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APPENDIX C

Technical and Community Advisory Committee

Long-term Biosolids Management Strategy Presentations

Presented to TCAC by Peter Kickham on October 27, 2023

Capital Regional District
Long-Term Biosolids Beneficial Use Strategy

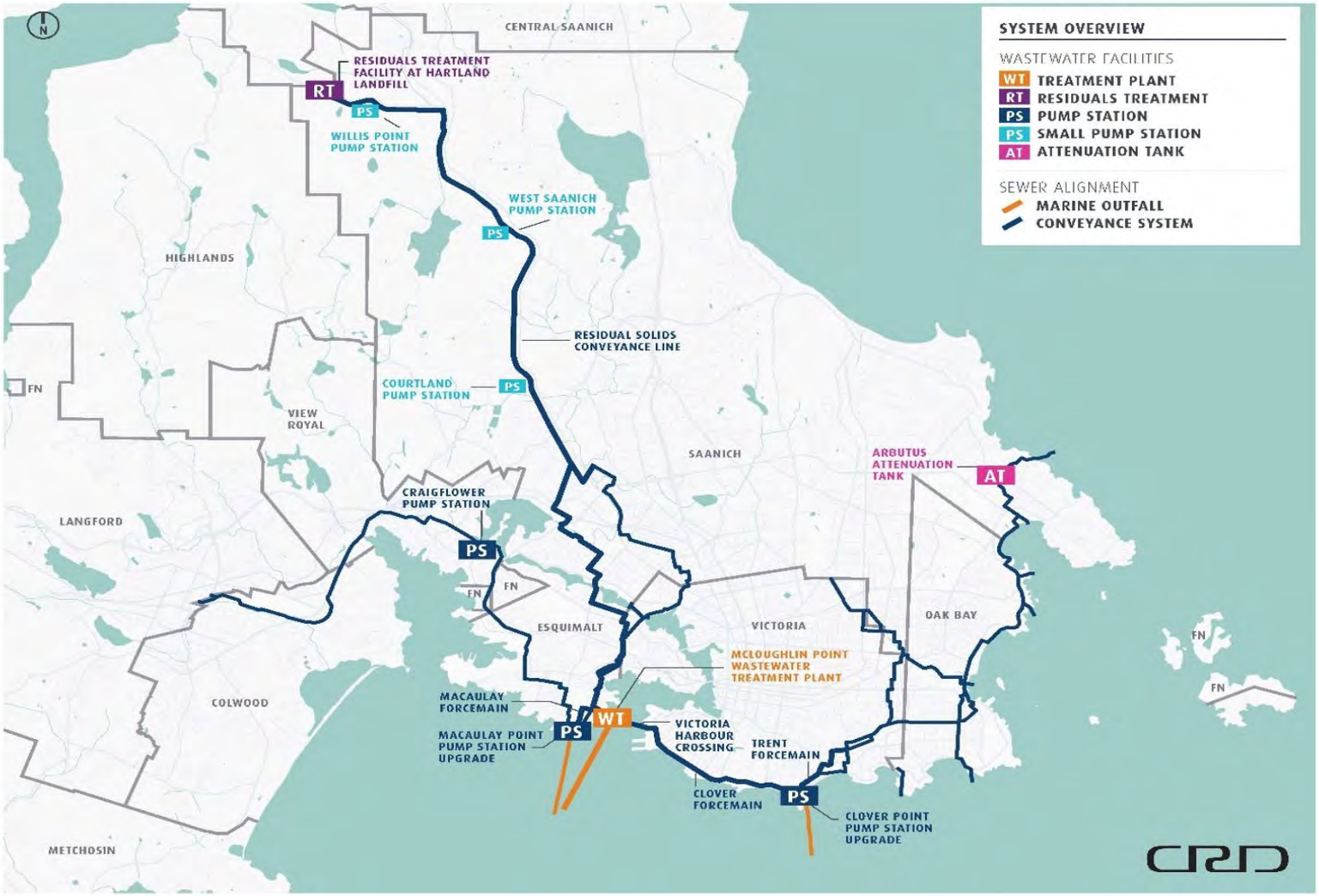
Peter Kickham, Manager, Regulatory Services, Environmental Protection

