Solid Waste Policy Report
Legislative charge

Minnesota Statute §115A.411 requires the Minnesota Pollution Control Agency to draft a solid waste policy report for the Legislature every four years. The report must contain information on the status of solid waste management in Minnesota and make recommendations for new or modified policies to advance the management of waste in the state.

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Summary

Minnesota’s Waste Management Act has been in place since 1980 and establishes criteria for the management of three types of solid waste — mixed municipal solid waste (MMSW), construction and demolition waste (C&D), and industrial solid waste (ISW). The waste management hierarchy establishes preferred management methods based on environmental impact. Reduction and reuse of materials are at the top of the hierarchy, followed by recycling, composting, and waste to energy, with the least preferable management method being land disposal. The current management system focuses largely on discards and what to do with a material at the end of its life. However, the waste management system is evolving, and sustainable materials management (SMM) approaches are becoming more prevalent.

SMM focuses on the best use and management of materials based on how they impact the environment throughout their life cycle (not only at disposal). As the population of Minnesota grows and the economy continues to improve, new and innovative ways of managing materials will be necessary. An effective SMM approach prioritizes management of materials based on the highest greenhouse gas emission savings or other environmental benefit, which oftentimes focuses on prevention and reuse of materials. SMM promotes managing an integrated solid waste system with the least amount of impact to human health and the environment.

The 2013 Waste Composition Study, Office of Legislative Auditor’s report, the 2015 Recycling and Solid Waste Infrastructure Evaluation, and other solid waste data helped guide the MPCA recommendations for the 2015 Solid Waste Policy Report. Those recommendations, combined with the Strategic Plan, Metro Policy Plan, and Solid Waste Program Plan, have helped refine and prioritize the 2019 SWPR recommendations. These reports provide insight into the current system and point toward recommendations to improve the prevention and management of solid waste in Minnesota. This report will also highlight priority areas of the Governor Walz and MPCA commissioner, including equity, climate, community prosperity, engagement and transparency, and efficiency and due diligence. Key issues addressed in this report, as they pertain to solid waste, include climate adaptation, environmental justice, sustainable materials management, and more.

All policy recommendations are summarized in Appendix A of this report. Recommendations are based on MPCA and solid waste priorities. Several recommendations require additional resources and legislative support. Recommendations are labeled as "legislative" when they necessitate legislative action. Recommendations may require long-term commitment, or several stages of implementation. They are not commitments to action, but identifiers for future short-term and long-term priorities intended to address barriers and help achieve solid waste goals.
Guiding documents

The recommendations in this report align with the mission of the MPCA to protect and improve the environment and human health. Recommendations both draw from and seek to inform the Solid Waste Program Plan, the MPCA Strategic Plan, and when appropriate, the Metropolitan Solid Waste Policy Plan 2016-2036 (Policy Plan).

MPCA Strategic Plan (2018-2022)

The MPCA’s five-year strategic plan charts the agency’s direction through 2022.

Cross-agency strategic plan goals include:

1. Incorporate strategies to address environmental justice concerns in all programs.
2. Increase involvement of communities in decisions and actions that affect them.
3. Act on opportunities to increase resilience of communities and the environment to climate change impacts.

The land-related goals, which are emphasized in this report, include:

1. Reduce food waste from households and businesses by generating less and rescuing and recycling more.
2. Prevent and reduce risks to groundwater from unlined construction and demolition landfills.

Land-related long-term environmental goal:

1. Solid waste is managed to conserve materials, resources, and energy.

The 2013 Waste Composition Study, OLA report, Waste Infrastructure and Capacity Assessment, and other solid waste data helped guide the MPCA recommendations for the 2015 Solid Waste Policy Report. Those recommendations, combined with the Strategic Plan, Policy Plan, and Solid Waste Program Plan, have helped refine and prioritize the 2019 SWPR recommendations. They are foundational pieces of information that provide insight on the current waste system and help identify actions necessary to continue to improve the prevention of solid waste and the management of solid waste in Minnesota.

Applicable cross-agency strategic plan goals

Climate adaptation

Act on opportunities to increase resilience of communities and the environment to climate change impacts.

Climate change is already occurring in Minnesota and its impacts are affecting communities, the environment, and the economy. For example, the top 10 combined warmest and wettest years on record in Minnesota have occurred since 1980. Heavy rains are now more common in Minnesota and more intense than at any time on record; and quantities of both contact water and landfill leachate are expected to increase with higher average precipitation and more frequent extreme rainfall.

MPCA also recognizes the connection between solid waste and climate change, as demonstrated by the GHG emissions identified by the consumptions-based emissions inventory (see page 17). Climate change
adaptation includes developing and implementing strategies to help human and natural systems prepare for and address climate change impacts.

Over the last several decades, the state has experienced substantial warming during winter and at night, with increased precipitation throughout the year, often from larger and more frequent heavy rainfall events. There is increased need to properly clean up and manage solid waste, hazardous materials, and debris after floods, storms, and other natural disasters. More frequent occurrences of natural disasters increase the demand for disaster remediation and coordination efforts, as well as for trained staff to meet these specific needs. Design standards for permitted waste management facilities are linked (by rule) to certain magnitudes of storm events (i.e., 25- or 100-year storms). As storm severity increases, this affects facility needs.

In terms of climate adaptation at permitted solid waste facilities, precipitation data is used for stormwater modeling. For lined landfills, there is a rule requirement that stormwater management systems must cope with 24-hour storms at 25-year intervals. When permits come up for reissuance, some of these landfills are voluntarily designing for 24-hour storms at 100-year intervals.

![Table of Hazard Observed Trends](image)

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Observed Trend</th>
<th>Confidence Change is Occurring</th>
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<tbody>
<tr>
<td>Extreme cold</td>
<td>Rapid decline in severity &amp; frequency</td>
<td>Highest</td>
</tr>
<tr>
<td>Extreme rainfall</td>
<td>Becoming larger and more frequent</td>
<td>High</td>
</tr>
<tr>
<td>Heavy snowfall</td>
<td>Large events more frequent</td>
<td>Moderately Low</td>
</tr>
<tr>
<td>Severe thunderstorms &amp; tornadoes</td>
<td>Overall numbers not changing but tendency toward more “outbreaks”</td>
<td>Lowest</td>
</tr>
<tr>
<td>Heat waves</td>
<td>No recent increases or worsening</td>
<td></td>
</tr>
<tr>
<td>Drought</td>
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**Confidence Scale**

![Confidence Scale Image](image)

*Snapshot of observed trends among common weather hazards in Minnesota, and confidence that those hazards are changing in response to climate change. Graphic based on information from 2014 National Climate Assessment and data analyzed by the Minnesota DNR State Climatology Office.*

*Figure 1 Identifies the observed trends among common weather hazards in Minnesota, based on information from 2014 National Climate Assessment and data analyzed by the Minnesota DNR State Climatology Office, as published in the 2017 Report of the Interagency Climate Adaptation Team, Adapting to Climate Change in Minnesota.*
Figure 2 Depicts the projected and expected trends among common weather hazards in Minnesota, and confidence that those hazards will be exacerbated by climate change, as reported in the 2017 Report of the Interagency Climate Adaptation Team, Adapting to Climate Change in Minnesota.

In spring 2019, the MPCA solid waste program participated in a climate change adaptation risk assessment which culminated in the publication of the Climate Change Risk Assessment: Summary of Process and Data. The report provides suggested actions and additional considerations for climate adaptation. Specific to solid waste, the report suggests providing appropriate gear and training for emergency response staff; updating landfill design rules so they can properly handle larger rain events; and creating waste management plans for anticipated large livestock and plant die-offs.
Environmental justice

Incorporate strategies to address environmental justice concerns in all programs.

The MPCA is committed to ensuring that pollution does not have a disproportionate impact on any group of people. This is the principal of environmental justice. This means that all people—regardless of their race, color, national origin, or income—benefit from equitable levels of environmental protection and have opportunities to participate in decisions that may affect their environment or health.

MPCA is working to ensure that all of its programs consider and address environmental justice as part of their work. This includes:

- Identifying how low-income residents and people of color may be experiencing disproportionate environmental impacts and harm.
- Identifying ways to reduce disproportionate impacts and prevent future harm.
- Evaluate how policies and programs under development or consideration may impact low-income communities and people of color.
- Conduct extra and early outreach and engagement to ensure that all Minnesotans have an opportunity to participate in decisions about activities that may affect their environment and health.

This policy report highlights opportunities for addressing environmental justice through solid waste programs and policies. To work toward environmental equity, decision makers can actively seek out and facilitate the involvement of potentially affected communities so that all people have an equal opportunity to participate in decisions that may affect their environment and health. Community members can provide authentic, qualitative information about the vulnerabilities and challenges they face, based on their lived experiences, culture, and social context.
Engagement

*Increase involvement of communities in decisions and actions that affect them.*

Community engagement means building relationships, improving trust, and involving all Minnesotans in our work in an accessible and responsive manner. The Solid Waste Program works to follow best practices in conducting engagement work, storing and analyzing data, and acting on information. MPCA values collaboration, inclusivity, accessibility, transparency, and accountability in public engagement processes.

Effective outreach will require MPCA to use trusted sources of information in the affected community, which may include local newspapers, newsletters, etc. Participation in local organizations’ meetings is also important. The MPCA Solid Waste Program can make an effort to ensure that written materials, presentations, and informal communication are accessible, easily understandable, free of jargon, accurate, truthful, and available in multiple languages, when appropriate. Languages will be determined based on community information and demographic data.

For some MPCA actions, a formal public meeting is required by state or federal regulations. Whether or not public outreach is formally required, MPCA can seek to provide community members with information early in any process, frequently, and in a variety of mediums.

