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Capital Regional District

Biosolids Beneficial Use Strategy
(Definitive Plan)

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EXECUTIVE SUMMARY

This document, titled Biosolids Beneficial Use Strategy, comprises the Definitive Plan for the beneficial use of Capital Regional District (CRD) biosolids, as required by the BC Ministry of Environment and Climate Change Strategy (ENV) in their November 2017 letter conditionally approving Amendment No.11 to the Core Area Liquid Waste Management Plan (CALWMP). The Definitive Plan includes short- and long-term biosolids management strategies, studies completed in support of these strategies, an implementation plan and a schedule, which ensures that management options are in place prior to the production of municipal biosolids from the CRD's new wastewater treatment plant (WWTP) in June 2020.

Currently, the CRD's wastewater undergoes preliminary screening prior to being discharged into the Strait of Juan de Fuca. Under the BC *Wastewater Systems Effluent Regulation,* the CRD is required to implement secondary treatment by December 31, 2020. As approved under the CALWMP, a WWTP is being constructed at McLoughlin Point to serve the core area municipalities and the Esquimalt and Songhees Nations. Wastewater will undergo tertiary treatment, with treated effluent discharged to the marine environment and residual solids conveyed through an 18-kilometre pipeline to a Residuals Treatment Facility (RTF) at Hartland landfill. Wastewater residual solids will undergo mesophilic anaerobic digestion and heat drying to produce biogas and biosolids, which are intended to be collected and used beneficially. The RTF is initially anticipated to produce 7,000 bulk tonnes (bt) of biosolids annually, at a moisture content of 5-10%. The biosolids are anticipated to meet Class A biosolids standards, as defined by the British Columbia (BC) *Organic Matter Recycling Regulation*. A sustainable and reliable biosolids management plan will be put in place for both the short- and long-term.

Policy positions from ENV and CRD influence the range of options that are available for the beneficial reuse of CRD biosolids. The CRD Board of Directors (the Board) passed a biosolids land application ban in 2011, based on the concerns of several advocacy groups and members of the public. Land application of biosolids was part of the full spectrum of options the CRD investigated at ENV's request; however, land application of biosolids is not currently being considered as a beneficial use option in the CRD.

The CRD submitted Amendment No.11 to the CALWMP, which ENV conditionally approved in 2016 with the stipulation that the CRD develop a Definitive Plan outlining both a short-term use for biosolids that does not include disposal or biocell storage options and a long-term strategy for biosolids beneficial use, which is to be submitted by June 30, 2019. The plan is to include assessments of management options and a review of biosolids management in similar jurisdictions. ENV referenced the *Canada-Wide Approach for the Management of Wastewater Biosolids* beneficial use principles of resource recovery, minimization of environmental and human health risks, reduction of greenhouse gas (GHG) emissions, and adherence to all applicable standards, requirements and guidelines. ENV required that management decisions be scientifically based and the use of temporary storage and disposal of biosolids at the landfill be minimized. In response to ENV requirements, the CRD completed numerous additional assessments on biosolids management options available, including a jurisdictional scan of how

other municipalities manage their biosolids. A combustion and emissions characterization profile was completed using Class A biosolids representative of those that will be produced by the CRD, and GHG modelling was completed on combustion scenarios. The CRD's recent declaration of a climate emergency, and goal for becoming carbon neutral by 2030, will be additional considerations for long-term planning.

In the short-term, the CRD intends to transport biosolids to cement plants in the BC lower mainland where they will be managed through co-combustion-to-heat cement kilns. The ash generated from combustion will be integrated into the cement product. Storage capacity currently planned at the RTF site will accommodate five days of biosolids production, while the cement plants are intended to be able to accommodate up to a week's worth of production at any given time. This short-term plan was developed through an open request for qualifications (RFQ) process leading to a collaborative request for proposals (RFP) process with two pre-qualified cement plants. If biosolids management at the cement plants is temporarily suspended, due to a plant shutdown, or indefinitely if co-combustion becomes unfeasible, then the CRD intends to obtain prior authorization from ENV to landfill the material until an alternate method can be determined. First Nations and public engagement was completed in May 2019 and feedback received has been incorporated into the final Definitive Plan, (Appendix L and M, respectively). The short-term management plan will be implemented concurrently with biosolids production beginning in June 2020.

This document also presents a process for determining a long-term biosolids management strategy and outlines steps to develop a sustainable and financially feasible long-term management strategy. The long-term beneficial use strategy will consider synergies with other waste management projects, where possible. Technologies and methods presented in previous studies—as well as the short-term plan, if it proves feasible—will be collated and screened using pre-determined criteria to create a short-list of options. The short-listed options will be evaluated using a holistic framework to assess environmental, social and financial impacts. First Nations and the public will be engaged on the short-listed options. Information on the short-listed options, rankings and feedback collected from First Nations and public consultation will be considered in the selection of the long-term biosolids management strategy. Once the long-term management strategy has been decided, the CRD intends to initiate a transparent and competitive RFP process. The CRD intends to work with the successful proponent to develop an implementation plan to ensure that biosolids management under a long-term management strategy commences no later than December 31, 2025.

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APPENDICES

1 INTRODUCTION

The Capital Regional District (CRD) is currently constructing a wastewater treatment plant (WWTP) at McLoughlin Point to serve the core area municipalities, as well as the Esquimalt and Songhees Nations. By June 30, 2020, wastewater treatment will begin at the McLoughlin Point WWTP, with residual solids conveyed by pipe for treatment and dewatering at the Hartland landfill. The Residuals Treatment Facility (RTF) is currently being constructed at the landfill and will produce Class A biosolids through mesophilic anaerobic digestion. Development of this wastewater treatment system is occurring under the CRD's *Core Area Liquid Waste Management Plan* (Appendix A), which was approved by the BC Ministry of Environment and Climate Change (ENV) in 2003. Since that approval, several amendments initiated by ENV or the CRD have been made to the CALWMP.

