



**Reclay StewardEdge**

Product Stewardship Solutions

Appendix # A

to

Report # WM2017-007

City of Kawartha Lakes

Construction and Demolition Diversion Feasibility Study

July 2017

PREPARED BY: Reclay StewardEdge Inc.





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## 1. Introduction

The City of Kawartha Lakes (“the City”) is a single-tier municipality in Central Ontario located about 90 minutes northeast of Toronto. It has a land area of 3,083 km<sup>2</sup>, which accounts for about 0.34% of the province’s land area. The area is comprised of over 250 lakes and rivers nestled within farmland and scenic vistas. There are 38,444 residential homes in the City, with a population of 75,423, or 0.56% of the population of Ontario. Kawartha Lakes is known for its natural beauty and year-round recreational opportunities including snowmobiling and lake activities. Therefore, many households are vacation homes.

The City has a Strategic Plan that puts a top priority on having a “Healthy Environment”. The City has also developed a sustainability plan, and is working to ensure that natural resources are conserved, pollution is minimized, and that growth decisions are made with sustainability in mind. To compliment this document an Integrated Waste Management Strategy (IWMS) titled ‘Making Waste Matter’ was approved in 2015. The IWMS outlines short term and long term waste management goals over a 32 year timeframe. Currently, the City provides a recycling program, a clear bag garbage collection program, and operates five open landfill sites. Residents and businesses that participate in the City’s curbside collection program must adhere to weekly set out limits. This level of service is covered by the tax base, however, if waste generators exceed their allotted limits then they are able to purchase bag tags for additional waste or alternatively take waste directly to a landfill where the waste is subject to tipping fees based on tonnage and/or volume. Thus, the City is encouraging waste reduction of municipal solid waste generated by the community.

As identified in the IWMS, the City’s plan is to divert construction and demolition (C&D) debris from landfill disposal. In most communities the quantity of C&D waste generated far exceeds the amount of municipal solid waste (MSW) generated. C&D materials can also be bulky in a landfill and are challenging to compact. Many materials generated through C&D activities can be recycled or turned into fuel if properly managed. For all of these reasons, C&D is an important material type to divert from disposal.

In addition, because C&D waste is not currently a designated waste material by the Province there are no producer funded mechanisms to aid in the management of the material type. Until such time as full producer responsibility designation, management of C&D materials through a diversion program by the City will be seen as a pro-active approach to extend the lifespan of the landfills although solely funded through municipal taxes.

### 1.1. Purpose of Study

The City hired Reclay StewardEdge (RSE), an environmental consultancy, to assess the feasibility of a C&D recycling program at one or more of the five operating landfill sites in the City through a request for quotation process (RFQ 2016-012: Investigation Option for a Construction & Demolition Waste Recycling Program).

Currently, there are no diversion programs in place in the City for C&D materials other than scrap metal and reuse facilities for furniture. There are five landfills located throughout the City – two of which (Fenelon and Lindsay Ops) experience significantly more traffic and volume and are centrally located to the higher-population areas of the City than the other landfills.

## 2. Methodology of Study

In order to assess the status of C&D activities in the City and the quantity of C&D waste material generated, Reclay StewardEdge conducted several activities, including:

- Consultations with surrounding jurisdictions to obtain information about other C&D recycling programs and policies in the region;
- Consultations with members of industry identified in the region;
- Review of historic waste quantities generated by City of Kawartha Lakes; and
- Visual landfill audits at each of the five operating landfills in the City to gain an understanding of the types and quantities of materials generated and the generator types.

In addition, the project team drew on its experience and expertise regarding the management of C&D waste materials to develop policies and strategies that the City could undertake in order to encourage generators of C&D waste to recycle their materials as opposed to landfilling them.

### 2.1. Consultations

A broad range of municipal and industry contacts were identified and an initial list was compiled by RSE. The collective list was provided to the City to seek any further additions and approval. Although the lists were extensive, RSE highlighted the key organizations that would be engaged in consultation. This was done on the basis of seeking to engage a range of organizations that represented municipalities, waste management industry and C&D waste processing sector. The final list of target contacts was agreed to in direct consultation with the City.

Tables 2 and 3 provide a list of the organizations consulted in each jurisdiction. However, it should be noted that organizations beyond those listed were invited to participate but may have declined to be included, or were unavailable at the time of consultation.

The range of organizations and individuals consulted included:

- Municipalities
- Transporters
- Material Processors
- End Markets
- City's Economic and Agricultural Development committee

The breadth of consultations was to ensure that the range of organizations spanning the C&D

waste management sector was covered, and that their engagement was sought. It should be acknowledged that the timeframe and resources available for the study meant that consultation was targeted to industry that has the potential to service the City. As well, contact was made with municipality's similar waste services and demographics. A broad range of stakeholders were consulted, although this does not represent an exhaustive list of all the individuals and organizations involved in the C&D waste management sector. The commentary seeks to clarify this when discussing various issues that are highlighted throughout the review.

The consultations were undertaken predominantly over the phone to discuss issues including:

- Material flows
- Pricing strategies
- Products and markets
- Incentives and programs
- Barriers and opportunities across all the aspects of the sector.

## 2.2. Waste Audit

The C&D waste audits were carried out at the City's five operating landfills: Lindsay Ops, Fenelon, Somerville, Eldon and Laxton. RSE's waste audit sub-contractor was based at the landfills during each site visit for the entire operating day. At the scalehouse, inbound loads of C&D waste materials were directed to the waste auditors positioned near the tipping face. As loads were audited, information such as scale ticket number, vehicle licence plate truck number, vehicle type, source of waste materials, and load dimensions were collected. A photograph was taken of each load after tipping. The net weight of each audited load was collected at the end of the day through a scale ticket printout provided by the City.

After each C&D waste materials load was tipped, an auditor did a walk around of the material pile and took photographs. During this time, a visual volumetric assessment of the material composition was completed. A list of material categories (Appendix A) was utilized for all sites. As inbound loads were visually audited, the percentage of materials by volume was recorded.

Following the completion of the field work, all collected data was entered electronically into excel based model which converted truck loads from volumetric composition to weight equivalents. This was completed using the net weights of each load, the size and fullness of each truck, and bulk density conversion factors (found in Appendix B) for each material type. The annual quantity of each material type received at the facilities was then calculated based on the results of the converted volume to weight equivalents and the provided annual total extrapolated weight of C&D waste disposed at each landfill from 2015.

The accuracy of each sample's bulk density conversion was calculated relative to the actual net weight of the load, as reported on the scale ticket. For example, if the bulk density conversion resulted in an estimated total weight of 1,000 kg for a particular sample, and the scale ticket indicated the load weight was 950 kg, then the accuracy for that sample was -5%. The combined



aggregate bulk density accuracy of all loads was also calculated, and was found to be within 6.7%. This variance is not unexpected and supports the observation of significant variance in material composition between loads (in particular mixed loads), which adds complexity in the audit of the loads.



**Drywall Load – Lindsay Ops**



**Wood Waste Load – Fenelon**



**Mixed C&D Load – Lindsay Ops**



**Mixed C&D Load – Fenelon**

### 3. Consultation Findings

Consultation findings revealed that the external infrastructure within Ontario for C&D waste processing is still in development, with four facilities identified as accepting mixed C&D waste loads. Mixed C&D waste is comprised of varying C&D wastes including wood, drywall, aggregates, glass, metals, and shingles. Most of these facilities rely on manual sorting, screens and magnets to sort the mixed loads of C&D waste into separated streams. Through the consultations, it was revealed that beneficial outlets exist for several types of C&D waste materials. However, many municipalities consulted (and industrial contacts as well) indicated that markets for most materials remain at a regional or local level. Table 1 provides a summary overview of C&D waste markets by material type.



**Table 1: Summary of C&D Waste Markets by Material Type**

<b>Material Type</b>	<b>Infrastructure/Markets</b>	<b>Cost/Revenues</b>
<b>Mixed C&amp;D</b>	<ul style="list-style-type: none"> <li>Emerging infrastructure with four known facilities that accept strictly mixed C&amp;D waste loads.</li> </ul>	<ul style="list-style-type: none"> <li>Net costs are volume driven. Markets are not strong, and get by on processing fees.</li> </ul>
<b>Concrete/Rubble</b>	<ul style="list-style-type: none"> <li>Recycled for use in road construction. Some material used for municipal projects.</li> </ul>	<ul style="list-style-type: none"> <li>End markets do not pay for material, but may pay for transport. Costly for service providers to mobilize equipment to crush material on site for municipal use (one program mentioned \$100K), however only needs to be done once every several years. This may be an attractive option provided that enough material is generated and the availability of storage.</li> </ul>
<b>Wood</b>	<ul style="list-style-type: none"> <li>Untreated wood is ground and used as a fuel locally.</li> <li>Limited market for treated/painted wood. Material is ground and used for fill in roadbeds. Some service providers will use mobile equipment and process material on site.</li> </ul>	<ul style="list-style-type: none"> <li>Most markets do not pay for material, but may pay for transportation of clean wood. Costs are dependent on location of market in relation to generation source.</li> <li>Wood market has declined in recent months.</li> </ul>
<b>Drywall</b>	<ul style="list-style-type: none"> <li>Gypsum recovered and shipped to drywall manufacturers.</li> <li>Paper backing used in animal bedding.</li> <li>Crushed and fine drywall can be used as a soil amendment material.</li> </ul>	<ul style="list-style-type: none"> <li>Gypsum – Most markets do not pay for material, but transportation costs may be covered.</li> </ul>
<b>Asphalt Shingles</b>	<ul style="list-style-type: none"> <li>Ground asphalt shingles are used internally by the municipality in road works. Municipalities stockpile/fill trailers until full load.</li> </ul>	<ul style="list-style-type: none"> <li>Most markets do not pay for material, but pay for transport/to spot trailer.</li> <li>Grinding shingles provides enhanced marketability. However, grinder to process is relatively costly, which may be a barrier to enter the market. Capital cost of a grinder as noted by one municipality consulted was \$750,000.</li> </ul>
<b>Scrap Metal</b>	<ul style="list-style-type: none"> <li>Scrap metal has strong markets.</li> </ul>	<ul style="list-style-type: none"> <li>The only material with positive revenues. Most municipalities accept at no fee.</li> <li>City currently has a scrap metal diversion program.</li> </ul>
<b>Other C&amp;D Materials</b>	<ul style="list-style-type: none"> <li>Some reuse for cabinets, fixtures through Habitat for Humanity.</li> </ul>	<ul style="list-style-type: none"> <li>Revenue opportunities are low, this is essentially a reuse opportunity.</li> </ul>

### 3.1. Municipal Consultations

RSE conducted consultations with ten local municipal jurisdictions in Ontario to identify the C&D materials they accept for recycling, how much material is diverted annually, and how they operate and fund their programs. Three of the ten jurisdictions accept mixed C&D materials for recycling. Table 2 below provides a summary of the C&D materials accepted, and tip fees charged for various material types. The City currently accepts C&D materials for disposal at \$100/MT, the same rate charged for garbage.

