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Marion County, Oregon

Solid Waste and Energy Final Report

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Marion County
OREGON

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Marion County, OR Solid Waste and Energy Report

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Table of Contents

List of Tables

List of Figures

GLOSSARY

AD	Anaerobic Digester
ADC	Alternative Daily Cover
BI	Browns Island Inert Landfill – Owned by County
CIP	Capital Improvement Program
Bio-CNG	Compressed Natural Gas
CPP	Clean Power Plan from EPA to reduce Carbon Emissions
C&D	Construction and Demolition Waste
EfWF	Energy from Waste Facility
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
GBB	Gershman, Brickner & Bratton, Inc.
GF	Garten Foundation
JRMA	JR Miller and Associates
Liners	Materials used to prevent the passage of leachate from one part of the landfill area to another. May be composed of soil or may be a synthetic material.
Leachate	Water or other liquid that has been contaminated by dissolved or suspended materials as a result of contact with solid waste or solid waste byproducts.
Landfill	A solid waste facility or part of a facility for the permanent disposal of solid wastes in or on the land. This includes a sanitary landfill, balefill, landspreading disposal facility, or a hazardous waste, problem waste, special waste, wood waste, limited purpose, inert, or demolition waste landfill.
MACT	Maximum Achievable Control Technologies
MRF	Material Recovery Facility – a facility that processes and separates materials for the purposes of recycling from incoming mixed solid waste stream, or from mixed source-separated recyclable stream.
MRRF	Marion Resource Recovery Facility, previously called Marion Recycling Facility, Inc. (see facility description in Chapter 2).
MSW	Municipal solid waste (see definition)
MW	Megawatts
MWC	Municipal Waste Combustors

MWPF	Mixed Waste Processing Facility
Municipal solid waste	Waste generated by residences, offices, institutions, commercial businesses and other waste generators not producing special wastes.
NMCDF	North Marion County Disposal Facility (see facility description in Chapter 2).
NPDES	National Pollution Discharge Elimination System
OCC	Old corrugated cardboard recovered and recycled
ODEQ	Oregon Department of Environmental Quality
OEA	Oregon Office of Economic Analysis
ORS	Oregon Revised Statutes
O&M	Operations and Maintenance
OPUC	Oregon Public Utility Commission
PGE	Portland General Electric
PURPA	Public Utility Regulatory Policy Act
PVC	Polyvinyl chloride
QF	a Qualifying Facility
RFP	Request for Proposals
Recovery rate	The percentage of materials recovered, relative to the amount of waste generated. The recovery rate, as determined by the statewide goal, is calculated by adding **DEQ** approved credits to the **recycling rate**. More information, including specific credits allowed, can be found in Oregon Revised Statutes, Chapter 459A – Reuse and Recycling (see References).
Recycling Rate	The percentage of materials recycled, relative to the amount of waste generated (compare to **recovery rate)**.
Residuals	Unrecoverable material received at the recycling centers.
SKRTS	Salem–Keizer Recycling and Transfer Station
SWM	Solid waste management
SWMP	Solid Waste Management Plan
Service providers	Privately-owned businesses that provide garbage collection services. Other terms used for service providers include: **franchised collection companies** and **waste haulers**.
Single-stream recycling	A collection method where trash and recyclables are mixed together in curbside disposal and taken to a facility for sorting.
Solid waste	As defined by the Resource Conversation and Recovery Act, a broad term which includes garbage, refuse (e.g., metal scrap, wall board, etc.), sludge from treatment facilities,

	and other materials including solids, semisolids, liquids, or gaseous material from industrial, commercial, mining, agricultural, and community activities. Exceptions include domestic sewage, industrial wastewater, irrigation return flows, nuclear materials, and mining material not removed during the extraction process.
Source-separated	Separation by residents of recyclable materials into several containers for curbside collection. Compare to **commingled**.
Special waste	Certain wastes which have disposal regulations that differ from **MSW.** Each special waste category has its own characteristics and handling requirements. Some examples of special waste are: incineration ash, fluorescent bulbs, hazardous waste, latex paint, Styrofoam, and appliances.
TPD	Tons per day
TPY	Tons per year
Tipping fee	The fee charged for disposing waste at a solid waste facility such a transfer station/MRF, a landfill or incinerator.
Transfer station	A permanent facility that accepts waste and recyclable materials from self-haulers and/or franchised haulers. The waste is dumped and reloaded into larger trailers for transportation to its final destination such as the WTEF or a landfill.
Waste disposal	The discharging, discarding, or abandoning of solid wastes, hazardous wastes, or moderate risk wastes. This includes the discharge of any such wastes into or on land, air, or water.
Energy from Waste Facility	The facility located in Brooks that burns municipal solid waste and produces electricity. The facility reduces the volume of waste by 90% and results in producing ash residue (see facility description in Chapters 2 and 6).
Waste reduction	To reduce, avoid, or eliminate the generation of wastes.
Waste stream	The entire spectrum of wastes produced by all waste generators.
WR/R	Waste Recovery/Recycling

1 - Background

Marion County successfully manages an integrated solid waste program that achieves one of the highest recovery rates (59.7% in 2014, as defined by the State of Oregon, including metals and ash used as Alternative Daily Cover (ADC) at landfill but not MSW processed in waste-to-energy) in the state of Oregon. The program includes waste reduction, reuse, recycling, composting programs and delivery of solid waste to an Energy-from-Waste Facility (EfWF).

The state of solid waste management in Oregon today was largely shaped by the decisions made in the late 1980's and early 1990's. The results of the events were instrumental in how Marion County's solid waste system and programs were developed. In 1987, the county made the decision to largely manage waste within its boundaries and not rely on outside jurisdictions. This decision led to building the EfWF which is the foundation of the county's system and has created a stable and cost effective solid waste disposal system.

Covanta Marion owns and operates the EfWF within Marion County. The facility is located in Brooks, Oregon and is able to combust 187,000 tons of municipal solid waste (MSW) annually while generating about 13 Megawatts (MW) of electricity. The electricity is sold to Portland General Electric (PGE) and the revenue derived from the sale is shared with Marion County (90% Marion County, 10% Covanta), which is deducted from service fee payment requirements. The county has historically delivered an average of about 184,000 tons per year of solid waste to the facility. In 2016, the county only delivered approximately 176,298 tons due to the processing of other materials including medical and other supplemental or proprietary wastes. At the same time waste in the county increased requiring the county to landfill more than 70,000 tons, primarily at the Coffin Butte landfill operated by Republic Services. Covanta Marion has proposed expanding the EfWF to accommodate additional waste disposal from the county as well as potentially taking more specialty wastes as well as transferred waste from Metro, and its regional system, based in Portland, Oregon. The county would like to consider its level of interest in participating in the proposed expansion through a commitment for delivering more waste. The agreement with Covanta Marion expires in 2019 and the county plans to initiate discussions on extending the agreement later this year.

Marion County engaged Gershman, Brickner & Bratton, Inc. (GBB) along with J.R. Miller and Associates and Sanger Law, (GBB Team) to work with Marion County Public Works, Environmental Services Division, to:

1. Complete an analysis of Marion County solid waste management systems and prepare findings and recommendations. The analysis will include:
    a. Consideration of options to meet the state established goal of 64% recovery rate;
    b. Evaluate and address special waste options including medical waste; and
    c. Provide current cost of disposal options and available landfill capacity.

2. Review, validate and update the "Solid Waste System Assessment Report 2016" with any new information regarding medical waste and other emerging issues.

3. Monitor state and regional policy considerations that might impact Marion County's system.

4. Analyze and advise the county regarding current and future markets for power and other trends impacting the EfWF.
5. Provide advice and support to the county during negotiations with Covanta and Portland General Electric (PGE) (Phase II).

This effort began with a meeting with the Board of Commissioners on April 4, 2017, to kick-off the project and establish objectives.

The board articulated several key guiding principles to be considered as the GBB Team proceeded to evaluate alternatives and develop next steps for managing solid waste in Marion County. The finalized key guiding principles as follows:

1. After consideration of technical and economic feasibility, establish an integrated solid waste management system that will:
    a. **reduce** the amount of solid waste generated
    b. **reuse** material for the purpose for which it was originally intended
    c. **recycle** material that cannot be reused
    d. **compost** material that cannot be reused or recycled
    e. **recover energy** from solid waste that cannot be reused, recycled or composted
    f. **dispose** of solid waste that cannot be reused recycled, composted or from which energy cannot be recovered by landfilling.
2. Continue to lead the state in recovery by increasing the recovery rate from 54% towards the state's 2025 goal of 64% for Marion County.
3. Continue to develop comprehensive programs and facilities to manage waste generated in the county while:
    a. Maintaining local control of material flow
    b. Using technology with a proven successful track record
    c. Assuring programs and facilities are cost effective and maintain long-term rate stability for residents and businesses
    d. Being environmentally sound
4. Consider alternative strategies that are most cost effective and minimally impact the current rate structure.
5. Continue a cooperative effort working with local governments, citizens, businesses, and the solid waste franchisees that support Marion County's integrated solid waste system.
6. Assure that solid waste generated by Marion County residents and businesses is prioritized first when considering approaches and strategies for managing solid waste.

2 - Overview

2.1 - Review of Existing Facilities

The current system is represented in Figure 1, below, with 2016 quantities shown along with estimated 2017 quantities. These values were projected based on available information provided for the first four operating months of 2017 and compared to the same months of 2016. The quantities observed in 2017 were extrapolated for the remaining months in 2017 for each incoming and outgoing waste stream shown on the Marion Resource Recovery Facility (MRRF) Section 24 report (waste quantity analysis prepared by facility operator - Mid-Valley Garbage & Recycling Association). With the current system (status quo), the projected 2017 quantity would require landfill disposal of 92,200 tons (52,400 tons from Construction and Demolition (C&D) processing and 39,800 tons from Salem/Keizer Recycling Transfer Station (SKRTS) and direct haul MSW). This analysis has estimated that 75,000 tons of material currently being delivered to the MRRF consists of C&D material, of which 22,600 tons can be recovered. The remaining 52,400 tons of C&D material may not be suitable for the EfWF, and for the purposes of this analysis, is assumed to require landfilling. Further analysis of the individual waste streams currently coming into the MRRF are required to establish how much of this stream may be suitable for combustion at the EfWF.

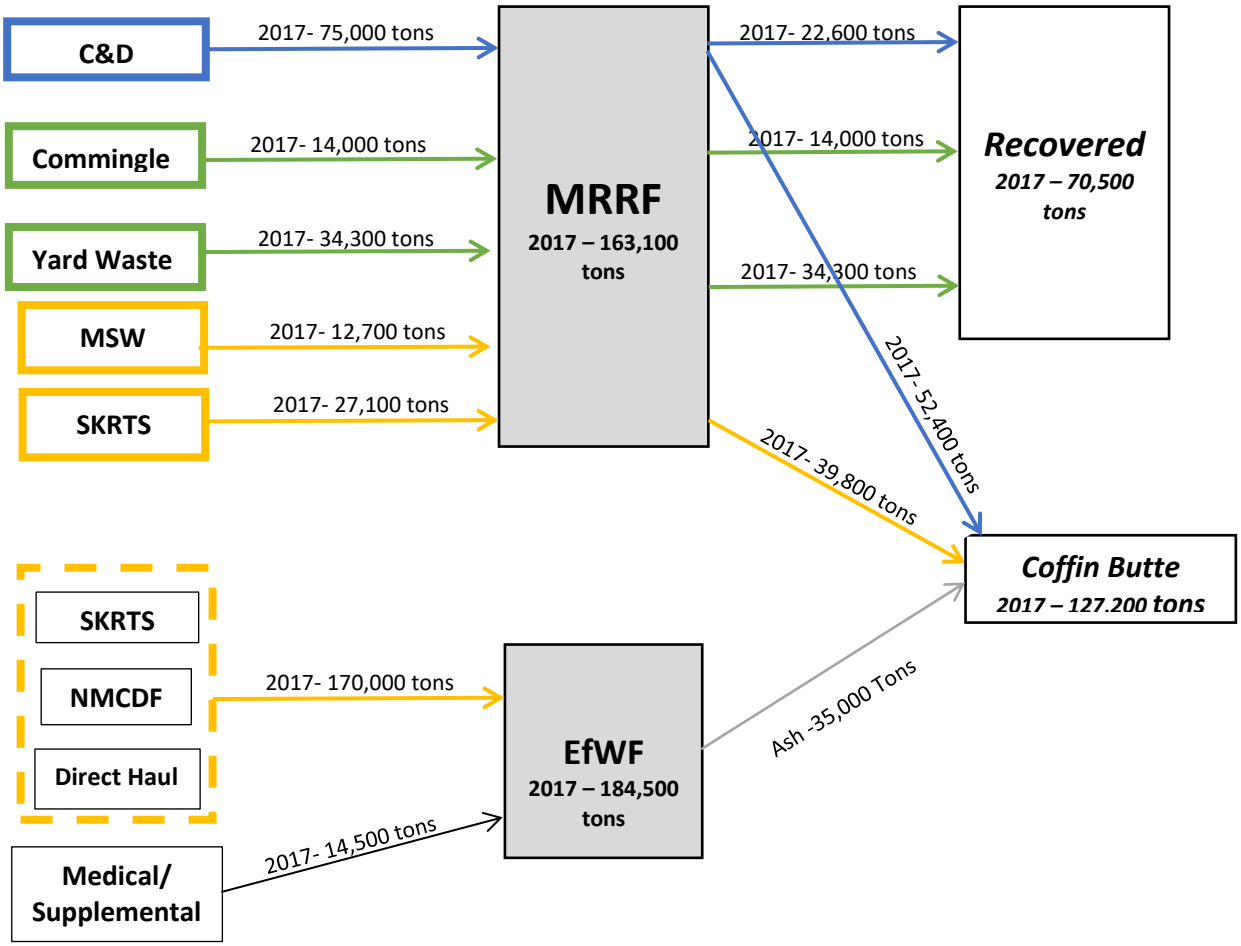


Figure 1: Waste Flows - 2017 Estimated

The county solid waste system relies on several facilities to provide convenient and cost-effective services to customers. One element of the solid waste system assessment is to evaluate the conditions and capacity of the existing facilities to meet future needs. The current operating facilities include:

1. EfWF - Owned and operated by Covanta;
2. MRRF – Owned and operated by Mid-Valley Garbage & Recycling Association;
3. SKRTS – Operated by Republic Services;
4. North Marion County Disposal Facility (NMCDF) – Owned by Marion County;
5. Browns Island Inert Landfill (BI)– Owned by Marion County; and,
6. Garten Foundation (GF).

Together these facilities comprise the infrastructure that supports the recycling and waste management services in the county. While most of the waste collected by franchised collection companies from residences and businesses is hauled directly to the EfWF, the remaining facilities are an important part of receiving recyclables and waste from various customers and for processing and transferring waste to appropriate disposal sites. The county owns and operates the NMCDF and BI. The other facilities are privately owned; however, the county operates the gatehouse and scales at the primary municipal waste handling facilities, EfWF and SKRTS.

All the facilities have been in operation for more than 25 years and each have made some improvements to adapt to provide needed services. In the 2009 SWMP, it was recommended that a facility plan be prepared to identify the improvements that may be needed to handle future needs. Unfortunately, this was not prepared and none of the facilities have made significant investments in recent years. It should be noted that substantially lower waste volumes received between 2009 and 2013 discouraged investment. However, with improved economic conditions over the past two years, including an increase in construction activity in the county, waste delivered to these facilities has increased by 30% and is more consistent with waste generated in pre-recession conditions.

With this background, the following provides a review of current facility conditions and capacity to handle future waste generated in Marion County.

