REGIONAL DISTRICT
of Fraser-Fort George

DEMOLITION, LAND CLEARING AND CONSTRUCTION WASTE

DIVERSION STUDY

MAY 2018

ISSUED FOR USE

Carey McIver & Associates Ltd.

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EXECUTIVE SUMMARY

In February 2016, the Regional District of Fraser-Fort George (RDFFG) approved the 2015 Regional Solid Waste Management Plan (RSWMP). The waste diversion components of the RSWMP aim to minimize the amount of waste to landfill through reducing, reusing, and recycling to achieve a targeted disposal rate of 570 kilograms per capita by 2020.Given that waste from the industrial, commercial, institutional (ICI) sector represents almost 60% of waste delivered to the Foothills Boulevard Regional Landfill (FBRL), the implementation of ICI and demolition, land clearing, and construction (DLC) waste diversion programs are the top priority in the RDFFG Waste Diversion Implementation Strategy approved in September 2016. As identified in the implementation strategy, the RDFFG commissioned this study to identify the programs, policies, and partnerships required to increase DLC diversion in RDFFG.

Demolition, land clearing and construction waste, or "DLC Waste" consists of largely inert solid waste (e.g., wood, roofing, concrete, and insulation) generated by construction, renovation land clearing and demolition projects. At project sites in the RDFFG, these wastes are typically commingled (mixed) and deposited in roll-off bins for transport by contract haulers to the landfill or loaded into pick-up trucks and self-hauled to the landfill by small contractors or homeowners.

DLC waste generation is dependent on economic activity in the region. In 2016, DLC waste accounted for 22% (16,000 tonnes) of the waste disposed from residents and businesses in the RDFFG. Although all this material was landfilled in the RDFFG, this is not the case in other regional districts where DLC waste materials are diverted from disposal to commodity markets or other beneficial uses. In other regional districts, source separation of DLC waste materials is encouraged or even required at project sites. This in turn provides separate material streams that can support the development of local recycling markets.

Under the RDFFG Municipal Solid Waste Tipping Fee and Regulation Bylaw No. 3023, 2016, DLC is a mixed waste which, as defined, may include wastes such as pipe, asphalt, lumber, stumps, roofing materials, masonry, and wire. DLC waste is charged at the same tipping fee as refuse so most contractors allocate a small site footprint for solid waste bins. In many instances a single bin is provided for all solid waste generated on the site resulting in mixed loads of DLC materials being buried in the landfill. The current DLC definition limits the RDFFG's ability to track the amount of potentially valuable materials being landfilled, or to encourage source separation and diversion of potentially valuable DLC materials and commodities.

A strategy and work plan to encourage the development of local diversion markets was completed based on an analysis of the current state of DLC material diversion in the RDFFG, a review of best practices for managing DLC materials, and stakeholder consultation.

PROPOSED STRATEGY AND WORK PLAN

The overall strategy to develop local diversion markets should be based on a collaborative approach that recognizes the interplay between building bylaws, generators and markets and disposal regulations. Given the current lack of local processing capacity, the strategy must also be phased to recognize the diversion of DLC waste in the RDFFG is challenging and it will take time to see any significant diversion.

Prioritized Work Plan

Based on the strategy described above the following detailed work plan was developed to encourage DLC waste diversion in the RDFFG. This work plan incorporates a collaborative approach and recognizes that any increase in DLC diversion will have an impact on the Solid Waste Financial Plan. These impacts must be considered in concert with the other action items to ensure that there are adequate revenues to fund the solid waste management service in the RDFFG.

Priority #1: Encourage source separation of DLC materials by amending Bylaw 3023

- Revise bylaw definitions to include additional source separated DLC materials (clean wood, painted or treated wood, recycled asphalt pavement, and recycled asphalt shingles).
- Revise Facility Use and General Provisions bylaw to include doubling tipping fees for mixed loads of DLC materials.
- Add new DLC material categories to the scale software program to allow for better tracking of source separated as well as mixed loads of DLC waste.

Priority #2: Promote source separation through Sort Smart

- Utilize the RDFFG rebranding program - encouraging generators and haulers for waste to start sorting their waste.
- Begin an education campaign to promote source separation of DLC materials such as clean wood, painted or treated wood, metals, concrete, recycled asphalt pavement, recycled asphalt shingles, and educate residents and industriy on the difference between source separated and mixed loads.

Priority #3: Provide financial incentives for source separation

- In collaboration with industry stakeholders, consider implementing variable tipping fees to encourage source separation once sustainable processing facilities and markets are developed. In future this could apply to asphalt, and eventually to clean wood. Phase in thresholds for variable tipping fee and surcharges for mixed loads of DLC materials.
- Review of the impact of variable rates on tipping fee revenue an adjust the Solid Waste Financial Plan if required.

Priority #4: Support local processing capacity and markets

- Work with the City of Prince George to make it easier for material recycling and handling facilities to launch. This could include the creation of facility permitting processes at a regional level, and supportive zoning particularly for existing concrete recyclers.
- Explore partnership potential with the Veolia biomass energy plant in Fort St. James and University of Northern British Columbia

Priority #5: Building design and permitting regulations

- Work with the City of Prince George to build on existing programs to encourage DLC waste diversion within the City, such as the City's tax exemption program for LEED® certified projects. The RDFFG can work with the CPG and based on the case studies detailed in this report, make recommendations on what aspects may suit the culture and current state of materials availability for the City.

Priority #6: Construction specifications

- Rewrite construction specifications where possible, in addition to lobbying the province to allow more recycled materials in future projects.
- Investigate and develop specific policies to encourage the use of RAP and RAS at the CPG asphalt plant and other processors in the region.

Priority #7: Disposal bans

- If required to promote more diversion, consider implementing full disposal bans on materials that have sustainable local diversion markets.
- Review of the impact of disposal bans on tipping fee revenue and adjust the Solid Waste Financial Plan if required.

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ACRONYMS & ABBREVIATIONS

Term/Acronym	Definition
Concrete	A hardened mixture of cement and sand, gravel, and/or rebar. Rebar protruding from cement shall not exceed 1ft. in length
C&D	Construction and Demolition
CSRD	Columbia-Shuswap Regional District
CRD	Cariboo Regional District
CR&D	Construction, Renovation and Demolition
CPG	City of Prince George
Demolition, Land Clearing, and Construction Waste	May include waste, such as pipe, asphalt, lumber, stumps, roofing materials, masonry, and wire, and shall not contain prohibited waste, controlled waste, recyclable materials, or hazardous waste
DLC	Demolition, Land Clearing, and Construction
ICI	Industrial, Commercial, Institutional
FBRL	Foothills Boulevard Regional Landfill
PRRD	Peace River Regional District
RAP	Recycled Asphalt Pavement
RAS	Recycled Asphalt Shingles
RDFFG	Regional District of Fraser-Fort George
RDN	Regional District of Nanaimo
RDNO	Regional District of North Okanagan
TNRD	Thompson-Nicola Regional District
Source Separated Waste	Means municipal solid waste that arrives at a facility which is separated by means of barriers or placement in containers into clearly distinguishable accumulations of: a) Recyclable materials b) Yard and garden waste c) Refuse d) Demolition, land clearing, and construction waste e) Controlled waste
Mixed Load	Means materials designated for disposal co-mingled with materials listed in Schedules “C”, “D” and “E” attached to this Bylaw

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1.0 INTRODUCTION

In February 2016, the Regional District of Fraser-Fort George (RDFFG) approved the 2015 Regional Solid Waste Management Plan (RSWMP). The waste diversion components of the RSWMP aim to minimize the amount of waste to landfill through reducing, reusing, and recycling to achieve a targeted disposal rate of 570 kg per capita by 2020.Given that waste from the industrial, commercial, institutional (ICI) sector represents almost 60% of waste delivered to the Foothills Boulevard Regional Landfill (FBRL), the implementation of ICI and demolition, land clearing, and construction (DLC) waste diversion programs are the top priority in the RDFFG Waste Diversion Implementation Strategy approved in September 2016.

The Implementation Strategy provides a work plan arranged in priority order to identify those programs that have the greatest potential for diversion. Given that waste from the ICI sector represents almost 60% of waste delivered to the FBRL, the implementation of ICI and DLC waste diversion programs are the top priority in the work plan.

Implementation of the ICI Diversion Program is well underway. The RDFFG has adopted a new consolidated tipping fee and site regulation bylaw. Changes to the Bylaw would provide the Regional District with the authority to restrict and enforce surcharges on controlled waste materials, prohibited materials and recyclable materials in the waste stream. A new scale software program has also been installed at the FBRL to better categorize and track diversion and disposal data. In July 2017, the RDFFG introduced a Commercial Cardboard Diversion Program for the ICI sector which uses phased thresholds and surcharges to divert this material to local markets.

There are currently limited opportunities to recycle DLC waste in the Prince George Region. Nevertheless, given that there are several relatively large construction and demolition projects upcoming in the region, a DLC waste diversion program may provide a significant opportunity for businesses in the region to launch services to divert these materials from the landfill.

Consequently, following the implementation of the Commercial Cardboard Diversion Program, and in step with the Waste Diversion Implementation strategy, in November 2017 the RDFFG engaged Tetra Tech Canada Inc. (Tetra Tech), in collaboration with Carey McIver & Associates Ltd. (the Project Team) to conduct a Demolition, Land Clearing and Construction (DLC) waste diversion study. This study provides a strategy and work plan to encourage the development of local diversion markets within the RDFFG.

