

Waste Disposal - Surface / Subsurface

This monograph, one in a series of single issue documents dealing with Lambton County environment, has been prepared by the Sarnia-Lambton Environmental Association in co-operation with the School Boards of Lambton Kent.


Introduction

Practising the four R's - reduce, reuse, recycle and recover - decreases waste but no matter how successful these efforts, the problems of waste disposal will not be eliminated. Lambton County is among the leaders in developing a sustainable waste management system.

In the past, wastes were generally deposited in open dumps. Problems associated with this method included unpleasant odours, fires, and movement of pollutants and disease-causing microorganisms from sites by rain and melted snow. Problems such as these are now addressed in the design, operation and monitoring of landfills. Most wastes are now placed in municipal and private sites while those that require special precautions are contained in hazardous waste landfills.

Over a period of some 20 years, ending in 1974, industrial wastes were injected into porous rock strata. Brine wastes only may now be disposed of by this method.

Facts

 <p>(MNR Map p.2715)</p> <p>St. Clair Clay Plains</p>	<i>Landfills Utilize Natural Geologic Materials such as Clay to Contain</i>		
	The St. Clair Clay Plains -	<i>Location and Extent</i>	<ul style="list-style-type: none"> • Sarnia to Windsor • 5880 km² (Middleton, 1988, page 17) • 40 metres in depth, ave. (unusually thick)
	the most extensive clay deposits in Ontario	<i>Hydraulic Conductivity</i>	<ul style="list-style-type: none"> • 0.003 metres/year, ave. • tiles are required to drain agricultural land, clay forms cracks when it dries out; when the rains come, these cracks allow water to enter the soil; the wet clay expands sealing the cracks.
	Lambton County has 75 Landfills	Active Landfills* in Lambton County	
8 are active 67 are closed	Blackwell Dawn LaSalle	Moore Petrolia Warwick	* landfills owned by individual industries excluded

Key Words

<i>dump</i>	- a waste disposal site that has few protective measures
<i>groundwater</i>	- water which exists in porous geological formations, it may supply wells and springs
<i>hazardous waste</i>	- requires special precautions in collection, transportation, treatment, storage, disposal
<i>landfill</i>	- an in-ground system for disposal of solid wastes; designed to protect the environment
<i>leachate</i>	- mainly rainwater and melted snow that have percolated through landfill wastes, extracting dissolved and/or suspended materials; also included is water produced by decomposition (rotting) processes

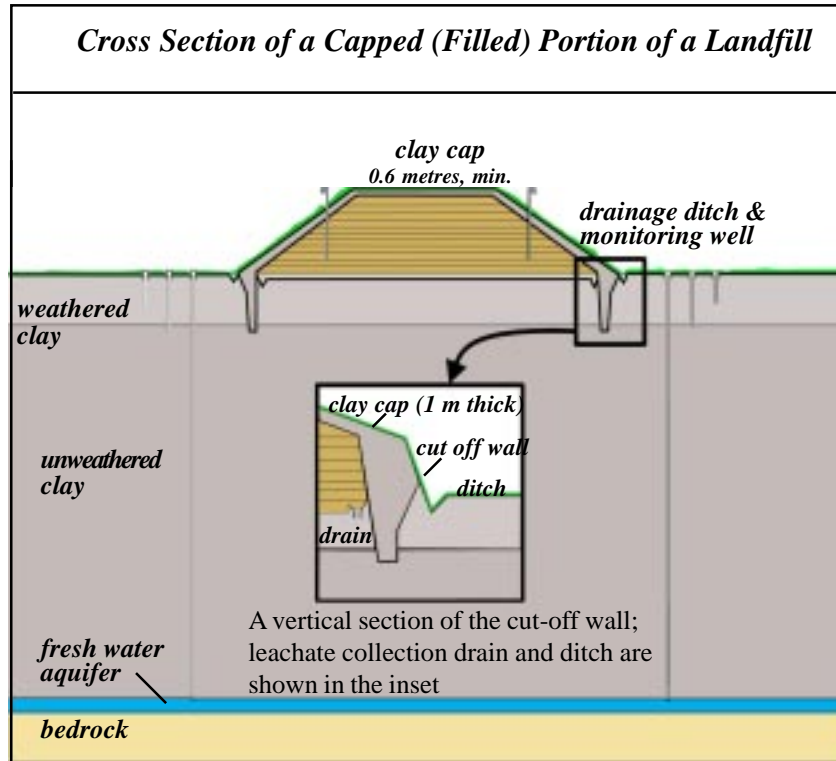
Municipal Waste

The landfill predecessor, commonly called the dump, was typically a hole in the ground, (often a quarry or land that is marginally productive), that was progressively filled with garbage. Odours, vermin and insects are some of the reasons for the change from dumps to landfills where bulldozers are used to compact wastes and cover them with soil, daily. Landfills are monitored regularly for possible impacts on surrounding properties.

In the past, water was allowed to flow freely out of dumps. To contain such watery waste (leachate), modern landfill design includes a cut-off wall which is keyed into the clay cap and into the unweathered clay; this wall is constructed around the perimeter of the landfill. A collection system just inside the wall ensures (see inset) that a build up of leachate on the site does not occur; such a buildup and resultant overflow could contaminate area water systems.

