

# **BIOSOLIDS MASTER PLAN Stakeholder Advisory Committee: What Was Heard**

Prepared by:

**MICHELLE HOLLAND CONSULTING INC.**  
Public Engagement | Communications | Facilitation

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## 1.0 Introduction

The City of Winnipeg is required by the Province of Manitoba to prepare a Biosolids Master Plan by October 2, 2014 that will provide direction on managing biosolids generated by the City's three sewage treatment plants to the year 2037.

As part of a process to gather input from the public, in September 2013, the City of Winnipeg established a Stakeholder Advisory Committee (SAC) to provide input on options for biosolids management, and on public participation in the master plan process. The work of the SAC involved learning about biosolids management and regulation, including current and past City of Winnipeg practices and options for future management of biosolids.

Options for biosolids management involve a broad spectrum of stakeholders, and a key goal for the SAC was to bring a variety of perspectives to the table early on in the planning process to ensure input from these diverse groups would be incorporated into decision making on the Biosolids Master Plan to the maximum extent possible.

### **Stakeholder Advisory Committee Purpose:**

To provide input on options for biosolids management, and on public participation in the master plan process. Input received will be incorporated into decision making on the Biosolids Master Plan to the maximum extent possible.

## 2.0 Stakeholder Advisory Committee members

The committee included technical, municipal, citizen, regulator and resource sector representatives with an interest or stake in biosolids management topics.

Consumers Association of Canada (Manitoba)	Gloria Desorcy
Green Action Centre	Sylvie Hébert
International Institute of Sustainable Development	Karla Zubrycki
Keystone Agricultural Producers	Curtis McRae
Manitoba Conservation and Water Stewardship	Robert Boswick
Manitoba Composting Association (MCAC)	Gérard (Gerry) Dubé
Compo-Stages Manitoba Services Co-op (CSMSC)	Tanis Ostermann
Manitoba Environmental Industries Association	D.R. (Deny) St. George
Manitoba Hydro	Colleen Sklar
Lake Friendly	Dave Angus
Partnership of the Manitoba Capital Region	
Winnipeg Chamber of Commerce	

### 3.0 Process

Input from the SAC was gathered in a number of ways:

- **In-person meetings**
  - Four facilitated meetings were held from October 2013 – February 2014 and were attended by SAC members, City project team members, and guest specialist Dr. Jan Oleszkiewicz.
    - **Meeting 1:** Overview of Biosolids Master Plan process and current practices.
    - **Meeting 2:** Review of options for biosolids management and initial discussion on evaluation criteria and principles.
    - **Meeting 3:** Review of options for biosolids management continued and refining of evaluation criteria and principles.
    - **Meeting 4:** Final discussion of preferred options, evaluation criteria and principles and other recommendations.
  - In addition to meeting discussion, **presentations** were given by:
    - Dr. Jan Oleszkiewicz on biosolids management trends in other jurisdictions;
    - Curtis McRae on experiences with land application of biosolids;
    - D.R. St. George on Water & Wastewater Technology Trade Mission to the Netherlands; and
    - Robert Boswick on standards, guidelines and regulations associated with biosolids management and options.
- **Conference call**
  - Held in December 2013 for committee members unable to attend the December meeting.
- **Online surveys**
  - Three surveys to collect input on evaluation criteria and guiding principles;
  - Three surveys to collect feedback on meetings and SAC process.
- **Emailed resources, articles and links** were provided by SAC members on several occasions and circulated to other SAC members and the City project team.
- A **formal submission** was received from Gérard Dubé.

In addition, SAC members were invited to **tour the North End Water Pollution Control Centre** and to participate in **two public meetings** held in January 2014.

Information about the SAC's purpose, terms of reference, a list of members, meeting notes, project team presentations and key links were posted on the project **website** at <http://wwdengage.winnipeg.ca/biosolids/biosolids-sac/>.

## 4.0 What Was Heard

Stakeholder Advisory Committee members were asked to provide input on options for biosolids management and on public participation in the master plan process. The following is a summary of the key themes and outcomes resulting from the SAC process. No votes were held to determine the group's position on issues or recommendations to the City of Winnipeg; however, where there was consensus, it has been noted.

