

# CONSTRUCTION & DEMOLITION WASTE DIVERSION: BASELINE INFORMATION & GAP ANALYSIS

## BOULDER COUNTY ZERO WASTE EFFORT

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for the Boulder County Resource Conservation Division  
BY GRACESTONE, INC.

*with LBA Associates, Inc., HDR Engineering, Inc. & Hoofnagle Consulting*  
January, 2009

## *I. Introduction and Key Findings*

Boulder County passed a resolution in November 2007 which adopted zero waste as a guiding principle for resource management and which supported the creation of a zero waste plan. This policy is guiding near- and short-term planning and projects in order to shift management of waste streams as discards to management of those streams as resources.

One of the largest fractions of the waste stream is debris from building, remodeling, repairing, and tearing down our built environment – more commonly known as construction and demolition (C&D) waste. C&D waste is a considerable fraction of overall wasted resources when looked at both from a volume and a weight perspective. As well, it contains some of the harder-to-recycle materials. This study is part of broader efforts by Boulder County to implement its Zero Waste plan.

Table 1 on page 3 characterizes the typical components in a C&D waste stream. The primary components estimated in Boulder County's C&D waste from all generators **by weight** (excluding debris from roadway & bridge construction and land-clearing) are estimated to be:

1. clean wood (including both dimensional lumber and land-clearing wood)
2. concrete & asphalt
3. aggregates
4. other wood (treated wood)
5. drywall

These weight-based material streams comprise 64% of the total estimated C&D waste tonnage.

When analyzed **by volume**, the primary components are:

1. corrugated cardboard
2. carpet & carpet pad
3. other wood (treated wood)
4. clean wood
5. plastic

These volume-based material streams comprise 76% of the total estimated C&D waste yardage. Additional, minor components of this waste stream include metals, asphalt shingles, other roofing materials, brick, insulation, soils, hazardous/problem wastes, glass, durable items, ceramics and mixed construction material.

Note that the Table 1 estimates are not based on actual data obtained from Boulder County's actual C&D waste stream, which was not available. Rather, data is extrapolated from waste composition analyses conducted in Colorado, by various states, and nationally. Variations in material types and relative quantities may be observed between local and national numbers, between incorporated and unincorporated areas and between types of projects generating C&D waste (such as residential versus commercial; new construction versus renovation; and demolition, deconstruction and roofing projects).

According to the US EPA [sources listed in Appendix A] Americans generate approximately

2.8 pounds per person per day of construction & demolition waste; this means that in 2007, there were approximately 1,035,800 cubic yards (150,600 tons) of C&D waste generated in Boulder County in 2007 (see Table 1). Using a population growth rate of 1.1% per year for a ten-year planning period [reference for growth rate is Colorado State Demography Office, November 2009], annual generation of C&D waste in Boulder County could reach approximately 1,155,500 cubic yards (168,000 tons). Low (10%) to high (50%) diversion of this material in 2017 could range from 115,600 to 577,800 cubic yards (16,800 to 84,000 tons).

For a brief discussion of the greenhouse gas impacts of C&D recycling, see Appendix G.

## ***II. Purpose of Project – Establish Baseline Information/ Gap Analysis***

Research was conducted in late 2008 to determine the potential size and nature of the C&D waste stream in Boulder County and to establish baseline data to use in future analysis, planning and implementation. This report is a ‘gap analysis’ and offers:

- an estimation of the size and components of the County’s C&D stream;
- a discussion of the infrastructure (from both a physical and policy perspective) that currently exists to manage C&D waste; and
- a preliminary conceptual evaluation of management options and infrastructure needs for diversion of more of Boulder’s C&D waste stream.

The focal area of this study is primarily Boulder County (the County’s jurisdiction) but activities in the jurisdictions within the County were examined, as both public and private sector initiatives will impact the development of the C&D diversion infrastructure.

The Gracestone team gathered data on current programs, practices and services that divert C&D waste from disposal. Key players in this sector for the County were identified and interviewed. The study looks ahead for a ten-year time frame.

## ***III. Characterization of C&D Waste Stream and Activities in Boulder County***

**Quantity.** The most accurate way to know what is in the waste stream – or a subset of it like C&D debris – is to conduct a waste characterization study. Because such a study is costly, it was outside the scope of this effort, and all quantities were estimated from other data sources.

The team compiled national data on C&D waste composition, from 15 relatively recent sources, including both local- and state-level waste characterizations and C&D waste stream profiles. Sources are listed at the end of this report; most locally relevant sources include the 2007 Larimer County, CO waste composition study and the Colorado 2007 Statewide Survey. Note that most of these waste composition studies did not create separate categories for ceramics, durable items, hazardous wastes, or soils which is why they appear as 0%. Mixed construction material is often categorized as waste. Items measuring 0% are expected to be present in small fractions in Boulder County’s waste stream; it would be impossible to know the fractions without a local waste sort.

**CONSTRUCTION & DEMOLITION WASTE DIVERSION  
BASELINE INFORMATION & GAP ANALYSIS  
BOULDER COUNTY ZERO WASTE EFFORT**

Estimation of the data on C&D debris in the generated waste stream in these sources was the basis of the estimated data presented in Table 1 for Boulder County, below.

**Table 1 – Estimated & Projected C&D Waste Generation in Unincorporated Boulder County**

Total Estimated Boulder County C&D Waste Generation							
Material Types (in order of increasing WEIGHT)	Percent by Weight	2007 Tons	2017 Tons	Material types (in order of increasing VOLUME)	Percent by Volume	2007 Cubic Yards	2017 Cubic Yards
Ceramics	0%	0	0	Ceramics	0%	0	0
Durable items	0%	0	0	Durable items	0%	0	0
Glass	0%	0	0	Glass	0%	0	0
Hazardous & Problem Wastes	0%	0	0	Hazardous & Problem Wastes	0%	0	0
Soils	0%	0	0	Soils	0%	0	0
Mixed Construction Material	0%	0	0	Mixed Construction Material	0%	0	0
Insulation	1%	1,506	1,680	Brick	0%	2,987	3,333
Plastic	1%	1,506	1,680	Aggregates	2%	21,535	24,025
Brick	3%	4,517	5,039	Concrete & Asphalt	2%	25,377	28,310
Carpet & Carpet Pad	3%	4,517	5,039	Metals	3%	26,590	29,664
Other Roofing	5%	7,528	8,399	Insulation	3%	27,129	30,266
Corrugated cardboard	7%	10,540	11,758	Other Roofing	3%	28,789	32,118
Asphalt shingles	8%	12,045	13,438	Asphalt shingles	4%	41,752	46,579
Metals	8%	12,045	13,438	Drywall	7%	76,431	85,267
Drywall	10%	15,057	16,798	Plastic	8%	81,388	90,797
Other Wood	11%	16,563	18,477	Clean wood waste	8%	84,389	94,145
Aggregates	12%	18,068	20,157	Other Wood	9%	90,259	100,693
Concrete & Asphalt	12%	18,068	20,157	Carpet & Carpet Pad	10%	107,549	119,982
Clean wood waste	19%	28,608	31,915	Corrugated cardboard	41%	421,591	470,330
<b>TOTALS</b>	<b>100%</b>	<b>150,568</b>	<b>167,975</b>	<b>TOTALS</b>	<b>100%</b>	<b>1,035,767</b>	<b>1,155,510</b>

Conversion factors used to estimate the C&D stream are included in Appendix D

C&D waste generation is based on a 2007 population estimate for unincorporated Boulder County of 294,654 and the 2017 projection assumes a population of 328,718 (using a 1.1% per annum growth rate) based on Colorado State Demography Office data (November 2008)

**Aspects of the C&D Stream & Local Market Option Assessment.** Because both Boulder County and the City of Boulder have ordinances addressing management of C&D waste from residential construction, the materials in the table above were synchronized with the materials named in those ordinances. A brief description of these local ordinances can be found in Appendix C.

A brief discussion of the diversion options (as of December 2008) for each of these materials follows, in the sequence listed above, in order of increasing percentage of the C&D stream. Materials specifically addressed in the County's ordinances are noted in *italics*:

- Ceramics – referring to porcelain fixtures, these items can be recycled at Eco-Cycle's Center for Hard to Recycle Materials (CHaRM) in Boulder
- Durable items, surplus materials (appliances, cabinets, doors (all types), lights and other fixtures, hardware, windows, major appliances) – Re-usable items can be donated for resale to the Center for ReSource Conservation's ReSource Yard in Boulder and to the Habitat for Humanity ReStore in Broomfield; *working appliances and usable items addressed in City and County's respective ordinances*
- Glass – a very small fraction by weight, there are no available markets for recycling window glass at this time; functional windows can be donated and resold at the ReSource Yard & ReStore; *addressed in County's ordinance*

- Hazardous & Problem Wastes (mercury switches from thermostats, chemical-treated lumber, leftover sealants, asbestos, lead-based painted wood) – materials from residential C&D should be managed through Boulder County’s Household Hazardous Waste facility; commercial hazardous wastes should be managed by generator in accordance with RCRA requirements at permitted facility; the new County Hazardous Materials Management Facility will begin accepting hazardous materials from conditionally-exempt small quantity generators by 2010
- Soils – if not contaminated, clean soil can flow to area landfills, or to local operations like farms, construction projects, or ranches that come and go around the County (both the generation of and need for clean soil as fill is linked to construction activity); some LFs are permitted to take petroleum-contaminated soils in the region.
- Mixed Construction Material (also known as used construction material – includes undifferentiated debris) – should generally be managed as municipal solid waste; Western Disposal will haul, sort, market and report diversion (for ordinance requirements)
- Insulation – if in good shape, can be re-used, otherwise should be disposed; ReSource Yard occasionally accepts if really clean and re-usable in large lots
- Plastic (vinyl siding, plastic tiles) – can be recycled if # 1 – 7 bottles, jugs, tubs and screw top containers ; otherwise should be disposed
- Brick (stone, block, and similar masonry) – re-used if in good shape, otherwise can be broken up with aggregates; local aggregate processors will crush and process; *addressed in City and County’s respective ordinances*
- Carpet & Carpet Pad – outlets for recycling these items have closed down in the Rockies; should be disposed if not clean enough for reuse; Waste-Not (Loveland) has markets for clean used carpet squares; *addressed in City and County’s respective ordinances*
- Other Roofing – wood shingles if untreated can go through clean wood processing; if treated must be disposed; metal roofing recycles as scrap metal; Western Disposal and A-1 take wood, plus local scrap metal drop-off and businesses take metal
- Corrugated Cardboard – generally robust recycling options including Boulder County Recycling Center; *addressed in City and County’s respective ordinances*
- Asphalt Shingles – ground shingles (high oil content) can be used in hot-mix asphalt (HMA) or as a refuse-derived fuel; end markets are developing locally – see Appendix E for a detailed discussion of a recent grant Boulder County (with a specialist team) received for developing this market and implications for further planning for diversion of asphalt shingles; *addressed in County’s ordinance*
- Metals (conduit, piping, plumbing fixtures, HVAC metals, scrap metals, wiring, etc.) – many robust recycling options with mature infrastructure for diversion along the Front Range; *addressed in City and County’s respective ordinances*
- Drywall (gypsum board, sheetrock, plaster) – scrap gypsum from new construction is more easily recycled than old gypsum (may contain asbestos) from deconstruction or demolition; for all end use markets, paper must be removed (may be composted); recovered gypsum in demand as soil amendment (retains water & adds nutrients), made into new gypsum wallboard (markets are too distant from Front Range though), or in

cement manufacture; painted or textured sheetrock (from deconstruction/remodeling) cannot be used as a soil amendment; Waste-Not accepts, processes, markets; *addressed in City and County's respective ordinances*

- Other Wood (fencing, treated/painted lumber) – can be chipped and used in non-agricultural landscaping; some outlets exist in Front Range
- Aggregates – rock and gravel generated primarily from roadway work can be re-sized and washed for reuse as road base on the project site; also generated by land clearing; demand from aggregate, concrete or asphalt plants for this material is low as it is generally a readily available resource
- Concrete & Asphalt – can be crushed and used as road base, drainage fill, general fill, pavement aggregate, or used in manufacture of new concrete depending on contamination; several HMA manufacturers will accept asphalt pavement for recycling; many generators also crush and recycle concrete on site, although there is still a glut on the local market caused largely by the Stapleton project; *addressed in City and County's respective ordinances*
- Clean Wood Waste (trees & stumps, pallets, lumber [dimensional, trim, sheathing], wood sheathing, plywood, flooring, trusses) – can be chipped and ground by large, often mobile grinders to produce mulch, compost, animal bedding, boiler fuel, other soil amendments, or particleboard; some outlets exist in Front Range; *addressed in City and County's respective ordinances*

The City of Boulder conducted a study in December 2007 with excellent discussion of building deconstruction dynamics and case studies [see Appendix A for the citation] as well as a discussion of C&D waste material types and general outlets nationally.

Further, in-depth end-market assessment for each of these waste material streams is beyond the scope of this report. Each one has specific recovery methods, processing techniques, and end-markets with detailed specifications and unique economics. To illustrate this point, see discussion on developing Asphalt Shingle end markets in Appendix E.

**Future Quantities that May be Diverted.** Table 2, on page 6, projects a range of C&D material diversion that may be expected, by material type, over a ten-year planning period, from the County.