In 2016, the CRD proposed Amendment No.11, which updated the configuration of the wastewater treatment system, as well as the biosolids management plan proposed in previous amendments. As part of the conditional approval of Amendment No.11 (BC Ministry of Environment and Climate Change Strategy, 2016), ENV has required that by June 30, 2019, the CRD develop a definitive plan for the beneficial reuse of biosolids, which would include a review of available biosolids beneficial use options assessed, as well as a biosolids management review in similar jurisdictions.

The purpose of this document is to fulfill ENV's conditional approval requirement for a definitive plan by defining the CRD's biosolids beneficial use strategies over the short- and long-terms. This document incorporates a summary of biosolids beneficial use options, regulatory requirements, a jurisdictional review, a description of the short-term plan and an implementation plan for the long-term strategy.

2 BACKGROUND

To date, wastewater in the CRD undergoes preliminary treatment (i.e., screening) before being discharged into the Strait of Juan de Fuca. The *Wastewater Systems Effluent Regulation* (Environment and Climate Change Canada, 2012), which became active in 2012, includes a risk rating system for wastewater treatment systems. An assessment of the CRD's historical core area wastewater treatment system placed it in the highest risk category (Environment and Climate Change Canada, 2016), requiring the CRD to achieve secondary treatment of its wastewater by December 31, 2020.

The CRD assessed a variety of wastewater treatment technologies and biosolids beneficial use options to determine which systems would best align with their treatment and end-use goals. By June 2020, wastewater will undergo tertiary treatment at the McLoughlin Point WWTP—the treated effluent will be discharged into the marine environment and residual solids conveyed through an 18-kilometre pipeline to the RTF at Hartland landfill. At the RTF, residual solids will undergo mesophilic anaerobic digestion and drying to produce biogas and biosolids, both of which are intended to be collected and used beneficially. The RTF is initially anticipated to produce 7,000 bt of biosolids annually at a moisture content of 5-10%. The biosolids are expected to meet

Class A biosolids standards, as defined in the BC *Organic Matter Recycling Regulation* (OMRR) (Province of British Columbia, 2002). The OMRR regulates the production, classification and distribution of organic residual materials—including biosolids, compost and biosolids-growing medium (BGM) for the purposes of beneficial use. The biosolids will require ongoing management, as they will be produced on a daily basis.

In February 2019, the CRD declared a state of climate emergency and established a goal of becoming carbon neutral by 2030. With respect to biosolids production and management, resource recovery and the reduction of GHG emissions will be important considerations for achieving this goal. Opportunities for emissions avoidance, emissions reduction and carbon sequestration are associated with various biosolids beneficial use options and will be considered during the development and implementation of a long-term strategy.

2.1 Residuals Treatment Facility

The RTF at the Hartland landfill is being developed by the Hartland Resource Management Group (HRMG), comprised of Maple Reinder's PPP Ltd., Bird Construction Inc. and Synagro Capital in a public-private partnership (P3). The project will be delivered under a design-build-finance-operate-maintain (DBFOM) model with a 20-year operate and maintain period. The facility will incorporate the latest processes for stabilizing and drying biosolids.

Residual solids from the McLoughlin Point WWTP will be conveyed through an 18-kilometre pipeline and a series of pump stations to the RTF at Hartland landfill, where they will be treated and processed into high-quality Class A biosolids suitable for a range of beneficial uses.

3 REGULATION AND POLICY INFLUENCING THE DEFINITIVE PLAN

A number of CRD policies and provincial regulations exist that influence biosolids production, quality and beneficial use options. These policies and regulations centre on issues of public health, environmental protection and beneficial waste management.

3.1 British Columbia Ministry of Environment & Climate Change Strategy

The BC provincial government regulates the production, quality and distribution of biosolids through the BC *Organic Matter Recycling Regulation* (OMRR). ENV also reviews and approves liquid waste management plans (LWMP) and associated amendments. The following sections provide details on biosolids regulations and ENV's conditional approval of the CRD's *Core Area Liquid Waste Management Plan*.

3.1.1 Organic Matter Recycling Regulation

The OMRR regulates the production, distribution, storage and land application of biosolids, compost and BGM (Province of British Columbia, 2002). The regulation prescribes criteria for trace element concentrations, foreign matter, pathogen reduction and vector attraction reduction. The OMRR biosolids treatment and management requirements were developed based on similar regulations, such as the United States Environmental Protection Agency's *Part 503 – Standards for the Use or Disposal of Sewage Sludge* and the Canadian Food Inspection Agency's *T-4-93*

Safety Guidelines for Fertilizers and Supplements Trade Memorandum. Receiving environment soil quality criteria in the OMRR are borrowed from the BC *Contaminated Sites Regulation* and are based on human and environmental health risk assessments (last updated November 2017).

As part of new regulatory requirements, biosolids management will be required to adhere to nutrient management principles, as defined in the recently released *Code of Practice for Agricultural Environmental Management* (detailed in Section 3.1.3).

3.1.2 Amendment No.11 ENV Conditional Approval

The CRD submitted CALWMP Amendment No.11 (Appendix B) to ENV in September 2016. The amendment proposed conveying residual solids from the wastewater treatment process through pipes from the McLoughlin Point WWTP to the Hartland landfill for further processing to produce Class A biosolids and the storage of biosolids in biocells at the Hartland landfill. In Section 7 of Amendment No.11, the CRD committed to determining a long-term option for the beneficial use of biosolids and providing ENV with interim progress reports, as well as a final report to be submitted by June 30, 2020. This final report would include a long-term management option to be implemented within five years of completion of the wastewater treatment system.