1.1 Purpose of the Study

The purpose of the study was to identify the policies, programs, and partnerships required to increase DLC diversion in RDFFG working in collaboration with RDFFG staff, waste haulers, and stakeholders. Critical to the project was understanding the effectiveness of the current system and providing recommendations that were suitable to and effective for the RDFFG.

1.2 Study Methodology

The Project Team completed the following tasks to develop a strategy and work plan to encourage the development of local diversion markets:

- Reviewed the solid waste tipping fee and site regulation bylaw and scale program data to understand how DLC wastes are currently managed and disposed of in the RDFFG;
- Estimated the volume and categories of DLC waste in the region;

- Reviewed best practices for diverting DLC waste including a scan of DLC waste diversion policies and programs in neighbouring regional districts;
- Engaged local stakeholders, including generators, haulers, and regulators to identify which DLC commodities and/or materials have the greatest diversion potential based on an assessment of sustainable local markets as well as identification of the barriers to more diversion by the demolition, land clearing and construction industry; and
- Identified supporting regulations, bylaws, policies, and programs needed to create an environment that encourages DLC waste diversion to sustainable local markets.

Recognizing that a successful DLC waste diversion program will rely on a collaborative approach, the RDFFG held two stakeholder workshops, one with regulators and one with representatives from the local construction and demolition sector to ensure that the Project Team developed a strategy and work plan that was tailored to the unique characteristics of the region.

1.3 Overview and Structure of the Report

Section 2.0 provides an overview of DLC management in the region including a review of the current solid waste tipping fee and site regulation bylaw and scale program data, the composition and estimated tonnages of DLC waste available for diversion in region as well an assessment of current diversion. Section 3.0 provides an overview of best practices in other jurisdictions in British Columbia and Western Canada. Section 4.0 provides the results of the scan of DLC waste diversion practices in neighbouring regional districts. Section 5.0 outlines the results of the two stakeholder workshops and Section 6.0 identifies a strategy and prioritized work plan to increase the diversion of DLC commodities/materials from landfill disposal.

2.0 DLC WASTE MANAGEMENT IN THE REGION

2.1 DLC Waste Generation and Disposal

DLC waste consists of largely inert solid waste resulting from construction, renovation, land clearing and demolition projects. Depending on the project DLC waste can consist of wood, roofing, concrete, asphalt, glass, insulation, floor covering, masonry, metal or plastic siding, gypsum or plaster wallboard and material or devices (such as cabinetry, electrical or plumbing fixtures) which are normally permanently affixed to the building as well as stumps and vegetation.

At project sites in the RDFFG, these wastes are typically commingled (mixed) and deposited in roll-off bins for transport by contract haulers to the landfill or loaded into pick-up trucks and self-hauled to the landfill by small contractors or homeowners.

DLC waste generation is dependent on economic activity in the region. In 2016, DLC waste accounted for 22% (16,000 tonnes) of the waste disposed from residents and businesses in the RDFFG.

Although all this material was landfilled in the RDFFG, this is not the case in other regional districts where DLC waste materials are diverted from disposal to commodity markets or other beneficial uses. However, in these regions, DLC waste is handled differently than the current practice in the RDFFG, in that source separation is encouraged or even required at project sites. This in turn provides separate material streams that can support the development of local recycling markets or that can possible be used on site.

The following sections of this report provide information on how the RDFFG can change current practices in the DLC sector to promote more sustainable waste management.

2.2 Tipping Fee and Site Regulation Bylaw

Policies and bylaws are the "rules of the road" for how solid waste will be managed in the region. RDFFG Municipal Solid Waste Tipping Fee and Regulation Bylaw No. 3023, 2016 defines the types of wastes that are accepted at disposal facilities as well as those wastes that are prohibited from disposal.

Under the bylaw, DLC is a mixed waste which, as defined, may include wastes such as pipe, asphalt, lumber, stumps, roofing materials, masonry, and wire. The current DLC definition under the bylaw limits the RDFFG's ability to encourage source separation and diversion of potentially valuable DLC materials and commodities. Additionally, wood waste, which is typically the largest component of DLC waste in other regions, is not included in this definition, nor is it defined in the bylaw. Nevertheless, wood waste is present in the loads of DLC waste that are accepted at the FBRL. DLC waste is charged at the same tipping fee as refuse which is currently $85 per tonne. As a result, most contractors allocate only a small amount of their site for solid waste bins. In many instances a single bin is provided for all solid waste generated on the site resulting in mixed loads of DLC materials being buried in the landfill.

Although the bylaw does have a definition for Source Separated Waste, which includes DLC waste, there is currently no requirement to deliver DLC materials in source separated loads, other than concrete and gypsum wallboard (controlled wastes). The bylaw does have a definition of mixed loads, meaning materials designated for disposal co-mingled with materials listed in Schedule C (controlled wastes that require special handling and/or have disposal restrictions in place), Schedule D (prohibited wastes that shall not be disposed of at any facility), and Schedule E (recyclable materials as defined by the British Columbia *Environmental Management Act)*. Tipping fees for controlled wastes range from $85 per tonne to $312 per tonne. Concrete is categorized as a controlled waste with a tipping fee of $101.25 per tonne providing a financial incentive for source separation. Gypsum Board or Wall Board is also a controlled waste and although the tipping fee is $85 per tonne, the waste must not include wallboard containing or manufactured with asbestos.

Consequently, as indicated in Table 2-1, except for concrete, there is currently no incentive for the generators of DLC waste to source separate this waste. As a result, the potentially valuable materials/commodities in mixed DLC loads are buried along with everything else from a site.

Table 2-1 Tipping Fees at the RDFFG

Material	Tipping fee
Refuse	$85.00/tonne
DLC	$85.00/tonne
Gypsum Board or Wallboard	$85.00/tonne
Concrete	$101.25/tonne

Although the RDFFG added new material categories to the region's scale software systems to support data collection and diversion of DLC waste, the system currently only tracks DLC that arrives in mixed loads and concrete and wallboard that arrive in source separated loads. This scale data is insufficient to determine the actual tonnage and composition of DLC waste in the region and instead estimated tonnages for each material category were generated based on past practices, the 2013 Waste Characterization study, and studies from comparable regions. Current disposal practices of accepting mixed DLC loads at all receiving facilities, unless a material is a controlled

waste, such as drywall or concrete, restricts the RDFFG's ability to provide data to potential business for market development other than estimations.

Encouraging source separation of DLC materials can be achieved by defining additional materials in the bylaw as well as a phased-in approach to thresholds for variable tipping fees and surcharges of loads disposed at the FBRL facility. Utilizing an approach to implementation that mirrors the ICI Cardboard Diversion Program, the RDFFG would begin with an education period to encourage source separation before moving into a surcharge phase. Having source separated DLC materials arrive at the FBRL would generate more accurate data on the tonnage of materials available for potential private sector diversion.

2.3 Composition

Due to the limited information on the composition of DLC waste in the RDFFG, a detailed estimate of DLC waste composition was developed. The Project Team reviewed recent waste composition studies from the RDFFG as well as waste composition from comparable jurisdictions to estimate the materials present in DLC loads received at RDFFG facilities.

In 2013, the RDFFG conducted a waste composition study at the FBRL. The study sorted material received at the landfill into multiple categories and estimated the composition of all waste being landfilled. DLC material was not targeted in the 2013 waste composition study but the study's report states that most self-haul loads were primarily DLC materials.

The limited information on DLC composition from the 2013 waste composition study was compared to DLC composition in other jurisdictions to create a composite estimate of DLC waste composition for the RDFFG. The estimated composition of DLC materials is summarized on Figure 2-1. Current and Projected Tonnages

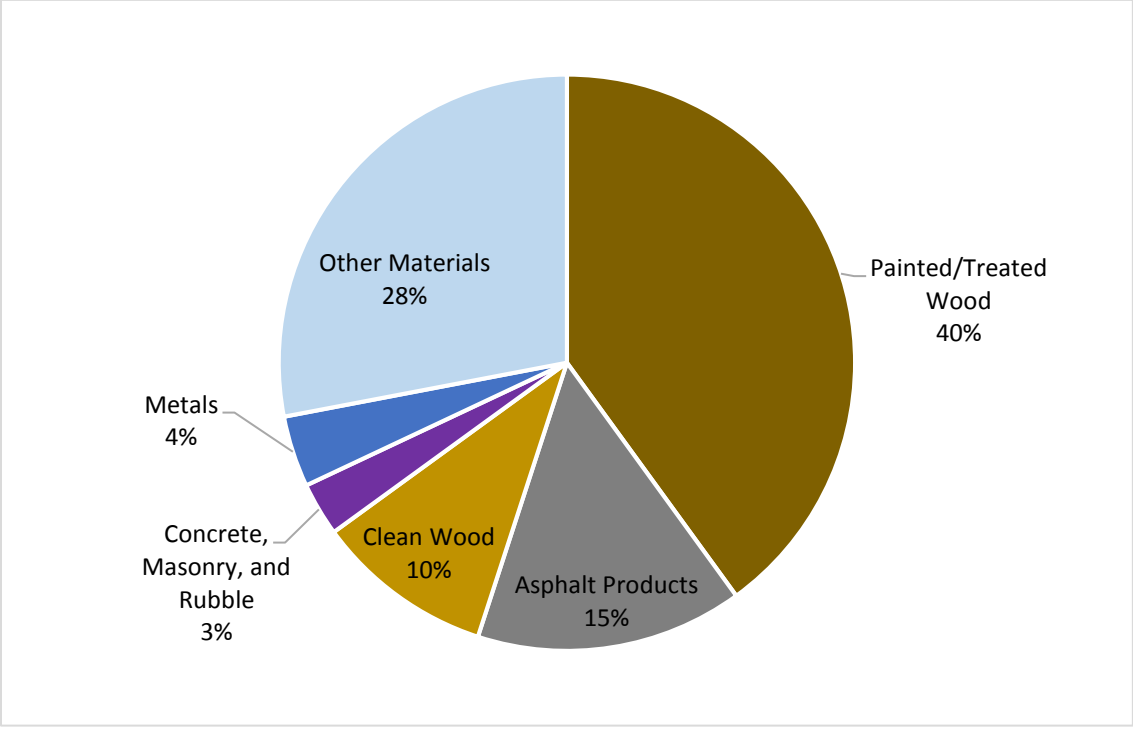

Figure 2-1: Estimated Composition of DLC in the RDFFG

In 2016, over 16,000 tonnes of DLC materials were landfilled in the RDFFG, with over 90% concentrated at the FBRL in Prince George. Several DLC materials are commonly diverted for beneficial use in other regions due to their ease of recycling and commodity value. The projected tonnages of DLC waste that is potentially valuable to industries within the RDFFG are summarized in Table 2-2.