### 4.1 Input on public participation in the master plan process

Committee input on public participation took several forms. This included input on content, feedback and suggestions for the SAC and public participation processes, promoting public meetings to their networks, and input on the role of public education moving forward.

#### **SAC process**

Comments from committee members about the SAC process, committee composition and the content and structure of meetings provided were generally positive. A few SAC members felt an additional meeting, or having the process spread out over a longer period of time could have been helpful.

"Participants in SAC were a well-chosen mix of experts and stakeholders."

"Effective group size with fairly diverse related backgrounds."

*-Feedback received from two SAC members via online survey*

#### **Public participation materials and outreach**

SAC discussion, questions and suggestions shaped how information was shared as part of broader public participation in the master plan process in several ways. This included the development of:

- Frequently Asked Questions (FAQs)
- A glossary of wastewater terms
- Feedback survey
- Public meeting presentation and storyboards

- Advertisements and promotion related to opportunities for public participation

Committee members also provided suggestions for additional stakeholder groups and individuals to contact about public meetings, and were in turn provided with information about public meetings and opportunities for participation to share back to their networks and contacts.

In addition to contributing input on the content for public participation, a few specific suggestions were received regarding *how* information could be shared, including issuing news releases or placing articles in advance of public meetings to promote public understanding of why the Biosolids Master Plan is important.

**Key theme: A need for more public education and public participation.**

Several committee members indicated that while broad participation from stakeholder groups through the SAC and at the public meetings was encouraging, engaging the broader public early on in the process isn't easy. Similarly, other members suggested that public concerns will be more clearly articulated once decisions are reached regarding preferred options and that given the technical nature of the topic, there would be a need for ongoing public participation and public education once more is known and preferred options have been identified. Members expressed a key aspect of the process moving forward would be clearly communicating "what decisions on preferred options mean" and "keeping the conversation going" with stakeholders and neighbours.

"Although the process of public consultation was good, the participants were mostly representatives of stakeholder organizations and agencies. To me, the words 'PUBLIC' consultation means accessing the input, ideas, and opinions of individuals, taxpayers, citizens of Winnipeg. I don't feel that this has been done, as yet."

*-Feedback received from SAC member via online survey*

There were also specific suggestions that more needs to be done in terms of public education regarding the role citizens can play in diverting substances of concern away from the wastewater system, including pharmaceutical take back programs and other initiatives.

**Key theme: Consider continued engagement with the stakeholder advisory committee as Biosolids Master Plan progresses.**

Many SAC members indicated a willingness to be part of further discussions or to provide further feedback as work on the Biosolids Master Plan progresses, new information is collected, and preferred options are identified, suggesting this could be of benefit to the City in terms of formal or informal feedback on preferred options and continued input and outreach on public participation.

## **4.2 Input on options for biosolids management**

Providing input on options for biosolids management was the second key aspect of the Committee's work. This included developing guiding principles for the City project team's consideration in formulating the Biosolids Master Plan, identifying criteria for evaluating individual biosolids management options, and reviewing and providing feedback on the various options under consideration.

### **Guiding Principles**

The following guiding principles were developed by the SAC for the City project team's consideration in formulating the Biosolids Master Plan. Consensus was achieved among SAC members on these principles.

1. **Resource recovery:** The plan approaches biosolids management as an opportunity to recover and reuse valuable resources, such as phosphorous, nitrogen and energy.
2. **Long-term sustainability:** The plan is rooted in long-term economic, social and environmental sustainability, and aligned with long-term goals and plan of the City, including future growth.
3. **Biosolids supply chain:** The plan considers the entire system involved in processing and reusing biosolids, including energy, raw materials, components and decommissioning.

4. **Health and safety:** The plan ensures the importance of public and worker health and safety in biosolids management.
5. **Realistic, achievable:** The plan is reliable, realistic and achievable.
6. **Adequate assessment of risk:** The plan adequately assesses and mitigates risk, including operational, financial and environmental.
7. **Mixed/integrated solutions:** The plan includes more than one option for biosolids management for greater adaptability.

