

TO: TIM BRODERICK, SUSIE STRIFE, BOULDER COUNTY
FROM: JD LINDEBERG, JURI FREEMAN, RESOURCE RECYCLING SYSTEMS
DATE: 11.26.2019
RE: C&D / COMPOST SITE ANALYSIS AND COMPARISON STUDY PHASE II SUMMARY FINDINGS

In June 2019, Boulder County contracted with Resource Recycling Systems' (RRS) project team¹ to conduct a due diligence comparison and fatal flaws analysis of sites for the development of zero waste infrastructure. Boulder County had previously identified organics and construction and demolition debris (C&D) as targeted streams for achieving zero waste. The goals of the project were as follows:

- Compare and analyze various sites within Boulder County for the location of future infrastructure
- Conduct due diligence review of past work and fatal flaw analysis of location and infrastructure options
- Provide recommendations for future site and operations to the County²

The project included the following keys tasks:

- Review existing information, previously conducted studies, and county data
- Update existing proforma outputs and data to include the information necessary to meet agreed upon decision criteria
- Convene key stakeholders for a series of in-depth meetings to discuss proforma findings, conduct a fatal flaws analysis, and determine the preliminary recommendation for optimal site and infrastructure

The results of the comparison and analysis, along with the consultant recommendation, were presented to the County Commissioners on October 9, 2019. The high level findings, along with the proforma output summaries are included in this memorandum.

¹ Resource Recycling Systems (RRS) is a Michigan based consultancy focused on materials management and closed loop recycling solutions. The project team included Drexel Barrel (Boulder based Civil Engineering Firm), R. Alexander Associates, Inc (agronomist and compost market experts), William Turley (executive director of Construction and Demolition Recycling Association, C&D processing and markets expert), and HDR (engineering and environmental construction firm).

² The recommendations presented to the County were based on a qualitative analysis of the options as well as a quantitative review of proforma cost outputs. The proforma outputs are directional in nature and should not be treated as feasibility level cost estimates.

RRS RECOMMENDATION

Based on the qualitative and quantitative review of the sites, processing options, available feedstocks, community impacts, regional end-markets, and other considerations, the project team recommended the following:

Site: *The recommended site is Old Rainbow Nursery (5762 North 107th Street, Longmont, CO 80504)*

Operation: *The recommended operation is to Process Compost on-site, followed by the development of a Transfer Operation for Construction and Demolition (C&D) debris in the future. In the long term, the County should continue to consider the development of a C&D processing site somewhere in the County.*

A summary of the recommendations is presented in figure 1.