Examples include holding informal meetings, listening sessions or “office hours” in the community at a variety of times at locations that are convenient for the community; attending other meetings and events being held in the community; supporting the formation of citizen advisory committees; offering to meet with representatives of community groups; and more.
Minnesota’s current solid waste system and dynamics

The Minnesota Waste Management Act (WMA, Minn. Stat §115A.02)

Adopted in 1980, the WMA established criteria for managing solid waste. The goal of the act is to protect Minnesota’s land, air, water, and other natural resources and public health by:

- reducing the amount and toxicity of waste generated.
- separating and recovering materials and energy from waste.
- reducing indiscriminate dependence on disposal of waste.
- coordinating solid waste management among political subdivisions.
- developing waste facilities in an orderly and deliberate way.

The waste management hierarchy

The WMA also aims to foster an integrated waste management system in a manner appropriate to the characteristics of the solid waste stream. Based on environmental factors, the waste management hierarchy (Figure 3) prioritizes waste reduction, reuse, recycling, and organics recovery above methods that preclude further use of the materials, including waste-to-energy (burning refuse to recover fuel or energy) and land disposal.

Roles and requirements

In Minnesota, the responsibility of managing solid waste is primarily delegated to the counties, while the state retains oversight authority and supports local efforts through permitting, planning, financial support, and technical assistance. Plans include how the county will ensure waste is managed properly to meet the goals and objectives of the WMA and all efforts that will be undertaken to manage waste in accordance with the hierarchy.

The seven-county Twin Cities Metropolitan Area (Metro Area) and Greater Minnesota counties have different sets of requirements governing their solid waste planning. Metropolitan County Solid Waste Master Plans must comply with the current Metropolitan Solid Waste Management Policy Plan (Metro Policy Plan), which is a 20-year plan updated every 6 years (Minnesota Statute § 473.149). Greater Minnesota County Solid Waste Plans must conform to WMA and Minnesota Rules. Greater Minnesota County Solid Waste plans are updated every 10 years and Metro County Solid Waste plans are updated every 6 years.
Case study: Greater Minnesota grants

The 2015 Legislature created a program and allocated $2M for recycling and composting grants in Greater Minnesota. In 2017 the funding was renewed at the same level. The focus of the funding is to promote and enhance recycling systems in rural areas. The MPCA distributed grants for all $4M between 2015 and 2019 for projects ranging from transition to single-stream curbside collection of recyclables to recycling demolition debris to initiating composting programs. In total, 29 grants have been awarded through this program to date.

Starting July 2017, the city of Moorhead (population 40,500) transitioned from multi-sort recycling to single-sort curbside recycling and provided 5,000 multi-family homes with the opportunity to recycle.

In the first six months after roll out, curbside collection increased from an average of 44 tons to 204 tons per month.

City of Moorhead used a Greater Minnesota Grants to help them purchase over 11,000 96-gallon totes and roll out a brand new, single-sort program. Moorhead can now accept materials that were previously not collected, such as office paper, mail, phonebooks, #3 and #6 plastics.

Moorhead created a "No-Sort" recycling guide which was posted on the City of Moorhead website and sent to all household residents and multi-family managers in Moorhead.

Increasing participation on the multi-unit housing recycling route to 20% of the total tonnage is Moorhead’s next goal. The actual tonnage for curbside collection was 1,464 tons for 2017.
Waste measurement and data

In 1989, the Minnesota Legislature set county recycling goals. Each Greater Minnesota county (outside of the seven-county metro area) must recycle a minimum of 35% (by weight) of total solid waste generation by 2030. The 2014 Legislature increased the recycling goal for the seven-county metro area from 50% to 75% of the MMSW they generate by 2030. In 2016, the Legislature also passed a commercial recycling law (§115A.151) that requires businesses to recycle at least three material types, like paper, metal, glass, organics, or plastics, if they are in a certain North American Industrial Classification System (NAICS) code and contract for pick-up of at least 4 cubic yards of trash per week.

This report addresses three types of solid waste: mixed municipal solid waste (MMSW), industrial solid waste (ISW), and construction and demolition waste (C&D). Most rules, laws, fees, and taxes are aimed at MSW disposal. The WMA does address all types of solid waste with separate requirements for industrial solid waste and C&D facilities. However, the emphasis has historically been on measuring and managing MMSW. The focus of state and local programs in the future should ensure that all material—MMSW, ISW, and C&D—is managed to its highest and best use.

Each type of solid waste has a different tax structure (table 1). Non-MMSW is much cheaper to dispose of, with a fee of only sixty cents per cubic yard, whereas commercial MMSW has a 17% state service fee and residential MMSW has a 9.75% service fee. Counties can also tax waste separately.

<table>
<thead>
<tr>
<th>Waste type</th>
<th>Fee</th>
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<tr>
<td>MMSW – residential</td>
<td>9.75% of service fee</td>
</tr>
<tr>
<td>MMSW – commercial</td>
<td>17% of service fee</td>
</tr>
<tr>
<td>MMSW – self haul</td>
<td>17% of tip fee</td>
</tr>
<tr>
<td>Non-MMSW (industrial, demolition, medical)</td>
<td>$0.60 per cubic yard of container</td>
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Figure 4. This figure shows how the solid waste management taxes applied for different waste types.

The MPCA conducted a waste characterization study in 2013 to determine the constituents in MMSW disposal streams across the state. A similar study was conducted in 2000. Comparisons of those two studies shows that the composition of disposed MMSW is changing. The top three categories of MMSW — paper, plastics, and organics — remain the largest material types in the waste stream by weight. There was a reduction in the percentage of paper generated and an increase in both plastics and organics (as a percentage of the total waste collected) from 2000 to 2013. Opportunities exist for these materials to be prevented or recovered for reuse, recycling, or organics recycling.
Figure 5. This figure shows a comparison between the 2000 and 2013 waste composition studies. The 2013 study found that Minnesota’s waste has changed over the last 13 years. Paper, plastics, and organics are still the top three components of our garbage, but the proportions have changed — https://www.pca.state.mn.us/waste/minnesota-msw-composition-study

The 2016 Metro Policy Plan currently has a WTE goal of 35% of total waste managed by 2020. Great River Energy Resource Recovery Facility in Elk River (GRE) stopped accepting MMSW in January of 2019, reducing the capacity for waste-to-energy (WTE) processing in the seven-county metro area by 33%. This is an opportunity to renew efforts to increase reduction, reuse, and recycling. However, if current trends continue, this will result in higher amounts of landfilling for 2019.

Nearly one third of the material we generate in Minnesota is landfilled. The MPCA’s Closed Landfill Program (CLP) was established by the Legislature in 1994 as an alternative to Superfund. The first such program in the nation, CLP is unique in that the MPCA has assumed the responsibility to “manage” closed, state-permitted, MMSW landfills, thereby mitigating risks to the public and the environment. There are 114 landfills eligible to be in the program. To date, 110 landfills have entered the program. Through fiscal year 2019, cumulative expenditures to address human health and environmental risks at the 110 landfills are $462,712,933.

Geographic maps of Minnesota’s landfills, recycling facilities, transfer stations, and compost sites can be found in Appendix C of this report.

Select Committee on Recycling and the Environment (SCORE)

The MPCA uses the SCORE annual report information from all 87 counties (and Western Lake Superior Sanitary District) to detail trends in waste generation, management, and disposal. SCORE data trends are used to help develop sound policy and solid waste plans to manage waste in a manner that protects the environment and human health. Funding for SCORE comes from the Environmental Fund and allocation is statutorily determined based on a county’s population.

2017 marks the highest documented combined recycling rate (organics recycling and traditional recycling) recorded for Minnesota since the start of the SCORE program in 1991. SCORE shows trends that more paper, plastics, and organics are being diverted from disposal. Those materials make up the
The majority of waste in the state. The total amount of municipal solid waste (MSW) generated in 2017 for Minnesota was 5.8 million tons, which is a 7.2% increase from 2016. Of that amount, combined recycling and organics makes up 44.8% of the total versus 43.1% the previous year (total tonnage increased 11.2% year-on-year). In 2015 (reporting year 2014), counties began entering their SCORE information online via Re-TRAC software, which was an improvement over the previous online portal.

The 2017 interactive SCORE report (based on 2017 data and published in 2019) summarizes the current state of recycling and waste diversion of MMSW in Minnesota. The 2017 SCORE report is the first version of an interactive Tableau report, and all data is available online from 1991 to 2017. Figure 4 shows waste-to-energy, landfiling, composting, and recycling over time, based on SCORE reporting.

![Figure 6. This figure shows a comparison between the 2000 and 2013 waste composition studies. The 2013 study found that Minnesota’s waste has changed over the last 13 years. Paper, plastics, and organics are still the top three components of our garbage, but the proportions have changed.](image)

2018 SCORE reporting has added an additional form in Re-TRAC for counties for licensed hauler lists that will assist MPCA with compliance and outreach for hauler reporting. As hauler reporting compliance improves, counties will be less burdened by collecting MSW data, and MPCA will have better documented tonnage from commercial entities.

Minn. Statute § 115A.93 requires haulers to report to the MPCA. Counties, as the licensing entity, have been integral to that process. In order to make this effort successful, we need additional support from counties, including follow-up with non-compliant haulers and the withholding of licenses in the future for those that do not come into compliance. The goal is to alleviate county reporting responsibilities and create a more efficient and accurate reporting structure.
Source reduction, SCORE data

Preventing waste is the only way to slow or stop the upward trend of total waste generation in Minnesota. While documenting the amount of waste not generated is more challenging, ongoing efforts focus on quantifying the avoided waste alongside other standard measurements. In the past, the MPCA has reported on the overall waste generated in the state and the per capita waste generated using population data. The MPCA can also use U.S. Environmental Protection Agency’s (EPA) documented methodology that predicts how much waste should have been generated based on personal consumption expenditure. This section describes the methodology of how the MPCA is predicting how much waste could have been generated as compared to our reported SCORE documented waste generation.