Table 2-2: Projected Tonnages of DLC Materials Landfilled

DLC Material for Diversion	Estimated Landfilled Tonnage (tonnes/year)
Clean Wood	1,500 to 2,000
Painted or Treated Wood	6,500 to 7,500
Metals (Ferrous and Non-Ferrous)	650 to 750
Concrete, Masonry, and Rubble	500 to 600
Asphalt Products	2,500 to 3,000

Increasing source separation of DLC materials on project sites will be a key factor in driving diversion of the potentially valuable materials/commodities listed in Table 2-2.

2.4 Current Diversion of DLC Materials

There are currently limited opportunities for DLC material diversion in the RDFFG. Diversion is completed by independent private facilities for specific materials or commodities with high value and common recycling processes. There is currently limited diversion of DLC materials in the RDFFG. For example, little asphalt pavement is received at the landfill as this material is used by existing asphalt plants as recycled asphalt pavement (RAP) to supplement virgin aggregates in their mixes. These limited recycling systems operate outside of the RDFFG's knowledge and with limited influence from disposal policies and practices at regional facilities. There is also one private facility operating in the RDFFG to crush waste concrete for use as aggregate. This facility has decreased the apparent amount of waste concrete received at the FBRL. Public concerns may result in this facility moving to a new site or shutting down, taking the RDFFG further from its DLC waste diversion goals.

Consequently, the majority of DLC waste is currently disposed in the region's landfills. Although the 2015 RSWMP had anticipated that there may be a local market for wood waste, this is not the case. As indicated in Table 2-3, there are markets for clean wood (biomass) in the region and adjacent regions but they may not be accessible as short-term alternatives to landfilling as they are either too far away to be economic or have a very low tolerance for contamination requiring significant pre-processing of feedstock material.

Table 2-3 Current Biomass Market

Facility	Veolia, Fort St. James	Atlantic Power, Williams Lake	University of Northern British Columbia BioEnergy Plant
Description	40MW biomass plant in commercial operation since December 2017. Warranty on boilers prevents acceptance of DLC waste prior to Dec 2019. Motivated to accept DLC stream to reach maximum capacity and replace diminishing feedstocks.	Biomass plant with a dedicated contract with BC Hydro. Currently partnering with the Cariboo Regional District (CRD) to receive clean DLC waste.	Biomass plant at the UNBC campus providing district heating. Currently supplied with hog fuel from nearby sawmill. Willing to consider very clean DLC material that meets specifications. Low to no tolerance for contamination.
Address	Fort St. James BC	4455 Mackenzie Ave N, Williams Lake BC V2G 5E8	3333 University Way, Prince George, BC V2N 4Z9
Distance to Foothills Landfill	161 km	238 km	20 km
Annual Capacity	200,000 oven dry tonnes/year	Maximum 600,000 green tonnes/year Current ~250,000 green tonnes/year	4,000 - 6,000 green tonnes/year
Feedstock Specifications	3 inches and smaller clean woody biomass. Currently unable to accept DLC wastes due to warranty on equipment.	4 inches and smaller, uniform, standard, clean biomass required. Tight contamination restrictions.	3 inches and smaller, clean wood only (very low tolerance for contamination). Potential to arrange for chipping on their site if material can be stockpiled at another location.
Fee / Cost Structure	Flexible, typically the Regional District would pay for processing, and the plant could bear the cost of hauling	Specialized arrangements for sharing costs and subsidizing hauling to deliver to the site. Relationship with CRD sets precedence.	Willing to collaborate if overall cost for UNBC is at or below market rate for biomass, estimated at $45/tonne.

3.0 BEST PRACTICE OVERVIEW

The following section provides a review of best practices to encourage DLC diversion in other jurisdictions in British Columbia and Western Canada. These best practices are organized according to: “front-end” policies that affect building design and permitting, “back-end” disposal regulations that restrict landfill disposal and additional market development opportunities that are not tied to the front-end and back-end practices.

It is important to note that these best practices are mainly occurring in the Lower Mainland and Vancouver Island where disposal capacity is limited, tipping fees are high, and the level of construction and demolition activity is large enough to develop local and regional markets for diverted materials. This is not the case in Northern BC where disposal capacity is abundant, tipping fees are relatively low, and volumes generated may not be adequate to drive local diversion markets.

3.1 Building Design and Permitting Regulations

DLC waste is generated on construction and demolition sites throughout the region. Regulations to encourage or require the separation and diversion of DLC waste at a project and site level are crucial to achieving high diversion of potentially valuable materials, while requirements at disposal sites create economic and operational incentives

to divert certain materials. There are demonstrated best practices for each of these regulatory measures applied at the site and project level across the Pacific Northwest and in British Columbia.

- Procurement requirements for new construction or demolition (e.g., required use of a certain percent of recycled or recovered materials for new construction). A range of examples from across the Pacific North West are provided.
- Recovery/diversion requirements for construction, renovation, demolition permits, and/or preferential approval for projects with high waste diversion. Examples include: Metro Vancouver, City of Vancouver, and City of Port Moody.
- Prevention by permitting house relocation. The example provided is of the Town of Sidney House Relocation permit.

3.1.1 Green Building and LEED® Procurement Requirements

Procurement practices for municipally-funded construction, renovation, and demolition contracts can also influence DLC waste diversion. The LEED® certification program prescribes requirements for construction and demolition waste management planning. Meeting requirements for diversion of wastes during construction, operation, and demolition of a building earns credits toward LEED® certification. In the words of the LEED® program outline, 'Construction debris is no longer waste, it is a resource.' Table 3-1 summarizes the application of Green Building and LEED® standards and incentives with additional detail provided in Appendix A. Building standards are minimum requirements set through bylaws and building codes while incentives are programs that offer financial benefits such as reduced permit fees or reduced taxes for projects that meet specified.

Table 3-1: Summary of Requirements for LEED®, Green Build, or Equivalent Standards in Western Canada

Jurisdiction	Population	Building Standard	Building Incentives	Applicable To
Town of Banff, AB	7,847	√		All new municipal buildings
City of Yellowknife	19,569	√		All downtown and city-owned facilities
City of North Vancouver, BC	52,900	√		All civic buildings
Regional Municipality of Wood Buffalo, AB	71,589	√		New construction greater than 1000 m^2 and building extension greater than 30% of existing gross floor area
City of Prince George, BC	74,003		√	All land development over a threshold value in some portions of the city
City of Maple Ridge, BC	82,256		√	Buildings under 51% of non-renewable energy
City of Victoria, BC	85,790	√		New municipal facilities or additions larger than 500 m^2
City of Nanaimo, BC	90,500	√		New public buildings over 900 m^2

Jurisdiction	Population	Building Standard	Building Incentives	Applicable To
City of Red Deer, AB	92,729	Principles to guide construction and renovation		All municipal facilities
Strathcona County, AB	98,044	√	√	New construction or major renovations of county facilities or buildings on county-owned land
City of Kelowna, BC	127,400	Voluntary Check-lists		All buildings
City of Richmond, BC	198,300	√		New public buildings or renovations of public buildings over 2000 m^2 or civic buildings under 2000 m^2
City of Vancouver, BC	631,500	√		New buildings on rezoned sites
City of Winnipeg	705,244	√		Newly constructed city-owned buildings and major additions greater than 500 m^2
City of Edmonton, AB	932,546	√		City-owned and occupied building construction or major renovations greater than 500 m^2
City of Calgary, AB	1,239,220	√		City-owned buildings over 500 m^2
Province of British Columbia	4,840,000	√		All new provincial buildings or facilities

As a region, Metro Vancouver has provided a Design Guide for Municipal LEED® Buildings as a measure to support municipalities in implementing LEED® procurement and building standards.

3.1.2 Advanced Deconstruction Permits

The City of Vancouver in Metro Vancouver has a population of 631,486. Their goal was to reduce and divert residential DLC waste by encouraging deconstruction rather than demolition, with an initial target of 75% recycling for pre-1940 homes. The impact in 2013 was that 12 of 900 homes demolished were issued a deconstruction permit.

The City of Vancouver has since amended their ‘green demolition bylaw’ to allow for three-week advanced permitting for demolition projects with a salvage/deconstruction plan in place, to enable the extra time taken to disassemble a building rather than conventional demolition.

