

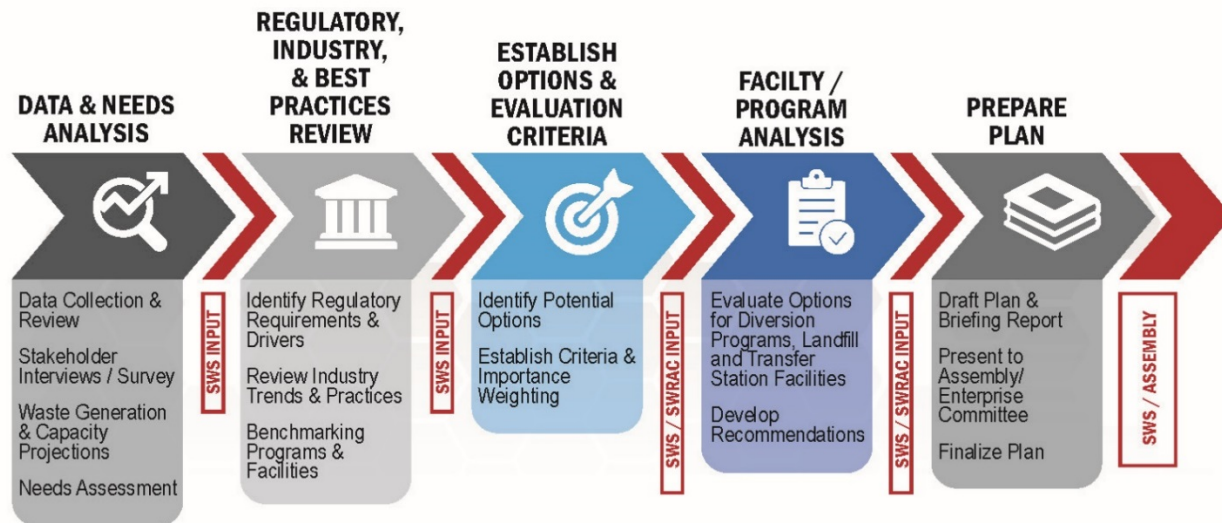
EXECUTIVE SUMMARY

The Municipality of Anchorage (MOA), Department of Solid Waste Services (SWS) authorized development of an integrated solid waste master plan (ISWMP) in order to optimize its system and assets through improved operational efficiencies, capital improvements and new practices/programs that increase landfill life, improve safety and customer service, protect the environment and increase waste reduction, improve reuse and recycling of materials that are currently disposed of as waste. SWS collaborated with Tetra Tech and DOWL consultants and the SWS Solid Waste & Recycling Advisory Committee (SWRAC) to develop the plan.

The ISWMP includes the following:

- Development of Strategies for Short, Medium and Long-term System Plan
- Optimization of Capacity at Anchorage Regional Landfill (ARL)
 - Optimizing Airspace Utilization
 - Evaluating Expansion Alternatives
 - Considering Alternative Technologies
- Optimization of Central Transfer Station (CTS) Operations
- Assessment of Diversion Opportunities

Tasks performed for development of the SWS ISWMP are presented in the planning process flow chart below:



As a municipality of almost 300,000 people, Anchorage generates a large quantity of waste each year (330,000 tons in 2016). SWS provides refuse collection services within the former City of Anchorage boundaries, which is approximately 20% of the population of the MOA and the remainder is serviced by the private sector. SWS services also include the disposal of solid waste, collection of household hazardous waste and drop off recycling at the Anchorage Regional Landfill (ARL) and seasonal food scraps collection programs at both the ARL and the Central Transfer Station (CTS). ARL is the only operating municipal

solid waste (MSW) landfill within the MOA and accepts more tonnage than any other landfill in the state. The ARL is located near the community of Eagle River and has a permitted total capacity of 45.2 million cubic yards. The SWS has three transfer stations located at Girdwood, midtown Anchorage (CTS), and ARL which reduces traffic to and controls access to the working face of the ARL. Waste disposed of and hauled from the transfer stations make up approximately 80% of the total waste disposed of at ARL, with the majority coming from the CTS.

The SWS disposal utility's budget includes a recycling fund which pays for the recycling coordinator position within SWS and various community recycling and outreach programs. The fund helps support several grants with ALPAR (Alaskans for Litter Prevention and Recycling) such as glass recycling, wharfage costs, youth litter patrol, and Christmas tree recycling. Funding has also been used to support school district recycling programs and pilot programs for curbside recycling, composting, and voluntary food scrap drop-off programs. SWS is implementing a pilot program to test curbside organic waste collection in 2018 and plans on offering this service area wide in 2019.

