2025 Waste Management Facility Master Plan

Landfill Expansion and Site Development
Final Report

Stantec

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City of Lloydminster

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Executive Summary

Stantec Consulting Ltd. (Stantec) was retained by the City of Lloydminster (the City) to prepare an updated Master Plan for the Waste Management Facility (WMF). The Master Plan provides a comprehensive framework for the development, operation, and long-term management of the WMF over the 2026–2045 planning horizon, with financial and environmental considerations extending through closure and post-closure to 2080.

The WMF remains a central component of the City's integrated solid waste management system. As the City continues to grow (it is projected to increase from approximately 32,000 residents in 2024 to more than 50,000 by 2045) waste generation will rise proportionally. This growth places increasing pressure on landfill capacity, environmental systems, and supporting infrastructure. The Master Plan responds to these pressures by outlining a coordinated program of capital improvements, operational enhancements, and regulatory compliance measures that together ensure the facility continues to operate safely, efficiently, and sustainably.

The plan integrates updated waste projections, airspace assessments, environmental monitoring requirements, and a detailed capital development schedule. It also aligns with the City's broader waste diversion and resource recovery objectives, recognizing that landfill capacity must be preserved through both operational efficiency and upstream waste reduction initiatives.

Key elements of the plan include the construction of new engineered landfill cells, a new facility entrance and weigh scale system, a modernized public drop-off (PDO) facility, a new equipment and maintenance building, expanded stormwater and leachate management systems, and a phased approach to landfill gas (LFG) monitoring and control in response to new federal methane regulations. The plan also incorporates updated closure and post-closure cost estimates in accordance with PS 3280, ensuring that the City's long-term financial obligations are fully recognized and planned for.

The following table shows the items addressed in the Master Plan and gives a brief overview of the objectives of each section.

Table ES-1 Overview of Objectives for Report Sections

Section	Objective
Background Information of Landfill Development to Date	A brief overview of the history of the landfill to date, to provide historical context for the reader.
Regulatory Framework	A brief overview of the applicable regulations that were and are in effect, regarding landfill development, to provide regulatory context.
Summary of Constraints	An overview of on-site and off-site constraints to landfill development and operations.
Waste Characterisation	A detailed analysis and forecast of expected waste streams to arrive at the landfill, including consideration of the impacts of population growth and increased recycling efforts

Section	Objective
Hydrogeological Considerations	A review of the site topography, regional geology and hydrogeology, as well as surface water hydrology and local subsurface conditions
Landfill Development Plan	Recommendation for the development of the remainder of landfillable space to maximize airspace. This section also includes a recommended set of guidelines for the design of future landfill cells*. Proposed details for the design and construction of future landfill cells
Infrastructure and Transportation	A summary of current infrastructure and transportation elements at the landfill and recommendations for infrastructure corridors and future changes in transportation systems.
Operational Considerations	Recommendations for future operations based on anticipated future development at the landfill and around the landfill site
Environmental Monitoring	A summary of current monitoring requirements and a forecast for future monitoring. A summary of existing leachate, landfill gas and stormwater management practices and recommendations for future management practices.
Landfill Closure and Post-Closure	A summary of current closure practices and recommendations for future landfill closure, including requirements for post-closure care.
Financial Planning	A financial model to aid in the timely development of landfill cells and to aid in budgeting for landfill development and operations.
Recommendations and Implementation Plan	An implementation plan for the phased development of the facility

Note:

* For clarity, the term cell is used to describe a discrete engineered landfill disposal unit, while phase refers to the sequencing and vertical development of waste placement within a cell. This terminology is used consistently throughout the Master Plan.

The proposed Landfill Development Plan is presented in Section 7. This section provides the central element of the Master Development Plan, and the discussion of other elements is based on the development proposed therein.

Recommendations are provided for future expansion of waste disposal cells within the existing property boundary including relocation of facility entrance with provision for separate inbound and outbound weigh scales, a separate public drop-off area away from the active face of the landfill to reduce interference with the commercial traffic, a lined snow melt holding pond to eliminate the need for overland pumping of leachate to the septic manhole/wastewater treatment facility, an equipment/ maintenance building, future material stockpile areas, snow disposal facility improvement and an interim and ultimate surface water management plan.

While providing recommendations for the future expansion of the landfill, the intent was to make efficient use of the area within the existing facility boundaries. For making effective use of available area for landfill expansion, two options are proposed for the reclamation of historical waste disposal area. One option is to reclaim by piggybacking the existing historical waste disposal area. This will involve designing an overliner system above the existing waste. However, this method will require a thorough understanding of the

geotechnical properties of the historically disposed waste. The other option is to reclaim this area by excavation (known as landfill mining) and re-disposing waste in a newly constructed and lined cell. This later method would enable efficient airspace utilization, organic fine, metals and other salvageable materials recovery and reduce the overall long-term liability for the City. A feasibility study should be performed to determine which option to pursue, with cost and timing being the main deciding factors.

Available airspace was estimated using the overliner approach, assuming a final waste elevation of 675 masl, which is 10 m higher than the elevation proposed in the 2016 Master Plan. The proposed final waste configuration incorporates the additional area currently occupied by the two wet cells located in the southeast portion of the site, adjacent to the existing waste footprint.

It should be noted that the structural stability of the landfill under the proposed final geometry and design elevation of 675 masl has not been evaluated as part of this Master Plan update. Furthermore, Stantec is not aware of any slope stability assessment having been completed for the previously proposed final elevation of 665 masl. Accordingly, it is recommended that a comprehensive slope stability analysis be undertaken for the proposed landfill configuration to confirm the feasibility of the design and validate the estimated available airspace.

Based on these assumptions, the conceptual design is estimated to provide approximately 5,200,500 m³ of available airspace, corresponding to a maximum waste elevation of 675 masl and an estimated remaining site life of approximately 54 years.

The discussion of landfill development and all associated elements concluded in a wide range of recommendations associated with future development and operation of the landfill. These recommendations are presented in the table below. The intent of the table is to provide a summary of the recommendations and to allow tracking of the implementation of each recommendation to facilitate the update of this Master Plan.

Table ES-2 Summary of Recommendations

Item	Recommendation	Status	Comments
1	Update the Master Plan every five years to ensure information contained within the plan is current and allows for detailed planning for the next five-year period.		
2	Ensure awareness of all staff with regards to (future) regulatory changes (Federal, Provincial, and Municipal) relating to waste management, air quality, surface water quality and groundwater quality and evaluate how these changes affect landfill development and operations		
3	The setback requirements should be applied for existing and new cell developments		
4	Waste projection data developed as part of this Master Plan should be periodically confirmed and updated as necessary.		

Item	Recommendation	Status	Comments
5	**New scale house facility Entrance from 40th Ave:** Construct new facility entrance from 40th Ave – South of the existing entry and scale house. Provide two weigh scales and construct new scale house with office space.		
6	Vehicle Maintenance Building: Construct a new equipment/maintenance building on the west side of the facility, just south of existing entrance		
7	**Interim Closure of Cell 1.3:** An interim cover should be applied to Cell 1.3 now that the design elevation of approximately 640 masl is reached and filling has begun in 1.4.		
8	**Public Drop-Off Area:** Develop new public drop-off facility at the southeast corner of the facility including wet cell development with protective material for metals/tires as per the concept shown in the Drawings Appendix A Figure A-1 (Assumed existing bins will be used).		
9	**Concrete/Crushed Concrete Stockpile:** All the stockpiled concrete/crushed concrete should be consumed from this location. Any future stockpiling of concrete should take place within the 100 m setback available towards 40th Avenue		
10	**Design and Develop Existing Snow Disposal Area:** Design and construct snow disposal area. That City should use gathered data from previous years regarding peak snow volumes to support the concept design proposed in this report.		
11	**Existing White Goods/Metal Pile Clean-Up:** This location will not be functional anymore. It is recommended that existing pile should be cleaned up/salvaged prior to construction of Cell 1.8.		
12	**Design and Construction of Phases 1.6 to 1.8 (Underliner) OPTIONAL or Prepare for Phase 2.1 (Overliner System):** Near the closure of Cell 1.5, the City should proceed with the feasibility assessment of an over- or underliner design and construction of Cells 1.6 to 1.8.		
13	**Alternative Final Cover:** Evaluate alternative final cover options based on the proposed landfill development and future landfill gas management system		
14	**Landfill Gas Quantification:** Assess LFG generation and plan for implementation of LFG control and mitigation systems with the upcoming federal regulations		

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1 Introduction

The Waste Management Facility (the 'facility') for the City of Lloydminster (the 'City') is located within Section SW ¼ 13-50-28-W3M in the northeast corner of the City at the intersection of 40th Avenue and 67th Street. The current fenced area occupied by this facility is approximately 50 hectares. However, the total area may be subject to change pending potential integration of the Ridgeline area to the north (approximately 8 ha). The City's wastewater treatment facility (WWTF) adjoins this facility towards its east perimeter fence. This facility is primarily used for disposal of waste generated from both City residents and users from outside the municipal boundary. Waste generated within the City is accepted at the in-town tipping rate, while waste originating from outside the City is subject to a higher out-of-town tipping fee, in accordance with the City's Fees and Charges Bylaw.

The facility operates under the Permit to Operate Waste Disposal Ground (PO 25-045) issued by the Saskatchewan Ministry of Environment.

1.1 Mission Statement

A Landfill Master Plan provides a single planning document for the landfill that addresses the current operations, infrastructure, and development, and outlines the planned future development through the expected life of the facility, through closure, and throughout the post-closure period. This document summarizes: development to date, constraints to landfill development, design criteria, recommendations for operations, environmental monitoring programs, interim surface water management plans, closure design, post-closure care and maintenance, and financial analysis.

The primary objective is to maximize the remaining waste capacity available at the landfill within practical constraints. Other objectives of the Master Plan include synthesis of existing information and planning for landfill development elements and ancillary systems, such as stormwater management, transportation, leachate management, and landfill gas (LFG) management.

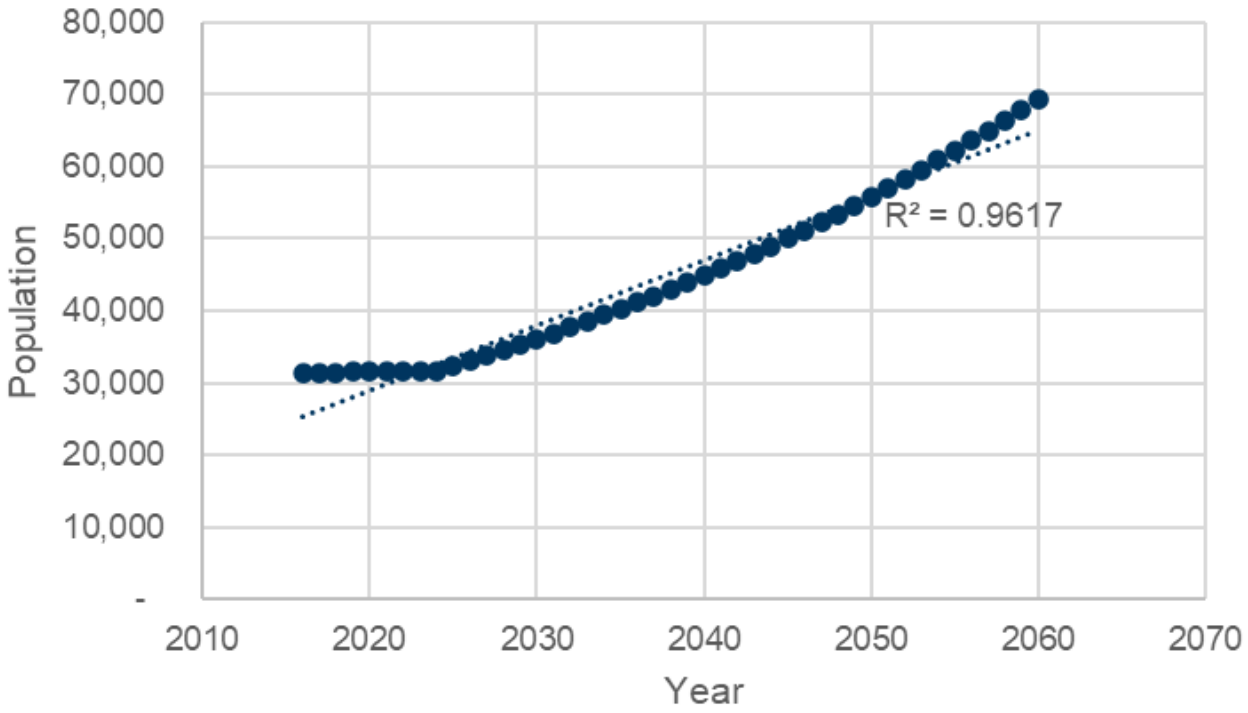
This document is primarily intended for internal use within the landfill department; however, it may be used outside of the Landfill Operations department for planning discussions with other city departments or the City Council. It is understood that the Master Plan will be a living document that will be updated on a regular basis (i.e., approximately every five years) or to take account of changing conditions in the market it serves.

1.2 Purpose and Scope

Between 2001 and 2021, the City's population increased from 17,482 to 31,582, representing an 81% increase over 20 years. Based on the population projections provided in the City's Integrated Waste Management Plan, the population is expected to increase to 69,357 by 2060. This reflects a projected increase of approximately 118% between 2021 and 2060. Figure 1-1 presents the City's projected population growth trend over this period.

While historical growth was relatively strong, the City's annual growth rate is expected to moderate gradually over time.

Figure 1-1 City's Population Trend Based on Estimated Growth Rate (2.2%)



Given the projected population growth rate, a significant enhancement to the existing municipal infrastructure will be necessary in the coming years including enhancement to solid waste management which primarily comprises three components:

- Waste collection infrastructure
- Waste recycling/material recovery infrastructure
- Residual waste management infrastructure i.e. Landfill

1.3 Information Gathering

Information used in the preparation of this Waste Management Facility Master Plan was obtained from a combination of publicly available sources, City of Lloydminster provided datasets, City bylaws and policies, and third-party technical reports previously commissioned by the City. Publicly available information included federal census data from Statistics Canada used for historical population baselines and growth trend analysis, provincial and federal legislation accessed through Saskatchewan and Government of Canada regulatory websites, stewardship and Extended Producer Responsibility (EPR) program documentation from Saskatchewan and Alberta, and aviation land-use guidance referenced through federal Aeronautics Act publications. City bylaws and municipal policies, including the Landfill Use Bylaw and Fees and Charges Bylaw, were obtained from the City of Lloydminster's official bylaw and municipal governance webpages.

Operational and technical data were provided directly by the City of Lloydminster. These included landfill weigh scale records and waste tonnage data categorized by Residential, Industrial, Commercial and Institutional (ICI), and Out-of-Town users; historical and current load count records; traffic volume data for the landfill facility; leachate generation, discharge, and hauling records; annual landfill operational reports. The City Website also provided waste collection program descriptions for curbside garbage, organics, and recycling services and fees, and information related type of accepted and banned material.

Engineering and site-related information supplied by the City included existing landfill layout drawings, historical waste disposal area records, landfill cell layouts, stormwater management pond location, leachate collection, drainage infrastructure, internal road networks, access roads, and stockpile locations. Data regarding existing landfill cells, active fill areas, interim cover status, and future development constraints were also derived from City-provided records and mapping. For clarity, in this report, the term cell is used to describe a discrete engineered landfill disposal unit, while phase refers to the sequencing and vertical development of waste placement within a cell. This terminology is used consistently throughout the Master Plan.

In addition, the Master Plan relied on technical studies and reports previously prepared for the City of Lloydminster by third-party consultants. These included earlier landfill master plan (2016), site-specific environmental and geotechnical investigations. Information from these reports was used to inform waste projections, airspace calculations, landfill phasing, historical waste reclamation options, soil balance assessments, drainage planning, and leachate management strategies.

All waste management system assessments, waste audits, diversion analyses, and strategic planning inputs referenced in this Master Plan were prepared by Stantec in 2024 and 2025. Public engagement activities, surveys, and outreach related to waste diversion, organics collection, recycling behaviour, and landfill service preferences were designed, administered, analyzed, and summarized by Stantec, with participation and direction from the City of Lloydminster where applicable. Comparative reviews of diversion practices, organics programs, education and enforcement approaches, and construction and demolition (C&D) waste diversion strategies were also conducted by Stantec and referenced throughout the Master Plan. These Stantec-prepared technical studies and engagement deliverables form a primary input to the development of this Master Plan.