This is the first year MPCA is showing “source reduction” in SCORE reporting at a statewide level. Figure 7 shows that our efforts at preventing waste matter. Source reduction (or waste prevention) means not generating any materials that require disposal. This estimate of source reduction is noted by the orange projection line labeled “Expected Waste Generation,” and it was calculated using a methodology pioneered by the EPA. Based on per capita expenditure, it projects from 1997 how much waste would be expected in 2017 if we generated waste at the same 1997 rate in waste per millions of dollars spent (Figure 5). Although SCORE data tells us that waste generation per capita is increasing since 2008, it is increasing at a rate slower than the EPA methodology predicted using consumption expenditure numbers.

Total generation of MSW increased by 7.2% from 2016 to 2017, but population only increased by an estimated 0.9%, indicating that we are producing more waste per capita in 2017 than in 2016. However, the EPA methodology predicted that Minnesota was expected to generate even more waste than SCORE reported. It is a positive that we have not generated the numbers predicted by personal consumption expenditure, but we must take action to promote waste prevention, so that SCORE-reported waste per capita starts to decline.
Figure 7. This chart compares source reduction (based on SCORE data) as compared to the expected waste generation (based on a 1997 waste generation rate using per capita expenditure.)

**Combined recycling, SCORE data**

Every year since 2010 has seen an increase in recycling rates. Recycling and organics collection grew to 44.75% in 2017. This is an increase of 11.2% from 2016. All major categories of recyclables increased statewide in 2017 compared to 2016 with the exception of the "other" category (e.g., textiles, mattresses, household hazardous waste). 2017 marks the highest true (no source reduction or yard waste credits included) combined recycling rate for the state ever recorded since the start of the SCORE program in 1991.
Figure 8. This graph shows Minnesota’s combined recycling goal (traditional recycling and organics recycling) over time using SCORE reporting.

Organics deep-dive, SCORE data

Figure 7 shows various organics management methods, including yard waste composting, source-separated organics composting, food-to-animals, and food-to-people. Since 2013, counties have made efforts to document yard waste composting and food-to-people in the SCORE survey (in addition to solid waste or source-separated organics composting). The amount of source-separated organics (SSO) increased 11.47% from 2016 and continues to show overall positive growth.
Figure 9. This graph shows organics management methods over time, including food to livestock, food to people, SSO composting, and yard waste composting.

It should be noted that, prior to 2013, yard waste was not included as a measured portion of the organics stream. Instead, 5 percent was added to the recycling rate if county programs demonstrated certain activities. In 2013, the MPCA stopped using estimates and allowed yard waste tonnage, if documented, to count toward the organics data.
Solid waste system focus areas and considerations

Minnesota’s solid waste system is ever evolving and responding to environmental issues, capacity challenges, and market directions. The MPCA takes a systematic view in sustainably managing materials to accomplish solid waste and agency-wide goals. The following focus areas are points of consideration, ranging from prevention of waste to contaminants of emerging concern. Foundational information in this section will lay the groundwork for recommendations.

Sustainable materials management (SMM)

The MPCA supports a sustainable materials management (SMM) framework. SMM is a systematic approach to minimizing the total environmental impacts of materials over their entire life cycles, including product design, raw material extraction, production, use (and reuse), and best management when discarded (Figure 8).

SMM includes traditional solid waste management, but is also concerned with the larger scope of materials and the toxic chemicals used to manufacture those materials. The MPCA agrees with the EPA that an SMM approach seeks to:

- use materials in the most productive way with an emphasis on using less.
- reduce toxic chemicals and environmental impacts throughout the material life cycle.
- ensure we have sufficient resources to meet today’s needs and those of the future.

As the solid waste management system matures from the early 1980s and new tools become available, the MPCA is tasked with integrating pollution prevention and solid waste programs to ensure materials and products are managed in the best way for the environment and human health. Without an integrating framework, we could miss opportunities to protect our air, water, land, and health. For example, when a discarded product can be recycled but contains a toxic component, should it be recycled? A purely solid waste perspective would say yes, recycling is preferred to disposal. A pollution prevention perspective would say no; it’s better to design out the toxic material or to remove it during recycling to prevent its recirculation. Electronic products provide another great example of this conundrum. Plastic casings for computers and other electronics often contain toxic flame-retardants that cause worker exposures during recycling and should not be present in some types of downstream products such as children’s or food contact packaging.

An SMM approach and life cycle assessment can help identify greatest environmental impacts at different life cycle stages of a product. These tools, however, cannot tell us which impacts to prioritize.

Figure 10. Shows the environmental life cycle of materials.
That is ultimately a question of judgement and values, not analysis. Additionally, while use of life cycle analysis and taking an SMM perspective yields information on environmental impacts and helps policy makers focus efforts on high leverage opportunities, neither SMM nor pollution prevention principals provides information on other important factors such as environmental justice or economic considerations. Though the focus of the MPCA is primarily on the environment and human health, the MPCA has and will continue to consider implications for all of these factors when making decisions on policy, planning, and implementation.

MPCA has chartered an SMM lateral team to operationalize sustainable materials management. This team finalized and shared an SMM vision (see Appendix D). The SMM team will analyze specific materials to determine if reuse, prevention, or recycling will yield the greatest environmental benefits for specific materials, thus identifying the highest and best use for each material.

Figure 11. This diagram uses the EPA’s WARM tool (Waste Reduction Model) to show the greenhouse gas impacts of various management methods for various material types. For all material types (except aluminum), source reduction (i.e., prevention) yields the least amount of greenhouse gas emissions. This is but one tool used to evaluate the environmental impact of materials using an SMM approach.

For example, Figure 9 shows that source reduction of food waste has significantly less greenhouse gas impacts when it can be prevented versus when it is disposed of, which is one of the reasons why the MPCA SMM team is prioritizing food waste reduction and food-to-people programs in its work.
While SMM does tend to favor prevention and reuse, it also reaffirms the importance of recycling. Recycling is commonly lauded for its ability to decrease demand for landfilling. However, there is a greater demonstrated environmental benefit in recycling because it alleviates the need for extracting virgin materials. Although recycling is important, identifying the highest and best use for each material is the primary consideration under this framework.

**Consumption-Based Emissions Inventory**

Under an SMM framework, greenhouse gas emissions data for all phases of a product's lifecycle can be used as a measure of environmental impact. To get a clearer picture of Minnesotans' total greenhouse gas (GHG) emissions, the MPCA recently completed a Consumption-Based Emissions Inventory (CBEI). The model uses Minnesota-specific data from 2012.

The CBEI is a method used to estimate the GHG emissions that are created when Minnesotans consume everyday goods and services. The model uses waste generation based on SCORE and uses EPA’s WARM (Waste Reduction Model) calculator to show how different materials have highest and best uses (https://www.pca.state.mn.us/air/consumption-related-emissions).

This approach accounts for emissions through a product or service’s entire life cycle. A CBEI includes everything that households and governments consume, as well as life-cycle GHG emissions resulting from any goods that businesses have not yet sold. The model breaks down emissions by five life-cycle phases:

- production (no matter where the emissions occur in the world)
- pre-purchase transportation
- wholesale and retail
- use
- disposal, including recycling, landfilling, WTE

The CBEI can help those looking to minimize the climate impacts of materials and consumption. The CBEI divides consumption-related emissions into about 20 categories such as food and beverages, electronics, and household supplies, and furniture. Identifying which parts of a product’s lifecycle have the largest impacts is an important step in prioritizing materials management policies and actions. For example, if impacts are primarily in the use phase, that may suggest a need for efficiency gains or reduction in overall use. Where impacts are primarily in production that might point to a need for cleaner production, extending the life of items, and in some cases, reduction of demand.

The CBEI shows that the biggest opportunity to reduce greenhouse gas emissions lies in the phases of production and use—the upstream design phases of the product. There is often a focus on transportation and disposal of waste, but CBEI data points to the importance of solid waste prevention and reuse. For example, the CBEI reveals that increasing repair and reuse to double the useful life of clothing and household furnishings and supplies would be equivalent to increasing vehicle efficiency by 15%. Each would reduce GHG emissions by about 2.5 million metric tons of carbon dioxide equivalent (CO2e).

The CBEI also shows that some of the largest emissions are production phase emissions occurring in the categories of food & beverages, construction materials, and furnishings and suppliers (see Figure 10). This is why the SMM team has prioritized working on prevention of wasted food, on food-to-people efforts, and reuse of C&D materials (building deconstruction). These focus areas would result in the
greatest marginal environmental benefits. Both of those issues help inform strategic plan goals and serve populations identified as living in areas of environmental justice concern.

![2012 MN consumption emissions by category and life cycle phase](image.png)

**Figure 12.** This bar graph shows the consumption-based emissions by sector spend, throughout each life-cycle phase, including production, pre-purchase transportation, wholesale & retail, use, and post-consumer disposal. The CBEI describes everything Minnesotans make, buy, and use, but it does not specifically account for the GHG impacts of Minnesota’s recycling efforts. Most GHG benefits from recycling arise from reduced need for virgin materials. Oregon DEQ conducted an additional analysis estimating additional GHG reduction from its recycling. The MPCA has not undertaken such an analysis at this time.

