COUNTY OF LAMBTON

LAMBTON COUNTY
WASTE MANAGEMENT MASTER PLAN

VOLUME 2

TECHNICAL APPENDICES

M.M. DILLON LIMITED • FEBRUARY 1995

LIST OF APPENDICES

LAMBTON COUNTY WASTE MANAGEMENT MASTER PLAN
TECHNICAL APPENDICES

APPENDIX 2A
GLOSSARY OF TERMS

M.M. DILLON LIMITED
FEBRUARY 1995

GLOSSARY OF TERMS

As in any specialized field, waste management has evolved a set of words and phrases which have a particular meaning. The following brief list will provide definitions for most of the terms used throughout this report.

ACCEPTANCE

Acceptance, as it is related to the *Environmental Assessment Act*, means that, "the proponent of an undertaking to which this *Act* applies shall submit to the Minister an environmental assessment of the undertaking and shall not proceed with the undertaking until,

a) the environmental assessment has been accepted by the Minister; and

b) the Minister has given approval to proceed with the undertaking."[1]

ADVERSE ENVIRONMENTAL IMPACT

Any direct or indirect undesirable effect on the environment resulting from an emission or discharge, which is caused or likely to be caused by humans.

AEROBIC

The biological state of living and growing in the presence of oxygen. Requiring the presence of free oxygen.

AEROBIC CONDITIONS

A situation in which there is an adequate supply of oxygen available (i.e., a compost heap that is aerated, mixed or turned over regularly).

[1] *Environmental Assessment Act, revised statutes of Ontario, 1980 Chapter 140; Section 5, Subsection (1); February 1985.*

AGRICULTURAL SOIL CAPABILITY CLASSIFICATION	Is a classification system which refers to the ability of the land to accommodate agricultural activity taking into account the characteristics of the land. The Ontario Food Land Guidelines defines lands of Class 1-4 as high capability lands which should be protected.
AIR	In the *Environmental Assessment Act*, "air" includes "enclosed air" [Clause 1(a)]. In the *Environmental Protection Act*, "air" is defined as "open air not enclosed in a building, structure, machine, chimney, stack or flue" (see Environmental and Natural Environment).
ALUMINUM CANS	Soft drinks or other beverage containers which are produced totally from aluminum. Aluminum is imported into Canada as bauxite ore from tropical areas. The recycling of aluminum cans conserves energy compared to smelting new aluminum ore.
ANAEROBIC	The biological state of living and growing in the absence of oxygen.
ANAEROBIC CONDITIONS	A situation in which there is an absence of oxygen available (i.e., within the well compacted waste of a landfill site).
APPLICANT	A person, private organization or a municipal authority applying for a license or permit to establish and operate a new waste management facility, to expand or extend an existing facility or to change an already issued Certificate of Approval.
APPROVED SITE OR FACILITY	A landfill site/facility for which there is a current Certificate of Approval.
AQUIFER	A saturated permeable geologic unit that can yield economic quantities of water to wells.

AREAS OF NATURAL AND SCIENTIFIC INTEREST (ANSI)	ANSIs are provincially identified areas of land and water containing natural landscapes and features which have been identified as having values related to conservation, natural heritage appreciation, scientific study or education. Provincially significant ANSIs are recognized as the best natural areas and make the greatest contribution to the Ontario Ministry of Natural Resources (OMNR) protection objective.
ATTENUATION	Natural process through which the concentrations of landfill-generated contaminants are reduced to safe levels.
BACKYARD COMPOSTER	A composting unit specifically designed for use in residential backyards. Generally consists of a plastic drum or wooden box having a lid, slots to allow for aeration, and holes on the bottom to provide drainage.
BACKYARD DIGESTER	Is similar to a backyard composter, except the unit does not have slots for aeration and the base is placed at a certain depth into the ground. Digesters operate based on anaerobic decomposition, and do not produce compost.
BALING (OF WASTE)	The process of compacting mixed solid wastes to form a compressed block or bale.
BIODEGRADATION	Breaking down, decomposing, decaying or rotting, by natural biological processes. The processes may take a very long time. If the processes occur in bodies of water, they use up valuable oxygen which is needed by the aquatic organisms and often release nutrients which increase the rate of eutrophication.
BI-METAL CAN	A can composed of steel coated with tin. Are also called steel cans. Bi-metal cans are commonly used for food packaging.

BLUE BOX	A blue plastic box used by residents of many municipalities and rural areas to collect and store recyclable items and to carry these items to the curbside/roadside for collection.
BORE HOLE	A hole in a geological formation which has been drilled, jetted, driven, or made by other similar techniques. It is used to determine soil and rock characteristics and also permits the installation of a water well or an observation well for groundwater monitoring purposes.
BUFFER AREA (ZONE)	An area of land situated within the peripheral area surrounding an active filling area, but limited in extent to the property boundary, assigned to provide space for remedial measures, contaminant control measures, and for the reduction or elimination of adverse environmental impacts caused by migrating contaminants.
BUMP-UP	A provision in the class EA process which enables the environmental assessment requirement to be raised or "bumped-up" from class EA to individual EA status when there are significant adverse environmental effects or where serious public concern exists.
BURIAL GROUND	Any lands which contain or consist of human burials.
CANDIDATE AREAS	Areas identified as being generally suitable for consideration as potential areas for siting a waste management facility/site based on preliminary screening of constraints and secondary screening based on an analysis of published data.
CAPTURE RATE	A measure of the effectiveness of a recycling program. Measures the amount of waste retrieved for recycling per person in the community per year.
CELL	A space or contained area within the active fill area identified and prepared for receiving waste during any stage of landfilling, and subsequently compacted, enclosed by soil or other cover material.

CENTROID OR WASTE CENTROID	The theoretical geographic centre of waste production of any specified area. Centroids are used to determine the point of origin for the source of waste production.
CENTRAL COMPOSTING	The collection and processing of large quantities of organic waste at a central facility to produce compost/humus; may be in-vessel (closed container), windrow (open air), or other technologies.
CERTIFICATE OF APPROVAL (C of A)	A license or permit issued by the MOEE for the operation of any waste management facility under the *Environmental Protection Act* (also known as a Provisional Certificate of Approval). Issued to the owner of the site with conditions of compliance stated therein.
CLASS 1 TO 3 WETLANDS	Provincially significant wetlands are defined by the OMNR as Classes 1 to 3 through the application of a wetland classification system. Wetlands contain critical fish, waterfowl and wildlife habitats. They may also perform an essential hydrological role and/or have significant social or economic benefits and are not desirable for landfill development.
CLASS EA	A pre-approved planning and implementation process for a group or class of projects which have some or all of the following characteristics: recurring, similar in nature, limited in scale, a predictable range of environmental effects and responsive to standard mitigation measures.
COMMINGLED RECYCLABLES	"Dry" source separated wastes, e.g. Blue Box recyclables.
COMPOSTABLE	Organic matter that is suitable for composting.

COMPOSTING	The controlled microbiological decomposition of the organic fraction of solid waste material resulting in a humus-like end-product which is primarily used for soil conditioning.
CONSTRAINT MAPPING	A method of overlaying inventory maps using the established exclusion criteria to assess the availability and suitability of candidate areas.
CONSTRUCTION WASTE	Waste produced in the course of the construction of homes, office buildings, industrial plants, etc. The materials usually include used lumber, miscellaneous metal parts, packaging materials, cans, corrugated cardboard boxes, wire, etc.
CONTAMINANT	A compound, element or physical parameter, usually resulting from human activity, or found at elevated concentrations, that has or may have a harmful effect on public health or the environment.
CONTINGENCY PLAN	A document plan detailing a coordinated course of action to be followed to control and remediate occurrences such as a fire, explosion or release of contaminants in an uncontrolled manner that could threaten the environment and public health.
CONTROL ORDER	Is a direction by the Ministry of Environment and Energy ordering a person to somehow change an existing operation to minimize or prevent further contamination of the environment.
COUNTY SYSTEM	A two-tier form of municipal government. Counties cover large mostly rural areas with local municipalities within the county providing the bulk of municipal services.
COVER MATERIAL	Material approved by the MOEE that is used to cover compacted solid waste. Usually a soil with suitable characteristics for specific end-use.

CRITERIA	Considerations or factors which assist in the elimination or composition of options such as alternative components or sites (see Evaluation Criteria and Exclusion Criteria).
CURBSIDE RECYCLING	A recycling program in which people separate recyclable materials from general waste and place them at the curbside/roadside for collection.
D & O PLAN (REPORT)	A Design and Operations Plan or Report is a document detailing the planned sequence of activities through a landfill site's active life. A D&O Plan covers the control systems, site facilities and monitoring systems that are necessary. This document is required for obtaining a Certificate of Approval.
DECOMPOSERS	Microscopic organisms (e.g., bacteria and fungi) or small animals (e.g., worms and insect larvae) which digest or eat organic materials and produce a nutrient-rich material suitable for compost.
DECOMPOSITION	See Biodegradation
DEPRECIATION	The reduction in value of fixed assets due to obsolescence, use, or accounting convention.
DEPOT RECYCLING	A facility, large or small, for the temporary storage of recyclable materials; in some areas, used as drop off locations by the public; in other areas, used only by municipalities to store materials collected by trucks.
DESIGN CAPACITY	The maximum amount of waste that is planned to be disposed of at a landfill site.
DISCOUNT RATE	The discount rate represents the real rate of increase in value of an asset. It is commonly represented by the difference between the interest rate and the inflation rate. The discount rate is used to determine the present or future value of an asset.

DIVERSION RATE	A measure of the effectiveness of a waste diversion initiative within a certain area. Is usually expressed in terms of the weight of waste diverted from disposal per person per day.
DOMESTIC WASTE	See Residential Waste
DUMP (SITE)	A location where garbage is "dumped"; usually a site not approved to take garbage in the first place. Not to be confused with an approved and properly managed landfill site.
EA DOCUMENT (S)	Refers to the document(s) which describe the carrying out of a process resulting in the selection of the recommended alternative and addresses the content requirements of subsection 5(3), EA Act.
ECOSYSTEM	Any given area of the earth where living organisms (the "biotic components") interact with non-living things (the "abiotic components") in a cyclic exchange of matter and energy (e.g., oxygen, nitrogen, water, carbon dioxide, etc.). The basic unit of ecology. Ecosystems range in size from very small to very large. Examples include a pond, forest, lake, desert, etc. An ecosystem consists of four types of organisms: plants, herbivores, carnivores, omnivores and decomposers. Depending on how an ecosystem is defined, many organisms can be part of more than one ecosystem.
EFFLUENT	Any liquid and associated material discharged into a surface watercourse or discharged on land as a means of final disposal.
ENERGY FROM WASTE (EFW)	The process of converting used or waste products into fuel or any form of energy. The construction of new EFW facilities is presently banned in Ontario (see also Refuse Derived Fuel (RDF)).

ENVIRONMENT	The definition of "environment" in the *Environmental Assessment Act*, which includes the technical, natural, social, economic, and cultural environments, and their inter-relationships.
ENVIRONMENTAL ASSESSMENT	A detailed environmental study of a proposed project. The study includes an assessment of the need for the project, various alternatives to the project, potential environmental impacts (including social impacts), methods to reduce the potential for any negative effects, methods to remediate any problems which do occur, and monitoring techniques and frequency.
ENVIRONMENTAL ASSESSMENT ACT (EAA)	*Environmental Assessment Act*, RSO, 1990. One of the primary acts of legislation intended to protect, conserve and wisely manage Ontario's environment through regulating planning and developing.
ENVIRONMENTAL ASSESSMENT ADVISORY COMMITTEE	A committee established by the Minister of Environment and Energy to provide advice to the government through the Minister on requests for exemption, designation or bump-up of undertakings under the EA Act or other EA related matters referred to the Committee by the Minister.

ENVIRONMENTAL ASSESSMENT BOARD (EA BOARD)	The Environmental Assessment Board is an independent body appointed by Order-in-Council, which has the authority to conduct hearings when required by the Minister of Environment and Energy under the *Environmental Assessment Act* (EAA), the *Environmental Protection Act* (EPA), and the *Ontario Water Resources Act* (OWRA). The Board also has the authority to conduct hearings under the *Consolidated Hearings Act* in appropriate circumstances (i.e., where more than one hearing would otherwise be required before more than one tribunal).
ENVIRONMENTALLY SENSITIVE AREA (ESA)	Are natural ecosystems or landforms considered either to be sensitive to human activities or unique thus requiring protection.
ENVIRONMENTAL PROTECTION ACT (EPA)	*Environmental Protection Act*, Revised Statutes of Ontario, 1990, Chapter 141, is a Provincial legislation governing the protection of the natural environment of the Province. The EPA regulates the discharge of pollution into the environment.
EUTROPHICATION	The gradual natural aging of a body of water. Eutrophication involves a series of related physical, chemical and biological changes in the aquatic ecosystem. Eutrophication becomes a problem when its rate is increased because of human activity (i.e., addition of excess nutrients from fertilizer run-off, feedlot operations and inadequate sewage treatment).
EVALUATION	The process of applying criteria and eliminating or comparing options.

EVALUATION CRITERIA	A set of broad factors (covering the natural, social, economic, financial, cultural, technical and land-use planning environments) used to determine the suitability of two or more waste management system alternatives and facility/site alternatives on the basis of common method of comparison.
EXCLUSION CRITERIA	Criteria used to identify areas that **are not** suitable for the establishment of a waste management facility/site. Exclusion criteria are used to narrow down areas for consideration, and to develop information for consideration in subsequent levels of the site selection process.
FEASIBILITY REPORT	A report documenting a rational, qualitative and quantitative comparison of the advantages and disadvantages of alternative landfill sites selected during the site selection process.
FILL AREA	The area of a landfill site designed and designated for the disposal of waste.
FILL LINE	A line delineating limits within which the placement or removal of fill may affect the control of flooding, the conservation of land, or the pollution of a watercourse. The lines are plotted on base maps and generally encompass an area slightly more extensive than that of the related regulatory floodplain, specifically to protect ravine slopes whenever possible. Fill lines are plotted to follow features, such as fence lines, that can be easily identified in the field.
FINE PAPER	A common term for paper such as copier or computer paper. For example, this report is printed on fine paper. In recycling programs, fine paper is usually collected from offices and schools.
FLOODPLAIN	The area, usually lowlands, adjoining a watercourse which has been or which may be covered by flood water.

FRONT LOAD PACKER TRUCK	A municipal waste collection truck that loads using lifting arms at the front to lift waste containers into the loading hopper on top. The wastes are compacted towards the rear of the truck. Front load packers are primarily used to collect wastes from larger municipal waste generators, such as apartment buildings and commercial establishments.
GARBAGE	A used material people no longer want and for which they can find no further uses. Also called: rubbish, refuse, residual (waste), and trash. Whatever it is called, garbage is something we classify as such by putting in a container for collection and disposal. Unfortunately, much of what we call garbage often contains many items which are reusable, recyclable or compostable (see Municipal Solid Waste).
GAS COLLECTION SYSTEM	An engineered system designed to contain and collect migrating landfill gas for safe dissipation, for energy recovery or incineration.
GAS EXTRACTION WELL	A constructed well, within or outside waste disposal areas, intended to draw in landfill gas for collection. Gas extraction wells are part of a landfill gas collection system.
GENERIC DESIGN	Is a preliminary conceptual design of a facility (i.e., landfill) assumed in the site selection process.
GROUNDWATER	Subsurface water that occurs beneath the water table in soils and rocks that are fully saturated.
HAUL ROUTE OR WASTE HAUL ROUTE	Is the assumed road route used by trucks to transport the waste from its source (waste centroid) to the designated waste management facility.
HAULER	Someone who collects materials such as garbage or recyclables and delivers them to a specified destination.

HERITAGE (CULTURAL) FEATURE	An individual part of a cultural landscape that may be focused upon as part of a broader scene, or viewed independently. The term refers to any constructed or modified object in or on the land or underwater such as buildings of various types, street furniture, engineering works, plantings and landscaping, archaeological sites, or a collection of such objects seen as a group because of close physical or social relationships.
HERITAGE (CULTURAL) LANDSCAPE	A cultural landscape is perceived as a collection of individual constructed features into a whole. Urban cultural landscapes are sometimes given special names such as townscape or streetscapes that describe various scales of perception from the general scene to the particular view. Cultural landscapes in the countryside are viewed in or adjacent to natural undisturbed landscapes or waterscapes, and include such land uses as agriculture, mining, forestry, recreation and transportation.
HERITAGE (CULTURAL) LANDSCAPE UNITS	Comprise collections of built features and other non-built landscape elements that are collectively considered to be of some historical or scenic interest.
HIGH DENSITY POLYETHYLENE (HDPE)	A type of plastic material that is identified by Society of Plastics Industries (SPI) code 2. HDPE is used primarily in milk, water, detergent, antifreeze and motor oil bottles.
HOUSEHOLD HAZARDOUS WASTE (HHW)	Substances for household use that are labelled corrosive, flammable, poison, or explosive and should be disposed of properly (not in a landfill site) e.g., paints and batteries.
HYDRO LINE RIGHT-OF-WAY	Is a corridor of land which either contains an existing or planned hydro transmission line.

IC&I WASTE (Industrial, Commercial & Institutional Waste)	Solid waste generated by industries and businesses of all types, including manufacturing, construction and demolition sites, shopping stores, restaurants, hotel/motel establishments and offices, schools, hospitals, government offices, and universities. IC&I waste makes up about 60 per cent of Ontario's total solid waste stream.
INCINERATION	Controlled burning of solid waste for the purpose of achieving volume and weight reduction. The construction of new municipal solid waste incinerators is currently banned in Ontario.
INDICATOR	Refers to the specific measures for each criterion, for example, number of residents within 500 m for the criterion "disruption to residents".
INDIVIDUAL EA	An environmental assessment for an undertaking which is proceeding under the full requirements of the Act including planning and consultation, submission of an EA document, review and approval and monitoring.
INDUSTRIAL WASTE	Any process waste that is the direct or indirect by-product of the manufacturing of a product or the performance of a service. (Note: This Master Plan does not address liquid industrial or hazardous waste.) Refer to Ontario Regulation 347 under Part V of the EPA for a legal definition of Industrial Waste.
IN-VESSEL	A method of composting in which the compost is mechanically mixed and aerated in a container or enclosed building.
LANDFILL MINING	The excavation of previously buried waste to reclaim recyclable and organic soil for cover.

LANDFILL SITE	An area of land used for the burial of wastes under controlled conditions. Often called a "sanitary landfill site". Landfilling involves the compaction of waste in sections, called "cells". The cells of waste are covered with soil at regular intervals. A properly designed landfill site includes plans for site preparation, leachate and bio-gas control, final capping, site rehabilitation, final use, and perpetual monitoring.
LEACHATE	The liquid which results when rain or melting snow percolates through a material and carries with it dissolved materials picked up as it moves. Depending on the location, leachate may contain hazardous materials which could contaminate groundwater or surface water. Leachate has more heavy metals if the rain or snow is acidic.
LEACHATE COLLECTION AND/OR TREATMENT SYSTEM	A system where landfill produced leachate is collected and treated to remove contaminants prior to its release to the environment.
LEACHATE MONITORING SYSTEM	A system of strategically placed wells or other measuring devices for scrutinizing and assessing qualitatively the movement of leachate off-site and its effect on adjacent ground and surface water resources.
LINER	A constructed continuous layer of reworked natural soil (usually clay), or artificial materials placed beneath and on the sides of a landfill or waste cell that restricts the downward or lateral migration of leachate or landfill gas.
LOW DENSITY POLYETHYLENE	A plastic material that is identified by Society of Plastics Industries (SPI) code 4. LDPE is primarily used in bags and food storage tubs or containers.

MANUAL SEPARATION	The separation of waste by hand, sometimes called "hand picking" or "hand sorting".
MATERIALS RECOVERY FACILITY (MRF)	A facility where specified materials are intentionally removed from mixed waste or where co-mingled recyclable materials are sorted into distinct categories.
METHANE GAS	An odourless, colourless, non-poisonous gas. It is explosive when mixed with air or oxygen in certain proportions. One source of methane is landfill sites undergoing anaerobic microbial decomposition.
MISA	Municipal Industrial Strategy for Abatement. A program developed by the MOEE for the regulation of the quality of effluent and discharges, and intended to protect human health and the environment by enforcement of rigorous quality control standards.
MITIGATION	Techniques for preventing, avoiding or reducing the impact of an environmental problem, such as water pollution caused by the movement of leachate from a landfill site.
MOEE	Ontario Ministry of the Environment and Energy
MONITORING	Regular or spontaneous procedures used to methodically inspect and collect data on the performance of a landfill site relating to environmental quality (i.e., air, leachate, gas, ground or surface water, unsaturated soils, etc.).
MONITORING WELL	A water well used for the purpose of monitoring ground water conditions.
MUNICIPAL WASTE	The combined residential and IC&I wastes generated in a given municipal area. The collection and disposal of these wastes is usually the responsibility of local government. Liquid and hazardous wastes from the IC&I sector are not included in this category.

MUNICIPAL WASTE COLLECTION TRUCK	A vehicle used to collect wastes from residences and smaller IC&I establishments in a municipality. Municipal collection trucks generally comprise pick-up trucks, stake trucks, rear load packers and front load packers. The vehicles have capacities ranging from 5 to 12 tonnes.
NATURAL ATTENUATION	Where contaminants are reduced to acceptable concentration levels by natural mechanisms such as dilution, adsorption onto the soil matrix, biological action, and chemical interaction.
NET EFFECTS	The residual environmental effects remaining following the consideration of mitigative and enhancement measures of potential effects.
NEWSPRINT	A type of paper used for newspapers, flyers and advertisements.
NIMBY (NOT-IN-MY-BACKYARD)	A label often given to people who oppose the siting of a waste management facility only because it is near their properties.
OFF-SITE	Areas outside of the site considered to be potentially influenced by any effects from a proposed facility.
OFFICIAL PLAN	Is a policy document of a local, county or regional council, that sets out the municipality's view on how land should be used.
OLD NEWSPAPERS	Newsprint that has been printed on. Consists of newspapers, flyers and advertisements.
ON-SITE	Areas within which features will be displaced or lost by property purchase and facility development.

PARTICIPATION RATE	The percentage of households, industries, commercial establishments or institutions that participate in a waste diversion program on a regular basis.
PERCOLATION	The movement of infiltrating water through soil.
PERMEABILITY	Often used interchangeably with hydraulic conductivity, but not strictly correct. Permeability is a property of the porous media only. Dependent upon media properties that affect flow, diameter, sphericity, roundness and packing of the grains.
PERMEABLE MATERIAL	A porous substance which allows the passage, or movement of materials through it (e.g., sandy soil).
PLANNED LAND USE	The future intended use of any land area usually described in an Official Plan.
POINT-OF-IMPINGEMENT	The location where a pollutant first comes in contact with a receptor (e.g., an individual or private property).
POLLUTANT	See *Contaminant.*
POLLUTION	The release of contaminants into the environment. Pollution abatement is the removal of contaminants from emissions or effluent before they are released into the environment. Even better than pollution abatement is pollution prevention which involves changing industrial processes/activities to ensure that they do not create contaminants in the first place.
POLYETHYLENE TEREPHTHALATE (PET)	A type of plastic material identified by Society of Plastics Industries (SPI) code 1. PET is primarily used in soft drink bottles.

POLYPROPYLENE (PP)	A type of plastic material that is identified by Society of Plastics Industries (SPI) code 5. PP is primarily used in battery cases, some cleaning product bottles, cereal box liners, and bottle labels and caps.
POLYSTYRENE (PS)	A type of plastic material that is identified by Society of Plastics Industries (SPI) code 6. PS is primarily used in cookie and muffin trays that are used in grocery stores, plastic cutlery, fast-food carry-out containers and egg cartons.
PRELIMINARY FIELD CHECK	A preliminary field check involves on-site field investigations.
PROCESSING FACILITY	A solid waste facility at which solid waste is shredded, baled, pulverized, composted, separated, combusted or other wise treated, or altered by some means to facilitate further transfer, processing, utilization or disposal.
PRODUCT STEWARDSHIP	A situation where the producers of products are responsible for the final disposal and environmental impacts created by their products.
PUBLIC HEARING	A quasi-judicial process, whereby the public or any affected parties have the opportunity to voice concerns or otherwise address studies and the planning process carried out by a proponent.
REASONABLE USE POLICY	A policy developed by the Ministry of Environment and Energy to stipulate limits to the level of groundwater quality impairment that may be permitted to occur at site property boundaries, to allow the reasonable use of adjacent properties or land without adversely affecting public health and the environment.

REAR LOAD PACKER TRUCK	A municipal waste collection truck which loads from the rear of the truck and compacts wastes towards the front. Rear load packers are most commonly used to collect wastes on residential streets.
RECYCLABLE MATERIAL	A material that is used in place of a primary, raw, or virgin material in manufacturing a product and consists of materials derived from post consumer waste, industrial scrap, and material derived from agricultural wastes and other items, all of which can be used in the manufacture of new products.
RECYCLING	The sorting, collecting and processing of a waste material or product so it can be used for a similar or new purpose. For example, the "Blue Box" system, in-plant scrap handling, or raw material recovery systems. Recycling is also the marketing of products made from recycled or recyclable materials. This is the third of the 3Rs.
RECYCLING DEPOT	A facility used for the temporary storage of recyclable materials; in some areas, used as drop-off locations by the public; in other areas, used only by municipalities to store materials collected by trucks.
RECYCLING FACILITY OR PLANT	A facility where recycling of used or waste products is carried out.
REDUCE	To decrease. See 3Rs of Waste Management.
REDUCTION	A decrease in the quantity of waste produced through modified consumer practices and changes in industrial production to generate fewer by-products requiring disposal.
REFUSE	See *Waste*.

REFUSE DERIVED FUEL (RDF)	Refers to any usable fuel produced by mechanically, thermally, chemically, or biologically processing solid waste. Typically, RDF is uniform in size and from which glass, metals, ceramics and other non-combustible materials have usually been removed.
REGULATION 347	Regulations pertaining to waste management under Ontario's *Environmental Protection Act*, formerly called Regulation 309.
REMEDIAL ACTION	Corrective action taken to clean-up or remedy a spill, an uncontrolled discharge of a contaminant, or a breach in a facility or its operations, in order to minimize the consequent threat to public health and the environment.
RESIDENTIAL WASTE	Waste produced by all types of households, including detached dwellings, row housing, condominiums and apartments. In Ontario, residential waste makes up about 40 per cent of the total municipal solid waste stream. (See also Municipal Solid Waste).
RESIDUAL WASTE	The materials remaining after all efforts have been made to reduce, reuse and recycle. Usually, these materials have to be put in approved landfill sites. Only residual waste is properly referred to as 'garbage'.
REUSABLE PRODUCT	Something which can be used again for the same, similar or different purpose.
REUSE	The return of a product or material to use either by reusing it for its original purpose or by finding a new use for it without modifying it. (See 3Rs of Waste Management). This is the second "R" of the 3Rs.
RISK ASSESSMENT	When applied to waste management; a way of measuring the significance of a waste problem for its impact on the environment or human health.

RUN-OFF	The part of precipitation (rainwater, snowmelt) that flows overland and does not infiltrate the surface material (soil or rock).
SEASONAL POPULATION	The seasonal transient population, in addition to the year round population, of a community or region.
SECONDARY RECYCLING	Recycling which makes entirely different products out of the reprocessed materials (e.g., making egg cartons from used newspapers; making an aggregate for asphalt from glass bottles; making a wood substitute from mixed plastics). These processes may not be as efficient as primary recycling but are definitely better than landfilling the materials.
SENSITIVE LAND USE	A land use where humans or the natural environment may experience an adverse impact.
SEPARATION	To divide waste into groups of similar materials, such as paper products, glass, food wastes, and metals.
SHREDDING	The mechanical size reduction of mixed solid wastes resulting in a final product that is relatively homogeneous, with reasonably uniform particle sizes much smaller than the original form but not necessarily of a reduced volume.
SINGLE-TIER MUNICIPALITY	Those government entities that do not form part of two-tier municipal structures (all municipalities in northern Ontario are single-tier except for the Regional Municipality of Sudbury). Single-tier municipalities are located within the geographical boundaries of counties. Is also termed Separated Municipality.
SITE CLOSURE	The planned and approved cessation or termination of landfilling activities at a landfill site upon reaching its site capacity.

SITE LIFE	This is the number of years a site can accept waste until the site reaches site capacity and ceases to receive any further waste.
SITE CAPACITY	The maximum amount of waste that is planned to be disposed (design capacity) or that has been disposed of at a landfill site.
SITE SELECTION	The process of locating and obtaining the use of suitable land; it is an important activity in the pre-operation steps in establishing a waste management facility.
SOLID WASTE	Non-hazardous, unwanted, discarded material (see also Municipal Solid Waste).
SOLID WASTE DISPOSAL SITE OR FACILITY	A site or facility such as a landfill site where solid waste is disposed.
SOLID WASTE MANAGEMENT	The systematic control of the storage, collection, transportation, processing and disposal of solid waste.
SOURCE REDUCTION	The avoidance or prevention of waste production through measures or efforts designed to reduce the quantities of waste requiring disposal. A reduction in the quantity of waste produced is achieved through modified consumer practices and changes in industrial production to generate fewer useless by-products. The minimization and prevention of waste through changes in lifestyle habits, product design, procedures, purchasing decisions, etc., is the first priority of the 3Rs.
SOURCE SEPARATION	The separation of specific materials from the waste stream at their point of generation for the purposes of reuse, recycling or further processing.

SPECIALTY CROPS	Are orchards, berries, extensive field vegetables, market garden/truck farms, tobacco system, nursery and sod farms. Specialty crops are considered to be particularly sensitive to the siting of waste management facilities due to their unique resource requirements (special soils and climate) and high crop value per hectare.
STOP ORDER	Is a direction issued by the Ministry of the Environment and Energy ordering a person to immediately stop an operation which is causing a contamination of the environment.
STORM WATER	Run-off that occurs as a direct result of a storm or thaw.
STUDY AREA	The geographic area which is examined in the search for the Preferred Site for a Waste Management facility.
3Rs OF WASTE MANAGEMENT	A hierarchy of waste diversion in the following order: 1) Reduce; 2) Reuse; and 3) Recycle.
THREE STREAM COLLECTION - WET/DRY PROGRAM	Refers to a waste collection system where waste is separated at source into wet compostables (yard and possibly food waste), dry recyclable (Blue Box materials) and waste. The remaining solid waste is landfilled.
TIPPING FEE	The amount of money charged by the operator of an approved waste management facility for receiving and managing waste. The charge is based on either the weight or volume of the waste. The cost is calculated as a percentage of or equal to the total cost (capital and operating) of the facility.
TIN CAN	A term commonly used for bi-metal cans.

TRANSFER STATION

A facility where wastes are transferred from small waste collection vehicles to larger waste hauling vehicles for transportation to a waste diversion, processing or disposal facility.

TRANSFER TRUCK

Transfer trucks are used to haul waste from transfer stations to the disposal site. Transfer trucks normally consist of tractor semi-trailer trucks with three axles on the tractor and two to four axles on the trailer. Transfer trailers are either open top, which are loaded from above, or enclosed, which are loaded from the rear with special compactors. They have capacities ranging from 22 tonnes to 30 tonnes.

TWO STREAM COLLECTION - WET/DRY PROGRAM

A waste collection system where waste is separated at source into wet compostables and dry recyclable materials which are processed at a Materials Recovery Facility (MRF).

UNDERTAKING

Defined in the *Environmental Assessment Act* as follows:

i) an enterprise or activity or a proposal, plan or program in respect of an enterprise or activity by or on behalf of Her Majesty in right of Ontario, by public body or public bodies or by a municipality or municipalities, or

ii) a major commercial or business enterprise or activity or a proposal, plan or program in respect of a major commercial or business enterprise of activity of a person or persons other than a person or persons referred to in sub-clause (i) that is designated by the regulations.

USER FEES/ SOLID WASTE MANAGEMENT FEES

Charges for the usage of solid waste management facilities; usually assessed by weight and category of waste material.

VECTORS	An organism that transmits disease (i.e., rat).
VERMICOMPOSTER	A type of aerobic composter in which worms are used to decompose organic wastes. Vermicomposters are small relative to backyard composters and are ideally suited to apartment dwellers.
VIEWSHED	The geographic area from which a facility, or portions of, will be visible.
VIRGIN MATERIAL	Any basic material for industrial processes which has not been previously used.
WASTE	Ashes, garbage, refuse, domestic waste, industrial waste, or municipal refuse and other used products as are designated or interpreted by the provisions of the *Environmental Protection Act* (see Garbage.)
WASTE AUDIT	A study of the generation and management of waste.
WASTE DISPOSAL	Placing waste for long-term or permanent storage in a landfill or waste disposal site. Landfill and waste disposal sites must be certified for use.
WASTE DISPOSAL SITE (FACILITY)	Any land upon, into, in or through which, or building or structure in which, waste is deposited or processed and any machinery or equipment or operation required for the treatment of disposal of waste.
WASTE DIVERSION	Using the 3Rs of waste management as part of a strategy to keep used materials from going to disposal. (See 3Rs of Waste Management).
WASTE EXCHANGE	A placement service where one company's waste becomes another's secondary resource.