### **Evaluation Criteria**

The following criteria were identified by the SAC for the City project team's consideration in evaluating individual biosolids management approaches that may be included in the Biosolids Master Plan. Perspectives on individual criterion and the relative importance of each differed. The evaluation criteria developed by the SAC were shared as part of the public meeting materials in January.

1. **Operational factors:** Manageable level of operational complexity, proven technology, reliable.
2. **Time to implement:** How quick can the option be implemented? Short (one to two years), medium (two to five years) or long term (five years or longer).
3. **Regional suitability:** Suited to Manitoba climate, resources and other regional factors.
4. **Stakeholders involved:** Who is involved, opportunity for private sector involvement or partnership.
5. **Regulation:** What regulations are involved and compliance with regulations.
6. **Good neighbour practice:** Ability to mitigate neighbour concerns.
7. **Ecological sustainability:** Makes a net positive contribution (e.g. nutrient recovery, energy recovery) and minimizes environmental impacts.



8. **Cost:** Are costs consistent with current costs for biosolids management, or approximately double or triple the current cost?

**Key theme: Composting and thermal oxidation, including hydrolysis, generated the most discussion as options for biosolids management.**

Very few members indicated a particular preferred option for biosolids management, with several members suggesting “more information would be required” in order to do so. However, amongst all the presented options, thermal oxidation and composting generated the most questions and discussion amongst the SAC.

Some of the comments regarding composting included the ability to build and replenish soil as a distinct advantage. Markets for compost, quality control of the product (it was noted that an “in vessel” approach is one way to potentially guarantee quality) and the potential use of regionally-sourced bulking agents such as agricultural by-products (e.g. straw) were key considerations mentioned by SAC members.

Discussion around thermal oxidation focused around the potential to use biosolids as fuel, and the subsequent recovery of energy for a useful purpose. This discussion encompassed both oxidation and hydrolysis. Some SAC members questioned the viability of these alternatives given Manitoba’s low energy costs. Another comment was that this option would represent the least potential liability for the City. The need for public education to mitigate “not-in-my-backyard” responses to the visible stacks that are part of thermal oxidation facilities, and the potential costs associated with emission controls were also mentioned as considerations. Still others suggested this option may be the most appealing to the broader public and could be “easiest to do”, or implement.

**Key theme: Landfilling as least preferable option.**

Consensus was achieved amongst all SAC members with regards to landfilling as a “last resort”, and the least preferable option for biosolids management.

### 4.3 Additional considerations for the Biosolids Master Plan

The SAC raised a handful of key issues and themes that were not specific to any one option, nor to the public participation process, but were raised as recommendations for the project team's broader consideration in the preparation of the Biosolids Master Plan.

**Key theme: Consider the overall waste management context in decision making.**

Considerable discussion focused on a broader context for biosolids management. This included biosolids as an integrated component of overall waste management for the City, and the need to consider a department-wide approach. Integrated full-scale anaerobic digestion and composting of organics, including green cart or kitchen waste, and wastewater sludge was discussed at some length, and was the subject of a formal submission.

Examples of integration and long-term planning were shared from a recent water and wastewater technology trade mission to the Netherlands and the idea of composting or vacuum toilets as part of future "sustainable communities of choice" was raised. The SAC noted in particular that there would be value in sharing with the public that these ideas and approaches were discussed and considered as part of the SAC and Biosolids Master Plan process.

**Key theme: Consider a phased approach to biosolids management that allows for adaptability.**

A number of SAC members spoke about the need for long-term thinking on biosolids management that considers how shifts and changes may affect biosolids management for the City, including future growth, shifts in social norms and behaviours related to the environment and sustainability, increased regulation, and new information about emerging substances of concern and public health. Taking a phased approach, considering "best available options" and otherwise ensuring adaptability of individual and overall solutions were all

"The more I learned about the decisions to be made, the more I realized that any decision made now must be continually re-evaluated in the light of new information, new technology, and changes in other aspects of waste treatment, diversion, and disposal."