The CBEI shows that the post-consumer disposal of a product accounts for less than 1% of a product’s total environmental (greenhouse gas) impact throughout its lifecycle, underscoring the importance of and opportunity for solid waste prevention and reuse. The CBEI shows that the phases of the life cycles that have the biggest opportunity to reduce greenhouse gas emissions are the phases of production and use—the upstream design phases of the product—underscoring the importance of solid waste prevention and reuse.
Dispersion is responsible for a small percentage of the carbon footprint of most products. The CBEI results suggest that post-consumer disposal (landfill and waste-to-energy) is responsible for just 1% of the carbon footprint of Minnesota’s consumption of goods and services. The CBEI captures some but not all of the benefits of Minnesotan’s recycling efforts. For example, to the extent that industries reduce their GHG emissions by using recycled feedstock instead of virgin, those reductions are included in the CBEI estimate. The CBEI analysis helps point to the largest carbon footprint areas of consumption in Minnesota. The CBEI is not the best tool for determining best management methods for materials (i.e., whether prevention or recycling is the ideal approach). It does clearly point out that there is no way that changes in disposal are going to impact the 99% of consumption-related emissions that are not from disposal. Only upstream production improvements (including use of recycled feedstock), reduced consumption, and extending use of what is already made will reduce those emissions.

Prevention and reuse

Based on life-cycle assessment and an SMM approach, the only way to slow or stop the upward trend of total generation of waste in Minnesota is through prevention. Most products cause greater environmental impact through their production (as with cement, clothing, food, packaging) and use (as with furnaces, refrigerators, cars), not in the waste created at the end-of-life. This highlights the importance of prevention and reuse as a means of extending the life of existing materials and products. Examples of waste prevention include providing products as a service, light-weighting materials, producing more durable goods, using less-toxic materials, extending material use through take-back and repair, buying secondhand, or simply not making unnecessary purchases. Prevention not only involves

Figure 13. This diagram shows the GHG emissions associated in each life-cycle phase of Minnesota products consumed. This graphic shows that most GHG emissions happened in the production and use of products. Emissions that happen after a material is disposed of account for 1% of a product’s total lifecycle GHG emissions.
redesigning the available products and the context in which people oper-ate, but also stressing education for behavior change.

Prevention and reuse have a higher potential to save resources and lessen environmental impacts compared to recycling and organics recycling. While recycling typically requires products to be disassembled and simplified into basic material forms for creating new products, reuse maintains the existing product to make the most of embedded resources (resources already used for original manufacturing).

Once an item is manufactured, it will inevitably become waste to be managed. However, reuse helps to delay the end-of-life management and avoid the need for new or recycled materials to be incorporated into a replacement product. It is important to account for the fact that materials vary drastically in terms of their environmental impact and the type of management strategy best suited to reduce that impact most efficiently and effectively. The SMM prioritization of materials influences decisions made to prevent continued use, encourage reuse, or capture a given material for recycling.

MPCA does its prevention work by:

- Promoting all options for extending the life of what has already been made.
- Encouraging thoughtful, informed, and often reduced consumption.

Recently this has included:

- Education and outreach: Presentations at community events and conferences; creation and support of GreenCorps prevention-focused sites.
- Partnership and infrastructure creation: Technical and financial assistance to local organizations and businesses; contract negotiations for government procurement to account for environmental impact; support of policy development to strengthen the reuse, rental, and repair sectors in Minnesota.
- Research and data-driven decisions: Completion of a Minnesota Consumption-Based Emissions Inventory (CBEI); product waste management methods based on the largest opportunities to reduce GHG and human and environmental toxics (prevention of wasted food, sustainable building, and materials management).

The MPCA has studied the economics of the reuse, rental, and repair industries over the past decade. These studies report on the employment numbers associated with these industries, as well as the economic activity such as gross annual sales information, percent of the state’s gross domestic product, annual wages, and individual income and sales tax. Most of this information was obtained by purchasing information from Dun & Bradstreet, but Regional Economic Models, Inc. (REMI) was also used to model areas such as the indirect jobs, induced jobs, salaries, tax revenue, and gross state product.

The recycling, reuse, rental, and repair sectors of the economy generated an estimated $1.338 billion in federal, state tax, and local tax revenue and employed approximately 63,500 thousand people in direct jobs in 2015. These jobs, in turn, supported another 74,500 people downstream in indirect and induced jobs. All together, these jobs (which paid a $6.28 billion in wages) represent a major force in Minnesota’s economy. This sector represents about $26 billion in sales, which is approximately 6% percent of Minnesota’s economy.
The MPCA is developing an approach to begin measuring the avoided greenhouse gas emissions due to reuse, rental, and repair activities across the state. Prevention and reuse are more challenging to measure, and have therefore not historically seen strong reporting metrics. After gathering financial information from Minnesota’s reuse, rental, and repair businesses, the MPCA intends to use an Economic Input-Output Life Cycle Analysis model, originally developed by a team at Carnegie Mellon University. By quantifying the avoided GHG emissions by not manufacturing new products, the MPCA will look to develop future strategies that support and strengthen areas with the greatest potential to reduce the state’s environmental footprint and advance more sustainable consumption.

### Prevention of wasted food

Up to 40% of the food in the United States goes uneaten, according to a Natural Resources Defense Council report. At the same time, one in eight Americans struggles to put enough food on the table. Life-cycle assessment shows that the greatest environmental impact (in energy and GHG emissions) is made when we can prevent food from being wasted.

Organics make up about one third of the waste stream in Minnesota. In line with the waste hierarchy, it is first preferable to prevent wasted food, followed by donating food to people, donating food to livestock, then composting. Food rescue, when reported to MPCA through annual reporting, does count toward a county’s recycling rate.

When food is wasted, so are the resources that go into producing it. Food waste is also a significant contributor to climate change, responsible for at least 2.6% of all U.S. greenhouse gas emissions. That’s equivalent to more than 37 million cars, or 1 in 7 cars on the road.

According to NRDC’s second release of Wasted in 2017, America throws out more than 1,250 calories per day per person, or more than 400 pounds of food per person annually. “If we could redirect just one-third of the food that we now throw away, and give it to people in need, it would more than cover unmet food needs across the country,” (NRDC). The MPCA knows that not all of the organics management methods have the same impact on the environment and will be working to report the environmental impact from each management method instead of a weight-based organics recycling rate.
In 2019 to help solve this social and environmental issue, MPCA sought and received funding to put toward expanding efforts to reduce the quantity of wasted food, improve the effectiveness of food rescue programs, and remove barriers to expanding organics recycling programs.

**Case study: Open Feasts**

Open Feasts is an event series held at Open Streets Events in Minneapolis. Open Feasts is collaboratively hosted by organizations across the MN food system to generate awareness about the issue of wasted food and inspire change in our community. Partners from government, nonprofit, education and for-profit entities have come together to put a spotlight on an issue that touches every part of our food system, from the farm all the way to the waste stream.

Three events each were held in the summer of 2017 and 2018. At each event free food is given out as people talk with volunteers about ways to prevent food from being wasted. Before each event food that otherwise would have gone to waste is gathered and prepared to serve over 1,000 participants. As visitors enjoy the free food they can strike up a conversation with volunteers about specific tips everyone can do to reduce the amount of food we waste; from learning how to store perishables so they stay fresh longer, to learning about date labels and recipes that use up leftovers. The events have been well received, lots of food has been saved from being thrown away and thousands of people gained awareness of the issue of food waste.
Managing organic waste

If prevention or donation programs are not in place—or the wasted food is not fit for donation—then it is preferable to follow the solid waste hierarchy and use food-to-animal programs, then composting.

Contact water management, processing capacity, and transportation are a significant challenge to the compost industry. Many communities are developing programs and plans to expand both residential and commercial collection of organics. As recently as 2013, the agency estimated 8% to 9% of residents had access to curbside organics recycling. More recent estimates suggest that number has grown to about 11%; and counting drop-sites, about a quarter of the state’s population has access to composting.

Transfer stations are used by the hauling industry to reduce disposal costs by allowing for more efficient transportation of material. But only a handful of transfer stations currently accept organics. Expanded transfer capacity will aid all facilities and better position communities across the state to start residential or commercial organics collection programs. Managing contact water has also been a barrier to compost development, largely due to elevated PFAS levels (see page 31). Preventing contact water or properly treating it is costly for compost operations. More damaging rains and the increasing annual precipitation characteristic of Minnesota’s changing climate further complicate the difficulty of managing contact water now and in the future.

To ensure clean compost product, it is important for programs to have the resources to educate participants on how to properly dispose of materials. A successful collection program takes advantage of educational materials and provides composters with a less-contaminated feedstock. This includes proper signs and colors for compost collection bins to ensure a cleaner, more marketable compost product with less contamination (e.g., non-compostable wrappers or food service ware).

The MPCA will continue to support policy that favors prevention of wasted food, food donation, and food-to-animals as strategies for managing organics. The MPCA will also look to expand markets for compost by encouraging use of compost for a wider array of projects.

One effort will be to more fully use compost with public sector projects. Compost helps landscapes better protect groundwater and surface water and prevent erosion. Thus, using compost during construction projects along roadways and in stormwater protection applications will continue to be important as Minnesota experiences increasing annual precipitation and more frequent extreme rainfall events.

The MPCA has worked with the Minnesota Department of Transportation to update their compost specifications to be more inclusive of food-waste-derived compost with the intention of expanding compost use in municipal projects across the state. The MPCA will also look to the private sector to support expanded use of compost through landscaping, construction, and with homeowners and farmers.