2.1.1 – Covanta Energy from Waste Facility (EfWF)

With a design capacity of 187,000 TPY, the Covanta EfWF has historically been able to process a majority of the municipal solid waste that is disposed in the county. In the past during certain times of the year when waste volumes are lower, waste from Metro was delivered to ensure the plant operated at full capacity. However, with the increase in county generated waste volumes experienced over the past few years, the county can provide ample MSW needed to fulfill the capacity of the EfWF.

GBB has toured the facility, meet with Covanta personnel, reviewed performance data and evaluated current plans for capital improvements. Based upon this limited review, GBB feels that the plant is in an acceptable condition to provide similar levels of service for years to come. This level of service, reliability and performance is contingent upon a continued similar maintenance program along with implementation of a capital improvement program (CIP). Covanta has developed a preliminary CIP and provided it to GBB for review. Table 1 is a summary of the Covanta CIP with additional comments provided

by GBB. The total program is estimated (by Covanta) to cost $50 million over 10 years. However, some of the work has been completed, some is already planned for 2018 and some will need further research to establish the need for the project, alternative approaches that may exist and the accuracy of the cost estimate. GBB feels the actual cost will be somewhat less than the preliminary $50 million estimate.

Table 1: Covanta Marion Capital Improvement Program Summary

Tier One (T-1) Projects	Scope – should be done in the next 2-5 years	Estimated Cost[1], Thousands
Refuse Cranes	Replacement including bridges, trolleys, hoists, grapples.	$4,000
Martin Stoker System	Replacement with new Martin grate systems and controls.	$3,400
Demin System	Complete replacement. **GBB comment: Research Reverse Oxidation (RO) including wastewater use.**	$3,400
Main Maintenance Control Center (MCC) Controls	Major retrofit or replacement.	$3,000
Retube generating sections	Major repair. Replaced once in 2000. **GBB comment: Some of this work has been completed.**	$1,750
Retube superheater bottom 3 bundles	Replacement of bottom three bundles. The top two bundles were replaced in 2011.	$1,200
Low nox System including tile install in the furnace as part of the project	The low Nox system will more than likely be required as a change in law. Possible savings in reagents if done sooner. **GBB comment: No current change in law to impose lower permit limits.**	$3,300
Boiler Aux. Gas burners upgrade and replacement.	Complete replacement including controls. **GBB comment: Covanta is budgeting one burner for 2018.**	$1,700
Replace wall tubes in furnace and second pass with Inconel wound tubes.	Major repair/replacement – 75% of wall tubes.	$4,000
Turbine Generator Upgrade	Upgrade/replacement of turbine vibration and governor control systems. **GBB comment: Covanta has replaced governor in 2017, planning for replacement of excitation system next year.**	$700

[1] Costs were developed by Covanta and are considered preliminary

Building HVAC system	Main admin building Heating, Ventilation, and Air Conditioning (HVAC) system is outdated and not sized large enough.	$400
Replace concrete floor walls and bunkers in ash building	Ash building has been refurbished twice – time new bunker and building walls.	$800
Complete Cooling Tower refurbishment	Major refurbishment including cement basin, wooden structure and circulating pumps. **GBB comment: Variable Frequency Drives (VFDs) have been installed.**	$2,300
Total Tier One		**$29,950**
Tier Two (T-2) Projects	**Scope - should be done in the next 4-6 years**	
Control room update system controls to Distributed Control System (DCS) system	Convert to DCS system. **GBB comment: This work has been started and estimated to be 30% complete.**	$2,500
Quench Reactor (QR)/baghouse refurbishment	Major refurbishment/replacement of QR vessels and baghouse modules. Electrical and control systems upgraded and/or replaced. **GBB comment: QR vessels and hoppers have been replaced.**	$2,000
Generator coolers	Replacement.	$750
D/A tank	Replacement.	$700
Forced Draft fans	Replace element and motors.	$800
Refurbish underground wiring system seal vaults	Major refurbishment to seal the existing vaults and replace terminals and connections in the vaults.	$1,700
Upgrade fire, and gas monitoring systems and wiring	Replacement. **GBB comment: Much of this work has been completed.**	$450
Boiler feed water pumps and control valves	Replacement. **GBB comment: One pump scheduled for 2018.**	$450
Replace roadways around the facility	Major repairs.	$350
Refurbish stack liners and stack	New liners.	$650
Soot blower system	Replace controls and wiring. **GBB comment: Some of this work has been done.**	$750
Total Tier Two		**$11,100**

Tier Three (T-3) Projects	Should be done in the next 6-10 years	
Main cross over conveyor	Replacement.	$750
Ash dischargers	Replacement. **GBB comment: Unit 2 replaced in 2017, unit 1 scheduled for next year.**	$650
Miscellaneous boiler auxiliary steam and condensate lines, associated control valves	Test and repair as needed. **GBB comment: This work is ongoing.**	$500
T-2 &T-3 transformer	Replacement. **GBB comment: Not showing problems unless temperature exceeds 95F.**	$600
Main electric switchgear	Replace 52L switch. **GBB comment: Not showing problems unless temperature exceeds 95F.**	$1,200
Domestic water system	Replacement.	$450
Administration offices	Refurbish plumbing, heating, electrical & Window upgrade. Upgrade the maintenance shop and tooling Security System Elevator replacement.	$1,200
Main building and ash building roof and siding replacement	The roofs are original to the facility they will need to be replaced in the next 6-10 years.	$700
Administration offices	Refurbishment.	$300
Facility security system including cameras fencing etc.	Refurbish/replace.	$600
Parking lot and roadway	Major repair/replacement.	$1,250
Reagent and chemical feed system feed system	Refurbish and upgrade.	$750
Total Tier Three		**$8,950**
Grand Total		**$50,000**

The mass burn technology used at the plant is both efficient and environmentally safe for destruction of medical waste, making it a desirable avenue to process this waste stream, which can command higher tipping fee charges than MSW. Since medical waste does burn at a higher heating value than MSW, the amount of MSW that can be processed is impacted. For instance, processing 10,000 TPY of medical waste is expected to decrease the EfWF' s MSW processing capacity to 170,000 TPY. The exact details of how much medical waste Covanta plans to source will be determined during the upcoming negotiations with Covanta.

Looking forward to 2025, the county is projected to generate 642,000 TPY of MSW and C&D waste. Assuming the recovery rate remains constant at 53%, the remaining waste requiring disposal is estimated

to be over 300,000 TPY. Further, if the EfWF processes 170,000 TPY, the remaining waste transferred to a disposal site that will require transfer to disposal will be upwards of 130,000 TPY. Currently, less than 40,000 TPY of MSW and an estimated 52,400 tons of non-recyclable, non-combustible material from the C&D stream at the MRRF are transferred to landfills.

The fixed capacity of the EfWF and the projected growth in the county clearly indicate that existing facilities will be forced to handle an increasing volume of waste.

2.1.2-Transfer Stations

There are two transfer stations that operate in Marion County, SKRTS and NMCDF. SKRTS, located southeast of Salem off Highway 22, is a primary recycling and transfer station. The site is owned by Republic Services and operated under a franchise agreement with the county. The facility provides a full range of services for managing recyclables and waste including:

1. Recyclable materials: including lead acid batteries, mixed paper, compost, cardboard, "greyboard," food, beverage containers, glass, electronics (including, stereos, computers, phones, cell phones, printers, TVs, microwaves, plastic rigid containers #1-7, and latex paint);
2. Source separated wood waste and yard debris;
3. Construction /demolition debris;
4. MSW; and
5. Household hazardous waste facility (HHW)[2].

SKRTS plays a critical role in providing a convenient site for customers in this portion of the county. Processed materials are transported to various locations such as markets, processing facilities, and disposal sites. Yard and wood waste are reloaded into trailers for transport to Pacific Region Compost (PRC) in Benton County. MSW in the past was transported to the EfWF, but now is delivered to the MRRF. Various recyclable materials are also taken to the MRRF for transport to processors. Other recyclable materials may be delivered directly to end markets or processors.

SKRTS did not originally plan for these services. As the demand for new services occurred SKRTS was retrofitted and expanded incrementally. In 2011, the total amount of waste delivered was less than 26,000 tons. By 2015 however that amount was close to 37,000 tons, an increase over 40% in four years. The county now projects the amount of waste delivered to SKRTS will be almost 47,000 TPY in 2017.

The 2009 SWMP recognized that the SKRTS facility was nearing its capacity to handle both the increased traffic and waste volumes. JR Miller and Associates (JRMA) had prepared a preliminary concept to increase capacity. However, with the decrease in waste volumes between 2011 and 2014 there was less interest in addressing changes. With the onset of waste volumes having rapidly increased in recent years, the ability to handle these waste streams in the most efficient manner faces a considerable challenge.

If SKRTS is to continue to play a key role in providing the most cost-effective services it should be re-evaluated to determine how best to retrofit and expand and/or modify this important asset. It is critical to address capacity, taking into account tonnage increases and emphasizing approaches to reduce double

[2] The HHW facility is owned by the County and operated under a contract with Clean Harbor

handling of materials, while also incorporating safer unloading conditions and possibilities to increase potential for material recovery.

The NMCDF is a smaller transfer station owned and operated by the county that serves the northern-most portion of the county. NMCDF consists of a series of elevated tipping bays that allow cars and trucks to dump waste directly into drop boxes. The drop boxes are transported to the EfWF. NMCDF also includes a drop-off area for source separated recyclable materials as well as yard debris.

Similar to SKRTS, the amount of waste received at the facility has increased from an average of 7,500 TPY over the recent period to an estimated 12,000 TPY in 2017.

Table 2 and Figure 2 depict the historic waste quantities received at the two transfer stations over the past 10 years.

Table 2: Transfer Station Waste Flows

Transfer Station	2008 Tons	2009 Tons	2010 Tons	2011 Tons	2012 Tons	2013 Tons	2014 Tons	2015 Tons	2016 Tons	2017 Tons
NMCDF	*7,269*	*6,742*	*6,635*	*6,751*	*7,472*	*7,837*	*8,734*	*11,242*	*14,012*	*12,000*
SKRTS	*29,145*	*26,975*	*25,943*	*25,698*	*26,198*	*26,259*	*28,278*	*36,798*	*42,130*	*47,000*
Total	**36,414**	**33,717**	**32,578**	**32,449**	**33,670**	**34,096**	**37,012**	**48,040**	**56,142**	**59,000**

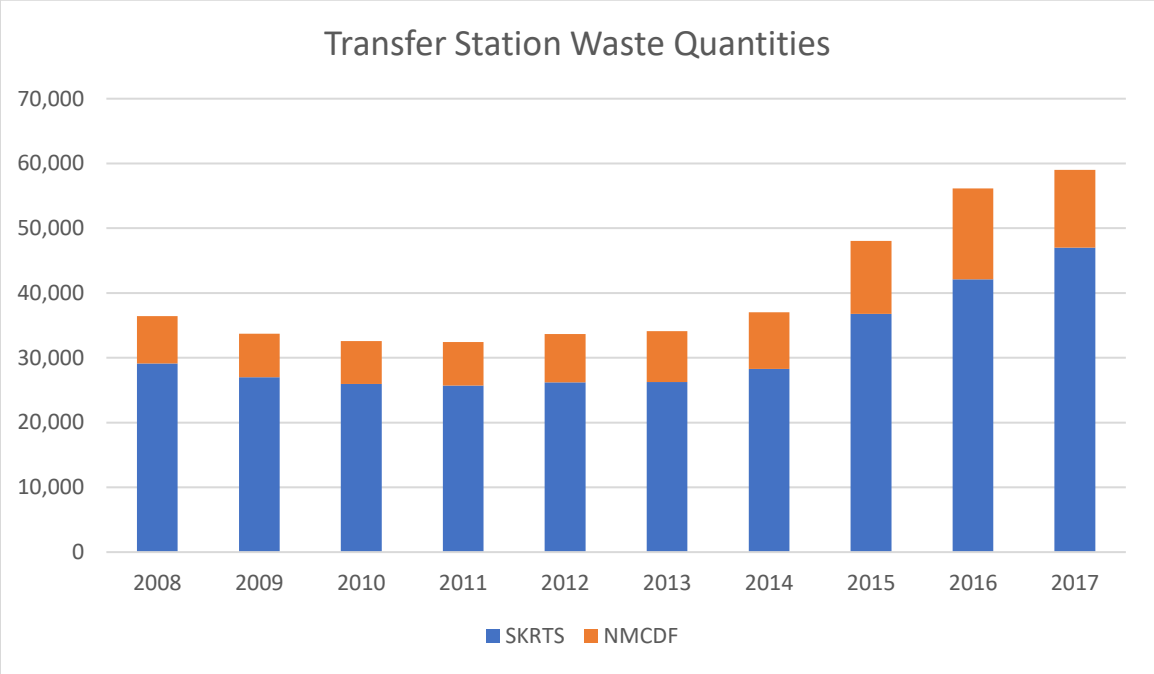


Figure 2: Transfer Station Waste Flows

For the near term, i.e. five (5) years, the NMCDF has the space and infrastructure to efficiently manage the forecasted waste quantities in this region, even while accounting for expected growth. However, certain regional events may impact the amount of waste delivered to the facility. If for instance the Riverbend landfill in Yamhill County is not granted an expansion, waste that was leaking from north Marion County will most likely be received at NMCDF. Also, other waste from south Clackamas County might migrate towards this facility. Precisely estimating how much waste may find its way to NMCDF as a result is extremely difficult but regional events of this kind could easily cause increases in waste at NMCDF.

2.1.3 - Marion Resource Recovery Facility (MRRF)

Marion Resource Recovery Facility (MRRF) is owned and operated by the Mid-Valley Garbage & Recycling Association, a cooperative of the eight (8) franchised collection companies in Marion County. The facility is located west of I-5 off the Brooks exit on a 5.4-acre parcel with a 37,000-sq. ft. building that houses processing equipment and a sorting line. The facility currently serves four primary functions:

1. MRRF processes between 150 to 200 tons per day of C&D waste material for recovery of wood, metal, cardboard, paper, concrete and other items. In addition, the MRRF removes items such as gypsum wallboard that can cause emission concerns at the EfWF. MRRF reports that it can sort select commercial loads containing higher amounts of readily recyclable materials such as cardboard, wood and metal at this facility. The loads received for processing typically do not contain putrescible (food waste) materials. The processing equipment has been in place for several years and there have not been significant changes in the unit processes. The MRRF provides a central receiving center for source separated yard debris

collected by franchised haulers. Yard waste is processed and transported to PRC in Benton County for composting.

2. The MRRF receives source separated recyclables collected by individual haulers. Previously, source separated recyclable materials were transported to one of several MRFs in Portland. However, in 2015 the Garten Foundation invested in retrofitting their operation and installed equipment to process commingled single stream recyclable materials. This allowed the franchised haulers to deliver materials directly and reduce the amount of materials transported to Portland. Garten is in the process of expanding the equipment line to increase processing capacity, thus potentially eliminating the need to receive and reload commingled single stream recyclables at the MRRF.
3. The MRRF receives MSW that would normally go to the EfWF when waste material generated within Marion County exceeds the plants' capacity. Also, the county now delivers excess waste from SKRTS to the MRRF. This waste may be processed to recover materials such as metals, wood and old corrugated cardboard (OCC), the residual is loaded into transfer trailers and taken to Coffin Butte.

For 2017, the county estimates that the MRRF will receive over 130,000 TPY which is a considerable increase from the 110,000 TPY average in years past. Most of this can be attributed to an increase in construction and the county's willingness to transport materials from SKRTS to the MRRF.

The MRRF has been a key component in the county's waste management system by effectively consolidating, processing, and recovering material generated in Marion County. However, like SKRTS, the current MRRF was not designed to handle and be the central processing and distribution center for the different waste streams. In addition, it is located on less than six (6) acres and there is limited space for expansion.

