Richmond Sanitary Landfill Site

Stormwater Contingency and Remedial Action Plan

March 2012

Prepared for:
Waste Management of Canada Corporation
1271 Beechwood Road
Napanee, ON K7R 3L1

Prepared by:
GENIVAR Inc.
1450 First Avenue West, Suite 101
Owen Sound, Ontario N4K 6W2

Project No. 081-12459-00 (8570)

GENIVAR

Project No. 081-12459-00 (8570)

March 22, 2012

Mr. Randy Harris, Landfill Manager
Waste Management of Canada Corporation
1271 Beechwood Road
Napanee, ON K7R 3L1

Re: Stormwater Contingency and Remedial Action Plan
Waste Management of Canada - Richmond Landfill Site

Dear Randy:

We are pleased to provide this Stormwater Contingency and Remedial Action Plan for the Richmond Landfill site. The report is being submitted to satisfy Condition 9 (1) of Environmental Compliance Approval (ECA) No. 1688-8HZNJG, amended January 10, 2012, which requires Waste Management to submit a detailed contingency plan for the stormwater management system, for approval within six (6) months of the date of ECA issuance.

Please find enclosed **fifteen (15) copies** for your distribution as you see fit. **One (1) copy** has been provided to the Ministry of the Environment, Environmental Assessment and Approvals Branch in Toronto, ON, by our office under separate cover. **One (1) copy** should be provided to the MOE district office in Kingston, ON, retain **one (1) copy** for your records, and the remainder can be distributed as needed at the landfill. If you require additional copies, please let us know. Please note that an electronic version of this document has been provided to Reid Cleland, Chris Prucha, and Wayne Jenken.

We trust the enclosed is satisfactory. However, if you have any additional questions, please do not hesitate to contact the writer.

Very truly yours,

GENIVAR Inc.

Jeff E. Armstrong, P.Eng.
Designated Consulting Engineer
Director, Solid Waste Management

JEA/bdl
Encl.

1450 1st Avenue West, Suite 101, Owen Sound, Ontario N4K 6W2
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1.0 INTRODUCTION

1.1 Background

Waste Management of Canada Corporation's (WM) Richmond Landfill site is located within Part of Lots 1, 2, and 3, Concession IV, Former Township of Richmond, now the Town of Greater Napanee. The landfill site consists of a 16.2 hectare waste disposal landfill site within a total site area of 138 hectares, and operates under Environmental Compliance Approval (formerly Certificate of Approval) No. A371203, including amendments.

The landfill is located between Kingston and Belleville, just north of Highway 401, and is shown on the following **Figure 1.** More specifically, the landfill is located just east of Lennox and Addington County Road 10, and just north of Beechwood Road. The site is located in a rural setting, surrounded by land that is used primarily for agricultural purposes.

On June 30, 2011, the Richmond Landfill ceased to accept waste for landfilling, as per a condition of Environmental Compliance Approval No. A371203. The final cover system was installed over the remaining uncapped portion of the landfill in September 2011.

1.2 Purpose and Scope

The purpose of this Stormwater Contingency and Remedial Action Plan (Plan) is to provide a framework for responding to a failure of the stormwater management system at the Richmond Landfill. As such the objectives of this Plan are as follows:

- To provide a summary of the trigger mechanisms for failure of the stormwater management system;
- To identify the remedial actions that would be implemented once a trigger mechanism has been identified; and
- To identify contingency systems that should be considered for the long-term remediation and repair of the stormwater management system.

This Plan is provided in accordance with Condition 9 (1) of Environmental Compliance Approval No. 1688-8HZNJG, issued January 10, 2012, which states the following:

> *"Within six (6) months of the issuance date of this Approval, the Owner shall prepare a "Stormwater Contingency and Remedial Action Plan" for the Works and submit to the District Manager for approval.*

G:\1985\8570\DRAWINGS\2009\8570-F1-GENIVAR.dwg PLOTTED Tuesday, March 13, 2012 10:02:21 AM

SHEET 1	DWN BY: T C G DATE: MAR 2004 CHK BY: J E A SCALE: SEE BAR SCALE	SITE LOCATION PLAN
	WASTE MANAGEMENT OF CANADA CORP.	RICHMOND LANDFILL
	DRAWING NO. 0857013 – Figure 1	

WM. WASTE MANAGEMENT

GENIVAR
1450 First Avenue West, Suite 101,
Owen Sound, ON, N4K 2K8
Telephone: (519) 376-7612 / Fax: (519) 376-8008

Remedial actions and contingency systems described in subsequent sections of this report are presented in conceptual detail only, in order to consider the benefits and design requirements of each action or system. As the final design of each action or system will depend upon yet to be determined variables, such as location, the use of an action or system to address a need, or timing, engineered drawings are not presented in this document. However, detailed engineered drawings will be prepared for review, and shall receive final approval from the MOE, prior to or concurrent with the implementation of a remedial action or contingency system at the Richmond Landfill.

2.0 STORMWATER MANAGEMENT SYSTEM

2.1 Background

The Richmond Landfill's stormwater management system is approved under Environmental Compliance Approval (ECA) No. 1688-8HZNJG, with amendments. The site is designed with ditches, culverts, and stormwater ponds to drain the site. Stormwater ponds are designed to draw off coarse sediment in the forebay and settle finer particles in the much larger aft bay. In addition, the aft bay is planted with submergent and emergent wetland vegetation to absorb nutrients, filter sediment, assist with settling and generally improve effluent quality. The ponds are designed to have sufficient storage so that flood flows are equal to or less than the pre-development flows from the site when routed through the ponds. All ponds ultimately outlet to culverts or ditches, which then flow offsite.

The ECA for the stormwater management system covers the following items listed below. The location and details of the various components of the system are shown on the drawings contained in **Appendix A**:

2.1.1 Stormwater Management Pond No. 1

This pond, also referred to as SWM Pond No. 1, is located north of the landfill mound. The pond was constructed in 1999 for a 25 year design storm having a minimum storage volume of 228 cubic metres to retain surface runoff from an area of 3.38 hectares. SWM Pond No. 1 discharges at a rate of 70 litres per second via a 375mm diameter outlet pipe fitted to a drop inlet pipe structure, to a headwater tributary of Marysville Creek. Other items associated with SWM Pond No. 1 include a drawdown structure, a 1200mm diameter drop inlet pipe, a 3.5 metre wide emergency spillway channel, rock baffle, erosion and silt control protection.

2.1.2 Stormwater Management Pond No. 2

This pond, also referred to as SWM Pond No. 2, is located northwest of the landfill mound. The pond was constructed in the early 1990s for a 25 year design storm having a minimum storage volume of 332 cubic metres to retain surface runoff from an area of 4.94 hectares. SWM Pond No. 2 discharges at a rate of 103 litres per second via a 375mm diameter outlet pipe (fitted to a drop inlet pipe structure) to a headwater tributary of Marysville Creek. Other items associated with SWM Pond No. 2 include a drawdown structure, a 1200mm diameter drop inlet pipe, a 3.5 metre wide emergency spillway channel, rock baffle, erosion and silt control protection.

2.1.3 Stormwater Management Pond No. 3

This pond, also referred to as SWM Pond No. 3, is located south of the approved landfill footprint and north of Beechwood Road. The pond was constructed in the early 1990s for a 25 year design storm having a minimum storage volume of 563 cubic metres to retain surface runoff from an area of 8.18 hectares.

In 2008, Waste Management applied for, and received approval from the MOE, to reconstruct SWM Pond No. 3 to improve water quality from the site and to improve the aesthetics of the site entrance. The facility was constructed for a 100 year design storm, and comprised of two (2) extended wet detention ponds interconnected by two (2) 750mm diameter culverts. The upgraded pond now provides a permanent pool storage capacity, including sediment, of 19,642 cubic metres between the elevations of 122.4 metres above sea level and 124.4 metres above sea level, and an active storage capacity of 7,620 cubic metres between the elevations of 124.4 metres above sea level and 124.73 metres above sea level. The overall total storage capacity of SWM Pond No. 3 is 27,262 cubic metres. Each detention pond is equipped with a rip rap lined structure, a forebay, and cattails planted in the shallow areas surrounding the permanent pool. An outlet structure consisting of one (1) 600mm by 600mm precast concrete catch basis equipped with a 100mm diameter orifice, one (1) 300mm diameter polyvinyl chloride (PVC) discharge pipe equipped with one (1) 300mm diameter gate valve is also present at SWM Pond No. 3, which discharges via a drainage ditch to the Beechwood Road side ditch eventually flowing to Marysville Creek. The pond also contains a 3.0 metre wide rip rap lined emergency spillway with an invert elevation of 124.73 metres above sea level, which discharges via a drainage ditch to the Beechwood Road side ditch, and associated controls and appurtenances.

