

TECHNICAL MEMORANDUM E.1.4

Regional Municipality of Wood Buffalo

Closed Systems Standards



May 2014

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Executive Summary

This technical memorandum discusses greywater reuse in the context of landscape irrigation, and toilet/urinals flushing for Municipal buildings and exploring opportunity for wider implementation in private buildings. A secondary use for greywater is heat recovery, which this technical memorandum has briefly discussed.

Greywater is defined as water used from baths, showers, hand basins, dishwashers, and washing machines. It is not reclaimed water that has been piped to a centralized, municipal wastewater treatment plant and treated for potable or non-potable reuse. A closed system is a system of water reuse whereby greywater and black water would undergo an on-site treatment to a level where it is usable for flushing toilets/urinals; however, this practice is often modified to exclude black water. Greywater is treated and used for flushing toilet/urinal and/or irrigation, and black water is drained into the municipal sewer pipe system to the wastewater treatment plant.

Regulatory review showed that Health Canada accepts application of treated greywater to toilet and urinal flushing, and subsurface irrigation. On the contrary, Alberta Government does not allow reclaimed wastewater from any source to be used inside buildings or for other domestic applications. However, in 2010, Alberta passed Alberta Guidelines for rainwater harvesting, which allows reuse of water collected from roofs. Having that being said, AESRD recognizes growing interests in using greywater and allows case-by-case evaluation of proposed variance during permitting process. The conflicting regulatory regime between the federal and provincial discourages the use of greywater in buildings application.

In terms of implementation, the National Plumbing Code provides specific design and installation of plumbing systems in buildings and facilities. This document provides guidance to greywater reuse and references CSA B128 Standard.

Other than the regulatory challenges, the use of greywater in buildings has been controversial with arguments of low water rates in Canada, and public perception of health concerns. These discusses do not motivate the implementation of greywater reuse.

Greywater reuse opportunities in residential, commercial, institutional, and light industrial include landscape irrigation, toilet/urinal flushing, as well as heat recovery. Specifically in commercial and institution buildings, large volume of greywater are generated through toilet flushing, and hand washing. Environment Canada reported the Canadian residential water consumption rate for 2009 was approximately 275 L/capita/day with Alberta at about 210 L/capita/day. Approximately, 25% to 30% of the water is used for toilet flushing, 35% in showers and baths, and 20% in laundry.

Alberta's Water for Life Strategy commits the province to improve overall efficiency and productivity of water use by 30% from 2005 to 2015. This Strategy aligns with the Municipality's intent to reduce water consumption under the current Municipality's Water Conservation Retrofit program, which gives the Municipality an excellent backing to advance water conservation further with greywater reuse program.

This technical memorandum proposes an Implementation Strategy that provides a general guidance to initiate discussions and consensus amongst multi-level stakeholders within the Municipality. The Municipality may then consider application for municipal buildings, and private buildings. Subsequently, the Implementation Strategy can be further developed with details to suit the needs of the region. Concurrently, the Municipality can engage in conversation with regulatory agencies and advocate for regulatory change. The implementation for greywater reuse within Municipality can continue on a voluntary basis and plan for future inclusion of greywater reuse as part of the overall sustainability goal.

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1 Introduction

The purpose of this technical memorandum (TM) is to provide and discuss greywater reuse opportunities within the Regional Municipality of Wood Buffalo (Municipality). The primary potential uses of greywater are landscape irrigation, and toilet/urinals flushing. A secondary potential usage is heat recovery, which this TM briefly introduces. This TM is part of the Wastewater Green Initiatives discussion under the Wastewater Master Plan project.

The tasks included:

1. Review regulatory requirement and guidelines for greywater reuse in United States, Canada and in Alberta.
2. Identify greywater reuse strategy opportunities.
3. Identify potential challenges that may preclude greywater reuse.
4. Provide general guidance for future implementation.

This information has also been presented to the Municipality during Workshop Meeting No. 6 on March 20, 2014. Comments from the workshop are incorporated into this TM.

2 Definitions

2.1 GREYWATER REUSE

Greywater is defined as water from baths, showers, hand basins, dishwashers, and washing machines. The water gets its name from its cloudy appearance or a suedo-classification as being “between” fresh potable water (white water), and sewage water that contains human waste (black water).

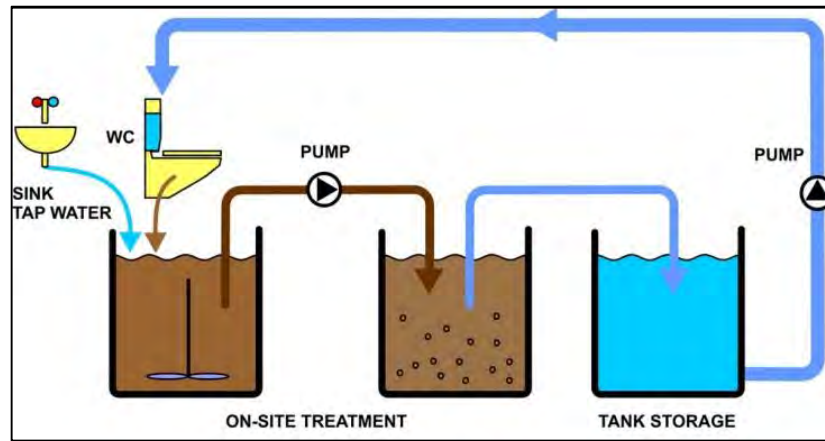
Greywater, in theory has lower levels of contaminants than black water; however, there are different “shades of grey” where dark greywater is wastewater from kitchen sinks and dishwashers, which have a higher concentration of organic matter that encourages bacteria growth. As such, dark greywater is often not permitted for reuse and is treated with black water.