As Table 2 indicates, several jurisdictions accept scrap metal, a positive revenue material, at no fee. Durham Region, accepts porcelain and drywall from residential generators at no fee, and Oxford County accepts cardboard, not a C&D material, but prevalent in C&D, at no fee. Several communities, including the City, charge an extra high tip fee (e.g., double that of the fee for garbage) for “mixed loads” – those containing a specified or unwanted quantity of recyclable/compostable diversion materials mixed in the waste load. This is to serve as a deterrent for not separating materials for recycling/composting. Muskoka District charges different rates for some materials based on the quantity delivered, as well as the generator type (residential or commercial).

C&D programs are essentially all drop-off (i.e., materials must be delivered to the landfill or transfer station). One exception is that porcelain items in some communities in Durham Region are collected curbside, by appointment only. Most drop-off programs are serviced by City staff with private haulers collecting some materials and transporting them to processing facilities. Most municipalities only receive revenues for scrap metal, though one (Simcoe County) indicated that they receive revenues for asphalt shingles. Most communities, when implementing their C&D programs, first began with a pilot program to better understand the quantities that they could expect to be generated, and the issues they might face. Some communities indicate that they did not start as a pilot but wished they had. Most communities rely on tip fees to fully or partially fund their program, but many also use taxes.

A detailed table of the municipal C&D programs and their response is provided in Appendix C.



Table 2: Municipal Consultation

Municipality	Materials Accepted for Recycling						General Tip Fees Charged in Metric Tonnes (MT)
	Dry-wall	Wood	Scrap Metal	Asphalt Shingles	Concrete	Asphalt	Mixed C&D
County of Northumberland	✓		✓				<ul style="list-style-type: none"> <li>Mixed Loads \$115/MT</li> <li>Drywall \$85/MT</li> </ul>
City of Barrie	✓			✓			<ul style="list-style-type: none"> <li>Garbage, non-recyclable C&amp;D \$142/MT</li> <li>Mixed Loads with 10% or more recyclable, compostable, \$262.50/MT</li> </ul>
City of Orillia	✓	✓	✓	✓	✓	✓	<ul style="list-style-type: none"> <li>Mixed Loads with &gt; 10% Recyclable \$310/MT</li> <li>Garbage, C&amp;D Wood, \$155/MT</li> <li>Concrete/Asphalt \$80/MT</li> <li>Drywall \$110/MT</li> <li>Shingles \$130/MT</li> </ul>
County of Simcoe	✓	✓		✓			<ul style="list-style-type: none"> <li>Mixed Waste \$310/MT</li> <li>Carpet, Window Glass, Pressure Treated Wood \$155/MT</li> <li>Asphalt Shingles, Drywall, \$75/MT</li> <li>Clean Wood \$75/MT</li> </ul>
Haldimand County	✓	✓	✓	✓			<ul style="list-style-type: none"> <li>Garbage/Waste \$121/MT</li> </ul>
Muskoka County		✓		✓			<ul style="list-style-type: none"> <li>Shingles \$157-\$163/MT</li> <li>Clean Wood \$67/MT</li> <li>Unclean Wood \$133-\$157/MT</li> </ul>



Municipality	Materials Accepted for Recycling						General Tip Fees Charged in Metric Tonnes (MT)
	Dry-wall	Wood	Scrap Metal	Asphalt Shingles	Concrete	Asphalt	
							<ul style="list-style-type: none"> <li>• Other Waste \$133-157/MT</li> </ul>
Oxford County			✓	✓			<ul style="list-style-type: none"> <li>• C&amp;D Materials \$71.40/MT</li> <li>• Garbage \$68.89/MT</li> </ul>
York Region	✓	✓	✓		✓		<ul style="list-style-type: none"> <li>• Garbage, Concrete \$100/MT</li> </ul>
Durham Region	✓	✓	✓				<ul style="list-style-type: none"> <li>• Garbage \$125/MT</li> <li>• Porcelain, Drywall \$125/MT</li> </ul>
City of Peterborough	✓	✓		✓			<ul style="list-style-type: none"> <li>• Shingles, Construction Material, Drywall \$95/MT</li> <li>• Cardboard \$45/MT</li> <li>• Asbestos \$200/MT</li> </ul>

### 3.2. Industry Consultations

RSE conducted consultations and other research with ten industry representatives. While industrial stakeholders identified do not represent an exhaustive listing, a summary of information obtained about their operations is provided in Table 3. Note that costs charged by private service providers will vary according to market factors and logistics, particularly distance hauled or driven to process material on site.

A more detailed table of the industry C&D programs and their response is provided in Appendix D.

Table 3: Industry Consultations

Company	Role			Materials Accepted						Notes
	Trans- porter	Processor	End Market	Drywall	Wood	Scrap Metal	Asphalt Shingles	Aggregate	Mixed C&D	
New West Gypsum Oakville, ON		✓		✓						Only receive drywall. Gypsum at the plant is separated from paper and sent back to wallboard manufacturer.
Try Recycling London, ON Arva, ON	✓	✓		✓	✓	✓	✓	✓	✓	Material travels down a sorting line, (screen, magnets, and then manually sorted). Currently very labour intensive, but looking at new options.
Countrywide Recycling Mount Hope, ON	✓	✓		✓	✓	✓	✓	✓	✓	Material pre-sorted on floor. Excavator feeds onto different conveyors. System automatically sorts smaller and larger material (12"). Material fed to a manual sort room.
Habitat for Humanity Lindsay, ON		✓	✓	✓		✓				For resale at local store. General C&D materials from renovations (cabinets, fixtures, etc.)
M+M Disposal Lakefield, ON	✓	✓			✓	✓	✓	✓	✓	Material placed on conveyor, screened, (2"). Fines used as landfill cover. Larger material continues on manual sort line, positively sorted.



Company	Role			Materials Accepted						Notes
	Transporter	Processor	End Market	Drywall	Wood	Scrap Metal	Asphalt Shingles	Aggregate	Mixed C&D	
Simtor Environmental/ Durham Disposal Whitby, ON	✓	✓	✓		✓	✓	✓	✓	✓	Tipped onto sort floor for manual sort. Have a new Untreated wood chipped onsite chipping (new chipper).
LaFarge Lindsay, Kirkfield, ON		✓	✓							Recycler and end user of aggregate material. Typically not involved in municipal waste management contracts.
Ken Redmond Little Britain, ON	✓									Hauler of materials, does not process.
Walker Environmental Niagara Falls, ON		✓			✓		✓			Grind wood, shingles under contract with municipalities. They have mobile equipment to provide service on site.
Ecowood Products Concord, ON		✓	✓		✓					Grind clean wood for mulch and fuel.

## 4. Policies and Programs that Can Support C&D Recycling

There are several programs and policies that communities can implement that encourage and/or mandate the recycling of certain C&D materials. For example, it is vital that markets or beneficial uses diverted materials exists and are encouraged. Also, generators must be made aware of opportunities to recycle materials and the proper way to prepare materials (e.g., to separate clean wood from painted/treated wood, etc.). These policies and programs are meant to compliment an existing C&D recycling program and are secondary to overall project objectives. Some jurisdictions in Ontario with which RSE consulted have implemented certain policies and programs (or program features) to encourage the recovery of C&D. They include:

- **Charging a lower tip fee for recyclable materials** – Many communities in the region will accept recyclable C&D materials at a lower rate than garbage. (e.g. County of Northumberland, County of Simcoe, Muskoka District, York Region)
- **Banning the disposal of certain C&D materials** – No communities in Ontario are known to have implemented such a policy.
- **Requiring certain C&D materials to be recycled** -- Oxford County, through Bylaw requires the recycling of certain C&D materials, including scrap metal, corrugated cardboard, wood and pallets, and construction wastes (by definition, includes any discarded building material, resulting from the erection, demolition, repair, removal or improvement of any building, structure or property, including, but not limited to, concrete, stones, earth from excavations or grading, shingles, lumber, plaster, sawdust and shavings.). A significant fine (double the tip fee for the first violation, three times the tip fee for the second violation, and five times the tip fee for the third violation) is imposed for loads that are in violation.
- **Developing beneficial uses for materials locally** – Some jurisdictions grind rubble/concrete, asphalt shingles and wood for beneficial use in landfill or municipal projects. Processing can be achieved through purchasing equipment (often a cost prohibitive option) or hiring processors with mobile equipment.