2.1.4 – Browns Island Landfill (BI)

BI, owned and operated by Marion County, is permitted to accept only inert demolition waste. The landfill primarily receives gypsum wallboard and asphalt roofing from private haulers in Marion County. The facility also receives roofing tiles, ceramics, bricks, concrete, and other inert materials. Some plastics materials such as Polyvinylchloride (PVC) and vinyl products are accepted so as to limit this material from processing at the EfWF. Since there are no liner systems installed at BI, the landfill is restricted from accepting all other types of waste.

Between 2009 and 2012, waste quantities received at BI were more than 30% less than preceding years. More recently the amount of waste received increased to pre-recessionary levels. The Marion County Environmental Services Division provided updated projections that indicate the landfill has about 300,000 cubic yards of capacity. Assuming a worst-case scenario that it will average 50,000 yards of loose material and a compaction ratio of 2:1, the landfill life remaining is estimated between 10 and 14 years. Environmental Services routinely completes an aerial survey to monitor the fill rate and remaining capacity.

Based on current projections there is sufficient capacity in BI to handle inert waste generated in the county for 12-14 years, depending on waste flow trends. The facility is an integral part of the solid waste system since it offers a proper disposal site for waste that cannot be processed at the EfWF, and the waste does not need to be transported outside the county.

BI also has a composting operation for yard debris generated from the parks and public spaces maintenance activities, as well as from the City of Salem and NMTS.

There appears to be sufficient capacity to continue operating BI for up to 14 years. However, the site's proximity to the Willamette River may potentially be considered a future liability.

2.1.5 – Garten Foundation – Material Recovery Facility (MRF)

Garten Foundation operates a recycling facility in Salem and is an important component of recycling services in the county as well as the entire region. The facility has worked with the county and haulers to process mixed fiber loads into various categories for specific markets. Garten also operates an electronics recycling facility.

In 2015, Garten installed new equipment to process commingled single stream materials, enhancing their capacity to process recyclable materials collected from residential customers in Marion County. The initial equipment installation primarily focused on increasing throughput and effectively separating large fiber from the containers. Whereas this initial screening process has been very effective, over the past two years Garten has learned there is still an appreciable quantity of small fiber that is being conveyed to the container line and is not recovered. This was somewhat anticipated; however, because of budget limitations it was decided to delay any investments in additional equipment until there was more operational experience to determine the best approach to maximize recovery.

Garten is now installing additional equipment to recover the smaller fiber materials, remove glass and more effectively recover aluminum. This new equipment will enhance the quality of materials recovered from the containers line and improve throughput. The equipment is scheduled to be operational by December 2017. Once commissioned, the facility is expected to have the capacity to process all the commingled materials collected from residential customers in the county. This may result in lowering overall system cost as materials will be processed in Marion County thereby eliminating transportation expenses. It may also allow for all recycled materials to be delivered directly to Garten and not to the MRRF. This will provide space at the MRRF to handle other materials.

2.2 - Regional Solid Waste Environment

There are several events that may have an impact on how waste is managed in the northwest region of the state. One is in neighboring Yamhill County where the Riverbend Landfill has applied for an expansion that will provide a minimum of 10 years additional landfill capacity. Another relates to how waste is managed in the Portland Metro region, which largely serves the incorporated areas of Multnomah, Washington and Clackamas Counties.

Yamhill County

The Riverbend Landfill is one of two regional landfills located in the northwest region that is permitted to dispose of MSW. It has been in operation since the mid 1980's. In addition to serving Yamhill County, wastes from the northern coastal region and from Washington County in the Portland Metro region are disposed at Riverbend. It previously received on average 500,000 TPY.

The existing permitted site has very little capacity remaining. Metro has ceased disposing at the site. Waste Management, owner and operator of the facility, applied several years ago to expand the facility. Legal challenges to the land use process have not been resolved so it is uncertain if the site will be expanded.

The impact to Marion County is twofold. First, some waste from the northernmost portions of the county is reported to be disposed of at the site. This waste is delivered by self-haulers as no franchised collection companies from Marion County dispose of waste at Riverbend. Second, should Riverbend close only Coffin Butte will remain available to accept MSW from the region. This could drive more waste to Coffin Butte and reduce the availability to Marion County in the future. If the expansion is approved there may be little or no impact to Marion County's immediate needs.

Portland Metro (Metro)

About 1,300,000 tons of solid waste from the Metro region each year is disposed in landfills. Metro operates two regional transfer stations that handle about 60% of its waste. The remainder is delivered to private facilities where it is transferred to landfills, or in some cases to recover recyclables, with residue then being transferred to approved disposal sites.

In 1990, Metro entered into a contract to deliver 90% of all waste to landfills operated by Waste Management. Most of the waste is transported and disposed at the Columbia Ridge Landfill in Arlington, Oregon, while a portion is disposed at Riverbend. With this contract due to expire in 2019 Metro is in the process of soliciting proposals from all disposal sites with approved capacity. Recently Metro completed the initial qualification phase of the solicitation and has selected four (4) sites offered by three (3) vendors to submit proposals.

1. Waste Management – Columbia Ridge Landfill, Arlington, OR
2. Republic Services – Roosevelt Regional Landfill, Roosevelt, WA
3. Waste Connections – Finley Butte Landfill in Boardman, OR and Wasco Landfill in The Dalles, OR.

This solicitation process is expected to continue through mid-2018.

Metro has also received proposals from qualified vendors to construct and operate an anaerobic digester system to process food waste from residential and commercial collection programs.

There were seven companies that submitted proposals in July 2017 and Metro is currently reviewing and evaluating the responses but there is no certain date for when a decision will be made.

Metro was considering the possibility of sending waste to the Covanta EfWF. However, after completing an environmental assessment, the Metro Council decided not to pursue this option.

Metro's plans for managing their solid waste should have little impact on Marion County. If, however, tip fees increase dramatically some self-haulers may migrate to the NMCDF. Metro maintains the authority to regulate this and may take action to prevent this event.

One other action that Metro is taking that could impact the region is their move to regulate MRFs that process commingled materials. There are six (6) MRFs in the Metro area permitted to process commingled materials. These MRFs are privately owned and operated and process recyclables collected in the Metro area along with materials delivered from across the state, including Marion County. Metro's regulations could impact the marketplace and potentially result in higher processing fees.

2.3 - Energy Production

2.3.1 - Power Generation Markets

A producer of electrical energy that generates more power than the facility (at which it is produced) can consume must seek a means to sell the excess power, and such power is identified as Net Generation. Generally, the producer must sell the power to an electric utility, but not necessarily the one which serves the area in which the facility is located, in what is called a wholesale electricity sale. Wholesale electricity sales are sales between an electric generator and a party that intends to resell the electricity. Wholesale sales are generally regulated by the Federal Energy Regulatory Commission ("FERC") and are made at negotiated prices between the buyer and seller, similar to how other commodities are transacted. A generator can sell its electricity in the wholesale power market, or to the local utility through a negotiated bi-lateral contract, or a mandatory sale under the Public Utility Regulatory Policies Act ("PURPA").

Wholesale sales under PURPA are regulated by both the states and the FERC through a system of cooperative federalism in which the states directly implement the law and the FERC sets general policy and reviews at least some state decisions. PURPA requires "States to implement utility conservation programs and create special markets for co-generators and small producers who meet certain standards, including the requirement that States set the prices and quantities of power the utilities must buy from such facilities."

Whether an electricity sales agreement is for wholesale power to another entity or through a contract under PURPA, one thing is clear: The current price paid for generated electricity is at historic lows following a trend downward for several years. The primary driver behind this low cost has been an ample supply of natural gas leading to low fossil fuel prices. Another element has been the decline in the price of renewable energy (wind and solar), which is also now being produced at all-time highs. These two forces are expected to keep prices for electrical generation low for years to come. Prices in the Northwest have been and continue to be lower than much of the rest of the country, generally because of the abundance of low cost hydroelectric power.

2.3.2 - Covanta Power Purchase Agreement

Covanta Marion can sell its electricity in the wholesale power market, or directly to the local utility, PGE, through a negotiated bi-lateral contract or a mandatory sale under PURPA. There are several reasons that a wholesale power sale to a third party in the market is unlikely to benefit Covanta Marion:

1. Wholesale power prices are currently low, as explained above; and
2. Covanta Marion would likely need to pay for transmission costs to deliver power across PGE and potentially other utilities' electric systems in order to reach the buyer.

In contrast, several reasons suggest that a sale under PURPA directly to PGE is likely to result in more favorable rates:

1. PGE's PURPA prices have recently been higher than the market; and
2. Covanta Marion will not need to pay for transmission. Therefore, Covanta Marion's decision to attempt to sell power directly to PGE as a Qualifying Facility ("QF") is reasonable.

Covanta Marion elected to take an unusual approach to negotiating a new PURPA contract with PGE. Under current Oregon Public Utility Commission ("OPUC") policy, there are different pricing options for projects with a generator nameplate capacity of ten megawatts ("MW") and lower, and those over 10 MW. PGE's "Schedule 201" rates for projects up to 10 MW are approved by the OPUC and published on

PGE's website. PGE's "Schedule 202" rates for projects above 10 MW are negotiated between PGE and the QF. However, the starting point for Schedule 202 negotiations is PGE's published Schedule 201 rates. Schedule 202 rates are generally lower, but can be very similar to the Schedule 201 rates or potentially even higher under the right circumstances.

Covanta Marion is a 13 MW facility that is eligible to sell power under Schedule 202 rates. However, it does not appear that Covanta fully understood how the Schedule 202 process works. When deciding whether to ask for Schedule 202 rates, Covanta Marion compared Schedule 201 rates with a reasonable estimate of market price forecasts. Covanta Marion concluded that it would be more economical to reduce its size to 10 MW and sell its power at Schedule 201 rates rather than sell its power at market rates. This was a false choice between market and Schedule 201 rates because Covanta Marion would never have needed to sell power at market rates. Instead, Covanta Marion should have compared selling 10 MW of power at Schedule 201 rates with selling 13 MW of power at Schedule 202 rates. As Covanta Marion never asked PGE to provide Schedule 202 rates, we cannot know what the difference would have been. However, it is possible that Covanta Marion could have obtained more revenue selling 13 MW of power at Schedule 202 rates. In addition to potentially being more economical, selling power at Schedule 202 rates would have significantly reduced Covanta Marion's litigation risk. The outcome of this litigation, if Covanta completely loses its case before the FERC and OPUC, could result in overall payments of tens of millions of dollars lower than either the then effective Schedule 201 or Schedule 202 rates over a 15-year time frame.

Covanta Marion filed a complaint at the FERC claiming that the OPUC has improperly implemented PURPA by not allowing it to reduce its size from 13 to 10 MW. The FERC had the discretion to address Covanta Marion's complaint on the merits, or take no action, which would allow Covanta Marion to sue PGE in court. The FERC took no action and now Covanta Marion is planning to sue the OPUC and/or PGE in court. Covanta Marion's FERC filing and expected court lawsuit is unusual because: 1) generally these types of matters are first adjudicated by a state administration agency like the OPUC; and 2) the OPUC has never addressed Covanta Marion's attempt to reduce its size to 10 MW. This means that the OPUC has not yet ruled against Covanta Marion, which was the underlying reason Covanta Marion has filed at the FERC. PGE has now filed its own complaint against Covanta Marion at the OPUC requesting that the OPUC resolve its dispute about whether Covanta Marion can reduce its size and be eligible for Schedule 201 rates.

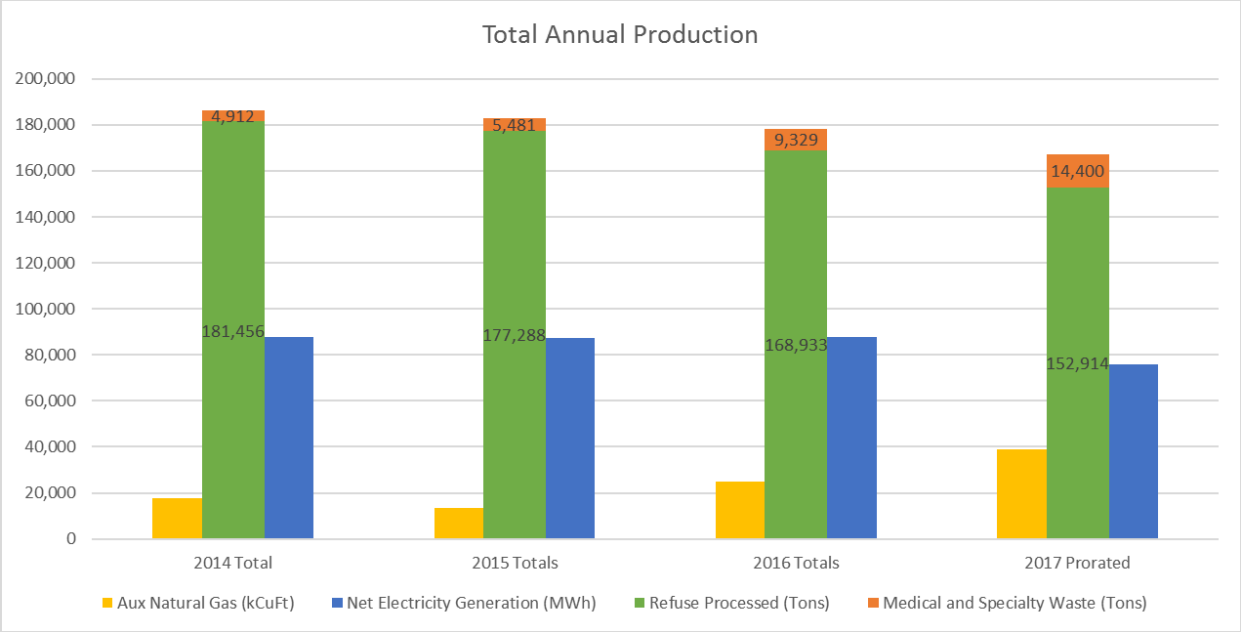
The monetary impact of Covanta Marion completely losing its complaints cannot be understated. Schedule 201 rates (as well as the negotiated Schedule 202 rates) have dropped about 40% since Covanta Marion started negotiations with PGE. If Covanta Marion fails to convince the FERC, the OPUC or a court that it can reduce its size and be paid the older Schedule 201 rates, then Covanta Marion could be required to sell power at negotiated Schedule 202 rates based on the current (and much lower) Schedule 201 rates. Schedule 201 rates fluctuate and could increase or decrease again. Depending on the term of the contract, this could result in about $50 to $60 million less in revenues over an approximate 15-year time frame.

Under these circumstances, it may be most favorable for Marion County to take whatever actions it can to ensure that Covanta Marion is able to reduce its size from 13 MW to 10 MW, and be paid the older Schedule 201 rates as is Covanta's current approach. If this approach fails, Covanta will find it necessary to proceed with negotiating a new agreement based on Schedule 202 rates. During this process, it could possibly be beneficial to seek a negotiated settlement that allows for a rate more satisfactory to both parties at the full 13 MW generation rate.

2.3.3 - EfWF Performance

The overall performance of the EfWF can be summarized by comparing the historical quantity of waste processed and other energy inputs with the net electrical production. Figure 3 provides a summary of these components for the last 4 years.

Figure 3: Energy Inputs and Outputs



From this data, one can observe a drop in net electrical generation and increase in natural gas usage in both 2016 and 2017. The observed degradation in performance may be a result of the condition of the combustion grate and boiler system. In some cases, wear on grate components and leaks associated with corrosion can lead to poor control of combustion air and improper mixing of fuel with the air. The resulting poor combustion may result in the need to use natural gas to control carbon monoxide (CO) emissions.

