EXCELLENCE IN ENVIRONMENTAL CONSULTING SERVICES

September 13, 2007 **XCG File No. 1-664-02-07**

Rod Jeffries, Chief Administrative Officer, and
Chief and Council, and
CARE (Citizens Against Richmond Expansion)
c/o Mohawks of the Bay of Quinte
13 Old York Road, RR#1
Tyendinaga Mohawk Territory, ON K0K 1X0

Attention: Todd Kring

RE: PEER REVIEW, WASTE MANAGEMENT OF CANADA CLOSURE PLAN, RICHMOND LANDFILL SITE, ONTARIO

Dear Chief and Council and CARE:

XCG Consultants Ltd. (XCG) is pleased to provide this review of the Richmond Sanitary Landfill Site Final Closure Plan that has been submitted to the Ministry of the Environment (MOE) by Waste Management of Canada Corporation (WM).

The package received by XCG included the following information:

- Cover letter from the Mohawks of the Bay of Quinte (MBQ) to XCG, entitled "Waste Management Inc., Final Closure Plan – Richmond Landfill Site", August 17, 2007;
- Letter from John Allen of the MOE to Chief Don Maracle of MBQ, entitled "Closure Plan, Richmond Landfill Site", August 2, 2007;
- Undated page of typewritten notes regarding discussions with the MOE about the closure plan;
- Henderson Paddon report entitled "Richmond Sanitary Landfill Site Final Closure Plan", June 2007.

As part of the review, the MBQ requested that XCG's review of the closure plan address the following in particular.

1. Assessment of compliance of the closure plan with applicable laws and regulations;
2. Discussion of potential concerns or adverse impacts to the Tyendinaga Mohawk Territory;
3. Determination of the adequacy of the contingency plan;
4. Assessment of the manner in which leachate is to be managed following closure, including an assessment of the potential for surface water discharges of leachate;
5. Assessment of the adequacy of the monitoring program;

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6. Assessment of the compliance of the proposed end uses with applicable laws and regulations

The scope required in the Closure Plan for the Richmond Landfill (site) is defined primarily by Condition 34 of Certificate of Approval A371203, the Environmental Protection Act and the document entitled "Guidance Manual for Landfill Sites Receiving Municipal Waste" prepared by the Ontario Ministry of the Environment, November 1993. The requirements of the document entitled "A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites" by the Ontario Ministry of the Environment, dated May 1998, generally referred to as Regulation 232/98, does not specifically apply to the site since it is not new or expanding. Condition 34 of Certificate of Approval A371203 is as follows:

34. Within 90 days of issuance of this amendment [March 21, 2007], the Owner shall submit to the Director for Approval, with copies to the District Manager, a detailed site Closure Plan pertaining to the termination of landfilling at the site, post-closure inspection, maintenance and monitoring, and end use. The plan shall include, but not be limited to the following:

a. A plan showing site appearance after closure including side slopes and final contours of the site.

b. A description of the proposed end use of the site.

c. A description of the procedures for closure of the site, including:

- *advance notification of the public of the landfill closure;*
- *posting of a sign at the site entrance indicating the landfill is closed and identifying any alternative waste disposal arrangements;*
- *completion, inspection and maintenance of the final cover and landscaping;*
- *site security;*
- *removal of unnecessary landfill related structures, buildings and facilities; and*
- *final construction of any control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas.*

d. A schedule indicating the time period for implementing sub-conditions listed above.

e. Descriptions of the procedures for post-closure care of the site, including:

- *operation, inspection and maintenance of the control, treatment, disposal and monitoring facilities for leachate, groundwater, surface water and landfill gas;*
- *record keeping and reporting; and*
- *complaint contact and response procedures.*

f. An assessment of the adequacy of and need to implement the contingency plans for leachate and methane gas;

g. *An updated estimate of the contaminating life span of the site, based on the results of the monitoring programs to date.*

h. *An update of the cost estimates for financial assurance and the amount which has been provided to the Director to date.*

The following comments are based on our review of the above noted documents. The comments are presented in the following sections:

A. Comments regarding compliance with Condition 34.

B. General comments regarding regulatory requirements and best practices.

C. Comments regarding the specific areas of concern identified by the MBQ.

A. CONDITION 34

The following provides a summary of the portions of Condition 34 that are not properly addressed in the Closure Plan.