Construction of SWM Pond No. 3 began in late 2008 and was completed in early 2009. During the summer of 2009, repairs were made to the outlet control area and the south berm of the pond located west of the entrance to the landfill. In late summer of 2010, the outlet control structure was relocated to the north toe of the outlet berm. A summary of the repair work completed on SWM Pond No. 3 in 2009 and 2010 can be found in **Appendix B.**

2.1.4 Leachate Storage Lagoon

A high density polyethylene (HDPE) and clay lined storage lagoon is located to the north of the waste mound. This structure was built in the early 1990s, and has a volume of approximately 16,245 cubic metres. This structure is used for temporary storage of leachate or leachate contaminated stormwater, until it can be removed by vacuum truck and disposed offsite at a pre-approved sewage treatment facility. The lagoon was decommissioned in 2010 but remains as a contingency for storage of leachate.

2.2 Operational Controls

Under normal conditions, the sluice gates on the outlet piping in the dedicated valve chambers will be open. Stormwater will flow into the ponds, deposit the coarse fraction of sediment in the forebay and settle smaller particles in the aft bay. All ponds have sluice gates to shut off discharge if required.

2.3 Monitoring and Reporting

2.3.1 Inspection and Maintenance Program

Conditions of ECA No. A371203 and ECA No. 1688-8HZNJG govern the inspection and maintenance of the stormwater management facilities. Quarterly (every three (3) month) inspections of the surface water

drainage works and erosion and sediment in the surface water drainage system are required. Ditches and culverts are to be cleaned on an annual basis for the first five (5) years after site closure. Prior to five (5) years after closure, WM will submit a proposed maintenance schedule for approval to the MOE, which will cover the period from five (5) years after closure until the end of the contaminating lifespan.

If cleaning of the aft bay of the stormwater pond is required where submergent and emergent vegetation is growing, it is recommended that the cleaning and excavation be carried out over a period of more than one (1) year, and preferably every three (3) years. This way, alternating amounts of material can be excavated and removed leaving existing vegetation to populate the cleaned area before removal is required in that particular area.

A dedicated electronic log documenting the results of inspection, and cleaning and maintenance activities is maintained and kept onsite. A cost for pond maintenance activities through the end of the site's contaminating lifespan has been provided in the financial assurances for the site.

2.3.2 Stormwater Monitoring Program

Conditions of ECA No. 1688-8HZNJG govern the stormwater monitoring program in place at the Richmond Landfill. Stormwater sampling events occur at a monthly frequency during spring (March, April, and May) and fall (September, October, and November), and samples collected from SWM Pond No. 1, SWM Pond No. 2, and SWM Pond No. 3 are analyzed for the parameters listed in the ECA. Samples are also collected from the three (3) ponds on a quarterly basis and acute lethality tests for Daphnia *magna* and rainbow trout are performed. All records of monitoring activities, including analytical results, will be retained onsite for a minimum of three (3) years.

2.3.3 Reporting

On an annual basis, a performance report on the stormwater management system must be completed and submitted to the MOE within 90 days of the end of the calendar year being reported. The following information is to be included in the performance report:

- A summary and interpretation of all stormwater monitoring data and a comparison to the Provincial Water Quality Objectives (PWQO), including an overview of the success and adequacy of the works;
- A description of any operating problems encountered and corrective actions taken;
- A summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism, or thing forming part of the works;
- A summary of all by-pass, spill, or abnormal discharge events; and
- Any other information the District Manger requires from time to time.

In the event that leachate contaminated stormwater is discharged from the site, WM is required to notify the MOE orally as soon as the event occurs, and in writing within seven (7) days of the event. WM must provide an assessment of the extent of the contamination, the estimated volume of stormwater discharged, and proposed or completed remedial actions.

3.0 TRIGGER MECHANISMS

Trigger mechanisms for the stormwater management system are provided through regular monitoring programs and site inspections. The trigger mechanisms are identified below:

- Acute lethality analytical results
    - If stormwater sampling results reveal that the stormwater is acutely lethal either to Daphnia *magna* or rainbow trout, further investigation will be required to determine the cause.
- Reduced Stormwater Flow from Outlet Pipe
    - If the quantity of stormwater draining from the outlet pipe has decreased, it can be determined there is a potential blockage. Further investigation may be required to determine the cause.
- Overflow of the Emergency Spillway
    - In the event that stormwater is seen to be draining from the ponds via the emergency spillway, it can be determined that a failure of the outlet control structure may have occurred. Further investigation may be required to determine the cause.
- Presence of Contamination in Onsite Ditches leading to Stormwater Ponds
    - If discolouration of the water is present in onsite ditches leading to the stormwater ponds, it can be determined there may be contamination occurring onsite. Further investigation may be required to determine the cause.

4.0 REMEDIAL ACTIONS

In the event of a failure of the stormwater management system, remedial measures would have to be taken such that the control of stormwater could be continued at the landfill site. Various alternatives for the remedial actions are presented below.

4.1 Additional Stormwater Sampling Events

If it has been determined that a quarterly sampling analytical result has revealed stormwater is acutely lethal to Daphnia *magna* and rainbow trout, a condition of ECA No. 1688-8HZNJG requires WM to perform a second round of sampling within two (2) weeks of receiving the initial laboratory results, to confirm the toxicity results. If the additional sampling event does not confirm the toxicity results, then normal stormwater monitoring procedures will resume.

In the event that the second round of sampling confirms the toxicity results, WM is required to operate the stormwater management ponds in a closed position (as opposed to the normally open position), and the MOE will be notified of the confirmatory results. Acute lethality testing for Daphnia *magna* and rainbow trout will be performed on a monthly basis while the ponds are operating in a closed position. The stormwater ponds will resume operation in a normally open position if toxicity monitoring results from two (2) consecutive sampling events reveal that stormwater is not acutely lethal to Daphnia *magna* and rainbow trout.

Removal of contaminated stormwater from the ponds can be performed in one of two ways. The vacuum pumper trucks used to remove leachate from the north chamber and south pump station can be utilized to remove stormwater directly from the ponds for disposal at the sewage treatment plant in the Town of Greater Napanee. In the event that a significant amount of contaminated stormwater is involved, the stormwater could be pumped via aboveground pipeline to the leachate storage lagoon located north of the landfill mound. The lagoon has a storage volume of over 16,000 cubic metres, and water could be contained within the lagoon until it is removed from the site via vacuum pumper trucks for disposal at the sewage treatment plant.

4.2 Replacement of Outlet Piping

If a portion of the outlet control piping is no longer allowing stormwater to flow, the section of pipe should be inspected and cleaned. If cleaning of the pipe does not improve flow, then the pipe could be replaced. A section of the outlet control berm would be removed to expose the piping. Excavation would be controlled to ensure that no damage would be done to the surrounding infrastructure. The pipe would be removed and replaced with new material. Piping would be installed at the same grade as the previous piping. Once the repair has been completed, the outlet berm material would be replaced.

To prevent stormwater from discharging from the site during this activity, the pond under repair would be dewatered.

4.3 Reconstruction of Outlet Structures

Monitoring of structures for failure is expected to be monitored over a longer period of time, to assess the seriousness of the defect. If it is determined that the structure may fail, either replacement or repair could be considered. Replacement would involve similar procedures as outlined above for the repair of a drainage outlet pipe.

The repair will depend on the type and location of the defect. Repair could involve the replacement of a valve, or entire outlet control structure.

4.4 Additional Cleaning of Stormwater Ponds

Additional material removal from the aft bay of the stormwater ponds may be required to increase the storage volume of the ponds. As well, contaminated material present in the ditches will have to be removed to avoid further contamination of the ponds.

Material dredged from the ponds or ditches would be removed from the site by an approved waste hauler and disposed of at a licensed facility.

4.5 Repair of Leachate Seeps

During the post-closure period, WM is required to inspect the site on a weekly basis for the presence of leachate seeps. A seep is defined as an area where a fluid contained in the ground oozes slowly to the surface and often forms a pool. Seeps can be caused by several factors, including the presence of impermeable layers, which prevents liquid from draining into the landfill's collection system, excessive liquid levels, gas pressure, erosion rills, and weather conditions. Seeps can be detected either by areas on the final cap where vegetation is usually dead or dying, by odours emanating from the area, or by the presence of black staining on the final cap.

The installation of the final cover system at the Richmond Landfill, combined with an effective landfill gas collection system, is intended to reduce or eliminate the presence of leachate seeps. However, seeps may still occur. If seeps are detected, repairs are to be made within 48 hours of notice. Leachate seep repairs consist of removal of the final cover system, removal of the blockage, installation of a vertical drainage pack, and replacement of the final cover system.

If a seep has resulted in leachate flowing to the ditches surrounding the landfill footprint, any contaminated stormwater present will be removed via vacuum truck and disposed of at the sewage treatment facility. Any accumulated sediment present in the ditches in the vicinity of the seep will also be removed and disposed of at an approved facility.

5.0 CONCLUSION

The Richmond Landfill Stormwater Contingency and Remedial Action Plan contains details regarding the steps that may be taken in the event of a failure of the stormwater management system. The main components of the program involve monitoring the system at regular intervals, conducting sampling programs, and recording findings. Through the review of long term observations, trends can be evaluated to determine if failure may occur. Each contingency plan would be evaluated at the specific time to determine which alternative is best, or if there is a more suitable alternative.

Respectfully submitted,

GENIVAR Inc.

