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# CONSULTANT'S RECOMMENDATION ON RESIDUAL WASTE TECHNOLOGY

**The Solid Waste Management Committee recommends the following:**

**1. The presentation by Andrew Campbell, Director, Solid Waste Management, be received;**

**2. The following public delegations be received and referred to staff for incorporation in the final version of the Consultant's conclusion:**

1. **Peter and Heather Gillies, Brock and Georgina Against Garbage, May 4, 2006 regarding Brock Landfill – 17th Side Road, Durham.**
2. **Ernst von Bezold, Resident, Richmond Hill.**
3. **Gloria Marsh, York Region Environmental Alliance, Richmond Hill.**
4. **Frank Condlln, Resident, Aurora.**
5. **Fred Jesty, Resident, King City.**
6. **Jan d'Ailly, for Organic Energy, Waterloo.**
7. **John Hopkins, Resident, Toronto.**
8. **Mary Ann Colin, Resident, Richmond Hill (verbal comments only).**
9. **Solveig Vohl, May 14, 2006, regarding "How can garbage be avoided in the first place?"(communication only.)**
10. **Jason Balsdon, Resident, Newmarket, May 16, 2006 (communication only).**

**3. The recommendation contained in the following report, May 8, 2006, from the Commissioner of Transportation and Works, be adopted:**

## 1. RECOMMENDATION

It is recommended that this report be received for information.

## 2. PURPOSE

The purpose of this report is to provide information for the Solid Waste Management Committee with respect to the selection of residual waste management technologies as recommended by the Consultant for the Durham York Residual Waste Environmental Assessment.

## 3. BACKGROUND

On June 23, 2005, Council adopted Clause 1 of Report No. 4 of the Commissioner of Transportation and Works to partner with Durham Region to undertake an Individual Environmental Assessment (EA) to study residual waste management for the two Regions. On December 15, 2005, Council adopted Clause 1 of Report No. 8 of the Solid Waste Management Committee to approve and submit the Proposed Terms of Reference (TOR) for the EA to the Ministry of the Environment for approval.

On March 31, 2006, the Minister of the Environment approved our Terms of Reference for the EA (*see Attachment 1*). The TOR for the EA as well as all reports and records of the public consultation events can be viewed at www.durhamyorkwaste.ca.

## 4. ANALYSIS AND OPTIONS

The purpose of EA undertaking as approved by the Minister of the Environment is:

> "To process-physically, biologically and/or thermally – the waste that remains after the application of both Regions' at source waste diversion programs in order to recover resources – both material and energy – and to minimize the amount of material requiring landfill disposal. In proceeding with this undertaking only those approaches that will meet or exceed all regulatory requirements will be considered."

The EA process has two initial steps: Evaluation of "Alternate to" (i.e. technology selection) and evaluation of "Alternate methods" (i.e. facility siting). Our consultants, MacViro Consults Inc. and Jacques Whitford Limited (jointly referred to as the Consultant), have completed their analysis of "Alternates to" and presented their conclusions for a recommended technology to the Joint Waste Management Group for the project on April 17, 2006. Public information sessions were held on May 7, 8 and 9 in York and Durham Regions on the Consultant's recommendation and both Regions are receiving deputations from the public on May 17, 2006. In addition, all governmental review agencies, environmental groups and individuals on our extensive mailing list have been informed of the Consultant's technology recommendations and requested their comments.

The results of the initial EA step as outlined in this report is presented as a conclusion from the Consultant's consideration of alternative system advantages and disadvantages and environmental priorities. The environmental priorities presented represent the results of consultation with the public and review agencies.

A final version of the Consultant's conclusion, incorporating input from the public and agencies, is scheduled to be prepared and presented to the Joint Waste Management Group on May 30, 2006, after the 30-day consultation period which began on April 19,

2006. The recommendation from the Joint Waste Management Group may be forwarded for consideration to the respective Committees and Councils of both Regions in June 2006.

The following section of this report is an excerpt from the Consultant's Executive Summary and outlines the process the Consultant undertook to arrive at its conclusion.

### 4.1 Evaluation Process

To fully address the purpose of the undertaking, different waste management approaches capable of processing and recovering resources from post-diversion waste were combined into alternative residuals processing systems. The TOR established that alternative systems comprised of the following approaches and technologies would be formulated and evaluated:

- Mechanical Treatment
- Biological Treatment
- Thermal Treatment (includes combustion, gasification and pyrolysis).

The following summarizes the seven step methodology outlined in the TOR to be applied to formulate and then comparatively evaluate alternative residuals processing systems.