**Table 2 – Potential 2017 Diversion of Boulder County’s C&D Waste Streams**

Potential Diversion: 2017 Cubic Yards (in order of increasing VOLUME)			
Material types	Low (10%)	Medium (30%)	High (50%)
Ceramics	0	0	0
Durable items	0	0	0
Glass	0	0	0
Hazardous & Problem Wastes	0	0	0
Soils	0	0	0
Mixed Construction Material	0	0	0
Brick	333	1,000	1,666
Aggregates	2,403	7,208	12,013
Concrete & Asphalt	2,831	8,493	14,155
Metals	2,966	8,899	14,832
Insulation	2,966	8,899	14,832
Other Roofing	3,212	9,635	16,059
Asphalt shingles	4,658	13,974	23,289
Drywall	8,527	25,580	42,633
Plastic	9,080	27,239	45,399
Clean wood waste	9,415	28,244	47,073
Other Wood	10,069	30,208	50,347
Carpet & Carpet Pad	11,998	35,995	59,991
Corrugated cardboard	47,033	141,099	235,165
<b>TOTALS</b>	<b>115,491</b>	<b>346,473</b>	<b>577,454</b>

*Note: Items listed as having 0 cubic yards are likely still present in small amounts; waste composition analysis and/or analysis of diversion reporting from Build Smart/Green Points would be needed to quantify.*

**Future Considerations & Market Forces.** C&D waste stream generation is very closely linked to overall economic activity and growth. As 2008 has experienced a dramatic economic downturn, particularly affecting the housing – and by extension – large-scale residential housing and commercial building markets – C&D waste generation may slow down over the next year or so. Concurrently, global – and thus local – prices for recycled commodities – such as the cardboard and metals found in the C&D stream – have taken a significant downturn. The caution learned from the normal swings found over time in all recovered materials markets should be exercised when planning for increased C&D diversion.

The two ordinances in Boulder County were designed to increase C&D waste diversion – Boulder County’s “Build Smart” and the City of Boulder’s “Green Points” programs – are in the first year of full implementation and meaningful data is not yet available. (These ordinances are briefly explained in Appendix C.) Ideally, these ordinances will be rigorously enforced and data generated will be carefully maintained. Early, anecdotal discussions indicate that builders and remodellers are not yet fully in compliance with these programs, and diversion is not noticeably increasing. Time will tell if this is just normal start-up barriers being worked out (and if many builders made a point of pulling permits before the C&D reporting requirements kicked in) – or if the ordinances will require more education or enforcement to yield higher C&D diversion rates.

Other factors in the next ten years which may influence future C&D debris diversion include:

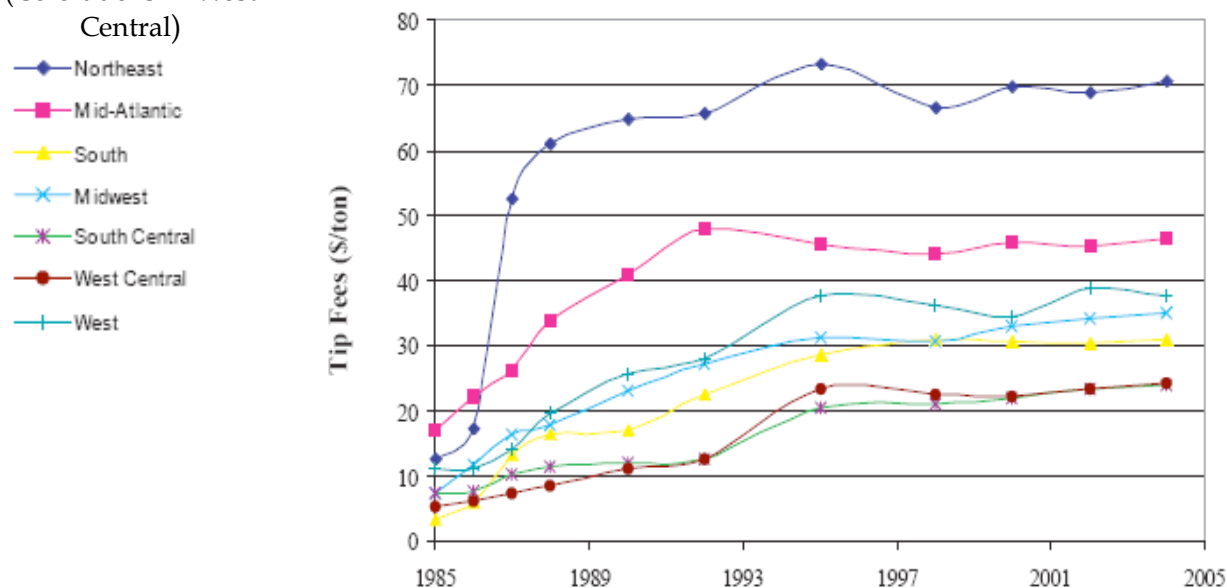
- More construction and remodeling to LEED standards in all building sectors
- Self-imposed requirements for better C&D waste diversion in new construction and renovation by the large institutions in the County (such as the University, County, Cities, large malls, and large employers)
- Increasing landfill prices and increasing fuel costs for waste transport
- Landfill bans on recyclable commodities
- Development of better local end markets, especially for items that have been proven to be recyclable elsewhere, like carpet (in the Southeast U.S.) or mixed construction material (in California's Bay Area)
- Development of common measures and incentives for managing greenhouse gas (GHG) impacts as linked with resource use and management; standardized GHG metrics will enable better comparison of waste diversion with energy measures in Build Smart and Green Points building codes (see Appendix H)

**Current Costs of C&D Diversion Activities in Colorado.** Unlike other parts of the nation, Colorado enjoys very low tipping fees for disposal of solid waste. This is a huge disincentive to more diversion of waste, unfortunately. Table 3 depicts MSW tip fee trends over approximately the past two decades. Most of the population of the U.S. is in regions where diversion of C&D debris makes economic sense either due to bans prohibiting most C&D waste materials from being landfilled, or because the costs of landfilling make diverting C&D debris to reuse and recycling economically beneficial. Colorado's tip fees remain consistently amongst the nation's lowest.

Tip fees for Colorado are in the West Central line shown on Table 3, on the following page.

**Table 3 – U.S. MSW Tip Fees by Region**

(Colorado is in West Central)



Source: NSWMA's 2005 Tip Fee Survey, Edward W. Repa, Ph.D., NSWMA Research Bulletin 05-3, March 2005



**CONSTRUCTION & DEMOLITION WASTE DIVERSION**  
**BASELINE INFORMATION & GAP ANALYSIS**  
**BOULDER COUNTY ZERO WASTE EFFORT**

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Because there are no full-scale dedicated C&D processing facilities (accepting all materials and marketing them) in Colorado, in order to establish a basis of comparison, this study looked at the processing and resale of C&D waste-derived materials occurring at landfills, private sector facilities, and non-profit operations in Colorado.

Landfill tip fees for the primary Front Range landfills accepting C&D waste are summarized in Table 4, below. Other Colorado landfills with C&D waste processing operations and variable rates for C&D waste are also included in this table. As well, landfills selling C&D-generated materials to the public are presented, with charges shown, where available.

**Table 4 – Summary of Landfill Tip Fees & Sales Prices for Common C&D Materials in Colorado**

Facility	Materials Accepted	2008 Tipping Fees	Sales Prices per ton				Distance from Boulder County Centroid
Landfills							
DADS LF (SE Denver metro)	MSW, C&D	\$10/CY	do not sell materials				50 mi
Front Range LF (Erie, CO)	MSW, C&D	\$15.50/CY					15 mi
Tower Road LF (near DIA)	MSW, C&D	\$20/ton					38 mi
Denver Regional LF (Erie, CO)	MSW, C&D	\$15.50 - \$23.21/CY					15 mi
Foothills (north of Golden, CO)	MSW, C&D	\$20/ton					15 mi
Mesa County (Grand Junction)	MSW, C&D	\$20/ton					not relevant
	Wood debris	no charge					
	Metal						
Eagle (Wolcott, CO)	MSW, C&D	\$33.03 - \$47.45/ton	do not sell materials				not relevant
	Wood deris	\$21/ton					
	Metal	\$21/ton					
			3/4" Road Base	3/8" Crusher Fines	Topsoil	Compost	
Pitkin County LF (Aspen, CO)	MSW, C&D	\$26.25/cy - \$50/ton	n/a	n/a	n/a	n/a	not relevant
	Wood debris	\$15.00/cy	n/a	n/a	n/a	\$15.00	
	Crushable aggregate	\$8.00/cy	\$14.00	\$11.00	n/a	n/a	
	topsoil	\$2.00/cy	n/a	n/a	\$25.00		
	metal	\$15.00/cv	n/a	n/a	n/a	n/a	

The data in Table 5, on page 9, following is presented to convey the variety of players involved in C&D diversion and processing in Boulder County and the vicinity. This provides an initial operational and economic context for a C&D waste processing.

CONSTRUCTION & DEMOLITION WASTE DIVERSION  
 BASELINE INFORMATION & GAP ANALYSIS  
 BOULDER COUNTY ZERO WASTE EFFORT

Table 5 – Summary of Tip Fees & Sales Prices for Common C&D Materials in Colorado

Facility	Materials Accepted	2008 Tipping Fees	Sales Prices per Ton				Miles from Boulder Co Centroid
Used Building Material Facilities							
ReSource yard (Boulder)	Used building materials <sup>[1]</sup>	Approved donations only <sup>[2]</sup>	Priced per item <sup>[3]</sup>				5 mi.
Habitat ReStore (Broomfield)	Used building materials	Approved donations only <sup>[2]</sup>	Priced per item				10 mi.
Eco-Cycle	Porcelain fixtures, OCC	\$2-\$10/item; no fee for OCC					
C&D Waste Hauling & Marketing Operations							
Waste-Not (W-N) Recycling - C&D Waste haul, process & recycle service (Loveland)	Wood, drywall, OCC, concrete, asphalt, brick, rock, metal, porcelain, carpet, squares, ceiling tiles	Places roll-off, hauls, sorts, processes; fee is for hauling. W-N staff inspects for contamination. No drop-off at W-N ops.	Sells into various end markets directly after processing. No public sales				41 mi.
Western Disposal - Deconstruction Service (Boulder)	Clean wood, wire, OCC, metal, appliances, yard waste, concrete, cedar shingles	Places roll-off & hauls; fee is for hauling. Will sort & process. LEED service too.	Sells into various end markets directly after processing. No public sales				5 mi.
			3/4" Road Base	3/8" Crusher Fines	Topsoil, Compost	Mulch	
Aggregate Recyclers							
Recycled Materials Company (old Stapleton airport site in Denver)	Concrete	\$2.50/ton	\$7.95	\$3.95	n/a	n/a	20 mi
	Reinforced concrete	\$5/ton	n/a	n/a	n/a	n/a	
	Heavily reinforced concrete	\$25/ton	n/a	n/a	n/a	n/a	
	Asphalt	\$3/ton	n/a	n/a	n/a	n/a	
LaFarge North America (Denver)	Asphalt pavement (clean)	No charge, no payment					15 mi.
Asphalt Shingle Recyclers							
Asphalt Specialties Co. (Henderson)	Asphalt shingles	\$7/cy (clean), \$9/cy (contaminatd					25 mi.
Organics Composting							
A-1 Organics	Wood debris, organic waste	\$5.00/CY	n/a	n/a	\$27/cy	n/a	20 mi
Western Disposal Compost (Boulder)	Clean wood debris, organic waste; OCC	\$48/ton Yard waste \$24/ton Wood waste	n/a	n/a	\$24/cy	\$7.50/cy	5 mi.
Metals							
Busy Bee Metals (Longmont)	All scrap metal	Pay market prices for metal	Do not sell to the public. Recovered metals are sold to the refinery market after separation.				10 mi.
Eco-Cycle	All scrap metal	None					5 mi.
Western Aluminum (Boulder)	Non-ferrous scrap metal	Pay market prices for metal					5 mi.
Scrap metal yards (throughout region)	All scrap metal	Pay market prices for metal					up to 40 mi.

[1] List of accepted items online at [www.resourceyard.org/mat\\_donations.php](http://www.resourceyard.org/mat_donations.php)

[2] Donations are tax deductible

[3] See [http://resourceyard.org/mat\\_gallery.php?category\\_id=1&parent\\_id=0](http://resourceyard.org/mat_gallery.php?category_id=1&parent_id=0); rest priced at yard

**Key:** MSW = municipal solid waste; LF = landfill; OCC = old corrugated cardboard; ;n/a = not applicable

**No Landfill Facility in Boulder County.** Realistically, Boulder County faces significant limitations by not owning a landfill to use for directing the flow of waste, landfill bans, tip fee surcharges, and other landfill-linked mechanisms to help spur diversion. While a landfill is a logical place to co-locate operations that process traditional recyclables, aggregates, organics, scrap metal and tires, this is not an option for Boulder County. C&D waste diversion and processing can occur, however, at project building sites, under processing contracts controlled by local governments, at storage/transfer facilities (publicly or privately operated), or possibly at a dedicated C&D processing facility (see Section V). With options such as this, differential tipping (or hauling) fees can encourage source separation of C&D materials as needed.