WASTE EXPORT	Refers to shipment by truck or rail of mixed waste from one municipality/province/country to another municipality/ province/country.
WASTE GENERATION RATE	The quantity of non-hazardous solid waste generated by a single person or group of persons on a daily basis (kg/capita/day).
WASTE GENERATOR	The person, business, institution or industry which has created waste materials.
WASTE MANAGEMENT	The management of waste and used materials through the 3Rs and disposal. Proper waste management puts first emphasis on waste reduction, reuse and recycling before disposal methods are used.
WASTE MANAGEMENT MASTER PLAN (WMMP) or WASTE MANAGEMENT SYSTEMS PLAN (WMSP)	A long-term plan for the design and implementation of a waste management system to service the waste management needs of a particular area.
WASTE MANAGEMENT SITE(S) ALTERNATIVES	Areas upon which a waste management facility or activity is physically located or conducted (i.e., landfill site, central composting facility, etc.).
WASTE MANAGEMENT SYSTEM	All the facilities, buildings and equipment used for the collection, treatment and disposal of wastes, and for the reduction of used materials going to disposal. A complete waste management system consists of disposal and diversion components. A waste management system is defined for a particular "service area", which is the population living in one or more municipalities.

WASTE MANAGEMENT SYSTEM ALTERNATIVES	Combinations of various waste management system components.
WASTE MANAGEMENT SYSTEM COMPONENTS	Alternative waste management technologies and/or processes which includes but are not limited to: · reduction/reuse activities; · source separation; · transfer stations; · composting; and · landfilling.
WASTE REDUCTION ACTION PLAN (WRAP)	A plan which was announced by the Minister of the Environment on February 21, 1991 containing specific activities aimed at ensuring that Ontario accomplishes its goal of diverting 25 per cent of waste by 1992 and 50 per cent by the year 2000.
WASTE REDUCTION OFFICE (WRO)	Created in February 1991 within the Ministry of the Environment and Energy to oversee implementation of Ontario's Waste Reduction Action Plan and other waste reduction initiatives province wide.
WATER COURSES	Any drain, creek, stream or river.
WASTE SHED AREA	A service area within which wastes are handled by a common means or by a common organization.
WATER TABLE	Surface of the ground water at which the pressure is atmospheric. Generally the top of the saturated zone.
WATERSHED	A dividing ridge between two drainage areas or an area drained by a particular water body.
WET/DRY RECYCLING	See Two Stream Recycling

WETLANDS	Land areas where excess water is the dominant factor determining the nature of soil development and the type of plant and animal communities living at the soil surface.
WHITE GOODS	Consumer goods such as large household appliances.
WINDROW	A long row of heaped material left on the ground in a controlled area. In composting, waste material is sometimes made into windrows so that the materials can be easily turned over and aerated.

SOME COMMONLY USED ABBREVIATIONS

3Rs	Reduce, Reuse, Recycle
C of A	Certificate of Approval
EA	Environmental Assessment
EAA	*Environmental Assessment Act*
EFW	Energy From Waste
EPA	*Environmental Protection Act*
HHW	Household Hazardous Waste
IC&I	Industrial, Commercial and Institutional
MOEE	Ontario Ministry of Environment and Energy
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
NIMBY	"Not In My Backyard"
PAC	Public Advisory Committee
PLC	Public Liaison Committee
WMMP	Waste Management Master Plan
WRO	Waste Reduction Office

LAMBTON COUNTY WASTE MANAGEMENT MASTER PLAN
TECHNICAL APPENDICES

APPENDIX 2B
TERMS OF REFERENCE

M.M. DILLON LIMITED
FEBRUARY 1995

September 16th, 1985

Re: Sarnia/Lambton Waste Management Master Plan:
Terms of Reference

The County of Lambton and the City of Sarnia have agreed to jointly undertake the development of their Waste Management Master Plan. The County of Lambton is acting for both municipalities in calling for this Request for Proposals. The result of the project will be a Waste Management Master Plan for the study area.

In preparing your proposal, every effort should be made to give a complete breakdown of costs, time and timing, and disbursements for each stage of the terms of reference, meetings and the public participation program.

To assist you in determining an appropriate budget for the project, the following should be noted:

a) all meetings will be held in the study area;

b) the overall Steering Committee has representatives from each of the municipalities as well as the Ministry of the Environment;

c) the consultant should consider the use of local public participation personnel;

d) 125 copies are required for draft reports;

e) 200 copies are required for final reports and executive summary;

.../2

f) costs for additional copies of reports;

g) costs for additional meetings (Steering Committee and/or public).

If the consultant should have any specific questions in preparing his proposal, please contact William Hollo or Janet Smolders, County of Lambton Planning and Development Department, or Al Patterson or Berta Krichker at the City of Sarnia, Engineering Department. Questions of a general nature may be referred to the Ministry of the Environment, Sarnia District Office, or Waste Management Branch, Toronto.

Fifteen (15) copies of your proposal are required for review by members of the Steering Committee. Consultants may, at the option of the Steering Committee, be required to attend an interview which will be held on October 31, 1985. Proposals are due no later than 4:00 p.m. on October 11, 1985. Please send your proposal to the County Offices in Wyoming.

If your firm should decline from submitting a proposal for this project, the committee would appreciate notice in writing prior to the closing for proposals.

Yours very truly,

William S. Hollo, MCIP
Planning & Development Director

County of Lambton: (519) 845-3303
Box 3000, Wyoming, Ont. N0N 1T0

City of Sarnia: (519) 332-0330
City Hall,
255 North Christina Street,
Sarnia, Ont. N7T 7N2

Ministry of the Environment:
Mr. Joe Burnham, Project Manager,
Municipal Waste Disposal Unit,
Municipal Waste Management Policy Section,
Waste Management Branch,
40 St. Clair Avenue West, Toronto, Ont. M4V 1P5

Mr. Neil Hester, Environmental Planner,
Environmental Assessment Branch,
135 St. Clair Avenue West, Toronto, Ont. M4V 1P5

WSH/pp

TERMS OF REFERENCE

WASTE MANAGEMENT MASTER PLAN

INTRODUCTION

The City of Sarnia and the County of Lambton have decided to embark on a Waste Management Master Plan Study for Sarnia-Lambton, with the assistance and participation of the Ontario Ministry of the Environment.

The basic reason for the study is to analyze our present needs and waste management systems, project future needs, identify future alternative approaches, and select a preferred approach, which appears to be feasible, and meets all environmental assessment requirements. The study is not being undertaken because of a crisis, although there is a very limited site life remaining for one or two small landfills, and some operational problems with other landfills which are being dealt with by the owner and/or operator.

BACKGROUND

There are eight (8) operating landfills in Sarnia-Lambton today. Table 1, on the following page, shows their location, area, municipalities served, and estimated remaining site life. The Petrolia, Sarnia and Warwick sites are by far the three largest sites. Applications are currently before the Ministry to expand the capacity of the Warwick site (owned and operated by Laidlaw) and discussions are underway to expand the service area of the Petrolia site (owned by the Town of Petrolia, operated under contract by K&E Waste Management Systems), and to improve the leachate control system and site operations of the Sarnia site (owned by the City of Sarnia). The County of Lambton itself is not directly involved in ownership or operation of waste management systems. Lower tier municipalities handle this function themselves.

BLE 1: MUNICIPAL LANDFILL SITES: LAMBTON COUNTY

SITE	LOCATION	AREA	MUNICIPALITIES SERVED	REMAINING SITE LIFE
Bosanquet	Lt. 16, LRE Bosanquet Tp.	9.74 ha. total 3 ha. to be filled	Grand Bend	0-1 years (application pending)
Brooke	Lt. 15, Con 12 Brooke Tp.	3.7 ha. total 3.7 ha. filled	Brooke Tp.	1-2 years
Dawn	Lt. 21, Con 5 Dawn Tp.	13.77 ha. total 13.77 ha. to be filled	Dawn Tp.	19 years
Moore	Lt. 21, Con 5 Moore Tp.	40.63 ha. total 18.2 ha. to be filled	Moore Tp.	15 years
Petrolia	Lt. 16, Con 10 Petrolia	40.26 ha. total 26.04 ha. to be filled plus additional subject to conditions	Petrolia, Wyoming Plympton Tp., Oil Springs, Enniskillen	50 years
Sarnia	Lt. 12, Con 3 Sarnia Tp.	40.5 ha. total 38.1 ha. to be filled	Sarnia Tp., City of Sarnia, Point Edward	7-9 years (application pending)
Sombra	Lt. 11, Con 12 Sombra Tp.	4.46 ha. total 4.46 ha. to be filled	Sombra Tp.	1 year
Warwick	Lt. 20, Con 3 Warwick Tp.	40.5 ha. total 32.4 ha. to be filled	Forest, Watford, Warwick Tp., Thedford, Arkona, Alvinston, Bosanquet, Pinery, Ipperwash, Kettle Point Ailsa Craig	20 years plus (application to expand)

Euphemia Tp. Takes its garbage to Blenheim

PREAMBLE

1. PURPOSE OF THE STUDY

The overall purpose of this study is to prepare a Waste Management Master Plan which will provide a comprehensive, long range waste management plan to serve the needs of the County of Lambton and the City of Sarnia, and to serve as the rationale for subsequent approvals under the Environmental Assessment Act.

1.2 STUDY GOAL

To develop a plan for the management of waste in Sarnia/ Lambton which incorporates the best approach taking into account economic, financial, social, cultural, technical, land use planning and natural environmental perspectives.

1.3 APPROACH

The study will identify the most economical and environmentally sound systems for the handling, transportation, processing, and disposal of domestic, commercial and non-hazardous industrial waste generated in the study area. The study will examine the feasibility of waste reduction, source separation, and material and energy recovery as intergral parts of the waste management strategy.

The study will include a comprehensive review of all waste management options, and the entire program will include effective public participation. The end result will be a waste management plan which will outline the best approach to waste management, methods and programs for implementation, and for the rationale for subsequent environmental assessment approvals on specific undertakings identified in the plan.

2. SCOPE OF THE STUDY

2.1 GENERAL

This section highlights the overall requirements of the study. Details are provided in subsequent sections.

2.2 OVERALL SCOPE

The study and master plan shall address the needs of Sarnia/ Lambton for at least a 20 year period. However, waste projections should be developed for a 40 year period to assess long-term impacts. The study area is all of the County of Lambton and the City of Sarnia, excluding the three Indian Reserves.

The wastes to be considered are primarily domestic, commercial, and non-hazardous solid industrial waste. The generation of other wastes and the impact of this generation on the waste management system shall be reviewed. The "other wastes" referred to include septage (septic tank pump-out), sewage and water treatment plant sludges, biomedical, construction and inert wastes. Thirdly, the impact of hauled liquid industrial and hazardous solid industrial wastes on the waste management system should be assessed using existing sources of information.

2.3 COMPONENTS

The study will include the following components or activities.

2.3.1 The assessments (ie. studies and evaluation of alternatives) should be comprehensive enough to cover the full definition of "environment" as found in Clause 1 (c) of the Environmental Assessment Act.

2.3.2 Documentation relating to the alternatives considered and the selected system of solid waste management will be appropriate for use as an environmental assessment document to provide the rationale for subsequent specific waste management facilities.

2.3.3 The study will include a review of the financial and administrative procedures and the identification of all costs, public and private, associated with the collection, transportation, utilization, treatment and disposal of subject wastes.

A procedure for ready review and update of financial information which could reasonably be undertaken by the client municipalities should be established.

The possible roles of the County in waste management will be assessed as part of the examination of the financial and administrative aspects of waste management.

2.3.4 The study will evaluate methods available and the effects of waste reduction, reuse, recycling and recovery on all alternatives considered.

2.3.5 The effects of importing or exporting waste from the study area will be assessed.

2.3.6 The consultant will develop criteria for identifying:

a) general candidate areas suitable for the location of waste management facilities; and

b) the location of potential sites for specific facilities recommended in the Plan which may be applied following a) for the later establishment of such facilites.

These criteria should incorporate the "natural environment" criteria developed by the Ministry of the Environment in "Planning Considerations for the Establishment of Waste Management Facilities".

The criteria developed should consider and be applied to existing waste management facilities as well.

2.3.7 The consultant will design and implement an effective public awareness and consultation program which will form an integral part of the work program. The public awareness and consultation program will be used to both inform the public and generate meaningful programs for ongoing public consultation after the master plan program has been completed.

2.3.8 The study program will also consider other areas of specific concern to the municipalities, the public, or the Ministry of the Environment. These concerns are generally described in Schedule 'A' to these Terms of Reference.

2.3.9 The plan will contain policies and programs for the implementation of selected preferred alternatives, and will contain direction on the methods of review and updating on a five year basis, or where major changes occur.

2.3.10 Public Participation

Effective public participation in the study is required. A detailed program on how to best achieve this is required. The public is to be involved from the outset in a genuine effort to both inform and hear concerns and options so that the final plan will be more acceptable in the communities through the public's involvement in the planning process.

Co-ordination of the public participation program could be achieved by the formation of a committee with public and municipal representation.

3. STAGING

The study will be conducted in three stages. Specific requirements for each stage are outlined following. The consultants should note that the requirements listed do not necessarily comprise the total requirements at each stage. Submissions should ensure that the proposed program, and its costing, incorporate these specific requirements within the general requirements outlined in Section 2 of these Terms of Reference.

3.1 STAGE ONE: DATA COLLECTION

This stage of the study is intended to collect, assemble and document data required for the second and third stages of the program. The public participation component of this stage is intended to publicize the study, provide information and education on waste management to the public, to generate input and to set the stage for effective and meaningful public participation in subsequent stages.

3.2 STAGE ONE INCLUDES:

3.2.1 Collection and organization of data concerning the types (domestic, commercial, industrial) and quantites of waste, sources of generation and quantites of privately, commercially and municipally collected solid waste. An assessment of the accuracy of the data is required, and a clear listing of data sources for use in subsequent updates.

3.2.2 Documentation of quantities generated and methods currently used in the study area for collection, transportation, transfer, treatment, disposal and other uses of waste identified in 3.2.1, plus other wastes described in Section 2.2. The inventory of other wastes (or "special wastes") is required for awareness and contingency planning for the study area.

3.2.3 Review existing waste generation rates and estimate future waste generation changes. Waste generation projections will be included in this review.

3.2.4 Develop criteria for assessing the economic, financial, social, cultural, technical, land use planning and natural environmental factors which can be used to assess alternative waste management systems and components.

3.2.5 Describe types of possible waste management system components. These components may include, but should not be limited to, reduction of waste generation, source separation, mechanized material separation, recycling, transfer stations, refuse derived fuel (rdf), incineration, energy from waste (efw), composting, landfill, and waste import and export. The description should include capital and operating costs, any proposed revenue, including grants or subsidies, system components, and manpower requirements.

3.2.6 Assess existing waste management facilities in terms of their remaining life capacity, potential for expansion and environmental effects, making use of existing reports where available. This work should be carried out with the assistance of the site owners and local Ministry of the Environment staff.

3.2.7 Landfilling is a controversial component of any waste management system which cannot be eliminated. There is a need to identify, in general terms, suitable candidate

areas for landfill. In Stage One, this will not be extended to the identification of specific sites.

The consultant will prepare a terrain evaluation of the study area outlining candidate areas for landfilling, through a process of constraint mapping and analysis of economic, financial, social, cultural, technical, land use planning and the natural environmental factors.

3.2.8 The consultant will analyze markets for recovered materials and energy users. Locations for waste management facilities other than landfill should be identified.

3.2.9 Sections 3.2.7 and 3.2.8 will include a review of physiographic data, regional and local planning documents and any additional criteria which may be developed by the Steering Committee, with input from municipalities, industry, the public and government review agencies. The analyses of these factors for outlining candidate areas/markets should be based on a review of the positive and negative aspects of each site and facility type, mitigation measures which can be undertaken to reduce the negative aspects of each and the net effects remaining on the "environment". Site specific investigations will not be required at this time.

3.2.10 The County of Lambton and the City of Sarnia have several specific issues which they wish to be examined as part of Stage One:

a) municipal liability for post-closure care of municipally owned and operated landfills and privately owned and/or operated landfills;

b) a review of the "true" costs of operation of the existing municipal waste management system;

c) a review of the existing financial and administrative systems, possible alternative systems, and the means of achieving those alternative systems, with particular emphasis on the role of the Corporation of the County of Lambton and the Corporation of the City of Sarnia.

3.2.11 The completion of Stage 1 will result in a report stating the purpose for the study, identifying problems to be solved and opportunities to be taken advantage of. This will include identifying the present system of waste managment in the study area, including types of wastes, current and future waste management costs, existing and future site capabilities, future waste generation factors, possible waste management system components and proposed evaulation criteria. This report will include input from the public participation program.

3.3 STAGE TWO: DEVELOPMENT OF MASTER PLAN OPTIONS

The report from Stage 1 will be used as the basis for developing and evaluating alternatives in Stage 2. The public participation component will continue with modifications as required. The work for Stage 2 will be as follows:

3.3.1 Develop and assess alternatives for possible changes in waste management systems. This will include a further refining of candidate areas for all facilities to enable the identification of potential sites for review in the waste management system analyses. Landowners and adjacent and affected landowners will be notified concerning preferred potential sites.

3.3.2 The number of alternatives to be analyzed will be approved by the Steering Committee with public input and should include, but not be limited to:

i) retention of the present system;

ii) modification of the present system through either the co-ordination or consolidation of site use, both existing and future, for the study area;

iii) establishment of new waste management systems appropriate to the area, which includes components of waste reduction, reuse, recycling and recovery components.

3.3.3 Using criteria developed in and refined from Stage 1, evaluate and rank each of the alternatives from economic, financial, social, cultural, technical, land use planning and natural environmental perspectives.

The ranking process should include input from the public, government review agencies, the Steering Committee and political representatives from the study area. Evaluation of each alternative should include any proposed mitigating measures for the negative effects, any enhancement measures to increase the positive effects and any net effects which would remain after the mitigation and enhancement measures are implemented, e.g., develop criteria and procedures for mediation with and compensation of individuals or area municipalities affected by the location of waste management facilities.

3.3.4 Preferred or recommended alternatives should be identified. Stage 2 concludes with the Councils adopting a report which evaluates and ranks the alternatives (preferred sites and system components) available for waste management in the study area. This report should document input from the public and government review agencies and how it was used in the decision making process.

3.4 STAGE THREE: MASTER PLAN FORMULATION

Stage 3 will produce a Master Plan for Waste Management for Sarnia/Lambton which will outline the preferred approaches and systems for waste management in Sarnia/Lambton, measures for implementation, and a system for periodic review and update.

3.4.1 After the selection of a preferred waste management alternative by the area Councils, the consultant will examine in detail and report on the net environmental effects of the selected alternative for the study area including social, cultural, natural environmental, economic, financial, and administrative considerations.

3.4.2 The Master Plan will:

a) describe sites/facilities in order of preference for development (as determined in Stage 2);

b) recommend changes to present financial and administrative practices;

c) if required, describe possible changes in local legislative authority;

d) outline methods for the financing of facility development and operation;

e) provide a detailed schedule and budgets for facility development including further studies, approvals and hearings;

f) provide a procedure for updating the Master Plan. The procedure should include criteria and guidelines for the

future inclusion of additional facilities into the waste management system which may be appropriate in changing circumstances.

3.4.3 The Plan should be written in a format which will permit ease of review and updating. A minimum updating of five years is recommended for scheduling purposes.

3.4.4 The conclusion of Stage 3 will result in a Master Plan which will identify the system for waste management in the study area and how best to implement the system. The study will include input from the public and government review agencies.

SCHEDULE 'A'

POSSIBLE ISSUES OF WASTE MANAGEMENT FOR REVIEW AS PART OF THE MASTER PLAN

1. Methods of charging back costs of waste handling, processing and disposal:

   a) user charges tip fees

   b) charges to waste generators outside the study area

   c) per capita or assessment charges

2. Municipal or private ownership of facilities.

3. Municipal or private (contract) operation of facilities.

4. PROPOSAL CALL AND CONTRACT AWARD

4.1 PROJECT MANAGMENT

The study is managed by a joint Steering Committee made up of representatives from the municipalities and the Ministry of the Environment. The consultant will carry out the study under the direction of the Steering Committee.

4.2 CONSULTANTS PROPOSALS

Proposals are invited from consultants or teams of consultants capable of undertaking the study analysis and report preparation. The firms should have expertise in the following areas:

a) solid waste management practices and costs, including collection, handling, transfer, processing, disposal and pre- and post- closure;

b) environmental planning, environmental assessment, approvals and hearings;

c) public participation;

d) municipal financial and administrative practices and procedures;

e) municipal fiscal planning;

f) financial and sensitivity analysis of a facility over its lifetime, including estimation of operational cost and income escalators;

g) optimization procedures utilitzing computer modelling techniques;

h) 4R's including recycling (source separation), recovery (energy production from wastes), reduction and reuse;

i) terrain evaluation/constraint mapping.

4.3 CONSULTANT PROPOSAL CONTENTS

4.3.1 The proposal should include the consultant's interpretation of the requirements of the study, together with a description of the approach planned to facilitate carrying out the terms of reference, together with a schedule of tasks and decision points, including the time and costs required to complete each stage.

4.3.2 In addition, the consultant should also provide:

a) a list of key personnel who will be assigned to the project with identification of the areas for which each will be responsible. A resume for each person should be included;

b) a description of team structures, accountabilities and backup for key personnel;

c) a detailed cost estimate which includes manpower costs by individual and/or level. The per diem rate and the proportion of costs for each stage and sub-section should be indicated;

d) estimate of disbursement costs should be given, as well as, costs for attending additional meetings beyond those

proposed, additional copies of the reports, or other areas the consultant feels appropriate;

e) a resume of any recent assignments on similar projects;

f) a list of all current contracts with area municipalities and contracts with private companies in the waste management field.

4.3.3 The consultant shall disclose to the Steering Committee prior to accepting the assignment, any potential conflict of interest. If, in the opinion of the Steering Committee, the retention of a consultant will give rise to such a conflict of interest, it shall be sufficient reason to disqualify this consultant from being considered for the assignment. A condition to be included in the Agreement will require the consultant, during the conduct of the assignment, to refrain from accepting other assignments which will give rise to a potential conflict of interest. If such a conflict of interest in the opinion of the Steering Committee is deemed to exist, the Steering Committee may, at its discretion, withhold the assignment from the consultant until the matter is suitably resolved.

4.3.4 TIME ESTIMATES

Consultants should provide a time estimate for the completion of the study.

4.4 MEETINGS AND REPORTS

4.4.1 Written progress reports will be provided by the consultant for the Steering Committee at meetings as outlined in the consultants proposal. The consultant shall be responsible

for preparing minutes of all meetings when in attendance. Upon completion of each stage of the project, a draft report shall be prepared and delivered 14 days prior to a meeting of the Steering Committee where the report will be formally presented. The final report for each stage may be required to be presented at additional meetings.

4.4.2 One hundred and twenty-five (125) copies of the draft reports and two-hundred (200) copies of final reports and executive summarizes for each stage shall be provided to the Steering Committee. After authorization of the draft, a master copy and/or camera ready copy of the final report for each stage suitable for printing will be required. The format of the reports will be determined by the Steering Committee.

4.4.3 It is emphasized that the final report must be concise, understandable to the layman and well presented. All complex and technical data should be confined to appendices or presented in separate volumes.

4.5 AWARD OF CONTRACT AND CONDITIONS OF WORK

4.5.1 All work will be performed under contract to the municipalities according to the terms and conditions set down in the municipalities' contract or letter of agreement. Work must be to a standard satisfactory to the Steering Committee. Conflicts of interpretation of the meaning of the terms of reference will be made by the Steering Committee with the advice of the Ministry of the Environment.

4.5.2 Computer programs developed for the study are the property of the municipalities and, the Ministry of the Environment. Computer programs will be compatible with and operate on IBM PC's using standard spread sheet programs such as Lotus 1-2-3.

4.5.3 The successful consultant will be required to provide a monthly cashflow for the duration of the study at the firs Steering Committee meeting which is attended. The cashflo should be updated as required or as a minimum at the begin ning of each subsequent stage of the study.

4.5.4 The study may be terminated at the end of Stage 1 or Stage by the City or the County. If this occurs, the consultant shall be entitled to fees for work undertaken to complete stage at which work was terminated.

4.5.5 If, in the opinion of the Steering Committee, the perform of the consultant is unsatisfactory, the Committee may di the consultant, who shall be entitled to fees for work in red up to the day of dismissal.

4.5.6 All maps, files, information, or material gathered, acqui formulated or developed by the consultant shall be and re the property of the Steering Committee and, upon request, shall be provided to the Steering Committee or the County Lambton or the City of Sarnia.

4.6 COSTING

The consultant will be required to provide a reasonable, itemized cost estimate for the overall study, by stages. upset limit cost for each stage, and for the entire study will be determined.

Where preparing cost estimates, the consultant should inc

Stage One:

3 meetings with Steering Commi

4 technical meetings minimum w staff

1 joint City/County Council mee-

itemized public participation cos (including meetings or presenta- tions)

Stage Two:	3 meetings minimum with Steering Committee
	6 meetings minimum with staff
	1 joint City/County Council meeting
	itemized public participation costs
Stage Three:	4 meetings minimum with Steering Committee
	6 meetings minimum with staff
	1 joint City/County Council meeting
	public participation costs

The consultant should also provide a cost per meeting for additional meetings (including Steering Committee Meetings, public meetings or presentations) if additional meetings are required.

The consultant will provide:

- 25 copies of documents for Steering Committee meetings;
- 125 copies of draft reports;
- 200 copies of final reports (including executive summary);
- 1 camera - ready original of each final report will be provided by the consultant (maps and charts in reports should be xeroxable). If colour maps or diagrams are used, the consultant will provide the printing plates.

ADDITIONAL INFORMATION

The consultant is expected to outline the proposal approach and methodology. Cost estimates should be provided for each phase and an upset limit price of the study should also be provided.

The City and County will provide base mapping at various scales on mylar, current and projected population statistics, and available reports and information in their possession.

WASTE MANAGEMENT MASTER PLAN
PROPOSAL EVALUATION CRITERIA

EXPERIENCE:

1. Solid waste management
2. Environmental assessment/approvals/hearings
3. Public participation
4. Municipal finance/administration
5. Municipal planning
6. Financial analysis
7. Computer modelling
8. Energy from waste/resource recovery/ 4R's
9. Terrain evaluation

PROJECT MANAGEMENT:

1. Lead consultant
2. Proposed team

TERMS OF REFERENCE

1. Stage 1
2. Stage 2
3. Stage 3
4. Public participation
5. EA scope of inquiry and method of analysis

TIMING/COST:

1. Cost/Breakdown
2. Time judgement

WSH/pp

LCPD:
w/p#: 4822A
09/05/85

DRAFT

LAMBTON COUNTY WASTE MANAGEMENT MASTER PLAN
TECHNICAL APPENDICES

APPENDIX 2C
LEGISLATION, REGULATIONS AND GUIDELINES PERTAINING TO WASTE MANAGEMENT PLANNING IN ONTARIO

M.M. DILLON LIMITED
FEBRUARY 1995

LEGISLATION, REGULATIONS AND GUIDELINES PERTAINING TO WASTE MANAGEMENT PLANNING IN ONTARIO

ENVIRONMENTAL ASSESSMENT ACT, 1980

The *Environmental Assessment Act* (EAA) is an Ontario statute administered by the Ministry of Environment and Energy (MOEE). It was passed in 1975 and made applicable to municipalities as of 1980. The EAA provides for the assessment of the potential effects on the environment of a proposed undertaking and its alternatives. This Act differs from other pieces of environmental legislation in that it promotes an environmental planning process rather than a regulatory process. The planning process set out by the EAA requires that proponents make decisions based on an early consideration and evaluation of the alternative means of achieving a desired goal, the net environmental effects of those alternatives and the advantage and disadvantages of each.

The term "environment" is defined in the EAA in very broad terms. Section 1(c) of the Act states that "environment" means:

(i) air, land or water;

(ii) plant and animal life, including man;

(iii) the social, economic and cultural conditions that influence the life of man or a community;

(iv) any building, structure, machine or other device or thing made by man;

(v) any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from the activities of man; or

(vi) any part or combination of the foregoing and the inter-relationships between any two or more of them, in or of Ontario.

The EAA defines the term "undertaking" as "an enterprise or activity or a proposal, plan or program in respect of an enterprise or activity...". Therefore, a Waste Management Master Plan must, as a whole, meet the requirements of the EAA, just as some individual projects generated by the plan must meet the requirements.

Effective planning requires effective public consultation. The EAA does not specifically require that the public be consulted prior to the formal submission of an environmental

assessment document. However, the intent of the Act and of the MOEE's Pre-Submission Consultation Guidelines (1988) is that an adequate assessment of any undertaking requires consultation with members of the relevant public, government reviewers and potentially affected parties. This applies to Waste Management Master Plans since they become either part of or supportive to an environmental assessment document.

THE *ENVIRONMENTAL PROTECTION ACT, 1980*

The *Environmental Protection Act* (EPA) is an Ontario statute administered by the Ministry of Environment and Energy. It sets out the prohibitions related to the deposit, addition, emission or discharge of contaminants into the natural environment. It provides the mandate for the Ministry to issue control orders or stop orders related to contaminant sources. It also establishes the powers and procedures used by the Ministry in the regulation and control of contaminant discharges. Part V of the EPA sets out the specific interpretations, prohibitions and requirements related to waste management.

A specific requirement of the EPA is that a Certificate of Approval must be granted by the Ministry before a proponent can operate a waste collection/transportation system or develop or operate a waste treatment and disposal facility.

SECTORAL ENVIRONMENTAL ASSESSMENT PROPOSAL FOR WASTE MANAGEMENT PLANNING, VOLUMES 1, 2, 3, JUNE 1994

The Sectoral Environmental Assessment Proposal (EAP) was issued by the Ministry of Environment and Energy (MOEE) in June 1994. The EAP describes how to undertake comprehensive waste management planning in keeping with the requirements of the *EA Act*. The EAP sets out a systematic waste management planning process that the MOEE wants proponents to follow leading up to the submission of an EA document to the Minister of Environment and Energy.

The EAP was prepared in response to a Ministry initiative to clearly articulate its expectations for sound and comprehensive waste management planning under the *EA Act*. The document states that the sectoral EAP is based on:

- lessons derived from several years of waste management planning;
- decisions of the Environmental Assessment Board; and
- input received from a variety of review agencies and waste management practitioners.

The EAP describes how to identify and evaluate alternative waste management systems, and provides a detailed methodology on how to locate new landfill capacity within a given study area.

The Ministry recommends that proponents adopt and adhere to the planning process described in the sectoral EAP. The Ministry notes, however, that even though the EAP provides numerous benefits for proponents, adherence to the EAP does not guarantee "acceptance" or "approval" for an undertaking subject to the provisions of the *EA Act.*

THE 3Rs REGULATIONS

The Government of Ontario has established a waste diversion objective of at least 50% diversion from landfill by the year 2000. In February 1991, the Provincial Government announced Ontario's Waste Reduction Action Plan in order to help accelerate ongoing initiatives to achieve this target. Subsequently, in October 1991, the Provincial Government issued the first of a series of discussion papers outlining proposed waste diversion regulations that will comprise the Waste Reduction Action Plan. This first discussion paper, entitled *"Initiatives Paper No. 1: Regulatory Measures to Achieve Ontario's Waste Reduction Targets"*, was intended to outline specific regulatory actions that will make certain waste reduction, reuse and recycling opportunities mandatory. It is the Provincial Government's view that these opportunities must be implemented if Ontario is going to meet the waste diversion objective.

Following the release of Initiatives Paper No. 1, the Provincial Government allotted two months time to receive public comments. The number of comments received was substantial, resulting in delays in implementing the proposed regulations. The regulations were finalized in April, 1993 and approved in March 1994. The result is a set of 5 waste diversion regulations under the EPA. The following sections describe the 3Rs Regulations that will directly impact municipal waste management.

The Recycling and Composting of Municipal Waste

The 3Rs Regulations specify that all Ontario municipalities with a population of 5,000 or more are required to establish and maintain Blue Box recycling programs. The programs are to include the following:

- The collection method is to provide a level of service equal to the level of service provided by the garbage collection service. This implies Blue Box curbside collection in areas serviced by curbside garbage collection and recycling depots in areas where residents direct haul their wastes to a depot or landfill site. The frequency of curbside Blue Box collection must be at least half of the frequency of garbage collection.

- Transportation of the collected recyclables to a recycling site or end user.

- Efforts to ensure that the collected materials are recycled.

- Public education programs to ensure that participating residents are aware of how the program works.

- Preparation of an annual report form to be submitted to the MOEE.

The materials to be collected by the source separation programs are to include old newspapers, aluminum food or beverage cans, steel food or beverage cans, glass bottles and jars for food or beverages, and PET bottles for food or beverages. In addition, materials from two of the following categories of additional Blue Box materials must also be collected: aluminum foil, boxboard or paperboard, corrugated cardboard, expanded polystyrene food or beverage containers, fine paper, magazines, paper cups and plates, plastic film (low density polyethylene grocery bags or plastic wrapping), rigid plastic containers (made from either high density polyethylene or polystyrene), telephone books, textiles and food or beverage polycoat paperboard containers.