**Step 1** Prior to initiation of the evaluation of "Alternatives To", the proposed evaluation methodology and criteria will be reviewed in consultation with the public and agencies. This review will seek additional input on the proposed evaluation steps and evaluation criteria presented in the EA Terms of Reference and will seek to establish and confirm the relative priorities to be considered during the evaluation.

**Step 2** The component alternatives will be assembled into alternative residuals processing systems with each system being capable of managing the entire projected residual waste stream.

**Step 3** Data collection will be undertaken for the purpose of applying each of the comparative evaluation criteria to each of the alternative residuals processing systems.

**Step 4** The comparative evaluation criteria will be applied to each of the alternative residual processing systems and potential effects identified.

**Step 5** Each of the potential effects identified at Step 4 will be considered with respect to the availability of measures to mitigate (i.e., measures that may be applied to reduce or eliminate a negative potential effect) or enhance (measures that may be applied to improve or increase the magnitude of a benefit or positive effect) the effects, and identify the remaining or 'net effects'.

**Step 6** The net effects associated with each residuals processing system under each comparative criterion will be compared and a list of relative advantages and disadvantages associated with each alternative processing system developed.

**Step 7** The relative advantages and disadvantages of each alternative residuals processing system will be considered in the context of priorities established in consultation with the public and agencies and the preferred system selected. The preferred system will be the one exhibiting the preferred balance of advantages and disadvantages accounting for the significance of environmental categories and criteria established by the public and agencies.

As an initial task in the system development step, each municipality's at-source waste diversion program was reviewed to assess the suitability of the established sixty percent at-source diversion targets. This review concluded that waste reduction and 'at-source' diversion approaches will continue to be preferred over disposal but that, given the current and projected diversion opportunities available to Durham and York, the set targets of 60% diversion by 2011 and 75% diversion in future years are reasonable for use in the formulation and evaluation of alternative systems.

In determining the scope of alternative systems to be evaluated, the focus was on covering the range of options to recover resources, both materials and energy, from the residual waste stream rather than all possible combinations of the alternative approaches available for consideration. Resource recovery options included recovery of recyclable materials for sale to market, energy from biogas and energy from the thermal treatment of wastes or solid recovered fuel. The intent of the Study is to identify a preferred long-term alternative that maximizes the recovery of resources and minimizes the reliance on landfill as a primary method of disposal.

Landfill facilities will be assumed to continue to play a role for the disposal of certain materials that cannot be otherwise processed or diverted. A landfill only system, whereby a new landfill site capable of managing all waste that remains after at-source diversion would not meet the purpose of the undertaking, and thus was not considered in this study. Rationale for the exclusion of this option is provided in the approved TOR and detailed documentation supporting the identification of the preferred "Alternative to".

Once developed, the alternative residuals processing systems were evaluated by application of the established evaluation criteria and environmental priorities and using the net effects analysis outlined in Steps 3 to 7 in the "Alternatives to" evaluation methodology. The preferred residuals processing system is that which offers the preferred balance of advantages and disadvantages given the environmental priorities established by the communities of Durham and York through the public consultation process.

## 4.2 Consultation with the Public and Agencies

On March 7, 8 and 9, the Regions of Durham and York held Public Information Sessions to discuss the "Alternatives to" and the proposed evaluations process (See Table 1). The four alternative systems to be evaluated were presented, as well as at-source diversion measures and the potential for resource recovery that was considered with each system alternative. In addition, the evaluation methodology and evaluation priorities that were developed during the preparation of the TOR were presented for public review. To verify public agreement with the range of alternative systems to be evaluated and the evaluation priorities, attendees were asked to complete a questionnaire. In the questionnaire, respondents were asked for input on the range of alternatives to be evaluated to rank the five categories of the environment as "Extremely Important", "Very Important", "Somewhat Important", "Not Very Important", or "Not at all Important". The environmental categories considered in the evaluation process included the Natural, Social/Cultural, Economic, Technical and Legal/Jurisdictional Environments. A total of 83 open house attendants completed the questionnaire.

**Table 1**
Public Information Sessions

| Location | Date | Number of Attendees |
|---|---|---|
| Vaughan | March 7 | 106 |
| Markham | March 8 | 47 |
| Newmarket | March 9 | 22 |
| Total | | 175 |

In addition, the Joint Waste Management Group retained the services of the public polling firm Ipsos Reid. Ipsos Reid maintains a list of survey panellists in York and Durham that is representative the general demographics of the two Regions. A random sample from the list was selected for survey. The firm conducted an online self-complete Internet survey, and received responses from a total of 449 Durham residents and 423 York residents. The sample was chosen to be representative of the population demographics of the two Regions. The format was similar to the open house questionnaire, and respondents were asked to assign priority levels to the same five environmental categories listed above.