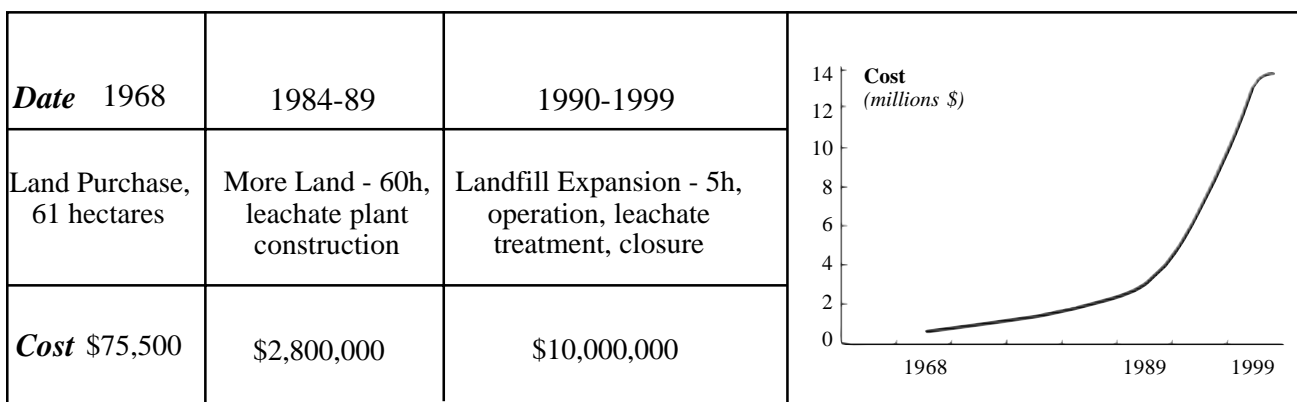
Leachate is treated to remove contaminants before release to the environment.

A series of monitoring wells at the perimeter (outside the cut-off wall) guard against impacts on groundwater.



Landfill Costs Are Substantial

Sarnia Landfill - Time Line Cost to Closure in 1999

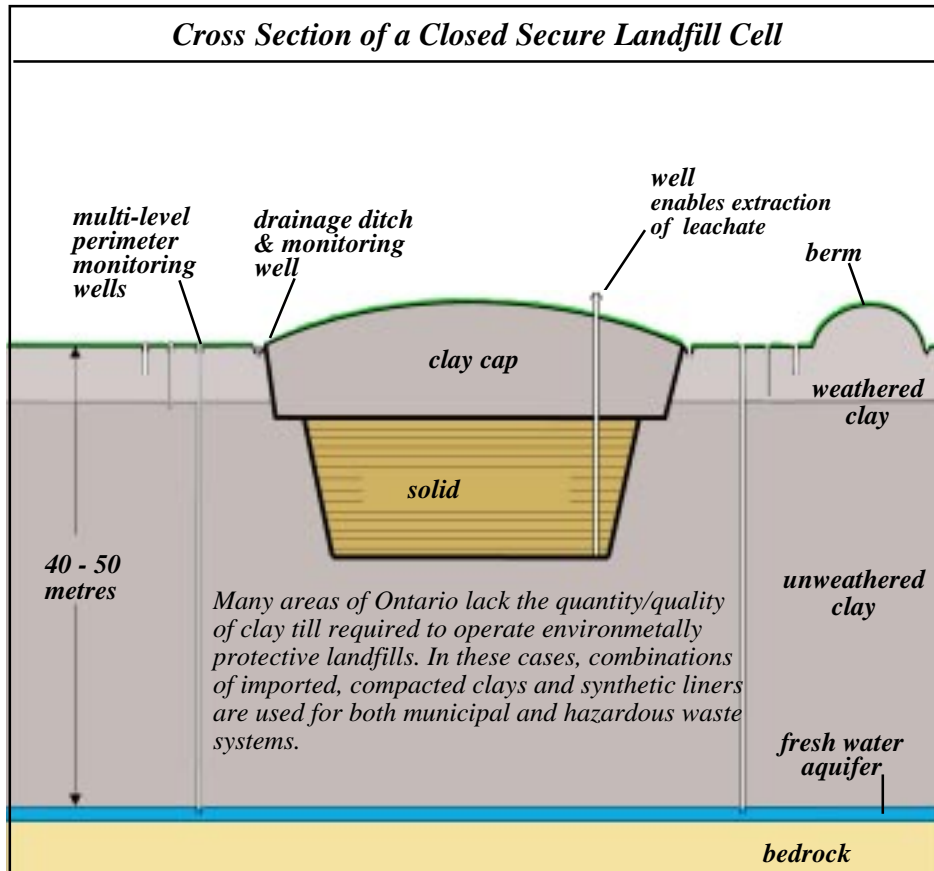


Plant Closure Costs

approximately \$250,000 annually; these costs for leachate treatment, monitoring and maintenance will continue for some 25 years.