Municipalities in Southern Ontario targeted for source separation programs are required to have their programs established, if they don't already have a program, before January 1, 1995.

The 3Rs Regulations also require municipalities with populations of 5,000 or more to establish and operate backyard composter programs. These programs are to consist of the provision of home composters to residents at cost or less and public education on how to use the composters. Backyard composter programs are required by January 1, 1995.

Municipalities with populations of 5,000 or more that have separate collections for leaf and yard wastes are required to compost these wastes. Municipalities with populations of 50,000 or more are required to collect and compost leaf and yard wastes if they don't already have a program for these wastes in place. The program is to include, at minimum, the following:

- The materials that are collected can only be composted or applied directly to land.
- Efforts to ensure that the compost is used as a soil conditioner.
- The system must be capable of handling the quantities and types of leaf and yard wastes that are produced.
- Public education to ensure that participants source separate their leaf and yard wastes properly.
- Preparation of an annual report to be submitted to the MOEE.

Collection of leaf and yard wastes is to be reasonably accessible to the residents served. The method used, either curbside collection or depots, is to be decided by the municipality.

The 3Rs Regulations include measures that help to streamline approvals for certain municipal recycling facilities. A recycling facility is defined as either a municipal waste recycling site, a leaf and yard waste composting site, or a municipal waste recycling depot. A recycling site is exempt from obtaining a Certificate of Approval for waste disposal from the MOEE if the proponent meets certain siting, design, notification, operating, and reporting requirements.

A municipal waste recycling site is a facility that accepts only source separated materials for processing. The processing activities allowed at these facilities include sorting, grading, deinking, size reduction, pulping, composting, baling, packaging, or pelletizing. The facility must comply with a number of requirements pertaining to where the processed materials are sent, limits on the amount of material stored on the site, efforts to control litter, dust, noise and other nuisances, record keeping and regular reporting to the MOEE.

A leaf and yard waste composting site is a facility where source separated leaf and yard wastes are accepted for composting. Food wastes from kitchens are not allowed. These facilities must comply with a number of requirements pertaining to the materials accepted, composting process, record keeping, sampling of the compost, and final use of the compost.

A municipal waste recycling depot is a facility where source separated materials are accepted but not processed. Containers are provided into which the materials are collected. Once the containers are full, they are to be taken to a recycling site for processing. These facilities must comply with a number of requirements pertaining to the types of materials collected and management of the site.

Waste Audits, Waste Reduction Work Plans, and
Industrial, Commercial, and Institutional Source Separation Programs

The 3Rs Regulations include measures that make it mandatory for Industrial, Commercial and Institutional (IC&I) sector establishments to conduct waste audits, develop waste reduction work plans and implement source separation (recycling) programs. IC&I establishments have been defined as construction and demolition projects, educational institutions, restaurants, hospitals, hotels/motels, manufacturing businesses, multi-unit residential buildings, office buildings and retail shopping complexes. Size requirements have been established to determine which IC&I establishments are designated under the Regulations.

A waste audit is defined as a study of waste generation and management, excluding consideration of liquid industrial or hazardous wastes. Designated major IC&I sector establishments are required to have their waste audit completed by September 3, 1994. The audit is to consider waste management practices and identify opportunities for and obstacles limiting waste reduction, reuse and recycling. The audit is to be updated on an annual basis.

The results of the waste audits are to be used to develop waste reduction work plans. The work plan is to detail how wastes identified in the audit will be reduced, reused or recycled. The work plans are required to be completed by September 3, 1994.

Designated major IC&I sector establishments are also required to implement source separation programs under the 3Rs Regulations. The programs are to include:

- collection, handling, processing and storage facilities for recyclables;
- efforts to ensure full use of the program;
- education of employees; and
- marketing of the collected materials for reuse or recycling.

The materials required to be collected are a function of the type of establishment. For example, construction businesses are required to source separate cardboard, wood, drywall, steel, concrete and brick. Office buildings are required to source separate cardboard, fine paper, old newspapers, aluminum cans, steel cans and glass containers. Designated major

IC&I establishments in Southern Ontario are required to have their source separation programs in place by March 3, 1995.

ONTARIO REGULATION 347: WASTE MANAGEMENT - GENERAL

Ontario Regulation 347 is a statutory regulation promulgated under the authority of the *Environmental Protection Act*, 1980, and administered by the Ministry of Environment and Energy. This Regulation, which was formerly known as Regulation 309, is often referred to as the "Waste Management Regulation".

Regulation 347 outlines definitions, exemptions and classifications related to waste management. It prescribes standards for the location, maintenance and operation of various types of waste disposal facilities and for the management of certain types of waste. It outlines requirements for waste generators and for the transfer and transport of wastes. Schedules 1 and 2 of the Regulation provide lists of hazardous industrial wastes and hazardous waste chemicals. The other schedules identify severely toxic contaminants, leachate quality criteria, leachate extraction procedures and a method for testing liquid industrial waste.

The purpose of Regulation 347 is to provide specific guidance for the implementation of the EPA's waste management requirements.

Proposed amendments to Regulation 347 address the need to make the Regulation more specific for municipal waste management. It is proposed that waste disposal sites be classified into different categories based on their lifetime design capacity and proximity to and nature of surrounding land use. Operating standards for each of the categories are to be developed. These standards are to cover buffer zones, contingency plans, hydrogeological and hydrological evaluation, cell cover, final cover, leachate control, gas control and monitoring programs.

ONTARIO REGULATION 346: AIR POLLUTION - GENERAL

Ontario Regulation 346 specifies air emission standards and outlines a means of calculating such emissions. This Regulation applies to any facility which will have a stationary source of emissions such as a materials recovery facility or transfer station.

PLANNING ACT, 1983

The *Planning Act* is an Ontario Statute administered by the Ministry of Municipal Affairs. The Act addresses a wide range of issues pertaining to municipal planning. Sections of the Act which have a bearing on the establishment of proposed waste management facilities include Section 24, ss.(1), (2) and (3), which address public works and their conformity with official plans.

Sec. 24(1) Despite any other general or special Act, where an official plan is in effect, no public work shall be undertaken and, except as provided in subsections (92) and (4), no by-laws shall be passed for any purpose that does not conform therewith.

Sec. 24(2) Where a council has adopted an amendment to an official plan, it may, before the Minister has approved the amendment, pass a by-law that does not conform with the official plan but will conform therewith if the amendment is approved, and the by-law shall be conclusively deemed to have conformed with the official plan on and from the day it was passed if the Minister approves the amendment to the official plan.

Sec. 24(3) Despite subsections (1) and (2), the council of a municipality may take into consideration the undertaking of a public work that does not conform with the official plan and for that purpose the council may apply for any approval that may be required for the work, carry out any investigations, obtain any reports or take other preliminary steps incidental to and reasonably necessary for the undertaking of the work, but nothing in this subsection authorizes the actual undertaking of any public work that does not conform with an official plan.

MUNICIPAL ACT, 1980

The *Municipal Act* is an Ontario Statute which addresses matters related to municipal land use and is administered by the Ministry of Municipal Affairs.

A number of sections of the act have implications for proposed waste management facilities. The following section is of particular interest:

Sec. 210 For acquiring land in any local municipality or in territory without (84) municipal organization for any of the purposes of paragraph 83, a system for the collection, removal and disposal of garbage or of garbage and other refuse or of ashes, garbage and other refuse,

(a) No land shall be acquired in a local municipality under this paragraph without the approval of the local municipality, which approval may be granted upon such terms and conditions as may be agreed upon, or failing such approval or agreement, the approval of the Municipal Board, and no land shall be acquired in territory without municipal organization under this paragraph without the approval of the Municipal Board.

(b) The Municipal Board, before giving its approval under this paragraph, shall hold a public hearing and shall give or cause to be given at least 10 days notice of the hearing to the clerk of the local municipality concerned and to such other persons in such manner as the Municipal Board may direct and the Municipal Board, as a condition to giving any such approval, may by its order impose such restrictions, limitations and conditions respecting the acquisition or use of such land as to the Municipal Board may appear necessary or expedient and the Municipal Board may order the amendment of any official plan or of any by-law passed under Section 39 of the *Planning Act* to permit the use of the land for the purposes for which it is to be acquired.

In 1989 the *Municipal Act* was amended (Bill 201) by adding that the council of a County may pass a by-law to empower it to adopt a waste management plan or to assume any or all of the waste management powers, or both, for all of the local municipalities forming part of the County. If a waste management plan is in effect, the County shall not undertake any waste management service or facility or pass a by-law under a waste management power that does not conform to the plan.

If the County has assumed the power for providing specific waste management services or facilities, no municipality or person can provide those same services without the consent of the Council of the County. All of the assets and liabilities in connection with waste management powers of participating municipalities must be determined. Financial adjustments shall be made between the County and the participating local municipality.

BILL 7 (3RD SESSION, 35TH LEGISLATURE, ONTARIO, 1993)

Bill 7 is an act to amend the *Municipal Act* to expand the waste management powers available to municipalities. Bill 7 was given Royal Assent on November 4, 1993. The amendments to the *Municipal Act* allow local municipalities to pass by-laws to prohibit or regulate the use of any part of their waste management systems. Municipalities can now:

- require wastes to be separated for recycling;
- charge fees for the use of any part of the waste management system;
- establish financial incentives to encourage waste diversion;
- designate one or more persons as inspectors for obtaining information that a local municipality will need to obtain approval for a waste management facility; and
- apply to a judge or a justice of the peace for a warrant authorizing an inspector to inspect land.

The amendments in Bill 7 also stipulate that in cases where a County has assumed control of part or all of the waste management system, the following conditions will apply:

- a local municipality or person within the County will not be allowed to provide similar services without the consent of the Council of the County;
- a person may provide waste collection services to non-residential properties and apartment buildings containing more than 5 units;
- the County may designate any services or facilities under its waste management powers to participating municipalities; and
- if a service or facility has been designated to a local municipality, that municipality cannot utilize any other services or facilities.

Similar powers were also proposed for Regional Municipalities in Bill 7 under the "*Regional Municipalities Act*".

GUIDELINES FOR THE ESTABLISHMENT, OPERATION, MANAGEMENT, MAINTENANCE AND CLOSURE OF LANDFILLING SITES IN ONTARIO (UNDATED)

This set of guidelines was prepared by the Guideline Subcommittee of the Committee on Amendments to Legislation and Regulation for Waste Management, Ministry of Environment and Energy. It is stated that adherence to the principles advanced in the guidelines is required for approval under Section 27 of the *Environmental Protection Act* (1980). These guidelines therefore carry greater regulatory force than would a set of guidelines which are purely advisory in nature.

The primary purpose of the Guidelines is to provide information to the Ministry of Environment and Energy field services staff on procedures relating to landfilling. Second, the Guidelines are intended to be of assistance to persons who intend to establish, manage and/or operate a landfilling site in Ontario. Third, the Guidelines aim to clarify the intent of Ontario Regulation 824, Section 10(1). Fourth, the Guidelines have the underlying purpose of facilitating the establishment of safe, acceptable and efficient landfilling sites.

The Guidelines apply to all persons who intend to establish, manage or operate a landfilling site in Ontario and to the people providing advice to those persons.

POLICY NO. 07-07
GUIDELINES FOR LAND USE ON OR NEAR LANDFILLS, DUMPS
MARCH 1986

These guidelines are a statement of Ministry of Environment and Energy (MOEE) policy. They have been issued under the legislative authority of the *Environmental Protection Act*, Part V, Ontario Regulation 347; and the *Planning Act*, Sections 2(e) and 2(l). This policy essentially provides guidelines for MOEE staff reviewing proposals for land use on or near operating and non-operating landfills and dumps. Both the MOEE and the Ministry of Municipal Affairs have responsibility for implementing the provisions of this policy.

The objective of this policy is stated as follows: "To protect the health, safety, convenience and welfare of residents from potential adverse environmental effects of landfills and dumps, by restricting or controlling land use." The policy applies to all proposals for land use on or near operating and non-operating landfills and dumps, which contain or contained municipal domestic waste, industrial solid waste and/or sewage sludges. It does not apply to lands certified as organic soil conditioning sites under Regulation 347. Although this policy can

also apply to landfills and dumps that have accepted liquid industrial, toxic or hazardous waste, additional studies and measures beyond those stipulated in this policy may be required.

POLICY NO. 15-08
THE INCORPORATION OF THE REASONABLE USE CONCEPT INTO THE GROUND WATER MANAGEMENT ACTIVITIES OF THE MINISTRY OF THE ENVIRONMENT AND ENERGY
SEPTEMBER, 1986

This document is essentially a set of guidelines drawn up to facilitate implementation of the ground water quality management policies and procedures of the Ministry of Environment and Energy (MOEE). It was prepared by a working group of MOEE's Water Management Steering Committee and issued by the MOEE Water Resources Branch. These "Reasonable Use Guidelines" point out that only when matters are under the *Environmental Protection Act* or the *Ontario Water Resources Act* can the Ministry insist on adherence to its own policies and guidelines. When the EAA or the *Consolidated Hearings Act* is applied, Ministry policies and guidelines bear the status of suggestions or recommendations.

This document is mainly concerned with the impact of waste disposal facilities (particularly landfills) on the uses or potential uses of ground water resources. The document established procedures for the determination of what constitutes reasonable use of ground water on property adjacent to sources of contaminants. It provides a definition of terms related to waste disposal sites, describes the type of environments considered unsuitable for waste disposal (with respect to the reasonable use concept), and outlines the circumstances and environments considered suitable for a contaminant attenuation zone of a waste disposal site.

The expressed purpose of this document is "to establish procedures for the determination of what constitutes reasonable use of ground water on property adjacent to sources of contaminants and to explain the role of a reasonable use approach in the Ministry's various activities related to ground water quality".

The "Reasonable Use Guidelines" apply to the issuance of Certificates of Approval for proposed landfills, operating landfills, landfills requesting approval for expansion, exfiltration lagoons, and large subsurface sewage systems. The guidelines do not apply to the clean-up of contaminated ground water or to the restoration of ground water supplies that have been contaminated by, for example, closed landfills or spills. The guidelines are intended for application to current and future Ministry reviews rather than for retroactive application. As

well, the "Reasonable Use Guidelines" apply only to ground water quality management, not to the management of surface water quality.

LAMBTON COUNTY WASTE MANAGEMENT MASTER PLAN
TECHNICAL APPENDICES

APPENDIX 2D
DETERMINATION OF PAST, PRESENT AND FUTURE WASTE QUANTITIES

M.M. DILLON LIMITED
FEBRUARY 1995

DETERMINATION OF PAST, PRESENT AND FUTURE WASTE QUANTITIES

INTRODUCTION

The purpose of this appendix is to provide details on the determination of waste quantities in the Waste Management Master Plan (WMMP) study. The results are summarized in Chapter 3, Section 1, of the Master Plan Report (Volume 1).

Waste quantities were originally estimated during the development of the Sarnia-Lambton Waste Management Master Plan Stage 1 Report (September 1986). These waste quantities have been updated using 1992 waste generation data and population information from the 1991 census.

Future waste quantities were determined by multiplying waste generation rates by future population forecasts. A waste generation rate is an estimate of the amount of waste produced by each person per day in a given area. Generation rates tend to differ, based on the area, and are generally lower in rural areas than in urban areas.

Since 1991, when the County took over waste disposal from the local municipalities, the County has accepted and disposed of mainly municipal wastes from residential sources in Sarnia and from residential and commercial sources outside of Sarnia. The remaining municipal waste stream, which comprises wastes from small commercial and institutional establishments within Sarnia, traditionally was disposed at municipally owned landfill sites. However, most of this portion of the municipal waste stream was redirected away from the Sarnia landfill in 1988 in order to extend the life of the landfill. The County presently does not accept and dispose of wastes which have traditionally not been disposed at municipally owned landfill sites.

For the purpose of determining future waste quantities, it was assumed that in the future the County will continue to not accept and dispose of wastes which have traditionally not been disposed at municipally owned landfill sites. However, it was assumed that in the future the County will continue to accept and dispose of municipal wastes from sources that it presently accepts wastes from plus the municipal wastes that were previously redirected away from the Sarnia landfill.

It is important to note that the waste quantity information in this appendix has been developed for the purposes of the Master Plan Study only. This information should not be

used for other purposes, such as in contractual agreements with waste management facility operators or equipment vendors. Waste quantity information for these purposes should be developed as part of the detailed feasibility analysis for the facility or equipment being considered.

1985 WASTE QUANTITIES

Waste quantity projections were determined for the December 1986 Stage 1 Report using waste generation rates that were based on waste quantities from 1985. The best method for calculating waste quantities is to review the weight records for all wastes brought to each disposal facility. However, at the time that the Stage 1 Report was prepared, there were no weigh scales at the existing landfill sites licensed for municipal waste disposal.[1] As a result, other methods were used to determine waste quantities for the Stage 1 Report. These methods included:

- Questionnaires were sent to all of the County's local municipalities, including the City of Sarnia. The questionnaires requested information on current waste handling and collection practices, waste quantities and disposal facilities.

- Questionnaires were also sent to area industries to determine their waste streams and quantities.

- Site visits and inspections of the existing disposal facilities and discussions with municipal staff, MOEE staff, private waste management operators/contractors, private disposal site operators and waste generators. This provided additional information on the existing waste management system and the types and quantities of wastes generated.

Based on the 1986 questionnaire and other data, the total amount of wastes generated in the County in 1985 was estimated to be approximately 226,700 tonnes. Municipal waste accounted for approximately 39 percent of this total, or 87,960 tonnes.

Per capita municipal waste generation rates were calculated for each municipality in 1986, using the 1985 estimated waste tonnage (from the 1986 survey) and 1985 population figures (from assessment data). The calculated rates ranged from a high of 2.5 kg per capital per day

[1] In 1990, weigh scales were installed at the Sarnia Landfill Site.

for Sarnia and Point Edward to a low of 0.4 kg per capita per day from some of the rural areas. The calculation of these waste generation rates is summarized in Table D-1.

TABLE D-1
MUNICIPAL WASTE GENERATION RATES DETERMINED
BASED ON 1985 WASTE QUANTITIES

Municipality	Population 1985	Estimated Tonnes (1985)	Generation Rate (kg/cap/day)
City			
Sarnia	72,384	67,830	2.5
Towns			
Forest	2,614	1,160	1.2
Petrolia	4,468	2,390	1.5
Villages			
Alvinston	767	210	0.8
Arkona	473	210	1.2
Grand Bend	**1,107	980	2.4
Oil Springs	750	400	1.5
Point Edward	2,313	2,170	2.5
Thedford	651	330	1.4
Watford	1,426	460	0.9
Wyoming	1,791	470	0.7
Townships			
Bosanquet Twp.*	**8,600	1,130	0.4
Brooke Twp.	1,995	530	0.7
Dawn Twp.	1,642	460	0.8
Enniskillen Twp.	3,717	2,000	1.5
Euphemia Twp.	1,162	480	1.1
Moore Twp.	10,148	1,750	0.6
Plympton Twp.	5,924	3,190	1.5
Sombra Twp.	4,193	1,120	0.7
Warwick Twp.	2,442	690	0.8
TOTALS	**124,973**	**87,960**	

* *Bosanquet became a Town on December 1, 1994.*
** *Seasonally adjusted annual population.*

The generation rates were compared with rates developed by the Ontario Ministry of Environment and Energy (MOEE). These rates were 2 kg/capita/day for urban areas and 1 kg/capita/day for rural areas. It was assumed that cities, towns and villages represented urban areas and that townships represented rural areas. Based on this assumption, it was found that the generation rates presented in Table D-1 were generally slightly higher than the

rates developed by the MOEE. As a result, municipal waste generation rates that were slightly higher than the provincial estimates were used in the Master Plan for planning purposes. The estimates that were used were 2.2 kg/capita/day for urban areas and 1.1 kg/capita/day for rural areas.

The generation rates for Moore and Plympton Townships were adjusted to take into account the high degree of urbanized area in these townships relative to the other townships. This is due to the highly urbanized areas located along the shores of Lake Huron and the St. Clair River. It was assumed that Moore Township was 80% urban and 20% rural, and that Plympton Township was 50% urban and 50% rural. Based on these assumptions, generation rates of 2.0 kg/capita/day for Moore Township and 1.7 kg/capita/day for Plympton Township were determined. The waste generation rates that were determined are summarized in Table D-2.

TABLE D-2
FUTURE WASTE GENERATION RATES BY MUNICIPALITY
DETERMINED IN 1986

Municipality	Waste Generation Rate (kg/cap/day)
City	
Sarnia	2.2
Towns	
Forest	2.2
Petrolia	2.2
Villages	
Alvinston	2.2
Arkona	2.2
Grand Bend	2.2
Oil Springs	2.2
Point Edward	2.2
Thedford	2.2
Watford	2.2
Wyoming	2.2
Townships	
Bosanquet*	1.1
Brooke	1.1
Dawn	1.1
Enniskillen	1.1
Euphemia	1.1
Moore	2.0
Plympton	1.7
Sombra	1.1
Warwick	1.1

** Bosanquet became a Town on December 1, 1994.*

1989 REVIEW OF WASTE QUANTITIES

A partial survey of waste haulers and landfill site operators in the County was conducted in 1989 to ascertain the accuracy of the waste generation rates calculated previously for 1985. The results of the survey are summarized in Table D-3.

TABLE D-3
MUNICIPAL WASTE GENERATION RATES DETERMINED BASED ON 1989 WASTE QUANTITIES

Municipality Type	Municipalities[1]	1989 Population[2]	1989 Waste Quantities Residential Wastes (tonnes)	Waste Generation Rate (kg/cap/day)
City	Sarnia	49,675	17,730	0.98
Town	Petrolia	4,459	1,065	0.65
Villages	Alvinston Arkona Grand Bend Thedford Watford Wyoming	6,304	3,200	1.39
Townships	Plympton	5,199	1,240	0.65

[1] *The survey covered some but not all of the municipalities in the County.*
[2] *Extrapolated values using 1986 and 1991 Census Canada values.*

Comparison of the generation rates determined using the 1989 data with the rates determined for 1985 indicated that the 1989 rates were significantly lower. This decrease was not attributable to waste diversion initiatives because many such initiatives did not commence in Lambton County until after 1989. It was assumed that the decrease in generation rates was caused by the redirection of wastes away from the Sarnia landfill site in 1988. These wastes were from commercial and institutional sources which had traditionally gone to the Sarnia landfill. As part of the subsequent report titled, *Sarnia Landfill - Application for Expansion Addendum Document, September, 1991*, it was determined that up to 32,500 tonnes per year of commercial and institutional wastes that had traditionally been disposed of in the Sarnia landfill were being redirected to other privately owned landfill sites.

1993 REVIEW OF WASTE QUANTITIES

The waste quantities produced in Lambton County were reviewed in 1993 to determine whether or not the waste generation rates originally determined for 1985 were still representative of waste generation in the County. The 1985 waste generation rates were multiplied by estimates of 1992 populations to determine a theoretical waste quantity for 1992. It was assumed that if the theoretical waste quantity for 1992 was close to the actual amount of waste produced in the County, then the 1985 generation rates would still provide accurate estimates of future waste generation quantities.

Review of the 1992 waste quantities produced in Lambton County indicated that the municipal wastes produced in the County were either disposed of in one of the County's landfill sites or diverted through one of the existing waste diversion programs. In addition, wastes which were previously redirected away from the Sarnia Landfill were also added in. These wastes were traditionally disposed of in municipal landfill sites and were included in the 1985 waste generation rates. It is expected that once the County's new landfill site opens that these wastes will be accepted and disposed of by the County.

The calculation of waste quantities produced in Lambton County in 1992 is summarized in Table D-4. The calculations indicate that 80,821 tonnes of municipal waste were produced in Lambton County in 1992.

TABLE D-4
WASTE QUANTITIES PRODUCED IN LAMBTON COUNTY IN 1992

Description	Quantity (tonnes)
Municipal Wastes Disposed in County Landfill Sites or Private Sites Designated by the County	39,670
Waste Quantities Diverted through Recycling, Backyard Composting and Central Composting Programs. (See Chapter 3 of Volume 1: Master Plan Report)	8,650
Commercial and Institutional Wastes Redirected Away from County Landfill Sites	32,500
Total Quantity	**80,820**

The waste generation rates determined for 1985 were multiplied by estimates of 1992 populations to determine the waste quantities that theoretically would have been produced if the 1985 generation rates for municipal wastes had prevailed. The 1992 populations were determined by multiplying 1991 Canada Census population figures by assumed growth rates.

The growth rates were determined based on a review of 1981, 1986 and 1991 Canada Census population data. These growth rates were also used for calculating future population estimates.

The calculation of waste quantities for 1992 using the 1985 generation rates is summarized in Table D-5. The calculation shows that 92,770 tonnes of municipal waste would have been produced in Lambton County in 1992 using the 1985 municipal waste generation rates.

TABLE D-5
DETERMINATION OF 1992 WASTE GENERATION USING THE 1985 PER CAPITA GENERATION RATES

Municipality Type	Municipality	1991 Census Population	Assumed Annual Growth Rate	1992 Population	Waste Generation Rate (kg/cap/day)	1992 Waste Generation (tonnes/year)
City	Sarnia	74,376	0.3%	74,599	2.2	59,900
Towns	Forest	2,787	0.6%	2,804	2.2	2,250
	Petrolia	4,594	0.5%	4,617	2.2	3,710
Villages	Alvinston	920	0.2%	922	2.2	740
	Arkona	530	0.5%	533	2.2	430
	Grand Bend	789	2.2%	806	2.2	650
	Oil Springs	690	1.0%	697	2.2	560
	Point Edward	2,336	0.2%	2,341	2.2	1,880
	Thedford	791	0.2%	793	2.2	640
	Watford	1,524	0.1%	1,526	2.2	1,230
	Wyoming	2,048	2.2%	2,093	2.2	1,680
Townships	Bosanquet*	5,249	1.0%	5,301	1.1	2,130
	Brooke	1,902	-1.0%	1,883	1.1	760
	Dawn	1,687	-0.8%	1,674	1.1	670
	Enniskillen	3,171	0.1%	3,174	1.1	1,270
	Euphemia	1,017	-0.9%	1,008	1.1	400
	Moore	10,664	1.0%	10,771	2.0	7,860
	Plympton	5,304	1.0%	5,357	1.7	3,320
	Sombra	4,179	0.2%	4,187	1.1	1,680
	Warwick	2,521	-0.2%	2,516	1.1	1,010
TOTALS		**127,079**		**127,602**		**92,770**

* *Bosanquet became a Town on December 1, 1994.*

Comparison of the amount of waste that would have been generated in Lambton County in 1992 at the 1985 waste generation rates with the amount actually generated indicated that 87% of the theoretical amount was actually generated. It is expected that this percentage would even be higher if the effects of at-source waste diversion and the current economic recession were taken into account. As a result, it was concluded that the waste generation rates determined for 1985 are still reasonably accurate and that they should be used to determine future waste quantities.

DETERMINATION OF FUTURE WASTE QUANTITIES

Future waste generation estimates were determined by multiplying the waste generation rates developed for 1985 by population projections. Population projections were originally determined in 1986 for the Stage 1 Report. The projections were updated in 1989 to incorporate 1986 census data. The projections were again updated in 1993 to incorporate 1991 census data and reflect recent growth rates. The updated growth rates and population projections are shown in Table D-6. The projections were developed on a year-by-year basis for the 20 year period commencing January 1, 1996 and ending December 31, 2015. The projections were extended for an additional 20 years at 5 year intervals to December 31, 2035. The projections for Grand Bend and Bosanquet Township were adjusted to include seasonal populations. The projections do not include people living on the Indian Reservations within the study area.

Table D-7 shows total cumulative waste generation for the 40 year period from the start of 1996 to the end of 2035. These waste quantities represent 100 percent of the municipal wastes that could be produced, and do not account for waste diversion that will occur in the future.

Table D-8 shows cumulative waste generation with waste diversion. As part of this study, it was determined that Lambton County complied with the MOEE's waste diversion from landfill objective of at least 25% by 1992 (see Chapter 3 of Volume 1: Master Plan Report). It was assumed that the County will also comply with the MOEE's year 2000 diversion objective of at least 50%. In conjunction with this assumption, it was assumed that waste diversion in the County will increase at a steady rate from 25% in 1992 to 50% in the year 2000 and then remain constant at 50% diversion for the remainder of the study period.

The waste quantity calculations indicate that, without waste diversion, the County will require approximately 2 million tonnes of landfill capacity for the 20 year period starting in 1996 and ending in 2015. With waste diversion, the total landfill requirement is reduced to approximately 1 million tonnes for the same 20 year period.