1. The newspapers to be used to advertise notification of closure of the site should be identified.
2. The section on signage (Section 4.6 of the Closure Plan) does not address provisions for indicating alternative disposal locations/arrangements. The information provided regarding signage is inadequate. The sign(s) should include a phone number for complaints or reporting of emergencies.
3. A detailed schedule for removal of facilities should be provided. A specific date should be provided for the termination of waste receipt at the site, and for completion of all other key activities related to closure of the site.
4. The complaint procedure should be described in detail and should include a minimum response time and some formal description of how complaints and/or emergencies will be addressed.
5. There is inadequate discussion of proposed contingency measures related to potential problems involving leachate and landfill gas. For example, developing a fracture trench was discussed as a contingency measure in the Environmental Assessment documentation released by WM in 2005 ("Richmond Landfill Expansion Environmental Assessment", dated October 2005, and associated discussion papers). There is no detailed contingency plan, involving fracture trenches or any other similar methods, provided in the Closure Plan. Similarly, no detailed contingency plan addressing landfill gas problems is provided.
6. An updated estimate of the contaminating life span of the site, including details of how the estimate was arrived at, is not provided in the Closure Plan.
7. The details of calculation of the financial assurance costs were not provided in the copy of the Closure Plan provided for review. Ensuring the adequacy of the financial assurances to cover all aspects of closure, post-closure care, and contingency plans for dealing with emergency conditions is essential, and therefore an opportunity for public and third party review of the details of the financial assurance calculations should be provided.

B. REGULATORY REQUIREMENTS AND BEST PRACTICES

8. As mentioned in Section A, the schedule for completion of the closure works is not defined. It is XCG's opinion that the landfill closure should proceed immediately. This is based on the concerns about the current landfill operation that were raised by the MOE, other reviewing regulatory agencies, third party reviewers (including XCG), and the public during the review of the Richmond Landfill Expansion Environmental Assessment (EA) documents. There were many concerns expressed during this process related to the sensitive nature of the hydrogeology of the site, the inadequacy of the existing liner beneath the landfill, the inadequacy of the existing environmental monitoring program, and the possibility of off-site groundwater quality impacts arising from the landfill operations. Based on these concerns, it would be prudent to proceed with immediate closure of the landfill, in order to reduce the risk of increasing the severity of ongoing environmental impacts and/or causing new negative environmental impacts in the future.
9. A definitive time frame for cleanup of illegal dumping (Section 6.7 of the Closure Plan) should be provided. Typically waste cleanup should be completed within 48 hours of notification.
10. A minimum frequency for conducting Liaison Committee meeting should be provided. The Closure Plan indicates that Liaison Committee meetings will be held as required. Furthermore, the Liaison Committee meetings should not terminate after two years, but should continue indefinitely in order to address public concerns that may arise in the future.
11. The method of management of leachate is stated as a continuation of haulage to local sewage treatment plants. However, no details are provided regarding the quantity of leachate generation, the capacity of the sewage treatment plants discussed to accept leachate, any agreements in place to continue acceptance, and the contingency plans to be used in the event that these plants cannot accept the quantity required. These details should be provided in the Closure Plan. Furthermore, it is stated that an existing approval is in place for spray irrigation of the leachate, and that this may be implemented in the future as a contingency measure (page 1-4 of the Closure Plan). Given the many concerns expressed during the EA review process regarding odour impacts and surface water impacts, spray irrigation of leachate should not be accepted as a contingency measure for leachate management following closure.
12. There are references throughout the document to abandoning or "dismantling" surface water ponds. During post-closure, sediment generation will be minimized; however, the surface water ponds have functions in addition to sediment retention. The ponds need to be maintained in order to provide appropriate stormwater management at the site (e.g., limiting peak flows during runoff events) and to provide an ongoing and consistent location for collection of surface water quality samples. In addition, the plan for monitoring of the northwest and northeast ponds is poorly defined. The Environmental Monitoring Program (EMP) in Appendix C of the Closure Plan indicates that the water from these ponds will be sampled "up to twice per year", during discharge events. The minimum monitoring frequency (not the maximum) should be defined for these ponds. The water quality trends in the ponds will be key in determining the presence of impacts from the closed landfill, especially with respect to the performance of the final cover.