Technical And Community Advisory Committee

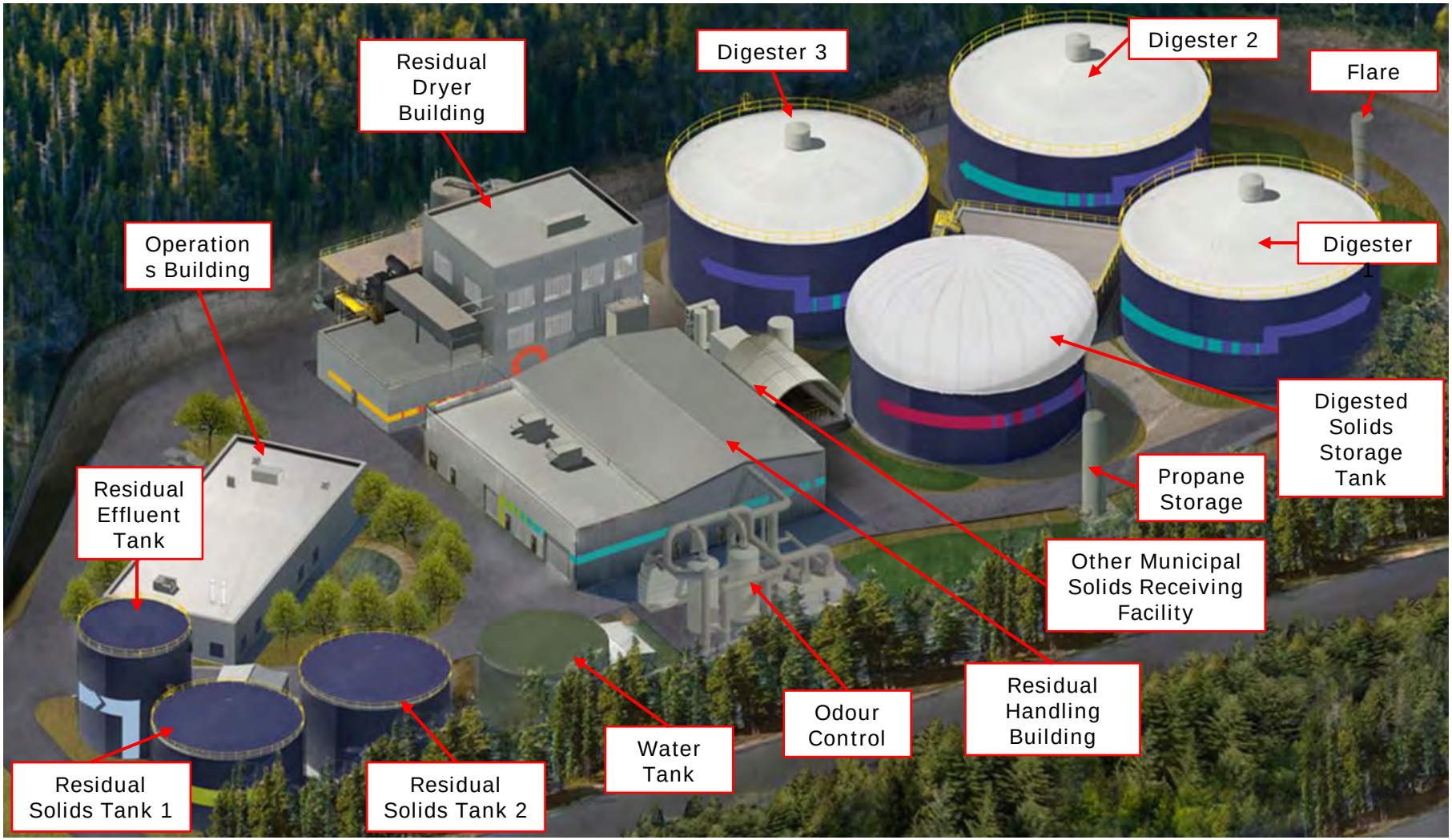
October 27, 2023

CRD Wastewater Treatment

Core Area Wastewater Treatment Overview Map



Residuals Treatment Facility



Dried Class A Biosolids

What is Beneficial Use?

Beneficial use is defined in the *Canadian Council for Ministry of the Environment* (CCME) *Canada-Wide Approach for the Management of Wastewater Biosolids.*

Beneficial use options capitalize on the nutrient and organic matter value and energy content of the municipal biosolids for use in:

- energy production (e.g. combustion)
- compost and soil products
- agricultural land application as a fertilizer or soil conditioner
- forestry application as a fertilizer or soil conditioner
- land reclamation.

When combustion is used for municipal sludge or municipal biosolids management, it may be considered a disposal option or a beneficial use option. To qualify as a beneficial use option, combustion must meet the following three criteria:

- result in a positive energy balance
- emit low levels of nitrous oxides
- recover a significant portion of ash or phosphorus.

Broadly, beneficial use options fit into two categories; land application or energy production.

Short Term Biosolids Beneficial Use Strategy (Definitive Plan): Alternative fuel in cement kiln

Short-Term Biosolids Contingency Plan: Engineered Cover at Hartland Landfill

Short Term Alternative Contingency Plan: Gravel Quarry Reclamation

Long Term Biosolids Management

As a condition to the Provincial approval of the short-term strategy, the CRD must:

a) Consult with the public on all available beneficial use options, and

b) Submit a long term biosolids management strategy by June 2024, to be implemented by January 2025.

Options Analysis

The CRD has hired an external consultant to act as a technical advisor for biosolids planning.

This consultant has completed an analysis of available beneficial use options, and after public and first nations engagement will be drafting the long-term strategy.