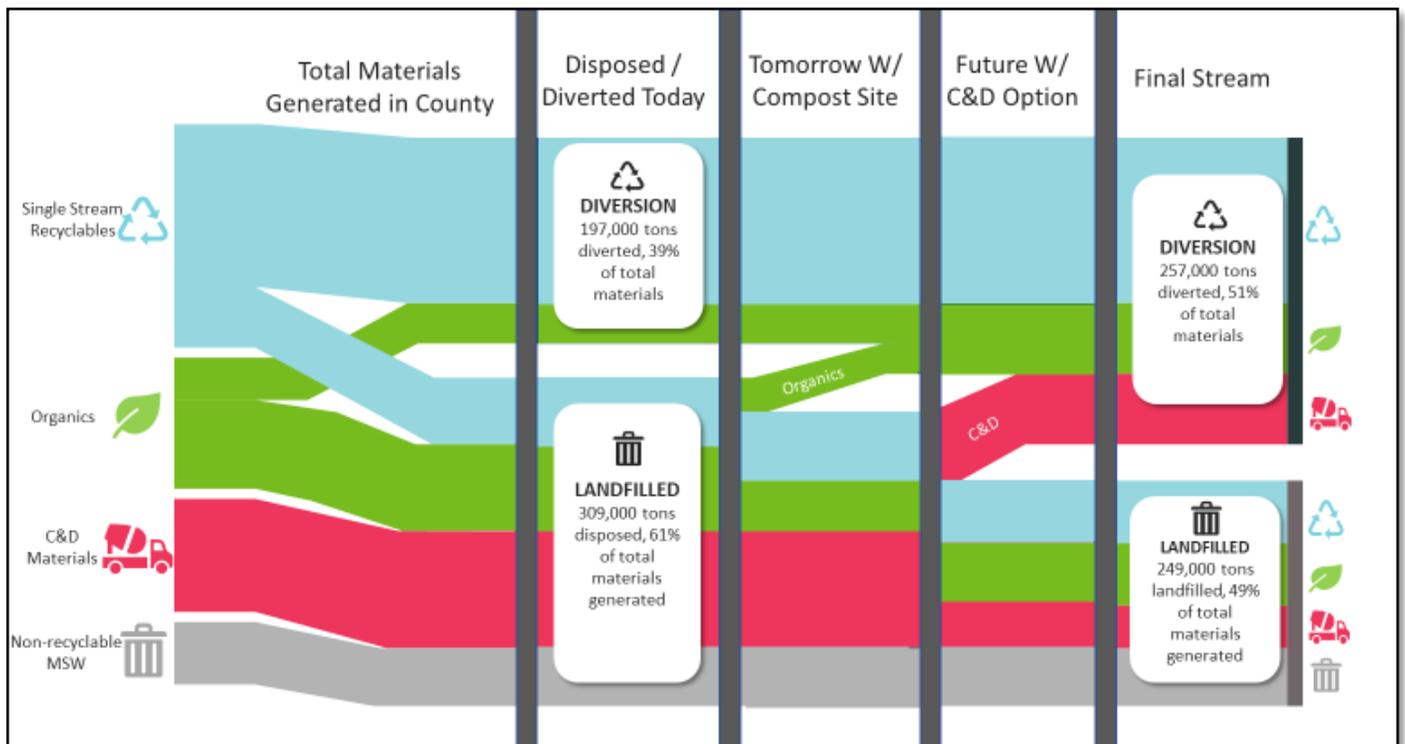
Figure 1: Consultant Recommendation Summary

SITE OPTIONS	<ol style="list-style-type: none"> 1. <u>Old Rainbow Nursery (5762 N 107th St, Longmont): Recommended location. Site is zoned for agricultural uses, implications of zoning and development must be considered for C&D transfer option. C&D processing is not allowed under current zoning.</u> 2. <u>Old Longmont Landfill (10916 County Rd 5, Longmont, CO): Not recommended.</u> Primarily due to site development costs and risks of building on a closed landfill. 3. <u>St Vrain (7698 St Vrain Rd Longmont, CO): Fatal flaw.</u> Not recommended.
FACILITY OPTIONS	<ol style="list-style-type: none"> 1. <u>C&D Processing: Long-term consideration only.</u> Primarily due to issues related to zoning, end-markets, capital costs, and volumes available in County. 2. <u>Compost Processing: Recommended.</u> Option best matches Boulder County’s objectives, provides county with a large environmental benefit over the base case, development will require approval through land use process. 3. <u>C&D Transfer Station: Recommended for consideration.</u> County should consider this option in the short term (2 – 5 years) for C&D. Primarily due to immature end-markets and volumes. There needs to be further evaluation to land use impacts for the Old Rainbow site. There is currently no C&D processor in the region that can accept the transfer loads. Boulder County should continue to monitor Larimer County (public) and Adams County (private) C&D site development. 4. <u>Compost Transfer Station: Not recommended.</u> <p><i>Recommend exploration of options and partnerships to leverage existing private transfer stations for C&D, also consider incremental growth and other options for C&D transfer and processing.</i></p>

IMPACTS

In 2018 Boulder County generated an estimated 506,000 tons of materials³. The county reports that approximately 197,000⁴ tons or 39% is already being diverted from disposal through single stream recycling, composting, and other activities. If developed, the C&D transfer (or processing site) and compost site have the **potential to capture, transfer, or process a combined 100,000 tons on an annual basis**. This equates to approximately one-third of the currently disposed wastes. Overall, the development of the sites has the potential to increase diversion over the current base case by processing **approximately 58,000 additional tons of material**⁵. This would move the county's overall diversion rate from the current estimate of 39% to over 50%. To realize the full potential of the infrastructure RRS recommends that the county evaluate partnerships, new programs, contracts, and policies to drive tonnage to the sites. Figure 2 displays the base case and estimated potential impact of the facilities

Figure 2: Estimated Impacts



³ Boulder County Resource Conservation Division, October 2019

⁴ The county believes that these data do not capture all of the tons of concrete, asphalt, and other construction project generated in the County and sent out of county for processing.

