To: Chair and Members
   Public Works Committee

From: Scott Stewart, C.E.T.
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Date: March 30, 2007

Re: Biosolids Master Plan - (PW07047)

Council Direction:
N/A

Information:
In order to meet existing commitments, accommodate future growth and address regulatory requirements, a biosolids master plan (BMP) for the City of Hamilton was developed to identify a preferred biosolids management strategy for the next 30 years and beyond.

In general, wastewater treatment entails two output trains, liquids and solids. The liquids train is discharged from the treatment plant to a body of water as “treated effluent” and regulated by the Ministry of the Environment (MOE) under site specific Certificates of Approval (CofA). The solids train is treated and dewatered producing a by-product known as “biosolids”. Currently, biosolids generated by the City of Hamilton are utilized as a soil amendment or beneficial soil additive for agricultural land application. The average annual dry biosolids production at the Woodward Avenue Wastewater Treatment Plant (WWTP) is approximately 12,500 tonnes/year of dry solids or approximately 50,000 wet tonnes/year, representing a total of 1200 to 1250 truck loads per annum from the WWTP.

Two recommended management solutions have been put forth by the BMP’s Stakeholder Advisory Committee (SAC): land application of Class “A” biosolids (US EPA term to define a higher stabilized product) and/or thermal reduction (incineration). These recommendations were presented to the public at Public Information Centres in September 2006. The options were well received, and the constraining issues (decreasing available land base, trucking cost, odour, metal and pathogen concerns) associated with continuation of the present land application program and any potential ‘Class A’ production program were acknowledged by the public. Recent significant advances in thermal reduction technology have also served to increase the public's perception of its viability and application.
The preferred BMP management strategy will be finalized through further assessment of the above recommended BMP alternatives. Considering that each of the alternatives is likely to be located at the Woodward site, (except for any storage facilities related to land application programs, which due to the size would need to be sited elsewhere in the City), it becomes imperative that the biosolids handling solution arising from the BMP must be effectively incorporated into the overall plant footprint. As Phase 3 of the concurrent Schedule C Environmental Assessment process for the Combined Sewer Overflow and Woodward Avenue Wastewater Treatment Plant (WWTP) expansion (herein referred to as Woodward WWTP Expansion) is ongoing, additional assessments of the BMP alternatives will be further studied in collaboration with that project to ensure that all future plant expansion processes are adequately sized and configured. The resulting preferred BMP management strategy will then be brought before the Public Works Committee and Council for approval in the summer of 2007 and in conjunction with the Woodward WWTP Expansion.

**Current Practice**

The City of Hamilton’s Woodward Avenue Wastewater Treatment Plant currently services a population of approximately 480,000. Treatment process solids from the Waterdown WWTP and Dundas WWTP are blended with the solids produced at the Woodward WWTP and anaerobically digested (without oxygen at 35°C for 15 days to reduce pathogens) to form a Class ‘B’ biosolids. At present, the biosolids are dewatered and, under contract to the City, applied to agricultural land or stored temporarily at the contractor’s Power Grow Systems Facility located in Niagara Region. When seasonal or climatic circumstances preclude land application, the biosolids may be landfilled by the City’s contractor as a contingency.

**The Problem**

Generally, wastewater treatment entails two output trains, liquids and solids. The liquids train is discharged from the plant to a body of water as “treated effluent” and regulated by the Ministry of the Environment (MOE) under site specific Certificates of Approval (CofA). The solids train is treated and dewatered producing a by-product known as “biosolids”. Biosolids must be managed in an environmentally sustainable, reliable, and cost-effective manner and are subject to stringent Provincial and Federal regulations. Historically, the City incinerated its biosolids up to 1996 when the infrastructure refurbishment necessary to meet regulatory requirements was deemed cost-ineffective when compared to land application. Since 1996, biosolids generated by the City of Hamilton have been utilized as a soil amendment or soil additive in agricultural land application. The average production at the Woodward Avenue WWTP is approximately 12,500 tonnes/year of dry biosolids or approximately 50,000 wet tones biosolids/year, representing 106 truck loads per month or 1200 to 1250 truck loads per annum.