Table 4 below provides a broad summary of these policies and others that can be used to encourage the recycling of C&D. A more detailed table further describing potential policy nuances is provided in Appendix E.



**Table 4: C&D Recycling Policies and Mechanisms**

<b>Policy/Program</b>	<b>Potential Nuances</b>	<b>Strength of Approach</b>	<b>Drawbacks of Approach</b>	<b>Diversion Impact</b>
Ban disposal of certain materials	<ul style="list-style-type: none"> <li>By material type</li> </ul>	<ul style="list-style-type: none"> <li>Can implement by material as markets develop</li> </ul>	<ul style="list-style-type: none"> <li>Must be enforced</li> </ul>	<ul style="list-style-type: none"> <li>High – C&amp;D materials otherwise landfilled would be diverted. Overall impact is dependent on material type banned</li> </ul>
Require recycling of C&D materials	<ul style="list-style-type: none"> <li>Can be by material type</li> <li>Can be by project size/value</li> <li>Can be by generator type (e.g., municipal projects)</li> <li>Can be by overall weight percentage)</li> <li>Require haulers to deliver material to mixed C&amp;D processing facility</li> </ul>	<ul style="list-style-type: none"> <li>Can implement by material as markets developed</li> <li>Can fast track or provide partial or full permit application rebate to incentivize higher rates.</li> </ul>	<ul style="list-style-type: none"> <li>Must be enforced</li> <li>May not be seen as politically palatable</li> <li>Some options require hauler licensing</li> </ul>	<ul style="list-style-type: none"> <li>Medium – diversion impact is dependent on the material types that would require recycling</li> </ul>
Require recycling plan	<ul style="list-style-type: none"> <li>Can be paired with other policies</li> <li>Can apply to projects of certain size/value</li> <li>Can be by generator type (e.g., municipal projects)</li> </ul>	<ul style="list-style-type: none"> <li>Forces generator to consider markets</li> </ul>	<ul style="list-style-type: none"> <li>Requires staff time</li> <li>May not be seen as politically palatable</li> </ul>	<ul style="list-style-type: none"> <li>Low – scope and scale of recycling plan is highly variable and may be insufficient to force generator to avoid landfill</li> </ul>
Charge lower tip fee for recyclable materials	<ul style="list-style-type: none"> <li>By material type</li> </ul>	<ul style="list-style-type: none"> <li>Can implement by material as markets develop</li> <li>Provides financial incentive</li> </ul>	<ul style="list-style-type: none"> <li>May result in lower revenues overall to facility</li> </ul>	<ul style="list-style-type: none"> <li>Low to medium – diversion impact dependent on material type in question and willingness of generators to recycle</li> </ul>



<b>Policy/Program</b>	<b>Potential Nuances</b>	<b>Strength of Approach</b>	<b>Drawbacks of Approach</b>	<b>Diversion Impact</b>
Provide additional opportunities to recycle materials	<ul style="list-style-type: none"> <li>• By material type</li> <li>• By additional site</li> <li>• Curbside</li> </ul>	<ul style="list-style-type: none"> <li>• Can expand as markets develop</li> <li>• Convenience may expand participation</li> </ul>	<ul style="list-style-type: none"> <li>• Can become costly, particularly where markets are not lucrative</li> </ul>	<ul style="list-style-type: none"> <li>• Low to high – dependent on material type examined and supported through market development</li> </ul>
Education and outreach	<ul style="list-style-type: none"> <li>• Signs, website, recycling guide</li> <li>• Education for developers on best practices for managing materials</li> <li>• Recognition program for developers that recover a high percentage</li> </ul>	<ul style="list-style-type: none"> <li>• Relatively low cost</li> <li>• Seen as a service to generators</li> </ul>	<ul style="list-style-type: none"> <li>• May not have much influence unless paired with other options</li> </ul>	<ul style="list-style-type: none"> <li>• Low – limited diversion impact on its own</li> </ul>
Grants, Studies, other Municipal Benefits	<ul style="list-style-type: none"> <li>• Provide grants for equipment, pilot program</li> <li>• Conduct beneficial reuse study/develop markets</li> <li>• Relax certain permit requirements (e.g., roll-off placement on sidewalk) to encourage recycling</li> </ul>	<ul style="list-style-type: none"> <li>• Provides an opportunity for innovation</li> <li>• City seen as partner</li> </ul>	<ul style="list-style-type: none"> <li>• Can be costly</li> </ul>	<ul style="list-style-type: none"> <li>• Low – medium – dependent on scope and support provided</li> </ul>

## 5. Results and Data Analysis

This section of the report seeks to characterize the overall C&D waste stream for all five landfill sites based on the audits carried out and the savings that may be achieved at Fenelon and Lindsay Ops through a diversion program.

### 5.1. Landfill Audits

A total of 236 sample loads were characterized to produce the composition estimates in this section. A summary of the site visits and number of C&D waste loads audited at the five landfills is displayed in Table 5.

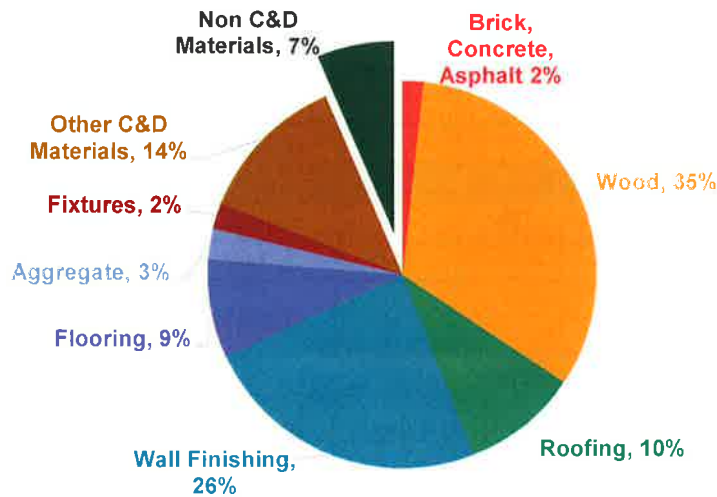
**Table 5: Landfill C&D Loads Audited by Site**

Landfill	Site Visits	Loads Audited
Lindsay Ops	7	107
Fenelon	5	89
Somerville	3	19
Eldon	3	17
Laxton	3	4
<b>Total</b>	<b>21</b>	<b>236</b>

Table 6 and Figure 1 below illustrate composition estimates of the overall C&D waste stream received at City landfills. Approximately 93% of the stream was estimated to be C&D waste materials. The largest recoverable category was wood waste, which made up about 35%. Wall finishing, which includes items such as drywall, ceiling tiles, and insulation, accounted for about 26%. Other C&D materials which include glass and metals made up 14% of the C&D stream. The roofing material category (which includes shingles) made up 10% of the stream. The composition results generated through this study are consistent with results obtained from a September 2012 study.



Figure 1: Composition of the C&D Waste Stream



The colour coding in the table 6 below relates to ranking which indicates

- Red, a high percentage of the material type in the stream and high number of loads audited that contained the material type;
- Green, with the least amount of the material in the stream and number of loads; and
- Orange, is a presence within the mid-range.

Table 6: C&D Waste Loads Audit Results (February/ March 2017)

	Somerville (kg)	Lindsay Ops (kg)	Fenelon (kg)	Eldon (kg)	Laxton (kg)	Total (kg)	Composi tion (%)	Count
Total Audited Weight (kg)	11,400	103,180	70,946	4,750	710	190,986	100%	
<b>Brick, Concrete, Asphalt</b>								
Bricks	146	193	302	-	-	641	0.3%	6
Concrete	553	1,063	753	-	-	2,369	1.2%	16
Concrete with metal	-	523	-	-	-	523	0.3%	1
<b>Wood</b>								
Dimensional Lumber – Untreated	808	15,556	12,319	1,134	117	29,934	15.6%	168
Dimensional Lumber -	756	14,723	5,614	721	60	21,875	11.4%	108

	Somerville (kg)	Lindsay Ops (kg)	Fenelon (kg)	Eldon (kg)	Laxton (kg)	Total (kg)	Composi tion (%)	Count
Treated/Paint ed								
Composite (e.g. particle board)	1,519	5,453	3,587	124	-	10,683	5.6%	65
Pallets	-	1,683	2,699	-	-	4,381	2.3%	26
<b>Roofing</b>								
Shingles	110	9,038	5,967	291	-	15,405	8.1%	33
Tarpaper	11	508	726	-	-	1,246	0.7%	17
Other roofing material	-	2,649	311	-	-	2,960	1.6%	4
<b>Wall Finishing</b>								
Drywall	4,445	22,740	13,988	1,570	416	43,159	22.5%	132
Compound	1	-	46	11	5	64	0.0%	7
Stucco Wall Finishing	-	91	181	-	-	272	0.1%	2
Ceiling Tiles	437	3,746	159	-	-	4,341	2.3%	16
Insulation	148	469	742	71	2	1,433	0.7%	125
<b>Flooring</b>								
Floor Tiles	247	914	273	300	48	1,782	0.9%	30
Carpet	114	3,244	1,688	195	-	5,241	2.7%	54
Under Padding	23	1,267	663	131	-	2,085	1.1%	27
Linoleum	260	1,092	319	198	119	1,988	1.0%	32
Wood Flooring	-	1,939	3,483	249	-	5,671	3.0%	16
<b>Aggregate</b>								
Rock and Gravel	-	2,915	69	-	-	2,984	1.6%	3
Dirt and Sand	-	1,703	606	-	-	2,309	1.2%	2
<b>Fixtures</b>								
Vanities and Countertops	114	864	133	35	242	1,389	0.7%	15
Cabinets	-	91	1,547	6	133	1,777	0.9%	14
Ceramic Fixtures	21	728	588	114	-	1,452	0.7%	23
<b>Other C&amp;D Materials</b>								

