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Disclaimers

- The results contained in this presentation are in draft form and subject to change. Results are not currently available for public distribution.
- Although the information in this presentation has been funded fully or in part by the United States Environmental Protection Agency (U.S. EPA) under agreement with the Maine Department of Environmental Protection (Department), it has not been subjected to the Agency's publications review process and therefore, may not reflect the views of the Agency and no official endorsement should be inferred.
- This presentation contains draft results of Maine's first agency-sponsored statewide waste characterization study. However, we wish to acknowledge an earlier attempt at characterizing Maine's MSW stream: *2011 Maine Residential Waste Characterization Study,* University of Maine School of Economics Staff Paper #601, by Professor George K. Criner and student Travis L. Blackmer. No attempt has been made to compare results.

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Acronyms

- **ADC**: Alternative Daily Cover
- **CDD**: Construction and Demolition Debris
- **EPA**: US Environmental Protection Agency
- **EPR**: Extended Producer Responsibility
- **HHW**: Household Hazardous Waste
- **ICI:** Industrial/Commercial/ Institutional
- **MSW**: Municipal Solid Waste
- **QAPP**: Quality Assurance Project Plan
- **SAHP:** Safety and Health Plan
- **WCS**: Waste Composition Study or Waste Characterization Study
- **WTE**: Waste-to-Energy

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About MSW Consultants

- Independent Consultants Specializing in the **Municipal Waste Management Sector**
- Wide Knowledge of **National Waste Management Best Practices**
- Deep Understanding of **Materials Management Market Dynamics**
- Industry-Leading **Solid Waste Operational Evaluation & Performance Modeling**
- **Collection, Disposal & Recycling Procurement** Experts

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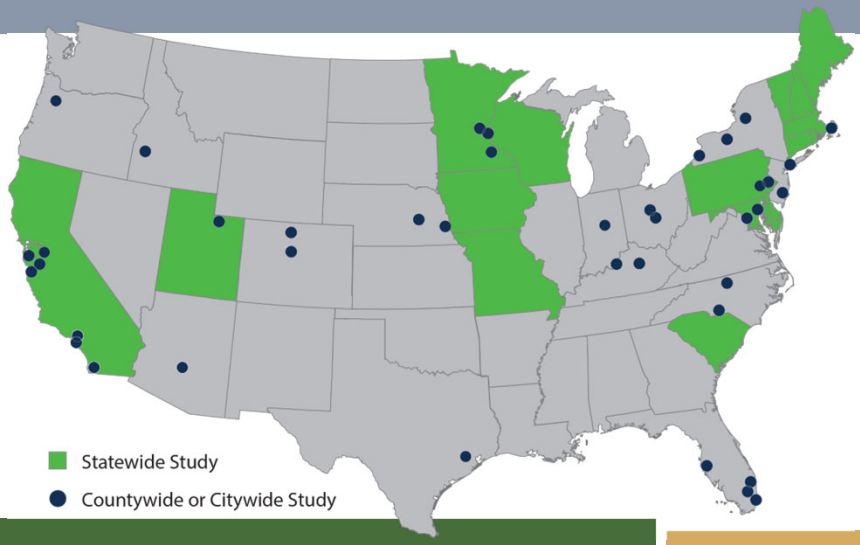
Large-Scale Materials Characterization Specialists



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Solid Waste



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Maine MSW and CDD Disposal

Disposal Facility	MSW	CDD	Total
Landfills	544,148	527,981	1,072,129
WTE	305,923		305,923
Total	850,071	527,981	1,378,053

Project Focus:

- MSW and CDD generated and disposed in Maine
- We did not deploy field research teams to other states that may receive Maine wastes
- We avoided imported MSW and CDD

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Study Elements

Waste Composition Field Research

- **Annual Tonnage** data review
- **Gate Surveys** at 8 facilities
- **MSW Composition** (manual sorts) at 10 facilities over 2 seasons
- **CDD/Bulky Waste Composition** (visual surveys) at 11 facilities over 2 seasons

Supplemental Research

- Residential Food Scrap Management Survey
- Organics Transportation Research
- CDD Disposition Data Analysis

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Gate Survey Summary

Facility Name	Location	Facility Type	Number of Gate Survey Days
Waterville Transfer Sation	Waterville	Transfer Station	1
Westbrook Transfer Station	Westbrook	Transfer Station	1
Pine Tree Waste TS - West Bath	West Bath	Transfer Station	1
Crossroads Landfill	Norridgewock	Landfill	2
Hatch Hill Solid Waste Landfill	Augusta	Landfill	1
Juniper Ridge Landfill	Old Town	Landfill	2
ecomaine Waste-to-Energy	Portland	WTE	1
Maine Waste-to-Energy	Auburn	WTE	1
Total			10

- 1,001 inbound trucks were surveyed
- Many drivers reported collecting both residential and ICI material on the same route
- The gate surveys focused on the sites receiving the largest tonnages; additional sites were included in the field surveys for manual sorts and CDD visuals

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Gate Surveys Results: Transfer Stations

Metrics	Residential MSW	ICI MSW	CDD	Total
Composition of Inbound MSW	41.1%	58.9%	N/A	100.0%
Composition of All Inbound Wastes	31.4%	45.1%	23.5%	100.0%
Adjusted Tons	219,377	314,542	163,942	697,861

Findings

- Roughly one-quarter of inbound material was CDD/Bulky Waste
- ICI (non-residential) wastes were more prevalent than residential wastes

DRAFT RESULTS

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Gate Surveys Results: WTE Facilities

Findings

- Similar residential/ICI split as transfer stations
- De minimis inbound CDD is incinerated at ecomaine
- Maine WTE inbound CDD loads are transferred to landfill

