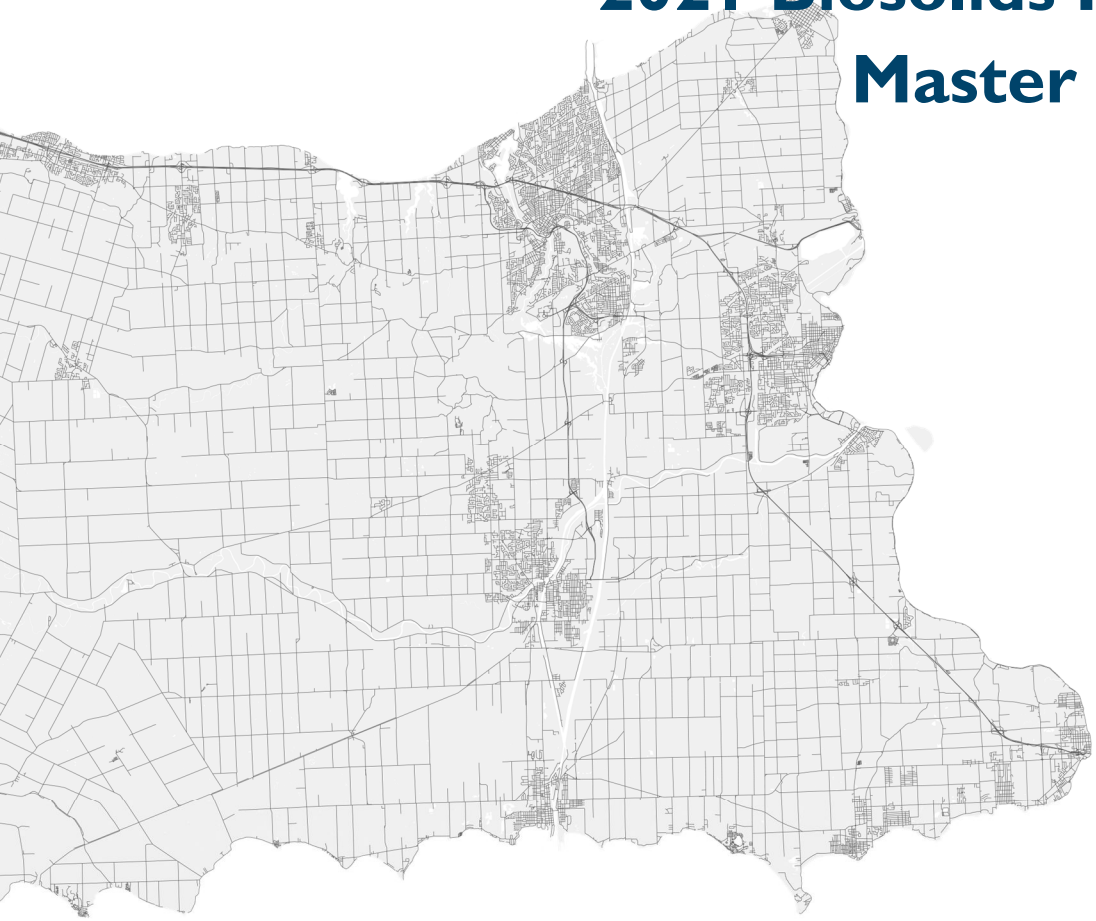
APPENDIX A11:
TM 11 – Contingency Plan

Technical Memorandum 11
Contingency Plan

2021 Biosolids Management Master Plan Update

November 2023



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QA/QC - SIGN OFF SHEET

This report has been reviewed and approved by the undersigned.

Laurie Boyce, B.Sc., M.A.
Senior Advisor

Zhifei Hu, P.Eng.
Assistant Project Manager, Technical Lead

1.0 Introduction

1.1 Background and Purpose

Niagara Region has extensive water and wastewater infrastructure, with ten (10) wastewater treatment plants (WWTP) and six (6) water treatment plants (WTP). Most of the solids generated at the WWTPs are anaerobically digested, and the resulting liquid biosolids are currently transported to the centralized Garner Road Biosolids Storage and Dewatering Facility (Garner Road Biosolids Facility) for storage prior to land application or dewatering and further processing. The solid residuals from the six water treatment plants are either transported to the Garner Road Biosolids Facility or discharged into sanitary sewers to be treated at the receiving WWTP and managed as part of the resulting wastewater solids.

The Region currently has contracts with two third-party contractors as part of their biosolids management program: Walker Environmental and Thomas Nutrient Solutions (TNS).

Walker Environmental currently transports dewatered cake from the Garner Road Facility and Niagara Falls WWTP to its N-Viro Alkaline Stabilization facility in Thorold. Walker provides enhanced treatment of the Region biosolids, and markets and sells the final soil amendment product through licensed distributors.

Thomas Nutrient Solutions manages Niagara's land application program and identifying and partnering with farmers for biosolids application to their agricultural land. They are also responsible for transporting biosolids to Garner Road facility as well as operation and maintenance of this facility. Thomas Nutrient maintains a Non-Agricultural Source Materials (NASM) plan for each agricultural end user and is responsible for acting in accordance with the Nutrient Management Act.

As summarized in TM 7, seven biosolids management strategies were developed and evaluated, and the top three strategies identified were:

1. Strategy 4: Anaerobic Digestion + Dewatering + Advanced Alkaline Treatment to produce a fertilizer product for land application
2. Strategy 2: Anaerobic digestion + Dewatering + Cake Land Application
3. Strategy 1: Anaerobic Digestion + Liquid Biosolids Land Application

These strategies are further described in TM 5 and TM 8 which provide specific capital projects and operational recommendations, as summarized below:

1. Continue dewatering at Niagara Falls WWTP and contracting with Walker Environmental to transport and process cake until, at a minimum, the existing centrifuge at the Niagara Falls WWTP reach the end of its useful life.

2. Send liquid biosolids from all WWTPs, and thickened WTP residuals from Decew WTP and Niagara Falls WTP to the Garner Road Facility. Continue discharging WTP residuals from Welland WTP, Rosehill WTP and Port Colborne WTP to local wastewater collection systems.

3. Pilot test land application of dewatered biosolids cake in collaboration with Thomas Nutrient Solution and area farmers to assess feasibility and end-user buy-in. Pending success of this pilot, complete additional upgrades at the Garner Road Facility:
    a. Option 1 (pilot is successful): Increase dewatering capacity and add cake storage at Garner Road Facility.
    b. Option 2 (pilot is not successful): Increase dewatering capacity and add liquid storage capacity at Garner Road Facility.

TM 10 reviewed current contractual obligations with third-party contractors, including the existing basis of measurement and payment, as well as opportunities to improve the service delivery model in alignment with the biosolids management program recommendations previously described in TM 5, TM 7, and TM 8.

This Technical Memorandum 11 summarizes a revised contingency plan that is based on the Region's current contingency plan and the recommendations presented in the TMs. It also outlines the program risks and measures to mitigate these risks. Potential program risks were identified early in the study during the initial Risk Workshop held on April 20, 2022 (See Appendix A). A revised risk register was developed that describes how the proposed biosolids management strategies address identified risks and presented in Appendix B. This TM will form the basis for an updated contingency plan for their Biosolids Management Program.

1.2 Technical Memorandum Outline

This technical memorandum (TM) is organized into the following sections:

1. **Introduction:** This section provides the background and purpose of the TM and its outline.
2. **Risk Identification and Assessment:** This Section summarizes all the risks associated with the current biosolids management program, and associated mitigation measures. This provides context for development of the contingency plan.
3. **Existing Contingency Plan**: This section describes the Region's current contingency plan for their biosolids management program.
4. **Contingency Plan Alternatives:** This section will evaluate potential contingency processing and end use alternatives
5. **Contingency Plan Recommendations, Implementation and Monitoring:** This section provides the recommended approach to contingency planning, preferred contingency measures and how to monitor success of the program.
6. **Summary and Next Steps**

2.0 Risk Identification and Assessment

A detailed risk register was developed early in the Master Plan study and reviewed during a Risk Workshop on April 20, 2022. Minutes and presentation slides are contained in Appendix A.

Each risk was assigned a probability, cost impact, schedule impact and reputational impact rating to determine a risk score. The risk score was calculated by multiplying the probability score by the highest of the cost impact, schedule impact and reputational impact score. This score represented the perceived risk at the initiation of the BMMP. It was then decided to either mitigate, transfer, or accept each risk, and associated measures that were applicable to mitigate the risks. A target risk score was also developed, which represented the level of risk that the Region was targeting at the completion of the BMMP. The preliminary risk register is presented in Appendix A.

This risk register has been updated at the end of Phase 2 of the Class EA, based on the preliminary recommendations of the Master Plan. This risk register is contained in Appendix B. The risk register will be updated again at the end of the BMMP, after the 30-day public review period. It will also be considered during implementation of the preferred strategy identified in the BMMP.

The legends presented in Table 2-1 and Table 2-2 below describe how risks were evaluated and scored:

Table 2-1 – Risk Scoring Method

	Very Low (1)	Low (2)	Medium (3)	High (4)	Extreme (5)
Probability	< 5%	< > 5- 20%	< > 20 – 35%	< > 35 – 50%	> 50%
Cost Impact	< $500K	$500K - $1M	$1M - $2.5M	$2.5M - $5M	> $5M
Schedule Impact	< 3 months	< > 3 – 6 months	< > 6 – 12 months	< > 12 – 18 months	> 18 months
Reputational Impact	Minor	2	3	4	Major

Table 2-2 – Risk Classification Legend

Risk Level	Legend
Immaterial / Low	< 5
Medium	5 - 10
High	11 - 16
Extreme	> 16

The risks were organized into the following categories for evaluation:

- Operational Risks
- Contractual Risks
- Social and Community Risks

- Environmental, Site Conditions and Health & Safety Risks
- Compliance Risks
- Project Management and Cost Risks

The following sections provide details on each category of risk, a list of each risk identified, scoring, strategy to manage the risk, and the risk response at this stage of the BMMP. Risks that do not currently meet the risk target score will be reviewed at the completion of the 30-day public review period and reassessed.

2.1 Operational Risks

Operational risks are those related to operation and maintenance of the biosolids management equipment used to maintain required biosolids quantities and quality, and implications of failure of this equipment.

Table 2-3 - Summary of Operational Risks and Management Approaches

DESCRIPTION	INITIAL RISK SCORE	RISK PHASE 2 UPDATE	TARGET SCORE	STRATEGY	RISK RESPONSE
	25	4	4		
Increasing wet weather events due to climate change	20				**Increase dewatering and storage at Garner Road and increase maximum quantity of cake that can be sent to N-Viro facility.**
Water residuals sent to sewer cause upsets at WWTPs		4	4		Continue hauling residuals to Garner Road from WTPs that have historically caused process upsets (i.e., Niagara Falls). Consider portable centrifuge to dewater residuals during clean-outs and haul to landfill
Failure of digester boiler system / heat exchanger	12	3	3	Mitigate	Continue monitoring performance and plan for replacement
Dewatering / centrifuge failure at Niagara Falls WWTP		3	3		Plan for centrifuge replacement at Garner Road. Use portable centrifuge as emergency back-up.
Market Availability		2	2		Market assessment completed in TM 9 verified availability of sufficient land bank to receive biosolids in Region to meet future needs to 2051. Responsibility for final disposal is transferred to third-party contractors. Increasing biosolids storage at Garner Road will also help mitigate this risk.

DESCRIPTION	INITIAL RISK SCORE	RISK PHASE 2 UPDATE	TARGET SCORE	STRATEGY	RISK RESPONSE
Recommendation of new biosolids treatment or stabilization technology	9	3	3	Avoid	Master Plan does not recommend implementing a new technology after detailed review of alternative technologies.
Failure of digester mixing system	9	3	3	Mitigate	Include redundancy, alternate mixer designs to increase reliability
Sludge thickening operational issues at WWTPs	8	2	2	Mitigate	Include redundant thickening units and polymer system upgrades
Changes to population forecasts and flows	4	8	8	Accept	This BMMP is based on the population growth and flow forecasts identified in the 2021 Water and Wastewater Master Plan. Bill 23 was passed during the BMMP process, increasing the Region's rate of population growth. While this will not affect the overall strategy, it may require specific projects be implemented earlier than anticipated.

***Most Critical Risks are Bolded**

Operation of the Garner Road Facility poses the greatest risk, along with weather conditions that limit the ability to land apply during periods of the year. Specific operational risks at Garner Road include:

- Accessibility issues when maintaining the dewatering centrifuges, requiring a longer shutdown period and reliance on liquid storage
- Liquid storage limitations during times of the year when land application is more restricted; liquid storage shortfalls are more significant when dewatering equipment is also down for maintenance
- Limited forcemain capacity to remove supernatant / stormwater from lagoons
- No cake storage, requiring trucks from Walker Environmental to wait onsite while being loaded over several hours. This limits the volume of cake that can be transported offsite per day as the truck loading is restricted from 7:00 am to 9:00 pm
- Walker Environmental not accepting cake if the total solids concentration of the dewatered cake is below 22 percent or other quality requirements are not met.

This Biosolids Management Master Plan update recommends the following upgrades at the Garner Road Facility, which act to mitigate operational risks associated with the facility:

- New dewatering facility with improved accessibility for maintenance of equipment, and increased capacity to allow for generation of larger volumes of cake

- New cake storage facility to be used prior to and during growing season, which allows for an increase in dewatering output, reducing reliance on liquid storage
- Restore the capacity of the forcemain from Garner Road that conveys decanted water from the lagoons and dewatering sidestream flows into Niagara Falls WWTP wastewater collection system.
- Maintain the existing liquid storage lagoons and storage tanks along with increased decanting of lagoons to increase their effective capacity. This requires the use of the full forcemain capacity. Monitor impacts of increased decanting on Niagara Falls WWTP performance and adjust decanting as necessary to reduce impacts until upgrades at Niagara Falls WWTP are complete. Maintaining liquid storage along with cake storage increases the diversity of product outlets, and better ensures the ability to move material offsite in a timely manner.
- Maintain the contract with Walker Environmental to provide an alternative biosolids management strategy when direct land application of biosolids is not possible.
- Maintain one or more third party contractors to manage liquid biosolids hauling and land application.

Additional details of the proposed recommendations for the Garner Road Facility can be found in TM 5. Details of contract recommendations are found in TM 10.

2.2 Contractual Risks

Contractual risks are those arising from contractual obligations with third-party contractors. As mentioned, the Region currently has contracts with Thomas Nutrient Solutions and Walker Environmental to manage portions of their biosolids. Generally, contractual risks can be mitigated through contract language updates and maintaining a good relationship with third-party contractors. Further details on recommendations for improvements to third-party contracts are discussed in TM 10.

Table 2-4 provides an overview of the contractual risks associated with biosolids management including risk identification, scoring and response.

Table 2-4 - Summary of Contractual Risks and Management Approaches

DESCRIPTION	INITIAL RISK SCORE	RISK PHASE 2 UPDATE	TARGET SCORE	STRATEGY	RISK RESPONSE
Reliance on Existing Third-Party Contractors	20	4	4	Mitigate	**Update terms of contract as noted in TM 10. Consider breaking biosolids transportation into multiple contracts (i.e., separate contracts for hauling to Garner Road and land application). Provide quality product to third-party contractors to increase ability of third-party contractors to provide quality product to end users.**
Existing Contractual Obligations	20	4	4	Mitigate	**Potential improvements to existing contracts are identified in TM 10, including incentives to increase decanting of biosolids in lagoons to reduce hauling costs.**
Third-party contractor acquisition / consolidation, reducing competition	20	12	8	Mitigate	**Monitor the market and maintain good relationships with contractors. Maintain fair contracts that are attractive to contractors once current contract expires. Consider utilizing multiple contracts for different services (i.e., liquid biosolids hauling, cake hauling) to add diversity and reduce reliance on a single entity.**

***Most Critical Risks are Bolded**

Since the Region currently relies on third-party contractors to manage the distribution of all biosolids produced by the WWTPs serving their population, the risk classification level associated with these contracts is considered high. Currently, a single contractor, Thomas Nutrient Solutions, is responsible for managing transport of liquid biosolids between each WWTP and the Garner Road Biosolids facility, managing the liquid storage lagoons at Garner Road, transporting liquid biosolids to land application, and managing contracts with agricultural end-users for land application. TM 10 provides recommendations for updating the contract with TNS to reduce risks to the Region.

It is recommended that the Region increase the flexibility of their contracts with these firms to maintain diverse product outlets and increase allocation of processing capacity for Niagara Region. As part of the contract reviews it is recommended that the Region increase the quantity of solids that can be managed at the Walker Environmental Facility. Contract updates should also incentivize increased thickening and dewatering of biosolids before transport to land application. The Region should also consider separate contracts for hauling liquid biosolids to Garner Road for storage and land application. Updates to the existing contracts are recommended once the current contract period expires. These recommendations are discussed in TM 10.

2.3 Social and Community Risks

Social risks are those related to community and human impacts of the biosolids program. Social risks are generally mitigated through a strong planning process and on-going communication with key stakeholders. Biosolids management strategies were evaluated against multiple criteria, including social impacts. The recommended strategies aim to reduce community impacts by increasing dewatering to reduce hauling and associated truck traffic.