#### *IV. Current C&D Diversion Infrastructure in Front Range and Colorado*

**Key Players.** In the northern Front Range of Colorado, C&D waste processing and recycling operations exist in a segmented fashion. Contact information for these organizations is listed in Appendix F. Prominent players – both for-profit and non-profit – in the local infrastructure currently include:

- *Recycled Materials Company Inc.*, Arvada, in business for many years, led the demolition and recycling of material from the old Stapleton Airport in Denver, as well as aggregate accepted from throughout the Denver metro area; has mobile equipment that could be brought to Boulder County area for crushing brick, asphalt, aggregate, and concrete
- *A1-Organics* recycles thousands of tons of organic materials throughout the Front Range; may have mobile equipment that can be brought to Boulder County area for grinding wood waste
- *ReSource Yard*, a decade-old leader in building deconstruction and resale of recovered building materials, cabinetry, durable items, and other salvaged building components
- Habitat for Humanity's *ReStore* in Broomfield, selling recovered building materials
- *Eco-Cycle's CHaRM*, recycling porcelain household fixtures
- *Boulder County Recycling Center* offers drop-off for scrap metal and cardboard
- *Western Disposal*, pulling clean wood waste from C&D waste loads and diverting to wood chipping; accepts cardboard for drop-off; accepts clean wood waste for chipping
- *Waste-Not Recycling*, Loveland, privately owned & operated hauling and processing operation collecting, processing and marketing wood; drywall; concrete, asphalt, bricks, & rock; and porcelain from job sites by pre-arrangement. Charge per-pull fee and guarantee recycling – with limits on contamination. Has mobile equipment that could be brought to Boulder County area for crushing and grinding
- Many other operations of various sizes recycling metals, wood, and cardboard from the C&D stream throughout the Denver Metro and Northern Front Range areas

Most of these operations are material-specific, and all of them have particular acceptance limitations that inhibit some C&D material inflows and can make developing a reliable end market for a particular material challenging. To our knowledge, there are no processing “parks” or operations in Colorado where C&D materials, as a distinct waste stream, can be

properly tipped by many users, and then sorted, processed, and prepared for sale into ready markets. Tables 4 and 5 in the previous section provide an overview of the costs and charges for products made from recovered C&D materials.

**Statewide C&D Processing Operations.** Beyond the Front Range, there are various elements of the C&D debris stream getting processed. These programs are worth examining to better understand Colorado's C&D waste recovery market dynamics:

- Publicly-operated programs at the Eagle, Pitkin, and Mesa County landfills operate grinding and/or composting programs that combined divert over 25,000 tons of organic materials, including clean wood waste from the C&D waste stream.
  - These landfills also operate metal and tire recycling programs, and cardboard diversion is available in those communities as well.
  - Businesses involved in the construction trades know to bring their loads of C&D waste to these landfills, and enjoy variable tip fees – lower than the fee for MSW – for specific materials in the C&D waste stream.
  - Each of these landfills has developed sound end markets for the sale of processed materials recovered from specific C&D wastes.
- Details on Pitkin County's C&D waste diversion program (part of overall landfill and recycling operations):
  - Accepts about 200,000 cy/year of all wastes, of which about 60% is C&D waste on over 10 acres
  - Diverts aggregates, wood and yard debris, scrap metal, cardboard, HHW from the C&D stream
  - Makes and sells landscaping and aggregate products into local end markets and for Pitkin County's own operations, providing a net positive revenue for the County
  - Co-located at County-owned landfill, which provides control over policies that influence materials flows, e.g., setting differential tipping fees in order to incent source separation.

While these operations show promise for future C&D diversion, there still are not feasible diversion options and strong markets for many of the key components of C&D waste generated in Colorado.

## ***V. Potential Boulder County C&D Diversion Program***

**Future Program Options.** With this report, Boulder County is asking hard questions about C&D waste stream management that build upon the Zero Waste policy decisions made by both the County and the City of Boulder. However, much is yet to be learned about the needs and constraints of a future Boulder County C&D program such as:

- Current & future trends in construction and demolition of the built environment (project types and number)
- Hard data on County-specific C&D waste materials & quantities generated
- Long-term, viable end markets for these materials, the County's influence on these

markets (if any), and the likely sustainability of same

- Political will of the County and municipalities to collaborate on County-wide (or regional) policy

As a result, it is not possible to describe what the *most feasible* future County-wide C&D diversion program will look like at this time. There are a number of options and programs that may fit the needs of the County, once those needs and constraints are much better defined and understood. It is also possible that a future Boulder County program will evolve from one option to another as it grows. Other successful County waste diversion programs, such as household hazardous waste diversion efforts, have evolved similarly. A sampling of potential program types described below includes a range of non-facility and facility options/programs, presented in order of increasing complexity to develop and administer:

#### Non-Facility C&D Diversion Programs

1. *County Administration Only* - In the simplest scenario, Boulder County could work with the local municipalities to implement policies that further encourage and/or mandate C&D waste recycling. The County could serve local jurisdictions (that have established their own C&D diversion ordinances) in implementing more C&D waste diversion with services including tracking quantities, sharing resources, and aiding in enforcing policy requirements. The County may also develop, verify, and support end-markets for diverted C&D wastes. Finally, the County could possibly and occasionally contract for processing services (e.g., bringing in a mobile crusher for a few months to move around the County crushing concrete/asphalt/etc. for localities to use to make road base for their own road maintenance needs).
2. *County Administration Plus County-Provided Mobile Processing* - In this scenario, the County may add the provision (through established direct ownership or vendor contracting) of mobile services to builders and roofers including crushing, grinding and screening. Access to a truck scale in this scenario would enable the County (and users such as builders, roofers, and deconstructors) to measure recycled and disposed C&D materials to better document diversion activities.

Examples of processing equipment capital and operating costs developed by Pitkin County are presented in Table 6 below.

**Table 6 – Preliminary, Estimated C&D Waste Processing Equipment Costs, Staffing Needs, and Throughput (2008 dollars)**

Operations Type	Equipment Requirements	FTEs Needed	Throughput	Approximate Capital Cost	Estimated O & M Costs
<b>Organics</b>					
Wood processing	Horizontal Grinder		100 tons/hr	\$280,000	\$20-30/hr
	Excavator	1		\$320,000	\$100/hr
	Front-End Loader	1		\$200,000	\$100/hr
Composting	Trommel Screen		80 tons/hr	\$375,000	\$30/hr
	Water Truck			\$55,000	\$50/hr
<b>Aggregates</b>					
Rock & Mineral Soils	Mobile Jaw Crusher		150 tons/hr	\$500,000	\$30/hr
Concrete, asphalt, brick, etc.	Trommel Screen				\$30/hr
	Excavator	1			\$100/hr
	Front-End Loader	1			\$100/hr

*Pitkin County's wood grinder is mobile and can be trailered to other locations for County processing needs. Further specifications can be provided on physical size of the units outlined above (beyond capacity), such as data on motor, bucket, tub diameter, power needs, safety & training needs, etc.*

#### Facility-Based C&D Diversion Programs

3. *Storage & Transfer Facility* – The most low-technology C&D facility option for Boulder County may address only the transportation needs of builders and roofers who have several recyclable streams. Such a facility may be a centrally-located site that provides space for short-term accumulation of source-separated recyclables from C&D projects. The County could then take advantages of the economy of scale achieved from multiple projects, and provide transportation to appropriate end markets.

Because of its weight, C&D debris is expensive to haul long distances. In 2002 research, SWANA identified 15 miles as the cut-off for economically transporting these materials. Obviously, that distance will vary with the price of diesel, geography, materials hauled, local tipping fees, labor costs, etc. However, it is clear from Tables 4 and 5 that markets outside of the Boulder County area may not be cost-effective. As a result, the net cost of recycling (including transportation) could quickly erode the benefit of avoided disposal without a centralized accumulation and transfer location.

4. *Processing of Source-Separated Materials* - A medium-technology facility option would include processing of source-separated materials. This option may make more economic sense than mobile processing when numerous small to mid-sized projects (versus large-scale projects) scattered throughout the County prevail.

Based on Pitkin County's C&D waste processing experience, the general land requirements for a Boulder County facility that accepts source-separated materials from C&D and conducts some processing (such as crushing, grinding and screening) would be:

- 10 to 20 acres of industrially-zoned land – assuming:
  - 1 acre for every 10,000 cubic yards of un-compacted wood waste
  - 1 acre for every 13,000 cubic yards of aggregates/concrete/asphalt

Processing equipment needs for the Storage & Transfer Facility above. It should be noted that equipment designed for primarily one material type (source-separated) is less



capital-intensive than the equipment needed to process mixed C&D.

5. *Full-scale Processing of Mixed C&D Waste* - This option would represent the most expensive option for the County from both the capitalization and operation standpoint, but would allow processing of mixed waste. Sorting mixed C&D is an increasingly common practice in some parts of the country (typically in very large population areas or areas with high tipping fees, such as L.A. and the Bay Area in CA, and the Northeast cities). However:
  - Equipment required for this level of processing is on a larger industrial scale and notably more expensive; equipment needed, in addition to that described above, will include conveyors, magnets, grapples, nuisance control equipment, air, etc. (environmental controls for surface water may also be required)
  - Volumes necessary to break even are much higher than with lower technology options involving source-separated materials
  - Siting is more difficult due to noise, dust, and poor aesthetics
  - More acreage is needed to support large tipping space and sorting areas
  - Landfilling of process residue will be required

**Materials & Markets: Prioritizing Materials Streams for Processing.** Developing County-wide policy and/or a C&D diversion program will be difficult to accomplish until the County fully understands which C&D materials can realistically be targeted for diversion on the basis of tons generated, as well as the location, price and sustainability of existing or developing markets. This report, along with the City of Boulder's December 2007 study (see Appendix A) constitute a preliminary assessment of these factors. However, Boulder County still needs to complete both an analysis of the local C&D streams as well as local markets before establishing a successful diversion program.

The largest fraction of Boulder County's C&D waste stream (by volume) with potential markets at this time include cardboard, clean wood, metals, concrete & asphalt and aggregates. Some market considerations for these materials are included in Table 7.

**Table 7 - Market Considerations for C&D Materials with Greatest Diversion Potential**

Material	2017 Cubic Yards	Potential Processor & End Markets	Considerations
Cardboard	470,330	County MRF	Possibly guarantee \$0 tip fee or rebate
Clean Wood	94,150	Western Disposal, A-1 Organics; selling into local end markets	County may consider partnership to ensure sustainability, may need to provide grinding
Asphalt Shingles	46,580	Asphalt Specialties; supplying local hot mix market	Market may not be sustainable (research under way); ASCI charges \$7-\$9/CY tip fee; long-term markets may require grinding
Scrap Metal	29,660	Multiple local & Front Range buyers; sold to well-established metal markets	No County influence on market pricing, Front Range markets have long haul distance
Concrete & Asphalt	28,310	Multiple local & Front Range crushers; sold to aggregate, hot mix aggregate companies	Currently only asphalt pavement recycled, market may not be sustainable, Front Range markets have long haul distance; alternative local markets (roadway projects) may require crushing

Other materials with markets that could potentially be developed with targeted research (including possible pilot studies) includes:

- carpet/carpet pad (limited recycling of carpet tiles from commercial sources is occurring in the northern Front Range),
- plastic (both film and rigid components), and
- drywall (limited agricultural use of ground, clean scrap drywall locally).

Table 7 includes asphalt shingles due to the Boulder County project currently under way (see Appendix E).

The markets for all recovered materials are dynamic and, in some conditions (such as the last few months), extremely volatile. As noted, the current availability of sustainable markets is limited for every material except cardboard and scrap metals. Boulder County should consider how to verify and support markets for these materials before implementing policy or programs. Mechanisms for doing this may include partnerships or contracts with local markets, establishing minimum market price thresholds below which recycling is not required (such as in the current market down turn), providing processing capability and minimizing the impacts of long-distance hauling.

**Policy Options.** While Boulder County's authority is only over its own jurisdiction (the unincorporated part of the County) its influence with the municipalities within the County – and perhaps with neighbouring counties and jurisdictions and state-wide – may be needed in order to develop a flow of C&D waste materials large enough to justify capital investment and development of a more formal C&D diversion facility.

Locally, deconstruction and/or the additional processing required for recycling makes the costs of recovering the majority of C&D wastes higher than landfilling in most cases. Since economics are unlikely to drive recycling of construction waste, ordinances could be the strongest driver to create incentives to divert C&D waste. One type of ordinance or policy can play a role: incentives or requirements (possibly tied to building permits) that encourage or force builders and roofers to divert C&D materials, and an ordinance controlling flow of waste. The Build Smart and Green Points programs tie requirements for waste diversion to building permits. In Boulder County's case, ordinances controlling flow are likely to be the main driver for landfill diversion.

The following information provides an overview of additional policy tools and mechanisms that can significantly increase C&D diversion. These policy tools are presented for consideration over the ten-year planning horizon. They represent options which local governments could implement to increase recycling of C&D debris. Some of these are in place now. Not all of these options will be applicable to Boulder County in the near future, but may be appropriate tools to implement as the County's C&D diversion program develops over time. The table in Appendix B provides an overview and summary of many of the leading C&D diversion policies around the nation, with details on their implementation. And, sample, "fill-in-the-blanks" ordinances are provided in Appendix G as an additional reference.

**Policy “carrots” (or incentives) may include:**

- Create recognition programs to encourage contractors to reuse, reduce and recycle: King County, Washington (Seattle metro area) has a recognition program called Construction Works which publicizes construction companies that recycle and reduce waste and use recycled products on the job site. To become a member, an organization must recycle 40% of its waste, practice at least three waste reduction strategies, and use at least three recycled products. To become a Distinguished Construction Works member, an organization must recycle 60% of its waste, practice at least six waste reduction strategies, use at least six recycled products, as well, it must also be involved in three additional activities that promote recycling, waste prevention, and buying recycled. This type of program can motivate diversion without the need for an ordinance.
- Provide sales tax exemptions for recycling equipment: some states like Florida offer tax exemptions for certain machinery and equipment (e.g., on-site grinding) used for processing recyclable materials. Companies must demonstrate that recyclable materials consumption was increased by 10% and provide receipts for taxes paid on equipment that contributed to this increase after one full year of use. The Emergency Economic Stabilization Act of 2008 (enacted in Fall 2008) included sales tax credits for the purchase of processing equipment by private recyclers.
- Access grants (such as CDPHE’s RREO 1288 grants) or low-interest loans (e.g., via CHFA) to businesses to purchase equipment and machinery to expand recycling capacity, create secondary and end markets for drywall and roofing materials and/or develop public/private partnerships for innovative pilot or demonstration projects. Florida and California both operate Recycling Loan Programs and offer grants to stimulate expansion of C&D infrastructure.