Metrics	Residential MSW	ICI MSW	Mixed MSW	Total
Composition of Inbound Wastes Identifiable by Generator	43.1%	56.9%	0.0%	100.0%
Composition of All Wastes	40.5%	53.5%	6.0%	100.0%
Adjusted Tons	123,982	163,546	18,394	305,923

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Gate Surveys Results: Landfills

Metrics	Residential MSW	ICI MSW	CDD	Mixed	Total
Composition of Inbound MSW	17.3%	22.4%	N/A	60.3%	100.0%
Adjusted Tons	94,070	121,706	N/A	328,372	544,148
Composition of All Inbound Wastes	8.8%	11.4%	49.2%	30.6%	100.0%
Adjusted Tons	94,070	121,706	527,981	328,372	1,072,129

Findings

- Similar residential/ICI split as transfer stations and WTEs in inbound MSW
- Over 60% of reported MSW arrives on transfer trailers
- Roughly half of inbound wastes are reported by the facilities as CDD

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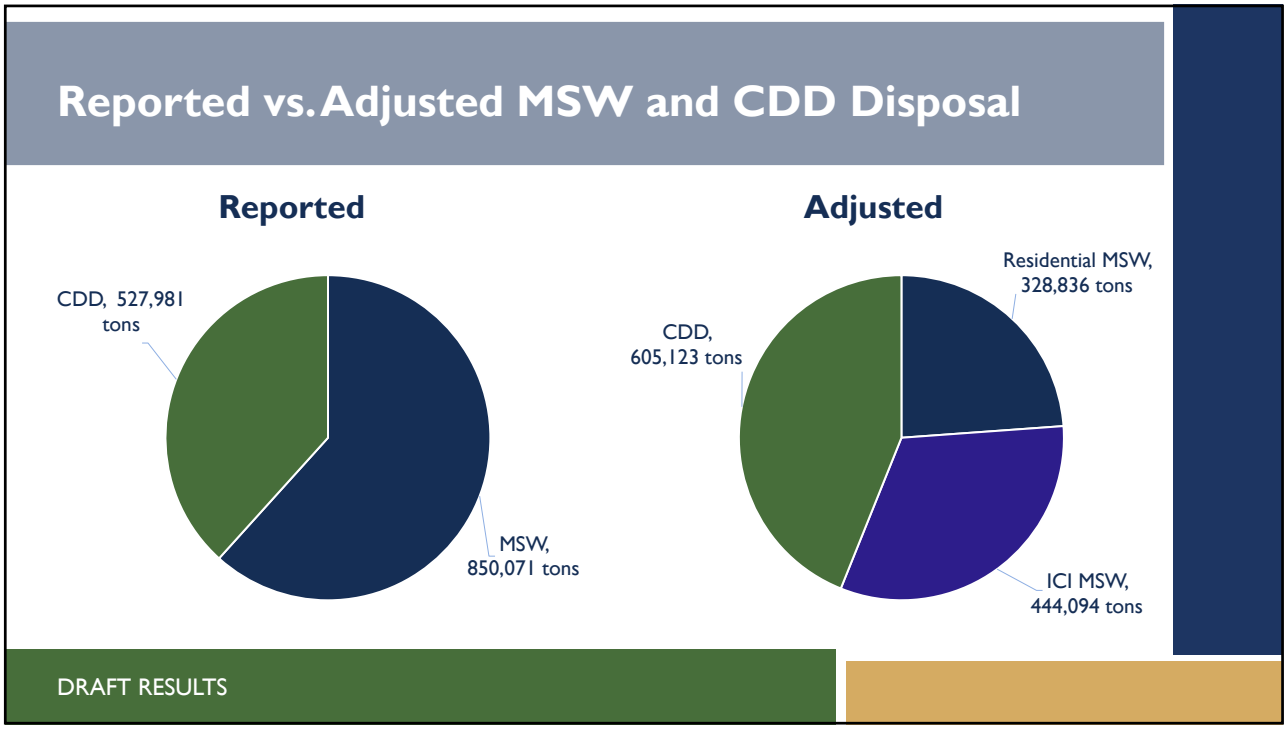
Reported vs. Adjusted MSW and CDD Disposal
Reported
CDD, 527,981 tons
MSW, 850,071 tons
Adjusted
Residential MSW, 328,836 tons
CDD, 605,123 tons
ICI MSW, 444,094 tons
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Field Data Collection

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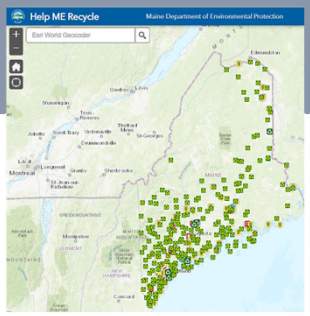
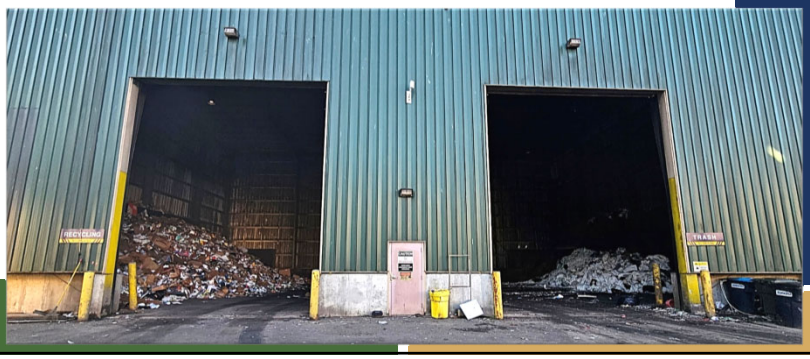
Methodology

- Sampling Plan
- Host Facilities
- Material Categories
- "Divertibility" of Wastes
  - Recyclable
  - Compostable
  - Special Collections
  - Non-divertible
- Data Management
- Safety and Health