13. There are several design criteria utilized in the document that are not given adequate discussion or detail. These design criteria may have been accepted in the past as adequate but current landfill design practices require additional detail to ensure the adequacy of these assumptions. These design criteria are as follows:
    - A final maximum slope of 3.5 horizontal to 1 vertical is used. The standard acceptable slope in Ontario is no steeper than 4 horizontal to 1 vertical (as specified in Section 30(1) of Regulation 232/98). No justification is provided for adopting this steeper slope and no assessment of the geotechnical slope stability, short-term or long-term, is provided, as well as implications regarding erosion and soil loss and potential impacts to the performance of the final cover.
    - A final cover design of 0.9 metres clay and 0.15 metres topsoil is used. No justification is provided for the use of 0.9 metres of clay. No calculations are provided regarding the water balance and leachate generation contrasting this final cover design and the existing liner and the impacts on leachate generation. In addition no definition of the properties of the clay is provided. It is not indicated if this material is native to the site or imported and what the geotechnical properties of this material are, and whether it is adequate for construction of final cover. Furthermore, a drainage layer should be provided beneath the final cover layer to reduce the likelihood of leachate seeps and to improve the operation of gas collection wells. Incorporation of a synthetic cap material as part of the final cover design would also be prudent, given the concerns regarding the sensitive hydrogeology of the area, as described above.
    - A Construction Quality Assurance Plan should be provided for construction of the final cover at the site to ensure that the final cover will be constructed as designed and will provide adequate protection.
    - Topsoil or organic soil should be required to be capable of supporting vegetative growth, rather than defined by its colour.
14. Annual cleaning and camera inspection of leachate collection system should be mandatory. The Closure Plan discusses leachate collection system cleaning on an as required basis. Many landfills, especially attenuation (soil liner) landfills, are required to clean and camera inspect the leachate collection system twice per year.
15. The inspection frequency stated is inadequate. Inspections should be monthly for the first two years, quarterly for three years and then twice annually thereafter. It is noted that significant waste settlement is likely to occur following closure, especially during the first few years. Since settlement could compromise final cover integrity, frequent inspections should occur during the first few years after closure. Furthermore, until the vegetation on the final cover layer becomes well-established, there is significant risk of damage due to erosion, particularly given that the design side slope is steeper that the 4:1 maximum specified by Ontario Regulation 232/98.
16. The seed recommended for establishment of vegetation on the final cover should include a nurse crop in accordance with the Ontario Provincial Standard Specifications and good practice. Nurse crop seed should be either Fall Rye Grain or Winter Wheat Grain. In addition, consideration should be given to using alternative vegetation to match with any end use and per the discussion presented below.
17. There is no detail provided for frequency and type of maintenance for vegetation. Cutting the grass established on the landfill final cover two to three times during the growing

season during the first several years of growth is key to encouraging establishment and health of the vegetation. Not maintaining the grass by cutting can lead to bare spots, proliferation of weeds and other invasive species as well as being aesthetically unpleasing.