**Policy “sticks” (or requirements) may include:**

- Implement a mandatory recycling policy for selected materials prior to permit issuance when the project’s dollar value exceeds a specific threshold, i.e. \$50,000. A project’s trigger points where mandatory recycling requirements kick in can vary by cost, depending on project type (residential, commercial, etc.). Typical ordinance language usually states that reusing and recycling C&D debris is cost-effective and essential to furthering the jurisdiction’s efforts to reduce waste; that it is feasible to divert an average of at least 50% of all C&D debris from construction, demolition and renovation projects; and recycling and sound waste management practices increases job site and worker safety. A mandatory recycling policy for selected materials should target cardboard, metal, clean wood. Urban jurisdictions such as Chicago, IL, Austin, TX, and many in California use this approach.
- Require C&D debris to be processed before disposal: several states and local governments have regulations that ban many types of C&D debris from entering landfills except as residue after being processed through a C&D recycling facility. For this approach to be successful, the net value of processing & recycling must exceed the easy cost of landfill disposal. As well, regional market development efforts are needed to boost end markets for materials that do not have established recycling infrastructures (e.g., for drywall). Bans are effective only if adequate markets exist to recycle the banned materials. For the

state level in Colorado, this would be a longer-term policy strategy. At a regional level, cooperation among the counties in the northern Front Range would be needed to effect such a landfill ban.

- Issue permits to roll-off box haulers. Haulers of roll-off boxes placed at C&D waste-generating job sites are required to obtain a permit from the local government and follow certain regulations governing placement of the boxes, transportation and recycling or disposal of the C&D debris. The Palm Beach County Solid Waste Authority uses this system.
- Require deposits with building permits that are refunded when recycling is documented: a rebate system places a deposit on construction, demolition and remodeling projects when the project permit is issued. The deposit rate is based on square footage and the type and quantity of material expected to be generated by the project, in conjunction with the costs of recycling or processing that material. Upon demonstration of diversion of a pre-established percentage of the C&D debris, the full deposit or appropriate portion would be refunded to the permitted participant. San Jose and San Diego use this approach.
- Place a tax on the disposal of C&D debris: could create an incentive to recycle more so that the tax will be reduced. Iowa has extended its state-level tax on solid waste to apply to the disposal of C&D debris.
- Promulgate a Solid Waste Impact Fee that would be assessed prior to issuance of a deconstruction or building permit. The funds could be refunded upon recycling, or used by the County to offset a C&D operation for example. Broward County, Florida has successfully implemented such a fee and Pitkin County is currently working on developing a similar fee. Many jurisdictions mentioned in the table at end of this document include similar fees.

**Flow Control Requirements for C&D Processing Facility Option.** For the County to engage in the development of some type of C&D diversion facility, mechanisms to assure there will be adequate revenue and throughput to keep equipment running and the facility operating smoothly must be identified and put in place.

Controlling the flow of waste streams is a formidable task for any community. This is due to waste's status as a commodity under the commerce clause of the U.S. Constitution. The Supreme Court of the United States has rendered two decisions in flow control cases. In one of them, *United Haulers Association, Inc. v. Oneida-Herkimer Solid Waste Authority*, the Court ruled that a public entity could control flow to a publicly owned and operated site if there were certain community benefits that are in danger without control of flow; in those cases with the public owner had to have completed rigorous due diligence to support its case. There is still a question as to whether a publicly-owned and *privately*-operated site would enjoy the same ability. The Court has not ruled on this question. Therefore, any entity that attempts this may run the risk of being a test case for the judicial system.

## ***VI. Recommended Actions for Future Boulder County C&D Diversion Program***

The following three steps are key to obtaining the necessary information about the needs and constraints of a future Boulder County C&D diversion program.

1. *Convene Stakeholders* – The step will identify those stakeholders critical to the successful implementation of an appropriate policy and programmatic approach County-wide. Stakeholder meetings may be convened in multiple tracks but should include:

- County and municipal building, transportation and diversion staff (e.g., asking for their commitment to use recovered C&D materials in their own operations)
- Builders and roofers (including the Boulder Green Building Guild)
- Potential end markets
- Landfill managers of Boulder County C&D waste

These meetings should assess the range, pros/cons and feasibility of policy options from a logistics, costs and political standpoint. The County's planned stakeholder roundtable on C&D debris for February 12, 2009 is an excellent first step.

2. *Obtain County-Specific C&D Project & Material Data* – This step should include two critical components. The first component would be a comprehensive review of building permits issued by the County and municipalities over at least a one-year time frame (noting that the recession of 2008/2009 is likely to skew findings). This review should identify types of projects as well as the size, cost and location of each. This information will be used to characterize the projects generating C&D in Boulder County, including the following for all residential and commercial projects:

- New construction
- Renovation
- Demolition
- Deconstruction
- Roofing

The second component should include an analysis of waste materials generated by type and quantity for representative projects in each of these categories. This will include the sorting and measuring of up to 20 materials, and will include a sorting location equipped with scales and heavy equipment to sort and move the materials.

This step will produce data invaluable in planning for program implementation.

3. *Conduct Targeted Research* – This research should target specific materials, as well as address the need to weigh C&D materials as a key aspect of most policies (i.e., access to permanent scale system). Examples may include:
- Carpet & carpet pad – exploring ability to recycle from commercial deconstruction projects
  - Clean wood – exploring acceptance by Western Disposal and/or others (quantity limits, quality limits, grinding requirement, storage needs) and possible partnership/contractual agreements to ensure adequate processing capacity if all clean wood waste can be captured from the C&D stream
  - Plastic – exploring opportunities to recycle film and rigid plastic (the Colorado Senate is entertaining a disposal ban on film in the 2009 legislative session)

- Drywall – exploring additional outlets for ground, new scrap drywall
- Asphalt pavement & concrete – identifying additional and/or alternative markets to increase overall sustainability (quantity/quality limits, sizing and washing requirements, storage needs)

It is suggested that Boulder County take advantage of grant funding for this research. Three key opportunities includes

- the Resource Recycling Economic Opportunity grant fund through CDPHE that is current open (proposals due mid-March)
- the Advanced Technology Fund grants, and the USDA Solid Waste Management Grants (next award cycle will be fall, 2010).

Finally, the ability to weigh recycled and disposed streams from C&D projects will be critical to the implementation and evaluation of new policy. The availability of centrally-located scales will eventually be needed. In the absence of a local landfill, scales could be located at a Boulder County C&D facility or other location.



## APPENDIX A – SOURCES OF INFORMATION

### *For Waste Composition Analyses*

#### National

*Characterization of Building-Related Construction and Demolition Debris in the United States; U.S EPA; EPA 530-R-98-010; June 1998 [the most recent national study]*

#### State-level Analyses

- California CIWMB 2004, Statewide Solid Waste Characterization Study
- California CIWMB 2006, State C&D Targeted Study, 2005 data
- Colorado 2007 Statewide Survey, 2006 data
- Florida 2000 C&D Recycling Study, 1998 data
- Iowa Department of Natural Resources, C&D Study, 2001
- North Carolina C&D Profile, 1997 & 2002 data
- Oregon Department of Environmental Quality, Statewide Solid Waste Characterization, 1998
- South Carolina C&D Study, 1999 data
- Washington Department of Environmental Quality, 1992 Statewide Solid Waste Characterization
- Wisconsin Department of Natural Resources, 2003, Statewide Solid Waste Characterization
- Alberta, Canada 2000 C&D Study

#### Local-level Analyses

- Babylon, NY 1993 GBB C&D Articles 2003 data
- Larimer County, CO 2007 Waste Composition Study 2006 data
- Palo Alto, CA 2007 – Zero Waste Plan with 2004 Waste Composition Study data
- Seattle, WA 1996 C&D Study 2005 data

### *Other Data*

#### Population Projections

1. July 2007 population estimated by Colorado State Demography Office (CO Department of Local Affairs) for Unincorporated Boulder County, November 2008
2. 2017 Boulder County estimate: Population increased over 10-year planning period by average annual growth rate of 1.1% projected for overall Boulder County by Colorado State Demography Office (CO Department of Local Affairs), November 2008.

*Boulder C&D Report*, also known as “An Overview of Building Deconstruction: A National Glance with a Local Focus” for the City of Boulder, December, 2007, unpublished draft, by Kurt Buss.

*Cost-Effectiveness of Processing C&D Waste and Markets for Recovered C&D Materials; Solid Waste Association of North America Applied Research Foundation Disposal Group Research Paper; August 2002*

## BASELINE INFORMATION &amp; GAP ANALYSIS

## BOULDER COUNTY ZERO WASTE EFFORT

Jurisdiction	Overview	Diversion Requirement C= New Construction D = Demolition/ Remodel	Deposit Requirement	Use of "Unclaimed" Deposit Funds	Project Threshold (Residential)	Project Threshold (Commercial)	Waste Mgmt. Plan (WMP) Required?	Condition of Occupancy Permit?
<b>San Jose, CA</b> www.sjrecycles.org	The City requires building permit applicant to place a diversion deposit with the City. The deposit is refunded when the person demonstrates that 50% of the waste has been diverted from the landfill.	C = 50% D = 50%	Based on project size and square foot. Roofing projects have fixed amounts.	Program admin., other LF diversion programs, & to build C&D diversion infrastructure.	New Construction > \$115,000; Remodel > \$2,000	New Construction > \$135,000; Remodel > \$5,000	Yes	
<b>Berkeley, CA</b> www.ci.berkeley.ca.us	Applicants shall make salvageable materials available for reuse <b>prior to demolition</b>	100% of Concrete & Asphalt; 50% of remaining waste generated			All construction or renovation projects valued at \$100,000 or greater; All demolition projects.	All construction or renovation projects > \$100,000; All demolition projects		
<b>Alameda County, CA</b> www.stopwaste.org	As a condition of approval on any building or demolition permit, projects must comply with the waste diversion requirements.	100% of Concrete & Asphalt C&D = 50%	3% of project value (minimum of \$10,000)		Construction > \$50,000; Demolition > \$25,000; All projects > 1,000 sq. ft.		Yes	Yes
<b>Alameda County</b> (both County's and Public Works' own projects)	Construction: County Projects and Traditional Public Works projects. Demolition: County Projects only	75% of asphalt, concrete and similar material for Traditional Public Works Projects only. 50%- County Projects and Traditional Public Works Projects				Construction: County & traditional PW projects valued >\$100,000. County demolition projects > \$25,000		

## BASELINE INFORMATION &amp; GAP ANALYSIS

## BOULDER COUNTY ZERO WASTE EFFORT

Jurisdiction	Overview	Diversion Requirement C= New Construction D = Demolition/ Remodel	Deposit Requirement	Use of "Unclaimed" Deposit Funds	Project Threshold (Residential)	Project Threshold (Commercial)	Waste Mgmt. Plan (WMP) Required?	Condition of Occupancy Permit?
<b>Long Beach, CA</b> <a href="http://www.longbeach.gov">www.longbeach.gov</a>	As a condition of approval on any building or demolition permit, projects must comply with the waste diversion requirements.	C&D = 60% of Waste Note - Limit 20% may be from inerts	3% of project value (Minimum of \$1,500, Maximum of \$50,000)		Construction projects > \$75,000; Demolition projects > \$50,000		Yes	Yes
<b>Oakland, CA</b> <a href="http://www.oaklandpw.com">www.oaklandpw.com</a>	Requires 65% diversion. Assists interested parties to hit 75% for LEED Points	100% Asphalt and Concrete; C&D = 65% of remaining waste generated			New Construction and Projects > \$50,000	All Demolition and Projects > \$50,000	Prior to issuing building permit	Yes
<b>San Diego, CA</b> <a href="http://www.sandiego.gov/environmental-services/recycling">www.sandiego.gov/environmental-services/recycling</a>	C&D Deposit program to increase diversion on C&D projects. Requires projects to divert 50% of material. Will increase to 75% when a mixed C&D facility is on line.	C&D = 50% of Waste	\$0.20 to \$0.70 per sq. ft. Fees can range from \$200 up to \$40,000	City General Fund	Construction > 500 sq. ft. Demolition > 286 sq. ft. Alterations > 500 sq. ft.	Construction > 1000 sq. ft. Demolition > 1000 sq. ft.	Yes	No
<b>Santa Barbara, CA</b> <a href="http://www.santabarbara.ca.gov">www.santabarbara.ca.gov</a>	City has hauler-based diversion programs. All "Unscheduled" remodeling and construction loads > 7 tons to be delivered to a Certified Recycling Facility. Audit revealed nearly 95% diversion.		No	NA	NA	NA	Yes	No
<b>Santa Monica, CA</b> <a href="http://greenbuildings.santamonica.org">http://greenbuildings.santamonica.org</a>	City requires 65% diversion. Green Building pgm: Req't to recycle is included in construction contracts; use of salvaged building & landscape materials is required; interior building components are designed for future disassembly, reuse and recycling.	C&D = 65% of Waste	3% of project value (maximum of \$30,000)		C&D projects over \$50,000 All projects over 1,000 sq. ft.			Yes