3.1.3 House Reuse/Relocation

The Town of Sidney in the Capital Regional District has a population of 11,191. Their goal is prevention of residential DLC waste by permitting full-house relocation. The impact as of 2013 was four to five homes being moved per year in Sidney, totaling 400 tonnes to 500 tonnes of DLC materials diverted from landfill.

3.1.4 Sample Bylaw for Increased Recycling of Demolition Materials

Metro Vancouver, with a population of 2.5 million, intended to direct recyclable materials to licensed processing facilities. The regional district developed a sample bylaw for use by municipalities to increase the recycling of demolition materials, which included sample clauses on permitting deposits and salvaging/diversion requirements as a part of permitting. This was provided to municipalities as an informational resource, and was adopted by some municipalities who are now customizing to their needs.

3.1.5 Mandatory Waste Management Plans with Refundable Deposit

The City of Port Moody, Metro Vancouver, with population of 34, 479, had a goal to increase diversion by requiring a waste management plan for DLC permitting, with a refundable diversion deposit fee. Their target was 70% diversion, and as of 2013, their diversion for all DLC waste was 84% over 24 projects tracked.

3.1.6 Preferential Treatment for Faster Approvals

In 2014, the Town of Canmore, with a population of 13,992 started to offer reduced demolition permit fees if salvaging or reuse and recycling of DLC waste takes place. In 2017, the demolition permit fee is $101.50 if 75% diversion is achieved or 50% diversion and a salvage day is hosted (the Town of Canmore can assist with advertising costs for the salvage day). A copy of a Waste Diversion Report from the Bow Valley Waste Management Commission and a salvage day ad must be submitted to the Town of Canmore to fulfil requirements of the demolition permit and to close the permit. If no waste diversion takes place the demolition permit fee, in 2017, is $517.65.

3.2 Disposal Regulations

Local governments typically use regulations and policies enforced at disposal sites to create economic and operational incentives for diversion. Increased fees or bans on materials are common in many regions in BC. The following case studies outline the approach adopted by the Regional District of North Okanagan (RDNO) where DLC materials are restricted from disposal using the financial incentive of varying tipping fees to discourage mixed loads and landfilling of recyclable materials (variable tipping fees) and the Regional District of Nanaimo (RDN) which implemented a full ban on the disposal of wood waste. Section 4 also provides information on the introduction of variable tipping fees in neighbouring regional districts.

3.2.1 Regional District of North Okanagan Regulated Waste Policy

Under RDNO Municipal Solid Waste (MSW) Management Bylaw 2659, construction and demolition (C&D) waste is defined as MSW originating from the construction, demolition and/or renovation of buildings and structures, including but not limited to, materials such as plastic, wood, metal, insulation, roofing, flooring, carpet, plumbing, electrical, concrete, masonry ceramics and glass. The tipping fee for loads of C&D waste, which are essentially mixed loads, is $202 per tonne while mixed refuse is $100 per tonne.

However, to encourage source separation, the bylaw provides separate definitions for asphalt roofing, crushable material for aggregate, drywall, logs and stumps, and wood waste. These typical DLC materials are classified as regulated materials and are charged at variable rates as indicated in Table 3-2.

Table 3-2 – RDNO Bylaw 2659 Rates for Refuse, C&D and Regulated Waste

Description	Product Code at Scale	Fee/Tonne	Minimum Fee
Refuse	Refuse	$100	$5
Construction and Demolition Waste	C and D Waste	$202	$6
Asphalt Roofing - Clean	ASPH Roofing - Clean	$82	$10
Asphalt Roofing – Minor Contamination	ASPH Roofing - Minor	$110	$13
Asphalt Roofing – Major Contamination	ASPH Roofing - Major	$200	$20
Chipped Wood Waste	Wood-Chipped	$4	$5
Crushable Material for Aggregate	Crushable	$10	$5
Drywall-Recyclable	Drywall -Rec	$135	$5
Drywall – Non-Recyclable	Drywall-Non- Recyclable	$140	$5
Logs and Stumps – Clean and Grindable	Logs and Stumps Clean	$20	$5
Logs and Stumps – Large, Dirty or Ungrindable	Logs and Stumps -Dirty	$75	$10
Wood Waste -Clean	Wood - Clean	$20	$5
Wood Waste - Dirty	Wood - Dirty	$20	$5

Currently the RDNO uses most of these regulated DLC materials for beneficial use on site. To date, the variable rates charged for these materials have not created any local markets. According to local haulers, this may be because a variable fee allows waste generators that choose not to source separate in favor of paying a higher fee. Since regulated waste is not banned from disposal, this tool may not be adequate to promote the development of local diversion markets.

3.2.2 Regional District of Nanaimo Wood Waste Disposal Ban

To encourage more source separation and diversion without relying solely on variable tipping fees, many regional districts implement disposal bans on readily recyclable materials. This is a low-cost policy tool used to signal to waste generators and waste collection companies that they are expected to separate and recycle specific materials for which markets are readily available.

In the RDN, a waste composition study completed in 2004 confirmed that 16% of total waste sent to landfill was construction, renovation and demolition (CR&D) waste material of which the majority was clean wood waste. Consequently, in January 2008, in accordance with the RDN's Zero Waste Plan (2004) and the Construction/ Demolition Waste Diversion Strategy (2007), the Region introduced a landfill ban on the disposal of clean wood waste. The landfill ban was imposed through an amendment to Solid Waste Management Regulation Bylaw No. 1531, which came into effect in January 2008 and included new definitions for wood waste and CR&D waste.

This ban was developed and implemented in collaboration with waste haulers, wood waste generators and licensed private processing facilities. The collaborative approach ensured that all stakeholders had advanced notice of this important zero waste initiative. Enforcement consisted of load inspections and surcharges at disposal facilities by landfill staff as well as on-site education and compliance checks by the RDN's Zero Waste staff.

The wood waste ban provided a cost-effective way for the Region to divert clean wood waste. As a regulator, the Region did not provide any capital investment for the processing of clean wood waste, as these costs were borne by the private sector.

3.3 Additional Market Development Opportunities

While building design and permitting regulations at the site and building level can support the separation of materials, and the creation of local end markets, this section addresses additional opportunities to develop end-use markets by adjusting specifications to use recycled materials in government projects. Case studies are provided specifically on:

- Asphalt and concrete recycling in North America.
- Glass recycling in Anchorage.

3.3.1 Asphalt Pavement, Concrete, and Asphalt Shingle Recycling End Use

RAP and recycled asphalt shingles (RAS) are increasingly considered recoverable and valuable resources for base materials. Typically, reclaimed concrete aggregate is used as a base material or rip-rap for erosion control while asphalt pavement from projects is incorporated into base or backfill, or added back into asphalt pavement. Table 3-3 summarizes several jurisdictions currently recycling concrete, RAP, or RAS. Additional detail is provided in Appendix B.

Table 3-3: Summary of Jurisdictions Recycling Concrete, RAP, and RAS

Jurisdiction	Population	Concrete	RAP	RAS	Summary of Use
City of Camrose, AB	18,742	√			Camrose operates a processing facility. Private contractor crushes concrete for use in municipal projects.
City of Calgary, AB	1,239,220	√	√	√	Concrete crushed by the City of Calgary and used for base in sidewalks. RAP incorporated into Calgary's asphalt. Select RAS allowed in asphalt.
City of Edmonton, AB	932,546	√	√		Edmonton manages an Aggregates Recycling Program that recycles over 99% of all aggregate rubble in Edmonton.
City of Grande Prairie, AB	63,166		√		RAP accepted from internal projects for inclusion in new hot mix asphalt.
City of Regina, SK	215,106	√	√		Concrete and RAP are accepted at the Fleet Street Landfill where they are crushed periodically and used by the Roadways and Transportation, and the Waterworks and Parks Departments.
City of Winnipeg, MB	705,244			√	RAS is allowed in hot-mix pavement; percentage of RAS allowed is based on municipal road specifications.

A scan of current practices concluded that ten jurisdictions or provincial ministries across Saskatchewan, Alberta, and British Columbia are incorporating RAP and/or RAS in asphalt mixes.

3.3.2 Glass Recycling

In Anchorage, Alaska, population 298, 695, local markets for recyclable glass developed through collaboration with public and private entities. A new local market was successfully created for crushed glass as a pipe bedding medium for the Anchorage Water and Wastewater Utility. This market development was accomplished through collaboration between the Solid Waste and Water and Wastewater Utilities.

4.0 DLC MANAGEMENT IN SURROUNDING REGIONS

Northern Regional Districts share in having:

- A lack of waste diversion opportunities;
- Low cost of waste disposal, coupled with abundant landfill capacity; and
- Growth of oil and gas industry and associated personnel waste.

The regional districts compared under this study, which surround the RDFFG include the Regional Districts of Bulkley-Nechako (RDBN), Peace River Regional District (PRRD), Cariboo Regional District (CRD), Thompson-Nicola Regional District (TNRD) and Columbia-Shuswap Regional District (CSRD).

Each regional district was assessed in terms of the regulatory mechanisms and measures for market development in practice.

Figure 4-1 Regional Districts Surrounding the RDFFG

The surrounding regional districts assessed vary in their implementation of bylaw definitions, variable tipping fees, and disposal bans for readily recyclable materials. None assessed have mandatory diversion nor a deposit system to approve permits.

The following sections provide an overview of the DLC management context in each regional district, concluding with a summary table comparing key factors.

