SOLID WASTE MANAGEMENT PRACTICES
Prepared by the Dalhousie University Office of Sustainability

The Dalhousie University Solid Waste Management Plan draws information from meetings with custodial staff, students, employees, government and the Resource Recovery Fund Board; the Office of Sustainability waste reports and guides; the Waste Management Master Plan and Project Report prepared by Dillon Consulting Limited (2014); and journals, government websites, and other professional sources.

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1.0 WASTE MANAGEMENT IN NOVA SCOTIA

In 1995, the province of Nova Scotia introduced the Solid Waste Management Strategy in response to public concern regarding the issues associated with landfills and the incineration of waste. At that time, the provincial government officially adopted a solid waste diversion target of 50% by 2000 as identified in the Environment Act (1995). Major programs came into place including bans on materials such as organics, creation of the Resource Recovery Fund Board and waste management regions, and the launching of enviro-depots and centralized composting.

Nova Scotia achieved its diversion target of 50% by 2000. To further the commitment, a per capita waste disposal target of 300kg by 2015 was legislated in the Environment Act in 2006. This target is also recognized in the Environmental Goals and Sustainable Prosperity Act (EGSPA) (2007). In 2011, the province released a revised strategy, Our Path Forward, that includes a commitment to future regulatory reviews to help meet waste objectives.
2.0 MANAGEMENT DRIVERS

There are many factors, both external and internal, that impact waste management at the University (Figure 1).

2.1 Global Trends

The 20th century experienced widespread change in consumption and waste disposal patterns. The invention of new products (such as ready-to-serve meals), contributed to significant alterations in purchasing behaviour. In addition, the end of the century lead way to enhanced globalization, and emerging technology and science provided new opportunities for increased consumption and waste (Bampilis, 2012). The connectivity between global regions has provided an opportunity for the transfer of waste from one country to the next. The Basel Convention addresses issues of transboundary transfers of hazardous waste.

Although product life-cycle is typically considered in the product design stage, an important, but often overlooked consideration is the end-of-life-cycle.

Upon retiring, many products are sent for disposal, contributing to waste streams; however, other alternatives could be assessed. Rather than accepting that products have a single life-cycle, society should consider products to have multiple life-cycles which can be attained through recovery, reuse, refurbishment, re manufacture, or recycling (Ryan, 2014).

Unfortunately, a great deal of products are disposed of prematurely. Such concerns have led to the development of initiatives such as Extended Producer Responsibility as well as the Polluter-Pays Principle. Organizations such as Electronics Product Stewardship Canada strive to offset some of the disposability issues associated with e-waste.
Many current societal concerns, including waste management and disposal, have evolved from excessive consumption; part of the solution exists in consumer behavioural adjustments that ultimately reduce consumption (MacKay, 2008). Often, a consumer’s ability to purchase goods is disconnected from the rest of the commodity-chain (Hartwick, 1999); however, with improved accessibility to information through technology, consumers have started to identify unfavourable marketing practices including those that result in an increased production of waste (Bekin, Carrigan, & Szmigin, 2014). In recent years, the concept of ‘green consumption’ has gained momentum and green purchase decisions can sway production (Hartwick, 1999). Green consumers may consider the following components of the commodity-chain when making purchase decisions: the production, transportation, marketing, use, and/or disposal of a product (Harrison, 2006).

The success of a solid waste management strategy is highly dependent upon the type of goods purchased and consumer disposal decisions. Consumers may have positive intentions towards solid waste diversion and recycling; however, actual behaviour may not reflect these intentions (Buelow, Lewis, & Sonneveld, 2010). Attitudes towards recycling are a strong driver for recycling behaviour and a number of factors shape consumer attitudes (Tonglet, Philips, & Bates, 2004). Recycling opportunities, convenience, access to the necessary recycling facilities, and an understanding of how to recycle can all influence the attitude of an individual. In addition, attitudes can evolve from: past experiences, moral norms, and concern for the community and environment (Tonglet, Philips, & Bates, 2004).