## BASELINE INFORMATION &amp; GAP ANALYSIS

## BOULDER COUNTY ZERO WASTE EFFORT

<b>Jurisdiction</b>	<b>Overview</b>	<b>Diversions Requirement</b> C = New Construction D = Demolition/ Remodel	<b>Deposit Requirement</b>	<b>Use of "Unclaimed" Deposit Funds</b>	<b>Project Threshold (Residential)</b>	<b>Project Threshold (Commercial)</b>	<b>Waste Mgmt. Plan (WMP) Required?</b>	<b>Condition of Occupancy Permit?</b>
<b>Portland, Oregon</b> www.portlandonline.com	City requires on-site recycling in all permitted construction projects > \$50,000. Contractor must complete construction site recycling form to get building permit. Must recycle wood, cardboard, metal, land clearing debris and rubble.		None – but City can fine up to \$500 per violation.				Yes, contractor must fill out "Pre-Construction Recycling Plan Form".	
<b>Chicago, Illinois</b> www.cityofchicago.org	Ordinance ok'd 12/04; started 3/06: 25% recycling requirement. Increased to 50% after 1/1/07. 3/0 added site cleanliness standards including fencing, using mesh for dust control, containing waste and litter and neatly stacking materials and tools.	C&D = must recycle 50% of all recyclable materials produced on site by WEIGHT for all permitted projects	No		New construction and structures that have been substantially rehabilitated as determined by the Department of Buildings	Any construction requiring a certificate of occupancy; any building demolition over \$10,000	Projects not meeting recycle %age subject to fines (linked to sq. ft.). Notarized affidavits from contractor & hauler req'd to certify compliance.	Yes
<b>Austin, Texas</b> www.austinenenergy.com	Austin Energy Green Building gives 1 point to recycle and/or salvage at least 75% (by weight) of construction, demolition and land-clearing waste (no soil, stone). Weight tickets from both landfill and recycler/salvager are required	C&D= Basic requirement must recycle at least 50% by WEIGHT of non-hazardous C&D excluding excavated soil and stone						

## APPENDIX C – A BRIEF SYNOPSIS OF THE BOULDER COUNTY BUILD SMART AND CITY OF BOULDER GREEN POINTS PROGRAMS

**Boulder County Build Smart.** Starting May 1, 2008, new residential construction and additions in unincorporated Boulder County must meet requirements of the County's residential green building code, Boulder County BuildSmart. This code sets requirements and recommendations for a variety of areas of environmental impact, and applies to all new residential construction in unincorporated Boulder County requiring a building permit per the currently adopted building code. Demolition of residential buildings is no longer permitted – they must be deconstructed. Deconstruction involves the salvage of materials from an existing structure and the recycling, resale or reuse of those materials as an alternative to sending materials to the landfill.

Requirements apply to new residential development, including restoration of an existing residential structure that has been damaged or destroyed; additions to an existing residential buildings; and some additional exterior construction. For deconstruction and recycling, the following mechanisms must be followed to reduce the waste generated by new residential construction and additions:

### Deconstruction

- A Deconstruction Plan or the County's Deconstruction Checklist must be prepared and signed off by a Deconstruction Professional; it must include the name of the professional approving the plan, the deconstruction contractor, company or person completing the deconstruction, and a list of materials to be recovered, recycled, reused, and/or the destination of materials to be resold.
- The deconstruction must include the salvage of all reusable cabinets, doors, windows, flooring, and fixtures and the reuse or recycling of lumber and wood sheathing.
- The Deconstruction Plan must be submitted at the time of building permit application.
- Receipts or other documentation showing that the Plan was followed must be submitted to the Building Division.

### Recycling

- Wood, scrap metal, cardboard, and concrete must be either recycled on site, sent to a facility that will sort and recapture recyclable materials and/or extra materials must be donated to a building materials exchange.
- Labeled container(s) must be on-site with evidence of use and service.
- The placement of recycling containers should be shown on construction plans and verified during building permit inspections.
- Documentation provided by waste/recycling service and/or documentation from a building exchange verifying the material donated must be submitted to the Building Division.

See [www.bouldercounty.org/lu/buildsmart/](http://www.bouldercounty.org/lu/buildsmart/) for more information.

**City of Boulder Green Points.** Ordinance 7565 which established the City's Green Building and Green Points Program was adopted by Boulder City Council in November, 2007 and

went into effect on February 1, 2008. The purpose of the Green Points program is to protect the public health, safety, and welfare by regulating residential construction with the intent to conserve energy, water, and other natural resources, while preserving the health of our environment through optional and mandatory requirements related to design, construction, operations, recycling, and deconstruction.

An applicant for a building permit for a new dwelling or an addition to a dwelling shall demonstrate that a minimum of 50% of construction waste is recycled. Those seeking building permits must submit a Deconstruction Plan and Construction Waste Recycling Form with the Green Points/building permit applications. At final inspection, the building permit holder must present completed Construction Waste Recycling Tracking Spreadsheet to verify that the minimum recycling requirements have been met.

If a permit applicant proposes to demolish more than 50% of exterior walls of a structure, it must be demonstrated through a deconstruction plan that at least 65% of material by weight from the deconstruction of the existing structure, including concrete and asphalt, will be diverted from the landfill. For this demolition management, the applicant must submit a Deconstruction Plan and Construction Waste Recycling Form with the Demolition Permit or Green Points/building permit applications, whichever is applicable. For verification, the applicant must provide the Deconstruction Plan at permit application and complete verification attachments and place in permit sleeve prior to the final inspection.

The full application and necessary forms are online at  
[www.bouldercolorado.gov/files/final\\_green\\_pts\\_deconstruction\\_form\\_att\\_c\\_021508.pdf](http://www.bouldercolorado.gov/files/final_green_pts_deconstruction_form_att_c_021508.pdf).



**CONSTRUCTION & DEMOLITION WASTE DIVERSION**  
**BASELINE INFORMATION & GAP ANALYSIS**  
**BOULDER COUNTY ZERO WASTE EFFORT**

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**APPENDIX D – CONVERSION FACTORS**

<b>Material Type</b>	<b>Conversion Factor: lbs/cubic yard</b>	<b>Comment</b>	<b>Source [1]</b>
Insulation	111	structural fiberglass	CCG
Plastic	37	mixed, loose film plastic; mixed, loose rigid plastic	Tellus, MN State
Brick	3,024	whole	Tellus
Carpet & Carpet Pad	84	loose	Tellus
Other Roofing	523	composition shingles	CCG
Corrugated Cardboard	50	flattened boxes, loose	Tellus
Asphalt Shingles	577	loose	Tellus, CCG
Metals	906	ferrous scrap	EPA
Drywall	394	scrap, loose	Tellus
Other Wood	367	painted, stained	CCG
Aggregates	1,678	rock, soil, fines	CCG
Concrete & Asphalt	1,424	crushed asphalt paving, loose C&A, scrap concrete	Tellus, CCG
Clean wood waste	678	large limbs, stumps, clean dimensional lumber	Tellus, CCG

[1] Sources:

CCG = Cascadia Consulting Group, [www.cascadiaconsulting.com](http://www.cascadiaconsulting.com)

MN State = Minnesota Office of Environmental Assistance, [www.moea.state.mn.us](http://www.moea.state.mn.us)

Tellus = Tellus Institute, [www.tellus.org](http://www.tellus.org)

## APPENDIX E – ASPHALT SHINGLES: A CASE STUDY FOR C&D WASTE DIVERSION PLANNING

Each subset of the C&D waste stream has its own set of considerations to review and understand when planning for diversion. These start with ease of separation from the C&D waste stream and end with viable end markets; in between are factors including processing technologies, economies of scale, transportation, avoided landfill tip fees, operational matters, costs, and more. Asphalt shingles are discussed briefly here to illustrate those considerations. Boulder County is part of a team that has recently received the “Roofs to Roads” research funding from the Colorado Department of Public Health and Environment’s Advanced Technology Grant fund to investigate the feasibility of bringing Recycled Asphalt Shingle (RAS) technology to Colorado.

While ground shingles (high oil content) can be used in hot-mix asphalt (HMA) or as a refuse-derived fuel (high BTU content), local markets have been virtually non-existent until recently due to low landfill tip fees and lack of research. Asphalt Specialties Company, Inc. (ASCI, of Erie, CO, a hot-mix asphalt (HMA) contractor) conducted successful research in 2008 with pre-consumer shingle waste from local manufacturers. In 2009 ASCI is teaming with the Colorado Department of Transportation (CDOT) Research Division; Boulder County’s Transportation Department, Architects Division, and Resource Conservation Division; and 3R Roofing to conduct the “Roofs to Roads” demonstration project with post-consumer asphalt shingle “tear-offs.”

The Roofs to Roads (R2R) demonstration project will compare conventional asphalt to asphalt with 5% RAS, using shingles from tear-offs at up to three paving installations in Boulder County. CDOT has expressed significant interest in RAS technology for asphalt applications and will provide technical assistance to this project. ASCI will provide an accumulation and processing site, and will make available a new RAS grinder they have recently purchased, for this project.

To plan for a regular flow of asphalt shingles to diverted end markets, a waste diversion manager will seek to answer the following questions (the R2R project may not address all of these):

- What does this method have the potential to divert? All the tear-off shingles generated in the County per year?
- What is the weight and volume of scrap asphalt shingles generated per year in Boulder County? This study projected, based on analysis of waste composition studies, that 13,400 Ts (46,600 cubic yards) of asphalt shingles would be generated in 2017 – if the R2R study or RAS professionals have a better metric, that would help “truth” this model.
- Is there a viable place (within about 15 miles) for roofers and construction workers to haul scrap shingles?
- How will we educate and incent builders, remodellers, etc. to capture and separate shingles from building projects, and to correctly identify the right types?
- How much asphalt shingles (weight, volume) would be used in Boulder County per year if the 5% HMA experiment works out?
- Will pre-consumer scrap from the roofing process be added in with the RAS?

- What is the exact process?
  - Grind RAS
  - Add to raw materials at what stage?
  - Other?
  - What are the environmental, health, and safety aspects and impacts of this process? Are they well under control at the site doing the grinding and processing?
- Does the manufacture of recycled shingles require any additives, modified procedures, or new costs that virgin materials don't? (i.e., like we see with use of glass as aggregate in HMA production)
- What is the correlation of pounds of asphalt shingles to lane-miles using HMA with the 5% addition?
- What is the detailed cost analysis comparing tipping of shingles for HMA use versus local tipping fees?
- What minimum quantity of tear-offs will be needed to satisfy annual use of 5% RAS in HMA in the County, region or state?
- Will the R2R project assess whether 5% RAS content is the best number (i.e., what if the 'recipe' for HMA works better at 3% or 10% asphalt shingle content)?
- What are the economies of scale for successful use of RAS, from the hot-mix maker's point of view?
- If the R2R project shows feasibility, will ASCI be able to provide these services to Boulder County and the region? Would other HMA vendors need to get involved to provide end market diversity and reliability?
- Will the County commit to using some level of RAS content in its HMA road applications? Are there any procurement or other specifications that need to be changed to effect this use? Any training or changes to ongoing operations?

It should also be noted that ASCI is currently accepting whole asphalt shingles from any roofer. If they are clean, the tip fee is \$7/cubic yard, with contamination the fee is \$9/cubic yard.

Finally, LaFarge North America has also researched the recycling of pre-consumer asphalt shingle scrap into its HMA but has not yet begun practicing in Colorado.

Sources for more information:

"Benefits of Recycling Asphalt Shingles," by Gary Stillmunkes, Asphalt Specialties Company, Inc., Henderson, CO, in Colorado Roofing Association newsletter, August 2008, online at [www.coloradoroofing.org/2005/newsletters/August08/index.html#BusinessGrowth](http://www.coloradoroofing.org/2005/newsletters/August08/index.html#BusinessGrowth)

Construction Material Recycling Association – material-specific website on Asphalt Shingles: [www.shinglerecycling.org](http://www.shinglerecycling.org)

## APPENDIX F – CONTACT INFORMATION

### **Recycled Materials Company, Inc.**

6425 W. 52nd Avenue, Suite #1

Arvada, Colorado 80002

(303) 431-3701      (303) 431-3705 fax      [www.rmci-usa.com](http://www.rmci-usa.com)

### **A-1 Organics**

16350 County Road 76

Eaton, CO 80615

(970) 454-3492      [www.a1organics.com](http://www.a1organics.com)

### **ReSource Yard**

c/o Center for ReSource Conservation

2639 Spruce St.

Boulder, CO 80302

(303) 419-8534      [www.conservationcenter.org](http://www.conservationcenter.org)

### **Habitat for Humanity's ReStore**

6900 W 117th Ave

Broomfield, CO 80020-2951

(303) 404-2008

### **Eco-Cycle's CHaRM – Center for Hard-to-Recycle Materials**

5030 "old" Pearl Street

Boulder, CO

(303) 444-6634      [www.ecocycle.org/charm/index.cfm](http://www.ecocycle.org/charm/index.cfm)

### **Boulder County Recycling Center**

1901 63rd Street,

Boulder, CO

(720) 564-2220

### **Western Disposal**

5880 Butte Mill Road

Boulder, CO 80301

(303) 440.2037      [www.westerndisposal.com](http://www.westerndisposal.com)

### **Waste-Not Recycling**

1065 Poplar St

Loveland, CO 80537

(970) 669-9912; (800) 584-9912    (970) 669-9926 fax

[www.waste-not.com](http://www.waste-not.com)

## APPENDIX G – MODEL CONSTRUCTION AND DEMOLITION DIVERSION ORDINANCES

### Example 1

California Integrated Waste Management Board (CIWMB) staff developed the model ordinance presented below, based on feedback solicited from local government, building industry representatives, C&D recyclers and waste management companies, and on C&D diversion ordinances already being implemented by jurisdictions.

The most typically used sections in existing ordinances have been incorporated into the model ordinance, making the model a composite of ordinances reviewed. The model is quasi-modular in format so that you may pick and choose which sections of the model you want to include in your own ordinance.