*-Feedback received from SAC member via online survey*

ways SAC members expressed this sentiment. This was discussed in relation to the City's composting pilot, but also more broadly for the plan.

**Key theme: Quantify overall ecological and economic sustainability.**

Defining overall ecological sustainability, and making clear the connections between ecological sustainability and economic viability, were key elements of SAC discussions the process. "Make it real" was how one committee member put it. Quantifying sustainability in both the evaluation of options and in communicating preferred options to the public was strongly suggested by several SAC members. Suggested components in this calculation included the potential for Manitoba partnerships, compliance (and cost of non-compliance), energy offsets, benefits to the City and region in opportunities and jobs.

## Appendix A - Formal submission and response

### Formal submission by SAC member Gérard (Gerry) Dubé (January 23, 2014)

*BIOSOLIDS MASTER PLAN OPTIONS: Anaerobic Digestion(AD) and Composting*

*Content: Review of existing situation*

*Compatibility of AD and Composting*

*Ecosystems benefits*

*Evaluation to the guiding principles and criteria*

*Life Cycle Assessment(LCA): all options*

*Review:*

*It seems to me that the City of Winnipeg has segregation within its “waste” departments (ei biosolids, used food resource, leaf and yard nutrient recovery, parks... ). A more unified vision of all these departments would facilitate a better cooperation towards a more economically and environmentally sustainable future.*

*Point in case- a CH<sub>4</sub> collection system has been installed at the Brady landfill , piping is installed once a certain area is covered , the gas is collected and burned off. According to “Putting the Landfill Energy Myth to Rest” (1), within the existing system of the Brady Landfill (not bioreactor landfill set up) this is the least efficient way to collect methane. We now as well bury, within that system, the “biosolids” from the Waste Water Treatment Plants. We then haul many truckloads a week of leachate from Brady back to the WWTP. The leachate is derived from all organics(food waste, carcasses, biosolids) buried at the Brady landfill. The result is that much of the leachate will go full circle many times in one year. (Note: both CH<sub>4</sub> collection and moratorium on biosolids land application resulted from provincial regulation)*

*The city is poised to start a food waste collection system within the next year, it would be a good time to decide if the food waste will go to composting or to AD. Encouragingly – the City has setup a permanent compost site for leaf and yard waste at Brady.*

*Let rearrange this scenario. Let’s take all organics of Brady. We are already composting leaf and yard waste. Remove the food waste (FW) fraction from Brady; the FW could be digested with the WW, tripling the energy production of the AD – making it a net energy producer. This mix (FW&WW) would further dilute the problematic contaminants (3) from the WW which subsequently, through the composting process, would further reduce contaminants. The more diverse the resources (wood chips, leaf and yard waste, straw...) used in the composting process with the digestate, the greater the biological biodiversity in the compost end product will be. (Will explain biodiversity benefits in LCA). Carcasses can also be removed from Brady and composted on farm site.(2) If this is done – at least that we plan for this – we could eliminate the need for leachate and methane(CH<sub>4</sub>) collection.(eventually). What would be trucked to the landfill, at that point, would be non organic.*

*Compatibility of AD and Composting*

*“Biogas production would strip out odorous “volatile fatty acids” (VFA’s) that are problematic to composting, and convert them directly into methane energy. Theoretically, the resulting residue would be more readily- and less odourously- compostable.” See the entire article (4). In this article , Will Brinton speaks specifically of food waste. The city will be doing trials on biosolids composting at the Brady landfill using a negatively aerated static pile(AST)- this method is well chosen because it permits the system to filter (compost-woodchip filter)the air flowing out of the piles allowing good control over possible odors. And odor is by far the greatest and most challenging issue when it comes to any organics recycling. Once those organics composted (through an appropriate well controlled process) the end product has a healthy earthy smell. (note: the biosolids composting trials in the AST would do best under cover- one heavy rain could saturate the pile resulting in serious odor issues; raw materials to be used for AD should also be stored inside a negatively aerated building)*