The management of biosolids land application is increasing in complexity. Recently implemented Provincial legislation (for example, the Nutrient Management Act [NMA]), creates greater competition for land from other municipalities, continuing concerns with certain biosolids constituents levels (metals and pathogens) and biosolids odour have limited the future land bank available to the City for the spreading of biosolids. Off-season and inclement weather storage costs, increasing transportation distances and stringent approval requirement for securing land are further complicating and increasing
the risk of the application process. In addition to the above-mentioned pressures, one of the major elements to sustaining this alternative is the dependence on a volunteer farmer base which has proven difficult to secure and maintain because of application timing logistics and neighbour odour concerns. During off-season or times of inclement weather when land application is not feasible, or when biosolids storage is precluded, the City’s contingency of landflling has been used.

The overall sustainability of this management approach, especially over the medium- to long-term, is tentative and uncertain. While the City’s experiences with land application over the past 11 years have been generally positive, opportunities to continue the program are limited; this due primarily to the growing constraints of increasing regulation and decreasing land availability. In order to better meet existing commitments, accommodate future growth, and address regulatory requirements, a biosolids master plan (BMP) was developed for the City of Hamilton to identify the preferred management strategy for the next 30 years and beyond.

The Objective

Through a Master Planning approach under the Municipal Engineers Association’s (MEA) Municipal Class Environmental Assessment (Class EA) process, a long-term strategy for the environmentally sustainable, reliable, and cost-effective management of the City’s biosolids is being identified.

Approach

The City retained the services of Hydromantis, Inc. and XCG Consultants Ltd. who, together with input from other specialists and a Stakeholder Advisory Committee, evaluated feasible biosolids processing options and end uses in order to determine the most appropriate long-term management strategy for the City. The BMP Stakeholder Advisory Committee (SAC) was comprised of staff from relevant City departments (Health, Regulatory, etc.), industry health and safety representatives, biosolids and consultant specialists, academics and interested members of the public. The Ministry of the Environment, the agricultural practitioners and neighbouring municipalities where Hamilton biosolids are applied and City Council were also represented on the SAC.

The Master Plan, as framed by the MEA’s Municipal Class EA, entails a two-phase process with problem/opportunity identification undertaken in the first phase, and alternative solution/strategy identification, evaluation and the selection of a preferred solution/strategy undertaken in Phase 2. Public consultation is an important component of the process and the City typically endeavours to extend beyond minimum EA requirements. During Phase 1 of the BMP, discretionary Public Information Centres (PICs) were held in March 2005 at three locations to engage the public in the problem/opportunity definition process. A second round of PICs was held in September 2006 during Phase 2 of the study and offered further opportunity for the public to participate and provide input. Refer to the Relevant Consultation portion of this report for further detail.

Methodology

The BMP project team has prepared a total of 17 Technical Memoranda (TMs) as a means to convey information on the regulatory environment as it pertains to the management of biosolids and to provide information with respect to the management
options. The data was vital to making an informed evaluation of the alternatives. The following provides a chronology of the BMP process.

**BMP Phase 1 - Problem/Opportunity Identification**

The first six TMs addressed the problem/opportunity identification requirements of Phase 1 of the EA process and provided factual information on the following topics:

**TM 1 - Existing Conditions and Practices:** Identified the management of the City’s current biosolids program, including quantities, quality, land application practices, design parameters for treatment processes, and the operating costs for the current program. The TM outlines how sludge produced at the Dundas and Waterdown WWTPs is trucked to the Woodward WWTP and pumped directly to the digesters, the combined biosolids are then dewatered and hauled to land application or storage when required. The average production at the Woodward WWTP is approximately 50,000 wet tonnes/year.

**TM 2 - Projected Future Biosolids Quantities:** Assesses treatment capacity and process improvements in light of the projected increases in biosolids production associated with growth over the next 30 years (population projections were taken from the Places to Grow legislation and subsequently GRIDS). With the projected increases in population and sewage flow, the City can anticipate significant increases in volume and mass of the biosolids generated. Without the addition of alternative technologies for volume and mass reduction, the 2035 biosolids production is estimated at over 94,000 wet tonnes per year based upon the City’s current growth rate.

**TM 3 - Current Land Application Practices:** Describes in detail the land application practice of the current biosolids management program, including present and projected future costs and sustainability. Biosolids generated at the Woodward WWTP are applied directly to agricultural land or stored temporarily at the contractor’s Power Grow Systems Facility (PGSF) prior to land application, or they are landfilled as a contingency. The land application sites for the Woodward WWTP have historically been located in the Regional Municipality of Niagara, the City of Hamilton and the Counties of Haldimand and Norfolk with storage during off-season at the contractors and PGSF. The total amount of biosolids land applied was low in some years relative to other years, due to wet weather conditions that restrict the land application of biosolids.