ENV conditionally approved Amendment No.11, requiring the CRD to instead develop a Definitive Plan for biosolids management to be submitted by June 30, 2019 (see Appendix C). This plan was to outline a short-term plan for the use of the CRD's Class A biosolids that did not include disposal or multi-year storage options (i.e., biocells) at Hartland landfill. ENV also requested a long-term management beneficial use strategy that considers the full spectrum of beneficial uses and incorporates a jurisdictional review of how other municipalities successfully and beneficially manage their biosolids. The management method must be chosen based on scientific evidence and must fulfill the beneficial use definition, as per the Canadian Council of Ministers of the Environment's *Canada-Wide Approach for the Management of Wastewater Biosolids* (detailed in Section 3.2.1).

3.1.3 Code of Practice for Agricultural Environmental Management

On February 28, 2019, the *Agricultural Waste Control Regulation* was replaced by the *Code of Practice for Agricultural Environmental Management* (Province of British Columbia, 2019) (the Code). Under the Code, materials produced in accordance with the OMRR (Class A and B biosolids, BGM and compost) are considered nutrient sources and may require a nutrient management plan when applied to land, depending on the location of the application site. The application of nutrient sources as part of agricultural operations must follow nutrient management principles in order to reduce the risk of nutrient leaching. As specified in the Code, the entirety of Vancouver Island is considered a phosphorus-affected area, requiring increased monitoring of nutrients and nutrient management plans for agricultural sites. The Code outlines nutrient source application restrictions and requirements to maximize agronomic practices, while minimizing impacts to watersheds and surrounding properties. Appendix 3 of the Code includes scheduled amendments to tighten restrictions and increase requirements over the period 2019-2029.

Although the CRD is not currently considering any changes to the current ban on land application of biosolids within the CRD, this regulation is summarized here, as it relates to review of biosolids beneficial use throughout the province.

3.2 Canadian Council of Ministers of the Environment

3.2.1 Canada-Wide Approach for the Management of Wastewater Biosolids

The *Canada-Wide Approach for the Management of Wastewater Biosolids* (the Approach) (Canadian Council of Ministers of the Environment, 2012) details a set of priorities recognizing the value of biosolids as a resource, minimizing risks to the environment and human health, minimizing GHG emissions and adhering to all applicable regulatory standards, requirements, and/or guidelines. The Approach outlines principles and best management practices, which achieve beneficial use:

1. Municipal biosolids, municipal sludge and treated septage contain valuable nutrients and organic matter that can be recycled or recovered as energy.
2. Adequate source reduction and treatment of municipal sludge and septage should effectively reduce pathogens, trace metals, vector attraction, odours and other substances of concern.
3. The beneficial use of municipal biosolids, municipal sludge and treated septage should minimize the net GHG emissions.
4. Beneficial uses and sound management practices of municipal biosolids, municipal sludge and treated septage must adhere to all applicable safety, quality and management standards, requirements and guidelines.

The Approach identifies two main management categories of biosolids management: beneficial use and disposal. Beneficial use options adhere to the policy and principles of the Approach by recovering valuable nutrients, organic matter and energy, while disposal options do not. The Approach indicates that the beneficial use of biosolids allows for nutrient and resource recovery, while also reducing the demand for commercially produced fertilizers and fuel sources. The Approach identifies energy production, compost and soil production, application to agricultural or forestry land as a fertilizer or soil conditioner, and use in land reclamation as general beneficial use options. The Approach identifies the values of land application as providing micro- and macro-nutrients, reducing other fertilizer use, adding organic matter to improve soil porosity, bulk density, water-holding capacity and mitigating climate change through carbon sequestration.

In order for combustion to be considered a beneficial use option, there must be a positive energy balance, low production of nitrous oxide emissions and recovery of a significant proportion of the resulting fly ash or phosphorus through an additional beneficial use mechanism. In short, the potential for beneficial use, which complies with the Canadian Council of Ministers of the Environment (CCME) guidance, has many options, although most are land-based. The potential to comply with CCME guidance through energy recovery is restrictive and requires the satisfaction of several criteria.

In its conditional approval of Amendment No.11 (Appendix C), ENV has specifically referenced the Approach; as such, the Definitive Plan will be developed with consideration of these principles and best management practices.

3.3 Capital Regional District

The CRD has extensively debated and explored wastewater treatment and biosolids use options over the last decade (see Appendix F, Appendix G). Initially, the integration of municipal solid waste and organics into the biosolids treatment stream was proposed and has been shelved due to feasibility and cost considerations. The CRD has identified resource recovery and reduction of GHG emissions as priorities in biosolids management decisions (Capital Regional District, Parks & Environmental Services Department, 2015). The CRD's recent declared state of climate emergency will influence the development of a short-term plan and long-term strategy for biosolids management.

3.3.1 Declared State of Climate Emergency and Goal for Carbon Neutrality

On January 23, 2019, the CRD Parks & Environmental Services Committee unanimously passed a motion to declare a state of climate emergency. On February 13, 2019, the Board unanimously passed a motion to declare a state of climate emergency and also identified working towards achieving carbon neutrality by 2030.

The CRD's declared state of climate emergency, and goal of achieving carbon neutrality, will influence decision-making on biosolids management as the overall energy balance, treatment and transportation emissions, and opportunities for emissions reductions or carbon sequestration will need to be considered. Maximizing resource recovery and minimizing GHG emissions will be critical for meeting the CRD's goals.

4 METHODOLOGY

Since the CALWMP was first approved by ENV, there have been numerous technical studies focusing on various aspects or initiatives of the wastewater treatment and solids management system envisioned by the CRD. This Definitive Plan will consider the abundance of scientific information on biosolids management options when developing the short-term plan and long-term strategy for biosolids, in order to best align management with CRD goals and objectives, as well as provincial and federal policies and requirements. This section provides a chronological summary of technical assessments related to biosolids beneficial use options.

4.1 Previous Studies and Assessments

Numerous assessments were previously completed by consultants under contract to the CRD. Summaries of the information presented in the assessments, as they relate to biosolids beneficial use, are presented below.