Public education is crucial for the success of the management plan. Behavioural instruments play a role in waste management strategies through initiatives that inform and educate. Examples of these types of initiatives include waste audits, school programs, advertising, training, and competitions (CEF Consultants, 1994). Education has been shown to be a critical component in encouraging public participation in recycling programs (Bolaane, 2006; Grodzinska-Jurczak et al., 2006; UC Davis, n.d.).
2.2 Federal, Provincial, and Municipal Solid Waste Legal Considerations

All levels of government have a legal role in solid waste management. A number of regulations provide a framework for the university to manage waste material (Figure 2).

**Federal Legislation**

The Federal government involvement in waste legislation is primarily related to the regulation and management of certain types of hazardous substances, pollutants, and wastes through transportation and pollution regulations.

*Transportation of Dangerous Goods Act (1992)*
- Regulates the transportation of hazardous waste over air, sea, rail, and road

*The Canadian Environmental Protection Act (1999)*
- Establishes regulations for the management and control of certain toxic and hazardous waste

<table>
<thead>
<tr>
<th>Acts</th>
<th>Regulations</th>
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| Federal | · The Canadian Environmental Protection Act (1999)  
| Provincial | · Environment Act (1995)  
· Creation of the Resource Recovery Fund Board (RRFB) |
| Municipal | · Municipal Government Act (1998) | · HRM By-law 600: Solid Waste Resource Collection and Disposal By-law  
· Colchester County Solid Waste By-law  
· HRM By-law 200: C&D Materials Recycling and Disposal License By-law  
· Colchester County Construction and Demolition By-law |

**Provincial Legislation**

Provincial government involvement in waste legislation provides specific guidelines and restrictions regarding the handling and disposal of solid waste in Nova Scotia.

*Environment Act (1995)*
- Outlines specific targets for solid waste diversion in Nova Scotia
- 50% solid waste diversion target by 2000 (target established in 1996)
- 300kg per capita target by 2015 (target established in 2006)
- Permits the establishment of Solid Waste-Resource Management Regulations

**Figure 2. Key government acts and regulations relevant to waste management**

- Permitted under section 102 of the Nova Scotia Environment Act (1995). These regulations are the basis for banning the disposal of certain items from disposal sites (Figure 3), prohibiting the open burning of waste, and establishing seven regional waste management areas in the province.
- Established the Recovery Fund and the Resource Recovery Fund Board (RRFB) which is responsible for overseeing the Fund.

Resource Recovery Fund Board (RRFB)

- The RRFB is charged with developing: municipal or regional diversion programs; a deposit/refund system for beverage containers; industry stewardship programs; programs and materials to raise awareness for waste reduction, reuse, recycling and composting; and value-added manufacturing in the province (NSEL, nd; SWRMS, 1996). RRFB also manages over 80 Enviro-Depots located across Nova Scotia (RRFB, 2014).

Electronic Products Recycling Association (EPRA)

- In alignment with the Electronic Products Stewardship Program outlined in the SWRMR (1996), EPRA ‘...is responsible for implementing and operating an industry-led and government-approved electronic products recycling program that is available for consumers and businesses throughout the province’ (EPRA, 2013).

Figure 3: SWRMR Materials Banned from Nova Scotia Disposal sites

- Newsprint
- Computer monitors
- Ethylene glycol (automotive antifreeze)
- Televisions
- Redeemed beverage containers
- Post-consumer paint products
- Computer printers, including printers that have scanning or fax capabilities or both
- #2 HDPE non-hazardous containers (ice cream containers, plastic jugs, detergent bottles, etc.)
- Desktop, laptop, and notebook computers, including CPUs, Keyboards, mice, cables and other components
- Corrugated cardboard
- Used tires
- Automotive lead-acid batteries
- Leaf and yard waste
- Steel/tin food containers
- Glass food containers
- Low density polyethylene bags and packaging
- Compostable organic material (food waste, yard waste, soiled and non-recyclable paper

(Government of Nova Scotia, 2014)
EGSPA (2007)

- Commits the provincial government to achieving a variety of environmental objectives by the year 2020 including the 300kg per person per year disposal rate, although EGSPA does not contain provisions which allow the government to enforce or regulate waste management.