TABLE D-6
LAMBTON COUNTY PROJECTED POPULATIONS

Municipality	Assumed Population Growth Rate	Population to End of Year																						
		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
City																									
Sarnia	0.3%	75,498	75,725	75,952	76,180	76,408	76,638	76,868	77,098	77,329	77,561	77,794	78,028	78,262	78,496	78,732	78,968	79,205	79,443	79,681	79,920	81,126	82,350	83,593	84,854
Towns																									
Forest	0.6%	2,872	2,889	2,906	2,924	2,941	2,959	2,977	2,994	3,012	3,030	3,049	3,067	3,085	3,104	3,122	3,141	3,160	3,179	3,198	3,217	3,315	3,416	3,519	3,626
Petrolia	0.5%	4,710	4,734	4,757	4,781	4,805	4,829	4,853	4,877	4,902	4,926	4,951	4,976	5,001	5,026	5,051	5,076	5,101	5,127	5,152	5,178	5,309	5,443	5,580	5,721
Villages																									
Alvinston	0.2%	929	931	933	935	937	939	940	942	944	946	948	950	952	954	956	958	959	961	963	965	975	985	995	1,005
Arkona	0.5%	543	546	549	552	554	557	560	563	566	568	571	574	577	580	583	586	589	591	594	597	612	628	644	660
Grand Bend	2.2%	1,903	1,945	1,988	2,032	2,076	2,122	2,169	2,216	2,265	2,315	2,366	2,418	2,471	2,526	2,581	2,638	2,696	2,755	2,816	2,878	3,209	3,577	3,989	4,447
Oil Springs	1.0%	725	732	740	747	755	762	770	778	785	793	801	809	817	825	834	842	850	859	867	876	921	968	1,017	1,069
Point Edward	0.2%	2,359	2,364	2,369	2,374	2,378	2,383	2,388	2,393	2,397	2,402	2,407	2,412	2,417	2,422	2,426	2,431	2,436	2,441	2,446	2,451	2,475	2,500	2,525	2,551
Thedford	0.2%	799	801	802	804	805	807	809	810	812	813	815	817	818	820	822	823	825	827	828	830	838	847	855	864
Watford	0.1%	1,532	1,533	1,535	1,536	1,538	1,539	1,541	1,542	1,544	1,545	1,547	1,549	1,550	1,552	1,553	1,555	1,556	1,558	1,559	1,561	1,569	1,577	1,585	1,593
Wyoming	2.2%	2,283	2,334	2,385	2,437	2,491	2,546	2,602	2,659	2,718	2,777	2,839	2,901	2,965	3,030	3,097	3,165	3,234	3,306	3,378	3,453	3,850	4,292	4,785	5,335
Townships																									
Bosanquet*	1.0%	9,863	9,961	10,061	10,162	10,263	10,366	10,469	10,574	10,680	10,787	10,895	11,003	11,114	11,225	11,337	11,450	11,565	11,680	11,797	11,915	12,523	13,162	13,833	14,539
Brooke	-1.0%	1,809	1,791	1,773	1,755	1,738	1,720	1,703	1,686	1,669	1,652	1,636	1,619	1,603	1,587	1,571	1,556	1,540	1,525	1,509	1,494	1,421	1,351	1,285	1,222
Dawn	-0.8%	1,621	1,608	1,595	1,582	1,569	1,557	1,544	1,532	1,520	1,508	1,496	1,484	1,472	1,460	1,448	1,437	1,425	1,414	1,402	1,391	1,336	1,284	1,233	1,185
Enniskillen	0.1%	3,187	3,190	3,193	3,196	3,200	3,203	3,206	3,209	3,212	3,216	3,219	3,222	3,225	3,229	3,232	3,235	3,238	3,241	3,245	3,248	3,264	3,281	3,297	3,314
Euphemia	-0.9%	972	963	955	946	938	929	921	912	904	896	888	880	872	864	856	849	841	834	826	819	782	748	715	683
Moore	1.0%	11,208	11,320	11,433	11,548	11,663	11,780	11,897	12,016	12,137	12,258	12,381	12,504	12,629	12,756	12,883	13,012	13,142	13,274	13,406	13,540	14,231	14,957	15,720	16,522
Plympton	1.0%	5,575	5,630	5,687	5,743	5,801	5,859	5,918	5,977	6,036	6,097	6,158	6,219	6,282	6,344	6,408	6,472	6,537	6,602	6,668	6,735	7,078	7,439	7,819	8,218
Sombra	0.2%	4,221	4,229	4,238	4,246	4,255	4,263	4,272	4,280	4,289	4,298	4,306	4,315	4,323	4,332	4,341	4,349	4,358	4,367	4,376	4,384	4,428	4,473	4,518	4,563
Warwick	-0.2%	2,496	2,491	2,486	2,481	2,476	2,471	2,466	2,461	2,456	2,451	2,446	2,442	2,437	2,432	2,427	2,422	2,417	2,412	2,408	2,403	2,379	2,355	2,332	2,308
TOTAL		135,105	135,717	136,336	136,960	137,591	138,228	138,872	139,522	140,178	140,841	141,511	142,188	142,871	143,562	144,259	144,964	145,676	146,395	147,122	147,856	151,642	155,632	159,839	164,278

** Bosanquet became a Town on December 1, 1994.*

TABLE D-7
LAMBTON COUNTY PROJECTED CUMULATIVE WASTES

Municipality	Waste Generation Rate (kg/cap/day)	Cumulative Waste Generation to End of Year (tonnes)																						
		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
City																									
Sarnia	2.2	60,625	121,432	182,422	243,594	304,950	366,490	428,215	490,125	552,220	614,502	676,971	739,629	802,471	865,503	928,725	992,136	1,055,738	1,119,530	1,183,514	1,247,690	1,570,990	1,899,168	2,232,299	2,570,456
Towns																									
Forest	2.2	2,306	4,626	6,959	9,307	11,669	14,045	16,435	18,839	21,258	23,692	26,140	28,603	31,080	33,572	36,080	38,602	41,140	43,693	46,261	48,844	61,958	75,469	89,391	103,736
Petrolia	2.2	3,782	7,583	11,403	15,242	19,101	22,978	26,875	30,792	34,728	38,684	42,659	46,655	50,670	54,706	58,761	62,837	66,934	71,050	75,188	79,346	100,399	121,983	144,113	166,801
Villages																									
Alvinston	2.2	746	1,494	2,243	2,994	3,746	4,500	5,255	6,011	6,770	7,529	8,291	9,053	9,818	10,583	11,351	12,120	12,890	13,662	14,435	15,211	19,105	23,039	27,012	31,025
Arkona	2.2	436	875	1,316	1,758	2,204	2,651	3,101	3,552	4,006	4,463	4,922	5,382	5,846	6,311	6,779	7,249	7,722	8,197	8,674	9,154	11,583	14,073	16,626	19,243
Grand Bend	2.2	1,528	3,090	4,686	6,318	7,985	9,689	11,431	13,210	15,029	16,888	18,788	20,730	22,714	24,742	26,814	28,933	31,097	33,310	35,571	37,882	50,100	63,723	78,912	95,846
Oil Springs	2.2	582	1,170	1,765	2,365	2,970	3,583	4,201	4,825	5,456	6,092	6,736	7,385	8,042	8,704	9,374	10,050	10,733	11,422	12,119	12,822	16,430	20,221	24,206	28,394
Point Edward	2.2	1,895	3,793	5,695	7,601	9,511	11,425	13,342	15,264	17,189	19,118	21,051	22,987	24,928	26,873	28,821	30,773	32,729	34,690	36,654	38,622	48,511	58,499	68,588	78,778
Thedford	2.2	642	1,284	1,929	2,574	3,221	3,869	4,518	5,168	5,820	6,474	7,128	7,784	8,441	9,099	9,759	10,420	11,083	11,746	12,411	13,078	16,426	19,809	23,225	26,675
Watford	2.2	1,230	2,461	3,693	4,927	6,162	7,398	8,635	9,874	11,114	12,355	13,597	14,840	16,085	17,331	18,578	19,827	21,076	22,327	23,580	24,833	31,116	37,431	43,777	50,155
Wyoming	2.2	1,834	3,707	5,623	7,580	9,580	11,625	13,714	15,849	18,031	20,262	22,541	24,871	27,251	29,684	32,171	34,712	37,310	39,964	42,677	45,449	60,108	76,452	94,675	114,993
Townships																									
Bosanquet*	1.1	3,960	7,959	11,999	16,079	20,199	24,361	28,565	32,810	37,098	41,429	45,803	50,221	54,683	59,190	63,742	68,339	72,982	77,672	82,408	87,192	111,722	137,503	164,599	193,078
Brooke	1.1	726	1,445	2,157	2,862	3,559	4,250	4,934	5,610	6,281	6,944	7,601	8,251	8,895	9,532	10,163	10,788	11,406	12,018	12,624	13,224	16,150	18,933	21,580	24,097
Dawn	1.1	651	1,296	1,936	2,572	3,202	3,827	4,447	5,062	5,672	6,277	6,878	7,473	8,064	8,650	9,232	9,809	10,381	10,949	11,512	12,070	14,808	17,438	19,965	22,392
Enniskillen	1.1	1,280	2,560	3,842	5,126	6,410	7,696	8,984	10,272	11,562	12,853	14,145	15,439	16,734	18,030	19,328	20,627	21,927	23,228	24,531	25,835	32,372	38,941	45,544	52,179
Euphemia	1.1	390	777	1,160	1,540	1,917	2,290	2,659	3,026	3,389	3,748	4,105	4,458	4,808	5,155	5,499	5,840	6,178	6,513	6,844	7,173	8,780	10,316	11,784	13,187
Moore	2.0	8,182	16,445	24,792	33,221	41,735	50,335	59,020	67,792	76,652	85,600	94,638	103,766	112,985	122,297	131,702	141,201	150,795	160,484	170,271	180,156	230,839	284,107	340,093	398,935
Plympton	1.7	3,459	6,953	10,481	14,045	17,644	21,280	24,952	28,660	32,406	36,189	40,010	43,869	47,767	51,703	55,679	59,695	63,751	67,848	71,985	76,164	97,591	120,111	143,780	168,657
Sombra	1.1	1,695	3,393	5,094	6,799	8,508	10,219	11,934	13,653	15,375	17,100	18,829	20,562	22,298	24,037	25,780	27,526	29,276	31,029	32,786	34,546	43,392	52,326	61,350	70,465
Warwick	1.1	1,002	2,002	3,000	3,996	4,990	5,983	6,973	7,961	8,947	9,931	10,914	11,894	12,872	13,848	14,823	15,795	16,766	17,734	18,701	19,666	24,465	29,217	33,921	38,579
TOTAL		96,950	194,348	292,196	390,500	489,264	588,491	688,187	788,356	889,002	990,130	1,091,745	1,193,850	1,296,452	1,399,554	1,503,161	1,607,279	1,711,913	1,817,067	1,922,746	2,028,956	2,566,845	3,118,761	3,685,440	4,267,671

* *Bosanquet became a Town on December 1, 1994.*

TABLE D-8
LAMBTON COUNTY PROJECTED CUMULATIVE WASTES - WITH WASTE DIVERSION

Municipality	Waste Generation Rate (kg/cap/day)	Cumulative Waste Generation to End of Year (tonnes)																						
		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035
City																									
Sarnia	2.2	37,891	74,010	108,286	140,769	171,447	202,217	233,079	264,034	295,082	326,223	357,457	388,785	420,207	451,723	483,334	515,040	546,841	578,737	610,729	642,817	804,467	968,556	1,135,121	1,304-,200
Towns																									
Forest	2.2	1,441	2,819	4,131	5,377	6,558	7,746	8,941	10,143	11,353	12,570	13,794	15,025	16,264	17,510	18,764	20,025	21,294	22,570	23,854	25,146	31,703	38,458	45,419	52,592
Petrolia	2.2	2,364	4,622	6,769	8,807	10,736	12,675	14,624	16,582	18,550	20,528	22,516	24,513	26,521	28,539	30,567	32,605	34,653	36,711	38,780	40,859	51,385	62,177	73,242	84,586
Villages																									
Alvinston	2.2	466	910	1,332	1,730	2,106	2,483	2,861	3,239	3,618	3,998	4,379	4,760	5,142	5,525	5,909	6,293	6,678	7,064	7,451	7,839	9,786	11,753	13,739	15,746
Arkona	2.2	273	533	781	1,016	1,239	1,462	1,687	1,913	2,140	2,368	2,598	2,828	3,060	3,292	3,526	3,762	3,998	4,235	4,474	4,714	5,928	7,173	8,450	9,759
Grand Bend	2.2	955	1,883	2,780	3,646	4,480	5,332	6,203	7,093	8,002	8,931	9,881	10,852	11,844	12,858	13,895	14,954	16,036	17,142	18,273	19,428	25,537	32,349	39,943	48,410
Oil Springs	2.2	364	713	1,047	1,366	1,669	1,975	2,284	2,596	2,911	3,230	3,551	3,876	4,204	4,536	4,870	5,208	5,550	5,895	6,243	6,595	8,398	10,294	12,286	14,380
Point Edward	2.2	1,184	2,312	3,381	4,393	5,348	6,305	7,263	8,224	9,187	10,151	11,118	12,086	13,056	14,029	15,003	15,979	16,957	17,937	18,919	19,903	24,848	29,842	34,886	39,981
Thedford	2.2	401	783	1,145	1,488	1,811	2,135	2,460	2,785	3,111	3,437	3,765	4,092	4,421	4,750	5,080	5,411	5,742	6,074	6,406	6,739	8,414	10,105	11,813	13,538
Watford	2.2	769	1,500	2,193	2,848	3,465	4,083	4,702	5,321	5,941	6,561	7,183	7,804	8,427	9,050	9,673	10,297	10,922	11,548	12,174	12,801	15,942	19,100	22,273	25,462
Wyoming	2.2	1,146	2,259	3,335	4,375	5,375	6,397	7,442	8,509	9,601	10,716	11,855	13,020	14,210	15,427	16,670	17,941	19,240	20,567	21,923	23,309	30,639	38,811	47,922	58,081
Townships																									
Bosanquet*	1.1	2,475	4,851	7,121	9,287	11,348	13,428	15,530	17,653	19,797	21,962	24,149	26,358	28,589	30,843	33,119	35,417	37,739	40,084	42,452	44,844	57,109	69,999	83,548	97,787
Brooke	1.1	454	881	1,281	1,655	2,004	2,349	2,691	3,030	3,365	3,696	4,025	4,350	4,672	4,990	5,306	5,618	5,927	6,233	6,536	6,836	8,300	9,691	11,014	12,273
Dawn	1.1	407	790	1,150	1,487	1,802	2,115	2,425	2,732	3,037	3,340	3,640	3,938	4,234	4,527	4,817	5,106	5,392	5,676	5,957	6,237	7,605	8,921	10,184	11,397
Enniskillen	1.1	800	1,561	2,281	2,963	3,605	4,248	4,891	5,536	6,181	6,826	7,472	8,119	8,767	9,415	10,064	10,713	11,363	12,014	12,665	13,317	16,586	19,870	23,171	26,489
Euphemia	1.1	244	474	689	891	1,079	1,265	1,450	1,633	1,815	1,995	2,173	2,350	2,525	2,698	2,870	3,041	3,210	3,377	3,543	3,707	4,511	5,279	6,013	6,714
Moore	2.0	5,114	10,022	14,713	19,189	23,446	27,746	32,088	36,474	40,904	45,378	49,897	54,461	59,071	63,727	68,429	73,179	77,976	82,820	87,714	92,656	117,998	144,632	172,625	202,046
Plympton	1.7	2,162	4,237	6,220	8,113	9,912	11,730	13,566	15,420	17,293	19,184	21,095	23,024	24,973	26,942	28,930	30,938	32,966	35,014	37,083	39,172	49,886	61,146	72,980	85,418
Sombra	1.1	1,059	2,068	3,024	3,929	4,784	5,639	6,497	7,356	8,217	9,080	9,945	10,811	11,679	12,548	13,420	14,293	15,168	16,044	16,923	17,803	22,226	26,693	31,205	35,762
Warwick	1.1	626	1,220	1,781	2,310	2,807	3,303	3,798	4,292	4,786	5,278	5,769	6,259	6,748	7,236	7,723	8,210	8,695	9,179	9,663	10,145	12,545	14,920	17,273	19,601
TOTAL		60,594	118,448	173,439	225,638	275,020	324,634	374,482	424,566	474,889	525,453	576,261	627,313	678,614	730,165	781,969	834,028	886,344	938,921	991,761	1,044,866	1,313,811	1,589,769	1,873,108	2,164-,224

* *Bosanquet became a Town on December 1, 1994.*

DETERMINATION OF 1987 WASTE GENERATION RATES

The MOEE has outlined procedures for calculating waste diversion in the Waste Reduction Office's Initiatives Paper No. 4. This paper, which is entitled *Measuring Progress Towards Ontario's Waste Reduction Targets*, was released in June 1992. It recommends that waste diversion be calculated on a waste generation per capita basis using 1987 waste quantities as the basis. However, detailed information on the actual waste quantities disposed in Lambton County in 1987 is not available. This is due primarily to two reasons:

1) The County did not assume management of the County's waste management system until 1991. Prior to this time, each of the lower-tier municipalities in the County were responsible for the management and disposal of their own wastes. As a result, there was no effort made by a central body, such as the County, to monitor the amount of wastes disposed.

2) In 1987, most of the landfill sites in the County did not have weigh scales or did not keep records of the vehicles entering the landfill sites. Scales were installed at the Sarnia landfill in 1991. The County also monitors the amounts of wastes disposed at its other landfill sites using other methods (e.g. counting the number of trucks that enter the sites).

Municipal waste quantities for 1987 were determined by calculating municipal waste generation rates and multiplying them by population estimates. Municipal waste generation rate estimates for 1987 were determined by reviewing generation rates calculated using the 1985 and the 1989 data. Comparisons were made based on the type of municipality, such as the City of Sarnia, towns, villages or townships. Municipal waste generation rates for these groupings of municipalities for the 1985 data are shown in Table D-9. Similar data for the 1989 waste quantities is shown in Table D-3. It is important to note that the 1989 data does not include commercial and institutional wastes that were redirected away from the Sarnia landfill in 1988.

TABLE D-9
WASTE GENERATION RATES
BASED ON 1985 WASTE QUANTITIES

Municipality Type	Municipalities	1985 Population	1985 Waste Quantities Municipal Wastes (tonnes)	Waste Generation Rate (kg/cap/day)
City	Sarnia	72,787	67,830	2.50
Towns	Forest Petrolia	7,005	3,550	1.40
Villages	Alvinston Arkona Grand Bend Oil Springs Point Edward Thedford Watford Wyoming	8,823	5,230	1.62
Townships	Bosanquet* Brooke Dawn Enniskillen Euphemia Moore Plympton Sombra Warwick	34,163	11,350	0.91
Totals		**122,778**	**87,960**	

* *Bosanquet became a Town on December 1, 1994.*

In order to make the 1985 waste quantities and generation rates more comparable with the 1989 and 1992 data, the commercial and institutional wastes that were redirected from the Sarnia landfill in 1988 were subtracted from the 1985 data. In the *Sarnia Landfill Application for Expansion Addendum Document, September, 1991*, it is noted that wastes that had traditionally been disposed in the Sarnia Landfill by private contractors were redirected to other sites. These wastes consisted primarily of commercial and institutional wastes from Sarnia and represented approximately 32,500 tonnes per year. This value was subtracted from the 1985 waste quantities, which resulted in a reduction of the waste generation rate from 2.5 to 1.3 kg/capita/day. This new generation rate was determined as follows:

$$\frac{(67{,}830 - 32{,}500)\ tonnes/year}{(72{,}787)\ people} \times \frac{1000\ kg}{tonne} \times \frac{1\ year}{365\ days} = 1.3\ kg/capita/day$$

This generation rate is more consistent with the observed generation rates from the 1989 and 1992 data.

Municipal waste generation rates for 1987 were determined by comparing generation rates from the 1985 and 1989 data. The generation rates that were used for 1987 and the rationale for using them are summarized in Table D-10.

TABLE D-10
1987 WASTE GENERATION RATES
BASED ON 1985 and 1989 WASTE QUANTITIES

Municipality Type	1987 Waste Generation Rate (kg/cap/day)	Rationale for Generation Rate
City	1.2	Based on the 1985 data, an adjusted generation rate of 1.3 kg/cap/day was determined for Sarnia. The 1989 data resulted in a generation rate of 1.0 kg/cap/day for Sarnia. As a result, a generation rate of 1.2 kg/cap/day for 1987 was considered to be most appropriate.
Towns	1.2	A generation rate of 1.4 kg/cap/day was determined for Forest and Petrolia using the 1985 data. The data for 1989 resulted in a generation rate of 0.65 kg/cap/day for Petrolia. This was extremely low compared to the 1985 data and was considered to be inaccurate. As a result, a generation rate of 1.2 kg/cap/day for 1987 was also considered to be most appropriate for Forest and Petrolia.
Villages	1.5	A generation rate of 1.6 kg/cap/day was determined from the 1985 data. A rate of 1.4 kg/cap/day was determined using the 1989 data. Therefore, a generation rate of 1.5 kg/cap/day was considered appropriate for the villages in 1987.
Townships	0.9	For the townships, which were considered to be rural areas, a generation rate of 0.9 kg/cap/day was determined using the 1985 data. The 1989 data only included one township, which was not considered to be representative. Therefore, a generation rate of 0.9 kg/cap/year for 1987 was considered appropriate for the townships.

Calculations were completed to verify the 1987 waste generation rate estimates that were used to determine the 1992 waste diversion rate. The calculations involved multiplying the waste generation rates determined for 1987 by the 1992 population estimates. This resulted in the determination of the quantities of waste that would have been disposed in 1992 if the 1987 generation rates had prevailed. This resulted in 53,100 tonnes of waste. The calculations are summarized in Table D-11.

TABLE D-11
CALCULATION OF 1992 WASTE QUANTITIES
USING 1987 GENERATION RATES

Municipality Type	1992 Population (see Table D-5)	1987 Waste Generation Rate (kg/capita/day)	Waste Quantity (Tonnes)
City	74,599	1.2	32,700
Towns	7,421	1.2	3,300
Villages	9,711	1.5	5,300
Townships	35,871	0.9	11,800
Totals	**127,602**		**53,100**

In 1992, 39,670 tonnes of residential waste were disposed in Lambton County. The difference between this amount and what would have been disposed at the 1987 generation rates was 13,430 tonnes (53,100 - 39,670 = 13,430 tonnes). Most of this difference can be accounted for by considering the amount of wastes diverted through existing diversion programs.

As reported in Chapter 3, Section 2, of Volume 1: Master Plan Report, the total amount of waste diverted through Blue Box and composting programs in 1992 in Lambton County was 8,650 tonnes. This represents 65% of the 13,430 tonne difference. The remaining 4,800 tonne difference is likely due to at-source waste reduction and reuse and the effects of the economic recession. This difference is not considered to be significant. It is important to note that the MOEE has not determined a meaningful method for accounting for the effects of the economy on waste diversion (Per. Comm., Ron Neilsen, April 8, 1993).

LIST OF REFERENCES AND PERSONAL COMMUNICATIONS

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Neilsen, Ron. Ontario Ministry of the Environment and Energy, Waste Reduction Office. April 8, 1993. Telephone: (416) 325-4419.

Ontario Ministry of the Environment, Waste Reduction Office. (1992). *Measuring Progress Toward Ontario's Waste Reduction Targets - Initiatives Paper No. 4.* Queen's Printer for Ontario, PIBS 1945E.

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LAMBTON COUNTY WASTE MANAGEMENT MASTER PLAN
TECHNICAL APPENDICES

APPENDIX 2E
WASTE MANAGEMENT COMPONENT AND SYSTEM EVALUATION AND SELECTION

M.M. DILLON LIMITED
FEBRUARY 1995

ALTERNATIVE: Materials Recovery Facility (MRF)

DEFINITION: A facility where wastes are processed to separate and recover recyclable and compostable materials from the residual materials in the waste stream.

DESCRIPTION:

- A materials recovery facility can use manual and/or mechanical methods to separate the waste into recyclable, compostable and residual materials.

- A materials recovery facility with mechanical processing systems often includes equipment such as belts, screens, trommels, air classifiers, magnetic separators, optical separators and ballistics to separate recoverable material.

- Facilities that maximize recovery usually use non-destructive labour intensive sorting techniques.

- Collected wastes are delivered to the facility and dumped onto the floor. The wastes are then directed to a series of belts or conveyors. The moving wastes pass by facility staff or equipment which remove specific materials from the waste stream at different locations along the processing line. The various separated and recovered materials are then directed to an area within the facility to be prepared (compacted and baled) for delivery to markets.

- A materials recovery facility is designed based on the type of waste collection program used. The method of materials processing and recovery varies for mixed wastes, co-mingled recyclables only, and separated dry and organic wastes.

USE OF COMPONENT:

- Several materials recovery facilities are in operation in Europe and the United States. These facilities are relatively new in Canada with most facilities being constructed in the late 1980's and early 1990's.

- Most of the materials recovery facilities in Ontario have been designed to process co-mingled recyclable material from a source separation (Blue Box) program.

- Materials recovery facilities which service only the industrial, commercial and institutional sectors are also operating in Ontario. These facilities typically separate paper, cardboard and wood wastes.

WASTE QUANTITY REQUIREMENTS:

- Materials recovery facilities can be designed to process a range of waste quantities. Typically these facilities range in size from 10 tonnes/day to over 200 tonnes/day.

- Analysis of the minimum waste quantity requirements for a production scale plant requires an analysis of the available markets for the various recoverable materials.

HUMAN RESOURCE REQUIREMENTS:

- The human resource requirements at a materials recovery facility can be extensive if the materials are separated and recovered by manual labour. Human resource requirements are reduced with the addition of automated waste processing equipment.

EFFECT OF GEOGRAPHIC SETTING ON COMPONENT:

- A materials recovery facility is usually considered to be an industry and should be located in an area established for industrial land uses. Alternatively, a materials recovery facility is compatible with a waste disposal site and may be located at the same site.

- An environmentally-based site selection process should be undertaken to ensure that the materials recovery facility is compatible with surrounding land uses and will not cause any adverse impacts on the environment.

- Urban or densely populated areas which generate larger quantities of waste are most suitable for a materials recovery facility due to the associated capital and operating costs.

COST:

- Capital costs depend on facility size and degree of mechanization. The least cost facility is one that uses only manual labour for separating the wastes. Capital costs are limited to land purchase and a processing building.

- Operating costs include labour, equipment operation and maintenance. Revenues obtained from the sale of recovered recyclable materials to markets reduces the net operating costs of a facility.

- Operating costs at a materials recovery facility are covered by the facility operator charging a tipping fee to each waste generator delivering wastes for processing to the facility.

TABLE E-1
SCREENING OF ALTERNATIVE COMPONENTS - MATERIALS RECOVERY FACILITY

Alternative	Technology/Policy	Costs	Applicability/Benefits	Recommendation
16. Materials Recovery Facility	· Relatively new and still developing technology · Currently used in Europe, USA and Canada · Technology used in large scale automated facilities, well studied but not commonly used or proven. Small scale manual type facilities are proven and are becoming more common · Helps to achieve MOEE waste diversion objectives · Is consistent with the objectives under the MOEE's 3Rs Regulations. Is applicable under the streamlined approvals process for municipal recycling sites. · Technology can be considered proven and consistent with policies	· Capital and operating costs depend on the facility size and degree of mechanization · Facility can be designed to be consistent with the needs of the County and at a low cost	· Can be designed to be compatible with the study area · Provides benefits of waste diversion, decreased dependence on landfill disposal, and will assist to achieve MOEE waste diversion objectives · Applicable to study area. Three existing facilities owned and operated by private recycling contractors.	· Alternative complies with the criteria. Include for further consideration.

TABLE E-2
GENERIC ENVIRONMENTAL EFFECTS - MATERIALS RECOVERY FACILITY (MRF)

Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
Social/Cultural Environment · Effects from truck traffic and facility operation (i.e. noise, dust, etc.) · May represent a community commitment to significant reductions in waste volumes for landfilling · Resident displacement effects possible	· Locate facility in area with compatible land use · Utilize dust control equipment, if required · Utilize control for noise and odours · Review traffic impacts and consider alternative routes, controls, etc. · Visual improvements may be incorporated	· Effects on local features should be minimized through proper siting, design and operation · Results in positive effects by demonstrating community commitment to reducing waste	<u>Advantages</u>: · Maximum waste diversion rates may be achieved · Significant reduction in waste quantities will increase life of existing landfill(s) and reduce future landfill requirements · Resource savings for future generations · Good community involvement with effective conservation strategies <u>Disadvantages</u>: · Relatively high capital and operating costs for municipality · Success of program may be dependent on materials markets · Facility will generate negative social/cultural and natural environment effects
Natural Environment · Reduction in waste quantities requiring disposal at landfill, i.e. reduced volume, less land displaced, fewer negative effects · Facility siting may displace natural features · Potential nuisance effects due to truck traffic, displacement, noise and odour	· Locate facility in area with compatible use · Avoid features during siting or incorporate features into facility design (screening, buffer, where possible)	· Effects on natural features should be minimized through proper siting	
Economic Environment · Capital and operating costs depend on facility size and degree of mechanization	· Develop markets for materials to offset costs.	· Operating costs reduced by revenue generated from sale of materials	

TABLE E-3
EVALUATION OF UPDATED WASTE MANAGEMENT SYSTEMS – SYSTEM 1 ("DO NOTHING" ALTERNATIVE)

System Option	Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
SYSTEM 1 **DO NOTHING** · Existing Collection System · Landfills at Existing Sites	<u>Social/Cultural Environment</u> · No public awareness and participation in waste management activities is realized due to no 3Rs component · Negative public/social reaction to reliance on landfill disposal of wastes · Lack of long-term disposal capacity may result in more litter, less frequent waste collection, etc. <u>Natural Environment</u> · Negative natural environment effects from existing landfill sites are related to negative effects on features, nuisance effects and impacts from contaminants. Effects increase due to illegal dumping of wastes since no long-term disposal capacity available · No natural resource conservation is realized through waste diversion programs. Maximum waste volumes are disposed	· Recycling and composting not components of system. Public awareness is limited to personal reduction/reuse options and existing diversion programs · Continue public consultation program after implementation of the Master Plan · Enforce local littering and dumping by-laws · Ongoing monitoring at existing landfill sites will help to identify effects so that contingency measures can be implemented as required · Recycling and composting programs are not components of the system. No mitigation available	· Public awareness and participation is restricted to personal reduction/reuse options and existing diversion programs due to no 3Rs programs · Ongoing liaison with public allows concerns with existing landfill sites to be identified and addressed · Impacts on residents and land uses due to littering and dumping of wastes if no disposal capacity is available · Natural environment effects are reduced through ongoing monitoring of existing landfill designs and operations. Effects will increase due to illegal dumping of wastes since no additional long-term disposal capacity is provided · No conservation of natural resources or diversion of wastes from landfills. Effects of landfill on natural environment do not change	<u>Advantages:</u> · Collection system costs remain the same. <u>Disadvantages:</u> · No public awareness and participation in waste diversion · Impacts on residents due to littering and dumping of wastes · No conservation of natural resources · MOEE waste diversion objectives not achieved · Reliance on landfill as only disposal alternative · Prohibitive costs due to reliance of private landfill sites

TABLE E-3
EVALUATION OF UPDATED WASTE MANAGEMENT SYSTEMS – SYSTEM 1 ("DO NOTHING" ALTERNATIVE)
(Continued)

System Option	Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
	Technical Environment · Existing landfills have minimal capacity and will not last for whole study period · MOEE waste diversion objectives will not be achieved since no diversion components are included in the system · Landfill is the only disposal component and must manage the majority of the waste · Existing level of service for disposal is maintained	· Obtain approval for interim expansion of existing Sarnia landfill · None available except for personal reduction/reuse and existing programs · Implement personal waste reduction and reuse programs to reduce waste disposal · Optimize existing operations	· Disposal capacity remaining is not sufficient. Interim expansion of Sarnia landfill site is required. · Diversion only achieved through personal reduction/reuse and existing programs since no diversion components in systems. MOEE diversion objectives not achieved · Reliance on landfill for those wastes that cannot be reduced or reused · No change to present level of service for disposal	

TABLE E-3
EVALUATION OF UPDATED WASTE MANAGEMENT SYSTEMS – SYSTEM 1 ("DO NOTHING" ALTERNATIVE)
(Continued)

System Option	Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
	Economic Environment · Long-term monitoring, care and closure costs for existing landfill sites · Lack of long-term disposal capacity may result in the need to export wastes to alternative disposal sites, or increased dependence on existing private sites · Costs for collection and direct haul components similar to present operations	· Ensure development and operation of existing landfills is controlled and monitored to avoid potential long-term costs associated with site clean-up and/or remedial contingency measures · Minimum standards have been established by the MOEE for establishing and operating a landfill · Apply for financial assistance from the MOEE · Export waste for disposal outside Lambton County, or use existing private sites more · Implement at-source waste reduction and reuse initiatives in order to reduce collection costs	· Long-term monitoring, care and closure costs may be reduced. · Lack of long-term disposal capacity will result in prohibitive costs (transportation and disposal fees) to private disposal sites · Collection system costs remain the same but reduction in costs if initiatives reduce waste generation	

TABLE E-4
EVALUATION OF UPDATED WASTE MANAGEMENT SYSTEMS – SYSTEM 2

System Option	Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
SYSTEM 2 · collection · source separation/recycling · household composting · landfill (existing plus new sites) · transfer stations	<u>Social/Cultural Environment</u> · Source separation/recycling and household composting will encourage public participation and awareness of waste management issues · Negative public/social reaction due to development of new landfill site(s)· Potential negative impact to residents and land uses on site, in vicinity and along haul routes for new landfill	· Initiate and promote 3Rs programs · Initiate and promote household composting and source separation by householders · Continue public consultation program after implementation of the Master Plan · Choose access routes to minimize impacts · Implement waste diversion to reduce number of vehicles going to landfill	· Increased public awareness and participation in waste management issues due to inclusion of 3Rs components in system · Ongoing liaison with the public allows concerns with landfill to be identified and mitigated · Impacts to residents and land uses near landfill or on routes to landfill reduced through route selection, siting process and diversion of waste	<u>Advantages:</u> · Increased public awareness due to 3Rs components · Conservation of natural resources through waste diversion · Decreased dependence on landfill through waste diversion · Collection system costs remain the same · Waste haul costs may be reduced by transfer stations
	<u>Natural Environment</u> · Natural resource conservation realized through recycling and composting · Negative natural environment effects from development of landfill site are related to negative effects on features, nuisance effects and impacts from contaminants	· Implement recycling and household composting programs · Develop an engineered landfill that will reduce impacts on the natural environment · Site landfill using criteria to avoid creating negative effects to natural features	· Conservation of natural resources and diversion of waste are realized · Natural environment effects minimized through landfill design and operation and site selection process	<u>Disadvantages:</u> · impacts to residents from new landfill site · natural environment impacts caused by new landfill · MOEE waste diversion objectives will not be met · Costs for new landfill and recycling program will be higher than existing system

TABLE E-4
EVALUATION OF UPDATED WASTE MANAGEMENT SYSTEMS – SYSTEM 2
(Continued)

System Option	Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
	Technical Environment			
	· Landfill is commonly used, well developed and successfully proven technology · Existing collection and transportation system is expanded to accommodate recycling	· Develop engineered landfill with operations and management plan to minimize environmental impacts · Make improvements to the existing system to allow incorporation of recycling	· Disposal of waste at an engineered landfill reduces overall environmental impacts · The efficiency of the existing collection and transportation system is enhanced to accommodate recycling	
	· Source separation/ recycling and household composting may divert waste from disposal by landfill and assist in efforts to achieve MOEE waste diversion objectives · Bins may be used for collecting recyclables at transfer stations in rural areas	· Implement source separation/recycling and backyard composting to reduce dependence on landfilling · Establish rural recycling facilities as needed	· Waste diversion will be achieved resulting in reduced dependence on landfill disposal. MOEE diversion objectives will not be met · Rural recycling facilities can increase the amount of recyclables collected	

TABLE E-4
EVALUATION OF UPDATED WASTE MANAGEMENT SYSTEMS – SYSTEM 2
(Continued)

System Option	Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
	Economic Environment · Operating cost of recycling program will result in higher costs than existing system. Markets for recyclables are needed to reduce operating costs · Capital costs associated with the development of new landfill will be greater than existing system · Long-term monitoring, care and closure costs for landfill · Costs for collection and direct haul components similar to present operations · Transfer stations may help to reduce waste haul costs to the new landfill site	· Secure markets for recyclables as part of establishing a recycling program · Apply to the MOEE for financial assistance to develop landfill · Ensure development and operation of landfill is controlled and monitored to avoid potential long-term costs associated with site clean-up and/or remedial contingency measures · Implement waste reduction and reuse initiatives in order to reduce collection costs · Construct transfer stations at strategic locations	· Recycling program may result in an operating deficit or higher costs than existing systems · Costs associated with landfill development may be reduced through financial assistance. Costs will be higher than existing system · Long-term monitoring, care and closure costs at landfill site which may be reduced but not eliminated · Collection system costs remain the same but reduction in costs may occur if initiatives reduce waste generation · Waste haul costs minimized by construction and operation of transfer stations at strategic locations	