The relative disposal rates per capita of select northern regional districts in 2016 as reported to the Ministry of Environment and Climate Change (MOE) Strategy 2016 are shown in Table 4.1.

Table 4-1: Disposal Rates per Capita of Select Regional Districts

Regional District	2016 Disposal Rates (kg/capita)
Bulkley-Nechako	600
Cariboo	748
Columbia-Shuswap	643
Fraser Fort-George	844
Peace River	685
Thompson-Nicola	595

4.1 Regional District of Bulkley-Nechako

The RDBN Bylaw No. 1764 specifically addresses the regulation and prohibition of DLC wastes. Its definitions distinguish categories of DLC waste, which are considered recyclable. The RDBN's bylaw does not charge for general municipal solid waste or residential sized loads (smaller than 2 m^3) of DLC waste. Loads larger than 2 m^3 are directed to one of two scaled sub-regional landfills where they are assessed the current tipping fee for construction and demolition material. There are currently no local markets for DLC materials collected at RDBN disposal facilities and consequently the materials are used on site, burned, or buried in accordance with the facility's Operating Certificate.

4.2 Cariboo Regional District

The CRD manages three landfills and uses variable tipping fees as an incentive to promote separation of clean wood waste, asphalt, and concrete as shown on Figure 4-2. Concrete is stockpiled and crushed for use on site. Diverted clean wood materials are sent to the co-generation Atlantic Power facility in Williams Lake. The Regional District has plans to significantly increase the tipping fee on wood waste, and is considering a disposal ban on wood waste since many generators are willing to pay the higher fee.

Additionally, the Williams Lake public works department uses recycled asphalt pavement to fix potholes.

WASTE CATEGORY	TIPPING FEES	TIPPING FEES
Municipal Solid Waste	**Secured, Segregated Loads [1.]**	**Non-Segregated Loads [2.]**
Commercial mixed waste	$53.00 per tonne	$200.00 per tonne
Clean wood waste	$53.00 per tonne, $18.00 minimum charge	$200.00 per tonne
Demolition and Construction Waste (DLC)	$180.00 per tonne, $18.00 minimum charge	$200.00 per tonne
Controlled Waste	**Secured, Segregated Loads [1.]**	**Non-Segregated Loads [2.]**
Asbestos [3.]	$175.00 per tonne, $175.00 minimum charge	Not Accepted
Asphalt roofing	$53.00 per tonne, $18.00 minimum charge	$200.00 per tonne
Leaves and grass	No Charge	$200.00 per tonne
Concrete and rock	$18.00 per tonne, $18.00 minimum charge	$200.00 per tonne

Figure 4-2 Variable Tipping Fees in the Cariboo Regional District to Encourage Segregation

4.3 Columbia-Shuswap Regional District

The CSRD variable tipping fees encourage separation of DLC materials. The definitions in their bylaw do not differentiate materials targeted for segregation, although and a thorough definition of the target materials is provided in their 2010 C&D Waste Diversion Program Toolkit as pictured on Figure 4-3.

Material*	Description	Disposal Fee – If Separated	Disposal Fee – If Material Represents Highest Priced Component of the Load**
Asphalt shingles	Roofing shingles, not including wrap or torch on membrane	$140/tonne	$280/tonne
Concrete/asphalt pavement/bricks/ porcelain	Cement, aggregate and water as a hardened mixture; structural concrete, cinder blocks, asphalt pavement, bricks	$35/tonne	$70/tonne
Refuse	Loose household garbage, material that does not fall into one of the other categories (plastic pipe, insulation, carpet, tile, windows, etc.)	$70/tonne	$140/tonne
Gypsum or drywall	Off cuts or scraps from new construction or old drywall that has been painted, covered in wallpaper, tiles, etc.	$140/tonne	$280/tonne
Metal	Sheet metal, siding, roofing, rebar, flashings, pipe, window frames, doors, wire, bathtubs, fencing, furnaces, etc.	$35/tonne	$70/tonne
Wood waste	Un-treated or painted wood, processed as well as unprocessed wood, stumps, tree trunks and limbs greater than 8" in diameter	$35/tonne	$70/tonne
Yard and Garden	Organic materials, including, grass, lawn and hedge clippings, grass sod, flowers, weeds leaves, vegetable stacks, shrubs, and shrub and tree branches less than 8' in diameter	$35/tonne	$70/tonne

Figure 4-3 Excerpt from CSRD 2010 C&D Waste Diversion Program Toolkit

4.4 Peace River Regional District

The PRRD uses variable tipping fees to encourage separation of DLC for recycling or beneficial use on site, with disposal of comingled loads double the per-tonne cost of segregated clean wood or concrete. They are considering increasing the tipping fee for non-segregated (i.e., comingled) DLC loads as they have found that variable tipping fees do not provide sufficient incentive to segregate recoverable materials. Following an increase to the tipping fee for mixed DLC loads they may also consider a ban on these loads altogether. The private sector has indicated that banning these types of loads is possibly the only way to achieve the high diversion rates targeted.

4.5 Thompson-Nicola Regional District

The TNRD promotes variable tipping fees for segregating recoverable waste, including metal, wood, drywall, concrete, and asphalt shingles. A sample of this differentiation is shown on Figure 4-4. The region's largest city (Kamloops) promotes source separation and variable tipping fees at its landfill as well, with no disposal bans.

Additionally, the region has comprehensive definitions for DLC in their solid waste bylaw which differentiate between individual materials, such as contaminated vs clean wood waste, and all materials aimed at segregation through their differential tipping fees.

Household Refuse	$80/tonne ($1/per bag)
Comingled DLC	$160/tonne
Clean Wood Waste	$100/tonne
Contaminated Wood Waste	$100/tonne
Concrete & Asphalt	$100/tonne
Asphalt Shingles	$100/tonne

Figure 4-4 TNRD 2015 Tipping Fees for Segregated DLC Waste

4.6 Comparison Summary

Table 4-2 provides a summary benchmark based on information available in early 2018 on the state of DLC management and regulatory measures across the regional districts surrounding the RDFFG.

Table 4-2 Comparison of DLC Management in Surrounding Regional Districts

Regional District	Pop. and Density (person/km^2)	Definitions Support Diversion?	Promotes/ Practices Variable Tip Fee?	Disposal Bans?	Mandatory Diversion/ Deposits?
RDBN	38K *0.52*	**Yes**	No (clean wood and amounts < 2m^3 free)	No	No
CRD	63K *0.8*	**Yes**	**Yes,** and increasing	**Yes** (asphalt, concrete, aggregate)	No
CSRD	51K *1.8*	**Yes**	**Yes**	Double fee on mixed loads	No
PRRD	63K *0.54*	**Yes**	**Yes**	Considering for mixed loads	No
RDFFG	94K *1.9*	No	No	No	No
TNRD	133K *3.0*	**Yes**	**Yes**	No	No

5.0 STAKEHOLDER ENGAGEMENT SUMMARY

The RDFFG hosted a workshop with stakeholders representing regulators in the RDFFG on March 8, 2018, and another with industry stakeholders on March 9, 2018. Stakeholders were presented with information on DLC material management in the region and best practices from comparable jurisdictions. They provided feedback on the current system for managing DLC waste, and the applicability of best practices in the RDFFG. A detailed summary is included in Appendix C.

5.1 Regulatory Stakeholder Workshop

Regulatory stakeholders including the City of Prince George (CPG) and RDFFG were engaged to identify opportunities to adjust permitting processes and project regulations to encourage DLC diversion:

- There are a limited number of permitted full-building demolitions in the RDFFG with most demolitions related to municipal projects. Demolition permits for CPG and RDFFG require that utilities are disconnected and hazardous waste is identified prior to issuing the permit.
- There is potential to use one of the upcoming municipal projects to pilot source separation or diversion of DLC materials. Further discussions are required between the RDFFG and CPG to determine details of the trial such as tipping fees for source separated materials. Challenges with existing recyclers and lack of services may limit the potential for diversion from projects in 2018.
- Variable tipping fees were generally supported by all stakeholders as a method to encourage diversion.
- A collaborative approach between regulators, industry, and the RDFFG was identified as the preferred path forward to increase diversion of DLC waste.

5.2 Industry Stakeholder Workshop

Industry stakeholders were engaged to identify opportunities to encourage DLC diversion. Several key items were identified by industry stakeholders:

- Creating sustainable markets for end products of recycling is a key component needed to encourage the private sector to build processing capacity in the region.
- Limiting barriers to private sector facility development was identified as a key issue to increase processing capacity.
- Variable tipping fees were generally supported by stakeholders provided that targeted materials have an available alternative to disposal.

5.2.1 Materials to Target for Diversion

Drywall diversion was identified as an area of interest but deprioritized by the stakeholder group due to cost and challenge to haul materials to the lower mainland for recycling. RDFFG shared that the goal is to divert materials that will be used, not to separate materials to store at the landfill indefinitely. Stakeholders suggested that asphalt pavement, concrete, and cardboard have existing solutions that should be encouraged as a starting point.

5.2.2 Receiving and Storing Materials

There was a discussion of whether the landfill could receive and stockpile divertible materials until diversion markets can be developed. Limited space at the FBRL does not allow the RDFFG to act as a consolidator for materials but if necessary, a variable tipping fee could be set to encourage diversion of materials to processors.

Use of wood waste on site as alternative daily cover (ADC) and grinding wood waste to decrease airspace consumed was identified as one potential to minimize impact on the landfill. Fire and safety concerns eliminate the possibility of running a large-scale grinding operation at the FBRL and ADC is already available from an alternative source.

