



# WASTE DIVERSION DATA SURVEY

## FRONT RANGE WASTE DIVERSION BOARD

NOVEMBER 2020

PREPARED BY:



recycle.com

COMMISSIONED BY:



**COLORADO**  
Department of Public  
Health & Environment

## Contents

GLOSSARY .....	3
EXECUTIVE SUMMARY .....	4
1: DATA AND MEASUREMENT GUIDANCE.....	9
2: EVALUATION OF WASTE DIVERSION DATA.....	13
3: MATERIAL OPPORTUNITY ANALYSIS.....	21
4: NATIONAL RESEARCH SUMMARY .....	24
APPENDIX A: MSW DIVERSION RATE .....	29
APPENDIX B: METRICS.....	30
APPENDIX C: STATISTICAL ANALYSIS.....	31
APPENDIX D: COUNTING DIVERSION .....	33
APPENDIX E: STRENGTHS AND WEAKNESSES.....	34
APPENDIX F: CASE STUDIES.....	38
APPENDIX G: 2019 COLORADO DATA .....	67

### **Acknowledgements**

*Resource Recycling Systems would like to thank the following individuals and organizations for their willingness to provide the data, resources, and opinions integral in the completion of the project.*

*Wolf Kray and Jace Driver, CDPHE; Tyler Bandemer, City of Loveland; Caroline Mitchell, City of Fort Collins; Tay Dunklee and Courtney Cotton, City and County of Denver; Cody Lillstrom, Boulder County; Barbara Monaco, State of Minnesota; Dan Brown, CalRecycle; Sandy Skolochenko, State of North Carolina; Meghan Starkey, Alameda County StopWaste; Nancy Plunkett, CSWD VT; and Pete Chism-Winfield, City of Portland.*

# GLOSSARY

Commonly used acronyms and industry-specific terminology.

- **ADC:** Alternative daily cover. A cover material placed on the surface of a landfill at the end of each operating day to control for fires, vectors, blowing litter, and pests.
- **Beneficial Use:** The utilization of previously discarded materials as a commodity. Determination of acceptable uses and materials is generally defined by governmental agencies.
- **C&D:** Construction and demolition debris. Refers to the generator sector or the materials generated during the construction, deconstruction, or demolition of structures. Includes materials such as metal, rubble, shingles, wood, drywall, and others.
- **Diversion:** The process of redirecting materials from disposal in a landfill to other uses, generally achieved through composting, recycling, and reuse.
- **HHW:** Household hazardous waste. Post-consumer waste that is labeled as flammable, toxic, corrosive, or reactive.
- **ICI:** Industrial, commercial, and institutional. Refers to the entities that generate waste in the sector, or to waste generated by the sector, which is sometimes referred to as the commercial sector.
- **MRF:** Material recovery facility. A specialized facility that accepts and processes recyclable materials and prepares them for sale as specified commodities.
- **MRF Residue:** The portion of the materials sent to a material recovery facility for processing that is not captured as a commodity. Residue is instead sent to a landfill for disposal. Residue includes non-recyclable materials as well as recyclable items that cannot be captured by the MRF process.
- **MSW:** Municipal solid waste. Defined by the US EPA as *'items we use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. This comes from our homes, schools, hospitals, and businesses.'*
- **OCC:** Old corrugated containers. Covers all corrugated cardboard boxes, including corrugated containers having liners of either test liner or kraft.
- **Source Reduction:** The act of minimizing waste before it happens through changes in design, packaging and material volume and mass, consumer behavior choices, reuse, or others.
- **SWMD:** Solid waste management district. A government agency that oversees how solid waste is managed, including recycling, in its member regions, counties and / or cities.
- **White Goods:** Large electrical goods used by households. Examples include refrigerators, stoves, dryers, and washers.
- **WTE:** Waste to energy. Process of generating electricity and / or heat from waste materials through combustion, pyrolysis, chemical transformation, or other techniques.



# EXECUTIVE SUMMARY

---

---

The Front Range Waste Diversion (FRWD) enterprise board contracted with Resource Recycling Systems (RRS, [recycle.com](https://www.recycle.com)) to complete a survey and analysis of waste diversion data. The project included the following major activities:

- Research methodologies for tracking and benchmarking progress in waste diversion.
- Identify the best practices in benchmarking, including an evaluation of program strengths and weaknesses.

Following the data survey, the project team applied the lessons learned in the research phase to Colorado's waste diversion tracking systems. This report includes the research, lessons learned, and the consultant recommendations on metrics and benchmarking in the state.

## Recommendations

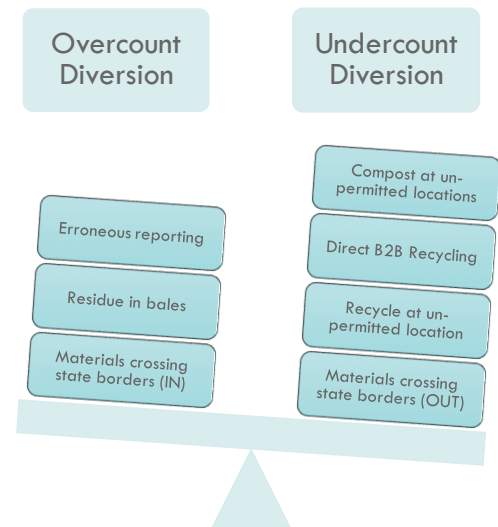
The recommendations are based on a review of best practices locally and nationally, interviews with state and local staff, and input from Colorado Department of Public Health and Environment (CDPHE) data collection experts. The recommendations are presented at two levels: 1) State Level and 2) Local Level.

### STATE LEVEL

Methodology for Calculating Diversion: The project team does not recommend significant changes to CDPHE's methodology for calculating diversion rates.

**Metrics:** To fully assess progress in materials management, the project team recommends that the state track three main metrics on a regular basis: Diversion Rate, Per Capita Rates, and Material Capture Rates.

**Data Collection and Analysis:** There are no significant changes recommended to the state’s data collection and tracking process. However, the project team recommends the adoption of a mechanism to require, incentivize, or otherwise collect a separate set of data at the county level. CDPHE and FRWD should also consider funding a Colorado-based density study of select materials to improve conversion factors.



## EVALUATION OF STATE DATA

Table 1 highlights the potential ways in which data may be overcounted or undercounted at the state level in Colorado. The areas of error are not unique to Colorado and, in fact, most of the states researched reported similar challenges. Table 1 also includes a risk analysis of the potential impact the data may have on reported diversion rates (undercount or overcount the diversion rate<sup>1</sup>).

**Table 1: Potential for Variance in Data Tracking**

(Undercount: Error results in an under-reported diversion rate, Overcount: Error results in an over-reported diversion rate)

Element	Undercount	Overcount	Risk
Materials Crossing State Borders – Out	✓		Minimal
Materials Crossing State Borders – In		✓	Low
Materials Crossing Regional Borders (In/ Out)	✓	✓	Low for state, Med. for washed
Residue at MRFs	N/A	N/A	N/A – Colorado already tracks
Residue in Marketed Commodities		✓	Low
Business-to-Business Recycling	✓		Unknown, may be significant
Erroneous Data Reporting – Tons, Materials, Consistency	✓	✓	Unknown, most likely low
Waste Conversion Factors	✓	✓	Low
Agricultural, Non-registered, Backyard Composting	✓		Medium <sup>2</sup>
Construction Debris Managed On-Site	✓		Large <sup>3</sup>
Scrap Metal Processors	✓		Medium
Double Counting – Reporting Errors		✓	Low

<sup>1</sup> For example, there are tons of recycling generated in Colorado that are assumed to be direct hauled to a MRF in New Mexico; the tons are not counted in the state’s diversion rate and as a result, the error represents a potential *undercount* of the current diversion rate. Conversely, there are also tons of recyclables from Wyoming that are being hauled to MRFs in Denver for processing; these tons are counted in Colorado’s diversion rate and result in an *overcount* of the state’s diversion rate.

<sup>2</sup> Assumes that agricultural composting of manure should ‘count’ as diversion. If agricultural compost of manure does not count, the impact is much lower.

<sup>3</sup> Assumes that inert materials that were never landfill bound ‘count’ as diversion. If inert material does not count, there is no impact.

## Local Level

The project team recognizes the many challenges in Colorado that hinder local level reporting, including impacts on staff time, the open market subscription services, and political will. Despite the challenges, the team recommends that the state pursue local data tracking, whether it is voluntary or required.

Methodology for Calculating Diversion: The project team recommends that local governments use the same general formula for calculating the MSW Diversion Rate as the state. Local governments are encouraged to track and count additional materials types, including industrial materials that are counted in the state's Total Diversion Rate, but they should not be counted in the local MSW Diversion Rate. The recommended level of data (Level 1) that should be included in the county and local level MSW Diversion Rate calculations<sup>4</sup> is presented below.

### Local Level Data Tracking Recommendation

<b>LEVEL 1: Basic MSW Diversion Rate Reporting</b>	<ul style="list-style-type: none"><li>• Single family and multi-family residential trash, recycle, organics</li><li>• Commercial / Institutional trash, recycle, compost</li><li>• Drop-off recycling</li><li>• Municipal / County buildings (i.e. municipal offices, courthouses, libraries)</li><li>• City / County programs and events (i.e. e-waste events, white goods programs, HHW centers, county fairs, street festivals, etc.)</li><li>• Residue from the MRF sent to landfills for disposal (removed from numerator and added to denominator)</li></ul>
--	--

Metrics: The project team recommends that counties track and report the MSW Diversion Rate metric (Level 1) to allow for an 'apples-to-apples' comparison between counties and to the state. In addition, counties should calculate per capita MSW waste generation and diversion (using Level 1 data). Counties with over 100,000 residents should be funded by FRWD or RREO to conduct waste composition studies with capture rates at least once every 10 years; counties with fewer residents should be encouraged to do so when funding is available or consider a regional study including multiple counties.

Data Collection: Solid waste data can only be collected at the points where the material is collected or where it is processed. This means that regardless of the reporting mechanism, the burden of data collection and reporting will fall to the haulers, the processing facilities, or both. While there are multiple viable options for amassing and reporting local data, the project recommends that counties are responsible for collecting and reporting data to CDPHE. The three main ways the state can track data at the local level are presented in Table 2; note that all options have benefits and challenges, and FRWD should consider the input of stakeholders in making a final determination.

<sup>4</sup> Additional detail on the sectors is included in Appendix B.

**Table 2: Tracking County Data**

Method	Description
<b>County Tracks and Reports (RECOMMENDED)</b>	Counties report diversion rates and per capita data to CDPHE on an annual basis. Cities report data to counties, and counties are responsible for unincorporated area data. Cities are responsible for working with haulers operating locally to collect data.
<b>State Hauler Licensing</b>	State agency licenses all haulers operating in Colorado; haulers are required to report local level data to the state annually.
<b>Facilities Report</b>	Reporting entities (landfills, MRFs, compost yard, etc.) are required to collect and report data on the county of origination for the tons they accept and process.

RRS is recommending tracking data at the county level for several key reasons:

- 1) Counties, and the cities within the counties, have the local knowledge of the haulers operating in their borders and are thus better suited to collect data from all actors.
- 2) Recycling programs are local and ultimately it will be the cities and counties, not the state, that are responsible for enacting diversion programs.
- 3) Tracking data from haulers, as opposed to processors, allows for more detailed reporting.

## RECOGNITION OF LOCAL CHALLENGES

Tracking and reporting data at the local level is not without its challenges. A summary of the major issues faced by local governments and haulers along with potential solutions are presented below.

- **City / County Funding:** Cities and counties may not have the funding, either for staff (full or partial FTEs) or tools (online reporting), to effectively track data.
  - *Use RREO, FRWD, or other state funding to support local governments in data tracking. Provide a data tracking tool at no cost to the user, preferably online, for cities and counties to use.*
- **Hauler / Processor Staff Time:** Reporting data to cities / counties typically falls on private sector haulers, and the reporting forms take time and effort to complete. This issue is often more challenging for smaller companies with less experience in data reporting and fewer staff available.
  - *Provide mini-grants or other easy to access funding to haulers to help offset a portion of the costs for the first year of a new reporting. Work with the haulers and cities to streamline the reporting process.*
- **Lack of Consistency:** The lack of city consistency in reporting forms, definitions, and methodologies may mean that a single hauler is reporting the tonnage data in multiple ways at different times of the year to different entities, causing confusion and requiring additional staff time.
  - *Coordinate efforts at the county level to reduce city-to-city redundancies; FRWD or CDPHE to coordinate across counties to use similar formats, definitions, sectors, and conversion factors to reduce county to county redundancies and make it easier for all haulers in the state<sup>5</sup>.*

<sup>5</sup> An alternative option to county level reporting is to require hauler reporting at the state level. This would allow haulers to file a single state level report for all of the cities / counties they operate in and has the potential to reduce the number of times data is reported.

- **County Authority:** Counties do not have the authority to require cities to report tonnage data. Voluntary data efforts often come up short. This is a significant barrier.
  - *Voluntary reporting of data has not proven to be effective in Colorado and other states. Counties must collaborate with cities in the county to adopt similar hauler licensing ordinances (as needed). This is a time-intensive and potentially politically charged activity. Counties and cities must also be willing to enforce reporting requirements to collect consistent data from all haulers operating in the reporting boundary.*
- **Open Market System:** The majority of Colorado’s solid waste services are provided by the private sector in an open competitive market. Without a reporting requirement at the city level, counties and cities cannot compel haulers to share their tonnage data.
  - See County Authority above.
- **Proprietary Data:** Haulers are hesitant to share internal information with governmental entities that may provide their competitors with an advantage.
  - *Do not ask for proprietary data (rates charged to customers, percent of market share, etc.), allow reporting entities to clearly delineate proprietary data, and only publicly share data in aggregate.*
- **Cost to Private Sector:** Local hauler licensing requirements often impose a fee per vehicle for licensing, which increases the operational costs for haulers.
  - *Minimize the fees to simply cover the minimum cost of administration and consider options to keep costs down for large fleets or small companies with tighter profit margins.*
- **Crossing Borders:** Haulers often cross city and county borders, making it hard to report the city or county of origin for their materials.
  - *Allow for easy estimations of cross-border tonnages (i.e. 60 percent of the weight ticket came from City A, and 40 percent from City B).*

## TOPICS OF FURTHER DISCUSSION

The project team recommends the following discussion topics for further consideration by the FRWD enterprise board:

- **Local Reporting Mechanism:** Three mechanisms are presented for collecting and reporting local level data; all have benefits and drawbacks. The project team’s recommendation has not been vetted through a stakeholder process. FRWD may wish to consider the input of haulers, local authorities, cities, counties, and CDPHE in determining the best pathway for collecting local level data.
- **Waste Composition and Capture Rate Studies:** The report recommends that a consistent set of material definitions and methodologies are used for these studies. However, the development of the definitions and methodologies was out of scope. FRWD may wish to consider defining the study categories and methodologies for sampling.
- **Leveraging FRWD and RREO Funding:** What is the best way to leverage FRWD and RREO grant funding to support, encourage, or incentivize local governments and private sector actors to collect and report data?





# 1: DATA AND MEASUREMENT GUIDANCE

---

Section 2 includes the recommendations for waste diversion calculations, measurement, and data collection in Colorado. The recommendations are based on a review of best practices locally and nationally and interviews with state and local staff and consider input from Colorado Department of Public Health and Environment (CDPHE) data collection experts. The recommendations are presented at two levels: 1) State Level and 2) Local Level.

## State Level

**Methodology for Calculating Diversion:** The project team does not recommend significant changes to CDPHE's methodology for calculating diversion rates. The state should continue to calculate and present two diversion rates (MSW Diversion Rate and the Total Solid Waste Diversion) for two waste sheds and the state overall (Front Range, Greater Colorado, and Colorado). The general formulas utilized by the state are as follows (more detail is included later in the report):

$$\frac{(MSW\ Recycled + MSW\ Composted)}{(MSW\ Recycled + MSW\ Composted + MSW\ Disposed)}$$

**MSW Diversion Rate** (follows US EPA guidance, includes residential and commercial wastes)

$$\frac{(MSW\ Recycled + MSW\ Composted + Non\ MSW\ Materials\ Diverted)}{(MSW\ Recycled + MSW\ Composted + MSW\ Disposed + Non\ MSW\ Materials\ Diverted + Non\ MSW\ Materials\ Disposed)}$$

**Total Diversion Rate** (includes the industrial waste such as biosolids, ash, ag. waste, etc.)

The tonnages included in the numerators of the diversion rate calculations are those derived from recycling, composting, and other activities that shift materials from landfill disposal to entering a manufacturing process or second life. The project team recommends that CDPHE continue to improve upon their current practice of not counting material that may be designated as recycling but ends up in the landfill (i.e. MRF residue, alternative daily cover, consider secondary and end-market residue) as diversion. Additionally, when possible, materials that are recycled but do not go through a registered recycling or composting facility (i.e. direct-to-market materials

recycled by commercial businesses, deconstruction materials that are reused or resold, food donation) should be counted in the future. Material that was never going to enter a municipal landfill (i.e. backfill reused on-site at large construction projects, manure composted on-site in agricultural operations) should not be counted in either the numerator or the denominator of the diversion rate calculation<sup>6</sup>. CDPHE only counts tonnages that are measured and does not count activities, such as source reduction, in their formulas, a practice which is defensible and in line with other state agencies.

**Metrics:** To fully assess progress in materials management, the project team recommends that the state track three main metrics on a regular basis: Diversion Rate, Per Capita Generation, and Material Capture Rates. Together, the metrics will provide the state with an accurate representation of progress to date and future needs.

*Diversion Rate:* CDPHE should continue to benchmark progress using Diversion Rates. This includes the continued calculation of the MSW Diversion Rate and the Total Diversion Rate inclusive of industrial activities. The metrics are in line with EPA recommendations and the best practices in state reporting, and of course, the calculation matches the state's goals. Likewise, progress should continue to be tracked for the Front Range, Greater Colorado, and Colorado to allow for benchmarking against the state goals.

*Per Capita:* In addition to the diversion rate metric, the state should promote the use of the already calculated per capita generation rate (total lbs. of MSW generated per person per day). The per capita rate allows Colorado to measure source reduction and normalize tonnage data against population growth. In addition to per capita generation, CDPHE should continue to report per capita diversion (compost + recycle) and landfilled amounts.

*Material Capture Rate:* Lastly, FRWD and CDPHE should consider funding a state-wide waste composition study with recyclable and organics capture rates at least once every five to seven years<sup>7</sup>. While there are numerous waste composition studies in Colorado, they do not use consistent methodologies, sampling protocols, or material categories and definitions.

**Data Collection and Analysis:** CDPHE tracks data at the facility level (MRF, compost yard, landfill, transfer station); there are no significant changes recommended to the state's data collection and tracking process. However, the project team recommends the adoption of a mechanism to require, incentivize, encourage, or otherwise facilitate the collection of a separate set of data at the county level. CDPHE and FRWD should also consider funding a Colorado-based density study of select materials including the following: residential organics with and without food scraps, commercial organics, mixed-load organics, baled and un-baled cardboard, and loose and compacted single stream recyclables. The results of the study would be used to improve the accuracy of the volume-to-weight (e.g., yd<sup>3</sup> to lbs.) conversion factors as the existing conversion factors are outdated and non-Colorado specific.<sup>8</sup>

## Local Level

The project team recognizes the many challenges in Colorado that hinder local level reporting including staff time, open market subscription services, and political will. Despite the challenges, the team recommends that the state

---

<sup>6</sup> This does not mean that these data should not be tracked, only that they should not be counted as MSW or Total diversion.

<sup>7</sup> Additional information on the statistical analysis and capture rate studies are included in Appendix C.

<sup>8</sup> Volume to weight conversion factors most commonly used in the solid waste industry come from the EPA's 1997 "Measuring Recycling: A guide for State and Local Governments" report which was somewhat updated in 2006. ([https://www.epa.gov/sites/production/files/2016-04/documents/volume\\_to\\_weight\\_conversion\\_factors\\_memo\\_04192016\\_508fnl.pdf](https://www.epa.gov/sites/production/files/2016-04/documents/volume_to_weight_conversion_factors_memo_04192016_508fnl.pdf))

pursue local data tracking, whether it is voluntary or required. Despite Colorado’s open market system and home rule authority challenges, the project team believes that counties should be the units of government responsible for amassing and reporting the local level data to CDPHE. More detail on local data collection and reporting is included in Section 3 of the report.

Methodology for Calculating Diversion: Local governments should use the same general formula for calculating the MSW Diversion Rate as the state. Local governments, of course, have the option of tracking and counting additional materials types, including industrial materials that are counted in the state’s Total Diversion Rate, but they should not be counted in the MSW Diversion Rate. Table 3 represents the recommended level of data (Level 1) that should be included in the county level rate calculations<sup>9</sup>.

**Table 3: County Level Reporting Recommendation**

Level	Description	Materials Included in Measurement
<b>LEVEL 1: Basic MSW Diversion Rate Reporting (Recommended)</b>	<p>The minimum level of data tracking and reporting follows CDPHE MSW diversion rate in terms of sectors, materials, and formula.</p> <ul style="list-style-type: none"> <li>Allows for a comparable rate among all counties, cities within the county, and state.</li> <li>Data is broken out by three destinations only – compost, recycle, landfill.</li> <li>To reduce staff and hauler reporting burden, data does <i>not</i> need to be separated by generating sector (e.g. commercial from residential).</li> <li>Per Capita metric uses the same tonnages / sectors as the MSW Diversion Rate.</li> </ul>	<ul style="list-style-type: none"> <li>Single family and multi-family residential trash, recycle, organics</li> <li>Commercial / institutional trash, recycle, organics</li> <li>Drop-off recycling and organics</li> <li>Municipal / County buildings (i.e. municipal offices, courthouses, libraries) trash, recycle, organics</li> <li>City / County programs and events (e-waste events, white goods programs, HHW centers, county fairs, street festivals, etc.)</li> <li>Residue from the MRF sent to landfills for disposal (removed from numerator and added to denominator)</li> </ul>
<b>LEVEL 2: Advanced Reporting (Optional)</b>	<p>As counties and cities progress, the quality and level of detail of the data tracked and reported will improve.</p> <ul style="list-style-type: none"> <li>Level 2 data is broken out by generating sector (single family, multi-family, commercial, and C&amp;D<sup>10</sup>).</li> <li>Level 2 is not required, additional tonnage data in Level 2 should be shared and published but will not serve as the basis for city / county MSW Diversion Rate comparisons.</li> <li>Level 2 includes industrial tonnages, C&amp;D data, harder-to-track MSW tons, and tons that may be ‘counted’ but are not ‘measured’</li> <li>To allow for comparison between counties, those choosing to track</li> </ul>	<p>Same as above, with the addition of the following types of data:</p> <ul style="list-style-type: none"> <li>Roll-off service trash and recycle (classified as C&amp;D in breakout)</li> <li>Capital projects (concrete, asphalt, soil, others)</li> <li>Biosolids from waste treatment</li> <li>Landscapers and contractors who haul waste during business activities but for whom waste hauling is not a primary business</li> <li>Reuse of demolition and deconstruction materials</li> <li>Resale stores and centers</li> <li>Beneficial reuse</li> <li>Tires as energy</li> <li>Credits for source reduction or backyard composting, food rescue and / or repair programs</li> </ul>

<sup>9</sup> Additional detail on the sectors is included in Appendix A.