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Sampling Targets – MSW (Manual Sorts)

Facility	Targeted	Actual
Juniper Ridge Landfill	56	61
Crossroads Landfill	42	42
ecomaine Waste-to-Energy	40	50
Maine Waste-to-Energy	20	23
Hatch Hill Solid Waste Landfill	10	11
Westbrook Transfer Station	8	10
Waterville Transfer Station	8	15
Wells Transfer Station	8	12
Pine Tree Waste Transfer Station (West Bath)	8	14
Tri-Community Landfill	N/A	30
Total	200	268

Notes

- Wide distribution of facility participation across Maine
  - Tri-Community in The County was an add-on site to ensure coverage of northern Maine
- Overall targets were met or exceeded

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Sampling Targets – CDD/Bulky Waste (Visual Surveys)

Notes

- Based on reported tonnage, JRL and Crossroads were assigned substantial CDD survey targets
  - Gate surveys and field observations revealed limited direct haul CDD
  - JRL primarily receives CDD in transfer trailers in the form of:
    - CDD from Maine Transfer Stations
    - Imported CDD "Product" for ADC stabilization
- Redistribution of targets after gate surveys
- Targets met or exceeded

Facility	Targeted	Actual
Juniper Ridge Landfill (JRL)	220	0
Crossroads Landfill	50	19
Troiano Waste Services	30	51
City of Portland (Riverside Facility)	24	52
Waterville Transfer Station	14	50
Pine Tree Waste Transfer Station (West Bath)	10	17
Westbrook Transfer Station	10	29
Wells Transfer Station	2	12
Hatch Hill Solid Waste Landfill	0	34
Tri-Community Landfill	0	23
Maine Waste-to-Energy	0	60
ecomaine Waste-to-Energy	0	39
Total	360	386

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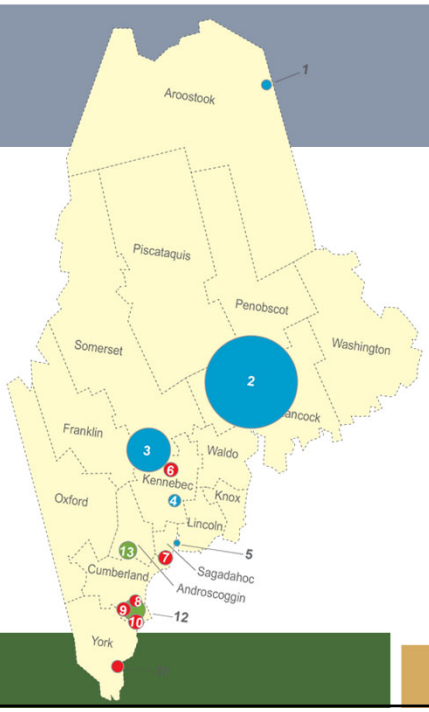
Host Facilities

1 Tri-Community Landfill
2 Juniper Ridge Landfill
3 Crossroads Landfill
4 Hatch Hill Solid Waste Landfill
5 City of Bath Landfill
6 Waterville Transfer Station
7 Pine Tree Waste Transfer Station (West Bath)
8 Riverside Recycling Facility Transfer Station
9 Westbrook Transfer Station
10 Troiano Waste Services Transfer Station
11 Wells Transfer Station
12 ecomaine Waste-to-Energy
13 Maine Waste-to-Energy



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MSW Material Categories & Divertibility

Material Groups

- Paper
- Plastic
- Metal
- Glass
- Organics
- Electronics
- Batteries
- Universal/Hazardous Waste
- CDD
- Special and Other Waste

"Divertibility"

- Commonly Recycled
- Compostable
- Recyclable via Special Collection
- Potentially Divertible
- Processible CDD of Source Separated
- Not Currently Recoverable in Maine

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CDD/Bulky Waste Material Categories & Divertibility

Material Groups

- Same as MSW

Recast Material Groups

- Wood
- Shingles
- Metal
- Inert Materials
- Bulky Items
- Other CDD
- MSW

Divertibility

- Commonly Recycled
- Green Waste and Clean Wood
- Divertible in Select Markets
- Suitable for Alternate Daily Cover
- Not Currently Divertible in Maine

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Data Management

- Tablet-based data entry
- Built-in QA/QC
- Upload to cloud

Result:

Maximum accuracy and data security

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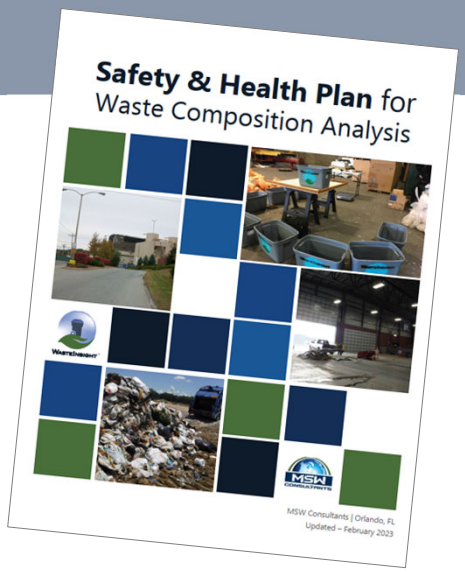
Safety and Health

- Site specific safety briefings
- Zero accidents while in the field
- SAHP QA'd by professional Health and Safety Inspector



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Manual Sorting



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CDD/Bulky Waste Visual Surveys