Source: California Integrated Waste Management Board, [www.ciwmb.ca.gov/ConDemo](http://www.ciwmb.ca.gov/ConDemo)

**ORDINANCE NO.** [REDACTED] *(Insert ordinance number)*

**ORDINANCE OF THE CITY/COUNTY OF** [REDACTED] *(Insert jurisdiction name)* **AMENDING THE** [REDACTED] *(Insert jurisdiction name)* **MUNICIPAL CODE, ADDING CHAPTER** [REDACTED] *Insert chapter number)* **RELATING TO RECYCLING AND DIVERSION OF CONSTRUCTION AND DEMOLITION WASTE**

**The Governing Body of the City/County of** [REDACTED] *(insert jurisdiction name)* **does hereby enact as follows:**

**Chapter** [REDACTED] *(insert chapter number)* **[Recycling and Diversion of Construction and Demolition Waste] is hereby added to Title** [REDACTED] *(insert title number)* **of the City/County of** [REDACTED] *'s (insert jurisdiction name)* **Municipal Code to read as follows:**

**Chapter** [REDACTED] *(insert chapter number)* **Recycling and Diversion of Construction and Demolition (C&D) Waste**

**Section** [REDACTED].01. [REDACTED] *(insert section number)* **Findings and Statement of Intent**

**Section** [REDACTED].02. [REDACTED] *(insert section number)* **Definitions**

**Section** [REDACTED].03. [REDACTED] *(insert section number)* **Diversion Requirement**

**Section** [REDACTED].04. [REDACTED] *(insert section number)* **Diversion Requirement Exemption**

**Section** [REDACTED].05. [REDACTED] *(insert section number)* **Threshold**

**Section** [REDACTED].06. [REDACTED] *(insert section number)* **Waste Management Plan**

**Section** [REDACTED].07. [REDACTED] *(insert section number)* **Deposit Required**

CONSTRUCTION & DEMOLITION WASTE DIVERSION  
BASELINE INFORMATION & GAP ANALYSIS  
BOULDER COUNTY ZERO WASTE EFFORT

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Section \_\_\_\_\_.08. \_\_\_\_\_.: (insert section number) **On-Site Practices**

Section \_\_\_\_\_.09. \_\_\_\_\_.: (insert section number) **Reporting**

Section \_\_\_\_\_.10. \_\_\_\_\_.: (insert section number) **Fines/Penalties**

Section \_\_\_\_\_.11. \_\_\_\_\_.: (insert section number) **Appeals**

Section \_\_\_\_\_.12. \_\_\_\_\_.: (insert section number) **Option to Revise**

Section \_\_\_\_\_.13. \_\_\_\_\_.: (insert section number) **Severability**

Section \_\_\_\_\_.01. .: Findings and Statement of Intent

**RESOLVED**, by the Governing Body of the City/County of \_\_\_\_\_, (insert jurisdiction name) California, that:

**WHEREAS**, under California law as embodied in the California Waste Management Act of 1989 (California Public Resources Code Sections 40000 et seq.), the City/County of \_\_\_\_\_ (insert jurisdiction name) is required to prepare, adopt and implement source reduction and recycling plans to reach landfill diversion goals, and is required to make substantial reductions in the volume of waste materials going to the landfills, or face fines up to \$10,000 per day;

**WHEREAS**, in order to meet these goals it is necessary that the City/County promote the reduction of solid waste, and reduces the stream of solid waste going to landfills; and

**WHEREAS**, waste from construction, demolition, and renovation of buildings represents a significant portion of the volume of waste presently coming from the City/County of \_\_\_\_\_, (insert jurisdiction name) and much of this waste is particularly suitable for recycling and reuse;

**WHEREAS**, the City's/County's commitment to the reduction of waste requires the establishment of programs for recycling and salvaging of construction and demolition (C&D) waste;

**WHEREAS**, certain types of projects are exempt from these requirements;

NOW, THEREFORE, THE Governing Body OF THE CITY/COUNTY OF \_\_\_\_\_, (insert jurisdiction name), \_\_\_\_\_ [state], ORDAINS THAT:

**Chapter \_\_\_\_\_** (insert chapter number) is added to the \_\_\_\_\_ (insert jurisdiction name) Municipal Code.

**Section \_\_\_\_\_.02. .: Definitions**

(Note to jurisdictions: It is suggested jurisdictions include a list of definitions in the ordinance, for example, covered projects, exempt projects, and types of activities that qualify as diversion. Examples of applicable definitions can be viewed in the sample ordinances located on the Board's [C&D Debris Recycling](#) Web page. The Board's Construction and Demolition and Inert Debris Transfer/Processing Regulatory Requirements



also contain applicable definitions that may be used.)

### **Section .03.: Diversion Requirement**

It is required that at least [REDACTED] (insert waste diversion goal here) of waste tonnage from construction, demolition, and renovation waste shall be diverted from disposal. (Note to jurisdictions: it is encouraged that the goal be at least 50 to 75%, but the goal needs to reflect the jurisdiction's conditions. Also, some jurisdictions set separate goals for demolition projects than for construction projects, or individual diversion goals for each material type, some of which could be higher than 75%, e.g., for concrete/asphalt. In addition, jurisdictions should be aware that clean inerts disposed in engineered fills are not counted as disposal or diversion in the Board's CDI regulations [PRC Section 41821.3 (h)].

### **Section .04.: Diversion Requirement Exemption**

- a. Application: If an Applicant for a Covered Project experiences circumstances that the Applicant believes make it infeasible to comply with the Diversion Requirement, the Applicant may apply for a diversion requirement exemption at the time that he or she submits the Waste Management Plan (WMP) required under Section .06. (Waste Management Plan) of this Ordinance.
- b. Meeting with Compliance Official: The WMP Compliance Official shall review the information supplied by the Applicant and may meet with the Applicant to discuss feasible ways of meeting the diversion requirement. Upon request of the jurisdiction, the WMP Compliance Official may request that staff from [REDACTED] (insert agency name) attend this meeting or may require the Applicant to request a separate meeting with this agency. (Note to jurisdictions: this will be a local agency that provides waste diversion assistance.) Based on the information supplied by the Applicant and, if applicable, the [REDACTED] (insert agency name) agency listed above, the WMP Compliance Official shall determine whether it is feasible for the Applicant to meet the Diversion Requirement.
- c. Granting of Exemption: If the WMP Compliance Official determines that it is infeasible for the Applicant to meet the Diversion Requirements, he or she shall determine the maximum feasible diversion rate for waste generated by the project and shall indicate the new diversion requirement the Applicant shall be required to meet, and will inform the Applicant in writing of the new requirement. The Applicant shall then have [REDACTED] (insert number of days) days to resubmit another WMP, which is in compliance with the new diversion requirement. If the Applicant fails to resubmit, or if the resubmitted WMP does not comply with Section .06 (Waste Management Plan), the WMP Compliance Official shall disapprove the WMP in accordance with Section .06 (Waste Management Plan).

### **Section .05.: Thresholds for Covered Projects**

(Note to jurisdictions: Consider options one through three. In addition to the options presented, many other variations are included in the sample ordinances on the Board's Web page. For example, some jurisdictions include multi-family structures only over a certain number of units. As a general rule, demolition activities generate significantly larger amounts of C&D waste per dollar than new construction activities, so you should consider setting a lower threshold for demolition projects and a higher one for projects not including demolition. However, in some areas of the state, demolition contractors routinely recycle their project waste, so you may want to first determine if that is true for your jurisdiction, and for what size of project, before requiring that demolition projects be subject to the ordinance.)

**Option One (Threshold Based on Project Cost)**

- A. Covered Projects (Construction and Renovation): All construction and renovation projects within the City/County, the total costs of which are projected to be greater than or equal to \$\_\_\_\_\_, (insert threshold dollar amount) shall comply with Chapter \_\_\_\_\_, shall submit a Waste Management Plan prior to beginning any construction or renovation activities, and shall be subject to the provisions of this Chapter. (For ordinances including Fines or Penalties, insert the following text) Failure to comply with any of the terms of Chapter \_\_\_\_\_ shall subject the Project Applicant to the full range of enforcement mechanisms set forth in Section \_\_\_\_\_,10 (Fines/Penalties) below.
- B. Covered Projects (Demolition): All demolition projects within the City/County, the total costs of which are projected to be greater than or equal to \$\_\_\_\_\_, (insert threshold dollar amount) shall comply with Chapter \_\_\_\_\_, shall submit a Waste Management Plan prior to beginning any demolition activities, and shall be subject to the provisions of this Chapter. (For ordinances including Fines or Penalties, insert the following text) Failure to comply with any of the terms of Chapter \_\_\_\_\_ shall subject the Project Applicant to the full range of enforcement mechanisms set forth in Section \_\_\_\_\_,10 (Fines/Penalties) below.
- C. Non-Covered Projects (Construction and Renovation): Applicants for construction and renovation projects within the City/County whose total costs are less than \$\_\_\_\_\_ (insert threshold dollar amount) are not required, but shall be encouraged, to divert at least \_\_\_\_\_ (insert diversion requirement percentage) of all project- related construction and demolition waste.
- D. Non-Covered Projects (Demolition): Applicants for demolition projects within the City/County whose total costs are less than \$\_\_\_\_\_ (insert threshold dollar amount) are not required, but shall be encouraged, to divert at least \_\_\_\_\_ (insert diversion requirement percentage) of all project- related demolition waste.
- E. City/County-sponsored Projects (Construction and Renovation): All City/County-sponsored construction and renovation projects whose total costs are equal or greater than \$\_\_\_\_\_, (insert threshold dollar amount) shall be considered "Covered Projects" for the purposes of this Chapter, shall submit a Waste Management Plan prior to beginning any construction or demolition activities, and shall be subject to the provisions of this Chapter. City/County sponsored projects whose total costs are less than \$\_\_\_\_\_ (insert threshold dollar amount) shall be considered Non-Covered projects and are not required, but shall be encouraged, to divert at least \_\_\_\_\_ (insert diversion requirement percentage) of all project- related construction and demolition waste.
- F. City/County-sponsored Projects (Demolition): All City/County-sponsored demolition projects whose total costs are equal or greater than \$\_\_\_\_\_, (insert threshold dollar amount) shall be considered "Covered Projects" for the purposes of this Chapter, shall submit a Waste Management Plan prior to beginning any demolition activities, and shall be subject to the provisions of this Chapter. City/County sponsored projects whose total costs are less than \$\_\_\_\_\_ (insert threshold dollar amount) shall be considered Non-Covered projects and are not required, but shall be encouraged, to divert at least \_\_\_\_\_ (insert diversion requirement percentage) of all project- related demolition waste.

- G. Deconstruction/Recovery Interval for Covered Demolition Projects - Optional (*use in conjunction with covered demolition projects language B or F*): Every Covered demolition project shall be made available for deconstruction, salvage, and recovery prior to demolition. It shall be the responsibility of the applicant to recover the maximum feasible amount of designated recyclable and reusable materials prior to demolition. In order to provide sufficient time for deconstruction, salvage, and recovery, no demolition may take place until a period of [REDACTED] (*insert number of working days*) working days has elapsed from the date of issuance of the demolition permit. Recovered and salvaged designated recyclable and reusable material from every project shall qualify to be counted in meeting diversion requirements of Section [REDACTED].03 (Diversion Requirement). Recovered or salvaged designated recyclables and reusable materials may be given away or sold on the premises, or may be removed to reuse facilities for storage or sale.
- H. Compliance with this Chapter shall be listed as a condition of approval on any construction, renovation and or demolition permit issued for a Covered Project.

**Option Two (Threshold Based on square footage)**

- A. Covered Projects (Construction and Renovation): All construction and renovation projects within the City/County that are [REDACTED] (*insert threshold size*) square feet or greater shall comply with Chapter [REDACTED], shall submit a Waste Management Plan prior to beginning any construction or demolition activities, and shall be subject to the provisions of this Chapter. (*For ordinances including Fines or Penalties, insert the following text*) Failure to comply with any of the terms of Chapter [REDACTED] shall subject the Project Applicant to the full range of enforcement mechanisms set forth in Section [REDACTED].10 (Fines/Penalties) below.
- B. Covered Projects (Demolition): All demolition projects within the City/County that are [REDACTED] (*insert threshold size*) square feet or greater shall comply with Chapter [REDACTED], shall submit a Waste Management Plan prior to beginning any demolition activities, and shall be subject to the provisions of this Chapter. (*For ordinances including Fines or Penalties, insert the following text*) Failure to comply with any of the terms of Chapter [REDACTED] shall subject the Project Applicant to the full range of enforcement mechanisms set forth in Section [REDACTED].10 (Fines/Penalties) below.
- C. Non-Covered Projects (Construction and Renovation): Applicants for construction and renovation projects within the City/County whose projects are [REDACTED] (*insert threshold size*) square feet or less are not required, but shall be encouraged, to divert at least [REDACTED] (*insert diversion requirement percentage*) of all project-related construction and demolition waste.
- D. Non-Covered Projects (Demolition): Applicants for demolition projects within the City/County whose projects are [REDACTED] (*insert threshold size*) square feet or less are not required, but shall be encouraged, to divert at least [REDACTED] (*insert diversion requirement percentage*) of all project-related demolition waste.
- E. City/County-sponsored Projects (Construction and Renovation): All City/County-sponsored construction and renovation projects that are [REDACTED] (*insert threshold size*) square feet

or greater, shall be considered “Covered Projects” for the purposes of this Chapter, shall submit a Waste Management Plan prior to beginning any construction or demolition activities, and shall be subjected to the provisions of this Chapter. City/County sponsored construction and renovation projects that are less than [REDACTED] (*insert threshold size*) shall be considered Non-Covered projects and are not required, but shall be encouraged, to divert at least [REDACTED] (*insert diversion requirement percentage*) of all project-related construction and demolition waste.