5.2.3 Barriers to DLC Diversion

Stakeholders indicated that provincial regulations in some areas limit the utilization of recycled product (MOE definition of clean wood, eliminating recycled concrete from being used as riprap on watercourses).

New specifications are needed to allow recycled materials to be used in construction projects (e.g. use of recycled concrete to replace aggregate in pavement). Stakeholders indicated that political direction is needed to encourage public servants to look for ways to utilize recycled materials in their projects. CPG and RDFFG could update their specifications to allow use of these materials. It was suggested that RDFFG work with UBCM to apply pressure to the Ministry of Transportation and Infrastructure (MOTI) to allow use of recycled materials in their specifications.

Labour shortages were identified as a key barrier to diversion. Short construction seasons and lack of workers means that contractors don't want to delay schedules to sort waste into many streams. Stakeholders indicated that a central sorting facility would be preferable to limit the pressures on construction sites. RDFFG indicated that the region would not be creating a facility but would encourage the private sector to consider it.

5.2.4 Methods to Encourage Diversion

In order to encourage source separation, facilities often charge twice or more the regular load cost if garbage is mixed with any materials that could be diverted. There may be opportunities to make small adjustments to tipping fees for DLC materials over time as additional alternatives to disposal come online. Stakeholders expressed that higher tipping fees for divertible materials would encourage diversion from the landfill if an alternative is available.

6.0 PROPOSED STRATEGY AND WORK PLAN

Based the overview of DLC management in the region, a review of best practices in British Columbia, Western Canada, a scan of DLC diversion practices in neighboring regional districts and, most importantly, the results of two stakeholder workshops, the Project Team propose the following strategy and prioritized work plan to encourage the development of local diversion markets within the RDFFG.

6.1 Strategy for DLC Diversion

The overall strategy to develop local diversion markets should be based on a collaborative approach as indicated on Figure 6-1. This collaborative approach recognizes the interplay between building bylaws, generators and markets and disposal regulations. Given the current lack of local processing capacity, the strategy must also be phased to recognize the diversion of DLC waste in the RDFFG is challenging and it will take time so see any significant diversion.

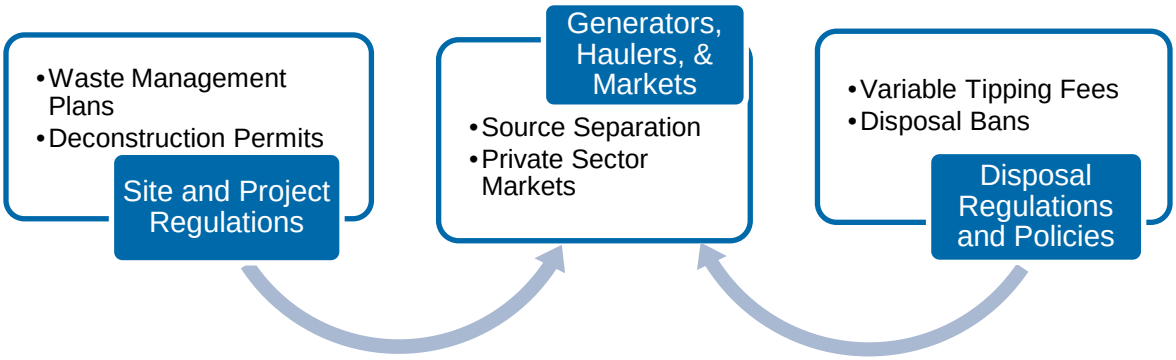

Figure 6-1: Collaborative Approach to Diverting DLC Waste

6.2 Prioritized Work Plan

Based on the strategy described above the Project Team recommend the following detailed work plan to encourage DLC waste diversion in the RDFFG. This work plan incorporates a collaborative approach and recognizes that any increase in DLC diversion will have an impact on the Solid Waste Financial Plan. These impacts must be considered in concert with the other action items to ensure that there are adequate revenues to fund the solid waste management service in the RDFFG.

Priority #1: Encourage source separation of DLC materials by amending Bylaw 3023

- Revise bylaw definitions to include additional source separated DLC materials (clean wood, painted or treated wood, asphalt pavement, and asphalt shingles).
- Revise Facility Use and General Provisions bylaw to include doubling tipping fees for mixed loads of DLC materials.
- Add new DLC material categories to the scale software program to allow for better tracking of source separated as well as mixed loads of DLC waste.

Priority #2: Promote source separation through Sort Smart

- Utilize the RDFFG rebranding program - encouraging generators and haulers for waste to start sorting their waste.
- Begin an education campaign to promote source separation of DLC materials such as clean wood, painted or treated wood, metals, concrete, asphalt pavement, asphalt shingles, and educate residents and industriy on the difference between source separated and mixed loads.

Priority #3: Provide financial incentives for source separation

- In collaboration with industry stakeholders, consider implementing variable tipping fees to encourage source separation once sustainable processing facilities and markets are developed. In future this could apply to asphalt, and eventually to clean wood. Phase in thresholds for variable tipping fee and surcharges for mixed loads of DLC materials.
- Review of the impact of variable rates on tipping fee revenue an adjust the Solid Waste Financial Plan if required.

Priority #4: Support local processing capacity and markets

- Work with the City of Prince George to make it easier for material recycling and handling facilities to launch. This could include the creation of facility permitting processes at a regional level, and supportive zoning particularly for existing concrete recyclers.
- Explore partnership potential with the Veolia biomass energy plant in Fort St. James and University of Northern British Columbia.

Priority #5: Building design and permitting regulations

- Work with the City of Prince George to build on existing programs to encourage DLC waste diversion within the City, such as the City's tax exemption program for LEED® certified projects. The RDFFG can work with the CPG and based on the case studies detailed in this report, make recommendations on what aspects may suit the culture and current state of materials availability for the City.

Priority #6: Construction specifications

- Rewrite construction specifications where possible, in addition to lobbying the province to allow more recycled materials in future projects.
- Investigate and develop specific policies to encourage the use of RAP and RAS at the CPG asphalt plant and other processors in the region.

Priority #7: Disposal bans

- If required to promote more diversion, consider implementing full disposal bans on materials that have sustainable local diversion markets.
- Review of the impact of disposal bans on tipping fee revenue and adjust the Solid Waste Financial Plan if required.

7.0 CLOSURE

We trust this draft report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
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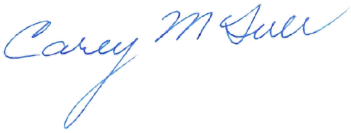

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APPENDIX A

JURISDICTIONAL REQUIREMENTS FOR LEED®, GREEN BUILD, OR EQUIVALENT STANDARDS

Table A-1: Summary of Green Building and LEED® Procurement Requirements in Western Canada

Jurisdiction	Population	Year Enacted	LEED®, Green Build, or Equivalent Building Standard	LEED®, Green Build, or Equivalent Building Incentives	Applicable To	Description of Regulation
Town of Banff, AB	7,847	2007	√		All new municipal buildings.	Municipal Sustainable Building Policy requires that all new municipal buildings meet or exceed LEED® Silver certification.
City of Yellowknife	19,569	2012	√		All downtown and city-owned facilities.	The General Plan Bylaw requires buildings downtown to apply for LEED® Silver as the minimum development standard for new City-owned facilities and all new City-owned facilities to achieve LEED® Silver or measurable equivalent standards as minimum development standard.
City of North Vancouver, BC	52,900	2007	√		All civic buildings.	LEED® Silver is the minimum acceptable building standard for newly constructed civic buildings, with the LEED® Gold as the preferred standard for any building over 900m ^{2}.
Regional Municipality of Wood Buffalo, AB	71,589	2012	√		New construction greater than 1000 m ^{2} and building extension greater than 30% of existing gross floor area.	City Centre Land Use Bylaw requires LEED® Gold certification for new construction greater than 1,000 m ^{2} and existing building extension greater than 30% of the existing gross floor area with area greater than 1,000 m^2.
City of Prince George, BC	74,003	2011		√	All land development over a threshold value in some portions of the city.	Incentives for LEED® certification are provided through bylaws including tax exemption of up to 100% of assessed value of land and improvements for development (over a threshold value in certain areas of the city) that achieve LEED® certification.
City of Maple Ridge, BC	82,256	2013		√	Buildings under 51% of non-renewable energy.	Incentives for LEED® certification are provided through bylaws including tax exemption for 100% tax exemption program which applies to LEED® Silver, Gold, or Platinum certification, or for buildings under a 51% threshold of non-renewable energy during operations.
City of Victoria, BC	85,790	2007	√		New municipal facilities or additions larger than 500 m^2.	New municipal facilities (including new construction and additions larger than 500m ^{2}) are required to meet LEED® Silver, while aiming for Gold.
City of Nanaimo, BC	90,500	2011	√		New public buildings over 900m^2.	Green Building Policy requires new public buildings over 900m ^{2} to follow LEED® Gold with exemptions available where it can be demonstrated that the proposed building contains LEED® equivalent green features.
City of Red Deer, AB	92,729	2009	Principles to guide construction and renovation		All municipal facilities.	The Capital Plan acknowledges that LEED® planning principles will be used to guide construction and renovation of all its facilities.
Strathcona County, AB	98,044	2010	√	√	New construction or major renovations of county facilities or buildings on county-owned land.	Municipal Sustainable Buildings Resolution sets requirements to meet either the Strathcona County Sustainable Building Protocol or a LEED® standard for the new construction or for major renovations of County facilities, or buildings on county-owned land that are over 500 m ^{2}. Permit rebates are offered to builders who achieve LEED®, Built Green, R-2000 (or equivalent) certification and are registered in the program.
City of Kelowna, BC	127,400	2007	Voluntary Check-lists		All buildings.	Sustainability Checklists are included in Development Permits. This awards points for third-party Green Building Certifications, including LEED®. Use of the checklist is voluntary.
City of Richmond, BC	198,300	2004	√		New public buildings or renovations of public buildings over 2000 m ^{2} or civic buildings under 2000 m^2.	LEED® Gold is the standard for new public buildings 2000m ^{2} or more, and LEED® Silver for major renovations to existing facilities, and new civic buildings under 2000m ^{2}.
City of Vancouver, BC	631,500	2014	√		New buildings on rezoned sites.	Green Building Policy requires that all new buildings on rezoned sites be built to the LEED® Gold. Equivalent green certification is accepted for buildings not eligible or suitable for LEED®.
City of Winnipeg	705,244	2011	√		Newly constructed city-owned buildings and major additions greater than 500 m^2.	The Green Building Policy requires all newly constructed City-owned buildings and major additions with a footprint greater than 500 m ^{2} to be certified under LEED® Certification (Silver level or better), Green Globes Design™ (3 Globes level or better), or other such third-party verified standards.
City of Edmonton, AB	932,546	2008	√		City-owned and occupied building construction or major renovations greater than 500 m^2.	Sustainable Building Policy LEED® Silver standard as a minimum for city-owned and occupied building construction or major renovations (of 500 m ^{2} or greater). An alternative sustainable building certification that meets or exceeds LEED® Silver is acceptable.
City of Calgary, AB	1,239,220	2004	√		City-owned buildings over 500 m ^{2}.	Sustainable Building Policy requires that all city-owned (constructed, owned, managed or financed by The City of Calgary) buildings over 500 m ^{2} achieve LEED®-NC Gold or higher.
Province of British Columbia	4,840,000	2008	√		All new provincial buildings or facilities.	Energy Efficient Buildings Strategy requires LEED® Gold, or equivalent green standards for all new provincial buildings or facilities.