Beverly D. Leno, CET
Environmental Technologist
Solid Waste Management
BDL/JEA/emm

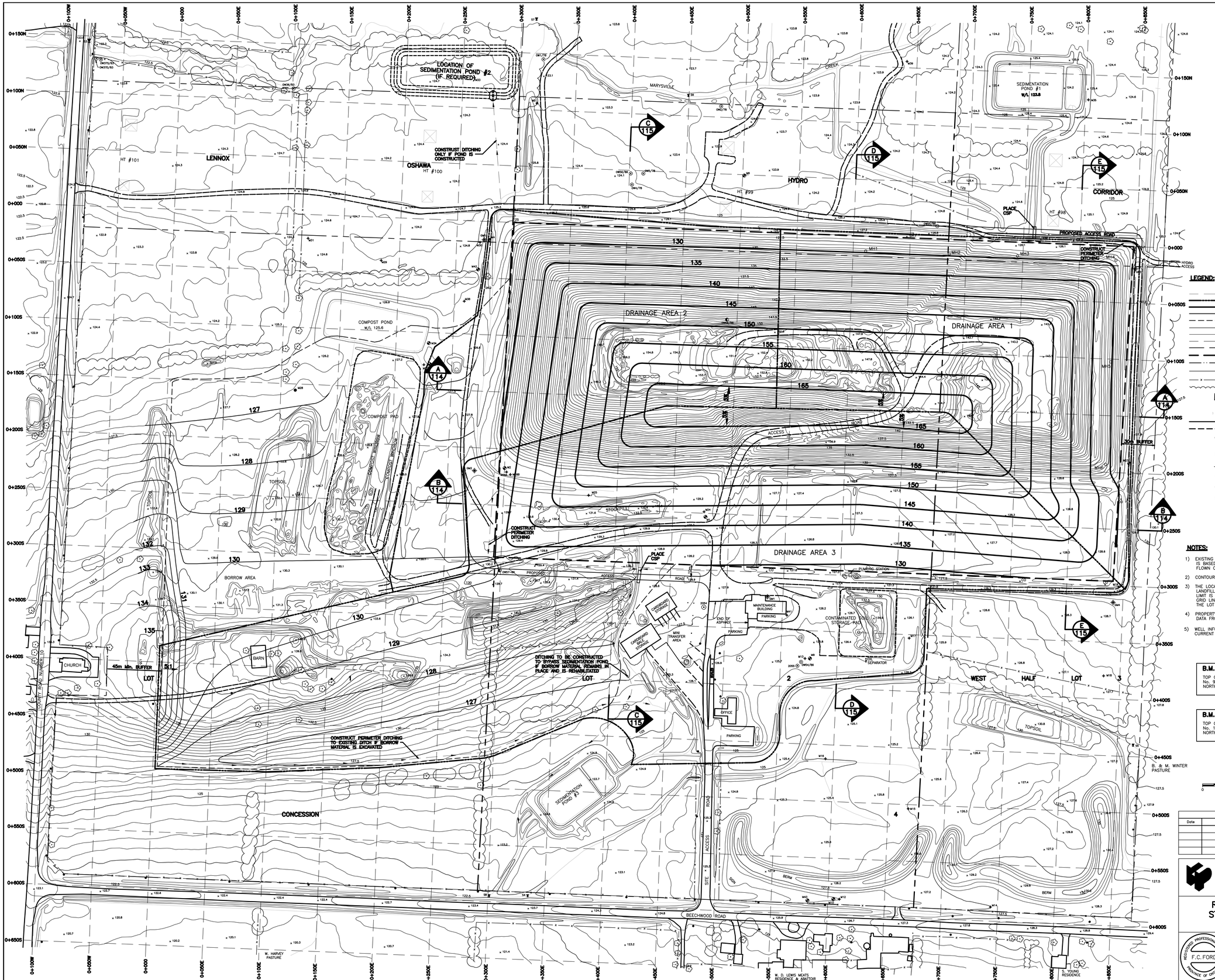
Jeff E. Armstrong, P.Eng.
Designated Consulting Engineer
Director - Solid Waste Management

Appendix A

Stormwater Management System Drawings

Appendix A.1

Drawing 8570F-107: Stormwater Management Drainage Areas March 1996



LEGEND:

- PROPOSED SURFACE DRAINAGE DITCHING
- LIMIT OF DRAINAGE AREAS
- PROPOSED FINAL LANDFILL CONTOURS
- PROPOSED FINAL BORROW AREA CONTOURS
- PROPOSED BORROW AREA LIMIT
- INDEX CONTOURS
- INTERVAL CONTOURS
- REFERENCE GRID LINE
- PROPERTY LINE
- APPROVED LIMIT OF LANDFILL
- PHASING LIMITS
- EXISTING DITCH
- EXISTING FENCELINE
- EXISTING TREELINE
- HT #98 — EXISTING HYDRO TOWER (ID #)
- EXISTING HYDRO POLE
- EXISTING CULVERT
- EXISTING ROAD EDGE (ASPHALT)
- EXISTING ROAD EDGE (GRAVEL)
- OW51/85 — BEDROCK OBSERVATION WELL (BY MORRISION BEATTY LTD.)
- OW50/85 — OVERBURDEN OBSERVATION WELL (BY MORRISION BEATTY LTD.)
- GM4 — GAS MONITORING WELLS (BY W.E.S.A.)
- M22 — OVERBURDEN PIEZOMETER WELL (BY W.E.S.A.)
- M44 — BEDROCK PIEZOMETER WELL (BY W.E.S.A.)
- SS — SURFACE WATER SAMPLING POINT

NOTES:

1) EXISTING GROUND CONTOURS AND TOPOGRAPHIC INFORMATION SHOWN IS BASED ON INFORMATION OBTAINED FROM AERIAL PHOTOGRAPHY FLOWN ON DECEMBER 8, 1995 BY INTERMAP TECHNOLOGIES.
2) CONTOUR INTERVAL SHOWN IS 0.5m
3) THE LOCAL SITE GRID IS BASED ON 0+000N BEING THE NORTH LANDFILL LIMIT. THE NORTH WEST CORNER OF THE LANDFILL LIMIT IS 0+300E AND IS PERPENDICULAR TO THE EAST/WEST GRID LINE. THE WEST LIMIT OF THE LANDFILL IS LOCATED ALONG THE LOT LINE BETWEEN LOTS 1 AND 2, CONCESSION 4.
4) PROPERTY OWNERS SHOWN ARE BASED ON ASSESSMENT ROLL DATA FROM THE TOWNSHIPS OF RICHMOND AND TYENDINAGA.
5) WELL INFORMATION SHOWN WAS PROVIDED BY W.E.S.A. AND IS CURRENT TO FEBRUARY 1995.

B.M. #1 ELEV. = 124.667

TOP OF BRACKET, NORTH WEST LEG OF HYDRO TOWER No. 99. LOCATED ±25m NORTH AND ±180m EAST OF NORTH WEST CORNER OF APPROVED LANDFILL LIMIT.

B.M. #2 ELEV. = 125.146

TOP OF BRACKET, NORTH WEST LEG OF HYDRO TOWER No. 100. LOCATED ±25m NORTH AND ±80m WEST OF NORTH WEST CORNER OF APPROVED LANDFILL LIMIT.

SCALE :
0 50 100m

REVISIONS		
Date	Description	By

HENDERSON, PADDON & ASSOCIATES LIMITED
CIVIL ENGINEERING CONSULTANTS & PLANNERS
OWEN SOUND ◆ BLIND RIVER ◆ PORT ELGIN

RICHMOND LANDFILL SITE STORMWATER MANAGEMENT DRAINAGE AREAS

CLIENT: LAIDLAW WASTE SYSTEMS (RICHMOND) LTD.

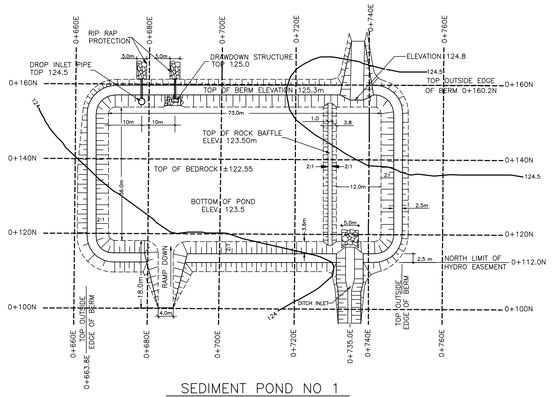
Design:	J.E.A.	Scale:	SEE BAR SCALE
Drawn:	T.C.G.	Date:	MARCH 1996
Traced:		Approved:	
Checked:	F.C.F.		Design Engineer