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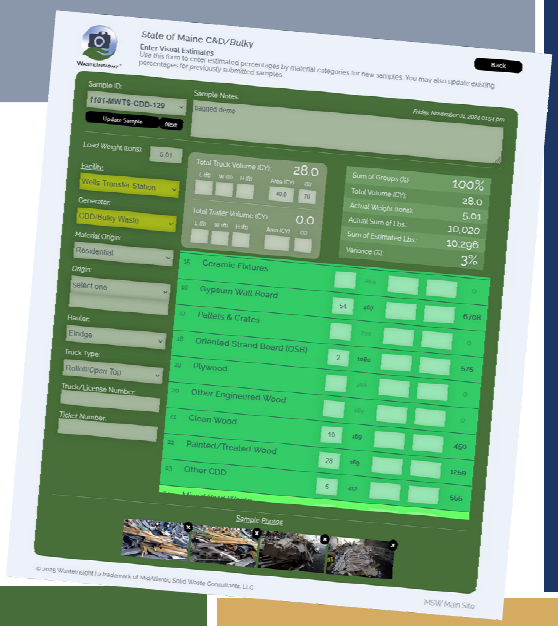
CDD/Bulky Waste Visual Surveying

- Apply industry standard density factors for CDD categories
- Volumetric surveys
- Tablet functionality



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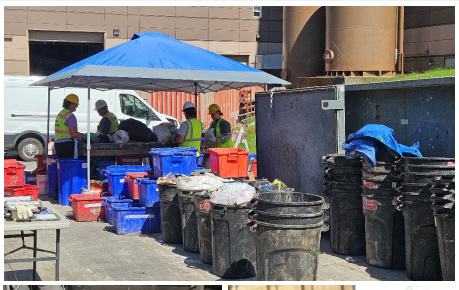
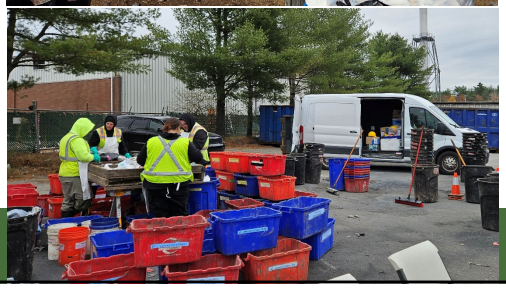
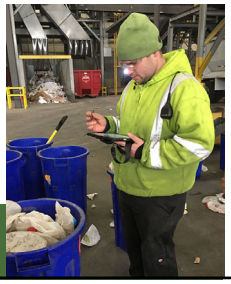
Data Management







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Acknowledgements

- **Facility Hosts**
  - Juniper Ridge Landfill
  - Crossroads Landfill
  - Hatch Hill Solid Waste Landfill
  - Tri-Community
  - ecomaine Waste-to-Energy
  - Maine Waste-to-Energy
  - Westbrook Transfer Station
  - Waterville Transfer Station
  - Wells Transfer Station
  - Pine Tree Waste Transfer Station (West Bath)
  - Troiano Waste Services
  - City of Portland (Riverside Facility)

Thank You!

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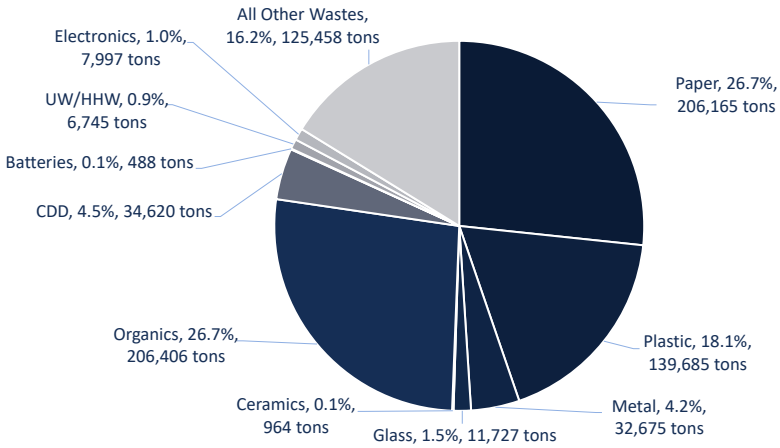
Maine MSW Composition by Material Group



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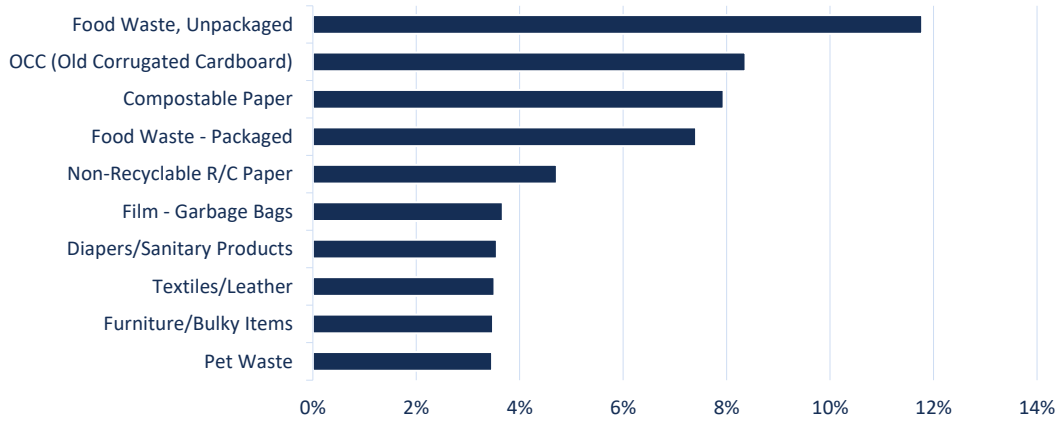
Top 10 Constituents in MSW