Collectively, these sources provided the technical, regulatory, operational, and planning foundation for the development of waste projections, diversion strategies, site layout options, landfill phasing plans, infrastructure recommendations, and implementation schedules presented in this Master Plan.

1.4 Report Format

This report has been structured in the following manner to address the various requirements of the Master Plan:

- **Section 1 – Introduction:** This section describes background information and site history, purpose/objectives and scope of this project.
- **Section 2 – Background Information:** This section provides an assessment of facility operation and existing infrastructure at the facility.

- **Section 3 – Regulatory Framework:** A brief overview of the applicable current and past regulations regarding landfill development
- **Section 4 – Summary of Constraints:** An overview of on-site and off-site constraints to landfill development and operations.
- **Section 5 – Waste Characterization:** An analysis of expected waste streams to arrive at the landfill. Included for consideration of the impacts of population growth and increased recycling efforts
- **Section 6 – Hydrogeological Considerations:** This section describes topography, subsurface hydrogeology and hydrology of this site on a local and regional scale in relation to the existing facility and future site development.
- **Section 7 – Landfill Development Plan:** This section describes the proposed 2025 Waste Management Facility Master Plan based on information contained within the previous Sections. Major components addressed includes facility entrance relocation and traffic accommodation to enable smooth and efficient operation, alternate public drop-off, improvement to snow disposal area, facilitate commercial and residential traffic movement and phased development of the landfill during the Master Plan period of 20 years.
- **Section 8 – Infrastructure and Transportation:** A summary of current infrastructure and transportation systems at the landfill and recommendations for infrastructure corridors and future changes in transportation systems
- **Section 9 – Operational Considerations**: Recommendations for future operations based on anticipated future development around the landfill site.
- **Section 10 – Environmental Monitoring:** A summary of current monitoring requirements and a forecast of future monitoring requirements for groundwater, leachate and landfill gas.
- **Section 11 – Financial Plan:** A financial model to aid in the timely development of landfill cells and to aid in budgeting for landfill development and operations.
- **Section 12 – Recommendations and Implementation Plan:** This section outlines an implementation plan for the phased improvement/development of the facility.

2 Background Information

2.1 Landfill Operations

The Lloydminster Landfill is a municipal solid waste landfill, regulated under the Saskatchewan Environmental Management and Protection Act and is permitted to accept municipal solid waste and approved non-hazardous waste streams, including construction and demolition waste and inert materials, in accordance with applicable provincial requirements under Permit to Operate Waste Disposal Ground PO 25-045.

2.1.1 Operations Summary

2.1.1.1 Hours of Operation

The City of Lloydminster Landfill operates 6 days a week from October to April and 7 days a week from May – September. On statutory holidays, the Landfill operated at a limited capacity to accommodate residential curbside collection. The facility's operating hours and emergency contact information is posted at the entrance as well as on the City's website.

2.1.1.2 Site Inspections

City staff provides supervision of operations and disposal activities during operating hours. Staff conducts regular inspection of loads disposed throughout the site's designated disposal areas. Staff also conduct regular site inspection and maintenance in accordance with the approved Operations Plan.

2.1.1.3 Site Security

Entrances to the site are secured by locked gates on the west (40th Avenue) and the south (67th Street). Although the northern section of the site is not fully fenced, natural topography of the northern section limits unauthorized access. The east south and west portions of the landfill are fenced with a 6ft chain-link. Unauthorized access is typically noted along the fenced areas. Over the last couple of years, the City has made significant investments to further secure the site which includes installation of a new gate on 40th Avenue, installation of camera and monitoring equipment and contracting security services. Recently, the City has also started storing "hot items" inside a locked shop to further discourage unauthorized access. The City continues to work with law enforcement to encourage regular police patrols in the area.

2.1.2 Landfilling history

Landfilling at this facility dates back to 1970. Prior to the construction of engineered landfill cells, waste disposal practices at the site varied by location and time period. Between 1970s and early 1990s, waste was placed directly on the ground surface in areas north of the current landfill infrastructure, without trenching or engineered controls. This material was subsequently covered by fill and, more recently, by stockpiled Ridgeline materials. In other portions of the site, waste was historically disposed of in long trenches, oriented north–south. These trenches were not equipped with seepage barriers or leachate

collection systems, but partial containment was provided by excavation into native clay soils. Landfill activities were conducted north of the 40 Avenue entrance till around 1999 some time after the trenches were constructed. It is estimated that the area occupied by the historical waste is approximately 20-25% of the total fenced area of the facility. The presence of historical waste beneath both the northern disposal area and trenched areas is an important consideration for future landfill development.

Until 2007, landfilling of waste progressed from the southwest corner of the facility towards the east. The majority of waste during that period was disposed in the south-southwest area which is currently used as public drop off facility for cardboard, blue bag materials, e-waste, tires and HHW (paint, oil, glycol and battery). The area towards 67th Street, which is currently used for stockpiling lumber/chipped wood, white goods and metals, is also expected to be underlain with historical waste.

The first engineered cell i.e., Cell 1.1 was developed in 2007 and was constructed with a 1.1 m thick compacted clay liner and a leachate collection and removal system (LCRS). Cell 1.1 operated from 2007 to 2012. Cell 1.2, located south of Cell 1.1, was constructed in 2012 and designed in a similar manner but with a geosynthetic clay liner (GCL) incorporated along the west side slope adjoining the historical waste disposal area. Cell 1.3 was constructed in 2019 and constructed with a compacted clay liner, GCL and HDPE. Although this cell has since been provided with an intermediate cover, it has airspace available which may be utilized, as needed. Cell 1.4, constructed in 2024 using a GCL, adjoins Cells 1.1 and 1.2 and is the currently active disposal cell.

The leachate management system was developed in two stages. Under the original system, leachate generated from Cells 1.1 and 1.2 was conveyed by gravity to a leachate lift station and pumped to a small holding (overflow) pond, from where leachate was periodically pumped overland via a 150 mm diameter hose to a septic manhole located south of the facility for conveying to the sanitary sewer running parallel to 67th Street. In 2019, a centralized leachate management system (LMS) pond was constructed to integrate with the existing infrastructure and accommodate leachate generated from newer landfill Cells, including Cells 1.3, 1.4, and 1.5. and pump the leachate to WWTF via underground pipes tied to sewer main on 67 St.

Two wet cells were constructed in 2010 in the southeast portion of the facility, adjacent to the east boundary of Cell 1.2. These wet cells were developed for decanting sump waste from hydrovac trucks and are planned to be repurposed as landfill disposal cells following decommissioning. The City is also continuing to evaluate biosolids management options. During construction this well be removed and Cell 1.5 will be built in place. The City plans to move sump/hydrovac materials to the new Wet Cell north of the landfill.

The facility includes 20 groundwater monitoring wells, 3 leachate wells, and landfill gas probes that are monitored in accordance with the site's Environmental Protection Plan (EPP). In 2024, 3,303 m^3 of leachate was pumped from the LMS and discharged to the WWTF.

Surface water runoff from the landfill is currently managed through an engineered stormwater management pond and an eastern perimeter drainage ditch that discharges to adjacent wetlands. Due to water quality considerations, stormwater collected in these ponds is pumped to the LMS and ultimately conveyed to the WWTF for treatment, rather than being discharged directly to the environment. However, the existing

eastern perimeter drainage represents a constraint to future site development and may require regrading, diversion to the stormwater pond, or further regulatory consultation.

2.2 Site Boundary

As of 2025, the Waste Management Facility occupies approximately 50 hectares within its current fenced boundaries. The approved landfill footprint and associated operational areas are contained within this fenced extent. The total site area may be subject to future change pending the potential integration of the adjacent Ridgeline lands located to the north of the existing facility. Any future boundary modifications would be subject to regulatory approvals and would be undertaken as part of phased site development planning to support long-term operational efficiency and infrastructure needs.

A map of the facility with the site boundaries are provided in the Appendix A, Figure A-1.

2.3 Landfill and Surrounding Lands

The City of Lloydminster Waste Management Facility is located in the northeast area of the City and is situated within a broader municipal service and utility corridor. The landfill is bounded by City-owned lands and key supporting infrastructure that collectively influence site access, drainage, and long-term development planning. The City's WWTF is located immediately east of the landfill property and represents a critical adjacent land use, particularly with respect to liquid management systems, environmental protection measures, and long-term infrastructure coordination.

Lands located to the north of the landfill, commonly referred to as the Ridgeline area (8 ha), are owned by the City and have historically been used to support waste management–related activities. Portions of the Ridgeline lands have previously been leased for soil treatment and material storage purposes and continue to play an important role in overall site planning. These northern lands provide opportunities for future integration into the Waste Management Facility footprint, including support functions such as material stockpiling, snow disposal, and other landfill-related infrastructure, subject to regulatory approvals and phased development planning. Lands immediately south of the landfill are occupied by a major utility and pipeline corridor, which represents a permanent land-use constraint. Development activities in this area are subject to setback requirements, access restrictions, and coordination with utility operators.

2.4 Landfill Infrastructure

The current landfill infrastructure is composed of three structures. The oldest is an equipment storage shop from the 1980s. A scale house (ATCO-style trailer) constructed in Fall 2016 is located near the active scale. To the north of this buildings site a supervisor support office (ATCO-style trailer) installed in 2014. The site infrastructure includes the following:

- Facility Entrance from the 40th Avenue
    - Weigh scale and data logging at the scale house
- Waste Disposal Cells:
    - Historical waste disposal Cells for municipal solid waste (MSW) and construction, renovation and demolition waste (C&D)

    - Engineered Cell 1.1 through Cell 1.4 and operationally, may be accessed as needed.
- Facility Infrastructure:
    - Public drop-off area
    - Snow disposal area
    - Wet cells (not in use currently)
    - Impacted soil management area
    - Material stockpiles – clean fill, lumber, concrete, white metals, treated soils
    - Vehicle maintenance area
    - Landfill equipment
    - Litter fencing

2.4.1 Public Drop-Off Areas

Currently, all vehicles including residential have direct access to the active face of the landfill for disposal of waste. A designated public drop-off (PDO) area is located adjacent to the historical waste disposal zone, where residents can dispose salvageable/ recyclable materials accepted by the city into clearly marked bins and pads. The west boundary of the facility contains the HHW sorting zone and is used for the storage and staging of recyclable materials including cardboard, paint, used oil, oil filters, e-waste, propane cylinders, batteries, aerosol cans, glycol, fluorescent tubes, and tires.

Metals and white goods are stockpiled in a separate drop-off area on the south side of the WMF, with Freon recovered by certified contractors prior to shipment. Concrete and clean wood waste are stockpiled toward the south property boundary; wood is chipped on site and used for daily cover, along with stockpiled soil and treated soils supplied from the impacted soil management area.

2.4.2 Impacted Soil Management Area

A portion of the facility towards its extreme north boundary beyond the current snow disposal area was historically leased out to Ridgeline Inc. where they treated petroleum hydrocarbon impacted soils and liquid waste. This operation is currently in the process of being decommissioned by Ridgeline (Ambipar). It is understood that as of 2025, treated petroleum hydrocarbon-impacted soils remain stockpiled in the designated area. These treated materials continue to be reused as daily cover at the landfill as needed.

The agreement with Ridgeline Inc. expired as of May 2024, and no further treatment of petroleum-contaminated soils is anticipated at the site. All reclamation and regrading activities associated with this area will be completed by Ridgeline (Ambipar). Potential reuses may include long-term soil storage, snow disposal area, or future landfill infrastructure.

2.4.3 Snow Disposal Area

The snow disposal area is located just north of the historical waste/ Contaminated soil area and can be accessed through the existing facility entrance on the 40th Avenue. This snow disposal area even though seasonal, interferes with the general facility traffic. The snow disposal area is not engineered and does not provide detention of melt water and reduce sediment and contaminant loading on the receiving environment. The nearby creek which likely receives meltwater discharge from this snow disposal area ultimately merges into the Neale Lake which is part of local sub surficial aquifer.

2.4.4 Equipment

Below is a list of the equipment/machinery currently used at this facility:

- Loader – Volvo L70H (Purchased 2022)
- Compactor – BOMAG OM 471 LA (Purchased in 2018)
- Dozer – John Deere 850L (Purchased in 2024)
- Tandem Axle Truck – Freightliner MM1120645 (Purchased in 2010)

2.5 Site History

2.5.1 Historical Waste Disposal: Pre-2006

Historically, waste disposal at this facility began in the 1970s. at the north of the shop, waste was placed directly on the ground until the 1990s, after which disposal occurred in unlined trenches until 2006 when the first engineered cell (Cell 1.1) was constructed. As evident from previous reports and per communication with the City, this historical waste disposal area is significant in size and comprises the area between the existing weigh scale and property boundary to the south and between the west property boundary towards 40th Avenue and Cells 1.1 and 1.2. Although, the precise extent of the historical waste footprint is unknown, based on figures included in the Functional Landfill Study Report, this area measure approximately 8-10 hectares.

An assessment of waste quantities historically disposed at this site pre-2006 was made as shown in Table **2-1**. The waste quantity was estimated based on historical populations census data obtained from Statistics Canada and interpolating data for the missing information. The lower bound estimate of waste quantity was made based on average residential waste generation rate of 0.3 tonnes per capita per year[1]. The upper bound value was obtained considering both residential and non-residential waste.

[1] Waste Management Industry Survey: Business and Govt. Sectors (2010) published by Statistics Canada

Table 2-1 Assessment of In-Place Historical Waste Quantity (1971-2006)

Year	Population	National Waste Generation Rate (Residential + Non-Residential)*	Lower bound Estimate (Residential Waste Only)#	Upper bound Estimate (Residential + Non-Residential)	Notes
		Kg/Capita/Year	(tonnes)	(tonnes)	
1971	8691	472	2,607	4,101	* Rate extrapolated based on 1990 and 2006 data obtained from Conference Board of Canada # Based on 0.3 tonnes/capita/ year obtained from Statistics Canada Data in bold represents values obtained from documented sources
1972	9015	481	2,705	4,338	
1973	9339	491	2,802	4,582	
1974	9663	500	2,899	4,832	
1975	9987	509	2,996	5,087	
1976	10311	519	3,093	5,349	
1977	11255	528	3,377	5,944	
1978	12199	538	3,660	6,557	
1979	13143	547	3,943	7,188	
1980	14087	556	4,226	7,836	
1981	15031	566	4,509	8,502	
1982	15496	575	4,649	8,910	
1983	15961	584	4,788	9,327	
1984	16426	594	4,928	9,753	
1985	16891	603	5,067	10,187	
1986	17356	613	5,207	10,631	
1987	17341	622	5,202	10,784	
1988	17327	631	5,198	10,938	
1989	17312	641	5,194	11,091	
1990	17298	650	5,189	11,243	
1991	17283	659	5,185	11,396	
1992	17617	669	5,285	11,781	
1993	17951	678	5,385	12,173	
1994	18285	688	5,486	12,571	
1995	18619	697	5,586	12,975	
1996	18953	706	5,686	13,386	
1997	19360	716	5,808	13,855	
1998	19767	725	5,930	14,331	
1999	20174	734	6,052	14,815	

Year	Population	National Waste Generation Rate (Residential + Non-Residential)*	Lower bound Estimate (Residential Waste Only)#	Upper bound Estimate (Residential + Non-Residential)	Notes
		Kg/Capita/Year	(tonnes)	(tonnes)	
2000	20581	744	6,174	15,307	
2001	20988	753	6,296	15,807	
2002	21596	763	6,479	16,467	
2003	22204	772	6,661	17,139	
2004	22812	781	6,844	17,822	
2005	23420	791	7,026	18,516	
2006	24028	800	7,208	19,222	
Estimated Waste Quality in Place (Tonnes)			**179,330**	**394,742**	

The waste generation rate from 1970 to 2002 was obtained using linear extrapolation of waste generation rate in 1990 and 2006 obtained from Conference Board of Canada. For 2003 through 2006, the actual waste quantities disposed were obtained from the Functional Landfill Study Report[2]. Based on the data above, it was estimated that approximately 180,000 to 400,000 tonnes of waste may have been disposed at this site between 1971 and 2006 as shown in Table 2-1.

Further, historical municipal landfills may contain up to 50-60 % (w/w) of soil type material (cover material and heavily degraded waste). To provide a conservative estimate of thickness of historical waste disposed at this facility, the cover soil was assumed to comprise 50% w/w which is approximately equivalent to 20% v/v based on an assumed cover soil density of 1,300 kg/m^3. This would mean another approximately 90,000 - 200,000 tonnes of soil may have been disposed with the historical waste as a daily/interim cover. Assuming an average in-place waste density of 500 kg/m^3 and cover soil density of 1,300 kg/m^3, the average thickness of waste and soil disposed together in this area is estimated to vary from 4.0 m to 10.0 m.