Thermal Options

Pyrolysis


(Silicon Valley Clean Water, 2023)

- Absence of oxygen
- 300-800 °C
- Produces syngas, biochar, steam, ash

Gasification


(Water Online, 2022)

- Limited oxygen
- 600-1000 °C
- Produces syngas, biochar, pyrolysis oil, ash

Incineration


(Budimex, 2008)

- Excess oxygen
- 800-1200 °C
- Produces energy (steam, electricity, heat)

Land Application Options

Soil Products


(NW Biosolids, 2021)

- Mixing with soil/sand to create nutrient rich soil
- Mixing with organics for compost

Agricultural


(Metro Vancouver, 2023)

- Fertilizing for agricultural land
- Reduces use of synthetic fertilizers

Forest Fertilization


(Sylvis, 2013)

- Supplementing nutrients in forest soil
- Increases tree production

Mine Reclamation


(Sylvis, 2010)

- Reclaiming barren soils damaged from mining activity
- Minimizes impact of long-term effects of mining sites on ecosystem

Options Portfolios

Regardless of the type of management option selected, the CRD requires a combination of multiple options to ensure redundancy and resiliency as well as consistent service delivery and regulatory compliance.

1. Preferred Option
2. Support Option
3. Contingency Options

Public Engagement

Presented to TCAC by Katie Tavola, Tavola Strategy Group on October 27, 2023

CAPITAL REGIONAL DISTRICT

LONG TERM BIOSOLIDS MANAGEMENT PUBLIC ENGAGEMENT STRATEGY OCTOBER 2023

CRD Making a difference...together

TAVOLA STRATEGY GROUP

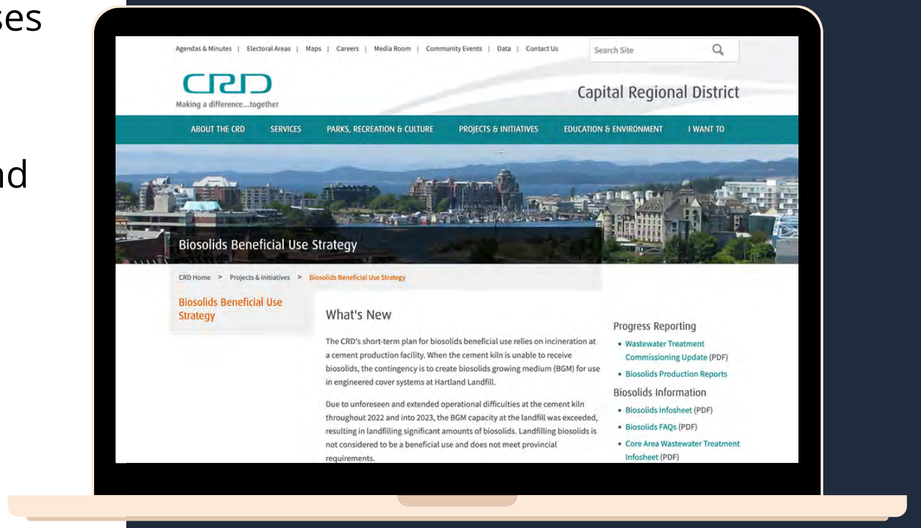
BACKGROUND

- The leftover material from the sewage treatment process, “biosolids” are a nutrient-rich resource that can benefit the community in a variety of different ways.

- The Province of BC’s Organic Matter Recycling Regulation sets the requirements for the production of high-quality biosolids and subsequent beneficial uses related to land application and composting. The CRD produces Class A biosolids, the highest quality category of biosolids.

- A Definitive (Long-term) Biosolids Management plan must be submitted to the Province by June 2024. The Province of BC has specific requirements for what must be included in the plan. It’s expected that a combination of beneficial uses may need to be considered within the long-term plan.

- Public consultation about the potential in-region beneficial uses, including land application, must be included in the plan.



COMMUNICATIONS AND CONSULTATION OBJECTIVES

1. Raise awareness of the need to develop a long-term biosolids management plan that outlines how the Capital Regional District will utilize the benefits of biosolids in-region.

2. Provide multiple channels and opportunities for the community to learn more and provide input into the development of the definitive biosolids management plan.

3. Seek to understand public awareness, perceptions, concerns and top-of-mind considerations for how biosolids should be managed in the Capital Region.

AUDIENCES

Residents and taxpayers of LWMP Core area
Residents of the Capital Region
CRD Board of Directors
Municipal Councils within the Capital Region
Technical and Community Advisory Committee (Core Area Liquid Waste Management)
News media
Various sectors/groups

a. Environmental organizations (non-profits, advocacy, volunteers)
b. General business
c. Agriculture (farmers, agricultural organizations)
d. Silviculture (forestry companies)
e. Mine reclamation (mining companies)
f. Construction industry
g. Industry and technology providers
h. Research institutions and individuals (universities, research groups, scientists)

AUDIENCES (CON'T)

Community members and groups

a. Biosolid Free BC, Peninsula Biosolids Coalition

Hartland landfill neighbours

a. Community Associations (e.g., Willis Point Community Association, Mount Work Coalition)
b. Local Stream keeper and Watershed Protection Community Groups

Other regional districts in the Province of BC

Communities outside of the Capital Region that are currently receiving CRD biosolids