*Ecosystems Services of composts*

- High nutrient retention and cycling
- Volume reduction & moisture reduction
- Water retention, filtration, and permeability (5-slides 20&21,&6)
- Rich earthy smell (non odourous)
- Better tillth and aggregation (energy savings)(5- slide19)
- Higher SOC sequestration (actual – adding compost will increase soil organic matter content (5 slides 15, 16, &17); and through soil biology “...the formation of topsoil is dependent on photosynthesis and the transport of dissolved carbon, via a microbial bridge, from plant to soil.” (7)
- Promote higher biological activity (8)
- Increased residue decomposition (ag producers in the Red River Valley are burning straw- the biology in those soils has been seriously compromised therefore crop residue does not breakdown creating some issues for the growing crop =no nutrient cycling, more dependency on commercial fertilizers & pesticides+ more compaction= more energy use(increasingly harder to till+ use of fossil fuel based inputs)
- Slow release and storage of available (+ to be available ) nutrients (biology at work)(8)(11)
- Disease suppression (9)(10)- this is an increased field of study- demonstrating that symbiotic relationships develop between plants and soil biology to promote disease suppression via “systemic acquired resistance”(SAR)or Induced Resistance, competition, antibiosis(production of antimicrobial compounds), and parasitism. “ Plant disease suppression is considered to be a direct result of the activities of microorganisms which naturally recolonize compost during the cooling phase”(10)

#### *Evaluating to the Guiding Principles and Criteria*

*Environmental degradation has only increased in the last years from loss of top soil due to SOM depletion (50% of original native levels) across the planet; loss of diversity through species extinctions, increasing GHG emissions (Canadians being 4<sup>th</sup> from the top of the list on per capita emissions), pollution of waterways... to name a few...*

*It is therefore imperative, that when we engage in a long term project, that we understand all aspects of any project’s sustainability in a changing world. The Biosolids SAC has set Guiding Principles to better encompass the desired objective; according to the CCME report , AD and Composting(of digestate) is the BMP in dealing with contaminants from WWTP. I would argue that it is also the BMP for all organic waste- for an efficient resource recovery plan.*

*Long term sustainability- AD and composting are well known technologies (already practiced by the City of Winnipeg). The two systems are compatible (4). There are a multitude of systems in place across the planet and in areas that have similar weather constraints(Scandinavian countries). We have a tremendous amount of examples and knowledge from which we can base our systems’approach.*

*We can produce energy (CH4) and reduce energy consumption(12)- through compost use , we reduce fossil fuel use through the diminished use of commercial fertilizers(Koch Industries who produce nitrogen fertilizers is Manitoba Largest GHG emitter), pesticides, irrigation, fuels for cultivation, etc. Adding compost to the land increases SOM which is THE measure of soil productivity. As Dr. Katherine Buckley (AAFC Brandon) stated “...applications of compost(s)... are of utmost importance in maintaining tillth, fertility, and productivity of agricultural soils, protecting them from wind and water erosion, and preventing nutrient losses through runoff and leaching . These materials have predictable beneficial effects on soil physical properties such as increased water holding capacity, soil aggregation, soil aeration and permeability and decreased soil crusting and bulk density.”(Proceedings of the 2005 Organic Matters on the Prairies) page 36. There is a need to reduce the dependence of commercial fertilizers and pesticides to diminish the use of energy and potentially create fertility close to where it is needed. Winnipeg is the CAFO for the Red River Valley!*

*Mixed –Intergrated Solution. We have already address the compatibility of AD and Composting(4) and CCME’s BMP for reducing contaminant pressure.*

*Resource Recovery-* The ecosystems services provided by a quality compost end product addresses this legitimate concern. However adding concentrated nutrients (ie-phosphorous, nitrogen- and depending the quality of those) to the soil will have a long term negative impact on the SOM- (7) “impoverishment of agricultural soils”p.3 (13)[www.soildoctor.org](http://www.soildoctor.org) - Doug Weatherbee offers how soil functions in a 45minute video) Certain forms of phosphorous and nitrogen inhibit soil carbon sequestration; using quality composts promotes SOC sequestration through microbial channels.