**TM 4 - Current and Evolving Trends in Biosolids Management:** Reviewed the broad practices, procedures, trends, policies and criteria used by other jurisdictions across Canada, the US and Europe, and evaluated these conditions in light of the City’s objectives over the planning period. It was determined that preferred biosolids disposal/utilization options will remain highly region specific and future wastewater treatment facilities will be designed and operated in order to minimize biosolids production. European countries are increasingly interested in nutrient (phosphorus) recovery/extraction from biosolids and this practice may be adopted in North America, if proven viable. Municipalities that would like to utilize land application will need to be more proactive with the public in order to secure adequate quantities of land. The amount of land available for spreading will be limited due to new regulations (e.g. NMA) and while the Greenbelt legislation may limit some conversion of agricultural land to residential use, there is a net result of increasingly extended transport requirements. Land availability is further challenged by the City’s geographical location in that
additional agriculture land can only be acquired through increased distances to the southwest only, as the north is confined by Lake Ontario, to the north and west by urban centres and to the east and south-east by the United States and Lake Erie. For example, after allowing for manure application and for the current residual nutrient contents of applicable soils, less than 7000 ha are available for biosolids application in the City. To meet the present biosolid spreading requirements, at least 18% of this land would be required, rising to 32% in 2035 and realizing a considerable volunteer base requirement. Securing additional land is also highly dependent on farmers in the target area volunteering to have biosolids applied to their land, and on land with the minimum required characteristics being available.

**TM 5 - Current and Future Practices in Ontario Municipalities:** Reviewed in detail the practices and planning undertaken in biosolids management by the City’s neighbouring jurisdictions, and identified the relevance and opportunities available for the City. The review found 7 of the 10 reviewed municipalities currently use land application (Class B) as their primary biosolids disposal route. Based on available information, this is unlikely to change significantly in the future. A City of Toronto inventory identified that there is insufficient agricultural land available in Ontario for that City’s biosolids (after allowance for nominal agricultural practices such as manure application and the requirements of soils and crops as prescribed by the NMA). The inventory identified the greatest capacity for land application of biosolids as being in the areas of Haldimand County, Norfolk County and Brant County, with moderate availability within Halton Region. Lands in the eastern Niagara, Waterloo and Guelph areas required extraordinarily extended hauling distances. As a result of the expected current and future land application of biosolids by the municipalities reviewed and land availability in the locale of the City of Hamilton, the City may encounter difficulty in finding sufficient accessible land for biosolids application in the future. Thermal reduction is currently used by 3 of the 10 municipalities contacted, and this is not expected to change for the near future. Thermally reduced biosolids ash realizes a 90% reduction in hauling and disposal weight.

**TM 6 - Regulatory Review:** Provided detail on the environmental regulations that guide the major considerations for decision-making in the City’s master planning process at present and in anticipation of future regulatory directions. Generally, there are three regulatory streams that may apply; land application, thermal reduction, and fertilizer production. Regulations in Ontario and guidelines/regulations from other jurisdictions are particularly focused on land application, and define pathogen reduction requirements and/or acceptable stabilization methods as well as maximum acceptable metal concentrations in sewage biosolids for land application. The various land application guidelines/regulations have elements in common but there are some differences in soil quality and land application site requirements, recommended land application practices and recommended cropping practices. Alternatives to direct land application are limited, consisting primarily of landfilling, thermal reduction and/or energy-from-waste. Regulations concerning these alternate process paths for biosolids are discussed in this report. In general, there are not specific regulations for the technical alternatives themselves (such as thermal reduction); however, the technical processes must meet specific codes and regulations such as those regarding air emissions. In each case it is the requirements under the [Environmental Assessment Act](#) that would govern applications of newer and evolving technologies. If residuals from any processes are to
be marketable as soil amendment products, then fertilizer regulations under the Canadian Food Inspection Agency (CFIA) must be met.

**BMP Phase 2 – Alternative Solution Identification**

The remaining 9 TMs provided detail on each of the *Alternative Biosolids Management Technologies* for consideration in the Master Planning process. These documents (TMs 7 to 15) each described and assessed in detail a particular biosolids management technology (i.e. land application, landfill, thermal reduction, various Class ‘A’ production processes) available to be considered by the City and SAC as viable options or as components of an overall preferred management strategy for the next 30 years. The consideration of a particular alternative in the management strategy was based not only upon its demonstration of technological viability and feasibility, but also upon its physical capacities and costs (both capital and operational).