Based on various historical site investigations and monitoring wells constructed by AMEC between 1997 and 2003, domestic waste was observed at a depth of 3.0 m to 7.0 m bgs. The thickness of such historical waste deposits varied from 1.0 m to 3.0 m as evidenced from the two boreholes (MW2 and MW 3) that have since been decommissioned. Further, four leachate monitoring wells were installed by AMEC in 2011 in the historical waste disposal area (MW11-1, MW11-2, MW11-3 and MW11-4)[3]. From the borehole logs as shown in Table 2-2, the thickness of historical waste disposed at these locations appears to vary from 3.0 m to 10.0 m which tends to support the thickness estimated based on historical waste quantity assessment shown in Table 2-1.

[2] Krook, J., Svensson, N and Eklund, M. (2012). Landfill Mining: A critical review of two decades of research. *Waste Management* 32, pp 513-520.
[3] Boreholes logs obtained from 2015 Groundwater Monitoring Report prepared by GHD Ltd.

Table 2-2 Waste Thickness Observed in Borehole Logs for Leachate Monitoring Wells

Leachate Monitoring Well ID	Ground Elevation (masl)	End of Borehole (masl)	Depth of Borehole (m)	Waste Elevation (masl)		Inferred Historical Waste Thickness (m)
				Start	End	
MW 11-1	635.82	627.59	8.23	635.07	628.81	6.26
MW 11-2	635.96	630.47	5.49	634.43	631.69	2.74
MW 11-3	637.19	627.74	9.45	636.27	628.35	7.92
MW 11-4	637.19	621.95	15.24	634.75	625.3	9.45

2.5.2 Historical Waste Disposal: 2006-2016

The first engineered cell (Cell 1.1) came into operation in 2007. The base elevation of this varies from approximately 620 masl on the north end to 625 masl at the south end. Cell 1.2 was constructed in 2012 adjoining Cell 1.1 on the south. Cell 1.2 was filled to an elevation of approximately 640 masl which is higher than the closure elevation of Cell 1.1. The data presented in Table 2-3 for the waste quantities disposed between 2006 and 2015 was extracted from the weigh scale data and information provided in various reports provided by the City. The average growth rate in waste quantity received from 2006 to 2015 is approximately 2% with only a few years indicating a negative growth rate.

Table 2-3 Waste Quantities Disposed from 2006-2015

Year	Actual Quantities Received at the Weigh Scale (2006-2015)		
	MSW (tonnes)	Wood + Concrete (tonnes)	Total (tonne)
2006	30,678	685	31,363
2007	31,263	567	31,830
2008	29,000	231	29,231
2009	26,430	270	26,700
2010	29,819	109	29,928
2011	33,337	1,519	34,856
2012	30,089	564	30,653
2013	35,343	576	35,919
2014	39,459	588	40,047
2015	34,347	600	34,947

2.5.3 Waste Disposal from 2016 to date

Cell 1.3 became operational in 2019 and still has available capacity for material placement. Unlike Cells 1.1 and 1.2, this cell was constructed with a GCL and HDPE liner system in addition to the CCL. The landfill is currently filling in Cell 1.4 which is an engineered cell, adjoins Cells 1.1 and 1.2 and became active in 2024.

In 2023, the landfill received a total of 27,313 tonnes of landfilled waste, up from 25,472 tonnes in 2022 (excluding sludge) and 27,077 tonnes in 2021, reflecting fluctuating but generally stable disposal trends. The City projects an average annual increase of 2.2% in landfilled waste through 2060 (tied to population growth rate). Waste Quantities Disposed from 2021-2023 provided by the City presented in Table 2-4.

Leachate management has also evolved, with 3,303 m³ of leachate pumped from the landfill's Leachate Management System (LMS) in 2024 and transferred to the Wastewater Treatment Facility. This includes runoff collected from the stormwater ponds and older leachate collection areas.

Acceptable waste includes municipal solid waste (MSW), construction and demolition waste, e-waste, treated hydrocarbon-impacted soils, asbestos, and unrecyclable concrete. However, petroleum-contaminated soils are being phased out following the expiration of the City’s agreement with Ridgeline in May 2024.

Table 2-4 Waste Quantities Disposed from 2021-2023

Year	Residential Waste Landfill (tonnes)	IC&I Waste Landfill (tonnes)	Out-of-Town Waste Landfill (tonnes)	Total Waste Landfilled (tonnes)
2021	7,229	17,549	2,299	27,077
2022	6,336	17,403	1,733	25,472
2023	6,829	18,777	1,707	27,313

The most recent estimate for the landfill’s remaining life is 20 years, with potential for expansion on City-owned land to the north.

2.6 On-Site Constraints and Buffer Zones

Landfill development and future site expansion are subject to regulatory considerations outlined in the applicable provincial approvals and environmental legislation, including requirements related to setbacks, buffer zones, environmental protection features, and adjacent land uses. These considerations influence the placement and sequencing of landfill phases, supporting infrastructure, stormwater management features, and access roads within the Waste Management Facility. Compliance with these requirements is a key factor in identifying developable areas and managing interactions with surrounding municipal infrastructure and City-owned lands. The presence of historical waste beneath both the northern disposal area and trenched areas is also an important consideration for future landfill development. Any expansion or redevelopment within these areas will require detailed geotechnical and environmental investigation to confirm subsurface conditions and appropriate liner system design.

Further discussion of applicable regulatory requirements and their influence on landfill development, buffer zones, and site constraints is provided in the next section, Section 3, with implementation considerations addressed in Section 7.

3 Regulatory Framework

3.1 Applicable Regulations

The following are the governing regulations for the operation and development of this facility:

- The Municipal Refuse Management Regulations (MRMR), 1986
- The Hazardous Substances and Waste Dangerous Goods Regulations
- The Environmental Management and Protection (EMPA), General Regulations, 2010; Regulates landfill operations across Saskatchewan, including permitting, inspections, environmental assessments, closure, and post-closure care, through the Saskatchewan Ministry of Environment's Landfill Division.
- Municipal Refuse Management Regulations, E-10.2 Reg 4 – Provincial regulation updated to align with EMPA and solid waste best practices.
- Canadian Environmental Protection Act (CEPA), 1999 – Applies to hazardous waste and recyclable materials, including the Greenhouse Gas Reporting Program (GHGRP) for facilities emitting ≥10,000 tonnes CO_2e/year
- City of Lloydminster Landfill Use Bylaw 28-2022 – Regulates material acceptance, recycling bans, operational compliance, and user obligations
- City of Lloydminster Fees and Charges Bylaw 20-2025 – Outlines service and tipping fees for waste management and recycling
- Saskatchewan Extended Producer Responsibility (EPR) Regulation; as of 2024, producers are now required to fully fund the recycling of PPP (packaging and paper products); Lloydminster will transition under Phase 3 starting December 1, 2026
- Alberta Extended Producer Responsibility (EPR) Regulation (Alta Reg 194/2022); Alberta's EPR system for PPP (single-use products, packaging and printed paper products) and HSP (hazardous and special products) launched April 1, 2025, shifting financial and operational responsibility for recycling from municipalities to producers.
- Saskatchewan delivers recycling and extended producer responsibility through provincially approved stewardship organizations that manage specific material streams. Programs such as SK Recycles (packaging and paper), SARRC (used oil and antifreeze), Tire Stewardship of Saskatchewan, EPRA (electronics), Product Care (paint and household hazardous waste), and Call2Recycle (batteries) are responsible for the collection, recycling, and end-of-life management of designated products, helping divert materials from municipal landfills and shifting responsibility from municipalities to producers.
- Alberta Recycling Management Authority: Applies to materials originating from these provinces, including electronics, paint, tires, used oil, and household hazardous waste

3.2 Setback Requirements

Section 8(2) of the MRMR specifies maintaining a setback distance of 100 m from a highway to the waste footprint. For this facility, 40th Avenue and 67th Street are considered as highway within the definition specified in the MRMR.

The Master Plan has been developed to maintain a 100 m setback from the 40th Avenue and the 67th Street. Further, SaskPower requires a horizontal clearance of 15 m from the overhead powerline. An overhead power line exists towards the existing sewage treatment lagoon which runs N-S. Therefore, necessary horizontal clearance has been provided while staging the facility development to account for the existing overhead power line.

Additional setback requirements are applicable as per provincial regulations:

- 450 m setback from private water wells under the Nuisance and General Sanitation Regulation (AR 243), verified through the 2022 site audit.
- 300 m setback from controlled highways and 800 m from intersections under the Highway Development and Protection Regulation (AR 326).
- 30 m setback from landfill property lines and 300 m from man-made drainage ditches under the Standards for Landfills in Alberta.
- 450 m setback from residences, hospitals, and food establishments to active landfill working Phases per the Subdivision and Development Regulation.

The Master Plan assumes that no setback is required for the north property boundary which adjoins the current snow disposal area, but consideration has been made to align with recent 2022-2024 regulatory clarifications, especially regarding proximity to nearby water bodies.

The City Land Use Bylaw also requires 3.0 m to 6.0 m setbacks from property boundaries to adjacent developed Cells, consistent with updated municipal zoning frameworks.

No formal setback was required due to airport zoning; however, an 8 km distance from the Lloydminster Airport boundary to the landfill complies with the guidance of the Aeronautics Act's zoning recommendation (2005 Aviation Land Use Guidelines[4]).

[4] Government of Canada, Aviation - Land Use in the Vicinity of Aerodromes - TP 1247 https://tc.canada.ca/sites/default/files/migrated/tp1247e.pdf (accessed 2025)

4 Summary of Constraints

The development and long-term operation of the City of Lloydminster Waste Management Facility are constrained by a combination of historical site conditions, existing infrastructure, surrounding municipal land uses, and regulatory requirements. Historical waste disposal areas limit the availability of developable land and influence where future landfill phases and supporting infrastructure can be located. Existing engineered landfill phases, leachate and stormwater management features, access roads, and operational facilities further define the usable footprint of the site and affect the sequencing of future development.

Additional constraints arise from adjacent land uses and environmental protection considerations, including the proximity of the Wastewater Treatment Facility, stormwater management ponds, and natural drainage features. City-owned lands to the north, including the Ridgeline area, present both constraints and opportunities, as their current and future use must be coordinated with landfill operations and regulatory approvals. Regulatory setback and buffer requirements outlined in the applicable provincial approvals and environmental legislation also restrict development near property boundaries, surface water features, and sensitive infrastructure. Collectively, these constraints will guide the layout, phasing, and timing of landfill expansion and are addressed through the planning framework and design strategies presented in the following sections of this Master Plan.

5 Waste Characterisation

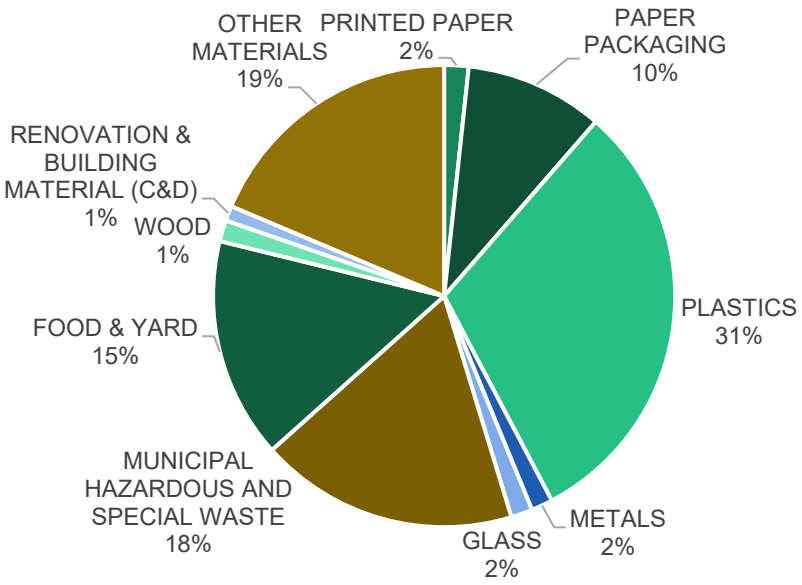
5.1 Waste Categories

A comprehensive waste audit was conducted for the City of Lloydminster in August 2024 to assess the composition and sources of waste disposed of at the landfill. The audit evaluated waste from both single-family residential curbside collection and the industrial, commercial, and institutional (ICI) sector, which includes multi-family residential sources.

5.1.1 Single-Family Residential Curbside Waste Composition

The 2024 audit revealed that the single-family residential waste stream is dominated by plastics (31%), followed by municipal hazardous and special waste (18%), food and yard waste (15%), other materials (19%), and paper packaging (10%). Smaller proportions include printed paper (2%), glass (2%), metals (2%), wood (1%), and construction & demolition (C&D) material (1%). Figure 5-1 illustrates the 2024 Single-Family Residential Curbside Waste Composition, based on audit results.

Figure 5-1 2024 Single-Family Residential Curbside Waste Composition



This data highlights significant opportunities for diversion. Plastics, which represent the largest portion of this stream, suggest further expansion of recycling programs or partnerships with EPR agencies may yield results. Food and yard waste also comprise a substantial proportion, underlining the importance of enhancing organics collection. Similarly, the high percentage of hazardous and special waste[5] demonstrates the need to expand collection opportunities for household hazardous waste (HHW),

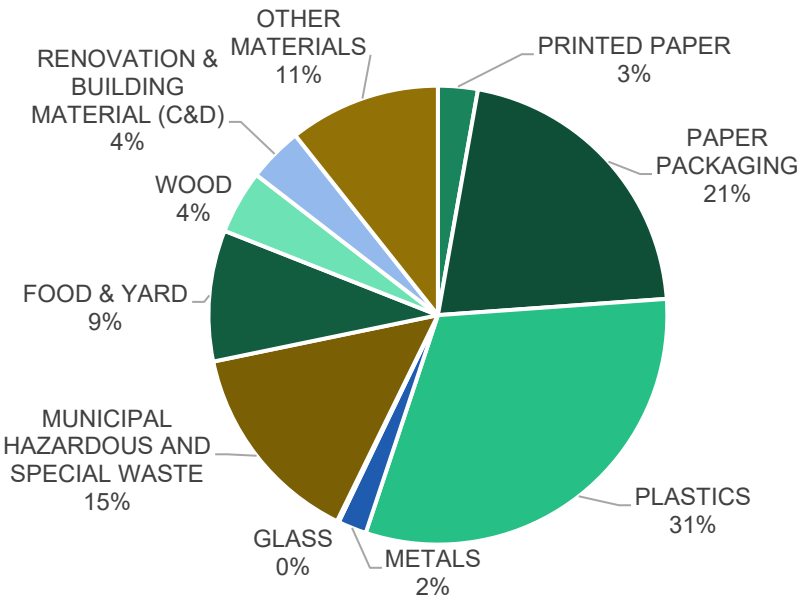
[5] The “hazardous and special waste” category represents a waste audit classification rather than a regulatory definition and generally includes materials such as household hazardous waste (e.g., diaper), batteries, pressurized containers identified through audit review.

especially through events like the Household Recycling Roundup, already hosted in partnership with ARMA.

5.1.2 ICI Waste Composition (Including Multi-Family Residential)

The ICI waste stream, including multi-family residential, also shows plastics (31%) as the largest component, followed by paper packaging (21%), municipal hazardous and special waste (15%), food and yard waste (9%), other materials (11%), renovation & building material (4%), wood (4%), printed paper (3%), and metals (2%). Notably, glass was found to be negligible (0%) in this stream. Figure 5-2 presents the 2024 ICI Waste Composition, including multi-family residential sources.

Figure 5-2 2024 ICI Waste Composition, Including Multi-Family Residential Sources



The presence of food and yard waste (9%) and paper packaging (21%) in ICI waste suggests that expanding organics and paper recycling programs for businesses and multi-unit residences could drive major diversion gains. Moreover, the consistent 15% hazardous/special waste content further supports exploring pop-up collection events and increased access to hazardous waste drop-off for the ICI sector.

6 Hydrogeological Considerations

6.1 Topography

The topography of the Lloydminster area is generally flat to gently rolling with a gentle regional slope towards the northeast. The 620 masl (meter above sea level) ground elevation contour passes beneath the landfill across the north-northeast portion of the facility.

6.2 Regional Geology and Hydrogeology

The regional scale geology and hydrogeology of this site have been summarized in the Functional Landfill Study Report[6] as well as in various groundwater monitoring reports prepared by AMEC.