Municipal Legislation

Section 325 of the Municipal Government Act (1998) permits the municipality to create by-laws regarding solid waste management. HRM and Colchester County have developed by-laws that influence solid waste management at each of Dalhousie’s campuses.

SOLID WASTE BY-LAWS

HRM By-law 600: Solid Waste Resource Collection and Disposal By-law

- States limits, restrictions, and eligibility requirements for private, industrial, commercial, and institutional disposal of waste
- Identifies storage and bin standards, waste separation expectations, and appropriate transportation of waste
- Outlines specifications (allowances) and preparation requirements for collection
- Highlights prohibitions, disposal fee structure, and penalties for violations of the By-law

Colchester County Solid Waste By-law

- States limits, restrictions, and eligibility requirements for disposal of waste
- Identifies storage and bin standards, waste separation expectations, and preparation requirements for collection
- Identifies requirements and expectations of waste collectors
- Highlights prohibitions, disposal fee structure, and penalties for violations of the By-law

Construction and Demolition (C&D) By-laws

- HRM has committed to a C&D diversion rate of 75%, although Colchester County does not have specific C&D targets, Dalhousie University abides by the 75% diversion target across all campuses.

HRM By-law 200: C&D Materials Recycling and Disposal License By-Law

- States license and insurance requirements for operation of a C&D processing facility
- Outlines operational plan specifications
- Identifies material storage requirements and disposal specifics
- States offenses under the By-law and the associated penalties

Colchester County Construction and Demolition By-law

- States license requirements and associated fees
- Highlights the necessity for recording and reporting on the C&D load details
- States offenses under the By-law and the associated penalties

Dalhousie has specific waste management internal and external drivers that set the context for action planning (Figure 4).
### Figure 4. Dalhousie Waste Management Drivers

<table>
<thead>
<tr>
<th>STRENGTHS</th>
<th>CHALLENGES</th>
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<tbody>
<tr>
<td><strong>INTERNAL</strong></td>
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<tr>
<td>· Long involvement in operating waste management programs</td>
<td>· “Bolting” on programs – system is not as efficient as it could be</td>
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<tr>
<td>· Waste management research and programs through the Office of Sustainability; Facilities Management; and the Office of Environmental Health and Safety</td>
<td>· Clear roles and procedures for handling all waste management streams including universal waste</td>
</tr>
<tr>
<td>· Many waste issues are in our direct sphere of influence to change</td>
<td>· Open access to bins – illegal dumping</td>
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<tr>
<td>· A number of interested groups and individuals on campus</td>
<td>· Extra costs and environmental impacts as material is not used efficiently – upstream and downstream</td>
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<td>· Staff dedicated to hazardous and solid waste-resource management</td>
<td>· Decentralized procurement and constant influx of people engaged in the system</td>
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<td>· Special events encourage diversion (ex. Dump and Run program)</td>
<td>· Educational issues</td>
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*(Davidson & Owen, 2011 and Dillon, 2014)*
3.0 CURRENT SITUATION

3.1 Dalhousie Solid Waste Management Structure

There are over 7000 employees and 18,500 students at Dalhousie’s three urban campuses (Halifax) and agricultural campus (Bible Hill). Each year thousands of new students arrive to attend the university. The university has residence accommodations, food services, athletics venues, research labs from multiple disciplines, a farm and agricultural lands, and thousands of offices. The breadth of the activity on campus results in a wide-variety of waste types and volumes. A number of departments are involved in aspects of waste management on campus (Figure 5).

Figure 5: Dalhousie University – Solid Waste Program Management (adapted from Dillon 2014)
3.2 Waste Streams

A Material Categorization Guide was created that classifies materials types for each of the following streams: fibre, organics, plastics, recyclables (plastics, metals, and glass), white goods, universal waste, C&D waste, and garbage (Table 1). The Dalhousie Office of Environmental Health and Safety provides specific information pertaining to hazardous and bio-medical waste.