Waste generation and capacity projections were performed for the ISWMP resulting in a gross remaining airspace of 30.3 million cubic yards at the ARL (as of 2017). Utilizing population growth projections from the Anchorage 2040 Land Use Plan, future site life projections ranged from 2062 to 2070. Internal and external data were reviewed, stakeholder interviews and a solid waste services survey were conducted, and a comprehensive review of regulatory requirements/drivers, key policies, and industry trends were considered to identify specific facility and diversion program options, potential improvements, and potential new approaches for SWS to manage solid waste. A benchmarking analysis was also completed to compare key performance indicators (KPI) of solid waste management system performance in 12 similar medium-sized jurisdictions with limited access to material markets, high annual snowfall, and sub-zero winter temperatures.

Issues and opportunities identified for the ISWMP included aging (30+ years) assets at CTS creating safety issues and operational/customer service constraints, capacity increase opportunities at ARL and low diversion rates due to lack of local markets and regulatory constraints for the MOA.

Several options for each system component (ARL, CTS and diversion programs) were evaluated for the following criteria:

- Capacity Savings;
- Capital/O&M Costs;
- Revenue Generation Potential;
- Technical Feasibility;
- Permitting Feasibility; and,
- Environmental Impacts.

The above criteria were ranked for each option identified utilizing high, medium and low rankings; resulting in a total score for each option. More detailed evaluations were then performed on the highest ranked options.

Recommendations for short, medium and long-term strategies were developed to optimize capacity through landfill operational improvements and diversion programs and to optimize CTS operations with new and expanded facilities and services.

Short-Term Recommendations (Years 1 TO 5)

Landfill Improvements



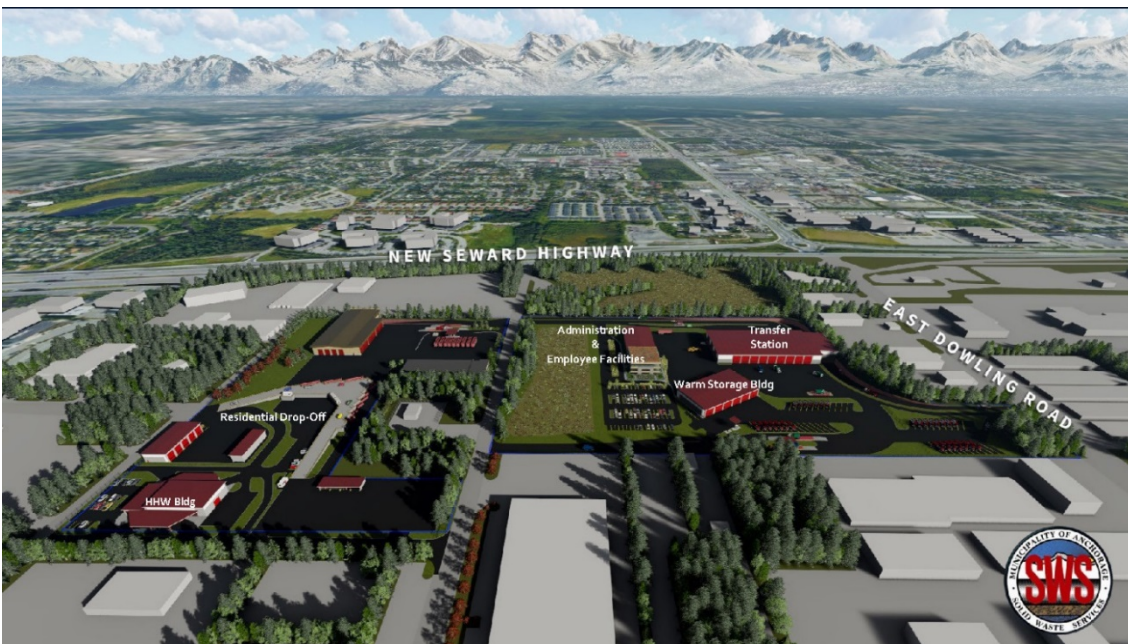
Increase Landfill Capacity by 30 to 40% or 5 to 9 years through the use of alternative daily covers to minimize soil use and an additional 8 to 11 years with an alternative final cover design to support steepening of final slopes.