REGISTERED PROFESSIONAL ENGINEER F.C. FORD PROVINCE OF ONTARIO

DRAWING No. 8570F – 107

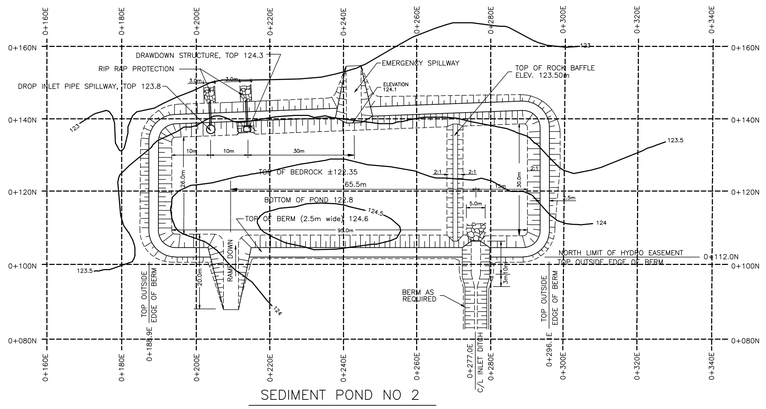
Appendix A.2

Drawing 8570F-108: Sediment and Leachate Pond Details March 1996



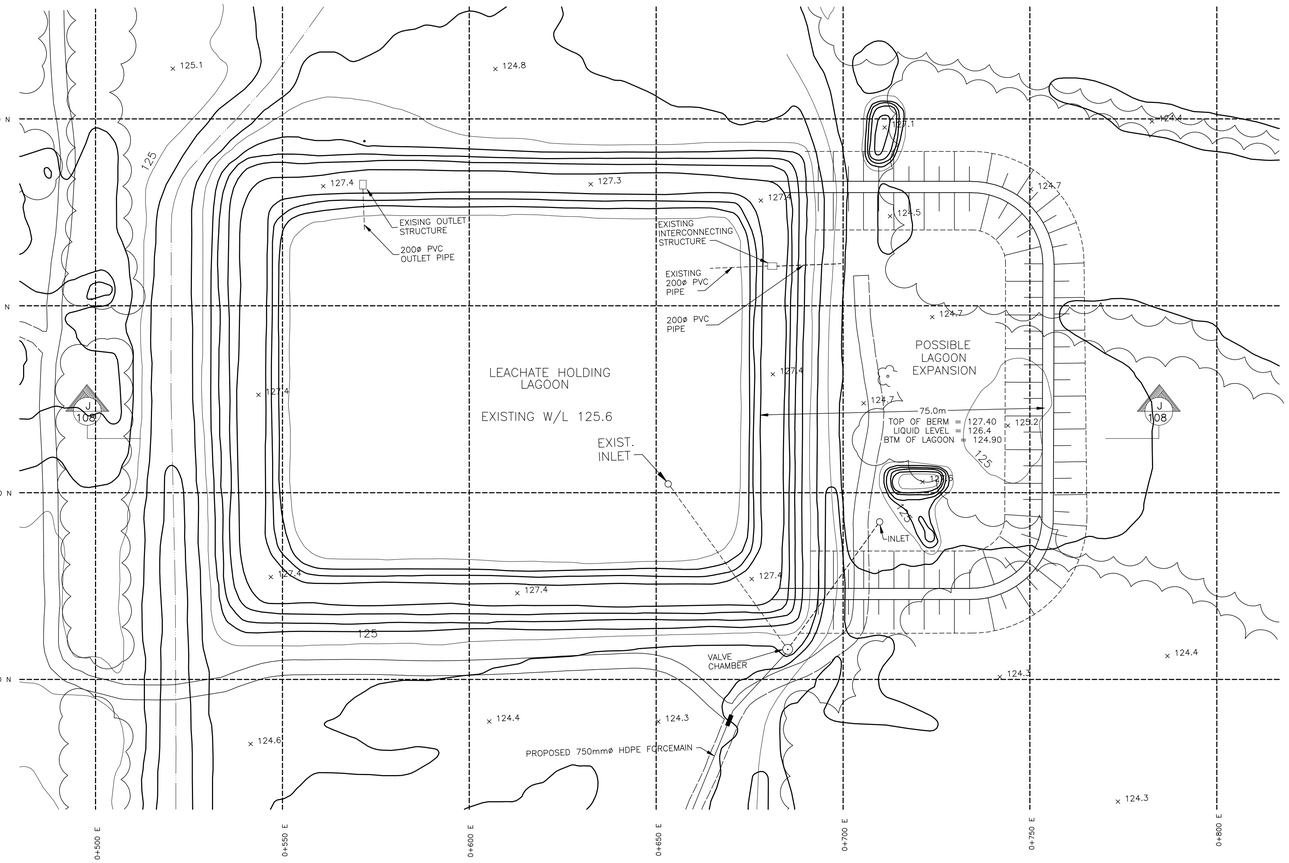
SEDIMENT POND NO 1

SCALE ~ 1:500



SEDIMENT POND NO 2

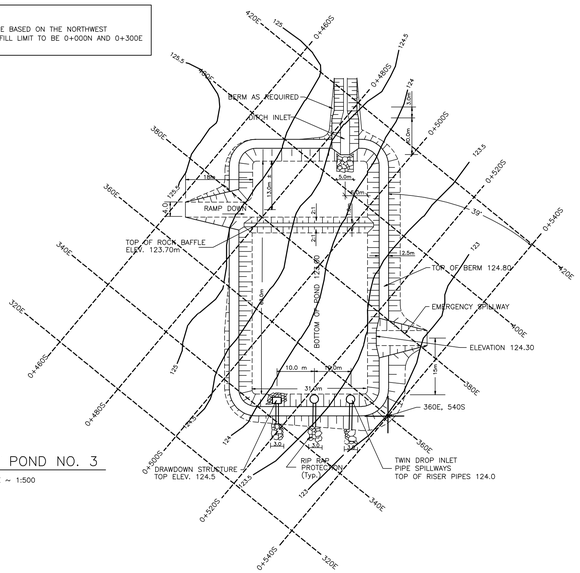
SCALE ~1: 500



PLAN OF LEACHATE HOLDING LAGOON

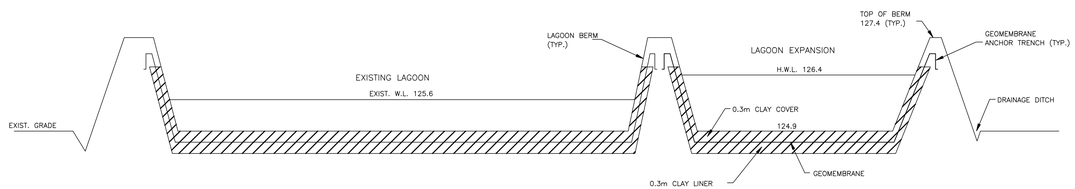
SCALE ~1: 500

NOTE:
GRID LINES SHOWN ARE BASED ON THE NORTHWEST CORNER OF THE LANDFILL LIMIT TO BE 0+000N AND 0+300E



SEDIMENT POND NO. 3

SCALE ~ 1:500



LEACHATE HOLDING LAGOON (J 108)

SCALE :
1 : 500 HORIZONTAL
1 : 50 VERTICAL

REVISIONS		
Date	Description	By

HENDERSON, PADDON & ASSOCIATES LIMITED
CIVIL ENGINEERING CONSULTANTS & PLANNERS
OWEN SOUND ◆ BLIND RIVER ◆ PORT ELGIN

RICHMOND LANDFILL SITE SEDIMENT AND LEACHATE POND DETAILS

CLIENT: LAIDLAW WASTE SYSTEMS (RICHMOND) LTD.

Design:	J.E.A.	Scale:	SEE BAR SCALE
Drawn:	T.C.G.	Date:	MARCH 1996
Traced:		Approved:	
Checked:	F.C.F.		Design Engineer