2.3.4 - Environmental Regulation Impacts

Greenhouse Gas Emissions, Clean Power Plan and United States Climate Alliance - On August 3, 2015, the U.S. Environmental Protection Agency (EPA) issued the Clean Power Plan (CPP) to reduce carbon emissions. This plan would require states to develop plans for reducing carbon emissions and allows for emission credits from the biogenic emissions from EfW facilities such as the Covanta Marion facility. In February of 2016, the Supreme Court stayed the implementation of the CPP. In March of this year, President Donald Trump signed an executive order that requires the EPA to review the CPP and explained the decision by calling the CPP a "job-killing regulation." This action sets in motion a review by the EPA with the intent of dismantling the new rules. The EPA would need to go through the formal rulemaking process to change the current rule.

The CPP was also the mechanism by which the United States could achieve greenhouse gas emission standards agreed to under the Paris Agreement. President Trump announced that the United States is withdrawing from the Paris Agreement in June of this year.

The State of Oregon has joined 12 other states and Puerto Rico to form a coalition that is committed to upholding the objectives of the Paris Agreement and meeting the Greenhouse Gas (GHG) targets of the CPP. Oregon has committed to reduce GHG emissions below 1990 levels by 10% in 2020 and by 75% in 2050. At this time, the potential impact of the state requirements to the existing EfWF or future expansions are unclear and will depend heavily on the model calculation methodologies used to establish GHG emissions from EfW facilities in comparison to other solid waste disposal methods.

Maximum Achievable Control Technologies (MACT) for Large Municipal Waste Combustors – Last year the EPA initiated promulgating updated rules for large municipal waste combustors (MWCs). The rules are intended to be revisited every five (5) years to determine if improvements in control technology for various regulated pollutants have been developed and if stricter emissions limitations should be considered based on new developments. The review of MACT for Large MWCs are widely considered overdue. A draft of the rule was expected in the summer of 2017. However, the status is not clear under the new Trump administration. At this time, we do not expect any potential rule change to require additional emissions control equipment be added to the EfWF.

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3 - Solid Waste Projections

Estimating future waste generation with precision is difficult based on data available for the following reasons:

1. The Oregon Department of Environmental Quality (DEQ) solid waste information for 2016 is not currently available. Data used in the 2009 Solid Waste Management Plan (SWMP) report and 2016 update was used herein.
2. Based on data collected and provided by Marion County, a significant increase in total waste generated is observed when comparing 2015 data to 2016. Reports in 2017 thus far also show sustained and significant growth in waste generated. Furthermore, population increases are expected to continue in coming years as residents in the Metro area move to Marion County.

Nevertheless, a methodology was developed which allows for 2017 projections based on available DEQ data from 2014 and 2015, 2016 data from Marion County's records, and 2017 data for the first four months of operation. The available data and 2017 projections are shown in Table 3.

Year	2014 Actual	2015 Actual	2016	2017
Population *	328,381	331,643	336,352	341,061
Total Solid Waste Generated	443,108	461,256	520,895	548,846
Total Material Recovered	238,117	239,926	273,577	286,646
Total Material Disposed	204,991	221,600	247,318	262,200
Per Capita Generated (lb)	2,699	2,801	3,097	3,218
Per Capita Recovered (lb)	1,450	1,456	1,627	1,681
Per Capita Disposed (lb)	1,248	1,365	1,471	1,538

Table 3: Solid Waste Data

*According to Forecasts of Oregon's County Populations and Components of Change, 2010 - 2050, prepared by the Oregon Office of Economic Analysis, released on March 28, 2013.

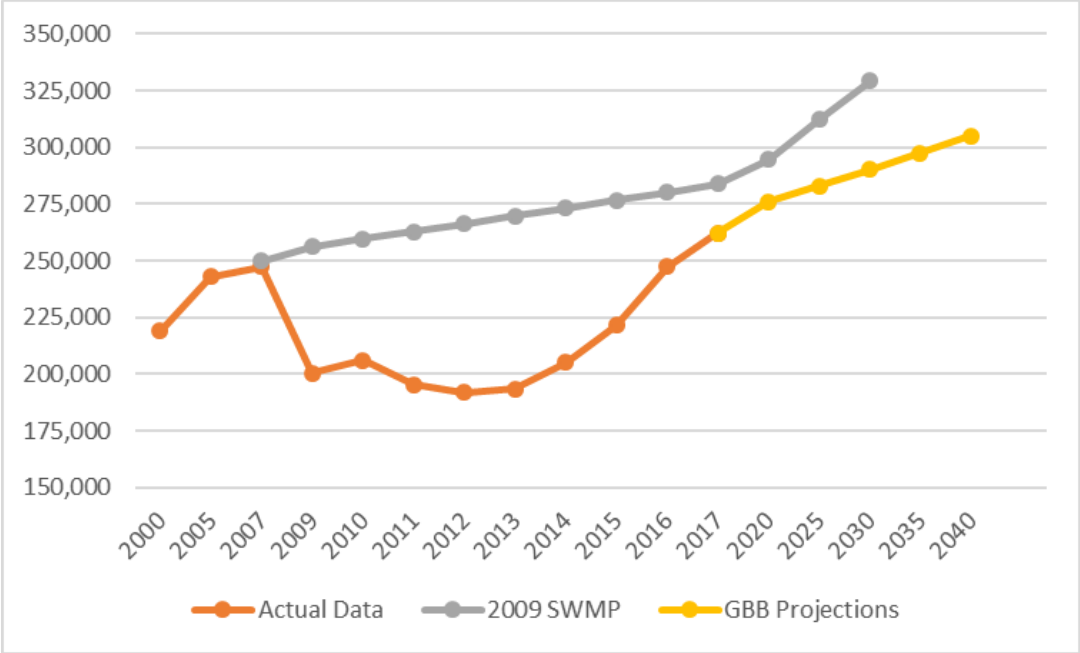
Figure 4, shown below, compares recent solid waste quantities with past projections. The actual DEQ data for years through 2015 is compared against what was projected in the 2009 SWMP. The decrease in quantities in 2008 through 2015 is a result of the recession period. It is important to note that since 2015, waste quantities have increased by 18%, as shown by the orange line in Figure 4. The exact reasons for this sudden increase has not been verified. However, it is expected that a good portion of the increase is related to an increase in the C&D waste stream. Also, because there have been recent improvements in the economy, it is reasonable to assume that a portion of the increase can be attributed to the commercial and perhaps to a lesser degree the residential waste streams. Other jurisdictions have experienced similar trends.

From this graph, one can observe several things including:

1. The economic recession that began around 2008 resulted in significant reductions in quantities of waste disposed.
2. The projections made in the 2009 report were immediately inaccurate for most years since it predicted a consistent increase in the waste stream while a significant drop in the following years was actually realized.

3. A significant increase in waste generation was experienced in 2016 and appears to be exceeding expectations in the projected quantities for 2017. The data appears to be 'making up' for the significant decline observed in 2008 and beyond.

Figure 4: Marion County Disposal Projections



Solid waste projections shown in Table 4 assumes that per capita generation decreases by the ten (10) year annual average of 0.88 percent, while recovery and disposal rates stay the same and the population of Marion County grows as by 1.4 percent annually as estimated by the Oregon Office of Economic Analysis. The decrease in per capita generation can be attributed to a nation-wide trend of material commercial and residential packaging lightweighting.

Year	2017	2020	2025	2030	2035	2040
Population*	341,061	355,543	381,058	408,404	437,713	469,125
Total Solid Waste Generated	548,846	588,690	603,588	618,863	634,524	650,582
Total Material Recovered	286,646	312,812	320,729	328,845	337,167	345,700
Total Material Disposed	262,200	275,877	282,859	290,017	297,357	304,882
Per Capita Generated (lb)	3,218	3,312	3,168	3,031	2,899	2,774
Per Capita Recovered (lb)	1,681	1,760	1,683	1,610	1,541	1,474
Per Capita Disposed (lb)	1,538	1,552	1,485	1,420	1,359	1,300

Table 4: Solid Waste Projections

*According to Forecasts of Oregon's County Populations and Components of Change, 2010 - 2050, prepared by the Oregon Office of Economic Analysis, released on March 28, 2013.

4 - Landfill Options

Since the opening of the EfWF in 1987, the county has disposed a limited amount of solid waste in landfills. Given the finite capacity of the Covanta Marion plant, along with an expected increase in waste generated,

more waste will need to be transported to regional landfills unless additional waste processing capacity is added. The amount of waste disposed will depend on new initiatives to increase recovery of materials and possibly expanding the EfWF.

There are several regional disposal sites that provide a large amount of landfill capacity. The most convenient and closest facility for Marion County is the Coffin Butte Landfill, owned and operated by Republic Services in Benton County. This is the only regional landfill operating west of the Cascades that has appreciable capacity. Unofficially, it is reported to have 30 to 40 years of permitted capacity. However, Benton County does monitor the available capacity annually and it is not certain whether Benton County may at some point choose to work with the landfill owners to regulate out of county waste disposed at Coffin Butte.

A second landfill, located within 30 miles of Marion County, is the Riverbend Landfill outside McMinnville. Owned and operated by Waste Management, Riverbend Landfill has applied for a permit to create additional capacity. The permit is currently under appeal and it is uncertain whether it will be available in the near future. In the past, this landfill not only served Yamhill County, but accepted waste from Portland Metro and the jurisdictions along the Oregon coast. There has been no new permitted landfill capacity in the northwest region of the state or west of the Cascades since the early 1990's.

Currently, there are four regional landfills that serve Oregon and parts of Washington; all located east of the Cascades. To the best of our knowledge each of these landfills has capacity of 30 years or much longer. Three are located in Oregon, the closest of which is the Wasco Landfill operated by Waste Connections in The Dalles. Waste Connections is open to accepting out of county waste. Waste Connections also operates the Finley Buttes Landfill near Boardman, Oregon. This landfill receives waste delivered via barge from Clark County, WA and some waste from the Portland Metro.

One of the primary regional landfills in Oregon is the Columbia Ridge site owned and operated by Waste Management outside of Arlington, Oregon. This landfill is currently serving Metro with transportation provided by truck and the city of Seattle, Washington where waste is delivered by rail. The actual cost to Metro is reflected in item 3 in Table 5.

Another regional; landfill is the Roosevelt Regional landfill, located almost directly across the Columbia River from Columbia Ridge in the State of Washington and is owned and operated by Republic Services. Most of the waste disposed in Roosevelt is collected from a number of jurisdictions along the I-5 corridor in Washington state reaching as far north as Blaine, Washington to Olympia, Washington and is transported by rail. It should also be noted that this landfill is a host for the advanced ash metals recovery system owned and operated by Lab USA discussed in Section 5.3.

Table 5 shows the estimated cost to build and operate a new transfer station and the estimated cost to transport and dispose of waste at the various sites. Some costs represent estimates based on marketplace conditions.

Table 5: Estimated Landfill Disposal Costs

Description (miles from Salem)	Est. Cost to Build Transfer Station	Station Operating Costs $/Ton	Transportation Costs $/Ton	Est. Landfill Disposal $/Ton	Total $/Ton
1. Coffin Butte (30 miles one way)		**Included in Current rates**	$10	$30.69	**$40.69**
2. Wasco Landfill (137 miles one way)	$10 M	**$8 - $12**	$17	$25	**$50 - $54**
3. Columbia Ridge (200 miles one way) ***(1)***	$10 M	**$16**	$24	$18 *(1)*	**$58**
4. Finley Buttes (230 miles one way)	$10 M	**$8 - $12**	$28	$27	**$63 - $67**

(1) Transportation and disposal costs are based on recent data provided by Portland Metro (3/23/17) and reflect current price of fuel that is lower in recent years. Transfer station operations include additional incentives for the contract operator to recover materials from the tip floor.

Assumptions

1. Transfer Station Improvement cost is $10 million
2. Daily Volume in Tons is based on 53 ft. Open Top with 25 Tons per Trailer
3. Station Operation Costs - Assumes Top Load Operation including Labor / Maintenance / Equipment / No Compactor / No Recovery Services
4. Transportation Costs include fuel, operations, maintenance
5. Landfill Disposal - Landfill Tipper or Walking Floor, unless noted, are estimates

It is important to note the actual cost may vary based on each landfill's interest in signing long-term agreements to secure waste for disposal. The contract for waste from Metro is set to expire in 2019 and they are in the process of bidding out transportation and disposal services and, have just completed the initial qualification phase of this process. As a result, they have announced that the four (4) landfills listed in Table 4 have been shortlisted to submit bids. Note that Coffin Butte was not included, and because Riverbend did not have the permitted sufficient capacity available they were excluded from further consideration.

One future alternative to consider might involve a scenario where no waste is delivered to the Covanta facility; this is represented in Figure 5 below. This 'no EfWF' approach would likely require additional infrastructure including transfer station capabilities to load and haul a significantly increased quantity of waste to Coffin Butte.

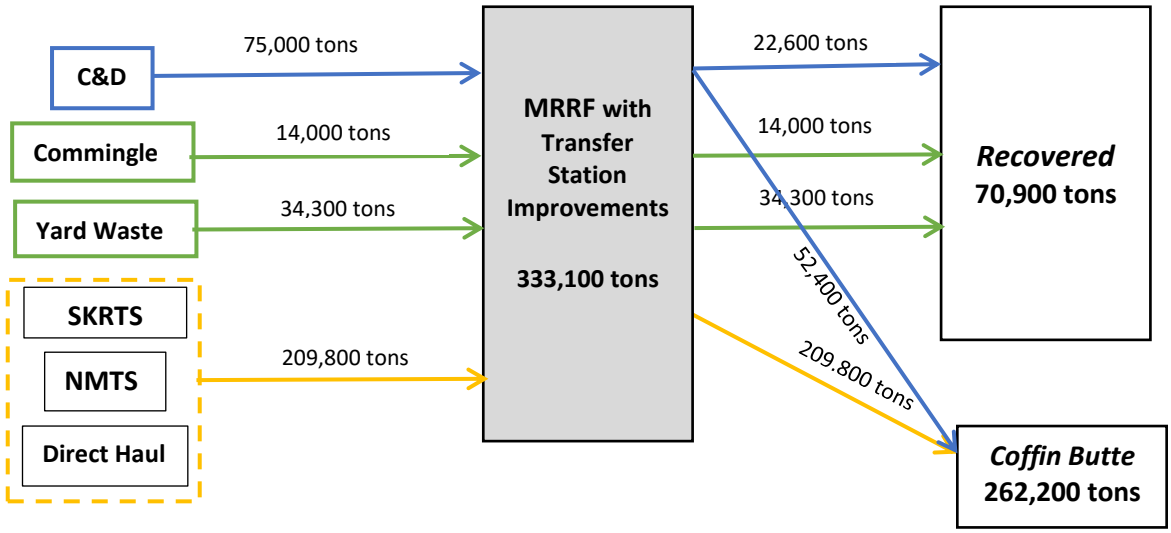


Figure 5: Disposal at Coffin Butte

Preliminary discussions with Republic Services regarding disposal services at Coffin Butte landfill for excess waste indicated that a long-term arrangement could be established for a disposal cost at approximately $31 per ton. Assuming an approximate hauling cost of $10 per ton, the total disposal cost for operation without the EfWF would be around $41 per ton. In future years, the cost of this disposal option will be impacted by any escalation factor required in a long-term agreement with Republic Services.

In this scenario, it is assumed that additional transfer station capacity will be needed. The current system is transporting about 300 TPD on a five-day average. If all waste is transferred, 800 TPD of MSW in addition to the residue from the MRRF(about 200 TPD) would require transport. The current facilities are not designed to receive and transport 1,000 TPD.