Several private and public entities are also interested in anaerobic digestion, particularly as a tool to manage food waste. Anaerobic digestion is a process in which microorganisms break down organic material without oxygen, creating biogas and digestate. Several metro counties are exploring the feasibility of building an anaerobic digester to manage increased food waste from commercial and residential collection. The type of anaerobic digestion, use of digestate, leachate generation, and energy production of any anaerobic digester differs based on technology type and feedstock, and numerous other factors.
Sustainable purchasing

The Minnesota state purchasing program seeks to:

- continuously strengthen the sustainability requirements for the goods and services the state purchases.
- increase the ability of small, targeted group vendors (including women or minority-owned businesses), veteran-owned vendors, and economically disadvantaged vendors to be competitive to win more environmentally stringent contracts.
- support efficient government operations, with the best value for every taxpayer dollar.

“Sustainable” in sustainable purchasing means economically, socially, and environmentally sustainable. Purchasing decisions (i.e., consumption) drives most of our environmental impacts. A focus on what the State of Minnesota and local governments purchase allows us the best opportunity to reduce the life-cycle environmental impacts of our consumption, including toxic chemicals in products and especially "embedded" emissions. An embedded emission is a GHG emission associated with the resource extraction, manufacturing, production, and use of a product.

State and local purchasing is critical to address because it accounts for a large amount of greenhouse gas pollution, especially when counting both direct emissions (like driving state-owned vehicles) as well as indirect and embedded emissions (like those from making the computers the state purchases). MPCA analysis shows that the direct and indirect emissions from State of Minnesota purchasing of goods and services (not counting road or building construction) is over 900,000 metric tons of CO2e.

GHG emissions associated with Minnesota state and local government purchasing accounts for about 8.5% of all the GHG emissions from Minnesota’s consumption-related GHG (not counting road or building construction). This is estimated at 11.5 million metric tons of CO2e according to MPCA CBEI results.

Since the 2015 Solid Waste Policy Report, sustainable purchasing has improved services, reduced waste, reduced toxics in waste, and reduced air, water, and climate pollution through several contract changes. A few examples include the statewide hauling contract, which now requires monthly reporting of collected waste to allow tracking of waste trends over time. A “hazardous handful” of chemicals was eliminated from office furniture on the state furniture contract. Flame retardants, formaldehyde, fluorinated chemicals (like PFAS), antimicrobials, and polyvinyl chloride (PVC) are prohibited from certain furniture and cannot be purchased without an exception approval. PFAS-containing products were removed from the compostable foodware contract, with cooperation with contract vendors. Additionally, quaternary-ammonium-based surface disinfectants were removed from the cleaning compound contract, reducing harm to aquatic life, the potential for endocrine disruption to users, and bioaccumulation.
Case study: Purchasing more sustainable IT products for the state

The State of Minnesota is requiring more sustainable IT hardware in our master contracts, which means agencies purchasing desktops, monitors, laptops, and tablets will be given more sustainable “EPEAT-registered” options to choose from. The lifecycle of IT hardware includes mining of raw materials, manufacturing, transportation, distribution, use and maintenance, and end of life management. All stages of IT hardware’s lifecycle are really high-impact in terms of both monetary and environmental cost. Keeping IT products longer is a good way to reduce the product’s impact.

The more sustainable options offered to state agencies must meet criteria for product longevity and design for repair, reuse and recycling. When products meet these criteria, it helps reduce the number of products purchased because you can keep your products for longer, and in some cases, even save money. This also decreases the number of products going to landfill.

Responsible end-of-life management, preferable materials use, and substance management are other criteria that must be met. These criteria decrease the toxicity of the products and improve how they are disposed. Purchasing products that meet the criteria required in state IT hardware contracts has big benefits. In FY2018, the state’s purchase of more sustainable IT products, including servers, desktops, laptops, tablets, and monitors reduced the state’s non-hazardous solid waste production by 690,777 pounds. That is equivalent to the solid waste generated by 168 US households in one year and saved the state $17,473 in solid waste disposal costs. It also avoided 3,730 pounds of toxic substances in the product, which means that those toxic substances are not getting into our waste stream. Reducing the products you purchase, and purchasing smarter, can save money, decrease waste and reduce pollution.

Product stewardship

Product stewardship is the idea that manufacturers are stewards of the products they put into the world and that they take responsibility for preventing harm from those products. A subset of that is extended producer responsibility (EPR), where manufacturers help pay for the costs of managing their products after their useful life — either by providing repair and refurbishment options, administering take-back programs, or by paying for collection and recycling programs. As a results of industry/stakeholder legislative initiatives, Minnesota has EPR programs for e-waste, architectural paint, and rechargeable batteries. Several other products, such as pharmaceuticals, mercury and LED lamps, solar panels, and carpet are candidates for product stewardship programs.

There are four reasons to institute product stewardship policies in Minnesota. One is that treating waste as a resource has economic benefits. Minnesota and national manufacturers use recyclable materials, so looking at discarded products as resources rather than waste has the potential to bring additional jobs,
economic wealth, and tax revenue to the state. Second, the amount of garbage in Minnesota keeps growing. Product stewardship can bring about changes in products so that we have less waste and recycle more. A third factor is that local governments can have high costs to manage material as waste. It’s less costly to recycle with financial help from manufacturers. Finally, certain materials used in products are toxic and should be managed properly. Managing in a responsible way means public taxes and fees have to be spent on pollution control equipment or special disposal. Product stewardship can lead to less public money spent for these activities. It encourages redesign of products to remove problem materials before they become environmental issues. Future initiatives by industries and their stakeholders should consider policy or guidelines to limit toxic chemicals used in new products at the same time as end-of-life EPR programs are being developed.

**Architectural paint** is a successful product stewardship program that started in 2014 and now has 249 year-round collection sites in Minnesota. Collection in the first year of the program totaled about 700,000 gallons. Nearly one million gallons have been collected over the program’s lifetime.

**Electronics** Ninety-three percent of Minnesotans are within 15 miles of an e-waste drop-off site. Keeping the weight-based e-waste statute in step with the decreasing size and weight of electronics is a challenge. Recycling costs exceed what manufacturers are currently paying. MPCA continues to work with collectors, recyclers, and manufacturers to make statute changes to get the true cost of recycling covered by the manufacturers.

**Medications and controlled substances** are also a candidate for product stewardship. They are found in Minnesota’s surface water and groundwater, and they threaten aquatic life. MPCA participates in two multi-agency projects to help manage opioids and antibiotics. In addition, MPCA supports and regulates a statewide collection network of over 350 collection sites. As of January, 2019, 95.4% of Minnesotans are within 15 miles of a pharmaceuticals collection site.

### Case study: Environmental product declarations

According to the International Environmental Product Declaration (EPD) System, an Environmental Product Declaration is an independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products. A Product category Rule (PCR) is developed first to ensure the scope of the EPD and life cycle assessment are standardized.

These declarations can be useful because they provide a transparent way to see the impacts from products. EPDs are being incorporated into the building sector. Leadership in Energy and Environmental Design or LEED, the most widely used green building rating system in the world, offers incentives for project teams to specify products from manufacturers that provide full transparency of their product’s environmental performance. Points are awarded towards LEED certification for the use of EPDs. If this type of system were available and required for all building materials it could help architects choose the products that are better for the environment and push manufacturers to continue to develop materials that are more sustainable.
Recycling education and market development

In July 2017, China announced its intent to stop accepting many types of recyclable materials unless bales had contamination rates of less than 0.5%. Recyclable materials from the United States are generally unable to meet this standard. As a result, domestic markets are flooded with recyclable materials and facing record-low prices for items such as plastic, glass, and paper. There is a growing concern that material collected for recycling may have to be stored long-term and ultimately disposed of if there are not markets for the materials.

In light of stressors from China, a Recycling Market Development Workgroup formed as a multi-stakeholder group (including haulers, material recovery facilities, cities, counties, and the state) to set market priorities and make recommendations to improve recycling end markets in Minnesota. MPCA also sought and received funding toward recycling market development from the 2019 Legislature and are now working toward administering funds for market development projects.

All Minnesotans are indirectly impacted by the development of recycling markets in the state. By increasing the demand for recyclables, living wage jobs could be created that will be accessible locally to Minnesotans of all backgrounds. By not recovering materials that could be recycled, $2.3 billion of potential material was thrown in the trash between 1996 and 2013 in Minnesota.

MPCA obtained data for a recycling economic analysis by purchasing information from Dun & Bradstreet, and using Regional Economic Models, Inc. (REMI) to model things such as the indirect jobs, induced jobs, salaries, tax revenue and gross state product. In 2015, based on REMI data, the recycling industry in Minnesota was responsible for 60,200 direct and indirect jobs.

Marketable recyclables starts with education. The Recycling Education Committee, composed of state, city, county, and industry stakeholders, is working toward providing better education for residents and businesses to encourage proper recycling, thus keeping recycling streams clean and profitable.

Figure 15. Shows economic activity associated with Minnesota’s value-added recycling manufacturers.
Case study: Recycling Education Committee

Starting in June 2016 representatives from haulers, cities, counties, the state and other organizations met to discuss how to improve recycling efficiency through coordinated messaging and community outreach. Recognizing the discord of recycling messages, the Recycling Education Committee (REC) sought to better coordinate on recycling communications and outreach.

Recycling can be different regionally, or based on market variabilities. REC works to dismantle confusion and make sure residents are receiving consistent information from both their cities, counties, and haulers. REC fosters a space for municipalities and industry to share perspectives, challenges, and work toward a common goal of increasing recycling quality and quantity.