APPENDIX B

SUMMARY OF JURISDICTIONS RECYCLING CONCRETE, RAP, AND RAS

Table B-1: Summary of Asphalt Pavement, Concrete, and Asphalt Shingle Recycling in Western Canada

Jurisdiction	Population	Concrete	RAP	RAS	Summary of Use	Description of Regulation
City of Camrose, AB	18,742	√			City operates a processing facility. Private contractor crushes concrete for use in City projects.	The City of Camrose operates a concrete processing facility adjacent to the Camrose Regional Sanitary Landfill that accepts non-contaminated waste concrete generated by the City and private contractors (e.g., building demolition and sidewalk replacements). To recycle concrete, customers must contact Public Works at (780) 672-5513 and apply for concrete disposal. Tipping fees that cover the costs of storage, crushing and other costs related to concrete recycling are listed below. A private contractor crushes the concrete into a usable aggregate material that is stockpiled and typically sold for use in City projects (e.g., road building and stabilization).
City of Calgary, AB	1,239,220	√	√	√	Concrete crushed by the City and used for base in sidewalks. RAP incorporated into City asphalt. Select RAS allowed in asphalt.	The City of Calgary recycles concrete from internal projects by crushing it and using it as the base layer for new sidewalk or sidewalk repairs. - The Roads Construction Division receives 60,000 – 70,000 tonnes of millings chips (top 50 mil of asphalt pavement) from road resurfacing projects annually. The City of Calgary Manchester Asphalt Plant started making RAP in 2010 and mixes roughly 6,000 tonnes of milling chips with virgin materials annually to create RAP that is used primarily by City crews for resurfacing existing roads. Roads Construction 2015 Standard Specifications sets the percentage requirements of milling chips allowed in RAP for specific uses. The Manchester Plant sells RAP to private contractors and sells milling chips directly to Lafarge, Burnco and others. - The City of Calgary allows recycled asphalt shingles (RAS) in hot-mix pavement; percentage of RAS allowed is based on municipal road specifications. The City allows both tear-offs and manufacturer's waste. Private Businesses in Calgary participate in asphalt recycling, namely: - Burnco, Fish Creek Excavating, Inland Aggregates and Lafarge all crush asphalt for construction projects (e.g., base layer in industrial parking lots that are not paved); Burnco and Lafarge also produce RAP. - ECCO Pave began processing asphalt shingles for RAP in 2011, while Environmental Processors West started in 2012. Synchor Recycling also accepts asphalt shingles for recycling.
City of Edmonton, AB	932,546	√	√		The City manages an Aggregates Recycling Program that recycles over 99% of all aggregate rubble in Edmonton.	The City of Edmonton continues its Aggregates Recycling Program that started in 1978, with roughly 200,000 tonnes of aggregate (concrete and asphalt) materials recycled annually and over four million tonnes of material recycled since the program inception. More than 99% of all aggregate rubble in Edmonton is recycled. Concrete and asphalt are accepted free of charge from construction projects, household renovations and private demolitions at the Southwest and West recycling sites. Materials accepted include: - Concrete (fresh, rubble, truck washouts) - Asphalt (rubble, grindings, millings) - Bricks and paving stones - Gravel - Soil cement - Stucco (mesh free) - Sand (coarse and clean) Materials are inspected upon site entry to ensure they do not exceed the maximum size and are contaminant free. Asphalt and concrete rubble, and mesh-free rebar have no minimum size; maximum size is 80 cm x 80 cm and 80 cm. Additionally, this program provides a certificate of recycling for LEED® projects upon request. The Aggregate Recycling Program brochure is available online for more information. This service provides an economical source of aggregates that are used to build and maintain the City roads. The City of Edmonton allows RAS in hot-mix pavement; percentage of RAS allowed is based on municipal road specifications.
City of Grande Prairie, AB	63,166		√		RAP accepted from internal projects for inclusion in new hot mix asphalt.	RAP is accepted from internal projects only. Clean RAP is used on City roads and is not available to the public.
City of Regina, SK	215,106	√	√		Concrete and RAP are accepted at the Fleet Street Landfill where they are crushed periodically and used by the Roadways and Transportation, and the Waterworks and Parks Departments.	The City of Regina Fleet Street Landfill accepts clean asphalt pavement and concrete at no charge if the following requirements are met: - Asphalt – No garbage. Less than 20% clay, dirt and gravel. Loads with mixed garbage will be charged $85/tonne. - Concrete – No garbage. No detached rebar/steel. Less than 20% clay, dirt and gravel. Reinforcing maximum 38 mm diameter (1.5 inches). Exposed reinforcing steel less than 600 mm (2 feet). Any size slabs with maximum 600 mm (2 feet) beam thickness. Concrete and asphalt pavement are stockpiled at the landfill and are crushed every two to three years and as needed respectively. The City contracts out granular material crushing through separate bid processes. Once the materials are crushed they are transported to the St. John Street Yard, operated by the Roadways and Transportation Department, where it is scaled in and scaled out. The City uses granular materials for many internal Roadways and Transportation, Waterworks and Parks projects; tonnage used is charged to each project. Additionally, the Roadways and Transportation Department stockpiles all millings from internal projects at the St. John Street Yard. Roughly 20,000 to 25,000 tonnes of millings are sold annually, typically from May to mid-November (Norman, 2018). In order to purchase any granular materials customers must complete the Granular Material Sales Application Form. The City of Regina offers the following recycled granular materials for purchase to both contractors and the public at the St. John Street Yard. The rates below are from the 2017 External Price List. - Crushed Concrete ($22.52/tonne) – A granular base material made from recycled concrete that can be used as a base for under concrete, asphalt, gravel road maintenance and parking lots. - Crushed Concrete Mixed with Subbase ($23.34/tonne) – Same as crushed concrete with some added fines to make compaction of the material easier. - Crushed Asphalt/Concrete ($26.63/tonne) – Made from recycled asphalt, asphalt is crushed screened and blended with other aggregate to create a granular base that can be used under asphalt, gravel road maintenance and parking lots. - Cold Planings/Millings ($18.00/tonne) – From when a machine grinds off a layer of asphalt so a new layer can be placed. This material is commonly used for gravel maintenance, gravel road dust suppressant (when applied correctly) and parking lots. - Coarse Concrete ($25.07/tonne) – 1"- 4" crushed concrete that is good for rip rap applications or base for sub-grade as the material size and shape is ideal for creating a solid base for other materials to be placed on top.
City of Winnipeg, MB	705,244			√	RAS is allowed in hot-mix pavement; percentage of RAS allowed is based on municipal road specifications.	RAS is allowed in hot-mix pavement; percentage of RAS allowed is based on municipal road specifications.

APPENDIX D

TECHNICAL MEMO 1 - DLC STAKEHOLDER MEETING SUMMARIES

TETRA TECH

TECHNICAL MEMO

ISSUED FOR REVIEW

To:	Laura Zapotichny, RDFFG	**Date:**	March 19, 2018
c:	Petra Wildauer, RDFFG	**Memo No.:**	1
From:	Lauren Quan, Tetra Tech Canada Carey McIver, Carey McIver & Associates	**File:**	704-SWM.PLAN03009-01
Subject:	DLC Stakeholder Meeting Summaries		

This 'Issued for Review' document is provided solely for the purpose of client review and presents our interim findings and recommendations to date. Our usable findings and recommendations are provided only through an 'Issued for Use' document, which will be issued subsequent to this review. Final design should not be undertaken based on the interim recommendations made herein. Once our report is issued for use, the 'Issued for Review' document should be either returned to Tetra Tech Canada Inc. (Tetra Tech) or destroyed.