Biosolids also present a risk of odour generation that must be properly managed. Odour prevention is preferred to odour treatment and can be accomplished by building facilities away from residential land. A summary of the Social and Community Risks identified along with recommended management approaches are presented in Table 2-5.

Table 2-5 - Summary of Social and Community Risks and Management Approaches

DESCRIPTION	INITIAL RISK SCORE	RISK PHASE 2 UPDATE	TARGET SCORE	STRATEGY	RISK RESPONSE
	20		4		
New vendors opposition	16		4	Mitigate	A long list of technologies was considered and reviewed in TM 7, and proposed strategies are clearly justified and have been communicated through PIC 2 and stakeholder meetings. Risk remains moderate until after 30-day review period.
Truck traffic complaints	15	4	4	Mitigate	Current contracts clearly identify acceptable truck traffic routes to limit community impacts. Overall, truck traffic will be reduced with the recommended biosolids program as dewatering will reduce volumes that need to be hauled.
Odour generation at Garner Road or WWTPs leading to complaints	10	3	3	Mitigate	Continue providing clear method to allow for complaints to be received, filed and responded to. Consider acquiring property adjacent to Garner Road if it becomes available (i.e., through 'first right of refusal' agreement with current landowner). Contain odour and treat once new dewatering building is constructed.

DESCRIPTION	INITIAL RISK SCORE	RISK PHASE 2 UPDATE	TARGET SCORE	STRATEGY	RISK RESPONSE
Opposition from Indigenous Groups	10	8	2	Mitigate	Indigenous groups were notified of the project early on, and additional letters were sent prior to PIC 2 to provide an additional opportunity to engage/comment on the study. Risk is moderate until completion of 30-day review period.
Local community / public opposition	9	6	6	Mitigate	Consultation with the public and agencies, and indigenous engagement have been on-going through the Master Plan Study. Preferred alternative strategies will reduce impacts to communities through reduced truck traffic. Based on increased public awareness of PFAS being land applied and potential dissent, this risk has increased since the Phase 2 update, although could be maintained at a moderate level following the 30 day review period.
Future development encroachment	9	4	4	Mitigate	Meet with local municipality to discuss future development implications. Consider acquiring property adjacent to Garner Road if it becomes available.

***Most Critical Risks are Bolded**

The most critical social and community risk is lack of buy-in from local farmers to receive biosolids. There is also a risk that the application of dewatered biosolids cake will not be acceptable. To address this risk, a pilot study is being initiated in the summer of 2023 with Thomas Nutrient Solutions, select area farmers and the Region to determine the feasibility of a cake land application program. This pilot will also clarify operational requirements and considerations to ensure the success of this program.

Further details on the cake land application pilot are found in TM 5.

2.4 Environmental, Site Conditions and Health & Safety Risks

Risks in this category include environmental and health and safety risks associated with the biosolids management program, as well as limiting site conditions that may restrict opportunities for biosolids management. The environmental risks identified are presented in Table 2-6.

Table 2-6 - Summary of Environmental, Site Conditions and Health & Safety Risks and Management Approaches

DESCRIPTION	INITIAL RISK SCORE	RISK PHASE 2 UPDATE	TARGET SCORE	STRATEGY	RISK RESPONSE
Lack of space at WWTPs for dewatering facilities	20	4	4	**Mitigate**	**Consider dewatering upgrades at WWTPs that have sufficient space only, and consider option to expand dewatering at Garner Road rather than at WWTPs**
Climate Change and Greenhouse Gas Emissions	16	6	3	Mitigate	Recommended strategy reduces hauling by increasing dewatering and introducing of a cake land application program. Success of cake land application will determine final risk level.
Biosolids spill into environment during truck loading /unloading	4	4	4	Mitigate	Provide spill containment at truck loading/unloading area
Groundwater and surface water impacts from continued land application of biosolids	4	4	4	Transfer	Third-party contractor will continue being responsible for ensuring all land applied biosolids are in conformance with NASM plan to reduce ground water and surface water impacts to acceptable level. Use tanks for any liquid storage to reduce risk of soil impacts through infiltration

***Most Critical Risks are Bolded**

Many of the Region's WWTPs are space-constrained and cannot easily accommodate a new facility for dewatering or thickening. This Master Plan recommends adding dewatering or thickening only at WWTPs that can accommodate this additional equipment. Additional dewatering is proposed at Garner Road in the short term and should be considered at Baker Road WWTP in the long term. Further, it is recommended that thickening be considered at Port Dalhousie, Port Weller and Welland WWTP, where space is available, especially considering new property recently acquired at Welland WWTP. Recommendations for dewatering and thickening upgrades are discussed in more detail in TM 5.

The recommended strategy also reduces environmental impacts by reducing transportation and the associated greenhouse gas emissions.

2.5 Compliance Risks

Compliance risks, including those identified in Table 2-7 below, are situations that will impact the Region's ability to manage the solids generated in their WWTPs in accordance with current and future Federal and Provincial regulations associated with biosolids management. This focuses on the ability to meet quality requirements to ensure biosolids can continue to be land applied.

Table 2-7 - Summary of Compliance Risks and Management Approaches

DESCRIPTION	INITIAL RISK SCORE	RISK PHASE 2 UPDATE	TARGET SCORE	STRATEGY	RISK RESPONSE
Sludge Quality Issues	15	6	3	Mitigate	Do not pursue co-digestion of biosolids with Source-Separated Organics (SSO). Continue to work with industrial dischargers to reduce exceedances, protecting the characteristics of the Region's Biosolids.
Changes to future regulations	15	12	12	Mitigate	In May 2023, Environment and Climate Change Canada, as well as Health Canada released a draft 'State of PFAS Report', and Canadian Food Inspection Agency is initiating a process to implement interim standards biosolids contaminated with PFAS sold in Canada as commercial fertilizers. Stakeholder consultation is beginning in Fall 2023. Region of Niagara should provide feedback on impacts of this change to their operation. It is possible that OMAFRA or MECP may follow with similar restrictions in future, so continued discussions are essential.
Impacts of PFAS and other emerging contaminants	12	9	6	Mitigate	PFAS. Consider including PFAS limits in sewer use by-
Section 16 Order Request	10	8	2	Mitigate	Amendment to Municipal Class EA process in March 2023 only allows Part 2 orders from a person with concerns pertaining to potential adverse impacts to Aboriginal or treaty rights and cannot be issued to stop or delay the project for other reasons. Maintain active engagement with Indigenous peoples. Moderate risk until after 30-day review period.
Biosolids quality impacts due to winery waste	6	1	1	Mitigate	Send winery waste to WWTPs with capacity to handle additional loads. Currently most of the winery waste is sent to Niagara-on-the-Lake WWTP, and no process upsets have been reported.

As noted in Table 2-7, the most notable risk to the current and proposed biosolids program is the

CFIA implementing a higher quality standard related to PFAS in biosolids sold as commercial fertilizers. The recommended changes to the regulation have undergone a public review period, although the final report with recommendations is still pending as of November 2023. If these changes move ahead, it is possible that OMAFRA may implement a similar limit for PFAS for land application of digested biosolids. Continued discussions with regulatory agencies are critical, and support of regulating or banning manufacture of products containing PFAS is recommended.

2.6 Project Management and Cost Risks

Project Management and cost risks, summarized in Table 2-8, are those that impact the delivery of the current study, as well as subsequent recommended capital projects.

Table 2-8 - Summary of Project Management and Cost Risks and Management Approaches

DESCRIPTION	INITIAL RISK SCORE	RISK PHASE 2 UPDATE	TARGET SCORE	STRATEGY	RISK RESPONSE
Obtaining consensus from Project Team on preferred alternative	16	1	1	Mitigate	Development of criteria was done with full Region input through workshop survey. Sensitivity analysis was completed for detailed evaluation to determine impacts of weightings and reach a balanced and representative outcome.
Economic uncertainty, supply chain disruptions and inflation impacting cost of capital investments	15	12	12	Mitigate	Budget estimates will include a more conservative inflation estimate.
Delays to Critical WWTP Upgrades while BMMP updated is completed	12	4	4	Mitigate	Majority of projects at WWTPs are not impacted by the recommendations of the Master Plan and are continuing as planned.
Third-party Contracts may not be providing best value for Region	12	4	4	Mitigate	Potential improvements to existing contracts are identified in TM 10. Includes renegotiating terms.
Delays in completing Master Plan	8	4	1	Mitigate	Multiple workshops have been held with Region to ensure ongoing engagement with steering committee, allowing decisions to be made in a timely manner.

Project Management risks related to schedule have been managed throughout the project through clear communication with the steering committee, and key workshops to allow for decision making. Cost implications of future projects due to the inflation are difficult to control, but cost estimates should be more conservative to account for economic uncertainty.

3.0 Existing Contingency Plan

The Region's existing contingency plan is consistent with recommendations made during the 2010 Biosolids Management Master Plan Update and is based on the diversification inherent within the current program of land applying approximately 50 percent of the Region's biosolids as a liquid and sending the other 50 percent to the Walker Environmental facility for further processing and management as a fertilizer product.

Historically, if wet weather prevented land application of liquid biosolids, the Region would use temporary dewatering equipment to create a cake that could be sent to a landfill for disposal. The Region has not landfilled biosolids or water treatment residuals in over a decade. After centrifuges were installed at the Garner Road facility and the Region contracted Walker Environmental to process approximately 50 percent of the Region's biosolids, the practice of the Region using temporary dewatering and sending cake to landfill was discontinued except under specific 'emergency' type conditions.

While landfilling is not practiced by the Region, the Region should maintain the option as a contingency measure should biosolids materials not meet the NASM standards. Conditions where landfilling may be required include:

1. Biosolids quality for land application is not met;
2. Operational interruptions at the N-Viro processing facility preventing them from receiving biosolids; or
3. Liquid land application is unavailable due to prolonged wet weather, labour disruptions, including strikes, lockouts, labour disruptions and so on along with storage conditions at the site.

Under most circumstances, either liquid land application or processing at N-Viro will be available, and biosolids storage is available at Garner Road. This flexibility in the Region's program allows the potential to need landfilling to remain low. As mentioned above, it is recommended that the Region maintain landfill option as a contingency measure.

4.0 Contingency Plan Alternatives

Updates to Niagara Region's Biosolids Management Program recommended through this Master Plan serve to increase the reliability and resilience of the Region's biosolids management program, reducing risks associated with biosolids management. Details on proposed risk mitigation measures are provided in Section 2.0. Contingency planning will further protect the Region and ensure their continued ability to manage biosolids under a wide range of conditions.

The contingency plan considers both processing methods and end use alternatives for biosolids.

4.1 Contingency Processing Alternatives

The Region's wastewater solids are currently anaerobically digested at individual WWTPs and transported as a liquid to Garner Road for storage. Water treatment residuals generated at the Grimsby, Niagara Falls and Decew WTPs are also transported to Garner Road to be mixed with the wastewater biosolids. The biosolids are then either dewatered and transported to the N-Viro facility for alkaline stabilization or applied to agricultural land as a fertilizer in liquid form. The solids generated at Niagara Falls WWTP are digested, dewatered and transported to the N-Viro Facility.

Overall, current technologies used to process biosolids, post anaerobic digestion, produced by Niagara Region are listed below. The dewatering centrifuges at The Niagara Falls WWTP and Garner Road are typically operated 8 hours per day, 5 days per week. Centrifuge operation is not limited in the ECA for Garner Road or Niagara Falls WWTP, so additional run time can be practiced to increase cake production as required. Longer run times result in fewer starts and stops of equipment, reducing wear and tear and increasing useful life. The current dewatering operations are summarized below:

- Dewatering
    - 1 centrifuge at Niagara Falls WWTP
    - 2 centrifuges at Garner Road Biosolids Facility
- Alkaline Stabilization (N-Viro Facility)

Under the Master Plan recommendations, the same treatment technologies will be used, but with a different configuration.

The potential 2051 build-out, noted below, anticipates that the centrifuge at Niagara Falls WWTP will be decommissioned at the end of its useful life, expected to be by 2034. The total number of centrifuges presented below is based on matching the existing centrifuge capacity and operating 8 hours per day.

As these parameters may vary, the number of centrifuges shown is for illustrative purposes only:

- Dewatering
  - 6 centrifuges (5 duty, 1 stand-by) at Garner Road Biosolids Facility (proposed to replace existing and increase capacity); note that this number of centrifuges is based on proceeding with the cake land application program. If cake land application is not pursued, the total number of centrifuges could decrease.
- Alkaline Stabilization (N-Viro Facility)

A partial list of failure scenarios and the alternative contingency measures that can be taken are presented in **Error! Not a valid bookmark self-reference.**.

Table 4-1 – Biosolids Processing Failure Scenarios and Contingency Measure Alternatives

Failure Scenario	Contingency Measure Alternatives
1. Partial loss of dewatering capacity at Garner Road	• Continue running other operating centrifuges to maintain capacity, increasing daily operating hours if required • Increase volume sent to liquid land application
2. Total loss of dewatering capacity at Garner Road	• Seasonally land apply all biosolids as liquid • Seasonally land apply any stored cake to minimize potential odours • Maintain sufficient storage to accommodate loss of dewatering (ie. to handle liquid land application of 100% of Region biosolids for set duration)
3. Power Failure at Garner Road (short duration)	• As a preventive measure, review quality of power supply and consider filtering mainline power to reduce short-term power fluctuations that may impact dewatering operations • Run essential equipment only on back-up power generator (i.e., pumps to discharge supernatant and avoid overfilling lagoons), and cease dewatering operations • Land apply all biosolids as liquid
4. Power Failure at Garner Road (longer duration)	• Run essential equipment and 1 centrifuge on back-up power generator to provide more operational flexibility for longer term shutdowns (i.e., longer than 1 or 2 days) • Land apply biosolids as liquid or cake, or transport cake to Walker Environmental

Failure Scenario	Contingency Measure Alternatives
5. Walker Environmental Facility is not available to receive any dewatered cake (i.e., due to equipment failure or power outage)	• Transport dewatered cake from Baker Road WWTP to Garner Road for storage or direct land application • Continue to land apply biosolids stored at Garner Road Facility, liquid, or dewatered cake. • If biosolid land application is not available (i.e., during winter months or wet weather and storage is also not available, dewatered biosolids at Garner Road and transport to landfill disposal until the Walker Environmental facility can accept biosolids.
6. Run out of liquid storage due to lengthy wet weather conditions where land application is not possible	• Increase decanting • Dewater greater quantities to be processed by N-Viro
7. Labour disruptions with Region Operations staff that reduce available staff to manage dewatering facility	• Reduce or temporarily stop dewatering based on alternative (management) personnel availability • Land apply biosolids as a liquid using third-party contractor

Overall, the expansion of the Region's dewatering capacity will increase the biosolids management program flexibility, redundancy, resilience and ability to maintain the operations under adverse conditions.

4.2 Contingency End Use Alternatives

A variety of end use markets are available for biosolids as described in TM 9. The end use products recommended are:

1. Land application of anaerobically digested biosolids meeting NASM Standards and the Nutrient Management Act as a liquid or dewatered cake.
2. Soil amendment with fertilizers (biosolids products) meeting CFIA requirements

The recommended biosolids management strategies identified in TM 7 result in product types 1 and 2, namely:

- Anaerobically digested liquid biosolids (up to 6% total solids), applied on agricultural land
- Anaerobically digested dewatered cake biosolids (22 – 35% total solids), applied on agricultural land

- N-Rich fertilizer produced by Walker Environmental at the N-Viro facility, sold as fertilizer for use as a soil amendment

The proposed end uses involve land application. Specific quality standards must be met to land apply biosolids in conformance the Nutrient Management Act (for liquid and cake biosolids applied on land) and the Canadian Food Inspection Agency (CFIA) Fertilizers Act (for N-Rich). Other factors could also prevent land application, including season of year and weather conditions that result in variations in agricultural demand as well as labour disruptions. Furthermore, operational failure scenarios described in Existing Contingency Plan

The Region's existing contingency plan is consistent with recommendations made during the 2010 Biosolids Management Master Plan Update and is based on the diversification inherent within the current program of land applying approximately 50 percent of the Region's biosolids as a liquid and sending the other 50 percent to the Walker Environmental facility for further processing and management as a fertilizer product.

Historically, if wet weather prevented land application of liquid biosolids, the Region would use temporary dewatering equipment to create a cake that could be sent to a landfill for disposal. The Region has not landfilled biosolids or water treatment residuals in over a decade. After centrifuges were installed at the Garner Road facility and the Region contracted Walker Environmental to process approximately 50 percent of the Region's biosolids, the practice of the Region using temporary dewatering and sending cake to landfill was discontinued except under specific 'emergency' type conditions.

While landfilling is not practiced by the Region, the Region should maintain the option as a contingency measure should biosolids materials not meet the NASM standards. Conditions where landfilling may be required include:

4. Biosolids quality for land application is not met;
5. Operational interruptions at the N-Viro processing facility preventing them from receiving biosolids; or
6. Liquid land application is unavailable due to prolonged wet weather, labour disruptions, including strikes, lockouts, labour disruptions and so on along with storage conditions at the site.

Under most circumstances, either liquid land application or processing at N-Viro will be available, and biosolids storage is available at Garner Road. This flexibility in the Region's program allows the potential to need landfilling to remain low. As mentioned above, it is recommended that the Region maintain landfill option as a contingency measure.