The results of the Public Information Sessions questionnaire and online public survey were combined to determine the priorities, pending approval by the Joint Waste Management Group, to be assigned to each of the environmental categories. The final ranking of the priorities is shown in Table 2.

The Regions of Durham and York also distributed the proposed evaluation criteria and copies of the open house display panels to the stakeholders and agencies that have been identified to date for review and comment. This list of stakeholders and agencies

includes approximately 400 groups consisting of government agencies (Federal, Provincial, and Municipal), educational institutions, First Nations organizations, and environmental groups.

### 4.3 Establishment of Priorities and Application in the Evaluation

An influential aspect of the evaluation process was the identification and application of priorities assigned to the various components of the environment by the public. A key characteristic of the Environmental Assessment Act, and most planning processes with a focus on sustainability, is the requirement to consider a broadly defined environment (i.e., more than just the natural environment). Accordingly, the different categories of the environment considered in this study and the relative priorities assigned by the communities of Durham and York were as follows:

**Table 2**
Environmental Considerations by Assigned Priorities

| Environmental Category | Relative Priority |
|---|---|
| Natural Environmental Considerations | Most Important |
| Social / Cultural Considerations | Important |
| Economic / Financial Considerations | Important |
| Technical Considerations | Important |
| Legal Considerations | Least Important |

### 4.4 Formulation and Evaluation of Alternative System

The evaluation of "Alternatives to", as a first finding, concluded that the reduction and "at source" diversion of municipal solid waste are and will remain the most preferred components of an integrated waste management system. With this in mind and given the current and projected diversion opportunities available to Durham and York, it was determined that the established percent at-source waste diversion targets are reasonably aggressive targets on which to base the planning of long-term residuals processing capacity.

Four alternative systems (see Table 3) were then formulated using the alternative processing approaches from the approved TOR and are graphically illustrated in *Attachment 2*.

**Table 3**
Summary of Recommended Alternative Systems

| Alternative Systems | | | Potentially Recovered Resources | | | | Residuals Management |
|---|---|---|---|---|---|---|---|
| | | | Recyclable Materials for Markets | Energy Produced from Biogas/Landfill Gas | Energy Produced from Solid Recovered Fuel | Energy Produced from Mixed Waste | Landfilling of Residuals |
| Mechanical & Biological Treatment | 1 | Mechanical Biological Treatment with Biogas Recovery and Landfilling of Stabilized Residuals | √ | √ | | | √ |
| Thermal Treatment (TT) | 2a | Thermal Treatment of Mixed Waste with Recovery of Materials from the Ash/Char | √ | | | √ | √ |
| | 2b | Thermal Treatment of Solid Recovery Fuel | √ | | √ | | √ |
| | 2c | Thermal Treatment of Solid Recovery Fuel with Biogas Recovery | √ | √ | √ | | √ |

Utilizing the seven step alternative system evaluation methodology described above the relative advantages and disadvantages of the alternative residuals processing systems were identified and summarized below.

#### 4.4.1 System 1 – Mechanical Biological Treatment with Biogas Recovery

System 1 involves mechanical processing to recover recyclable material from the waste, anaerobic digestion of the food waste to recover a relatively small amount of renewable energy, and the landfilling of the resulting residues. It is essentially a stabilized landfill alternative with 77% of the residual waste stream ultimately going to landfill.

Advantages of this system include:

- Lowest potential impacts on the air environment
- More flexible to changes in waste quantities and composition
- Potentially lower overall system costs provided low cost landfill capacity can be obtained from a third party
- Potential to increase diversion through the recovery of additional recyclables – an advantage shared with Systems 2b and 2c.

Because this system is primarily a landfill alternative, it has a number of disadvantages including:

- Greatest potential impacts for water and land
- Greatest potential to disrupt sensitive habitat
- Lowest energy generation – both renewable and total
- Greatest potential social impact on the landfill host community
- Least reliable due to dependence on export landfill contracts.

#### 4.4.2 Systems 2a and 2b – Thermal Treatment of Municipal Solid Waste of Solid Recovered Fuel

Systems 2a and 2b are both based on thermal treatment. In 2a, recyclable metals are recovered following thermal treatment from the ash or char. In 2b, recyclable materials, including metals and some plastics, are recovered prior to thermal treatment. In both cases, only the small proportion of the residual waste stream – typically 10-15% by volume – goes to landfill. If the bottom ash could be used as construction material as it is in Europe and is being studied in the United States, this number could be reduced to less than 5%.