Landfill Gas Beneficial Use



Expand Landfill Gas to Energy (LFGTE) facility by generating 5.6 MW of additional electricity. If LFGTE facility expansion does not proceed, LFG to CNG vehicle fuel or leachate treatment fueled by medium-BTU LFG to be explored. Also, using LFG to evaporate and minimize leachate disposal requirements is currently in the process of being evaluated by SWS.

Central Transfer Station



New transfer station, administration, maintenance and warm storage building, and public drop-off facilities to replace 30+ year old assets. This improves safety, customer service, efficiency, and materials management which increases the life of the ARL through improved community diversion opportunities. Moving to a new property would prevent a 2- to 3-year shutdown of the existing facility for improvements and allows for future uses by other MOA departments (i.e. grit management facility at existing transfer station, additional warm storage and administrative space). It also controls adjacent uses that may impact future CTS operations.

Diversion Programs



Increase diversion through food waste reduction, organics collection/drop-off programs, expanded compost facility capacity and end market development, public sector recycling, community outreach and education programs and, C&D reuse. Increase SWS diversion rate from 16% to 27% and reduce per capita disposal from 6.1 to 5.4 lbs./day (for those within the SWS Service Area).

Alternative Technologies



Conduct feasibility study of technology alternatives to landfill disposal (including biological or thermal treatment) for addressing SWS and potentially Anchorage Water & Wastewater Utility (AWWU) needs. A 20% to 90% reduction in landfill disposal (by volume) may be achieved with biological or thermal treatment, respectively.

Medium-Term Recommendations (Years 5 to 10)

Landfill Expansion Potential



Evaluate landfill expansion permitting feasibility for ARL. Potential expansion to the west of ARL estimated to provide additional 40 mcy of capacity resulting in 45 additional years (extended site life to beyond 2100).

Diversion Programs



Increase diversion through commercial organics education, expanded C&D reuse and recycling and tire recycling. Increase SWS diversion rate an additional 17% to almost 40% by 2028 and decrease per capita disposal from 5.4 to 4.6 lbs./day (for those within the SWS Service Area).

Long-Term Recommendations (Years 11 and Beyond)

Plan for ARL Reaching Capacity



Implement permitting process for ARL expansion or alternative technology facility 20 to 25 years prior to ARL capacity projected to be reached.

Diversion Programs



Increase diversion through expanding and improving residential curbside recycling and bulky item reuse/recycling. Assessment of market demand and regulatory authority to increase recycling throughout MOA is needed.

Preliminary costs based on ISWMP recommendations and concept plans have been developed which range from \$90M to \$120M (in 2018 \$) in the short to mid-term.

The SWS ISWMP provides a roadmap for improved customer service, safety, environmental protection and operational efficiencies resulting in preserving landfill life up to 20 additional years or to 2090, cost savings and a plan for expansion of the ARL (providing more than 45 years of additional landfill life) or an alternative technology facility (reducing landfill disposal by 20 to 90%) to address the solid waste management needs of the MOA over the next 100 years. Periodic updates are recommended to assess progress, needs and changed conditions over time.

5.0 RECOMMENDATIONS

The ISWMP prepared for the SWS provides a roadmap to optimize SWS's solid waste management system and assets through improved operational efficiencies, capital improvements and new practices/programs that increase landfill life, improve safety and customer service, protect the environment and increase waste reduction, reuse and recycling of materials that are currently disposed of as waste. Recommended strategies for short, medium and long-term system planning periods were developed as a collaboration between SWS staff, Tetra Tech and DOWL consultants, and the SWRAC.

A revised final grading plan was prepared for the ARL resulting in a gross remaining airspace of 30.3 million cubic yards (as of 2017). Utilizing population growth projections from the Anchorage 2040 Land Use Plan, future site life projections ranged from 2062 to 2070.

Issues and opportunities identified for the ISWMP in Sections 1.0 and 2.0 included aging (30+ years) assets at the CTS creating safety issues and operational/customer service constraints, capacity increase opportunities at the ARL and low diversion rates due to lack of local markets and regulatory constraints for the MOA.

Several options for each system component (ARL, CTS and diversion programs) were evaluated in Section 3.0 of the ISWMP for the following criteria:

- Capacity Savings;
- Capital/O&M Costs;
- Revenue Generation Potential;
- Technical Feasibility;
- Permitting Feasibility; and,
- Environmental Impacts.

The above criteria were ranked for each option identified utilizing high, medium and low scores; resulting in a total score for each option. More detailed evaluations were then performed on the highest ranked options for the ARL, CTS and Diversion Programs, including a review of potential technology alternatives to landfill disposal, which findings are presented in Section 4.0 of the ISWMP.