Provincial Government

Ministry of Environment and Climate Change Strategy

**A parallel engagement effort will occur with Core Area and Regional First Nations.*

STRATEGIC CONSIDERATIONS

- The importance of plain language and visuals to make the topic of biosolids more accessible and ensure those who are less familiar aren't intimidated by the technical jargon or dialogue.
- Establishing a solid context of the need to plan for the long term and the many associated considerations is critical to community and stakeholder understanding and support.
- Recognize that there are different opinions and that all perspectives are welcome, including many less familiar with biosolids and their potential uses.
- Ensure all considerations associated with beneficial uses are presented (e.g. environmental, health, beneficial uses, costs, timelines, siting, etc.)
- Aside from levels of acceptance about various options, it is important to explore how biosolids can be an opportunity and resource, not merely a waste product/problem.
- Important to create a space where people can learn more and understand the community's values and top-of-mind considerations, concerns, and mitigations and avoid a debate over options.
- A transparent process with a detailed *What We Heard Consultation Summary report* will ensure participants to see their input and how it influenced the long-term plan.

KEY TOPICS

What are biosolids	Inform
Why is a long-term plan needed / provincial requirement	Inform
Engagement process and opportunities to provide input	Inform
Potential options for beneficial use of biosolids / and associated considerations	Inform
Level of acceptance for various options	Consult
Top of mind considerations associated with biosolids management and specific options	Consult
Perceived benefits with options	Consult
Perceived concerns and potential mitigations associated with options	Consult
How best to keep you informed about biosolids management	Consult
What we heard during engagement process	Inform

ENGAGEMENT METHODS

AWARENESS-RAISING

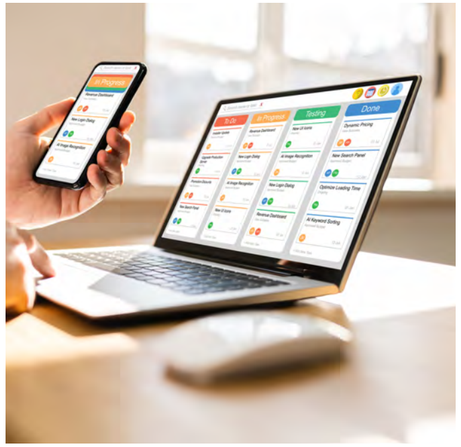
- “One-stop” project website with FAQ, videos, interactive features and technical documents
- Fact sheet/FAQ
- Videos
  - What are biosolids and “beneficial uses”, tour of facility
- Social media and digital advertising
- Earned media
- Letter to stakeholders
- Presentation materials

WAYS TO PROVIDE INPUT

- Online survey and interactive engagement platform
- Written submissions
- Online Open House
- Representative focus groups
- Facility Tour*
- Technical and Community Advisory Committee

STAGES IN THE PROCESS

A 3-month consultation process utilizing a variety of engagement methods.