	Somerville (kg)	Lindsay Ops (kg)	Fenelon (kg)	Eldon (kg)	Laxton (kg)	Total (kg)	Composi tion (%)	Count
Electrical	53	514	127	39	-	734	0.4%	24
Metals	893	3,989	7,470	195	-	12,547	6.3%	98
Glass	1,476	4,650	3,608	363	242	10,339	5.4%	35
Plastic	89	1,229	1,259	32	6	2,615	1.4%	149
<b>Non C&amp;D Materials</b>								
OCC (cardboard)	135	704	319	18	2	1,178	0.6%	117
Blue Box Recyclables	159	779	592	75	-	1,605	0.8%	93
HHW	48	131	175	-	-	354	0.2%	7
Furniture	88	1,264	1,065	-	24	2,442	1.3%	29
Bulky Plastic	45	533	587	36	-	1,201	0.6%	82
Organic Waste	306	422	617	25	-	1,369	0.7%	20
Appliances	63	163	196	-	-	422	0.2%	15
Other	281	2,829	1,075	291	34	4,509	2.3%	156

## 5.2. Extrapolated Figures

Using 2015<sup>1</sup> total waste to landfill actuals provided by the City and 2017 audit data, RSE was able to extrapolate the C&D portion from the total waste category. For example, of the 1,302 tonnes reported by the City that was landfilled at Eldon, 669 tonnes is estimated to be C&D waste based on this study. In total for all sites, approximately 38% of the waste stream is estimated to be C&D waste materials (see Table 7).

**Table 7: Landfilled Actual Totals and Estimated C&D Waste for 2015 (Metric Tonnes- MT)**

Landfill	Total Waste to Landfill (MT)	C&D Waste to Landfill (MT) <sup>2</sup>	C&D Portion (%)
Eldon	1,302	669	51.4%
Laxton	2,582	898	34.8%
Fenelon	6,806	2,770	40.7%
Lindsay Ops	29,152	10,624	36.4%
Somerville	1,960	884	45.1%
<b>Total</b>	<b>41,802</b>	<b>15,846</b>	<b>37.9%</b>

<sup>1</sup> At the time of this analysis, total 2016 actuals were not available.

<sup>2</sup> Extrapolated using 2017 audit data and 2015 tonnage actuals.

Table 8 below provides a breakdown of the 15,846 tonnes of C&D waste stream generated at the five landfill sites based on recent audits. Using drywall as an example, 2,393 tonnes are generated annually at Lindsay Ops, with an additional 624 tonnes generated at Fenelon.

**Table 8: Annual Estimated Generation C&D Waste Materials (MT) per Site**

	Somerville (MT)	Lindsay Ops (MT)	Fenelon (MT)	Eldon (MT)	Laxton (MT)	Total (MT)
<b>Total C&amp;D Waste (MT)</b>	<b>884</b>	<b>10,624</b>	<b>2,770</b>	<b>669</b>	<b>898</b>	<b>15,846</b>
<b>Brick, Concrete, Asphalt</b>						
Bricks	3	36	9	2	3	53
Concrete	11	132	34	8	11	197
Concrete with metal	2	29	8	2	2	43
<b>Wood</b>						
Dimensional Lumber - Untreated	138	1,661	433	105	140	2,477
Dimensional Lumber - Treated/Painted	101	1,208	315	76	102	1,802
Composite (e.g. particle board)	49	593	155	37	50	884
Pallets	20	244	64	15	21	364
<b>Roofing</b>						
Shingles	71	857	224	54	73	1,279
Tarpaper	6	69	18	4	6	103
Other roofing material	14	165	43	10	14	246
<b>Wall Finishing</b>						
Drywall	199	2,393	624	151	202	3,569
Compound	0	4	1	0	0	5
Stucco Wall Finishing	1	15	4	1	1	23
Ceiling Tiles	20	242	63	15	20	360
Insulation	6	77	20	5	6	115
<b>Flooring</b>						
Floor Tiles	8	99	26	6	8	148
Carpet	24	286	75	18	24	427
Under Padding	10	116	30	7	10	172
Linoleum	9	110	29	7	9	164
Wood Flooring	26	316	82	20	27	471
<b>Aggregate</b>						
Rock and Gravel	14	166	43	10	14	248
Dirt and Sand	11	128	34	8	11	192

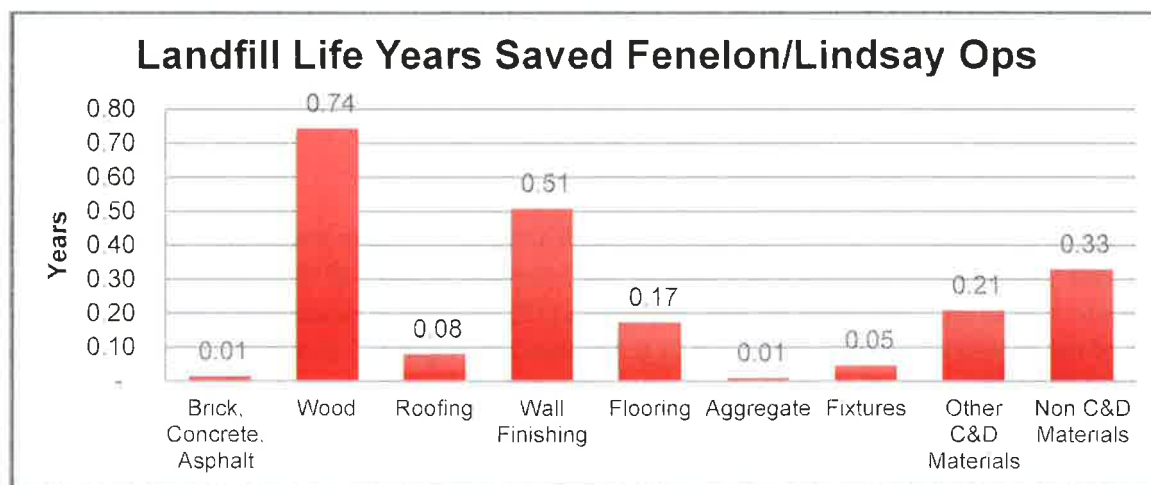
	Somerville (MT)	Lindsay Ops (MT)	Fenelon (MT)	Eldon (MT)	Laxton (MT)	Total (MT)
<b>Fixtures</b>						
<b>Vanities and Countertops</b>	6	77	20	5	7	115
<b>Cabinets</b>	8	91	24	6	8	136
<b>Ceramic Fixtures</b>	6	78	20	5	7	116
<b>Other C&amp;D Materials</b>						
<b>Electrical</b>	3	40	11	3	3	60
<b>Metals</b>	56	674	176	42	57	1,006
<b>Glass</b>	48	575	150	36	49	858
<b>Plastic</b>	12	144	38	9	12	215
<b>Non C&amp;D Materials</b>						
<b>OCC (cardboard)</b>	5	64	17	4	5	96
<b>Blue Box Recyclables</b>	7	89	23	6	8	132
<b>HHW</b>	2	20	5	1	2	29
<b>Furniture</b>	11	136	35	9	11	203
<b>Bulky Plastic</b>	6	67	17	4	6	99
<b>Organic Waste</b>	6	76	20	5	6	114
<b>Appliances</b>	2	24	6	1	2	35
<b>Other</b>	21	249	65	16	21	372

### 5.3. Savings at Landfill

Table 9 below calculates the annual savings of landfill airspace, lifespan and costs if all amounts of certain C&D materials are diverted from landfill. For example, if 100% of the currently landfilled wood waste is diverted from Fenelon and Lindsay Ops, 31,697 m<sup>3</sup> of airspace would be saved, lifespan of the landfills would be extended by 0.74 years (see Figure 2) and with a landfill cost savings of \$828,049.

**Table 9: Landfill Life and Cost Savings Through Diversion**

Items	Total			Fenelon		Lindsay Ops	
	Airspace Saved (m3)	Years Saved	Cost Savings	Airspace Saved (m3)	Years Saved	Airspace Saved (m3)	Years Saved
Brick, Concrete, Asphalt	585	0.01	\$44,003	121	0.003	464	0.01
Wood	31,697	0.74	\$828,949	6,555	0.15	25,142	0.59
Roofing	3,379	0.08	\$244,200	699	0.02	2,680	0.06
Wall Finishing	21,679	0.51	\$610,769	4,484	0.11	17,196	0.40
Flooring	7,350	0.17	\$207,243	1,520	0.04	5,830	0.14
Aggregate	395	0.01	\$65,900	82	0.00	313	0.01
Fixtures	1,951	0.05	\$55,166	403	0.01	1,547	0.04
Other C&D Materials	8,867	0.21	\$320,963	1,834	0.04	7,033	0.16
Non C&D Materials	14,020	0.33	\$162,066	2,900	0.07	11,121	0.26
<b>Total</b>	<b>89,924</b>	<b>2.11</b>	<b>\$2,539,260</b>	<b>18,598</b>	<b>0.44</b>	<b>71,326</b>	<b>1.67</b>



**Figure 2: Landfill Life Years Saved Through C&D Diversion at Fenelon and Lindsay Ops**

## 6. Recommendations

The combination of consultations and landfill audits reveal the potential for the cost-effective operation of a C&D recycling program in the City. Consultations with industry identified market potential for specific C&D materials, and consultations with the municipalities revealed that a C&D diversion program can be implemented to be a cost effective means of reducing the amount of material landfilled.