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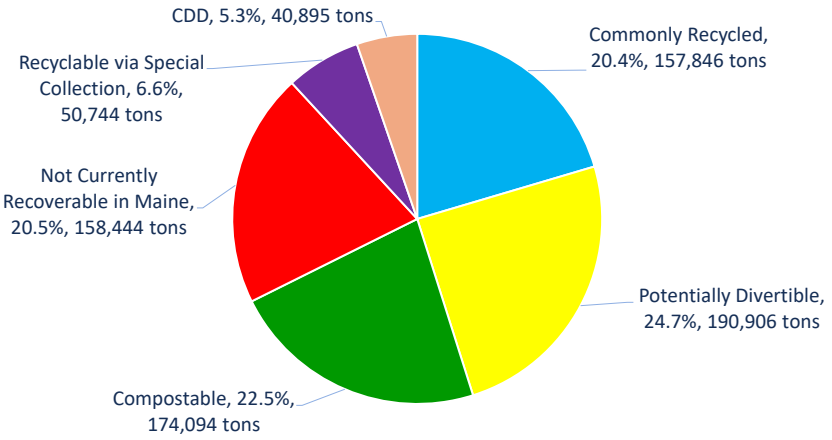
Divertibility of MSW



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Detailed Results

Key	Material Category	Mean	Margin of Error	Tons
Material Group 1 - Paper		**26.7%**	**1.1%**	**206,165**
CR	OCC (Old Corrugated Cardboard)	8.4%	0.9%	64,665
CR	Boxboard (Chipboard)	1.5%	0.1%	11,537
CR	Aseptic and Gable Top Cartons	0.4%	0.1%	3,194
CR	High Grade Office Paper	0.3%	0.1%	2,037
CR	Magazines/Catalogs	0.5%	0.1%	3,523
CR	Mixed Recyclable Paper	2.3%	0.2%	18,037
CR	Newsprint	0.3%	0.0%	2,049
PD	Books	0.4%	0.1%	3,268
CO	Compostable Paper	7.9%	0.4%	61,388
NR	Non-Recyclable R/C Paper	4.7%	0.7%	36,468
Material Group 2 - Plastic		**18.1%**	**0.9%**	**139,685**
CR	#1 PET Beverage Bottles	0.9%	0.2%	6,725
CR	#1 PET Thermoforms	0.6%	0.1%	4,408
CR	#2 HDPE Beverage Bottles	0.0%	0.1%	149
CR	#2 HDPE Containers	1.1%	0.2%	8,716
CR	#3, 4, 5, 7 Bottles & Cont.	0.0%	0.0%	233
CR	#5 PP Containers	1.1%	0.1%	8,495
CR	#6 PS Rigid Containers	0.3%	0.1%	2,049
NR	#6 EPS Foam Food and Bev. Cont.	0.1%	0.0%	1,089
NR	#6 EPS Foam Non-Food Pkg./Prod.	0.2%	0.1%	1,621
PD	Bulky Rigids >1 Gallons	2.3%	0.3%	17,593
PD	Plastic Film	8.6%	0.1%	66,106
NR	Remainder/Other Plastic	2.9%	0.4%	22,500
Material Group 3 - Metal		**4.2%**	**0.5%**	**32,675**
CR	Aluminum Cans	0.5%	0.0%	4,116
CR	Aluminum Foil & Pans - NBB	0.3%	0.0%	2,665
CR	Ferrous Containers	0.8%	0.1%	6,171
PD	Other Ferrous	1.6%	0.4%	12,517
PD	Other Non-Ferrous	0.9%	0.2%	7,206
Material Group 4 - Organics		**26.7%**	**1.3%**	**206,406**
PD	Food Waste - Packaged	7.4%	0.6%	57,276
CO	Food Waste, Unpackaged	11.8%	0.8%	91,064
CO	Branches and Stumps >1"	0.0%	0.1%	250
CO	Mixed Yard Waste	1.4%	0.4%	10,795
CO	Clean Wood	1.4%	0.4%	10,598
NR	Other Organics	1.2%	0.2%	9,642
NR	Pet Waste	3.5%	0.5%	26,781
Material Group 5 - Batteries		**0.1%**	**0.0%**	**488**
RS	Batteries	0.1%	0.0%	488
Material Group 6 - Glass		**1.5%**	**0.2%**	**11,727**
CR	Glass Bev. Bottles & Cont.	1.2%	0.2%	9,077
NR	Other Glass (Non-Container)	0.3%	0.2%	2,650
Material Group 7 - Electronics		**1.0%**	**0.2%**	**7,997**
RS	Non-CED Electronics	0.2%	0.0%	1,301
RS	CED Electronics	0.1%	0.0%	628
RS	Other Electronics	0.1%	0.1%	609
RS	Small Appliances	0.5%	0.1%	3,915
RS	White Goods	0.2%	0.2%	1,544
RS	Solar/PV Panels/Compon.	0.0%	0.0%	0
Material Group 8 - Hazardous Waste		**0.9%**	**0.3%**	**6,745**
RS	Mercury-Containing Prod.	0.0%	0.0%	12
RS	Paint	0.1%	0.0%	528
RS	HHW	0.1%	0.1%	1,107
RS	Medical Waste	0.7%	0.0%	5,098
Material Group 9 - Ceramics		**0.1%**	**0.0%**	**964**
PD	Ceramic Bottles - BB	0.0%	0.0%	5
NR	Other Ceramics Containers	0.1%	0.0%	959
Material Group 10 - CDD		**4.5%**	**0.7%**	**34,620**
CD	Asphalt Brick and Concrete	0.0%	0.0%	164
CD	Asphalt Shingles	0.1%	0.1%	1,122
CD	CDD Metal	0.2%	0.1%	1,629
CD	Ceramic Fixtures	0.0%	0.0%	306
CD	Drywall/Gypsum Board	0.4%	0.2%	2,757
CD	OSB/Plywood	0.1%	0.1%	837
CD	Other/Residual CDD	2.1%	0.4%	16,205
CD	Painted/Treated Wood	1.5%	0.4%	11,601
Material Group 11 - All Other Waste		**16.2%**	**1.1%**	**125,458**
CD	Carpet/Padding	0.8%	0.3%	6,275
NR	Diapers/Sanitary Products	3.6%	0.5%	27,500
PD	Furniture/Bulky Items	3.5%	0.9%	26,935
RS	Supplem./Pharma./Medic.	0.0%	0.0%	229
RS	Textiles/Leather	3.5%	0.3%	27,144
RS	Rubber/Tires	0.8%	0.2%	6,140
RS	Mattresses	0.3%	0.2%	2,001
NR	All Other Materials	1.5%	0.2%	11,280
NR	Fines	2.3%	0.1%	17,955
	Total	**100.0%**		**772,930**
	Samples	*268*		