Recommendations for short, medium and long-term strategies were developed to optimize disposal capacity through landfill operational improvements, diversion programs and alternative technologies and to optimize CTS operations with new and expanded facilities and services. Table 5-1 presents a summary of the recommendations with associated cost and benefit for the short (Years 1 to 5), medium (Years 6 to 10) and long-term (Year 11 and beyond) planning periods.

Table 5-1: SWS ISWMP Recommendations Summary

Recommendations	Capital Cost (2018 \$)	Annual Cost (2018 \$)	Capacity/Cost Savings
Short Term Recommendations (0 to 5 Years)			
Anchorage Regional Landfill Improvements			
Alternative Daily Cover (reusable geosynthetic tarps)	Initial Purchase = \$50,000	Annual Replacement = \$13,000/year	104,200 cy/year (63,000 tons/year)
Alternative Final Cover Design/Slope Stability Analysis	\$10,000 to \$25,000		7,300,000cy ¹³
Landfill Master Development Plan ¹⁴	\$50,000 to \$75,000		Not Applicable (N/A)
Temporary Scrim Covers		\$22,000/year	<\$52,250/Year> ¹⁵
Reduced Refuse Cell (7.5 acres)	\$2,950,000		<\$600,000> ¹⁶
Leachate Evaporator (if Landfill Gas-to-Energy facility is not expanded)	Installation = \$16,400,000	Annual Operating Expenses = \$140,000/Year 1 FTE (\$115,000)/year for Operations	<\$1,125,000/Year> ¹⁷
Modify and upgrade leachate lagoons for enhanced zinc removal	\$4,225,000		N/A
Landfill Entrance Building Replacement ¹⁸	\$10,780,000		N/A
Central Transfer Station			
Conceptual Plan No. 2A ¹⁹	\$81,026,000 to \$106,239,000		N/A
Material Recovery Facility			
New Material Recovery Facility	\$27,500,000 to \$29,500,000		<\$70,000/Year

¹³ Based on additional capacity potential with 2:1 versus 3:1 final slopes between benches.

¹⁴ Includes fill sequencing plans, soil management plan, interim and permanent storm water improvement plans, leachate reduction design and operations measures and capital improvement budget/schedule for full build-out of ARL.

¹⁵ Reduced leachate management costs.

¹⁶ Delayed capital improvement costs with reduced cell size.

¹⁷ Cost savings based on system processing 100,000 gallons/day; estimated \$0.045/gallon avoided leachate management costs (250 days/yr.).

¹⁸ Landfill Entrance Building replacement cost shown in 2019 dollars and includes 30% contingency, 12% design budget, and 6% construction administration budget (see Appendix B for detailed cost)

¹⁹ Includes property acquisition and capital improvements shown in 2018 dollars (see Appendix E, Attachment 3 for detailed cost).

Recommendations	Capital Cost (2018 \$)	Annual Cost (2018 \$)	Capacity/Cost Savings
Short Term Recommendations (0 to 5 Years) Continued			
Alternative Technology			
Alternative Technology Feasibility Study	\$100,000 to \$150,000		
Waste to Energy (Mass-Burn Incinerator) Implementation Steps (Develop Project Team)	\$25,000 Secure Waste Flow Control \$50,000 Negotiate Power Purchase Agreement \$150,000 Siting Study/Permitting Discussions	\$1,000,000/year	
Diversion			
Organics Diversion <ul style="list-style-type: none"> Food Scraps Reduction, Prevention, Rescue, and Recovery Programs Backyard Composting Residential Curbside Organics Collection Increase Organics Processing Capacity and Facilities Increase Yard and Garden Waste Drop-Off 	\$50,000 Market Assessment \$20 to \$200/ton for processing 20 to 30% increase in Residential Collection Costs	\$10,000/year rebate budget \$10,000 (every 3 years) training budget 0.5 to 1.0 FTE (\$50,000 to \$100,000)/year to coordinate	6,230 tons/year for SWS service area
Public Sector Recycling <ul style="list-style-type: none"> Approach 1: Increase Effectiveness of Existing Recycling Programs in Government Buildings Approach 2: Increase the Number of Government Offices and Facilities with Recycling Programs 		\$15,000/year for standardized waste diversion signage and containers 0.25 FTE (\$25,000)/year during program roll-out	1,320 tons/year for SWS
Residential & Commercial Recycling <ul style="list-style-type: none"> Develop Commercial Waste Reduction Strategy and Toolkit 		\$15,000/year for standardized waste diversion signage and containers 0.1 to 0.25 FTE (\$10,000 to \$25,000)/year to coordinate and develop tool kit	N/A
Construction & Demolition (C&D) Recycling & Reuse <ul style="list-style-type: none"> Promote/Facilitate C&D Reuse Programs Develop and Expand Thrift Store/Free Store/Reuse Center System 	0.25 FTE for 3 months (\$25,000) to coordinate development	0.1 FTE (\$10,000)/year long-term/ongoing promotion	N/A