## 6.1. Establish a Pilot C&D Materials Recycling Program

Based on audit results, Fenelon and Lindsay Ops landfills are the only recommended locations for a one year pilot C&D recycling program. After the one year, the success of the program should be evaluated. If successful, program can be made permanent and potentially expanded to the more rural landfill sites. The C&D materials that currently have a market<sup>3</sup> and that can be diverted are:

- Mixed C&D Waste (including wood, drywall, aggregates, glass, metals and shingles)
- Drywall
- Wood Waste

The amount of available drywall, wood waste and mixed C&D waste at Fenelon and Lindsay Ops is outlined in Table 10. However, it is not expected that if a C&D diversion program is implemented that the entire amounts will be captured. For example, if drywall is collected through a segregated stream it is not likely that generators will separate the drywall from a mixed load. Instead, the likely users of the program will be the generators with homogenous loads of drywall.

**Table 10: Annual C&D Waste Generation at Fenelon and Lindsay Ops**

Material Type	Fenelon (MT)	Lindsay Ops (MT)
<b>Drywall</b>	624	2,393
<b>Wood Waste</b>	966	3,705
<b>Mixed C&amp;D Waste</b>	2,770	10,624

Accordingly, and as outlined in Table 11, it is estimated that based on results from other municipalities that 5 to 10% of drywall and wood waste can be recovered through a source separated diversion program. For drywall this translates to a total of 151 and 302 MT. For wood waste, total amount for both sites is 234 and 467 MT. Mixed C&D waste because it does not require source separation by the generator will see greater uptake with an estimated 20% recovery rate. This translates to a total of 2,679 MT.

**Table 11: Potential Amount of C&D Waste to be Diverted**

Material Type	Fenelon (MT)			Lindsay Ops (MT)			Total (MT)		
	5%	10%	20%	5%	10%	20%	5%	10%	20%
<b>Drywall</b>	31	62	-	120	239	-	151	302	-
<b>Wood Waste</b>	48	97	-	185	371	-	234	467	-
<b>Mixed C&amp;D Waste<sup>4</sup></b>	-	277	554	-	1,062	2,125	-	1,339	2,679

<sup>3</sup> Source separation for other C&D materials such as shingles, glass, carpet are not currently recommended. Limited market outlets exists for the materials.

<sup>4</sup> These figures represent the total tonnes diverted through a mixed C&D waste collection only. It is not recommended to collect drywall and wood waste separately, as well as mixed C&D waste at the same time. The City must elect either to collect drywall and wood waste separately, or collected mixed C&D waste.

Through a scenario analysis, Table 12 below highlights the amount of landfill airspace, lifespan in years and costs saved through a C&D diversion program of drywall and wood waste or mixed waste at both Fenelon and Lindsay Ops landfills. For example, if 10% of the generated drywall and wood waste is diverted, this would result in a savings of 5,338 m<sup>3</sup> in landfill airspace, 0.125 years in landfill life and \$115,318 in landfill costs. For mixed waste, if 20% is diverted, this would result in a savings of 17,985 m<sup>3</sup> in landfill airspace, 0.42 years in landfill life and \$401,831 in landfill costs. The landfill airspace cost has been valued at \$150/tonne which was determined to be an industry standard. It is an all-encompassing cost that includes the capital costs, operating costs as the landfill is open, and maintenance cost during operation and after closure. This cost also includes all approvals, planning, EA, CofAs and miscellaneous costs.

**Table 12: Annual Savings at Landfill from Diversion**

	Airspace (m3) Saved			Years Saved			Cost (\$) Saved		
	5%	10%	20%	5%	10%	20%	5%	10%	20%
<b>Drywall</b>	1,084	2,168	-	0.025	0.051	-	\$22,625	\$45,250	-
<b>Wood Waste</b>	1,585	3,170	-	0.037	0.074	-	\$35,034	\$70,068	-
<b>Mixed Waste</b>	-	8,992	17,985	-	0.21	0.42	-	\$200,916	\$401,831
<b>Drywall &amp; Wood Waste Only</b>	2,669	5,338		0.063	0.125		\$57,659		

Through an additional scenario analysis, Table 13 outlines the costs to process the amount of C&D materials that could be reasonably diverted from Fenelon and Lindsay Ops landfills. For example, if the cost to collect, transport and recycle one tonne of drywall is at \$80 (based on a competitive process, see section 6.2 below), this translates to an annual cost of \$12,067 at 5% recovery or \$24,134 at 10% recovery.

**Table 13: Cost to Process Diverted C&D Waste**

Cost/MT	Drywall		Wood Waste		Mixed C&D Waste
	5%	10%	5%	10%	20%
<b>\$80</b>	\$12,067	\$24,134	\$18,685	\$37,370	\$214,310
<b>\$90</b>	\$13,575	\$27,150	\$21,020	\$42,041	\$241,099
<b>\$100</b>	\$15,083	\$30,167	\$23,356	\$46,712	\$267,887

It should be noted that mixed C&D waste cannot be diverted at the same time as drywall and wood waste through a separate program as they are in competition with each other. Drywall and wood waste will be lost in mixed C&D waste and the inverse is true. The assumption is that a market outlet may be interested in collecting mixed C&D waste for the benefit of being able to recover drywall and wood waste materials. If drywall and wood waste is diverted through separate programs, this will effectively reduce the demand for the mixed C&D waste stream.

#### 6.1.1. Site Specifications

In order to establish a C&D recycling program at Fenelon and Lindsay Ops landfills, a number of site specific questions need to be considered, they include:

- Regulatory Approval – Both the Fenelon and Lindsay Ops landfill sites are provisionally approved to accept non-hazardous waste materials generated within the City, which includes C&D waste. However, the establishment of a permanent C&D waste diversion program may still require a technical amendment to both site ECAs. The local MOECC district office should be consulted in order to verify amendment application requirements. For a pilot program to take place, an approval letter from the MOECC should suffice.

In addition, for Fenelon, additional discussions may be required with the MOECC as it pertains to any updates to the 2015 Design and Operations (D&O) plan for the site. For Lindsay Ops, the Operations and Maintenance Manual (O&M) is scheduled to be updated in the next year, which provides a good opportunity for the City to include any C&D related diversion programs.

Lastly, support for a C&D recycling program from the public review committees for both should be considered.

- Site Staging – The staging of the C&D program will be dependent on the response from interested end markets through an RFP process (see section 6.2 below). For some local end markets, collecting diverted C&D waste material using roll off bins is preferred. However, for outlets that are not local, collection of C&D waste material via open top trailer loading will require the construction of open bunkers. The frequency of material loading into a trailer is dependent on the reception the program received from the general public. Using drywall and wood waste, it is anticipated that they may need to be collected through open top trailer on a monthly basis. Loading of one trailer using a loader takes approximately 30-40 minutes.
- Health and Safety – If a C&D diversion program is established, it is recommended that working conditions at the sites meet or exceed occupational health and safety standards. This includes the provision of good quality personal protective equipment for staff and the

tools necessary to ensure work is carried out safely. In addition, on-site personnel will need to be trained in the management of the program, including the identification of hazardous and unacceptable materials. Maintaining the appropriate level of training/certification will help ensure C&D waste is disposed of properly, and that hazardous and unacceptable materials are disposed safely and appropriately.

- **Data Tracking** – If a C&D diversion program is implemented, the amount of material that is diverted should be tracked. This will be relatively easy for the City to control utilizing the existing data management program.

## 6.2. Marketing of C&D Materials Through a Competitive Procurement Process

For the pilot program, it is recommended that the City develop and issue a public tender document (e.g. RFP) seeking a contractor to collect and transport and recycle the above noted C&D materials. The material is to be collected from Lindsay Ops and Fenelon landfill sites. To provide greater flexibility for potential bidders, it is recommended that pricing is requested per material stream through both a large roll-off bin (e.g. 40 yd3) and open top trailer collection (see Table 13). Having the ability to transport the materials through an open-top trailer provides non-regional markets the competitive ability to bid on the materials, in relation to local markets. Contract duration should be for one year, with multiple one year extensions.

**Table 14: Sample Pricing Sheet**

<b>Recyclable Material</b>	<b>Price per tonne for transportation and diversion of recyclable material. The price is to include the provision of 40-yard roll-off bin(s).</b>	<b>Price per tonne for transportation and diversion of recyclable material through open-top trailer collection.</b>
<b>Drywall</b>	\$__	\$__
<b>Wood Waste</b>	\$__	\$__
<b>Mixed C&amp;D</b>	\$__	\$__

In addition to pricing, it is also recommended that the RFP require bidders to provide references where similar goods and services were provided in the last three years. References will help ensure the sustainability of their program by confirming the reputation of the bidder. In addition, bidders should also be required to provide a diversion plan, outlining the intended use for each material included in their proposal. Lastly, the proponents capabilities should be reviewed based on a description of services provided and number of years in operation.

The proposals submitted should then be evaluated according to pricing, diversion plan,

capabilities of the proponent and references. Sample evaluation criteria are noted in Table 13.

**Table 15: Sample Evaluation Criteria**

Component	Maximum Score
Pricing	70
Diversion Plan	15
Proponent Capabilities	10
References	5
<b>Total</b>	<b>100</b>

### 6.3. Drywall as a Soil Amendment Material

Through the industry consultations, specifically with the City's Agricultural Development Advisory Board, it was identified that gypsum, the primary component in drywall, can be utilized as a soil amendment material. It is recommended that the City investigate and consider the diversion of drywall waste as a soil amendment material on City farms. This will require an examination of the quality of the drywall to determine its suitability. If the drywall is deemed suitable, the City will need to investigate the process required to convert drywall scrap into a farm-ready amendment material or require their contracted recycler to divert a portion of the material back to the City for farm use.