<sup>10</sup> C&D sector is represented by the roll-off data. While it does include some non-C&D tonnages such as special events or garage cleanouts, it is the best estimation of city / county level C&D material generation and recovery.

Level	Description	Materials Included in Measurement
	additional tons should clearly label the sources, materials types, and destinations.	<ul style="list-style-type: none"> <li>Residue from the end markets sent to landfills for disposal (removed from numerator and added to denominator)</li> </ul>

**Metrics:** The project team recommends that counties track and report the MSW Diversion Rate metric (Level 1) to allow for an “apples-to-apples” comparison between counties and to the state. In addition, counties should also track per capita MSW waste generation (using Level 1 data plus population growth projections). Counties with over 100,000 residents should be funded to conduct waste composition studies with capture rates at least once every 10 years, this may be in conjunction with state waste composition studies. Other counties should be encouraged to do so.

**Data Collection and Analysis:** County level data tracking requires reporting from waste haulers, drop-offs, and roll-off service providers. The onus of the data collection falls on city and county staff, as well as on the haulers operating locally (see Section 3 for further discussion of the challenges and opportunities). To improve the consistency of the data collection and analysis, the following recommendations are provided:

- *Material and Sector Definitions:* Clearly define the materials and generating sectors that do and do not count in the MSW Diversion Rate metric for counties and cities.
- *Online Data Collection Tool:* Provide a consistent and convenient tool for counties to enter data. Tool should include the following basic elements: clear definitions of materials, ability to systematically run Quality Assurance and Quality Control (QA/ QC), automated conversion factors, data security, and ability to designate material in / out of diversion calculations.
- *Grants:* Provide FRWD, RREO, or other grant funding to cities, counties, and reporting entities to offset staff time and labor costs.
- *Staff Support:* Provide hands-on support to county and city staff in the design and improvement of data collection systems, and support municipalities in adopting policies and tools to collect data from haulers. Additionally, provide support to haulers in reporting their data.



## 2: EVALUATION OF WASTE DIVERSION DATA

The following section assesses the existing data collection and measurement methodologies in the state of Colorado.

### State Methodology Summary

Starting in 2007, the Colorado Department of Public Health and Environment became the agency charged with tracking and reporting solid waste generation, disposal, and diversion data in Colorado. Prior to 2007, data was not tracked in the state. CDPHE collects the data to calculate and report two diversion rates annually. They are:

<p><b>Landfills.</b> Landfills submit data to CDPHE on the weight or volume of waste received. Data is used to track the solid waste user fee surcharge.</p>	<p><b>MRFs.</b> All recycling facilities that process (bale and/or sort) recyclables required to report incoming / outgoing tons annually to CDPHE.</p> <p><b>Compost Facilities.</b> All permitted or registered composting facilities required to report incoming / outgoing tons annually.</p>	<p><b>Transfer Stations.</b> Unless processing recyclables, no state reporting requirements</p> <p><b>Haulers.</b> No state reporting requirements.</p> <p><b>Cities / Counties.</b> No state reporting requirements.</p>
--	---	---

Figure 1. CDPHE Data Tracking Methodology

- Municipal Solid Waste Diversion Rate:** CDPHE uses the same categories and definitions as those established by the EPA and the State Data Measurement Program (SMP)<sup>11</sup>. The state measurement program considers commercial and residential materials to be MSW; materials generated by other sectors are not counted as MSW. The materials counted include: metal containers (aluminum/steel/tin), metal scrap (white goods and MSW sources of metal, no industrial metal), paper, cardboard, glass, plastics (#1-7),

<sup>11</sup> More information on EPA’s State Data Measurement Program can be found online: <https://www.epa.gov/smm/resources-participating-us-state-data-measurement-sharing-program>

yard waste, food waste, electronics, tires, HHW, paint, batteries, lighting, textiles, mixed recycling. The formula for calculating the MSW diversion rate is:

$$\text{MSW Diversion Rate} = (\text{MSW Recycled} + \text{MSW Composted}) \div (\text{MSW Recycled} + \text{MSW Composted} + \text{MSW Disposed})$$

- **Total Solid Waste Diversion rate.** The Total Solid Waste Diversion rate includes MSW tonnages with the addition of the industrial waste generated in Colorado. Once again, this is aligned with the EPA methodology and the other states participating in the SMP. Industrial waste includes construction and demolition debris, concrete and asphalt, industrial and agricultural compost feedstocks (sludges, manure, biosolids), oil and antifreeze, tires used for energy recovery, produced water, beneficial use (land application of organics and other suitable materials), coal combustion residuals. The formula for calculating the Total Diversion rate is:

$$\text{Total Diversion Rate} = (\text{MSW Recycled} + \text{MSW Composted} + \text{Non MSW Materials Diverted}) \div (\text{MSW Recycled} + \text{MSW Composted} + \text{MSW Disposed} + \text{Non MSW Materials Diverted} + \text{Non MSW Materials Disposed})$$

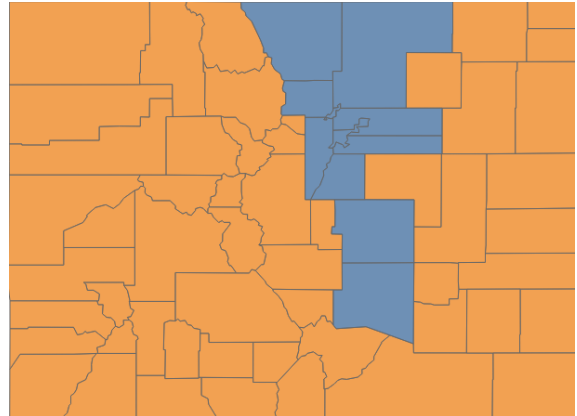


Figure 2. Colorado Waste Sheds and Diversion Rates  
Blue: Front Range MSW Diversion Rate: 16.2%  
Orange: Greater Colorado MSW Diversion: 12.0%  
Statewide MSW Diversion Rate: 15.9%  
(Source: CDPHE 2019 Recycling Totals)

Diversion rates are reported at three levels to match state goals: Statewide, Front Range, and Greater Colorado. The state goals are for MSW Diversion Rate, not Total Diversion. In addition to the MSW and Total Diversion rates, CDPHE publishes<sup>12</sup> a per capita disposal, generation, and diversion rate. However, there are no goals related to the per capita metrics. The state also shares recycling tonnage data by material. Data at local or county levels of government are not tracked by the state, and there is no requirement for local governments to track or report data.

Quality Assurance and Quality Control of tonnage data is completed by CDPHE manually. Staff systematically review all incoming data reports for quality and potential anomalies or errors. Generally, errors are identified through inconsistencies over time or are due to an error in the order of magnitude. Staff will follow up with reporting entities to reduce reporting errors. While on-site validation and inspection is allowable, in practice it is rarely done due to staff's limited availability.

## ANALYSIS OF STATE DATA AND METHODOLOGY

Over time, CDPHE has continued to improve their data collection and analysis and as a result, Colorado is aligned with the activities in the leading states researched for this project. The state follows EPA guidance on material categories and definitions, which allows for a comparison of Colorado to other states. Additionally, the state publishes material-level tonnages and clearly defines materials types, allowing those accessing the data to determine what does and does not count as diversion in the state. In 2018, a Colorado state level reporting change required reporting entities to separate industrial and MSW tonnages in their reporting forms, and this

<sup>12</sup> The data from 2019 (as reported and published by CDPHE) is included in Appendix F.

change has greatly improved the accuracy of the data tracking and published rates. It also allows for the state to better identify target materials and programs.

Colorado's QA/QC and analytics are similar to other states, and like other states, CDPHE relies on reporting entities to share data with little on-site verification of the data's validity or consistency. Like North Carolina and California, Colorado tracks C&D disposal and diversion activities separately. Colorado was the only state researched that did not have a statewide waste composition study completed in the last 10 years.

One of the largest gaps of Colorado's methodology, when compared to the other leading states, is that county level data is not collected and reported. The gap is not a failure of CDPHE data tracking; it is instead a result of the fact that county level tracking is out of CDPHE's purview. It is not currently feasible for CDPHE to report diversion at the county level as the data is not available. Even with the local data gap, the state is still able to report diversion rates for the Greater Colorado and Front Range regions as the two multi-county regions tend to follow economic and geographic wastesheds. However, without county level tracking, the Front Range and Greater Colorado diversion rates do have potential for error as tons cross the regional borders for both processing and disposal (see Table 4 for details).

Table 4 below highlights the potential ways in which data may be overcounted or undercounted in Colorado. The areas of error are not unique to Colorado and, in fact, most of the other states researched for this project face similar challenges. In an effort to help CDPHE and FRWD focus future efforts, Table 4 also includes a risk analysis of the potential impact the data may have on reported diversion rates (increase or decrease diversion<sup>13</sup>).

**Table 4: Potential for Variance in Data Tracking**

*(Undercount: Error results in an under-reported diversion rate, Overcount: Error results in an over-reported diversion rate)*

Element	Details	Undercount	Overcount	Risk
<b>Materials Crossing State Borders - Out</b>	Recyclables generated in Colorado (Four Corners Region) direct hauled to NM not counted.	✓		Minimal
<b>Materials Crossing State Borders - In</b>	Materials generated in WY, UT sent to Colorado MRFs (Denver, Grand Junction) for processing are counted.		✓	Low
<b>Materials Crossing Regional Borders</b>	MSW, Recycle, Organics generated in Front Range, or Greater Colorado, may flow across regional wasteshed borders for processing. <sup>14</sup>	✓	✓	Low for state, Medium for wasteshed
<b>Residue at MRFs</b>	CDPHE tracks incoming / outgoing MRF tons to identify residue, residue is not included as diversion – note that is already happening at the State level.	N/A	N/A	N/A – Colorado already tracks

<sup>13</sup> For example, there are tons of recycling generated in Colorado that are assumed to be direct hauled to a MRF in New Mexico; the tons are not counted in the state's diversion rate and, as a result, the error represents a potential *undercount* of the current diversion rate. Conversely, there are also tons of recyclables from Wyoming that are being hauled to MRFs in Denver for processing; these tons are counted in Colorado's diversion rate and result in an *overcount* of the state's diversion rate.

<sup>14</sup> Tons of recycling from Greater Colorado are more often sent to the Front Range than the other way around. This decreases the Greater Colorado diversion rate and increases the Front Range rate. The impact on Greater Colorado's diversion rate is more pronounced as the total tons from the waste shed are smaller (smaller denominator).

Element	Details	Undercount	Overcount	Risk
<b>Residue in Marketed Commodities</b>	All MRF marketed materials are counted as recycled; the residue in the bales sent to end markets is not tracked.		✓	Low
<b>Business-to-Business Recycling</b>	Commodities (like OCC at a large box store) that are baled by a business and sold directly to an out-of-state end market without going to a MRF or transfer station first are not counted, other businesses may be doing recycling on-site and this is not counted.	✓		Unknown, may be significant
<b>Erroneous Data Reporting – Tons and Materials</b>	CDPHE relies on reporting entities to share all data; potential for errors on both the total tonnages as well as the material categories.	✓	✓	Unknown, but most likely low
<b>Waste Conversion Factors</b>	The densities used in conversion factors may not be accurate. For example, compost processors / CDPHE use US EPA density for organics to convert yd <sup>3</sup> to tons, which may not be accurate in Colorado's arid climate.	✓	✓	Low
<b>Agricultural, Non-registered, Backyard Composting</b>	Tons from on-site agricultural composting (manure), backyard composting, or non-registered compost activities are not fully counted.	✓		Medium <sup>15</sup>
<b>Construction Debris Managed on Site</b>	Soil, rubble, asphalt, and other inert materials that may be reused on site during construction projects, or beneficially reused as backfill elsewhere, do not go to a facility and thus, are not tracked.	✓		Large <sup>16</sup>
<b>Scrap Metal Processors</b>	Metal (auto bodies, construction metals, some white goods) processed at scrap metal recyclers is not fully counted. Scrap yards are not required to register or report data. Some data is voluntarily reported.	✓		Medium
<b>Double Counting – Reporting Errors</b>	Entity-reported data on the sources and destinations of tons may be incorrect or missing, meaning that some recycling data may be counted twice.		✓	Low

## Local Level Data Summary

Of the five states researched for this project (Colorado, California, Minnesota, North Carolina, and Ohio), all of them, other than Colorado, have a mechanism to collect and report data at the local unit of government. Colorado does not require municipalities, counties, or other levels of local government to collect or report solid waste data. Without a local or county level reporting mechanism, data comparing county and city performance, identification of investment needs, or potential for intervention is not possible in Colorado.

<sup>15</sup> Assumes that agricultural composting of manure should 'count' as diversion. If this does not count, the impact is much lower.

<sup>16</sup> Assumes that inert materials that were never landfill bound 'count' as diversion. If this does not count, there is no impact.



While state level data tracking and benchmarking relies on facility level data (landfills MRFs, compost sites, etc.), local level data is tracked and reported by haulers, not facilities (with a few exceptions<sup>17</sup>). At the local level, tons are often moving beyond county or municipal borders and are driven by wastesheds, rendering facility level data, unless it is tracked and reported by point of origin, less useful.

Despite the lack of requirements, there are numerous examples of robust local data collection and reporting in Colorado. There is no common methodology, set of definitions, or agreement on what does or does not count as diversion among Colorado counties or cities. The lack of consistency in what does and does not count as diversion, how data is tracked, and who reports makes comparing city and county performance nearly impossible without additional data manipulation.

Among cities and counties that report data, the burden of data tracking falls on governmental staff and the haulers<sup>18</sup> operating in the city or county. All locations researched for this project count residential materials (residential curbside materials and drop-off materials), and all but one of the research locations (Loveland, Colorado) count materials generated by the commercial and multi-family sectors. None of the Colorado locations researched count materials that are self-hauled to landfills, and Denver is the only city that is consistently working to count the materials that are hauled by small landscaping companies. **Table 5** compares what does and does not count as recycling and diversion in different locations in Colorado and beyond.

**Table 5: Material Streams Counted in Diversion Numerator (✓=yes, ✗=no, O=Some)**

Location	Residential	Multi-family	Commercial	Roll-Offs <sup>19</sup>	Concrete / Soil / Inert	C&D Materials	Capital Projects	Self-Haul	Landscaping Companies	Biosolids	MRF Residue Removed	Backyard Compost	Source Reduction	Bottle Bill
Boulder County, CO	✓	✓	✓	✓	O	✓	✗ <sup>20</sup>	✗	✗	✗	✗	✗	✗	N/A
Colorado Springs, CO	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	N/A	✗	✗	N/A
Denver, CO	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✓	✗	N/A
Fort Collins, CO	✓	✓	✓	✓	✓	✓	✓	✗	O	✓	✓	✗	✓	N/A
Loveland, CO	✓	O	✗	O	✗	✗	✗	✗	✗	✗	✗	✗	✗	N/A
Alameda County StopWaste, CA	✓	✓	✓	O	✗	✗	O	✓	✗	✗	✗	✗	✗	✗
Chittenden Solid Waste District, VT	✓	✓	✓	✓	✗	✓ <sup>21</sup>	✗	✓	✗	✗	✗	✓	✗	✓
Portland, OR	✓	✓	✓	✓	✗	✓	✗	✓	✗	✗	✓	✗	✗	✓
Seattle, WA	✓	✓	✓	✓	✗	✓ <sup>18</sup>	O	✓	✗	✗	✓	✓	✗	N/A

<sup>17</sup> For example, drop-offs, HHW facilities, and locally operated MRFs may report data to a county, but it is still primarily based on hauler reported data.

<sup>18</sup> Haulers are often defined to include companies that provide one-off, or regular, roll-off services. It is less common to see self-haul data<sup>18</sup> collected and tracked by locales. Self-haul may include both residential self-haul (like a garage cleanout, a large piece of furniture, etc.) or small contractors and landscaper materials that go straight to a landfill or recycler. These data are captured at the facility level reporting.

<sup>19</sup> Tonnages reported in the roll-off category are generally considered to be C&D debris even though they may contain materials from special events, home or yard clean-outs, and other non-C&D activities.

<sup>20</sup> Will begin to count in 2020.

<sup>21</sup> Chittenden Solid Waste District and Seattle count C&D in separate diversion rates.

## STATUS OF DATA TRACKING IN FRONT RANGE REGION

More than 80 percent of Colorado’s population lives in the Front Range watershed. Among the eleven counties that make up the region, only three track and report data on a county level (Denver, Boulder, and Broomfield). These three counties make up a combined 19 percent of the state’s total population. While there are large municipalities in other Front Range counties that track data, the data is not tracked on a county level<sup>22</sup>. Solid waste data is not regularly tracked at any level by governments in El Paso and Pueblo County<sup>23</sup>.

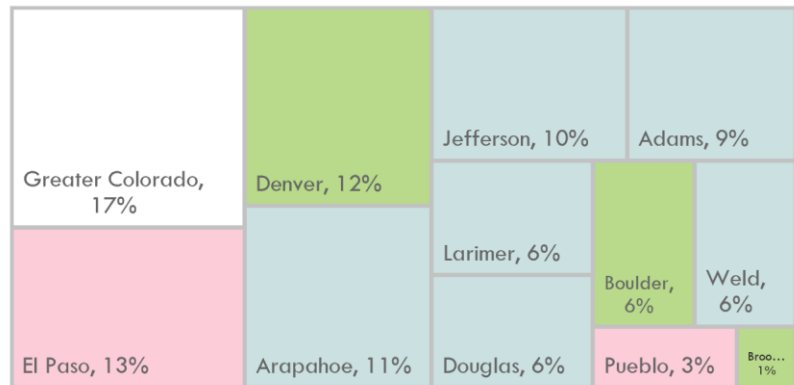


Figure 3. Percent of Colorado Population in FRWD Counties  
 Green: County tracks data  
 Blue: Some cities in county track data  
 Red: No data

At the city level, 52 percent of the state’s population lives in the 15 largest cities in the Colorado, all of which are in the Front Range watershed. Among these cities, 53 percent (eight out of 15) track data, yet what is tracked and what counts as diversion is not consistent among the cities, making comparisons difficult. Of the largest municipalities, four have published waste composition studies in the last five years. Like the diversion measurements, the methodologies and definitions used in the waste composition studies are not consistent across cities, complicating side-by-side comparisons of performance and opportunities. Table 6 lists the locations, their data tracking / reporting status, and whether they have conducted a waste composition study within the last five years.

Table 6: Data Tracking in Colorado’s 15 Largest Cities

City	Population	Data Tracked	Waste Composition Study in Last 5 Years
Denver	727,000	Yes	Yes
Colorado Springs	478,000	No	No
Aurora	379,000	No	No
Fort Collins	170,000	Yes	Yes
Lakewood	158,000	Yes <sup>24</sup>	No
Thornton	141,000	Yes	No
Arvada	121,000	No	No
Westminster	113,000	Yes <sup>25</sup>	No
Pueblo	112,000	No	County Level
Centennial	111,000	No	No
Greeley	109,000	No	No
Boulder	106,000	Yes	Yes
Highlands Ranch	105,000	No	No
Longmont	97,000	Yes	County Level
Loveland	79,000	Yes	No

<sup>22</sup> Examples of cities that collect and report data on a regular basis include Westminster (Adams and Jefferson), Fort Collins (Larimer), Loveland (Larimer), Golden (Jefferson), Thornton (Adams), Greenwood Village (Arapahoe).

<sup>23</sup> Pueblo and El Paso have occasionally estimated a recycling rate as part of individual projects, but data is not normally tracked.

<sup>24</sup> Partial data collection only

<sup>25</sup> Partial data collection only

## TRACKING COUNTY LEVEL DATA

Solid waste data can only be collected at the points where the material is collected or where it is processed. This means that regardless of the reporting mechanism, the burden of data collection and reporting will fall to the haulers, the processing facilities, or both. The three main ways the state can track data at the local level, along with the benefits and drawbacks of each, are presented in Table 7.

**Table 7: Tracking County Data**

Method	Description	Pro	Con
<b>County Tracks and Reports (RECOMMENDED)</b>	Counties report diversion rates and per capita data to CDPHE on an annual basis. Cities report data to counties; counties are responsible for unincorporated area data. Cities are responsible for working with haulers operating locally to collect data.	<ul style="list-style-type: none"> <li>• Allow for sector and material level tracking.</li> <li>• Counties, and in turn cities in the counties, know the local actors and are best suited to track data.</li> <li>• Allows for easy roll-up to wastesheds and the state.</li> <li>• Examples of success in CO and elsewhere.</li> <li>• Increases county and city ownership of local diversion programs.</li> </ul>	<ul style="list-style-type: none"> <li>• Data must be tracked at the city level.</li> <li>• Counties cannot require home rule cities to report.</li> <li>• Places onus of reporting on haulers.</li> <li>• Haulers may need to file multiple reports for each boundary they operate within, increasing staff time.</li> <li>• Counties, and cities, need the resources (staff, funding) to track data.</li> <li>• Counties and cities have been opposed to this in the past.</li> </ul>
<b>State Hauler Licensing</b>	State agency licenses all haulers operating in Colorado; haulers are required to report data to the state annually.	<ul style="list-style-type: none"> <li>• Allow for sector and material level tracking.</li> <li>• Takes the onus off counties and cities to track data.</li> <li>• Can ensure that reporting categories are consistent across the state.</li> <li>• May reduce reporting burden for haulers to file a single report with the state as opposed to individual county / city reports.</li> <li>• CDPHE may have the staff resources, or funding already in place, to manage the tracking.</li> </ul>	<ul style="list-style-type: none"> <li>• Places onus of reporting on haulers.</li> <li>• Operationally difficult for the state to accurately identify all the haulers in Colorado.</li> <li>• May allow smaller hyper-local haulers to go unnoticed, resulting in an uneven playing field.</li> <li>• Diversion programs are local, not state level; having the state collect and report removes responsibility for the local governments, which may slow local progress.</li> </ul>
<b>Facilities Report</b>	Reporting entities (landfills, MRFs, compost yard, etc.) are required to report the county of origination for the tons they accept and process.	<ul style="list-style-type: none"> <li>• Uses already established mechanism to collect local data.</li> <li>• CDPHE already has staff that track data.</li> </ul>	<ul style="list-style-type: none"> <li>• Cannot track data by generating sector (single family, multi-family, commercial).</li> <li>• Places the full burden of all data reporting on processors and landfills.</li> </ul>

## RECOGNITION OF LOCAL CHALLENGES

- **City / County Funding:** Cities and counties may not have the funding, either for staff (full or partial FTEs) or tools (online reporting), to effectively track data.
  - *Use RREO, FRWD, or other state funding to support local governments in data tracking. Provide a data tracking tool at no cost to the user, preferably online, for cities and counties to use.*
- **Hauler / Processor Staff Time:** Reporting data to cities / counties typically falls on private sector haulers, and the reporting forms take time and effort to complete. This issue is often more challenging for smaller companies with less experience in data reporting and fewer staff available.
  - *Provide mini-grants or other easy-to-access funding to haulers to help offset a portion of the costs for the first year of a new reporting. Work with the haulers and cities to streamline the reporting process.*
- **Lack of Consistency:** The lack of city consistency in reporting forms, definitions, and methodologies may mean that a single hauler is reporting the tonnage data in multiple ways at different times of the year to different entities, causing confusion and requiring additional staff time.
  - *Coordinate efforts at the county level to reduce city redundancies, and coordinate across counties to use similar formats, definitions, sectors, and conversion factors to make it easier for all haulers in the state.*
- **County Authority:** Counties do not have the authority to require cities to report tonnage data.
  - *Counties must collaborate with cities in the county to adopt similar hauler licensing ordinances (if needed), this is a time intensive and potentially politically charged activity.*
- **Open Market System:** The majority of Colorado's solid waste services are provided by the private sector in an open competitive market. Without a reporting requirement at the city level, counties and cities cannot compel haulers to share their tonnage data.
  - *See County Authority above.*
- **Proprietary Data:** Haulers are hesitant to share internal information with governmental entities that may provide their competitors with an advantage.
  - *Do not ask for proprietary data (rates charged to customers, percent of market share, etc.), allow reporting entities to clearly delineate proprietary data, and only publicly share data in aggregate.*
- **Cost to Private Sector:** Local hauler licensing requirements often impose a fee per vehicle for licensing, which increases the operational costs for haulers.
  - *Minimize the fees to simply cover the minimum cost of administration, and consider options to keep costs down for large fleets or small companies with tighter profit margins.*
- **Crossing Borders:** Haulers often cross city and county borders, making it hard to report the city or county of origin for their materials.
  - *Allow for easy estimations of cross-border tonnages (i.e. 60 percent of the weight ticket came from City A, and 40 percent from City B).*



### 3: MATERIAL OPPORTUNITY ANALYSIS

In 2019, Colorado disposed 6.1 million tons of municipal solid waste<sup>26</sup>. The disposed material includes commodities that if recovered would positively contribute to Colorado’s economy, such as ferrous and non-ferrous metals, plastics #1 and #2, mixed paper, and organics and compostables. Depending on commodity values, the landfilled material’s total worth could range from approximately \$58 to \$101.1 million (Table 8)<sup>27</sup>. The three largest positive value items that are being disposed are organics and compostables, cardboard, and steel/tin, accounting for approximately half to two-thirds of the estimated total commodity value. It is important to note that commodity values shift significantly over time, so the estimated value is only a snapshot of potential opportunity. Additionally, the commodity value is only one positive economic piece to a more circular economy. The recycling, reuse, and remanufacturing economy also creates local jobs and manufacturing and innovation opportunities throughout the state and beyond.