⁵ The discrepancy between the total processed tons (100,000) and total new tons (58,000) is due to the approximately 42,000 tons of organics already being diverted today. The study assumes that nearly all of the currently diverted organics would be sent to the future compost site, and the compost site and C&D site would also process approximately 58,000 new tons of materials, resulting in 100,000 total tons.

PROCESSING COSTS

The project team developed a proforma cost analysis to compare the total and on-going annual costs to locally manage C&D and organic materials. The costs per ton are based on the 2018 generation data and the best available data on potential capture rates for each facility type. The capture rates account for competition for feedstock with existing concrete and asphalt facilities located in Weld County, as well as regional gate fees and transportation costs for organics. Figure 3 displays the total costs per ton for the recommended site, Old Rainbow Nursery.

Figure 3: Costs Per Ton Estimates

	Compost Processing	Transfer C&D / Process Compost (Recommended)	Process Both C&D/Compost	Transfer Both C&D/Compost	C&D Processing
Total Processing Cost/Ton <i>(Includes site development, labor, O&M, residue disposal, transfer costs, and revenue from sale of commodities)</i>	\$ 38	\$ 57	\$ 64	\$ 63	\$ 102
GHG Value / Ton <i>(Based on the social cost of carbon with 3% discount rate for 2020⁶, includes avoided emissions and carbon sequestration from compost)</i>	(\$ 3)	(\$ 4)	(\$ 4)	(\$ 2)	(\$ 2)
Facility Gate Fee <i>(Priced to be competitive with regional sites and local transfer operations)</i>	(\$ 40)	(\$ 40)	(\$ 40)	(\$ 40)	(\$ 40)
Total Net Cost	(\$5)	\$ 13	\$ 20	\$ 19	\$ 60

SITE DEVELOPMENT REVIEW

Prior to beginning the project, the Boulder County Sustainability Siting Task Force created a map of all potential C&D Recycling and Composting sites within county limits. Of those sites identified, only three met the criteria as viable within the parameters the task force laid out and as such, only three sites were included in the RRS evaluation. Those three sites included the Old Rainbow Nursery, the Old Longmont landfill, and the Strain Vrain site.

The project team conducted visits to the three potential sites identified by the County⁷. In addition to the site reviews, the evaluation included a fatal flaws review of sites, review of previous work including sensitive receptors, wind, community impacts, and zoning. With the support of Drexel, Barrell & Co, the project team estimated the costs of additional site work needed for future development including utilities and access roads. A summary of the qualitative review of each site is included in Figure 4. The site development costs are included in the proforma outputs.

⁶ \$42/ ton of CO₂, Jenkins, J.D. & Karplus, V.J. (2016) Carbon pricing under binding political constraints. 2016/44. Helsinki: UNU-WIDER

⁷ Prior to the RRS evaluation, County staff conducted a thorough review of the full range of potential site options. The review identified only three sites that met the criteria for development.