Recommendations	Capital Cost (2018 \$)	Annual Cost (2018 \$)	Capacity/Cost Savings
Short Term Recommendations (0 to 5 Years) Continued			
Diversion			
Supporting Programs <ul style="list-style-type: none"> • Disaster Debris Plan • Organics Market Analysis • Plans and Strategies • Communication, Education, Monitoring and Promotion • Policies and Measurement Tools 	\$40,000 for Development	\$25,000 annually for education and communication programs \$100,000 every three years for waste composition studies 1 FTE (\$100,000)/year	N/A
Total	\$143,431,000 to \$170,734,000 One-Time Costs (construction/program implementation)	\$1,586,666 to \$1,651,666 Annual Cost	7,300,000 cy one-time 70,550 tons/year Capacity Savings \$600,000 One-Time \$1,247,250/year Cost Savings
Medium-Term Recommendations (6 to 10 Years) Continued			
Anchorage Regional Landfill			
Landfill Expansion Potential/Permitting Requirements ²⁰	\$250,000 to \$500,000		
Additional Refuse Cell (assumes reduced size of 7.5 acres)	\$3,000,000		
Alternative Technologies			
Waste to Energy (Mass-Burn Incinerator) Implementation Steps	\$100,000 Facility Construction Procurement \$50,000 Facility Budgeting and Financing Determination \$300M-\$400M Facility Construction	\$1,000,000/year	

²⁰ Evaluate potential for approval of Westerly expansion of ARL with JBER and NALA considerations.

Recommendations	Capital Cost (2018 \$)	Annual Cost (2018 \$)	Capacity Savings
Medium-Term Recommendations (6 to 10 Years) Continued			
Diversion			
Organics Diversion <ul style="list-style-type: none"> Commercial Organics Collection Evaluate Recycling Market Conditions Increase Organics Processing Capacity and Facilities 	\$50,000 Market Assessment \$20 to \$200/ton for processing 30% increase in Residential Collection Costs	0.5 FTE (\$50,000)/year to coordinate	8,000 tons/year
Construction & Demolition Recycling <ul style="list-style-type: none"> Develop Policies that Support C&D Recycling (e.g., minimum diversion for C&D projects) 	0.25 FTE for 9 months (\$18,750) to coordinate procurement standards and policies		N/A
Increase Tire Diversion			3,000 tons/year
Supporting Programs <ul style="list-style-type: none"> Organics Market Analysis Plans and Strategies Communication, Education, Monitoring and Promotion Policies and Measurement Tools 		\$25,000 annually for additional education and communication programs	N/A
Total	\$303,378,750 to \$403,628,750 One-Time Cost (construction/program implementation)	\$1,075,000 Annual Cost²¹	11,000 tons/year Capacity Savings

²¹ Additional annual cost over short-term recommendation annual recurring cost.

Recommendations	Capital Cost (2018 \$)	Annual Cost (2018 \$)	Capacity Savings
Long-Term Recommendations (11+ Years)			
Anchorage Regional Landfill			
Plan for ARL Reaching Capacity ²²	\$250,000 to \$500,000		40 million cy ARL Expansion or 66,000 to 200,000 tons per year ²³ Alternative Technology
Additional Refuse Cells (assumes two at 7.5 acres)	\$6,000,000		<\$600,000> ²⁴
Diversion			
Organics and Recycling Diversion Pending re-evaluation of market conditions, shipping opportunities, and regulatory/legal changes to expand recycling throughout MOA.	\$50,000 to \$100,000 Market and Regulatory/Legal Assessment		
Residential & Commercial Recycling <ul style="list-style-type: none"> Increase Bulky Item Diversion 		\$5,500/year for additional vans to ship recyclables to lower 48 states 0.25 FTE (\$25,000)/year to develop	120 tons/year
Supporting Programs <ul style="list-style-type: none"> Organics Market Analysis Communication, Education, Monitoring and Promotion Policies and Measurement Tools 		\$25,000 annually for additional education and communication programs	N/A
Total	\$6.3 to \$6.6M One-Time Cost (construction/program implementation)	\$55,500 Annual Cost²⁵	40 million cy One-Time 66,120 to 200,120 tons per year Capacity Savings \$600,000 One-Time Cost Savings

²² Implement permitting process for ARL expansion or alternative technology facility at least 20 to 25 years prior to ARL reaching capacity.