F. City/County-sponsored Projects (Demolition): All City/County-sponsored demolition projects that are [REDACTED] (*insert threshold size*) square feet or greater, shall be considered “Covered Projects” for the purposes of this Chapter, shall submit a Waste Management Plan prior to beginning any demolition activities, and shall be subjected to the provisions of this Chapter. City/County sponsored demolition projects that are less than [REDACTED] (*insert threshold size*) shall be considered Non-Covered projects and are not required, but shall be encouraged, to divert at least [REDACTED] (*insert diversion requirement percentage*) of all project-related construction and demolition waste.

G. Deconstruction/Recovery Interval for Covered Demolition Projects - Optional (*use in conjunction with covered demolition projects language B or F*): Every Covered demolition project shall be made available for deconstruction, salvage, and recovery prior to demolition. It shall be the responsibility of the applicant to recover the maximum feasible amount of designated recyclable and reusable materials prior to demolition. In order to provide sufficient time for deconstruction, salvage, and recovery, no demolition may take place until a period of [REDACTED] (*insert number of working days*) working days has elapsed from the date of issuance of the demolition permit. Recovered and salvaged designated recyclable and reusable material from every project shall qualify to be counted in meeting diversion requirements of Section [REDACTED].03 (Diversion Requirement). Recovered or salvaged designated recyclables and reusable materials may be given away or sold on the premises, or may be removed to reuse facilities for storage or sale.

H. Compliance with this Chapter shall be listed as a condition of approval on any building or demolition permit issued for a Covered Project.

**Option Three (Progressive Threshold):** (*Note to jurisdictions: In this approach, a jurisdiction can choose to establish a threshold in phases, by first targeting specific types and sizes of projects to be subject to the ordinance, in order to stimulate markets for the recovered materials and divert materials from projects that generate the most waste. Then, once markets have been established, the types or sizes of projects covered by the ordinance can be expanded. For example, a jurisdiction may choose to: First target only large projects to allow C&D markets time to develop, and then expand the types of projects subject to the ordinance to include smaller projects by gradually decreasing the minimum square footage threshold or dollar amount threshold for complying with the ordinance.*)

A. Covered Projects (Construction and Renovation): The [REDACTED] (*insert time frame*) the ordinance is in effect, all construction and renovation projects within the City/County that are [REDACTED] (*insert threshold amount here*) shall be considered Covered Projects, shall comply with Chapter [REDACTED], shall submit a Waste Management Plan prior to beginning any construction or demolition activities, and shall be subject to the provisions of this Chapter. (*For ordinances including Fines or Penalties, insert the following text*) Failure to comply with any of the terms of

this Chapter shall subject the Project Applicant to the full range of enforcement mechanisms set forth in **Section \_\_\_\_\_.10** (Fines/Penalties), below.

- B. Covered Projects (Construction and Renovation): The **\_\_\_\_\_** *(insert time frame)* the ordinance is in effect, all construction and renovation projects within the City/County that are **\_\_\_\_\_** *(insert threshold amount here)* shall be considered Covered Projects, shall comply with Chapter **\_\_\_\_\_**, shall submit a Waste Management Plan prior to beginning any construction or demolition activities, and shall be subject to the provisions of this Chapter. *(For ordinances including Fines or Penalties, insert the following text)* Failure to comply with any of the terms of this Chapter shall subject the Project Applicant to the full range of enforcement mechanisms set forth in **Section \_\_\_\_\_.10** (Fines/Penalties), below.
- C. Covered Projects (Construction and Renovation): The **\_\_\_\_\_** *(insert time frame)* the ordinance is in effect, all construction and renovation projects within the City/County that are **\_\_\_\_\_** *(insert threshold amount here)* shall be considered Covered Projects, shall comply with Chapter **\_\_\_\_\_**, shall submit a Waste Management Plan prior to beginning any construction or demolition activities, and shall be subject to the provisions of this Chapter. *(For ordinances including Fines or Penalties, insert the following text)* Failure to comply with any of the terms of this Chapter shall subject the Project Applicant to the full range of enforcement mechanisms set forth in **Section \_\_\_\_\_.10** (Fines/Penalties), below.
- D. Covered Projects (Construction and Renovation): The **\_\_\_\_\_** *(insert time frame)* the ordinance is in effect, all construction and renovation projects within the City/County that are **\_\_\_\_\_** *(insert lowest final threshold amount here)* shall be considered Covered Projects, shall comply with Chapter **\_\_\_\_\_**, shall submit a Waste Management Plan prior to beginning any construction or demolition activities, and shall be subject to the provisions of this Chapter. *(For ordinances including Fines or Penalties, insert the following text)* Failure to comply with any of the terms of this Chapter shall subject the Project Applicant to the full range of enforcement mechanisms set forth in **Section \_\_\_\_\_.10** (Fines/Penalties), below.
- E. Covered Projects (Demolition): The **\_\_\_\_\_** *(insert time frame)* the ordinance is in effect, all demolition projects within the City/County that are **\_\_\_\_\_** *(insert threshold amount here)* shall be considered Covered Projects, shall comply with Chapter **\_\_\_\_\_**, shall submit a Waste Management Plan prior to beginning any demolition activities, and shall be subject to the provisions of this Chapter. *(For ordinances including Fines or Penalties, insert the following text)* Failure to comply with any of the terms of this Chapter shall subject the Project Applicant to the full range of enforcement mechanisms set forth in **Section \_\_\_\_\_.10** (Fines/Penalties), below.
- F. Covered Projects (Demolition): The **\_\_\_\_\_** *(insert time frame)* the ordinance is in effect, all demolition projects within the City/County that are **\_\_\_\_\_** *(insert threshold amount here)* shall be considered Covered Projects, shall comply with Chapter **\_\_\_\_\_**, shall submit a Waste Management Plan prior to beginning any demolition activities, and shall be subject to the provisions of this Chapter. *(For ordinances including Fines or Penalties, insert the following text)* Failure to comply with any of the terms of this Chapter shall subject the Project Applicant to the full range of enforcement mechanisms set forth in **Section \_\_\_\_\_.10** (Fines/Penalties), below.



- G. Covered Projects (Demolition): The [redacted] (*insert time frame*) the ordinance is in effect, all demolition projects within the City/County that are [redacted] (*insert threshold amount here*) shall be considered Covered Projects, shall comply with Chapter [redacted], shall submit a Waste Management Plan prior to beginning any demolition activities, and shall be subject to the provisions of this Chapter. (*For ordinances including Fines or Penalties, insert the following text*) Failure to comply with any of the terms of this Chapter shall subject the Project Applicant to the full range of enforcement mechanisms set forth in Section [redacted].10 (Fines/Penalties), below.
- H. Covered Projects (Demolition): The [redacted] (*insert time frame*) the ordinance is in effect, all demolition projects within the City/County that are [redacted] (*insert lowest final threshold amount here*) shall be considered Covered Projects, shall comply with Chapter [redacted], shall submit a Waste Management Plan prior to beginning any demolition activities, and shall be subject to the provisions of this Chapter. (*For ordinances including Fines or Penalties, insert the following text*) Failure to comply with any of the terms of this Chapter shall subject the Project Applicant to the full range of enforcement mechanisms set forth in Section [redacted].10 (Fines/Penalties), below.
- I. Deconstruction/Recovery Interval for Covered Demolition Projects - Optional (*use in conjunction with covered demolition projects language E, F, G & H*): Every Covered demolition project shall be made available for deconstruction, salvage, and recovery prior to demolition. It shall be the responsibility of the applicant to recover the maximum feasible amount of designated recyclable and reusable materials prior to demolition. In order to provide sufficient time for deconstruction, salvage, and recovery, no demolition may take place until a period of [redacted] (*insert number of working days*) working days has elapsed from the date of issuance of the demolition permit. Recovered and salvaged designated recyclable and reusable material from every project shall qualify to be counted in meeting diversion requirements of Section [redacted].03 (Diversion Requirement). Recovered or salvaged designated recyclables and reusable materials may be given away or sold on the premises, or may be removed to reuse facilities for storage or sale.
- J. Compliance with this Chapter shall be listed as a condition of approval on any building or demolition permit issued for a Covered Project.

Exemptions:

A diversion deposit and a Waste Management Plan shall not be required for the following (*select from the following samples and/or include your own*):

1. Work for which a building or demolition permit is not required.
2. New residential projects of less than \$ [redacted] (*insert dollar amount*) in value.
3. New non-residential construction projects of less than \$ [redacted] (*insert dollar amount*) in value.
4. Residential alterations of less than \$ [redacted] (*insert dollar amount*) in value.
5. Non-residential alterations of less than \$ [redacted] (*insert dollar amount*) in value.
6. Roofing projects that do not include tear-off of existing roof.
7. Work for which only a plumbing, only an electrical, or only a mechanical permit is required.
8. Seismic tie-down projects.
9. Projects where no structural building modifications are required.



10. Emergency demolition required to protect the public health and safety.

While not required, it shall be encouraged, that at least [REDACTED] (*insert diversion requirement percentage*) of all project-related construction and demolition waste from Exempt projects be diverted.

**Section .06.: Waste Management Plan**

Prior to starting the project, every applicant shall submit a properly completed "Waste Management Plan" (WMP) to the WMP Compliance Official, in a form as prescribed by that Official, as a portion of the building or demolition permit process. The completed WMP shall contain the following:

- A. The estimated volume or weight of project waste to be generated by material type;
- B. The maximum volume or weight of such materials that can feasibly be diverted via Reuse or Recycling by material type;
- C. The vendor(s) that the applicant proposes to use to haul the materials;
- D. Facility(s) the materials will be hauled to, and their expected diversion rates by material type;
- E. Estimated volume or weight of construction and demolition waste that will be disposed.

Because actual material weights are not available in this stage, estimates are used. In estimating the volume or weight of materials as identified in the WMP, the Applicant shall use the standardized conversion rates approved by the City/County of [REDACTED] (*insert jurisdiction name*) for this purpose. Approval of the WMP as complete and accurate shall be a condition precedent to the issuance of any building or demolition permit. If the applicant calculates the projected feasible diversion rate as described above, and finds the rate does not meet the diversion goal, the applicant must then submit information supporting the lower diversion rate. If this documentation is not included, the WMP shall be deemed incomplete.

- a. Approval: No building or demolition permit shall be issued for any Covered Project unless and until the WMP Compliance Official has approved the WMP. Approval shall not be required, however, where emergency demolition is required to protect public health or safety. The WMP Compliance Official shall only approve a WMP if he or she determines that all of the following conditions have been met:
  - i. The WMP provides all of the information set forth in this section.
  - ii. The WMP indicates that [REDACTED] (*insert required diversion goal*) percent of all C&D waste generated by the project shall be diverted (or new diversion goal set in accordance with the Applicant's approved Diversion Exemption request); and
  - iii. The Applicant has submitted an appropriate Deposit for the project (*If a deposit is required by the ordinance*).
- b. Non-Approval: If the WMP Compliance Official determines that the WMP is incomplete or fails to indicate that at least [REDACTED] (*insert required diversion goal*) percent (or new diversion goal set in accordance with the Applicant's approved Diversion Exemption request) of all C&D waste generated by the project will be diverted, he or she shall either:
  - i. Return the WMP to the Applicant marked "Disapproved", including a statement of reasons, and will notify the building department, which shall then immediately stop processing the building or demolition permit application, or
  - ii. Return the WMP to the Applicant marked "Further Explanation Required."

### **Section .07.: Deposit Required**

*(Note to jurisdictions: Some jurisdictions base the deposit amount on project type, e.g., new construction, demolition, or renovation. In deciding whether to utilize a deposit as part of your ordinance, be aware that general law cities and counties may have some limitations on their use of this enforcement mechanism. You should check with your city attorney's office or county counsel's office before making any decisions on how to proceed.)*

As a condition precedent to the issuance of any permit for construction or demolition for a Covered Project, the Applicant shall post a deposit (cash, letter of credit, performance or surety bond, money order) in the amount of \$ [ ] (insert deposit amount) for each estimated [ ] (insert applicable standard of measurement; e.g., ton of waste, square footage, project cost, fixed amount, etc.) waste, but not less than [ ] (insert minimum deposit amount). The deposit shall be returned, without interest, in total or pro-rated, upon proof of satisfaction by the WMP Compliance Official that no less than the required percentage of construction and demolition waste tonnage generated by the Covered project has been diverted from disposal and has been recycled or reused or stored for later reuse or recycling. If a lesser percentage of construction and demolition waste tonnage than required is diverted, a proportionate share of the deposit shall be returned. The deposit shall be forfeited entirely or to the pro-rated extent that there is a failure to comply with the requirements of this chapter. The City/County may, by formal resolution, modify the amount of the required deposit.

### **Section .08.: On-site Practices**

During the term of the Covered project, the Applicant shall recycle and reuse the required percentage of waste, and keep records of the tonnage or other measurements approved by the City/County that can be converted to tonnage amounts. The WMP Compliance Official will evaluate and may monitor each Covered project to determine the percentage of waste salvaged and recycled or reused from the Covered project. For Covered projects including both construction and demolition, diversion of materials shall be tracked and measured separately. To the maximum extent feasible, project waste shall be separated on-site if this practice increases diversion. For construction and/or demolition projects, on-site separation shall include salvageable materials (e.g., appliances, fixtures, plumbing, metals, etc.) and dimensional lumber, wallboard, concrete and corrugated cardboard.