After a series of meetings, the group identified a set of materials that were agreed upon to always or never be acceptable for curbside recycling almost everywhere in Minnesota. Since its inception, REC has grown to over 50 active members. REC can identify problem materials that could threaten the industry (like plastic bags) and communicate uniform resistance on such products.

REC published a Minnesota Recycling Outreach Guide which provides guidance to inform recycling educators across the state. REC is partnered with the Recycling Partnership, which is a national non-profit, to develop a toolkit of online and traditional media resources about common recycling contaminants (like no bags, no tanglers, no lithium batteries, etc.) REC is excited to become a premier resource for recycling educators.
Construction and demolition (C&D)

There is an estimated 9.2 million tons of C&D waste generated annually in Minnesota, based on EPA data applied to Minnesota population. Much of this could be prevented, reused, or recycled. As of 2017, Minnesota reported 1.6 million tons of C&D—17% of the estimated C&D generated—sent to landfills. The MPCA is taking a whole-system look at how to minimize impacts of building materials throughout the lifecycles of C&D materials.

The MPCA is making a holistic analysis of C&D impacts using an SMM framework to minimize impacts of building materials throughout their lifecycles. These wastes include materials such as concrete, bricks, wood, lumber, roofing, drywall, and other wastes. C&D landfills have largely been managed in the same way since the early 1980s. Almost all landfills collecting ISW/MMSW were required to upgrade and add liners and other protections to their facilities following a 1988 rule revision, but not much has changed related to C&D landfills. Prior to data acquisition, there was an assumption that C&D landfills were, for the most part, inert.

There are 88 Minnesota landfills that accept construction and demolition debris that were constructed without liners. Groundwater monitoring has shown elevated pollution levels in groundwater at these landfills which can be evaluated for contaminants of concern (such as boron, manganese, and/or arsenic). As such, the MPCA has continued to explore the sources and severity of these pollutant loads and is moving forward with rule revisions to address these environmental concerns. MPCA anticipates the publication of a C&D groundwater data report which summarizes the groundwater data submitted from these unlined C&D landfills.

Additionally, in late 2018, MPCA held four stakeholder meetings across the state for organizations and individuals involved in the C&D sector to provide feedback and suggestions on how to improve the overall construction and demolition system (including deconstruction and reuse of building materials). MCPA will be conducting a more formal stakeholder process (Sustainable Buildings and Materials Upstream Stakeholder Group) to start to plan a new system that improves how building materials are designed, used, reused, and recycled. This group will be composed of architects, building preservation organizations, local units of government, building reuse retailers, recycling and end markets, developers of building materials, deconstruction companies, disposal companies for building materials, and building contractors and remodelers.

A rulemaking process is underway and will continue for the next 2 to 3 years that will update the rules applicable to disposal facilities that manage C&D debris. The Rule Advisory Panel with representatives from government, industry, environmental groups, and citizens will advise the MPCA. The Upstream Stakeholder Group and Rule Advisory Panel will run in parallel to ensure that the entire C&D system is taken into consideration.

The MPCA is conducting a waste sort of C&D materials found in landfills. This study will identify products and materials discarded in landfills and look upstream to find ways to prevent those materials from being discarded as frequently. This will help in creating a new system to efficiently capture items to be reused or recycled and developing new markets for materials to be recycled.
Case study: Better futures, deconstruction

Better Futures Minnesota, a nonprofit that does deconstruction, works to transform the lives of men and support Minnesota’s environment. Unlike demolition, deconstruction carefully removes a structure so that materials are recycled, repurposed, or reused instead of being sent to a landfill. Through specialized deconstruction services, Better Futures Minnesota works to recover salvageable building materials and divert as much material from the landfill as possible. EPA estimations cite that construction waste accounts for up to 40% of the solid waste going into landfills. Of that, nearly 80 percent could be recycled or reused. Better Futures Minnesota’s deconstruction services recycles or reuses 75 to 85 percent of all building materials. In 2015, through our deconstruction services and ReUse Warehouse, Better Futures Minnesota worked to divert nearly 700 tons of construction and demolition waste from Minnesota’s landfills.
Landfill closure/post-closure tracking and monitoring

To minimize potential environmental impacts, landfills must be monitored and maintained even after they stop accepting waste. In some cases, contamination issues are only discovered at a landfill after closure. The Landfill Cleanup Act of 1994 created a state-run program that would assume control of certain closed MSW landfills, which met the eligibility requirements, to monitor, maintain, and—if necessary—clean up contamination. The Closed Landfill Program (CLP) oversees 110 facilities, with a total 114 eligible for it. Some MSW landfills, all C&D landfills and all industrial waste landfills are not eligible for the program. As these landfills close, the MPCA continues to regulate them through the Solid Waste Permitting Program and existing Minnesota rules.

When a permitted MSW landfill stops accepting waste, they are required to follow a closure plan that has been approved by the MPCA. This involves constructing the landfill cover and other engineered controls the facility may need. The MPCA approves the constructed elements and issues a closure document to regulate the facility while it is under the post-closure care period. Minnesota rules define this period as a term of at least 20 years throughout which the landfill operator is required to maintain and monitor the facility. Minnesota rules do not give specific direction on what must be done at a closed landfill after the 20-year post-closure period is completed.

Many landfills that closed during the late 1990s and early 2000s—and did not enter into the Closed Landfill Program—are beginning to reach the end of their required 20-year post-closure care period. Of the approximately 90 closed landfills not in the CLP, only 20 have received official closure documents from the MPCA. Without this regulatory document, it is difficult to track how long a facility has been in post-closure care and whether the facility still presents an ongoing risk to the environment.

Buried waste could potentially pose an environmental hazard even if the MPCA determines a landfill does not require additional monitoring beyond the 20 years. A landfill could be disturbed or destroyed, or leaching could affect groundwater. For example, redevelopment on top of a closed landfill could puncture a landfill cover or liner allowing a pathway for contamination to reach groundwater or surface water. Proper planning and zoning, which could prevent such activities, are controlled by local units of government.

The Unified Environmental Covenant Act (Minn. Stat. § 114E) allows the MPCA to place institutional controls on a piece of property that would remain in place regardless of future ownership over the property. Enacting the Unified Environmental Covenant Act, consistently, could prevent future owners of closed landfill properties from using the property in a way that could compromise the environment or human health, ensuring that landfills will remain safe for centuries after closure.

Per- and poly fluoroalkyl substances (PFAS)

PFAS chemicals are an emerging concern that will likely impact most waste facilities in the state. PFAS is a widely used chemical commonly used as an oil or grease barrier. It has been found in firefighting foam, cosmetics, commercial household products, food wrap or packaging, textiles and furniture, and in non-stick pans. PFAS is linked to cancer, thyroid hormone disruption, low infant birthweights, immune system effects, decreased fertility, developmental effects, and other health concerns. PFAS health-based values (HBV) and health risk limits (HRL) for certain analytes are set by Minnesota Department of Health (MDH). PFAS is currently regulated in the parts per trillion. MPCA solid waste uses an intervention limit that is a quarter of the HRL/HBV in order to be protective of drinking water and groundwater for Minnesota.
PFAS provides stain-, water-, or grease-resistant properties in food packaging, and it can be used in manufacturing of single-use disposable foodware products. PFAS can migrate out of these products and into the air, water, and our bodies, according to the Center for Environmental Health (CEH). PFAS from these products are entering our waste stream and therefore, creating challenges in managing the contact water and leachate from compost sites and landfills. In a study conducted at Minnesota compost sites, preliminary data reveals PFAS was detected in contact water at both yard waste and SSOM compost facilities at actionable levels. PFAS has also been detected at actionable levels in landfill leachate.

The predominant challenge of PFAS is that leachate and contact water can sometimes be land applied. In addition, if the leachate is sent to a waste water treatment plant, it either passes through or concentrates in biosolids which are commonly land applied in greater Minnesota. Both actions cause transfer of PFAS into the environment, specifically to groundwater and/or surface water.

PFAS is manufactured to be persistent in the environment and there are few available, practical treatment options. The only way to break the strong carbon-fluorine chains in PFAS is to burn it at temperatures roughly greater than 1,700-2,000 degrees Fahrenheit. MPCA is seeking legislative funding to test compost and biosolids for PFAS and to explore treatment options.

MPCA will continue to research possible treatment technologies, but PFAS prevention will be key. MPCA is looking toward other states’ regulations and PFAS planning, forming a cross-agency PFAS lateral team to research PFAS, identifying key areas for treatment, and working toward finding and promoting alternatives to PFAS in products like fire-fighting foam, furniture, carpet and rugs, outdoor wear, and food packaging.

In February 2019, EPA unveiled a PFAS Action Plan with the aim to provide a multi-media, multi-program, national research and risk communication plan to address this emerging environmental challenge. The Action Plan is also meant to "respond to the extensive public input the agency has received over the past year during the PFAS National Leadership Summit, multiple community engagements, and through the public docket."
Recommendations

The following recommendations are based on aforementioned reports and agency priorities. Several recommendations require additional resources and legislative support.

Recommendations may require long-term commitment or several stages of implementation. Recommendations are not commitments to action, but identifiers for future short-term and long-term priorities intended to address barriers and reach our goals. Implementation of recommendations is most successfully done in partnership with the Legislature, other state agencies, local units of government, and all public and private entities in the solid waste industry.

Recommendations are labeled with the following tabs to indicate their impact areas. Recommendations may have more than one label.

Needs legislative action to receive funding or enact policy

Aligns with MPCA strategic plan goals

Aligns with MPCA solid waste priority areas

Incorporate tribal support and eligibility into grant opportunities and solid waste planning.