Greywater is not reclaimed water that has been piped to a centralized municipal wastewater treatment plant and treated for potable or non-potable reuse. Greywater reuse is water that has undergone an on-site treatment to allow for reuse mainly in irrigation, and toilet/urinal flushing. Greywater reuse, in some extreme cases, is also treated for potable use; however, this is not the focus of this discussion.

2.2 CLOSED SYSTEM

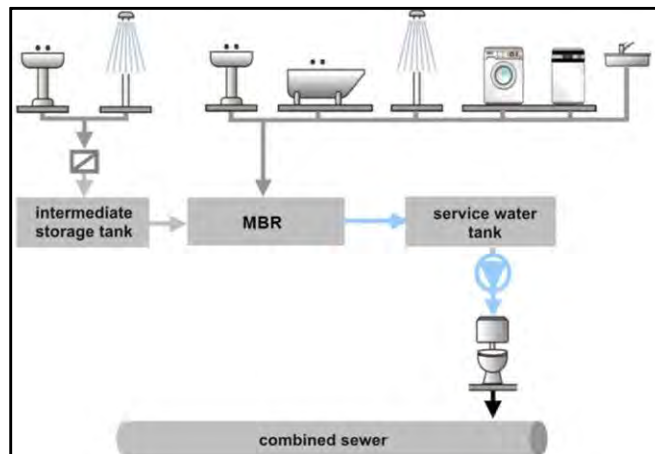
A closed system has been defined as a physical system that is closed and does not require transfers in or out of the system, or the mass is conserved within the boundaries of the system. The hydrological cycle is an example of a natural closed system. In the context of an on-site greywater closed system, the greywater and black water would undergo on-site wastewater treatment to a level where it is usable for flushing toilets/urinals. Figure 2-1 shows a typical concept of a closed-system for water.

Figure 2-1
Example of a Closed Greywater Reuse System



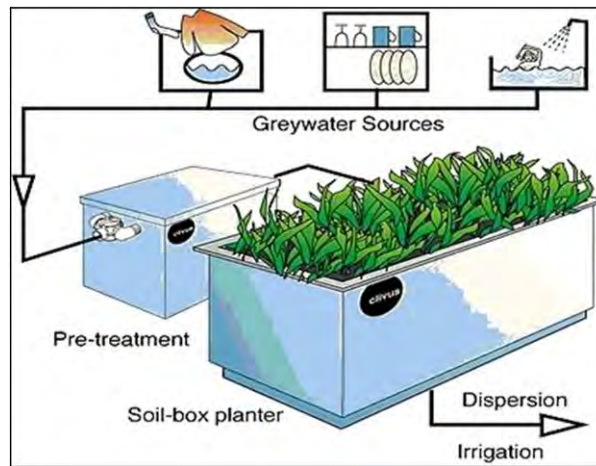
Currently, closed systems are not widely accepted for reasons that will be discussed later in this TM; thus, greywater reuse is not entirely a closed looped on-site. Once greywater is treated and used for flushing toilets, the black water will be drained into the municipal sewer pipe system to the wastewater treatment plant. Figure 2-2 illustrates one greywater reuse concept with the understanding that many variations of treatment can be applied depending on the desired water conservation strategy and level of on-site treatment.

Figure 2-2
Domestic Greywater Reuse Example



Other on-site application of treated greywater is irrigation as shown in the example below.

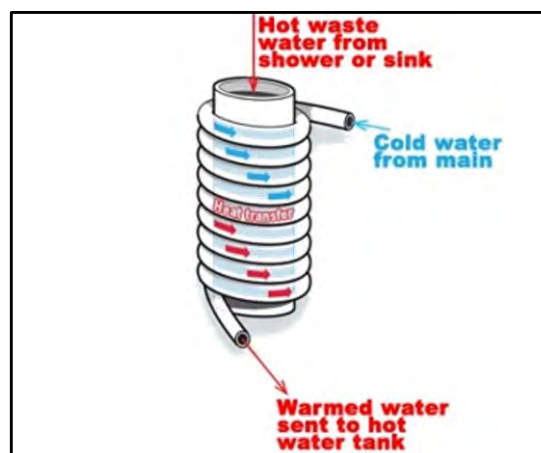
Figure 2-3
Greywater for Irrigation Reuse Example



2.3 HEAT RECOVERY

Heat recovery from greywater reuse in residential buildings is reclaimed through drain water heat exchanger (e.g. copper coil). Incoming potable cold water is preheated through the heat exchanger before it flows into the water heater tank; less energy is used to heat water in the tank. Figure 2-4 shows an example of a heat exchange system.

Figure 2-4
Heat Change Coil



3 Regulatory and Standards Review

3.1 WORLDWIDE

Recycled greywater from showers and bathtubs for flushing toilets is becoming a regular practice in most European, Caribbean, and Australian jurisdictions, and a few of US States, mainly Florida and California. In these countries where greywater reuse is widely accepted and implemented, the International Plumbing Code is used. There is one exception where most countries do not allow reuse of kitchen wastewater due to high cost and high market requirement for on-site treatment.