The collection of material is categorized and communicated according to government programs and regulations. Materials streams for solid waste collection include Paper, Organics, Recyclables, Refundables (in some locations) and garbage. Other streams such as construction and demolition (C&D), universal waste, and hazardous waste have separate processes and protocols.

3.3 Collection and Processing of Streams

**Recycling**

Paper, cardboard and recyclables are collected everyday in and outside buildings from Dalhousie’s four bin systems by Facilities staff. In HRM, recyclables are then brought to Youth Live, a provincial ENVIRO-Depot 10 km away, where material is sorted for recycling. Recycling is then sent to the Municipal Recycling Facility (MURPH) in Bayers Lake, 15 km away. Paper is picked up by a local paper recycler. Cardboard is picked up by the local hauler for transport to the MURPH. At the AC campus, recyclables, paper and cardboards, are brought to the Colchester Materials Recovery Centre approximately 20 km from campus.

**Paper and Cardboard include:**
- Dry and clean paper (white or coloured)
- Newsprint
- Envelopes
- Glossy flyers and magazines
- Hardcover books (with covers removed)
- Paper egg cartons and drink trays
- Corrugated cardboard including pizza boxes (must be flattened and placed beside the paper bin)
- Boxboard (cereal boxes, pizza slice trays, etc.) (Truro only)

Not acceptable:
- Coffee cups
- Carbon paper
- Soiled paper
- Boxboard is in composting stream (Halifax only)

**Recyclable Materials include:**
- All beverage containers
- All plastic containers
- Glass bottles and containers
- Tin, steel and aluminum cans
- Tetra juice packs and mini sips
- Clean aluminum foil and plates
- All plastic bags
## Table 1: Summary Sheet from Material Categorization Guide

<table>
<thead>
<tr>
<th>Fibre</th>
<th>Metal</th>
<th>Universal waste</th>
<th>Composite &amp; miscellaneous materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>· Corrugated cardboard</td>
<td>· Iron / steel</td>
<td>· Fluorescent bulbs / lamps</td>
<td>· Textiles (such as clothing and blankets)</td>
</tr>
<tr>
<td>· Office paper</td>
<td>· Tin / steel cans</td>
<td>· Paint</td>
<td>· Bulky appliances &amp; non-regulated electronic devices</td>
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<tr>
<td>· Miscellaneous paper</td>
<td>· Aluminum</td>
<td>· Vehicle and equipment fluids</td>
<td>· Bulky furniture</td>
</tr>
<tr>
<td>· Other mixed / composite paper</td>
<td>· Aluminum cans</td>
<td>· Batteries (all types)</td>
<td>· Special care waste (bio-medical)</td>
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<tr>
<td></td>
<td>· Copper</td>
<td>· Consumer household hazardous wastes</td>
<td>· Disposable cups</td>
</tr>
<tr>
<td></td>
<td>· Other non-ferrous</td>
<td>· Small appliances</td>
<td>· Composite packaging</td>
</tr>
<tr>
<td></td>
<td>· Remainder / composite metal</td>
<td>· Regulated electronic goods</td>
<td>· Soiled plastic wrap and foil</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>· End-of-life products</td>
</tr>
<tr>
<td><strong>Organic</strong></td>
<td><strong>Construction and Demolition</strong></td>
<td><strong>Hazardous</strong></td>
<td>(Davidson &amp; Owen, 2011)</td>
</tr>
<tr>
<td>· Food</td>
<td>· Concrete</td>
<td>Class 1 – explosives</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Boxboard / soiled paper</td>
<td>Class 2 – gases</td>
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<td></td>
<td>· Agricultural crop residues</td>
<td>Class 3 – flammable and combustible liquids</td>
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<td></td>
<td>· Manures</td>
<td>Class 4 – flammable solids</td>
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<td></td>
<td>· Cooking oil / grease</td>
<td>Class 5 – oxidizing substances; organic peroxides</td>
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<td></td>
<td>· Leaf and yard waste</td>
<td>Class 6 – poisonous (toxic) and infectious</td>
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<tr>
<td></td>
<td>· Remainder / composite organic</td>
<td>Class 7 – radioactive materials</td>
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<td></td>
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<td>Class 8 – corrosives</td>
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</tr>
<tr>
<td><strong>Plastic: Containers, Bags and Products</strong></td>
<td><strong>Hazardous</strong></td>
<td>Class 9 – miscellaneous products, substances</td>
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</tr>
<tr>
<td>1. Polyethylene terephthalate</td>
<td>Class 1 – explosives</td>
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<td>2. High-density polyethylene</td>
<td>Class 2 – gases</td>
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<td>3. Poly (vinyl chloride)</td>
<td>Class 3 – flammable and combustible liquids</td>
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<td>4. Low-density polyethylene</td>
<td>Class 4 – flammable solids</td>
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<td>5. Polypropylene</td>
<td>Class 5 – oxidizing substances; organic peroxides</td>
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<td>6. Polystyrene</td>
<td>Class 6 – poisonous (toxic) and infectious</td>
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<td>7. Any combination of plastics 1 through 6</td>
<td>Class 7 – radioactive materials</td>
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<td><strong>Glass</strong></td>
<td><strong>Hazardous</strong></td>
<td><strong>Class 9 – miscellaneous products, substances</strong></td>
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<tr>
<td>· Glass bottles and containers (refundable)</td>
<td><strong>Class 1 – explosives</strong></td>
<td></td>
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<tr>
<td>· Glass bottles and containers (non-refundable)</td>
<td><strong>Class 2 – gases</strong></td>
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<td>· Remainder / composite glass</td>
<td><strong>Class 3 – flammable and combustible liquids</strong></td>
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*Davidson & Owen, 2011*
Not-acceptable materials are:

- Coffee cups
- Non-container plastics such as straws, plastic cutlery and DVD cases
- Styrofoam
- Broken glass

Organics

Organic material is collected daily by custodians from the four-bin systems found in hallways and meeting rooms.

In Halifax, organic material is picked up at the building by grounds staff (every day or every two depending on volume), brought to the warehouse, sorted to remove contaminants, and the remaining material is repacked into green carts. Green carts are picked up directly from Dalhousie kitchens (every couple of days) by a commercial hauler, once every couple of days to a week. Material is trucked to Ragged Lake compost facility (HRM composting facility) 15 km from the university. On the AC, compost is trucked to the Colchester Composting Facility, roughly 20 km for campus.

Landscape waste is picked up by a commercial hauler regularly throughout the year with peak season being summer and fall. At the AC, landscape waste; biomass plant ash; and manure are composted for use on agricultural fields.

Vegetable oil is picked up by a commercial hauler (every two-three months) at the Halifax campuses. The oil is used to make animal feed and soap.

Organic Waste includes:

- All food waste
- Kitchen paper towels and food napkins
- Paper bags
- Boxboards
- Paper plates
- Small amounts of landscape waste
- Paper fast-food wrapping
- Wax paper
- Soil, biomass ash, plant waste and manure at the AC

Garbage

Waste is collected in and outside everyday from Dalhousie buildings’ four bin systems. Custodians then bring the waste to the dumpster. A local hauler collects waste from the dumpster locations (every couple of days depending on volume) and brings the material to the landfill in HRM at Otter Lake landfill (municipal landfill), 30 km away and the Colchester Balefill approximately 20 km away.

Waste Materials Include:

- Coffee Cups
- Aerosol Cans
- Floor Sweepings
- Broken Glass
- Disposable Gloves
- Ceramics
- Potato Chip Bags and Candy Wrappers
- Styrofoam

Not-acceptable materials include:

- Organics
- Recyclables
- Paper
- Cardboard
Universal Waste:

- Florescent light bulbs and lamps are handled and disposed of by Facilities Management and/or external contractors.
- External contractors working at Dalhousie are required to show proof of recycling and proper disposal.
- As part of Nova Scotia’s Solid Waste Resource Management Regulations, paint is banned from disposal in provincial landfills. When consumers purchase paint, they pay a recycling fee to support the costs of collecting and processing unused paint. Left over paint should be returned to an ENVIRO-DEPOT facility.
- Battery boxes are placed throughout the Dalhousie campus. Material is sent to Call2 Recycle for battery recycling.
- On-Campus, Dalhousie employees request office related electronic waste be picked up for hard drive-destruction and then recycling through the ENVIRO-DEPOT facility.