*Health and Safety-* As stated before, there are many AD & Composting existing operations where we can access information on “health and safety” concerns. The North End WWTP has already set up health and safety protocols as it pertains to AD technology. CCME has guidelines and courses(Composting Facility Operator Training Course; May 2013 at AAFC Brandon) are offered on a regular basis.

*Realistic and Achievable-* YES and YES

*Adequate Assessment of Risk-* AD technology is not recent; it has been around for hundreds of years in India and China. So has composting- of course and like everything else scaling up these technologies has created some risks , and here again , because we have now many systems functioning in North America - we have loads of information on what not to do, and on the same parallel , we have also many entities that prove these systems work. There also many systems to choose from that could be suitable to our particular situation.

*Evaluation Criteria-* this would be a discussion point in assessing all possible options. Using dewatered digestate (not composted biosolids) has an odour issue that can cover the whole spread area. Composting the biosolids, prior to agricultural use, would concentrate that issue to one area- and using the composting system (ASP as in the Brady trials) would be very efficient at controlling odors with the negative air flow exhausting through a biofilter.

*Life Cycle Assessment(LCA)*

The International Standards Organization (ISO) developed a LCA template (ISO 14044- 2006) to aid in the better understanding the complex issue related to the evaluation of decision-making processes regarding the environmental performances of proposed activities. In one particular study (using the ISO 14044), “Using LCA to evaluate impacts and resources conservation potential of composting: A Case Study of the ASTI District in Italy” (14) “...In order to address present and future solutions, it becomes therefore fundamental to assess the environmental performances of the current management of organic waste from separate collection,... the need for actual and reliable data on materials and energy input, as well as gross and net gains from materials recovery, including benefits arising from use of compost in farming activities, was probably the major drawback that had to be faced. ... The results may help public administrators to better understand the suitability of using LCA tools when dealing with solid waste management strategies.”

Several issues appear from the abstract of this study. Environmental impacts of waste collection and disposal (or other) have been addressed already. The city of Hamilton(15) has done extensive work in regards to those issues. From the study from the Asti Region , we can see the value of the LCA model... However the study shows its deficiencies in addressing benefits of compost use. One of the difficulties arises from failed attempts at monetizing the benefits (compost use will have varied impacts on land because of soil types, weather, crops grown, management, etc...) and it is most likely to be measured using a conventional NPK model.

The Australian (CFI) and Portuguese(Terra Prima) Governments have developed programs to measure carbon sequestration and set a price on carbon. W. Silver’s Carbon Marine Project(17) and Rodale Institute’s 9 year research on carbon sequestration(18) demonstrate how compost is a considerable tool for carbon sequestration. Studies(7, 8, 9, 10, 11,16...) demonstrate that diverse and beneficial biology , supplemented and activated by composts, can suppress diseases, protect the plants from heavy metal uptake, provide necessary nutrients to the plants, hold and filter water resources, and sequester carbon. In our assessment of choosing options , we absolutely need to account for the ecosystems services that quality composts provides- despite the difficulties in monetizing those benefits.(19)

Acronyms: AD – Anaerobic Digestion;  
 ASP- Aerobic Static Pile  
 BMP- Best Management Practices  
 CAFO- Concentrated Animal Feeding Operations  
 CH<sub>4</sub>- Methane; Natural Gas  
 FW-Food Waste  
 ISO-International Standards Organization  
 LCA- Life Cycle Assessment  
 LYW-Leaf and Yard Waste  
 SOC –Soil Organic Carbon  
 SOM- Soil Organic Matter  
 WW- Wastewater  
 WWTP- Wastewater Treatment Plant

REFERENCES:

- 1- "Putting the Landfill Energy Myth to Rest"; *Biocycle Magazine*, May 2010, p.23, Dr. Sally Brown
- 2- Manitoba Composting Association Website- [www.manitobacomposting.com](http://www.manitobacomposting.com)
- 3- Here I am just referring to public education in regards to what not to flush down; also on listing the Emerging Substances of Concern(ESOCs) –without the knowledge of the presence of ESOC's, the public does not have the necessary information to make educated decisions... or even lobbying industry to eliminate them (e.g. fire retardants,...
- 4- "Compatibility of Digestion and Composting"; *Biocycle Magazine*, Dr. Will Brinton
- 5- Eastern District Conservation District PowerPoint Presentation (Gerry Dube) Attached with this presentation
- 6- "Pay Dirt", Key Findings, Institute of Local Self Reliance- full report- [www.ilsr.org/paydirt](http://www.ilsr.org/paydirt)
- 7- "Soil Carbon- can it save agriculture's bacon" Dr. Christine Jones (attached)
- 8- "Deciphering the Rhizosphere Microbiome for Disease Suppressive Bacteria" can be found at [www.soildoctor.org](http://www.soildoctor.org)
- 9- "Intraspecies Variations in Border Cell Production: Rhizosphere Microbiome Implications" (attached)
- 10- "Suppressive Composts: Microbial Ecology Links Between Abiotic Environments and Healthy Plants" Yitzhak Hadar and Kalliope K. Papadopoulou (2012 publication)
- 11- [www.soildoctor.org](http://www.soildoctor.org) (45 minute video on plant & microbiology symbiotic relationship with Doug Weatherbee)
- 12- "Composting for Feedlot Manure Management and Soil Quality" T H Deluca & D K Deluca "Alliance of Crop, Soil, and Environmental Science Societies (ACSESS) published 19/04 2013 quote from abstract: "... the use of composted manure improves soil quality, and greatly reduces total energy consumption compared with the use of commercial fertilizers. A hypothetical example illustrates how compost applications to irrigated corn could result in a net energy savings of about 3.3 million BTU/acre, which is equivalent to energy contained in 19.4 gallons of diesel fuel/acre."
- 13- same as (11)
- 14- "Using LCA to Evaluate Impacts and Resources Conservation Potential of Composting: A Case Study of the Asti District in Italy." Gian Andrea Blengini "Resources, Conservation and Recycling" #52, (2008) 1373-1381
- 15- "Niagara-Hamilton Waste Plan Environmental Assessment Study" (google) (Appendix V- results from LCA Analysis MSW-DST: Original & Improved Systems Assumptions)
- 16- "Possible Role of Root Border Cells in Detection and Avoidance of Aluminum Toxicity" Susan C. Miyasaka and Martha Hayes
- 17- "Carbon Sequestration in California's Rangeland Soils" Whendee Silver, Department of Environmental Science, Policy, and Management. U. of California, Berkley
- 18- Rodale Institute "Rodale research paves the way for Pennsylvania's "Path to Organics" (google)
- 19- "Valuing the US Compost Industry" Ron Alexander; *Biocycle Magazine*, Dec. 2009, p.25

**City of Winnipeg response to formal submission by SAC member Gérard (Gerry) Dubé (February 13, 2014)**

*Hello committee members,*

*Thanks once again for your time spent and insight provided on the Biosolids Stakeholder Advisory Committee. At the end of the meeting last week there was some discussion around the overall waste management context for biosolids within the City – organics waste recycling, solid waste and wastewater. Last month, Gerry had prepared a very thoughtful technical submission that touched on these topics as well, and I wanted to share a few thoughts in follow up.*

*As we discussed at the meeting, integrated organics treatment and processing is ahead of the City of Winnipeg development at this time. In constructing a composting pilot facility we are taking steps to demonstrate the viability of composting here. This will provide us the confidence to take further steps towards a permanent composting operation as a long term solution in Winnipeg, together with the leaf and yard waste composting initiative.*

*The step of integrated full-scale anaerobic digestion and composting including organics and wastewater sludge will require a significant change in the City of Winnipeg disposal program. As the group discussed last week, this would require planning at the Department level. Should the Department proceed with an organic collection plan as a long term goal, then it must be implemented in a logical process to proceed with the anaerobic digestion and composting solution.*

*I will be forwarding Gerry's suggestion (and notes from the group's discussion) to the Water and Waste Department Management Team for consideration and further direction on long term development.*

*Thanks again for your input, time and consideration on this master plan.*

*Sincerely,*

*Duane Griffin*