One option to provide for additional transfer capacity would be to expand the existing MRRF and/or retrofit SKRTS. However, for this report, we have assumed that a new transfer station would be constructed. The cost of a new transfer station facility is estimated at $10 million for land, site improvements, and a 50,000-sq. ft. building for operations. Additional tractors and trailers to manage the transportation may be needed unless existing private contractors with tractor-trailer rigs can perform this service. This capital investment would result in an annual debt service expense of about $544,000 per year (3.5% at 30 yrs.). The operation of the transfer station, assuming a basic top load system, would be about $8 per ton or an additional $1,360,000 per year for the waste currently going to the EfWF.

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5 - Resource Recovery Options

The GBB team has completed a review of options that will reduce the amount of waste going to a landfill and potentially increase recovery of recyclable materials consistent with the guiding principles established in the Marion County board meeting held on April 4, 2016. The analysis contained herein is based on recent data collected by Marion County for the years 2016 and 2017 to date. This review preliminarily establishes the expected recovery rate for each option, potential landfill diversion rate, and the added annual cost associated with each disposal option. It is important to note that the financial information is comparative and not absolute. The three options considered are:

1. Transfer and disposal of all waste to the Coffin Butte Landfill under a long-term agreement with Republic Services. The analysis of this option is included in Section 4 of this report and is estimated to result in approximately 262,000 tons of MSW being disposed of at the Coffin Butte Landfill.
2. Construction of a MWPF that would process approximately 80,000 TPY of MSW or commercial waste. The facility would recover recyclable materials prior to combustion at the EfWF. Waste not recovered or processed at Covanta would be transported to the Coffin Butte landfill for disposal.
3. Addition of a third combustion unit at Covanta Marion, consistent with recent discussions, which could accommodate additional waste. Two sizes are considered in this analysis:
    a. 270 TPD (90,000 tons annually at 91% availability).
    b. 600 TPD (200,000 tons annually at 91% availability).

5.1- Policy and Program Initiatives

The Oregon DEQ convened a workgroup in 2011, tasked with developing a document that would guide state policy and programs to achieve the best environmental results for managing discards or what is commonly referred to as MSW. The final report titled “2050 Vision for Materials Management” was adopted by the Environmental Quality Commission on December 6, 2012. This document is intended to provide the vision and framework for action for managing waste considering the impacts and cost of producing and managing the materials over the life of the products. It serves as an update to the Solid Waste Management Plan (1995-2005) to guide statewide policy.

In summary, the 2050 Vision Report focused on increasing the recovery rate by targeting certain materials by establishing initiatives that would reduce the amount of food waste, organics, plastics, and carpet from being disposed in landfills. These materials were targeted as they represent opportunities to have the greatest impact to the environment and reduction of greenhouse gases. In addition to calling out these specific materials the 2050 Vision Report also points to establishing programs to reduce the total waste generated and disposed in landfills.

This document provided some background and guidance for recent legislation. In particular, SB 263, which established new recovery goals for the state and local jurisdictions. Codified as ORS459A, the law amends the Opportunity to Recycle Act. The following represents a few of the primary goals that were established for the State of Oregon.

1. By 2020, and for subsequent years the recovery rate of;
    a. Food waste is at least 25 percent; and
    b. Plastic waste is at least 25 percent.

2. For the calendar year 2025, and subsequent years, the material recovery rate of carpet waste shall be at least 25 percent.

3. By 2025, and for subsequent years, the recovery rate will be 55%.

To provide guidance for achieving these goals, the new regulations offer a large menu of approved waste reduction promotion and education programs. Local jurisdictions are to consider three to five of these programs for implementation as part of its solid waste reduction strategy. The complete list of the program options is provided in Appendix A – Statewide Policy and Programs for Managing Solid Waste

In addition to these goals, Oregon Revised Statutes (ORS 459A) also removed recovery credits granted to local jurisdictions for certain waste reduction, reuse and recycling programs. These credits ranged from 2% for meeting minimal programs requirements to as much as 6% credit for a jurisdiction with more aggressive programs. There are several other goals that are represented in the law that are included in Appendix A, Statewide Goals and Programs. Those mentioned here, however, have the most immediate impact to local jurisdictions as to what programs they might consider and how they plan to manage various waste streams. It is important to recognize that the goals adopted in the recent amendments to the Opportunity to Recycle Act are intended to be used for guidance and there are no penalties associated with not meeting them. If a jurisdiction does not meet stated goals the state will work with that jurisdiction to determine other approaches to increase the recovery rate and/or reduce waste generation.

5.1.1 Impacts to Marion County Solid Waste Programs

The county and service providers in the county have developed and implemented a comprehensive waste reduction and recycling promotion and education program. These programs and services fully address, and, in some cases, exceed the minimum requirements as required in state law. These programs and services are a critical component that has propelled the county as a leader in Oregon in attaining the highest recovery rate. Marion County has programs and services that are more comprehensive than most in the state. The new policies and requirements of ORS459A could impact the county's programs.

The immediate impact of these new statewide goals is that it establishes a new recovery goal of 64% for Marion County by 2025. This would seem very attainable considering the county's recovery rate has been as high as 58% in recent years. But this includes a 6% credit for waste reduction and reuse credits that no longer can be counted. Therefore, the current recovery rate for the county is at about 52%. Thus, the future solid waste system will need to consider cost effective strategies to attain a recovery rate increase of 12% by 2025.

To put into perspective the impact of this new goal, recent waste data is examined. In 2016, DEQ reported the county generated 520,000 tons and recovered 273,000 tons for a recovery rate of 52.5%. If the county were to meet the 64% goal it would require the county to recycle 333,000 tons or an increase of 60,000 tons. Considering the composition of the waste that is disposed the only way to increase the amount recovered is to focus on recovering more materials from commercial waste and to look at strategies to recover food waste and other organics for both residential and commercial service. Certainly, there is a continual push to reduce waste generated and to extend reuse programs but these efforts are only complimentary to larger efforts to recycle more materials.

Although the state has imposed these new goals, the county, similar to all jurisdictions, must consider what effective, realistic, and affordable approaches for increasing the recovery rate.

The direction of the state policy for increasing recovery rate does focus on separating food waste and reducing plastics. These challenges are not unique to Oregon. California recently has adopted legislation to reduce organics from being landfilled and requiring recovery of recyclable materials from the commercial waste stream. The actual strategies for achieving these goals center on either requiring generators to separate food waste and provide separate collection and /or technology to recover organics from the mixed waste stream. Portland Metro has just drafted a new ordinance that will require businesses and institutions that have full service cafeteria and restaurants to separate food waste from dry waste by 2020. In California, there are communities that are promoting separate collection while some are separating food waste and other organics through mixed waste processing systems.

Much more detailed analysis is needed to evaluate the best options for Marion County. It is advantageous that Marion County's is located in the center of the agriculturally rich Willamette valley as this provides opportunities to market composted products.

Current Waste Recovery and Recycling (WR/R) Programs and Services

The new state law may impact the promotion and education programs that are currently provided. In Table 6, listed below and on the next page, details current programs and their status in meeting the state requirements.

Table 6: Required Elements for Waste Recovery and Recycling (WR/R) Programs and Status of Marion County's Programs

Element A: Provide curbside recycling container	**Status:** All cities are meeting this requirement because the haulers provide residents curbside recycling.
Element B: Provide weekly curbside recycling	**Status:** Recycling services in all cities are offered every other week. This element is not satisfied.
Element C: Expanded recycling education and promotion program which includes a contamination reduction education plan.	**Status:** Basically, all cities meet this requirement. The county will review waste composition data for 2017 and work with service providers to determine future actions.
Element D: Provide multi-family recycling to apartment complexes that request it.	**Status:** No cities are meeting this requirement. While haulers provide recycling services to those that request it, participation is not mandatory.
Element E: Curbside yard debris collection is available.	**Status:** All cities above 4,000 satisfy this element since yard debris collection is offered.

Element F: Recycling is available to businesses and schools.	**Status:** All cities meet this requirement since haulers offer this service.
Element G: There is a recycling depot available for every 25,000 residents.	**Status:** All cities above 4,000, except Stayton, have at least one recycling depot.
Element H: Weight based collection rates.	**Status:** No cities use weight based rates. However, the current rates provide incentives for customers to use smaller containers to reduce waste disposal.
Element I: Food composting /anaerobic digestion is available for businesses.	**Status:** Salem and Keizer satisfy this element because commercial food composting is available. Silverton may add it.
NEW Element J: Cities (and county for the Urban Growth Boundary (UGB)) require businesses that generate four or more cubic yards (CY)/week of garbage to have a recycling program in place.	**Status:** No cities require businesses to recycle.
NEW Element K: Curbside food composting /anaerobic digestion is available for residents.	**Status:** All cities above 4,000 have residential curbside food collection available. Food waste is then composted.
NEW Element L: Cities require recycling program for construction/demolition (C/D) (6 cy for self-haul, 10 cy for collection service)	**Status:** No cities require construction/demolition recycling, although it is assumed most C/D waste is processed at the MRRF.
NEW Element M: Cities require food waste program for large generators (50 TPY).	**Status:** No cities require large generators to divert food.

A cursory review of the county's programs suggest the County is largely in compliance but there are some new program options prescribed by the regulations intended to increase waste shed recovery rates. These can further be evaluated as the state provides more direction.

In Appendix A – Statewide Policy and Programs for Managing Solid Waste a list of the policies and programs that may be required to meet the new goals. The only item that may require an increased effort will be to promote / encourage nonresidential generators to separate food waste at the source. This is happening in some cities in Marion County but, it is not universal. Any expansion of such a program would need to be tied to whatever collection and processing options are considered.

5.2 – EfWF Expansion Options

This alternative considers the option of developing new Energy from Waste (EFW) capacity at the existing Covanta Marion facility. The primary objective is to accommodate the anticipated MSW growth within Marion County. This analysis considers two sizes of facility, as proposed by Covanta, as follows:

1. The small facility would consist of a single unit, approximately equal in capacity to Unit 1 and 2 (90,000 tons annually processed per unit), and integrated with the existing EfWF to the greatest extent possible.
2. The larger facility would consist of a single unit sized for an annual processing capacity of 200,000 tons or 600 TPD. The larger facility would be required to be designed as a stand-alone facility with little opportunity for sharing infrastructure.

Figure 6 and Figure 7 represent the waste flow streams under these two scenarios. Both options show that additional waste would be required from outside of Marion County. However, it is likely that waste may be available from residuals identified in the processing of C&D materials at the MRRF. This analysis and the waste quantities shown are based on projected 2017 rates as established in Figure 1. It is noted that the waste projections show a significant increase in the quantities available in future years and that it would take several years to permit and construct a new facility.

The facility envisioned is a conventional mass-burn technology, similar to what is in place at the EfWF. The plant would generate electrical energy and contract with a utility for the purchase of the power. The turbine generator would have a gross output of about 6 MW with a net generation expected of 500 kw-hours per ton of MSW combusted for the small unit. The large unit would be somewhat more efficient with a net output of about 13.5 MW and an expected net generation of 545 kw-hours per ton of MSW.

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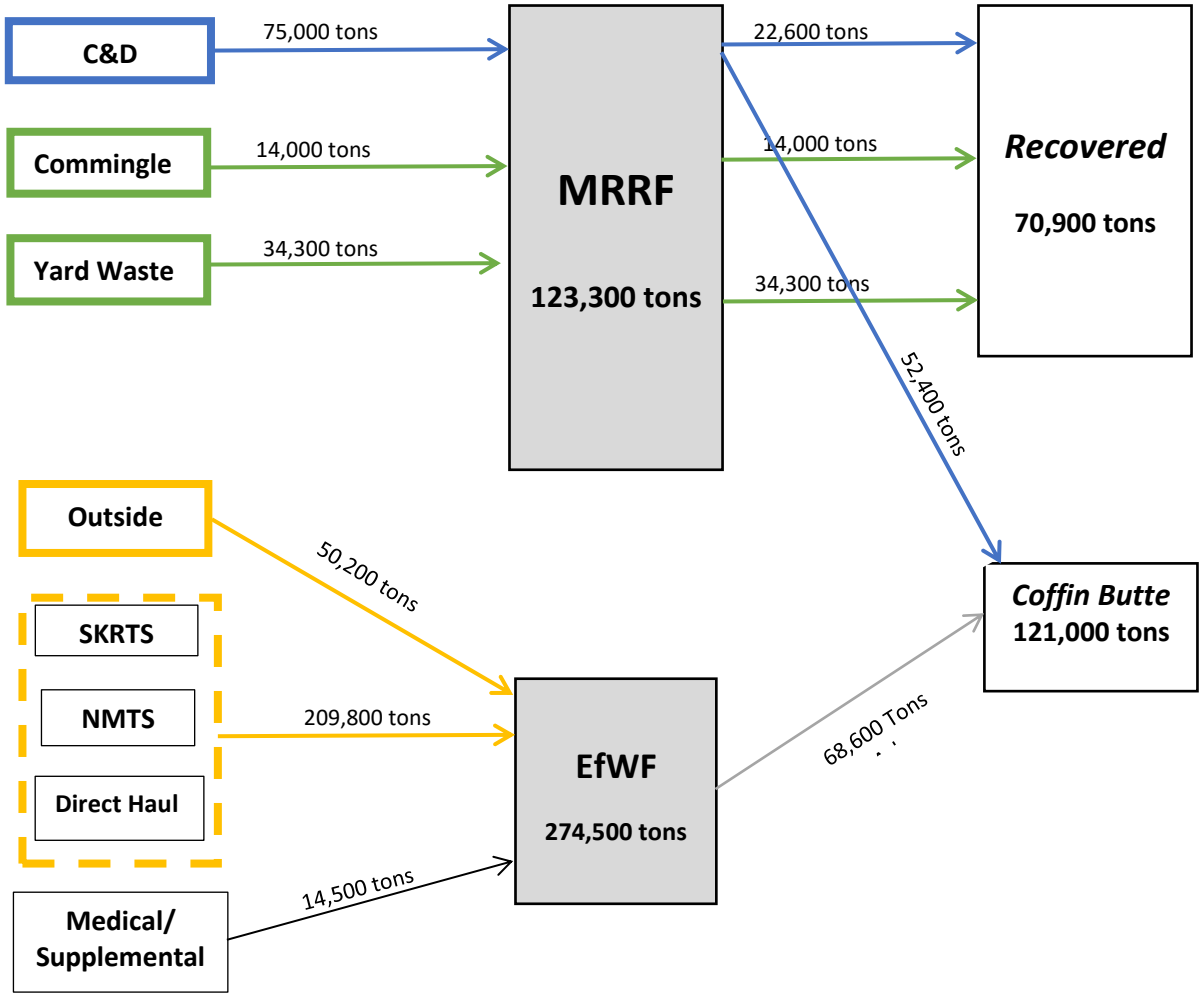


Figure 6: EfWF 90,000 Ton Expansion (90,000 tons)