5.0 Contingency Plan Alternatives

Updates to Niagara Region's Biosolids Management Program recommended through this Master Plan serve to increase the reliability and resilience of the Region's biosolids management program, reducing risks associated with biosolids management. Details on proposed risk mitigation measures are provided in Section 2.0. Contingency planning will further protect the Region and ensure their continued ability to manage biosolids under a wide range of conditions.

The contingency plan considers both processing methods and end use alternatives for biosolids.

5.1 Contingency Processing Alternatives

The Region's wastewater solids are currently anaerobically digested at individual WWTPs and transported as a liquid to Garner Road for storage. Water treatment residuals generated at the Grimsby, Niagara Falls and Decew WTPs are also transported to Garner Road to be mixed with the wastewater biosolids. The biosolids are then either dewatered and transported to the N-Viro facility for alkaline stabilization or applied to agricultural land as a fertilizer in liquid form. The solids generated at Niagara Falls WWTP are digested, dewatered and transported to the N-Viro Facility.

Overall, current technologies used to process biosolids, post anaerobic digestion, produced by Niagara Region are listed below. The dewatering centrifuges at The Niagara Falls WWTP and Garner Road are typically operated 8 hours per day, 5 days per week. Centrifuge operation is not limited in the ECA for Garner Road or Niagara Falls WWTP, so additional run time can be practiced to increase cake production as required. Longer run times result in fewer starts and stops of equipment, reducing wear and tear and increasing useful life. The current dewatering operations are summarized below:

- Dewatering
    - 1 centrifuge at Niagara Falls WWTP
    - 2 centrifuges at Garner Road Biosolids Facility
- Alkaline Stabilization (N-Viro Facility)

Under the Master Plan recommendations, the same treatment technologies will be used, but with a different configuration.

The potential 2051 build-out, noted below, anticipates that the centrifuge at Niagara Falls WWTP will be decommissioned at the end of its useful life, expected to be by 2034. The total number of centrifuges presented below is based on matching the existing centrifuge capacity and operating 8 hours per day.

As these parameters may vary, the number of centrifuges shown is for illustrative purposes only:

- Dewatering
  - 6 centrifuges (5 duty, 1 stand-by) at Garner Road Biosolids Facility (proposed to replace existing and increase capacity); note that this number of centrifuges is based on proceeding with the cake land application program. If cake land application is not pursued, the total number of centrifuges could decrease.
- Alkaline Stabilization (N-Viro Facility)

A partial list of failure scenarios and the alternative contingency measures that can be taken are presented in **Error! Not a valid bookmark self-reference.**.

Table 4-1 could impact the availability of materials for land application.

Table 5-1 provides a partial list of failure scenarios for biosolid end uses and the alternative contingency measures that could be undertaken.

Table 5-1 Biosolids End Use Failure Scenarios and Contingency Alternatives

Failure Scenario	Contingency Measure Alternatives
1. Biosolids brought to Garner Road do not meet quality standards required by N-Viro contract or NASM contracts managed by Thomas Nutrient Solutions so product cannot be land applied.	• Review any recent exceedances of Sewer-Use By-law by private dischargers, and look into additional enforcement • Modify operations at WWTPs, if possible/applicable to improve sludge quality • If acceptable, land apply at a lower rate to meet quality requirements (to be managed by Thomas Nutrient Solution) • Dewater and send to landfill directly
2. If dewatering is implemented at Baker Road WWTP in future, quality of residuals from Grimsby WTP exceed limits such that that when they are blended with biosolids at Baker Road WWTP, the dewatered cake does not meet quality requirement from Walker Environmental.	• Dewater and send to landfill until the biosolids quality issues are resolved. • If the Grimsby WTP residuals issue will be long term, the Region can purchase a portable dewatering unit for the Grimsby WTP, and send dewatered residuals directly to landfill
3. Land application as NASM material is not available (i.e., winter season, wet weather conditions)	• Utilize liquid storage at Garner Road until land application can resume (maintain a minimum 240 days of liquid storage onsite)

	• Dewatering portion of biosolids and send to N-Viro facility for processing, adjusting the volume as needed based on available liquid storage at Garner Road

Overall, the core recommended biosolids program has multiple product outlets that can be used if one is temporarily unavailable. Storage capacity at the Garner Road facility allows for further flexibility and delays in land application.

6.0 Contingency Plan Recommendations, Implementation and Monitoring

The failure scenarios described in Tables 4-1 and 4-2 can be responded to in multiple ways, which will vary based on the circumstances. A decision tree can be developed to clearly indicate which response is appropriate based on the scenario, and the order of precedence in which the alternative responses should be carried out. A sample decision tree structure that may be used is illustrated in Figure 6-1 below.

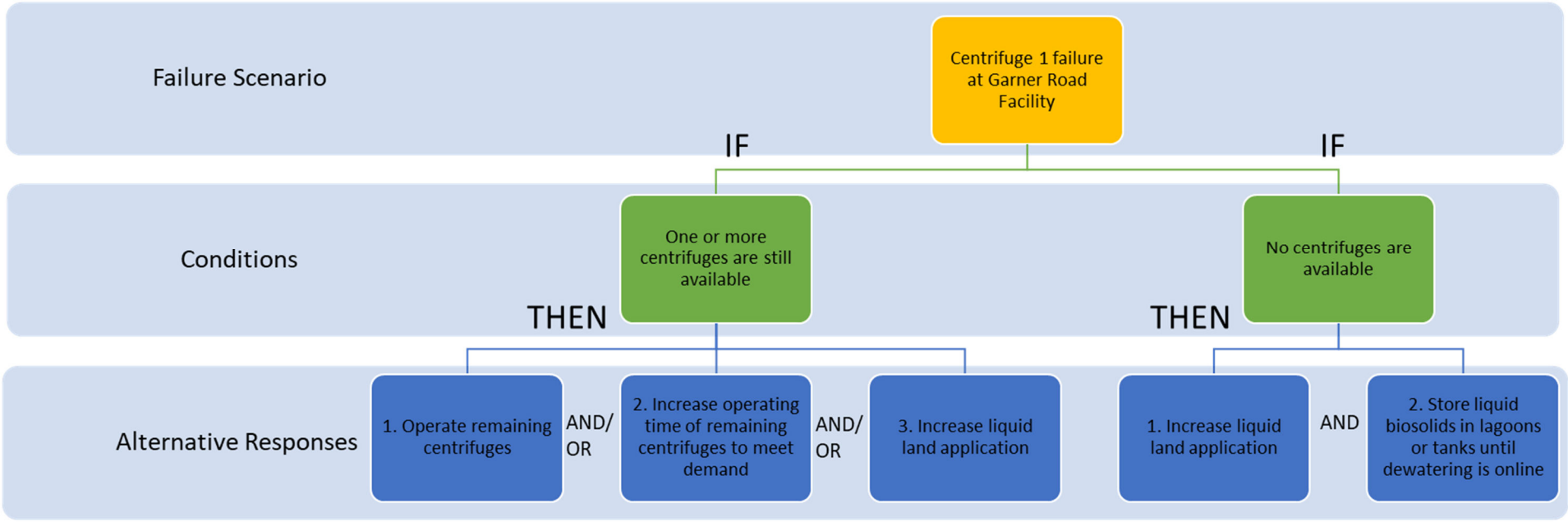


Figure 6-1 Sample Decision Tree

Creating this decision tree will allow Operations Staff to justify and record their response in a methodical, traceable way. A monitoring system should be used to track responses to failure events, and final outcomes. This should be reviewed on a regular basis to assess lessons learned and adjust future responses based on experience.

A potential format and sample entry for the monitoring program is shown in the table below:

Table 6-1 Potential Monitoring Program Format

Date	Failure Event	Decision Tree Recommended Response	Actual Response	Outcome	Comments
Jan 3, 2025	Centrifuge 1 offline at Garner Road	Use remaining centrifuges to maintain capacity	Use remaining centrifuges to maintain capacity and increase liquid land application	Centrifuge 1 was brought back online after 1 day; remaining centrifuges had sufficient capacity	--

7.0 Summary and Next Steps

With a contingency plan framework developed, the next step is to submit the draft Biosolids Management Master Plan Report for review and approval. Following the Region's review of the recommendations, the implementation plan will be finalized and approved by council. The Final Master Plan Report will incorporate any final comments provided by the Region and be issued for public and stakeholder review for a 30-day period.

Appendix A – Risk Workshop 1

- Meeting Minutes
- Presentation Slides

REGION OF NIAGARA
2021 BIOSOLIDS MANAGEMENT MASTER PLAN UPDATE
GMBP File No. 621143
PROJECT INITIATION MEETING AGENDA

DATE: Wednesday, April 20, 2022, 10:00 am– 12:00 pm

LOCATION: Microsoft Teams

ATTENDEES:	Albert Succi (AS)	Region of Niagara (Region), Project Manager
	Brad Stewart (BS)	Region, Biosolids Program Manager
	Christina Bellon-Graves (CB)	Region, Wastewater Operations Manager
	Dawn MacArthur (DM)	Region, Compliance Manager
	Gerry Atkinson (GA)	Region, Manager of Wastewater Operations
	Jason Oatley (JO)	Region, Wastewater Quality and Compliance Manager
	Jason Pepperall (JP)	Region, Manager, System Maintenance
	John Daniels (JD)	Region, Wastewater Maintenance manager
	John MacPherson (JM)	Region, Manager of Wastewater Operations
	Joseph Tonellato (JT)	Region, Director, Water and Wastewater Services
	Lisa Vespi (LiV)	Region, Manager of Capital Projects
	Michelle Max (MM)	Region of Niagara, Quality Management Specialist
	Richard Gabel (RG)	Region, Manager of Capital Projects
	Robert Daw (RD)	Region, Associate Director, Wastewater Operations
	Tony Cimino (TC)	Region, Associate Director of Water/Wastewater Engineering
	Laurie Boyce (LB)	GM BluePlan, Project Manager
	Laura Verhaeghe (LaV)	GM BluePlan, Assistant Project Manager
	Mike Watt (MW)	GM BluePlan, Senior Advisor / Risk Manager
	Zhifei Hu (ZH)	Black and Veatch, Technical Lead
	Mark Lang (ML)	Black and Veatch, Senior Advisor
	Bradley Young (BY)	CIMA+, Process Engineer
REGRETS:	Craig Courteau (CC)	Region of Niagara
	Frank Vasko (FV)	Region of Niagara
	Barry Robbins (BR)	Region of Niagara

		Action
1)	**INTRODUCTION AND PROJECT OBJECTIVE**	
	• Attendee introductions by LB and AS	--
	• LB reviewed objectives of study and problem opportunity statement (refer to presentation slides attached)	
	• LB reviewed status of deliverables and timeline of study; Tech Memos 1, 4 and 6 were submitted on April 14, 2022.	
2)	**BACKGROUND AND EXISTING CONDITIONS**	
	• BY provided overview of current biosolids management strategy (refer to presentation slides attached)	--
		--

Wastewater Treatment

- BY described typical biosolids processing at Region's wastewater treatment facilities; Region plants run as either conventional activated sludge or extended aeration, except Niagara Falls WWTP which uses rotating biological contactor (RBC) (refer to presentation slides attached)
- Conventional activated sludge plants in Region use co-thickening, which results in thinner waste activated sludge (WAS) concentrations sent to digester
- Biosolids produced at plants are generally meeting current standards for land application
- Digester mixing systems have operational issues at several plants, some due to plugging
- Digester heating systems are not working at optimal level at several plants; improvements to heat exchangers could improve digester performance
- Biosolids upgrades are planned at some facilities
- No comments from Region on existing WWTP operations --

Garner Road Biosolids Facility

- Facility has been operating at lower end of acceptable solids content over recent years
- Third party contractor is responsible for supernating and hauling
- Very high solids content in 2016 (average ~7%, max load near 20%) caused issues with hauler's equipment and made land application difficult
- In general, operational approach appears to be producing more stable solids albeit at lower TS content. For transparency, contract approach may be reviewed.
- Several operational challenges are present at Garner Road, including high expense and duration for centrifuge maintenance with current building layout, forcemain plugging, slow dewatered cake loading onto trucks and insufficient lagoon storage
- Upgrades to facility are currently planned
- No comments from Region on existing Garner Rd operations

Water Residuals

- Residuals produced at Rosehill and Welland have higher than expected based on 2010 data; Region to provide further details on any changes to residuals processing since that time AS
- Depending on which values are assumed, residuals percentage of total solids received at Garner Road ranges from 20 to 30%; other municipalities typically see ~20% of their total biosolids from residuals
- RD asked if costs have been considered for residuals hauling; ZH noted that only mass balance has been reviewed to date, and costs will be developed during alternative evaluation. The goal is to avoid overhandling solids
- BS noted that some residuals from Decew, Grimsby, and Niagara Falls are sent to sewer, and asked if these are being tracked. AS noted that data provided was only for hauled quantities from these plants, and volumes sewer from all WTP was not provided; additional information on residual volumes to sewer may be available. AS to confirm with Region's Water group. AS
- Water supply is from Lake Erie for all treatment plants except Grimsby WTP, which draws from Lake Ontario

3) FUTURE NEEDS

- Used flow projections from 2021 water/wastewater master servicing plan, incorporating winery waste flows, to determine future needs for biosolids management.

- CIMA completed first principles mass balance on biosolids produced in Region, and balance mostly closed within +/-10%, which is within reason
- Most WWTPs have insufficient digestion capacity to meet future demand, both hydraulically and based VSS destruction; many plants have upgrades planned to address shortfalls
- NOTL and Seaway WWTP have excess digester capacity, although NOTL WWTP have only 1 digester (no redundancy) – reduced loading on digester could be achieved through diversion of winery waste to other Region WWTPs.
- The proposed South Niagara Falls WWTP will partially relieve capacity stress at Niagara Falls WWTP once it is constructed
- Consulting team to review water residuals produced in future once additional data is received from Region. Current residuals are able to meet CM1 level for majority of contaminants for land applications, with the exception of arsenic, which meets CM2 levels. Once blended with wastewater biosolids, it is expected that all biosolids land applied will meet CM1 standard, which is consistent with historical quality data
- ZH confirmed that water plant residuals discharged to sewer are accounted for in solids mass balance
- Future needs at Garner Road Biosolids facility will be addressed in Tech Memo 5.

4) RISK MANAGEMENT

- LB describes strategy for risk management, with key steps of identifying, assessing, managing, monitoring and reporting risk (refer to presentation slides for details)
- Reviewed structure of risk register; no comments from Region.

Contractual Risks

- Reliance on 3rd party contractors transfers risk to outside parties, but Region still retains reputational risk for any impacts within their jurisdiction, so it is difficult to effectively transfer risk.
- A finite space is available for land application within the Region, and regulations limits how frequently biosolids can be applied on each property and in what quantity. Changing market for land appliers and consolidation of smaller firms (ie. Green-for-Life) may reduce available land for Region's third-party contractor through increased competition for available land. Must also consider changes to agricultural land area within the planning horizon (to 2051), as some may be developed during this time, reducing land bank.
- Optimization opportunities exist within current contracts to improve value to Region; these could include ensuring hauling company has equipment to handle higher solids content product, or provisions for storage.
- JD noted that there is motivation to look at alternative options beyond land application to improve diversification as a continency measure. Landfill is currently available under emergency conditions. MW noted that there is no current indication of a shortage of land area in the Region, and short-term dewatering could be used to allow any excess to be sent to landfill (ie. at Walker facility)
- Change in government could result in different regulations, and associated reduction in landbank for application.
- ZH noted that based on a recent study, the current market in the Golden Horseshoe region currently has sufficient land available. City of Toronto, a larger municipality, has a more diversified approach to end uses of biosolids, including pelletization and Lystek stabilization, in addition to storage facilities.
- JO noted it is easy to find contractors to haul biosolids OR manage a storage/treatment faciltity, but more difficult to find contractors that can do both, reducing available competition for bids. Three players are currently providing this service in Ontario, but may not have capacity to bid on new projects.

- There are advantages to diversifying contracts, and having multiple contractors to do this work
- MW noted that Walker Environmental currently receives some of Toronto's biosolids. Although no formal commitment is in place, the arrangement works as Toronto consistently sends biosolids. Niagara may not have enough volume to create diversity (too expensive).
- LB indicated the team will investigate the possibility of more in-house treatment, with less reliance on 3rd party contractors.

Operational Risks

- JO noted some inherent risk in developing BMMP when some data quality may be questionable
- There is risk in sending shock loads of residuals to sewer during cleaning (currently this is done at each plant, x2 per year), as this could stress receiving WWTPs if they are already nearing current rated capacity (ie. Niagara Falls WWTP). JO asked if study will evaluate option to send all residuals to Garner Road, instead of the sanitary sewer. This is being considered and may be particularly beneficial during cleanouts with large volumes produced. Residuals could alternatively be diluted prior to sending to sewer to reduce risk of shocking WWTPs. Furthermore, cleanouts at WTPs could be staggered to reduce loading to sewer, or storage tanks could be used to delay discharge.
- ZH noted that many other similar sized Ontario municipalities (except Toronto) discharge to residuals to sewer; Toronto trucks offsite to incineration facility, which is more cost effective due to large volumes.
- MW suggested dewatered residuals could also be used as cover material for landfill.
- AS noted poor mixing in lagoons at Garner Road due to limited available equipment of third party (Thomas Nutrient Solutions) for mixing (ie. large area in middle of lagoon that can't be mixed, and solids build up in this area). Tanks are easier to mix, and have less footprint so could be an approach to ensuring better mixing at Garner Road. Alternately, other hauling companies (ie. Wessuc) have equipment that can provide better mixing, which could be a requirement of a future contract.