In summary, the advantages associated with Systems 2a and 2b include:

- Lowest potential impacts to water and land
- Least potential to disrupt sensitive habitats
- Greatest energy generation – both renewable and total
- Lowest potential social impact on landfill host community due to a minimizing of the quantities requiring landfill
- Higher reliability due to minimum dependence on export landfill
- Costs, although high, are comparable in the case of System 2a, with System 1.

The disadvantages of the thermal treatment systems include:

- Highest potential impacts on the air environment, although current technology has proven ability to have emissions lower than all applicable air emissions standards
- Less flexibility to changes in waste quantities and composition
- Need to manage hazardous residues from the pollution control system. (It can be argued that this is not really a disadvantage as the hazardous compounds – primarily heavy metals – are in the waste stream to begin with and simply landfilled in System 1. With the thermal systems, these contaminants are concentrated and removed for stabilization and/or management in a secure landfill.).

When comparing Systems 2a and 2b, alternative 2a has the advantages of:

- More proven and reliable technology
- Lower costs – based on experience to-date.

Alternative 2b has the advantages of:

- The potential to recover more recyclables – some plastics as well as metals
- Potential improvements in air emissions, energy conversion efficiency and costs that may be provided by new technologies presently under development.

### 4.4.3 System 2c – Thermal Treatment of Solid Recovered Fuel With Biogas Recovery

System 2c includes the mechanical and biological treatment component of System 1 followed by the thermal treatment, rather than the straight landfilling of the residue. Ultimately the inert non-recyclable materials, anaerobic digestate and ash/char all require landfill disposal. Approximately 45% of the residual stream will require export landfill under this alternative versus the 77% for System 1.

The major advantage of the system includes:

- The ability to recover additional recyclable materials and also to make beneficial use of the post diversion waste stream.

It has the disadvantage of:

- Highest cost and lowest technical reliability due to the amount and complexity of the required processing equipment.

A more comprehensive overview of how each of the systems compares to one another in terms of their relative advantages and disadvantages when considering each of the evaluation criterion is available in the Consultant's complete report.

## 4.5 Consultant's Conclusion on a Preferred System

Based on the consideration of relative advantages and disadvantages and environmental priorities identified above and summarized in Attachment 3, the preferred long-term residuals processing system identified to manage the post-diversion or residual wastes is System 2(a) – Thermal Treatment of MSW and Recovery of Energy followed by Recovery of Materials from the Ash/Char. More specifically, System 2(a) entails the establishment of thermal treatment capacity to process the residual waste stream and recover energy, followed by the removal of materials that may be sold to market from the ash/char residue, and finally the landfilling of all process residues (non-combustible materials removed prior to treatment and the ash/char).

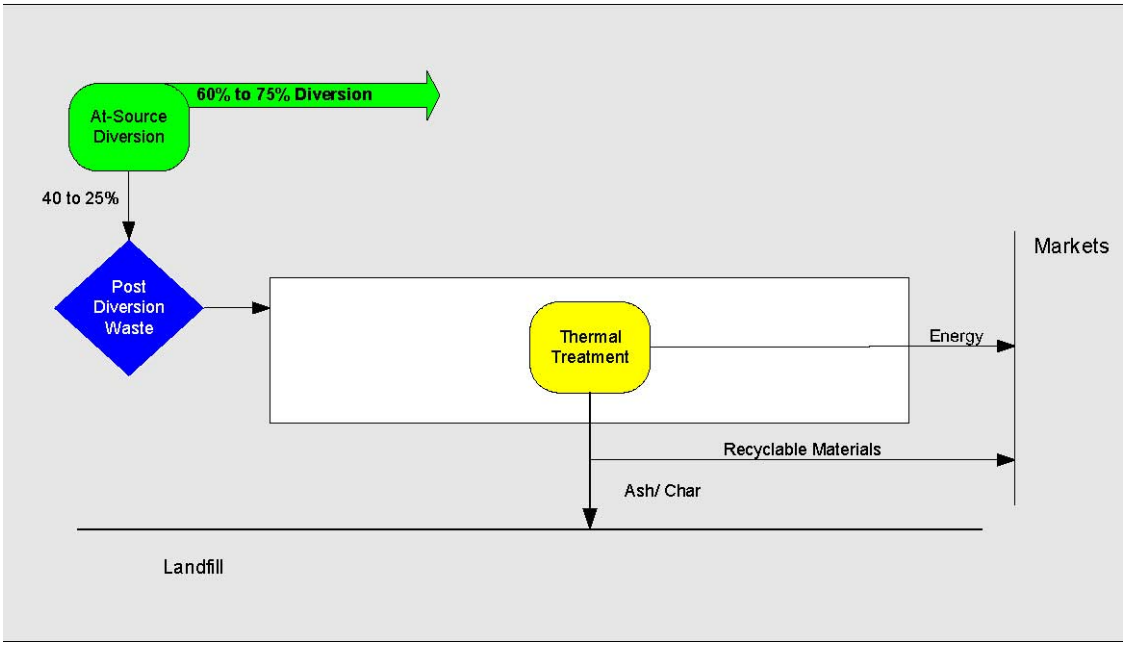
A more detailed description of the system, its individual components, and the need for a waste management hierarchy to support the continued improvement of waste reduction and at-source diversion performance prior to processing is provided in the Consultant's main report. The flow of materials through System 2(a) is represented in Figure 1.