4.1.1 Beneficial Use of Biosolids Jurisdictional Review

Following ENV's conditional approval of Amendment No.11 to the CALWMP, the CRD contracted Environmental Dynamics Inc. (EDI) to complete a jurisdictional review (Appendix E) of how other municipalities successfully and beneficially utilize their biosolids (Environmental Dynamics Inc., 2017). The report reviewed well-established biosolids use programs to inform decision-making regarding biosolids beneficial use options and Integrated Resource Management (IRM) projects. EDI's review found land application to be the most prevalent management method in BC and worldwide. Biosolids used for land application were produced using a variety of methods, such as aerobic or anaerobic digestion, alkaline stabilization and heat drying. Types of land application programs worldwide included application to agricultural or forestry land as a fertilizer and soil enhancer, land reclamation, reforestation and landfill closure material.

In the European Union (EU), agricultural land application accounted for over a third of biosolids produced, with the remainder being managed in landfills or incineration. In Australia, approximately two-thirds of biosolids were land-applied, with a large proportion being composted or used in forestry and land reclamation. At the time the report was written, Australia landfilled 11% of their biosolids, while New Zealand landfilled 61%, though they were moving towards vermicomposting destined for land application. Biosolids in Japan were managed through incineration, due to high population densities and a lack of suitable land available for fertilization. EDI's review included biosolids use in biogas and biodiesel production, thermal and biological hydrolysis, gasification, pyrolysis and incineration. Biosolids beneficial use case studies were presented for generators from Canada, the United States, the EU, Japan, Australia and New Zealand. Overall, many jurisdictions view biosolids as a resource rather than a waste product.

4.1.2 Integrated Resource Management Technology Gap Analysis

HDR was also retained in 2017 to review IRM technologies presented by Request for Expressions of Interest (RFEOI) respondents and identify any additional IRM technologies not included (Appendix H). Technologies presented in the IRM RFEOI were focused on biosolids and, individually, were only able to manage a subset of the solid and liquid waste streams available for management identified by the CRD. This gap analysis report identified that not all possible biosolids management options were represented in RFEOI responses and went on to detail additional technology options, such as autoclaving, pyrolysis, combustion, hydrolysis and depolymerization to provide the full spectrum of biosolids beneficial use technologies, both as part of an IRM process and independently. Due to concerns about lack of information on feedstock quantity and quality identified by RFEOI respondents, feedstock materials and annual tonnages available for IRM were further developed by the CRD.

A matrix of the IRM technologies, and feedstocks they are able to manage, is presented in the report and suggests that a single technology is not capable of managing all solid and liquid streams available in the CRD. In waste management systems, a large portion of organic wastes are typically diverted to composting or land application programs. In order to reach a reasonable economy of scale for an IRM facility, a large portion of source separated organics, yard waste

and biosolids need to be integrated. To determine a successful IRM solution, the feedstock quantities and properties, requirement for a process supplemental material, residuals produced and the market for the products, and the economic implications need to be considered.

4.1.3 Letter from Ministry regarding IRM

ENV provided a letter to the CRD on July 7, 2017 (Appendix D) in response to the Proposed Integrated Resource Management Work Plan (the Work Plan) submitted by the CRD on May 31, 2017. The Work Plan outlined the procedure and schedule for implementing a biosolids Definitive Plan, as requested in ENV's November 18, 2016 letter to the CRD (Section 3.1.2). ENV recognized that the Work Plan complied with the ministry's request that multi-year storage be removed from consideration, but expressed concern that a procedure and schedule for biosolids use, independent of the IRM facility, were not provided. ENV identified that the Work Plan did not provide the scope or details of IRM options and that the decision-making process and involvement of First Nations and public consultation were not detailed and would need to be addressed in future IRM plans.

The letter pointed out that the CALWMP and the IRM facility should be treated as distinct projects. IRM options were to be explored under the CRD *Solid Waste Management Plan*, whereas biosolids management fell under the CALWMP. ENV required a definitive biosolids management plan independent of IRM options to fulfill the CALWMP commitments. A deadline of June 30, 2019 was selected for the Definitive Plan, in order to assure the implementation of the plan concurrent with the start-up of the McLoughlin Point WWTP on December 31, 2020. ENV encouraged the CRD to continue with First Nations and public consultation, as they finalized the Definitive Plan.

4.1.4 Greenhouse Gas Emissions Estimate for Combustion Scenario - Biosolids Emission Assessment Model

In 2018, SYLVIS Environmental conducted a GHG emissions modelling assessment (Appendix I) for the CRD to help assess whether combustion of biosolids would be considered a beneficial use under the CCME combustion criteria (SYLVIS Environmental, 2018). Two incineration scenarios were modelled: the first involved using biosolids as an alternative fuel in cement manufacturing, and the second involved using biosolids ash as a compost odour control and/or enhancer. Using data from McLoughlin Point WWTP process flow diagrams and the CCME's Biosolids Emissions Assessment Model (BEAM), GHG emissions were modelled for conveyance of the residual solids to the Hartland RTF, treatment and drying to Class A biosolids, transportation and combustion of the biosolids to a selected beneficial use option (cement plant or compost facility).

Overall, GHG emissions estimates for these two scenarios were approximately equal. In GHG emissions accounting, ownership of the material translates to ownership of the emissions or credits. The CRD would be responsible for emissions generated during the treatment of wastewater residuals and the production and drying of biosolids. Ownership of emissions from transportation will depend on when biosolids ownership is transferred from one party to another.

The BEAM model calculates that using biosolids as an alternate fuel in cement manufacturing will result in the avoidance of 4,243 tonnes of CO_2-e. These emissions reductions result from avoided

coal combustion. GHG emissions from transport of biosolids from Hartland landfill to the end use site are factored into this calculation.