Figure 4: Site Overview

Site Location	Pros	Cons
Old Rainbow Nursery (5762 North 107th Street, Longmont, CO 80504)	<ul style="list-style-type: none"> – Centrally located in Boulder County – Lowest site development costs – Large and well screened site – Class A road access – Proximity to agricultural users for compost facility – Distance from neighbors (> 500' from nearest dwelling) – Largest reduction in GHG emissions 	<ul style="list-style-type: none"> – Inconsistent with 50-yr of County location of intense uses (C&D processing) – Site purchase cost \$625,000 – Planning/zoning requirements (C&D processing) – Potential citizen concerns
Old Longmont Landfill (10916 County Rd 5, Longmont, CO 80504)	<ul style="list-style-type: none"> – Site is 'free' and City of Longmont potential capital contribution – Reuse of a "brownfield" – Reduction in GHG emissions over base case or transfer 	<ul style="list-style-type: none"> – Significantly higher site development costs due to location on closed landfill – Potential for unmitigable site related risk – Unknown landfill gas management risk – Edge of County away from centroid (leakage) – Close business neighbors – Close proximity to eagle roosting area
St. Vrain (7698 St Vrain Rd Longmont, CO 80503)	<ul style="list-style-type: none"> – N/A Fatal Flaw identified 	<ul style="list-style-type: none"> – Fatal Flaw – Proximity to Vance Brand Airport makes site unsuitable for compost – FAA Regulations Section 2.2e page 10 – Composting Operations on or near airport property.... – CDPHE Section 14, page 364 – compliance with applicable federal, state or local statutes... – RRS spoke to several composters, none would recommend St Vrain as a site. Additional issues noted with turn lane sight lines and farmers ditch / run-off

FACILITY CAPITAL COSTS

As part of the proforma estimations, the project team developed directional cost estimates for the three facility types; Compost Yard, Construction and Demolition processing, and Transfer Station. A brief description of the facilities and the machinery and equipment, rolling stock, and building and improvement costs are displayed in Figure 5. The costs displayed in the figure are the total capital costs and do not include the site development, annual operating, maintained, labor, or other costs (these are included in the proforma as sperate modules).

Figure 5: Summary Capital Costs

Compost Yard

Type: Aerated Static Pile
Pad size: 76,000 cubic yards
Pile height: 10 feet, 26 feet wide, 90 feet long
ASP area: 1.0 acre
Composting time: 8 weeks
Capital Costs: \$5.7M



Transfer Station

Two-sided building
Size: 28,500 to 38,500 square feet
Site work: 73,500 to 83,500 square feet
Capital Costs: \$7.6M



C&D Processing

Four-sided building
Size: 50,000 square feet
Site work: 190,000 square feet
Capital Costs: \$20.6M



GHG IMPACTS

The proforma and presentation included a detailed evaluation of the environmental impacts of the processing and site options. The evaluation included the emissions related to travel distance to each site, the impacts of distance to markets and disposal for residue, as well as the potential for GHG avoidance realized through diversion opposed to the landfill base case. The evaluation also included an estimate of the potential for carbon farming on County farm and rangelands. The GHG impacts are presented in Figure 6.

Figure 6: Estimated GHG Impacts

	Compost Processing	Transfer C&D / Process Compost	Process Both C&D/Compost	Transfer Both C&D/Compost	C&D Processing
Old Rainbow Nursery (Net GHG Impacts MTCO ₂ e)	-6,300 MTCO ₂ e	-10,400 MTCO ₂ e	-10,700 MTCO ₂ e	-3,900 MTCO ₂ e	-4,400 MTCO ₂ e
Old Longmont Landfill (Net GHG Impacts MTCO ₂ e)	-5,900 MTCO ₂ e	-9,600 MTCO ₂ e	-9,700 MTCO ₂ e	-3,000 MTCO ₂ e	-3,800 MTCO ₂ e

MARKETS

The project team calculated the potential revenue that could be realized from the sale of finished compost as well as sorted C&D commodities. The proforma estimates included underlying assumptions for commodity sales on a material by material basis under the current market situation (September 2019) in Boulder County and the Denver Metro area. Unfortunately, with the current market for recyclables at a nadir and the lack of mature markets for processed C&D materials, there was little potential revenue from C&D commodity sales in the pro forma.

The team’s final recommendation that the County start with compost operations and transition to C&D is based on the underlying assumption that the County should wait to see how regional C&D markets evolve before determining whether it makes most sense to process within the County or transfer to a facility elsewhere. While the current markets are limited to a few materials streams, and the values are low for others, there is potential for both the overall recycling commodity markets to recover and for the other projects occurring in the region to help establish markets for commodities. Some of the future local market opportunities that should be monitored include; Wood synergies with composting facility, Used brick, County road base, Asphalt shingle, Concrete reuse, and Gypsum (drywall) recycling opportunities. Figure 7 displays the potential revenues.