DRAFT RESULTS

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Additional Data in Final Report

- Residential MSW Details
- ICI Composition Details
- Comparisons
- Statistical Tables
  - Mean Composition
  - Margin of Error

Interpreting Statistics

Ex: Corrugated Cardboard

Mean: 8.4%, or 64,665 tons

Margin of Error:

+/- 0.9%

+/- 6,676 tons

Confidence Interval (90%)

7.5% to 9.3%

57,989 to 71,341 tons

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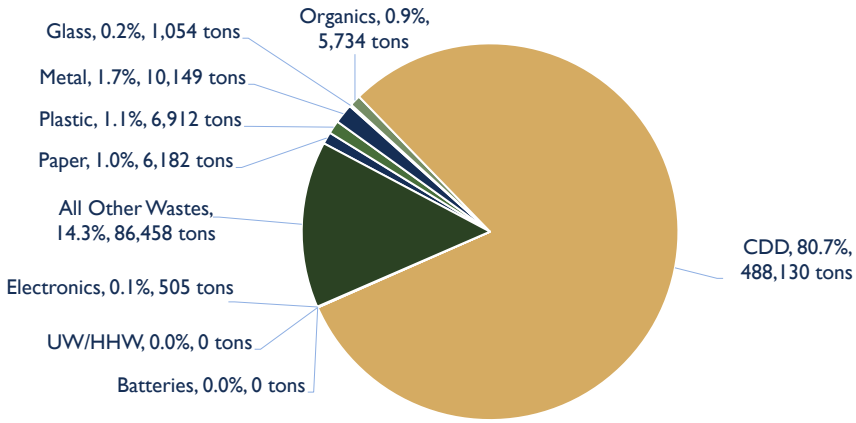
CDD Composition by Material Group



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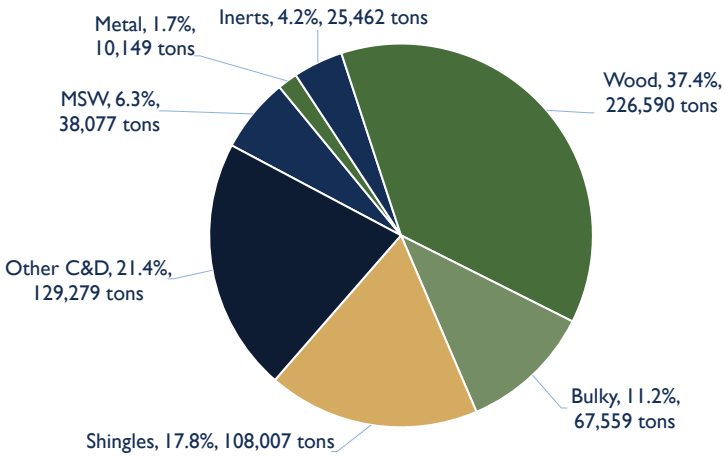
Recast CDD Composition



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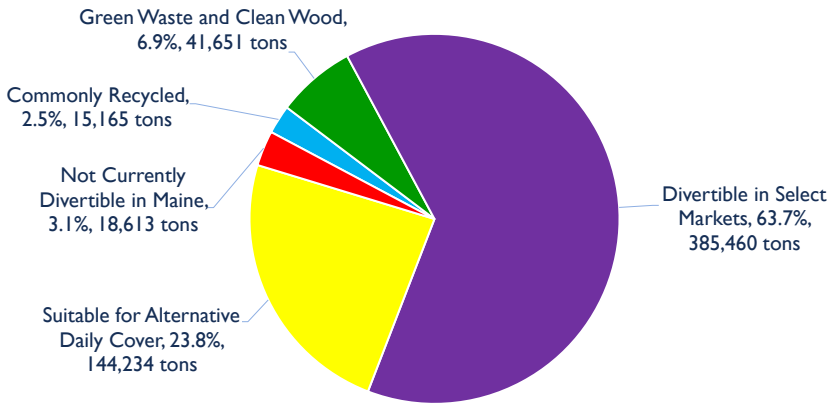
Divertibility of CDD



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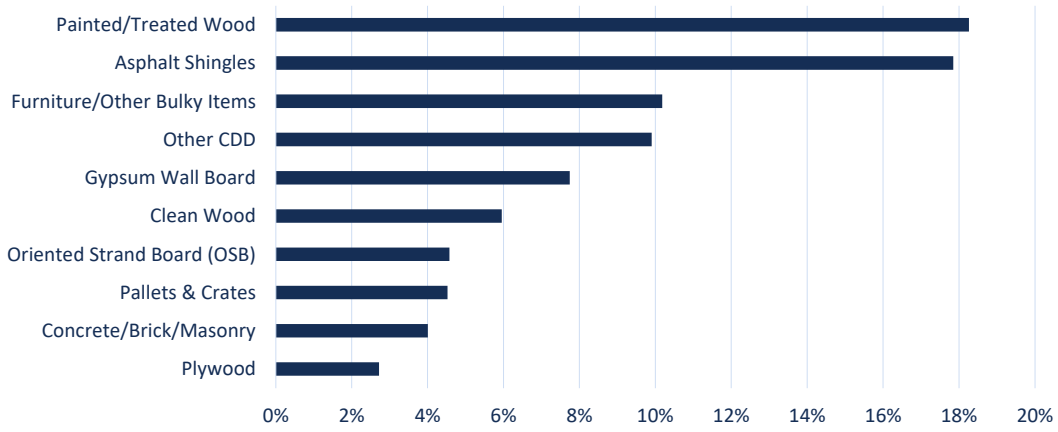
Top 10 CDD Materials