4.1.5 CRD - Biosolids Analyses, Combustion Study and Emission Profiling

The CRD is currently exploring offering Class A biosolids as an alternate fuel source for cement kilns and contracted Innotech Alberta to complete a biosolids incineration study in 2019 to support this option (Appendix J). Heat-dried granular biosolids (approximately 90% solids) from Synagro's Pinellas, Florida facility were procured to represent Hartland RTF biosolids, as they are produced using a similar process. The biosolids were analyzed for chemical composition, organic and inorganic compounds, pathogens and emerging substances of concern (ESOC), including pesticides and pharmaceuticals.

The biosolids analytical data met OMRR Class A biosolids limits and common pharmaceuticals, drugs and personal care products concentrations were below laboratory detection limits. Innotech determined the calorific value of the biosolids to be comparable to low-grade coal. The biosolids were incinerated to produce ash, which was analyzed for chemical composition, organic and inorganic compounds, and ESOC. The biosolids ash contained high concentrations of various metals (cobalt, copper, molybdenum and nickel), which exceeded limits in the Canadian Food Inspection Agency's *T-4-93 Safety Guidelines for Fertilizers and Supplements Trade Memorandum* (T-4-93)—rendering it unsuitable for land application, but usable as a cement additive.

It should be noted that the land application of biosolids ash is not regulated by T-4-93, but similar limits would likely be used if a provincial approval process for regulatory authorization of the use of the ash were pursued. The toxicity characteristic leaching procedure (TCLP) was used to determine landfill suitability. The ash meets all US Environmental Protection Agency limits in acidic, neutral and basic conditions, with the exception of chromium in acidic conditions. Polycyclic aromatic hydrocarbons (PAH), polybrominated diphenyl ethers (PBDE, common in flame retardants), dioxins and furans, and organochlorine pesticide compounds were almost completely eliminated during combustion, and concentrations in the ash were below CCME's *Canada-Wide Approach for the Management of Wastewater Biosolids* limits. Flue gas was monitored for nitrogen oxides (NO_x), sulfur oxides (SO_x), carbon monoxide, halide and metal concentrations. Emissions from biosolids incineration contained NO_x, SO_x and particulate matter (PM) exceeding the limits provided in the *British Columbia Ambient Air Quality Objectives*. The report concluded that biosolids would need to be mixed with nitrogen and sulfur-lean feedstocks to mitigate NO_x and SO_x exceedances.

5 IMPLEMENTATION PLAN

5.1 Short-Term Plan (3-5 years)

The CRD intends to manage heat-dried Class A biosolids through co-combustion in cement kilns at two plants in the lower mainland. Biosolids from the RTF will undergo drying to produce a 90-95% solids material. Dried biosolids will be pneumatically loaded into fully contained dry bulk tank

trailers and transported by ferry to the cement plants. It is estimated that 2-3 trucks, each with a 40 bt capacity, will transport approximately 80-120 bt of biosolids each week. At the cement plant, biosolids will be co-combusted with coal at a feed rate of 0.5-1 dry tonnes per hour to heat cement kilns, with the ash incorporated directly into the cement product as an additive and/or lime alternative.

Storage capacity at the RTF site is intended to accommodate five days of biosolids production, while the cement plants are intended to be able to accommodate up to a week's worth of production, at any given time. This short-term plan was developed through an open RFQ process leading to a collaborative RFP process with two pre-qualified cement plants. The short-term management plan will be implemented concurrently with biosolids production beginning in June 2020. First Nations and public engagement was completed in May 2019 and feedback received has been incorporated into this final Definitive Plan.

5.1.1 Beneficial Use

As per the CCME Approach, in order for the use of biosolids to be considered, the beneficial, nutrients or energy must be utilized, potential risks to the environment and human health must be minimized, GHG emissions should be minimized, where possible, and all applicable standards, requirements and guidelines must be adhered to. The CCME Approach also states that in order for combustion to be considered a beneficial use, the process should result in a positive energy balance, low NO_x emissions, and recovery or use of a significant portion of the fly ash, or phosphorus from the fly ash (Canadian Council of Ministers of the Environment, 2012).

The CRD intends to regularly submit biosolids samples for laboratory analysis to ensure biosolids are compliant with OMRR Class A criteria for trace elements, foreign matter, pathogen reduction and vector attraction reduction. The co-combustion of biosolids will reduce the need for fuels regularly used in cement kilns (i.e., coal) and will allow for energy recovery from the biosolids. Pollution control systems at the cement plants, including multi-cyclones and electrostatic precipitators, will reduce air emissions of particulate matter and trace elements. Although the two cement plants expressed concerns about the potential for mercury and phosphorus emissions, strong source control in wastewater collection systems of the CRD is intended to result in the biosolids having lower than normal mercury concentrations. The cement plants indicated that mixing biosolids NO_x, SO_x, and PM emissions would not be an issue, due to the relatively insignificant volume of biosolids that will be co-combusted with their other fuels. Emissions of these compounds will be decreased through pollution control systems and the cement plants will be responsible for regular emissions monitoring and reporting required under their permits.

A combustion and emissions profile, similar to that in Section 4.1.5, is intended be completed using CRD Class A biosolids in order to quantify the energy value and emissions compounds being produced through combustion. This assessment will aid in determining the net energy balance of co-combustion and to update the GHG emissions estimate. The previously completed GHG modelling assessment (Section 4.1.4) is intended to be updated to reflect the particular details of the short-term plan and the combustion and emissions profile of CRD Class A biosolids. GHG emissions and carbon sequestration credits are accounted for by the owner of the process

in question. The CRD is intended to be responsible for biosolids production, drying, loading and transportation (truck and ferry) to the plants. The cement plants are intended to be responsible for the GHG emissions and emissions avoidance associated with replacement of fossil fuels and incorporation of the ash into cement. The CRD's short-term plan for biosolids management, as an alternate fuel in cement kilns, will not be a carbon neutral or carbon sequestering process.