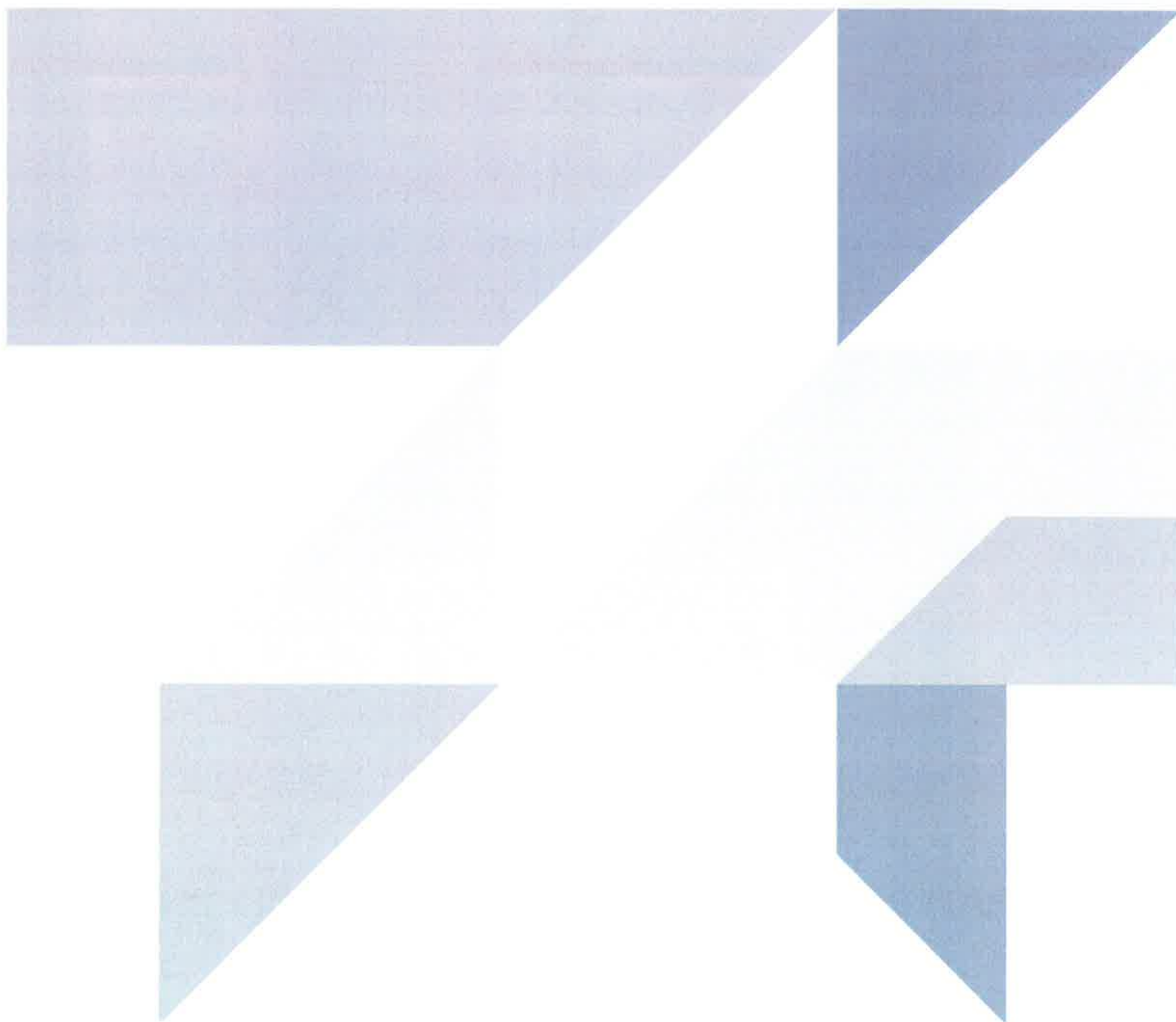
### 6.4. Best Practices Policy Review and Consideration

As a secondary recommendation best practice policy mechanisms, outlined in Section 5, should be reviewed for applicability within the City. This will require a multi-disciplinary approach with other departments. A policy mechanism example includes requiring construction contractors to prepare a recycling plan when applying for a building or demolition permit.





## Appendices





**Appendix A: City of Kawartha Lakes Audit Material Categories - 2017**

<b>Site:</b>	<b>Load</b>	<b>Load</b>	<b>Load</b>	<b>Load</b>	<b>Load</b>	<b>Load</b>
<b>Date:</b>	<b>Time:</b>					
<b>Scale Ticket #:</b>						
<b>Licence Plate #:</b>						
<b>Vehicle Type:</b>						
<b>Material Source (new, reno, demo):</b>						
<b>Load Dimensions (LxWxH):</b>						
<b>Load Weight:</b>						
<b><u>Brick, Concrete, Asphalt</u></b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Bricks - whole						
Bricks - cut offs/broken						
Concrete						
Concrete with metal						
Asphalt						
<b><u>Wood</u></b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Dimensional Lumber - Untreated						
Dimensional Lumber - Treated/Painted						
Composite (e.g. particle board)						
Pallets						
<b><u>Roofing</u></b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Shingles - asphalt						
Shingles - other (e.g. wood)						
Tarpaper						
Other roofing material						
<b><u>Wall Finishing</u></b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Drywall						
Compound						
Stucco Wall Finishing						
Ceiling Tiles						
Insulation (all types)						
<b><u>Flooring</u></b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Floor Tiles - ceramic/stone						
Carpet						
Under padding						
Linoleum						
Wood Flooring						
<b><u>Aggregate</u></b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Rock and Gravel						
Dirt and Sand						
<b><u>Fixtures</u></b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Vanities and Countertops						
Cabinets						
Ceramic Fixtures (e.g. toilet, sinks)						
<b><u>Other C&amp;D Materials</u></b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Electrical (e.g. conduit, ballast)						
Metals (e.g. piping)						
Glass (e.g. window panes)						
Plastic (e.g. piping, plastic film wrap)						
<b><u>Non C&amp;D Materials</u></b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
OCC						
Blue Box Recyclables						
HHW						
Furniture						
Bulky Plastic						
Organic Waste						
Appliances						
Other (make note of other materials)						



## Appendix B - Volume to Weight Bulk Densities

	Factors Used	Washington Study	US EPA
	Density (lb/cu. yd.)	Density (lb/cu. yd.)	Density (lb/cu. yd.)
<b>Brick, Concrete, Asphalt</b>			
Bricks - whole	484		484
Bricks - cut offs/broken	484		484
Concrete	712	2700	860
Concrete with metal	1780	2700	860
Asphalt	795.2	1215	773
<b>Wood</b>			
Dimensional Lumber - Untreated	249.5	330	169
Dimensional Lumber - Treated/Painted	249.5	330	169
Composite (e.g. particle board)	300	300	
Pallets	169		169
<b>Roofing</b>			
Shingles - asphalt	686.5	600	773
Shingles - other (e.g. wood)	600	600	
Tarpaper	600	600	
Other roofing material	730	600	860
<b>Wall Finishing</b>			
Drywall	394	394	
Compound	100	100	
Stucco Wall Finishing	100	100	
Ceiling Tiles	300	300	
Insulation (all types)	24.5	17	32
<b>Flooring</b>			
Floor Tiles - ceramic/stone	320	320	
Carpet	226	305	147
Under padding	183.5	305	62
Linoleum	370	370	
Wood Flooring	330	330	
<b>Aggregate</b>			
Rock and Gravel	1599.5	2200	999
Dirt and Sand	1564.5	2200	929
<b>Fixtures</b>			
Vanities and Countertops	250	250	
Cabinets	250	250	
Ceramic Fixtures (e.g. toilet, sinks)	320	320	
<b>Other C&amp;D Materials</b>			
Electrical (e.g. conduit, ballast)	440	440	
Metals (e.g. piping)	1094	1094	
Glass (e.g. window panes)	1000	1000	
Plastic (e.g. piping, plastic film wrap, vinyl, plastic lumber, siding,	50	50	
<b>Non C&amp;D Materials</b>			
OCC	50	50	
Blue Box Recyclables	262		262
HHW	825	825	
Furniture	150		150
Bulky Plastic	50	50	
Organic Waste	953.5	1443	464
Appliances	170	180	160
Other (make note of other materials)	100	100	

### Sources

CIWMB: California Integrated Waste Management Board. FEECO: FEECO Incorporated. Tellus: Tellus Institute, Boston Massachusetts. U.S. EPA: United States Environmental Protection Agency (Business Users Guide). Washington State Dep of Env