Social Risks

- Risk of local farming community opposition should be lowered from Extreme ranking; agricultural end-users are generally supportive of using biosolids. The risk is more related to compliance and the inability to land apply product in future if regulation change. GMBP will updated risk register accordingly.
- No vendors have reached out to the Region to date regarding evaluation of their technology

LV (complete)

Economic Risks

- Majority of economic risks are out of Region's control (ie. inflation, supply chain delays), but can be planned for and managed; no specific comments at this time.

Compliance Risks

- PFAS is largest uncertainty. In US, the EPA is implementing changes that will base land application on phosphorus loading, rather than nitrogen, cutting application rates approximately in half. In Canada, application rates are currently based on individual site characteristics (since update to Nutrient Management Act in 2011), but this may change, and should be monitored closely

Environmental/Site Conditions/ H&S Risks

- Limited area for development at existing plants could be managed through additional dewatering at plants to reduce storage requirements.

Project Communications Risks

- Working to ensure total buy-in from Region on proposed strategies through regular check-ins.

5) NEXT STEPS AND OTHER BUSINESS

- LB outlines next steps in study, which include development of long list of alternatives, and PIC 1
- JO asked if study will look at alternate technologies for biosolids management at WWTP instead of anaerobic digestion (ie. chemical stabilization such as Clean-B or Lystek); LB confirmed that alternative technologies will be evaluated under this study.

These minutes have been prepared by the undersigned. If there are any errors or omissions in these minutes, please contact the author as soon as possible.

Prepared by:

GM BLUEPLAN ENGINEERING LIMITED
Per:

Laura Verhaeghe, P.Eng.
Assistant Project Manager

2021 Biosolids Management Master Plan Update

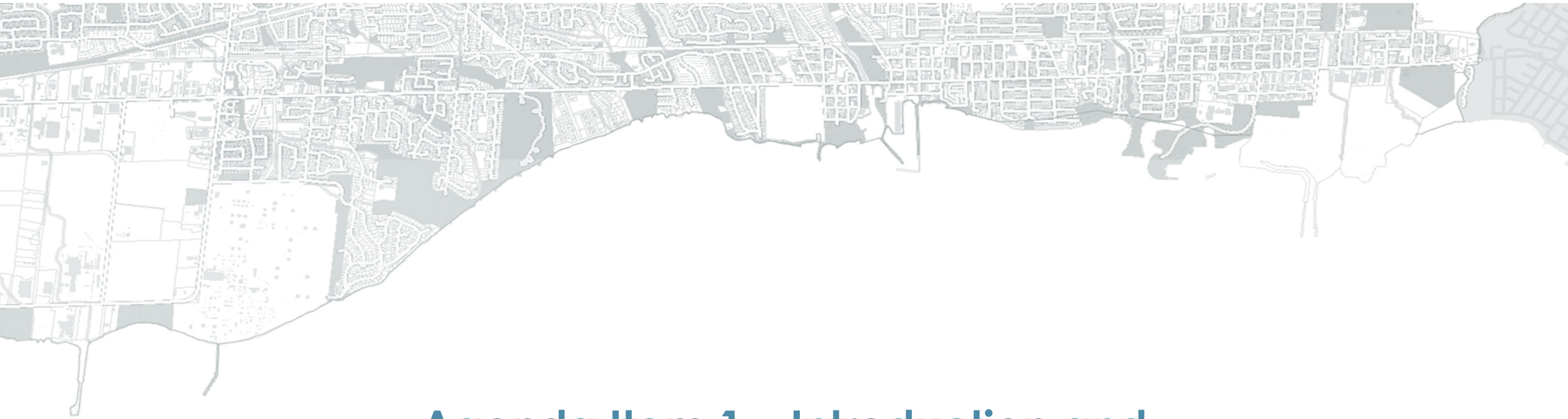
Risk Workshop – April 20, 2022

Agenda

1. Introduction and Project Objectives
2. Background and Existing Conditions
3. Future Needs
4. Risk Management
5. Next Steps

OBJECTIVES

1. Review existing conditions and identify key constraints to meet biosolids needs to 2051
2. Agree on process for identifying and monitoring risks
3. Identify risks and mitigation strategies



Agenda Item 1 – Introduction and Project Objectives

Provide direction for management of biosolids and water residuals in Niagara Region to the Year 2051

- Update 2010 Biosolids Management Master Plan (BMMP) – consider population growth, regulatory and environmental changes, and new programs & infrastructure implemented since 2010
- Meet Phase 1 and 2 of MEA Class Environmental Assessment Master Plan process
- Be consistent with Water and Wastewater Master Plan and other initiatives
- Manage Risks associated with Biosolids Management

Problem / Opportunity Statement

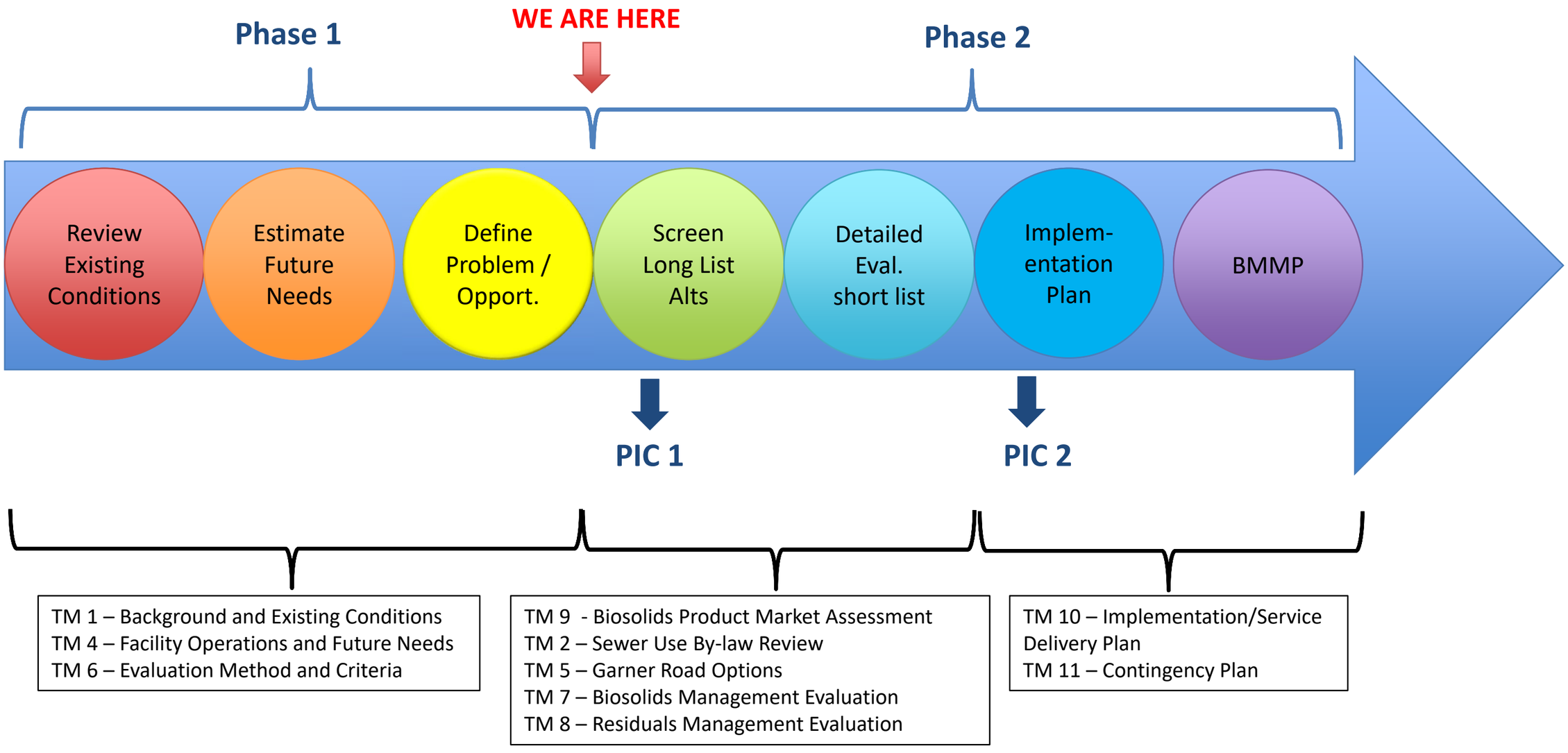
The draft problem/opportunity statement for this BMMP Update is to:

Identify and develop a strategy for meeting Niagara's biosolids treatment needs to the year 2051, in a manner that is transparent, sustainable, reliable, environmentally friendly, cost effective and flexible.

The BMMP will be developed to:

- Meet the unique needs of Niagara Region and its customers, including treatment requirements, land uses and users, and environmental features.
- Meet future needs associated with population growth, new regulations, climate resiliency, and energy efficiency.
- Provide greater flexibility and reliability for biosolids management, both in the short term (i.e., 5 years) and long term (to the year 2051).
- Address community expectations regarding level of service, odour, air/noise, water quality, protection of the environment and aesthetics.

Planning Process for Niagara BMMP Update



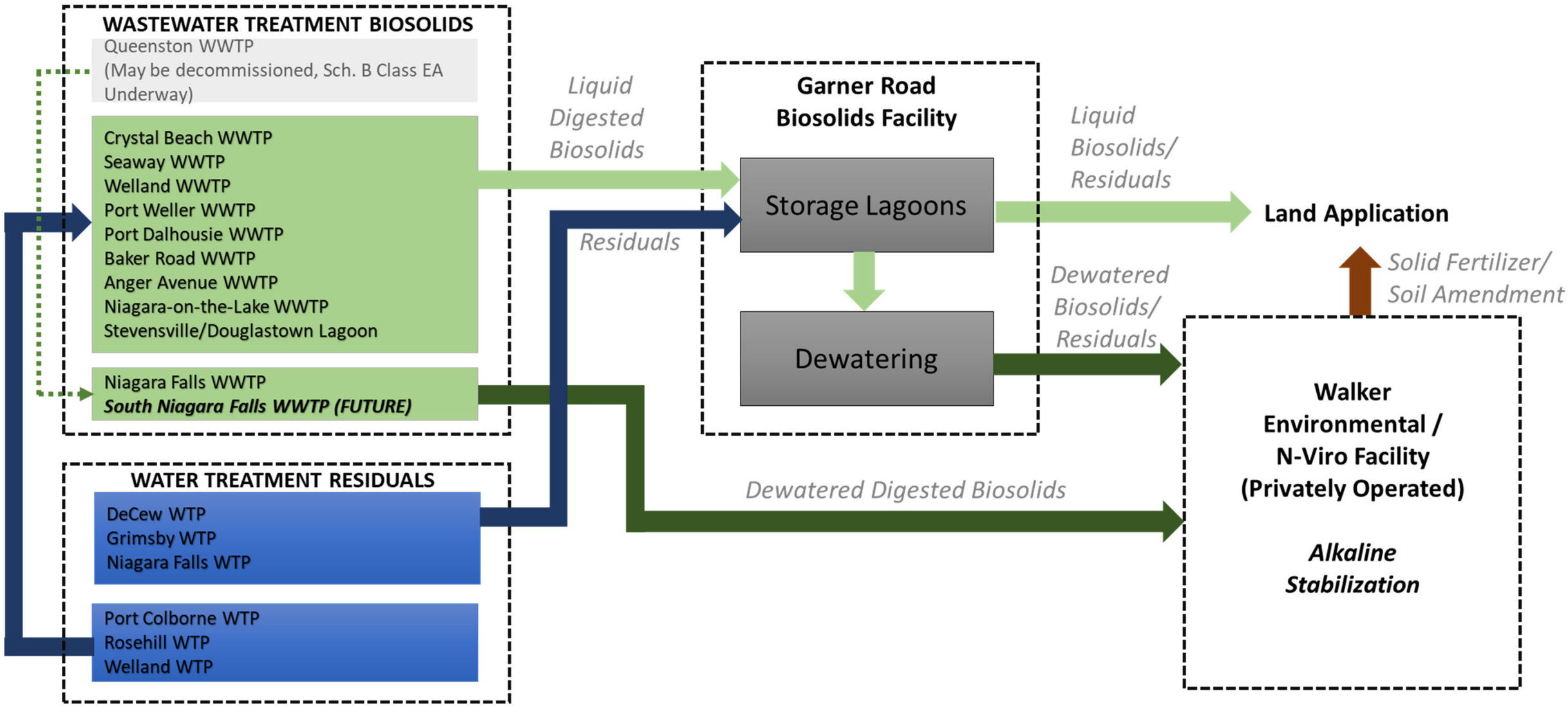
TM 3 – Public Consultation / Customer Service Plan

Technical Memorandum	Status
TM 1 - Background and Existing Conditions;	**Draft Submitted**
TM 2 - Sewer Use By Law;	In progress
TM 3 – Public Consultation + Customer Service Plan;	--
TM 4 – Facility Operations, Functions and Future Needs;	**Draft Submitted**
TM 5 – Garner Road Options;	In progress
TM 6 – Evaluation Method and Criteria;	**Draft Submitted**
TM 7 – Identification/Assessment of Alternatives for Biosolids Management;	In progress
TM 8 – Identification/Assessment of Alternatives for Water Residuals Management;	In progress
TM 9 – Market Strategies;	In progress
TM 10 – Existing contractual obligations/ Service Delivery Opportunities:	--
TM 11 – Contingency Plan;	--
Final Master Plan Report	--

Agenda Item 2

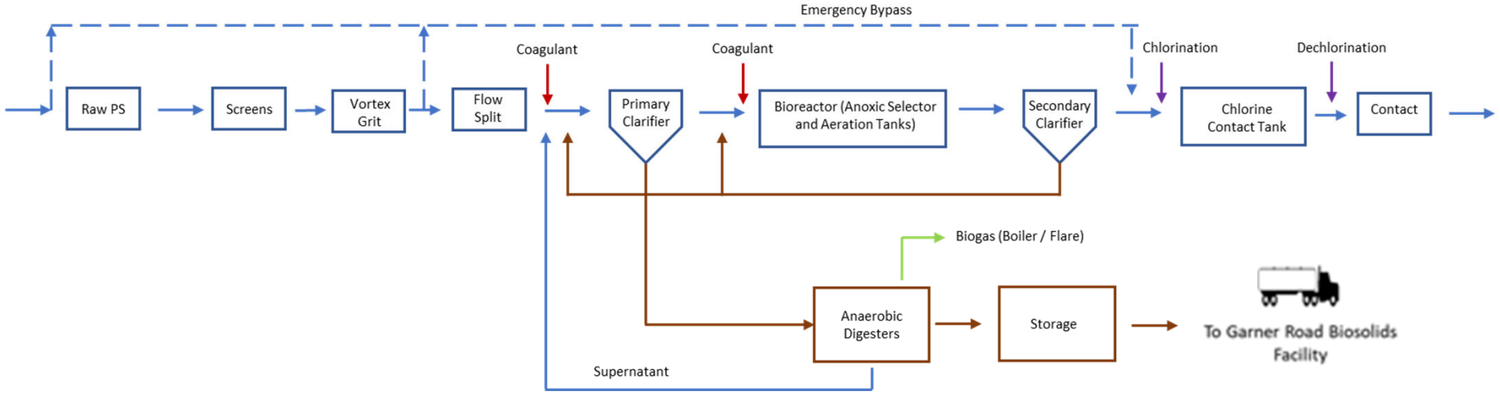
Background and Existing Conditions

Current Biosolids and Residuals Management Program



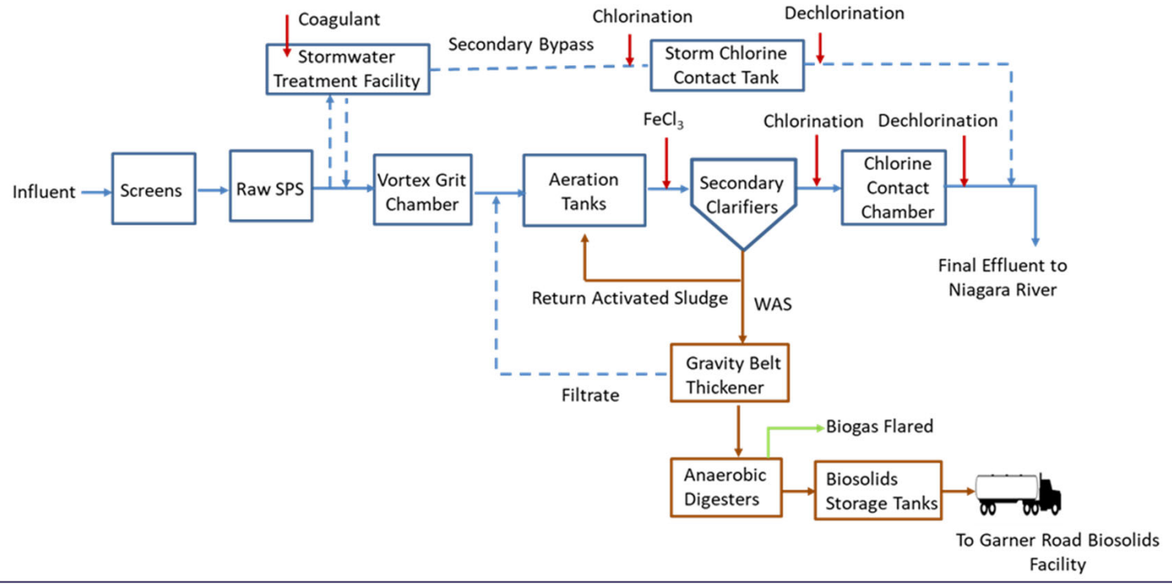
Typical CAS plant

- WAS Co-Thickening
- Chemical P Removal



Typical Extended Aeration Plant

- Gravity Belt Thickener
- Chemical P Removal



Observations

- Total Solids Generally Thin
- All plants achieving current standards

General operational challenges

- Digester mixing
- Digester heating

PLANT	FACILITY TYPE	AVERAGE SOLIDS HAULED (M^3/YR)	AVERAGE SOLIDS HAULED (KG/YR)	AVERAGE TOTAL SOLIDS	ACHIEVES LAND APP STANDARDS
Anger Avenue WWTP	Extended Aeration	16,719	478,163	2.86%	Yes
Baker Road WWTP	Conventional Activated Sludge	53,586	1,259,271	2.35%	Yes
Crystal Beach WWTP	Extended Aeration	8,045	220,433	2.74%	Yes
Niagara Falls WWTP[1]	Rotating Biological Contactor	-	-		Yes
Niagara-on-the-Lake WWTP	Extended Aeration	12,255	273,287	2.23%	Yes
Port Dalhousie WWTP	Conventional Activated Sludge	83,275	1,473,968	1.77%	Yes
Port Weller WWTP	Conventional Activated Sludge	70,305	1,694,351	2.41%	Yes
Queenston WWTP	Modified Extended Aeration	3,028	19,125	N/A	N/A
Seaway WWTP	Conventional Activated Sludge	24,590	427,866	1.74%	Yes
Welland WWTP	Conventional Activated Sludge	64,976	1,773,845	2.73%	Yes