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Residential Food Scraps Management

- Survey Approach
  - Historical: Phone survey
  - 2024 Best Practice: Pre-selected panel of representative Mainers
- 925 responses from Pine Tree State Panel members
  - 41% response rate
  - MOE +/- 3.2%

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Residential Food Scraps Management

- 7 out of 10 Mainers surveyed discard some food waste in regular trash
- More than ½ of respondents divert some of their food waste most commonly via:
  - Backyard composting
  - Pet or livestock feed
  - Disposal to woods

- "Most Mainers think it is true that diverting food waste is good for the environment and think that Mainers should participate in [diversion]."
- "It is estimated that the average household in Maine diverts about 7 pounds of food waste per week, which amounts to about 360 pounds per year."

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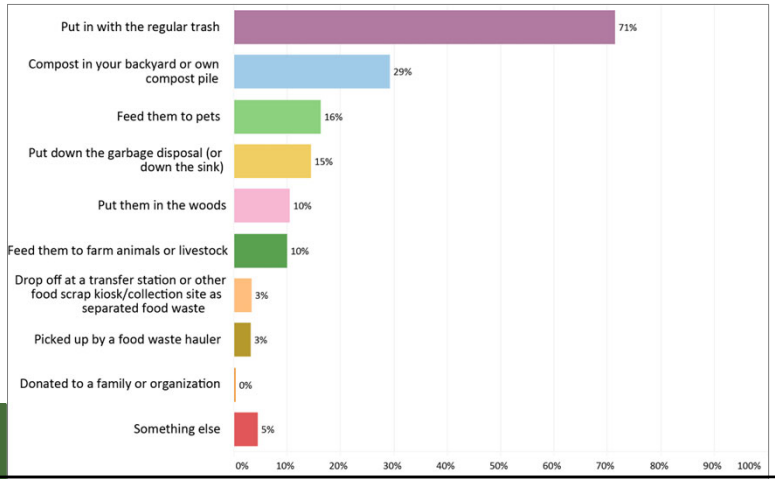
Estimating Residential Food Scraps Diversion

Figure 10a: Which of the following does your household do with food waste that comes from eating or preparing food, including any scraps, inedible parts, and spoiled or rotten foods? (Select all that apply)



Source: University of NH Survey Center

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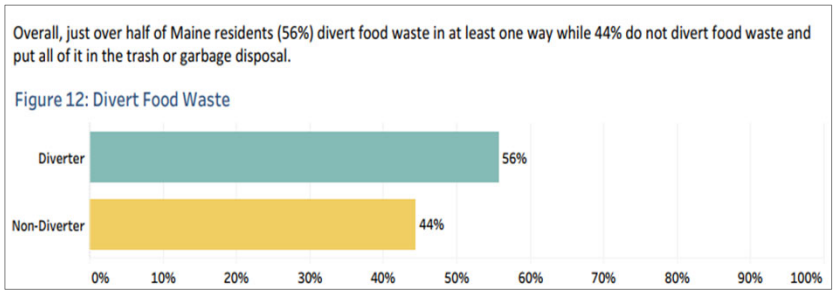
Estimating Residential Food Scraps Diversion

Figure 12: Overall, just over half of Maine residents (56%) divert food waste in at least one way while 44% do not divert food waste and put all of it in the trash or garbage disposal.



Source: University of NH Survey Center

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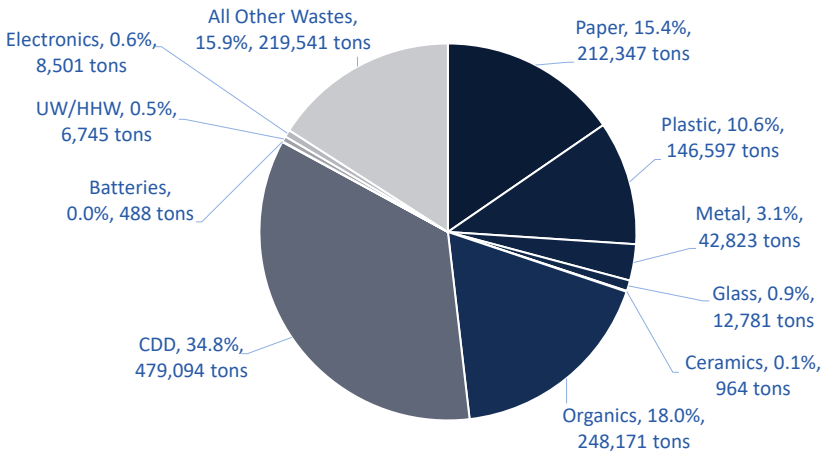
MSW + CDD Composition