In the United States, there are a number of states and local agencies that provide specific regulations or guidance for greywater reuse. US Environmental Protection Agency (USEPA) has published Guidelines for Water Reuse, 2012, that provides an extensive review and discussion on types of reuse applications, state regulatory programs, regional variations, environmental considerations for reclaimed water (purple water), greywater, stormwater runoff, and harvested rainwater. This Guideline also provides recommended water quality criteria for irrigation, livestock water, and industrial use. Specific for greywater, the NSF Standard 350 established water quality criteria for on-site systems in US:

- NSF/ANSI Standard 350 Onsite Residential and Commercial Water Reuse Treatment Systems; and
- NSF/ANSI Standard 350-1 Onsite Residential and Commercial Greywater Treatment Systems for Subsurface Discharge.

3.2 CANADA

Health Canada accepts the use of treated greywater for toilet and urinal flushing, and subsurface irrigation. They published the Domestic Reclaimed Water for Use in Toilet and Urinal Flushing in 2010 to provide guidance on water quality for toilet and urinal flushing as well as irrigation.

**Table 3-1
Guideline Values for Domestic Reclaimed Water
Used in Toilet and Urinal Flushing**

Parameter	Units	Median	Maximum
BOD ₅	mg/L	≤ 10	≤ 20
TSS	mg/L	≤ 10	≤ 20
Turbidity	NTU	≤ 2	≤ 5
Escherichia coli	CFU/100mL	Not detected	≤ 200
Thermotolerant coliforms	CFU/100mL	Not detected	≤ 200
Total chlorine residual	mg/L	≥ 0.5	≥ 0.5

This document also outlines the management programs for maintenance and operation of the system, and technology verification by third party, to ensure public health and water resources are protected. The NSF/ANSI Standard 40 and Bureau de Normalisation du Quebec Standards NQ 3680-910/NQ3680-915 provide testing protocols which are intended for the certification of on-site wastewater treatment system that can be adapted for reclaimed water systems such as that of greywater system. In terms of installation and commissioning, the required standard is the CSA Standard B128.01-06/B128.2-06, with emphasis on preventing cross-connection with potable water lines.

3.3 ALBERTA

Alberta Environment and Sustainable Resource Department (AESRD) do not allow reclaimed wastewater from any alternate water source for use inside buildings or for other domestic applications in Alberta. However, in 2010, Alberta passed Alberta Guidelines from Rainwater harvesting, which allows reuse of water collected from roofs. The rainwater reuse is mainly for flushing toilets, urinals, and subsurface irrigation systems (drip irrigation to avoid airborne particles). Having that being said, AESRD recognizes growing interests in using greywater in buildings and allows case-by-case evaluation of proposed variance during permitting process. The Water Centre in Calgary is an example. The Water Centre is the headquarters for the City of Calgary's Water Resources and Water Services Department. It achieved LEED® Silver standards with focus on reduce, reuse, and recycle of energy and water in operations, material selection, and construction of the building.

Figure 3-1
Photo 3-1: Water Centre, Calgary



The green building movement continues to put pressure on regulators to address the need for change in policy allowing practical water efficiency strategies to be implemented. The rating systems, LEED®, Green Globes, and Living Building Challenge, provides the avenue for innovation and transformation of technology in buildings for water supply conservation.

4 Opportunities for Greywater Reuse

Greywater reuse opportunities in residential, commercial, institutional, and light industrial include landscape irrigation, toilet/urinal flushing, as well as heat recovery. Specifically in commercial and institution buildings, large volume of greywater are generated through toilet/urinal flushing, and hand washing.

The Alliance for Water Efficiency, a non-profit organization dedicated to efficiency and sustainable use of water in Chicago showed an example calculation of a school of 200 male and 250 female students having 5 male toilets and 15 urinals and 20 female toilets. Assuming that the toilets are 6L/flush and urinals are 2L/flush, 3.5 flushes/day for toilets, and 2.5 flushes/day for urinal in this example, it showed that amount of water used for toilet/urinal flushing in one school could be upwards of 1.2ML/year.

Environment Canada reported the Canadian residential water consumption rate for 2009 was approximately 275 L/capita/day with Alberta at about 210 L/capita/day. A general breakdown of water use is: 25% to 30% for toilet flushing, 35% in showers and baths, and 20% in laundry.

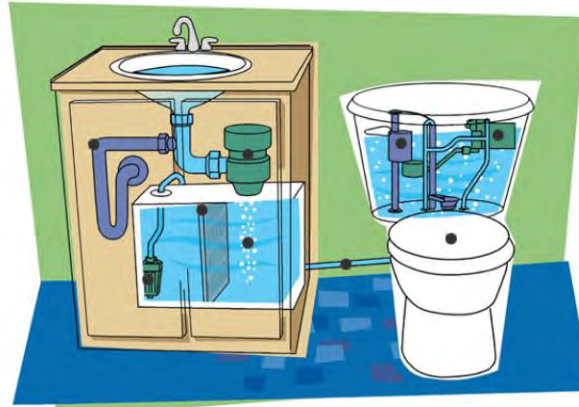
As evident, there is tremendous amount of volume of greywater for reuse application. Alberta's Water for Life Strategy commits the province to improve overall efficiency and productivity of water use by 30% from 2005 to 2015. This Strategy also aligns with the Municipality's intent to reduce water consumption under the current Municipality's Water Conservation Retrofit program, which gives the Municipality an excellent backing to advance water conservation further with greywater reuse program.