**Table 8: Estimated Range of Value of Commodities in Colorado’s MSW Stream**

Composition of MSW Tons Landfilled	Tons	Estimated Total Value - Low	Estimated Total Value - High
Glass Containers	204,000	\$300,000	\$4,100,000
Aluminum	58,000	\$2,500,000	\$3,200,000
Steel/Tin	94,000	\$8,900,000	\$13,000,000

<sup>27</sup> The commodity values are based on several sources. Mixed MRF recyclable prices are sourced from the 2019 and 2020 baled and picked-up prices from RecyclingMarkets.net. Market values for non-MRF material, such as other metals, plastic film, other plastics, organics and compostables, textiles, electronics, C&D, and HHW, are based on RRS industry knowledge. For each commodity, a low and high range was estimated, providing for the total value range presented here.

Composition of MSW Tons Landfilled	Tons	Estimated Total Value - Low	Estimated Total Value - High
Other Metal	89,000	\$4,800,000	\$9,600,000
Plastic #1-2	171,000	\$2,200,000	\$3,300,000
Rigid #3-7	57,000	\$0	\$0
Film, Bags, Wrap	263,000	\$2,600,000	\$3,900,000
Other Plastic	292,000	\$2,900,000	\$4,400,000
Cardboard/Kraft	305,000	\$13,000,000	\$21,700,000
Newspaper	76,000	\$1,500,000	\$2,400,000
Mixed Paper	568,000	\$500,000	\$4,800,000
Food Waste	1,020,000	\$6,200,000	\$7,000,000
Yard Waste/Wood Waste	1,115,000	\$6,800,000	\$7,700,000
Other Organics/Compostable Paper	613,000	\$3,700,000	\$4,200,000
Textiles	290,000	\$2,600,000	\$10,400,000
Electronics	98,000	\$0	\$0
C&D	331,000	-\$500,000	\$1,400,000
<b>TOTAL</b>	<b>5,644,000</b>	<b>\$58,000,000</b>	<b>\$101,100,000</b>

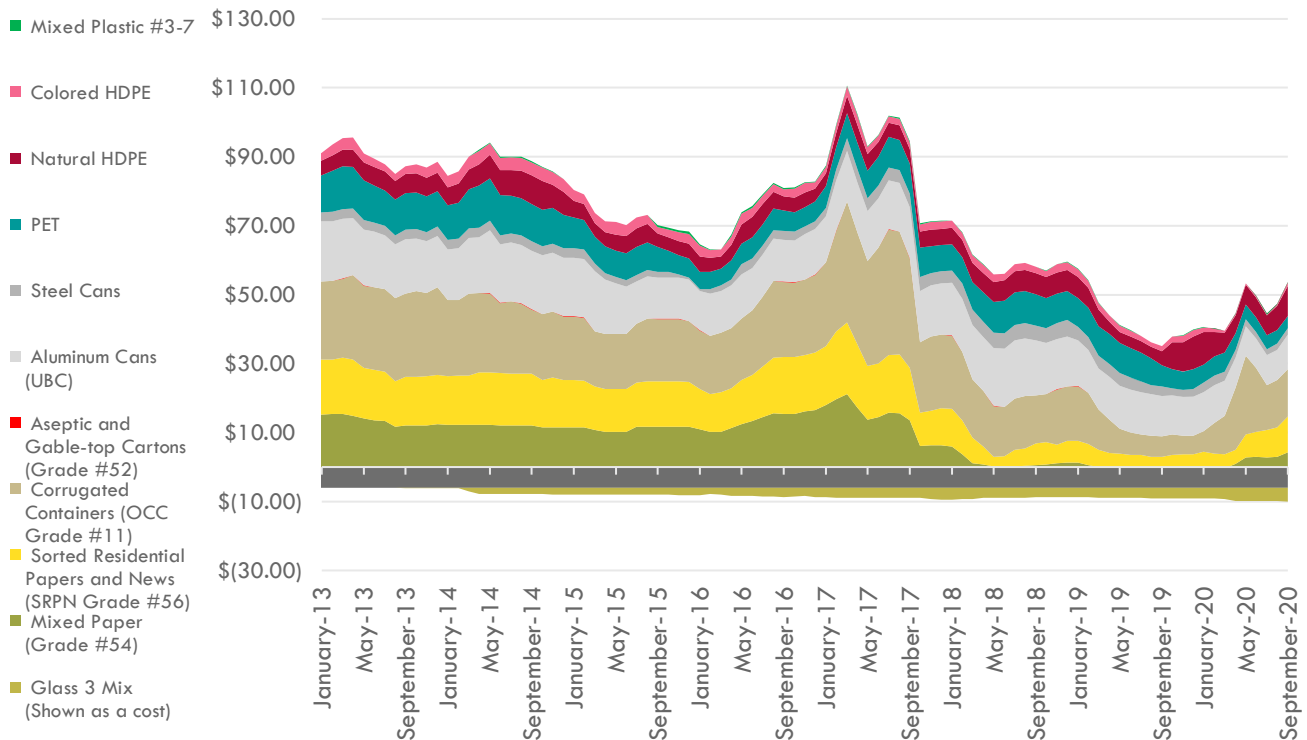
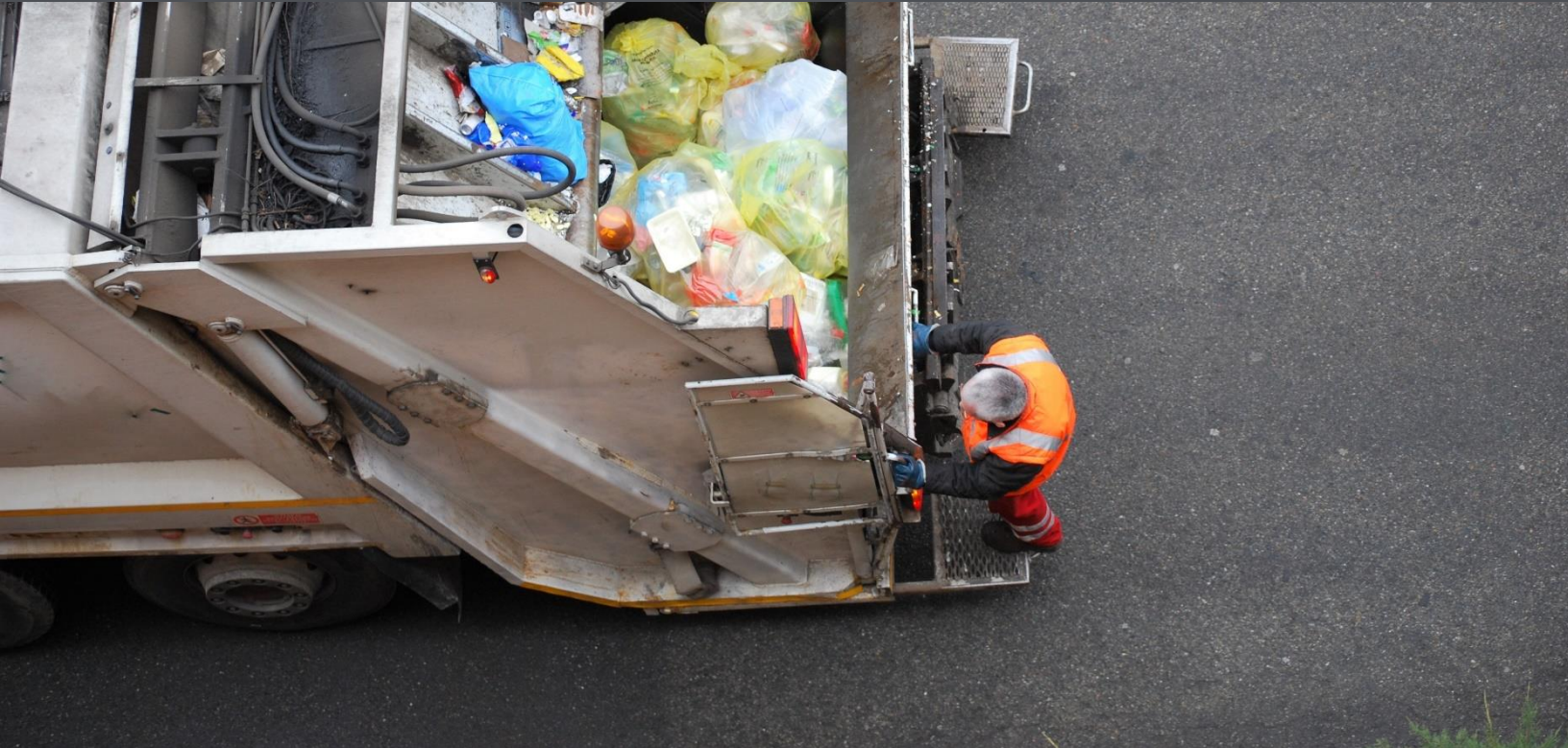


Figure 4. 5-Year Single Stream Composition Average Commodity Revenue

MSW accounted for approximately two-thirds of total disposal in 2019 for Colorado, and the remaining third of disposal was industrial waste. While some construction and demolition waste was disposed in the MSW stream, generally from small-scale homeowner renovations, the vast majority of C&D waste was disposed as industrial waste. Of the 3.6 million tons of industrial waste disposed in Colorado in 2019, around half or 1.9 million tons of that waste was C&D. Assuming a range of commodity values, compositions, and recovery infrastructure, the C&D could be worth as much as \$8.2 million if recycled in Colorado’s current C&D end markets. As Colorado’s C&D end markets continue to improve, this number is expected to grow.

**Table 9: Estimated Value Range of C&D in Colorado’s Industrial Waste Stream**

	Tons of C&D	Value Low	Value High
C&D Waste in Industrial Disposal Stream	1,911,400	-\$3,100,000	\$8,200,000



## 4: NATIONAL RESEARCH SUMMARY

---

---

The project team researched 14 locations (five states, nine local governments) across the US to gain a greater level of understanding of the leading practices in data collection and reporting. The locations outside of Colorado are recognized by the industry as leaders in data tracking and reporting. The in-state locations are all in the Front Range Waste Diversion region and, with only one exception, lead the state in terms of their data tracking and reporting systems. The following section provides a summary of the research. The full case studies are included in Appendix F.

### Leading Practices

The practices commonly identified by leaders in materials management data tracking and reporting are compiled in the list below.

#### MEASURING DIVERSION

- **Defining Recycling:** Sending materials to a MRF or compost site does not mean they were recycled or diverted from disposal in a landfill. Leading states and communities remove residue tonnages from their final diversion rate calculations. Leading locations are also considering or adopting methods to ‘count’ hard-to-measure impacts, such as backyard composting and source reduction.
  - *CDPHE and some cities in Colorado already follow this practice. As cities and counties expand their data tracking in Colorado, removing MRF residue from diversion should be the standard practice. CDPHE should consider ‘following’ bales to markets and evaluating whether removing the residue tons from the end market bales is feasible.*



- **Construction & Demolition Diversion:** Measuring C&D generation and diversion is consistently challenging across states and cities, yet the leading locations have developed systems and methodologies to define materials and track progress, even if they are imperfect.
  - *Although imperfect, 'counting' the roll-off tons as C&D (both disposed and recycled) is the recommended method for measuring C&D generation and diversion. Additionally, supplementing these data with that from reuse centers, as well as attempting to remove one-time clean-up and special event data, will improve the accuracy of C&D data.*
- **Per Capita Rates:** Leading states have already, or are currently, utilizing per capita generation and other metrics (NC, WA, CA) to measure progress.
  - *Recommended as a consistent metric in Colorado at the state and local level.*

## DATA AND REPORTING

- **Annual Reporting:** Reports are published to the public annually. Reports include data breakouts by generator sector (e.g., residential, commercial, industrial) and material type and clearly present the formulas or methodologies for calculating diversion.
  - *Recommended for cities and counties in Colorado, this is already the standard practice for CDPHE.*
- **Consistency in Materials and Formulas:** Material categories and what does / does not count as diversion are kept constant within a county, a solid waste agency, or ideally, a state.
  - *Counties within the state, and the state, should define MSW Diversion Rate as the standard metric and clearly indicate what is measured and what does / does not count as diversion.*
- **Constant Improvements:** Data tracking and reporting systems evolve over time to include more material streams, generators, and processors, allowing a more complete picture of materials management progress. Tracking and reporting systems are not static.
  - *Start with Level 1 local data (MSW Diversion Rate); as counties and cities improve their data collection, expand what is tracked and reported.*
- **QA / QC with Spot Check Verification:** While the authority may exist to do so, agencies do not generally conduct verification or auditing of reported data. The standard is manual QA /QC with spot checking to identify and correct potentially erroneous data entries or submissions.
  - *Use standard formula to consistently identify data variation (i.e. data that is more than 10 percent different, year over year, is automatically flagged and checked).*
- **Required Reporting:** Voluntary data reporting is rarely successful. The implementation of a reporting requirement, whether it be on haulers, processors, businesses, construction projects, cities, counties, or others, is a common practice in the leading locales.
  - *Counties are required to report data to CDPHE annually.*
- **Waste Compositions and Capture Rates:** Tonnage data tracking is supported by waste composition and capture rate studies to identify program targets, assist in tracking progress, and make future investments.
  - *Conduct a statewide study once every five to seven years; counties with over 100,000 residents are encouraged to conduct studies once a decade (Denver County, El Paso County, Arapahoe County,*

Jefferson County, Adams County, Larimer County, Douglas County, Boulder County, Weld County, Pueblo County, Mesa County).

## TRENDS AND BEST PRACTICES

- **Dedicated Staff:** There is a full or partial staff position dedicated to data tracking, reporting, QA / QC, and improvements. Leading locations had staff with a history with the agency and its data tracking methodology, which helps to identify errors in data. Large cities or authorities require a full FTE.
  - *No solutions or recommendations beyond using FRWD and / or CDPHE funding to provide off-setting grants or support staff resources. Grant funding is not a source of permanent staff funding.*
- **Look Beyond Residential:** It is not uncommon for 40 percent or more of the total waste stream to come from non-residential sources, ignoring these data under (or over) estimates diversion rates. Leading agencies track data from multiple sectors and sources.
- **Private Public Partnerships:** Public agencies rely on private entities (haulers, MRFs, landfills, etc.) to report data. Successful programs work alongside the private entities to ensure data is reliable, limit the burden of reporting, and keep proprietary data confidential.
- **Software and Online Reporting:** Cities and states are incorporating online data reporting tools to make it easier for reporting entities to supply data, reduce errors, and improve consistency in data.
  - *FRWD should evaluate software and online tools that can be made available to counties and cities for low cost or no cost to the user.*

## State Level Summaries

The states researched for the study along with a brief description of each are presented below:

- **Colorado** – State tracks data from landfills, MRFs, and compost facilities. Diversion rates are calculated for both MSW Diversion (generally residential and commercial materials) and Total Diversion (includes C&D, industrial wastes, beneficial use, concrete, asphalt, and other materials). Colorado tends to follow US EPA guidance on material inclusion and conversion factors. Cities and counties are not required to report data to the state.
- **California** – Changed reporting requirements substantially in 2019 from a solely disposal-focused system (landfilled tonnages compared to a baseline year) to a system that includes reporting requirements for MRFs and compost facilities along with continued reporting requirements for landfills. Haulers only report if collected material goes directly to beneficial use land application or is direct hauled out of state. Since 2019, counties and jurisdictions need only report if they operate a facility with reporting requirements. California does not calculate a diversion rate but instead focuses on per capita disposal rates. CalRecycle uses the per capita disposal rate as an indicator of the effectiveness of diversion programs.
- **Minnesota** –The Minnesota Pollution Control Agency (MPCA) requires landfills, MRFs, compost facilities, transfer facilities, and haulers to report annually through the state’s Re-TRAC system. The state legislature has set specific diversion goals for counties depending on where the county is located within Minnesota. Counties are required to report their waste generation to the state annually via Re-TRAC. Minnesota has

county level waste diversion goals that are measured through the state’s SCORE reports. The reports calculate diversion based on municipal solid waste (residential, commercial, and institutional streams) and excludes industrial and C&D waste.

- North Carolina** – North Carolina tracks facility data from landfills, compost facilities, and transfer stations. To obtain recycling information, the North Carolina Department of Environmental Quality (NC DEQ) relies on counties and municipal governments to collect data from haulers, MRFs, scrap yards, and commercial and private businesses and report diversion activities to the state. The state does not have specific diversion goals for counties. The state acknowledges that there is a gap in diversion reporting around MRFs and business-to-business activity. The NC DEQ uses the collected data to compile an annual report on the status of solid waste management to the Environmental Review Commission and calculate a county’s per capita disposal rate. NC does not have waste diversion goals.
- Ohio** – The Ohio EPA requires annual reporting from landfills, compost facilities, and transfer facilities. Recycling activities in the state are reported annually to the Ohio EPA by solid waste management districts (SWMD) in Ohio. SWMDs collect recycling information from haulers, MRFs, and businesses and industries on a voluntary basis in their district to complete their annual district report. There are no reporting requirements for MRFs, haulers, or businesses in Ohio. In addition to reporting, the Ohio EPA requires SWMDs to demonstrate achievement of one of two goals. Goal 1 requires SWMDs to provide at least 90 percent of the residential population with the opportunity to recycle in each county. Goal 2 requires that the SWMD shall reduce and recycle at least 25 percent of the solid waste generated by the residential/commercial sector. The SWMD chooses one of these goals and demonstrates achievement in their solid waste management plan.

Table 10 presents a comparison of the reporting requirements by state. For example, in Minnesota, haulers are required to report data to the state, while in Colorado, North Carolina, and Ohio, haulers are not required to report data annually. Table 10 presents both the materials counted, and omitted, from diversion rate calculations in each of the researched states.

**Table 10: Reporting Requirements by State (✓=yes, ✗=no)**

State	Landfills	Compost Facilities	Material Recovery Facilities	Transfer Stations	Haulers	Counties/ Authorities	Cities	Businesses & Institutions	QA/QC	Data Validation
CO	✓	✓	✓	Limited	✗	✗	✗	✗	✓	✗
CA	✓	✓	✓	✓	Limited	✓	✓	✗	✓	✗
MN	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗
NC	✓	✓	✗	✓	✗	✓	✓	Voluntary	✓	✗
OH	✓	✓	Voluntary	✓	✗	✓	✗	Voluntary	✓	✗

## County / Municipal Level Summaries

The county, solid waste authority, and municipal locations researched for the study along with a brief description of each are presented below:

- Boulder County, Colorado** – County coordinates with cities in the county to require haulers to report a wide range of data through an online platform.

- **Colorado Springs, Colorado** – Serviced by open market haulers, city does not own facilities or require haulers to report; no data tracked, measured, or reported.
- **City and County of Denver, Colorado** – Single-family materials collected and tracked by city staff. Commercial and multi-family haulers must be licensed and are required to report data to the city. Includes tracking of industrial and C&D materials.
- **Fort Collins, Colorado** – Robust data tracking and reporting of a wide range of data by sector and material. Counts industrial materials and includes credits for source reduction and reduction in diversion for residue at the MRF.
- **Loveland, Colorado** – Highest reported residential diversion rate in Colorado. Tracks and reports materials that are handled by the city; does not report on materials handled by commercial haulers.
- **Alameda County StopWaste, California** – Public agency with the county; cities and districts reporting data. Does not separate residential and commercial data but tracks diversion and per capita generation for each city.
- **Chittenden Solid Waste District, Vermont** – The solid waste district has tracked diversion data for 30 years. Has licensing requirements for haulers, processors, and disposal sites. Businesses report data directly to the district, including destinations of materials. C&D is tracked and reported separately.
- **Portland, Oregon** – The city of Portland tracks residential and commercial recycling, composting, and disposal. Portland counts C&D materials as part of the commercial sector waste. Extensive data tracking of haulers and partnerships with state and local agencies are leveraged to obtain data.
- **Seattle, Washington** – City has an overall MSW diversion goal, as well as separate sector goals for single family residential, multi-family residential, commercial, and self-haul. Seattle also has a separate construction and demolition stream goal. The city counts what is actually recycled, not just diverted to MRFs, composters, and other processors.

# APPENDIX A: MSW DIVERSION RATE

The table below indicates the generating sectors and materials included in the recommended diversion tracking.