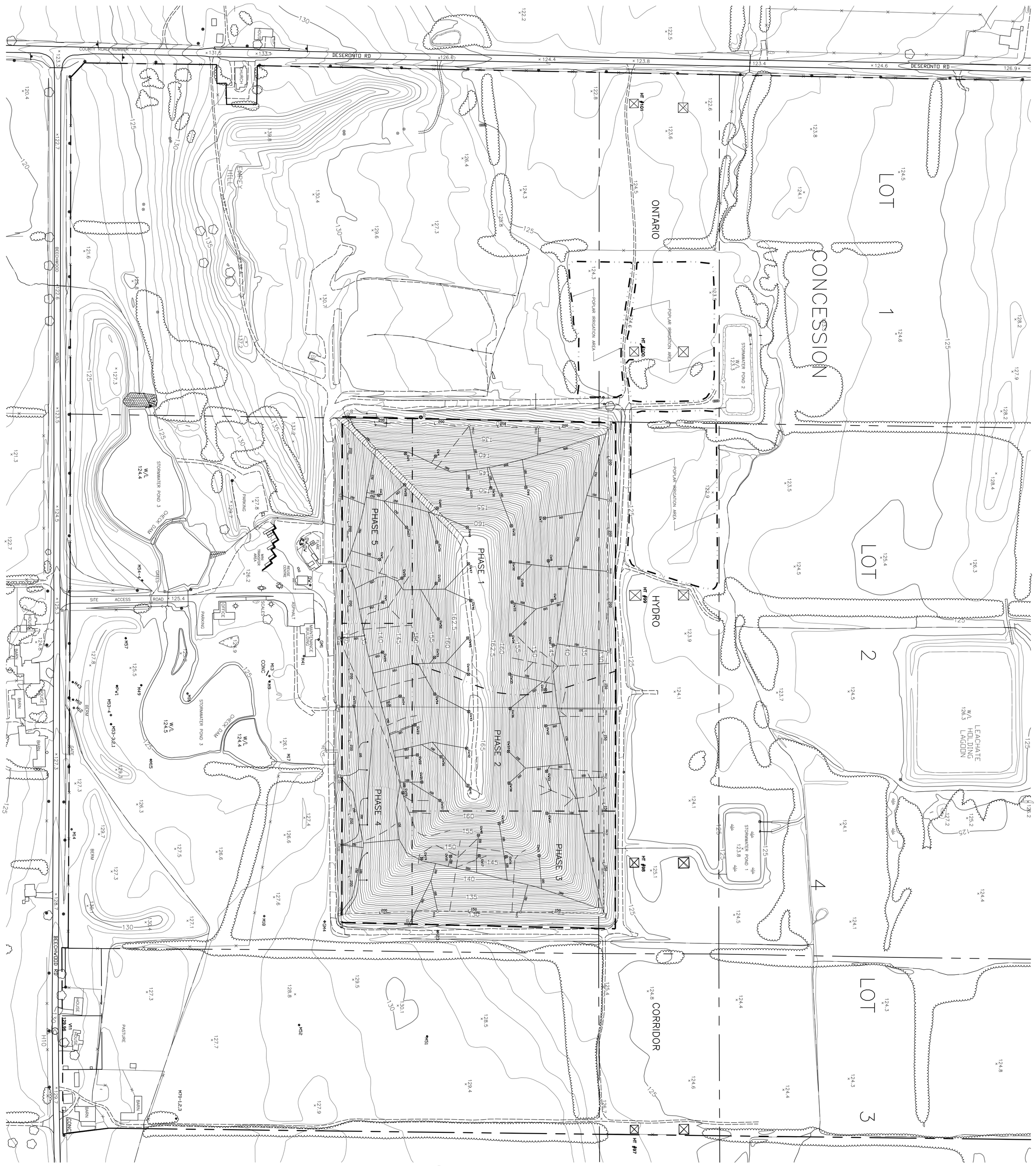
F.C. FORD — LICENCED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO

DRAWING No. 8570F – 108

Appendix A.3

Drawing 8570-2011: Existing Conditions Plan

G:\1985\8570\DRAWINGS\2011\CLOSURE PLAN\8570-2011 CLOSURE.dwg Mar 26, 2012 - 11:32am



LEGEND:

- INDEX CONTOURS
- INTERVAL CONTOURS
- REFERENCE GRID LINE
- LEGAL BOUNDARIES
- APPROVED LIMIT OF LANDFILL
- PHASING LIMITS
- EXISTING DRAINAGE DITCH
- EXISTING WEEPER
- EXISTING GAS LATERAL
- EXISTING FENCE LINE
- EXISTING TREE LINE
- EXISTING HYDRO TOWER (ID #)
- EXISTING HYDRO POLE
- EXISTING ROAD EDGE
- BEDROCK WELL LOCATION
- GAS MONITOR LOCATION
- OVERBURDEN WELL LOCATION
- EXISTING LEACHATE MANHOLE
- GAS WELL
- EXISTING TREE

NOTES:

1) EXISTING GROUND CONTOURS AND TOPOGRAPHIC INFORMATION SHOWN IS BASED ON INFORMATION OBTAINED FROM AERIAL PHOTOGRAPHY FLOWN ON JUNE 27, 2009 BY BASE MAPPING. WELL LOCATIONS AND LANDFILL MOUND CONTOURS WERE UPDATED FROM FIELD SURVEY DATA BY GENIVAR INC ON NOVEMBER 2011 AND FEBRUARY 22, 2012
2) CONTOUR INTERVAL SHOWN IS 0.5m
3) THE LOCAL SITE GRID IS BASED ON 0+000N ,BEING THE NORTH LANDFILL LIMIT AND NORTH WEST CORNER OF THE LANDFILL LIMIT, AND 0+000E BEING THE NORTH WEST CORNER OF THE LANDFILL. THE GRID LINE "0+000E" IS PERPENDICULAR TO THE EASTWEST GRID LINE. THE WEST LIMIT OF THE LANDFILL IS LOCATED ALONG THE LOT LINE BETWEEN LOTS 1 AND 2, CONCESSION 4.

B.M. #1 ELEV. = 124.667
TOP OF BRACKET, NORTH WEST LEG OF HYDRO TOWER No. 99, LOCATED ±25m NORTH AND ±180m EAST OF NORTH WEST CORNER OF APPROVED LANDFILL LIMIT.

B.M. #2 ELEV. = 125.146
TOP OF BRACKET, NORTH WEST LEG OF HYDRO TOWER No. 100, LOCATED ±25m NORTH AND ±80m WEST OF NORTH WEST CORNER OF APPROVED LANDFILL LIMIT.

SCALE : 1:2000
0 100 200m

DATE	DESCRIPTION	APP BY

DWN BY: T C G DATE: MARCH 20, 2012
CHK BY: J E A SCALE: SEE BAR SCALE

WASTE MANAGEMENT OF CANADA CORP.

DRAWING NO. 0857013 - 2011 CLOSURE

SHEET 2011

CLOSURE PLAN NOVEMBER 2011 EXISTING CONDITIONS

RICHMOND LANDFILL
NAPANEE, ONTARIO

WASTE MANAGEMENT

GENIVAR
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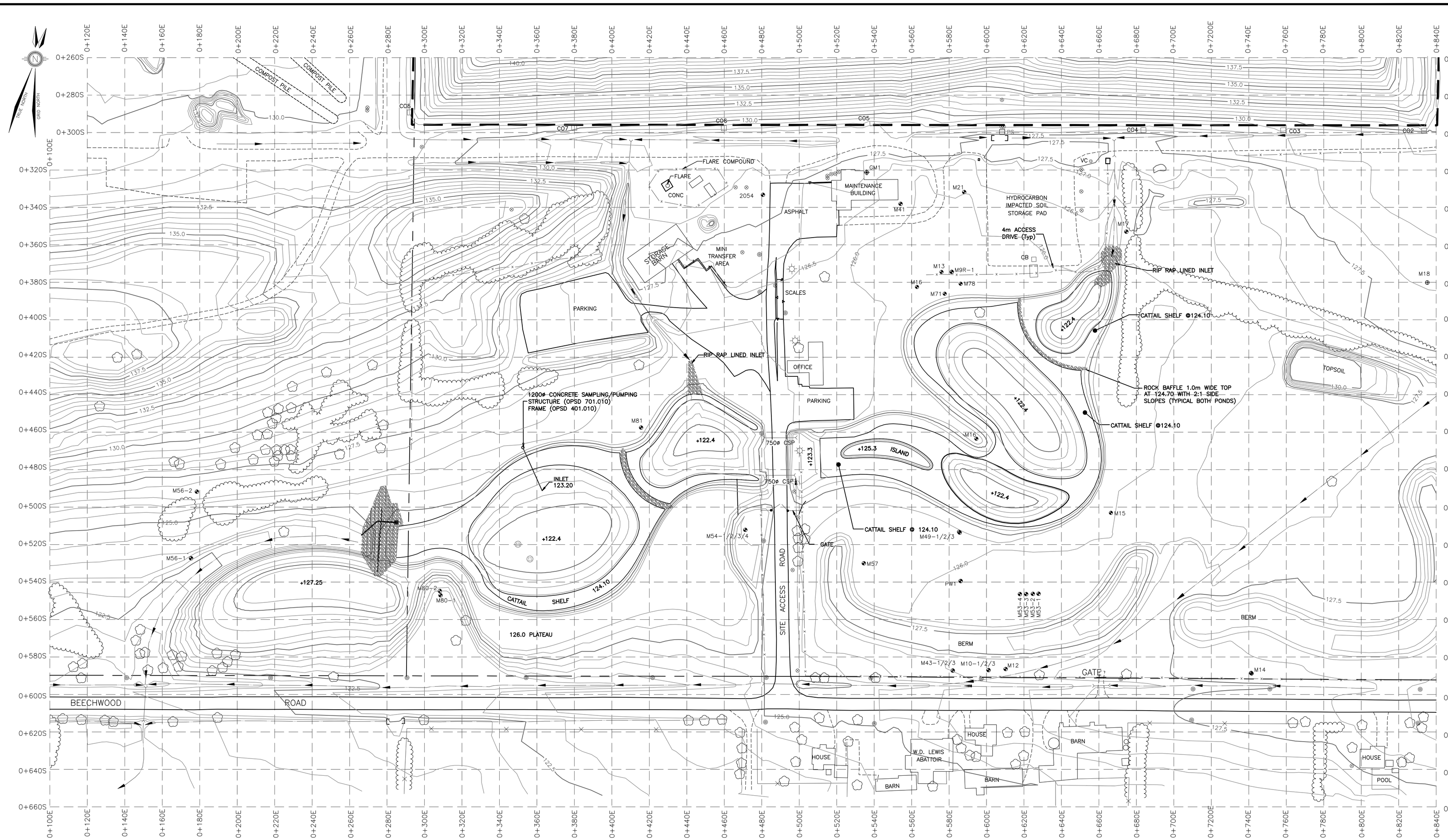
Toll Free: 1-888-376-7612