1.0 INTRODUCTION

The Regional District of Fraser-Fort George (RDFFG) is engaging Tetra Tech Canada Inc. (Tetra Tech) in association with Carey McIver & Associates Ltd. to conduct a study of Demolition, Land Clearing, and Construction (DLC) waste diversion.

Meetings were conducted on March 8, 2018, and March 9, 2018, to engage DLC waste stakeholders as potential partners in waste diversion with the RDFFG. The following sections summarize the meetings held at the RDFFG offices:

- Regulatory Stakeholders Workshop; and
- Private Sector Stakeholders Workshop.

Sections 2.0 and 3.0 summarize the discussions and outcomes of the workshop.

2.0 REGULATORY STAKEHOLDERS WORKSHOP

A regulatory stakeholders workshop with the City of Prince George (CPG) and RDFFG internal stakeholders was held on the afternoon of March 8, 2018, at the offices of the RDFFG. In attendance were:

Stakeholders

- Gina Layte-Liston, Director of Engineering and Public Works, CPG
- Ian Wells, General Manager of Planning and Development, CPG
- Dana Ferguson, Building Inspector, RDFFG

RDFFG Environmental Services Staff

- Petra Wildauer, General Manager of Environmental Services, RDFFG
- Laura Zapotichny, Waste Diversion Program Leader, RDFFG

Consulting Team

- Carey McIver, Principle Consultant, Carey McIver & Associates
- Lauren Quan, Project Engineer, Tetra Tech

Table 2-1: Regulatory Stakeholders - Meeting Summary

Agenda Item	Description
Introductions	**All attendees introduced themselves.**
Presentation (Attachment 1)	The consulting team presented information on: ▪ The reasons for diverting DLC waste ▪ Policies and programs in neighbouring regional districts – Cariboo Regional District – Thompson-Nicola Regional District – Columbia-Shuswap Regional District – Peace River Regional District – Regional District of Bulkley-Nechako ▪ Best practice case studies – Town of Sidney House Relocation – City of Vancouver Advanced Deconstruction Permits – Metro Vancouver Sample Bylaw – City of Port Moody Mandatory Diversion and Refundable Fees – Regional District of Nanaimo Wood Waste Disposal Ban – Asphalt Recycling in North America – Glass Recycling in Anchorage ▪ The need for collaboration to address DLC waste diversion
Discussion	**Demolition Permits** CPG demolition permits require that utilities are disconnected and that a hazardous waste is identified. City projects comprise most demolition in the region. A few houses are demolished following fires each year. RDFFG had six demolition permits in 2017 primarily for houses following fires and for a few cabins. Some demolition occurs in the region without permit. Wood is often burned on site during construction. **Potential Material Markets and Processors** CPG has an asphalt plant and would be interested in looking at recycling asphalt that is being disposed at the landfill. CPG district heating and UNBC are potential markets for clean wood. There was discussion of whether materials could be stored at the Foothills Landfill temporarily or used in place of other materials (crushed concrete instead of gravel). Could concrete be crushed using the MOT equipment/facility near the landfill. There was discussion of potential sites for DLC recycling facilities. CPG requested RDFFG assistance in discussions with the Province if Crowne Land near the Foothills Regional Landfill is identified as the preferred location for these facilities. CPG indicated support for variable tipping fees to encourage diversion of recyclable materials. **Upcoming Demolition Projects** CPG is open to source separating materials for an upcoming project as a trial but would require tipping fees to be negotiated to offset or partially offset the additional cost to the project. RDFFG indicated that tipping fees could be discussed in future but cost recovery would need to be maintained. Challenges with existing recyclers and lack of services available may limit the ability for 2018 projects to realize significant diversion.
Next Steps	RDFFG intends to work collaboratively with stakeholders to increase DLC waste diversion. This will require markets for materials and changes to disposal policies/fees on the back end but will also require regulatory requirements on sites. RDFFG and CPG will work together to support development of DLC diversion services in the Prince George area.

3.0 PRIVATE SECTOR STAKEHOLDERS WORKSHOP

A private sector stakeholders workshop with members of the local hauling, construction, demolition, and contracting industries was held on the morning of March 9, 2018 at the offices of the RDFFG. In attendance were:

Stakeholders

- Mike Guimond, Canada Recycle Corp
- Steve Johansen, Canada Recycle Corp
- Barky Barnes, NAPP Enterprises
- Loris Bedett, Westbin Waste
- Darren Wahl, Cascades Recovery
- Scott Bone, Northern Regional Construction Association
- Fred Fortin, Pitman Asphalt
- Cory Torgerson, Pitman Asphalt
- Bill Warner, WJ Stor&Go/Trash&Go
- Sheldon Mayert, Twin Rivers Developments

RDFFG Environmental Services Staff

- Petra Wildauer, General Manager of Environmental Services, RDFFG
- Laura Zapotichny, Waste Diversion Program Leader, RDFFG

Consulting Team

- Carey McIver, Principle Consultant, Carey McIver & Associates
- Lauren Quan, Project Engineer, Tetra Tech

Table 3-1: Private Sector Stakeholders - Meeting Summary

Agenda Item	Description
Introductions	RDFFG introduced the workshop. All attendees introduced themselves.
Presentation (Attachment 2)	The consulting team presented information on: ▪ The reasons for diverting DLC waste ▪ Policies and programs in neighbouring regional districts – Cariboo Regional District – Thompson-Nicola Regional District – Columbia-Shuswap Regional District – Peace River Regional District – Regional District of Bulkley-Nechako ▪ Best practice case studies – Town of Sidney House Relocation – City of Vancouver Advanced Deconstruction Permits – Metro Vancouver Sample Bylaw – City of Port Moody Mandatory Diversion and Refundable Fees – Regional District of Nanaimo Wood Waste Disposal Ban – Asphalt Recycling in North America ▪ The need for collaboration to address DLC waste diversion
Discussion	**Current Practices** There was discussion of the use of wood chips on site as ADC and the potential of grinding wood waste at the landfill to limit the amount of landfill airspace required for DLC waste. RDFFG does not intend to operate a large-scale grinding operation for DLC waste at the Foothills Regional Landfill due to fire and safety concerns. RDFFG currently receives contaminated/waste sawdust from a nearby mill as needed for ADC. There was discussion of facilities accepting wood waste. The Atlantic Power Williams Lake Project (APWL) in Williams Lake, BC accepts clean wood from CRD and other regions. Due to the distance to the facility stakeholders indicated limited interest in hauling the material from RDFFG to Williams Lake. Stakeholders indicated that they could not build businesses assuming backhaul opportunities would exist. **Receiving and Storing Materials** There was a discussion of whether the landfill could receive and stockpile divertible materials until diversion markets can be developed. There is limited space at the landfill and RDFFG prefers to remain in the disposal business, not becoming a consolidator for the private sector. There may be a roll for the landfill to accept materials at a higher rate than private facilities as a last resort. **Barriers to DLC Diversion** Stakeholders indicated that provincial regulations in some areas limit the utilization of recycled product (MOE definition of clean wood, eliminating recycled concrete from being used as riprap on watercourses). New specifications are needed to allow recycled materials to be used in construction projects (e.g. use of recycled concrete to replace aggregate in pavement). Stakeholders indicated that political direction is needed to encourage public servants to look for ways to utilize recycled materials in their projects. CPG and RDFFG could update their specifications to allow use of these materials. It was suggested that RDFFG work with UBCM to apply pressure to MOTI to allow use of recycled materials in their specifications. Labour shortages were identified as a key barrier to diversion. Short construction seasons and lack of workers means that contractors don't want to delay schedules to sort waste into many streams. Stakeholders indicated that a central sorting facility would be preferable to limit the pressures on construction sites. RDFFG indicated that the region would not be creating a facility but would encourage the private sector to consider it.

Agenda Item	Description
	Materials to Target for Diversion There was discussion of potential to divert drywall. Contractors working in regions with drywall disposal bans indicated that there were very high costs to truck drywall to the only recycler in BC and that WorkSafe BC and manifest requirements create administrative challenges with loads. RDFFG shared that the goal is to divert materials that will be used. Not to separate materials to store at the landfill indefinitely. Stakeholders suggested that Asphalt Pavement, Concrete, and Cardboard have existing solutions that should be encouraged. **Focus on Procurement** Stakeholders indicated that they need specification changes to allow use of recycled materials in construction. Regulators and politicians must be engaged to drive changes in specifications. The Roadbuilders and other industry groups could be partners to lobby regulators. **Methods to Encourage Diversion** Consultants indicated that variable tipping fees often charge twice or more the regular load cost if garbage is mixed with any materials that could be diverted. Stakeholders expressed that higher tipping fees for divertible materials would encourage diversion from the landfill. RDFFG indicated that variable tipping fees would be considered for materials that have an alternative to disposal. RDFFG indicated that new categories have been added to the scale systems to better track DLC waste. The private sector could aid in data collection by training drivers to know what materials they are bringing to the landfill.
Next Steps	A report will go to the RDFFG board for further consideration. RDFFG encourages further conversations about opportunities to divert DLC waste. Stakeholders will be informed of future policy changes.

4.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of RDFFG and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than RDFFG, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

TETRA TECH

Carey McIver & Associates Ltd.

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