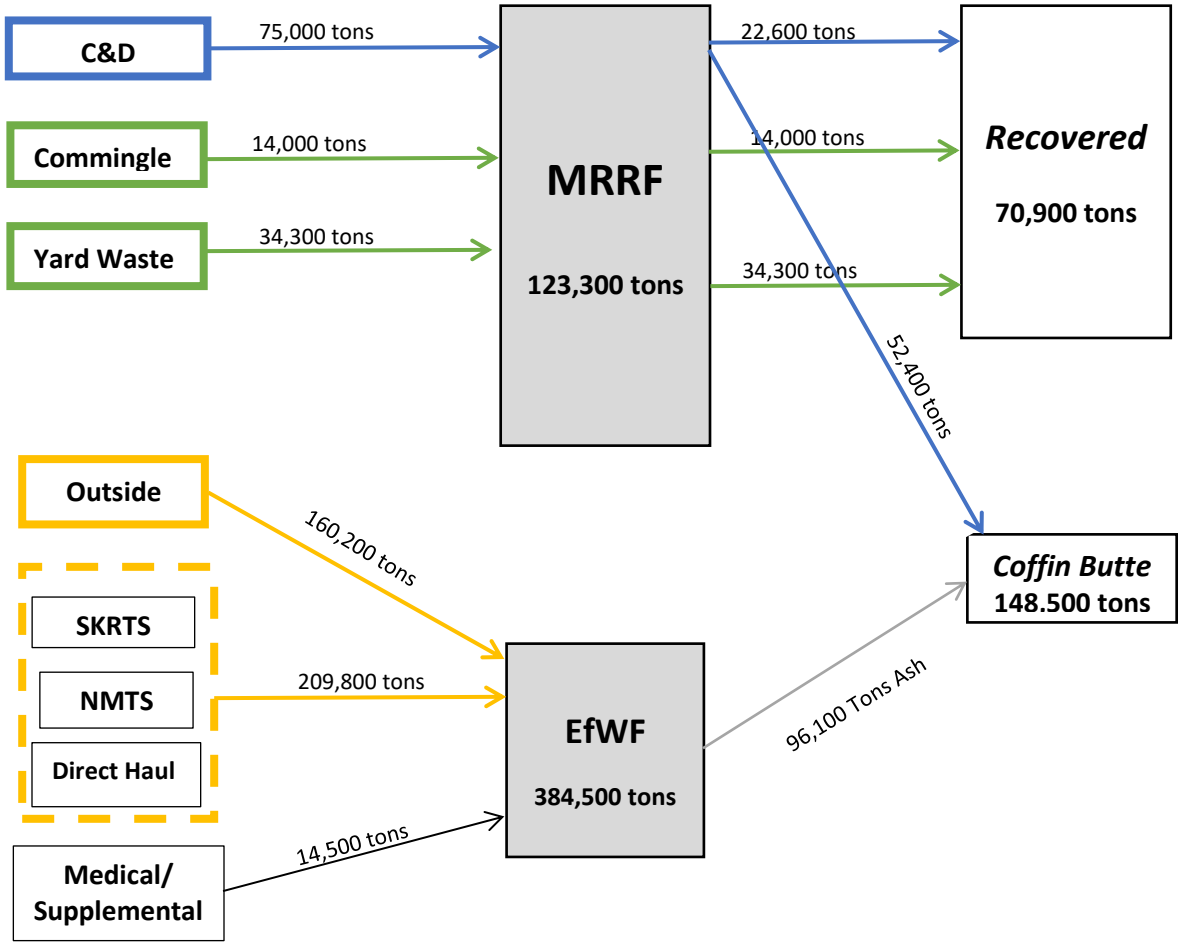


Figure 7: EfWF Expansion (200,000 tons)

5.2.1 - Site Requirements

Since the small unit would be accomplished through an expansion of the Covanta EfWF, site area requirements are minimized. The small unit would require an expanded EfWF building, cooling tower, water treatment capabilities, ash storage building (possibly requiring relocation), additional flue in the existing stack, staff parking, storm water retention, and access requirements as appropriate. While, the original facility was designed to accommodate a third unit, requirements for an expanded tipping floor and crane bay would likely be required; additional investigation is needed. For the larger unit, the assumption is that it would be an entirely new facility located on the same property as the existing plant. It is assumed that groundwater capacity or municipal water is available at the site to meet the new boiler's requirements for process and potable water.

5.2.2 - Schedule for Implementation

Developing, financing, constructing and achieving commercial operation of new mass-burn capacity would be a large capital project with extensive permitting requirements. Major project activities, milestones and durations in months include:

Project Phase	Months
Preliminary Planning	3
County conceptual approval	3
Project Definition and RFP Development	6
Procure and negotiate full service contract	6
Permitting	24
Release for Engineering and Fabrication	6
Facility construction	24
Facility commissioning and acceptance	6
Total project duration to commercial operation	78

This preliminary schedule shows total project duration of about 78 months or 6.5 years. It may be possible to condense this schedule by overlapping procurement activities with permitting, but this would place some risk of incurring expense should the project not be approved as planned.

5.2.3 - Cost to Implement

The construction cost of new EfWF capacity was developed based on available information on recently constructed or expanded facilities. The referenced facilities include; Olmsted County, Minnesota - expansion; Region of Durham, Ontario, Canada - new facility; H-Power, Honolulu, Hawaii – stand alone at existing facility; and West Palm Beach, Florida – stand alone at existing facility.

A preliminary cost to construct was developed for both options based on scaling these facilities using an industry accepted approach and considering specific site factors. In addition to site infrastructure savings, expanding the existing EfWF with the smaller unit may save some construction costs with regards to ash storage and processing, bridge crane savings and water treatment. This methodology yields an approximate constructed cost of $144 million for the 270 TPD unit and $233 million for the 600 TPD unit.

5.2.4 - Operations

As shown in Table 7,the estimated Operations and Maintenance (O&M) cost would be roughly $5,400,000 for the small unit and $11,900,000 for the large unit.

Table 7: EfWF Expansion - Operating and Maintenance Costs

O&M Costs			
	Existing	Small Unit	Large Unit
Operating Year	2016	2023	2023
TPD	550	270	600
Guaranteed Annual Tons (85% Capacity)	145,000	90,000	200,000
Excess Processed Tons	30,000	0	0
Total Processed Tons	175,000	90,000	200,000
Capacity Factor	94.4%	91.3%	91.3%
Base Fee @$56.45/ton	$ 8,185,250	$ 5,080,500	$ 11,290,000
Excess Waste, 15,000@22.99, more at 18.86	$ 627,900	$ -	$ -
Total O&M Base Cost	$ 8,813,150	$ 5,080,500	$ 11,290,000
Medical Waste (4,500 @ $250)	$ (1,125,000)		
Supplemental Waste (10,000 @ $100)	$ (1,000,000)	$ -	$ -
Pass Through Costs	$ 550,000	$ 282,857	$ 628,571
Total O&M Cost (rounded to 1000)	$ 7,238,000	$ 5,363,000	$ 11,919,000

5.2.5 - Revenue

Estimates for the sources of revenue considered here are from the sale of recovered metals and from the sale of electrical energy and are shown in Table 8.

Table 8: EfWF Expansion - Revenue Projections

	Existing	Small	Large
TPD	550	270	600
Total Processed Tons	175,000	90,000	200,000
Metals Revenue	$ 50,000	$ 25,000	$55,000
Electrical Generation, Net MW-hr (400, 500 and 545 KW-hr per ton, MSW)	70,000	45,000	109,000
Potential Electrical Energy Revenue at $40/MW-hr (90% to MC)	$2,520,000	$ 1,620,000	$ 3,924,000
Total Revenue	$2,570,000	$ 1,645,000	$ 3,979,000

5.2.6 - Recovery and Materials Diversion

Expanding the EfWF would result in diverting additional MSW away from landfills upon completion of the new unit. Based on current waste composition, approximately 25 percent of this quantity is inert material and would be delivered to the Coffin Butte landfill as ash residue that could be used as alternative daily cover (ADC). The Oregon DEQ calculation for recovered materials would include the quantity used for ADC. Some of the ferrous metals would be recovered from the stream and recycled.

5.2.7 - EfWF Summary

The comparative cost for the EfWF expansion options is shown in Table 9 and Table 10 on a dollar per ton of processed MSW basis. This preliminary analysis identifies the net operating cost for these options as

exceeding $100 per ton of processed waste, which significantly exceeds the waste processing costs of the current system. Note that the analysis assumes a publicly financed facility using revenue bonds with a 3.5% interest rate for 30 years.

Table 9: Small EfWF Expansion

SMALL UNIT (90,000 Tons) EXPENSES		$ / TON
Annual Operating Expense	$ 5,363,000	$ 60
Debt Service (On Capital - $144,000,000)	$ 7,829,000	$ 87
Total Annual Operating Expenses	$16,934,000	$147
Estimated Revenue	$ 1,645,000	$ 18
Ash Disposal (22,500 Tons, $29/Ton)	$ 653,000	$ 7
Net Operating Cost	$15,289,000	$136

Table 10: Large EfWF Expansion

LARGE UNIT (200,000 Tons) EXPENSES		$ / TON
Annual Operating Expense	$11,919,000	$ 60
Debt Service (On Capital - $233,000,000)	$12,669,000	$ 63
Total Annual Operating Expenses	$30,599,000	$123
Est. Revenue	$ 3,979,000	$ 20
Ash Disposal (50,000 Tons, $29/Ton)	$ 1,450,000	$ 7
Net Operating	$26,620,000	$110

5.3- Beneficial Ash Reuse

The combustion of MSW at the EfWF generates approximately 40,000 tons of ash products annually which are currently transported to the Coffin Butte Landfill and used as alternative daily cover(ADC) at a total cost of disposal of $29.05 including transportation. The material used as ADC is included in "Recovered Materials" as defined by the State of Oregon. At the EfWF, the ash is generated as two distinct products; bottom ash which drops off of the combustion grate and comprises about 80% of the final ash stream, and fly ash which is collected in the air pollution control equipment and comprises about 20% of the final ash stream (including added reagents for emissions control). The EfWF includes a system to recover ferrous and non-ferrous metals as shown in Figures 8, 9, and 10. This system is typical of metal recovery equipment used at other similar facilities around the country.

Figure 8: Grizzly Scalper for Large Ferrous Recovery

Figure 9: Drum Magnet for Small Ferrous

Figure 10: Eddy Current System for Non-Ferrous

A conventional system of metals recovery such as this, can be expected to remove about 80% of the ferrous metals and 20% of the non-ferrous metals found in the incoming waste stream, generally in particle sizes greater than 12mm. The Solid Waste Association of North America (SWANA), in a presentation at the 2017 North American Waste-to-Energy Conference (NAWTEC), estimates that typical incoming MSW streams include 3% ferrous, 0.7% aluminum and 0.2% other non-ferrous recoverable metals. Recovery of additional metals smaller than 12mm but larger than 2mm is generally referred to as enhanced metals recovery. Other facilities have found value in recovering the smaller metal products and the ash left over is more suitable for reuse as an aggregate.

Ash Reuse

The current approach of using the combined ash stream for ADC at Coffin Butte, owned and operated by Republic Services, is one way to reuse the ash with benefit. Marion County still pays a tipping fee for disposal at Coffin Butte, albeit at a lower rate of $18.20/ton (not including transportation). There is a limit as to how much ash can be accepted at Coffin Butte and used as ADC, but that limit has not been exceeded to date. It is reasonable to assume that this approach will be available to Marion County for the foreseeable future.

Another approach would be to seek a higher use for some of the ash generated such as using the bottom ash for aggregate in concrete or asphalt construction materials. This has been accomplished in very limited quantities at other EfW facilities around the country. The best approach would be to take a portion of the bottom ash, as much as 90%, and keep it separated from the fly ash stream. The remaining bottom ash would be combined with the fly ash and disposed of as is currently done. The 10% bottom ash component of the ash stream allows the combined product to pass tests that determine toxicity and keep it from being considered hazardous. The potential savings of reusing approximately 29,000 tons of bottom ash as an aggregate would be about $500,000 annually.

In order for the bottom ash, classified as a solid waste, to be used as an aggregate, a beneficial use determination (BUD) would need to be made by the State of Oregon. The process is well defined by the state and would require testing and additional research. There would be some equipment modifications and cost associated with this approach. In light of the potential cost savings, further consideration of this alternative should be considered.

Metals Recovery

The existing metals recovery system, over the past four years, has recovered an average of over 8,200 tons of ferrous annually with average net revenue to Marion County of about $440,000. It should be noted that current revenues are much lower due to historically low commodity prices.

The current recovery quantities of ferrous material represent 4.5% of the incoming MSW. This recovery quantity is high in comparison to typical similar facilities according to data presented by the SWANA Applied Research Foundation at NAWTEC 2017. Based on this information, opportunities to increase revenues from additional ferrous metals recovery may be very limited.

The EfWF has recovered an average of 300 tons annually of non-ferrous product over the last four years utilizing the system described above. Marion County does not receive revenue for this product currently.

Prior to disposing of ash at Coffin Butte, the ash was taken to the NMCDF. In fairly recent years, a metal recovery project was set up at NMCDF to mine the landfilled ash and recover metals. This system is no longer in operation.

Enhanced Metals Recovery

Opportunities for increased recovery of metals from combustor ash exist using state-of-the-art separation processes capable of extracting very small particle-size metals that the on-site equipment cannot effectively capture. The recent technological advances that are available, and that are not being utilized at the EfW plant, are capable of recovering the very small (3/8" minus) particle-size fraction of the ash which contains a great portion of the non-ferrous, precious, and semi-precious metals. These technologies are, in varying degrees, proprietary, and are offered within commercial terms and conditions that would engage the county (or Covanta Marion, depending upon the nature of the arrangement) on an on-going basis.

One such enhanced metals recovery system is owned by LabUSA and operated at the Roosevelt, Washington landfill. The LabUSA system processes ash from the Spokane EfWF in Spokane, Washington. This may present an opportunity for the ash generated at the EfWF to be processed at the same facility and generate additional revenue. This approach would require additional transportation costs since the distance to the Roosevelt landfill is greater than to Coffin Butte. Due to the current low commodity prices, this option may not warrant additional analysis.

5.4- Mixed Waste Processing

5.4.1 - Introduction

One strategy for increasing the county's recycling rate is to construct an in-county mixed waste processing facility (MWPF). The technology for processing and sorting materials from waste has dramatically improved over the past decade. Using improved screening systems and air density separation technology, in conjunction with optical sorting, has enabled processers to separate the organics and inerts and recover marketable materials such as cardboard, mixed paper, plastics containers, rigid plastics, and aluminum and ferrous metals. Several MWPFs designed to recover these materials have started operating in recent years and are successfully marketing materials to required specifications. Also, there are two known MWPFs' employing the latest sorting technology scheduled to start operations in 2018. These MWPFs' are all located in California and have been built to respond to new state laws to recycle more materials from commercial waste and to reduce the amount of food waste / organics disposed in landfills. Table 11 lists four facilities and the estimated amount of materials being recovered by each. The recovery rates are estimates since the two MWPFs in operation are privately owned and operated and their recovery information is not made public as they are in a competitive marketplace. The other two proposed MWPFs' show the estimated amount of materials expected to be recovered based on the equipment vendors performance requirements.

Table 11 - Mixed Waste Processing Facilities

Existing MWPF					
Facility	**Location**	**Material**	**Annual Waste**	**Recovered Organics**	**Recyclable Commodities**
Newby Island Resource Recovery Park	San Jose, CA	Wet/ Dry Mixed Commercial	180,000 TPY	30,000-40,000 TPY AD	50,000-60,000 TPY
Athens Sun Valley	Burbank, CA	Mixed Commercial (2-35 Ton Per Hour (TPH) Lines)	300,000 TPY	Evaluating Options	60,000-70,000 TPY (Est.)
MWPF Under Construction					
Monterey Regional Waste Management District (Operational 1/18)	Marina, CA	Mixed Commercial Waste and Commingled Recyclables	100,000 TPY	30,000-36,000 TPY Compost Future AD	16,000-20,000 TPY
Los Angeles County Sanitation Districts (LACSD)	Whittier, CA	Mixed Commercial and Commingled Recyclables	85,000 TPY Commercial	12,000 TPY Evaluating Options	24,000 TPY

These projects provide the most recent information that can be used to estimate the potential recovery rates if a similar processing system employing comparable technology were to be constructed in Marion County. The evaluation will be based on waste composition data that was published by DEQ in 2010. If a decision is made to consider the MWPF alternative further, GBB recommends that a new Marion County waste characterization study that provides statistically higher confidence limits be undertaken. DEQ does expect to release new waste composition data for Marion County in November.