Hazardous Waste

A hazardous waste landfill is designed to receive wastes that are potentially harmful if improperly handled. Pictured below is a closed landfill cell cross-section. In Lambton County, these cells are constructed using a continuous trench process; as the beginning of the trench is filled, the trench is extended. Excavated clay is transported to cover (cap) the deposited waste. The clay cap (6 metres thick) is compacted and then covered with soil and vegetation, usually grass cover.



Landfill design addresses the need to protect both surface and groundwater. Waste is deposited in the unweathered clay and then capped with compacted clay. An extension of this cap into the unweathered clay makes construction of cut-off walls (shown on previous page) unnecessary. A network of multi-level monitoring wells makes possible the sampling of groundwaters - a check to ensure that wastes are being contained.

Leachate formed by rainfall and/or snow melt is removed and treated by high-temperature incineration.

Landfill Standards, Introduced August 1998

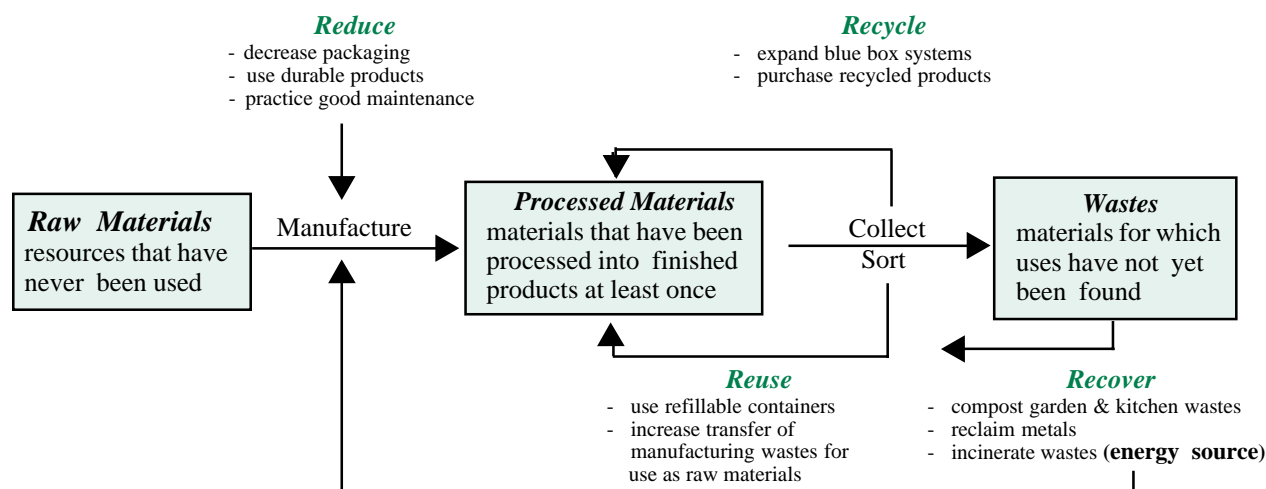
Regulation 232/98 describes requirements for design, operation, closure as well as financial assurances to ensure landfill standards are met.

- Design specifications include:
 - measures to protect groundwater and air emission controls
 - buffer areas surrounding landfills together with approved closure plans
- Operation
 - record operations daily
 - monitor air, surface water and groundwater
 - monitor leachate and treat if needed
 - cover wastes daily, to control nuisance effects such as insects, rodents, birds, litter and odour
- Closure, Post Closure, Financial Assurance
 - financial arrangements are required for closure and post-closure costs

Sustainable Resource Development

- meets present needs without compromising the ability of future generations to meet their needs
- is threatened by excessive generation of waste

Generation of wastes is minimized through **Reusing, Recycling and Recovering**; these actions **Reduce** consumption of raw materials



In the year 2000, Sarnians directed 4000 tonnes of paper, cardboard, plastics and metals through the Blue Box System; this is approximately 20% of the total garbage collected. With lawn and garden wastes included, the percentage of waste diverted from landfill was 30%. 100% of Lambton County residents have access to Blue Box Recycling or to recycling drop off depots.

Conclusion

Population increases and changing lifestyles have greatly accelerated the rate at which wastes are generated; improved methods of managing wastes are imperative. The blue box recycling program, increased use of backyard composters and, proper disposal of toxic household wastes are some of the responsible actions of area residents.

Resources and Suggested Readings

Environment Ontario. 1989, Regulation 309, Waste Management

City of Sarnia, 1990. Sarnia Leachate Treatment Plant

Middleton, T.A. et al, 1988. The Hydrogeology of Lambton County

Ministry of Environment (MOE), 1998, Landfill Standards - Requirements for New or Expanding Landfill Sites

Ministry of Natural Resources (MNR) 1984. Physiography of Southern Ontario

Husain Muen, 1996, Origin and Persistence of Pleistocene and Holocene Water in the Aquifer of S. W. Ontario

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* materials from this monograph may be reprinted

* references available in our resource centre

* additional copies of this monograph are available from the Sarnia-Lambton Environmental Association or on-line at <http://www.sarniaenvironment.com>

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