The net energy balance of biosolids production and distribution, including sludge conveyance to the RTF, digestion, dewatering, drying, and final handling, is estimated to be -56 gigajoules (GJ) per day. This net energy balance includes a total of 227 GJ/day of biogas energy, which is internally recycled between the digestion and heat-drying steps, as well as 59 GJ/day of waste heat from processes and products. The energy use estimates from biosolids transportation (5 GJ/day) and combustion (300 GJ/day) in cement kilns result in a net positive energy balance of 239 GJ/day.

An updated assessment of net GHG emissions and energy balance will determine how the short-term management of biosolids at cement plants fits into the CRD's objective of becoming carbon neutral by 2030.

5.1.2 Contingency

If biosolids management at the cement plants is temporarily suspended due to a plant shutdown, the CRD intends to temporarily store approximately only five days of the material at the Hartland site until the plant is up and running again. If co-combustion is suspended for longer periods where storage cannot be accommodated, or if it becomes unfeasible due to market conditions or the plant shuts down indefinitely, the CRD intends to obtain prior authorization from ENV to landfill the material until an alternate management method can be determined.

5.1.3 Short-Term Option Procurement Process

The CRD issued an RFQ for biosolids management in October 2018 and received six responses. Four responses did not meet the eligibility requirements identified by the CRD and were eliminated from consideration. The remaining two options were cement plants in the BC lower mainland, which both proposed the co-combustion of biosolids with coal in cement kiln burners and the subsequent incorporation of the ash into cement.

Following pre-qualification through the RFQ process, the CRD contacted the two cement plant proponents and issued an RFP for biosolids management to them in February 2019. The CRD worked collaboratively with the two plants to negotiate the terms of management agreements. These agreements will provide the CRD with certainty for biosolids management in the short term. The CRD is intended to be responsible for biosolids production, drying, loading, transportation, and the construction of silos (to contain the biosolids and provide limited storage) and feed systems at the cement plants. The cement plants are intended to be responsible for combustion of the biosolids and incorporation of the ash into cement.

5.1.4 First Nations Engagement

The CRD is committed to developing respectful government-to-government relationships and partnerships with First Nations to foster shared prosperity. First Nations engagement regarding the short-term management plan was undertaken in early May 2019. Feedback received from First Nations has been incorporated into this Definitive Plan.

5.1.5 Public Engagement

Public engagement regarding the short-term biosolids management plan was undertaken in early May 2019. Feedback received from public engagement has been incorporated into this Definitive Plan.

5.1.6 CALWMP 2020/2021 Amendment

ENV has provided conditional approval of the Core Area Liquid Waste Management Plan (the Plan) Amendments No. 11 and No. 12. As part of these approvals, the minister required an amendment to Section 5 of the Plan, with reference to control of wastewater overflows, as well as an amendment to Section 6 of the Plan requiring the development of a Definitive Plan for Beneficial Use of Biosolids. Given the significant changes to the core area wastewater service, and the need to update all chapters (programs), the entire Plan requires a comprehensive review. As an alternative to completing just the required, individual amendments, the CRD is currently in discussions with ENV to rewrite and modernize the overall document in a manner consistent with more recent liquid waste management plans (e.g., Metro Vancouver) approved by the ministry. The Plan would be more "high-level" in content, relying on comprehensive, detailed plans to address each of the current programs. Therefore, it is the CRD's intent to include the Definitive Plan as part of the complete update of the Plan that is required to be submitted to ENV no later than December 31, 2021. Preliminary text regarding the Biosolids Management Plan for that amendment is as follows:

"Biosolids generated within the Capital Region are managed via the Biosolids Beneficial Use Definitive Plan. This Plan includes both a short-term (up to 5 years) management plan for the beneficial use of biosolids to be activated upon start-up of the RTF, as well as a plan and schedule to establish a long-term (5-20 years) strategy. The long-term plan will be developed using a framework that incorporates environmental, social and financial considerations to determine how biosolids are to be best managed in the region. These plans are in accordance with CCME Guidelines and consistent with provincial legislation (e.g., Environmental Management Act, Organic Matter Recycling Regulation) as well as internal CRD Board policy. The CRD will also continue to engage local First Nations and the general public during development of the long-term strategy. It is anticipated that the long-term strategy will be finalized and implemented in 2025."

5.2 Long-Term Strategy (5-20 years)

Over the next three to five years, the CRD intends to manage Class A biosolids in co-combustion at cement plants while a long-term management plan is developed. A long-term management strategy will be selected that aligns with the CRD's objectives for environmental, social and financial sustainability. The procedure for developing the long-term management plan will be based on a thorough review of available management technologies and the best available science. The long-term biosolids management plan will be developed by June 1, 2023 and will consider a broad range of biosolids beneficial use options available to the CRD, including extension of the short-term plan, if feasible. Consideration of the full range of management options may involve re-examination of the current ban on land application, if directed by the Board. This procedure for development of the long-term strategy is outlined in the following sections and a schedule is provided in Section 6.2.

5.2.1 Beneficial Use

The CRD intends to incorporate the CCME Approach's beneficial use policy and principles (Section 3.2.1) for long-term management planning. The long-term strategy should capitalize on the energy value of biosolids, while minimizing potential risks to the environment and human health. The CRD intends to complete both: a combustion and emissions profile specific to CRD biosolids, similar to that in Section 4.1.5, and GHG modelling (Section 4.1.4) for all short-listed long-term options, to determine the energy and GHG balance associated with each option. Regulations and best management practices (BMP) associated with each option will be reviewed as part of the initial screening process and committed to upon final option selection. Unless there is a change in policy prior to the commencement of long-term management planning, land application options are not intended to be assessed within the process.

5.2.2 Project Synergies

The potential for synergies resulting from optimization of RTF processes or from partnerships with regional institutions will be considered during the development of the long-term strategy. Residuals, such as biogas or renewable natural gas generated during biosolids digestion at the RTF, will be recovered and used beneficially. While these residuals are currently planned to be recycled internally, in order to create heat for the drying process as wastewater volumes increase, there may be the potential to generate biogas in excess of internal process requirements, which could be used off-site or to generate electricity.