Appendix A.4

Drawings 8570G-1002 and 8570713-1008: As Built Drawings for SWM Pond 3 Reconstruction



LEGEND:

- INDEX CONTOURS
- INTERVAL CONTOURS
- REFERENCE GRID LINE
- LEGAL BOUNDARIES
- APPROVED LIMIT OF LANDFILL
- PHASING LIMITS
- PROPOSED DITCH
- EXISTING DRAINAGE DITCH
- EXISTING FENCE LINE
- EXISTING TREE LINE
- EXISTING HYDRO POLE
- EXISTING ROAD EDGE
- BEDROCK WELL LOCATION
- GAS MONITOR LOCATION
- OVERBURDEN WELL LOCATION
- MH3 EXISTING LEACHATE MANHOLE
- GW GAS WELL
- EXISTING TREE
- EXISTING LAMP STANDARD

NOTES:

1) EXISTING GROUND CONTOURS AND TOPOGRAPHIC INFORMATION SHOWN IS BASED ON INFORMATION OBTAINED FROM AERIAL PHOTOGRAPHY FLOWN ON JULY 4, 2002 BY BASE MAPPING AND MOUND CONTOURS UPDATED FROM FEILD SURVEY DATA BY HENDERSON PADDON AND ASSCIATES JUNE 21, 2006
2) CONTOUR INTERVAL SHOWN IS 0.5m
3) THE LOCAL SITE GRID IS BASED ON 0+000N BEING THE NORTH LANDFILL LIMIT. THE NORTH WEST CORNER OF THE LANDFILL LIMIT IS 0+300E AND IS PERPENDICULAR TO THE EAST/WEST GRID LINE. THE WEST LIMIT OF THE LANDFILL IS LOCATED ALONG THE LOT LINE BETWEEN LOTS 1 AND 2, CONCESSION 4.

B.M. #1 ELEV. = 124.667
TOP OF BRACKET, NORTH WEST LEG OF HYDRO TOWER No. 99. LOCATED ±25m NORTH AND ±180m EAST OF NORTH WEST CORNER OF APPROVED LANDFILL LIMIT.

B.M. #2 ELEV. = 125.146
TOP OF BRACKET, NORTH WEST LEG OF HYDRO TOWER No. 100, LOCATED ±25m NORTH AND ±80m WEST OF NORTH WEST CORNER OF APPROVED LANDFILL LIMIT.

SCALE : 1:1000
0 25 50 75m

"AS CONSTRUCTED"

DATE	DESCRIPTION	APP BY
APR. 2011	AS CONSTRUCTED	S M C

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WASTE MANAGEMENT

STORM WATER POND & DITCH AS BUILT

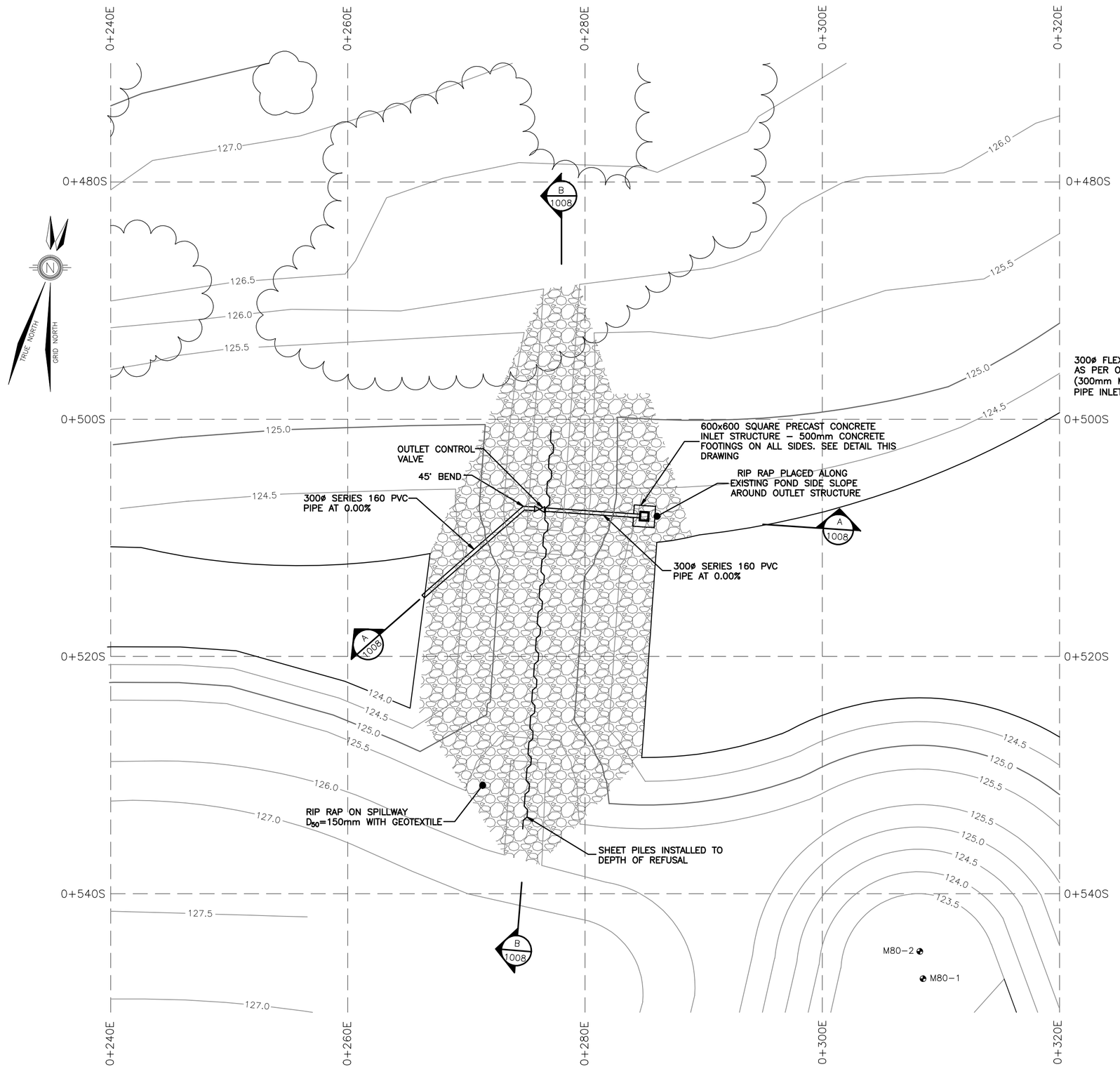
RICHMOND LANDFILL NAPANEE, ONTARIO

DWN BY: S M C
CHK BY: J E A
DATE: APRIL 19, 2010
SCALE: AS SHOWN

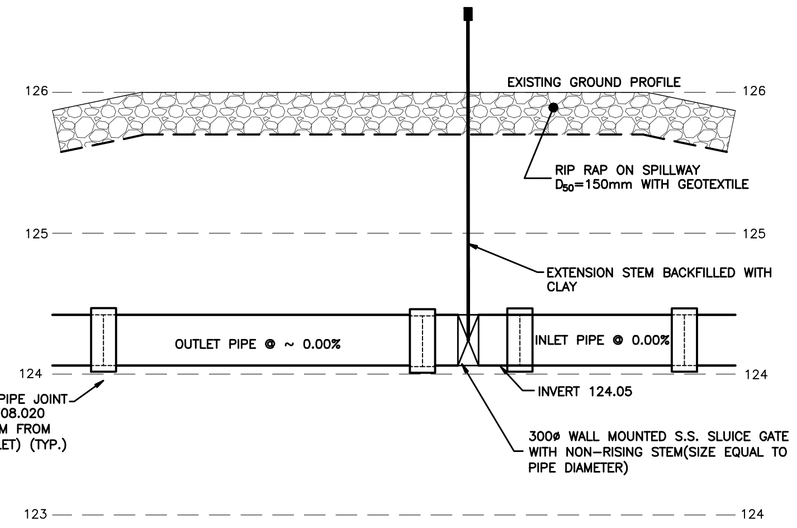
WASTE MANAGEMENT OF CANADA CORP.