TABLE E-5
EVALUATION OF UPDATED WASTE MANAGEMENT SYSTEMS – SYSTEM 3

System Option	Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
SYSTEM 3 · collection · source separation/recycling · household composting · central composting · materials recovery facility · landfill (existing plus new sites) · transfer stations	Social/Cultural Environment · Source separation/recycling, household composting, central composting and MRF will encourage public participation and awareness of waste management issues · Negative public/social reaction to landfill development · Potential negative impacts to residents and land uses on-site, along roads to MRF, central composting and landfill facilities and in site vicinity	· Initiate and promote 3Rs programs · Initiate and promote backyard composting and source separation by households · Start collection programs to provide materials for central composting and MRF facilities · Continue public consultation program after implementation of the Master Plan · Choose transportation routes to minimize impacts · Implement waste diversion to reduce number of trucks going to landfill · Site facilities using criteria to avoid impacts to social/cultural environment	· Increased public awareness and participation in waste management issues due to inclusion and promotion of 3Rs components in system · Reduced effects due to ongoing public liaison which will allow concerns with landfill to be identified and addressed · Impacts on residents and land uses near or on routes to MRF, central composting and landfill facilities reduced through route selection, siting process, and maximum waste diversion	Advantages: · Increased public awareness due to 3Rs components · Conservation of natural resources through maximum diversion of waste · Reduced dependence on landfill disposal through waste diversion · MOEE diversion targets may be exceed · Waste haul costs may be reduced by transfer stations

TABLE E-5
EVALUATION OF UPDATED WASTE MANAGEMENT SYSTEMS – SYSTEM 3
(Continued)

System Option	Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
	Natural Environment · Natural resource conservation realized through recycling, composting and MRF programs · Negative natural environment effects from potential landfill site are related to negative effects on features, nuisance effects and impacts from contaminants · Natural environment effects from central composting and MRF facilities are caused by siting the facilities	· Implement recycling, household composting, central composting and MRF programs · Develop landfill to reduce impacts on the natural environment · Site landfill using criteria to avoid creating negative effects to natural features · Site facilities using criteria to avoid creating negative effects to natural features	· Conservation of natural resources and maximum diversion of waste from disposal are realized, reducing impacts · Natural environment impacts minimized through site selection process and landfill design and operation · Natural environment impacts for central composting and MRF facilities are minimized through siting process	Disadvantages · Impacts to residents from new landfill site and MRF and central composting facility · Natural environment impacts due to landfill, central composting and MRF facilities · Costs for new landfill and recycling program will be higher than existing program · Central composting and MRF may result in higher costs than existing system

TABLE E-5
EVALUATION OF UPDATED WASTE MANAGEMENT SYSTEMS – SYSTEM 3
(Continued)

System Option	Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
	Technical Environment · Central composting and MRF have potential to divert portion of waste stream from disposal by landfill, exceeding MOEE objectives · Central composting and MRF systems can use low or high technology methods depending on the area's requirements · Landfill is commonly used, well developed and successfully proven technology · Landfill is an essential component of the waste management system and provides level of service similar to existing system · Bins may be used for collecting recyclables at transfer stations	· Implement source separation/ recycling, household composting, central composting, and MRF programs to reduce dependence on landfilling · Implement central composting and MRF systems that are flexible and suitable for the needs of the study area · Develop landfill with operations and management plan to minimize environmental impacts · Implement waste reduction initiatives to reduce dependence on landfilling · Establish rural recycling facilities as needed	· High waste diversion rates may be achieved resulting in reduced dependence on landfill disposal and MOEE diversion targets may be exceeded · Implementation of central composting and MRF facilities that will be suitable for the study area · Reduced effects due to appropriate landfill design and operation · Waste disposal needs can be reduced by implementing waste reduction initiatives · No change to present level of service for disposal · Rural recycling facilities can increase the amount of recyclables collected	

TABLE E-5
EVALUATION OF UPDATED WASTE MANAGEMENT SYSTEMS – SYSTEM 3
(Continued)

System Option	Environmental Effects	Mitigation/Enhancement	Net Effects	Advantages/Disadvantages
	Economic Environment			
	· Increased quantities of recyclables and markets for recyclables and composted materials are required to reduce operating costs · Capital costs associated with central composting and MRF facilities and new landfill site expected to be more than existing system	· Secure markets for recyclables and composted materials as part of establishing MRF and central composting facilities · Operate facilities on a regional basis with several municipalities · Apply to MOEE for financial assistance to develop facilities · Develop regional compost and MRF facilities	· Central composting and MRF may result in an operating deficit or higher costs than existing system · Capital costs associated with the development of facilities may be reduced through financial assistance programs	
	· Long term monitoring, care and closure costs · Costs for collection expected to be higher than existing system due to separate collection of recyclables and transportation to a regional facility or markets · Transfer stations may help to reduce waste haul costs to the new landfill site	· Ensure development and operation at landfill is controlled and monitored to avoid potential long-term costs associated with site clean-up and/or remedial contingency measures · Participate in regional recycling program to reduce costs to the County · Construct transfer stations at strategic locations	· Long-term monitoring, care and closure costs for landfill which may be reduced but not eliminated · Collection costs higher than existing system due to collection of recyclables. Costs reduced by participation in a regional recycling program · Waste haul costs minimized by construction and operation of transfer stations at strategic locations	

EVALUATION OF EXISTING LANDFILL SITES AND NEED FOR NEW SITES

INTRODUCTION

In 1989 an analysis of the remaining capacity and the environmental suitability of the municipal landfill sites in Lambton County was conducted. The purpose at this evaluation was to update the original evaluation documented in the September 1986 Stage 1 Report. The original evaluation concluded that sufficient long-term landfill capacity could be provided by the existing sites. However, in 1989, a detailed contour survey of the Sarnia Landfill was completed. The results of this survey indicated that the remaining capacity of the Sarnia Landfill was much lower than the capacity that had been assumed previously in the Stage 1 evaluation. As a result, the original Stage 1 evaluation was updated in 1989. This section describes the details of the updated evaluation.

It is important to note that the analysis described in this section was completed in 1989 and much of the data in this section is current to 1989. Since this time, the following significant events have occurred:

- The Grand Bend Landfill was closed in 1992.
- The Town of Clearwater amalgamated with the City of Sarnia in 1991 and is now part of the City.
- The Ed Johnston Construction landfill site is now owned and operated by Sussex Environmental Ltd. The site still accepts only non-hazardous solid industrial waste and construction debris.
- Weigh scales were installed at the Sarnia Landfill site in 1990.

For the analysis of the landfill sites, the planning period for the Master Plan was assumed to be the 25-year period starting in January 1991 and ending in December 2015.

LOCATION OF EXISTING DISPOSAL FACILITIES

Eight landfills in the County are licensed to accept residential and commercial (municipal) solid waste, and construction and inert wastes. The eight landfills, including their location and owner, are listed in Table E-6. Detailed descriptions of the facilities are contained in the "Stage 1 Report" (September 1986).

TABLE E-6
MUNICIPAL SOLID WASTE LANDFILL FACILITIES

Name and Site Location	Owner
Brooke Part of SE 1/2, Lot 15, Conc. 12 Township of Brooke	Township of Brooke
Dawn East 1/2, Lot 21, Conc.5 Township of Dawn	Township of Dawn
Grand Bend South 1/2 Lot 16, Conc. LRE Township of Bosanquet	Village of Grand Bend
Moore Part Lot 21, Conc.5 Township of Moore	Township of Moore
Petrolia South 1/2, Lot 16, Conc. 10 Town of Petrolia	K&E Solid Waste Management
Sarnia North 1/2, Lot 11, Conc. 3 Town of Clearwater	City of Sarnia
Sombra North 1/2, Lot 11, Conc. 12 Township of Sombra	Township of Sombra
Warwick (Laidlaw) East 1/2, Lot 20, Conc. 3 Township of Warwick	Laidlaw Waste Systems Ltd.

Three privately-owned and operated sites within the County are licensed to accept non-hazardous solid wastes from industries as well as construction wastes and other inert wastes. A fourth site, which is owned and operated by Laidlaw Waste Systems, is also licensed to accept municipal wastes. These sites and their location and owners are listed in Table E-7.

TABLE E-7
PRIVATE WASTE DISPOSAL FACILITIES

Site Location	Owner	Waste Types Accepted
Parts of Lots 47-51 Front Concession Town of Clearwater	K&E Solid Waste Management Div. of Wm. Kuindhrsma J. Esser Ltd.	Non-hazardous solid industrial waste, construction debris
North Part of Lots 42 & 43 Concession 9 Town of Clearwater	Ed Johnston Construction	Non-hazardous solid industrial waste, construction debris
East Half Lot 20* Concession 3, Ser. Township of Warwick	Laidlaw Waste Systems Ltd.	Non-hazardous solid industrial waste, construction debris and municipal wastes
West Half Lot 22 Concession 12 Township of Moore	Unitec Inc.	Non-hazardous solid industrial waste, construction debris

* *Laidlaw site is certified to receive municipal wastes. Refer to Table E-6.*

CAPACITY OF EXISTING DISPOSAL FACILITIES

Estimates of the remaining capacity and disposal period (site life) at the existing landfills in Lambton County were made. To estimate remaining capacity, the amount of waste already deposited in each site had to be determined. Since none of the landfills in the area have weigh scale data, it was necessary to estimate previously deposited waste quantities delivered to each site.

Weight estimates for the number of years the site had been operational were based on municipal populations up to the end of 1985 and waste generation rates expressed as kg/cap/day, for each municipality. The waste generation rates were determined from 1985 populations and estimated waste quantities for the year and assumed to be the same for all previous years. These values were then used to calculate the annual estimated tonnes of waste deposited into the landfill site up to and including 1985. Waste quantities from 1986 to 1989 were based on the population projections and waste generation rates.

The approved area and estimates of the remaining capacity for each landfill are summarized in Table E-8. The industrial and other waste tonnages are considered in the estimates. The Sombra and Grand Bend landfills, although shown to have no remaining capacity, are still

operating. Data and information available on the sites indicates that the landfills may be at or near capacity.

TABLE E-8
APPROVED AREA AND REMAINING CAPACITY
OF EXISTING MUNICIPAL WASTE LANDFILLS

Site	Approved Site Area (ha)	Estimated Waste to Site (tonnes) (January 1, 1989)	Estimated Capacity Remaining (tonnes) (January 1, 1989)	Estimated Remaining Site Life (years) (From January 1989)
Brooke	2.5	8,030	10,280	17+
Dawn	14.48	9,000	53,740	100+
Grand Bend	4.05	26,300	-	-
Moore	18.0	55,020	63,050	6+
Petrolia	26.02	136,460	2,145,540	100+
Sarnia	21.0	1,187,560	196,040	2.5+
Sombra	4.5	23,210	-	-
Laidlaw	32.4	204,650	[1]950,000	[1]14+

Note: Estimates are based on current certification, configuration, approved area, waste restrictions and present operating practices.

[1] *Capacity for all wastes entering the landfill, not just municipal waste. Based on verbal communication with M. Walters, Laidlaw Waste Management Systems Ltd., November 23, 1989.*

A more accurate assessment of the remaining capacity at all of the sites may be warranted. This assessment would include field surveys and mapping of the approved disposal areas.

Of the five private landfill sites in the County, two (K&E Waste Systems in Clearwater and Ed Johnston Construction) are worked-out gravel pits being brought back to original ground contours by filling with industrial non-hazardous solid wastes. Two landfills are also operating as municipal waste sites (Laidlaw and K&E Waste Systems in Petrolia). The fifth site, formerly owned by Holmes Insulation Group, is owned by Unitec Disposals Inc., Sarnia.

The capacity and life of the Laidlaw and K&E (Petrolia) sites are shown in Table E-8. For the other three private sites, a total remaining capacity of approximately 3.5 million m^3 exists. Based on present rates of use, these three sites provide an aggregate capacity greater than that required for the waste stream they serve during the study planning period. Table E-9 shows estimated capacity and remaining site lives for these three landfills as determined from information provided by the site owners.

TABLE E-9
ESTIMATED VOLUME AND SITE LIFE REMAINING
FOR PRIVATE LANDFILLS
(JANUARY 1, 1989)

Site	Estimated Volume Remaining (m^3)* (January 1, 1989)	Estimated Site Life (Years) (January 1, 1989)
E. Johnston Construction Ltd.	240,000	25+
K&E Waste Management (Clearwater)	2,190,000	70+
Unitec Disposals	1,110,000	10+
Laidlaw Waste Systems (Warwick)	950,000 tonnes	14+
K&E Waste Management (Petrolia)	2,145,540 tonnes	100+

* *Based on estimated area remaining and average working depth for each site.*

ENVIRONMENTAL SUITABILITY

The environmental suitability of the existing landfill facilities in the County was assessed to determine their potential for continued use.

A detailed discussion of the development of criteria for the assessment of existing site suitability and the assessment process employed, was provided in the September 1986 Stage 1 report. Table E-10 provides an assessment of the municipal landfill sites and describes the concerns associated with each landfill.

Mitigation, in the form of operational improvements, was considered to reduce existing impacts, risks, and long-term costs, and to improve level of service and operation. Types of mitigation are detailed in Table E-10.

MOEE files were reviewed and discussions with MOEE staff were held to identify any significant complaints or problems with any of the existing facilities. Field investigations by Dillon staff were also undertaken to identify areas of concern at the existing facilities. These areas of concern are described in Table E-10.

TABLE E-10
EVALUATION OF SITE SUITABILITY

Landfill Sites	Site Suitability Factors							Mitigation Potential	Advantages/ Disadvantages	Comments
	Risk to Ground Water	Risk to Surface Water	Risk to People	Natural Environmental Impacts	Social Environmental Impacts	Level of Service Considerations	Cost Considerations			
Brooke	- some sand and gravel lenses on-site - situated in thick clayey silty soil	- site run-off directed to Brown Creek is a potential concern - leachate springs (small) observed - potential for surface water impacts given location of site in clay environment - trench flooded	- no significant concerns	- located adjacent to ESA - potential impacts on aquatic life due to surface run-off - surface erosion at site	- isolated site - no significant concerns	- infrequent waste coverings - leachate observed	- disposal costs of $49/t	- leachate management program - berming and other drainage measures to control on-site surface water - rehabilitation of filled areas to reduce erosion of cover, improve site aesthetics and reduce leachate production - improve site operation, more frequent application of cover and reduced size of working area	Advantages - mitigation relatively easy to implement - relatively isolated Disadvantages - proximity to Brown creek - proximity to ESA - extent of sand and gravel on-site needs to be determined	- can mitigate surface water concerns - leachate problem requires further examination
Dawn	- situated on thick clayey till over bedrock - no significant concerns	- agricultural drain adjacent to north represents a potential constraint - can be mitigated with appropriate buffer - potential for surface water impacts given location of site in clay environment - trench flooded	- no significant concerns	- no significant concerns	- well screened - isolated - no significant concerns	- recommended burial of construction wastes - improve site drainage	- disposal costs of $9/t	- establishment of a buffer area between agricultural drain and active landfill area - burial of inert construction wastes will improve site aesthetics - establish drainage measures to control on-site water - develop leachate management program - tench dewatering	Advantages - isolated site - no sensitive adjacent uses - mitigation relatively easy to implement - good site operation Disadvantages - trench requires dewatering	- site considered suitable - can mitigate surface water concerns

TABLE E-10
EVALUATION OF SITE SUITABILITY
(Continued)

Landfill Sites	Site Suitability Factors							Mitigation Potential	Advantages/ Disadvantages	Comments
	Risk to Ground Water	Risk to Surface Water	Risk to People	Natural Environmental Impacts	Social Environmental Impacts	Level of Service Considerations	Cost Considerations			
Grand Bend	- potentially significant - situated on thick sand and gravel deposits - apparent leachate migration off-site - high permeability sand deposits	- appears to be no significant surface run-off	- potential drinking water contamination - apparent leachate migration off-site	- located adjacent to ESA and Life Science ANSI - Pinery Provincial Park adjacent	- proximity to recreation facilities - proximity to residences - proximate to Provincial Park - site well screened	- limited cover applied	- disposal costs at $28/t - revenue $1/t - expensive to mitigate ground water contamination	- leachate management program - truck/pipe water to affected residents - improve operations, more frequent cover application	Advantage - only landfill in proximity to Grand Bend Disadvantages - mitigation expensive - adjacent uses sensitive	- site suitability a concern due to hydrogeologic setting - potential drinking water concerns - not considered suitable for continued use
Moore	- situated in thick clayey till over bedrock - high water table	- high water table - trench flooded - potential for surface water impacts given location of site in clay environment	- no significant concerns	- large woodlot on-site - significance not determined - productive	- isolated - well screened - no significant concerns	- improve site drainage - reduce size of trench	- disposal costs of $15/t - revenues of $6/t	- tench dewatering - establish drainage measures to control on-site water - salvage timber when removing for site development - improve site operation to reduce size of working area - develop leachate management program	Advantages - isolated site - mitigation relatively easy to implement Disadvantages - high water table - loss of productive woodlot	- surface water concerns can be mitigated through operations - site considered suitable

TABLE E-10
EVALUATION OF SITE SUITABILITY
(Continued)

Landfill Sites	Site Suitability Factors							Mitigation Potential	Advantages/ Disadvantages	Comments
	Risk to Ground Water	Risk to Surface Water	Risk to People	Natural Environmental Impacts	Social Environmental Impacts	Level of Service Considerations	Cost Considerations			
Petrolia	- situated in thick clayey till - abandoned gas and oil wells require sealing	- creek currently crosses site - potential for surface water contamination is potentially significant - requires control measures to prevent contamination - potential for surface water impacts given location of site in clay environment - leachate/drainage system improvement included in development plan - approved disposal area is on both sides of creek	- proximity to Petrolia - future residential adjacent to west	- ESA on-site, heavily disturbed and impacts - creek on-site, heavily disturbed and impacted - potential surface water quality concerns	- proximity to Petrolia - future residential adjacent to west	- erosion along creek requires attention	- disposal costs of $26/t - revenues of $21/t	- establish further drainage measures to control on-site water - move creek to permanent location, restore aquatic habitat, implement erosion control measures - to reduce sediments in creek (straw bale, check dams, revegetation - establish suitable buffer between adjacent future residential and site - complete implementation of leachate management program - development/ operating plan in place, to deal with above issues	Advantages - mitigation will reduce effects Disadvantages - proximity to Petrolia - further downstream impacts will occur during relocation of creek - adjacent to ESA - continued disruption to ESA - approved disposal area is bisected by creek	- operations and mitigation can reduce concerns - site considered suitable if operations remain on one side of the creek - development/ operations plan will address concerns

TABLE E-10
EVALUATION OF SITE SUITABILITY
(Continued)

Landfill Sites	Site Suitability Factors							Mitigation Potential	Advantages/ Disadvantages	Comments
	Risk to Ground Water	Risk to Surface Water	Risk to People	Natural Environmental Impacts	Social Environmental Impacts	Level of Service Considerations	Cost Considerations			
Sarnia	- situated in thick clayey till - potential leachate problems	- potential for surface water impacts given location of site in clay environment - leachate/drainage system improvements installed to control run-off	- subject to Transport Canada Guidelines (i.e., airport bird hazards)	- wetland area to east	- proximity to residences along County Road 14	- no concerns	- disposal costs of $10/t - revenues of $4/t	- have completed installation of leachate collection system and drainage improvements - leachate treatment facility being constructed on-site - work with Transport Canada to define and control possible bird hazard - maintain suitable buffer between site and nearby residences on County Road 14 - determine significance of wetland adjacent to site	Advantages - most mitigation easy to implement Disadvantages - proximity to Sarnia Airport - extent of drinking water contamination needs to be determined	- concerns of well water contamination reported (1) and being investigated - can mitigate most impacts - proximity to airport a concern - site considered suitable
Sombra	- situated in thick clayey till - ground water discharge to surface - leachate generated will be directed to flood plain	- surface run-off directed to Indian Creek - potential water quality impacts - observed leachate - potential flooding impacts - situated in flood plain	- no significant concerns	- potential surface water quality concerns	- no significant concerns	- limited cover - observed leachate	- disposal costs of $40/t - revenues of $1/t	- improve on-site drainage - develop leachate management program - collect and treat contaminated surface run-off - improve site operations (complete covering of waste, remove waste from flood plain)	Advantages - isolated site Disadvantages - surface water discharge to flood plain and watercourse - site located in flood plain, difficult to mitigate flooding concerns	- surface water discharge to flood plain and location of site in flood plain represent significant constraints to further landfilling at this site - not considered suitable for continued use

TABLE E-10
EVALUATION OF SITE SUITABILITY
(Continued)

Landfill Sites	Site Suitability Factors							Mitigation Potential	Advantages/ Disadvantages	Comments
	Risk to Ground Water	Risk to Surface Water	Risk to People	Natural Environmental Impacts	Social Environmental Impacts	Level of Service Considerations	Cost Considerations			
Laidlaw	- situated in thick clayey till parent material - detailed hydrogeologic studies have been completed but are not available	- no significant concerns - potential for surface water impacts given location of site in clay environment	- proximity to Watford	- no significant concerns	- proximity to Watford	- no concerns	- not available	- ensure suitable buffer is maintained between site and Watford - develop leachate management program	Advantages - no significant impacts Disadvantages - proximity to Watford	- site considered suitable based on available information

Many of the concerns identified with the sites can be resolved through the implementation of mitigating measures. Potential mitigating measures are outlined in Table E-10. A brief summary of the major advantages and disadvantages of each site is also provided in Table E-10.

In view of the hydrogeologic settings and configurations of the landfill sites, consideration of leachate management will be required at some point in the future for all landfill sites. Leachate management at all sites will be required to reduce the potential for both surface water and ground water risks. A leachate collection system has been installed at the Sarnia landfill site. Pilot testing for an on-site leachate treatment facility at the Sarnia site has been completed and construction of the facility is underway.

On the basis of the analysis, two landfills were identified as being potentially unsuitable for continued use. Apparent leachate migration off-site at the Grand Bend landfill poses a risk to human health through potential contamination of drinking water supplies. Even with extensive mitigation, there may remain impacts which pose a risk to human health through contamination of the ground water resource.

Concerns with the Sombra Landfill also represent constraints to continued use. The location of the site in the floodplain of Indian Creek represents potential for impacts in the event of flooding. Extensive mitigation will not completely mitigate this concern. In addition, surface water drainage concerns exist at the site. Mitigation can help to reduce the effects by controlling on-site drainage.

Available information on the disposal capacity remaining at the Grand Bend and Sombra landfills was presented earlier. Capacity estimates indicate that these sites may be at or near their approved disposal capacity. This further reduces the suitability for continued use at these two sites. It is recommended that the Grand Bend Landfill and the Sombra Landfill be removed from further consideration in the development of the Master Plan in view of the significant constraints which exist at these sites. Site closure plans should be developed and implemented for these sites.

Concerns which exist with other landfills can largely be mitigated through operational or capital improvements. Concerns with ground water contamination raised by adjacent residents at the Sarnia Landfill are being examined to determine their significance.

The other landfill locations are considered suitable for continued use within current disposal areas and at current rates. Expansion and/or increases in the rate of landfilling from changes to the service area will require further evaluation. It is further recommended that all landfills

continuing to operate have a site operation and development plan. This should include a detailed assessment of remaining disposal capacity at each site by field surveys and/or mapping. Hydrogeological investigations should be completed for each site. Landfills should also be upgraded to address the concerns identified in Table E-10 and any other potential concerns.

FUTURE WASTE MANAGEMENT REQUIREMENTS

Lambton County will assume waste management responsibilities within the County on January 1, 1991. It is anticipated that it will take approximately five years to site, approve, design and construct replacement landfill capacity. Therefore, future waste capacity requirements were determined for a 25-year period from January 1, 1991. Table E-11 shows the estimated total tonnes of waste requiring disposal, from the start of the present calendar year (January 1, 1991) to January 1, 2016, at each of the existing landfill sites.

TABLE E-11
ESTIMATE OF WASTE REQUIRING DISPOSAL
(JANUARY 1, 1989 to JANUARY 1, 2016)

Waste from Area Currently Served by Landfill in:	Estimated Quantity of Waste Requiring Disposal (tonnes)
Brooke Township	13,640
Dawn Township	10,800
Grand Bend	46,440
Moore Township	274,320
Petrolia (K&E)	412,340
Sarnia	1,781,990
Sombra	45,460
Warwick (Laidlaw)	413,490
Export (Euphemia)	9,950
TOTAL	**3,008,430**

This estimate assumes that the municipal users of each landfill do not change. Also shown is the waste generated by Euphemia which is currently exported from the study area.

Assuming the waste flow (i.e., the users) do not change over the study period, ending on January 2016, there is a projected surplus of landfill capacity at some sites and a deficit at others. Required disposal capacities and available disposal capacities at the existing landfills are shown in Table E-12. The surplus/deficit of disposal capacity at each site over the planning period for the current waste management system is also shown.

TABLE E-12
DISPOSAL CAPACITY FOR PLANNING PERIOD
FROM JANUARY 1, 1989 to JANUARY 1, 2016
(TONNES)

Existing Landfill Site	Estimated Required Disposal Capacity (tonnes)	Estimated Remaining Available Disposal Capacity Per Site (tonnes)	Surplus/(Deficit) Capacity (tonnes)
Brooke Township	13,640	8,880	(4,760)
Dawn Township	10,800	52,500	41,700
Grand Bend	46,440	-[1]	(46,440)
Moore Township	274,320	45,570	(228,750)
Petrolia (K&E)	412,340	-[2]	(412,340)
Sarnia	1,781,990	60,520	(172,470)
Sombra	45,460	-[1]	(45,460)
Laidlaw	413,490	-[2]	(413,490)
Export (Euphemia)	9,950	-[2]	(9,950)
TOTAL	**3,008,430**	**167,470**	**(2,840,960)**

[1] *Landfill still being used but is recommended for closure.*
[2] *Private landfills; assumes County will not use as of January 1, 1991.*

As shown in Table E-12, sufficient disposal capacity over the entire study period only exists at the Dawn Township landfill site.

The Grand Bend and Sombra landfill sites were previously considered unsuitable for long-term continued use. As a result, these site were assumed to have no available disposal capacity for the study period.

6It is assumed that the remaining municipally-owned landfills in the study area will be closed once the new landfill capacity is established. Waste from the County will be routed through a centralized facility that will maximize materials recovery prior to disposal. The waste quantities requiring disposal over a 20-year period (January 1, 1996 to January 1, 2016) for all of the County is 2,004,780 tonnes.

Two of the municipally-owned landfills (Moore Township and Sarnia) have approval to operate on only a portion of the site land owned by the municipality. The potential to increase disposal capacity exists at these sites through expansion. However, in the context of this Master Plan, expansion is considered in the same manner as the establishment of a new site and can only be justified after a complete analysis of all reasonable alternative methods of providing new landfill capacity.

LAMBTON COUNTY WASTE MANAGEMENT MASTER PLAN
TECHNICAL APPENDICES

APPENDIX 2F
TRANSFER STATION
ECONOMIC FEASIBILITY STUDY

M.M. DILLON LIMITED
FEBRUARY 1995

TRANSFER STATION ECONOMIC FEASIBILITY STUDY

1.0 INTRODUCTION

As part of the Lambton County Waste Management Master Plan (WMMP) study, potential waste management systems were evaluated, and a recommended waste management system for the County was identified. The recommended system includes the materials recovery facility (MRF), central composting, landfill and transfer station components. All of these components will require sites. The Public Advisory Committee (PAC) reviewed the siting requirements for the recommended system at their meeting on October 11, 1990. The PAC requested that the MRF, central composting and landfill components be combined into one composite facility site. At the time that this request was made by the PAC, it was assumed that the transfer station component would require a separate site and that the location of this site would be contingent on the location of the composite facility.

Studies to identify a recommended site for the composite facility have resulted in the identification of a recommended site which is located in the western portion of Moore Township. Given the location of the recommended site, it was recognized that it may be beneficial, from an economic perspective, to provide transfer stations to serve the eastern portions of the County. As a result, a study was conducted to determine the economic feasibility of providing transfer stations as part of the County's waste management system.

The purpose of this appendix is to provide technical details of the transfer station economic feasibility study. An overview of the methodology and results of the study and a discussion of the results is provided in Chapter 7 of the Master Plan Report (Volume 1).

1.1 Description of the Method

The method for this study is based on a direct comparison between the direct haul savings that will be realized by providing transfer stations versus the costs of building and operating transfer stations. Direct haul refers to the use of municipal collection trucks to haul recyclables, compostables and wastes from the local municipalities to the composite facility or a transfer station. If transfer stations are provided, then the distance that waste materials, recyclables and compostables need to be direct hauled can be reduced. Because transfer trucks can haul materials at a lower cost per tonne, this can result in cost savings. However, these cost savings are offset by the costs for building and operating the transfer station and the cost of hauling waste materials, recyclables and compostables from the transfer station

to the composite facility. The purpose of this study is to determine if there is a situation in Lambton County where the cost savings for direct haul will exceed the cost of operating the transfer station and hauling the materials via transfer trucks to the composite facility.

It is important to note that for this study, it was assumed that only wastes going to the landfill component of the composite facility would be considered. Even though the composite facility may include a MRF and composting facility, the quantities of materials that will be handled to these facilities was not known when this study was completed. The quantities of waste going to the landfill component were more clearly defined, and were assumed to be greater than the quantities of recyclables and compostables going to the composite facility.

A computer model was developed to calculate the costs and savings for the feasibility study. The model consisted of the following components:

(1) Operating costs for direct hauling wastes to the composite facility or the transfer station using municipal collection trucks.

(2) Transfer truck operating costs for hauling wastes from the transfer stations to the composite facility.

(3) Transfer station operating costs.

(4) Travel times and distances for collection trucks and transfer trucks.

Additional calculations were completed to determine the waste haul costs for trips from the municipalities to the existing landfill sites that the municipalities use for waste disposal. The purpose of completing these calculations was to allow a comparison between the existing waste haul costs for the municipalities and the additional costs for transporting wastes to the new composite facility.

The feasibility model calculations were conducted for 1996, which is the year that the landfill site at the composite facility is expected to open.

Six potential waste transfer scenarios were considered in the analysis. For each scenario, it was assumed that one transfer station would be constructed within each service area. The municipalities included in each transfer scenario are listed in Table F-1. Moore and Sombra Townships were not included in the transfer scenarios because it was assumed that transportation costs to the new landfill site for these municipalities would not increase significantly.

TABLE F-1
SUMMARY OF WASTE TRANSFER SCENARIOS

Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Sarnia	Petrolia	Alvinston	Forest	Alvinston	Petrolia
Point Edward	Wyoming	Watford	Arkona	Watford	Wyoming
	Oil Springs	Brooke	Thedford	Brooke	Oil Springs
	Dawn	Euphemia	Grand Bend	Euphemia	Dawn
	Enniskillen		Warwick	Forest	Enniskillen
	Plympton		Bosanquet	Arkona	Plympton
				Thedford	Alvinston
				Grand Bend	Watford
				Warwick	Brooke
				Bosanquet	Euphemia
					Forest
					Arkona
					Thedford
					Grand Bend
					Warwick
					Bosanquet

The following sections describe the calculations for each component of the feasibility model.

2.0 COLLECTION TRUCK OPERATING COSTS

Costs for direct haul by municipal collection trucks to either the composite facility or the transfer stations were determined by multiplying the truck operating cost in terms of cost per hour by the travel time from the centre of the municipality to the destination.

Operating costs for municipal collection trucks were determined by surveying the private waste haulers in the County. Each hauler was contacted in May 1993 to determine the municipalities that they serviced, the number of waste collections done per week, the types of trucks used for the collections, and the average load size for the wastes collected in the municipality. Additional information on the total number of tonnes collected from each municipality per year and total cost for the collections was obtained from the County's 1991 Waste Management Cost Survey. It was also assumed that private waste haulers can collect 1.17 tonnes per hour per truck. This is based on the results of a recent study funded by the Ontario Waste Management Association.

The following description provides an example of the calculation of municipal collection truck operating costs for the Town of Wyoming. Municipal waste collection in Wyoming is provided by K&E Solid Waste Management. According to Paul McLister (Per. Comm., May 4, 1993), K&E provides one collection per week in Wyoming using a truck that can carry an average load of 8 to 10 tonnes. Information from the County's 1991 Waste Management Cost Survey indicated that 520 tonnes of waste was collected in Wyoming in 1991 and the cost for the collection service was $29,919. It was assumed that 10 tonnes per week is collected. This value was divided by 1.17 tonnes per hour, resulting in an estimated collection time of 8.5 hours per week. Using this information, the truck operating cost per hour was determined using Equation F.1.

$$\frac{\$29{,}919}{Year} \times \frac{Year}{52\ Weeks} \times \frac{1\ Week}{8.5\ Hours} = \frac{\$67.69}{Hour} \qquad \text{(F.1)}$$

Similar calculations were completed for each municipality in the County. The calculations are summarized in Table F-2. The average operating cost for municipal collection vehicles was determined to be $59.22 per hour.