5.2.3 Initial Assessment and Collation

The determination of a long-term management option will begin with a review of methods and technologies presented in previous studies (Section 4.1), as well as research into innovative technologies. An update to the jurisdictional scan will be undertaken to summarize how other municipalities beneficially manage their biosolids, with a focus on how technologies and methods have or have not functioned as intended.

5.2.4 Systematic Screening

In order to systematically screen all management methods, criteria such as the following will be applied:

- Does the method adhere to the CRD's current policies, as well as provincial and federal policies and regulations?
  - Does the process align with the CRD's goal of achieving carbon neutrality by 2030?
- Is this method considered a beneficial use under the CCME Approach?
- Does the technology have a proven track record of successful management?
  - Does the technology have experience utilizing biosolids as a main feedstock?
- Is the scale or minimum capacity feasible given the CRD's annual biosolids production?

Systematic screening will eliminate options that are not practical for managing the CRD's biosolids or do not strive to meet requirements, such as beneficial use, low GHG emissions or carbon sequestration.

5.2.5 Preliminary Assessment to Create Short-List

Management options that pass the initial screening are intended to be examined for any gaps or technology risks, whether sufficient feedstocks exist and are available for use, for net energy balance and process GHG emissions, residuals produced and their management options, and social impacts to the public and First Nations. Construction and operational costs of the screened options will be determined in order to compare investment requirements. The Envision framework will then be used to assess the environmental, social and economic implications of each option. Envision assessments will include impacts to First Nations and the public, geographical and existing conditions of the proposed management site, resource and residual utilization, and climate risks. All assessments, costs and Envision rankings will be considered for short-listing of the highest ranked options. The CRD intends to request feedback from ENV on the approach, assessment and short-listed options.

5.2.5.1 Envision Framework

The CRD has identified the Envision project framework as a potential decision-making tool for consideration of the environmental, social and economic implications of biosolids management strategies. The Envision Sustainable Infrastructure Rating System (Appendix K) was developed by a partnership headed by the Institute for Sustainable Infrastructure. This approach is specific to infrastructure development and considers social and environmental criteria to aid in balanced decision making by identifying gaps, evaluating areas for improvement and developing metrics. The rating system is categorized into Quality of Life, Leadership, Resource Allocation, Natural World and Climate and Risk components. The Water Environment Foundation has evaluated the applicability and relevance of the Envision approach in relation to wastewater projects (collection systems, stormwater, biosolids and municipal resource recovery facilities), and its interpretation (Water Environment Federation, 2016) serves as useful guidance for development of the long-

term biosolids management strategy. Short-term biosolids management did not consider the Envision framework in its development.

5.2.5.1.1 Quality of Life

Under the Envision framework, projects should strive to improve the net quality of life and to mitigate any negative impacts for all communities affected. In order to maximize benefits to affected communities, projects should develop skills and jobs, build capacity, and increase productivity, business attractiveness and livability. Partnerships and collaborations should be explored, when possible, with surrounding communities and First Nations. Methods to reduce risk or negative impacts during construction and operation of projects are prioritized, including noise and light pollution, minimal traffic congestion and accessibility to non-motorized and public transportation. Community values, such as history or character, should be preserved or improved. Minimized impact, maximized risk mitigation, commitment to capacity building and preservation of community values strengthens the link between project and community.

5.2.5.1.2 Leadership

The Envision framework envisions effective, sustainable and collaborative leadership as accountable to the project, in order to handle the complexity of the project. Collaboration in project decision-making includes effective teamwork and opportunities for stakeholder involvement. Project design should take advantage of a wide range of inputs in order to understand existing operational relationships among stakeholders, which can be leveraged for project success, and project planning should minimize conflicting design elements. Design can also be planned in order to reduce waste, enable beneficial use of process residuals and protect the environment by default. When making decisions, planning for long-term monitoring and maintenance, as well as identifying and preparing for conflicting regulations and policies, aids in the implementation of successful projects.

5.2.5.1.3 Resource Allocation

Projects should strive to incorporate sustainability values into project planning and resource recovery in processes, where possible. In wastewater treatment systems, the opportunities in this category are numerous. Appropriate design reduces energy requirements of the system. Biosolids or other residuals are recognized as resources, rather than wastes, and used beneficially. Biogas generated during solids treatment is collected and utilized. Process energy inputs and emissions outputs should be reduced by design, when possible.

5.2.5.1.4 Natural World

The Envision approach states that projects should protect land values and improve environmental conditions, where possible. These opportunities abound for the CRD's proposed wastewater treatment system. Treatment of wastewater will improve the marine environment, where effluent is discharged. The Envision framework considers that land improvement using biosolids is accomplished by improving soil quality through increasing organic matter and fertility—increased soil quality reduces impacts to water sources. Replacement of chemical fertilizers with biosolids,

an organic fertilizer, reduces nutrient leaching, protects surface and groundwater, restores degraded soils and reduces GHG production or sequesters carbon. The Envision framework also acknowledges the potential to develop and utilize renewable energy through wastewater and biosolids systems.

5.2.5.1.5 Climate and Risk

Projects should consider GHG mitigation over the life cycle of the project by identifying processes and opportunities for optimization of emissions reductions. A Climate Impacts Assessment and Adaptation Plan should be developed to fully consider all potential climate factors. Reduction of common emissions compounds, where possible, aids in creating a management method that is protective of public health. Management systems that are resilient in the face of climate change are preferred to infrastructure, which is less resilient and requires expensive maintenance.