Figure 7: Market Revenues by Processing Type

	Compost Processing	Transfer C&D / Process Compost	Process Both C&D/Compost	Transfer Both C&D/Compost	C&D Processing
Annual Revenue from Commodity Sales	\$315,000	\$315,000	\$319,000	\$0	\$4,000

SUMMARY OUTPUTS

The summary outputs of the proforma are displayed on the following page.

Summary Outputs

Tons Compost	60,500	Tons C&D	42,800	Total Tons	103,300
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Building, Equipment, O&M

	Old Longmont								Old Rainbow							
	Transfer Both C&D / Compost	Process Both C&D / Compost	Transfer C&D / Process Compost	Process C&D / Transfer Compost	Transfer C&D / No Compost	Process C&D / No Compost	No C&D / Process Compost	No C&D / Transfer Compost	Transfer Both C&D / Compost	Process Both C&D / Compost	Transfer C&D / Process Compost	Process C&D / Transfer Compost	Transfer C&D / No Compost	Process C&D / No Compost	No C&D / Process Compost	No C&D / Transfer Compost
Total Annual Costs	\$ 1,464,000	\$ 5,856,000	\$ 3,637,000	\$ 4,833,000	\$ 1,275,000	\$ 3,549,000	\$ 2,375,000	\$ 1,275,000	\$ 1,464,000	\$ 5,856,000	\$ 3,637,000	\$ 4,833,000	\$ 1,275,000	\$ 3,549,000	\$ 2,375,000	\$ 1,275,000
Total Annual Costs / Ton	14.20	56.70	35.20	46.80	29.80	82.90	39.30	21.10	14.20	56.70	35.20	46.80	29.80	82.90	39.30	21.10

Site Development Costs

Total Annual Costs	\$ 321,700	\$ 483,700	\$ 412,300	\$ 642,500	\$ 250,300	\$ 434,300	\$ 91,500	\$ 250,300	\$ 28,000	\$ 28,000	\$ 28,000	\$ 28,000	\$ 28,000	\$ 28,000	\$ 28,000	\$ 28,000
Total Annual Costs / Ton	\$ 3.10	\$ 4.70	\$ 4.00	\$ 6.20	\$ 5.80	\$ 10.10	\$ 1.50	\$ 4.10	\$ 0.30	\$ 0.30	\$ 0.30	\$ 0.30	\$ 0.70	\$ 0.70	\$ 0.50	\$ 0.50

Transfer Costs

Total Annual Costs	\$ 4,989,000	\$ 1,347,700	\$ 2,557,000	\$ 3,460,300	\$ 2,343,000	\$ 813,700	\$ 214,000	\$ 2,646,000	\$ 4,990,100	\$ 1,005,200	\$ 2,558,100	\$ 3,437,200	\$ 2,348,100	\$ 801,000	\$ 210,000	\$ 2,642,000
Total Annual Costs / Ton	\$ 48.30	\$ 13.00	\$ 24.80	\$ 33.50	\$ 54.70	\$ 19.00	\$ 3.50	\$ 43.70	\$ 48.30	\$ 9.70	\$ 24.80	\$ 33.30	\$ 54.90	\$ 18.70	\$ 3.50	\$ 43.70

Commodity Revenue

Total	\$	\$(319,000)	\$(315,000)	\$(4,000)	\$	\$(4,000)	\$(315,000)	\$	\$(319,000)	\$(315,000)	\$(4,000)	\$	\$(4,000)	\$(315,000)	\$	\$(319,000)
Total Annual Costs / Ton	\$	\$(3.10)	\$(3.00)	\$	\$(0.10)	\$(5.20)	\$	\$(3.10)	\$(3.00)	\$	\$(0.10)	\$(5.20)	\$	\$(0.10)	\$(5.20)	\$