On a regional scale, the geology consists of glacial till and stratified sediments of the Saskatoon group underlain by glacial till and stratified sediments of the Sutherland Group in buried valleys and bedrock depressions. Beneath the landfill, the thickness of the till is greater than 40 m. The Empress Group, approximately 60 m thick infilling the base of the valley, is interpreted to occur just north of the landfill location 150 m below ground surface (bgs). On the local scale, the subsurface geology exhibits till with low to medium plasticity up to a depth of approximately 18 m bgs. Intertill sand and gravels were observed in a few boreholes drilled near the south boundary of the facility towards 67th Street (MW01-5 & MW03-12).

The regional scale intertill sand and gravel aquifer just north of the landfill site is interpreted to be approximately 85 m bgs and is approximately 10-20 m thick. However, its continuity or a hydraulic connection with the underlying regional intertill sand and gravel aquifer located just north of the landfill site doesn't appear to have been established based on the reports reviewed. The regional groundwater flow was interpreted by others to be northeast with a downward vertical component.

The well recovery tests performed in 2003 indicated an average hydraulic conductivity in the range of 10^{-8} to 10^{-9} m/s. The western portion of the facility exhibited lower hydraulic conductivity compared to its eastern portion currently occupied by Cell 1.1 and 1.2. The location of the wells where these hydraulic conductivity tests were conducted was not readily available from the reports reviewed.

6.3 Surface Water Hydrology

The facility lies within the drainage basin of Gully Creek which is an east-southeast flowing tributary of the North Saskatchewan River. Further a small creek/stream located to the north of the current snow disposal area in the section NW-13-050-28-W3M flows eastward towards Neale Lake through a wetland area north of the landfill, and into a shallow water body to the east of the WWTF[7]. Surface water runoff from the landfill is currently managed through an engineered stormwater management pond and an eastern perimeter drainage ditch that discharges to adjacent wetlands. The existing eastern perimeter drainage represents a

[6] City of Lloydminster Sanitary Landfill Functional Study prepared by UMA Engineering Ltd. (December 2006)
[7] 2011 Annual Groundwater monitoring report prepared by AMEC

constraint to future site development and may require regrading, diversion to the stormwater pond, or further regulatory consultation.

6.4 Local Subsurface Conditions

Thurber conducted geotechnical field investigations in 2023 to support the construction of Cell 1.4. Four boreholes drilled in the area indicated subsurface profile consisting of 1.0 to 2.4 m of clay fill overlying medium-plasticity clay till, extending to the termination depths of the boreholes at approximately 9 to 12 m. Fine-grained sand was encountered in one borehole beneath the clay till. Overall, the subsurface conditions observed in the 2023 investigation are generally consistent with the regional geology and with the findings of previous investigations conducted by AMEC.

Groundwater monitoring results from the previous site monitoring program indicate that the inferred groundwater flow direction is from the southwest toward the wastewater treatment lagoons.

7 Landfill Development Plan

This section describes the long-term plan for the development of the facility. The section is broken into two subsections that focus on the proposed site development and the proposed landfill development. It begins with projections for population growth and waste generation and disposal quantities. These projections are then used to determine the airspace and cover material requirements for the landfill.

7.1 Population Projections

The projected population was estimated based on historical population census data obtained from Statistics Canada and the assumed population growth rate. These projections provide a picture of how the City's population is expected to grow, aiding in strategic planning and resource allocation.

The City has a population of 31,685. Between 2016 and 2021, the City's population changed by -0.6%. In the same period, the Saskatchewan part of the City's population increased by an average 0.48% annually[8]. This compares to the provincial average of 4.8% and the national average of 5.2%. Based on the 2019 Joint Regional Growth Study, a 2.2 % population growth per year was assumed, which equates to just over 700 people being added to the City every 12 months. This growth will undoubtedly impact the City's solid waste management system, necessitating a thorough review and strategic planning to accommodate future needs. Using this growth rate, Stantec calculated the projected population until 2060.

The projected population values for each year starting from the current population have been computed and are presented in Table 7-1, assuming a growth rate of 2.2%. Stantec used the method of linear interpolation for calculating the current population utilizing historical data. This method is based on historical data and an assumed constant absolute increase in population each year rather than a constant percentage growth rate. The updated population projection for the master plan period (2025–2045) is provided in Table 7-1. Considering the population estimates exhibited in Table 7-1, it is expected that in the next 20 years (i.e. by 2045), the City's population will increase by approximately 55% over its 2025 population.

Table 7-1 Population Projections for the Master Plan Period (2016-2045)

Year	Population	Data Source	Projection Year	Projected Population*
2016	31,410	Federal Census		
2017	31,444	Estimated (0.1% growth rate)		
2018	31,478	Estimated (0.1% growth rate)		
2019	31,513	Estimated (0.1% growth rate)		
2020	31,547	Estimated (0.1% growth rate)		
2021	31,582	Federal Census		

[8] Statistic Canada, https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&DGUIDlist=2021A00054810039&GENDERlist=1&STATISTIClist=1&HEADERlist=0 accessed Sep 2024.

Year	Population	Data Source	Projection Year	Projected Population*
2022	31,616	Estimated (0.1% growth rate)		
2023	31,651	Estimated (0.1% growth rate)		
2024	31,685	Estimated (0.1% growth rate)		
			2025	32,382
			2026	33,095
			2027	33,823
			2028	34,567
			2029	35,327
			2030	36,105
			2031	36,899
			2032	37,711
			2033	38,540
			2034	39,388
			2035	40,255
			2036	41,140
			2037	42,046
			2038	42,971
			2039	43,916
			2040	44,882
			2041	45,869
			2042	46,879
			2043	47,910
			2044	48,964
			2045	50,041

Note:

* Predicted (2.2% growth rate)

7.2 Waste Projections

Waste received at the facility generally comprises:

- Municipal Solid Waste (MSW) – also called as trash or garbage, is defined as wastes consisting of everyday items such as product packaging, grass clippings, furniture, clothing, bottles and cans, food scraps, newspaper, appliances, consumer electronics and batteries. These wastes come from homes and institutions such as schools, hospitals and commercial sources such as restaurants and small businesses[9]
- Construction and Demolition (C&D) waste
- Treated soil from the impacted soil management area operated by Ridgeline Inc.
- Waste recyclables regulated under various provincial waste stewardship programs

At the scale house, the vehicles entering the facility are primarily logged for the category of customer and the waste type. Customer categories include Residential, Commercial, City Operations and Out-of-Town. The recorded waste categories include:

- Landfilled: Garbage, mixed load, asbestos, wood chips, and unrecycled concrete
- Diverted: Organics, asphalt, blue bag recyclables, clean and concrete/asphalt, e-waste, cardboards, and metals that are diverted from the landfill
- Recycled: Wood, clean fill, and contaminated fill that is reused at the landfill (e.g., as alternative daily cover or for maintenance
- Treated: Septic waste and sump waste.

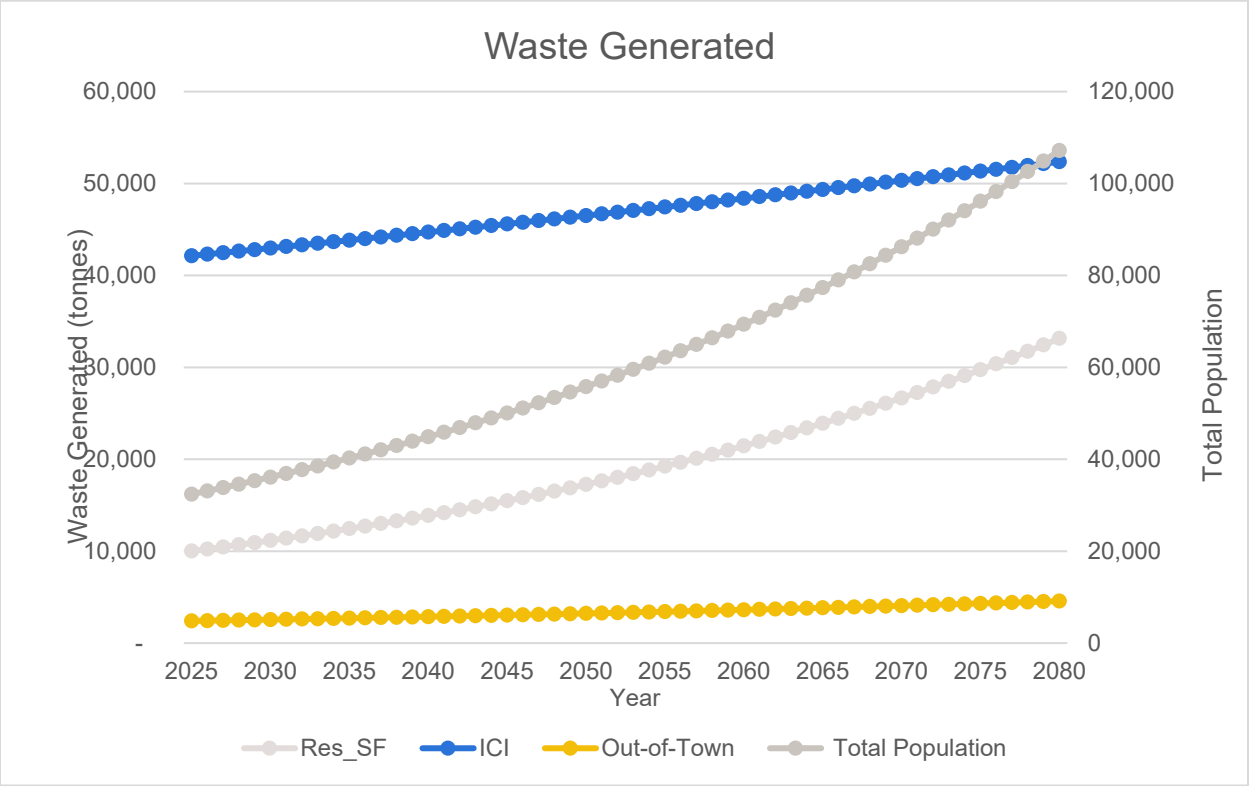
Garbage, per City's scale house record, is defined as a mixed load of MSW and C&D waste. Currently, C&D waste is not logged as an exclusive category. However, wood and concrete, the two major components of C&D waste, are logged individually. Actual weights are recorded at the weigh scale of commercial vehicles and City waste collection vehicles. Residents are allowed to drop off their MSW and recyclables for free. The waste quantities disposed by residents are logged in terms of 20, 30 or 50 kg based on visual examination of the waste loads. As a demonstration to their residency, the residents are required to show their Driver's license at the scale house.

Estimates of waste quantities that would require disposal during the Master Plan period were made considering a forecasted waste disposal growth rate under growth rate derived from projected population growth rate.

It is understood that the City tracks the weight of waste disposed by different sectors at the scale house. The three (3) sectors considered in this report include Residential, Institutional, Commercial and Industrial (ICI), and Out-of-Town. This section includes summaries of waste projections from the different sectors.

[9] USEPA Report on the Environment – Municipal Solid Waste (Accessed online Sep 22, 2016)

Figure 7-1 Waste Generated



Estimate of waste quantities that would require disposal during the master plan period were made considering a forecast-based disposal growth scenario. This projection used a single scenario: average per capita waste generation was calculated based on historical data (2021–2023) and then scaled using the projected population values described in above table. Waste quantities were not projected based on actual year-over-year disposal trends. Instead, the average of historical waste disposed during 2021–2023 was multiplied by the forecasted population to estimate future waste. This approach provides a simplified and consistent estimate of the total waste that will need to be managed based on anticipated population growth and current waste generation trends.

Waste Projection data is presented under these categories:

- Total Waste Generated represents the total amount of waste that is generated under the various sectors and is a sum of the waste landfilled, treated, diverted, or recycled.
- Waste Landfilled represents the tonnages of material that is landfilled.
- Waste Diverted represents the material that is diverted from the landfill.
- Waste Recycled represents the material that is reused at the landfill.
- Waste Treated represents the septic waste and sump waste.

Table 7-2 shows which waste categories considered in the waste disposal analysis.

Table 7-2 Waste Categories and Types Included in the Waste Projections

Waste Category	Type of Waste	Notes
Waste Landfilled	Garbage, mixed load, asbestos, wood chips and unrecycled concrete, as defined in the City's weigh scale data.	These are the materials that end up in the landfill
Waste Diverted	Organics, asphalt, blue bag (recyclables), clean and concrete/asphalt, e-waste, cardboards and metals that are diverted from the landfill, as defined in the City's weigh scale data.	Organics and recycling programs are currently contracted out to GFL and are managed at a different facility
Waste Recycled	Wood, clean fill and contaminated fill that is reused at the landfill, usually as alternative daily cover or for maintenance work on the site, as defined in the City's weigh scale data.	These materials are reused on site for landfilling.
Waste Treated	Septic waste and sump waste, as defined in the City's weigh scale data.	Septic waste disposal service is no longer offered at the landfill, and it is not associated with landfill operations. Septic waste handling transitioned to a key card access system located just outside the wastewater treatment facility as of April 2025.

7.2.1 Residential Waste Projections

At present, the city only provides residential curbside collection to single family, semi-detached, and duplexes dwellings. Waste from the multi-family sector is privately contracted out and collected under the ICI stream. The City's three-stream residential curbside collection program includes garbage, organics, and blue bags/recyclable material. Organic waste includes items such as food and yard waste where recyclable items include cardboard and some plastics.

Table 7-3 below presents historical (2021-2023) and projected (2024-2080) residential waste tonnages. The residential waste projection rates, based on the historical waste tonnages, for the various material streams are also provided in

Table 7-4. Residential tonnages and collection rates pertain to waste, recycling, and organics collected from residences through the City's curbside collection services.

Table 7-3 Residential Population and Estimated Waste Quantities (tonnes)

Year	Population	Waste Landfilled	Waste Diverted	Waste Recycled	Total Waste Generated
2021	31,582	7,229	2,899	80	10,207
2022	31,616	6,336	2,779	11	9,126
2023	31,651	6,829	2,878	30	9,738
2024	31,685	6,875	2,884	41	9,800

Year	Population	Waste Landfilled	Waste Diverted	Waste Recycled	Total Waste Generated
2025	32,382	7,027	2,948	42	10,016
2026	33,095	7,181	3,012	43	10,236
2027	33,823	7,339	3,079	44	10,462
2028	34,567	7,501	3,146	45	10,692
2029	35,327	7,666	3,216	46	10,927
2030	36,105	7,834	3,286	47	11,167
2031	36,899	8,007	3,359	48	11,413
2032	37,711	8,183	3,433	49	11,664
2033	38,540	8,363	3,508	50	11,921
2034	39,388	8,547	3,585	51	12,183
2035	40,255	8,735	3,664	52	12,451
2036	41,140	8,927	3,745	53	12,725
2037	42,046	9,123	3,827	54	13,005
2038	42,971	9,324	3,911	56	13,291
2039	43,916	9,529	3,997	57	13,583
2040	44,882	9,739	4,085	58	13,882
2041	45,869	9,953	4,175	59	14,188
2042	46,879	10,172	4,267	61	14,500
2043	47,910	10,396	4,361	62	14,819
2044	48,964	10,625	4,457	63	15,145
2045	50,041	10,858	4,555	65	15,478
2046	51,142	11,097	4,655	66	15,819
2047	52,267	11,341	4,758	68	16,167
2048	53,417	11,591	4,862	69	16,522
2049	54,592	11,846	4,969	71	16,886
2050	55,793	12,106	5,078	72	17,257
2051	57,021	12,373	5,190	74	17,637
2052	58,275	12,645	5,304	75	18,025
2053	59,557	12,923	5,421	77	18,421
2054	60,867	13,207	5,540	79	18,827
2055	62,206	13,498	5,662	80	19,241
2056	63,575	13,795	5,787	82	19,664
2057	64,974	14,098	5,914	84	20,097

Year	Population	Waste Landfilled	Waste Diverted	Waste Recycled	Total Waste Generated
2058	66,403	14,409	6,044	86	20,539
2059	67,864	14,726	6,177	88	20,991
2060	69,357	15,050	6,313	90	21,453
2061	70,883	15,381	6,452	92	21,924
2062	72,442	15,719	6,594	94	22,407
2063	74,036	16,065	6,739	96	22,900
2064	75,665	16,418	6,887	98	23,404
2065	77,329	16,780	7,039	100	23,918
2066	79,031	17,149	7,194	102	24,445
2067	80,769	17,526	7,352	104	24,982
2068	82,546	17,912	7,514	107	25,532
2069	84,362	18,306	7,679	109	26,094
2070	86,218	18,708	7,848	112	26,668
2071	88,115	19,120	8,021	114	27,254
2072	90,054	19,540	8,197	117	27,854
2073	92,035	19,970	8,377	119	28,467
2074	94,060	20,410	8,562	122	29,093
2075	96,129	20,859	8,750	124	29,733
2076	98,244	21,318	8,942	127	30,387
2077	100,405	21,787	9,139	130	31,056
2078	102,614	22,266	9,340	133	31,739
2079	104,871	22,756	9,546	136	32,437
2080	107,179	23,256	9,756	139	33,151

Table 7-4 Material Generation & Collection Rates for Residential Waste

Description	Rate (Tonnes/Capita/Year)
Waste Generation Rate	0.45
Waste Landfilled Rate	0.32
Waste Treated Rate	0.00
Waste Recycled Rate	0.10
Waste Diverted Rate	0.13

7.2.2 ICI Waste Projections

The load counts from the ICI sector (including waste from City Operations) for garbage, organic, and recyclables were used as a proxy for the number of businesses/households, due to the lack of actual population data. Between 2021 and 2023, the load counts from the ICI sector in the City averaged 7,157 (City background information). The projected rate of change for ICI load counts is 0.4% and was calculated using the average load counts of the year 2021 to 2023. Using the assumed rate of load count change of 0.4% the projected waste tonnages were calculated until 2080.