### **Section .09.: Reporting**

Within [ ] (insert number of days) days following the completion of the demolition phase of a Covered project, and again within [ ] (insert number of days) days following the completion of the construction phase of a Covered project, the applicant shall, as a condition precedent to final inspection and to issuance of any certificate of occupancy or final approval of project, submit documentation to the WMP Compliance Official that proves compliance with the requirements of Sections .06 (Waste Management Plan) and .03 (Diversion Requirement). The documentation shall consist of a final completed WMP showing actual waste tonnage data, supported by original or certified photocopies of receipts and weight tags or other records of measurement from recycling companies, deconstruction contractors, and/or landfill and disposal companies. Receipts and weight tags will be used to verify whether waste generated from the Covered project has been or are to be recycled, reused, salvaged or disposed. The applicant shall make reasonable efforts to ensure that all designated recyclable and reuse waste salvaged or disposed are measured and recorded using the most accurate method of measurement available.

To the extent practical, all construction and demolition waste shall be weighed in compliance with all regulatory requirements for accuracy and maintenance. For construction and demolition waste for which weighing is not practical due to small size or other considerations, a volumetric measurement shall be used. For conversion of volumetric measurements to weight, the applicant shall use the standardized conversion rates approved by the City/County for this purpose.

If a Covered project involves both demolition and construction, the report and documentation for the demolition project must be submitted and approved by the WMP compliance official before issuance of a building permit for the construction phase of a Covered project. Alternatively, the applicant may submit a letter stating that no waste or recyclable materials were generated from the Covered project, in which case this statement shall be subject to verification by the WMP Compliance Official. Any deposit posted pursuant to Section \_\_\_\_\_.07 (Deposit Required) shall be forfeited if the applicant does not meet the timely reporting requirements of this section

#### **Section \_\_\_\_\_.10.: Fines/Penalties**

*(Note to jurisdictions: Some jurisdictions have adopted C&D ordinances that do not include mechanisms for fines or penalties. Others have initially implemented an ordinance without the use of fines or penalties and then added them after a specified time period, or added them when it was determined that compliance with the ordinance could be more effective with fines or penalties used as an enforcement mechanism. General law cities and counties need to consult Government Code sections 25132 and 36901, as well as their respective legal counsel, prior to determining the dollar amounts to use in this section.)*

##### Option One. Fines According to Degrees of Infraction

Violation of any provision of this Chapter may be enforced by civil action including an action for injunctive relief. In any civil enforcement action, administrative or judicial, the City/County shall be entitled to recover its attorney's fees and costs from an Applicant who is determined by a court of competent jurisdiction to have violated this Chapter.

- A. Violation of any provision of this Chapter shall constitute an infraction punishable by a fine not to exceed \$\_\_\_\_\_ (insert dollar amount) for the first violation, a fine not to exceed \$\_\_\_\_\_ (insert dollar amount) for the second violation within \_\_\_\_\_ (insert time frame), a not fine not to exceed \$\_\_\_\_\_ for each additional violation within (insert time frame). There shall be a separate infraction for each day on which a violation occurs. Where the violation is the failure to achieve the diversion requirement applicable to the project and the construction and demolition materials from the project have already been disposed, the violation shall be deemed to have ceased after a period of \_\_\_\_\_ (insert time frame) days. The City/County shall recover costs and attorneys' fees incurred in connection with enforcement of this Chapter.
- B. Enforcement pursuant to this section shall be undertaken by the City/County through its \_\_\_\_\_ (insert compliance official) and the City/County Attorney.

##### Option Two- Misdemeanour Violation

Each violation of the provisions of this Chapter shall constitute a misdemeanour, and shall be punishable by imprisonment in the County jail for a time period not to exceed \_\_\_\_\_ (insert time frame) months, or by fine not exceeding \_\_\_\_\_, (insert fine amount) or by both such fine and imprisonment. Each day that a violation continues shall be deemed a new and separate offence.

**Section .11.: Appeals**

*(Note to Jurisdictions: Cities/Counties may want to provide for appeals of any determinations made under this Article pursuant to their existing procedures and those of the department responsible for making WMP determinations. Determinations subject to appeal would include, but not necessarily be limited to: (1) the granting or denial of an exemption; (2) whether the applicant has acted in good faith; and (3) the amount of deposit to be released.)*

**Section .12.: Option to Revise**

Beginning [redacted] (insert date) the City/County will evaluate the Recycling and Diversion of Construction and Demolition Waste Ordinance to determine its effectiveness in reducing the amount of C&D waste disposed. In this determination, the City/County will consider issues such as the amount of C&D waste disposed, volume of C&D activity, markets for C&D waste, and other barriers encountered by applicants. If the City/County determines the C&D disposed had the potential for diversion, then the City may amend these provisions and implement the necessary measures to divert more C&D waste

**Section .13.: Severability**

If any section, subsection, subdivision, paragraph, sentence, clause, or phrase of this ordinance, or any part thereof, is for any reason held to be unconstitutional, invalid, or ineffective by any court of competent jurisdiction, such decision shall not affect the validity or effectiveness of the remaining portions of this ordinance or any part thereof. The City/County Governing Body hereby declare that it would have passed each section, subsection, subdivision, paragraph, sentence, clause, or phrase of this Ordinance irrespective of the fact that one or more sections, subsections, subdivisions, paragraphs, sentences, clauses, or phrases be declared unconstitutional, invalid, or ineffective. To this end, the provisions of this Ordinance are declared severable.

1. This ordinance is hereby PASSED and ADOPTED by the Governing Body of the City/County of [redacted] (insert jurisdiction name) at a regular meeting on the [redacted] (insert day) day of [redacted] (insert month) 200 [redacted] (insert year).

**Mayor/Chair, Board of Supervisors**

**City/County Clerk**

.....  
ORDINANCE CERTIFICATION

2. **STATE OF** [redacted] (insert State name)  
**COUNTY OF** [redacted] (insert County name)  
**CITY OF** [redacted] (insert jurisdiction name)

**ORDINANCE NO.** [redacted] (insert ordinance number)

- .....
3. I, [redacted] (insert clerk's name) City/County Clerk of the City/County of [redacted] (insert jurisdiction name) do hereby certify that the foregoing ordinance was introduced at a regular meeting of

CONSTRUCTION & DEMOLITION WASTE DIVERSION  
BASELINE INFORMATION & GAP ANALYSIS  
BOULDER COUNTY ZERO WASTE EFFORT

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the Governing Body held on the \_\_\_\_\_ (insert day) day of 200\_\_\_\_\_ (insert year) and adopted thereafter at a regular meeting of the Governing Body held on the \_\_\_\_\_ (insert day) day of 200\_\_\_\_\_ (insert year) by the following vote:

Ayes:

Noes:

Abstained:

Absent:

\_\_\_\_\_  
City/County Clerk

Published: \_\_\_\_\_ (insert date)

## Example 2

The following are sample documents (ordinances, contract language, and permit conditions) and links to programs used by California cities or counties to encourage the diversion of C&D materials from landfills. For specific information regarding these samples, please contact the jurisdiction or author listed.

### City

- [Town of Atherton: C&D Ordinance](#)
- [City of Brawley: C&D Ordinance](#) (Adobe PDF, 1.3 MB)
- [Castro Valley: Administrative Provisions for Processing of Construction and Demolition Debris](#)
- [City of Cotati: C&D Ordinance](#)
- [City of Fortuna: C&D Policy](#) (Adobe PDF, 25 KB)
- [City of Half Moon Bay: Contractor's Guide to the Construction and Demolition Debris Waste Management Plan](#) (Adobe PDF, Size Unknown)
- [City of La Habra: C&D Ordinance](#) (Adobe PDF, 27 KB)
- City of Laguna Hills: Requires all "covered projects" to submit a plan, divert 50 percent, and includes a security deposit based upon square footage.
  - [C&D Ordinance](#) (Adobe PDF, 334 KB)
  - [Resolution](#) (Adobe PDF, 107 KB)
  - [C&D Impound Resolution](#) (Adobe PDF, 45 KB)--sets fees for the disposal/processing and storage of non-franchise drop-off and front loader bins.
  - [Municipal Code](#) (Adobe PDF, 428 KB)--addresses franchise hauler bins.
- [City of Palo Alto: C&D Ordinance](#) (Adobe PDF, Size Unknown)--requires that 90 percent of inert solids (ex. asphalt, concrete, rock) and at least 50 percent of the remaining C&D debris be diverted from landfills through salvage and recycling.
- [City of Oakland: Waste Reduction & Recycling Requirements for Building Permit Applicants](#)
- [City of Sacramento: C&D Ordinance](#)
- [City of San Francisco: C&D Debris Management Ordinance](#)
- [City of San Jose: Construction and Demolition Diversion Deposit Program and Ordinance](#)
- [City of Santa Monica: Ordinance on Construction and Material Waste](#)

**CONSTRUCTION & DEMOLITION WASTE DIVERSION  
BASELINE INFORMATION & GAP ANALYSIS  
BOULDER COUNTY ZERO WASTE EFFORT**

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- [City of Santa Rosa: C&D Debris Ordinance](#)
- [City of Willits: C&D Ordinance](#) (Adobe PDF, 288 KB)--requires demolition, roofing, and construction and remodeling projects to divert 50 percent of waste, and includes a \$0.35/ft<sup>2</sup> deposit.

**County**

- [Contra Costa County: C&D Ordinance and Supporting Information](#)
- [San Mateo County--Unincorporated Area: C&D Ordinance](#)
- [County of Ventura: C&D Ordinance](#)

**Other Model/Sample Ordinances**

- [Local Green Building Programs](#)
- [Alameda County Waste Management Board: Model C&D Ordinance](#) (Adobe PDF, Size Unknown)
- [Marin County: C&D Debris Model Ordinance](#) Adobe PDF, Size Unknown)
- [Rural Alternative Model Ordinance: Rural Counties' Environmental Services Joint Power Authority \(ESJPA\)](#) (MS Word, 48 KB)
- [Sample C&D Ordinance](#) (Adobe PDF, 116 KB)--prepared by Rufus C. Young, Jr., Esq of [Burke, Williams & Sorensen, LLP](#)



## APPENDIX H – Greenhouse Gas Savings

Recycling some of the components of the construction and demolition waste stream can yield some of the strongest resources savings – especially in terms of net avoided greenhouse gas (GHG) emissions – of all the materials that can be currently recycled. In the latest life cycle assessment of solid waste management and greenhouse gases<sup>1</sup> from the U.S. EPA, a number of elements of the C&D waste stream were assessed. (Unless noted otherwise, data in this section is from that source.) C&D waste is not an insignificant fraction of the overall waste stream, and should be evaluated with regard to global warming impacts.

The EPA study estimates that several of the elements found in C&D debris have respectable net GHG emissions, as measured in metric tons of Carbon Equivalent per Ton of carpet (MTCE/Ton). Interestingly, recycling carpet – a common and difficult to recycle material in the C&D stream – results in a net GHG emission of -1.96 MTCE/Ton. This is a dramatic GHG impact – the table below shows the net GHG emissions from recycling several other common materials found in the C&D stream, as compared to other commonly recyclable materials. This suggests that if a C&D waste program were going to be structured based on GHG impacts, carpet is the first item that should be targeted, with wood next, and concrete not as important. Only aluminum yields greater positive GHG impacts from recycling than carpet.

**Net GHG Emissions from Recycling – C&D waste streams are highlighted in grey**  
(in Metric Ton Carbon Equivalent per Short Ton Recycled)

Material Recycled	MTCE/ Ton Recycled
Aluminium cans	-3.70
Carpet	-1.96
Mixed metals	-1.43
Copper wire	-1.34
Mixed paper	-0.96
Corrugated cardboard	-0.85
Dimensional lumber	-0.67
Medium-density fiberboard	-0.67
Personal computers	-0.62
Concrete	0.00

To put the GHG savings in context, it is important to remember that C&D wastes are the result of many steps: extraction and processing of raw materials; manufacture of building materials; transportation of building materials and products to markets; use in the built environment; and finally, end-of-life choices for those materials. All these steps impact GHG emissions.

Implementing more robust C&D waste diversion programs and policy can reduce GHGs by

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<sup>1</sup> SOLID WASTE MANAGEMENT AND GREENHOUSE GASES: A Life-Cycle Assessment of Emissions and Sinks, 3<sup>rd</sup> Edition, September 2006, US EPA, available at <http://epa.gov/climatechange/wycd/waste/SWMGHGreport.html>.

affecting one or more of the following:

- Energy consumption (specifically, combustion of fossil fuels) associated with making, transporting, using, and disposing building materials that become waste.
- Non-energy-related manufacturing emissions, such as the CO<sub>2</sub> released when limestone is converted to lime (e.g., steel manufacturing for steel used in commercial construction).
- Methane (CH<sub>4</sub>) emissions from landfills where the waste is disposed.
- Carbon dioxide (CO<sub>2</sub>) and nitrous oxide (N<sub>2</sub>O) emissions from waste combustion.
- Carbon sequestration, which refers to natural or manmade processes that remove carbon from the atmosphere and store it for long periods or permanently.

Energy consumption, manufacturing, and landfilling/waste combustion *contribute* GHGs to the atmosphere and thus to global warming. Carbon sequestration *reduces* GHG concentrations by removing CO<sub>2</sub> from the atmosphere.

Were the costs of GHG impacts to be factored into tip fees, recycling C&D debris would become a much less expensive option as compared to landfilling.

C&D recycling is strongly argued for by the environmental data. In advance of carbon trading systems being established, and in light of local government interest in managing its own GHG emissions, it is recommended that key stakeholders in developing a C&D infrastructure for Boulder County and the region push for policies that incorporate price signals into waste management costs that measure and value the currently externalized impact of GHG emissions.