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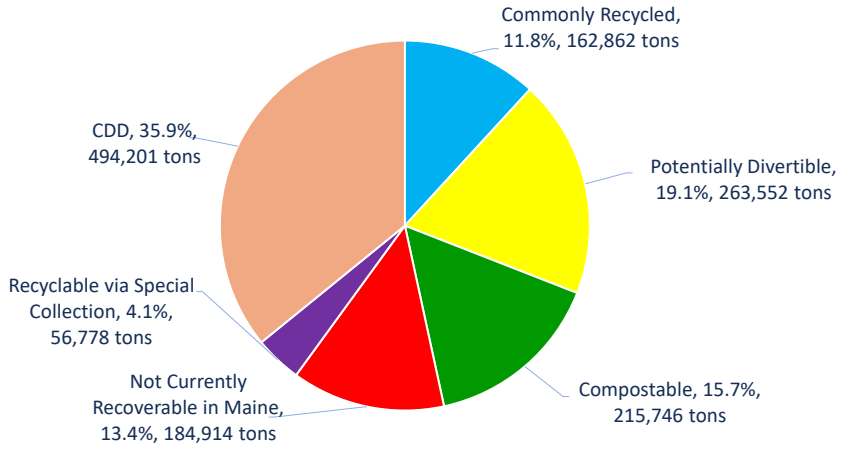
MSW + CDD Divertibility



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Value of Disposed Recyclable Fiber and Containers

Recyclable Paper

Material Components	Estimated Tons Disposed	Average Market Price ($/ton) [1]	Estimated Total Market Value ($) [2]
OCC (Old Corrugated Cardboard)	64,665	$101	$6,531,000
High Grade Office Paper	2,037	$127	$259,000
Mixed Recyclable Paper	18,037	$58	$1,046,000
Newsprint	2,049	$80	$164,000
Magazines/Catalogs	3,523	$80	$282,000
Boxboard (Chipboard)	11,537	$58	$669,000
Total Paper	101,847	$88	$8,951,000

[1] Source: Recyclingmarkets.net - Northeast Region of U.S., 2024 annual average.
[2] Rounded to the nearest whole thousand.

Recyclable Containers

Material Components	Estimated Tons Disposed	Average Market Price ($/ton) [1]	Estimated Total Market Value ($) [2]
#1 PET Beverage Bottles - BB	3,857	$340	$1,311,000
#1 PET Bottles and Jars -NBB	2,868	$340	$975,000
#1 PET Thermoforms	4,408	$170	$749,000
#2 HDPE Natural Beverage Bottles - BB	83	$871	$73,000
#2 HDPE Colored Beverage Bottles - BB	66	$319	$21,000
#2 HDPE Natural Containers - NBB	4,034	$871	$3,513,000
#2 HDPE Colored Containers - NBB	4,682	$319	$1,494,000
#3, 4, 5, 7 Beverage Bottles - BB	11	$35	$0
#3, 4, 7 Bottles, Jars, Containers - NBB	222	$35	$8,000
#5 PP Containers	8,495	$165	$1,402,000
#6 PS Rigid Containers	2,049	$60	$123,000
Aluminum Cans - BB	2,885	$1,515	$4,370,000
Aluminum Cans - NBB	1,231	$1,515	$1,865,000
Aluminum Foil & Pans - NBB	2,665	$0	$0
Ferrous Containers	6,171	$188	$1,160,000
Glass Beverage Bottles - BB	3,910	-$15	-$59,000
Glass Bottles and Jars - NBB	5,168	-$15	-$78,000
Total Recyclable Containers	52,805	$321	$16,927,000

DRAFT RESULTS

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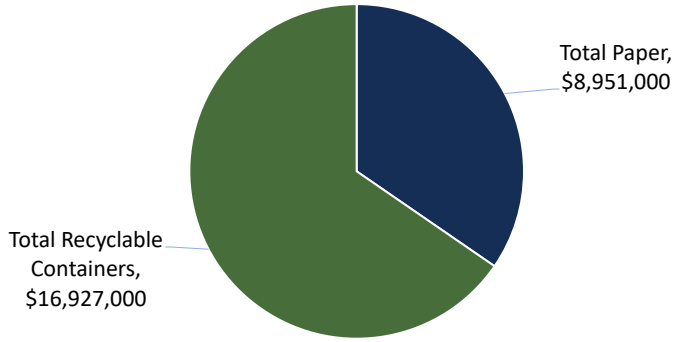
Value of Disposed Recyclable Fiber & Containers



[1] Source: Recyclingmarkets.net - Northeast Region of U.S., 2024 annual average.
[2] Rounded to the nearest whole thousand.

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Carbon Emissions from Landfilled and WTE Materials

Material Components	Tons Recycled/ Composted [1]	Emissions Reduced ($MTCO_2E$) [2]
Recyclable Paper	101,847	312,052
Corrugated Cardboard/Kraft Paper	64,665	193,023
High Grade Office Paper	2,037	6,573
Mixed Recyclable Paper	29,574	98,925
Newsprint	2,049	4,103
Magazines/Catalogs	3,523	9,428
Recyclable Containers	52,805	116,579
Aluminum	6,781	62,045
Steel Cans	6,171	7,482
Glass	9,077	2,692
PET	11,133	18,331
HDPE	8,866	13,136
PP	8,495	12,893
Mixed Plastics	2,282	0
Compostable	159,384	52,341
Food Waste	148,340	53,349
Yard Waste[3]	11,044	-1,008

TOTALS:

Tons Recycled or Composted
314,036

Emission Reduced ($MTCO_2E$)
480,972

[1] Based on estimated overall MSW waste composition estimated by this study and Maine reported MSW disposal tonnage for calendar year 2023. Assumes the materials would be recycled/composted instead of disposed.

[2] U.S. EPA Waste Reduction Model, Version 15; New England region, landfill emissions scenarios assume landfill gas recovery in place and methane is recovered for energy.

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Next Steps

- Conclude Supplemental Research
- Deliver Draft Report to the Department
- Incorporate Department Comments
- Deliver ADA-Compliant Final Report
- *Improve diversion & repeat the study in a few years!*

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Thank You

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