18. A detailed site drainage plan should be provided in the Closure Plan, with a Stormwater Management Plan to support it.
19. The following comments are provided regarding the monitoring program:
    - The work completed to establish Reasonable Use (RU) Criteria is inadequate and some of the information needed to review the RU calculations was not provided in the copy of the Closure Plan provided for review: Table A4 and A5 and Figures A2 to A16. There is no discussion of whether any of the suggested analytes can replace a conservative parameter such as chloride and provide the same level of protection as chloride as an indicator of impact. In addition, no discussion is provided regarding the detection of the suggested analytes in the leachate. The proposed indicator parameters are of no use if the leachate from the site does not contain significant concentrations of that parameter. During the period from 1998 to 2000, WM conducted several isotopic studies to identify parameters that would be of greater value as leachate indicators. Based on these studies, tritium appears to be a valuable parameter for assessing leachate impacts. As discussed on page 23 of the WM EA document Detailed Background Report to Discussion Paper#5, Part A, Hydrogeology Baseline Conditions, tritium activities found in the raw leachate range from about 3985 TU to 8000 TU, while typical background tritium activities in modern precipitation (and non-leachate-impacted groundwater) do not exceed 50 TU. On this basis, tritium is a valuable leachate indicator parameter and should be incorporated as a key part of the post-closure monitoring program.
    - The selection of monitoring wells for groundwater quality is inadequate. The monitoring wells selected leave large gaps in the southwest corner, southeast corner and north side of the site for both early warning and point of compliance locations. It is noted that only 12 groundwater monitoring locations are included for post-closure monitoring, compared to more than 70 that have been routinely monitored during operation of the landfill. Also, the frequency of monitoring is inadequate in the cases of some of the monitoring wells: once every two years. In the current monitoring program for the existing landfill, sampling frequencies are semi-annually for some wells and annually for others.
    - The proposed landfill gas monitoring of probes around the perimeter of the site is inadequate. This monitoring should include concentrations of methane, carbon dioxide, oxygen, hydrogen sulphide and pressure.
20. The following comments are provided regarding the trigger level assessment plan:
    - The procedure for groundwater is inadequate. After an initial exceedance additional sampling should be performed immediately. Additional sampling should not wait until the next monitoring round.
    - The procedure should include notification of the Ministry of the Environment and possibly adjacent property owners or the liaison committee when exceedances occur.

21. No comparison is provided between the proposed post-closure monitoring program and the existing monitoring program. This comparison should be provided to show what changes are proposed regarding locations, frequency and parameters; and the justification for any changes.
22. As noted previously, there is essentially no contingency plan, since there is no discussion of potential or defined contingency measures for any of the trigger situations or for negative results of inspections.
23. The time period for the post-closure care and maintenance of the landfill site should be defined in the closure plan. It is noted that the contaminating life span of the existing Richmond Landfill Site was calculated by WM's consultants to be approximately 300 years (based on toluene), as documented in Appendix K of WM's "Detailed Background Report to Discussion Paper #5, Addendum, Hydrogeology Baseline Conditions", Part B. On this basis, it would be prudent to continue with the post-closure maintenance and monitoring measures indefinitely.

C. MBQ SPECIFIC CONCERNS

1. Assessment of compliance of the closure plan with applicable laws and regulations.

   If the items described previously in Section A are addressed the closure plan should be compliant. However, as indicated by the comments provided in Section B, there is a significant difference between compliance and best practices, and, given the concerns related to this landfill site, the best practices findings outlined in Section B above should be addressed in the closure plan.

2. Discussion of potential concerns or adverse impacts to the Tyendinaga Mohawk Territory (TMT).

   Although the TMT is located approximately 3.5 km away from the landfill site, there are a number of potential concerns in terms of possible negative environmental impacts on the TMT arising from the landfill. These include:

   - Significant impacts on the water quality in Marysville Creek could occur and could have impacts as far downstream as the TMT. Such impacts could potentially arise in the event, for example, of a leachate seep escaping in a relatively concentrated form into Marysville Creek or the Beechwood Ditch (which is a tributary of Marysville Creek). Since WM is proposing to conduct inspections of the closed landfill only semi-annually, a leachate seep could go undetected for a long time, with considerable damage done before its repair. Furthermore, decomissioning of the stormwater management ponds, according to the Closure Plan, is to take place two years after closure, removing buffering capacity that would help to mitigate the effect of a leachate release.

