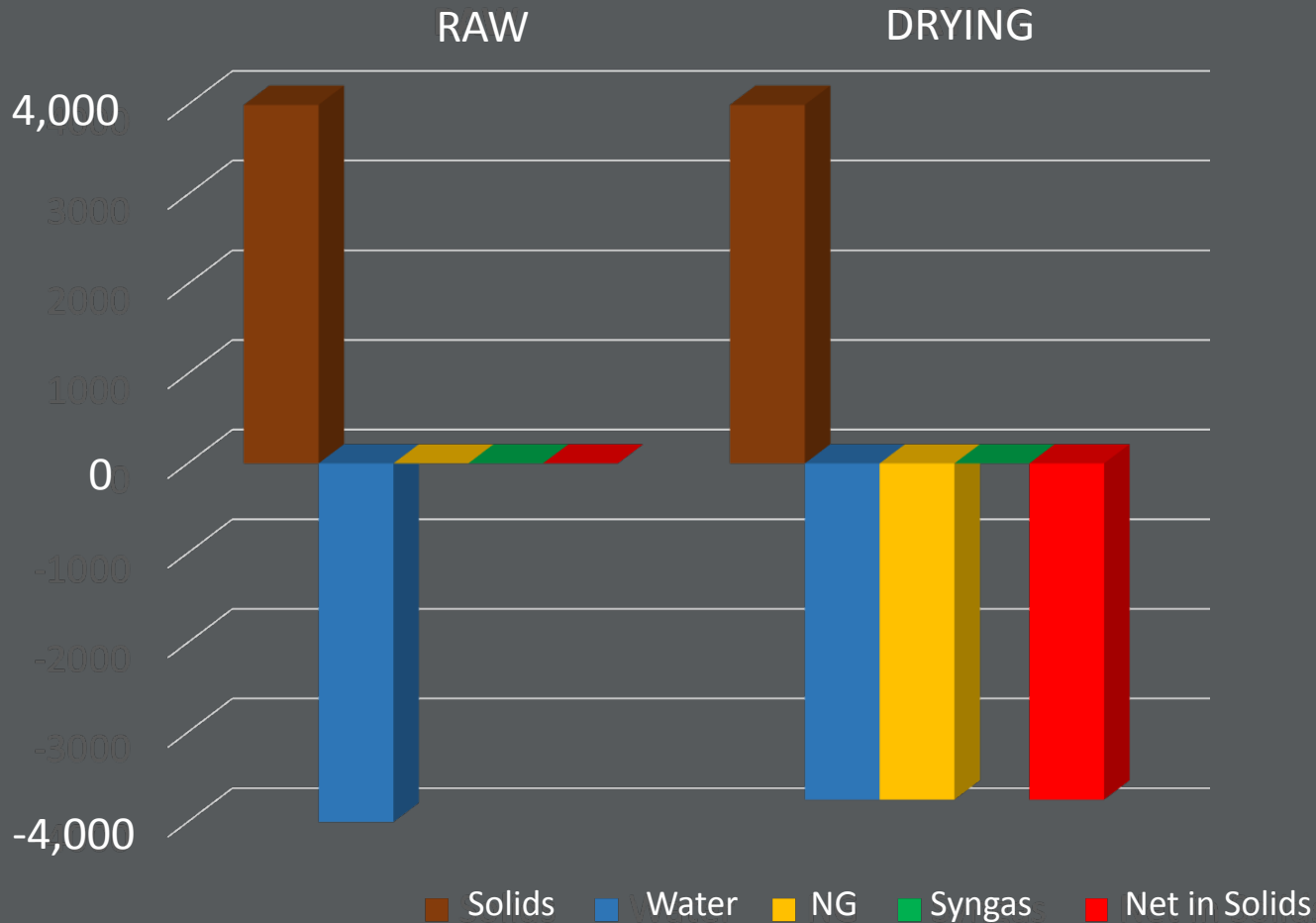
RAW





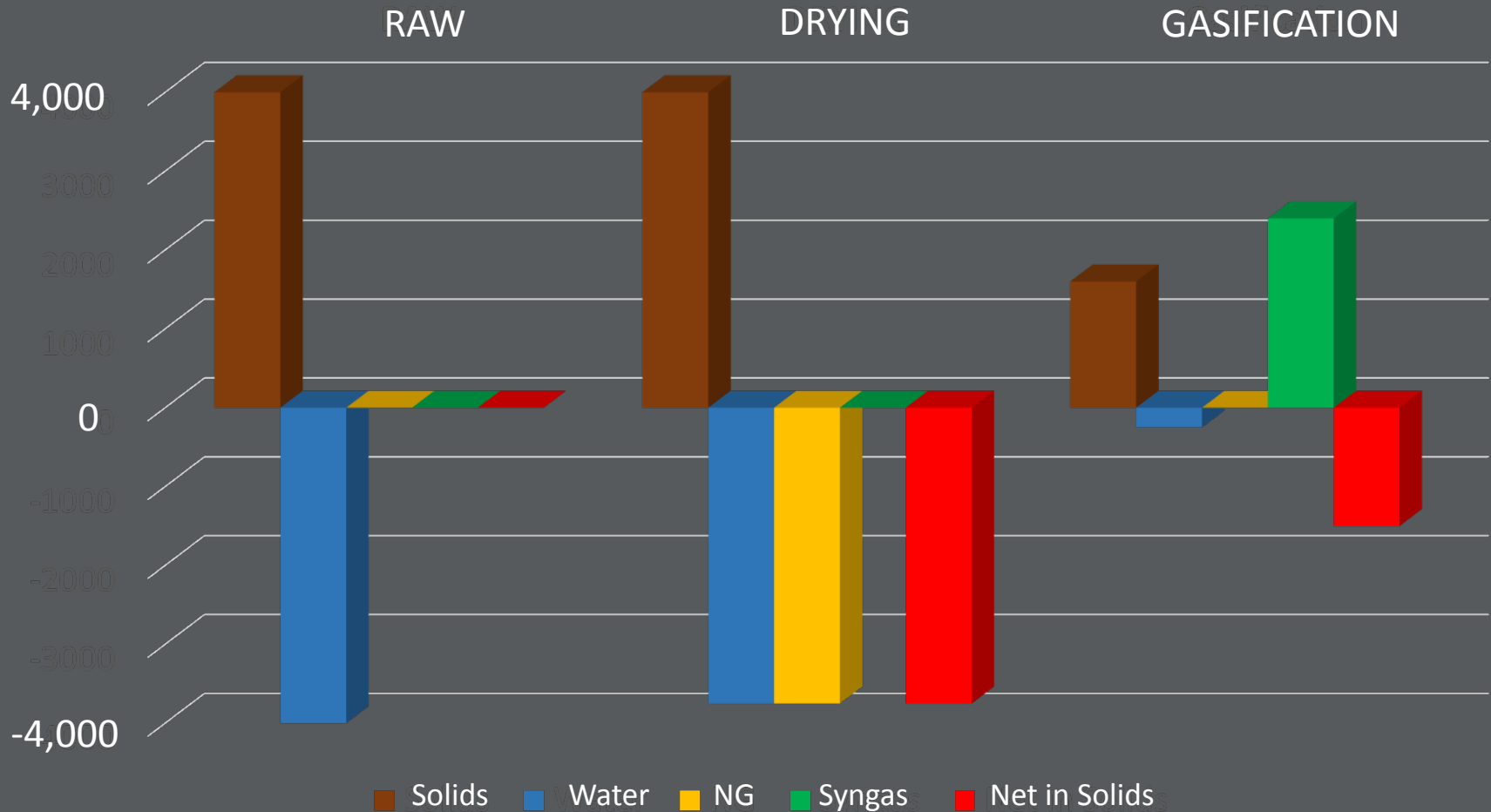
*“Tipping Points”*

# Water + Energy Balance



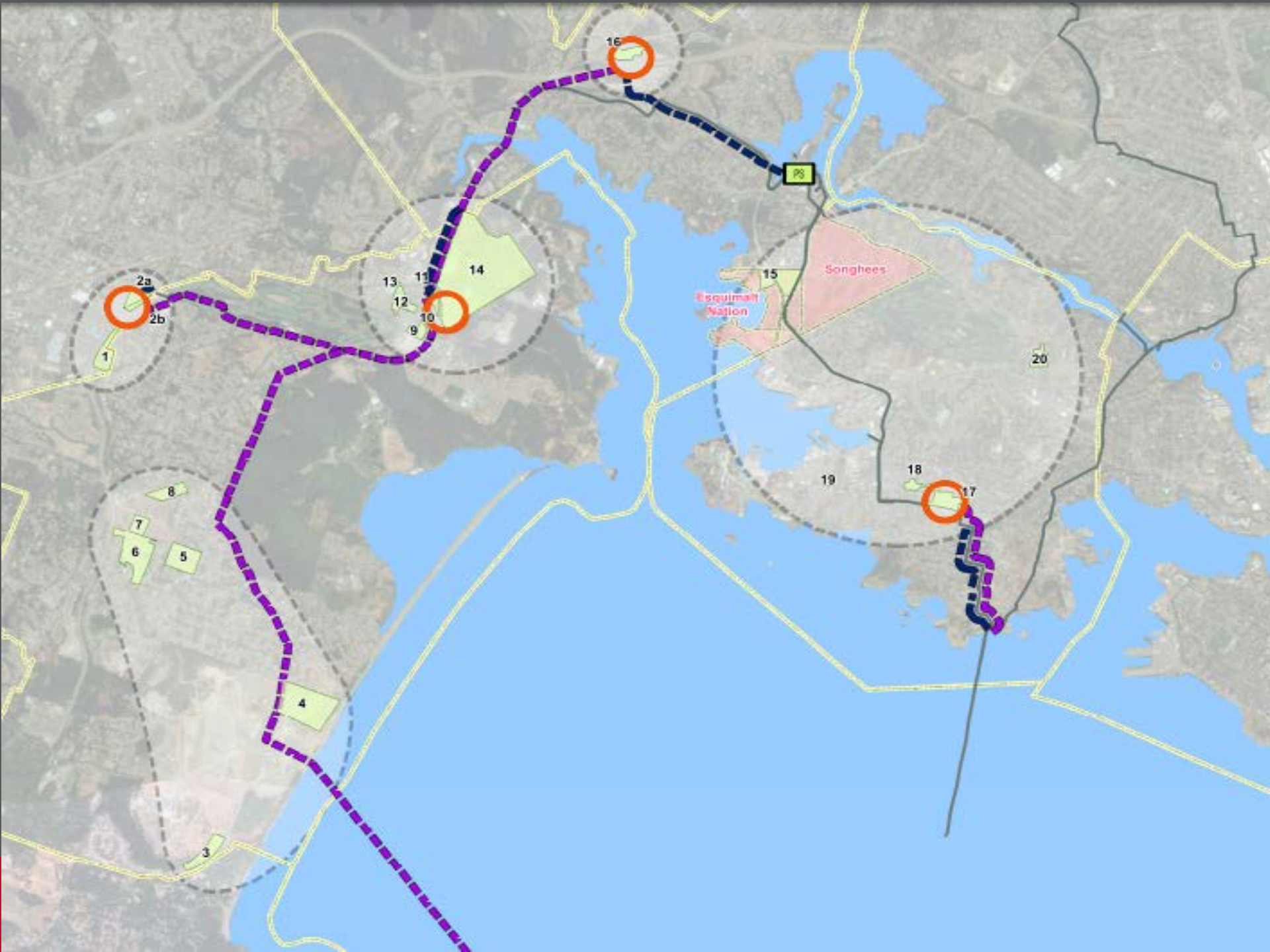
*“Tipping Points”*

# Water + Energy Balance



# Option Sets