Currently, greywater reuse in the Municipality is conducted on a voluntary basis that is reviewed with AESRD on a case-by-case basis. Such example is the MacDonal Island Development Project, which models an innovative water reuse system for a recreational complex. The Municipality is also discussing future buildings in the City Centre redevelopment to consider LEED certification and pursue greywater as an alternate water supply.

4.1 TECHNOLOGY BRIEF

There are numerous technologies available in the market that can be implemented for on-site residential, commercial, and institutional use. The level of installation, maintenance, and operation would vary depending on the size, treatment process, and volume of greywater to be treated. Technology has advanced such that systems are more compact, easier to operate and maintained for on-site purpose. For example, commercial providers such as AQUA System, Flotender, and GREEN 3 System from the US have products that can be used in residential applications to capture water from bathroom sinks, filter, and treat the greywater for toilet flushing/irrigation. Figure 4-1 shows a simplified schematic for toilet flushing use.

Figure 4-1
Bathroom Sink Greywater Treated for Toilet Flushing



On a larger scale, an example provider is Greyter Water Systems, which has been applied for institution and commercial buildings in Ontario, mainly in treating greywater from bathrooms sinks, and showers for toilets/urinals flushing and irrigation.

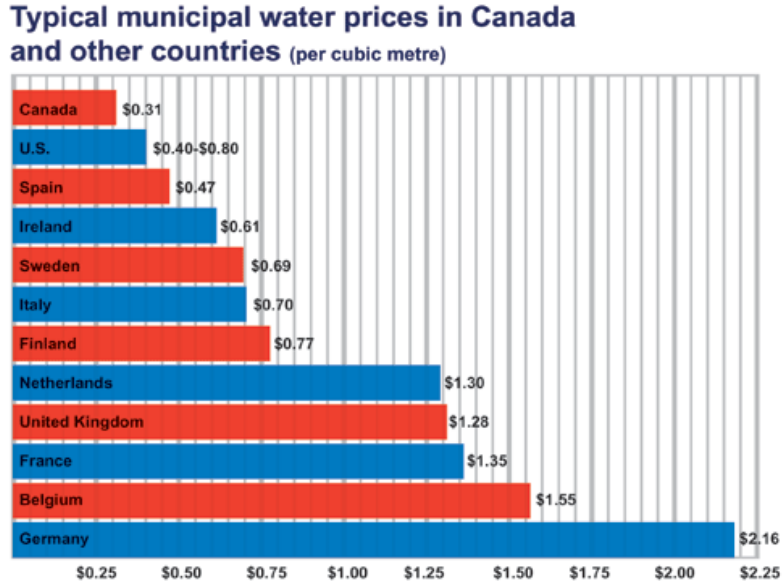
5 Challenges and Issues

The use of greywater in buildings has been controversial. Low water rates, public perception and concerns, and lack of political will and guidance, make the process of implementing greywater reuse onerous.

The public perception in Canada is that water is abundant and there is no urgency to conserve water. Typical municipal water price in Canada is low compared to other countries. Figure 5-1, from Environment Canada, shows the differences in potable water bulk production prices and does not include wastewater treatment. This shows a distinct relationship between the cost of producing treated water and regions that have readily adopted greywater reuse strategies.

The combined public perception of water abundance and low water rates does not provide a compelling argument for behavioural change. This continues to be a challenge when municipalities are introducing water conservation and efficiency programs to combat increasing cost for infrastructure expansion while meeting ever increasing water demand.

Figure 5-1
Typical Municipal Water Prices Comparison



Other reported public concerns that greywater may be seen as a threat to human health and adversely impacting the current treatment system include:

- Potential cross-connection with either potable or reclaimed water.
- Reduction of raw material flow into the wastewater treatment plants, thus impacting the treatment regime and reducing the reliable production of recycled water (purple water).
- Reduction in flow into the sewer pipe system, thus reducing carrying capacity and not providing regular pipe scour.
- Onerous maintenance and repairs for on-site greywater systems
- Reliability for cold weather application.
- Relatively high level of fecal coliform in greywater that need to be properly treated.
- Potential additional individual costs associated with energy consumption in an on-site greywater treatment system.

Although the concerns can be addressed by engineering and technology, public notion that is built on fear and ignorance are difficult to convince. There are no documented cases in the US of any diseases that have been caused by exposure to greywater (USEPA, 2012). As well, there is neither provincial/federal regulatory to dispel the concerns, nor any leadership to demonstrate reliability in the system that would foster confidence and trust in the public. These are challenges that the Municipality would need to consider and understand, so that the implementation strategy are designed to address these issues.

6 Greywater Implementation Strategy

The recommended approach to a greywater reuse strategy is similar to the Waste Reduction and Water Conservation Retrofit Program that the Municipality has already initiated. Waste Reduction program has been successfully implemented and the Water Conservation Retrofit Program has begun its marketing and public education strategy in early 2014.

By recognizing the challenges and issues discussed above, the Municipality can show leadership and commitment to the environment and the community through strong public education and engagement, and initiating demonstration programs with tangible case studies to build confidence and trust in the public. The following outlines the recommended approach with estimated implementation timelines.