Construction and Demolition Debris

For small internal jobs, staff coordinate materials for a local hauler to bring to the local C&D recycling site or bring material back to a C&D bin on campus. For larger jobs, external contractors are required to meet the 75% diversion outlined by HRM and for LEED projects. C&D material is often source separated further to ensure recycling efforts are beyond landfill cover.

Construction and Demolition Waste includes:

- Asphalt/brick/concrete
- Clean shingles/ Gravel roofing
- Clean and painted wood
- Vinyl/plastic
- Glass
- Insulation
- Drywall and ceiling tiles
- Scrap metal

Hazardous Waste

The University has a comprehensive Hazardous waste management program. Annual reports are available for the breakdown of all classes of hazardous waste by tonnage.

Hazardous Waste includes:

- Class 1: Explosives
- Class 2: Gases
- Class 3: Flammable and Combustible Liquids
- Class 4: Flammable Solids
- Class 5: Oxidizing Substances; Organic Peroxides
- Class 6: Poisonous (Toxic) and Infectious
- Class 7: Radioactive Material
- Class 8: Corrosives

Details on on-campus hazardous waste programs, are provided by the Environmental Health and Safety Office.
3.4 Waste Baseline Estimation

A number of data sets have been used to create an estimation of waste diversion from the landfill (Figure 6). For some streams like paper recycling, reliable and consistent weight data is available. For other streams such as garbage, weight data is not consistently provided. Waste audits, invoice data, and comparison to other institutions has been used to create a reasonable estimation using kgs as the metric. A particular focus area for the future is to secure accurate and reliable data to confirm estimates and track progress. Conservative estimations are 60% diversion from the landfill. Construction and demolition waste % does not include new construction. New construction has a high target over 75%+ of material from the landfill. Depending on the building site it can be tonnes of material recycled thus changing overall % numbers annually.
3.5 What We’ve Done

Positive Actions and Outcomes

In the last five years, a number of actions have been taken with regards to waste management planning and action. These include:

- Creation of a surplus goods process and website to facilitate the reuse of university goods on and off campus;
- Addition of sustainability criteria to the purchasing policy and promotion of sustainability purchasing tips;
- Adoption of no trays in dining halls which resulted in major organics waste reduction;
- Development of a Chemical Stores facility with some bulk solvent dispensing and recycling;
- Creating specific space waste bin guideline standards for solid waste. This included having new signage designed and protocols established;
- Creating and updating a Dalhousie specific What Goes Where Guide;
- Adding an electronic recycling program for employees;
- Creating waste auditing methodology and conducting a number of waste audits;
- Establishing a contract for waste vegetable oil recycling at the Halifax campuses;
- Conducting research on waste bin ratios, bin standards, laboratory opportunities, and construction and demolition diversion;
- Re-writing RFP and tender information for C&D work that requires material diversion and tracking;
- Working with municipal and RRFB solid waste educators to provide training for food services and custodial staff;
- Piloting new office bin protocol and system in Facilities Management;
- Deconstructing a campus house and comparing economic and environmental benefits versus regular C&D methods; and
- Producing a number of reports for the broader ICI community and the university which are available on the Office of Sustainability site.

Challenges

There are a number of challenges to waste reduction and diversion that need to be considered to improve waste management goals. The size, scope, and diversity of players at the university results in a number of products arriving on campus for many departments and specialized users. Dalhousie is a research-intensive university with hundreds of labs requiring specialized packaged products and the use of items such as disposable gloves and chemical wipes.

Each year thousands of new people come to campus from around the world. They are unfamiliar with the waste management systems and currently there is no dedicated waste educator resource on campus.

Tracking actual weights for different material streams has been challenging. Due to the current system, open dumpster
lend themselves to illegal dumping and all haulers are not providing accurate weights. A system also needs to be determining to accurately weighing for recyclables.