**Stakeholder Advisory Committee (SAC) Activities**

The documentation in TMs 1 through 6 assisted the SAC in defining the problems and opportunities in developing a long-term strategy for the environmentally sustainable, reliable, and cost-effective management of the City’s biosolids. The SAC reviewed the TM content, provided input on biosolids management alternative evaluation criteria and participated in the selection of a short list of preferred solutions.

The proposed *Evaluation Criteria and Selection of the Preferred Solution* process framework was described in TM 16 and utilized by the SAC to evaluate the long list of alternative technologies. The alternatives were evaluated with respect to the natural environment, social environment, technical considerations, and financial implications.

The evaluation criteria matrix referenced the values of Vision 2020, sustainability and the ‘triple bottom line’ of environment, society and economy. Refer to Table 1 of Appendix A for a summary of the categories and criteria.

The BMP SAC independently reviewed, analyzed and evaluated the various options for biosolids. The results were compiled and the SAC met to collectively discuss the results of the evaluation and gain a consensus on the short list of options to be vetted through the public. The recommended solutions from the SAC, together with the analytical rationale, are summarized in Table 2 of the Appendix. These recommended solutions were presented to the public at the second round of PICs. Of particular note is the recommendation to not proceed with the current practice of land applying Class ‘B’ biosolids. This recommendation is supported by the fact that from a Triple Bottom Line (TBL) perspective, biosolids can be treated to a higher level (Class ‘A’) thereby minimizing environmental risk as well as social risk as it relates to odour generation. Additionally, emerging technologies were deemed as effective in small pilot applications but unproven in broad wastewater applications. Landfilling of biosolids was dismissed as a prime alternative as it was considered contrary to waste diversion policy.

**The SAC Recommendation**

The SAC’s short list recommended that the City undertake any one, or a combination of two approaches; these being the production of a ‘Class A’ stabilized product (a US Environmental Protection Agency [EPA] reference for an enhanced level of odour and pathogen reduction in comparison to standard stabilization processes) for further land
application, and/or thermal reduction of the biosolids as summarized in Table 2 of the Appendix.

Analysis:

The master plan developed several alternative management strategies. Refer to Table 1 in Appendix A for the evaluation criteria and to Table 2 for the list of alternatives, evaluative rationale and summary analyses considered through the master planning process.

The SAC recommendations were well received at the PICs, and the constraining issues associated with continuation of the present land application program or any ’Class A’ production program (decreasingly available land base, residual odour and pathogen concerns) were acknowledged by the public. Recent significant advances in the technology of thermal reduction have also increased the public’s perception of its viability and application.

For Committee and Council’s benefit, the recommended alternatives, the various permutations and implications of their implementation, and the impacts on existing and planned plant process are further detailed following.

**Class ‘A’ Production**

Class ‘A’ biosolids, as defined by the US EPA, have substantially lower pathogen content and can typically be less odourous than Class ‘B’ biosolids; two qualities that realize a greater level of regulatory standard and public acceptance. Class ‘A’ biosolids can be land applied with reduced site restrictions.

Any Class ‘A’ biosolids product to be further distributed by the City or through its contract would be required to continually and consistently meet the maximum acceptable metal concentrations set by the Canadian Food Inspection Agency under the *Fertilizer Act*. At present, the City’s biosolids meet those requirements readily for the majority of regulated metals, however for two specific metals, molybdenum and selenium (generally found in personal care products) producing consistent and reliable levels are yet to be achieved and remain a limiting factor for marketing biosolids as a Class ‘A’ product. In addition, the marketing of a Class ‘A’ product is challenged by a lack of customer base who would consistently purchase such a product. For these reasons, proceeding with marketing a Class ‘A’ product is not recommended and disposal would be limited to land applying to agriculture lands. In future, should opportunities for marketing a Class ‘A’ product arise, the numbers in Table 2 would require adjustment.

Two Class ‘A’ biosolids production alternatives were identified by the SAC through the BMP process; one involving the alkaline stabilization process, and a second that would involve altering the existing digestion process at the Woodward WWTP to include an enhanced temperature treatment.