## Appendix C – Audit Material Categories

Jurisdiction	Materials Accepted for Recycling						Annual Tonnage Collected (MT)	Operations	Tip Fees Charged	Program Funding Source(s)	Annual Operating Costs/ Serv. Provider Terms	Diversion Impact/LF Space Saved
	Drywall	Wood	Scrap Metal	Asphalt Shingles	Concrete	Asphalt	Mixed C&D	Other				
County of Northumberland	✓		✓						Mixed Loads with > 10% Recyclable \$115/MT Drywall \$85/MT Metal \$0/MT	Tip Fees/ Scrap Metal Revenue Government Funds (WDO Grants?)	Difficult to determine due to shared admin. Pay \$85/MT for drywall removal.	Unknown beyond MT diverted annually.
City of Barrie	✓			✓					Garbage, non recyclable C&D \$142/MT Mixed Loads with 10% or more recyclable, compostable, \$262.50/MT	Taxes	The City budgets \$40K per year.	Since program began (September 2016), estimated space saved is 206 m³
City of Orillia	✓	✓	✓	✓	✓	✓			Mixed Loads with > 10% Recyclable \$310/MT Garbage, C&D Wood, \$155/MT Concrete/Asphalt \$80/MT Drywall \$110/MT Shingles \$130/MT	Tonnage, cost to market the product, cost to ship, administrative costs divided by expected tonnage	C+D Depot costs: Gypsum \$8,000, Scrap metal \$3,500, Concrete (every 5-10 years as necessary \$100,000 to crush concrete for on-site use)	
County of Simcoe	✓	✓		✓				Window-panes Rubble	Mixed/Difficult Waste \$310/MT	Mostly funded via tipping fees.	Unknown	

											e.g., purchased grinding equipment, grind shingles.	Carpet, Window Glass, Pressure Treated Wood \$155/MT Asphalt Shingles, Drywall, \$75/MT Clean Wood \$75/MT	Some admin is covered under general departmental costs.		
Haldimand County	✓	✓	✓	✓	✓	✓	✓	✓	787 MT	City operates Private service providers collect/process material in bins. (Countrywide for most material, Try Recycling for shingles)	\$121/MT for all Waste Scrap Metal \$0/MT	Tip fees and taxes	C+D program budgeted \$82K which was \$83/MT	4-5% once taking into consideration residual waste. Estimated to be 1.5 MT/m <sup>3</sup> and estimated space saved is 500M <sup>3</sup> .	
Muskoka District	✓	✓	✓	✓	✓	✓	✓	✓		Pvt. - Walker Environmental grinds yard waste, wood and shingles.	Shingles \$163 (R) or \$157 (C)/MT > 10 cy; \$63/MT for less Clean Wood \$67/MT Unclean Wood \$133 (R) or \$157 (C)/MT Other Waste \$133 (R) or \$157 (C)/MT			Unknown	
Oxford County			✓	✓	✓	✓	✓	Glass	About 7K annually, 2016: 2200: Shingles, 3400 Mixed C+D, 30 Glass. 49K total since 2010.	City Staff run the program, but Pvt. contractor (Try Recycling) removes bins.	C&D Materials \$71.40/MT Scrap Metal, Cardboard \$0/MT	Tip fees – 100%	Unknown Pay for removal with Try Recycling	Landfill was set to close in 2014, and now have another 40 years of capacity.	
York Region	✓	✓	✓	✓	✓	✓	✓	Rubble	3,977 MT	Pvt. - SP. Collection/trans- port included in the fee (cost per	Garbage, Concrete (at TS), \$100/MT Scrap Metal, drywall,	Currently costs determined by vehicle size.	Unknown	Accounts for < 1% of all diversion.	



[illegible]



Appendix D: Consultation - Industry

	Company	Role	Materials Accepted	Sorting Process/Material Processing	Cost to Transport (Mixed or Individual)	End Market Opportunities	Other Comments
1	New West Gypsum Oakville, ON	Processor	Drywall	Only receive drywall. Gypsum is separated from paper and sent back to manufacturer.	Depends on trucking, \$80-\$90 M/T.	Send the Gypsum back to the manufacturer, but they pay to ship at \$30/MT. Paper sent to farms for bedding/compost.	Manufacturer goal to have 25% recycled content in drywall.
2	Try Recycling London, ON Arva, ON	Transporter, Processor	Wood, asphalt shingles, concrete drywall	Material travels down a sorting line, (screen, magnets, and then manually sorted). Currently very labour intensive, but looking at new options.	Cost to pickup transport a tonne of mixed C+D to Oxford County would be about \$20 M/T.	Wood markets are not strong. Generally, markets are regional, [for example] an energy plant in Ajax would buy wood chips. Most material goes to local markets, [for example] most of the wood goes to greenhouses in Leamington to be used in the boilers.	Rick was adamant that this information (pricing) is confidential and can only be used in aggregate form and that I cannot use the pricing estimates provided as quotes.
3	Countrywide Recycling Mount Hope, ON	Transporter, Processor	Wood, metal, concrete, red brick, granite, marble, ceramic tile, drywall etc.)	Sorting process is two-fold, automated and manual. First material is tipped out onto the pre-sort floor where it is pushed into piles and the excavator feeds into different conveyors to be sorted by weight and size. Automatically the system will sort smaller and larger material (12 inches) and then material is fed into a manual sort room, where 12	\$34 per M/T. Does not include transportation/collection (average across all materials).	Only scrap metal has an end market opportunity in terms of revenue – other avenues for diversion but at a cost. Some material used for road aggregate (LaFarge).	Volume driven. They take everything and do not require the customers to sort but business is driven by volume. Even for smaller Municipalities – stockpiling material becomes most feasible.

Appendix D: Consultation - Industry

	Company	Role	Materials Accepted	Sorting Process/Material Processing	Cost to Transport (Mixed or Individual)	End Market Opportunities	Other Comments
				people will be responsible for the different material categories and complete dedicated picks.			
4	Habitat for Humanity Lindsay, ON	Processor, End Market	Whole clean drywall pieces, fixtures, vanities	NA	NA	NA	Material is collected at the store or in drop-off bins and is sorted based on material type (clothing, cabinets, e-waste, scrap metal etc.).
5	M+M Disposal Lakefield, ON	Transporter, Processor	Wood, clean shingles, rubble/concrete	Material goes up the line and goes up to a screener (2" -) that material goes to landfill as cover material. The larger material continues up the line to a manual sort room where sorters will pick off materials (wood, concrete, metal, and shingles).	Shingles \$50-55/MT, wood \$30-35/MT but all in costs are probably closer to \$68-70/MT.	Untreated Wood has the most volume, but no revenue. Only revenue comes from cardboard and metal.	Wood is difficult to move – markets have dropped. Wood is ground, burned as fuel, and therefore does not actually count as diverted material. Fill (dirt, bottom of load) counts for 40-45% of the weight of the load and goes to landfill as cover material – but have to pay (county of Peterborough takes it).  M+M is currently doing a pilot program for shingles, grind it and then used with local contact as road aggregate. If it meets the 30% tar content then it goes right into the asphalt mix, if not goes into the recycled content mix.

Appendix D: Consultation - Industry

	Company	Role	Materials Accepted	Sorting Process/Material Processing	Cost to Transport (Mixed or Individual)	End Market Opportunities	Other Comments
6	Simtor Environmental/ Durham Disposal Whitby, ON	Transporter, Processor	Wood, scrap metal, concrete/rubble, glass, shingles	All manual – tipped onto the floor and manually sorted by material. Have a new onsite chipping machine (to process the untreated wood).	General charge of 170 per bin plus \$85 per MT of material inside. Cheaper if it is all wood (because they want it) flat fee for concrete, \$79.50 for shingles.	Some materials are processed internally (wood chips) metal is sold, Concrete goes to Hardco or CoCo Paving, Glass is landfilled and shingles they use as a weight in their garbage trucks.	Chipper purchased in the last 6 months.
7	LaFarge Lindsay, Kirkfield, ON	Processor, End Market	Aggregate	Aggregate is crushed.	NA	Material is used internally.	Recycler and end user of aggregate material. Typically not involved in municipal waste management contracts.
8	Ken Redmond Little Britain, ON	Transporter	Hauler of all material types	NA	Dependent on bin size, travel distance, etc.	NA	A bin provider and hauler of waste materials.
9	Walker Environmental Niagara Falls, ON	Processor	Asphalt shingles, wood	NA	NA	NA	Grind wood, shingles under contract with municipalities. They have mobile equipment to provide service on site.
10	Ecowood Products Concord, ON	Processor, End Market	Wood	NA	NA	NA	Grind clean wood for mulch and fuel.



Appendix E – Detailed Policy/Program Options

Mechanism	Description	Potential Strengths	Potential Drawbacks
<b>PROJECT RECYCLING PLAN REQUIREMENTS</b>			
<b>Requires that projects of a certain size have a recycling/waste management plan and follow up report</b>	C&D waste generators must submit a recycling/waste management plan for projects of a certain size with their building permit application. Do not have to recycle everything – but if not recycled, must provide reason in post-project report. Documentation (weight slips or other receipts from C&D processor/recycler or reuse center) would be required. Plans would include material types, quantities to be generated, how they will be transported, where they will be delivered, if not recycled, why not, with documentation. Receiving facility may also be required to submit documentation to City. Might be combined with other policies, such as requirement that a percentage of material is recycled. A refundable fee can also be required, with the percentage refunded based upon portion of waste recycled (can waive material for which no markets exist, if desired). Works best with mandatory tag on bins (provided by mixed C&D processing facility) – so all weights recorded. Another option is to have fast track permitting for those who plan to reach a certain recycling rate	<ul style="list-style-type: none"> <li>Can encourage markets to develop and Generators are not penalized if markets do not exist</li> <li>Can make certificate of occupancy dependent upon final report</li> <li>Delivery of material to a processing facility (or certified processing facility) may suffice</li> <li>Works best when weight slips/container tags required</li> <li>Can phase in based on size (value or square footage) of project, initially requiring only larger projects, then lowering the size requirement</li> <li>Refundable fee provides a financial incentive to recycle</li> </ul>	<ul style="list-style-type: none"> <li>Effectiveness is dependent upon markets development and proper enforcement</li> <li>Requires city staff resources to implement and enforce, including reviewing weight tags</li> </ul>
<b>RECYCLING REQUIREMENTS/DISPOSAL BANS</b>			
<b>Require that a certain percentage of material generated be recycled</b>	Require that a certain percentage of material, by weight, be recycled. This percent could increase over time, as markets develop. Would work best if combined with recovery plan/report requirement.	<ul style="list-style-type: none"> <li>Can encourage the development of material markets</li> <li>Can phase in by increasing percentage over time, as more markets develop</li> </ul>	<ul style="list-style-type: none"> <li>Requires staff resources for enforcement</li> <li>Adequate material markets must exist</li> <li>May encourage recovery of only heavy materials</li> <li>Relies upon full submittal of documentation</li> </ul>
<b>Require that specific materials be recycled</b>	Require certain material type(s) to be recycled.	<ul style="list-style-type: none"> <li>Can be expanded as markets for additional materials exist.</li> </ul>	<ul style="list-style-type: none"> <li>Must have markets in place for material type(s) selected</li> <li>Does not address other materials</li> <li>Requires staff resources to enforce at disposal facilities</li> </ul>
<b>Set recycling standards for City building projects</b>	By requiring public building projects (or those of a certain size or value) to recycle certain materials, reach a certain recycling rate, use deconstruction techniques, etc., the City shows	<ul style="list-style-type: none"> <li>Can encourage market development</li> </ul>	<ul style="list-style-type: none"> <li>May not be influential alone, but could be combined with other approaches.</li> </ul>