Garner Road – Existing Conditions

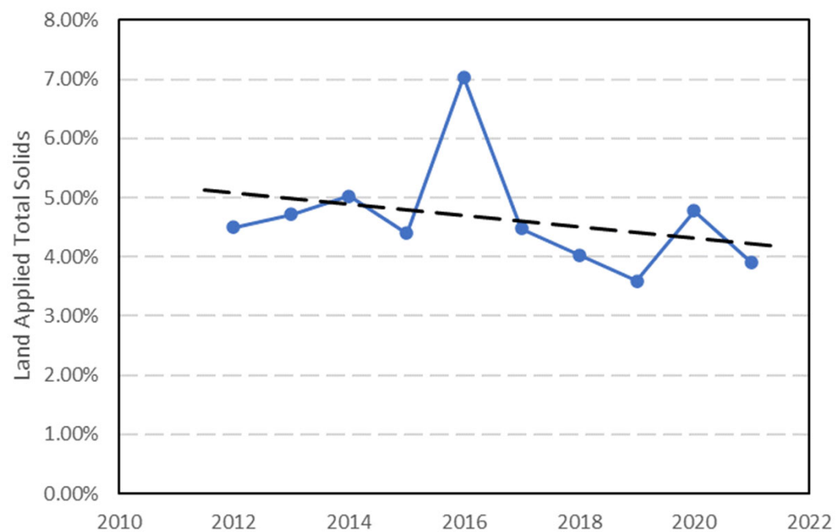
Observations

- Land application variable by season
- Total solids lower end of 4-6% in recent years
- Dewatered cake high end of typical

General operational challenges

- Centrifuge reliability
- Dewatered cake loading
- Centrifuge access
- Forcemain plugging
- Insufficient lagoon storage

	UNIT	2017	2018	2019
Land Application	m^3	75,234	120,564	104,764
Land Application Solids %	%	4.48%	4.03%	3.59%
Land Application	DT*	3370	4859	3761
Supernatant	m^3	242,578	212,317	218,809
Cake	DT	3825	3805	3208
Average Cake		32.7%	31.6%	32.0%
Cake Volume	m^3	10596	10966	9101
Centrate	m^3	119,939	129,231	105,407
Percent Land Applied		47%	56%	54%
Outbound	m^3	448,347	473,078	438,081

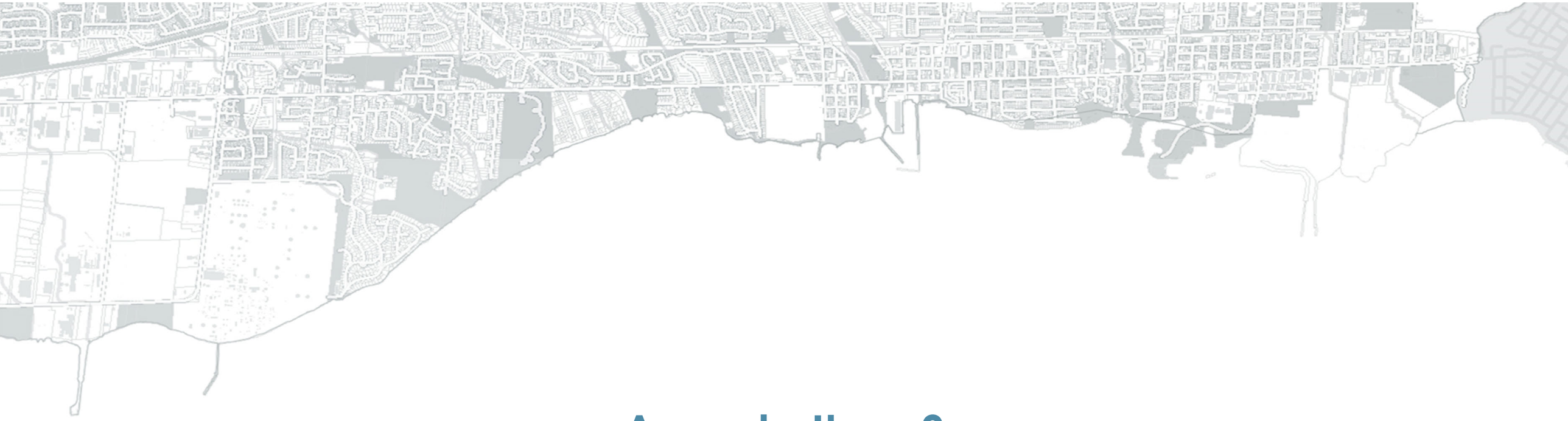


Planned Facility Upgrades

Facility	Planned Biosolids Management Upgrades
Queenston WWTP	Sch B Class EA underway; may be decommissioned and converted to SPS
Crystal Beach WWTP	Feasibility study underway to increase plant cap.
Seaway WWTP	Digester upgrades in design phase, planned construction in 2023
Welland WWTP	--
Port Weller WWTP	Winery Waste receiving station in design phase, may increase biogas generation; early planning for digester upgrades underway
Port Dalhousie WWTP	Digester cleanout and flare upgrade currently in design
Niagara-on-the-Lake WWTP	--
Baker Road WWTP	Design for plant capacity upgrade from 32 MLD to 48 MLD to begin in 2023
Niagara Falls WWTP	Current construction to replace RBCs with MBBRs; phase 2 of this project includes new primary digestion. Preliminary discussions with Enbridge to install centralized biogas treatment facility at this WWTP.
Anger Avenue WWTP	Conceptual design underway for thickening and digestion upgrades
Stevensville-Douglastown Lagoon	Lagoon cleanout and sludge dredging planned for 2022
Garner Road Biosolids Facility	New administration building under design; dewatering upgrades on hold pending BMMP

WTP	RATED CAPACITY (ML/D)	RESIDUAL DESTINATION	RESIDUAL MANAGEMENT	AVERAGE RESIDUALS (ML/YR)	CALCULATED RESIDUAL SOLIDS (DRY KG/YR)
Decew	227.3	Garner Road	Process involves thickening of residuals then trucking to the Garner Road Facility for management, with larger quantities removed bi-annually during routine tank clean-out.	35.4	685,790
Grimsby	44	Garner Road	Process involves thickening of waste then trucking to Garner Road, with larger quantities removed bi-annually during routine tank clean-out.	17.5	185,500
Niagara Falls	145.4	Garner Road	Process involves thickening of waste then trucking to Garner Road, with larger quantities removed bi-annually during routine tank clean-out.	29.9	409,858
Port Colborne	36	Seaway WWTP	Residual discharged to sanitary sewer, then received and monitored as an integral part of the WWTP influent.	23.4	53,820
Rosehill	50	Anger Avenue WWTP	Residual discharged to sanitary sewer, then received and monitored as an integral part of the WWTP influent, with larger quantity discharged quarterly during routine tank clean-out.	*176.1*	*686,803*
Welland	65	Welland WWTP	Residual discharged to sewer, then received and monitored as an integral part of the WWTP influent.	*350.7*	*[1] 1,262,424*
			TOTAL	**632.9**	**3,284,195**
			REVISED TOTAL[2]		***1,721,020***

[1] Residual solids dry weight produced is twice the amount at Welland WTP than at Decew Falls WTP. Average treated flow is half the amount at Welland WTP than at Decew Falls WTP.
2 Average Residual solids over treated flow ratio from Rosehill and Welland WTP adjusted to match values seen at other WTP for more realistic estimate of residual generation



Agenda Item 3
Future Needs

Historical Flows and Loads

- Influent loadings
- Volume hauled
- Total solids concentrations

Future Flows and Loads

- Add future per capita loadings
- Existing max month factors
- 70 gBOD/p/d
- 85 gTSS/p/d

Parameter	Unit	Values	Historical 2017-2021
Population 2051	p	143,723	
Growth 2051	p	61,327	82,396
tBOD	g/p/d	70	50.29
TSS	g/p/d	85	60.03
VSS fraction	-	85%	
VSS	*g/m3*		
TP	g/p/d	2.2	
TKN	g/p/d	13.3	

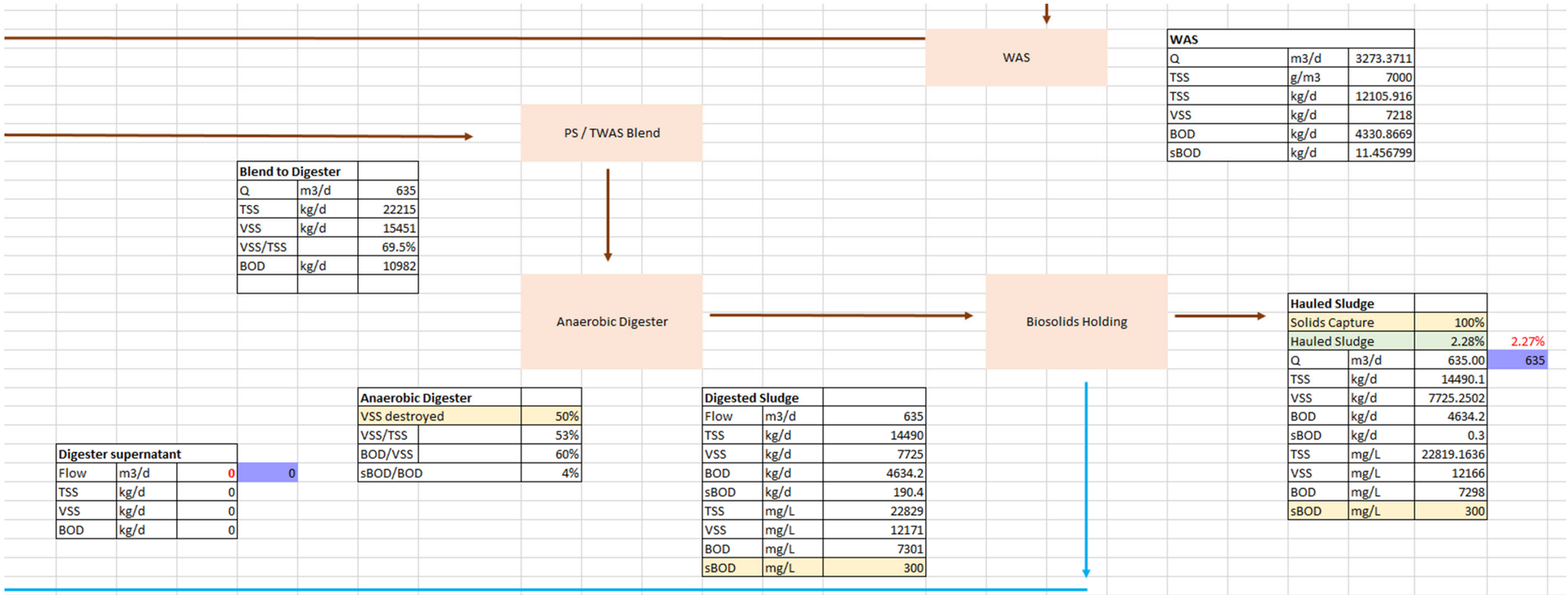
Influent	Unit	Value	Historical 2017-2021
Q - ADF	m3/d	35817.88	
Q - ADF comp.	m3/d	16471.88	19346
Q Factor	unls.	1.58	1.58
Q Factored	m3/d	56592.25	-
tBOD	g/m3	261	214.20
TSS	g/m3	317	255.66
VSS fraction	-	85%	-
VSS	g/m3	487	-
TP	g/m3	9	-
TKN	g/m3	54	-
tBOD	kg/d	4299.161	4144
TSS	kg/d	5221.587	4946
BOD Factor	unls.	1.44	1.44
TSS Factor	unls.	1.47	1.47
tBOD Factored	kg/d	12158	
TSS Factored	kg/d	14946	
VSS	kg/d	12704	

Mass Balance

- Compared to historical conditions
- Simulated at 2051 conditions
- Assumes all process units functional

Projections

- Annual Average (hauled sludge)
- Max Month (digester capacity)



WAS		
Q	m3/d	3273.3711
TSS	g/m3	7000
TSS	kg/d	12105.916
VSS	kg/d	7218
BOD	kg/d	4330.8669
sBOD	kg/d	11.456799

Blend to Digester		
Q	m3/d	635
TSS	kg/d	22215
VSS	kg/d	15451
VSS/TSS		69.5%
BOD	kg/d	10982

Anaerobic Digester	
VSS destroyed	50%
VSS/TSS	53%
BOD/VSS	60%
sBOD/BOD	4%

Digested Sludge		
Flow	m3/d	635
TSS	kg/d	14490
VSS	kg/d	7725
BOD	kg/d	4634.2
sBOD	kg/d	190.4
TSS	mg/L	22829
VSS	mg/L	12171
BOD	mg/L	7301
sBOD	mg/L	300

Hauled Sludge			
Solids Capture		100%	
Hauled Sludge		2.28%	2.27%
Q	m3/d	635.00	635
TSS	kg/d	14490.1	
VSS	kg/d	7725.2502	
BOD	kg/d	4634.2	
sBOD	kg/d	0.3	
TSS	mg/L	22819.1636	
VSS	mg/L	12166	
BOD	mg/L	7298	
sBOD	mg/L	300	

Digester supernatant			
Flow	m3/d	0	0
TSS	kg/d	0	
VSS	kg/d	0	
BOD	kg/d	0	

Future Needs – Wastewater Treatment

Observations

- Most plants short on capacity
- Hydraulic and VS loading
- SNF partially relieves Niagara Falls WWTP
- NOTL and Seaway have excess capacity

Annual Hauled Biosolids

- To be used for Garner Rd. Facility

PLANT	FACILITY TYPE	ANAEROBIC DIGESTION UPGRADES[1]		UPGRADES CURRENTLY PLANNED? (YES/NO)	ANNUAL HAULED BIOSOLIDS (ML)
		Additional Volume Required (m^3) – based on Hydraulics	Additional Volume Required (m^3) – based on VSS load		
Anger Avenue WWTP	Extended aeration	555	367	yes	22.44
Baker Road WWTP	Conventional Activated Sludge	2701	2892	yes	106
Crystal Beach WWTP	Extended aeration	0	0	no	7.80
Niagara Falls WWTP (with SNF offline)	Rotating Biological Contactor / MBBR	15215	9254	Yes	3315 t/y (dewatered biosolids)
Niagara Falls WWTP (with SNF online)	Rotating Biological Contactor / MBBR	10492	6045	Yes	2473 t/yr (dewatered biosolids)
Niagara-on-the-Lake WWTP	Extended aeration	0	0	no	16
Port Dalhousie WWTP	Conventional Activated Sludge	953	1248	no	118
Port Weller WWTP (with SNF offline)	Conventional Activated Sludge	1651	793	yes	86.7
Port Weller WWTP (with SNF online)	Conventional Activated Sludge	1654	799	yes	86.6
Queenston WWTP	Extended aeration	n/a	n/a	no	1.87 (undigested sludge)
Seaway WWTP	Conventional Activated Sludge	0	0	no	22.4
Welland WWTP	Conventional Activated Sludge	2343	2418	no	88.7
South Niagara Falls WWTP	Conventional Activated Sludge	-	-	no	130
Stevensville-Douglastown Lagoon	Aerated-Facultative Lagoons	n/a	n/a	n/a	n/a

WTP	CURRENT RATED CAPACITY (MLD)	2051 PROJECTED AVERAGE DEMAND (MLD)	RESIDUALS SOLIDS / ML OF TREATED WATER (DRY KG/ML)	2051 ESTIMATED RESIDUALS GENERATION (DRY KG/YEAR)
Decew WTP	227.3	68.2	36	896,148
Niagara Falls WTP	145.4	55.3	27	544,982
Grimsby WTP	44	25.1	34	311,491
Port Colborne WTP	36	8.2	21	62,853
Rosehill WTP	50	15.5	*30	169,725
Welland WTP	65	34.4	*30	375,585
Total	**567.7**	**206.7**	**145**	**2,360,784**

Note:
***Due to limited data availability for The Rosehill and Welland WTPs, the average residuals solids generation rate from the Decew, Niagara Falls, Grimsby, and Port Colborne WTPs was used estimate the future residuals generation for the Rosehill and Welland WTPs.**

Garner Road Future Evaluation

- 2051 solids generation to include WWTP biosolids including SNF
- Assume Niagara Falls WWTP dewatered cake to N-Viro
- Decew, Grimsby and Niagara Falls WTP residual to Garner

To be developed in TM5

PARAMETER	UNIT	VALUE	COMMENT
Total Annual Biosolids [1]	ML	598	
Total Annual Residuals [2]	kg	1,281,148	

Notes:

1. Considers biosolids generated with SNF online. Does not include dewatered biosolids generated at Niagara Falls WWTP, which is not managed at Garner Road.
2. Considers residuals generated at Decew Falls, Grimsby and Niagara Falls WTPs.