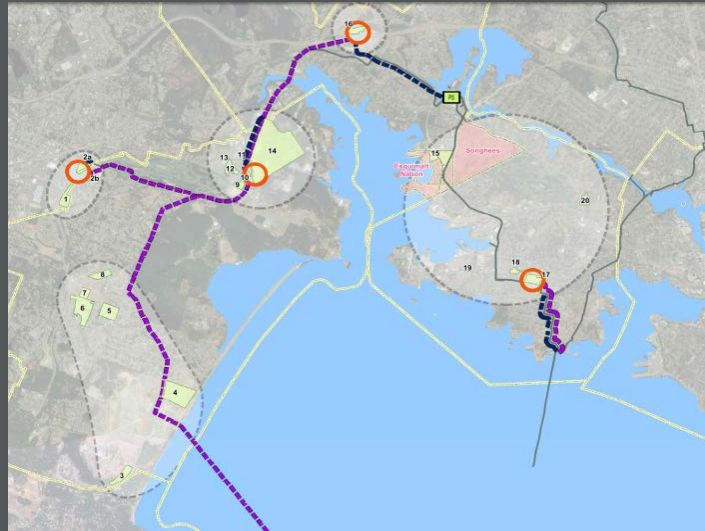
- >20 Sites and 9 Option Sets
  - *Examine 4 Plant & 1 Plant Option Sets*
  - *Insights on 2 Plant Option*
  - *Order of Magnitude Costing*



# 4 Plant Option Set

## Advantages

- Scale flows and footprint to suit communities
- Stronger alignment with potential water reuse e.g. more effluent @ tertiary quality
- Utilizes some existing infrastructure
- Esquimalt facility close to outfall
- Ability to phase in capacity for/at growth