The strategy of building a MWPF may have several advantages to the Marion County system.

1. It will result in recycling more materials and increasing the county's recovery rate from 52% to perhaps over 64% depending how the organics are managed.
2. Processing mixed waste and recovering materials from commercial waste will provide needed capacity for the EfWF to handle future growth.
3. Separating organics from commercial waste will provide flexibility to expand composting and/or consider other options to produce renewable energy.

4. The MWPF can be designed to be easily expanded to process additional waste if necessary.

5.4.2 - Description

Most MWPFs are designed to process commercial waste streams as they typically contain a larger percentage of recyclable materials than residential. In reviewing a previous waste composition of 2010 data from DEQ, it appears that commercial truck and compacted drop box routes contain over 25% of recyclable commodities and almost 30% organic materials. The organics are comprised primarily of food waste, wood and yard debris, and do not include compostable paper products.

DEQ showed there were 50,000 TPY of mixed commercial waste and another 30,000 TPY collected in compacted drop boxes. The waste typically collected in compacted drop boxes mostly includes a majority of waste generated at multi-family units. The mixed collection routes were also sampled and could also be processed however, the preliminary data shows these loads contain a higher percentage of organics and therefore may contain more moisture and less recoverable materials. As such, these loads may be more suitable to go directly to the Covanta Marion EfWF.

Table 12 shows the composition of the commercial waste streams that could potentially be processed.

Table 12: Potential Municipal Solid Waste (MSW) to Process at MWPF

Tons per Year (TPY)		% of Processed Waste
Commercial Routes	50,000	
Compacted Drop box	30,000	
Total MSW	**80,000**	
Estimated Commodities	23,000	(28.8%)
Estimated Organics	28,000	(35%)
Residue to EfW / Disposal	29,000	(36.2%)

Although the MWPF will separate approximately 28,000 tons of mixed organics, this material typically requires additional processing in order to produce a marketable compost product. Depending on the quantity of materials delivered directly to the Covanta plant, the county may have the flexibility of sending mixed organics to Covanta or perhaps composting some materials to increase the diversion rate. Also, the county may consider anaerobic digestion (AD) in future years. Figure 11,, shown below, is a flow diagram representation of the waste stream in this scenario. It should be noted that as shown, the quantity of waste being delivered to the EfWF is 170,000 tons (not including medical/supplemental waste) and assumes that the organics stream from the MWPF is included with that material.

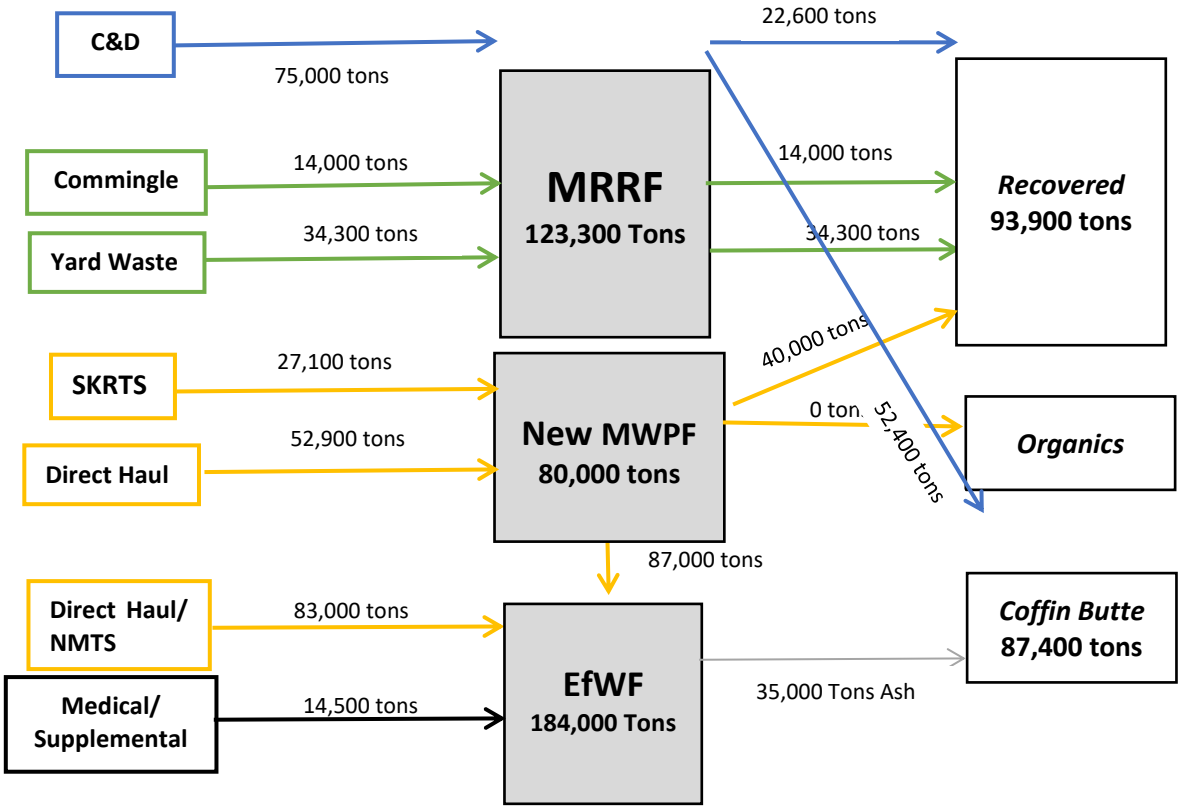


Figure 11: Flow Diagram of New MWPF (80,000 tons)

5.4.3 – Mixed Waste Processing Facility (MWPF) Facility Requirements

A new MWPF will require a minimum of a 10-acre site. The following provides a list of the basic facilities that would be constructed on the site.

	Facility	Assumptions
1.	MRF Building	100,000 sq. ft.
2.	Office and Employee Center	5,000 – 10,000 sq. ft.
3.	Scales / gatehouse	2 – 3 Scales
4.	Truck Parking	-
5.	Rolling Stock Maintenance	-
6.	Container storage	-
7.	Employee Parking	40-50 spaces

It is desirable however, to acquire a larger parcel than 10 acres, if possible. This will allow for integration of other material handling activities and services such as: C&D processing, possible future AD, possible composting operations as well as support activities like truck parking and maintenance facilities. For these assets as much as an additional 15 to 20 acres would be required, which could include a large area for composting.

A location close to the Covanta plant would be beneficial, assuming the contract is extended. In addition to being in close proximity to the EfWF, it is somewhat central to the collection services and the MRRF and closer to materials markets in Portland.

5.4.4 - Schedule for Implementation

The schedule for planning, construction of the MWPF and installation of equipment is estimated to span almost five (5) years. The most unpredictable element is the time necessary to secure the site and land use permits. To site and permit the facility would most likely require a conditional use permit and can be expected to be controversial regardless of location. With this understanding, the following represents an estimated schedule for implementing this option.

Project Phase	Months
Preliminary Planning	3
Acquire and permit a site	24
Design and Procure Equipment	9
Construction of Site and Buildings	12
Installation / Startup of Equipment	8
Total Time	56

Considering the time frame of two years to acquire and permit the site, the project may be operational in about five years. However, similar projects have been expedited to reduce this timeframe by overlapping the equipment installation with the building improvements. Also, if design of the project could overlap with the land use permitting process, or if property is already permitted for solid waste, that could also reduce the timeline for implementing the MWPF. Likewise, the land use process can be impacted and extended due to appeals.

5.4.5 - Financial Information

Capital Cost Requirements - An "Order of Magnitude" construction cost estimate for building a MWPF along with the processing system is presented in Table 13. Construction would include a 100,000-sq. ft. pre-engineered metal building (PEMB) for housing the materials receiving, processing equipment system, bale storage and shipping.

The estimated cost of equipment is based on recent projects for systems to process similar volumes.

Table 13: Summary of Capital Cost for MWPF

Description	Cost Associated
Cost of Land	$1,000,000
MWPF Building and Site	$26,000,000
MWPF Equipment	$16,000,000
Total Estimated Cost	**$43,000,000**
Annual Debt Services	$ 2,340,000

The facilities and equipment are assumed to be financed with a revenue bond at 3.5% interest rate. Buildings, site infrastructure and equipment are expected to be financed over a 30-year period.

There are several approaches to consider on how the MWPF is built and financed. It could be totally a privately owned and operated facility, but some jurisdictions plan to own the facility. Then the county can decide whether to contract with a private vendor to operate or in some cases operate the facility themselves. There are advantages to each of these approaches and further evaluation of how the facility is developed can be addressed if this is selected as a preferred strategy.

Operating Cost - The operational costs are shown in Table 14 and were developed considering both the labor expenses and the cost to operate and maintain the equipment. It is based on an annual throughput of 80,000 TPY or 256 TPD over six (6) - day operations on one shift.

Table 14: Cost of Operations MWPF

ANNUAL THROUGHPUT	**TPY**	
MSW (40 TPH)	80,000	
Total Throughput	**80,000**	
Daily Throughput	*256 TPD @ 6 days/wk – 1 Shift*	
OPERATIONAL EXPENSES		
Labor (42 Employees -1 Shift)	$2,600,000	
Operation & Maintenance	$1,100,000	
Annual Operating	**$3,700,000**	**($46.25/ton)**

Revenues – MWPF revenues from the sale of recovered commodities will routinely vary with market conditions. For this analysis, we have used recent data published by DEQ that shows the market values for commodities over the last 28 years. Specifically, we used the market prices for the 8 years prior to 2008 in conjunction with more recent prices for the low revenue estimate while using the market prices for the last 10 years, or post 2008, period for the recent market prices. The average price is for all commodities sold.

Low market Revenue	$2,500,000– Average Price $107 / ton
Recent Market Revenue (8yrs)	$3,200,000 – Average Price $139/ ton

While these market prices do present a range of the potential revenue it must be understood that market prices can fluctuate to lower or even higher prices than shown. For the analysis below, it is assumed that 23,000 TPY would be marketed at $ 107 value per ton. However, in both cases we used averages estimated over a certain period since typically these larger swings in prices tend to be for a short time (less than 2 years).

Table 15: MWPF Financial Summary (80,000 Tons Per Year (TPY))

	Annual ($)	Cost (revenue)
Annual Operating Expense	**$ 3,700,000**	**$ 46.25**
Debt Service (On Capital - $43,000,000)	**$ 2,340,000**	**$ 15.60**
Covanta Processing Residuals ($55/ton)	**$ 3,135,000**	**$ 39.18**
Total Annual Operating Expenses	**$9,190,000**	**$ 114.87**
Estimated Revenue	**$ 2,500,000**	**($ 31.25)**
Net Operating Cost	**$ 6,690,000**	**$ 83.62**

A summary of financial information is provided in Table 15. The net operating cost is estimated to be about $84 per ton of total waste processed. It also assumes that all residue, 29,000 TPY and all mixed organics, 28,000 TPY recovered from the MWPF are processed at the EfWF at a service fee charge of $55 per ton. However, the mixed organics may be further processed for composting instead of being processed at the EfWF. If the recovered organics are composted versus delivery to the EfWF the net operating cost of the MWPF may be somewhat lower due to the avoided cost of processing at the EfWF.

Also, the summary of the MWPF operations assumes a lower market value of the recovered commodities. Using the 10-year average represents a slightly higher potential revenue of about $700,000 per year that would reduce the net operating cost by about $9 per ton.

5.4.6 - Impacts

By processing 80,000 tons it is estimated that the county will increase the recycling rate by recovering an estimated 23,000 tons of recyclable commodities from the mixed commercial waste stream. This estimate is predicated on the basis that there are only 80,000 tons mixed commercial waste and compacted drop box waste suitable to be processed. However, the MWPF is assumed to be operating on a single shift. The benefit of installing an advanced mixed waste processing system is that the county can grow into the capacity by adding a second shift. Commercial waste from other jurisdictions may be processed in the initial years which would help offset fixed expenses and lower the unit operating cost per ton. As the

county's waste stream increases, more in-county waste can be processed. This system can be designed to process commingled materials on the same equipment thus providing added flexibility.

In addition to the commodities recovered, the system will separate an estimated 28,000 TPY of mixed organics. This includes food waste, yard waste and compostable paper. Here again the system will provide flexibility with the Covanta EfWF. This organic stream may be able to be blended with the mixed waste residue and sent to the EfWF which is assumed in the financial analysis. However, as the waste stream grows the mixed organics stream can be processed further to be composted or sent to an anaerobic digester to produce renewable energy.

5.5 - Organics Recovery

With current recycling programs having removed the higher value marketable commodities from the waste stream, the industry is focusing more on how to recover food waste and in some cases compostable fiber byproducts. Commonly referred to as mixed organics, food waste and compostable paper products represent anywhere from 25% to 35% of the municipal waste stream. Similar to Marion County, many communities have initiated programs to collect source separated food wastes from residential properties, commercial generators with large food preparation functions, including restaurants and grocery stores. Provided the food waste is not contaminated too severely with plastic packaging, the material is quite suitable for composting. Nationwide, these collection programs are collecting only a small portion of the total mixed organic waste stream.

Continuing to send organics in the waste stream to landfills increases the production of landfill generated methane gas, which may be recovered and used to generate a renewable gas. If not recovered and flared fully, fugitive methane emissions become a major contributor to GHGs and are recognized as such in the state of Oregon.

There are a few strategies for recovering more food waste from the waste stream. The first would be to expand food waste collection programs to restaurants and target commercial accounts. Additional education and perhaps even rate incentives may be needed to encourage participation and ensure cleaner materials. This approach may result in some additional cost to the collection system, but if clean materials can be generated there are two compost facilities that serve Marion County that can process and market this material. The cost for separate collection can be very significant and methods to fund this need to be considered and addressed to achieve a high level of participation.

A second approach is to recover the mixed organics stream from an integrated mixed waste materials recovery facility. As discussed in the previous section, it is estimated that as much as 36,000 TPY of mixed organics is present in the commercial waste stream. In some cases, this mixed organic stream is being composted but it should be emphasized that additional processing is necessary to produce a product that does not contain glass fragments and plastics.

The other option is to process the mixed organic stream in an AD unit to produce renewable gas and a digestate that can be composted. This is a preferred approach in Europe. Also, there are several AD plants in California, and more coming on line throughout the US. Although these plants do produce electricity for onsite use, the primary product is compressed natural gas (bio-CNG) for collection fleets.

The approach that best suits the Marion County system requires more evaluation. However, recovery of food waste and/or mixed organic waste stream does provide a pathway towards reducing waste disposed in out-of-county landfills and can help in attaining the county's recovery rate.

5.6 – Multi-Family

Many jurisdictions have focused on programs to collect source separated recyclables from multi-family residential complexes. The programs are intended to be an extension of curbside collection of source separated commingled collection services provided to single family residents. However, there are many obstacles to overcome to establish an effective program not the least is the logistics of creating a dedicated space for storing materials in the limited space provided in most complexes. In addition, promotion and education for such collection programs is more difficult as residents tend to be more transient and often move.

Multi-family waste is reported to contain a higher percentage of recoverable materials but instituting a reliable collection programs is challenging. In most cases multi-family complexes are served by front load collection trucks. These same collection trucks pick up waste at strip malls and/or individual retail/commercial customers. As this material is mixed with the commercial waste stream, one alternative approach is to process the multi-family waste at a MWPF as mentioned previously.