GHG Impacts

Net GHG Impacts MTC02e	(3,000)	(9,700)	(9,600)	(3,200)	(3,600)	(3,800)	(5,900)	600	(3,900)	(10,700)	(10,400)	(4,100)	(4,200)	(4,400)	(6,300)	300
Carbon Value Total	\$ (126,000)	\$ (407,000)	\$ (403,000)	\$ (134,000)	\$ (151,000)	\$ (160,000)	\$ (248,000)	\$ 25,000	\$ (164,000)	\$ (449,000)	\$ (437,000)	\$ (172,000)	\$ (176,000)	\$ (185,000)	\$ (265,000)	\$ 13,000

TOTALS (No Carbon Credits)

Total Capital Costs	\$ 14,518,000	\$ 32,181,000	\$ 18,994,000	\$ 37,209,250	\$ 11,166,250	\$ 26,778,000	\$ 6,963,000	\$ 11,166,250	\$ 10,345,000	\$ 25,705,000	\$ 13,533,000	\$ 28,476,000	\$ 8,008,000	\$ 21,005,000	\$ 6,062,000	\$ 8,008,000
Total Annual Costs	\$ 6,772,000	\$ 7,359,000	\$ 6,282,000	\$ 8,929,000	\$ 3,865,000	\$ 4,789,000	\$ 2,360,000	\$ 4,172,000	\$ 6,478,000	\$ 6,560,000	\$ 5,898,000	\$ 8,290,000	\$ 3,647,000	\$ 4,370,000	\$ 2,292,000	\$ 3,945,000
Total Annual Costs / Ton	\$ 65.60	\$ 71.20	\$ 60.80	\$ 86.40	\$ 90.30	\$ 111.90	\$ 39.00	\$ 69.00	\$ 62.70	\$ 63.50	\$ 57.10	\$ 80.30	\$ 85.20	\$ 102.10	\$ 37.90	\$ 65.20

TOTALS (With Carbon Credits)

Total Capital Costs	\$ 14,518,250	\$ 32,181,000	\$ 18,994,000	\$ 37,209,250	\$ 11,166,250	\$ 26,778,000	\$ 6,963,000	\$ 11,166,250	\$ 10,345,000	\$ 25,705,000	\$ 13,533,000	\$ 28,476,000	\$ 8,008,000	\$ 21,005,000	\$ 6,062,000	\$ 8,008,000
Total Annual Costs	\$ 6,646,000	\$ 6,952,000	\$ 5,879,000	\$ 8,795,000	\$ 3,714,000	\$ 4,629,000	\$ 2,112,000	\$ 4,197,000	\$ 6,314,000	\$ 6,111,000	\$ 5,461,000	\$ 8,118,000	\$ 3,471,000	\$ 4,185,000	\$ 2,027,000	\$ 3,958,000
Total Annual Costs / Ton	\$ 64.30	\$ 67.30	\$ 56.90	\$ 85.10	\$ 86.80	\$ 108.20	\$ 34.90	\$ 69.40	\$ 61.10	\$ 59.20	\$ 52.90	\$ 78.60	\$ 81.10	\$ 97.80	\$ 33.50	\$ 65.40

TOTALS (With \$40 / ton Gate Fee & Carbon Credits)

Total Capital Costs	\$ 14,518,250	\$ 32,181,000	\$ 18,994,000	\$ 37,209,250	\$ 11,166,250	\$ 26,778,000	\$ 6,963,000	\$ 11,166,250	\$ 10,345,000	\$ 25,705,000	\$ 13,533,000	\$ 28,476,000	\$ 8,008,000	\$ 21,005,000	\$ 6,062,000	\$ 8,008,000
Total Annual Costs	\$ 6,646,000	\$ 2,820,000	\$ 3,459,000	\$ 7,083,000	\$ 3,714,000	\$ 2,917,000	\$ (308,000)	\$ 4,197,000	\$ 6,314,000	\$ 1,979,000	\$ 3,041,000	\$ 6,406,000	\$ 3,471,000	\$ 2,473,000	\$ (393,000)	\$ 3,958,000
Total Annual Costs / Ton	\$ 64.30	\$ 27.30	\$ 33.50	\$ 68.60	\$ 86.80	\$ 68.20	\$ (5.10)	\$ 69.40	\$ 61.10	\$ 19.20	\$ 29.40	\$ 62.00	\$ 81.10	\$ 57.80	\$ (6.50)	\$ 65.42