**Alkaline Stabilization**

The high temperature and pH changes that occur with the addition of lime to digested or undigested biosolids result in a sterilized and low odour product. The alkaline stabilization process can be implemented in-house or through contract. There remains a need to further manage distribution/disposal of the end product, and a continuing requirement that the product meet the metal constituent levels as regulated for its end
use as a fertilizer. The alternative assumes that a consistent and reliable source of lime be available as process feed through the planning period. Perhaps less controllable is the requirement to have access to low pH (acidic) agricultural soils that will benefit from the neutralizing application of the alkaline stabilized biosolids. Such soil characteristics in Ontario are typically found only in the lacustrine clays of the southwest (Essex and Lambton) and Niagara regions.

**In-House Alkaline Stabilization**

This alternative would see an alkaline stabilization facility constructed and operated at the Woodward WWTP site. The treatment may be applied to undigested (high solids content) or digested sludge (lower solids content) with a correspondent lime volume addition requirement and associated operational cost. As fertilizers are applied seasonally and must be actively distributed, there would be further storage and transportation requirements. Further, sludge metal constituent concentrations would have to meet or exceed those stipulated by the *Fertilizer Act*, and any future revisions, as described above.

**Contract Alkaline Stabilization**

A regional alkaline stabilization plant is currently being established in Niagara through a joint venture of Walker Industries Holdings and the technology firm N-Viro, with an existing contract to take 50% of the Niagara Region’s sludge production. The facility has been sized to process higher volumes, and potential exists where the City of Hamilton may secure through contract the remaining capacity.

Under this alternative, a contract would be entered into with N-Viro and sludge would be transported from Woodward WWTP to the facility in Niagara. Under contract, the City’s sludge would be stabilized and then further distributed by N-Viro in accordance with the *Fertilizer Act*.

There are some associated risks and uncertainties; contract timeframes, contract default, facility size or process failure to handle future production volumes may require that the City have a well established and definitive contingency management program. Further, the City would need to ensure that its sludge constituent metal concentrations are maintained at or below those of present and future *Fertilizer Act* requirements, as described above. For these reasons, proceeding with marketing a Class ‘A’ alkaline product is not recommended and disposal would be limited to land applying to agriculture lands. In future, should opportunities for marketing an alkaline Class ‘A’ product arise, the numbers in Table 2 would require adjustment.

**Temperature Phased Anaerobic Digestion (TPAD)**

A second method of achieving production of the equivalent of a Class ‘A’ biosolids product is through the process of temperature-phased anaerobic digestion (TPAD). The Woodward WWTP currently operates a mesophilic (35° to 40° C) digestion process. The TPAD process consists of thermophilic (> 55° C) digestion as a first phase, further promoting a greater decomposition and conversion of acids to methane and carbon dioxide in the subsequent mesophilic phase. The TPAD process has demonstrated high rates of pathogen kill and the ability to produce Class ‘A’ biosolids if configured properly.
In comparison to conventional mesophilic digestion, the TPAD process creates a higher ammonia recycle load and the requirement for a corresponding nitrification capacity being available in the liquid train at the Woodward WWTP. Alternatively, a side-stream ammonia removal process would need to be incorporated into the design of the Woodward WWTP Expansion.

The TPAD process, as compared to conventional anaerobic digestion, results in higher methane gas production. The additional gas produced through the TPAD process could be included in the gas recovery and reuse design already in place at the Woodward WWTP and currently operated by Hamilton Renewable Power Incorporated.

There remains a need to further manage distribution/disposal (including transport) of the TPAD Class ‘A’ end product, and a continuing requirement that the product meet the metal constituent levels as regulated and marketed for its end use as a fertilizer, or similarly as applicable for further land application.

**Thermal Reduction (Incineration)**

Thermal reduction is a process for sludge management that “oxidizes” the organic matter present in the sludge. Combustion releases the heating value of the organic matter in the sludge through rapid high temperature chemical oxidation reactions, and reduces considerably the volume and weight of solid residuals for ultimate disposal, resulting in greatly reduced transport and disposal requirements. Depending upon temperature, this process can also destroy or reduce trace organic materials.

The City, using multiple hearth technology, incinerated its biosolids up to 1996 when the process infrastructure refurbishment necessary to meet regulatory requirements was deemed cost-ineffective. Fluidized bed incineration is now the state of the art technology and the type considered for any new installation. There are currently a number of biosolids thermal reduction systems in Ontario, including at the Lakeview (Peel), Highland Creek (Toronto) and Greenway (London) WWTPs.