Table 7-5 presents historical (2021-2023) and projected (2024-2060) ICI waste tonnages. The waste projection rates, based on the historical waste tonnages, for the various material streams are also provided in Table 7-6.

Table 7-5 Estimated Quantities - ICI Waste

Year	Waste Landfilled	Waste Diverted	Waste Recycled	Waste Treated	Total Waste Generated
2021	17,549	23,512	16,830	11,715	69,607
2022	17,403	16,788	60,106	4,991	99,289
2023	18,777	14,700	18,459	155	52,092
2024	18,037	20,742	30,786	5,564	75,129
2025	18,149	21,127	31,245	5,591	76,112
2026	18,262	21,521	31,714	5,618	77,116
2027	18,376	21,925	32,194	5,646	78,141
2028	18,492	22,338	32,685	5,673	79,188
2029	18,610	22,760	33,186	5,701	80,257
2030	18,729	23,193	33,699	5,729	81,349
2031	18,850	23,635	34,223	5,757	82,465
2032	18,972	24,088	34,758	5,786	83,605
2033	19,096	24,552	35,306	5,814	84,769
2034	19,222	25,027	35,866	5,844	85,958
2035	19,350	25,512	36,438	5,873	87,173
2036	19,479	26,010	37,024	5,902	88,415
2037	19,611	26,519	37,622	5,932	89,684
2038	19,744	27,040	38,234	5,962	90,980
2039	19,879	27,573	38,860	5,993	92,305
2040	20,016	28,119	39,500	6,023	93,659
2041	20,155	28,678	40,155	6,054	95,042
2042	20,297	29,250	40,824	6,085	96,456
2043	20,440	29,836	41,509	6,117	97,902

Year	Waste Landfilled	Waste Diverted	Waste Recycled	Waste Treated	Total Waste Generated
2044	20,586	30,435	42,210	6,149	99,379
2045	20,733	31,049	42,926	6,181	100,890
2046	20,884	31,678	43,659	6,214	102,434
2047	21,036	32,321	44,408	6,246	104,012
2048	21,191	32,980	45,175	6,279	105,626
2049	21,348	33,655	45,959	6,313	107,275
2050	21,508	34,345	46,762	6,347	108,962
2051	21,671	35,053	47,583	6,381	110,687
2052	21,836	35,777	48,423	6,416	112,450
2053	22,003	36,518	49,282	6,450	114,254
2054	22,174	37,277	50,161	6,486	116,098
2055	22,347	38,055	51,061	6,521	117,984
2056	22,524	38,851	51,981	6,557	119,913
2057	22,703	39,666	52,923	6,594	121,886
2058	22,886	40,501	53,886	6,631	123,903
2059	23,071	41,356	54,873	6,668	125,967
2060	23,260	42,231	55,882	6,706	128,078
2061	23,452	43,127	56,915	6,744	130,238
2062	23,648	44,045	57,971	6,782	132,447
2063	23,847	44,986	59,053	6,821	134,707
2064	24,049	45,948	60,160	6,861	137,019
2065	24,256	46,934	61,293	6,901	139,384
2066	24,466	47,944	62,453	6,941	141,804
2067	24,680	48,979	63,640	6,982	144,280
2068	24,898	50,038	64,854	7,023	146,813
2069	25,120	51,123	66,098	7,065	149,406
2070	25,346	52,234	67,371	7,107	152,059
2071	25,577	53,373	68,674	7,150	154,773
2072	25,812	54,538	70,007	7,194	157,551
2073	26,052	55,733	71,373	7,237	160,394
2074	26,296	56,956	72,770	7,282	163,304
2075	26,545	58,209	74,201	7,327	166,282
2076	26,799	59,492	75,666	7,373	169,330

Year	Waste Landfilled	Waste Diverted	Waste Recycled	Waste Treated	Total Waste Generated
2077	27,059	60,807	77,166	7,419	172,450
2078	27,323	62,153	78,701	7,466	175,643
2079	27,593	63,533	80,273	7,513	178,912
2080	27,868	64,946	81,883	7,561	182,258

Table 7-6 Material Generation and Collection Rates for ICI Waste

Description	Rate (Tonnes/Load Count/Year)
Waste Generation Rate	5.86
Waste Landfilled Rate	2.25
Waste Treated Rate	0.70
Waste Recycled Rate	2.02
Waste Diverted Rate	0.85

7.2.3 Out-of-Town Waste Projections

Like the ICI projection, the number of load counts from the Out-of-Town sector for garbage, organic, and recyclables were used as a proxy for the number of households/users, due to the lack of actual data.

Between 2021 and 2023, the number of load counts in the Out-of-Town category in averaged 962, as calculated from the provided City data. The projected rate of change (of load counts) for Out-of-Town is 1.2% and was calculated using the average load counts for 2021 to 2023. Using the assumed rate of change of 1.2%, the projected waste tonnages were calculated until 2060.

Table 7-7 below presents historical (2021-2023) and projected (2024-2060) Out-of-Town waste tonnages. The waste projection rates, based on the historical waste tonnages, for the various material streams are also provided in Table 7-8.

Table 7-7 Estimated Quantities - Out-of-Town Waste

Year	Waste Landfilled	Waste Diverted	Waste Recycled	Waste Treated	Total Waste Generated
2021	2,299	162	86	12	2,559
2022	1,733	461	171	-	5,821
2023	1,707	260	259	18	2,243
2024	1,990	210	166	15	2,381
2025	2,013	213	168	15	2,409
2026	2,037	215	170	15	2,437
2027	2,061	218	172	15	2,466

Year	Waste Landfilled	Waste Diverted	Waste Recycled	Waste Treated	Total Waste Generated
2028	2,085	220	174	15	2,495
2029	2,109	223	176	16	2,524
2030	2,134	225	178	16	2,553
2031	2,159	228	181	16	2,583
2032	2,184	231	183	16	2,614
2033	2,210	233	185	16	2,644
2034	2,236	236	187	17	2,675
2035	2,262	239	189	17	2,706
2036	2,288	242	191	17	2,738
2037	2,315	244	194	17	2,770
2038	2,342	247	196	17	2,803
2039	2,370	250	198	17	2,835
2040	2,397	253	200	18	2,869
2041	2,425	256	203	18	2,902
2042	2,454	259	205	18	2,936
2043	2,483	262	208	18	2,971
2044	2,512	265	210	19	3,005
2045	2,541	268	212	19	3,040
2046	2,571	271	215	19	3,076
2047	2,601	275	217	19	3,112
2048	2,631	278	220	19	3,148
2049	2,662	281	223	20	3,185
2050	2,693	284	225	20	3,223
2051	2,725	288	228	20	3,260
2052	2,757	291	231	20	3,298
2053	2,789	294	233	21	3,337
2054	2,822	298	236	21	3,376
2055	2,855	301	239	21	3,416
2056	2,888	305	241	21	3,456
2057	2,922	308	244	22	3,496
2058	2,956	312	247	22	3,537
2059	2,991	316	250	22	3,578
2060	3,026	319	253	22	3,620

Year	Waste Landfilled	Waste Diverted	Waste Recycled	Waste Treated	Total Waste Generated
2061	3,061	323	256	23	3,663
2062	3,097	327	259	23	3,706
2063	3,133	331	262	23	3,749
2064	3,170	335	265	23	3,793
2065	3,207	338	268	24	3,837
2066	3,244	342	271	24	3,882
2067	3,282	346	274	24	3,928
2068	3,321	350	278	25	3,974
2069	3,360	355	281	25	4,020
2070	3,399	359	284	25	4,067
2071	3,439	363	288	25	4,115
2072	3,479	367	291	26	4,163
2073	3,520	371	294	26	4,212
2074	3,561	376	298	26	4,261
2075	3,603	380	301	27	4,311
2076	3,645	385	305	27	4,361
2077	3,687	389	308	27	4,412
2078	3,731	394	312	28	4,464
2079	3,774	398	316	28	4,516
2080	3,818	403	319	28	4,569

Table 7-8 Material Generation and Collection Rates for Out-of-Town Waste

Description	Rate (Tonnes/Load Count/Year)
Waste Generation Rate	2.48
Waste Landfilled Rate	2.07
Waste Treated Rate	0.00
Waste Recycled Rate	0.17
Waste Diverted Rate	0.22

7.2.4 Sludge Data

The City currently manages sewage sludge separately from regular municipal solid waste. At present, the City is evaluating long-term sludge management options, which may not include landfilling. For the purpose of this Master Plan update, sewage sludge was not included in the projected landfill waste tonnage used to estimate long-term airspace requirements. The projected waste quantities used in this report for estimating airspace requirements were obtained by dividing the projected waste tonnage by an assumed waste compaction density of 0.5 tonnes per m³. A 20% volume was also added to the airspace requirement to account for daily cover soil.

Sewage sludge was not included in the total projected landfill waste quantities. Instead, sludge volumes were added separately and only at the airspace calculation stage, alongside considerations for cover layers and cover soil, for the sole purpose of assessing available landfill airspace.

7.2.5 Total Airspace Requirement

From the estimates shown in Table 7-9, it is anticipated that approximately 666,598 tonnes of waste will be disposed at this facility in the next 54 years (2025–2080), which will require an airspace of approximately 5.2 million m³.

Table 7-9 Airspace Requirement

Year	Total Population	Projected Waste Residential (tonnes)	Projected Waste ICI (Tonnes)	Projected Waste Out-of-Town (tonnes)	Projected Waste Not Specified (tonnes)	Projected Waste City Operations (tonnes)	Total Projected Waste (tonnes)	Total Projected Waste Quantities (m^3)	Sewage Sludge Solid (m^3)*	Cover Soil (20%) (m^3)	Airspace Requirement (m^3)	Cumulative Airspace Requirement (m^3)
2025	32,382	7,027	16,178	2,013	14	1,957	27,189	54,378	1,359	0,876	66,613	66,613
2026	33,095	7,181	16,242	2,037	15	2,005	27,480	54,960	1,374	10,992	67,326	133,939
2027	33,823	7,339	16,307	2,061	16	2,054	27,776	55,553	1,389	11,111	68,052	201,991
2028	34,567	7,501	16,371	2,085	16	2,105	28,078	56,156	1,404	11,231	68,791	270,782
2029	35,327	7,666	16,436	2,109	17	2,157	28,385	56,770	1,419	11,354	69,543	340,325
2030	36,105	7,834	16,501	2,134	18	2,210	28,697	57,395	1,435	11,479	70,309	410,634
2031	36,899	8,007	16,566	2,159	20	2,264	29,016	58,031	1,451	11,606	71,088	481,722
2032	37,711	8,183	16,632	2,184	21	2,320	29,339	58,679	1,467	11,736	71,881	553,603
2033	38,540	8,363	16,698	2,210	22	2,377	29,669	59,338	1,483	11,868	72,689	626,292
2034	39,388	8,547	16,764	2,236	23	2,435	30,005	60,010	1,500	12,002	73,512	699,804
2035	40,255	8,735	16,830	2,262	24	2,495	30,347	60,693	1,517	12,139	74,349	774,153
2036	41,140	8,927	16,897	2,288	26	2,557	30,695	61,389	1,535	12,278	75,202	849,355
2037	42,046	9,123	16,964	2,315	27	2,619	31,049	62,098	1,552	12,420	76,071	925,426
2038	42,971	9,324	17,031	2,342	29	2,684	31,410	62,820	1,571	12,564	76,955	1,002,381
2039	43,916	9,529	17,098	2,370	31	2,750	31,778	63,556	1,589	12,711	77,856	1,080,237
2040	44,882	9,739	17,166	2,397	32	2,818	32,152	64,305	1,608	12,861	78,773	1,159,010
2041	45,869	9,953	17,234	2,425	34	2,887	32,534	65,068	1,627	13,014	79,708	1,238,719
2042	46,879	10,172	17,302	2,454	36	2,958	32,923	65,845	1,646	13,169	80,660	1,319,379
2043	47,910	10,396	17,371	2,483	39	3,031	33,318	66,637	1,666	13,327	81,630	1,401,009
2044	48,964	10,625	17,440	2,512	41	3,105	33,722	67,444	1,686	13,489	82,618	1,483,628
2045	50,041	10,858	17,509	2,541	43	3,182	34,133	68,266	1,707	13,653	83,625	1,567,253
2046	51,142	11,097	17,578	2,571	46	3,260	34,552	69,103	1,728	13,821	84,651	1,651,904
2047	52,267	11,341	17,648	2,601	48	3,340	34,978	69,956	1,749	13,991	85,697	1,737,601
2048	53,417	11,591	17,717	2,631	51	3,422	35,413	70,826	1,771	14,165	86,762	1,824,363
2049	54,592	11,846	17,788	2,662	54	3,507	35,856	71,712	1,793	14,342	87,848	1,912,210
2050	55,793	12,106	17,858	2,693	57	3,593	36,308	72,616	1,815	14,523	88,954	2,001,164
2051	57,021	12,373	17,929	2,725	61	3,681	36,768	73,536	1,838	14,707	90,082	2,091,246
2052	58,275	12,645	18,000	2,757	64	3,772	37,237	74,475	1,862	14,895	91,231	2,182,477
2053	59,557	12,923	18,071	2,789	68	3,865	37,716	75,431	1,886	15,086	92,403	2,274,880
2054	60,867	13,207	18,143	2,822	72	3,960	38,203	76,406	1,910	15,281	93,598	2,368,478
2055	62,206	13,498	18,214	2,855	76	4,057	38,700	77,400	1,935	15,480	94,815	2,463,293

Year	Total Population	Projected Waste Residential (tonnes)	Projected Waste ICI (Tonnes)	Projected Waste Out-of-Town (tonnes)	Projected Waste Not Specified (tonnes)	Projected Waste City Operations (tonnes)	Total Projected Waste (tonnes)	Total Projected Waste Quantities (m^3)	Sewage Sludge Solid (m^3)*	Cover Soil (20%) (m^3)	Airspace Requirement (m^3)	Cumulative Airspace Requirement (m^3)
2056	63,575	13,795	18,286	2,888	80	4,157	39,207	78,414	1,960	15,683	96,057	2,559,350
2057	64,974	14,098	18,359	2,922	85	4,259	39,723	79,447	1,986	15,889	97,323	2,656,672
2058	66,403	14,409	18,432	2,956	90	4,364	40,250	80,501	2,013	16,100	98,613	2,755,286
2059	67,864	14,726	18,505	2,991	95	4,471	40,787	81,575	2,039	16,315	99,929	2,855,215
2060	69,357	15,050	18,578	3,026	101	4,581	41,335	82,671	2,067	16,534	101,271	2,956,487
2061	70,883	15,381	18,651	3,061	107	4,694	41,894	83,788	2,095	16,758	102,640	3,059,127
2062	72,442	15,719	18,725	3,097	113	4,809	42,464	84,927	2,123	16,985	104,036	3,163,163
2063	74,036	16,065	18,799	3,133	120	4,928	43,045	86,090	2,152	17,218	105,460	3,268,623
2064	75,665	16,418	18,874	3,170	127	5,049	43,638	87,275	2,182	17,455	106,912	3,375,535
2065	77,329	16,780	18,949	3,207	134	5,173	44,242	88,484	2,212	17,697	108,393	3,483,928
2066	79,031	17,149	19,024	3,244	142	5,301	44,859	89,718	2,243	17,944	109,905	3,593,833
2067	80,769	17,526	19,099	3,282	150	5,431	45,488	90,977	2,274	18,195	111,446	3,705,279
2068	82,546	17,912	19,174	3,321	159	5,565	46,130	92,261	2,307	18,452	113,019	3,818,298
2069	84,362	18,306	19,250	3,360	168	5,701	46,785	93,571	2,339	18,714	114,624	3,932,922
2070	86,218	18,708	19,327	3,399	178	5,842	47,454	94,907	2,373	18,981	116,261	4,049,184
2071	88,115	19,120	19,403	3,439	188	5,985	48,136	96,271	2,407	19,254	117,932	4,167,116
2072	90,054	19,540	19,480	3,479	199	6,133	48,832	97,663	2,442	19,533	119,637	4,286,754
2073	92,035	19,970	19,557	3,520	211	6,284	49,542	99,084	2,477	19,817	121,377	4,408,131
2074	94,060	20,410	19,635	3,561	223	6,438	50,267	100,533	2,513	20,107	123,153	4,531,284
2075	96,129	20,859	19,712	3,603	236	6,597	51,007	102,013	2,550	20,403	124,966	4,656,251
2076	98,244	21,318	19,790	3,645	250	6,759	51,762	103,524	2,588	20,705	126,816	4,783,067
2077	100,405	21,787	19,869	3,687	265	6,925	52,533	105,065	2,627	21,013	128,705	4,911,772
2078	102,614	22,266	19,947	3,731	280	7,095	53,320	106,639	2,666	21,328	130,633	5,042,405
2079	104,871	22,756	20,026	3,774	297	7,270	54,123	108,246	2,706	21,649	132,601	5,175,006
2080	107,179	23,256	20,106	3,818	314	7,449	54,943	109,886	2,747	21,977	134,611	5,309,617

Note:

* Sludge quantities included in waste projections are based on historical reporting and represent episodic rather than recurring disposal events. The city is actively evaluating alternative sludge management options, and future landfilling of sludge may be reduced or eliminated. The inclusion of sludge volumes in this Master Plan is intended to provide context for historical impacts on landfill airspace rather than to predict ongoing disposal rates.