Mechanism	Description	Potential Strengths	Potential Drawbacks
	leadership. Works best when city touts successes. Some cities require LEED certification of a specified level or higher, but the City could develop other types of standards. The City would ban the disposal of certain material type(s).		<ul style="list-style-type: none"> <li>Requires staff resources to enforce at disposal facilities</li> <li>Requires the existence of end markets</li> </ul>
Ban the disposal of certain recyclable materials.		<ul style="list-style-type: none"> <li>Announcing ban in advance can spur development of end markets.</li> </ul>	
Require licensed haulers to deliver materials to C&D sort facility.	The City would require haulers to be licensed, and set certain conditions to obtain a license.	<ul style="list-style-type: none"> <li>Can encourage the development of C&amp;D facilities if announced then later implemented</li> <li>Requirements can also include tracking tonnage data/tagging containers to obtain accurate records, provide data to City</li> </ul>	<ul style="list-style-type: none"> <li>Will not capture self-hauled material</li> <li>Requires the existence of C&amp;D facilities</li> <li>Requires a hauler licensing program</li> </ul>
<b>LOWER TIP FEES FOR RECYCLABLE MATERIALS</b>			
Charge lower tip fees at C&D processing facility and/or drop-off site where materials are source separated for recycling (versus disposal tip fee)	Can be initiated with public facility – eventually competing facilities may develop, if demand is strong. Tip fee differential must be adequately significant to encourage generators to rent another container. May work best in combination with disposal fee on C&D.	<ul style="list-style-type: none"> <li>Providing a less costly alternative may be more appealing to generators than mandates</li> </ul>	<ul style="list-style-type: none"> <li>City must own facility to influence fees – requires some investment and expense</li> <li>Many generators may still not take initiative depending upon level of convenience relative to cost differential and space constraints/other barriers.</li> <li>City may not cover costs</li> <li>City may discourage private sector facilities if tip fee at facility is artificially low</li> <li>May result in overall reduced revenues</li> </ul>
<b>HIGHER TIP FEE FOR MIXED LOADS/LOADS TO BE DISPOSED/REQUIRING SORTING</b>			
Charge a disposal surcharge (or require that one be assessed) on C&D that is disposed, at all disposal facilities.	A per-ton fee would be charged on all C&D loads disposed at in-City landfills.	<ul style="list-style-type: none"> <li>May make C&amp;D processing more cost-competitive</li> <li>Funds can be used to develop C&amp;D recovery programs</li> </ul>	<ul style="list-style-type: none"> <li>Requires monitoring, enforcement, administration</li> <li>May not be well accepted</li> <li>May provide for a competitive advantage for nearby landfills not affected by the fee</li> </ul>
Charge a higher tip fee (or require that one be assessed) on C&D that is	Specific fees, price differentials or per-ton surcharges assessed on all mixed C&D loads and or “mixed loads” – those that contain at least 10% of recyclable materials.	<ul style="list-style-type: none"> <li>May make C&amp;D processing more cost competitive</li> </ul>	<ul style="list-style-type: none"> <li>Requires monitoring, enforcement, administration</li> </ul>



Mechanism	Description	Potential Strengths	Potential Drawbacks
mixed, versus separated by material type, at all disposal and processing facilities.		<ul style="list-style-type: none"> <li>Would provide a financial incentive to source separate materials, increasing likelihood they will be reused or recycled.</li> </ul>	<ul style="list-style-type: none"> <li>May not be well accepted</li> <li>May provide for a competitive advantage for nearby facilities not affected by the fee</li> </ul>
Provide “free” disposal of reusable materials at a swap shop.	City could operate a swap shop on site for materials that are readily reusable and in demand. Might require changing what is accepted from time to time, if material is not in demand. Specifications would be clear (e.g., no nails, no mold, no wood rot, etc.).	<ul style="list-style-type: none"> <li>Encourages reuse, which retains resource value to a greater degree than recycling</li> </ul>	<ul style="list-style-type: none"> <li>Must be monitored or could encourage “dumping” of non-reusable materials.</li> <li>Some materials may never be claimed, and will require management without a tip fee having been paid.</li> </ul>
PROVIDE ADDITIONAL OPPORTUNITIES TO RECYCLE MATERIALS			
Provide curbside collection of certain recoverable, reusable materials.	City could operate a curbside collection program for certain material types with high demand and/or high value. (Examples: clean wood, cardboard, metals). Some costs might be recouped through permitting fees.	<ul style="list-style-type: none"> <li>Generators may be financially motivated to set materials at curb vs. include in dumpster/roll-off</li> </ul>	<ul style="list-style-type: none"> <li>Would require significant education and outreach</li> <li>Would require additional resources</li> <li>If material not acceptable, may sit at curb for long periods of time</li> <li>Would likely be a net cost to City through contracted hauler, even if City were able to beneficially use materials</li> <li>City would have to develop weighing/recording/data protocol to report accurately to WDO</li> </ul>
Develop/expand drop-off sites for certain recoverable/reusable materials.	City would provide drop-off sites where certain materials could be tipped at no cost. Could potentially combine with disposal surcharge or permitting fees to help cover costs.	<ul style="list-style-type: none"> <li>Could start with one material type and one drop-off and expand</li> </ul>	<ul style="list-style-type: none"> <li>Would work best if sites monitored – otherwise other materials may be illegally dumped, or materials in unacceptable condition may be left</li> <li>Requires staff resources and capital to construct</li> <li>Would require education and outreach efforts</li> </ul>

Mechanism	Description	Potential Strengths	Potential Drawbacks
<b>EDUCATION AND OUTREACH</b>			
Provide training to developers and staff about best practices for material management	Training can be geared toward building inspectors, developers, and DIY-ers. Might include tips for source separation, how to deconstruct, benefits of recycling, existing markets.	<ul style="list-style-type: none"> <li>May be able to make training mandatory</li> <li>May be able to recoup costs through permitting fees</li> </ul>	<ul style="list-style-type: none"> <li>Requires staff resources to implement.</li> <li>Program is only as good as the staff.</li> <li>May not reach a large portion of DIY-ers.</li> </ul>
Provide information to developers about existing end markets for materials and the benefits of recycling C&D materials	The City can create awareness about reuse and recycling opportunities for C&D materials, as well as educate about the benefits of C&D reuse and recycling. This can be done through printed materials provided when applying for permits, via website, and possibly through hardware retail outlets and lumber mills	<ul style="list-style-type: none"> <li>May help encourage the development of new markets and strengthen existing markets</li> <li>Develops awareness of the benefits of C&amp;D recovery</li> </ul>	<ul style="list-style-type: none"> <li>End markets must exist to be beneficial</li> </ul>
Develop recognition program	By developing a recognition program of developers that meet certain recovery rates of C&D materials, the City provides a mechanism for developers to differentiate themselves. The City could recognize on a part of website, by allowing the use of an established logo, etc. Another category might be developed for DIY-ers.	<ul style="list-style-type: none"> <li>Can encourage developers to seek out recovery options, perhaps developing innovative end markets themselves</li> <li>May be more widely accepted than mandates</li> </ul>	<ul style="list-style-type: none"> <li>Requires city monitoring, enforcement and development and assessment of standards</li> </ul>
<b>GRANTS/STUDIES AND OTHER MUNICIPAL BENEFITS</b>			
Provide grants for recycling project or pilot study.	The City would develop a grant program, provide technical assistance, and/or develop a pilot study to implement C&D recycling projects. Program could possibly be funded through permitting fees.	<ul style="list-style-type: none"> <li>If partner with entrepreneur, can help develop market for material</li> <li>Can be more accepted by generators than a mandate</li> <li>Could be coupled with the start of a City innovative end market</li> </ul>	<ul style="list-style-type: none"> <li>Requires City funds</li> <li>Requires staff resources to implement/monitor</li> </ul>
If space is an issue, relax constraints regarding roll-off setbacks, etc., to allow for more containers on site.	Relaxing setbacks, allowing dumpsters on sidewalks, etc., can encourage multiple containers – which encourages recycling – but not at risk of safety.	<ul style="list-style-type: none"> <li>Can remove one barrier to recycling.</li> <li>Minimal resources required.</li> </ul>	<ul style="list-style-type: none"> <li>May not be influential alone, but could be combined with other approaches.</li> </ul>



[www.reclaystewardedge.com](http://www.reclaystewardedge.com)