Either digested or undigested sludge may be incinerated. There is a slightly greater net fuel consumption for digested solids relative to undigested solids. Cogeneration use of digester methane production would further off-set the costs associated with digestion incineration. Heat and energy recovery processes can also be considered in this application, and as a result of recently announced provincial initiatives related to renewable energy, staff will be further analyzing the opportunities to generate electricity utilizing thermal reduction technologies. Any additional financial benefit would be in addition to those as outlined in Table 2.

Air emissions criteria for an incinerator installation are a major consideration in the selection and cost of the incinerator system. The emissions resulting from the incinerator system operation are monitored by regulatory agencies. Technologies to control emissions are now readily available, proven, and are further designed and implemented to meet or exceed regulatory requirements. Emissions criteria have been well addressed by other municipalities in southern Ontario with the satisfactory meeting of regulatory requirements by their thermal facilities.

Unlike municipal solid wastes, wastewater biosolids generally have comparatively low levels of persistent organics and provide a more consistent feed product which in turn ensures a better control of the overall incinerator process. For wastewater biosolids, the
incinerated ash is assessed as non-hazardous waste and may be disposed of at a municipal landfill. Opportunities exist to also utilize the ash generated in cement manufacturing and road construction. These options will be analyzed prior to completing this phase of the project.

There have been recent significant technical improvements in the thermal reduction process. The presence of facilities in southern Ontario provides local expertise in the practice. The public has typically expressed concern with thermal reduction alternatives, however, the operating experience of these local facilities can be referenced to provide information to those less comfortable with the concept of thermal reduction.

**Identifying A Preferred BMP Strategy**

Table 2 in Appendix A provides a summary of the analytical rationale and net assessment of the alternatives recommended for further review. Overall, both 'Class A' alternatives realize the production of end products that continue to be subject to regulatory and land availability issues, and involve transportation and management costs similar to those associated with the current land application program. These costs and considerations are additional to the comparatively substantial costs (capital, operations and maintenance) of implementing/operating/maintaining the Class 'A' process infrastructure itself. There are benefits realized, however, through the recycling of nutrients and soil amendments provided that the levels of biosolid constituents of concern such as metals, pathogens and certain organics are reduced and consistently maintained at required levels. Any Class ‘A’ alternative also requires that a readily available supply of agricultural land is maintained for exclusive City access within a reasonable distance of the WWTP plant site.

A concern raised related to the thermal reduction alternative is the cost associated with the treatment of emissions and control required to meet environmental and regulatory requirements. It has been found that emissions impact can be managed and mitigated with the application of currently available technologies. Further, significant opportunities for energy conservation and emissions control are associated with the thermal reduction alternative, recognizing the associated reduction or elimination of significant offsite transportation requirements for process residuals and the potential for process heat recovery.

**Integration of BMP and WWTP Schedule C Activities**

The preferred BMP management strategy will be finalized through further assessment of the above recommended BMP alternatives. Considering that each of the alternatives are likely to be located at the Woodward site, (except for any storage facilities which due to the size would need to be sited elsewhere in the City), it becomes imperative that the biosolids handling solution arising from the BMP must be effectively incorporated into the overall plant footprint. As Phase 3 of the concurrent Schedule C Environmental Assessment process for the Combined Sewer Overflow and Woodward Avenue Wastewater Treatment Plant (WWTP) expansion (herein referred to as Woodward WWTP Expansion) is ongoing, additional assessments of the BMP alternatives will be further studied in collaboration with that project to ensure that all future plant expansion processes are adequately sized and configured.
The TM documentation will conclude with TM 17, describing a **Preferred Biosolids Management Strategy** produced following the technical assessment described above and through further application of the SAC’s criteria and evaluation screening process on the recommended biosolids management strategies. The resulting preferred BMP management strategy will then be brought before the Public Works Committee and Council for approval in the summer of 2007 and in conjunction with the Woodward WWTP Expansion.

**Financial Implications:**

Estimated net present value (NPV) costs for the recommended alternatives are provided in Table 2 of Appendix A.

The Net Present Value (NPV) costs of the recommended BMP alternatives have been estimated at ranging between $116 M (thermal reduction without digestion) through $168 M (TPAD) to $264 M (alkaline stabilization without digestion).