TABLE F-2
SUMMARY OF MUNICIPAL WASTE HAUL CALCULATIONS

Municipality	Annual Collection Cost (1)	Estimated Collection Time Per Week (hours) (2)	Operating Cost per Hour ($) (1) ÷ [(2) x 52]	1996 Operating Cost per Hour
City				
Sarnia	$717,311	224	$ 61.58	$ 69.28
Towns				
Bosanquet	$110,536	30.0	$ 70.86	$ 79.92
Forest	$ 72,887	19	$ 73.77	$ 82.99
Petrolia	$ 48,323	23	$ 40.40	$ 45.45
Villages				
Alvinston	$ 10,971	4	$ 52.75	$ 59.34
Arkona	$ 9,480	3	$ 60.77	$ 68.37
Grand Bend	$ 41,425	8.7	$ 91.57	$103.02
Oil Springs	$ 7,515	3.5	$ 41.29	$ 46.45
Point Edward	$ 44,815	16.9	$ 51.05	$ 57.43
Thedford	$ 11,294	4.6	$ 47.22	$ 53.12
Watford	$ 16,344	11.0	$ 28.57	$ 32.14
Wyoming	$ 29.919	8.5	$ 67.69	$ 76.15
Townships				
Euphemia	$ 4,130	1.5	$ 52.95	$ 59.57
Plympton	$ 98,761	22.4	$ 84.79	$ 95.39
Averages			$ 59.22	$ 66.22

The collection truck operating costs were determined using data current to 1991. The costs were increased to represent 1996 values by assuming an annual inflation rate of 0% per year for 1992 and 1993 and 4% per year for 1994, 1995 and 1996. The 1996 operating cost estimates are also shown in Table F-2.

Municipal collection truck operating costs were not determined for Moore and Sombra Townships because the recommended site for the composite facility is located in Moore Township. In addition, Sombra Township is also close to the recommended site and produces a relatively small amount of waste. These townships were not included in the transfer station feasibility study.

Municipal collection truck operating costs were not determined for Brooke, Dawn, Enniskillen and Warwick Townships. In these municipalities, door to door waste collection service is not provided and residents are required to direct haul their wastes to the landfill site. It was assumed that when the County opens its new landfill site at the composite facility, these municipalities will hire their own waste collection contractors who will provide collection service and haul the wastes to the new landfill site or transfer station. It was also assumed that the operating cost for the collection contractor's trucks would be the same as the average cost for the other municipalities (e.g. $66.22 per hour in 1996).

Table F-2 shows how collection truck operating costs vary significantly between municipalities. This variance is due to factors such as the level of service provided by the contractor (e.g. number of collections per week), the distance that the contractor has to travel to the landfill site, the number of houses served, etc.

The average collection truck operating cost determined in this study was compared to similar figures determined in other studies. The Interim Waste Authority (IWA) is a public sector authority responsible for selecting long-term solid waste disposal sites for the Greater Toronto Area (GTA). The IWA recently published information on waste collection vehicle operating costs that indicated that the average cost of operating a waste collection vehicle was $63.00 per hour in 1992. This value compares favourably to the 1991 average operating cost of $59.22 that was determined in this study.

The average collection truck operating cost determined in this study was also compared with the results from the Federal Government's study entitled "Operating Costs of Trucks in Canada - 1990". The Federal Government study provides operating costs for a variety of classifications of trucks. It was assumed that a garbage collection truck is similar to a 2-axle diesel straight truck carrying bulk commodities on paved roads in Ontario travelling an annual distance of 40,000 kilometre per year. The operating cost of this class of truck was $42.50 per hour, including $20.00 per hour for one driver. It was assumed that a garbage collection truck would have two drivers - one to drive the truck and the second to pick-up wastes and load the truck. An additional $20.00 per hour was added to the operating cost resulting in a total cost of $62.50 per hour. This figure is similar to the operating cost determined in this study.

3.0 TRANSFER STATION OPERATING COSTS

The costs considered for operating the transfer stations were the cost of owning and operating the station, the cost of operating waste handling equipment, and labour costs. The station ownership and operating costs considered in the evaluation were interest costs, depreciation costs, maintenance and utility costs, and insurance costs.

3.1 Transfer Station Capital Cost

A conceptual design for the transfer station building was developed so that estimates of capital, interest and depreciation costs for the station could be determined. The conceptual design was developed based on the assumption that a minimum cost facility that would be able to meet the approval requirements of the Ontario Ministry of Environment and Energy (MOEE) would be constructed. To achieve this goal, three different station design concepts were considered. In each case it was assumed that the station would be enclosed in order to comply with the MOEE's anticipated requirements for approval.

The first transfer station concept considered consisted of 40 cubic yard roll-off containers, a stationary compactor to compact wastes into the containers, and a skid steer loader to load wastes into the compactor. The primary advantages of this concept were considered to be the simple design and the fact that the equipment is readily available and inexpensive. In addition, the building costs for this concept were expected to be relatively low because a simple one-storey building containing a flat concrete slab floor would be all that would be required. However, it was determined that a roll-off container could only hold the equivalent of 1.5 loads of waste from a municipal rear load packer truck. A relatively large number of trips from the transfer station to the landfill site would be required for this type of facility. This could result in high transportation costs. As a result, this design concept was not considered further.

The second transfer station design concept that was considered represented a further refinement of the first concept. In the second concept, it was assumed that tractor semi-trailer trucks with open tops would be used instead of roll-off containers and compactors. Transfer trailers can carry up to as many as three loads from a municipal packer truck, thereby resulting in fewer trips from the transfer station to the landfill site. It was also assumed that the station design would be a simple one-storey building with a flat concrete slab floor and that a special front-end loader would be used to load the transfer trailers. Courtesy Disposal Ltd. presently operates a transfer station similar to this near Toronto.

The second transfer station concept was not considered feasible because of the high cost of owning and operating the special front-end loader. The only front-end loader available on the market that is capable of loading open-top transfer trailers is the Caterpillar Model 966 WDA. This unit costs about $300,000 to purchase (Per. Comm., Alistair Commins, May 21, 1993). It is unlikely that a used unit would be available because there are presently only three of these types of front-end loaders operating in Ontario. According to the April 1992 Ontario Provincial Standard Specifications, the cost of operating a front end loader similar in size to the 966 WDA is about $117.05 per hour. Experience at the Courtesy Disposal transfer station has indicated that this unit is capable of loading a full size open top transfer trailer in approximately 40 minutes. In all but one of the transfer scenarios considered, less than five transfer loads per day will be needed. Therefore, this loader would likely be highly under-utilized. Given the high capital and operating cost for the front-end loader, this second transfer scenario would probably not be cost effective.

The third transfer station design concept considered consisted of a simple building with a two level concrete slab floor and open top transfer trailers. This station design operates by having the incoming wastes unloaded on the upper level and then pushing them with a skid steer loader into an open-top trailer parked on the lower level. This concept involves higher capital costs relative to the first two concepts considered because of the need to construct a two-level floor. However, this concept is potentially more cost efficient in terms of operating costs because high capacity open-top trailers are used and a relatively inexpensive skid steer loader can be used to load the trailers.

The transfer station conceptual design that was adopted is presented in Figure F.1. Details of the conceptual design are as follows:

- The station will not be located on a specific piece of property that has a predetermined shape or size. It was assumed that a piece of property large enough to accommodate the conceptual design will be purchased. The conceptual design shown in Figure F.1 will require a site approximately 72 metres long by 61 metres wide. This is equal to 0.44 hectares (1.1 acres).

- The station building is 25 metres (82 feet) wide by 30 metres (98 feet) long and has a floor area of 750 square metres.

- The station is capable of accommodating a transfer trailer between 13.7 metres (45 feet) and 16.2 metres (53 feet) long by 2.4 metres wide (8 feet) and 4 metres (13 feet) high. The floor of the lower level is 4.5 metres (14.8 feet) below the tipping floor.

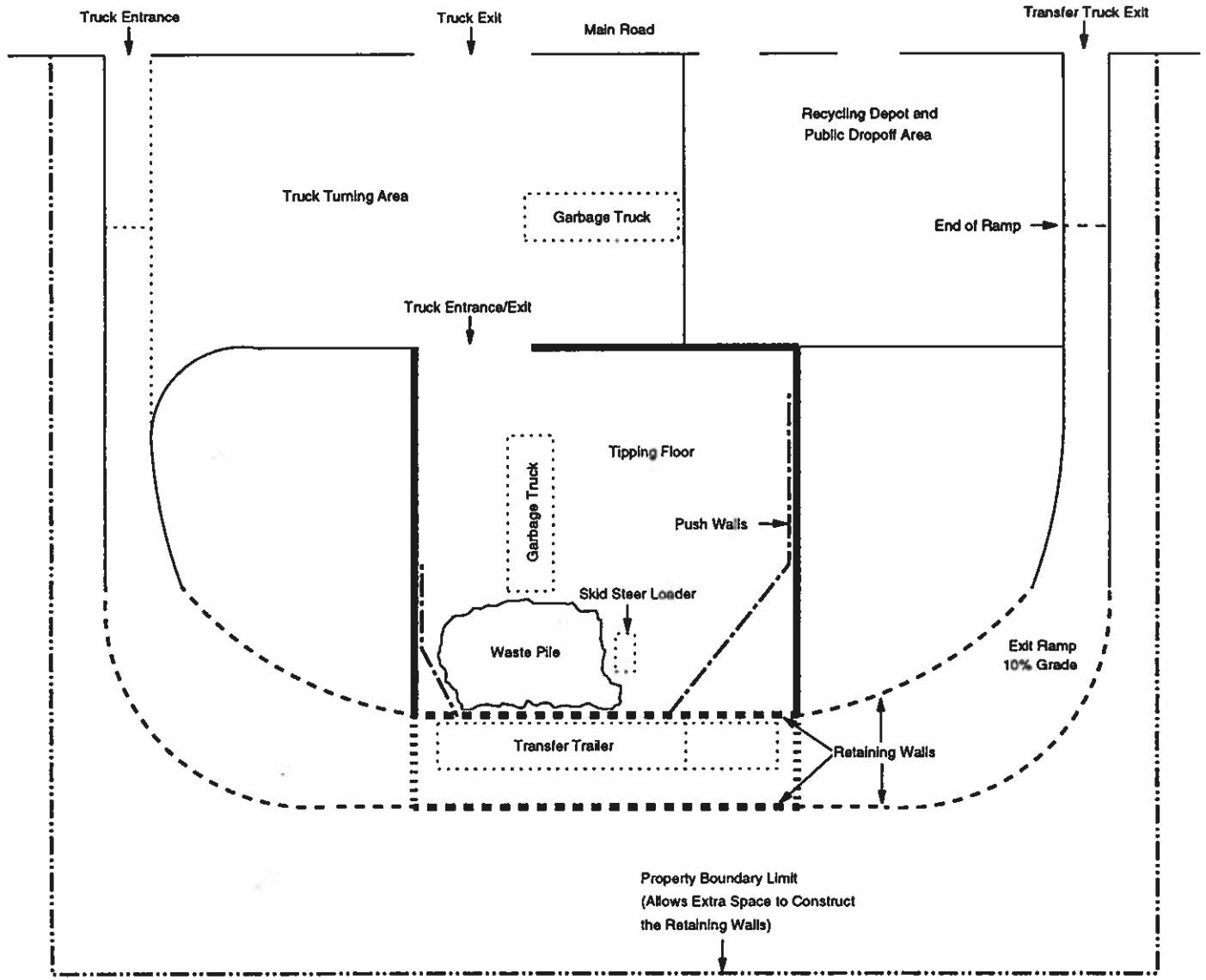

FIGURE F.1 - LAMBTON COUNTY WMMP TRANSFER STATION FEASIBILITY STUDY
TRANSFER STATION CONCEPTUAL DESIGN

N.T.S.

- The largest vehicles unloading at the station will be municipal rear loading packer trucks. A large packer truck is assumed to be 10 metres long by 2.6 metres wide. The tipping floor is 24 metres wide by 24 metres long which should be large enough to accommodate several packer trucks at one time. The trucks will turn around outside in front of the building and back into the tipping floor area. The turning area is 19 metres wide by 34.5 metres long.

- The interior of the building is 8 metres high. This will be sufficient height to allow packer trucks to unload.

- Push walls are located along the side walls. These will be approximately 2 metres high.

- The entrance/exit ramps for the transfer trailers are 45 metres long and have a maximum grade of 10%. The sides of the ramps will be constructed as retaining walls. The total length of retaining walls required will be a function of the natural grading on the site and the amount of room available. For these calculations, it was assumed that only the lower half of the ramps would require retaining walls, resulting in a total length of 135 metres.

- A public drop off and recycling depot area is provided. It is 25 metres long by 19 metres wide.

The cost to construct the transfer station conceptual design was calculated so that the annual interest and depreciation costs could be determined. The cost calculations are summarized in Table F-3. The cost estimates are based on 1993 information. The total cost was factored up to represent 1996 total costs by assuming an annual inflation rate of 4% per year for 1994 and 1995. This resulted in a total estimated cost for the transfer station of $1.6 million in 1996.

TABLE F-3
TRANSFER STATION CAPITAL COST CALCULATIONS

Item	Amount Required	Unit Cost	Total Cost
1. Land	0.44 ha, 1.1 ac.	$7,500/ac.	$10,000
2. Site Preparation		Lump Sum	$20,000
3. Transfer Building	750 m^2	$1,000/$m^2$	$750,000
4. Retaining Walls	135 m	Lump Sum	$200,000
5. Drainage for Lower Level		Lump Sum	$30,000
6. Site Servicing		Lump Sum	$25,000
7. Power Line Installation		Lump Sum	$20,000
8. Asphalt Paving	2,000 m^2	$35/$m^2$	$70,000
9. Fencing	230 m	$70/m	$20,000
10. Landscaping	1,500 m^2	$35/$m^2$	$12,000
11. Site Lighting		Lump Sum	$10,000
12. Signs		Lump Sum	$5,000
13. Fire Suppression System		Lump Sum	$5,000
14. Dust Collection System		Lump Sum	$15,000
Sub Total Cost for 1993			$1,192,000
Contingency (20%)			$240,000
Sub. Total with Contingency			$1,432,000
Total Cost for 1996			$1,610,000

3.2 Interest Costs

Interest costs for the transfer station were determined assuming that the capital costs for the station would be financed through debt financing over a 20 year period at an interest rate of 9% per annum.

Interest costs decrease each year as the financed principal is paid off. An average cost for interest was determined by calculating the present value of the interest payment at the mid-period of the loan. A discount rate of 4% was assumed, resulting in an annual interest payment of $62,000 per year.

3.3 Depreciation Costs

The annual depreciation cost for the transfer stations was determined using two methods. The first method involved amortizing the total depreciation of the station over its 20 year operating life. It was assumed that the value of the building at the end of 20 years would be $1 million, resulting in a total depreciation of $600,000. This amount was amortized over the 20 year period at an interest rate of 9%. This resulted in an annual depreciation cost of $65,730 per year.

The second method used for determining the annual depreciation cost was to apply capital cost allowance (CCA) rates to the capital cost of the building. The CCA rate for Class 3 buildings is 4% per annum. This rate was applied to the transfer station capital cost, resulting in an annual depreciation cost of $64,000 per year. This cost is similar to the cost determined using the amortized net value method. As a result, an annual depreciation cost of $65,000 per year was considered appropriate.

3.4 Transfer Station Operating Costs

The transfer station operating costs that were considered were maintenance, utility, and insurance costs. It was assumed that the station would be owned by Lambton County and would not be subject to local property taxes.

The maintenance costs that were considered were the maintenance and repair of the station building and driveways, grounds keeping (e.g. lawn mowing, raking of leaves and picking up garbage on the grounds), and snow removal in the winter. Costs were determined assuming that, on average, 3 to 4 hours of maintenance will be required per week throughout the year. It was also assumed that wages will make up half the cost of the maintenance cost as material and supply requirements would be minimal. Assuming a labour cost of $15.00 per hour resulted in a total cost of $3,120 per year for labour. Therefore, the total maintenance costs were valued at $6,240 per year. This value was rounded off to $7,000 per year.

The annual utility costs for the transfer station are expected to be minimal. The only equipment that will require power will be lighting, ventilation fans, heating for the staff facilities and a water pump for draining the pit where the transfer trucks will park. It is expected that the tipping floor area will not be heated. The only water needs will be for staff facilities and for spraying the tipping floor. Given the minimal expected requirements for power and water, an annual cost of $3,000 was assumed to be appropriate for utilities.

Insurance costs were assumed to be equivalent to 1% of the operating costs for the transfer stations. According to Lambton County, insurance costs for the Sarnia landfill are about 0.5% of total operating costs (Per. Comm., Jim Kutyba, June 15, 1993). For the transfer stations, this value was doubled to provide an additional margin of safety. Insurance costs were determined to be $1,400 per year.

Total transfer station operating costs were determined to be $138,400 per year. The calculations are summarized in Table F-4.

TABLE F-4
CALCULATION OF ANNUAL TRANSFER STATION OPERATING COST

Cost Item	Cost
1. Interest Cost on Capital	$ 62,000/yr
2. Station Depreciation Cost	$ 65,000/yr
3. Station Maintenance	$ 7,000/yr
4. Utilities	$ 3,000/yr
Subtotal	$137,000/yr
Insurance (1% of Operating Cost)	$ 1,400/yr
	$138,400/yr

3.5 Machine Operating Costs

A skid steer loader will be used in the transfer stations to move wastes around and to push them off of the tipping floor into the transfer truck. Costs for operating a loader were determined using the April 1992 Ontario Provincial Standard (OPS) Specifications. The OPS specifications indicate that the cost of operating a skid steer type loader with a 0.75 m^3 bucket is $18.15 per hour. This cost includes depreciation, interest, insurance, repairs, maintenance, fuels, lubricants, overhead and profit. Profit was not subtracted from the cost because it is not known whether or not the County will own and operate the machine or whether a contractor will be hired to operate it. It is likely that profit does not represent a large portion of the total operating cost. The 1992 operating cost was converted to a 1996 value by assuming an inflation rate of 4% per year between 1993 and 1996. This resulted in a 1996 operating cost of $21.23 per hour.

The rate at which a skid steer loader could load the transfer trucks was determined by assuming that a loader can push two bucket loads of waste per minute into the transfer trailers. Assuming a waste density on the tipping floor of 400 lbs/yd^3, which is half of the assumed density of the waste in the collection trucks, it was determined that a skid steer loader could load 16 tonnes of waste per hour using a 0.75 yd^3 bucket. Annual operating costs for a skid steer loader were determined by dividing the annual tonnage handled at the transfer station for each waste transfer scenario by 16 tonnes per hour and then multiplying by the hourly operating cost of $21.23 per hour. This calculation is summarized in Equation F.2.

$$\textit{Annual Machine Operating Cost} = \left(\frac{\textit{Annual Waste Tonnage for Transfer Scenario}}{16\ \textit{Tonnes Per Hour}} \right) x\ \$21.23\ \textit{per Hour} \qquad \text{(F.2)}$$

The calculation for each transfer scenario is summarized in Table F-5.

TABLE F-5
CALCULATION OF MACHINE OPERATING COSTS

Waste Transfer Scenario	Annual Tonnage (tonnes/yr) (1)	Machine Loading Rate (tonnes/hr) (2)	Machine Operating Time (hours/yr) (3) = (1) ÷ (2)	Hourly Machine Operating Cost ($/hr) (4)	Annual Machine Operating Cost ($/yr) (3) x (4)
1	39,075	16	2,442	$21.23	$51,800
2	7,243	16	453	$21.23	$ 9,600
3	1,933	16	121	$21.23	$ 2,600
4	6,171	16	386	$21.23	$ 8,200
5	8,104	16	507	$21.23	$10,800
6	15,347	16	959	$21.23	$20,400

3.6 Labour Costs

Labour costs for the transfer stations were determined by considering the operating hours and labour requirements. Labour requirements were considered to be a function of the amount of waste handled at the stations and the number of transfer truck loads hauled per day.

The number of transfer truck loads hauled per year was determined by dividing the annual waste tonnage for each transfer scenario by the assumed transfer trailer capacity of 22 tonnes per load. The number of transfer loads hauled per day was determined by dividing the number of loads handled per year by the number of operating days. It was also assumed that the station would operate for 300 days per year (e.g. 365 days - 52 Sundays - 13 statutory holidays = 300 days). The calculations are summarized in Table F-6. In cases where less than one load per day was required, it was assumed that the transfer trailer would be unloaded at the end of each day so that a minimum of 300 loads per year would originate from the stations.

The operating hours for the transfer stations were assumed to be 7:00 a.m. to 5:00 p.m. on weekdays and 7:00 a.m. to 12:00 noon on Saturdays. This equals a total of 55 hours per week.

Staff for the transfer stations was assumed to comprise one station operator and equipment operators. The station operator was assumed to be responsible for all aspects of station operation, including supervising activities on the tipping floor, loading the transfer trailers with the skid steer loader, driving the transfer trucks to the landfill site and maintaining the station. It was assumed that equipment operators would be employed to assist the station operator on a part-time basis in loading the transfer trailers and driving them to the landfill.

For Scenario 3, it was assumed that the station operator would only be required for 25 hours per week. For the other scenarios, which require one or more transfer loads per day, it was assumed that the station operator would work the full 55 hours per week.

For the transfer scenarios that will require more than one transfer truck load of waste to be taken to the landfill per day (e.g. Scenarios 1 and 6), it was assumed that additional equipment operators would be brought in to help the station operator. It was also assumed that the cycle time for a transfer load would be 3 hours (e.g., 1.5 hour loading time, 1.0 hour travel time, 0.5 hour unloading time), and that the station operator would handle two loads per day and the equipment operator(s) would be responsible for the remaining loads. According to sources at the Metropolitan Toronto Works Department, a transfer trailer can generally be loaded in less than half an hour (Per. Comm., Vello Varangu, July 20, 1990). A loading time of 1.5 hours was assumed, which represents a conservative estimate that is consistent with the skid steer loader rate of 16 tonnes per hour. The predicted working hours for the station operators and the equipment operators are summarized in Table F-6.

Wage rates for the transfer station operator and the equipment operators were determined using data reported by the Sarnia-Lambton Economic Development Commission in 1992. The data was obtained from the Canada Employment Centre. Wage rates of $23.00 per hour for the site operator and $18.00 per hour for the equipment operator were determined using this data. These wage rates were converted to 1996 rates by assuming an average wage increase of 3% per year between 1992 and 1996. This resulted in 1996 wage rates of $25.89 for the station operator and $20.26 for the equipment operator. The wage rates were increased by 15% to account for benefits. The calculation of wage rates is summarized in Table F-6.

TABLE F-6
CALCULATION OF LABOUR COSTS

Transfer Scenario	Annual Tonnage (tonnes/hr) (1)	Transfer Loads Per Year for 1996 (2) = (1) ÷ 22	Transfer Loads Per Day (3) = (2) ÷ 300	Station Operator Hours (hrs/wk)	Equipment Operator Hours (hrs/wk)	Annual Wage Cost ($/yr)[3]	Total Annual Wage Cost With Benefits
1	39,075	1,780	5.9	55	60	$137,300	$157,900
2	7,243	330	1.1	55	0	$ 74,100	$ 85,200
3	1,933	300	1.0[1]	25	0	$ 33,650	$ 38,700
4	6,171	280	1.0	55	0	$ 74,100	$ 85,200
5	8,104	370	1.2	55	0	$ 74,100	$ 85,200
6	15,347	700	2.3	55	20[2]	$ 95,100	$109,400

(1) In cases where less than one load per day is required, it was assumed that the transfer trailer would be unloaded at the end of each day, resulting in a minimum of 300 loads per year.

(2) This value was determined by assuming that the station operator would haul one load per day and the equipment operator would haul the other 1.3 loads. Assuming a cycle time of three hours per transfer load, the equipment operator would be required for 20 hours per week (1.3 lds/day x 3 hrs/ld x 5 days/wk = 20 hrs/wk).

(3) Assumed wage rates - Station Operator = $25.89 per hour; Equipment Operator = $20.26 per hour.

4.0 TRANSFER TRUCK OPERATING COSTS

Operating costs for the transfer trucks were determined using data from the report entitled "Operating Costs of Trucks in Canada - 1990", which is produced by Motor Carrier Policy and Programs Department of Transport Canada. This report provided operating costs for several different types of trucks. It was assumed that the classification for 5 axle semi-trailer trucks carrying dry freight was similar to a transfer truck.

The Government data indicated that the base cost for operating a 5 axle semi-trailer truck in Ontario in 1990 for a distance of 80,000 km per year was 175.3 ¢/km. This cost includes the driver, fuel, cleaning, repair, tires, depreciation, licenses, insurance and administration costs and profit. The driver cost was subtracted because it was assumed that the truck would be driven by the station or equipment operators. The profit was also subtracted from the operating cost. This resulted in a net operating cost of 115.1 ¢/km for the base case.

The base operating cost was adjusted to account for inflation between 1990 and 1996, and to account for differences in the actual operating conditions and the assumptions used in the base case for trip length and annual distance travelled. Additional corrections for vehicle load size and empty kilometres travelled were considered but not applied because it was determined that the actual values for these parameters were similar to the assumptions used in the base case.

Inflation rates of 5.6%, 1.1% and 1.8% were used for 1991, 1992 and 1993, respectively. These values are based on Consumer Price Index data reported by Statistics Canada. An inflation rate of 4% was used for 1994, 1995 and 1996. This rate is based on the historical trend in the Consumer Price Index, which has averaged 3.92% per year over the last 10 years. The total correction factor for inflation for the period 1990 to 1996 was 1.22.

A trip distance of 320 km per trip was assumed in the base case. Actual trip distances shorter than this value result in higher unit operating costs. As shown in Table F-7, all of the trip distances for transfer trucks in the six transfer scenarios are less than 320 km. This resulted in correction factors greater than 1.0 for all six scenarios. The correction factors that were used are shown in Table F-7. The correction factors were derived from data provided in the Transport Canada report.

The predicted annual distances travelled per year by the transfer trucks in the six scenarios were all less than the value of 80,000 km per year that was assumed in the base case. Similar to the trip distance corrections, if the annual distance travelled by a truck is less than the distance assumed in the base case, then the unit operating cost will be greater. Correction

factors were determined by extrapolating operating costs for annual distances of 80,000 km, 160,000 km and 240,000 km per year. The correction factors that were used are shown in Table F-7. For Scenario 1, it was assumed that there would be three transfer trucks and each truck would travel 30,000 km per year.

Total annual operating costs for transfer trucks for the six scenarios were determined by multiplying the base operating cost by the correction factors and the total distance per year. The calculations are summarized in Table F-7.

TABLE F-7
TRANSFER TRUCK OPERATING COSTS

Transfer Scenario	Transfer Loads Per Year for 1996	Return Travel Distance (km)	Total Travel Distance Per Year (km)	1990 Base Operating Cost (¢/km)	CORRECTION FACTORS			Total Unit Operating Cost (¢/km)	Total Annual Operating Cost ($/yr)
					Inflation to 1996	Trip Distance	Annual Distance		
	(1)	(2)	(3)=(1)x(2)	(4)	(5)	(6)	(7)	(8)=(4)x(5)x(6)x(7)	(3)x(8)÷100
1	1,780	50	89,000	115.1	1.22	1.18	1.20	198.8	$177,000
2	330	70	23,100	115.1	1.22	1.12	1.25	196.6	$ 45,400
3	300	92	27,600	115.1	1.22	1.10	1.22	188.5	$ 52,000
4	280	166	46,480	115.1	1.22	1.03	1.08	156.2	$ 72,600
5	370	144	53,280	115.1	1.22	1.04	1.07	158.3	$ 83,250
6	700	104	72,800	115.1	1.22	1.09	1.01	154.6	$112,550

5.0 HAUL ROUTES AND TRAVEL TIMES

Travel distances and times for the municipal waste collection and waste transfer trucks were determined by assuming a travel route, measuring the distance and then dividing the distance by the travel speeds on the route. Each travel route was divided into links based on the type of road. Road links were classified into the following groups: freeway, highway, County road and rural/local road. The length of each link was divided by the speed to determine the travel time for each link. The travel times for the links were summed to determine the total travel time for the route.

Travel routes were determined based on the assumption that the municipal collection and transfer trucks will use upgraded roads, such as freeways and highways, wherever possible. Travel routes for the municipal collection trucks were assumed to start at the major intersection closest to the waste generation or centroid of the municipality. A major intersection was defined as consisting of at least two rural roads. In most municipalities, intersections between highways and County roads were used. In townships where the distribution of population is not even (e.g. Plympton and Bosanquet Townships), the centroid was located closer to the more densely populated areas.

The posted speeds assumed for the different types of roads are summarized in Table F-8. A speed correction factor was used to account for the fact that on highways, County roads and rural roads it will be difficult for the trucks to maintain the posted speeds due to reduced speed limits in built-up areas, sharp curves, lower design standards and lower upkeep. The speed correction factors are listed in Table F-8.

TABLE F-8
POSTED SPEEDS AND SPEED CORRECTION FACTORS

Type of Road	Assumed Posted Speed (kph)	Speed Correction Factor
Freeway	100	1.0
Highway	80	0.9
County Road	80	0.8
Rural Road	80	0.7

The haul routes and travel time calculations for the existing system where the municipal collection trucks travel from the municipalities to the existing disposal sites are summarized in Table F-9. The travel times represent round-trip times. It was assumed that 15 minutes is required to unload the truck at the landfill site.

Travel distances and times for the existing system were not determined for Sombra and Moore Townships because these municipalities were not included in the waste transfer scenarios that were considered.

The assumed haul routes and travel time calculations for municipal collection trucks travelling from the municipalities to the composite facility are summarized in Table F-10. All haul routes were assumed to start at the centroid of the municipality and end at the Highway 40 and Highway 80 intersection. The travel times represent round trip times. It was assumed that 15 minutes would be required to unload the trucks at the landfill site. Travel distances and times were not determined for Moore and Sombra Townships because these municipalities were not included in the waste transfer scenarios.

For the transfer scenarios, travel distances and times were determined for the following two situations: a) for municipal collection trucks travelling from the municipalities to the transfer stations; and b) for transfer trucks travelling from the transfer stations to the composite facility site in Moore Township. The transfer stations were assumed to be located at the closest major intersection to the centroid of the waste shed area for the centroid. A different centroid was identified for each transfer scenario. A major intersection was assumed to comprise at minimum at least two County roads. It was assumed that it would take 15 minutes to unload both the waste collection and the transfer trucks . All transfer truck routes were assumed to end at the Highway 40 and Highway 80 intersection. The calculations for travel distances and times for municipal trucks travelling between the municipalities and the transfer station locations are summarized in Table F-11. The calculation of travel distances and times for transfer trucks travelling between the transfer stations and the recommended landfill site in Moore Township are summarized in Table F-12.