   - It is possible that impacts on the groundwater could extend to the TMT. Although it would be usual for leachate impacts in groundwater to occur at such a distance from the source area, there are many documented cases in scientific of literature of contaminant plumes extending to greater distances, sometimes 5 km or more. Some of the key issues that point to the possibility of existing or future transboundary impacts in groundwater include: (i) estimated groundwater seepage rates in shallow

bedrock on site of up to 84,787 m/yr; (ii) inadequate investigation of the possibility of significant vertical fractures on site and in the surrounding area; (iii) preliminary evidence of an off-site leachate impact in wells along Beechwood Road[1]; (iv) groundwater flow directions towards the south and west, generally in the direction of the TMT. Also, salinization of the shallow aquifer groundwater could potentially occur in the event of the construction of a fracture trench in response to problem with leachate migration: pumping of groundwater from the fracture trench could give rise to upwelling of high salinity deep groundwater and consequent salinization of the shallow aquifer. The fracture trench contingency plan was previously proposed in the WM EA documents. For the above reasons, the Closure Plan should include measures aimed at minimizing leachate production and migration at the closed site.

- It is possible that odours and landfill gases released from the landfill could impact air quality in the TMT (note that some TMT residents have reported detecting odours originating from the existing Richmond Landfill operation). As mentioned above, spray irrigation of leachate has been proposed as a possible contingency measure. This could give rise to increased odours at the proposed site, possibly impacting the TMT.

3. Determination of the adequacy of the contingency plan.

   The contingency plan is inadequate. At a minimum contingency measures should include a discussion of potential contingency measures for repair of leachate seeps, leachate collection system, off-site groundwater impacts, surface water works, odours, final cover, and leachate management.

4. Assessment of the manner in which leachate is to be managed following closure, including an assessment of the potential for surface water discharges of leachate.

   As discussed previously, the discussion of the management of leachate is inadequate. The site will be unattended so leachate seepage could go undetected between inspections, as discussed above. Accordingly, we have recommended an increased inspection frequency in the first two years and the establishment of surface water monitoring points at the pond outlets.

5. Assessment of the adequacy of the monitoring program.

   See comments above.

6. Assessment of the compliance of the proposed end uses with applicable laws and regulations.

   There are no specific legal requirements for end use, except that certain types of developments (e.g., constructing buildings) cannot legally be carried out on former landfill properties for at least 25 years after closure (unless special permission is obtained from the MOE). The requirement regarding a statement of the end use included in Condition 34 is targeted at determining if the proponent intends to develop the landfill in

[1]These potential impacts were documented in XCG's reports "Groundwater Investigation, Vicinity of Richmond Landfill, Napanee, Ontario," May 24, 2006; and "Statistical Analysis of Historic Monitoring Data at the Richmond Landfill, Napanee, Ontario," May 26, 2006.

some way that is unacceptable, rather than specifying particular usage. End use is a local planning and/or zoning issue. The MBQ should consider encouraging the owner to partner with the local Conservation Authority or other stakeholder to establish the site as a wildlife habitat area or other established passive use. This can include an agreement for an extended period to develop the site including planting of trees outside the limit of waste. This will discourage future reopening of the site as a landfill or other ancillary waste use such as a transfer station and provide a local green space. Typically a small parking lot and some wood chip covered trails are constructed for use by the public for walking and hiking.

If you have any questions, comments, or require further assistance, please do not hesitate to contact the undersigned.

Yours truly,

XCG CONSULTANTS LTD.

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cc: Todd Kring