DRAWING NO. **8570G - 1002**

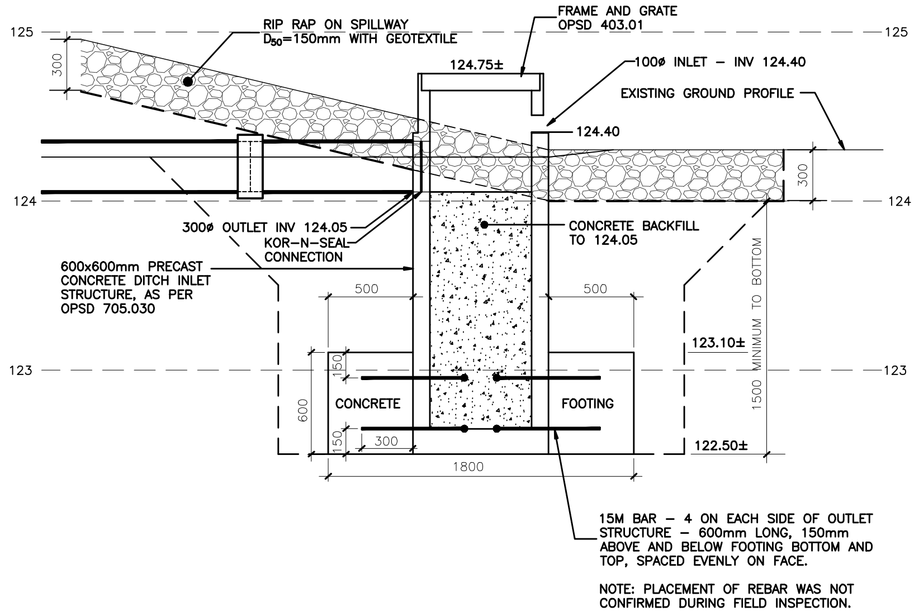
SHEET **1002**

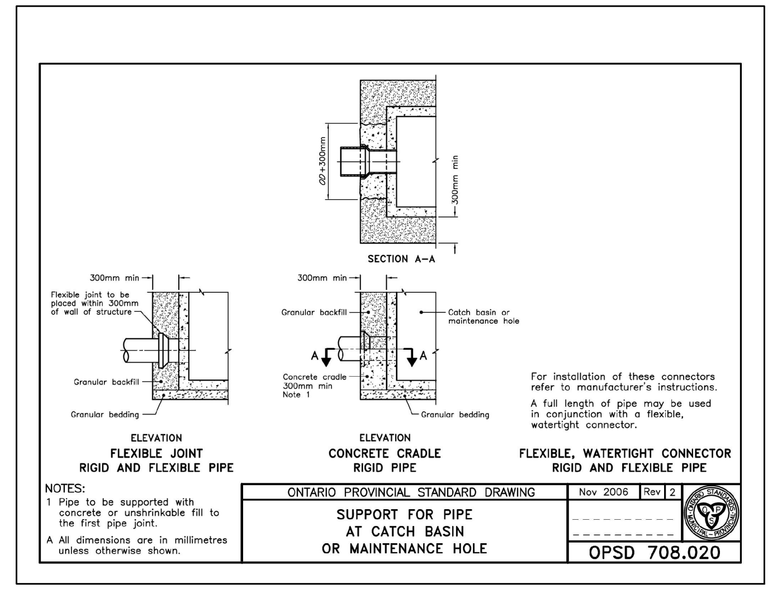


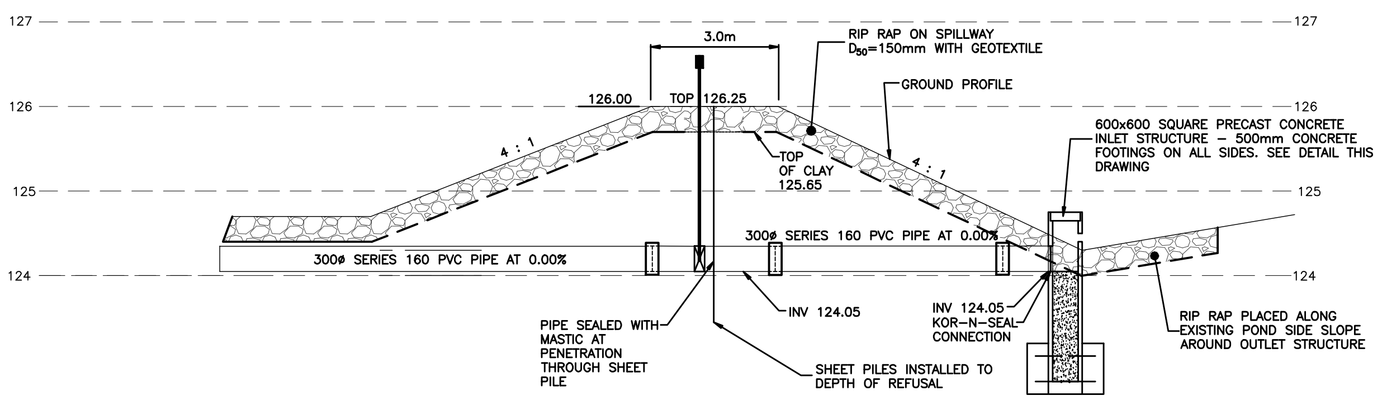
PLAN
SCALES : 1 : 250



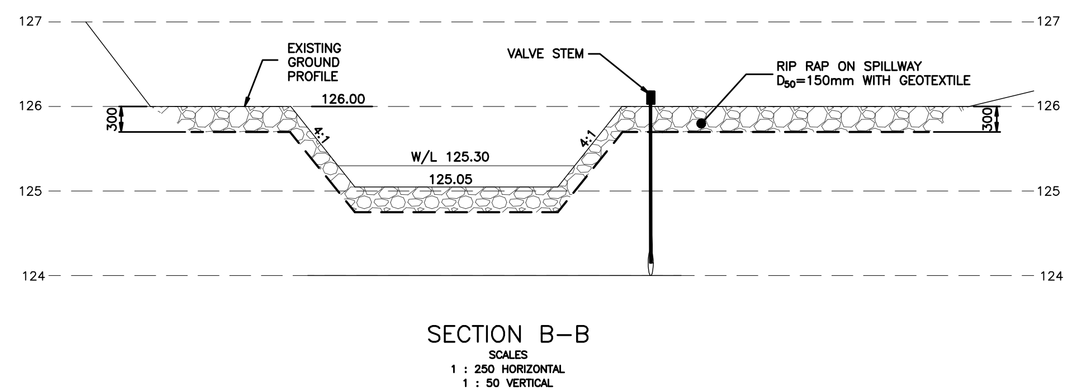
VALVE STEM SECTION
SCALE: 1:30







SECTION A–A
SCALES
1 : 100 HORIZONTAL
1 : 50 VERTICAL



SECTION B–B
SCALES
1 : 250 HORIZONTAL
1 : 50 VERTICAL

"AS CONSTRUCTED"

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WM WASTE MANAGEMENT

AS BUILT DRAWING
EMERGENCY SPILLWAY BERM

RICHMOND LANDFILL
NAPANEE, ONTARIO

DWN BY: S M C
CHK BY: J E A
DATE: APRIL 19, 2011
SCALE: AS SHOWN

WASTE MANAGEMENT OF CANADA CORP.

DRAWING NO. 8570713 - 1008

SHEET 1008

G:\1985\85700\DRAW\2011\Pond 3 as built drawings\85700-2011 REVISED.dwg Jan 19, 2012 - 2:51pm

Appendix B

Summary of Repairs Completed on SWM Pond 3

Appendix B.1

Memorandum for 2009 Repair on SWM Pond 3 – South Berm and Outlet Control Area

GENIVAR

Proj.No. 081-12493-00 (8570G)

December 7, 2010

Mr. Randy Harris, Landfill Manager
Waste Management of Canada Corporation
1271 Beechwood Road
Napanee, ON K7R 3L1

Re: Richmond Landfill Site
Southwest Sedimentation Pond – South Berm Repair

Dear Mr. Harris:

We are providing this letter to you to outline the history and inspection that was completed to the repair of the south berm along the southwest sedimentation pond, completed in the summer of 2009 at the Richmond Landfill Site. This letter will also summarize findings by GENIVAR during the pond repairs.

In May 2009, you contacted Mr. Jeff Armstrong of GENIVAR Consultants regarding differential settlement occurring in the pond. At the time, it was believed that unsuitable material was used to construct approximately 40 metre section of the south berm between stations 290E and 330E. This area was also not built to the specified height as shown on the Contract Drawings, and a breach of the containment berm occurred at this location during a heavy rain event. It was recommended by GENIVAR that this section be removed and reconstructed following the lines and grades on the Contract Drawings, with the completed berm having a minimum crest measuring three (3) metres wide, extending down to existing grade with 3:1 sideslopes. The berm would be constructed with native clay till material or another suitable clay type placed in lifts and compacted to the 95% SPMDD listed in the Contract Specifications. Waste Management accepted GENIVAR's recommendations, and retained Build-All Contractors of Shannonville, ON to complete the repair.

In July 2009, prior to Build-All commencing work, GENIVAR completed an inspection of the south berm. During this time, additional areas of settlement were found east and west of the repair area, along with extensive cracks. The crest of the berm was noted to be highly saturated, with depressions left by heavy equipment measuring approximately 200mm in some locations. A survey was completed on the south berm between 280E and 480E, or from the drainage outlet berm extending east to the end of the berm adjacent to the site entrance road, and found that the berm was not constructed to the lines and grades shown on the Contract Drawings. In some areas, the crest was as much as one (1) metre lower than shown on the design. Since the potential for additional berm failures was not limited to the previously defined location, it was no longer appropriate to complete the original repair and GENIVAR recommended that the scope of the repair work be extended to remove the 200 metre section of berm, and that reconstruction of the structure should follow procedures outlined for the smaller repair. Waste Management accepted GENIVAR's recommendations, notified Build-All of the work modification, and requested GENIVAR personnel supervise Build-All's activities.