²³ Potential Capacity Savings based on 2016 Annual Tonnage (330,000 tons per year).

²⁴ Delayed capital improvement costs with reduced cell size.

²⁵ Additional annual cost over short and medium-term recommendations annual recurring cost.

The SWS ISWMP recommendations provide for increased landfill life, revenue generation and renewable energy potential, cost savings, improved customer service, safety and operational efficiencies, environmental protection and increased diversion resulting in:

- **Preserving landfill life by 30% to 40% or up to 20 additional years** (to 2090) through use of alternative daily covers and steepening of final fill slopes with an alternative final cover design;
- **Revenue and electricity generation of an additional 5.6 MW** if the existing landfill gas to electricity plant at the ARL is expanded or;
- **Reduction in refuse-to-soil ratio to 3.5:1** through use of alternative daily covers (SWS Strategic Plan goal is 1.4:1);
- **Reduction in leachate generation and associated costs** through use of scrim covers, separate wet weather operations, less permeable daily cover (reduce/eliminate use of snow), and interim storm water management;
- **Reduction in leachate treatment costs** if landfill gas utilized for leachate evaporation as an alternative to LFGTE plant expansion (if deemed infeasible due to reduced base cost of power);
- New CTS transfer station, administration, maintenance and warm storage buildings and public drop-off facilities to replace 30+ year assets provide **improved safety, customer service, efficiency and materials management**;
- New property acquisition for CTS **prevents a 2- to 3- year shutdown of existing facility** for improvements, **allows for future uses by other MOA departments** (i.e. grit management facility at existing transfer station and additional warm storage and administration building space) and **controls adjacent uses** that may impact future CTS operations;
- New Material Recovery Facility to meet new industry standards for recycling markets can **support increased diversion through mandatory recycling programs**.
- **Increase in SWS service area diversion rate in the short-term from 16% to 27% and reduced per capita disposal from 6.1 to 5.4 lbs./day** through food scraps reduction, organics collection/drop-off programs, expanded compost facility capacity and end market development, public sector recycling, community outreach and education programs (including tool kits), Construction & Demolition (C & D) reuse and recycling;
- **Increase in SWS service area diversion rate in the medium-term by an additional 17% to over 40% by 2028 and reduced per capita disposal to 4.6 lbs./day** through expanded commercial organics, community outreach and education programs, increasing organics processing capacity and facilities and reuse/recycling of C & D waste;
- **Potential 20% to 90% reduction in landfill disposal (by volume)** could be achieved with technology alternatives (biological and thermal respectively) if deemed feasible in future study;
- **Potential for additional 40 million cubic yards of landfill capacity or 45 additional years** if expansion of the ARL to the west is deemed permissible; and

- **Increase in SWS diversion rate in the long-term** through expanding and improving residential curbside recycling and bulky item reuse/recycling. Assessment of market demand, increases in back-haul capacity and legal/regulatory authority to increase recycling throughout the MOA is needed to significantly increase diversion rates in the long-term.

Programmatic recommendations have been made for assessment of recycling markets; feasibility studies of expanding organics infrastructure capacity, landfill expansion permitting/approvals, further evaluation of alternative technologies; and expansion of recycling programs in the future throughout the MOA (with changes in legal/regulatory authorities as well as increased back-haul potential). Engineering recommendations include preparation of a Landfill Master Development Plan that includes future fill phasing, soil management, interim and permanent storm water improvements, capital improvement budgets/schedule, revised final cover design, and slope stability analysis to provide cost savings and additional landfill life. Engineering feasibility studies are also recommended for the best use of excess landfill gas and for management of leachate.

The SWS ISWMP recommendations for short, medium and long-term strategies address the solid waste management needs of the MOA for over the next 100 years. In October 2018, the MOA Assembly authorized SWS to proceed with acquisition of the Wal Mart property adjacent to the CTS in order to provide for new and upgraded facilities to meet future needs. Periodic updates of the ISWMP are recommended to assess progress, needs and changed conditions over time.