TABLE F-9
MUNICIPAL COLLECTION TRUCK TRAVEL TIMES - MUNICIPALITIES TO EXISTING DISPOSAL SITES

Municipality	Centroid Location	Travel Route	Landfill Site	Travel Time (Hours)
City				
Sarnia	Highway 40 and Highway 402	Highway 40, County Rd. 25, 12/13 Sideline	Sarnia	0.46
Towns				
Forest	Highway 21 in Forest	County Rd. 12, County Rd. 19, Hwy. 79, 2/3 SER. Conc. Rd.	Laidlaw	0.95
Petrolia	Highway 21 in Petrolia	Hwy. 21	Philip	0.29
Villages				
Alvinston	Hwy. 79 in Alvinston	Hwy. 79, 2/3 SER. Conc. Rd.	Laidlaw	0.78
Arkona	Hwy. 7/79 in Arkona	Hwy. 7/79, 2/3 SER. Conc. Rd.	Laidlaw	0.68
Grand Bend	Hwy. 21 in Grand Bend	Hwy 21/79, County Rd. 9 Hwy. 79, 2/3 SER. Conc. Rd.	Laidlaw	1.49
Oil Springs	Hwy. 21 in Oil Springs	Hwy. 21	Philip	0.52
Point Edward	Hwy. 402 & Front St.	Hwy. 402, Hwy. 40, County Rd. 25, 12/13 Sideline	Sarnia	0.56
Thedford	Hwy. 79 in Thedford	Hwy. 7/79, 2/3 SER. Conc. Rd.	Laidlaw	1.00
Watford	Hwy. 79 in Watford	Hwy. 79, 2/3 SER. Conc. Rd.	Laidlaw	0.38
Wyoming	Hwy. 21 in Wyoming	Hwy. 21	Philip	0.50
Townships				
Bosanquet*	Hwy 79 & County Rd. 19	Hwy. 79, County Rd. 9, Hwy. 79, 2/3 SER Conc. Rd.	Laidlaw	1.05
Brooke	County Rd. 4 & 12/13 Sideline	County Rd. 4 & 15/16 Sideline	Brooke	0.36
Dawn	Hwy. 21 & County Rd. 2	Hwy. 21 & Sideline 20/21	Dawn	0.45
Enniskillen	8/9 Conc. Rd. & Hwy. 21	Hwy. 21	Philip	0.30
Euphemia	County Rd. 2 & 5/6 Sideline	County Rd. 2, Hwy. 79, 2/3 SER. Conc. Rd.	Laidlaw	1.27
Plympton	County Rd. 30 & 8/9 Conc. Rd.	County Rd. 30, Hwy. 21	Philip	0.75
Warwick	Hwy. 79 & 7 & County Rd. 9	Hwy. 79, 2/3 SER Conc. Rd.	Laidlaw	0.36

* *Bosanquet became a Town on December 1, 1994.*

TABLE F-10
MUNICIPAL COLLECTION TRUCK TRAVEL TIMES - MUNICIPALITIES TO NEW COMPOSITE FACILITY

Municipality	Centroid Location	Route	Travel Time (hours)
City			
Sarnia	Hwy. 40 & Hwy. 402	Hwy. 40	0.93
Towns			
Forest	Hwy. 21 in Forest	Hwy. 21, Hwy. 402, Hwy. 40	1.81
Petrolia	Hwy. 21 in Petrolia	Hwy. 21, Hwy. 80	1.14
Villages			
Alvinston	Hwy. 79 in Alvinston	Hwy. 79, Hwy. 80	1.54
Arkona	Hwy. 7/79 in Arkona	Hwy. 7/79, Hwy. 402, Hwy, 40	2.04
Grand Bend	Hwy. 21 in Grand Bend	Hwy. 21/79, Hwy. 402, Hwy. 40	2.81
Oil Springs	Hwy. 21 in Oil Springs	Hwy. 21, Hwy. 80	1.00
Point Edward	Hwy. 402 & Front St.	Hwy. 402, Hwy. 40	1.04
Thedford	Hwy. 79 in Thedford	Hwy. 79, Hwy. 7/79, Hwy. 402, Hwy. 40	2.35
Watford	Hwy. 79 in Watford	Hwy. 79, Hwy. 402, Hwy. 40	1.81
Wyoming	Hwy. 21 in Wyoming	Hwy. 21, Hwy. 402, Hwy. 40	1.44
Townships			
Bosanquet*	Hwy. 79 & County Rd. 8	County Rd. 9, Hwy. 79, Hwy. 402, Hwy. 40	2.43
Brooke	County Road 4 and Lot 12/13 Sideline Rd.	County Rd. 4, County Rd. 8, Hwy. 80	1.66
Dawn	Hwy. 21 and County Rd. 2	Hwy. 21 and Hwy. 80	1.21
Enniskillen	8/9 Concession Rd. & Hwy. 21	Hwy. 21, Hwy. 80	1.03
Euphemia	County Rd. 2 & Lots 5/6 Sideline Road	County Rd. 2, County Rd. 8, Hwy. 80	1.75
Plympton	County Rd. 30 & 8/9 Concession Road	County Rd. 30, Hwy. 402, Hwy. 40	1.5
Warwick	Hwy. 79/7 and County Rd. 9	Hwy. 79, Hwy. 402, Hwy. 40	1.73

* *Bosanquet became a Town on December 1, 1994.*

TABLE F-11
MUNICIPAL COLLECTION TRUCK TRAVEL TIMES - MUNICIPALITIES TO TRANSFER STATIONS

Transfer Scenario	Municipality	Centroid Location	Route	Station Location/ Wasteshed Centroid	Travel Time (hours)
1	Sarnia	Hwy. 402 & Hwy. 40	Hwy. 402	Hwy. 402 & Hwy. 40	0.30
	Point Edward	Hwy. 402 & Front St.	Hwy. 402	Hwy. 402 & Hwy. 40	0.35
2	Petrolia	Hwy. 21 in Petrolia	Hwy. 21	Hwy. 21 & Enniskillen Township, Concession VII/VIII Road	0.33
	Oil Springs	Hwy. 21 in Oil Springs	Hwy. 21	"	0.63
	Wyoming	Hwy. 21 in Wyoming	Hwy. 21	"	0.39
	Enniskillen	Hwy. 21 & 8/9 Concession Rd.	Hwy. 21	"	0.40
	Dawn	Hwy. 21 & County Rd. 2	Hwy. 21 & County Rd. 14	"	0.85
	Plympton	County Rd. 30 & 8/9 Concession Rd.	County Rd. 30, Hwy. 21	"	0.64
3	Alvinston	Hwy. 79 in Alvinston	Hwy. 79, Brooke 6/7 Concession Rd.	Brooke 6/7 Concession Rd., Lot 15/16 Sideline Rd.	0.34
	Watford	Hwy. 79 in Watford	Hwy. 79, Brooke 6/7 Concession Rd.	"	0.68
	Brooke	County Rd. 4 & Lot 12/13 Sideline Rd.	Road 4, Lot 15/16 Sideline Rd.	"	0.50
	Euphemia	County Rd. 2 & Lot 5/6 Sideline Rd.	County Rd. 2, Hwy. 79, Brooke 6/7 Concession Rd.	"	0.83
4	Forest	Hwy. 21 in Forest	Hwy. 21, County Rd. 6	County Rds. 6 & 9 & Hwy. 79	0.79
	Arkona	Hwy. 7/79 in Arkona	Hwy. 7/79, Hwy. 79	"	0.64
	Grand Bend	Hwy. 21 in Grand Bend	Hwy. 21, Hwy. 79	"	0.81
	Thedford	Hwy. 79 in Thedford	Hwy. 79	"	0.32
	Bosanquet	Hwy. 79 & County Rd. 18	Hwy. 79	"	0.35
	Warwick	Hwy. 7/79 & County Rd. 9	County Rd. 9	"	0.84

TABLE F-11
MUNICIPAL COLLECTION TRUCK TRAVEL TIMES - MUNICIPALITIES TO TRANSFER STATIONS
(Continued)

Transfer Scenario	Municipality	Centroid Location	Route	Station Location/ Wasteshed Centroid	Travel Time (hours)
5	Alvinston	Hwy. 79 in Alvinston	Hwy. 79, County Rd. 9	County Rd. 9 & County Rd. 12	1.07
	Watford	Hwy. 79 in Watford	Hwy. 79, County Rd. 9	"	0.69
	Brooke	County Rd. 4 & Lot 12/13 Sideline	County Rd. 4, Hwy. 79, County Rd. 9	"	1.00
	Euphemia	County Rd. 2, Lot 5/6, Sideline Rd.	County Rd, 2, Hwy. 79, County Rd. 9	"	1.53
	Forest	Hwy. 21 in Forest	County Rd. 12	"	0.57
	Arkona	Hwy. 7/79 in Arkona	County Rd. 12	"	0.38
	Grand Bend	Hwy. 21 in Grand Bend	Hwy. 21, Hwy. 79, County Rd. 9	"	1.11
	Thedford	Hwy. 79 in Thedford	Hwy. 79, County Rd. 9	"	0.62
	Bosanquet	Hwy. 79 & County Rd. 18	Hwy. 79, County Rd. 9	"	0.52
	Warwick	Hwy. 7/79 & County Rd. 9	County Rd. 9	"	0.66
6	Petrolia	Hwy. 21 in Petrolia	County Rd. 4, County Rd. 8	Hwy. 402 & Hwy. 21	1.00
	Oil Springs	Hwy. 21 in Oil Springs	Hwy. 21, Hwy. 80, County Rd. 8	"	1.34
	Dawn	Hwy. 21 & County Rd. 2	Hwy. 21, Hwy. 80, County Rd. 8	"	1.56
	Wyoming	Hwy. 21 in Wyoming	Hwy. 21, Hwy. 402	"	0.57
	Enniskillen	Hwy. 21 & 8/9 Concession Rd.	Hwy. 21, County Rd. 4, County Rd. 8	"	0.99
	Plympton	County Rd. 30 & 8/9 Concession Rd.	County Rd. 30, Hwy. 402	"	0.56
	Alvinston	Hwy. 79 in Alvinston	Hwy. 79, County Rd. 4, County Rd. 8	"	1.14

TABLE F-11
MUNICIPAL COLLECTION TRUCK TRAVEL TIMES - MUNICIPALITIES TO TRANSFER STATIONS
(Continued)

Transfer Scenario	Municipality	Centroid Location	Route	Station Location/ Wasteshed Centroid	Travel Time (hours)
	Watford	Hwy. 79 in Watford	Hwy. 79, Hwy. 402	"	0.58
	Brooke	County Rd. 4 & Lot 12/13 Sideline Rd.	Hwy. 402 & Hwy. 21	"	0.86
	Euphemia	County Rd. 2, & Lot 5/6 Sideline Rd.	County Rd. 2, County Rd. 8	"	1.46
	Forest	Hwy. 21 in Forest	Hwy. 21	"	0.53
	Arkona	Hwy. 7/79 in Arkona	Hwy. 7/79, Hwy. 7, Hwy. 402	"	0.80
	Grand Bend	Hwy. 21 in Grand Bend	Hwy. 21/79, County Rd. 9, Hwy. 402	"	1.61
	Thedford	Hwy. 79 in Thedford	Hwy. 79, Hwy. 7/79, Hwy. 79, Hwy. 402	"	1.11
	Bosanquet	Hwy. 79 & County Rd. 18	County Rd. 9, Hwy. 79, Hwy. 402	"	1.62
	Warwick	Hwy. 7/79 & County Rd. 9	Hwy. 79, Hwy. 402	"	0.51

TABLE F-12
TRANSFER TRUCK TRAVEL TIMES - TRANSFER STATIONS TO COMPOSITE FACILITY

Scenario Number	Trip Origin/ Watershed Centroid	Route	Travel Time (hours)
1	Hwy. 402 & Hwy. 40	Hwy. 40	0.93
2	Hwy. 21 & County Rd. 14	Hwy. 21, Hwy. 80	1.22
3	Brooke 6/7, Concession Rd. & Lot 15/16 Sideline Rd.	Brooke Lot 15/16 Sideline Rd., Hwy 80	1.54
4	County Rds. 6 & 9 & Hwy. 79	County Rd. 9, Hwy. 402, Hwy. 40	2.32
5	County Rd. 9 & County Rd. 12	County Rd. 9, Hwy. 402, Hwy. 40	2.00
6	Hwy. 402 & Hwy. 21	Hwy. 402, Hwy. 40	1.49

6.0 CALCULATION OF OVERALL COMBINED COSTS

The existing waste haul costs for the municipalities were determined by multiplying the operating costs for the collection trucks by the number of trips to the landfill per year and the travel time between the municipalities and the landfill sites. Details on the calculation of operating costs and travel times were provided in previous sections of this appendix. The number of trips required per year was determined by dividing the number of tonnes of waste expected to be produced in 1996 by the average load size. Load sizes were determined using information provided by the waste haulers. It was assumed that there would be a minimum of 52 collections per year for each municipality. In the municipalities where there is no waste collection and the residents direct haul their wastes to the landfill site, it was assumed that a collection contractor would be hired and the contractor would have trucks that carry 7.5 tonnes and cost $66.62 per hour to operate in 1996. These values are equal to the average values observed for all collection trucks in Lambton County. The calculations are summarized in Table F-13.

The method used to determine waste haul costs for trips by collection trucks from the municipalities to the composite facility was similar to the method used to determine existing haul costs. The load sizes, number of trips, and truck operating costs are similar. However, in this case, the travel time for each trip is longer due to the longer distances to the composite facility. The calculations are summarized in Table F-14.

The determination of truck haul costs for trips to the existing landfills and to the composite facility for each of the transfer scenarios are summarized in Table F-15.

The operating costs for the transfer stations were determined by summing the interest costs, depreciation costs, and labour costs. These costs were determined previously in this appendix. The predicted operating costs for the transfer stations are summarized in Table F-16.

The collection truck operating costs for trips from the municipalities to the transfer stations were determined using the same method that was used to determine the collection truck haul costs for trips to the composite facility. The hourly operating costs and number of trips required per year are similar. The trip distance for each municipality in each scenario is different because the transfer station location is different in each scenario. The calculations are summarized in Table F-17.

TABLE F-13
CALCULATION OF WASTE HAUL COSTS FOR DIRECT HAUL TO EXISTING LANDFILL SITES

Municipality	1996 Waste Generation (tonnes/yr) (1)	Load Size (tonnes/ld) (2)	Number of Trips/yr (3)=(1)÷(2)	Travel Time Per Trip (hours) (4)	Truck Operating Cost ($/hr) (5)	Total Operating Cost (3)x(4)x(5)
City						
Sarnia	37,891	10.0	3,789	0.46	$69.28	$120,100
Towns						
Bosanquet	2,475	12.0	206	1.05	$79.72	$ 17,300
Forest	1,441	11.0	131	0.95	$82.99	$ 10,300
Petrolia	2,364	10.0	236	0.29	$45.45	$ 3,150
Villages						
Alvinston	466	5.7	82	0.78	$59.34	$ 3,800
Arkona	273	5.3	52	0.68	$68.37	$ 2,400
Grand Bend	955	4.5	212	1.49	$103.02	$ 32,550
Oil Springs	364	7.0	52	0.52	$46.45	$ 1,250
Point Edward	1,184	4.5	263	0.56	$57.43	$ 8,400
Thedford	401	4.5	89	1.00	$53.12	$ 4,750
Watford	769	5.7	135	0.38	$32.14	$ 1,650
Wyoming	1,146	10.0	115	0.50	$76.15	$ 4,400
Townships						
Brooke	454	7.5	61	0.36	$66.62	$ 1,450
Dawn	407	7.5	54	0.45	$66.62	$ 1,600
Enniskillen	800	7.5	107	0.30	$66.62	$ 2,100
Euphemia	244	4.7	52	1.27	$59.57	$ 3,950
Plympton	2,162	8.0	270	0.75	$95.39	$ 19,400
Warwick	626	7.5	84	0.36	$66.62	$ 2,000

TABLE F-14
CALCULATION OF WASTE HAUL COSTS FOR DIRECT HAUL TO COMPOSITE FACILITY

Municipality	1996 Waste Generation (tonnes/yr) (1)	Load Size (tonnes/ld) (2)	Number of Trips/yr (3)=(1)÷(2)	Travel Time Per Trip (hours) (4)	Truck Operating Cost ($/hr) (5)	Total Operating Cost (3)x(4)x(5)
City						
Sarnia	37,891	10.0	3,789	0.93	$69.28	$245,000
Towns						
Bosanquet	2,475	12.0	206	2.43	$79.72	$ 40,000
Forest	1,441	11.0	131	1.81	$82.99	$ 19,700
Petrolia	2,364	10.0	236	1.14	$45.45	$ 12,200
Villages						
Alvinston	466	5.7	82	1.54	$59.34	$ 7,500
Arkona	273	5.3	52	2.04	$68.37	$ 7,100
Grand Bend	955	4.5	212	2.81	$103.02	$ 61,400
Oil Springs	364	7.0	52	0.99	$46.45	$ 2,250
Point Edward	1,184	4.5	263	1.04	$57.43	$ 15,700
Thedford	401	4.5	89	2.35	$53.12	$ 11,100
Watford	769	5.7	135	1.81	$32.14	$ 7,900
Wyoming	1,146	10.0	115	1.44	$76.15	$ 12,600
Townships						
Brooke	454	7.5	61	1.86	$66.62	$ 6,700
Dawn	407	7.5	54	1.21	$66.62	$ 4,700
Enniskillen	800	7.5	107	1.03	$66.62	$ 7,300
Euphemia	244	4.7	52	1.75	$59.57	$ 5,400
Plympton	2,162	8.0	270	1.45	$95.39	$ 37,300
Warwick	626	7.5	84	1.73	$66.62	$ 9,700

TABLE F-15
SUMMARY OF DIRECT HAUL COSTS FOR MUNICIPAL COLLECTION TRUCKS

Transfer Scenario	Municipality	Haul Cost to Existing Landfills ($/yr)	Total Cost For Scenario ($/yr)	Haul Cost to Composite Facility ($/yr)	Total Cost for Scenario ($/yr)
1	Sarnia	$120,100		$245,000	
	Point Edward	8,400	$128,500	15,700	$260,700
2	Petrolia	3,150		12,200	
	Wyoming	4,400		12,600	
	Oil Springs	1,250		2,300	
	Dawn	1,600		4,400	
	Enniskillen	2,100		7,300	
	Plympton	19,400	$31,900	37,300	$76,100
3	Alvinston	3,800		7,500	
	Watford	1,650		7,900	
	Brooke	1,450		6,750	
	Euphemia	3,950	$10,850	5,400	$27,500
4	Forest	10,300		19,700	
	Arkona	2,400		7,100	
	Thedford	4,750		11,100	
	Grand Bend	32,500		61,400	
	Warwick	2,000		9,700	
	Bosanquet	17,300	$69,250	40,000	$149,000
5	Alvinston	3,800		7,500	
	Watford	1,650		7,900	
	Brooke	1,450		6,700	
	Euphemia	3,950		5,400	
	Forest	10,300		19,700	
	Arkona	2,400		7,100	
	Thedford	4,750		11,100	
	Grand Bend	32,500		61,400	
	Warwick	2,000		9,700	
	Bosanquet	17,300	$80,100	40,000	$176,500
6	Petrolia	3,150		12,200	
	Wyoming	4,400		12,600	
	Oil Springs	1,250		2,300	
	Dawn	1,600		4,400	
	Enniskillen	2,100		7,300	
	Plympton	19,400		37,300	
	Alvinston	3,800		7,500	
	Watford	1,650		7,900	
	Brooke	1,450		6,700	
	Euphemia	3,950		5,400	
	Forest	10,300		19,700	
	Arkona	2,400		7,100	
	Thedford	4,750		11,100	
	Grand Bend	32,500		61,400	
	Warwick	2,000		9,700	
	Bosanquet	17,300	$112,000	40,000	$252,600

TABLE F-16
TRANSFER STATION OPERATING COSTS

Transfer Scenario	Building Operating Cost ($/yr) (1)	Machine Operating Cost ($/yr) (2)	Labour Costs ($/yr) (3)	Total Station Operating Cost ($/yr) (1)+(2)+(3)
1	$138,400	$51,800	$157,900	$348,100
2	$138,400	$ 9,600	$ 85,200	$233,200
3	$138,400	$ 2,600	$ 38,700	$179,700
4	$138,400	$ 8,200	$ 85,200	$231,800
5	$138,400	$ 10,800	$ 85,200	$234,400
6	$138,400	$20,400	$109,400	$268,200

TABLE F-17
HAUL COSTS FOR TRIPS FROM MUNICIPALITIES TO TRANSFER STATIONS

Transfer Scenario	Municipality	Number of Trips (1)	Travel Time (hrs) (2)	Operating Cost ($/hr) (3)	Total Truck Cost ($/yr) (1)x(2)x(3)	Truck Cost for Scenario ($/yr)
1	Sarnia	3,789	0.30	$69.28	$78,750	
	Point Edward	263	0.35	57.43	5,350	$84,100
2	Petrolia	236	0.33	45.45	3,500	
	Wyoming	115	0.39	76.15	3,450	
	Oil Springs	52	0.63	46.45	1,500	
	Dawn	54	0.85	66.62	3,100	
	Enniskillen	107	0.40	66.62	2,850	
	Plympton	270	0.64	95.39	16,600	$31,000
3	Alvinston	82	0.34	59.34	1,650	
	Watford	135	0.68	32.13	2,950	
	Brooke	61	0.50	66.62	2,050	
	Euphemia	52	0.83	59.57	2,550	$9,200
4	Forest	131	0.79	82.99	8,600	
	Arkona	52	0.64	68.37	2,250	
	Thedford	89	0.32	53.12	1,500	
	Grand Bend	212	0.81	103.02	17,750	
	Warwick	83	0.84	66.62	4,700	
	Bosanquet	206	0.35	79.72	5,800	$40,600
5	Alvinston	82	1.07	59.34	5,200	
	Watford	135	0.69	32.14	2,950	
	Brooke	61	1.00	66.62	4,000	
	Euphemia	52	1.53	59.57	4,750	
	Forest	131	0.57	82.99	6,200	
	Arkona	52	0.38	68.37	1,300	
	Thedford	89	0.62	53.12	2,950	
	Grand Bend	212	1.11	103.02	24,350	
	Warwick	83	0.52	66.62	2,900	
	Bosanquet	206	0.66	79.72	10,800	$65,400
6	Petrolia	236	1.00	45.45	10,750	
	Wyoming	115	0.57	76.15	4,950	
	Oil Springs	52	1.34	46.45	3,250	
	Dawn	54	1.56	66.62	5,650	
	Enniskillen	107	0.99	66.62	7,050	
	Plympton	270	0.56	95.39	14,500	
	Alvinston	67	1.14	59.34	4,500	
	Watford	135	0.58	32.14	2,500	
	Brooke	61	0.86	66.62	3,500	
	Euphemia	52	1.46	59.57	4,500	
	Forest	131	0.58	82.99	6,250	
	Arkona	52	0.80	68.37	2,800	
	Thedford	89	1.11	53.12	5,250	
	Grand Bend	212	1.61	103.02	35,100	
	Warwick	83	0.51	66.62	2,800	
	Bosanquet	206	1.62	79.72	26,650	$140,000

The overall calculation of the transfer station operating cost or benefit for each scenario was determined using equation F.3:

$$\begin{pmatrix}\text{Net Cost / Benefit}\\ \text{of Providing}\\ \text{Transfer Stations}\end{pmatrix} = \left(\begin{pmatrix}\text{Cost of Direct}\\ \text{Hauling to the}\\ \text{Composite Facility}\end{pmatrix} - \begin{pmatrix}\text{Cost of Direct}\\ \text{Hauling to the}\\ \text{Transfer Stations}\end{pmatrix}\right) - \left(\begin{pmatrix}\text{Cost of}\\ \text{Operating the}\\ \text{Transfer Station}\end{pmatrix} + \begin{pmatrix}\text{Cost of Hauling to}\\ \text{the Composite Facility}\\ \text{UsingTransferTrucks}\end{pmatrix}\right) \quad \text{(F.3)}$$

The overall calculations for the economic feasibility study are summarized in Table F-18. The calculations show that for all six of the transfer scenarios, transfer stations will not provide a benefit and will cost the County. These costs range from a low of about $200,000 per year to a high of nearly $350,000 per year.

TABLE F-18
SUMMARY OF TRANSFER STATION
ECONOMIC FEASIBILITY MODEL RESULTS

Transfer Scenario	Direct Haul Cost to Composite Facility (From Table F-15) ($/yr) (1)	Direct Haul Cost to Transfer Station (From Table F-17) ($/yr) (2)	Transfer Station Operating Cost (From Table F-16) ($/yr) (3)	Transfer Truck Operating Cost (From Table F-7) ($/yr) (4)	Net Transfer Station Operating Benefit/(Cost) ($/yr) [(1)-(2)]-[(3)+(4)]
1	$260,700	$84,100	$348,100	$177,000	(348,500)
2	76,100	31,000	233,200	45,400	(233,500)
3	27,500	9,200	179,700	52,000	(213,400)
4	149,000	40,600	231,800	72,600	(196,000)
5	176,500	65,400	234,400	83,250	(206,550)
6	252,600	140,000	268,200	112,550	(268,150)

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LAMBTON COUNTY WASTE MANAGEMENT MASTER PLAN
TECHNICAL APPENDICES

APPENDIX 2G
LONG-TERM WASTE DIVERSION STRATEGY

M.M. DILLON LIMITED
FEBRUARY 1995

TABLE OF CONTENTS

1.0 INTRODUCTION

A recommended long-term waste diversion strategy for Lambton County was identified as part of the development of the County's Waste Management Master Plan (WMMP). The overall aim of the strategy was to identify the best combination of waste diversion technologies and processes available that will help the County comply with the Ontario Ministry of Environment and Energy's (MOEE) waste diversion objective of at least 50% diversion by the year 2000. The identification of the recommended strategy involved identifying available technologies and processes, developing alternative strategies, and evaluating of the alternatives to identify a recommended strategy for the County. The identification of available technologies and processes and the development of alternative strategies are documented in Chapter 5 of Volume 1.

The alternative strategies were evaluated using four criteria. The criteria were:

i) Potential for Waste Diversion;
ii) Ease of Implementation;
iii) Potential for Impacts from New Facilities; and
iv) Cost.

Descriptions of these criteria and rationale for using them are provided in Chapter 5 of Volume 1. The evaluation method and results of the evaluation are also provided in Chapter 5.

The purpose of this technical appendix is to provide additional details on how the waste diversion potentials and costs were calculated as part of the evaluation of the alternative strategies. The results of the waste diversion survey that was conducted as part of the Master Plan are also provided.

2.0 CALCULATION OF POTENTIAL FOR WASTE DIVERSION

The amount of waste that could potentially be diverted was determined for each of the five alternative diversion strategies that were identified. The purpose of determining potential for waste diversion was to identify differences between the alternative strategies so that they could be ranked within the potential diversion criterion. These ranks were combined with ranks for the other three criteria in order to identify a recommended diversion strategy for the County.

Waste diversion resulting from initiatives intended for residential wastes and initiatives intended for industrial, commercial and institutional (IC&I) wastes were considered separately. IC&I wastes have traditionally been part of the municipal waste stream in the County. However, little is known about the quantities and composition of the IC&I waste stream disposed in municipal landfill sites. As a result, assumed diversion rates for IC&I wastes were combined with calculated values for residential wastes in order to determine overall diversion rates for the County.

Estimates of the quantities of wastes that could potentially be diverted by the enhanced public education on the 3Rs and the household hazardous waste collection initiatives were not considered in this analysis. There is little information on the quantitative impact that these initiatives have with respect to waste diversion. Therefore, the following calculations of potential for waste diversion can be considered to be minimum values.

Estimates of the quantities of residential wastes that could potentially be diverted were determined using waste quantity data for 1992. All of the diversion estimates for the alternative strategies were based on this year.

The quantity of residential wastes that could potentially be diverted in each alternative diversion strategy was calculated by estimating the amount of each type of waste available for each corresponding diversion initiative (e.g. the amount of glass available for recycling). This quantity was then multiplied by the capture rate for each initiative. A capture rate represents the proportion of the total quantity of a type of waste that is produced that can be readily diverted by a diversion initiative. The calculation of the available waste quantities and capture rates for the diversion initiatives are described in detail in the following sections.

2.1 Waste Composition

As there have been no waste composition studies completed in Lambton County, the results of the MOEE's 1991 Waste Composition Study were used. Waste composition profiles were determined for the Town of Fergus, Borough of East York, and the City of North Bay. It was assumed that the wastes produced in Lambton County had a composition similar to the composition determined for Fergus. The waste composition profile from the MOEE study is presented in Table G-1.

The MOEE waste composition study did not include consideration of leaf and yard wastes. A waste composition study recently completed in the Regional Municipality of Ottawa-Carleton (RMOC) indicated that yard wastes comprise 15% of the waste stream generated by single-family households. As a result, it was assumed single-family households in urban and rural areas in Lambton County produce 15% more wastes than households in multi-family housing complexes and apartment buildings. A separate waste composition profile for single-family households was generated based on this assumption. This second profile is also shown in Table G-1. The first composition profile shown in Table G-1, which does not include leaf and yard wastes, was used for households in multi-family housing complexes and apartment buildings.

Phone books were also not considered in the MOEE waste composition study. It was assumed that each household in Lambton County produces 5 pounds of phone books per year. This is equivalent to 0.2% of the waste stream. This quantity was determined using the results of the waste composition study conducted by the Centre and South Hastings Waste Management Board as part of their enhanced Blue Box study. The waste composition profiles presented in Table G-1 were adjusted to include phone books.

2.2 Number of Households

All of the municipalities in Lambton County presently provide their residents with either curbside pickup of Blue Box recyclables or recycling depots. It was assumed that in the future the level of service provided for recycling collection will be maintained by the municipalities.

TABLE G-1
ESTIMATED WASTE COMPOSITION FOR LAMBTON COUNTY

Material			Percent Composition	
			No Yard Waste	With Yard Waste
Paper	Newsprint		10.3	9.0
	Corrugated Cardboard		3.1	2.7
	Magazines		4.2	3.7
	Boxboard		5.0	4.3
	Phone Books		0.2	0.2
	Household Misc/Paper		1.9	1.7
	Other		7.7	6.7
	Sub-Total - Paper		32.4	28.3
Glass	All		7.6	6.6
Metals	Ferrous	Cans	2.9	2.5
		Other	1.5	1.3
	Aluminum	Cans	0.6	0.5
		Foil	0.5	0.4
		Other	0.2	0.2
Sub-Total - Metals			5.7	4.9
Plastics	PET		0.2	0.2
	PE		6.4	5.6
	PVC		0.2	0.2
	PS		0.7	0.6
	Other		1.2	1.0
Sub-total - Plastics			8.7	7.6
Organics	Food Wastes		28.8	25.0
	Leaf and Yard Wastes		0.0	15.0
Sub-total - Organics			28.8	40.0
Wood Wastes			1.4	1.2
Construction and Demolition Debris			1.8	1.6
Textiles/Leather/Rubber			4.2	3.6
Other			9.4	6.2
Total Composition			100.0	100.0

It was considered in the waste diversion calculations that participation in some diversion initiatives may vary between rural and urban areas and single-family and multi-family households. In order to accurately estimate waste diversion potential with respect to the level of collection service provided and the type of household (e.g. single-family/multi-family or rural/urban) the number of households in each of the following classifications was determined:

i) single-family households in urban areas with curbside recyclables collection;
ii) single-family households in urban areas with depots for recyclables;
iii) single-family households in rural areas with curbside recyclables collection;
iv) single-family households in rural areas with depots for recyclables; and
v) households in multi-family housing complexes and apartment buildings.

It was assumed that all multi-family housing complexes and apartment buildings are located in urban areas. An urban areas was defined as either a city, a town or a village.

Single-family households were divided into households located in urban areas and households located in rural areas so that expected differences in participation rates in backyard composting programs could be accounted for. Households in rural areas are less likely to use a backyard composter because they have larger lawns and tend to not collect their grass clippings. Households in rural areas are also more likely to feed food scraps to animals and pets or dump them in their gardens.

Single-family households were divided into households serviced by Blue Box collection programs and households serviced by depots so that expected differences in participation rates between these two types of recyclables collection programs could be considered in the calculations. Households in multi-family housing complexes and apartment buildings were separated from single-family households so that the different levels of service that can be reasonably provided to these housing types could also be considered. This is because recycling and household composting programs are more difficult to implement in multi-family housing complexes and apartment buildings. These programs rely much on initiatives that provide a lower level of service, such as depots. In addition, as noted previously, it was assumed that leaf and yard wastes are not produced in multi-family housing complexes and apartment buildings.

The number of households in each of the classifications in 1992 was determined using information provided by the County of Lambton Planning and Development Department (Per.Com., Anne Marie Howard, September 20, 1993). The number of households determined for each classification are shown in Table G-2.

TABLE G-2
NUMBER OF HOUSEHOLDS IN EACH CLASSIFICATION

	Household Classification	Number in 1992
i)	Single-Family Urban with Curbside Recyclables Collection	31,420
ii)	Single-Family Urban with Depots for Recyclables	1,940
iii)	Single-Family Rural with Curbside Recyclables Collection	6,990
iv)	Single-Family Rural with Depots for Recyclables	3,500
v)	Multi-Family Complexes and Apartment Buildings	3,280
	Total	47,130

2.3 Existing Diversion Initiatives

Alternative Diversion Strategy 1 consists of the existing diversion initiatives in Lambton County. The calculations to determine the quantity of wastes diverted in Lambton County in 1992 by the existing diversion initiatives are described in Volume 1, Chapter 3. It was determined that 8,651 tonnes of recyclable and compostable materials were diverted by existing diversion initiatives in Lambton County in 1992.

2.4 Enhanced Blue Box Strategies

Alternative waste diversion Strategies 2 and 3 are based on enhanced Blue Box collection programs. These strategies are described in detail in Chapter 5 in Volume 1. The enhanced Blue Box strategies were assumed to be similar to the Blue Box 2000 program operated in Quinte Region by the Centre and South Hastings Waste Management Board. The recyclables collected in the Blue Box 2000 program, which are normally not collected in Blue Box programs, include rigid plastic bottles and tubs, film plastics, polystyrene foam plastics and rigid trays, boxboard, corrugated cardboard, phone books, mixed household paper, aluminum trays and foil, and textiles.

A mathematical model was developed to determine the waste diversion potential for alternative waste diversion Strategies 2, 3, 4 and 5. The assumptions used in the model for Strategies 2 and 3 are described as follows:

Enhanced Blue Box Collection

- The capture rates for recyclable materials in the enhanced Blue Box program were assumed to be equal to the capture rates observed in the Blue Box 2000 program multiplied by a factor of 0.65. This factor was determined by plugging the Blue Box 2000 capture rates for the types of recyclables presently collected into the diversion model. The resulting predicted weight of recyclables determined by the model was 50% higher than the weight actually collected in 1992. The 0.65 factor was used to adjust the Blue Box 2000 capture rates so that they would be more representative of the level of participation presently occurring in the existing recycling program in Lambton County.

- Strategy 3 includes both enhanced Blue Box collection and direct cost waste collection. In this strategy, it was assumed that the direct cost waste collection component would result in increased participation in the enhanced Blue Box collection program. As a result, the capture rates used in Strategy 3 were assumed to be 20% higher than those observed in the Blue Box 2000 study. This resulted in capture rates that were 85% higher than the rates used in Strategy 2. This difference is consistent with the observed impacts of the direct cost program in Grand Bend. When direct cost waste collection was implemented in Grand Bend in 1992, the quantities of recyclables collected increased by 80% (Per. Com., Paul Turnbull, March 22, 1992).