Under a thermal reduction alternative, further opportunities will be available for cost offsets through process heat recovery and, potentially through energy production. If current solids digestion processes at the plant were eliminated, capital associated with the upgrading of digestion facilities (currently budgeted to 2015 at $20 M) is released and reflected in the NPV cost in Table 2. The disposition of biosolids through thermal reduction would also eliminate the need for the contracting out of biosolids removal which currently carries a cost of approximately $3.5 M annually.

The NPV cost of the continuation of the current land application program is $82 M, plus an additional $32 M for new storage facilities required for off-season management and logistics compliance under new legislation as well as approximately $20 M in required capital cost and $24 M O&M for the digesters, for an overall total of $158 M. Refer to Table 2 in Appendix A for a summary of NPV cost estimates for each recommended alternative.

**Staffing Implications:**

The addition of a new process at the wastewater facility will have implications on staffing levels; however, the long-term solution may also recommend the elimination of digestion of solids. Thus, there is a small or no net increase projected in staffing requirements.

**Legal Implications:**

Each of the recommended alternatives have specific regulatory/legal implications that stem from the overall responsibility that the City carries with respect to the production and the regulated management of its biosolids.

Wherever the City’s control over process is contracted out of the City’s facilities there is a risk of contract default. Further, any alternative wherein there is a dependence upon the contractor for land application compliance there are risks of spills and contamination.

Under a thermal reduction alternative, other regulations associated with emissions will require compliance; however, proper design, sampling and monitoring can ensure that compliance will be met. As mentioned above, emissions criteria have been well addressed by other municipalities in southern Ontario with the satisfactory meeting of regulatory requirements by their thermal facilities.
A number of policies, regulations and statutes pertain to this document, namely:

- **Nutrient Management Act**.
- Regulation 347.
- Places to Grow Legislation.
- Greenbelt Protection Act.
- **Safe Drinking Water Act**.
- Environmental Assessment Act.
- Source Water Protection Act.

**Consultation Process:**

An extensive public consultation program was undertaken for the BMP. A Stakeholder Advisory Committee (SAC) was convened and consulted throughout the process. As part of the advertisement for the Notice of Commencement, an invitation was extended to any parties interested in being a part of a stakeholder group. No responses were received. City staff, in turn, issued Letters of Invitation to groups/committees and parties that were felt would have in interest in being on the SAC. The composition of the SAC was as follows:

- City of Hamilton:
  - Public Works, Waste Management Division
  - Public Works, Water and Wastewater Division, Compliance and Regulation Section
  - Public Health Services
  - Agricultural and Rural Affairs Committee Representative
- County of Haldimand
- Ministry of the Environment
- Environment Hamilton
- Hamilton Industrial Environmental Association
- Dr. George Sorger, Microbiology Professor Emeritus, McMaster University
- Councillor David Mitchell, Ward 11

Consultative communications to explore potential strategic cooperative opportunities and initiatives were undertaken throughout the BMP process with the following entities:

- The Regional Municipality of Peel
- The Regional Municipality of Halton
- The Regional Municipality of Niagara
- Hamilton/Niagara Wasteplan
- Terratec

Regulatory agencies were notified and consulted throughout the BMP process. Feedback has been supportive of the Master Plan. Consultation will continue through Phase 3 and 4 of the Schedule C Class EA. A Community Liaison Committee has been formed to provide input into Phases 3 and 4 of the Class Environmental Assessment for the CSO Control Program and Woodward Avenue WWTP Expansion. A Technical Advisory Committee has been struck with representation from pertinent regulators and
industry experts. A Public Works Sub-committee has also been developed to assist with this project.

The following summarizes the public consultation process which took place during the development of Phases 1 and 2 of the Biosolids Master Plan:

- Notice of Commencement and Advertising for Members of the Stakeholder Advisory Committee, September 2004
- Stakeholder Advisory Committee Meeting #1, February 25, 2005
- Public Information Centres #1, March 7, 2005 (Glanbrook Municipal Service Centre (MSC), March 8, 2005 (Dundas MSC) and March 10, 2005 (Stoney Creek MSC)
- Stakeholder Advisory Committee Meeting #2, June 28, 2005
- Stakeholder Advisory Committee Meeting #3, June 7, 2006
- Public Information Centres #2, September 19, 2006 (Stoney Creek MSC), September 21, 2006 (Woodward Public School)

Scott Stewart, C.E.T.
General Manager
Public Works Department
Table 1: Evaluation Categories and Criteria, Summary Evaluation Tables