## Challenges

- Increases reuse but requires extensive new infrastructure
- Multiple truck patterns
- Reinvestment into Craigflower PS
- Esquimalt site challenged to accommodate liquids & solids
- Challenges in *minimizing life cycle costs*





# 1 Plant Option Set

## Advantages

- Site suits significant capital investment
- Some local opportunities for water reuse
- Lowest infrastructure needs
- Opportunity for comprehensive 'green' development
- Lowest cost option / revenues virtually unchanged



## Challenges

- Modest reuse opportunities
- Concentrates capacity in one location
- Meets effluent regulations yet less flow to tertiary levels

# Option Set Reflections

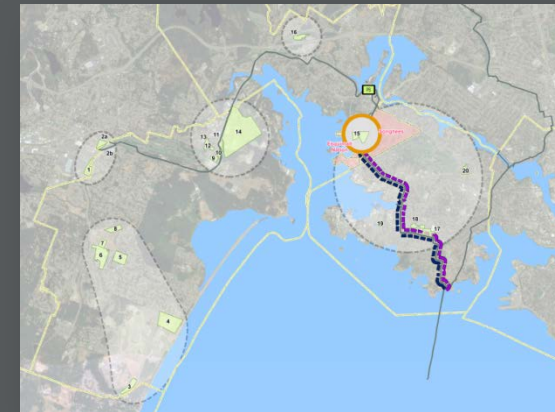
## How To?

- Expand and innovate water reuse without extensive infrastructure
- Phase capacity with growth @ growth
- Better address project goals
- Distribute facilities without substantial effect on overall cost



## Encourages a scaled-back two-plant option that:

- ✓ *Adjacent new growth*
- ✓ *Adjacent known reuse opportunities*
- ✓ *Does not need new outfall*
- ✓ *Allows for expansion with growth*
- ✓ *Lowers costs*
- ✓ *Westside solution that considers public input and aspirations*





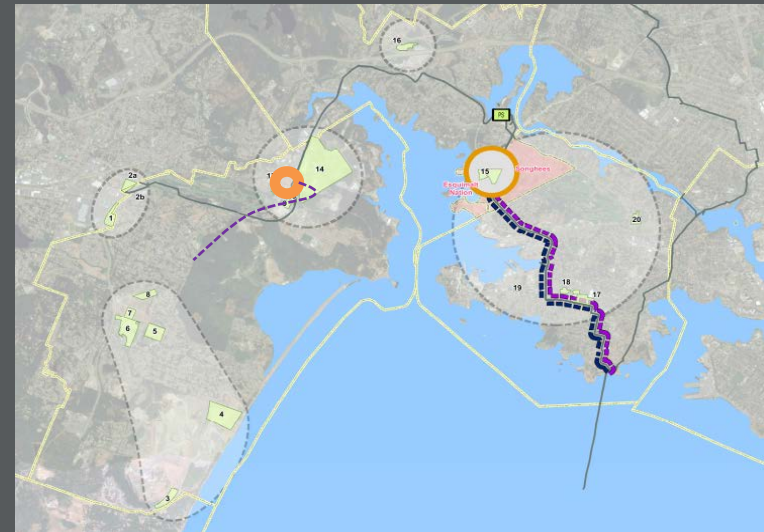


# 2 Plant Option Set

## Advantages

- Includes advantages of 1 Plant Option set
- Includes innovative reuse in aquifer recharge
- Addresses 1 Plant Challenges
  - ✓ Expands water reuse opportunities
  - ✓ Distributes capacity where there is growth
  - ✓ Increases amount of tertiary effluent

- Note: some loss of economies of scale



# Setting Direction

- 1. Consider reporting and analysis to focus on the 1-plant and 2-plant option sets*
- 2. Continue to assess costs for secondary versus tertiary at 1-Plant Option*
- 3. Develop potential revenue projections*
- 4. Further assess site feasibility to narrow most preferred*

# Setting Direction

1. *Consider aerobic, anaerobic and gasification process costs/revenues*
2. *Evaluate solids technologies (e.g. digestion and gasification) by creating expectations for a response by the private market:*
  - ✓ *end-product demand*
  - ✓ *Revenue*
  - ✓ *synergy with public service*
  - ✓ *life-cycle cost*
  - ✓ *overall energy balance*
3. *Costs and infrastructure lower for 1 location @ residual solids recovery*
4. *Select technologies to suit design criteria*

**Thank You**