Waste management systems depend on the successful interaction and integration of a diverse range of activities, processes, equipment, and people. Many times when changes are made, they are added to an existing waste management system in a “bolt-on” approach (McDougall et al., 2001). This approach will often create additional costs resulting in greater environmental burdens and inefficiencies even if the materials are being processed in a more environmentally-friendly manner (Davidson & Owen, 2011). Presently the ratio of garbage bins to other bins is higher as recycling programs were added to existing waste programs and additional garbage bins were never removed. This leads to contamination. In some areas the waste bin standardization protocols need to be implemented.

4.0 UNIVERSITY ROLE

Dalhousie University has been dedicated to environmental sustainability in its operations and curriculum for over 30 years and focuses on supporting solutions that create positive social, ecological, and economic change through university operations. As an institution that is committed to sustainability, waste management is considered an important action area and broad targets are outlined in the University Sustainability Plan.

The Dalhousie University Solid Waste Management Plan is suitable for application in other large institutions and industries. Given the size of the University as well as the number of students and employees, the plan has been prepared to accommodate a large number of people spanning a vast expanse of property. The plan will be administered across the four Dalhousie campuses and will be used to educate employees and student body. This plan outlines Dalhousie’s commitment to solid waste management concepts and action.

5.0 GUIDING PRINCIPLE

Various waste management principles were considered in the development of this plan. The concept of zero-waste, cradle-to-cradle (close loop systems), and eco-efficiency were assessed. The concept of zero-waste is a goal that Dalhousie will ultimately strive to achieve; however, until zero-waste is more attainable, solid waste management will focus on managing the waste created. Partnering with nearby organizations for waste management and disposal requirements are an economically viable alternative for the University. The Four R’s have been chosen as guiding principles for waste management approaches.

The Four R’s: Rethink, Reduce, Reuse, and Recycle are hierarchical principles that guide the Dalhousie University Solid Waste Management Plan. In an institutional setting, products are most often used rather than created. A wide-range of products are consumed. Hundreds of people are involved in procurement and sorting materials. Each year there is a large turn-over of students. Large volumes of a variety of material streams are processed. The Four R’s provide the framework and flexibility for the University conditions (Davidson & Owen, 2011).

6.0 VISION

To achieve 70% waste diversion from the landfill by 2020 and reduce weight created per campus user.
7.0 GOALS, ACTION, TARGETS

To meet the university solid waste management vision key goals, objectives, actions and targets have been identified through university discussions and Dillion, 2014 (Table 2).

Table 2: Goals, Objectives, Actions, and Targets

<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
<th>Actions</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimize waste</td>
<td>Reduce the quantity of waste generated per capita (tonnage)</td>
<td>Work on centralized purchasing (standing offers) and distribution of key commodities to reduce waste (packaging, amounts, and product type) ex. Furniture, chemicals</td>
<td>Reduce Campus User disposal rate</td>
</tr>
<tr>
<td>generation</td>
<td></td>
<td>Promote waste management diversion and tracking clauses in contracts</td>
<td>(First step is to create accurate baseline of waste tonnage. Need enforcement of quantification requirements of collection contracts)</td>
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<td></td>
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<td>Explore user pay for external food contracts</td>
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<td>Conduct an input analysis of all material streams to compare to output tonnage to identify inefficiencies</td>
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<td>Eliminate illegal dumping on campus by modifying collection process and/or bins</td>
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<td>Rewards for reuse amongst departments</td>
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<td>Clarify and educate staff on sustainability consideration obligations when making purchasing decisions</td>
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<tr>
<td></td>
<td></td>
<td>Purchase items that can be easily reused or recycled</td>
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</table>
### Table 2 Continued