Planning

October 2023

Public Consultation

November -
February 2023

What We Heard

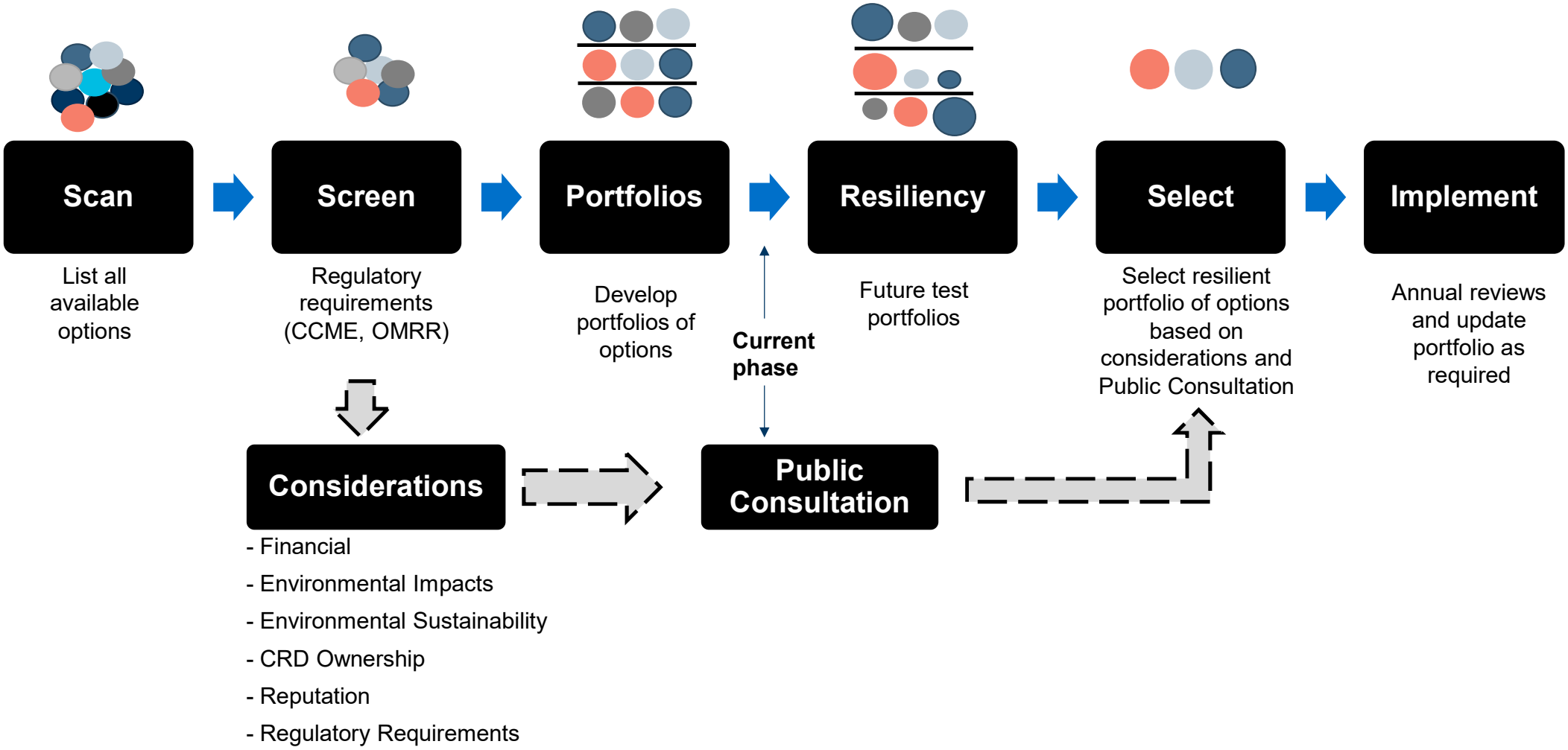
March 2024

Report to CRD Board

Spring 2024

QUESTIONS?

Approach



6.3 Options Evaluation

The results of the options evaluations using the proposed evaluation criteria are summarized in Table 6.4 below:

Table 6.4 General Option Pathway Evaluation Results

Evaluation Criteria	Description	Mine/Quarry Reclamation	Forest Fertilization	Land Improvement	Direct Land Application	BGM/Composting/Soil-Product	Fuel for Combustion/Incineration (Off-Site)	Pyrolysis (On-Site)	Gasification (On-Site)
Economic	CAPEX and OPEX	Low CAPEX given no investment for additional infrastructure. Medium OPEX due to labour, transport, materials handling, maintenance, storage, public outreach, etc.			Low CAPEX given no investment for additional infrastructure. Higher OPEX due to increased costs from bagging protocol and materials.	Low CAPEX given no investment for additional infrastructure. Medium OPEX due to labour, transport, materials handling, maintenance, storage, public outreach, etc.	Low to medium CAPEX depending on contract agreement. Some vendors may require investment for additional feedstock storage infrastructure. Medium OPEX due to labour, transport, materials handling, maintenance, storage, etc.	High CAPEX due to capital investment for on-site facility. OPEX induced from labour, utility demands (natural gas, electricity, and water), and the transport of biochar. In comparison to off-site alternatives, OPEX will be low in the long-term due to lack of tip-fees for biosolids. However, OPEX may be higher during the early commercial facility commissioning stage until the process becomes optimized.	
	Potential for revenue generation	Low potential for revenue generation as there are no residual products from this process.			Potential for revenue generation through the distribution of bagged biosolids fertilizer product to partially offset processing costs.	Low potential for revenue generation as CRD may not own the rights to the BGM/composting/soil-products.	Low potential for revenue generation as CRD may not own the rights to the value derived products (electricity, cement, heat, etc.).	Potential for revenue from value derived products (biochar, bio-oil) to partially off-set processing costs.	Potential for revenue from value derived product (biochar) to partially off-set processing costs.
	Estimated cost per tonne (CAPEX and OPEX estimate based on information available at the time of this report)	<$250/tonne	<$400/tonne	<$500/tonne	<$500/tonne	<$500/tonne	<$500/tonne	$500-4,500/tonne[1]	
Environmental Impacts	Odour	Potential for nuisance odour emissions at application site(s). May be mitigated via biosolids stabilization and mixing with soil. Application sites are generally far from population centres.					Minimal odour due to installation of an odour abatement system at the facility.		
	Noise	Noise emitted from land application equipment. However, mines/quarries are generally located far from population centres.			Noise potentially emitted from bagging equipment. However, site is located far from population centres	Noise emitted from land application equipment. However, application sites are generally	Minimal noise due to installation of noise abatement system at the facility.		