Item	Intent	Timeline	Activity
1	Buy-in and build consensus within community and leaders	≤ 2 years	Building a business case around the positive impact of greywater reuse that addresses long term social, economic and environment benefit to secure buy-in from community leaders and utilities.
2	Education and building awareness	≤ 3 years	Generating marketing and educational material to bring awareness and educate the public.
3	Demonstrate competency and show leadership	≤ 3 years	Providing resources on the technology, its application, and demonstrate expertise through pilot projects. The Municipality can collaborate with organization on local project to demonstrate effectiveness and success.
4	Initiate behavioural change	≥ 3 years	Developing incentive programs to entice greywater reuse in residential, commercial and institution.
5	Advocate for regulatory change	≥ 5 years	Initiating a discussion with AESRD, Alberta Health, Alberta Municipal Affairs advocating for change in regulations, standards, and guidelines to address greywater reuse.
6	Wide implementation of greywater for Municipal buildings	≥ 5 years	<ul style="list-style-type: none"> • Modifying appropriate engineering development and standards, local by-laws to include water efficiency and water reuse system in Municipal buildings. • Develop policy to guide future implementation.

7 Next Steps

The Municipality is exploring opportunities for greywater reuse in residential, commercial, institutional, and light industrial sectors. Implementing a greywater reuse program would elevate the Municipality's commitment towards a stronger environmental stewardship portfolio. Unfortunately, there is no mechanism for the Municipality to implement greywater reuse as a standard practice within the current regulatory regime. Presently, greywater reuse projects proposed within the Municipality are voluntary and are reviewed with AESRD on a case-by-case basis. However, the Municipality can engage in conversation with the regulatory agencies and advocate for regulatory change.

Concurrently, the implementation for greywater reuse within Municipality can continue on a voluntary basis and plan to include greywater reuse as part of the overall sustainability goal. The above proposed Implementation Strategy provides a general guidance to initiate discussions and consensus amongst multi-level stakeholders within the Municipality. The Municipality may then consider application for municipal and private buildings. Subsequently, the Implementation Strategy can be further developed with details to suit the needs of the Region.

TECHNICAL MEMORANDUM

Closure


This report was prepared for the Regional Municipality of Wood Buffalo to provide guidance for greywater reuse as part of wastewater green initiative strategy.

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Respectfully submitted,
Associated Engineering Alberta Ltd.



Juliana Tang, M.Sc., P.Eng., LEED AP
Geo-environmental Engineer,
Sustainable Practice Specialist

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TECHNICAL MEMORANDUM E.1.5

Regional Municipality of Wood Buffalo

Collaborative Ecological Model



August 2014

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Executive Summary

This report provides an overview of all the green initiatives discussed in the Wastewater Master Plan, and how these initiatives fit into the Municipality's long term sustainability objectives. This report provides guidance to the Municipality for future planning and decision making.

The report outlines the concept of an Ecological model and how this relates to the proposed Collaborative Ecosystem Model that the Municipality is planning to adopt for future implementation. The details of the green initiatives within the Wastewater Master Plan project have been discussed in the following technical memorandum:

1. TM A3.2.2, Reuse Water Systems
2. TM A3.2.3, Effluent Reuse Strategy
3. TM A3.4, Solids Management Review
4. TM A3.5, Foul Air Management
5. TM C2.3, Stormwater Quality and Reuse Plan
6. TM C3.3, Snow Storage Management Summary Document
7. TM E1.4, Closed Systems Standards (greywater system)

The recurring message is that there are current initiatives and many potential opportunities for the Municipality to implement green initiatives. The components of the Collaborative Model to be incorporated with this Wastewater Master Plan, as an ultimate plan are:

1. Municipal and Industrial solid waste
2. Greenhouse operation
3. District energy
4. Industrial wastewater
5. Industrial waste heat

Associated Engineering understands that the Municipality has already initiated an internal workshop to discuss the green opportunities within the Collaborative Ecosystem Model. The workshop would initiate critical conversation that allows the Municipality to begin its journey. Our goal is to provide strategic information regarding the Wastewater components, and to assist the Municipality in achieving the ultimate plan (the Plan) from a holistic approach.

The report provides general guidance with the understanding that the Municipality is already in the midst of such activities:

1. Establish a task force or champion(s) who will be committed to lead in the development, maintenance, and implementation of the Plan.

2. Identify the key multi-level stakeholders that would have impact or be influenced by this plan.
3. Request for clear direction and messaging from Council and upper management to ensure consistency across the organization and that their visions are understood and implemented.
4. Invite the key stakeholders to a series of collaborative workshops that would be led by the task force. A suggested workshop format is discussed in Section 4.1.
5. Develop and maintain the Plan and continue conversation with the stakeholders.
6. Develop a priority list with realistic schedule and milestones.
7. Identify performance measures and metrics. Develop a plan to monitor performance.
8. Execute the Plan.

The green initiatives within the Collaborative Ecosystem model are recognizably a living document and will need to be flexible to address change and emerging issues. The Plan will have success with collaboration and innovation.