Type	Sector of Material	LEVEL 1: MSW Diversion Rate	LEVEL 2: Advanced Reporting
<b>Generating sector or activity</b>	Single family	✓	✓
	Multi-family	✓	✓
	Commercial	✓	✓
	Roll-off services		✓
	Drop-offs	✓	✓
	Municipal recycling / collection events	✓	✓
	Household hazardous waste centers	✓	✓
	Municipal buildings	✓	✓
	Schools and universities	✓	✓
	Capital construction projects (roads, water, electric)		✓
	Re-use / second-hand stores		✓
	Deconstruction re-use		✓
	Food donation		✓
	On-site agricultural composting (non-permitted)		
	Backyard composting		✓
	Business to business recycling		✓
	Landscapers and small contractors		✓
	<b>Material Category</b>	Metal containers (aluminum, steel, tin)	✓
White goods		✓	✓
Scrap metal - auto bodies, industrial		✓	✓
Paper		✓	✓
Cardboard		✓	✓
Glass		✓	✓
Plastics #1 – 7		✓	✓
Yard waste		✓	✓
Food waste		✓	✓
E-waste		✓	✓
Tires		✓	✓
HHW		✓	✓
Paint		✓	✓
Batteries		✓	✓
Mattresses		✓	✓
Textiles		✓	✓
Residue from MRFs, secondary processor		✓	✓
Concrete and Asphalt			✓
Sludges, manure, biosolids			✓
Oil and Antifreeze			✓
Tires for energy recovery			✓
Beneficial use			✓
Coal ash			✓
Pallets			✓

# APPENDIX B: METRICS

RRS recommends using three metrics to track the state's progress in reducing landfill waste and increasing recycling and waste reduction activities.

**Diversion Rate:** Diversion rate is a widely utilized weight-based metric that tracks progress in recycling, composting, and beneficial use activities at the state, county, and city level. The calculated diversion rate represents the portion of the total generated waste materials that are diverted from final disposal landfills. The general formula for calculating diversion is presented below:

$$\text{Diversion Rate} = 100 * \frac{\text{Recycling} + \text{Composting}}{\text{Recycling} + \text{Composting} + \text{Disposal}}$$

The tonnages that should be included in the diversion rate calculations are those derived from recycling, composting and other activities that shift materials from landfill disposal to entering a manufacturing process or second life. Material that was never going to enter a municipal landfill (i.e. backfill re-used on-site at large construction projects, manure composted on-site in agricultural operations) should not be counted in the diversion rate<sup>28</sup>. Likewise, material that may be designated as recycling, but ends up in the landfill (i.e. MRF residue, alternative daily cover, residue sent to end markets as baled commodities) should not be counted as diverted.

**MSW Per Capita Generation:** Per capita generation represents the total amount of material diverted and disposed divided by the population base. This metric is commonly expressed as either per capita per day or per capita as annual measure. Per capita generation is used to track consumption and generation habits while accounting for economic and population growth.

$$\text{Per Capita Generation} = \frac{\text{MSW Generation}}{\text{Total Population}}$$

**Waste Composition:** A waste composition or characterization data comes from physically sorting the trash stream into different categories including recyclables, organics, hazardous waste, reuse / bulky items and residue or 'true' trash. Materials sorted into categories are weighed and used as a percentage of the total waste sorted. Waste composition studies are based on representative sampling of the trash stream and can also include sorts of recycling and composting streams. Waste composition data can be used to target materials for increased diversion, assess diversion programs impacts, track the changing waste stream (e.g. less newspapers, more plastics), and measure the economic and environmental impacts of increasing diversion. Waste characterization studies are used to collect the data needed to calculate material capture rates.

**Capture Rate:** Capture rate estimates what portion of the total generated materials are being diverted versus disposed. Capture rate calculations can be for targeted materials or for overall recycling / composting streams. Capture rates provide details on recycling program gaps (what items are not being recycled at high rates) and program successes.

$$\text{Capture Rate} = 100 * \frac{\text{Targeted Material Recycled}}{\text{Targeted Material Recycled} + \text{Target Material Disposed}}$$

---

<sup>28</sup> This does not mean that these data should not be tracked, only that they should not be counted as diversion.

# APPENDIX C: STATISTICAL ANALYSIS

The most common application of statistical analysis with waste data is estimating sample size, confidence interval, and margin of error with waste sorts. While the ideal for any population sampling approach is to maximize the confidence interval and minimize margin of error, when conducting waste sorts other factors such as study time and cost is often the limiting factor in determining the sampling approach. Due to time and cost limitations, the vast majority of waste sorts target a 90 percent rather than 95 percent confidence interval to reduce the number of samples needed to achieve the desired confidence. Additionally, the margin of error will depend on the standard deviation of the material category in the waste stream, and thus it often cannot be precisely determined prior to conducting a sort. In general, the greater the expected standard deviation of a material category in the waste stream, the more samples will need to be sorted to reduce the margin of error.

The anticipated standard deviations of material categories in the waste stream can be estimated following the ASTM Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste which provides a table of commonly sorted materials from the waste stream and their standard deviations as determined by MSW sampling at various locations across the United States. There are limitations to the ASTM standard deviation estimates. First, information on only a select set of categories is provided so that sorts looking to understand the composition of materials in MSW that fall outside those estimated by ASTM would only be guessing at the standard deviation to determine the number of samples needed to achieve a desired margin of error. Another limitation is that the ASTM standard deviation estimates only apply to MSW, and the study does not cover the composition of recycling or source separated organics.

Waste sort data can still provide valuable insights into the waste stream even when uncertainty is fairly high. Often what matters in a waste sort is understanding the order of magnitude of recoverability in the waste stream and defining the materials that make up a significant portion and are thus an ideal target for a recovery program. These studies can often provide guideposts for communities to direct programs and investments that in the end can have a significant impact on recovery program success (see APPENDIX B: METRICS).

Beyond the statistical analysis needed for waste sorts, the general data analysis applied to waste data is fairly simple. By far the most important aspect of waste data is obtaining accurate and complete reporting. Presently, the reported waste diversion in Colorado is likely under counted rather than over counted due to factors such as counties not reporting and activities such as scrap yards, metal reprocessors, and business to business recovery that is not captured by state data. It is unknown how much of an impact the unreported data would have on the state's diversion rate, however it is possible to conduct a simple sensitivity analysis to understand how additional diversion data might impact the state's overall diversion rate. In 2019, the MSW and industrial waste diversion rate was 33.0 percent in Colorado. If for example, the total tons diverted was one percent greater than the tonnage that was reported, and assuming disposal data is accurate, the additional tonnage data would boost Colorado's diversion rate by 0.2 percent. With greater underreporting however, the greater the impact to Colorado's diversion rate (see Table 11). Given how important data reporting is to the state's diversion rate, there is no amount of statistical analysis that can make up for data gaps.

**Table 11: Diversion Calculation Sensitivity Analysis**

<b>Percentage Increase in Tons Diverted</b>	<b>Potential Additional Diverted Tons</b>	<b>Change to Total Diversion Rate<sup>29</sup></b>
<b>1%</b>	47,766	+0.2%
<b>3%</b>	143,298	+0.7%
<b>5%</b>	238,830	+1.1%
<b>10%</b>	477,660	+2.2%
<b>15%</b>	716,490	+3.2%
<b>20%</b>	955,320	+4.2%
<b>25%</b>	1,194,150	+5.1%

---

<sup>29</sup> The potential boost to diversion calculation assumes no change in the 2019 disposal rate.



# APPENDIX D: COUNTING DIVERSION

Table 12: Materials Counted and Omitted by Researched States

State	Tracking Metric	Materials Counted	Materials Omitted
CO	Goals for State, Greater Colorado, and Front Range through 2036 with interim dates of 2021 and 2026. Front Range goal is 32% in 2021 and 51% by 2036. Statewide is 28% and 45% respectively. Goals are for MSW diversion and do not include Industrial Wastes (tracked as Total Diversion)	<p><b>MSW Diversion:</b> Metal containers (aluminum/steel/tin), metal scrap (white goods<sup>30</sup> and MSW sources of metal, no industrial metal), paper, cardboard, glass, plastics (#1-7), yard waste, food waste, electronics, tires, HHW, paint, batteries, lighting, textiles, mixed recycling</p> <p><b>Total Diversion:</b> Construction and demolition debris, concrete and asphalt, industrial and agricultural compost feedstocks (sludges, manure, biosolids), oil and antifreeze, tires used for energy recovery, produced water, beneficial use (land application of organics, and other suitable materials), coal combustion residuals.</p>	<p><b>Excluded from Diversion:</b> ADC, scrap metal</p> <p><b>Excluded from Measurement:</b> Source separated commercial / industrial recyclables (i.e. baled cardboard from the back of a grocery store) that goes direct to market and bypasses state processing facilities. Materials send directly out of state (mainly in Four Corners Region).</p>
OH	Solid waste management districts must either demonstrate they provide at least 90% of the residential population with the opportunity to recycle in each county or demonstrate reduction or recycling of at least 25% of the solid waste generated by the residential/commercial sector.	<p><b>MSW Diversion:</b> Appliances/white goods, HHW (only if recycled), used motor oil, electronics, scrap tires, dry cell batteries, lead-acid batteries, food, glass, ferrous metals, non-ferrous metals, corrugated cardboard, all other paper, plastics, textiles, wood, rubber, commingled recyclables (mixed), yard waste, other (ex: fluorescent lamps, ink/coatings)</p> <p><b>Industrial Diversion:</b> Glass, ferrous metals, non-ferrous metals, corrugated cardboard, plastics, textiles, wood, rubber, commingled recyclables (mixed), ash, non-excluded foundry sand, flue gas desulfurization, other (asphalt, acrylic, zinc shot, chipboard, sludge)</p>	<p><b>Excluded from Diversion:</b> ADC, WTE</p> <p><b>Excluded from Measurement:</b> Train boxcars, construction and demolition debris, metals from vehicle salvage, manure, agricultural waste (ex: crop waste, animal bedding), source separated commercial and industrial recycling activity not captured in the survey.</p>
MN	Waste diversion goals are set for counties. Greater Minnesota County (outside of the seven-county Metro Area) must recycle a minimum of 35% of total solid waste generation. Counties in the Twin Cities metropolitan area (seven counties) must recycle half of all solid waste generated, and by December 2030, counties in the Twin Cities metropolitan area will be required to recycle 75% of the solid waste they generate.	<p><b>MSW Diversion:</b> Aluminum, steel, and tin cans, corrugated cardboard, mixed paper, newsprint, glass food &amp; beverage, mixed plastics, source separated organics (yard, vegetative, and food waste, and compostable paper and plastic materials that meet ASTM standards), Food waste diverted-to-food to people and food-to-animal programs, textiles, shredded tires used in asphalt, pallets</p> <p>HHW, paint, bulbs, ballasts, tires, any tonnage that can be measured as diverted from the MSW stream that would have gone to disposal</p> <p><b>Industrial Diversion:</b> Industrial diversion is not tracked. Traditional recyclables collected from industrial generators (ex: plastic, glass, and metal bottles and jars, office paper) that was mixed in with commercial collections and sent to a MRF would be included in municipal solid waste calculations.</p>	<p><b>Excluded from Diversion:</b> ADC, WTE</p> <p><b>Excluded from Measurement:</b> ADC, WTE, C&amp;D, business to business that goes direct to market and bypasses state processing facilities is not counted.</p>
CA	CalRecycle compares reported disposal tons to population and calculates per capita disposal expressed in pounds/person/day for each county and jurisdiction.	<p><b>Per Capita Disposal:</b> Includes all waste generated within a jurisdiction or county. California does not separate industrial waste from commercial and institutional. C&amp;D is also included in the Per Capita Disposal category.</p>	<p><b>Excluded from Per Capita Disposal:</b> ADC and WTE above 10% of a jurisdiction's generation cannot be taken out of disposal calculation</p>
NC	North Carolina does not calculate MSW diversion. The state calculates a combined per capita MSW and C&D disposal per county.	<p><b>Per Capita Disposal:</b> Includes waste disposed of in MSW and C&amp;D landfills as well as coal ash.</p> <p><b>Per Capita Recovery:</b> Local units of government required to report annual tonnages of recovered materials. Includes paper, glass, plastics, metal (white goods, aluminum, steel cans), organics (yard waste, pallets, wood waste, food waste), special wastes, e-waste, construction and demolition debris, tires, and others. These data are used to calculate a per capita recovery (lbs. / person) and a recovery ratio (recycling: disposal).</p>	<p><b>Excluded from Per Capita Disposal:</b> ADC, waste sent to industrial landfills</p>

<sup>30</sup> White goods consist of items such as a dishwasher, dryer, furnace, hot water heater, stove, refrigerator, and washer.

# APPENDIX E: STRENGTHS AND WEAKNESSES

The strengths and opportunities for improvement of the various state and local methodologies researched for the report are included below.

**Table 13: Strengths and Opportunities – State Level**

State	Strengths	Opportunities
CO	<ul style="list-style-type: none"> <li>Tracks and reports two levels of data (MSW and Total) for three regions (State, Front Range, Greater Colorado).</li> <li>Generally, follows EPA guidance on materials that ‘count’ as MSW versus Industrial (Total), ameliorating comparisons between states.</li> <li>Tracks composition of materials diverted</li> <li>Tracking and reporting has been refined over time and continues to improve.</li> </ul>	<ul style="list-style-type: none"> <li>Relies on national EPA conversion factors for organics which may not be accurate in Colorado’s climate.</li> <li>Data is manually entered; on-line software may help streamline the process and make entry more consistent.</li> <li>Counties or other units of government are not required to report data.</li> <li>Establish consistent protocols (categories, sectors, conversion factors, software) for local governments to follow for data reporting.</li> <li>Not capturing business-to-business commercial and industrial diversion activity, the impact of which is unknown at this time.</li> </ul>
CA	<ul style="list-style-type: none"> <li>Reduced burden on counties and jurisdictions by implementing reporting requirements for landfills, MRFs, compost processors, and transfer stations directly to the state’s department, CalRecycle, in 2019.</li> <li>State is now (new in 2020) tracking amount of recycling and compost diverted instead of estimating these activities.</li> </ul>	<ul style="list-style-type: none"> <li>Not capturing business-to-business commercial and industrial diversion activity.</li> <li>New system requires many new facilities to report, this created a lot more touch points for CalRecycle to engage reporting entities and ensure compliance.</li> </ul>
MN	<ul style="list-style-type: none"> <li>Data tracking and reporting is a focus for the state with staff dedicated to improving their system.</li> <li>Uses a statewide reporting system that tracks county level progress.</li> <li>Looking at ways to track source reduction.</li> </ul>	<ul style="list-style-type: none"> <li>Work to improve reporting compliance and streamline data collection for better comparison measures.</li> <li>Recently dropped their waste reduction credit system as it was deemed to be no longer useful in tracking progress.</li> <li>Does not track industrial waste diversion.</li> <li>Not capturing business-to-business commercial and industrial diversion activity.</li> </ul>
NC	<ul style="list-style-type: none"> <li>Strong data tracking at the county and the municipal government level.</li> <li>Collects and tracks data on source reduction and diversion activities.</li> <li>Tracks and reports end market data (commodity prices, new markets, businesses) annually.</li> <li>Actively seeks reporting information from out-of-state landfills that receive waste from the state.</li> </ul>	<ul style="list-style-type: none"> <li>MRFs and haulers are not required to report. It is up to counties and jurisdictions to work with these entities to capture diversion data.</li> <li>Not capturing business-to-business commercial and industrial diversion activity.</li> </ul>

<b>OH</b>	<ul style="list-style-type: none"> <li>Regular solid waste management planning with diversion and recycling goals in place for Districts encourages Ohio counties to continuously think about waste management.</li> <li>Regular application of voluntary surveying of commercial and industrial sector means that Ohio is collecting some information on business- to-business diversion activity.</li> </ul>	<ul style="list-style-type: none"> <li>MRFs and haulers are not required to report. It is up to SWMD to work with these entities to capture diversion data and at the same time SWMD that choose to demonstrate the 25% diversion goal are out of compliance without this necessary data.</li> <li>Required plans and data tracking can be onerous for SWMDs.</li> <li>The state does not calculate a statewide diversion rate.</li> </ul>
-----------	--	--

**Table 14: Strengths and Opportunities – Local Government Level**

Locations	Strengths	Opportunities
<b>Colorado Springs, CO</b>	<ul style="list-style-type: none"> <li>None – the city does not track or report data. There are many other governments in the FRWD region that do not track data and Colorado Springs is not alone.</li> </ul>	<ul style="list-style-type: none"> <li>Follow the model of other cities with open hauler subscription to gather and report data.</li> <li>Use FRWD and / or RREO grant funding to encourage and support start tracking and reporting data for Colorado Springs and other similar cities without tracking.</li> </ul>
<b>Boulder County, CO</b>	<ul style="list-style-type: none"> <li>County makes Re-TRAC (on-line data tracking software) available to cities in the county at no charge.</li> <li>Requires granular data reporting, allowing users to compare data across county.</li> <li>Is starting to track more non-MSW materials in 2020 to help paint a complete picture of activities in the County.</li> </ul>	<ul style="list-style-type: none"> <li>County can only directly control data in the unincorporated areas, not all communities in County are fully reporting in 2019 (but it is getting close).</li> <li>Relies on haulers to accurately report tons, sources, and materials with no county authority to verify data.</li> <li>Potential to continue expanding what is counted and tracked as the data reporting system is refined.</li> </ul>
<b>Denver, CO</b>	<ul style="list-style-type: none"> <li>Recently adopted hauler licensing requirement that allows the city to reflect progress toward goals more accurately.</li> <li>Tracks and reports data from large capital projects (concrete, soil, asphalt, etc.)</li> <li>Have a staff person dedicated to data collection.</li> <li>Assumes a small credit for backyard composting.</li> </ul>	<ul style="list-style-type: none"> <li>Subject to variation in how haulers report data, unable to directly verify reported data.</li> <li>Potential to expand the material categories of reported data.</li> <li>Coordinate with other entities in FRWD on data tracking / reporting categories and consistency.</li> <li>Adopt an on-line tool to facilitate data entry and QA / QC.</li> </ul>
<b>Fort Collins, CO</b>	<ul style="list-style-type: none"> <li>The most robust data tracking and reporting in the state.</li> <li>Removes residue from single stream recycling at the MRF in the diversion rate calculations.</li> <li>Publicly reports raw data allowing users to pick and choose what counts in diversion.</li> <li>Track industrial material generation and diversion.</li> </ul>	<ul style="list-style-type: none"> <li>Hard to verify hauler reported data.</li> <li>Despite robust data tracking, some tonnages are omitted from tracking (i.e. business-to-business, cross border tonnages, self-haul, donations, etc.), however it may not be worth the effort to track these tons.</li> <li>Cannot break out C&amp;D tons from other roll-off tons.</li> </ul>

Locations	Strengths	Opportunities
Loveland, CO	<ul style="list-style-type: none"> <li>Data is based on daily weight tickets provided by City of Loveland staff, making it very accurate.</li> <li>Have been tracking and reporting for 15+ years and have a consistent methodology.</li> <li>Haulers operating in the city are required to report.</li> </ul>	<ul style="list-style-type: none"> <li>Do not tack data from the ICI sector or industrial materials.</li> <li>Organics tons reported by processor in cubic yards and are converted to tons.</li> </ul>
Alameda County StopWaste, CA	<ul style="list-style-type: none"> <li>County uses per capita rates to calculate diversion rates by city which accounts for changes in population.</li> <li>Conducts waste characterizations studies every five years to understand what material is still being landfilled.</li> <li>Use historic data to examine the impacts of different programs.</li> <li>Collects data on county building C&amp;D projects; goal to divert 75% of that waste stream.</li> </ul>	<ul style="list-style-type: none"> <li>Residential and commercial data is not separated out.</li> <li>Diversion rate only tells one side of the story; does not account for changes in economic activity for example.</li> <li>Focuses on activities that prevent waste – these are hard to measure with a diversion rate metric.</li> <li>Does not count C&amp;D material.</li> <li>Does not track data from the ICI sector or industrial materials.</li> </ul>
Chittenden Solid Waste District, VT	<ul style="list-style-type: none"> <li>Has been tracking data for 30 years, and has expanded tracking efforts over time.</li> <li>Publishes detailed tonnage report annually with specific material categories.</li> <li>Track material destinations to avoid double counting.</li> <li>State requires haulers, MRFs, compost facilities, landfills, and transfer stations to report data annually.</li> <li>Businesses report quantities of materials recycled in the district, including business-to-business recycling and materials that go to non-licensed recyclers.</li> <li>Scales at disposal facilities must be licensed by the district; district receives monthly electronic data from the scales.</li> </ul>	<ul style="list-style-type: none"> <li>Residential and commercial data is not separated out because the split would be arbitrary based on facility and hauler data.</li> <li>Manual entry of data into database to is time-consuming.</li> <li>Does not track data from the ICI sector or industrial materials.</li> </ul>
Portland, OR	<ul style="list-style-type: none"> <li>C&amp;D is included in the comprehensive diversion rate for the city.</li> <li>Strong relationships with processors, businesses and govt. agencies allows city to acquire and check data.</li> <li>Waste goals are a part of a larger climate action plan.</li> <li>Estimates for self-haul and bottle bill data included in the diversion rate.</li> </ul>	<ul style="list-style-type: none"> <li>Use multiple tracking tools and rely on data from multiple agencies which can be confusing and time-consuming to sort through.</li> <li>City acknowledges majority of a products' impact happens pre-consumer; diversion measures end of life impacts only.</li> <li>Does not track data from the ICI sector or industrial materials.</li> </ul>
Seattle, WA	<ul style="list-style-type: none"> <li>Detailed diversion rate goals by sector.</li> <li>Separate C&amp;D stream measurement and diversion goal.</li> </ul>	<ul style="list-style-type: none"> <li>Does not align with the state's methodology. State of Washington has switched from diversion goals to tracking overall waste generated to focus on waste prevention.</li> </ul>

Locations	Strengths	Opportunities
	<ul style="list-style-type: none"> <li>• Tracks and subtracts material that is diverted to recyclers / composters but not ultimately recycled (e.g. residue).</li> <li>• Large metro area tracks and focuses on multi-family generation and diversion.</li> <li>• Reports generation and recycling numbers in relation to population and economy activity.</li> <li>• Tracks self-haul tonnages.</li> <li>• C&amp;D processes are required to conduct waste characterizations on their C&amp;D residual material and weigh the total amount of banned material.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-haul data does not include material that is self-hauled to private facilities, only material that is brought to city-owned processors.</li> <li>• Does not track data from the ICI sector or industrial materials.</li> </ul>

# APPENDIX F: CASE STUDIES

Detailed case studies on each of the researched locations are provided in the sections below.