Evaluation Criteria	Description	Mine/Quarry Reclamation	Forest Fertilization	Land Improvement	Direct Land Application	BGM/Composting/Soil-Product	Fuel for Combustion/Incineration (Off-Site)	Pyrolysis (On-Site)	Gasification (On-Site)
Environmental Sustainability					and a noise abatement system would be designed as the bagging protocol is developed.	located far from population centres.			
	Estimated Truck Traffic	Truck traffic associated with transport of biosolids from site: Approximately one truck every three days (122 trucks each year)						Truck traffic associated with transport of biochar from site: – Approximately one truck every nine days (41 trucks each year)	
	Air Emissions and Dust	Generally low potential for particulate air emissions/dust.					Minimal air emissions/dust due to installation of advanced capture and treatment systems at facility, though residues from these capture and treatment systems need to be disposed of.		
	Contaminant mass balance	Potential accumulation of contaminants. However, class A biosolids have undergone contaminant reduction processes as per OMRR quality standards.					Contaminants have shown to be reduced through thermal processing. However, the level of reduction and ultimate environmental fate are still under investigation.		
	Production of value derived products e.g., biochar, biocrude, etc.	Biosolids may be considered a fertilizer product derived from a waste stream in the context of land-application, with the added benefit of reducing the need for energy-intensive synthetic fertilizer production.				Produces BGM, compost, soil-products which may be beneficially re-used in various applications and reduces the need for energy-intensive synthetic fertilizer production.	Produces energy which may be beneficially re-used for electricity/heating applications assuming nearby end-users.	Produces steam, syngas, , and bio-oil, which can be beneficially re-used in various applications such as heating, electricity, etc. Also produces biochar, however the potential beneficial applications of this product as a soil amendment are still under investigation.	Produces steam, syngas, and which can be beneficially re-used in various applications such as heating, electricity, etc. Also produces biochar, however the potential beneficial applications of this product as a soil amendment are still under investigation.
	GHG Emission Implications[2]	In comparison to landfilling, GHG emissions are significantly reduced due to lesser methane/nitrous-oxide emissions, carbon sequestration into soil, and an offset usage of synthetic fertilizers. In comparison to alternative beneficial use options, biosolids application to degraded areas (mines, quarries, forests, lands, etc.) presents the lowest potential for GHG emission reduction. Any off-site option will have higher GHG emission implications due to the transport distances and trucking frequency associated with the transport of			In comparison to landfilling, GHG emissions are significantly reduced due to lesser methane/nitrous-oxide emissions, carbon sequestration into soil, and offset usage of synthetic fertilizers. In comparison to alternative beneficial use options, the production and sale of biosolids as a soil fertilizer product through bagging, compost, or BGM, presents medium potential for GHG emission reduction, assuming it has greater potential to offset the usage of synthetic fertilizers.		In comparison to landfilling, GHG emissions are significantly reduced (lesser methane/nitrous-oxide emissions, non-renewable fuel usage offsets). Thermal processing options will have increased GHG implications from the oxidization of any gases produced.	In comparison to landfilling, GHG emissions are significantly reduced (lesser methane/nitrous-oxide emissions, non-renewable fuel usage offsets). Advanced thermal processing options will have increased GHG implications from the oxidization of any gases produced. Like combustion/incineration, pyrolysis and gasification present high potential for GHG emission reduction, if biosolids-derived energy (heat, syngas, or bio-oil from	

Evaluation Criteria	Description	Mine/Quarry Reclamation	Forest Fertilization	Land Improvement	Direct Land Application	BGM/Composting/Soil-Product	Fuel for Combustion/Incineration (Off-Site)	Pyrolysis (On-Site)	Gasification (On-Site)
		biosolids, resulting in increased non-renewable fuel usage.			Any off-site option will have higher GHG emission implications due to the transport distances and trucking frequency associated with the transport of biosolids, resulting in increased non-renewable fuel usage.		In comparison to land application options, utilizing biosolids as renewable fuel for cement combustion or energy production via incineration presents high potential for GHG emission reduction, assuming it offsets the usage of non-renewable fuel sources. Any off-site option will have higher GHG emission implications due to the transport distances and trucking frequency associated with the transport of biosolids, resulting in increased fuel usage.	pyrolysis) is beneficially used to offset the usage of non-renewable fuel sources. Depending on process design, this derived energy may not be reused or recycled, and may result in lower GHG emission reductions. On-site options will have lesser GHG emissions associated with transport, as the trucking frequency of hauling biochar will be less than that required of biosolids.	
	Potential to recover energy and reduce dependence on electric grid and natural gas	No potential to recover energy.					High potential to recover energy from products (steam, heat) to offset dependence on electric grid and natural gas. Fulsome energy recovery would depend on presence of nearby end-users.	High potential to recover energy from products (syngas, steam, heat) to offset dependence on electric grid and natural gas onsite. Fulsome energy recovery would depend on presence of nearby end-users.	
	Potential to co-process additional waste streams	No potential for co-processing.				Potential for co-processing via blending of biosolids with compost generated from organic waste streams.	Low potential to co-process mixed waste streams as CRD would not have control over off-site facility operations.	Potential to co-process mixed waste streams. However, co-processing may increase maintenance/operational costs due to added complexity of feedstock.	
	Soil/groundwater impacts	Supplementing soil cover and improving soil health via biosolids application reduces erosion into lakes and streams. Potential negative impact to soil/groundwater if application plan is not followed correctly as per OMRR.			Bagging process presents minimal impacts to soil/groundwater. End-use of the bagged product may present potential negative impact to soil/groundwater if applied in quantities greater than one bag ($5m^3$) per parcel of land. OMRR does not require a land application plan for application quantities less than or equal to $5m^3$ per parcel of land.	End-use of the products may present potential negative impact to soil/groundwater if application plan is not followed correctly as per OMRR.	Process presents minimal impact to soil/groundwater. End-use of the products (biochar, bio-oil, ash) may present potential negative impact to air/soil/groundwater if proper consideration not taken.		