Agenda Item 4
Risk Management

Risk Management Overview

1. Risk Identification – Date, Category, Description

Identify the categories of risk within the project…

- Contractual
- Operational
- Social
- Economic
- Compliance
- Environmental / Site Conditions and Health & Safety
- Project Communications

2. Risk Assessment Probability and Impact

2. Current Level of Risk – Probability, Impacts on Costs, Schedule and Reputation

	Very Low (1)	Low (2)	Medium (3)	High (4)	Extreme (5)
Probability	< 5%	< > 5 - 20%	< > 20 - 35%	< > 35 - 50%	> 50%
Cost Impact	< $500k	$500k - $1M	$1M - $2.5M	$2.5M - $5M	> $5M
Schedule Impact	< 3 months	3 - 6 months	6 - 12 months	12 - 18 months	> 18 months
Reputational Impact	Minor	2	3	4	Major

Overall Risk Level	Score
Immaterial / Low	1-4
Medium	5- 10
High	11-16
Extreme	17-25

Risk Management Strategies

3. Risk Management

Accept:
Acknowledge the existence of a particular risk and make a deliberate decision to accept it without engaging in special efforts to control it.

Avoid:
Adjust or change the program requirements to **eliminate** the risk.

Mitigate:
Adjust program requirements or constraints to **reduce** the risk

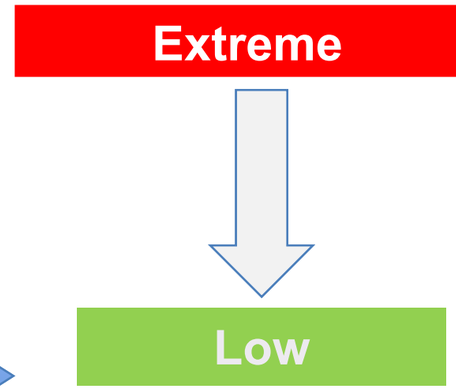
Share:
Reassign partial organizational accountability, responsibility, and authority to another stakeholder to minimize the impact or likelihood of the risk (usually achieved through a contract)

Transfer:
Reassign organizational accountability, responsibility, and authority to another stakeholder willing to accept the risk (usually achieved through a contract)

3. Risk Management

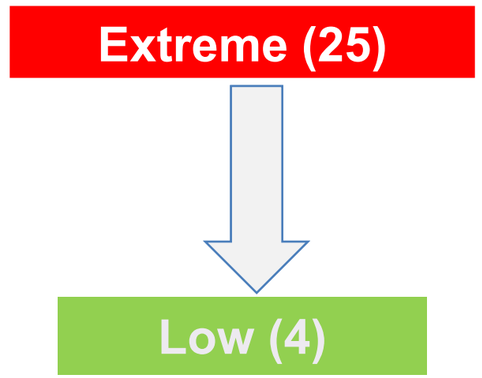
Describe Specific Strategy

Identify the Target Risk Level



4. Monitor Risk at Key Stages in the Process

1. Initial Risk
2. Risks After PIC #1
3. Risks After PIC #2 (2nd Risk Workshop)
4. Risks at the End of the Master Plan



5. Report

Risk Register

RISK IDENTIFICATION					Risk - Project Initiation					TARGET RISK					MANAGEMENT & MITIGATION		
Risk Number	Date Risk Identified or Reviewed	Category	Risk Title	Risk Description (Cause & Effect)	Prob	nancial	chedule	putation	Score	Prob	nancial	chedule	putation	Score	Risk Owner	Mitigation Strategy	Risk Strategy Implementation Plan (Mitigation)
1	4/13/2022	Operational	Garner Road Operations	Poor reliabity of centrifuges, insufficient dewatering performance to be accepted by N-Viro, no dewatered cake storage, slow loading trucks, reduced forcemain capacity/plugging, no formal contingency plan, other equipment failure (polymer addition, sump pumps, mixers, sludge conveyors)	5	4	2	5	25	2	2	1	1	4	Region	Mitigate	Increase dewatering capacity to allow more dewatered biosolids to be sent to N-Viro facility, which could include using a mobile dewatering unit for high flow conditons, and improving operability of centrifuges at Garner Road for better reliability. Dewatered sludge storage could also be considered in conjunction. Alternatively, could diversify end use of biosolid beyond land application. Clean and/or replace forcemain and identify cause of plugging. Develop formal contingency plan. Preventative maintenance of equipment.
2	4/13/2022	Contractual	Reliance on Existing 3rd Party Contractors	Reliance on 3rd Party Contractors if current situation changes (i.e. cost escalation, lack of product market, sludge quality/quantity changes, their capacities, lack of oversight on changes to land availability)	4	5	2	5	20	2	2	1	1	4	GMBP/Region	Transfer	Strategy now is to transfer risk of cost escalation, lack of product market, etc. Region is moving to mitigate these risks through this Master Plan, by identifying different market potential, reviewing existing contracts, and developing implementation plan to reduce risks.
3	4/13/2022	Contractual	Existing Contract Obligations	Does Niagara have the best value based on the current cost structure; risks/gaps in contracts	4	5	2	5	20	2	2	1	1	4	GMBP/Region	Mitigate	Through Master Plan, reviewing existing contracts, and recommending changes and /or new contacts
4	4/13/2022	Social	Local farming community opposition to changes in biosolids end use	Risk that farming community may oppose any changes in quantity, quality and type of end use of product that will impact their operations (ie. modify quantities of available N-Viro product for land application, produce greater quantities of liquid biosolids for land application, change to new end product that is potentially unfamiliar to farmers, reduce overall product available for land application)	5	2	3	4	20	2	2	2	2	4	GMBP/Region	Transfer	Engage agricultural groups during master plan to elicit feedback on current practices and any proposed changes.
5	4/13/2022	Operational	Increasing wet weather events due to climate change	Increasing wet weather events due to climate change limiting liquid biosolids storage capacity and timing window for land application (Garner Road)	5	2	4	4	20	4	2	1	1	8	Region	Mitigate	Increase dewatering capacity to allow more dewatered biosolids to be sent to N-Viro facility, which could include using a mobile dewatering unit for high flow conditons, and improving operability of centrifuges at Garner Road for better reliability. Dewatered sludge storage could also be considered in conjunction. Alternatively, could diversify end use of biosolid beyond land application.
6	4/13/2022	Environmental/Site Conditions and H&S	Lack of space at WWTP for facilities	Lack of space at the WWTP for additional dewatering (if alternative) e.g. Port Weller and Port Dalhousise	5	2	4	3	20	2	2	2	2	4	GMBP/Region	Mitigate	Ensure that recommended strategy takes into consideration existing plant processes, and configurations
7	4/13/2022	Contractual	Third Party vendor acquisition/consolidation	Reduced competition and potential impacts to contract renewals	4	5	3	4	20	4	3	3	3	12	Region	Mitigate	Monitor the market, and maintain good relationships with third party vendors
8	4/13/2022	Social	New Vendors opposition	Vendors trying to sell their technologies could delay the process.	4	2	4	4	16	2	2	2	2	4	GMBP/Region	Mitigate	Strategically consult with key vendors as part of stakeholder consultation
9	4/13/2022	Project Communications	Obtaining consensus from Project Team on preferred alternative	There are different impacts associated with the biosolids strategy options affecting both capital planning and operations; important to consider Region's priorities and the importance of the different criteria to the Region and obtain concensus	4	2	4	4	16	1	1	1	1	1	GMBP/Region	Mitigate	Detailed development of alternatives, ensure Region's weighting of criteria is consided in an appropriate manner, workshop with Region to discuss pros and cons, buy-in of the final recommendation by all team members
10	4/13/2022	Environmental/Site Conditions and H&S	Climate Change / GHG emissions	Increased pressure to reduce GHG emissions over time, lost opportunities to capture renewable energy, GHG associated with hauling	4	2	2	4	16	3	1	1	1	3	GMBP/Region	Mitigate	Develop strategy to reduce hauling, energy recovery strategies

Risk Management Team Discussion

- Contractual
- Operational
- Social
- Economic
- Compliance
- Environmental / Site Conditions and Health & Safetv
- Project Communications

Contractual Risks

Risk	Details	Risk Level
Reliance on Existing 3rd party contractors	• Contract terms may not be optimal if current situation changes (ie. cost escalation, reduced demand for final product, sludge quality/quantity changes)	
Existing Contractual Obligations	• Opportunities may exist to optimize terms of contract at next renewal period to improve value to Region	
Third party vendor acquisition/consolidation	• Reduced competition • Could impact contract renewals	

Operational Risks

Risk	Details	Risk Level
Garner Road Operations	• Insufficient dewatering capacity • Poor reliability of centrifuges, cannot be easily serviced • No dewatered cake storage • Slow loading trucks • Potential for other equipment failure (pumps, mixers, conveyors) • Forcemain plugging	
Increasing wet weather events due to climate change	• Limits biosolids land application timing window • Reduces lagoon storage capacity	
Sludge Quality Issues	• More stringent future regulations • Poor enforcement of sewer-use by-law • Acceptance of SSO for co-digestion	
Delays to critical plant upgrades until BMMP Update is completed	• Risk in delaying upgrades (ie. at Garner Rd) • Risk in proceeding with upgrades before BMMP complete	
Water residual loads cause WWTP upsets	• Inconsistent loading of residuals during WTP clean-outs can lead to process upsets at WWTPs (ie. Niagara Falls)	

Operational Risks

Risk	Details	Risk Level
Digester boiler system / heat exchanger failure	• Process upset due to poor temperature control • Performance issues	
Dewatering system / centrifuge failure at Niagara Falls WWTP	• Challenge in meeting N-Viro quota • Odour issues • Increased cost to haul liquid biosolids • Storage capacity limitations	
Recommendation of new biosolids treatment or stabilization technology	• Longer learning curve • Buy-in may be more challenging	
Digester mixing system failure	• Process upset due to poor temperature control • Performance issues	
Sludge thickening operational issues	• Reduced digester performance • Higher hauling costs	
Changes to population forecasts and flows	• May change over course of planning horizon	

Social Risks

Risk	Details	Risk Level
Local Farming Community Opposition to changes in biosolids end use	• May oppose changes to quantity, quality and type of end use product that could impact their operations	
New Vendors Opposition	• Vendors may try to sell technologies as potential alternatives, delaying process	
Truck Traffic Complaints	• Increases in hauling • Hauling route impacts	
Odour Complaints	• Related to biosolids operations at WWTPs or Garner Rd	
Local Community / Public Opposition	• May be opposition to proposed biosolids management strategy, particularly if significant changes are proposed • May be general concerns about hauling or odour	
Future development encroachment	• Residential or commercial development near facilities	

Economic Risks

Risk	Details	Risk Level
Economic uncertainty, supply chain disruptions and inflation	• Delays in currently planned upgrades at Region facilities (ie. Garner Road) leading to higher overall costs	
Third Party Contract Value	• Incentives to lower overall program cost (ie. encourage hauling of higher solids %)	
Market Availability	• Fluctuations in stability of biosolids product market, diversification is limited currently • Uncertainty in available agricultural land and demand for land application in future	

Compliance Risks

Risk	Details	Risk Level
Changes to future regulations	• Changes to Nutrient Management Act or Source Water Protection requirements, impact land application	
Impacts of PFAS and other emerging contaminants	• Growing concern in US	
Biosolids quantity impacts due to winery waste	• Variations in quantity produced	
Part II Order Requests	• May occur if stakeholders are aimed at delaying project	
Opposition from Indigenous groups	• May have concerns regarding land application of biosolids or proposed capital works under implementation plan	

Environmental/Site Conditions, Health & Safety Risks

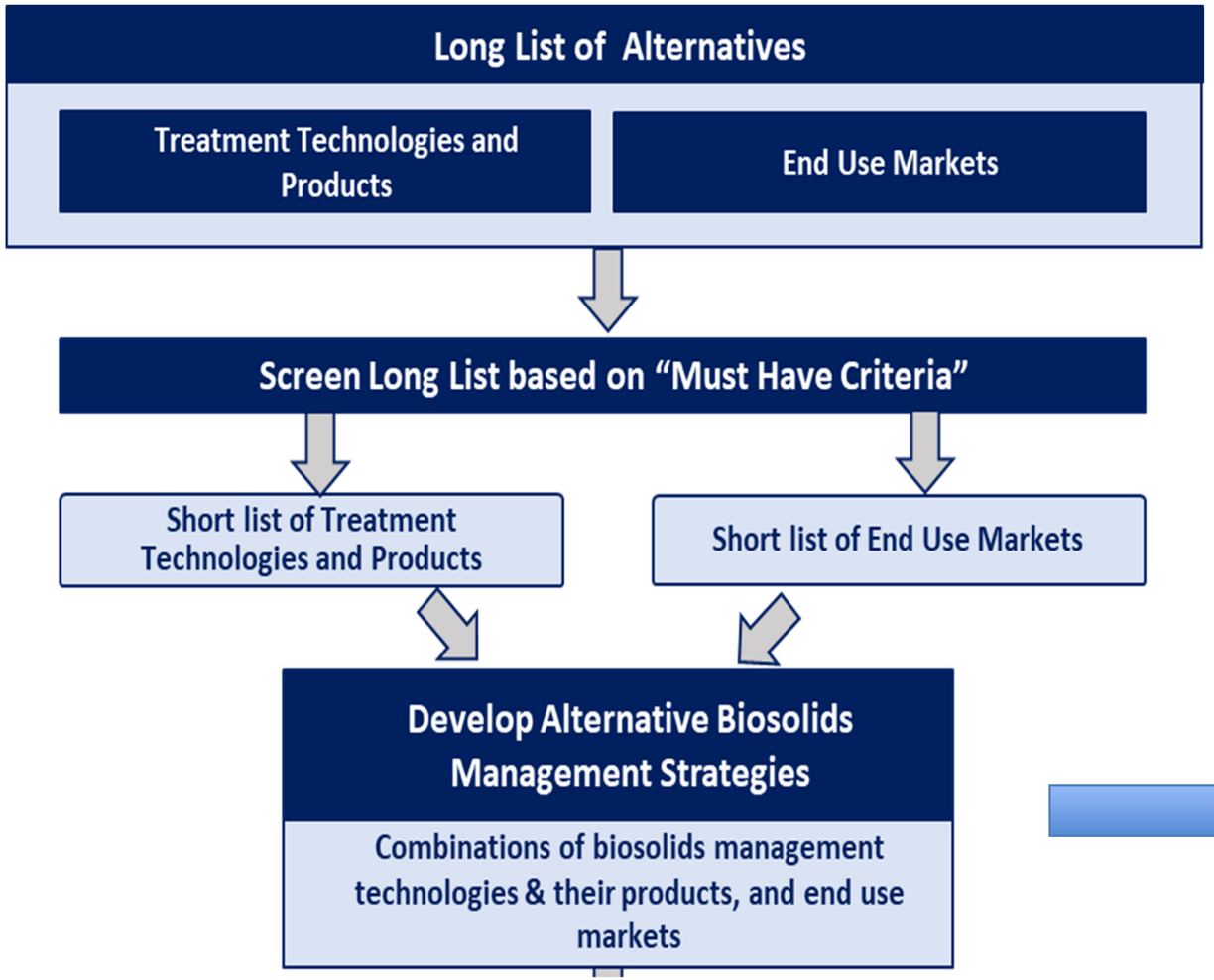
Risk	Details	Risk Level
Lack of space at WWTP for facilities	• Limited room for expansion at some WWTPs (ie. dewatering/thickening)	
Climate change / GHG emissions	• Hauling emissions • GHG emissions from flaring, not capturing potential renewable energy source • Digester leak	
Biosolids spill into environment	• Truck loading/unloading, contamination	
Groundwater/surface water impacts of land application	• Nutrient/pathogens loading to groundwater or surface water from land application	

Project Communications Risks

Risk	Details	Risk Level
Obtaining consensus from Project Team on preferred alternative	• Different impacts to capital, operations and planning groups	
Delays in completing BMMP	• Could result from scope changes, lack of consensus, stakeholder concerns, COVID-19 protocols	

Agenda Item 5 – Next Steps

Next Step: Long-List of Alternatives



Examples of Biosolids Management Strategies

Biosolid Process	Product	Market End Uses
Digestion	Liquid biosolids	Agricultural land
Digestion + Dewatering	Dewatered Biosolids	Agricultural land
Incineration	Residual ash	Municipal waste landfill Incorporation into cement Energy Recovery
Thermal Drying	Dried Product	Fertilizer Energy Recovery
Co-management with Source Separated Organics (SSO)	Compost products	Management with source separated organics
Alkaline stabilization (N-Viro)	Alkaline stabilized product	Fertilizer

Next Steps

1. Update Preliminary Risk Register per Region Feedback
2. **TM 9** – Biosolids Product Market Assessment- May 2022
3. **PIC 1** – May 31, 2022
4. **TM 2, 5, 7, 8** - Alternatives Assessment - Sewer-use By-law, Garner Road, Alts for biosolids and residuals – September 2022
5. **PIC 2** – November 2022
6. **TM 10, 11** – Service Delivery, Contingency plan – November 2022
7. **Risk Workshop 2** – December 2022
8. **Draft Biosolids Master Plan Report** – Jan 2023

Questions?