## State Level Methodologies

STATE OF COLORADO <small>(JACE DRIVER, <a href="mailto:JACE.DRIVER@STATE.CO.US">JACE.DRIVER@STATE.CO.US</a>, 303.691.4059)</small>		
<b>SUMMARY</b>	Summary of Measurement Methodology	Data is tracked by Colorado Department of Public Health and Environment (CDPHE). CDPHE produces two different diversion rates annually. They are: Municipal Solid Waste (MSW) Diversion Rate and Total Solid Waste Diversion Rate. The MSW rate does not include Industrial Waste. Industrial waste in CO includes C&D, agricultural waste, sludge, mining waste, oil & gas waste, coal combustion waste, and all other sources of all non-hazardous waste. There are currently no penalties for the state not meeting its recycling goals. Data is tracked at three levels that match state goals - statewide, Front Range, and Greater Colorado. Data at smaller levels of government (county, municipality) are not tracked or available.
<b>GOALS</b>	Diversion Rate/Year	2019 MSW Diversion rate: 15.9% Total Diversion rate: 33.0%
	Statewide Goal	Goals for State, Greater Colorado, and Front Range through 2036 with interim dates of 2021 and 2026. Front Range goal is 32% in 2021 and 51% by 2036. Statewide is 28% and 45% respectively. Goals are for MSW diversion and do not include Industrial Wastes.
	Regional, county, or municipal goals required state?	State has two regions - Front Range and Greater Colorado. The 'Front Range' includes Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, El Paso, Jefferson, Larimer, Pueblo and Weld counties. All other counties are 'Greater Colorado'.
<b>DIVERSION MEASUREMENT</b>	<b>MSW Solid Waste</b> Diversion Equation	$(MSW\ Recycled + MSW\ Composted) \div (MSW\ Recycled + MSW\ Composted + MSW\ Disposed)$
	<b>Total Solid Waste</b> Diversion Equation	$(MSW\ Recycled + MSW\ Composted + Non\ MSW\ Materials\ Diverted) \div (MSW\ Recycled + MSW\ Composted + MSW\ Disposed + Non\ MSW\ Materials\ Diverted + Non\ MSW\ Materials\ Disposed)$
	Materials Included as <b>MSW</b> Diversion	CDPHE uses the same categories and definitions as those established by the EPA and the State Measurement Program: Metal containers (aluminum/steel/tin), metal scrap (white goods and MSW sources of metal, no industrial metal), paper, cardboard, glass, plastics (#1-7), yard waste, food waste, electronics, tires, HHW, paint, batteries, lighting, textiles, and mixed recycling.
	Materials Included as <b>Total Solid Waste</b> Diversion	Construction and demolition debris, concrete and asphalt, industrial and agricultural compost feedstocks (sludges, manure, biosolids), oil and antifreeze, tires used for energy recovery, produced water, beneficial use (land application of organics, and other suitable materials), coal combustion residuals.
	C&D Diversion Measurement	Yes. Included in Industrial Diversion.
	'Other' Diversion Measurement	Beneficial Use – Land application of organics and other suitable materials is counted as beneficial use under the Industrial Diversion metric- state has some pre-determined beneficial uses such as concrete as backfill, novel beneficial uses must go through an approval process at the state
	Excluded or omitted tonnages	ADC is not counted, the source separated commercial / industrial recyclables (i.e. baled cardboard from the back of a grocery store) that goes direct to market and bypasses state processing facilities is not counted. State is not aware of how large, or small, a difference these tons may make. Residue from MRFs is included as landfilled. The state looks at incoming and outgoing / marketed commodities and the delta between the two.

# STATE OF COLORADO

(JACE DRIVER, [JACE.DRIVER@STATE.CO.US](mailto:JACE.DRIVER@STATE.CO.US), 303.691.4059)

<p>Diversion Measurement Notes</p>	<p>The state follows the US EPA for MSW diversion. The EPA's figures include municipal solid waste from homes, institutions such as schools and prisons, commercial sources such as restaurants and small businesses, and occasional industrial sources. MSW does not include wastes of other types or from other sources, including automobile bodies, municipal sludges, combustion ash, and industrial process wastes that might also be disposed in municipal waste landfills or combustion units (US EPA Characterization Methodology). In 2018, CDPHE began calculating diversion differently, based on recommendations in the 2016 Integrated Solid Waste and Materials Management Plan. Prior to this change, CDPHE did not have the ability to collect municipal solid waste disposal separately from industrial waste disposal. This change brought the state in line with EPA guidelines and how many other states calculate municipal solid waste diversion.</p>	
<p><b>DATA</b></p>	<p>Data Collection</p>	<p><b>Counties and jurisdictions</b> – No statewide reporting requirements.  <b>Landfills</b> – Landfills submit data to CDPHE on the weight or volume of waste received for the solid waste user fee surcharge.  <b>MRFs</b> – All recycling facilities that process (bale and/or sort) recyclables are required to report annually to CDPHE.  <b>Compost Facilities</b> – All permitted or registered composting facilities are required to report annually to CDPHE.  <b>Transfer Stations</b> – Unless a transfer station is processing recyclables, they are not required to report.  <b>Haulers</b> – No statewide reporting requirements.  <b>Other</b> – None.</p>
	<p>Data Validation</p>	<p>QA/QC is done by CDPHE manually. Staff systematically review all incoming data reports for quality and potential anomalies or errors. Staff follow-up with reporting entities to reduce any reporting errors. While on-site validation and inspection is allowable, in practice it is rarely done due to staff availability.</p>
	<p>Double counting</p>	<p>CDPHE tracks incoming and outgoing tonnages from sites and work to match the tons. For example - if Summit County reports X tons of outgoing single stream sent to Denver processors, CDPHE will track the tons and remove them from the Denver report. It is not a perfect system, but CDPHE reports that they are able to minimize double counting issues.</p>
	<p>Measuring materials that flow across borders</p>	<p>The incoming and outgoing reports help the department track some of this data. However, some recyclables from out of state may be missed. For example, if Larimer, WY sends baled single stream to a MRF in Denver, the tons and attributable diversion would count for Colorado not WY. There is some out of state seepage of tons in the SW corner of the state as well.</p>
	<p>Statistical analyses of data</p>	<p>None.</p>
<p><b>CHALLENGES / RECOMMENDATIONS</b></p>	<p>Largest challenges Reported</p>	<p>Challenging to chase people down to submit their tonnage reports on a timely basis. Additionally, although the reporting forms stay consistent, the submitted data is not always consistent. This could be due to staff changes in reporting entities, or sloppy data reporting by entities. CDPHE works hard to balance the reporting requirements and data quality for the reporting entities. An extremely detailed form does not necessarily mean better data. Double counting is still an issue, but CDPHE does not believe it significantly changes the reported annual diversion rates.</p>
	<p>Recommendations</p>	<p>Would like to see reporting at a county level. The current facility level and waste shed data does not allow for county by county tracking. Would like to see the state consider some type of reporting software to help reduce errors, streamline reporting, and cut down on double counting issues. The state is interested in techniques for measuring C&amp;D, and have considered whether the state could track MSW, C&amp;D, and Total Diversion (not just MSW and Total) but the way landfills report data may make this challenging.</p>

## STATE OF OHIO (JAMIE ZAWILA, [JZAWILA@RECYCLE.COM](mailto:JZAWILA@RECYCLE.COM), 734.996.1361 X130)

SUMMARY	Summary of Measurement Methodology	<p>Ohio is divided into solid waste management districts (SWMD) that encompass one or more counties. All SWMDs are required to report recycling activities in their District annually to the Ohio EPA. Landfills, transfer facilities, compost facilities, and scrap tire facilities are required to report annually as well to the Ohio EPA. MRFs are not required to report but are surveyed by the Ohio EPA for voluntary reporting annually. Commercial and industrial recycling activity is tracked through voluntary reporting by the SWMD and included on the District's annual district report to the Ohio EPA.</p> <p>In addition to reporting, the Ohio EPA requires SWMD to demonstrate achievement of one of two goals. Goal 1 requires SWMDs to provide at least 90 percent of the residential population with the opportunity to recycle in each county. Goal 2 requires that the SWMD shall reduce and recycle at least 25% percent of the solid waste generated by the residential/commercial sector. The SWMD chooses one of these goals and demonstrates achievement in their solid waste management plan. All SWMDs are required to prepare, receive approval of and implement a local solid waste management plan that provides for the safe management of waste in the SWMD for a minimum of 10 years. Solid waste plans must be updated by each SWMD every 5 years.</p> <p>The state also has a solid waste management plan with the purpose of reducing Ohio's reliance on using landfill facilities to manage solid waste. The state plan establishes the waste reduction and recycling goals for both the State and Ohio's 52 solid waste management districts (SWMDs).</p>
	Diversion Rate/Year	NA, Ohio does not calculate a statewide diversion rate.
	Statewide Goal	The state of Ohio does not have a statewide waste diversion goal.
GOALS	Regional, county, or municipal goals required state?	Each District must either demonstrate they provide at least 90 percent of the residential population with the opportunity to recycle in each county or demonstrate reduction or recycling of at least 25% percent of the solid waste generated by the residential/commercial sector. It is up to the SWMD to collect recycling data from haulers and commercial businesses in their counties.
	MSW Diversion Equation	$(\text{Commingled Recyclables} + \text{HHW Collections} + \text{Drop-off and Takeback Collections} + \text{Food and Yard Waste Collections} + \text{Wood} + \text{Source Reduction} + \text{Volume Reduction}) \div (\text{MSW Generation Excluding C\&D})$
DIVERSION MEASUREMENT	Industrial Diversion Equation	$(\text{Commingled Recyclables} + \text{Ash for Beneficial Use} + \text{Wood} + \text{Source Separated Collections (ex: textiles, ferrous metals)} + \text{Flue Gas Desulfurization} + \text{Other Non-Excluded Diversion (ex: asphalt, acrylic, zinc shot)} + \text{Source Reduction} + \text{Volume Reduction}) \div (\text{Industrial Waste Generation (excludes slag, uncontaminated earth, non-toxic fly ash, spent, non-toxic foundry sand, material from mining, and C\&D)})$
	Materials Included as <b>MSW</b> Diversion	Appliances/white goods, HHW (only if recycled), used motor oil, electronics, scrap tires, dry cell batteries, lead-acid batteries, food, glass, ferrous metals, non-ferrous metals, corrugated cardboard, all other paper, plastics, textiles, wood, rubber, commingled recyclables (mixed), yard waste, other (ex: fluorescent lamps, ink/coatings)
	Materials Included as <b>Industrial</b> Diversion	Glass, ferrous metals, non-ferrous metals, corrugated cardboard, plastics, textiles, wood, rubber, commingled recyclables (mixed), ash, non-excluded foundry sand, flue gas desulfurization, other (asphalt, acrylic, zinc shot, chipboard, sludge)
	C&D Diversion Measurement	No. C&D is not tracked as MSW or industrial waste so that it is not incorporated to either the numerator or denominator of the waste diversion equation.



# STATE OF OHIO (JAMIE ZAWILA, [JZAWILA@RECYCLE.COM](mailto:JZAWILA@RECYCLE.COM), 734.996.1361 X130)

‘Other’ Diversion Measurement	<p><b>Source reduction</b> – SWMD can only include tonnages associated with reductions achieved in the report year. Source reduction tonnages cannot be based on estimates nor can they be based on reductions achieved in previous years. Only measurable source reduction activities achieved in the reporting year can be counted. In order to take credit for tonnage from source reduction practices, the SWMD must annually survey each entity utilizing source reduction practices to determine the tonnage of waste reduced during the report year. Supporting information should be provided.</p> <p><b>Volume reduction</b> – Volume reduction that occurs through treatment, such as composting and incineration can be credited by the SWMD taking the difference between the waste that was composted or incinerated and the final compost product or ash produced. The Ohio EPA provides a specific volume reduction calculation if the amount of ash generated from waste to energy is unknown.</p> <p><b>Beneficial Use</b> – Incinerator ash applied to beneficial use can be counted towards diversion.</p>	
Excluded or omitted tonnages	<p>Train boxcars, construction and demolition debris, metals from vehicle salvage, manure, agricultural waste (ex: crop waste, animal bedding), are considered are excluded from any waste diversion estimate (not counted in numerator or denominator).</p>	
Municipal solid waste and industrial waste sent to waste to energy or used as alternative daily covered cannot be counted towards diversion and are considered disposal.		
Diversion Measurement Notes	<p>Ohio does not track residue from recycling activities. Tons reported by haulers as collected for recycling are all counted towards recycling, regardless of whether material was truly recycled.</p>	
DATA	Data Collection	<p><b>SWMD</b> – Required to submit an annual district report (ADR) to the Ohio EPA that must include data on residential, commercial, and industrial recycling by commodity type. MRFs, haulers, and commercial businesses are not required to report, so it is up to the SWMD to work with those entities to gather diversion data reported on a voluntary basis. To gather this data many SWMD conduct annual surveys of their commercial and industrial sectors. Response rates are an issue for most SWMD.</p> <p><b>Landfills</b> – All solid waste landfills in Ohio are required to report annually to the Ohio EPA by April 1 each year. The report collects general facility information, weighing information for solid waste, and waste flow (direct hauled, transferred waste, and other materials). Landfills are also required to report the source of the waste (in-district, out-of-district, and out-of-state).</p> <p><b>MRFs</b> – No reporting requirement; any data collected is reported on a voluntary basis. To help SWMD collect data on recycling, the Ohio EPA surveys MRFs to track tons of material processed by commodity type and which SWMD the material originated from. MRFs are not required to respond to the survey.</p> <p><b>Compost Facilities</b> – All compost facilities in Ohio are required to report annually to the Ohio EPA by February 1 each year. The report collects general facility information along with what materials were accepted per month, the volume of material, and the origin of the accepted material (in-district, out-of-district, out-of-state).</p> <p><b>Transfer Stations</b> – All transfer facilities in Ohio are required to report annually to the Ohio EPA by April 1 each year. The report collects general facility information along with what materials were accepted per month, the volume of material, and the origin of the accepted material (in-district, out-of-district, out-of-state).</p> <p><b>Haulers</b> – There are no hauler reporting requirements in Ohio, however most SWMD rely on some hauler reporting to complete their ADR on recycling activity occurring in their District.</p> <p><b>Other</b> – Scrap tire facilities are required to report annual on facility information along with what materials were accepted per month, the volume of material, and the origin of the accepted material (in-district, out-of-district, out-of-state).</p>

## STATE OF OHIO (JAMIE ZAWILA, [JZAWILA@RECYCLE.COM](mailto:JZAWILA@RECYCLE.COM), 734.996.1361 X130)

	Data Validation	QA/QC is the responsibility of SWMD. Districts must compare data to previous year as a required validation effort, and the SWMD must explain any changes between the years. Once data is annually submitted, Ohio EPA reviews the data, look at ADR comparisons done by the SWMD and checks for changes. The Ohio EPA then sends the review report back to the SWMD. If Ohio EPA feels there is an error, they will make the change themselves and inform the SWMD of the changes that were made. Typically, Ohio EPA only makes changes on data they have corresponding facility reporting data. For example, SWMD report on compost activity in the SWMD as part of the ADR form, and Ohio EPA receives reporting data from compost facilities. If Ohio EPA notices a discrepancy between what the SWMD reported as composted on their ADR and what the compost facility reported to the Ohio EPA as receiving from the SWMD, the Ohio EPA will correct the SWMD ADR to align with the compost facility reported data.
	Double counting	It is up to SWMD to adjust for any double counting in their ADR. The Ohio EPA reviews all ADRs and may ask a SWMD about double counting if they feel it is occurring.
	Measuring materials that flow across borders	Out-of-state landfills are not required or asked to report to the Ohio EPA or to SWMD. However, Ohio EPA maintains relationships with corresponding agencies in neighboring states and asks about any Ohio waste out-of-state landfills may have received. These efforts provide some data on exported waste and county of origin in Ohio, but the collection system is imperfect. Another means of obtaining data for waste that flows across state lines occurs when a SWMD has a contract with an out-of-state facility, the SWMD will collect accurate data on exported waste because generally tons of waste exported is tied to a per ton fee. Finally, a third source of understanding exported waste is through required transfer station reporting where a transfer station uses an out-of-state landfill or incinerator.  For recycling there is no measure of waste that is processed out-of-state and that data is not captured. Additionally, the Ohio EPA does not track out-of-state compost facilities, however given the abundance of compost facilities within Ohio and the challenges of transporting that material, it is likely that organics processed out-of-state is minimal.
	Statistical analyses of data	None.
<b>CHALLENGES / RECOMMENDATIONS</b>	Largest challenges Reported	The largest challenge is collecting accurate information on recycling activity in the state. SWMD are required to report residential, commercial, and industrial recycling activity to the Ohio EPA, however there is no regulations requiring haulers, MRFs, scrap yards, buy backs, or commercial and industrial generators to supply SWMD with these data. SWMD heavily rely on commercial and industrial generators, scrap yards, and buybacks in their Districts to complete annual surveys on their recycling activity, but typical survey participation is between 10-20% because responding is voluntary. SWMDs have raised these concerns with the Ohio EPA, and in response the Ohio EPA began surveying MRFs and large commercial generators in the state such as Walmart and other major retail chains to reduce the burden on SWMD. While Ohio EPAs survey efforts supply a major component of recycling information, survey responses are all voluntary and response rates remain an issue.
	Recommendations	The burden to gather and report recycling data is high on SWMD, and this occupies a substantial amount of their limited time and money. Additionally, SWMD are placed in a challenging position in which they are required to report on recycling activity within their District to the Ohio EPA each year, however MRFs, haulers, scrap yards, buybacks, and commercial and industrial generators have no requirements to track and report on recycling so that SWMD must rely on these entities providing them with data on a voluntary basis. A better approach would be to require recycling data be reported directly to the Ohio EPA from processors and major recycling generators. This would increase reporting compliance and accuracy while also freeing up SWMD to invest time and funding into recycling programs, education, and other diversion efforts.

# STATE OF MINNESOTA

(BARBARA MONACO, [BARBARA.MONACO@STATE.MN.US](mailto:BARBARA.MONACO@STATE.MN.US), 651.336.3236)

<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>SUMMARY</b></p>	<p>Summary of Measurement Methodology</p>	<p>Minnesota measures waste diversion efforts through their Select Committee on Recycling and the Environment (SCORE) reporting system. Counties complete the SCORE Report via ReTrac by April 1st each year which collects data on all waste generated from the residential and commercial sectors within the counties. Previously, Minnesota included source reduction and yard waste credits in the waste diversion estimate, however the state moved away from those credits in 2013 and now only accepts documented recycling, composting, or other diversion in tons. Landfills, waste to energy facilities, compost facilities, MRFs, transfer facilities, and haulers are all also required to report annually to the MPCA through the ReTrac system.</p> <p>The Minnesota Pollution Control Agency (MPCA), which is the waste and diversion data tracking agency of the state, divides Minnesota into two regions: Great Minnesota and the seven-county Metro Area. The two regions have slight differences in reporting requirements and goals (described below). The seven-county Metro Area includes Washington, Anoka, Hennepin, Carver, Scott, Dakota, and Ramsey counties which encompass the states most densely populated region, including the cities of Minneapolis and Saint Paul.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>GOALS</b></p>	<p>Diversion Rate/Year</p> <p>Statewide Goal</p> <p>Regional, county, or municipal goals required state?</p>	<p>45.9% (2018)</p> <p>The state of Minnesota does not have a statewide waste diversion goal.</p> <p>Each Greater Minnesota County (outside of the seven-county Metro Area) must recycle a minimum of 35% by weight of total solid waste generation. The goal for counties in the Twin Cities seven county metropolitan area was to recycle half of all solid waste generated. The 2014 Legislature increased the recycling goal for these counties; by December 2030, counties in the Twin Cities metropolitan area will be required to recycle 75% of the solid waste they generate.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>DIVERSION MEASUREMENT</b></p>	<p>MSW Diversion Equation</p> <p>Industrial Diversion Equation</p> <p>Materials Included as <b>MSW</b> Diversion</p> <p>Materials Included as <b>Industrial</b> Diversion</p> <p>C&amp;D Diversion Measurement</p> <p>'Other' Diversion Measurement</p> <p>Excluded or omitted tonnages</p>	<p>(Tons of Recycled and Composted Material from Residential and Commercial Sectors including HHW Recycled) ÷ (Mixed MSW + Problem Materials Banned from Landfill + Recycled Material + Waste Illegal Buried or Burned (estimated) + HHW)</p> <p>Industrial waste diversion is not calculated.</p> <p>Aluminum, steel, and tin cans, corrugated cardboard, mixed paper, newsprint, glass food &amp; beverage, mixed plastics, source Separated organics (yard, vegetative, and food waste, and compostable paper and plastic materials that meet ASTM standards), food waste diverted-to-food to people and food-to-animal programs, textiles, shredded tires used in asphalt, pallets HHW, paint, bulbs, ballasts, tires, any tonnage that can be measured as diverted from the MSW stream that would have gone to disposal.</p> <p>Industrial diversion is not tracked. Recyclables collected from industrial generators that was mixed in with commercial collections and sent to a MRF would be included in municipal solid waste calculations.</p> <p>No. Only the tonnage of recyclable materials that would otherwise be a part of MSW can be counted toward the SCORE recycling goal. Wastes that are normally handled as a part of a separate waste stream, such as most demolition materials or industrial wastes, cannot be counted toward the SCORE recycling goal.</p> <p><b>Source reduction</b> – Previously Minnesota applied a 3% credit to a county’s waste diversion estimate if the county engaged in certain waste reduction efforts. However, that credit was eliminated in 2013.</p> <p><b>Beneficial Use</b> – SCORE diversion estimate can include beneficial use of material collected from the municipal solid waste and used in for other purposes, such as for animal bedding or roads.</p> <p>Minnesota considers C&amp;D a separate waste stream so that diversion of construction and demolition cannot be counted in the SCORE report nor is the tonnage of C&amp;D waste include in the waste generation estimate of a county.</p> <p>MSW that is sent to WTE or used as ADC cannot be counted towards diversion. Any MSW sent to WTE or ADC would be counted as disposal.</p>

# STATE OF MINNESOTA

(BARBARA MONACO, [BARBARA.MONACO@STATE.MN.US](mailto:BARBARA.MONACO@STATE.MN.US), 651.336.3236)

	<p>Diversion Measurement Notes</p>	<p>Minnesota measures diversion at the point of collection and does not track if material was truly diverted. For example, all tons sent to a MRF can be counted as recycled regardless of percent residue that ends up disposed in a landfill or incinerated.</p>
DATA	Data Collection	<p><b>Counties</b> – Submit waste generation data for the SCORE reports via Re-TRAC annually.</p> <p><b>Landfills</b> – Submit annual reports using Re-TRAC. The form tracks waste types managed, waste volumes, leachate volumes, gas generation, tip fees, and personnel training information.</p> <p><b>MRFs</b> – Submit annual reports using Re-TRAC. The form tracks incoming tonnage, market tonnage, and calculates a residue rate from the difference. Facilities are also required to report by commodity type, tonnage collected, and destination of material.</p> <p><b>Compost Facilities</b> – Submit annual reports using Re-TRAC. The form tracks material type and quantity received, material type and quantity left on site from previous year, quantity and type of material that was produced, and information on contamination.</p> <p><b>Transfer Stations</b> – Submit annual reports using Re-TRAC. The form tracks material type and quantity received, county of origin, and destination of material.</p> <p><b>Haulers</b> – Haulers in Greater Minnesota are required to submit data on MSW and recyclables annually, and haulers in the Metro are required to report quarterly. A collector of mixed municipal solid waste or recyclable materials must report on quantity from commercial and residential customers, county of origin, and destination facility of materials.</p> <p><b>Other</b> – Waste to Energy facilities and refuse derived fuel facilities must report to the MPCA.</p>
	Data Validation	<p>The MPCA performs QA/QC for all reports received by comparing reported data with previous years and flagging any major changes. If large changes are noted, MPCA will follow up with the facility and county to try and understand if the reporting change is true or was due to an error. MPCA also checks that all diversion estimates reported via SCORE are for allowed materials. For example, brush that was burned cannot be counted as diverted.</p>
	Double counting	<p>MPCA only includes what has been reported by counties for SCORE data to avoid double counting. In the future MPCA is hoping to replace the county generation data with hauler and facility data but this has not happened yet because hauler and facility compliance data is still lagging. It is up to counties to check for double counting. MPCA works with some counties to check on double counting where possible if MPCA flags the data for suspected double counting.</p>
	Measuring materials that flow across borders	<p>Measuring material that flows across borders varies depending on whether material is generated in the metro region or greater Minnesota. Metro counties must submit certification report for MSW with detailed data on where MSW was sent because the state manages their metro counties' solid waste plans. As a result, waste that flows across state lines from the metro counties is well known. For greater MN, waste that flows over state lines is tracked in two ways. If the waste is direct hauled out-of-state, the hauler report will capture the tonnage sent to the receiving facility. If the waste, recycling, or organics are transferred first before leaving the state, the transfer facility reporting data captures the receiving facility. However, there are a couple challenges with measuring transferred waste. First, if a transfer facility is sending material to multiple landfills, it is not possible to determine exact quantities of waste sent to specific landfills from an origin county. Second, transfer facilities are currently writing in with a free form which landfills they are utilizing. The write in creates some ambiguity because it is not always clear if the landfill the transfer facility is referring to is in state or out-of-state.</p>
	Statistical analyses of data	<p>No, the main focus of the MPCA is to do visual inspections and QA/QC on incoming data.</p>