Evaluation Criteria	Description	Mine/Quarry Reclamation	Forest Fertilization	Land Improvement	Direct Land Application	BGM/Composting/Soil-Product	Fuel for Combustion/Incineration (Off-Site)	Pyrolysis (On-Site)	Gasification (On-Site)
CRD Owned	Yes or no	No. Biosolids would be sent to vendors who would own risk and land application responsibility.			Yes.	No. Biosolids would be sent to vendors who would own risk and responsibility.	No. Biosolids would be sent to off-site facility.	Yes.	
Experience and Reputation	Type of application	Mines/quarries are required by the government to eventually reclaim and close to minimize the long-term environmental effects of operations. Biosolids have shown to be an effective measure in the restoration of former mines/quarries by adding nutrients to promote vegetation growth in their barren soils. However, general public acceptance regarding land application varies due to concerns on noise, odour, contaminants, etc.	Biosolids have shown to be an effective measure in the fertilization of forests to increase tree production, reduce soil erosion, and improve soil health. However, general public acceptance regarding land application varies due to concerns on noise, odour, contaminants, etc.	Land application has demonstrated commercial success and is one of the commonly used management options worldwide. However, general public acceptance regarding land application varies due to concerns on noise, odour, contaminants, etc.	It is unclear if there is a local market for bagged biosolids fertilizer product. A pilot trial would be required to assess demand and feasibility. Biosolids as a bagged product is allowed under OMRR in packages of <5m^3. However, general public acceptance regarding land application varies due to concerns on noise, odour, contaminants, etc.	Land application has demonstrated commercial success and is one of the commonly used management options worldwide. However, general public acceptance regarding land application varies due to concerns on noise, odour, contaminants, etc.	High technological readiness as combustion/incineration is a commercially proven and widely used biosolids management process. However, the market for biosolids as fuel does not currently exist. Additionally, public acceptance of waste incinerators varies due to concerns regarding intensive energy usage and potential for air pollutant emissions.	Reputation of pyrolysis is gaining interest as an innovative technology which produces value added products from waste streams, however it has demonstrated low technological readiness as there are a limited number of operational facilities which use biosolids as a sole feedstock. In North America, pyrolysis is ahead of gasification with regards to technological readiness based on the number of operational facilities.	Reputation of gasification is gaining interest as an innovative technology which produces value added products from waste streams, however it has demonstrated low technological readiness as there are a limited number of operational facilities which use biosolids as a sole feedstock. In North America, gasification is below pyrolysis with regards to technological readiness based on the number of operational facilities.

Evaluation Criteria	Description	Mine/Quarry Reclamation	Forest Fertilization	Land Improvement	Direct Land Application	BGM/Composting/Soil-Product	Fuel for Combustion/Incineration (Off-Site)	Pyrolysis (On-Site)	Gasification (On-Site)
Regulatory	New permitting requirements and impacts to existing permits	May require approvals from: - ENV to ensure land application is carried out safely and does not pose a risk to human health or the environment.					Changes to boiler air mass permits may be required. May require approval from Environmental Management Act Air Quality Permit for any emissions associated with thermal process.	May require approval from Environmental Management Act Air Quality Permit for any emissions associated with thermal process.	

1. Due to pyrolysis and gasification being considered emerging technologies in the biosolids industry there are a number of unknown risks associated with these technologies which have the potential of increasing both CPAEX and OPEX associated these types of projects.
2. GHG Emission Implications are based on the 2022 BEAM Model developed by the Northeast Biosolids and Residuals Association, Northwest Biosolids, Northern Tilth LLC.