<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
<th>Actions</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>· Maximize reuse, composting, recycling and material recovery</td>
<td>· Decrease landfill waste (percentage)</td>
<td>· Create Design Guidelines, Request for Proposals (RFPs), and tender specifications with waste management criteria and requirements</td>
<td>· Divert solid, liquid and hazardous waste from landfills</td>
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<td></td>
<td>· Increase diversion rates for compostable and recyclable material (percentage)</td>
<td>· Implement Waste Bin Design Standards (2014) in all buildings. This will reduce single stand-alone bins, provide visual and language cues, create standardized brand and bins, reduce bags, and drive material to four-bin stations.</td>
<td>· 65% by 2016</td>
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<td>· Explore changing and enhancing collection and handling of on-campus streams. This includes bringing material back to a central location for value-added processing such as sorting of organics, compaction, weighing, and efficient one-site hauling.</td>
<td>· 70% between 2017 and 2020</td>
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<td>· Target education and monitoring efforts on key areas with high volume and contamination rates.</td>
<td>· 75% long-term diversion goal</td>
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<td>· Divert at least 75% C&amp;D materials from landfills</td>
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<tr>
<td>· Establish a waste management strategy that positively impacts human, environmental, and social health</td>
<td>· Invite community feedback and adapt waste management plans as required</td>
<td>· Create a waste management committee</td>
<td>· Waste diversion committee established (2015)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>· Ongoing engagement and participation of campus community</td>
<td>· Products and programs delivered (Annual report by committee)</td>
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<td></td>
<td></td>
<td>· Conduct staff training for key groups including custodial, grounds, health and safety, trades, and sustainability staff</td>
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<td></td>
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<td>· Information sharing</td>
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<td>· Communicate progress and explain efforts taken</td>
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### Table 2 Continued

<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
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<th>Targets</th>
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</thead>
<tbody>
<tr>
<td>- Become a regional leader in waste management</td>
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<td>- Develop educational programs</td>
<td>- Engage the community to increase awareness, meeting specific information needs, and fostering a sense of community commitment</td>
<td>- Implement ongoing campaigns, workshops, and other educational efforts to engage users</td>
<td>- Establish baseline reporting for 2014</td>
</tr>
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<td>- Support student research</td>
<td>- Go beyond compliance with regulations</td>
<td>- Provide additional resources on an ongoing basis for waste education and auditing</td>
<td>- Complete reporting in 2017</td>
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<td>- Establish a clear methodology to track ongoing diversion performance, consistent with an established quantifiable target</td>
<td>- Identify targets and track progress</td>
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<td>- Display stats-average amount of waste produced per person and set targets</td>
<td>- Perform yearly waste audits</td>
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<td>- Implement a methodology to track diverted/disposed waste quantity and cost data at Dalhousie campuses on an ongoing basis</td>
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<td>- Waste management website, social media, signage, recycling/waste management competitions – aiming to raise awareness of sustainability through acknowledging community members</td>
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<td></td>
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<td>- System for campus community to report wasteful practices</td>
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<td>- Continue research to identify problem areas and potential solutions.</td>
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8.0 EVALUATION

- Monitoring is an essential component to the continued success and growth of the plan. Monitoring also allows the expected impacts of the strategy to be measured against actual changes, and this can inform future revisions of the management plan. Evaluation and monitoring is typically conducted through use of waste characterization studies, bills, and weight tickets. Regular waste audits should be scheduled at least annually, but optimally at any time significant fluctuations in the waste stream are expected to occur throughout the year. The results from monitoring will allow for the calculation of diversion rates, waste reduction, participation, and costs. The information obtained from regular audits can then be used to inform a revised waste management strategy (CCME, 1996)

- A newly formed waste management committee will be responsible for creating an annual report that identifies progress made against the waste management plan goals and targets.

9.0 REFERENCES


Canadian Environmental Protection Act, 1999, SC 1999, c 33, canlii.ca/t/527px.


Environment Act, SNS 1994–95, c 1 canlii.ca/t/51zv1.

Environmental Goals and Sustainable Prosperity Act, SNS 2007, c 7 canlii.ca/t/5225x.


Municipal Government Act, SNS 1998, c 18, canlii.ca/t/523hb.


Solid Waste-Resource Management Regulations, NS Reg 25/96, canlii.ca/t/lczr.
[dx.doi.org/10.1016/j.resconrec.2004.02.001](dx.doi.org/10.1016/j.resconrec.2004.02.001)

*Transportation of Dangerous Goods Act, 1992, SC 1992, c 34, canlii.ca/t/kf5s.*