5.2.6 First Nations Engagement & Consultation

The CRD intends to determine which First Nations may potentially be affected by the short-listed long-term biosolids management options. The CRD will engage with identified First Nations through open houses and online postings. Feedback and concerns will be collected through the open houses, as well as through mail and online submissions. Feedback and concerns received will be addressed and considered, as part of the long-term biosolids management decision-making process. The schedule for First Nations engagement and consultation is provided in Section 6.2.

5.2.7 Public Engagement & Consultation

Following review by ENV, the short-list is intended to be shared with the general public, as part of consultation and engagement activities. Consultation and engagement will occur through open houses and online postings. Feedback was received through open houses, mail correspondence and online submissions. Feedback received during engagement and consultation will be addressed and considered in long-term management plan development. A schedule for public engagement and consultation is provided in Section 6.2.

5.2.8 Long-Term Plan Final Decision

The CRD intends to take into account feedback and concerns shared by ENV, First Nations and the general public, during consultation and engagement. All assessments, Envision rankings and costs will be considered. If any information gaps are identified, additional research will be completed to address gaps or unknown risks. The CRD intends to consider all information and feedback in the final determination of a long-term biosolids management strategy.

5.2.9 Long-Term Management Procurement & Scheduling

Once the long-term management option has been determined, the CRD intends to run a competitive, transparent and open procurement process aligned with CRD policies. Identification of stakeholders, siting details and environmental impact assessments will be completed during this process.

A schedule will be developed with the successful proponent and will outline the steps and scheduling needed to implement the method or technology no later than December 31, 2025. The implementation schedule will be provided to ENV for feedback.

6 DEFINITIVE PLAN IMPLEMENTATION STEPS WITH MILESTONES

The CRD has identified a timeline to achieve the implementation of the short-term biosolids management plan and milestones in determining the long-term management plan.

6.1 Short-Term Management Plan

The short-term biosolids management plan has been determined for CRD biosolids. Milestones with dates are included for management at cement plants in the lower mainland.

October 2018	RFQ issued by the CRD
February 2019	RFP with two cement plants in the lower mainland
April 5, 2019	Definitive Plan draft
April 12, 2019	RFP closes
April 24, 2019	Staff report to Parks & Environmental Services Committee on draft Definitive Plan
May 2019	First Nations engagement
May 2019	Public engagement
May 22, 2019	Staff report to Parks and Environmental Services Committee on final Definitive Plan
June 12, 2019	Staff report to CRD Board of Directors on final Definitive Plan
June 28, 2019	Definitive Plan submitted to ENV
Fall 2019	Financial Close with cement manufacturers pending ENV approval
June 30, 2020	Hartland RTF start up
June 30, 2020	Commence biosolids transport and management at cement plants
December 31, 2020	Hartland RTF commissioning completed

6.2 Long-Term Management Plan Development

The CRD intends to be developing a long-term management plan to manage Class A biosolids produced. A timeline is provided with milestones to reach a long-term management decision.

June 2020	Complete combustion and emissions profile on CRD Class A biosolids
November 2020	Compile all previous studies
January 2022	Update jurisdictional scan
February 2022	Develop technology evaluation criteria
February 2022	Systematic screening of short-term solution and long-term options
March 2022	Preliminary assessment of successful evaluated options
March 2022	Envision assessment
March 2022	Create short-list of options
April 2022	Short-list provided to ENV for review
September 2022	First Nations consultation on short-list of options
November 2022	Public consultation on short-list of options
January 2023	Additional assessments if required

June 2023	Long-term management plan final decision
June 2023	Complete Environmental Impact Study
July 2023	Initiate procurement process - RFP
January 2024	Develop final implementation schedule

7 SUMMARY

This Definitive Plan for the beneficial use of CRD biosolids lays out an approach for the development and implementation of short- and long-term biosolids management strategies. There are many considerations in determining short-term and long-term biosolids beneficial uses for the CRD Class A biosolids that will be produced starting in 2020. As per ENV requirements, the development of the long-term approach is intended to be underpinned by science, aligned with beneficial use principles, as defined by the CCME Approach, and minimizes the storage and disposal of biosolids.

The CRD Board passed a biosolids land application ban in 2011, based on concerns of advocacy groups and members of the public, which reduced the number of management options assessed, and will limit the options available to CRD moving forward. Following the land application ban, the CRD explored alternate biosolids management methods, including IRM. The CRD submitted Amendment No.11 of the CALWMP proposing changes to the biosolids management plan and wastewater treatment system. ENV conditionally approved Amendment No.11, stipulating that a Definitive Plan be prepared outlining short- and long-term plans for biosolids management that minimize the need for storage and disposal of biosolids. The management plans were to consider technical assessments and a jurisdictional review. Many studies were completed over the past decade and were referenced in this Definitive Plan, which explored biosolids management methods and IRM options and reviewed how other municipalities utilize their biosolids.

As per ENV's conditional approval of Amendment No.11 to the CALWMP, short- and long-term management must be beneficial uses and minimize the need for storage or disposal of the biosolids. In the short-term, CRD biosolids will be managed through co-combustion at cement plants in the BC lower mainland. Once management of biosolids at cement plants has begun, the CRD intends to assess the feasibility for use in the evaluation of the long-term options. The process for selecting a long-term strategy has been outlined and will be followed to ensure that biosolids management decisions are thoroughly assessed. Technical studies and jurisdictional reviews previously completed will be updated as part of the determination of a long-term management strategy. All environmental, social and economic impacts will be evaluated, in addition to project feasibility requirements. The CRD's recently declared state of climate emergency, and goal to become carbon neutral by 2030, will encourage the selection of a long-term management strategy that minimizes GHG production and maximizes resource recovery. Engagement and consultation with First Nations and the public will gather feedback, which will be carefully considered in determining the long-term management strategy. Provincial and federal policies and requirements will be reviewed and adhered to during the short-term and long-term management of the biosolids.

The CRD is committed to implementing biosolids management solutions that employ the most reliable technologies, minimize environmental and human health risks, adhere to all relevant regulations and policies, and provides value to residents.

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