Although System 2(a) has been identified as the Preferred Long Term Residual Processing System, it is important to note that System 2(b) also exhibits an acceptable range of advantages and disadvantages.

For some of the criteria where System 2(b) did not rank equivalent to 2 (a), (technical risks, costs and legal/contractual risks for example), the determination of the relative advantages and disadvantages was based upon the information that was readily available on both the mechanical and biological processes that are being used to recover solid fuel in other jurisdictions and on the thermal technologies that can process this fuel. Many of

the technologies that would be used to thermally treat the solid recovered fuel (e.g. gasification) in System 2(b) are regarded as 'new technologies', with active research and development, but a much lesser track record than the technologies that are currently available to combust residual waste in System 2(a).

**Figure 1 System 2(a) – Thermal Treatment of Mixed Waste with Recovery of Materials from the Ash / Char**




Should Durham and York Regions not meet their projected waste diversion targets within the currently planned timeframe, System 2(b) could be utilized to capture additional recyclables and compostables in the waste stream that have not been source separated by residents. This will contribute to the Regions' overall respective waste diversion rates.

It is therefore recommended that, pending the approval of System 2(a) as the preferred residuals processing system, the competitive process used during the evaluation of "Alternative Methods" (i.e. site selection) allow for the submission of proposals to implement both System 2(a) and System 2(b), and that the final decision on the technologies used to implement the preferred residuals processing system be based on the results of this competitive process.

It is important to note that, at this time, the identification of System 2(a) as the preferred "Alternative to" represents a conclusion of the Consultant and not a decision on the part of the two municipalities. This decision will not be made until the public and agencies have been consulted on the conclusion and its supporting rationale currently being presented by the Consultant.

## 5. FINANCIAL IMPLICATIONS

The Region's average cost per tonne for waste management processing and disposal are listed in Table 4.

**Table 4**
Waste Management Processing Fees

| Item | Total Tonnes | | Cost/tonne ($2005) |
|---|---|---|---|
| | 2005 | 2021 (est.) | |
| Landfill | 210,000 | 30,000 | $71 |
| Source Separated Organics | 12,000 | 69,000 | 150 |
| Blue Box (Net) | 65,000 | 112,000 | 9 |
| Dongara Pellet Fuel | 0 | 100,000 | 100 |
| Yard Waste | 24,000 | 44,000 | 58 |
| Thermal Processing | 0 | 135,000 | $120-$140 |

*Note: Costs are for processing only (i.e. paid to a contractor) and do not include collection costs.*

On a weighted average basis in 2005 dollars the system costs would increase from $60/tonne to $88/tonne from 2005 to 2021 based on the values in Table 4.

## 6. LOCAL MUNICIPAL IMPACT

The siting of a waste facility will impact one municipality in York or Durham Regions. The siting identification and review process is the second part of the EA process and will start in the fall of this year. A short list of sites will be available in early 2007 at which time there will be considerable involvement with the municipalities and public where the potential sites have been identified.

## 7. CONCLUSION

The Regions of York and Durham have undertaken an Environmental Assessment to find a long-term solution to manage their residual waste. The Consultant has recommended a thermal treatment of the mixed waste with a recovery of materials from the ash/char as the preferred technology.

A final version of the Consultant's conclusion, incorporating input from the public and agencies, is scheduled to be prepared and presented to the Joint Waste Management Group on May 30, 2006, after the 30-day consultation period which began on April 19, 2006. The Joint Waste Management Group will not make a decision on its recommendation until after the consultation period ends and comments received have been considered. The recommendation from the Joint Waste Management Group may be forwarded for consideration to the respective Committees and Councils of both Regions in June 2006.

The Senior Management Group has reviewed this report.

*(The attachments referred to in this clause are included with this report.)*