As mentioned previously, DEQ has presented programs for cities with populations over 4,000 to encourage increased recycling at multi-family complexes by offering services directly to tenants. Currently, owners of multi-family dwelling units can provide recycling containers in the complex. The new regulations promote the option of offering each tenant with individual containers for commingled materials. This approach is certainly one method to target more materials for recovery, although an alternative is to collect waste from multi-family units with commercial waste and recover materials at an advanced mixed waste processing facility.

6 - Conclusions

Table 16, shown below, compares and summarizes the scenarios evaluated in this report. From this analysis, the GBB team has concluded:

1. The lowest cost alternative is status quo, with continued operation of the MRRF and Covanta Marion EfWF and all excess waste to be hauled to Coffin Butte landfill for disposal.
2. The best alternative for recovering additional recyclable material is to construct a MWPF identified in Scenario 2. Scenario 2 increases recovery by 7.3% and has potential for more. If the organic stream can be recovered, the rate goes up 13.8% and allows Marion County to meet the objectives set by the Oregon DEQ of 64%.
3. Scenarios 2 (MWPF) and 3 (EfWF expansion) accomplish the same level of landfill diversion since there is an expected quantity of waste from the C&D stream that cannot be recovered or taken to the EfWF.
4. The EfWF expansion alternative has the highest operating cost of options considered, exceeding $100 per ton. The larger facility has a lower per ton operating cost and has more capacity to accommodate future increases in waste generation quantities. The economics will improve for the county if external waste is utilized at an expanded EfWF to fulfill excess capacity as the county would be generating more revenue from host or tipping fees.
5. When considering the project development schedule and the length of time for any new facility to become operational, the projected increase in waste disposed should also be considered in a proforma style analysis.
6. The best approach to meeting established objectives may be to consider a phased implementation of these scenarios. One possible scenario that would fit the projected waste stream disposal quantities would be to construct the MWPF to increase recovery rates as soon as a schedule would allow and then plan for an EfWF expansion at a point in time when the waste disposal quantities and market conditions would be supportive.

Table 16: Option Comparison

	Current 2017 Projections	Scenario 1 Landfill	Scenario 2 MWPF	EfWF Expansion	
				90,000 Tons	200,000 Tons
Capital Cost, $ (Annual)		$544,000	$2,340,000	$7,829,000	$12,669,000
Operations and		($5,878,000)[2]	$6,835,000	$5,363,000	$11,919,000
Landfill Savings, Tons		(170,000)	23,000	39,800	39,800
Landfill Costs/(Savings),		$6,917,000	($936,000)	($1,619,000)	($1,619,000)
Ash Disposal Costs				$ 653,000	$1,450,000
Revenue, $ (Annual)		($2,570,000)[3]	$2,500,000	$1,645,000	$3,979,000
Net Operating Cost, $[5]	Base Case	$4,153,000	$5,739,000	$10,581,000	$20,440,000
Recovery Rate Increase,			23,000	10,000	10,000
Recovery Rate Increase, %			4.2	1.8	1.8
Recovery Rate including			51,000	-	-
Recovery Rate including			9.3	-	-
Landfill Disposal, Tons	92,200	262,200	52,400	52,400[4]	52,400[4]
Landfill Diversion, % (1)	83.2	52.3	90.5	90.5	90.5
Additional O&M Jobs	No Change	No Change	42	21	39

1. Total estimated waste generated in 2017 is 548,846 tons.
2. O&M cost is estimated to be $1,360,000 of additional transfer station operations costs and an O&M savings of $7,238,000 when not taking waste to EfWF.
3. Electrical and metals revenue loss when not going to EfWF.
4. Required landfill disposal may be lower than 52,400 if some portion of the residuals from C&D processed can be combusted at the EfWF.
5. Total costs minus revenue.

7– Recommendations

1. Continue relationship with Covanta Marion through negotiation of new agreement.

   The Covanta Marion EfWF has been the keystone of the county's solid waste system since 1986. The plant has successfully processed millions of tons of MSW that would have otherwise gone into a landfill. The bonds that financed the construction of the facility initially have been retired which allows it to operate at a lower cost to Marion County. However, the current facility will require capital investment to operate reliably into the future, and may cause some incremental cost increase to the county, but at a fraction of the cost of a new facility.

2. Suspend current discussion of a Covanta Marion expansion.

   The disposal cost of the MSW that would be processed with a new facility is much greater than other options such as recovery of materials through a MWPF prior to combustion at the existing EfWF. Based on solid waste disposal projections in Section 3 of this report, GBB estimates that in 2025 there may be enough waste available for a third unit, sized similar to the existing units, assuming no MWPF is added. Implementation of a MWPF that could recover 40,000 tons of material would push the time frame for needing additional EfWF capacity to about 2035. Therefore, reconsideration of new EfWF capacity should be based on a decision whether to move forward with a MWPF alternative.

3. Detailed analysis of a MWPF scenario.

   The analysis contained in this report relies on assumptions about the waste streams and compositions available for a MWPF. It also relies on very preliminary information developed with regard to the facility size, location, ownership and operating parameters. Additional detailed analysis is necessary to increase confidence about the economic performance of such a facility and its impact on the overall system cost. GBB recommends a more detailed evaluation that would include a site plan, an anticipated process flow diagram and procurement of vendor budget proposals for turnkey/operate implementation. From this information, a more accurate financial model can be developed to assist the county decision making process.

4. Research separation and reuse of bottom ash as an aggregate.

   This would likely be done in coordination with Covanta Marion, since equipment modifications would be required. Other locations have engaged available university research groups to conduct the testing and development of the information required for a beneficial use determination.

5. Develop a financial analysis for scenarios based on added cost to existing system.

   GBB recommends development of a model that incorporates the preliminary cost of options identified in this report into the current system budget that the Marion County Environmental Services has for its integrated solid waste management system to establish the impact to the overall system cost. There are two alternative approaches to accomplishing this:

a. Marion County inputs the information developed into their existing model.
b. GBB develops an independent comprehensive model.

6. Marion County should obtain legal representation to follow and influence what Covanta is seeking from PGE regarding the current/future PPA.

   At this time, PGE and Covanta are litigating issues that could have a significant financial impact on Marion County. GBB recommends that Marion County intervene or at least monitor the OPUC proceeding, and (if Covanta files in court) similarly intervene or monitor any court proceedings.

7.1 Secondary Recommendations

In addition to the primary recommendations presented above, the secondary recommendations should also be considered to compliment several items discussed in this report.

1. Before any major investments are made, the county should work with Republic to prepare a master site development plan for SKRTS. The master plan should focus on updating facilities to enable a more efficient handling of materials across various waste streams, and address the potential of an increased volume of waste and traffic.
2. Attention should be paid to the function the MRRF in managing different waste streams in the future, especially considering the increase in waste that must be transferred from the county to a disposal site. Likewise, it will be necessary to continue processing C&D materials and to transfer residual waste out of county.
3. Since continued operation of Browns Island could present future liabilities due to potential environmental concerns, the county should develop a long term comprehensive strategy to handle materials - particularly C&D waste - with the ultimate goal of closing the site.
   a. This strategy may include policies to encourage source separation of recyclable materials by contractors as part of demolition plans and working with the MRRF to implement the necessary infrastructure to process all C&D waste materials at a single location.
4. Regarding the Covanta Power Purchase Agreement, the county should support the reduction of the turbine size from 13 MW to less than 10 MW provided it would impact neither the quantity of waste delivered nor the tipping fee at the EfWF.
5. A detailed explanation should be requested from Covanta Marion regarding the declining production at the EfWF corresponding with increasing natural gas usage.
6. Consideration of the revenue associated with recovery of metals at the EfWF should be given when contract extension discussions are undertaken.
7. It would be useful to contact a vendor such as LabUSA to understand the revenue potential and feasibility of ash processing and enhanced metals recovery.
   a. Another company active in this area is Inashco, who has a system operating in Pennsylvania processing ash from two EfWFs owned by Lancaster County Solid Waste Management Authority.
8. Upon updating the feasibility of proceeding with a mixed waste processing facility using data from DEQ and assuming there is interest in proceeding, a more detailed and statistically

accurate waste composition analysis should be performed. The purpose of this more detailed analysis will be to verify the materials recovery assumptions used in the preliminary analysis and to provide information to be used for selecting the most viable processing system.

Appendix A – Statewide Policy and Programs for Managing Solid Waste

Introduction

This Appendix contains background information related to the Statewide Policies and Regulations that can be referenced in evaluating future programs adopted by Marion County

Oregon's materials management hierarchy (ORS 459)

The Opportunity to Recycle Act provides that, to conserve energy and natural resources, materials management should follow a hierarchy:

- Reduce the amount of waste generated;
- Reuse materials for their original intended use;
- Recycle materials that cannot be reused;
- Compost materials that cannot be reused or recycled;
- Recover energy from materials that cannot be reused, recycled or composted; and
- Dispose of residual materials safely.

459A.010 Policy; statewide goals; recovery rates. (1) It is the policy of the State of Oregon that recovery of material is consistent with the priority of solid waste management set forth in ORS 459.015 (2).

It is the goal of the State of Oregon that:

(a) For the calendar year 2009 and subsequent years, there be no annual increase in total general solid waste;

(b) For the calendar year 2020 and subsequent years, the rate of material recovery from the general solid waste stream shall be at least 52 percent;

(c) For the calendar year 2020 and subsequent years, the rate of material recovery of certain materials from the general solid waste stream shall be as follows:

(A) Food waste, at least 25 percent; and

(B) Plastic waste, at least 25 percent;

(d) For the calendar year 2025 and subsequent years, the rate of material recovery of carpet waste from the general solid waste stream shall be at least 25 percent;

(e) For the calendar year 2025 and subsequent years, the rate of material recovery from the general solid waste stream shall be at least 55 percent;

(f) For calendar years 2025 through 2049, total general solid waste generation shall be 15 percent below total general solid waste generation for the calendar year 2012; and

(g) For the calendar year 2050 and subsequent years, total general solid waste generation shall be 40 percent below total general solid waste generation for the calendar year 2012.

Waste Reduction/ Reuse and Recycling Program Requirements

The following is the list of Reduce/ Reuse and Recycling Programs adopted by ORS459 that are to be provide by local governments to meet minimum performance requirements for achieving recovery goals.

Reduce and reuse – local governments' waste prevention and reuse programs

For waste prevention and reuse programs, certain cities must implement between three and five program elements from a menu of seven:

- A citywide or countywide education and promotion program about the environmental benefits of, and opportunities to reduce the generation of waste through, waste prevention and reuse;
- A waste prevention campaign targeting residential generators of waste and focused on one or more toxic or energy intensive materials or consumer purchasing practices;
- A waste prevention campaign targeting commercial or institutional generators of waste and focused on one or more toxic or energy intensive materials or consumer purchasing practices;
- A waste prevention and reuse education program in elementary and secondary schools;
- A program for the providing city or wasteshed funding or infrastructure support to promote and sustain reuse, repair, leasing, or sharing efforts;
- A program for the providing city or wasteshed technical assistance to promote and sustain the reuse, repair or leasing of materials or other sharing of efforts to reduce waste; and
- City or wasteshed support for a food rescue program.

Recycle and compost – local governments' recycling programs

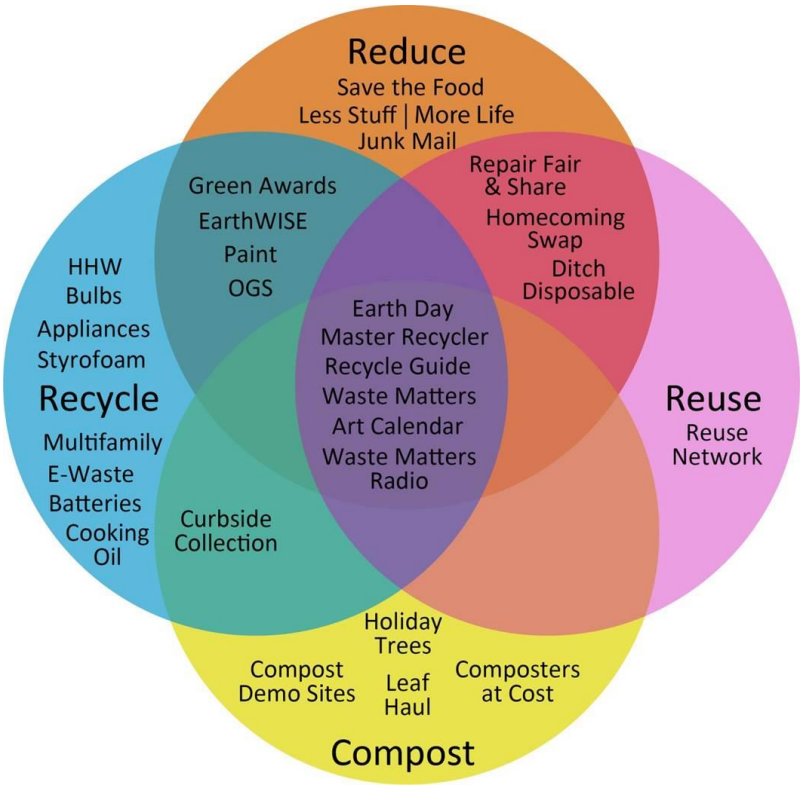
Oregon also offers local governments flexibility to implement their recycling programs using a menu of 13 program elements:

- Provision of at least one durable recycling container to each residential service customer;
- On-route collection at least once each week of source separated recyclable material from residential collection service customers, which is provided on the same day solid waste is collected from each customer;
- An expanded education and promotion program including a contamination reduction education plan;
- A multifamily collection program that includes recycling collection and education for tenants;
- An effective residential yard debris collection and composting program that includes the promotion of residential composting of yard debris;
- A commercial recycling program that includes weekly onsite collection of source separated principal recyclable materials and education for commercial generators;
- Expanded depots for recycling of at least all principal recyclable materials, and provisions for promotion or education to maximize the use of the depots;
- Solid waste residential collection rates that encourage waste reduction, reuse and recycling through reduced rates for smaller containers, including at least one rate for a container that is at least 21 gallons;
- A collection and composting system for food and other compostable waste from commercial and institutional entities that generate large amounts of such wastes;
- A commercial recycling program that requires commercial generators of solid waste that generate large amounts of recyclable materials to source separate recyclable materials;

- A program for monthly or more frequent on-route collection and composting for food and other compostable waste from residential collection service customers;
- A recovery program for C&D debris that requires construction and demolition debris to be source separated at the generation site or sent to a MRF for processing and recovery; and
- A food waste collection program requiring nonresidential generators that generate large amounts of food waste to source separate the food waste for recovery.

Marion County – Waste Reduction / Reuse and Recycling Programs (WR/R)

The following Venn diagram displays the comprehensive WR/R programs currently being provided by Marion County, haulers and other key participants in the solid waste system.



Waste Reduction Programs Managed by Marion County	Reuse Programs Managed by Marion County	Recycling Programs Managed or Promoted by Marion County	Compost Programs Managed or Promoted by Marion County	Events
Save the Food Less Stuff Junk Mail Art Calendar *EarthWISE *Oregon Green Schools *WM Tabloid *WM Radio *Master Recycler Class	Reuse Network *Repair Fair *Homecoming Swap Ditch Disposals *EarthWISE *Recycle Guide *WM Tabloid *WM Radio *Master Recycler Class	HHW Fluorescent Lights Appliances Styrofoam Multi-family e-Waste Batteries Cooking Oil Paint Contamination *EarthWISE *Oregon Green Schools *Curbside collection *Recycle Guide *WM Tabloid *WM Radio *Master Recycler Class	Christmas Trees Compost Demo Sites Leaf Haul Composters at Cost *Curbside collection *Recycle Guide *WM Tabloid *WM Radio *Master Recycler Class	Green Awards Earth Day Fairs, etc. Valley Roots *Repair Fair *Homecoming Swap

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