Appendix B – Risk Register

Niagara Biosolids Master Plan

Purpose of Risk Assessments:

The purpose of the risk assessment is to identify risk and determine their likelihood and magnitude, in order to establish and implement mitigation strategies.

Definition of Terms

Risk Number (Column A): Assign Risk a Number

Risk Date (Column B): The date the risk is identified

Risk Type (Column C): Types - Compliance, Contractual, Environmental/Site Conditions and H&S, Operational, Project Management and Cost, Social and Community

Risk Title (Column D): Give risk a title that gives it a relevant identifier

Risk Description (Cause and Effects) (Column E): Describe the key factors that contribute to the risk and identify the potential impacts they may have in terms of cost, schedule and potential reputational damage to the Region

Current Risks (Columns F, G, H, I)/Target Risks (Columns L, M, N, O): Existing probablility, costs, schedule and reputation risks/Targeted probability, cost, schedule and reputation risks after mitigation. The following scales are used to measure risks at the different stages in the project:

	Very Low (1)	Low (2)	Medium (3)	High (4)	Extreme (5)
Likelihood	< 5%	< > 5 -20%	< > 20 -35%	< > 35% - 50%	> 50%
Cost Impact	> $500K	$500K - $1M	$1M - $2.5M	$2.5 - $5 M	> $5M
Schedule Impact	< 3 months	< > 3- 6 months	< > 6 -12 months	< > 12 - 18 months	> 18 months
Reputational Impact	Minor	2	3	4	Major

Current Risk Score (Column K)/Target Risk Score (Column P): The total existing risk score (sum of the propability, cost, schedule and reputation risks)/. The total targeted risk score (sum of the targeted propability, cost, schedule and reputation risks). The level of scores represent the following:

Risk Level	Legend
Immaterial / Low	< 5
Medium	5 - 10
High	11 - 16
Extreme	> 16

Risk Owner (Column Q): For this project the risk owner is the Region, GMBP team, or both. May also add the name of the person on the team responsible.

Mitigation Strategy (column R)

Avoid Adjust program requirements or constraints to avoid the risk.
Mitigate Adjust program requirements or constraints to reduce the risk
Transfer Reassign organizational accountability, responsibility, and authority to another stakeholder willing to accept the risk (usually achieved
Share Reassign partial organizational accountability, responsibility, and authority to another stakeholder to minimize the impact or likelihood of the
Accept Acknowledge the existence of a particular risk and make a deliberate decision to accept it without engaging in special efforts to control it.

Risk Management and Mitigation (Column S): What strategies or measures will be put in place to reduce the risk from current to targeted. If measures are already in place that reduce risk also describe.

Monitoring and Control (Column T): The status of the risk mitigations will be reviewed and progress documented at the following stages of the project: Class EA Phases 2, Conceptual and Project Close-out). A second set of risk management workshops will be held at the beginning of Conceptual Design, when the preferred alternative at the plant is identified, to further quantify Design/Construction/O&M risks.

Biosolids Management Master Plan Update

Niagara Region

	Very Low (1)	Low (2)	Medium (3)	High (4)	Extreme (5)
Probability	< 5%	< > 5 -20%	< > 20 -35%	< > 35% - 50%	> 50%
Cost Impact	> $500K	$500K - $1M	$1M - $2.5M	$2.5 - $5 M	> $5M
Schedule Impact	< 3 months	< > 3- 6 months	< > 6 -12 months	< > 12 - 18 months	> 18 months
Reputational Impact	Minor	2	3	4	Major

Risk Level	Legend
Immaterial / Low	< 5
Medium	5 - 10
High	11 - 16
Extreme	> 16

RISK IDENTIFICATION					Risk - Project Initiation					Risk Phase 2 Update					TARGET RISK					MANAGEMENT & MITIGATION			MONITORING & CONTROL -PHASE 2 (Update)	MONITORING & CONTROL - Master Plan Completion
Risk Number	Date Risk Identified or Reviewed	Category	Risk Title	Risk Description (Cause & Effect)	Prob	Financial	Schedule	Reputation	Score	Prob	Cost	Schedule	Reputation	Score	Prob	Financial	Schedule	Reputation	Score	Risk Owner	Mitigation Strategy	Risk Strategy Implementation Plan (Mitigation)	Risk Response Progress and Comments	Final Risk Response Progress and Comments
1	4/13/2022	Operational	Garner Road Operations	Poor reliability of centrifuges, insufficient dewatering performance to be accepted by N-Viro, no dewatered cake storage, slow loading trucks, reduced forcemain capacity/plugging, no formal contingency plan, other equipment failure (polymer addition, sump pumps, mixers, sludge conveyors)	5	4	2	5	25	2	2	1	1	4	2	2	1	1	4	Region	Mitigate	Increase dewatering capacity to allow more dewatered biosolids to be sent to N-Viro facility, which could include using a mobile dewatering unit for high flow conditons, and improving operability of centrifuges at Garner Road for better reliability. Dewatered sludge storage could also be considered in conjunction. Alternatively, could diversify end use of biosolid beyond land application. Clean and/or replace forcemain and identify cause of plugging. Develop formal contingency plan. Preventative maintenance of equipment.	Proposed upgrades at Garner Road are documented in TM 5, and include adding dewatering capacity and adding storage to meet future needs (either liquid tank storage or cake storage). A new dewatering building is proposed to improve accessibility for centrifuge maintenance. The Region currently has a preventative maintenance program keep equipment in working order. The Region also recently purchased a portable centrifuge that they could potentially use if one or both the existing centrifuges are shutdown for maintenance. The Region has initiated a project to clean out the forcemain and restore capacity to reduce the need for hauling supernatent and centrate. A formal contingency plan for Garner Road is documented in TM 11	Proposed upgrades at Garner Road are documented in TM 5, and include adding dewatering capacity and adding storage to meet future needs (either liquid tank storage or cake storage). A new dewatering building is proposed to improve accessibility for centrifuge maintenance. The Region currently has a preventative maintenance program keep equipment in working order. The Region also recently purchased a portable centrifuge that they could potentially use if one or both the existing centrifuges are shutdown for maintenance. The Region has initiated a project to clean out the forcemain and restore capacity to reduce the need for hauling supernatent and centrate. A formal contingency plan for Garner Road is documented in TM 11
2	4/13/2022	Contractual	Reliance on Existing 3rd Party Contractors	Reliance on 3rd Party Contractors if current situation changes (i.e. cost escalation, lack of product market, sludge quality/quantity changes, their capacities, lack of oversight on changes to land availability)	4	5	2	5	20	2	2	1	1	4	2	2	1	1	4	GMBP/Region	Mitigate	Strategy now is to transfer risk of cost escalation, lack of product market, etc. Region is moving to mitigate these risks through this Master Plan, by identifying different market potential, reviewing existing contracts, and developing implementation plan to reduce risks.	Master plan recommends introducing direct land application of cake. Although this is also proposed through a third party contractor, it increases the potential land availability through diversification. Updates to contract language are proposed to require the Third Party Contractor responsible for land application (either as liquid or cake) to maintain a larger land bank than per the current contract to reduce risk. The Region has control over the quality of the sludge that is sent to Garner Road, by enforcing the Sewer Use Bylaw to reduce heavy metal loading that would reduce the abilty to land apply. Refer to TM 10 for details on recommended contract updates.	Update terms of contract as noted in TM 10. Consider breaking biosolids transportation into multiple contracts (ie. separate contracts for liquid and cake transportation). Provide quality product to third party contractors to increase ability of third-party contractors to provide quality product to end users.
3	4/13/2022	Contractual	Existing Contract Obligations	Does Niagara have the best value based on the current cost structure; risks/gaps in contracts. Opportunities may exist to improve value to Region through third party contracts	4	5	2	5	20	2	2	1	1	4	2	2	1	1	4	GMBP/Region	Mitigate	Through Master Plan, reviewing existing contracts, and recommending changes and /or new contacts. Consider renegotiating terms of third party contracts when the current contracts are scheduled to expire to improve value (ie. greater incentive for hauling contractor to accept higher concentration biosolids)	Potential improvements to existing contracts are identified in TM 10 as mentioned above. Includes increasing incentives to increase decanting of biosolids before hauling to land application	Potential improvements to existing contracts are identified in TM 10, including incentives to increase decanting of biosolids in lagoons to reduce hauling costs.
4	4/13/2022	Social and Community	Local farming community opposition to changes in biosolids end use	Risk that farming community may oppose any changes in quantity, quality and type of end use of product that will impact their operations (ie. modify quantities of available N-Viro product for land application, produce greater quantities of liquid biosolids for land application, change to new end product that is potentially unfamiliar to farmers, reduce overall product available for land application)	5	2	3	4	20	4	2	2	2	8	2	2	2	2	4	GMBP/Region	Transfer	Engage agricultural groups during master plan to elicit feedback on current practices and any proposed changes.	Recommended master plan strategies will not reduce the quantity of biosolids being send to end use on land (either as N-Rich, liquid biosolids or cake biosolids), and allows for flexibility between end users to meet market demands. THe Region is working with Third Party Contractor (Thomas Nutrient Solutions) that already has relationships with agricultural end users, to develop a pilot program for cake land application to ensure this strategy has acceptance in the farming community. The farming community acceptance will be determined through the pilot testing. Until the pilot testing is complete there remains a moderate risk.	Recommended master plan strategies will not reduce the quantity of biosolids being send to end use on land (either as N-Rich, liquid biosolids or cake biosolids), and allows for flexibility between end users to meet market demands. THe Region is working with Third Party Contractor (Thomas Nutrient Solutions) that already has relationships with agricultural end users, to develop a pilot program for cake land application to ensure this strategy has acceptance in the farming community. The farming community acceptance will be determined through the pilot testing. Until the pilot testing is complete there remains a moderate risk.
5	4/13/2022	Operational	Increasing wet weather events due to climate change	Increasing wet weather events due to climate change limiting liquid biosolids storage capacity and timing window for land application (Garner Road)	5	2	4	4	20	4	2	1	1	8	4	2	1	1	8	Region	Mitigate	Increase dewatering capacity to allow more dewatered biosolids to be sent to N-Viro facility, which could include using a mobile dewatering unit for high flow conditons, and improving operability of centrifuges at Garner Road for better reliability. Dewatered sludge storage could also be considered in conjunction. Alternatively, could diversify end use of biosolid beyond land application.	Recommended program include increased dewatering and storage at Garner Road to reduce impacts of wet weather events by providing storage or allowing material to be sent to N-Viro facility. Recommended program also increases the maximum capacity allocation for Niagara Region at the N-Viro facilitiy (see TM 10 for details)	Recommended program include increased dewatering and storage at Garner Road to reduce impacts of wet weather events by providing storage or allowing material to be sent to N-Viro facility. Recommended program also increases the maximum capacity allocation for Niagara Region at the N-Viro facilitiy (see TM 10 for details)
6	4/13/2022	Environmental/Site Conditions and H&S	Lack of space at WWTP for facilities	Lack of space at the WWTP for additional dewatering (if alternative) e.g. Port Weller and Port Dalhousie	5	2	4	3	20	2	2	2	1	4	2	2	2	2	4	GMBP/Region	Mitigate	Ensure that recommended strategy takes into consideration existing plant processes, and configurations	Recommended strategy proposes adding dewatering only at Baker Road WWTP, which has sufficient area available, as well as maintaining dewatering at Niagara Falls until this equipment reaches the end of its useful life.	Consider dewatering upgrades at WWTPs that have sufficient space only, and option to expand dewatering at Garner Road rather than at WWTPs
7	4/13/2022	Contractual	Third Party vendor acquisition/consolidation	Reduced competition and potential impacts to contract renewals	4	5	3	4	20	4	3	3	3	12	4	2	2	2	8	Region	Mitigate	Monitor the market, and maintain good relationships with third party vendors	Monitor the market, and maintain good relationships with third party vendors. Maintain fair contracts that are attractive to third party contractors, and not so stringent that they proclude competive bids.	Monitor the market and maintain good relationships with contractors. Maintain fair contracts that are attractive to contractors once current contract expires. Consider utilizing multiple contracts for different services (ie. liquid biosolids hauling, cake hauling) to add diversity and reduce reliance on a single entity
8	4/13/2022	Social and Community	New Vendors opposition	Vendors trying to sell their technologies could delay the process.	4	2	4	4	16	3	2	3	2	9	2	2	2	2	4	GMBP/Region	Mitigate	Strategically consult with key vendors as part of stakeholder consultation	A wide range of technologies was considering in the long list of treatment alternatives, which underwent a robust screening level evaluation. This was all presented to the public during virtual PIC 2. No comments from technology vendors have been received to date. Risk is moderate until after 30-day public review of final BMMP.	A wide range of technologies was considering in the long list of treatment alternatives, which underwent a robust screening level evaluation. This was all presented to the public during virtual PIC 2. No comments from technology vendors have been received to date. Risk is moderate until after 30-day public review of final BMMP.
9	4/13/2022	Project Management and Cost	Obtaining consensus from Project Team on preferred alternative	There are different impacts associated with the biosolids strategy options affecting both capital planning and operations; important to consider Region's priorities and the importance of the different criteria to the Region and obtain concensus	4	2	4	4	16	1	1	1	1	1	1	1	1	1	1	GMBP/Region	Mitigate	Detailed development of alternatives, ensure Region's weighting of criteria is consided in an appropriate manner, workshop with Region to discuss pros and cons, buy-in of the final recommendation by all team members	Development of criteria was done with full Region input through workshop survey. Sensitivity analysis was completed for detailed evaluation to determine impacts of weightings and reach a balanced and representative outcome.	
10	4/13/2022	Environmental/Site Conditions and H&S	Climate Change / GHG emissions	Increased pressure to reduce GHG emissions over time, lost opportunities to capture renewable energy, GHG associated with hauling	4	2	2	4	16	3	1	1	2	6	3	1	1	1	3	GMBP/Region	Mitigate	Develop strategy to reduce hauling, energy recovery strategies	Recommended strategy reduces hauling by increasing dewatering and introducing a cake land application program, which reduces GHG emissions.	
11	4/13/2022	Project Management and Cost	Economic uncertainty, supply chain disruptions and inflation impacting cost of future capital investments	Delays in currently planned upgrades at Region facilities (ie. Garner Road) leading to higher overall costs	3	5	4	2	15	3	3	4	2	12	3	3	4	2	12	Region	Mitigate	Incorporate consevative estimates for inflation in capital project budget estimates, and project duration estimates based on recent trends. Expedite completion of BMMP study to provide overall direction for plant upgrades as soon as possible	Budget estimates will include a more conservative inflation estimate.	
12	4/13/2022	Compliance	Sludge quality issues	Sludge quality issues arise due to process modification such as co-digestion of biosolids with source separated organics (SSO), or poor enforcement of sewer use by-law. Biosolids must meet specific quality requirements to be land applied or received by Walker Environmental	3	5	4	5	15	2	3	1	1	6	1	3	1	1	3	GMBP/Region	Mitigate	Develop quality management program to ensure any SSO accepted meets a minimum quality standard. Adequately fund sewer use by-law enforcement.	Codigestion of biosolids with SSO is not recommended as part of the biosolids management program. Continue to work with industrial dischargers to reduce quality exceedances.	Codigestion of biosolids with SSO is not recommended as part of the biosolids management program. Continue to work with industrial dischargers to reduce quality exceedances.
13	4/13/2022	Compliance	Changes to Future Regulations	Changes to Nutrient Management Act or source water protection requirements that impact ability to land apply biosolids (quantity and/or quality)	3	5	2	5	15	3	4	1	1	12	3	4	1	1	12	GMBP/Region	Mitigate	Consult with Ministry of Environment and OMAFRA to get input on any planned changes to regulations in short and long term	In May 2023, Environment and Climate Change Canada, as well as Health Canada released a draft 'State of PFAS Report', and Canadian Food Inspection Agency is initiating a process to implement interim standards biosolids contaminated with PFAS sold in Canada as commercial fertilizers. Stakeholder consultation is beginning in Fall 2023. Region of Niagara should provide feedback on impacts of this change to their operation. It is possible that OMAFRA or MECP may follow with similar restrictions in future, so continued discussions are essential.	In May 2023, Environment and Climate Change Canada, as well as Health Canada released a draft 'State of PFAS Report', and Canadian Food Inspection Agency is initiating a process to implement interim standards biosolids contaminated with PFAS sold in Canada as commercial fertilizers. Stakeholder consultation is beginning in Fall 2023. Region of Niagara should provide feedback on impacts of this change to their operation. It is possible that OMAFRA or MECP may follow with similar restrictions in future, so continued discussions are essential.
14	4/13/2022	Social and Community	Truck traffic complaints	Changes to truck traffic volumes or route could lead to complaints from community members	3	2	2	5	15	2	2	1	2	4	2	2	1	2	4	Region	Mitigate	Ensure contract are clear on acceptable truck routes; reduce truck traffic by increased dewatering	Current contracts clearly identify acceptable truck traffic routes to limit community impacts. Overall, truck traffic will be reduced with the recommended biosolids program as dewatering will reduce volumes that need to be hauled.	Current contracts clearly identify acceptable truck traffic routes to limit community impacts. Overall, truck traffic will be reduced with the recommended biosolids program as dewatering will reduce volumes that need to be hauled.