STATE OF MINNESOTA (BARBARA MONACO, <a href="mailto:BARBARA.MONACO@STATE.MN.US">BARBARA.MONACO@STATE.MN.US</a> , 651.336.3236)		
<b>CHALLENGES / RECOMMENDATIONS</b>	Largest challenges Reported	MPCA moved to the Re-TRAC reporting system in 2015 and this was a substantial change in reporting for landfills, transfer facilities, MRFs, compost facilities, and haulers. MPCA is still working to ensure good reporting compliance with all these entities. Additionally, the MPCA has identified areas they would like to improve on data tracking, for example linking hauler reporting with facility reporting and county reporting for additional QA/QC checks. With this type of linkage, MPCA could check that the tons reported by the hauler match with what the county generated, and facilities reported receiving from the same hauler.
	Recommendations	<p>Finally, a challenge for MPCA reporting is that more facilities have expanded over the years and are now operating as solid waste campuses that may fill multiple roles such as landfilling, composting, and transferring waste all on one site. Recording how waste was managed can be challenging at these sites. To improve this, MPCA would like to better connect the data tracking system in MPCA with the permitting tracking database.</p> <p>Because solid waste campuses are becoming more common where facilities are large, complex, and performing more than one activity, the database capturing information should fully identify what is happening on the site so it is clear there are multiple activities at one address and all activities are appropriately tracked. Data collection, QA/QC, and tracking is a lot of work and requires an FTE dedicated to the task. It cannot be someone's side job to perform this work.</p>

STATE OF CALIFORNIA (DAN BROWN, <a href="mailto:DAN.BROWN@CALRECYCLE.CA.GOV">DAN.BROWN@CALRECYCLE.CA.GOV</a> , 916.322.0957)		
<b>SUMMARY</b>	Summary of Measurement Methodology	<p>In 2019 the state changed reporting system from the Disposal Reporting System (DRS) that only tracked disposal tonnages to the Recycling and Disposal Reporting System (RDRS) that began requiring MRFs and composting facilities to report tons diverted. This was the first time CalRecycle collected direct tonnage data on diversion activities.</p> <p>The state does not officially calculate a diversion rate and instead focuses on per capita disposal for counties, cities, and jurisdictions. One of the reasons the state focused on per capita disposal was because they did not have direct data on recycling. Overall statewide diversion rates are reported by dividing reported disposal from an estimated overall generation estimate based on a per capita rate. The difference between the estimated generation and total disposal was attributed to recycling and source reduction.</p>
	<b>GOALS</b>	<p>Diversion Rate/Year: 42% (2017)</p> <p>Statewide Goal: The Legislature and Governor Brown set a goal of 75 percent recycling, composting or source reduction of solid waste by 2020.</p> <p>Regional, county, or municipal goals required state? CalRecycle compares reported disposal tons to population and calculates per capita disposal expressed in pounds/person/day. The per capita disposal rate only considers two factors: a jurisdiction's population (or in some cases employment) and its disposal as reported by disposal facilities. CalRecycle will look at a jurisdiction's per capita disposal rate as an indicator of how well its programs are doing to keep disposal at or below a jurisdiction's unique 50 percent equivalent per capita disposal target. The 50 percent equivalent per capita disposal target is the amount of disposal a jurisdiction would have had during the base period if it had been exactly at a 50 percent diversion rate. It is calculated using the average of 2003-2006 per capita generation for each jurisdiction. It divides this generation average in half to determine the 50 percent equivalent per capita disposal target.</p>
<b>DIVERSION MEASUREMENT</b>	MSW Diversion Equation	Prior to 2019, overall statewide diversion was estimated by subtracting overall disposal from an estimated generation based on a set per capita generation rate. The state relied on this method because data on recycling was unknown. In 2019 the state implemented a new reporting system that incorporated MRF and compost facility reporting requirements so that diversion will be more precisely measured.
	Industrial Diversion Equation	Industrial waste is included in commercial waste in California, so there is no distinction in this waste stream.

## STATE OF CALIFORNIA (DAN BROWN, [DAN.BROWN@CALRECYCLE.CA.GOV](mailto:DAN.BROWN@CALRECYCLE.CA.GOV), 916.322.0957)

Materials Included as <b>MSW</b> Diversion	Diversion is not directly measured by CalRecycle, and prior to 2019 recycling and composting tonnage were not tracked. Instead jurisdictions are encouraged to decrease their per capita disposal through source reduction, reuse, and recycling and composting activities. C&D is included in a jurisdictions waste generation, so that C&D diversion activities would decrease a jurisdictions disposal and improve their per capita disposal rate. Additionally, WTE up to 10% of generation can be counted as a means of decreasing disposal. Alternative daily cover cannot be included. While CalRecycle encourages source reduction it is not directly measured anywhere.
Materials Included as <b>Industrial</b> Diversion	Industrial waste is not separately tracked by CalRecycle.
C&D Diversion Measurement	Yes.
'Other' Diversion Measurement	None.
Excluded or omitted tonnages	WTE above 10% of a jurisdictions generation and ADC is not counted as diversion and tons managed in these ways would count as disposal.
Diversion Measurement Notes	Tracking of diverted tons via recycling or organics processing was only instituted in the 3 <sup>rd</sup> quarter of 2019, so the direct measurement of diversion is limited in the state.

# STATE OF CALIFORNIA (DAN BROWN, [DAN.BROWN@CALRECYCLE.CA.GOV](mailto:DAN.BROWN@CALRECYCLE.CA.GOV), 916.322.0957)

DATA	Data Collection	<p><b>Counties and Jurisdictions</b> – Counties are responsible for reporting in RDRS only if they operate a reporting entity such as a landfill, MRF, compost facility, or transfer station. All counties, cities, and jurisdictions must submit an annual report that describes the progress made in achieving the requirements of the Integrated Waste Management Act, (AB 939, Chapter 1095, Statutes of 1989) and the Per Capita Disposal Measurement Act of 2008 (Chapter 343, Statutes of 2008 [Wiggins, SB 1016]. The annual report includes the numbers used to calculate a per capita disposal rate plus all required supporting documentation and attachment of any required documentation to support changes to those numbers. It also includes a status report on planned and implemented solid waste diversion programs and facilities, as well as planned or implemented revisions to approved solid waste planning documents.</p> <p><b>Landfills</b> – In the DRS, all permitted and active facilities (landfills, stations, and transformation facilities) were required to complete an annual facility method report and submit to counties and regional agencies that then submitted this information to CalRecycle. These disposal reports detailed each jurisdiction’s disposal tonnage (including waste from out-of-state) at each landfill in the reporting county as well as each jurisdiction’s disposal tonnage at any landfills outside California (exports). Facility summary reports were also required for each landfill accepting waste in the reporting county. With implementation of the RDRS, landfills report directly to CalRecycle quarterly on direct-hauled and transferred material brought on site and leaving the site, categorized by specific waste types (designated waste, disaster waste, solid waste, etc.) and jurisdiction of origin in tons. Facilities are required to measure incoming and report in tons with a few exceptions around self-hauled waste and remote facilities.</p> <p><b>MRFs</b> – Under the DRS, recycling facilities did not report. Now the RDRS requires recycling facilities to report quarterly directly to CalRecycle. Recycling facilities must report the outflow of material, indicating if it went in-state or out-of-state and type (ex: solid waste disposal, recycling, and composting, brokering, etc.) by tons.</p> <p><b>Compost Facilities</b> – Under the DRS, composting facilities did not report. Now the RDRS requires composting facilities to report quarterly directly to CalRecycle. Compost facilities must report on type and quantity (tonnage) of material received and outflow of material indicating if it went in-state or out-of-state and type.</p> <p><b>Transfer Stations</b> – Under RDRS are required to report all incoming and outgoing tons by stream type (ex: solid waste, disaster debris, recycling, organics) and destination.</p> <p><b>Haulers</b> – Under RDRS regulations, contract haulers sending reportable material to direct land application in-state, or who haul reportable materials out-of-state and who meet or exceed the quarterly de minimis tonnage threshold will be required to register and report for each quarter for which they meet/exceed the applicable threshold. Contract haulers who only haul material in-state to a reporting entity are not and have never been required to report in either data system.</p> <p><b>Other</b> – Food waste self-haulers, brokers, transporters are also required to report under the new RDRS to CalRecycle quarterly.</p>
	Data Validation	<p>CalRecycle compares outflow data from one facility to inflow data from receiving facility. For example, outflow of a transfer facility to inflow of the corresponding landfill to check for any tonnage discrepancies. CalRecycle also checks year to year trends to track any major tonnage change. Because recycling reporting is still very new, CalRecycle cannot yet track tonnage changes year-over-year, but plans to implement this as data reporting continues. Additionally, CalRecycle gets independent tonnage disposal data from department of taxes and fee (disposal tipping fee) and can use that as a check against tonnages reported by facilities. Finally, jurisdictions can collection data as well from facilities and sometimes CalRecycle uses that to compare. If a facility fails to report, puts in bad data, or fraudulently reports, then CalRecycle has the authority to fine facilities.</p>
	Double counting	<p>Tonnage is only counted for disposal or recycling when it has left the CalRecycle system. For waste disposed of in the state, that would be the final destination landfill. For waste disposed of out-of-state either by direct haul or transfer, that would be when the waste leaves the state of California for disposal. For recycling, the tonnage would get counted once it leaves the recycling facility to go to the end market.</p>

STATE OF CALIFORNIA (DAN BROWN, <a href="mailto:DAN.BROWN@CALRECYCLE.CA.GOV">DAN.BROWN@CALRECYCLE.CA.GOV</a> , 916.322.0957)		
	Measuring materials that flow across borders	Measuring waste that flows across California's borders happens either from transfer station reporting or hauler reporting if material was direct hauled. Transfer stations are required to report facilities they are utilizing, including facilities out-of-state so that disposal or recycling set out-of-state for disposal or processing. Haulers are required to report tonnage that was direct hauled out-of-state. Finally recycling facilities must report on the outflow destination such as China, etc. when reporting to CalRecycle.
	Statistical analyses of data	None.
CHALLENGES / RECOMMENDATIONS	Largest challenges Reported	This year, CalRecycle has spent a lot of time working with reporting entities, especially reporting entities that are reporting for the first time such as MRFs and compost facilities. Previously CalRecycle worked with 50 county contacts for reporting. Under RDRS, CalRecycle is working with 2,800 contacts to obtain reports. The state created their own internal reporting system instead of relying on out of the box systems such as Re-TRAC. By creating their own reporting system, CalRecycle can tailor the system to their exact needs. At the same time, the state must work out the bugs on their own with the new system.
	Recommendations	Under the previous system, haulers, landfills, and transfer stations reported to counties and jurisdictions that then reported to CalRecycle. This was burdensome to the counties and jurisdictions. Now under the new reporting system, these facilities directly report to CalRecycle which is a substantial improvement. Enforcement authority on reporting requirements is key to obtaining accurate data. Previously CalRecycle did not collect data on recycling, but with new enforcement authority the state is able to collect that data.

STATE OF NORTH CAROLINA (SANDY SKOLOCHENKO, <a href="mailto:SANDY.SKOLOCHENKO@NCDENR.GOV">SANDY.SKOLOCHENKO@NCDENR.GOV</a> , 919.707.8147)		
SUMMARY	Summary of Measurement Methodology	<p>North Carolina tracks facility data from landfills, compost facilities, and transfer stations. To obtain recycling information, the North Carolina Department of Environmental Quality (NC DEQ) relies on counties and municipal governments to collect that data from haulers, MRFs, scrap yards, and commercial and private businesses and report diversion activities. The state acknowledges that there is a gap in diversion reporting around business-to-business activity. The NC DEQ uses the collected data to compile an annual report on the status of solid waste management to the Environmental Review Commission.</p> <p>North Carolina is required by state law to have a 10-year solid waste management plan in place. The most recent adopted plan is the 2003-2013 plan. Presently, the 2014-2024 plan is still under development and has not been adopted. The purpose of the plan is to present progress made to diversion activities and ensure appropriate landfill capacities and waste management needs are met in the state.</p> <p>Prior to 2013, each unit of government was required to have a 10-year solid waste plan, updated every three years. However, the state repealed this requirement in 2013 due to complaints the process was onerous for units of government and the statewide diversion goal had not been updated since 2001.</p>
	GOALS	<p>Diversion Rate/Year: N/A</p> <p>Statewide Goal: North Carolina does not have a specific diversion target however goal two of The Solid Waste Management Act of 1989 is to substantially increase the amount of waste recycled and composted. Previously the state set a goal to reach 40% diversion in 2001, and that goal has not been updated.</p> <p>Regional, county, or municipal goals required state?: None. The state tracks per capita disposal by county and includes the per capita disposal rate and percent change from previous year in the annual report on solid waste to the general assembly.</p>



## STATE OF NORTH CAROLINA (SANDY SKOLOCHENKO, [SANDY.SKOLOCHENKO@NCDENR.GOV](mailto:SANDY.SKOLOCHENKO@NCDENR.GOV), 919.707.8147)

DIVERSION MEASUREMENT	MSW Diversion Equation	North Carolina does not calculate MSW diversion. The state calculates a combined per capita MSW and C&D disposal per capita. County and municipal governments are required to submit annual reports to the state with local recovery data and a per capita recovery rate.
	Industrial Diversion Equation	North Carolina does not calculate Industrial diversion. The state tracks industrial waste disposal separate from MSW and C&D.
	Materials Included as <b>MSW</b> Diversion	The NC DEQ per capita disposal calculation includes MSW, C&D, and coal ash. Local units of government are required to report annual tonnages of recovered materials to calculate a per capita recovery (lbs. / person). The per capita recovery includes paper, glass, plastics, metal (white goods, aluminum, steel cans), organics (yard waste, pallets, wood waste, food waste), special wastes, e-waste, construction and demolition debris, tires, and others.
	Materials Included as <b>Industrial</b> Diversion	N/A
	C&D Diversion Measurement	North Carolina tracks C&D disposal and recycling in their per capita rates. Materials included as C&D are shingles, vinyl siding, sheetrock, carpet, and aggregate (brick, block and other rubble). Clean lumber, wood pallets, cardboard, and scrap metal from C&D are included in the Metals, Organics, and paper categories and are not counted as C&D.
	'Other' Diversion Measurement	None.
	Excluded or omitted tonnages	ADC, waste sent to industrial landfills.
	Diversion Measurement Notes	Commingled or single stream tons sent to MRFs are separated into material specific categories (paper, PET, HDPE, aluminum, steel, ONP, OCC, etc.) using MRF reported data on composition. The data is used to 'produce an average materials composition that is then used to project recycling of individual materials'.

# STATE OF NORTH CAROLINA (SANDY SKOLOCHENKO, [SANDY.SKOLOCHENKO@NCDENR.GOV](mailto:SANDY.SKOLOCHENKO@NCDENR.GOV), 919.707.8147)

<b>DATA</b>	<p>Data Collection</p> <p><b>Counties and Municipal Governments</b> – All counties and municipal governments are required to report to the NC DEQ annually. Failure to complete and submit this report could result in the local government being excluded from distributions of Solid Waste Disposal Tax Proceeds and other Department of Environmental Quality grants. The report collects general information on the county or municipality, whether there are any local ordinances in place around waste and whether the community provided for or contracted for solid waste and recycling collection services. The form has sections inquiring about:</p> <ul style="list-style-type: none"> <li>-Source Reduction.</li> <li>-Curbside Recycling - how service was provided, sectors receiving service (residential, commercial, industrial), number of HHLDs, sectors serviced, frequency of collection, collection container type, whether collection is single or dual stream.</li> <li>-Drop-Off Programs - how service is provided, who has access, single stream or dual stream, number of drop-off locations.</li> <li>-Electronics Recycling Program - whether collection was curbside, permanent drop-off, collection events, or part of HHW program, who has access to the program (residents, businesses), whether TV are accepted, and basic financial and funding information.</li> <li>-Other Recycling Programs - Range of questions asking about multi-family programs, recycling services to ABC holders, recycling of construction and demolition debris, etc.</li> <li>-Tonnage Data - tonnage data on curbside and drop-off recycling programs by commodity type, special waste collection type and quantity (used motor oil, antifreeze, batteries, etc.)</li> <li>-HHW Programs - whether community had a program, whether collection site was permanent, temporary, or even based, materials collection, HHW contractor, and estimated cost of program.</li> <li>-Yard Waste Programs - whether community had program, how yard waste is collected, destination and tonnage of collected materials.</li> <li>-Solid Waste Collection Services - Who collects solid waste for each sector, how collection is provided (curbside fully automated, semi-automated, etc.), frequency of service, type of collection container, whether bulky waste is included.</li> <li>-Solid Waste Education Activities - whether community has an education and outreach program and the annual budget.</li> <li>-Financial Information - whether community has an enterprise fund, funding sources.</li> </ul> <p><b>Landfills</b> – All landfills (municipal solid waste landfills, coal ash landfills, constructions and demolition landfills, industrial landfills, waste tire landfills, and land clearing and inert debris landfills) must report yearly to the NC DEQ by August 1. The municipal solid waste landfill report collects general information on the landfill, landfill capacity, tip fee per ton, county of origin of disposed material by month, and any recovered material</p> <p><b>MRFs</b> – No reporting requirements.</p> <p><b>Compost Facilities</b> – All compost facilities in North Carolina are required to report to the NC DEQ by August 1 each year. The state collects data on the general facility info, material types processed by the facility (yard waste, wood waste, food waste, etc.) along with info on received tons, composted tons, and un-used or disposed tons. Additionally, the form asks compost facilities for the amount of compost and mulch produced and what happened to the created compost (used internally, sold to the public, given to the public, etc.). Finally, compost facilities are asked to identify the county of origin for the input material.</p> <p><b>Transfer Stations</b> – All transfer stations must report annually to the NC DEQ by August 1. The report collects: general information on the transfer station, tip fee per ton, material accepted (municipal solid waste, construction and demolition, industrial waste, etc.), types of processing (grinding, incineration, recycling, etc.), county of origin for incoming material by month, information on the receiving facility, and any data on recovered materials.</p> <p><b>Haulers</b> – No reporting requirements</p> <p><b>Other</b> – The NC DEQ requires annual reporting for HHW facilities and mixed waste processing facilities.</p>
<b>DATA</b>	<p>Data Collection Notes</p> <p>Similar to Ohio, MRFs and the commercial and industrial sector are not required to report on diversion activities however counties and jurisdictions are required to submit annual reports documenting recycling in their locality. It is up to the counties and jurisdictions to work with MRFs and other diverting entities to collect these data.</p>

## STATE OF NORTH CAROLINA (SANDY SKOLOCHENKO, [SANDY.SKOLOCHENKO@NCDENR.GOV](mailto:SANDY.SKOLOCHENKO@NCDENR.GOV), 919.707.8147)

	Data Validation	NC DEQ QA/QCs each report that comes in by comparing data to previous year's and flagging any major changes. If major changes are noticed, NC DEQ follows up with the reporting entity to ask if the change was actual or a reporting error.
	Double Counting	NC DEQ tries to identify and address double counting however tracking double counting is an ongoing challenge. Double counting is an issue when a municipality takes recycling to a county facility and both entities are reporting to the state. For electronics, white goods, and yard waste which are often moved in this way, jurisdictions answer whether this material is taken to the county. If yes, North Carolina does not count any tons the municipality provides. For traditional recycling, avoiding double counting is based on relationships with counties and handled as a case by case basis by requiring active engagement with local governments to understand where double counting might occur.
	Measuring Materials That Flow Across Borders	Out-of-state landfills that accept waste from North Carolina report to division of waste management each year so that waste from North Carolina sent out-of-state for disposal is tracked. Every permitted transfer facility reports what county the incoming waste is from and where that waste was sent and tons. There is no tracking of out-of-state recycling.
	Statistical analyses of data	None.
<b>CHALLENGES / RECOMMENDATIONS</b>	Largest challenges Reported	The largest challenges for North Carolina are that MRFs are not required to report and additionally there is little tracking on commercial and industrial business-to-business diversion activity. Without required MRF reporting or any way to capture diversion happening in the private sector, the state does not feel it is possible to truly measure diversion activities occurring in North Carolina.
	Recommendations	A state should take advantage of any opportunity to make reporting mandatory and consider looking beyond waste diversion to per capita disposal, source reduction or reuse.