7.3 Material Stockpile

The current (December 2025) estimated volume of stockpiled clean fill material is approximately 112,565 m^3 as recorded in the datasheet received from the city. This material is part of the reuse strategy for alternative daily cover or site maintenance, similar to past practice. It is currently designated for stockpiling on historical waste disposal Cells, including the west side of Cell 1.1 and on top of Cell 1.3.

It is understood that as of 2025, treated petroleum hydrocarbon-impacted soils remain stockpiled in the designated area and are indented to be reused as daily cover at the landfill. However, no additional contaminated soil is being accepted at this time. It is noted that the Ridgeline partnership for treated soils expired in May 2024, and the City has instructed Ridgeline to decommission their storage pad within the next two years. Consequently, no new treated soils are being accepted, and all remaining stockpiled materials must be transferred to the City's pad before the decommissioning period ends.

The majority of wood/lumber disposed at this site is chipped and used as an alternative daily cover and for equipment pad construction. At the beginning of 2024, 6,180 m^3 of woodchips was produced. In December 2025, 1,100 m^3 of woodchips and 6,000 m^3 unprocessed wood were available at the landfill, particularly for alternative daily cover and site work stabilization. There are two large stockpiles of white goods/ metals occupying an area of approximately 200 m x 80 m (1.6 hectares). These materials are removed periodically for recycling when adequate quantities are accumulated. Metal area consists of 2x40 yard roll-off bins to reduce the amount of onsite stockpiling; these bins are serviced weekly in the summer and bi-weekly in the winter. All freon is removed by the hired contractor. There also exists a raw concrete stockpile with the volume of approximately 28,500 m^3 and a crushed concrete stockpile with the volume of approximately 19,400 m^3. As per communication with the city, majority of the crushed concrete is used for development projects including road works, site access improvements and utility trench backfill, consistent with past practice.

The landfill phasing plan, as discussed in the next section, has been proposed in a manner that extends the need to relocate existing stockpiles of cover soil, clay, and woodchips to further in the future, minimizing operational disruption and preserving airspace. The stockpiles to be removed during the cell development are identified in orange hatching on Figure A-1, Appendix A.

7.4 Proposed Site Development Plan

The current layout of the facility including various infrastructure is shown in Figure A-1, Appendix A. The site development plan as proposed is based on following important considerations:

1. Relocation of the current facility entrance in a manner that will not require further relocation in the future pursuant to proposed site development.
2. Future facility development limited to north of 67th Street
3. Development of a new office space and equipment maintenance area/workshop
4. Separate inbound and outbound weigh scales
5. Alternate public drop off area for recyclables and household waste so that access to the active face is limited to large loads/garbage trucks and commercial vehicles.

6. Provide unidirectional traffic flow throughout the facility to reduce traffic conflicts and ensure the safety of the patrons using the facility
7. A properly designed snow disposal area at its current location that would reduce sediment and contaminant loading on the receiving groundwater and stream located north of the facility
8. Development of an exclusive future C&D waste management area

The locations and nature of development proposed herein are for planning purposes and should be considered conceptual. Further detailed design and modelling will be necessary prior to implementation. All future design works should be based on updated site surveys.

7.4.1 Facility Entrance

An alternative entrance from 67th Street was previously explored in view of prevailing traffic issues on the 40th Avenue; however, based on discussions with the City, the facility entrance to remains from the 40th Avenue but with an alternate location as further discussed (Appendix A, Figure A-1). In accordance with waste regulations, the edge of the waste footprint must be maintained at least 100 m from the designated highways, which for this facility include 40th Avenue and 67th Street. Consequently, the 100 m setback area on the south (67th Street) and west (40th Avenue) will continue to be used for non-landfilling purposes such as soil stockpiles and maintenance activities.

The updated layout includes two inbound lanes and one outbound lane, optimizing stacking and maintaining separation between public and operational traffic. Bypass lanes for inbound and outbound movements are retained for emergency or contingency use. The yellow internal entrance road shown on Appendix A, Figure A-2 begins at 40th Avenue and leads directly to the scale facility. Parking space for 6–8 vehicles is available near the scale house, with the exact configuration to be finalized during detailed design.

A new ramp connection from the entrance road to the west perimeter/haul road near Cell 1.7 is proposed, enabling landfill staff to access internal operations without interfering with scale queuing.

The key operational concepts include the following:

- The need for dual inbound lanes to minimize public roadway stacking,
- Consolidation of inbound movements before the weigh scale to ensure all vehicles are weighed, and
- Gated bypass lanes for emergency or maintenance access.

These functional elements have been retained in principle and incorporated into the 40th Avenue entrance design. All bypass lanes will remain gated during normal operations.

7.4.1.1 Improvement to 67th Street

The 67th Street would require paving for the expected traffic loading if it were used to provide all-weather access to the facility. Although no entrance from 67th Street is proposed at this time, potential future improvements may include a right-turn deceleration lane onto 67th Street from 40th Avenue to support increased traffic flow for adjacent facilities such as the WWTF and racecourse.

The previously proposed three-lane entrance design from 67th Street has been removed from the current conceptual plan and will not proceed unless revisited in future studies. This will free-up a lane for the south bound traffic going straight on 40th Avenue and those turning left at the intersection with 67th Street.

7.4.2 Weigh Scale, Scale House, and Office

Two weigh scales, inbound and outbound including a scale house have been proposed within the 100 m setback as shown in Appendix A, Figure A-2. The new scale house is proposed to include office space for the landfill supervisor, ticketing office, a staff room/lunchroom and a washroom. These facilities will be housed in a pre-engineered building. The inbound and outbound lanes have been proposed with a full-size weigh scale (90 feet long) to accommodate large trailers. The service life and the size of the existing weigh scale is unknown to Stantec and therefore its re-usability at this new location cannot be determined. Since the scale house has been located within the property boundary of the facility in the buffer area, the traffic bound for the racetrack and the WWTF will not be influenced.

As shown in the proposed site layout, the scale house is positioned on the east side of the yellow internal entrance road, north of the proposed entrance off 40th Avenue. The alignment provides adequate setback for internal queueing and integrates well with the site's new traffic flow pattern. A clearly defined bypass road is also proposed west of the scales, allowing staff, visitors, or emergency vehicles to circumvent the scales when needed. These lanes will remain closed during regular use and will only be opened when emergency access, maintenance, or special routing is required.

Parking for 6–8 vehicles is planned adjacent to the scale facility and proposed workshop area, although not explicitly shown in the drawing (Appendix A, Figure A-2). Sufficient open space exists in this area and final parking layout will be refined during detailed design.

7.4.3 Perimeter Access Road

A 9.0 m wide two-lane perimeter access road shown north-south along the East boundary of the property has been proposed as a continuation of the facility entrance road from the weigh scales. A 15.0 m horizontal clearance from the existing overhead power line running N-S has been proposed in the layout. This perimeter access road will be constructed to provide all-weather access to the current and future constructed phases as well as access to the proposed public drop-off area. In the concept plan, this access road is proposed to terminate near the current location of the leachate pond. However, should a need arise, it can be extended further. The traffic movement on the perimeter access road is shown in Appendix A, Figure A-2.

To support internal circulation and future fill sequencing, a new ramped haul road has been introduced to connect the yellow facility entrance road to the western haul road near future Cells 1.6/1.7. A separate southern internal haul road (shown on Appendix A, Figure A-2) is proposed to extend east-west along the top of future waste fill in Cells 1.5 and 1.6. This internal bench road will not be constructed at existing grade but instead will be built progressively as waste is placed and compacted.

Minor localized grading required to support drainage adjacent to proposed facilities would be completed as part of associated infrastructure construction. Broader site-wide or perimeter regrading to optimize surface

drainage would be addressed as a separate future project and is not included in the scale house or maintenance building cost estimates.

7.4.4 Public Drop-Off Area

Currently, residents have access to the active face of the landfill for disposal of their waste. Given the residential traffic volume in relation to the total traffic at this facility, it is recommended that residential traffic be confined to the proposed public drop-off area. The intent is to ensure safety of patrons by eliminating residential traffic access to the active face of the landfill except, when necessary, e.g. disposal of large items which may be difficult to dispose of into the bins placed in the proposed public drop-off area.

In the concept plan, the area to the southwest of the existing operational wet cells and south of Cell 1.8 as shown in Appendix A, Figure A-2 has been proposed for the public drop-off area (30 m x 10 m) for recyclables, bagged residential waste and small items that could be easily disposed into the bins.

The current space, as proposed, is adequate for turning of standard vehicles accessing the public drop-off area and hydrovac trucks. However, some improvement to horizontal curves may be necessary to provide adequate space for turning of large trailers which are periodically required for bailing of stockpiled metal, appliances, tires and waste electronics. The traffic movement will be unidirectional counterclockwise to reduce traffic conflicts. Proper yield signs and traffic signage will be required to facilitate traffic movement.

It should be noted that this location is temporary. Once the Ridgeline facility is fully decommissioned, the City plans to move operations of the interim PDO to the Ridgeline facility area.

7.4.4.1 Mattresses

It is understood that the data for mattresses disposed at the landfill started being logged at the scale house in 2021. Between January 2023 and May 2024, approximately 3,691 mattresses were received at this facility, and were disposed in the landfill. Mattresses consume significant airspace in the landfill due to issues associated with their inflexible metal coil structure. It is recommended that a roofed area or an enclosed trailer unit within the proposed public drop-off area should be developed where patrons can dispose mattresses to keep them out of the landfill.

The designated area for mattress collection is located along the northern portion of the new public drop-off area, adjacent to the HHW and electronic waste bins. This ensures ease of resident access while maintaining distance from heavier waste handling zones such as white goods and concrete. The mattress bin area is to be sheltered, either using a roofed shed or enclosed trailer system, depending on final design and vendor logistics.

Approximately 90% of the mattress material could be recycled and the city should contact authorized mattress recyclers in Alberta and Saskatchewan once appropriate quantities have been accumulated. Paying a third party for handling accumulated mattresses would still be cheaper than the cost of airspace consumed when disposed by landfilling.

It is recommended that a nominal flat fee must be charged from the patrons disposing mattresses at the landfill as a recycling and handling fee. A minimum fee of $15-20 per mattress or box spring should be charged to cover the cost of shipping and handling at a third-party recycler based in Edmonton and

Calgary. Soiled mattresses should be charged an extra fee due to extra handling cost by the third-party recycler or for disposal in the landfill.

7.4.4.2 White Goods/Metals Stockpile

Currently, a significant area in the southern portion of the existing facility measuring approximately 80 m x 200 m is dedicated to the disposal of white goods and metals. The white goods/metal stockpiles are not recommended for placement within the proposed public drop-off area due to space limitation and safety of the public when they are processed. As per communication with the city, metal area consists of 2 x 40-yard roll-off bins to reduce the amount of onsite stockpiling, these bins are serviced weekly in the summer and bi-weekly in the winter. All freon is removed by the hired contractor. In the proposed layout, the white goods and metals stockpile area has been relocated to the western portion of the site along the west haul road, just south of Cell 1.6. This area is separate from the interim public drop-off (PDO) area and is intended to support periodic bulk storage and contractor access. The location provides all-weather access via the new ramped haul road connected to the facility entrance (yellow road), minimizing interference with residential or scale-bound traffic. As an overflow option, the space next to the PDO may still be considered for supplementary stockpiling of white goods/metals, especially during peak events or temporary staging.

7.4.5 Vehicle Maintenance Area

An equipment/vehicle maintenance area located directly adjacent to the existing scale house, allowing shared use of services such as power, water, and vehicle access infrastructure as shown in Appendix A, Figure A-2. This area is approximately 4,300 m^2 and adequate for providing a washroom, change room, lockers and small lunch area besides the area required for landfill equipment/vehicle maintenance. It is assumed that the facility is currently serviced or will be serviced with a water line and natural gas line.

The site layout provides sufficient internal clearance for equipment maneuvering and parking of large landfill vehicles. A gravel access pad and maintenance pad have been conceptually designated in this area to support operational flexibility.

7.4.6 Surface Drainage

Runoff generated within the site is divided between an engineered stormwater management pond located in the northeast portion of the facility and an eastern perimeter drainage system that conveys runoff toward adjacent wetlands. While limited discharge to surrounding natural areas may be acceptable under certain conditions, current regulatory frameworks increasingly emphasize the need for controlled collection, monitoring, and management of surface runoff prior to release to the environment. The existing eastern perimeter drainage system represents a constraint to future site development and landfill expansion. As development progresses into areas currently influencing or relying on this drainage pathway, modifications may be required, including regrading, redirection of runoff to the engineered stormwater management pond, or further consultation with regulatory agencies to confirm acceptable discharge conditions. To support long-term planning, a detailed site-wide drainage assessment is recommended as a future project to evaluate both interim and ultimate drainage conditions during active operations and post-closure.

In the proposed site layout, the existing stormwater management pond remains the primary controlled collection point for surface runoff. To supplement the existing drainage system and improve runoff control

from future landfill slopes and infrastructure, a new linear drainage ditch aligned east–west along the southern site boundary is proposed. This ditch is intended to intercept runoff from southern slopes and convey flows toward the stormwater pond via the eastern ditch tie-in.

7.4.6.1 Interim Drainage Plan during Phase Development

The current site surface drainage is shown in Appendix A. The proposed location of Cell 1.5 does not influence or change the existing surface water management system, and the existing system will remain functional so long as development does not occur in the historical waste disposal area. Once the development begins in the historical waste disposal area as proposed, the existing surface water management infrastructure will automatically become dysfunctional, and a surface drainage plan will need to be developed sequentially with the progression of phased development of the site.

The interim surface drainage required during the construction of Cell 1.5 has been proposed as part of this Master Plan and shown in Appendix A, Figure A-1. Drainage ditches and culverts have been designed to handle run-off generated from a 1 in 100-year design storm and will be constructed progressively with the construction of the landfill Cells. All the surface drainage generated from the phased development of the facility will be diverted to the existing stormwater pond.

A drainage ditch is proposed along the southern portion of the site, adjacent to Cells 1.5 through 1.8. This ditch is intended to capture runoff from waste slopes and internal haul roads and convey flows eastward toward the leachate pond drainage corridor. The southern ditch is particularly important due to the removal of the southern perimeter road and will prevent ponding along the southern site boundary while preserving the integrity of future landfill development areas. Final ditch geometry and discharge details will be refined during detailed design.