On July 21, 2009, work commenced on the berm repair. Material was removed from the east end of the berm by a Caterpillar 325B excavator down to a native ground surface free of topsoil and organic matter. GENIVAR field personnel noted that extremely saturated material containing wood waste and chunks of frozen material was present in the soil, which resulted in several slides of the material into the work area. As work progressed west, the berm widened, and the excavator was also unable to safely reach the material adjacent to the cattail shelf due to the saturated conditions. It was decided to split the existing berm into two sections, with the south half removed first in approximately 20 metre long sections. Soil was loaded into triaxle trucks and hauled to a stockpile area located on the southwestern edge of the compost pad. Once a section was completed, and GENIVAR field personnel was satisfied that the

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was loaded into triaxle trucks and hauled to a stockpile area located on the southwestern edge of the compost pad. Once a section was completed, and GENIVAR field personnel was satisfied that the existing ground was solid, native clay till material was excavated from the onsite borrow source by a JCB 220L excavator and placed into triaxle trucks, which then hauled the material to the work area, where it was spread in lifts varying from 200mm to 300mm thick using a Caterpillar D6K bulldozer and compacted using an Ingersoll Rand SD100 sheepsfoot roller. Inspec-Sol from Kingston, ON was retained to perform compaction testing to confirm that a minimum of 95% SPMDD was being achieved on the placed material. The excavation was backfilled to an elevation of 124.5 metres before a new section was started. Upon completion of the removal of the south half of the berm, Build-All returned to the east end to remove the north half of the existing berm adjacent to the cattail shelf. Material was removed to the stockpile area and native clay till was hauled from the borrow source to the work area, which was placed and compacted following previously described methods. Inspec-Sol performed additional compaction testing to confirm a minimum of 95% SPMDD was achieved on the placed material. Work was completed on the excavation and backfilling activities on August 11, 2009. GENIVAR field personnel confirmed through GPS surveying that the berm was re-built to the correct grades and elevations as shown on the Contract Drawings.

Upon completion of final grading activities, a small area of the cattail shelf where the breach occurred in May 2009, and the new berm were covered with 300mm and 150mm of topsoil, respectively. Material was loaded by a JCB 220L excavator from the onsite borrow area located north of the west sedimentation pond into triaxle trucks, which hauled the material to the work area. A Caterpillar D6K bulldozer, later replaced by a Caterpillar 1150E bulldozer, was used to spread, grade and track pack the topsoil. Topsoiling activities were completed by August 31, 2009, with hydroseeding of the berm completed in early September 2009.

It is noted that all work was completed to the satisfaction of GENIVAR field personnel in accordance with the recommendations made in July 2009. Daily field reports documenting Build-All's activities, along with photographs of construction, and compaction testing results can be provided to you upon request.

We trust that the enclosed is satisfactory. However, should you have any questions or comments, please do not hesitate to contact the undersigned.

Yours truly,

GENIVAR Consultants LP

Beverly D. Leno, C.E.T.
Environmental Technologist
Solid Waste Management

Jeff E. Armstrong, P. Eng
Designated Consulting Engineer
Director, Solid Waste Management

BDL/JEA/bdl

cc: Mr. Dave White, Senior District Manager, Waste Management of Canada Corporation
Mr. Wayne Jenken, Landfill Engineer, Waste Management of Canada Corporation

Appendix B.2

Memorandum for 2010 Repair on SWM Pond 3 – Outlet Control Area

GENIVAR

081-12493-00 (8570G)

January 3, 2011

Mr. Randy Harris, Landfill Manager
Waste Management of Canada Corporation
1271 Beechwood Road
Napanee, ON K7R 3L1

Re: Richmond Landfill Site
Southwest Sedimentation Pond – Drainage Outlet Berm and Structure Repair

Dear Mr. Harris:

We are providing this letter to you to outline the history and inspection that was completed on the repair of the drainage outlet berm and structure at the southwest sedimentation pond, completed in 2009 and 2010 at the Richmond Landfill Site. This letter will also summarize findings by GENIVAR during the repair process.

In July 2009, GENIVAR completed an inspection of the southwest sedimentation pond prior to the start of work to repair a section of the south containment berm, which was breached during a heavy rain event in May 2009. A GPS survey revealed that the clay core of the drainage outlet berm was not constructed to the elevation shown on the Contract Drawings. It was also found that the riprap covering the clay was not placed to the proper extents or elevations.

Based on these findings, GENIVAR made the following recommendations:

1. The existing riprap and geotextile should be removed, and additional clay be placed on the core of the berm in lifts, and compacted with a sheepsfoot roller, to the elevation shown on the Contract Drawings; and

2. Geotextile and riprap should be placed over the clay core, to the extents and elevations shown on the Contract Drawings.

Waste Management accepted GENIVAR's recommendations, and retained Build-All Contractors of Shannonville, ON to complete the task. Work commenced on the repair on July 20, 2009, and was completed on August 14, 2009. GENIVAR field personnel monitored and documented the repair activities, and confirmed through GPS surveying that the berm was built to the correct grades and elevations.

In February 2010, Waste Management contacted Mr. Jeff Armstrong of GENIVAR Consultants regarding drainage concerns in the southwest sedimentation pond. You had indicated that water was exiting the pond, but no evidence of water was present in the outlet channel on the west side of the berm. On February 16, 2010, Mr. Armstrong visited the site to inspect the drainage outlet structure. An excavator was used to expose the sides of the drainage outlet structure and the surface of the outlet pipe, and revealed the outlet structure had heaved due to frost and ice action. Since no flexible joint had been installed, the entire length of the outlet pipe was lifted, and water was draining through the berm and exiting under the outlet pipe. Also, bentonite had been placed around the outside of the outlet control structure, which was not listed in the design, which also worsened the frost heave.

Following the site inspection, GENIVAR provided the following options to Waste Management for consideration:

1. The existing berm and drainage structure would be removed and replaced following the details outlined in the Contract Drawings; or
2. The original design would be modified to include a headwall behind the outlet structure.

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Subsequent discussions regarding the repair were held between GENIVAR and Waste Management, and it was decided that most of the first option would be used. The drainage structure would be removed from its current location and relocated to the north side toe of the outlet berm, and a footing would be installed under the structure. Waste Management retained Doornekamp Contractors of Odessa, ON to perform the work, and requested GENIVAR personnel supervise Doornekamp's activities.

Prior to the commencement of the work, Doornekamp reviewed the repair details, and suggested that instead of removing the existing outlet berm, that sheet piles be installed through the centre of the berm to create a water tight barrier. GENIVAR reviewed Doornekamp's design, and approved the modification. Work commenced on September 7, 2010. The riprap and geotextile on the outlet berm was removed, along with the drainage structure, outlet pipe, and valve. An excavator was used to install sheet piles through the centre of the berm, and the piles were driven until refusal was encountered. A hole was cut in one of the sheet piles to permit the outlet pipe to cross through the sheet pile. The location of the drainage outlet structure was excavated as shown on the Drawing, and a footing was constructed, upon which the original structure was set and secured to the footing with frost straps. The outlet pipe was installed from the concrete basin, through the sheet pile, to the valve immediately west of the sheet pile, and was then angled to exit the berm at the drainage outlet channel. Flexible joints were installed on the pipe, and mastic was used to seal the opening between the sheet pile and the pipe. A subsequent survey by GENIVAR found that the outlet structure had been installed approximately 0.3 metres lower than the elevation shown on the Drawing, so an extension was added to the outlet structure, and the inlet hole was cored at the correct elevation.

Upon completion of the outlet structure installation, Doornekamp re-graded the area on the east side of the outlet berm toe so water would drain towards the outlet structure. Clay from an offsite source was used to increase the height of the core to the correct elevation. Material was placed in lifts not exceeding 200mm in thickness, and was compacted using a sheepsfoot roller. Geotextile was then placed over the clay, and riprap was placed over the geotextile in a thickness of approximately 0.3 metres. Work was completed on the outlet berm on September 15, 2010.

It is noted that GENIVAR field personnel confirmed through GPS surveying that the berm was reconstructed to the correct elevations as shown on the Drawings, and that all work was completed to the satisfaction of GENIVAR's satisfaction. Daily field reports documenting Doornekamp's activities, along with photographs of construction, can be provided to you upon request.

We trust that the enclosed is satisfactory. However, should you have any questions or comments, please do not hesitate to contact the undersigned.

Yours truly,

GENIVAR Consultants LP

Beverly D. Leno, C.E.T.
Environmental Technologist
Solid Waste Management

Jeff E. Armstrong, P. Eng
Senior Environmental Engineer
Director - Solid Waste Management

BDL/JEA/bdl

cc: Mr. Dave White, District Manager, Waste Management of Canada Corporation
Mr. Reid Cleland, Director of Operations – Ontario Landfills, Waste Management of Canada Corporation
Mr. Wayne Jenken, Landfill Engineer, Waste Management of Canada Corporation