Biosolids Management Master Plan Update

Niagara Region

	Very Low (1)	Low (2)	Medium (3)	High (4)	Extreme (5)
Probability	< 5%	< > 5 -20%	< > 20 -35%	< > 35% - 50%	> 50%
Cost Impact	> $500K	$500K - $1M	$1M - $2.5M	$2.5 - $5 M	> $5M
Schedule Impact	< 3 months	< > 3- 6 months	< > 6 -12 months	< > 12 - 18 months	> 18 months
Reputational Impact	Minor	2	3	4	Major

Risk Level	Legend
Immaterial / Low	< 5
Medium	5 - 10
High	11 - 16
Extreme	> 16

RISK IDENTIFICATION					Risk - Project Initiation					Risk Phase 2 Update					TARGET RISK					MANAGEMENT & MITIGATION			MONITORING & CONTROL -PHASE 2 (Update)	MONITORING & CONTROL - Master Plan Completion
Risk Number	Date Risk Identified or Reviewed	Category	Risk Title	Risk Description (Cause & Effect)	Prob	Financial	Schedule	Reputation	Score	Prob	Cost	Schedule	Reputation	Score	Prob	Financial	Schedule	Reputation	Score	Risk Owner	Mitigation Strategy	Risk Strategy Implementation Plan (Mitigation)	Risk Response Progress and Comments	Final Risk Response Progress and Comments
15	4/13/2022	Project Management and Cost	Delays to Critical Plant Upgrades while BMMP update is completed	Some facilities require upgrades to meet immediate needs (ex. Garner Road) that will impact biosolids processing. There is a risk in proceeding with plant upgrades before the BMMP is completed and overarching strategy is developed, but there is also a risk to delay facility upgrades.	3	2	4	4	12	2	2	2	1	4	2	2	2	1	4	GMBP/Region	Mitigate	Need to look at each plant on an individual basis. Overall, preference is to hold off completing upgrades related to biosolids at plants until BMMP is complete. Any proposed upgrades that need to be completed asap should be reviewed by GMBP team to assess risks of proceeding now.	Majority of projects at WWTPs are not impacted by the recommendations of the Master Plan and are continuing as planned.	
16	4/13/2022	Project Management and Cost	Third Party Contracts may not be providing best value for Region	Opportunities may exist to improve value to Region through third party contracts	4	3	2	2	12	2	2	1	2	4	2	2	2	2	4	Region	Mitigate	Consider renegotiating terms of third party contracts when the current contracts are scheduled to expire to improve value (ie. greater incentive for hauling contractor to accept higher concentration biosolids)	Potential improvements to existing contracts are identified in TM 10 as mentioned above. Includes renegotiating terms.	
17	4/13/2022	Operational	Water residual loads sent to sanitary sewer cause upsets at WWTPs	Inconsistency of residual loading based on clean-out schedule at WTPs may cause process impacts on receiving WWTPs (ie. Niagara Falls WTP discharging to Niagara Falls WWTP sewershed in recent months has cause process upsets)	4	3	1	1	12	2	2	1	1	4	2	2	1	1	4	Region	Mitigate	Implement hauling for WTP residuals that have shown impacts to downstream WWTPs when sent to sewer; monitor WWTP performance immediately after residuals are discharged to assess impacts and adjust program accordingly	WTPs that send residuals to the sewer do not historically see process impacts during clean-outs. Larger WTPs (ie. Decew, Niagara Falls) haul residuals to Garner Road already. Region is investigating option to using a portable centrifuge to dewater at Decew WTP during clean out periods and then landfilling, to reduce the storage requirements at Garner Road (as a contingency measure).	Continue hauling WTP residuals from Decew, Niagara Falls and Grimsby. Consider using portable centrifuge to dewater residuals during clean-outs and send directly to landfill to avoid impacting biosolids quality for land application, or disrupting downstream WWTPs for WTPs that discharge residuals to local sewer.
18	4/13/2022	Operational	Failure of digester boiler system / heat exchanger	Inadequate heating of digester resulting in process upsets and higher potential for non-compliance preventing land application. Likelihood varies with plant. Port Dalhousie boiler requires replacement soon.	3	4	3	2	12	1	3	3	1	3	1	3	3	1	3	Region	Mitigate	Monitor performance and replace close to end of useful life	Continue monitoring performance and plan for replacement	Continue monitoring performance and plan for replacement
19	4/13/2022	Operational	Dewatering system / centrifuge failure at Niagara Falls WWTP	Results in loss of production, inability to meet Walker/N-Viro quota, odour issues, increased costs to repair and haul greater quantities of liquid biosolids	3	4	3	1	12	1	3	2	1	3	1	3	2	1	3	Region	Mitigate	Add redundancy, replace aging equipment	Region has purchased portable centrifuge as an interim solution, with permanent dewatering proposed at Baker Road, and expansion of dewatering proposed at Garner Road. Once dewatering equipment reaches end of useful life at Niagara Falls, consider hauling to Garner Road for dewatering.	Region has purchased portable centrifuge as an interim solution, with expansion of dewatering proposed at Garner Road. Once dewatering equipment reaches end of useful life at Niagara Falls, consider hauling to Garner Road for dewatering.
20	4/13/2022	Compliance	Impacts of PFAS and other emerging contaminants	Could impact ability to land apply in future	4	3	2	3	12	3	3	2	1	9	3	2	1	1	6	Region	Mitigate	Update sewer use by-law to improve compliance	Continue conversations with regulatory bodies and promote tighter regulations on products that produce PFAS.	Continue conversations with regulatory bodies and promote tighter regulations on products that produce PFAS. Consider including PFAS limits in sewer use by-law, once future regulations are more clear.
21	4/13/2022	Social and Community	Odour generation at Garner Road or WWTPs leading to complaints	Biosolids management processes can generate odour and require management	2	3	2	5	10	1	2	2	3	3	1	2	2	3	3	Region	Mitigate	Maintain existing odour control equipment to ensure continued performance; ensure citizen have clear method to file compliants and responses are provided quickly	Continue providing clear method to allow for complaints to be received, filed and responded to. Consider acquiring property adjacent to Garner Road if it becomes available (ie. through 'first right of refusal' agreement with current landowner). Contain odour and treat once new dewatering building is constructed.	Continue providing clear method to allow for complaints to be received, filed and responded to. Consider acquiring property adjacent to Garner Road if it becomes available (ie. through 'first right of refusal' agreement with current landowner). Contain odour and treat once new dewatering building is constructed.
22	4/13/2022	Compliance	Section 16 Order Requests	Risk of Part II Orders, if stakeholders have other agendas aimed at delaying or stopping the project.	2	2	5	5	10	2	2	4	4	8	1	2	1	1	2	GMBP/Region	Mitigate	First step is to reduce the risks of Part II Orders through a strong consultation program. If Part II orders are received, must mitigate the impacts on schedule and reputation by early and continuous communications with MECP, as well as continued communication with Part II order requestors and general public. Negotiate with MECP on the most efficient and acceptable way to address in a timely fashion.	Section 16 orders relate only to concerns pertaining to potential adverse impacts to Aboriginal or treaty rights. Risk is moderate until 30-day public review period completed.	Section 16 orders relate only to concerns pertaining to potential adverse impacts to Aboriginal or treaty rights. Risk is moderate until 30-day public review period completed.
23	4/13/2022	Social and Community	Opposition from Indigenous Groups	May have concerns regarding land application or proposed capital works. Due to early stage in the implementation process, opposition from indigenous groups is unlikely	2	2	5	5	10	2	2	4	4	8	1	1	2	1	2	GMBP/Region	Mitigate	Engage with Indigeneous groups early in the process, and give opportunities for meetings to address any concerns.	Indigenous groups were notified of the project early on, and additional letters were sent prior to PIC 2 to provide an additional opportunity to engage/comment on the study. Risk is moderate until 30-day public review period completed.	Indigenous groups were notified of the project early on, and additional letters were sent prior to PIC 2 to provide an additional opportunity to engage/comment on the study. Risk is moderate until 30-day public review period completed.
24	4/13/2022	Operational	Market availability	Stability of the biosolids product market (is it diverse enough, is there enough agricultural land	3	3	3	3	9	2	1	1	1	2	2	1	1	1	2	GMBP/Region	Transfer	Transferring risk to Contractors, but through Master Plan, doing a market assessment to confirm long-term stability and if other markets are available.	Market Assessment documented in TM 9 confirms that sufficient land bank is available to support land application of biosolids in long term. Other end use markets were reviewed throught the Master Plan, and land application or use as fertilizer/landscaping product were recommended.	Market Assessment documented in TM 9 confirms that sufficient land bank is available to support land application of biosolids in long term. Other end use markets were reviewed throught the Master Plan, and land application or use as fertilizer/landscaping product were recommended. Increasing biosolids storage at Garner Road will also help mitigate this risk.
25	4/13/2022	Operational	Recommendation of new biosolids treatment or stabilization technology	Recommend investing in a newer technology that the Region is unfamiliar with due to potenial benefits. Longer period of learning curve before benefits are realized; greater challenge to obtain full buy-in from operators.	3	2	3	3	9	1	1	3	1	3	1	1	3	1	3	GMBP	Avoid	Obtain buy-in from operations staff during master plan on any potential changes to biosolids treatment/stabilization technology. Region to develop comprehensive training program on new technology multiple points within design and construction phases.	This risk no longer exists, as the Master Plan does not recommend implementing a technology not already in use within the Region.	This risk no longer exists, as the Master Plan does not recommend implementing a technology not already in use within the Region.
26	4/13/2022	Social and Community	Local community / public opposition	Risk of opposition to biosolids management strategy or late engagement in the Master Plan process, resulting in delays in approval.	3	2	2	3	9	3	2	2	2	6	3	2	2	2	6	GMBP/Region	Mitigate	Undertake appropriate level of engagement in a timely manner. Be proactive in engaging. Select alternative that aims to minimize community impact.	Consultation with the public and agencies, and indigenous engagement have been on-going through the Master Plan Study. Preferred alternative strategies will reduce impacts to communities through reduced truck traffic. Risk is moderate until 30-day public review period completed.	Consultation with the public and agencies, and indigenous engagement have been on-going through the Master Plan Study. Preferred alternative strategies will reduce impacts to communities through reduced truck traffic. Based on increased public awareness of PFAS being land applied and potential dissent, this risk has increased since the Phase 2 update, although could be maintained at a moderate level following the 30 day review period.
27	4/13/2022	Operational	Failure of digester mixing system	Results in digester process upsets, performance issues and higher potential for non-compliance preventing land application	3	3	3	1	9	1	3	2	1	3	1	3	2	1	3	Region	Mitigate	Include redundancy, alternate mixer designs to increase reliability	Include redundancy, alternate mixer designs to increase reliability	Include redundancy, alternate mixer designs to increase reliability
28	4/13/2022	Social and Community	Future development encroachment	Area near Garner Road is approved for development	3	3	3	3	9	2	2	2	2	4	2	2	2	2	4	GMBP/Region	Mitigate	Meet with local municipality to discuss any future development plans, education on impacts of approved development near this facility	Consider acquiring property adjacent to Garner Road if it becomes available (ie. through 'first right of refusal' agreement with current landowner).	Consider acquiring property adjacent to Garner Road if it becomes available (ie. through 'first right of refusal' agreement with current landowner).
29	4/13/2022	Project Management and Cost	Delays in completing Master Plan	Project management related - scope changes, lack of consensus, stakeholder concerns, COVID-19 protocols.	2	1	3	4	8	2	1	2	1	4	1	1	1	1	1	GMBP/Region	Mitigate	Detailed development of alternatives, ensure Region's weighting of criteria is consided in an appropriate manner, workshop with Region to discuss pros and cons, buy-in of the final recommendation by all team members	Multiple workshops with Region to ensure engagement with steering committee, and decisions were made in a timely manner.	
30	4/13/2022	Operational	Sludge thickening operational issues at WWTPs	Poor thickening performance could lead to reduced digester performance and increased hauling costs at plants with gravity belt thickeners. Operational issues may include failure of the thickener itself or polymer addition system. Higher probability of failure at NOTL WWTP; polymer system is slated for replacement	2	4	3	1	8	1	2	1	1	2	1	2	1	1	2	Region	Mitigate	Redundant thickening units and polymer addition pumps	Redundant thickening units and polymer addition pumps	Redundant thickening units and polymer addition pumps
31	4/13/2022	Compliance	Biosolids quantity impacts due to winery waste	May occur at Baker Road, Port Dalhousie, Port Weller or NOTL WWTP, where winery waste may be accepted.	2	3	2	2	6	1	1	1	1	1	1	1	1	1	1	Region	Mitigate	Develop strategy for winery waste management between WWTPs. Install winery waste equalization tank to better control flow of winery waste to digester (in design currently)	Send winery waste to WWTPs with capacity to handle additional loads.	Send winery waste to WWTPs with capacity to handle additional loads.
32	4/13/2022	Environmental/Site Conditions and H&S	Biosolids spill into environment during truck loading/unloading	Could occur at WWTPs or Garner Road during truck loading/unloading. Potential for a spill in some areas to reach watercourse (ie. Chippawa Creek if spill on east side ditch at Garner Rd)	1	4	3	3	4	1	4	3	2	4	1	4	3	2	4	Region	Mitigate	Provide spill containment at truck unloading areas	Provide spill containment at truck unloading areas	Provide spill containment at truck unloading areas

Biosolids Management Master Plan Update

Niagara Region

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Risk Number	Date Risk Identified or Reviewed	Category	Risk Title	Risk Description (Cause & Effect)	Prob	Financial	Schedule	Reputation	Score	Prob	Cost	Schedule	Reputation	Score	Prob	Financial	Schedule	Reputation	Score	Risk Owner	Mitigation Strategy	Risk Strategy Implementation Plan (Mitigation)	Risk Response Progress and Comments	Final Risk Response Progress and Comments
33	4/13/2022	Operational	Changes to Population Forecasts and Flows	Population and flow estimates may change during the planning and design period.	2	1	2	2	4	4	2	2	1	8	4	2	2	1	8	GMBP	Accept	Be consistent with Master Plan forecasts. Design infrastucture to meet longterm needs to 2051.	Sanitary Master Plan was completed in 2023, and Biosolids Master Plan incorporates latest flows from this study. Bill 23 however was implemented during the BMMP process, increasing population growth in the Region. While this will not affect the overall strategy, it may require specific projects be implemented earlier than anticipated.	Sanitary Master Plan was completed in 2023, and Biosolids Master Plan incorporates latest flows from this study. Bill 23 however was implemented during the BMMP process, increasing population growth in the Region. While this will not affect the overall strategy, it may require specific projects be implemented earlier than anticipated.
34	4/13/2022	Environmental/Site Conditions and H&S	Groundwater and surface water impacts from continued land application of biosolids	Nutrient loading to surface water, or potential to impact groundwater/drinking water sources	2	2	2	2	4	2	2	2	2	4	2	2	2	2	4	GMBP/Region	Transfer	Third party contractor is currently responsible for ensuring all land applied biosolids are in conformance with NASM plan to reduce ground water and surface water impacts to acceptable level	Third party contractor is will continue being responsible for ensuring all land applied biosolids are in conformance with NASM plan to reduce ground water and surface water impacts to acceptable level	Third party contractor will continue being responsible for ensuring all land applied biosolids are in conformance with NASM plan to reduce ground water and surface water impacts to acceptable level. Use tanks for any liquid storage to reduce risk of soil impacts through infiltration