7.4.6.2 Ultimate Drainage Plan

The layout of the proposed final surface management plan when all Cells are constructed and the facility is closed and decommissioned is shown in (Appendix A Figure A-1). Based on the proposed grading and conceptual design, surface drainage is not anticipated to present significant challenges during phased development or at closure. The final drainage configuration relies on an integrated system of perimeter swales, internal bench drainage, and the southern linear ditch to direct runoff toward low-lying collection areas in the northeast portion of the site.

Under ultimate conditions, runoff from final landfill grades will be directed toward interior collection features and conveyed to the stormwater management pond. No perimeter drainage features are proposed along the western boundary adjacent to 40th Avenue, as this area is reserved for soil and material stockpiles. The southern linear ditch is expected to remain part of the long-term drainage strategy and will continue to provide controlled conveyance toward the eastern drainage corridor.

The existing stormwater management pond is expected to provide adequate capacity under current assumptions; however, it is recommended that a detailed hydrologic and hydraulic assessment be undertaken within the next five years to confirm pond capacity under future development and final cover conditions. Any required expansion of the stormwater pond should be directed away from the southern portion of the site to maintain compatibility with landfill phasing and infrastructure layouts.

7.4.7 Leachate Holding Pond

A leachate holding pond is located at the northeast of the active landfill area. In the current scenario, leachate generated from Cells 1.1 through 1.4, and expectedly future Cells 1.5 to 1.8, will be conveyed under gravity to the leachate holding pond through a 300 mm diameter pipe. This location is maintained from earlier concepts but optimized to integrate with stormwater drainage ditches along the southern site boundary. The current leachate system includes dedicated sumps within each lined cell. Leachate collected from Cells 1.1 through 1.4 is conveyed via the internal leachate collection piping network to the centralized leachate holding pond prior to discharge to the WWTF. In 2024, a total of 3,303 m^3 of leachate and stormwater were discharged from this system.

The LCRS design conceptualized for Cells 1.5 through 1.8 suggests that leachate be collected in the sump provided at the base of each of these cells and conveyed by gravity through the 300 mm diameter leachate forcemain/collection pipe to the leachate holding pond. The leachate collected in the sump will be removed by a sump pump assembly installed in the sump to drain into one of the service manholes located at the surface along the outer edge of the waste footprint numbered as MH-01 to MH-10 as shown in Appendix A, Figure A-2 These manholes will be connected with a 300 mm diameter HDPE drainage pipe to allow leachate to flow under gravity to the proposed leachate pond. These manholes will be developed in a phased manner with the phased construction of the landfill in Phase 1. The leachate collection system should be designed to meet the leachate flow requirement expected during the operating life of the landfill and the post-closure care period.

The location of the leachate pond will not be affected by the ultimate development of the facility as proposed. Proper cleanouts will be provided for maintenance purposes during their service life. Some leachate treatment will be accomplished by oxidation and evaporation in the pond. However, all treatment of generated leachate happens at the WWTF.

The updated drainage network, including the southern ditch, provides additional flow conveyance capacity to direct any overflow or surface runoff away from the leachate pond area.

7.4.8 Material Stockpiles

The location of current material and soil stockpiles are accessible and do not interfere with future landfill Cells or traffic circulation.

The geotechnical properties of the stockpiled materials should be assessed prior to using this material for construction. If necessary, reinforcement using geotextile/geogrids may be used to achieve structural properties as desired for the constructed berm/road when using these stockpiled materials. A soil balance including annual requirement of soil has been estimated and has been discussed further in Section 7.6.

7.4.9 Snow Disposal Facility

Currently, the facility utilizes a non-engineered area north of the historical waste and contaminated soil for snow disposal. This current practice presents specific operational and environmental challenges that necessitates a dedicated engineered facility.

The current location lacks a dedicated all-weather working pad, which can lead to challenging site conditions during the spring thaw. The unmanaged placement of snow piles creates potential interference with general facility traffic. Furthermore, without a designated hardstand, the recovery of traction sand (sediment) for reuse is inefficient, increasing the facility's overall soil deficit.

Snow removed from municipal roadways contains significant concentrations of sediments, chlorides (road salts), trash, and hydrocarbons. The current snow disposal area is not engineered with a low-permeability liner or a dedicated meltwater management system.

This poses two primary risks:

- Groundwater and Surface Water Protection: Without containment, meltwater carrying dissolved chlorides and hydrocarbons can infiltrate the subsurface or discharge directly into the natural drainage course (Neale Lake watershed) without adequate treatment.
- Stormwater Pond Loading: As detailed below, the meltwater volume exceeds current capacity. Additionally, the sediment load from the melting snow can prematurely reduce the active storage volume of the existing stormwater pond, increasing the maintenance frequency.

Although specific regulations for snow disposal facilities are not yet formalized in Saskatchewan, it is recommended that the City adopt a proactive approach. The Master Plan proposes designing a separate detention pond or expanding the existing stormwater infrastructure to include a sediment forebay and sufficient capacity for the additional meltwater volumes. This engineered approach will mitigate environmental liabilities and improve site operability.

7.4.10 Relocation of Impacted Soil Management Area

Given the proposed development plan, the existing Impacted Soil Management Area can continue to operate for another 12 years at its current location before Phase 2 development begins.

The proposed layout confirms continued use of the current Impacted Soil Management Area located north of Cell 1.6 and west of the snow disposal zone. This area remains outside the landfill expansion footprint and can support long-term use without requiring relocation or interfering with future cells. Site access will be maintained via the internal haul road network. However, any unused material will have to be relocated prior to the construction of the Phase 2 cells.

7.5 Proposed Landfill Development Plan

Airspace is a crucial component for any landfill development. Therefore, finding ways to maximize airspace utilization within the available footprint should be the priority for the city.

7.5.1 Potential Landfill Expansion Area

Given the current layout of Cells 1.1 -1.4, the area within the existing property boundary which could potentially be used for future Cell construction includes:

1. The area currently occupied by the historical waste. However, this area can be utilized during landfill mining.
2. The wet cells south of Cell 1.4 and the east boundaries of Cells 1.1 and 1.2. This area has been allocated for Cell 1.5.
3. The former Impacted Soil Management Area, beginning with Cell 2.7 and continuing through Cell 3.7, Phases 4 and 5, is incorporated into the phased expansion layout under this Master Plan. This area may be landfilled, used as cover material for operations, and/or developed as part of the overliner cell construction and design.

Subsequent phases are designed for vertical development along designated slopes with progressively smaller perimeter access and staging zones. Best practices continue to favor vertical expansion before lateral growth, to minimize environmental impact, footprint size, and closure costs. As of 2025, no lateral expansion beyond the current property line is proposed. As of December 2025, the MRMR (1986) and its amendments do not impose any height restrictions on landfill expansion in Saskatchewan.

7.5.2 Design Criteria

The conceptual design provided for landfill development/expansion was developed in accordance with the Ministry guidelines, applicable regulations and industry best practices. The following considerations were made:

- A Master Plan period of 20 years (2026-2045).
- Proposed final design elevation of approximately 675 masl. This is a 10m increase in height over the previous maximum elevation of 665 masl that was proposed in the 2016 Master Plan. This higher elevation is due to the now broader footprint, with the conversion of the two wet cells in the southeast to landfill cells. This doesn’t restrict vertical expansion further beyond 675 masl if there is enough crest area available and structural stability of waste slopes has been ensured. The regulations currently do not impose restrictions on the maximum vertical height of landfills.
- Waste outer slopes not steeper than 3H:1V and not flatter than 5H:1V. The crest to be no flatter than 5%.
- New landfill Cells base to be graded at 2% and leachate collection pipes laid at minimum 1% grade.
- Daily cover maximum 20% (4-part waste: 1-part daily cover) for estimation of airspace requirement.
- Intermediate cover of 0.5 m thick between each phase.
- Apparent waste density of 0.5 tonnes/m^3 without accounting for daily cover.

- Each cell to be equipped with its own leachate sump in one corner of the cell with an automated sump pump to pump leachate into one of the dedicated manholes located at the periphery of the waste footprint. This is a preferred industry practice to have each cell equipped with its own leachate collection and removal system. Further, provision of these systems provides the ability to check leachate head build up above the liner in each cell. Being individual systems, it also ensures the leachate collection systems for other cells continue to function normally in the event of a malfunctioning.
- The leachate collected in these manholes will flow under gravity to the proposed leachate holding pond.
- The manholes to be located in a manner to allow for unhindered maintenance and clean out during the entire operating life of the landfill.
- The phasing of various cells should allow for progressive closure of the landfill so that leachate generation and closure costs could be reduced.
- Each cell is designed with a single-point access ramp connecting to the perimeter haul road, as shown in the development layout. These access points have been optimized to follow slope alignments identified in the cell-specific cross sections.
- Development is staged to follow logical adjacent cell sequencing with elevation-based transitions, ensuring fill continuity and reducing internal haul distances.

7.5.3 Limits of the Proposed Waste Footprint

Lateral Limit: The lateral limits of the final waste footprint proposed in the Master Plan are shown in Appendix A, Figure A-2. This will provide approximately a waste footprint 30 hectares in size that includes approximately 8-10 hectares occupied by existing historical waste disposal area. This footprint excludes the regulated setback of 100 m from 40th Avenue and 67th Street.

This Master Plan confirms that Phase 1.4 to Phase 2.6 avoid development within the existing Impacted Soil Management Area, with planned development beginning in this area from Phase 2.7 onward.

Vertical Limit: The vertical expansion of the landfill has been proposed in five phases with each phase comprising several individual cells. Each phase incorporates slope progression and fill sequencing as detailed in the cross-section plan (Appendix A, Figure A-2), ensuring elevation continuity and constructability. The vertical expansion of the fill may reach at approximately 675 masl if stability conditions and further design allow this elevation in future updates.

7.5.4 Proposed Landfill Phases

Two options are presented in the following sections describing approaches to historical waste area reclamation options. The subsequent sections describe the proposed landfill phases with Option A as summarized below.

7.5.4.1 Option A: Vertical Expansion by Constructing an Overliner System

One viable option is “piggybacking” the existing historical waste disposal area by constructing an overliner system on top of the area. The following are a few potential challenges with this approach:

- **Vertical and Horizontal Delineation of Waste Footprint and Waste Thickness:** As outlined earlier, the thickness of historical waste disposal is not well defined, and it varies from 1.0 m to 9.5 m. With such a high variability in thickness and unknown biological state of degradation of waste, potential for significant differential settlement may exist should vertical expansion be proposed. However, such settlements could be reasonably estimated based on geotechnical investigation of the historical waste disposal area. Together with varying waste thickness, the density of waste is also expected to vary significantly leading to potential differential settlements in the overliner.
- **Groundwater Contamination:** Although the groundwater quality underneath this site is generally poor as observed from the background groundwater quality data described in various groundwater monitoring reports, it does not exhibit elevated chloride levels. However, leachate levels showed an increasing trend based on available limited data. By designing an overliner system, moisture infiltration into the underlying historical waste will certainly reduce over time. However, the source of contamination will remain there forever and continue to provide long-term liability for the City.
- **Piggyback Landfill Design:** The concept of piggyback landfill expansion is not new and has been practiced at various historical landfill sites across North America. The prime design objective in this case would be to ensure that long-term settlement of the underlying waste does not lead to structural failure of the proposed vertical expansion. Geotechnical aspects such as slope stability and settlement issues will need to be assessed in detail considering the service life of the landfill up to the end of the post-closure care period. A thorough technical investigation will be necessary to evaluate geotechnical properties of the underlying historical waste and its current state of biological degradation. This would be a crucial step in providing a sound engineering design for the piggyback expansion as proposed.
- **Loss of Airspace:** Based on the review of borehole data from the historical waste disposal area, the thickness of fill material (clay) placed on top of the historical waste varies from 1.0 m to 6.0 m. Further, the waste thickness below this fill layer varies from 1.0 to 9.5 m. Therefore, by having to piggyback the historical waste disposal area, there could be significant loss of valuable airspace as illustrated further in Option B.

7.5.4.2 Option B: Vertical Expansion by Mining Existing Waste

This is another option for reclaiming the historical waste disposal area. Landfill mining is typically practiced for one or more of the following purposes (a) conservation of landfill space (b) elimination of potential contamination source (c) mitigation of an existing contamination source or (d) material/ energy recovery from excavated waste. Considering this, landfill mining of historical waste would offer following advantages:

- **Efficient Airspace Utilization:** The net gain in volumetric space by way of landfill mining and re-structuring of the historical waste disposal area as an engineered facility would be approximately 500,000 m^3 (Table 7-10) assuming that 65% of the excavated waste will still require re-disposal in the replacement engineered cells. This available airspace below ground can be expected to serve

the waste disposal needs of the city for additional 5-6 years. The fines and cover soil recovered from this excavation could be used to replace the demand for additional cover soil.

Table 7-10 Net Gain in Airspace from Underliner Construction

S. No.	Description	Unit	Quantity
1	Estimated Historical Waste In-Place	tonnes	394,742
2	Assume Recyclables Recovered (10%)	tonnes	39,474
3	Assume Finely Degraded Waste and Cover Soil Recovered (25%)	tonnes	98,686
4	Excavated Waste Requiring Re-Disposal	tonnes	256,583
5	Volume Equivalent @ 0.5 tonnes/m^3	m^3	513,165
6	Add 30% for Daily Cover	m^3	102,633
	Total Airspace Required for Re-Disposal	m^3	615,798
	Airspace Provided by Cells 1.6, 1.7, 1.8 (Underliner System)	m^3	1,125,900
	Net Gain in Airspace		**510,102**

- **Reduced Potential Liability:** Once the historical waste has been mined and the area redesigned to provide engineered containment, it will significantly reduce or even eliminate any potential liability for the City anticipated from the historical waste disposal area since the pathway, i.e. source of contamination would have been removed.
- **Resource Recovery:** Landfill mining provides an excellent opportunity to recover material that may not require landfilling. It would lead to various benefits besides airspace savings (a) there could be material such as lumber, metals which could be salvaged (b) it gives an opportunity to remove hazardous waste that may have been historically disposed and (c) re-use of cover material including interim cover including fines generated from biodegradation of organics to meet ongoing requirement of daily cover.

Landfill mining though has a few challenges as listed below; however, there are ways to mitigate those challenges.

- A Permit from the Ministry for such mining activity may be required since this is a non-traditional approach.
- Local risks such as pollutant emission during excavation (noxious odors, etcetera) may be a concern
- Cost of mining: This, however, should be evaluated in terms of:
    - cost of airspace gained,
    - reduced contaminated land footprint,
    - reduced liability for the City, and
    - protection of groundwater resources.

Landfill mining of the historical waste would be phased to align with the cell development of the landfill. The cost associated with mining waste could then possibly be distributed over several years.

7.5.4.3 Phase 1

The Phase 1 expansion area is proposed to include the historical waste disposal area and the area between the south boundary of Cell 1.4 (currently filling) and the wet cells, east boundary of Cells 1.1 and 1.2 and the existing wet cells. As discussed above, two options were assessed for the historical waste disposal area and based on discussions with the City, the overliner system was preferred and was included in Phase 1 development plan. It should be noted that Cell 1.3 currently has intermediate cover in place but retains some available airspace and may continue to receive waste as required. With the wet cells decommissioned, sump waste receiving will be moved to the Ridgeline site.

This new Cell 1.5, in the location of the existing wet cells, will be developed first to continue the current filling sequence and to meet final elevation targets around the crest area shared with Cells 1.1 and 1.2.

Access to each Phase is provided via internal haul roads connected to the perimeter road, with access ramp locations shown on the layout. Phase 1 avoids development over the existing Impacted Soil Management Area. Development over this area is deferred to later phases (e.g., Cell 2.7 and beyond) and is not part of the current Phase 1 construction footprint.

Appendix A, Figure A-2 shows the location of proposed Cells 1.5 through 1.8. Cells 1.3, 1.4 and 1.5 (in the location of the wet cells) are located on the east side adjoining existing Cells 1.1 and 1.2. Whereas Cells 1.6, 1.7 and 1.8 are proposed in the historical waste disposal area. Table 7-11 shows available airspaces for Phase 1 with an overliner system for a total design life of 11 years. In discussions with the City, Cell 1.6 will be the final cell developed in Phase 1, hence the order of the cells in Table 7-11 reflects the actual order of landfilling.