- The capture rates for households serviced by collection depots were assumed to be equal to the rates determined for curbside enhanced Blue Box collection multiplied by a factor of 0.44. This factor was calculated using 1992 recycling data provided by the County. The data indicated that on average the quantity of recyclables collected per capita in areas serviced by depots was equal to 44% of the quantities collected per capita in areas serviced by curbside Blue Box collection programs.

- Capture rates for recycling programs intended for households in multi-family housing complexes and apartment buildings were assumed to be equal to the rates determined for curbside enhanced Blue Box collection multiplied by a factor of 0.30. This factor is based on the results of a study conducted in Vermont which indicated that capture rates at drop-off depots ranged from 17% to 52% of the rates observed with curbside collection programs. An average of 30% was assumed to be reasonable. There was no data available that indicated what the capture rates are for the apartment building collection program for recyclables that is presently operating in Sarnia.

Expanded and Enhanced Leaf and Yard Waste Collections

- It was assumed that the existing leaf and yard waste collection and composting program in Sarnia will continue to operate in the future in Strategies 2 and 3. It was also assumed that this program will be expanded to serve single-family households in urban areas outside of Sarnia. Communities such as Petrolia, Forest, and the urban areas in Moore and Plympton Townships were considered to be likely candidates for this program. Petrolia opened a leaf and yard waste composting facility in 1994 and Forest is also planning to open their own facility. Even though Strategies 2 and 3 include increased emphasis on backyard composting, it was assumed that leaf and yard waste collections will still be needed to divert excessive quantities of leaf and yard wastes. In a study completed in the City of Ottawa, it was determined that many residents were putting leaf and yard wastes out for refuse collection instead of putting them in their backyard composters.

- It was assumed that urban areas that presently have curbside Blue Box collection would also be provided with curbside leaf and yard waste collections. Urban areas that do not have curbside Blue Box collection will be provided with depots for leaf and yard wastes. The capture rate for leaf and yard wastes collected at depots was assumed to be equal to 44% of the capture rate assumed for curbside collection.

- In rural areas it was assumed that there would be no collections of leaf and yard wastes and that any leaf and yard wastes diverted in rural areas would be diverted only by backyard composters.

- For single-family households, it was assumed that leaf and yard wastes would be diverted by backyard composters and by collection and central composting programs. In urban areas with curbside collection, it was assumed that 50% of all leaf and yard wastes would be diverted from landfill disposal by these programs. This assumption is based on the fact that in 1992 a total of 1,852 tonnes of leaf and yard wastes were collected and composted in Sarnia and Point Edward. This quantity is equal to approximately 50% of the estimated amount of leaf and yard wastes generated in Sarnia in 1992.

- For Strategy 3, which includes direct cost of waste collection, it was assumed that up to 80% of the leaf and yard wastes generated by single-family households receiving curbside Blue Box collection would be diverted from landfill disposal by backyard composters and leaf and yard waste collections.

Household Composting

- It was assumed that a County-wide program would be initiated to distribute backyard composters free of charge to residents interested in receiving them. This approach to distributing composters has been studied in Pickering and in Waterloo, Ontario. In both of these studies it was found that about 70 to 80% of residents accepted the composters and 80 to 90% of those who accepted them were still using them one year later. This is equal to an overall participation rate of approximately 65%.

- In rural areas it was assumed that the participation rate for accepting and using backyard composters would be equal to the rate assumed for urban areas multiplied by a factor of 0.70 (e.g. 65% x 0.7 = 46%). This factor is based on the County's 1992 composter distribution records, which show that at the end of 1992, the number of composters per household distributed in urban areas was 40% greater than the number per household distributed in rural areas.

- For Strategy 3, it was assumed that direct cost pay waste collection would increase the rate of acceptance and long-term use of backyard composters to 80%. The implementation of a direct cost program in Grand Bend resulted in a significant increase in the number of composters sold to local residents (Per. Com., Paul Turnbull, March 22, 1993). A pilot study was conducted in West Garafraxa Township, Wellington County, to determine the impacts that direct cost waste collection has on recycling and backyard composting programs. It was found in the test area where direct cost was implemented that 77% of the residents in the test area were composting kitchen and yard wastes.

- Estimates of the quantities of wastes typically diverted by backyard composters range from 100 kg/household/year to over 240 kg/household/year. The results of the Pickering study indicated a diversion rate of approximately 145 kg/household/year. The results of the Waterloo study indicated a diversion rate of 352 kg/household/year. A study completed in 1992 by City of Ottawa indicated that backyard composters typically diverted about 143 kg of organic kitchen and yard wastes per household per year. For this study, it was assumed that 25% of households that used their composters were avid composters who would divert 240 kg/household/year. The remaining composter users were assumed to be less eager participants who would only divert 100 kg/household/year. These assumptions resulted in an overall rate of 135 kg/household/year. This rate is similar to the rates observed in Pickering and Ottawa.

- For Strategy 3, which includes a direct cost pay waste collection component, it was assumed that direct cost would encourage more use of backyard composters so that strategy that 75% of composter users would be avid composters and would divert 240 kg/year of organic wastes using their composters. The remaining 25% of composter users were assumed to be less eager participants who would put 100 kg/year of organic wastes in their composters. The overall diversion rate for backyard composters in Strategy 3 is 205 kg/household/year, which is 50% greater than the rate assumed for Strategy 2.

- For households in multi-family housing complexes and apartment buildings, it was assumed that initiatives intended for diverting household organics, such as installing and operating multi-bin composters for tenants, would result in a 10% diversion of household organics.

- In Strategy 3, which includes direct cost waste collection, it was assumed that participation in composting programs would increase so that 30% of household organics would be diverted in multi-family housing complexes and apartment buildings by multi-bin backyard composters.

Other Materials

- The capture rates for other recyclable materials such as wood wastes, tires, construction and demolition debris and white goods (e.g. used appliances) were assumed to be equal to 10.0%. It was assumed that these materials would primarily be collected through programs for bulky materials.

- In Strategy 3, which includes direct cost waste collection, it was assumed that direct cost would result in increased participation in bulky item collections. It was considered appropriate to double the capture rate for bulky items such as wood waste, tires, white goods, etc. to 20%.

2.5 Wet/Dry Collection Strategies

Alternative waste diversion Strategies 4 and 5 are based on wet/dry collection programs. These strategies are described in detail in Chapter 5 in Volume 1. The wet/dry strategies were assumed to be similar to the pilot programs tested in Guelph, Mississauga, Oakville and Metro Toronto. It was also assumed that the wet/dry program in Lambton County will be

a 3-stream collection program. The rationale for this assumption is explained in Chapter 5 in Volume 1.

The County is helping to fund a wet/dry collection pilot study in Wyoming. The results from this study are not yet available and were not incorporated into the analysis of the long-term diversion strategies.

For diversion Strategies 4 and 5, it was assumed that the dry portion of the 3-stream wet/dry program would be similar to an enhanced Blue Box collection program. The assumptions and methods used for determining the waste diversion potential for the enhanced Blue Box collection programs in Strategies 2 and 3 were considered to be suitable for determining the diversion achievable in the dry waste collection portion of the 3-stream wet/dry collection programs in Strategies 4 and 5.

For Strategies 4 and 5, it was also assumed that the distribution program for backyard composters would be similar to the program proposed for Strategies 2 and 3. As a result, the assumptions used for determining the diversion potential for backyard composters in Strategies 2 and 3 were assumed to also be applicable to Strategies 4 and 5.

The mathematical model used in Strategies 2 and 3 was also used to determine the waste diversion potential for Strategies 4 and 5. As noted above, many of the assumptions used in the model for Strategies 4 and 5 for dry recyclables collection and the backyard composting programs are similar to the assumptions used for Strategies 2 and 3. Additional assumptions used for determining the waste diversion potential in Strategies 4 and 5 that were not used for Strategies 2 and 3 are described as follows:

- It was assumed that 3-stream wet/dry collection would only be implemented in areas that presently receive curbside collection of Blue Box recyclables. Urban and rural areas that do not have curbside Blue Box collection would continue with the existing system of depots for recyclables collection. The diversion of household organics at these households would be limited to the quantities diverted by backyard composters. Existing depots would be improved to allow collection of an enhanced variety of dry recyclables.

- The wet/dry collection program would enable up to 80% of the household organics and leaf and yard wastes generated in single-family households to be diverted from disposal. This assumption is based on the results of the City of Guelph wet/dry pilot study. In this study, it was determined that the 3-stream collection system diverted 83% of the organics generated in the households in the study area.

- Strategy 5 includes direct cost waste collection for the garbage portion of the 3-stream collection program. It was assumed in this strategy that the portion of household organics and leaf and yard wastes diverted from landfill disposal would increase to 90% as a result of the extra incentive that direct cost will provide.

2.6 Calculation of Diversion Rates

Diversion rates for the alternative diversion strategies were determined using the procedures recommended in the Ontario Ministry of the Environment and Energy's Initiatives Paper No. 4. This method assumes a base year of 1987. Waste diversion rates for the strategies were calculated using the following equation:

$$\textit{Percent Diversion} = \frac{\frac{\textit{1987 Waste Disposal}}{\textit{1987 Population}} - \frac{\textit{1992 Waste Disposal}}{\textit{1992 Population}}}{\frac{\textit{1987 Waste Disposal}}{\textit{1987 Population}}} \times 100$$

The 1987 waste disposal quantity was determined by adding the residential waste disposal quantity (51,000 tonnes) and the IC&I disposal quantity (32,500 tonnes). The method used to calculate the value for residential wastes is described in Volume 1, Chapter 3 (Determination of 1992 Waste Diversion).

The Census Canada population counts for 1986 and 1991 were used to determine populations for 1987 and 1992. Residents who live on the Kettle Point, Sarnia, and Walpole Island Indian Reserves were not included in the population counts because they do not contribute wastes to Lambton County. The populations used in the calculations were 122,778 for 1986 and 127,079 for 1991.

Waste disposal estimates for 1992 were determined by subtracting estimates of the amounts of waste diverted from the total quantity of waste generated. The total amount of waste generated in 1992 was determined by adding the amount disposed (39,691 tonnes), the amount diverted (8,651 tonnes) and the amount generated by the IC&I sector (32,500 tonnes). The quantities diverted in the alternative strategies were determined by adding the diversion estimates for residential wastes and IC&I wastes. The quantities of IC&I wastes diverted were determined by multiplying the total quantity of IC&I waste generated (e.g., 32,500 tonnes) by the assumed diversion rate (e.g., 10 to 60%). The calculations for all of

the assumed IC&I rates are summarized in Table G-3. As an example, the diversion rate calculation for Strategy 3 at an assumed IC&I diversion rate of 50% is as follows:

$$\frac{\frac{51{,}000 + 32{,}500}{122{,}778} - \frac{39{,}671 + 8{,}651 + 32{,}500 - (21{,}000 + (0.5 \times 32{,}500))}{127{,}079}}{\frac{51{,}000 + 32{,}500}{122{,}778}} \times 100 = 49.6\%$$

TABLE G-3
DIVERSION RATE CALCULATIONS

Diversion Strategy	Residential Diversion		Combined Diversion Rate for Assumed IC&I Diversion Rates					
	Quantity (Tonnes)	Rate (%)	10%	20%	30%	40%	50%	60%
2	11,600	30.4	23.7	27.4	31.2	34.9	38.7	42.5
3	21,000	48.2	34.5	38.3	42.1	45.8	49.6	53.3
4	19,000	44.5	32.2	36.0	39.7	43.5	47.3	51.0
5	26,700	59.0	41.1	44.9	48.7	52.4	56.2	59.19

The estimates of diversion potential shown in Table G-3 demonstrate that diversion Strategies 3 and 5 provide the most number of opportunities for the County to attain the MOEE's waste diversion objective of at least 50% diversion by the year 2000. Both of these strategies include direct cost waste collection. The diversion objective will only be attained in Strategy 4 if the IC&I diversion rate nears 60%. Strategy 2 does not provide any opportunities for the County to attain the diversion objective.

3.0 CALCULATION OF COSTS FOR DIVERSION STRATEGIES

Cost estimates were developed for each of the five alternative waste diversion strategies. The purpose of determining costs was to identify differences between alternative strategies so that they could be ranked within the cost criterion. These ranks were combined with ranks for the other three criteria in order to identify a recommended waste diversion strategy for the County.

The cost value determined for each diversion strategy was equal to the net operating cost. The net operating cost represents the difference between the operating cost for the diversion initiatives and the waste collection and disposal cost. Costs for diversion initiatives tend to increase for each diversion strategy as more initiatives are included. However, these increases are offset by reduced collection and disposal costs.

Capital costs for new facilities were not considered in the evaluation. This is because it is not known if new centralized composting or materials recovery facilities will be needed for any of the alternative diversion strategies. It is also not known what the capital costs for these facilities will be, if they are needed. Capital costs are normally determined as part of the conceptual design for a facility. Conceptual designs are typically not completed until the need for a facility is confirmed. As a result, unit operating costs which include the facility capital cost amortized over the expected life of the facility were used for this analysis.

Operating costs for the public education on the 3Rs (e.g. waste reduction, reuse and recycling) and the household hazardous waste (HHW) programs were not considered in this analysis. These initiatives are common to all of the alternative diversion strategies and their operating costs likely do not change significantly between strategies.

Revenue generated by direct cost waste collection programs was also not considered in the analysis. This is because it is not known how much revenue will be generated by the direct cost programs or if the revenue that is generated will more than offset revenue lost once waste collection and disposal costs are reduced or removed from municipal taxes. It is also not known how many of the municipalities will choose to implement direct cost collection programs. Additional details on direct cost waste collection and its implementation in Lambton County are provided in Chapters 5 and 8 in Volume 1.

3.1 Operating Costs for Waste Diversion Initiatives

Operating costs for the alternative diversion strategies were determined by considering the operating costs for the individual initiatives within the strategies. Individual operating costs were combined to determine overall operating costs. The unit costs used for each of the diversion initiatives are described as follows:

- costs for collecting and processing Blue Box recyclables within each municipality were obtained from the County's 1991 Waste Management Cost Survey. The unit costs reported in the survey report varied widely from municipality to municipality. This is because each municipality has its own collection contract for recyclables and costs vary depending on the level of service provided and the location of the municipality. As a result, the average cost of $139.87/tonne for all municipalities was used. This cost was converted to a 1993 cost of $143.95/tonne using inflation rates of 1.1% and 1.8% for 1991 and 1992, respectively. These inflation rates are based on Statistics Canada Consumer Price Index data. A unit cost of $150/tonne for recycling collection and processing was used for all municipalities.

- The cost for backyard composter distribution programs was determined by considering the capital costs and the amount of waste diverted by composters. The capital cost for a backyard composter was assumed to be $61.00 per composter. This cost includes the cost for the composter, the administration cost for purchase and distribution, the cost to monitor use of the composter, the cost of delivering and promoting the composter. Government subsidies for the purchase price of the composter were not considered. These costs were determined using the results of a study on the distribution of backyard composters completed in Pickering in 1992 (Nash, 1992). It was assumed that the composters will last 10 years and will result in the diversion of 135 kg of organic wastes per year per composter. This is equivalent to an operating cost of $45.18/tonne (e.g. $61.00 ÷ (10 x 0.135)). For the diversion strategies that included direct cost waste collection (e.g. Strategies 3 and 5), it was assumed that backyard composters would result in the diversion of 205 kg of organic wastes per year. The operating cost for composters in these strategies was assumed to be $29.76 per tonne (e.g. $61.00 ÷ (10 x 0.205)).

- The cost for central composting of leaf and yard wastes was determined by considering operating costs reported by several operating facilities in Ontario. The City of Sarnia indicated that they estimate the collection and processing cost at their existing facility to be $30 to $40 per tonne of leaf and yard wastes processed (Pers. Comm., Bill Veitch, October 19, 1993). A compost literature review study completed

for the MOEE in 1990 indicated that the average combined capital and operating costs for composting yard waste is $50.28 per tonne. Using the Statistics Canada Consumer Price Index data, this cost is equal to $55.23 in 1993. A study completed by the Association of Municipal Recycling Co-ordinators included consideration of the economics of establishing and operating outdoor leaf and yard waste composting facilities. A facility operated by the Region of Waterloo was examined. This facility handled 4,500 tonnes of leaf and yard wastes in 1991 at a cost of $22.22 per tonne for capital and $31.00 per tonne for operating. The total of $53.20 per tonne for 1991 was converted to a 1993 cost of $54.75 per tonne using the Statistics Canada Consumer Price Index data. Based on the results of the above studies, a cost of $60 per tonne for composting leaf and yard wastes was considered to be appropriate. This cost includes capital, operating and collection costs.

- The cost to collect and recycle bulky items such as tires, scrap wood, construction and demolition wastes, and etc. were considered in the cost calculations. It was assumed that the cost for these materials was the same as the cost assumed for collecting and processing Blue Box recyclables (e.g. $150 per tonne).

- The cost to collect and recycle other materials was also considered in the analysis. Other materials that could be diverted for recycling were assumed to consist mainly of white goods (e.g. used appliances). A survey of municipal white goods collection programs was completed in 1993 by the Association of Municipal Recycling Co-ordinators. It was determined that the average cost to divert white goods in municipal programs is about $190 per tonne. This cost includes collection, processing and disposal costs minus the revenues generated by the sale of recyclable materials.

- For the purposes of determining costs for wet/dry collection (e.g. Strategies 4 and 5), it was assumed that the cost for collecting and processing the dry recyclables stream would be same as the cost assumed for operating the enhanced Blue Box programs. For the wet waste stream, it was assumed that the cost for collecting and composting wet wastes (which includes household organics) would be higher than the costs for collecting and composting leaf and yard wastes. This is because composting wet wastes is generally more difficult and involves more complicated processes and equipment that will be more expensive to operate. A review of available data on collecting and composting wet wastes indicated that the unit cost of collecting wet wastes and operating wet waste facilities varies depending on the quantities handled. Considering the quantities of wet wastes that are predicted to be collected and composted in Strategies 4 and 5, a cost of $90 per tonne was considered to be reasonable.

3.2 Waste Collection and Disposal Costs

Costs for waste collection and disposal were determined using data from the County's 1991 Waste Management Cost Survey. The average cost for waste collection and disposal for all municipalities in the County was determined to be approximately $113 per tonne. This was converted to a 1993 value of $116 per tonne using the Statistics Canada Consumer Price Index data. An average cost of $115 per tonne was used for this analysis.

3.3 Results of Cost Calculations

The results of the cost calculations are summarized in Table G-4. Total waste management system operating costs per year range from $5,327,000 for Strategy 4 to $5,544,000 for Strategy 1.

3.4 Ranking of Diversion Strategies within the Cost Criterion

The results of the operating cost calculations for the diversion strategies indicate that there is little difference in costs between the five strategies. The difference between the highest and the lowest cost is less than 5%. However, it is important to note that the estimates of unit costs that were used in the calculations for the diversion initiatives and likely have levels of confidence that are higher than 5%. Therefore, it was not considered reasonable to rank the diversion strategies based on the results of the cost calculations.

The alternative waste diversion strategies were ranked based on whether or not new diversion facilities will be needed. Within Strategies 4 and 5, which include wet/dry collection, there is a greater probability that new centralized composting and materials recovery facilities will be needed. The capital costs for these facilities will be significant. Therefore, Strategies 1, 2 and 3, which do not include wet/dry collection, were ranked most preferred. Strategies 4 and 5, which do include wet/dry collection, were ranked least preferred.

TABLE G-4
SUMMARY OF DIVERSION STRATEGY OPERATING COST CALCULATIONS

Diversion Strategy	Recycling Collection and Processing Cost	Backyard Composting Program Cost	Central Composting and Collection Cost	Bulky Materials Collection and Processing Cost	White Goods Collection and Processing Cost	Waste Collection and Disposal Cost	Total Operating Cost per Year
Strategy 1 (Existing)	$ 874,000	$ 46,000	$111,000	$0	$0	$4,513,000	$5,544,000
Strategy 2 (Enhanced Blue Box)	$ 955,000	$125,000	$128,000	$26,000	$32,000	$4,181,000	$5,447,000
Strategy 3 (Enhanced Blue Box with Direct Cost)	$1,761,000	$150,000	$210,000	$47,000	$59,000	$3,102,000	$5,337,000
Strategy 4 (Wet/Dry)	$ 956,000	$125,000	$853,000	$25,000	$32,000	$3,335,000	$5,327,000
Strategy 5 (Wet/Dry With Direct Cost)	$1,761,000	$106,000	$972,000	$47,000	$59,000	$2,445,000	$5,390,000

4.0 MATERIALS RECOVERY FACILITY SURVEY

A newsletter for the Lambton County Waste Management Master Plan was distributed in March 1993 to residents in Lambton County. The newsletter included a materials recovery facility survey which was intended to solicit public opinion on potential waste diversion initiatives that the County could implement in the future. The survey also included a short description of the options available. The newsletter and survey was distributed to all households and businesses in the County. A total of 53,000 newsletters were distributed. A copy of the newsletter is presented in Volume 3, Appendix 3D, Schedule 3D-19.

A total of 729 completed surveys were returned. The return addresses on the surveys were analyzed to determine where the completed surveys originated from. The results of the analysis are listed in Table G-5. This analysis indicated that survey responses originated from all parts of the County.

TABLE G-5
DISTRIBUTION OF SURVEY RESPONSES

Municipality	Number of Responses	Percent of Total
City		
Sarnia (including Bright's Grove)	424	58.2
Towns		
Forest	41	5.6
Petrolia	39	5.3
Villages		
Alvinston	7	1.0
Arkona	8	1.1
Grand Bend	26	3.6
Oil Springs	7	1.0
Point Edward	9	1.2
Thedford	13	1.8
Watford	25	3.4
Wyoming	23	3.2
Townships		
Bosanquet (incl. Kettle Point and Port Franks)*	8	1.1
Brooke	0	0
Dawn (incl. Florence)	0	0
Enniskillen (incl. Oil City)	2	0.3
Euphemia	0	0
Moore (incl. Corunna, Brigden, Courtright and Mooretown)	41	5.6
Plympton (incl. Camlachie)	23	3.2
Sombra (incl. Port Lambton)	20	2.7
Warwick	0	0
No Address Provided	13	1.8
Total	**729**	**100.0**

* *Bosanquet became a Town on December 1, 1994.*

The survey results were also analyzed to determine if the respondents originated primarily from urban or rural areas. In order to simplify the analysis, it was assumed that urban areas were cities, towns and villages and that residents in these areas would either have a street number or a post office box number in their address. It was assumed that all rural residents had a rural route number in their addresses. An analysis of the data indicated that there were 583 responses from urban areas and 146 responses from rural areas. This means that 20% of the responses received originated from rural areas.

Question 1: *I prefer a Blue Box, emptied on a regular basis, in which to put my recyclables*

The responses to this question attest to the popularity of Blue Box programs in the County. In urban areas, 90% of responses to this question responded with a yes. In rural areas, 80% of the responses were positive.

Comments to this question provided by residents in urban areas were reviewed. The most prevalent comment (14 responses) was that weekly Blue Box collection was too frequent and that bi-weekly collection would be sufficient. Twelve respondents indicated that they would like to have a more advanced collection program, such as wet/dry collection.

Comments to this question provided by residents in rural areas were also reviewed. The most prevalent comment (4 responses) was that weekly Blue Box collection was too frequent and that bi-weekly or monthly collection would be acceptable. Three respondents indicated that they felt that Blue Box collection in rural areas was too expensive.

Question 2: *I prefer to take my recyclables to a recycling depot set up at convenient locations*

The responses to this question indicated that Blue Box curbside collection programs are preferred over recycling depots in both rural and urban areas. In urban areas, 81% of respondents indicated that they did not prefer to take their recyclables to a recycling depot. In rural areas, 69% of respondents indicated no to recycling depots.

The most predominant reason given for responding with a no to this question was that depots are unsightly and cause odours. Some respondents indicated that they are elderly and do not own a car. Other respondents indicated that driving to a depot would cause unnecessary gasoline consumption and pollution. Several respondents also commented that they questioned whether people would really use depots. The comments provided by respondents

who responded yes to this question indicated that they were willing to use depots because depots are less expensive to operate.

Question 3: *I prefer to haul my wastes to the local landfill site.*

In urban areas, 97% of respondents indicated that they did not prefer to haul their own wastes to the local landfill site. In urban areas outside of Sarnia, 95% of respondents indicated that they did not prefer to haul their own wastes to the landfill site. This result indicates that direct haul of wastes is not accepted by people in the smaller urban areas outside of Sarnia.

In rural areas, opposition to direct haul was also strong. Of the responses received, 77% indicated that they did not prefer to haul their own wastes to the landfill site. This is an expected response considering that the more heavily populated townships in the County, such as Bosanquet, Moore and Plympton, all provide curbside waste collection for their residents.

There were few comments provided for this question. The few comments that were made indicated that the main reasons why residents responded no to this question were that they were concerned about the cost of hauling their own wastes, and the fact that access to landfill sites is limited to certain times.

Question 4: *If Lambton County were to adopt a variation of the wet/dry collection program described above, I would be willing to participate in it*

Responses to this question indicated that participation in a wet/dry program would be significant. Of the responses received from urban areas, 90% indicated that they would be willing to participate in a wet/dry collection program. In rural areas, 77% of respondents indicated that they would be willing to participate. The high positive response rate for rural areas is surprising, considering that in rural areas many residents would have their own compost heaps and would potentially consider a wet/dry program unnecessary. A review of the comments provided by rural residents indicated that they would be willing to participate in a wet/dry program but they already compost their wet wastes on their own and use the compost on their gardens. This was also the most prevalent reason provided by respondents in rural areas who indicated that they were not interested in participating in a wet/dry program.

Question 5: *For a wet/dry collection system, I prefer either a two-container or three-container system or something else*

Only responses which indicated that the respondent would participate in a wet/dry collection system were considered in the analysis for this question. The results indicated that in both urban and rural areas, two out of every three respondents indicated that they preferred a three stream wet/dry program over a two-stream program. In the explanation that was included in the survey, it was pointed out that Blue Boxes would be used to collect the dry wastes in the 3-stream system.

The comments provided for this question did not provide any clear indications of why respondents chose a 2-stream or a 3-stream wet/dry system.

Question 6: *For a wet-dry collection system, I prefer to use either coloured bags or special containers/bins*

Similar to Question 5, only responses which indicated that the respondent would participate in a wet/dry collection system were considered in the analysis for this question. The results indicated that respondents from both rural and urban areas were indifferent to either bags or special containers/bins.

The comments that were provided for this question indicated that the main reasons why bins were preferred over bags is because bins are cheaper in the long-term, they create less waste, and bins are more resistant to animals. The main reasons why response chose bags over special containers/bins is that bins can be blown around in the wind, bins can be heavy and difficult to handle, and bags ultimately have more capacity.

Space was not provided on the survey for respondents to provide general comments. However, many respondents did provide general comments which were not associated specifically with any of the questions. A review of the comments indicated that the most prevalent comments provided by respondents in urban and rural areas were similar. The most prevalent type of comment that was provided indicated that the respondent was concerned about how much it was costing the County to operate the waste management system. Specifically, the comments indicated that the respondent either felt that the existing waste management system worked well and they did not want to see more money spent on it or the waste management system was too expensive and should be reorganized or cut back. The second most prevalent comment made by respondents from rural and urban areas indicated that they supported composting. The respondents indicated that they wanted to see more

emphasis placed on backyard composting, more collections of leaf and yard wastes, and more composting of organic wastes from restaurants and, hotels and food stores.

A general comment made by several respondents from urban areas indicated that they thought that there should be a direct cost system for waste collection. There appeared to be very little interest in direct cost from respondents in rural areas.

Several respondents in rural areas indicated that they wanted collection of or depots for bulky items such as used appliances, furniture and tree limbs, etc. Interest in the collection of bulky items in urban areas did not appear to be as prevalent.

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LAMBTON COUNTY WASTE MANAGEMENT MASTER PLAN
TECHNICAL APPENDICES

APPENDIX 2H
DESCRIPTION OF CONCORDANCE ANALYSIS

M.M. DILLON LIMITED
FEBRUARY 1995

THE CONCORDANCE METHOD

The Concordance Method is particularly useful for nominal, ordinal and interval data or where there is a combination of data types. This method uses a matrix of alternative sites, criteria groups, raw or scaled data and weights. The Concordance Method compares alternative sites in pairs for each criterion or indicator, identifying the better of the two sites. The site which is the best of the pair receives "points" equivalent to the weight of the criterion or indicator under which the two sites are being compared. If the sites are equally good for that criterion or indicator, the points are divided equally between the sites. This pair-wise comparison is carried out for all sites for each criterion or indicator. The results of each pair-wise comparison is placed in a Concordance Matrix. The "points" attributed to each site are then summed across rows and divided by the sum of the weights for the criteria. The scores can then be used to identify differences in levels of impacts between sites and to rank the sites.

This methodology can be summarized with the following formula:

$$CS_xS_y = \frac{\text{Sum of the weights for those criteria where Site x is better than Site y}}{\text{Sum of all the weights for the full set of criteria}}$$

where CS_xS_y is the Concordance Index for Sites x and y.

The range of values for the Concordance Index are 0 to 1. If $CS_xS_y = 1.0$, then Site 'x' (S_x) is better than Site 'y' (S_y) for all criteria. If $CS_xS_y = 0$, then Site 'x' (S_x) is inferior to Site 'y' (S_y) for all criteria.

Presented below is an example of the Concordance Method in order to help illustrate this evaluation method. The example demonstrates this method for the evaluation of three sites using three criteria.

AN EXAMPLE OF THE CONCORDANCE METHOD

The Concordance Method is a useful evaluation tool to assist in the assessment of information which includes nominal, ordinal or interval data. Table H-1 presents an example which combines nominal, ordinal and ratio data.

TABLE H-1
HYPOTHETICAL EXAMPLE

	CRITERION 1 Past use of site and ease for development	CRITERION 2 Number of houses off-site 0-500 m	CRITERION 3 Predominant soil capability of lands on-site
CRITERIA WEIGHTS (Sum of weights = 100)	40	50	10
SITE 1	Site previously a pit or quarry. No excavation required to reach base grade. (best)	1 house (best)	Class 5 (worst)
SITE 2	Site previously a pit or quarry. Minor excavation required to reach base grade.	1 house (best)	Class 6
SITE 3	Site is undeveloped and extensive excavation is required to reach base grades. (worst)	14 houses (worst)	Class 7 (best)

The Concordance Method involves the systematic comparison of sites. The site which is better is given the weight associated with the criterion. The first step is to ask: "Is Site 1 better than Site 2 for Criterion 1?". The answer is "yes". Therefore the concordance between Site 1 and Site 2 (identified as CS_1S_2 in formula below) for Criterion 1 is equal to the weight of Criterion 1. The weight value of 40 is used in the formula below.

The second step is to ask: "Is Site 1 better than Site 2 for Criterion 2?". The answer is that they are the same. As a result, the concordance between Site 1 and 2 for Criterion 2 is equal to the weight of Criterion 2 divided by two. The value of 25 (i.e. 50 ÷ 2) is added to the formula identified below.

The third step is to ask: "Is Site 1 better than Site 2 for Criterion 3?". The answer is "no", therefore a "0" is used in the formula:

$$CS_1S_2 = \frac{40 + 25 + 0}{100} = \frac{65}{100} = .65$$

The value of .65 is recorded in the Concordance Matrix for the cell [$Site_1$ $Site_2$].

The Concordance Index for (Site 2) is:

$$CS_2S_1 = \frac{0 + 25 + 10}{100} = .35$$

This value is recorded in the cell ($Site_2/Site_1$). It should be noted that $CS_2S_1 + CS_1S_2 = 1.0$; thus to complete all cells in the Concordance Matrix, it is only necessary to calculate half of the pair-wise comparisons of sites.

TABLE H-2

	SITE 1	SITE 2	SITE 3	SUM OF POINTS
SITE 1		.65		
SITE 2	.35			
SITE 3				

To complete the Concordance Matrix, the next Step is to compare Site 1 relative to Site 3. This has been done for all three criteria and is presented below:

$$CS_1S_3 = \frac{40 + 50 + 0}{100}$$

$$CS_1S_3 = \frac{90}{100} = .9$$

and $CS_3S_1 = .1$

The Concordance Matrix now reads:

TABLE H-3

	SITE 1	SITE 2	SITE 3	SUM OF POINTS
SITE 1		.65	.9	
SITE 2	.35			
SITE 3	.1			

The final step to the Concordance Matrix is to compare Site 2 with Site 3. This has been done for all three criteria and is presented below:

$$CS_2S_3 = \frac{40 + 50 + 0}{100}$$

$$CS_2S_3 = \frac{90}{100} = .9$$

and $CS_3S_2 = .1$

The Concordance Matrix is now complete. The points for each site can now be calculated by adding values across rows. Site 1 has the highest value and is therefore the most attractive site. Site 2 is slightly inferior while Site 3 is the least attractive site.

TABLE H-4

	SITE 1	SITE 2	SITE 3	SUM OF POINTS
SITE 1		.65	.9	1.55 most attractive
SITE 2	.35		.9	1.25
SITE 3	.1	.1		.2 least attractive