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<td>Impact on Landfill Life</td>
</tr>
<tr>
<td>Technical Feasibility</td>
<td>Reliability</td>
</tr>
<tr>
<td></td>
<td>Sustainability Within Region</td>
</tr>
<tr>
<td></td>
<td>Technical Risk / Acceptance</td>
</tr>
<tr>
<td></td>
<td>Ease of Operation/Complexity</td>
</tr>
<tr>
<td></td>
<td>Operational Flexibility and Control</td>
</tr>
<tr>
<td></td>
<td>Ease of Expansion</td>
</tr>
<tr>
<td>Regulatory Issues</td>
<td>Current Regulatory Constraints</td>
</tr>
<tr>
<td></td>
<td>Anticipated Future Regulatory Constraints</td>
</tr>
<tr>
<td>Economics</td>
<td>Capital Costs</td>
</tr>
<tr>
<td></td>
<td>Operational Costs</td>
</tr>
</tbody>
</table>
**Table 2: Long List - Summary Analysis of Recommended Alternatives Leading to Preferred Strategy**

<table>
<thead>
<tr>
<th>Cost</th>
<th>TM #7 Continuation of Land Application of Class &quot;B&quot; Biosolids</th>
<th>TM #8 Stabilization to Achieve Class &quot;A&quot; Biosolids (TPAD / Thermophilic Digestion)</th>
<th>TM #10 Alkaline Stabilization</th>
<th>TM #12 Incineration</th>
<th>TM #9 Compost</th>
<th>TM #11 Thermal Drying</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>With Digestion</td>
<td>With Digestion</td>
<td>With Digestion</td>
<td>With Digestion</td>
<td>With Digestion</td>
<td>With Digestion</td>
</tr>
<tr>
<td>Disposal Cost</td>
<td>$82,000,000</td>
<td>$82,000,000</td>
<td>$82,000,000</td>
<td>n/a</td>
<td>$82,000,000</td>
<td>$82,000,000</td>
</tr>
<tr>
<td>Existing Digester Improvements Capital Cost</td>
<td>$20,000,000</td>
<td>$20,000,000</td>
<td>$20,000,000</td>
<td>$20,000,000</td>
<td>$20,000,000</td>
<td>$20,000,000</td>
</tr>
<tr>
<td>New Process Capital Cost</td>
<td>n/a</td>
<td>$10,400,000</td>
<td>$15,800,000</td>
<td>$59,500,000</td>
<td>$7,220,000</td>
<td>$7,220,000</td>
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<tr>
<td>New Seasonal Storage</td>
<td>$32,000,000</td>
<td>$32,000,000</td>
<td>$32,000,000</td>
<td>n/a</td>
<td>$32,000,000</td>
<td>$32,000,000</td>
</tr>
<tr>
<td>O&amp;M Cost (20 Yr Basis)</td>
<td>$24,000,000</td>
<td>$24,000,000</td>
<td>$158,200,000</td>
<td>$117,000,000</td>
<td>$141,780,000</td>
<td>$157,400,000</td>
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<tr>
<td>Overall NPV</td>
<td>$158,000,000</td>
<td>$168,400,000</td>
<td>$308,000,000</td>
<td>$283,000,000</td>
<td>$315,000,000</td>
<td>$277,000,000</td>
</tr>
</tbody>
</table>

**Pros**
- Current program well known today.
- Recycle of nutrients to multiple land uses:
  - lowest NPV increase prior to land application/distribution costs
- Recycle of nutrients to multiple land uses
- Diverts from land; no agricultural land required. Trucking requirements significantly reduced. Potential for EFW.
- Recycle of nutrients to multiple land uses. New sewer use bylaw will lower metals in future.
- Recycle of nutrients to multiple land uses.

**Cons**
- Land unavailability foreseen. Future requirements will be increasingly stringent. Trucking distance, cost and emissions will increase.
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- High level of emissions control required; associated capital cost.
- Won't assuredly meet the present or future regulatory level for certain metals in compost; significantly higher cost.
- History of pelletizer fires. Unreliable operation. Metals remain a concern.

**SAC Short List**
- Not Recommended
- Recommended for Further Review
- Recommended for Further Review
- Recommended for Further Review
- Not Recommended
- Not Recommended

Note: Each 'with digestion' option will include $24M in the O&M and $20M for Capital SAM.
Each 'without digester' $20M Capital SAM is deducted and $24M Digester O&M not included.