Tribal nations are not currently considered political subdivisions per Minn. Statute § 465.719, and political subdivisions are the only eligible applicants under Greater Minnesota Recycling Program (Minn. Stat. §115A.565). Creating accessibility for solid waste grant funding would require amendments to Minn. Stat. §115A.565.c.

Develop a guidance for consistently incorporating environmental justice in Permit Review and Issuance.

The solid waste permitting program will develop a guidance to consistently inform and solicit input from traditionally vulnerable communities on solid waste projects that may affect them. If a facility is located in a documented environmental justice area, staff will determine what additional steps can be taken to identify disproportionate impacts, minimize those impacts, and ensure area residents are informed. Steps may include informational public meetings, collaboration with community leaders, and additional methods of community outreach before and during a public notice period.

Small area climate model projections for Minnesota.

The Board of Regents of the University of Minnesota, or similar research body, shall conduct a study that produces high-resolution, dynamically downscaled climate model projections for the entire state of Minnesota, so that state agencies have updated local climate projection data on which to base subsequent program decisions. High quality projections that use atmospheric modeling with updated climate models will enable a prioritized response to a changing climate allowing for more informed rule revisions, permit requirements, and emergency response tactics.
**CLIMATE ADAPTATION**

Update solid waste rules to adapt to the changing climate.

Solid waste emergency response programs must be able to respond to flood events, crop failures, livestock die-offs, or diseases that create large amounts of waste in a timely and safe way. Issues such as these are becoming more common with climate change affecting Minnesota. Adapting to a changing climate includes, but is not limited to, updating the landfill design rules so they are equipped to handle larger rain events, have appropriate lining for frequent freeze/thaw events and heavy rain events, and update design standards for leachate storage ponds. This may also include updating monitoring standards for groundwater at landfills and best practices for land application of leachate to avoid water pollution.

**LEGISLATIVE  SUSTAINABLE MATERIALS MANAGEMENT**

Consult with stakeholders to develop product stewardship programs to address electronic waste, household mercury-containing lamps, LED lighting, and potentially incandescent lighting due to lead content.

The existing e-waste law needs modification to ensure that collection, transportation and recycling of electronic waste is adequately funded by manufacturers. The lamps initiative could require producers to file a program plan, which must be approved, to sell their products in the state. The producers should also be required to submit annual progress reports to the MPCA, and it is expected that producers will establish a network of collection sites using existing HHW sites and retailers. LED lighting products are replacing mercury-containing lamps, but there will be a long tail on the disposal curve for mercury-containing lamps. The LED content of lead and other toxic components is not well-understood at this time.

**LEGISLATIVE**

PFAS: Focus on prevention.

PFAS compounds are persistent and ubiquitous, so there needs to be a strong effort on the prevention of PFAS production and use. Manufacturing bans and searches for alternatives should be considered, especially for items such as food packaging, carpeting and outdoor wear. PFAS-containing Class B firefighting foams are now banned in Minnesota for most training and testing purposes, but may still be used in incidents; since fluorine-free Class B foams have been used successfully around the world, a ban on use on fires may be needed.

**LEGISLATIVE**

PFAS: Prioritize continued research and testing and implement treatment/management methods.

Increased efforts to fund quantitative research on how PFAS affects the solid waste field will be critical. Testing and implementing technology for PFAS treatment will aim to provide MPCA, composters, recyclers, and landfill/incinerator operators better ways to address the impacts of PFAS on human health and the environment. We should help to develop testing standards and continued research for PFAS in groundwater and solids.

**SUSTAINABLE MATERIALS MANAGEMENT**

Explore the extent to which toxics are recycled in the waste stream and methods to avoid keeping toxic chemicals in circulation.

Some studies have shown evidence of toxic chemicals recirculating in recyclables, such as plastics from electronics containing flame retardants ending up in cookware. Further efforts are needed to understand the extent to which this is occurring, and develop policies, procedures, or assistance to avoid
After researching the issue, guidance can be provided on how this should be handled as part of the waste/recycling stream.

**LEGISLATIVE SUSTAINABLE MATERIALS MANAGEMENT**

Establish Minnesota Reuse Business Development and Growth Grants.

This recommendation establishes ongoing grants for eligible reuse, repair, and rental business development or expansion. Funding should also go toward projects to incentivize repurposing existing municipal buildings and grow Minnesota’s reuse markets. (Eligibility would not include auto, large appliance repair, or manufacturing machinery or construction vehicles, or other large fuel/electricity-using items where “use phase” is the majority impact). Grants would establish reuse funds to parallel the Greater Minnesota Recycling Grants and CAP funds.

**EFFICIENCY AND DUE DILIGENCE SUSTAINABLE MATERIALS MANAGEMENT**

Set management goals (source reduction or recycling) for specific materials that are high priority based on life-cycle environmental impacts.

Designate materials better suited for reduction and materials better suited for recycling; set target reuse or source reduction goals for each of those materials. Target management and goal setting will be based on remaining recovery or reduction opportunity over current management, and best management approach given life-cycle evaluation. To accomplish a more nuanced analysis of materials, MPCA will require regular waste composition studies and life-cycle analysis.

**SUSTAINABLE MATERIALS MANAGEMENT**

Prioritize materials for recycling markets by life-cycle assessment.

Life-cycle assessment (LCA) is a technique to assess environmental and human health impacts associated with all stages of a product’s life from raw material extraction to processing, manufacturing, distribution, use, repair, maintenance, and sometimes disposal. In terms of environmental benefit, a market development stakeholder group is examining various materials to focus market development efforts. The Sustainable Materials Management Team is working closely with the market development group to provide recommendations based on environmental life-cycle assessments.

**ENVIRONMENTAL JUSTICE REDUCE FOOD WASTE COMMUNITY ENGAGEMENT SUSTAINABLE MATERIALS MANAGEMENT**

Create and support a Sustainable Food Waste Management Council.

Establish a group that meets regularly that focuses on food from a sustainable materials management perspective, specifically food waste prevention and donation. The benefits of this group include efficiency in efforts to strategize on large-scale food donation efforts and maximize existing resources. This will also help coordinate inter-agency efforts on the topics of food waste prevention and food donation. The group will convene private and public stakeholders. Topics for discussion and implementation include but are not limited to starting and expanding food donation programs to feed hungry people and best management practices to reduce wasted food.

**LEGISLATIVE SUSTAINABLE MATERIALS MANAGEMENT ENVIRONMENTAL JUSTICE REDUCE FOOD WASTE**

Establish a food waste management hierarchy (Minn. Stat. Statute §115A).

Food waste and other organic materials, including yard waste, wood and additional items, comprise 31% of the waste stream in Minnesota. Establishing a Minnesota food waste hierarchy would encourage food to be managed according to the hierarchy instead of disposal. Certain management methods are considered to count toward recycling goals but other management methods are not eligible for recycling goals. Creating a hierarchy would encourage food to be managed through prevention first, then rescued for food donation, turned into animal feed, collected for compost and/or anaerobically digested. As a
last resort, it would be sent to disposal. Less organics in landfills reduces the release of methane, a high potency greenhouse gas. In general, food waste is a significant contributor to climate change, responsible for at least 2.6% of all U.S. greenhouse gas emissions. In addition, the MPCA is currently responsible in perpetuity for maintaining 110 closed landfills in Minnesota. This proposal will reduce the amount of waste going to our landfills and, ultimately, the space needed for landfilling. Fewer landfills translates to less spending to operate and maintain them for decades after they close.

**Require sustainable materials management of organics from large food generators.**

Commercial and industrial entities that generate large volumes of organic waste have an opportunity to reduce their environmental impacts, and often reduce their disposal costs, by first preventing food from going to waste, then rescuing food, and finally recycling food waste. (Recycling is not subject to the state solid waste management tax). This recommendation should have a phased-in approach in areas within a certain distance of organics facilities or transfer stations (likely starting in the metro or other large population centers.) This recommendation would also prioritize food management in accordance with the proposed food waste hierarchy (above).

**Expand metro requirement that yard waste is collected in compostable bags statewide.**

Yard waste in conventional plastic bags is a source of contamination at yard waste sites, and efforts to remove plastic bags can create contamination and worker safety issues. In 2010, Minn. Stat. §115A.931 was amended to require compostable bags at yard waste sites in the Metro Area. Expanding this requirement statewide will increase organics quality and marketability. Compostable bags are meant to replace non-compostable bags.

**Explore appropriate waste reporting to measure all waste.**

This recommendation proposes measuring and reporting all waste for better data acquisition and policy development that focuses on addressing the environment and human health. Measuring and reporting all waste (including MMSW, C&D, and industrial disposal, recycling, reuse, waste prevention) to accurately represent the waste flow — from generation to disposal — in Minnesota.

**Require Waste Composition Study on a routine basis (Statute 115A).**

Requiring waste composition studies at a certain number of facilities per year will help determine generation rates and material type breakdown. Understanding the composition of MMSW, C&D, and industrial waste streams is critical information to perform life cycle assessment. Facilities should be mixed municipal solid waste land disposal facilities, industrial solid waste land disposal facilities, construction and demolition landfills, resource recovery facilities, transfer stations, and other facilities identified by the commissioner, to perform a waste composition study at the sole expense of each owner or operator as directed by the commissioner.

**Measure and report C&D and industrial waste through annual reporting.**

The MPCA currently does not have a mechanism to track industrial or C&D debris that is generated in Minnesota unless it is delivered to a landfill or other permitted facility. Hauler reporting does not include C&D at this time (only MMSW and Recycling materials). Accurate measurement and reporting means better forecasting. With better forecasting, we will be able to plan for our capacity needs for the
future and assist in solid waste planning throughout the state. MMSW is the metric that is tracked most directly through SCORE program and hauler reporting, but this does not include all industrial and C&D waste that is generated in state. Waste that is disposed of on site (burying or burning), taken out of state, or sent directly to an end market for recycling is also not reported to MPCA.