## County and Municipal Level Methodologies

<b>BOULDER COUNTY, COLORADO</b> (CODY LILLSTROM, <a href="mailto:JLILLSTROM@BOULDERCOUNTY.ORG">JLILLSTROM@BOULDERCOUNTY.ORG</a> , 720.564.2757)		
<b>SUMMARY</b>	Summary of Measurement Methodology	Haulers operating in Boulder County are required to report annual tonnage data using an on-line platform (Re-TRAC). The county tracks data on a municipal and county-wide basis. County only has control over reporting requirements in unincorporated areas. Over the past several years the county has worked to encourage cities to adopt local hauler reporting requirements. As an incentive to require local municipality reporting, the county pays for the on-line tracking system and makes it available for no cost to cities that require reporting. Data includes three sectors (Single Family, Multi-Family, Commercial) and multiple material types. The material types are aggregated into recycle, compost, C&D, reuse, and refuse. C&D data is based primarily on roll-off reports. While there may be some materials that are not being counted (direct to market commercial, concrete and aggregates direct haul) the county is a good model for data tracking in the state and region.
<b>GOALS</b>	Diversion Rate/ Year	2019 is not finalized yet, rate is expected to be between 37% and 39%
<b>GOALS</b>	Statewide Goal	Yes, see state of Colorado for more information.
<b>GOALS</b>	Regional, county, or municipal goals required in state?	Yes, located in FRWD region, see state of Colorado for more information.
<b>GOALS</b>	City or municipal goal?	Yes, the county adopted a resolution in 2005. The goal is to increase waste diversion for the county as a whole to 50% or better by 2010 and eliminate waste (i.e. achieve zero waste or 'darn near') by 2025.
<b>DIVERSION MEASUREMENT</b>	Materials Included as Diversion	Data is tracked for Residential, Multi-Family, and Commercial separately and in total. Each sector reports data on single stream recycling / cardboard, scrap metal recycling, construction and demolition recycle, construction demolition reuse, yard waste, wood, e-waste recycle, e-waste reuse, household hazardous waste, building salvage, home furnishing, appliances, textiles, compost, food donation.
<b>DIVERSION MEASUREMENT</b>	Industrial Diversion Measurement	N/A To be added in 2020 (see notes).
<b>DIVERSION MEASUREMENT</b>	C&D Diversion Measurement	Yes. Tracked as roll off services- these tonnages are reported separate from Regularly Scheduled Services, also includes special events.
<b>DIVERSION MEASUREMENT</b>	'Other' Diversion Measurement	N/A
<b>DIVERSION MEASUREMENT</b>	Excluded or omitted tonnages	Industrial wastes are not included. Commercial materials sold direct to markets by brokers (i.e. cardboard from a grocery store) not tracked, the county knows that there are tons of C&D that are direct hauler out of county (e.g. asphalt, concrete) that are not tracked but does not know how much.
<b>DIVERSION MEASUREMENT</b>	Notes	County also tracks Special One-Time Use collections - this does not include roll-offs but is for things like garage clean outs. Starting in 2020, the county is requiring that materials generated during capital projects (roads, bridges, etc.) will be tracked and counted. Companies winning capital bids will need to report data into Re-TRAC. Cities in the county have not done this yet, but the county will be pushing them to follow suit. This is expected to change the tonnage totals. Unclear where in the diversion formulas these data will be included - perhaps C&D, but the county has not fully decided yet.
<b>DATA</b>	Data Collection	Haulers operating in the county must be licensed, as part of the licensing requirements they must report data to the county. This includes unincorporated Boulder County. The cities of Louisville, Lafayette, Broomfield, Longmont and Town of Erie and City of Boulder also require licensing and reporting to the county. New in 2020 will be licensing in Lyons and Nederland. The license applies to trash, recyclables, compostable, C&D waste, aggregate, or landscaping materials. All haulers must complete an annual form. The form is through Re-TRAC, a web-based data collection software.
<b>DATA</b>	Data Collection Notes	The transfer station, county owned MRF, HHW site, and drop-offs must also report data into Re-TRAC

<b>BOULDER COUNTY, COLORADO</b> (CODY LILLSTROM, <a href="mailto:JLILLSTROM@BOULDERCOUNTY.ORG">JLILLSTROM@BOULDERCOUNTY.ORG</a> , 720.564.2757)		
	Data Validation	The county goes into Re-TRAC and checks all reports individually, looking for anomalies in data (i.e. unexpected tonnages, inconsistencies between years, etc.), the only major issues have been units or input errors but it hasn't been a big deal. If the county sees something suspicious, they will reach out to reporting entity to figure out what happened. There is no on-site validation and data is taken at face value. It is more QA/QC as opposed to validation.
	Double counting	Have a rule built into Re-TRAC to reduce the potential for double counting. The algorithm looks at the sources and destinations and ties them together to ensure the tons do not get counted twice. Took some time to get this right but they are getting better at it.
	Measuring materials that flow across borders	Allow haulers to do estimates of routes by city, haulers have had to get used to this, but it is working. For example, a hauler can attribute 50% of a route to City A, and the other 50% to City B in their reports. There is no verification or checking of the estimates for attribution.
	Statistical analyses of data	None.
<b>CHALLENGES / RECOMMENDATIONS</b>	Largest challenges Reported	One of the largest challenges has been the garnering municipal buy-in and getting them on board with the data tracking protocols. The county has control over unincorporated haulers only. It took several years to encourage cities in the county to adopt and enforce consistent hauler reporting requirements. Having the software was integral in building consistency, but it took a lot of work to make sure that the cities and the hauler understand what it means to enter data into Re-TRAC. Going forward, the more cities get on-board with Re-TRAC, the more likely it is that the haulers already know how to use the platform, so it is easier to get them trained on the data entry.
	Recommendations	Would love to see a statewide reporting requirement for counties to report to the state. It would be great if all counties must at least submit a minimum level of data. Would also like to see a software / reporting mechanism at the state level to help make the reporting categories and quality consistent. The county is happy with Re-TRAC and something similar may work at the FRWD or state level.

<b>COLORADO SPRINGS, COLORADO</b>		
<b>SUMMARY</b>	Summary of Measurement Methodology	Colorado Springs is serviced by private haulers operating in an open market. The city does not own or operate any recycling or solid waste processing facilities, and all hauling and processing operations are managed by the private sector with limited to no governmental involvement. Neither the city, nor the county, require haulers or processing facilities to report data. As a result, the city does not track, measure, or report any information on tonnages generated, landfilled, or diverted.
<b>GOALS</b>	Diversion Rate/ Year	None.
	Statewide Goal	Yes, see state of Colorado for more information.
	Regional, county, or municipal goals required state?	Yes, located in FRWD region, see state of Colorado for more information.
	City or municipal goal?	No.

# DENVER, COLORADO (COURTNEY COTTON, [COURTNEY.COTTON@DENVERGOV.ORG](mailto:COURTNEY.COTTON@DENVERGOV.ORG))

<b>SUMMARY</b>	Summary of Measurement Methodology	Residential (up to and including seven units) hauling is provided by Denver Solid Waste Management. It includes residential recycling, composting, and events and additional Denver SWM routes (Denver Public Schools, Denver municipal facilities). City staff receive weight tickets from the landfill, MRF, and compost processor. Data is tracked daily by route, material, and total. All private haulers operating in the city must be licensed and report data annually. Tracked data includes landfilled, recycled, compost and the major categories are Commercial, Commercial/ Multi-Family / Institutional, C&D. All hauler data is self-reported.
	Diversion Rate/ Year	2019 Diversion Rate Data: 23.9% Residential, 35.6% Commercial, 21.0% C&D, total diversion is 28%. The city generated 1.36M tons in total generation in 2019, of this total 17% was from Denver SWM routes (mainly single family residential), 43% is ICI, and 40% is classified as C&D.
<b>RATE &amp; GOALS</b>	Statewide Goal	Yes, see state of Colorado for more information.
	Regional, county, or municipal goals required state?	Yes, located in FRWD region, see state of Colorado for more information.
	City or municipal goal?	Yes, 34% city wide diversion
<b>DIVERSION MEASUREMENT</b>	Materials Included as Diversion	Single family recycle, compost, commercial (includes multi-family) recycle, compost, event recycling, appliance collection, HHW, back yard compost credit, city municipal building compost and recycle, Denver Public Schools routes compost and recycle, city owned drop-off.
	Industrial Diversion Measurement	City also tracks materials generated, recycled, and landfilled from city capital projects. Denver SWM sits in on bidders meeting for capital projects to tell contractors about the requirement. Winning contractors must register as a 'hauler' and report their data. This includes materials like soil, concrete, asphalt, and others. Large industrial processors that self-manage their materials are not tracked.
	C&D Diversion Measurement	Yes. It is included in Total Diversion, tracked in its own category. Haulers are asked to self-report Construction and Demolition Debris taken to Landfill and to Recycling Facility. The city does not check to see what materials haulers 'count' as C&D.
	'Other' Diversion Measurement	City includes credit for back yard composting. City hosts compost bin sales and master composter training. Uses class and sales data to estimate number of HHs in the city that are back yard composting and assumes on the tons diverted through these programs - <.1% of total.
	Excluded or omitted tonnages	Scrap metal, exploration and production wastes, shredded circuit boards that are being recycled, any solid or dissolved materials in domestic sewage (bio-solids).
	Notes	
<b>DATA</b>	Data Collection	City hauls single family (up to eight units) and tracks tonnage tickets from landfill, compost, and recycle to estimate diversion, city contracts for other services (e-waste, white goods, HHW) and requires contractors to report data.  All haulers operating in the city / county limits, including yard services, must be licensed and report data on an annual basis. City also requires capital project contractors to register as haulers and report data.
	Data Collection Notes	
	Data Validation	Licensed hauler data is spot checking with a focus on the 'big numbers'. A handful of haulers are responsible for the majority of the materials and the city works especially closely with these haulers to ensure their data is submitted. There is no on-site validation or auditing of data, the city trusts that haulers report data correctly, however they have seen some pretty large variations from haulers year over year and are still working out how to make sure data is reported consistently. The city is looking into allowing and encouraging haulers to do quarterly reports to try and improve consistency in the future.

<b>DENVER, COLORADO</b> (COURTNEY COTTON, <a href="mailto:COURTNEY.COTTON@DENVERGOV.ORG">COURTNEY.COTTON@DENVERGOV.ORG</a> )	
	<p>Double counting Not considered.</p> <p>Measuring materials that flow across borders Not considered – it is up to the haulers to figure this out.</p> <p>Statistical analyses of data None.</p>
<b>CHALLENGES / RECOMMENDATIONS</b>	<p><b>Challenges</b> For hauler licensing, the challenge is that the data is only as good as what is reported. The city is relying on haulers to be accurate yet consistency across years and companies does not always occur. Some companies are more sophisticated than others and do a better job reporting. There is no opportunity for validation or auditing - the city needs to trust haulers to report to the best of their ability.</p>
	<p><b>Recommendations</b> Recommend that all cities / counties consider tracking capital project data - require contractors to report their tons as part of the specs in a capital contract bid.</p> <p>For good data tracking it is important to find someone that is interested in data. It takes a lot of work and the person collecting data should know what they are doing and have an interest in it. Denver is complex enough that they could have someone doing it full time because it is that much work.</p> <p>Even if the hauler reports are not always right, if you are using a consistent measurement protocol year over year you can track progress against a baseline, thus for Denver, the hauler data validation doesn't mean it's 'bad' data.</p> <p>Would also recommend looking at doing waste composition studies and capture rate studies to show results or programs. They are a good way to track progress and identify future program needs, however, they are expensive to conduct.</p>

<b>FORT COLLINS, COLORADO</b> (CAROLINE MITCHELL, <a href="mailto:CMITCHELL@FCGOV.COM">CMITCHELL@FCGOV.COM</a> , 970.221.6288)	
<b>SUMMARY</b>	<p>Summary of Measurement Methodology Fort Collins has one of the most mature data tracking and reporting systems in the state. The city is serviced by haulers in an open market, and all haulers operating in the city are required to report data annually. The city tracks and reports data from all sectors and includes a wide range of material streams in their granular reporting. Fort Collins tracks and reports industrial materials such as soil, concrete, and asphalt. Fort Collins includes credits for source reduction as well as a subtraction for residue in single family recycling in their final calculation. Diversion rates are publicly reported annually by totality, by sector, and by stream.</p>
<b>GOALS</b>	<p>Diversion Rate/Year 52.7% in 2019, 28.4% Residential, 25.1% Commercial/Multi-Family, 66.9% Industrial</p>
	<p>Statewide Goal Yes, see state of Colorado for more information.</p> <p>Regional, county, or municipal goals required state? Yes, located in FRWD region, see state of Colorado for more information.</p>
	<p>City or municipal goal? Yes. City council adopted the following goals in 2013: 75% waste diversion 2020, 3.5 lbs. / day / capita waste generation, 90% diversion by 2025, 2.8 lbs. / day / capita generation, 2030 Goal, zero waste.</p>
<b>DIVERSI</b>	<p>Materials Included as Diversion Residential single stream, commercial single stream, multi-family single stream, paper mix (ONP, OMX, etc.), office paper, corrugated cardboard, glass, comingled containers, food scraps residential &amp; commercial, yard trimmings residential &amp; commercial, wood commercial.</p>

# FORT COLLINS, COLORADO

(CAROLINE MITCHELL, [CMITCHELL@FCGOV.COM](mailto:CMITCHELL@FCGOV.COM), 970.221.6288)

	Industrial Diversion Measurement	Waste generated by City government operations, concrete and asphalt recycled at crushing facilities, brewery wastes, and land applied bio-solids, includes scrap metal, concrete, asphalt, other aggregate / soil.
	C&D Diversion Measurement	Yes, C&D data is based on roll off data. They also have data reported by construction contracting companies who self-haul their C&D.
	'Other' Diversion Measurement	Diversion includes a credit for the estimate of residential tons are 'source reduced'. The credit, about 5% of the total residential tons annually, is included to account for the impacts of the residential PAYT program. Fort Collins assumes that without the PAYT program these tons would have gone in the trash, but due to the economic incentives are no longer generated.
	Excluded or omitted tonnages	ADC is excluded. The city states that many of these materials have 'higher and better' uses and thus, are not to be counted as diversion.
	Notes	% Single stream recycling totals are reduced by a factor to account for contamination in the recycling stream, the trash totals are increased commensurately. In 2019 the contamination rate was 13.7%
DATA	Data Collection	Haulers operating in the city must be licensed. License requires quarterly tonnage reporting. Reports are by material and sector (Residential, MFU, Commercial). Reports indicate tons landfilled and landfill destination. CSU must also report. Recently, started requiring construction or demo companies that haul materials as part of their work - i.e., not a hauling professional, to report data to the city. Fort Collins gets the data through the building permit process, contractors are not being licensed as haulers, but they do have to report data.
	Data Collection Notes	City manages Hoffman Mill, an industrial / C&D processing site. Data is reported by site.
	Data Validation	City has an environmental compliance manager who is responsible for managing C&D data and reports including materials disposed of by non-licensed haulers such as demolition companies- manually spot check data, do year over year comparison to see trends and flag anything that looks like it may be off - identify tonnages that are potentially erroneous or missing and reach back out the reporting entity to confirm data accuracy.
	Double counting	N/A
	Measuring materials that flow across borders	City just makes assumptions. Haulers can do what they want
	Statistical analyses of data	None.
CHALLENGE FC /	Largest challenges Reported	The time sink is reminding haulers and tracking down data from them, it just takes time. The haulers in Fort Collins have been doing reporting for years and the quality of data continues to improve.



## FORT COLLINS, COLORADO

(CAROLINE MITCHELL, [CMITCHELL@FCGOV.COM](mailto:CMITCHELL@FCGOV.COM), 970.221.6288)

	<p><b>Recommendations</b> All cities / counties should start tracking data, even if they have never done it before. It is a constant cycle of improvement, do not assume that it will be perfect in the first year, or even first few years. Build upon past years and the data will get better over time. As you track you start to learn more, including identifying ways to refine the data categories and to count new materials streams or sectors.</p> <p>The more information and granularity you can collect the better. The city's philosophy is to collect and share as much data, with as much granularity, as they can. This allows interested parties to parse out information they are interested in and allow an "apples-to-apples" comparison. For instance, Fort Collins diversion metrics include concrete, soils, biosolids, and other items that some cities do not count. These materials are generated, and they are diverted, so the city does not want to ignore them, even though other places do not count them. By sharing the detailed data, a user can pull those materials out of the data and diversion rate to see residential only. They can easily do so when reviewing the reports.</p> <p>Cities should look at ways to make it easier for the reporting entities to report different categories of data. Think about the ways that haulers collect materials, and make the data reporting requirements mirror their practices - i.e. have categories for rolls offs, OCC only dumpsters, etc.</p>
--	--

## LOVELAND, COLORADO

(TYLER BANDEMER, [TYLER.BANDEMER@CITYOFLOVELAND.ORG](mailto:TYLER.BANDEMER@CITYOFLOVELAND.ORG))

<b>SUMMARY</b>	<p><b>Summary of Measurement Methodology</b> Loveland has the highest reported residential diversion rate in the state. The diversion rate is based on the materials that are directly managed by the municipal staff. This includes single family materials (up to and including seven units), some multi-family customers and roll-offs collected by the city, as well as the city managed drop-off. Recycling and landfill tonnages are tracked daily using hauler weight tickets. Yard waste tonnage is converted from cubic yards hauled (transfer loads) and processed by A1. Licensed commercial haulers are required to report data bi-annually, but the data is not included in the reported diversion rates.</p>
<b>GOALS</b>	<p><b>Diversion Rate/ Year</b> 60.34% in 2019</p>
	<p><b>Statewide Goal</b> Yes, see state of Colorado for more information.</p>
	<p><b>Regional, county, or municipal goals required state?</b> Yes, located in FRWD region, see state of Colorado for more information.</p>
	<p><b>City or municipal goal?</b> No.</p>
<b>DIVERSION MEASUREMENT</b>	<p><b>Materials Included as Diversion</b> Residential recycling, yard waste, some multi-family recycling, mulch that is chipped and sold, wide range of drop-off recyclable materials, electronics.</p>
	<p><b>Industrial Diversion Measurement</b> Not counted.</p>
	<p><b>C&amp;D Diversion Measurement</b> No - city does track some roll-off data that they supply to residents for clean-ups, but it is all landfilled and not counted as C&amp;D.</p>
	<p><b>'Other' Diversion Measurement</b> None</p>
	<p><b>Excluded or omitted tonnages</b> Concrete at the drop-off is not counted, commercial, industrial, and most multi-family is not counted.</p>
	<p><b>Notes</b> Drop off includes tires, oil, vehicle batteries, scrap metal (white goods)</p>

<b>LOVELAND, COLORADO</b> (TYLER BANDEMER, <a href="mailto:TYLER.BANDEMER@CITYOFLOVELAND.ORG">TYLER.BANDEMER@CITYOFLOVELAND.ORG</a> )		
<b>DATA</b>	Data Collection	Daily weight tickets provided by Loveland collection staff to the supervisor, includes limited MFU routes, roll-offs, and large item collections. Residential yard waste is hauled to a central location for consolidation, materials are then transferred via contracted hauler to a processing facility. The yard waste reports are in cubic yards and converted to tonnages based on EPA conversion factors. Private sector haulers are required to report to the city on a bi-annual basis. The hauler report includes data on the following: Sector (Single Family, Multi-Family, ICI, C&D) and tons (Refuse, Recycled) and the number of customers. However, this data is not tracked.
	Data Collection Notes	Loveland does not include the hauler data in their reported diversion rate and does not track the data, the data is not well reported by the licensed haulers.
	Data Validation	City has the authority to audit haulers if they choose to do so but prefer to maintain good relationships with the hauler as opposed to auditing books / data. Haulers are required to report tonnages, but the data is not well reported or tracked.
	Double counting	Not an issue with the city data.
	Measuring materials that flow across borders	N/A as the city does not provide services outside of the city limits.
	Statistical analyses of data	None.
<b>CHALLENGES / RECOMMENDATIONS</b>	Largest challenges Reported	Not that hard for them to report as the drivers get daily weight tickets and they have reported tonnages from the drop-offs. The only challenge is gauging the accuracy of the numbers are for organics because they must convert from cubic yard to tons.
	Recommendations	Would prefer to be able get scaled weights on everything and not use conversion factors, but its logistically not really feasible. Would eventually to like to get better organics data.

<b>ALAMEDA COUNTY, CALIFORNIA</b> (MEGHAN STARKEY, <a href="mailto:MSTARKEY@STOPWASTE.ORG">MSTARKEY@STOPWASTE.ORG</a> , 510.891.6513)		
<b>SUMMARY</b>	Summary of Measurement Methodology	Alameda StopWaste is a public agency governed by the Alameda County Waste Management Authority, the Alameda County Source Reduction and Recycling Board and the Energy Council. The agency includes the County of Alameda, the 14 cities in the county and two sanitary districts that provide refuse and recycling collection. Each city in Alameda County reports the total annual tonnage disposed, recycled, and composted to the StopWaste agency. StopWaste uses the state's approved method of estimating diversion rate. CalRecycle compares reported disposal tons to population and calculates per capita disposal expressed in pounds/person/day. StopWaste's diversion rate is calculated by converting a per capita average of generation and per capita average of disposal to a diversion percentage.
<b>GOALS</b>	Diversion Rate/ Year	67% countywide weighted diversion rate in 2018

# ALAMEDA COUNTY, CALIFORNIA

(MEGHAN STARKEY, [MSTARKEY@STOPWASTE.ORG](mailto:MSTARKEY@STOPWASTE.ORG), 510.891.6513)

	Statewide Goal	Yes. State goal of reaching 75% recycling, composting, or source reduction of solid waste by 2020. The statewide goal is a recycling goal, not a diversion goal. Recycling counts a range of activities from source reduction, recycling, and composting. Does not count WTE, ADC and other beneficial reuse at landfills.
	Regional, county, or municipal goals required state?	Yes. State law AB 939 required each jurisdiction in the state to reach a 50% diversion goal by the year 2000 which is the legal minimum. This law established a framework of program implementation, solid waste planning and solid waste facility / landfill compliance. If the jurisdiction does not reach the 50% solid waste diversion and has not made sufficient “good-faith efforts” CalRecycle, the state’s governing body, can place the jurisdiction under a compliance order. If a jurisdiction fails to meet the requirements of the compliance order CalRecycle conducts a penalty hearing which can fine the jurisdiction up to \$10,000 per day.
	City or municipal goal?	Yes. The Alameda County StopWaste agency made a commitment to reach 75% diversion and beyond. One of the milestones the district set was to achieve 10% or less material deposited into landfills being readily recyclable or compostable by 2020, which was called a “% Good Stuff Measurement”. This goal was discontinued because of measurement difficulties (See Challenges Section). In 2003, the county also passed the Green Building Ordinance which requires 75% waste diversion on construction and demolition debris at county projects.
DIVERSION MEASUREMENT	Materials Included as Diversion	Residential curbside recycling and curbside organics, commercial recycling, multi-family curbside recycling, self-haul recycling / composting / disposal, HHW permanent county and private collection locations and events, recycling drop-offs, and buy-back programs.
	Industrial Diversion Measurement	N/A
	C&D Diversion Measurement	C&D is considered a part of the industrial sector. The county measures it for county building projects only.
	‘Other’ Diversion Measurement	N/A – Use to use “% Good Stuff Measurement”. See Challenges section for more details.
	Excluded or omitted tonnages	ADC is counted as disposal. There are no credits / accounting for beneficial use or source reduction.
	Notes	
DATA	Data Collection	Each jurisdiction within the district is required to submit annual reports to the Recycling Board and Waste Management Agency. These reports include a description of program, providers, and destinations for collected materials, tonnages, and number of accounts by collection type (cart, bin, drop box, etc.) and customer types (residential, commercial, and multifamily). Cities receive tonnage data from solid waste processing facilities (MRFs, compost facilities, C&D processors) and landfills.
	Data Collection Notes	Data used by the county include: Measure D Annual reports from member agencies, recent waste characterizations studies, CalRecycle Disposal Reporting System, and CalRecycle Electronic Annual Reports. Measure D is an amendment to the Alameda County Charter that outlines a recycling plan for the county and creates funding for the County Recycling Board.
	Data Validation	Data validation / verification is a challenge, especially when there are natural fluctuations due to economic or seasonal changes. The district tries to look at the overall tonnages that cities are reporting and question whether they make sense with how the cities have performed historically. If there are new program changes, they are reflected in the overall tonnages.
	Double counting Measuring materials that flow across borders	N/A Out-of-county waste is excluded from diversion calculations by asking haulers at landfills and other solid waste facilities where their load origination. There are issues with self-haulers or small commercial haulers misidentifying where the material is coming from (for example, haulers will state where their company is based but not where the C&D project actually took place). The district does have some reciprocity with other facilities outside of the district to get data from them about the materials that move out-of-county. However, materials do not usually move out of county (90%+ of waste is deposited in the county’s landfills). The district has the following facilities: C&D sort facility, landfills, transfer stations, MRFs and composting facilities.