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TECHNICAL MEMORANDUM E.1.5

1 Introduction

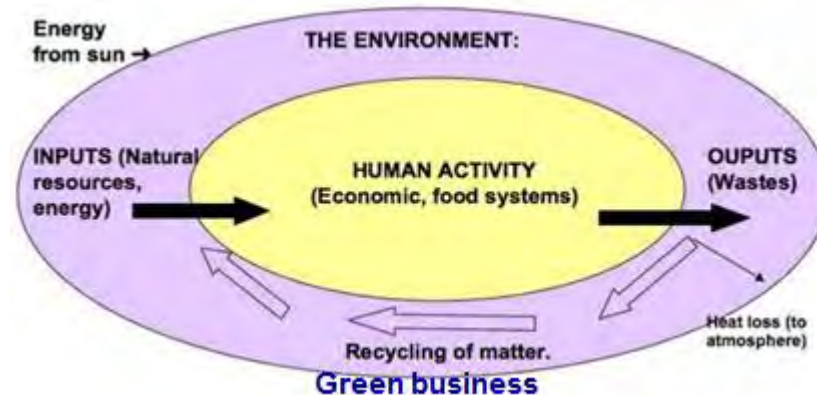
This technical memorandum (TM) provides an overview of the green initiatives that have been discussed in the Wastewater Master Plan and how these initiatives fit into the Regional Municipality of Wood Buffalo's (Municipality) overall intention and long term sustainability goals. This report provides guidance to the Municipality for future planning and decision making.

This information has been presented to the Municipality, during Workshop Meeting No. 6 on March 20, 2014. Comments from the workshop are incorporated into this TM.

2 Collaborative Ecosystem Model

An ecological model, in general, is defined as a model that relates how human activity impacts the environment. The ecological model views the environment as the main support for economic and social prosperity – the environment supplies natural resources that would be extracted, harvested, manufactured, and produced for human consumption and utilization. Through this system, waste is generated, but it is viewed to have an inherent value that can create green business opportunities in recycling and reuse. The model recognizes that there will be some small percentage of waste that cannot be recovered.

Figure 2-1
Ecological Model Example



3 Collaborative Ecosystem

The Municipality introduced a Collaborative Ecosystem that emulates the ecological model that views waste as an alternate resource, and that green businesses are potentially created through this model. The Municipality has goals to achieve zero waste. A presentation at a TEDx Fort McMurray Conference, given in March 2012, defined goals to reduce environmental pollution and greenhouse gases, generate local businesses, preserve and conserve natural resources, and improve the social quality and well-being of the community. As the community continues to grow, the Municipality is well positioned to incorporate these green initiatives in future development.

The proposed Collaborative Ecosystem includes the following key concepts:

- Municipal solid waste and industrial (e.g. oil sands) domestic waste are fed into gasifiers instead of the traditional landfill operation.
- The gasifying process produces waste energy that can be used as heat and electricity. This energy can be fed into the power grid for communities or to a greenhouse for growing local produce.
- Other waste such as used cooking oil can be fed into a biodiesel unit that will supplement the gasifier's energy production.
- Waste heat from remote industries or oil sands operations can be harnessed to support a community district energy facility. The wastewater treatment plants, located north of the city and the proposed south plant, has potential for heat recovery to supplement and support district energy projects.
- Reclaimed water from the wastewater treatment plants can be used for residential, commercial, and industrial application.



Sustainability planning and implementation are best applied with a holistic approach that clearly identifies the synergistic solutions in using wastewater, water, and solid waste. This approach avoids any missed opportunities, and optimizes on their benefits. In this Wastewater Master Plan, green initiatives are discussed with recommendations of planning and implementation strategies; now, a relevant question is, *“How does the Wastewater Master Plan green initiatives fit into the Collaborative Ecosystem, and what are the next steps for the Municipality?”* The following sections provide guidance to this discussion.

3.1 WASTEWATER GREEN INITIATIVES REVIEW

The details of the green initiatives within the Wastewater Master Plan project have been discussed in the following technical memorandums (TM):

1. TM A3.2.2 - Reuse Water Systems
2. TM A3.2.3 - Effluent Reuse Strategy
3. TM A3.4 - Solids Management Review
4. TM A3.5 - Foul Air Management
5. TM C2.3 - Stormwater Quality and Reuse Plan
6. TM C3.3 - Snow Storage Management Summary Document
7. TM E1.4 - Closed Systems Standards (Greywater System)

The recurring message is that there are current initiatives and many potential opportunities for the Municipality to implement these green initiatives. These reports provided guidance for planning and future implementation framework with recommended tasks including:

- Opportunity identification and confirmation.
- Collaborative discussion on a multi-level stakeholder to identify risks, challenges, and issues that would prevent the initiatives to proceed.

Sequential tasks including:

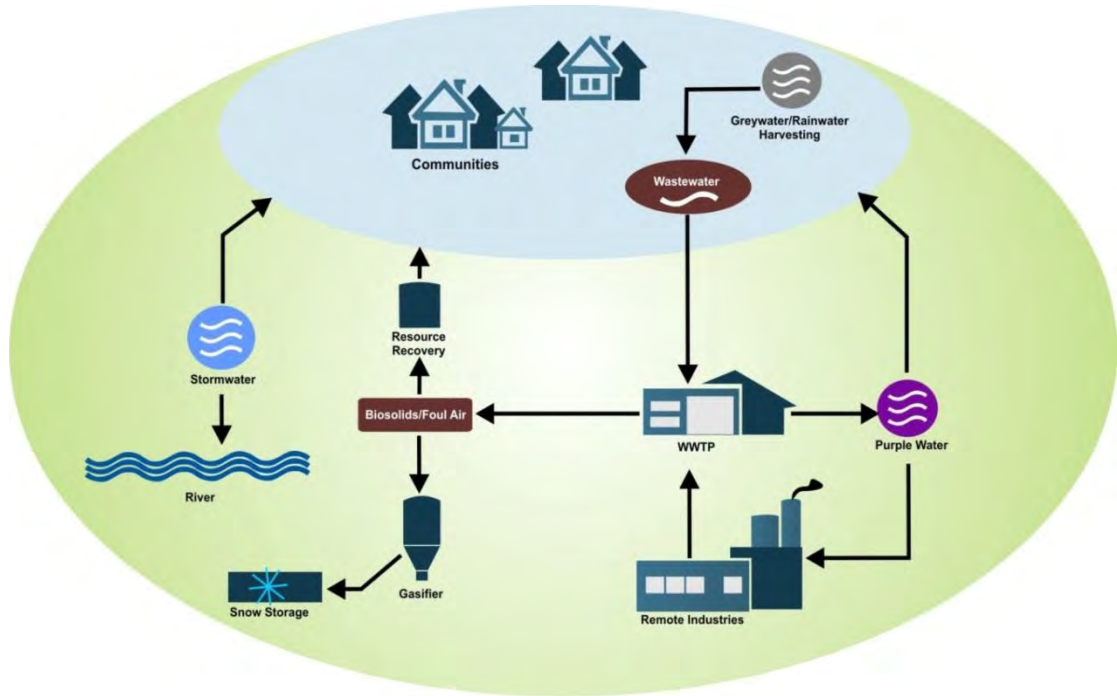
- Initiate pilot testing;
- Consult and educate the public;
- Consult with regulatory agencies and advocate for regulatory change or modification;
- Review engineering and development standards;
- Conduct triple-bottom-line analysis to aid in decision making; and
- Develop policies to guide implementation.

Within the Wastewater Master Plan, specific opportunities focused on water reuse, solid waste/biosolids resource recovery, and greenhouse gas reduction. The green initiatives envision the following possibilities within the wastewater management system:

- Gasification of wastewater biosolids to produce energy to power and heat greenhouses and communities. The energy from the gasifier can also be used for melting snow at the snow storage operation.
- Gasification by-products can be used for further recycling.
- Resource recovery (RR) including nutrients, organics and energy of the solid waste from wastewater treatment plant.
- Reclaimed water from the wastewater treatment plant can be reused for industrial process water, and for commercial use.
- Greywater reuse and stormwater reuse concepts can help reduce demands on potable water for irrigation, flushing toilets/urinals, and cleaning.

Figure 3-1 illustrates a simplified Wastewater Ecological Model that emulates the ecological model described above.

Figure 3-1
Simplified Wastewater Ecological Model

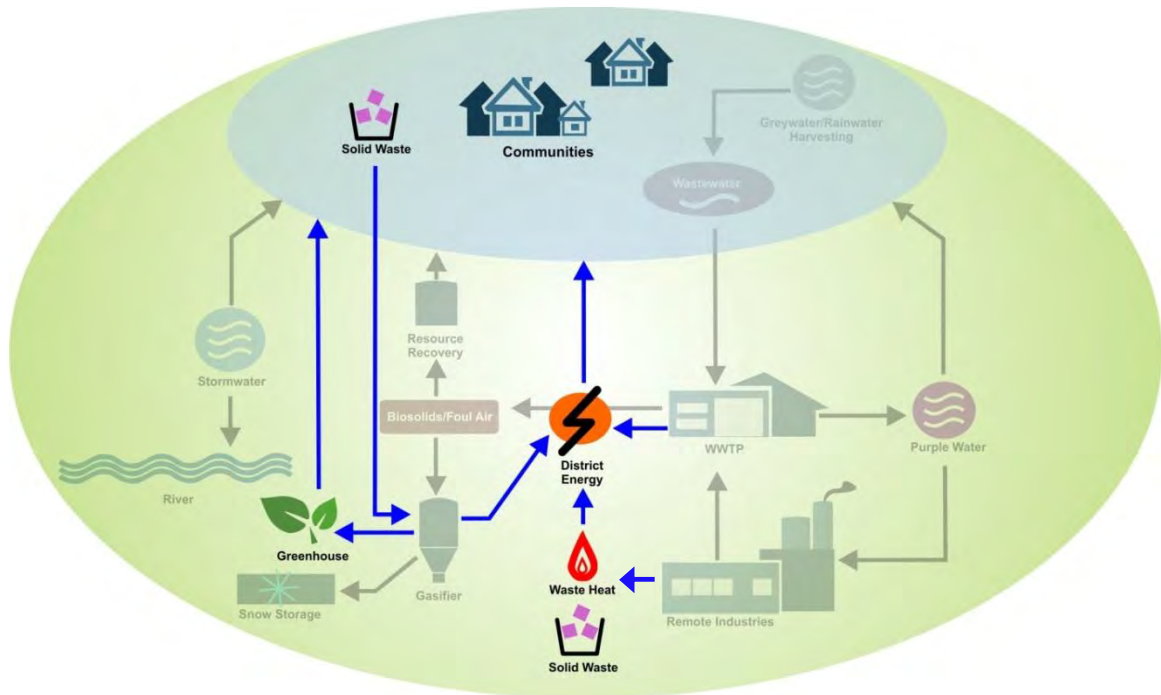


The components of the Collaborative Model to be incorporated with this Wastewater Ecological Model, as an ultimate plan are:

1. Municipal and industrial solid waste
2. Greenhouse operation
3. District energy
4. Industrial wastewater
5. Industrial waste heat

Figure 3-2 illustrates a collaborative ecosystem. This model not only addresses the ecological responsibility, but also considers the social and economic prospects with less reliant on non-renewable resources. There are also potential opportunities to invest in social capital by providing monetary incentives (e.g. tax relief programs), and sharing information/resources with the public to create social enterprise in green businesses within the community. Studies in the US showed that social enterprise is gaining major momentum in contributing to the economy with approximately \$500 billion in revenue and upwards of 3.5% of the national GDP. In Canada, social enterprise contributed \$106.4 billion to Canada's GDP in 2008 or 7.1% of Canada's economic activity (McKinnon, S. Report R11-01).

**Figure 3-2
Collaborative Ecosystem (Ultimate Plan)**



4 Next Steps

The Municipality has a vision and is committed to a sustainable community. It is also resourceful in seeing the opportunities and having the curiosity to discover them. Associated Engineering understands that the Municipality has already initiated an internal workshop to discuss the green opportunities within the Collaborative Ecosystem Model. The workshop would initiate critical conversation that allows the Municipality to begin its journey. Our goal is to assist the Municipality in achieving the ultimate plan (the Plan) from a holistic approach.

The following provides a general guidance to this internal conversation with the understanding that the Municipality is already in the midst of such activities:

1. Establish a task force or champion(s) who will be committed to lead in the development, maintenance, and implementation of the Plan.
2. Identify the key multi-level stakeholders that would have impact or be influenced by this plan.
3. Request for clear direction and messaging from Council and upper management to ensure consistency across the organization and that their visions are understood and implemented.
4. Invite the key stakeholders to a series of collaborative workshops that would be led by the task force. A suggested workshop format is discussed in Section 4.1.
5. Develop and maintain the Plan and continue conversation with the stakeholders.

6. Develop a priority list with realistic schedule and milestones.
7. Identify performance measures and metrics. Develop a plan to monitor performance.
8. Execute the Plan.

4.1 COLLABORATIVE WORKSHOP FORMAT

There are many workshop or discussion formats that the Municipality can adopt that would result in the similar outcome. In this report, we are suggesting a collaborative workshop process that adopts the concept of a Logic Model to systematically identify desired end goal or outcome with specific tasks and timelines for implementation. This modified Logic Model helps the team to first identify the desired outcome, and then working backwards to identify specific output (deliverables) and activities at different sequential phases of the project with respect to time. The diagram below illustrates the concept.

Figure 4-1
A Modified Logic Model for Workshop Format



A timeline will be established throughout each phases of activities and deliverables. The timeline could span 2 to 3 years, 5 to 10 years, or greater than 10 years. The critical path is then identified, and priorities are being set. A life-cycle analysis can be conducted to evaluate its cost-benefit based on a time scale.

There are inherent risks and challenges to the project that need to be identified for each output and activity. The risk management process recognizes an ever changing environment that can impact the outcome of the projects. These parameters are:

- Population
- Technology
- Stakeholders
- Costs (technology, labour force, raw material, etc.)
- Regulatory regime and requirements
- Land use
- Local government

The risks can be rated from high to low probability of occurrence with respect to its potential financial, environment, and social disruption or damage. Subsequently, mitigation measures would be established to reduce or eliminate the risk; however, understanding that some risks cannot be mitigated.

Performance success can be measured qualitatively or quantitatively. An example of qualitative measurements can be behavioural change, but this measurement is often subjective, and may skew the evaluation. A public survey may be conducted at the onset of the program to establish baseline; subsequent survey can then be conducted to measure change. Quantitative measurement may include parameters such as percentage, ratio, number of events implemented, CO₂ reduction, water utilization, energy utilization, etc. Similarly, a baseline measurement is recommended to monitor progress and performance. These metrics can be identified, substantiated, and agreed upon with the stakeholders during the workshops.

TECHNICAL MEMORANDUM

Closure


The green initiatives within the Collaborative Ecosystem model are recognizably a living document and will need to be flexible to address change and emerging issues. It will have success with collaboration and innovation. The Municipality's vision for a sustainable community using the Collaborative Ecosystem Model is admirable. As was presented by the Municipality, *"the municipal is young and is in the position to embark on these initiatives with collaboration. The opportunities are unbounded."*

This report was prepared for the Regional Municipality of Wood Buffalo to provide an overview and guidance for implementing green initiatives.

The services provided by Associated Engineering Alberta Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering Alberta Ltd.



ASSOCIATED ENGINEERING QUALITY MANAGEMENT SIGN-OFF	
Signature:	
Date:	<u>Aug. 12, 2014</u>
APEGA Permit to Practice P 3979	

Juliana Tang, M.Sc., P.Eng., LEED AP
Geo-environmental Engineer,
Sustainable Practice Specialist



Associated
Engineering

GLOBAL PERSPECTIVE.
LOCAL FOCUS.

TECHNICAL MEMORANDUM E.1.5

References

For more information, refer to:

<http://carleton.ca/3ci/wp-content/uploads/3ci-Social-Enterprise-Primer1.pdf>