**EFFICIENCY AND DUE DILIGENCE**

Create a guidance for standardization of permit nomenclature and data entry through peer review.

A guidance document to ensure permit limits are in the same units, use standard language, and have standardized data entry will allow for better documentation and data management. This will improve data integrity and visualization while improving communications and efficiencies with the public. This applies to all types of facilities. Steps include creating better permit application guidance, data management, and updated reporting that reflect modern operations.

**LEGISLATIVE**

**EFFICIENCY AND DUE DILIGENCE**

**SUSTAINABLE MATERIALS MANAGEMENT**

Develop permitting system to emphasize the goals of the Waste Management Hierarchy.

We must also provide more resources and expediency toward permitting in order to allow for more preferable materials management facilities to come online (like compost sites) quicker in a way that manages risk, but also moves waste up the waste hierarchy.

**LEGISLATIVE**

Develop a closure/post closure tracking and monitoring system including facility conditions necessary for exiting post closure care.

Minnesota Rules require landfills to perform ongoing maintenance and monitoring for at least a 20 year “Post-closure care period” after a landfill stops accepting waste. A process is needed to track the post-closure care schedules for landfills that have been closed and to identify facilities that are nearing the end of the required 20-year post closure care period. By identifying and evaluating these sites, the MPCA can make informed decisions on the necessary steps that to prevent long-term environmental contamination.

**LEGISLATIVE**

**EFFICIENCY AND DUE DILIGENCE**

Develop standardized language and protocols for the use of restrictive covenants based on the Uniform Environmental Covenants Act.

The Unified Environmental Covenant Act (Minn. Stat. 114E) provides the MPCA the ability to place institutional controls on a piece of property that remain in place no matter how ownership over the property changes in the future. In some cases, a landfill may still pose an environmental risk after post-closure care is completed and continued maintenance and monitoring might be necessary to mitigate that risk. The Uniform Environmental Covenants Act has been used to place restrictions on certain types of property use on areas that pose an environmental risk. The solid waste program should develop standardized language to include in landfill closure documents that requires the placement of an environmental convent on the landfill property.
### Appendix A

#### Summary of 2019 SWPR recommendations

<table>
<thead>
<tr>
<th>2019 Solid Waste Policy Report recommendation</th>
<th>Labels</th>
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<tbody>
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Develop permitting system to emphasize the goals of the waste management hierarchy

Develop a closure/post closure tracking and monitoring system including facility conditions necessary for exiting post-closure care

Develop standardized language and protocols for the use of restrictive covenants based on the Uniform Environmental Covenants Act.
Appendix B

Recommendations and progress from 2015 Solid Waste Policy Report

### Appendix B: Past SWPR recommendations implemented in Minnesota

Over the years, the Solid Waste Policy Report has recommended numerous policy updates and changes. Many of those recommendations have resulted in changes to policy and Rule. The following have all been featured in past SWPRs.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Progress</th>
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<tbody>
<tr>
<td>Commercial recycling</td>
<td>· Mandatory recycling for commercial entities in the Metro are generating 4 cubic yards of more of waste adopted by the 2014 Legislature and becomes effective January 1, 2016</td>
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<tr>
<td>Organized collection</td>
<td>· Revisions to the organized collection statute streamlined the process for cities to seek organized collection of trash</td>
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<tr>
<td>Organics management</td>
<td>· Ban of non-compostable plastic bags for yard waste in Metro in effect January 1, 2010</td>
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<td>· Compost Rule revisions to reduce barriers to opening new compost facilities and to streamline and modernize requirements for existing facilities adopted in December 2014</td>
</tr>
<tr>
<td>Product stewardship</td>
<td>· Manufacturer managed and funded rechargeable battery collection program enacted in 1994</td>
</tr>
<tr>
<td></td>
<td>· Minnesota Electronics Recycling Act enacted in 2007</td>
</tr>
<tr>
<td></td>
<td>· Paint stewardship program enacted in 2013</td>
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<tr>
<td>Burn barrels</td>
<td>· Initial burn barrel survey conducted in 2005; follow up surveys in 2010 and 2016, with the intention of conducting a similar survey every five years</td>
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<td></td>
<td>· No-burn resolutions adopted by 31 counties throughout the state</td>
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<tr>
<td>County funding</td>
<td>· Additional funds for SCORE program were implemented by 2014 Legislature</td>
</tr>
<tr>
<td>SCORE reporting</td>
<td>· Statute revisions reduced the burden on counties related to SCORE surveys</td>
</tr>
</tbody>
</table>
Appendix C

Solid waste maps of permitted facilities in Minnesota

The solid waste program at the MPCA uses a variety of regulatory tools to manage the treatment, reuse, and disposal of solid waste in the state of Minnesota including individual permits, general permits, Permits-by-Rule (PBRs) and beneficial use determinations. The types of facilities that are covered under PBRs include yard-waste compost sites and small volume solid waste transfer facilities.

Individual permits are used for major solid waste treatment and disposal facilities. This allows regulators to examine site-specific conditions to ensure that the individual permit requirements for a facility provide the appropriate environmental protections as specified by Minnesota solid waste rules. Facilities that receive individual permits include landfills (MMSW, Industrial, and C&D) recycling centers, combustor ash disposal facilities, refuse-derived fuel (RDF) processing facilities, source-separated organic matter composting facilities, and larger solid waste transfer facilities.

Facility locations were mapped using the highest accuracy measuring method available to the MCPA. This location information is primarily from GPS, Address Matching, and Digitized Mapping methods which provide a high amount of accuracy in portraying the correct location of the facility. However, roughly 17% of the facilities displayed on these figures were mapped using location collection methods of lower accuracy such as Public Land Surveys or County and Zip Code Centroids. Location information comes from multiple sources, including information submitted by the facility owner, information determined by MPCA staff, and information derived based on the location of the facility.
Compost activity count

For the purposes of this map, "SSOM" refers to sites that are permitted to accept food waste.
- Yard waste activity: 182
- SSOM activity: 18
- SSOM transfer stations: 3
Recycling activity refers to any site that stores, processes, or transfers recycling materials.

- Recycling activity: 236
Transfer station count

PBR transfer stations handle up to 120 cubic yards at any given time.

- PBR transfer station: 64
- Individual permit transfer station: 124
Industrial landfill count

- Industrial landfills: 33
MSW landfill count

- MSW landfills: 21
Demolition landfill count

- PBR demolition landfill means a facility can have up to 15,000 cubic yards on site at any given time.
  - Demolition landfill individual permit: 127
  - PBR Demo: 200
Appendix D

Sustainable materials management vision for Minnesota

Minnesotans—in our homes, businesses and communities—design, extract, make and use materials and products in ways that protect and/or enhance the environment, and thereby, human health and well-being.

Recognizing that Earth’s resources are limited, we design, make and use materials and products to last as long as possible, to obtain the maximum use from them, and then to recover and regenerate products and materials at the end of each service life. We decrease the total amount of materials used, and the concept of disposal fades as an increasingly circular economy emerges.

Environmental health supports economic productivity and human health. Minnesotans prosper in environmentally just communities with jobs that support a thriving environment, and which conserve material and natural resources for future generations.

We understand that extraction, manufacturing, purchase and use of materials and products have local, state, and global impacts. Minnesotans make consumption decisions that support responsible local, state, and global production and human well-being.

Materials and products are designed, produced and used to minimize and/or eliminate the use and release of toxins and to minimize the use of water and non-renewable energy and the release of GHG emissions and other pollutants. When materials and products are no longer useable or wanted, they are recovered for their next highest and best use in order to minimize the extraction of raw materials.

We take into account the full lifecycle environmental, economic and societal impacts of materials throughout their life cycle and implement public policies and financial mechanisms to reflect those impacts so that materials and their use are accurately priced in the marketplace.

We create local and regional economic development opportunities to build an economy that prioritizes sustainable material management actions and use of nature’s systems as inspiration for design.

Minnesota’s materials economy shifts to primarily local renewable energy sources such as solar, wind, water, and geothermal. Minnesotans preserve, protect and enhance ecosystems, which serve as the foundation for healthy and resilient environments and communities. Minnesota leads in the research and development of renewable raw materials for the manufacturing sector that decrease lifecycle impacts.
Appendix E: Acronyms

AD: anaerobic digestion
C&D: construction and demolition
CFL: compact fluorescent light bulb
CLP: Closed Landfill Program
EA: environmental assistance
EJ: environmental justice
FTE: full time equivalent
FY: fiscal year
GBP: green bond principles
GHG: greenhouse gas
HHW: household hazardous waste
ISW: industrial solid waste
LCA: life cycle analysis
MMSW: mixed municipal solid waste
MNCC: Minnesota Composting Council
Mn/DOT: Minnesota Department of Transportation
MPCA: Minnesota Pollution Control Agency
MRF: materials recovery facility
MSDS: materials safety data sheet
OCC: old corrugated cardboard
OLA: Office of the Legislative Auditor
PCE: personal consumption expenditure
ROD: restriction on disposal
REMI: Regional Economic Models, Inc.
SCORE: select committee on recycling and the environment
SMM: sustainable materials management
SWMT: solid waste management tax
SWPR: solid waste policy report
TCMA: Twin Cities Metropolitan Area
TCLP: toxicity characteristic leaching procedure
U.S. EPA: United States Environmental Protection Agency
WMA: waste management act
WLSSD: Western Lake Superior Sanitary District
WTE: waste to energy