1.0 INTRODUCTION

1.1 Background

Oxford County operates a very successful municipal solid waste management program having achieved a ranking of 6th out of 230 Ontario municipalities for diverting residential waste from landfill, as well as a ranking of 1st in diversion for municipalities within its grouping[2]. The County has also embarked on an ambitious program to achieve two significant long term Sustainability goals, being 1) achievement of 100% renewable energy by 2050[3], in accordance with the County's June 2015 resolution; and, 2) achievement of Zero Waste, as articulated in the September 2016 draft Zero Waste Plan[4]. Oxford County's renewable energy commitment provides a mechanism for linking the two goals outlined above and recognizes that residual waste can form a useful feedstock for generating energy from waste. As part of its program toward achieving Zero Waste and other related goals, OC has undertaken this ***Assessment of Waste Recovery and Reduction Technologies*** (the Project). The Project is being undertaken amidst the development of recent climate change and waste management legislation (and related policies, strategies, and emerging programs), intended to dramatically reduce waste generation and disposal, and intended to drive the 'Circular Economy'.

The County has retained the consulting team of SLR Consulting (Canada) Ltd., in association with Love Environment to assist them in carrying out the Project, which will consist of five main tasks described in following **Section 1.2.**

1.2 Project Scope

1.2.1 Task 1: Assessment of Existing Waste Recovery Technologies

Task 1 is a comprehensive review of existing approaches to the reduction of residual waste, leading to identification of technologies that are relevant to Oxford County. This will be undertaken in three stages:

- Stage 1: Setting the Scene: This is an analysis of the current waste management situation in Oxford County aimed at characterising the County's waste management situation in terms of scale, current approach, types of waste, barriers and opportunities.

- Stage 2: Technology Options (Inclusive List). Stage 2 is identification of a long list of technology suppliers under each material type and technology class. This long list would subsequently be screened against a set of criteria which would be agreed with the County.

- Stage 3: In-depth Evaluation. Stage 3 is a more in-depth analysis of the individual technologies using the County's Multi Criteria Analysis Tool (MCA).

[2] Full Report County of Oxford Waste Management Strategy, Oxford County, August 2014.

[3] Draft 100% Renewable Energy Plan, Oxford County, June 22 2016.

[4] Draft Zero Waste Plan, Oxford County, September 22, 2016.

1.2.2 Task 2: Case Studies of Implemented Technologies

Task 2 will result in the documentation of case studies of technologies implemented in other jurisdictions, as well as highlighting of those technologies which have been successfully implemented and which have highest likelihood of successful implementation in Oxford County.

1.2.3 Task 3: Review of New and Emerging Technologies

This task will be the documentation of new and emerging technologies as identified in Task 1, as supplemented by gathering of additional data as required and prepare meaningful commentary.

1.2.4 Task 4: Relationship of EPR and Resource Recovery with Current Waste Stream

Task 4 will examine and assess the impacts of recent climate change and waste management legislation, namely:

- Bill 151 – the *Waste Free Ontario Act* which includes both *Resource Recovery and Circular Economy Act* and the *Waste Diversion Transition Act;*
- The *Strategy for a Waste Free Ontario* (through which topics like the future of organics, disposal bans, new material designations and IC&I diversion are prominent); and,
- The *Ontario Climate Change Action Plan* (and it potential impact on municipal waste operations).

This legislation will be examined in the context of several key questions, including the County's role in the delivery of waste management services in areas where producer responsibility is significantly changing, and the County's role in ensuring that expanded EPR programs that are implemented are well integrated with the overall waste management system.

1.2.5 Task 5: Economic Potential of Full Resource Recovery

This task will seek to identify the net economic benefits of implementing the preferred technology solutions identified in Task 1, considering the outline CAPEX and OPEX costs of technologies, and accounting for the value within recovered materials, the potential sale of power and/or heat from certain categories of technology, and avoided costs of landfilling and long-term management of impacts.

1.3 Document Objectives and Organization

Documentation generated during this study was presented in technical memoranda covering each task. In this regard Technical Memos 1a, 1b, 1c, 2, 3, 4 and 5 were submitted to the County over the period from March to June 2017. Following review and agreement by the County, the technical memos have been combined into this document, the Final Study Report.

The Final Study Report is organized as follows:

Section 2 summarizes the three stages of **Task 1** work:

- Stage 1 - projection of waste quantities and composition, and identification of applicable classes of waste treatment technology;

- Stage 2 – identification of commercial vendors providing applicable technology components; and,
- Stage 3 – identification of specific technology scenarios and their analysis using the County's MCA.

Section 3 summarizes **Task 2** work, which was compilation of information on projects where waste reduction and recovery technologies which are applicable to the County have been implemented.

Section 4 summarizes **Task 3** work, which summarizes emerging trends relating waste reduction and recovery technologies.

Section 5 summarizes **Task 4** work which was identification of the potential impacts of extended producer responsibility and resource recovery legislation, regulations and provincial government actions on Oxford County's current (and future) waste stream (and thus on the county's goal of achieving zero waste).

Section 6 summarizes **Task 5**, which considers the economic potential of full resource recovery. Specifically, the two highest scoring technology scenarios are analysed.

Sections 7 and 8 provide a **summary of the specific conclusions and recommendations** respectively arising from the study.

1.4 Glossary

As an aid to the reader the following glossary is provided for terminology used in this memorandum:

%	Percent
AD	Anaerobic Digestion
APCr	Air pollution control residues
Biomethane	Methane derived from non-fossil fuel origins.
BtL	Biomass to liquid
CAPEX	Capital expense
CHP	Combined Heat and Power.
CLO	Compost-like output. Digestate derived from residual MSW organics which cannot be applied to agricultural land and can be only used for landfill restoration or the remediation of contaminated land, or otherwise sent to a landfill for disposal.
CO_2	Carbon dioxide
CV	Calorific Value

DS	Dry solids
ECA	Environmental compliance approval.
EfW	Energy from Waste (also known as Waste to Energy WtE). The conversion of waste into a useable form of energy, e.g., heat or electricity. A common conversion process is waste combustion.
EPC	Engineering, procurement and construction
EPR	Extended Producer Responsibility
EU	European Union
GtL	Gas to liquids. A refinery process to convert natural gas or other gaseous hydrocarbons into longer-chain hydrocarbons
h	hour
HAZOP	Hazard and operability study
IC&I	Industrial, Commercial and Institutional
IVC	In-vessel Composting
kg/m^3	kilograms per cubic meter
kpta	kilo tonnes per annum
kWh/te	kilowatt hours per tonne equivalent
LBM	Liquid biomethane
MBT	Mechanical-biological treatment
MCA	Oxford County's Multi Criteria Assessment tool, a framework for making decisions on the basis of criteria categorized as Community, Economic, Environmental, and Implementation
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
MW	Megawatts (10^6 W) is a unit of power equal to one million watts
MWe	Megawatt equivalents
NASM	Non-agricultural source material
NIR	Near infra-red

NMA	Nutrient Management Act
NMP	Nutrient management plan
OC	Oxford County
OPEX	Operating expense
PE	Population equivalents
PFI	Private finance initiative
RDF	Refuse-derived fuel. Waste that has a relatively high calorific value but where the compositional quality and environmental parameters are not described in a standardized way.
te	Tonnes equivalent
tph	Tonnes per hour
US	United States
UK	United Kingdom
WWTP	Waste water treatment plant