Portfolios

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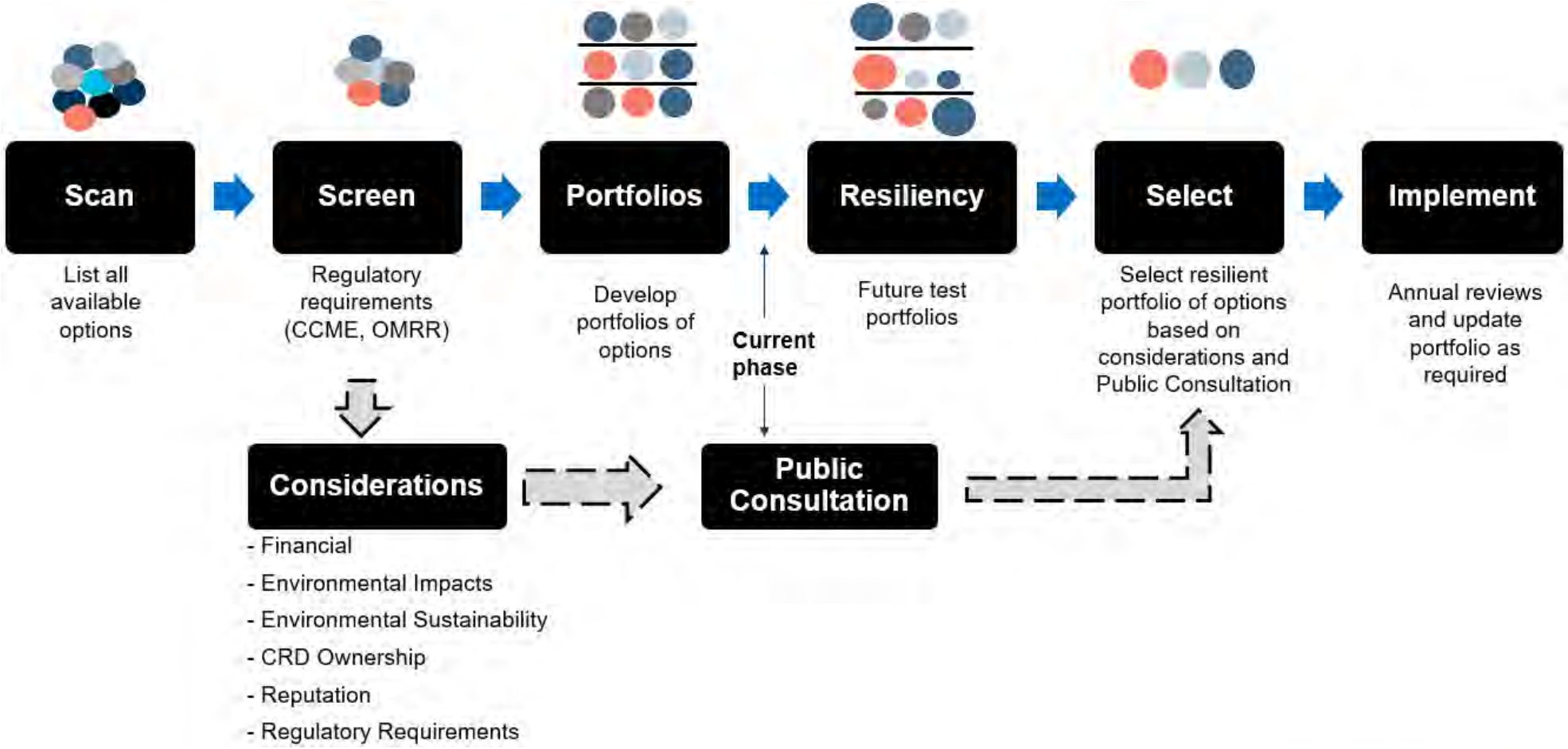
Risks of interruption may be mitigated through **redundancy of options,** achieved by **portfolios** composed of **multiple contingent options.**



Considerations

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	Thermal Processing  	Land Application     
Financial	– High initial capital cost, low economies of scale – Potential for revenue to partially offset processing costs	– Comparatively low capital cost. Additional investment into storage/transport infrastructure may be required. – No potential for revenue generation
Environmental Impacts	– Facility will have nuisance emission abatement systems (odour, noise, air/dust)	– Potential for nuisance odour, noise, air/dust emissions at application sites (far from population centers)
Environmental Sustainability	– Potential to recover energy from waste product – GHG emissions from transport (off-site combustion)	– Reduction of need for synthetic fertilizer – Potential for soil/groundwater impacts if OMRR not followed – GHG emissions from transport
Experience and Reputational	– Advanced thermal technology is emerging – No advanced thermal plants using biosolids feedstock operating in North America	– Demonstrated commercial implementation
CRD Ownership	– CRD would own advanced thermal facility or send biosolids to third-party for off-site combustion	– Biosolids would be sent to third-parties or be bagged by the CRD and sold commercially
Regulatory	– Facility permits required	– Land application plan required per OMRR
Potential Risks of Interruption	– Multiple years required to implement advanced thermal facility – Unknown market for biochar – Unscheduled shutdowns for operational maintenance/commissioning – Limited commercially operational biosolids thermal facilities in North America	– Fluctuations in need for biosolids (typically project-based, seasonal) – Unclear if market exists for bagged biosolids product

Available Options

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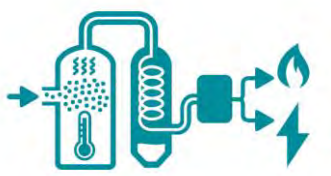
Available options can be broadly categorized as various forms of **thermal processing** or **land application**.

Pyrolysis or Gasification



- Heating with little to no oxygen
- 300-800 °C (pyrolysis)
- 600-1000 °C (gasification)
- Produces syngas, biochar, steam, ash
- $500 - $4,500/tonne

Incineration or Combustion

- Heating with excess oxygen
- 800-1200 °C cement kilns, pulp mills
- Converts to energy (steam, electricity, heat)
- >$500/tonne

Forest Fertilization

- Supplementing nutrients in forest soil
- >$400/tonne

Industrial Land Reclamation

- Reclaiming barren soils damaged from mining
- >$250/tonne

Wholesale Fertilizer for Landscaping

- Blending with soil, compost, or wood chips
- Wholesale distribution (e.g., golf courses)
- >$500/tonne

Bagged Fertilizer for Residential Use

- Blending with soil, compost, or wood chips
- Residential distribution (e.g., gardens)
- >$500/tonne

Fertilizer for Agriculture

- Fertilizer for crops
- >$500/tonne

Questions?