## ALAMEDA COUNTY, CALIFORNIA

(MEGHAN STARKEY, [MSTARKEY@STOPWASTE.ORG](mailto:MSTARKEY@STOPWASTE.ORG), 510.891.6513)

	Statistical analyses of data	None.
<b>CHALLENGES / RECOMMENDATIONS</b>	Largest challenges Reported	<p>% Good Stuff Goal - The district adopted a new way to communicate and measure their diversion goal in 2010. The updated goal was to reduce the amount of readily recyclable and compostable material deposited into the landfill to no more than 10% of the total material landfilled by 2020. This was a well intention step to try to reduce the issues from weight-based diversion rates. However, the fatal flaw was in trying to measure the amount of the recoverable material in the trash. By measuring as a percentage instead of a total, the data is heavily skewed by the size of the container. If someone makes a mistake and throws a compostable orange peel into a small trash can, in terms of percentages, it looks like there is a lot of the 'good stuff' in the trash.</p> <p>A challenge with traditional weight-based diversion rates is that it only tells one story. For example, because of the pandemic, commercial sectors have decreased trash and recycling generated. By using just diversion rate to evaluate how successful programs are, there is a missing piece of the larger context, like economic challenges or global recycling market.</p> <p>The district also uses waste characterizations studies to measure progress towards discard goals and measure impacts of current programs where possible. However, waste characterizations are time-consuming and expense and have to be repeated every few years to see the trends.</p>
	Recommendations	<p>The district spends money on the upstream systems. The district is much more focused on how to prevent food waste or trashed recyclables or non-recyclable packaging in the first place. In terms of diversion strategy, that might not always appear the best in the numbers, but they want to educate the public first and then see whether that translates to a diversion impact, which it does not always.</p> <p>Look at the historic tonnage data to understand whether a program or combination of programs are working.</p> <p>Consider using a per capita disposal rate or a per employee disposal rate instead of just tonnage-based diversion. This can help programs understand whether changes in tonnage are reflecting population growth.</p>

## CHITTENDEN COUNTY, VERMONT

(NANCY PLUNKETT, [NPLUNKETT@CSWD.NET](mailto:NPLUNKETT@CSWD.NET), 802.482.4085)

<b>SUMMARY</b>	Summary of Measurement Methodology	<p>The District and state require processors and haulers to be licensed; a key piece of the licensing is that those entities are required to report quantities and destinations of materials. The District has licensing requirements for MRFs, C&amp;D processors, composting facilities, transfer stations, landfills, and haulers. Processors report data to the district twice a year. Businesses that send materials directly to markets, out-district processors, or non-licensed facilities, are mandated to report quantities. Destination of material is checked for hauler, transfer station and business data so that there is no double counting. Materials that are shipped to markets do not subtract weight that the end market winds up discarding. For example, any paper from the MRF shipped to a mill that has too much residue to be used in the mill is not discounted from the diversion rate.</p>
	<b>GOALS</b>	<p>Diversion Rate/ Year: 2018 Estimated Minimum MSW Diversion Rate - 48.4%, 2018 Estimated Minimum C&amp;D Diversion Rate - 79.4% 2018 Estimated Minimum MSW &amp; C&amp;D Diversion Rate - 60.6%</p> <p>Statewide Goal: Yes. The statewide goals are to reduce the disposal municipal solid waste to 1,000 lbs. / person / year and to increase diversion rates to 50% by 2024.</p> <p>Regional, county, or municipal goals required state?: No.</p> <p>City or municipal goal?: No.</p>

# CHITTENDEN COUNTY, VERMONT

(NANCY PLUNKETT, [NPLUNKETT@CSWD.NET](mailto:NPLUNKETT@CSWD.NET), 802.482.4085)

DIVERSION MEASUREMENT	
Materials Included as Diversion	Paper, plastic, glass, metal cans & foil, single stream recyclables, estimated share of redeemed bottle bill material, estimated additional commercial recyclables, estimated backyard composting / on-site management, wood, reported & estimated yard trimmings, food residuals & non-recyclable paper, textiles, scrap metal, hazardous waste, electronics, and tires.
Industrial Diversion Measurement	N/A
C&D Diversion Measurement	There is a separate diversion rate for C&D, and then another rate for MSW + C&D which includes the materials listed above. C&D includes asphalt, concrete, brick, drywall, wood, scrap metal and asphalt shingles.
'Other' Diversion Measurement	N/A
Excluded or omitted tonnages	WTE is counted as disposal in the district (but as beneficial use on the state level). ADC is reported separately but not measure / counted in diversion rates. No credits / accounting for beneficial use, volume reduction or source reduction. Out-of-district materials are not counted. Scrap metal delivered directly to scrap metal dealers by generators are not counted with some exceptions.
Notes	Waste disposed includes MSW landfilled and incinerated.
DATA	
Data Collection	District has licensing requirements for MRFs, C&D processors, transfer stations, compost facilities, landfills, and haulers. Quantity of material, source and destination are reported to the district every 6 months by facilities and monthly by haulers. One large processor out-of-district also reports data to the district voluntarily. These processors also must report to the state. The scales used at these facilities also must be licensed by the district. Options to report the data include paper reports, Excel, PDF, or online entry.  Residential data is not separated out from residential and commercial. Haulers report quantities of materials that go to MRFs / landfills, but the system is open market, so their routes consist of both types of properties. Diversion includes estimate of bottles and cans redeemed under the Bottle Bill are based on Chittenden County's population.  Businesses report quantities of materials recycled directly to CSWD. The district looks at destination of material to make sure there is no double counting with facility data.  Estimate of on-site food scrap and yard trimmings are based on participation rates from biennial household solid waste surveys and the EPA's 1995 estimate that 650 lbs. / person / household / year is composted through backyard composting.
Data Collection Notes	Data is reported to the CSWD directly.
Data Validation	Data is hand entered, even when the reports are submitted through the online entry form. The reason being is that different businesses will call the destinations of their materials different things. Also, QA/QC data by looking back at previous years to make sure the numbers make sense and determine if and why there are discrepancies.
Double counting	Hand enter so CSWD can identify where materials are going and make sure not to include them if they are going to one of the licensed facilities that also reports data.
Measuring materials that flow across borders	As part of the processors reporting, they must report what is from in-district and from out-of-district. For the landfill since it is not in the county, CSWD also gets a report from them to make sure the district is counting what they are sending to the landfill.
Statistical analyses of data	None.

## CHITTENDEN COUNTY, VERMONT

(NANCY PLUNKETT, [NPLUNKETT@CSWD.NET](mailto:NPLUNKETT@CSWD.NET), 802.482.4085)

<b>CHALLENGES / RECOMMENDATIONS</b>	Largest challenges Reported	Largest challenges are getting business data from those businesses that ship materials directly to non-licensed markets. For example, breweries that ship spent grain to farms.
	Recommendations	Recommend that communities set up a database first and figure out what data is desired prior to collecting data. Also, it is useful to know what the maximum diversion rate is prior to setting goals. To do this, it is important to conduct a waste composition study. For example, it is more useful to know that the district's highest possible diversion rate is 75% based on what's in the waste stream than assuming a program will divert everything from the landfill and set an unattainable goal.

## PORTLAND, OREGON

(PETE CHISM-WINFIELD, [PETE.CHISM-WINFIELD@PORTLANDOREGON.GOV](mailto:PETE.CHISM-WINFIELD@PORTLANDOREGON.GOV), 503.823.7652)

<b>SUMMARY</b>	Summary of Measurement Methodology	The City of Portland bases its diversion measurement and methodology on the state of Oregon's Department of Environmental Quality (DEQ). The DEQ combines information about quantities of material collected from privately operated recycling and material recovery facilities with recovery information from collection service providers and disposal site collection, in a manner that eliminates double-counting of material as it's passed from collection through processors to end users. This data determines the total weight of material recovered. DEQ adds the total weight of material recovered to the total weight of material disposed which is obtained from disposal site reports. The recovery rate is calculated by dividing the total weight of material recovered by total weight generated. Materials that are diverted to recycling and composting facilities but not recycled (e.g. residue) are counted as disposed material.
	<b>GOALS</b>	<p>Diversion Rate/Year: 54% of the total waste generated was diverted in 2018</p> <p>Statewide Goal: Yes. The state has a mandatory goal of 52% material recovered from the general solid waste stream by 2020, which is set to rise to 55% for 2025.</p> <p>Regional, county, or municipal goals required state?: No. There are voluntary watershed goals only. Each watershed - Oregon counties, Metro, and the City of Milton-Freewater- have voluntary recovery goals in statute. A watershed as defined in Oregon is an area of the state that shares a common solid waste disposal system or an appropriate area which to develop a common recycling system. Watersheds set their recovery goals through whatever methods they chose. Watersheds' recovery goals range from 20% to 64%.</p> <p>City or municipal goal?: Yes. The City of Portland developed a Climate Action Plan with 20 objectives for 2030 including 4 for solid waste management: 1) Reduce consumption related emissions by encouraging sustainable consumption and supporting Portland businesses in minimizing the carbon intensity of their supply chains 2) Reduce food scraps sent to landfills by 90% 3) Reduce per capita solid waste by 33% 4) Recover 90% of all waste generated.</p>
<b>DIVERSION MEASUREMENT</b>	Materials Included as Diversion	Recycling materials include: antifreeze, appliances, carpet and carpet padding, Christmas trees, electronics, food scraps, glass (container and non-container), gypsum wallboard (drywall), milk cartons and aseptic containers, metal containers, motor oil, newsprint and magazines, OCC and Kraft bags, office pack/ high grade paper, oil filters, phone directories, plastic bottles and tubes, plastic film, roofing/tarpaper, salvage and used building materials, scrap metal, scrap paper, tires, wood/lumber and yard debris.
	Industrial Diversion Measurement	N/A

# PORTLAND, OREGON

(PETE CHISM-WINFIELD, [PETE.CHISM-WINFIELD@PORTLANDOREGON.GOV](mailto:PETE.CHISM-WINFIELD@PORTLANDOREGON.GOV), 503.823.7652)

	C&D Diversion Measurement	C&D is considered MSW and is included in the city's reported diversion rate. (C&D is does not have a separate diversion rate unlike some other cities). C&D materials recovered at C&D facilities count towards commercial recovery. Materials that enter C&D facilities but are ultimately landfilled are counted towards disposal.
	'Other' Diversion Measurement	The city also uses a residential recycling rate from Re-TRAC residential collection data (no C&D, no commercial sector) to provide targeted education to households.
	Excluded or omitted tonnages	Inert materials including cement, asphalt and brick are not counted toward the recovery rate. Some scrap metals including discard vehicles are also excluded. MSW excludes industrial and agricultural waste. ADC is not counted. MRF residual is counted as disposal weight.
	Notes	
DATA	Data Collection	<p>Oregon requires all publicly and privately operated recycling and material recovery operations to complete a Material Recovery Survey form. This includes landfills, local recycling collectors, private recycling collection companies and depots, transfer stations, material recovery facilities, composters, local governments, and any other operations that handles post-consumer recoverable materials. One exception is scrap metal companies because of the difficulty in separating industrial and commercial metal. The survey requires companies to report all recyclable material they handle, including the amount of each material collection, the county of origin, the company they received any transfers from and where or to whom the material was marketed.</p> <p>The City's Bureau of Planning and Sustainability tracks quantities on the residential side including hauler- reported curbside recycling and composting and adds in an estimate of bottle bill recycling from the Oregon Department of Environmental Quality. Residential solid waste disposed includes amounts report by franchisees as well as estimates for self-hauled garbage.</p> <p>On the commercial side, recycling tonnages include materials collected by haulers and material sorted at recovery facilities, as well as a jobs-based estimate of material collected via independent recyclers that is reported to the Oregon DEQ. Commercial solid waste disposal tonnages are computed by adding tonnages of waste reported by haulers, residue at recovery facilities, and estimates of material that is self-hauled to transfer stations.</p>
	Data Collection Notes	<p>Data sources:</p> <p>ReTrac- residential curbside recycling and composting, commercial curbside recycling, and composting.</p> <p>DEQ- bottle bill, independent recyclers (do not haul MSW), independent composters (do not haul anything)</p> <p>Twilight (data tracking program)- residential curbside garbage and all commercial garbage, materials recovered and landfilled at C&amp;D MRFs</p> <p>Metro- residential and commercial self-hauled tons</p>
	Data Validation	<p>Total tonnages attributed to the city are based on the ratio of population and number of jobs in the city vs. the larger Metro region.</p> <p>Once a year government official from Metro, DEQ and the city of Portland meet to review the data and avoid double counting.</p> <p>The city also reviews historic data to catch anomalies and mislabeled or misreported data.</p>
	Double counting	<p>The city keeps open lines of communication with the other reporting agency to double check data.</p> <p>Portland uses the DEQ's methods and mechanisms to look at in-county vs. out-of-county waste.</p>
	Measuring materials that flow across borders	Limited analyses.
CHALLENGE	Largest challenges Reported	<p>In measuring diversion, a community is only seeing the end of life story of a product not it is whole life. Seventy-five percent of a product's impact happens before the consumer even touches the material and by just measuring diversion these impacts are not counted.</p> <p>The diversion rate shows only one side of what is happening, it does not for example show the impacts of business growth.</p>

## PORTLAND, OREGON

(PETE CHISM-WINFIELD, [PETE.CHISM-WINFIELD@PORTLANDOREGON.GOV](mailto:PETE.CHISM-WINFIELD@PORTLANDOREGON.GOV), 503.823.7652)

	Recommendations	<p>Develop strong relationships with the MRFs and other facilities. These relationships are critical in getting and maintaining a flow of data and understanding their challenges or issues.</p> <p>Keep the lines of communication open with other agencies to collaborate on the collection and analysis of data.</p>
--	-----------------	---

## SEATTLE, WASHINGTON

(LUIS HILLON, [LUIS.HILLON@SEATTLE.GOV](mailto:LUIS.HILLON@SEATTLE.GOV))

<b>SUMMARY</b>	Summary of Measurement Methodology	Seattle collects recycling and disposal data from the residential, commercial, self-haul and C&D sectors. The city has hauler contracts and processor license requirements that mandate material tonnage data be reported to the city. The city also tracks self-haul data from material brought to the city's transfer stations for compost and recyclables. The city created and uses the Seattle Discards Model which establishes a relationship between garbage, recycling and organics collection quantities and factors that affect these discard amounts including factors like housing prices, household size and unemployment rate. The city has an overall targeted recycling rate goal as well as goals for single family homes, multi-family homes, the commercial sector, C&D waste, and the self-haul sector.							
	<b>GOALS</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">Diversion Rate/Year</td> <td>2018 estimated recycling rate- 56.5% 2018 C&amp;D sector diversion rate- 73.6%</td> </tr> <tr> <td>Statewide Goal</td> <td>No diversion rate goal, only a generation goal. In 2019 the state, after achieving their 50% diversion rate goal in 2011, decided to change their key metrics from tracking statewide recycling rate to tracking the overall waste generation to encourage waste prevention.</td> </tr> <tr> <td>Regional, county, or municipal goals required state?</td> <td>No.</td> </tr> <tr> <td>City or municipal goal?</td> <td>Yes. The city has a goal of reaching 70% recycling rate by 2022 and a goal of 70% diversion of construction and demolition debris by 2020. Additionally, the city has sector goals of reaching 83% diversion in single family residential homes, 54% in multifamily residential, 75% in the commercial sector and 46% in the self-haul sector by 2022.</td> </tr> </table>	Diversion Rate/Year	2018 estimated recycling rate- 56.5% 2018 C&D sector diversion rate- 73.6%	Statewide Goal	No diversion rate goal, only a generation goal. In 2019 the state, after achieving their 50% diversion rate goal in 2011, decided to change their key metrics from tracking statewide recycling rate to tracking the overall waste generation to encourage waste prevention.	Regional, county, or municipal goals required state?	No.	City or municipal goal?
Diversion Rate/Year	2018 estimated recycling rate- 56.5% 2018 C&D sector diversion rate- 73.6%								
Statewide Goal	No diversion rate goal, only a generation goal. In 2019 the state, after achieving their 50% diversion rate goal in 2011, decided to change their key metrics from tracking statewide recycling rate to tracking the overall waste generation to encourage waste prevention.								
Regional, county, or municipal goals required state?	No.								
City or municipal goal?	Yes. The city has a goal of reaching 70% recycling rate by 2022 and a goal of 70% diversion of construction and demolition debris by 2020. Additionally, the city has sector goals of reaching 83% diversion in single family residential homes, 54% in multifamily residential, 75% in the commercial sector and 46% in the self-haul sector by 2022.								
<b>DIVERSION MEASUREMENT</b>	Materials Included as Diversion	All recycling, and composting (e.g., yard waste, food waste, and compostable paper/packaging) residents and businesses set out for collection, all recycling, and composting self-hauled to the City's two transfer stations and composting managed on-site by residents.							
	Industrial Diversion Measurement	N/A							
	C&D Diversion Measurement	C&D materials are not considered MSW and are not included in how Seattle calculates the City's overall recycling rate. C&D are measured separately and have a separate recycling goal.							
	'Other' Diversion Measurement	Seattle includes waste prevention data on a program-by-program basis. To estimate tons not generated the city employs various methodologies including: self-weighing; pre and post intervention survey (attitudes, behaviors, participation rates); collection data' composition studies and modeling.							
	Excluded or omitted tonnages	The MSW recycling rate excludes: the vast majority of C&D debris, HHW, biomedical waste, biosolids, asbestos, petroleum contaminated soils, scrap yard metals, dangerous (generally industrial) waste, recycling from auto wrecks, tires, any material used for beneficial use, and ADC.							
	Notes								



# SEATTLE, WASHINGTON (LUIS HILLON, [LUIS.HILLON@SEATTLE.GOV](mailto:LUIS.HILLON@SEATTLE.GOV))

<b>DATA</b>	Data Collection	<p>Solid waste processing facilities / disposal facilities and haulers are required to report tonnage annually. Amount of material is reported by material type (e.g. newspaper, ferrous metal, PET #1 etc.), material source and material destination annually. Seattle counts only what is actually recycled, composted, or reused and not just “diverted” from landfills.</p> <p>Commercial data is collected from businesses, contractors, and non-governmental entities that are required to self-report what they collect for recycling.</p> <p>Self-haul data is based on the cities’ transfer station scale house data and drop-off data.</p> <p>The city receives residential recycling and composting data from contracted haulers. Each truck trip is tracked from neighborhood to processing center. The city summaries the data into quarterly reports and publishes these on-line. Oil and electronics tonnage collected curbside is also reported by haulers. Seattle also conducts periodic composition studies on residential recycling stream.</p> <p>On-site, backyard composting data is gathered through the Home Organics Survey that is completed every five years.</p>
	Data Collection Notes	In compliance with city Ordinance 124076, C&D processing facilities cannot send certain banned materials to landfills including: concrete, asphalt paving, bricks, metal carpet, cardboard, plastic film wrap, new construction scrap, untreated wood, and tear off asphalt shingles. In order to ensure these processors are in compliances they are required to conduct a waste characterization on their C&D residual material and weigh the total amount of banned and non-banned material per sample.
	Data Validation	<p>Seattle compares report year data to historic data to check data. The city regularly does quality checks on the data it receives especially for commercial sector data.</p> <p>The city also uses a tool to analyze its recycling performance: the Seattle Discards Model (SDM). The SDM establishes a relationship between trash, recycling and organics and factors that affect the amount of material discard. The SDM contains a set of equations to calculate expected garbage, recycling and organics discard quantities depending on factors such as: unemployment rate, housing prices, household size, actual status of household income, average and marginal fees for collection, and other factors such as temperature and precipitation. The model includes equations for residential garbage, residential recycling, residential organics, self-haul garbage and commercial garbage. Each equation has its own set of factors which explain variations in the waste streams.</p>
	Double counting	Double counting is an issue in the city. Frequent revisitations of the data prevents double counting of materials.
	Measuring materials that flow across borders	They do have an issue with materials being generated in city hauled to facilities outside the city and vice versa, outside materials coming into city. Try to track based on haulers’ data and working with out of city facilities.
	Statistical analyses of data	Limited.
	<b>CHALLENGES / RECOMMENDATI</b>	Largest challenges Reported

## SEATTLE, WASHINGTON (LUIS HILLON, [LUIS.HILLON@SEATTLE.GOV](mailto:LUIS.HILLON@SEATTLE.GOV))

**Recommendations** An important aspect of gathering and tracking data is continuously checking to determine quality and accuracy of the data.

Examining waste streams by activity / location, like single family vs multifamily homes, can help a city set realistic diversion goals. The waste and recycling streams might be similar but different sectors have different challenge, whether it be around education and outreach or turnover or something else. Making more specific goals can help set a city up for success and help track which areas need the most help.

# APPENDIX G: 2019 COLORADO DATA

## Colorado diversion data, 2019

2019 Diversion rates	2019 Totals	Diversion by region	Diversion composition	Material diversion trends	Total generation
----------------------	-------------	---------------------	-----------------------	---------------------------	------------------

### 2019 Recycling

Material	
Cardboard	303,461
Commingled (mixed) recyclables	1,937
Electronics	13,995
Glass containers	42,646
Metal containers	11,389
Other (batteries, bulbs, paint)	3,270
Paper	104,910
Plastics (#1-7)	30,312
Textiles (carpet, clothing)	5,977
Tires	25,406
White goods/ferrous, nonferrous metals	71,076
Yard trimmings/ wood (mulch)	237,358
<b>TOTAL</b>	<b>851,737</b>

### 2019 Composting

Material	
Food scraps	170,755
Yard trimmings/wood	133,447
<b>TOTAL</b>	<b>304,202</b>

### 2019 MSW per capita rates

MSW type	
MSW disposal (landfill)	5.8
MSW diversion (recycling + composting)	1.1
MSW generation	6.9

### 2019 Industrial diversion totals

Industrial diversion by type	
Asphalt, concrete, aggregate	2,931,557
Coal combustion residuals	183,035
Compost feedstock (Industrial, Ag.)	188,745
Construction & demolition debris	65,495
Land application of organics (beneficial use)	166,319
Tires (energy recovery)	54,164
Used oil, antifreeze	31,345
<b>Total Industrial Disposal</b>	<b>3,578,452</b>
<b>Total Industrial Diversion</b>	<b>3,620,660</b>

### 2019 MSW

MSW category	
MSW disposal (landfill)	6,115,262
MSW diversion (recycling + composting)	1,155,939
MSW generation	7,271,201

MSW Diversion Rate: **15.9%**

### 2019 diversion totals

2019 Colorado Totals	
Total diversion (Industrial + MSW diversion)	4,776,599
Total disposal (Industrial waste + MSW)	9,693,714
Total generation	14,470,313

Total Diversion Rate: **33.0%**