Table 7-11 Phase 1: Details of Potential Available Airspace

Phase 1 Cells	Plan Area (m^2)	Available Airspace (m^3) with Overliner System	Life (Years)
1.3 & 1.4	41,200	185,525	3
1.5	40,900	257,225	4
1.7	41,800	58,725	0.5
1.8	50,600	52,500	0.5
1.6	73,000	246,425	4
Totals	**247,500**	**800,400**	**12**

7.5.4.4 Phase 2

Phase 2 is the above ground Phase proposed on top of Phase 1. Phase 2 extends toward the area south of the existing snow disposal site and over a portion of the previously undeveloped land near the historical Impacted Soil Management Area. The base layout plan for Phase 2 is shown in Appendix A, Figure A-3 and comprises Cells 2.1 through 2.7.

The access road to Phase 2 will be from west side of Phase 1.7 and from the South. The potential airspace contribution from Phase 2 is shown in Table 7-12.

Table 7-12 Phase 2: Details of Potential Available Airspace

Phase 2 Cells	Plan Area (m^2)	Available Airspace (m^3) with Overliner System	Life (Years)
2.1	39,160	227,170	3
2.2	32,510	188,590	2
2.3	42,500	246,540	3
2.4	38,530	223,510	3
2.5	47,120	273,340	3
2.6	34,400	199,550	2
2.7	35,680	207,000	2
Total	**269,900**	**1,244,800**	**18**

7.5.4.5 Phase 3

Phase 3 is proposed above Phase 2. The base layout plan for Phase 3 is shown in Appendix A, Figure A-4, and comprises Cells 3.1 through 3.7. The access road to Phase 3 will be from east side of Cell 2.2 and west side of Cell 2.5. Phase 3 expansion will partially overlap the historical Impacted Soil Management Area, particularly in the northeast portion of Cells 3.6 and 3.7. This area is no longer reserved for soil management and has been designated for landfilling. The potential airspace contribution from Phase 3 is shown in Table 7-13.

Table 7-13 Phase 3: Details of Potential Available Airspace

Phase 3 Cells	Area (m^2)	Volume (m^3)	Life (Years)
3.1	32,240	253,260	3
3.2	23,900	187,740	2
3.3	29,300	230,160	2
3.4	25,780	202,510	2
3.5	32,320	253,890	2
3.6	24,850	195,210	2
3.7	28,570	224,430	2
Total	**196,960**	**1,547,200**	**15**

7.5.4.6 Phase 4

Phase 4 is proposed above Phase 3. The base layout plan for Phase 4 is shown in Appendix A, Figure A-5, and comprises Cells 4.1 through 4.7. Perimeter haul roads will provide access with the previously constructed haul routes and ramps from south side of Cell 3.1. The potential airspace contribution from Phase 4 is shown in Table 7-14.

Table 7-14 Phase 4: Details of Potential Available Airspace

Phase 4 Cells	Area (m^2)	Volume (m^3)	Life (Years)
4.1	20,110	148,270	1
4.2	16,130	118,920	1
4.3	17,550	129,390	1
4.4	16,860	124,310	1
4.5	22,900	168,840	2
4.6	16,950	124,970	1
4.7	17,130	126,300	1
Total	**127,630**	**868,300**	**8**

7.5.4.7 Phase 5

Phase 5 represents the final stage of the proposed landfill expansion. It includes Cells 5.1 through 5.5. Access to Phase 5 is provided via the ramp connection from east side of the Cell 4.2 and west side of the Cell 4.7 (Appendix A, Figure A-6). The potential airspace contribution from Phase 5 is shown in Table 7-15.

Table 7-15 Phase 5: Details of Potential Available Airspace

Phase 5	Area (m^2)	Volume (m^3)	Life (Years)
5.1	11,580	80,012	0.25
5.2	11,155	77,075	0.25
5.3	10,390	71,790	0.25
5.4	10,520	72,688	0.25
5.5	6,460	44,635	0.25
Total	**50,105**	**346,200**	**1.25**

7.5.4.8 Airspace Utilization

All the five (5) phases described above need to be constructed as these would provide adequate airspace required to accommodate waste generation. A cross-section A-A drawn in Appendix A, Figure A-7, which illustrates final shape of the landfill at the time of closure. The approximate design elevations proposed for various phases are tabulated in Table 7-16.

Table 7-16 Description of Proposed Phases of Landfill Development

	Phase	Overliner System			Proposed Average Elevation (masl)	
		Waste Footprint (ha)	No. of Cells	Estimated Life (Years)	Phase Base	Phase Top
	1	24.8	5	12 (2025 - 2037)	623	634.0
	2	27.0	5	18 (2038 - 2055)	634.0	644.20
	3	19.7	7	15 (2056 - 2069)	644.20	654.40
	4	12.8	7	8 (2070 – 2078)	654.40	664.60
	5	5	5	1.25 (2079 - 2080)	664.60	675.0
			Total	**54 (2025 - 2080)**		

Details about airspace requirements is included in Table 7-9 for reference. Sludge quantities included in waste projections are based on historical reporting and represent episodic rather than recurring disposal events (56,784 tonnes reported to ECCC in 2020). The inclusion of sludge volumes in this Master Plan is intended to provide context for historical impacts on landfill airspace rather than to predict ongoing disposal rates.

7.6 Soil Storage and Usage

Currently, large stockpiles of soils are located on the historical waste disposal area as well as in the impacted soil management area. The estimation of soil balance was made considering the historical waste disposal area will be reclaimed by piggybacking i.e. construction of an overliner system.

Table 7-17 shows the soil balance for the estimated soil sources, uses and surpluses for the proposed facility development for an overliner system. Based on estimates of waste projections, over the life of the landfill (to 2080), there could be a total deficit of 877,637 m^3 of daily cover (using a 4:1 waste-to-cover ratio). To meet this deficit an average approximately 16,252 m^3 of fill material or treated soil will need to be stockpiled annually on site to meet the ongoing demand for daily/intermediate cover (over the life of the landfill).

Since the site receives approximately 30,000 tonnes of clean fill a year. This quantity should be sufficient to meet the annual deficit.

Table 7-17 Soil Balance for an Overliner System (over the life of the landfill)

Description of Item	Unit	Amount	Available Soil Volume (m^3)	Required Soil Volume (m^3)
Stockpile Material				
a) Located west of Cell 1.1/1.2 and on 1.3 (based on Information provided by the City)	m^3		112,565	
b) Treated Impacted Soil (to be removed prior to landfilling Phase 1.6)	m^3		232,000	
c) Average annual requirement of treated soil- over the life of the landfill*	**m^3**	**(16,252)**	**(887,637)**	

Note:

* The annual average requirement of treated soil for the Master Plan period (2026-2045) and details of stockpile material was provided in Appendix B

7.7 Containment Berms

The above grade waste placement will be contained by constructing permanent perimeter berms. The perimeter berm would be continuous all-round and constructed with a minimum height of 2.0 m and a top width of 5.0-10.0 m or as required by the site conditions and proposed development. The side slopes of the berms should be no steeper than 1V:3H. Prior to construction, the berm design should be checked for adequate structural stability against lateral pressures generated from waste mass disposal.

8 Infrastructure and Transportation

8.1 Existing Road Network

The current entrance to the facility is from 40th Avenue through a single lane weigh scale which serves both inbound and outbound traffic as shown in Appendix A, Figure A-1. The 40th Avenue is a two lanes N-S highway. Given its current geometric design in relation to the facility entrance, it does not offer clear line of sight for the vehicles entering and exiting the facility from the northbound and southbound traffic. Moreover, due to the single lane weigh scale at the facility, the commercial vehicles must make undue turns to get on to the weigh scale for their tare weight before they can exit the facility. This traffic arrangement often creates undesirable traffic conflicts and operational challenges with traffic movement especially near the facility entrance and the public drop-off area (per communication with the city). Further, interactions of residential traffic using the public-drop off area with the commercial traffic present safety issues.

To address these challenges, the city considered several conceptual design options, ultimately settling on a layout that includes the following features:

- Future installation of two weigh scales to separate inbound and outbound traffic.
- Site entry and exit from both the north and south sides of 40th Avenue, with the goal of keeping internal traffic parallel to 40th Avenue and minimizing queueing.
- A relocated and reconfigured public drop-off area with enhanced separation from commercial traffic to improve user safety and site efficiency.
    - The public drop-off area will ultimately be moved to the Ridgeline facility once that is decommissioned.

8.1.1 Existing Traffic Volumes

The current facility is open 7-days a week during the summer months (May–Sep) and 6-days a week in the winter months (Oct–Apr) with the exception of statutory holidays. The scale house data provided by the city for 2021 to 2024 was analyzed for the current traffic volume and composition. In 2023, the landfill served a total of 41,825 customers. This includes Residential, Commercial, City Operations and Out-of-Town users. The updated traffic volume shows a rebound and increase in site activity, aligning with ongoing population growth and regional development. Table 8-1 shows the traffic volume at the facility contributed by city residents, commercial, outside the city and others for the period between Jan 1, 2021, to June 03, 2024.

The city continues to explore infrastructure upgrades, including installation of two future weigh scales to improve traffic flow and data logging accuracy at the site.

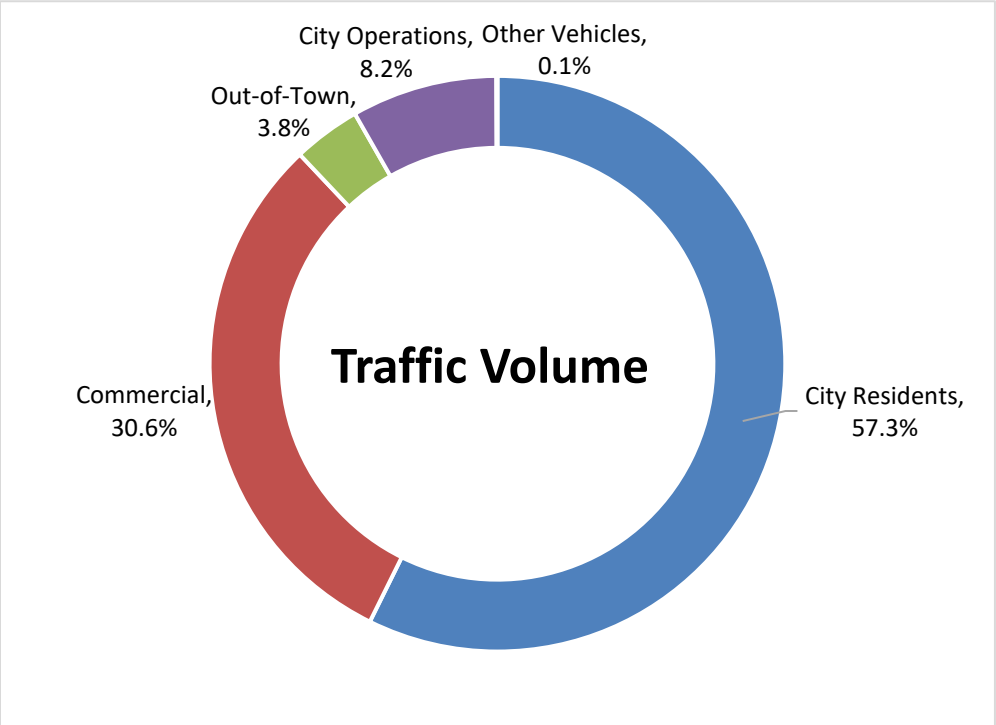
Table 8-1 Traffic Volume Assessment

Year	Annual Traffic Count					Total Annual Traffic Count	Annual Traffic Count (%)				
	City Residents	Commercial	Out-of-Town	City Operations	Other Vehicles*		City Residents	Commercial	Out-of-Town	City of Lloydminster	Other Vehicles
2021	24,952	13,040	1,462	3,912	13	43,379	57.5%	30.1%	3.4%	9.0%	0.0%
2022	22,223	13,002	2,004	3,613	18	40,860	54.4%	31.8%	4.9%	8.8%	0.0%
2023	24,435	12,086	1,511	3,742	51	41,825	58.4%	28.9%	3.6%	8.9%	0.1%
2024	8,969	4,838	503	905	8	15,223	58.9%	31.8%	3.3%	5.9%	0.1%
4-Year Average Traffic Contribution							**57.3%**	**30.6%**	**3.8%**	**8.2%**	**0.1%**

During this period (2021-2024), the Residential traffic volume contributed an average of 57.3% of traffic, followed by Commercial users (30.6%), City of Lloydminster vehicles (8.2%), Outside City traffic (3.8%), and Other Vehicles (0.1%). Together City Residents and Commercial traffic contribute approximately 88% of the total vehicular traffic. The remaining 12% is contributed by City vehicles, snow haulers, septic haulers, outside vehicles, and other users as shown in Figure 8-1.

Given the estimated margin of error in the average value shown in Table 8-1, it is expected that the contribution of residential vehicles, commercial vehicles and other vehicles in the future will be in the range of 53–61%, 28–33% and 10–14% respectively.

Figure 8-1 Traffic Volume Distribution for the Customer Types



Although, any conflicts between the two major traffic streams (Residential and commercial) were not evident from the documents, it does indicate that when determining facility upgrades and developing the Master Plan, both traffic streams would require equal emphasis. This would be crucial for achieving reduced wait times as well as increased safety of the patrons using this facility.

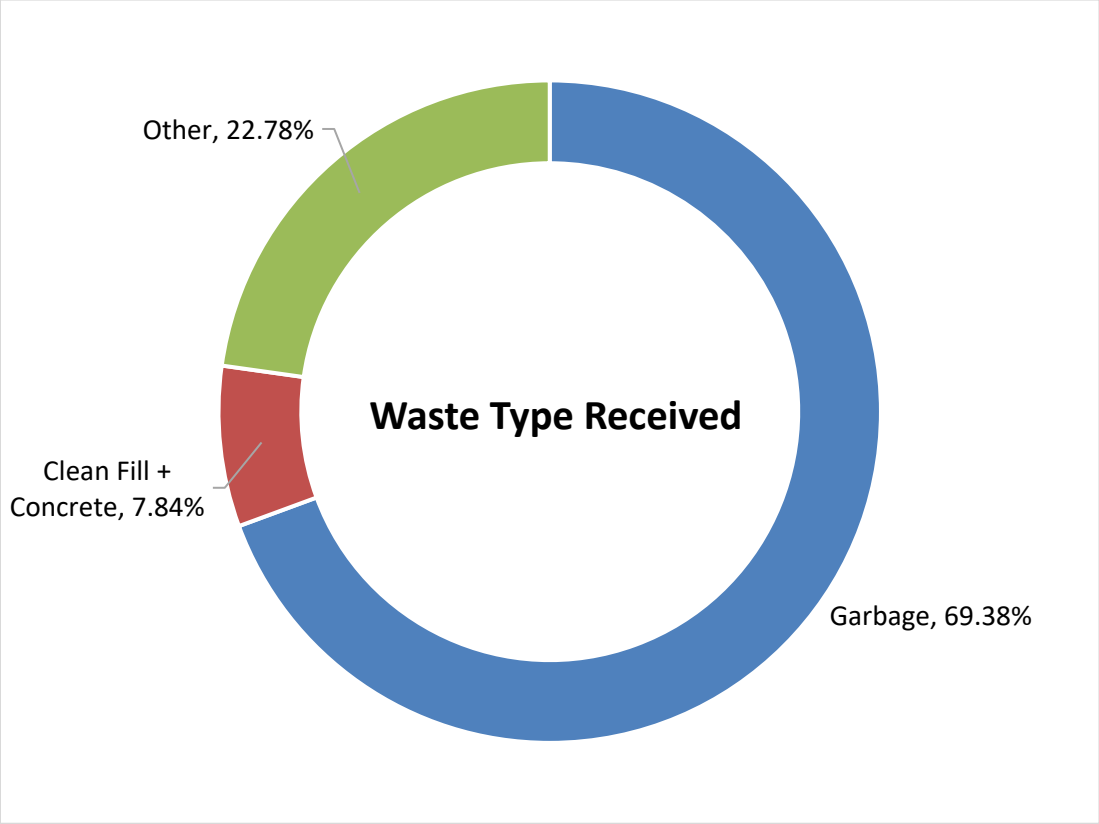
Shown in Table 8-2 are the traffic count for the prominent waste types received at the facility. The count shown for garbage includes all customers–Residents, Commercial, City Operations and Out-of-Town that disposed garbage at this facility.

Table 8-2 Traffic Volume Contribution for the Type of Waste Received

Year	Vehicle Count				Total	Vehicle Count (%)		
	Garbage	Clean Fill	Concrete	Other		Garbage	Clean Fill + Concrete	Other
2021	29162	1501	2676	10040	43379	67.2%	9.6%	23.1%
2022	27241	1932	1837	9850	40860	66.7%	9.2%	24.1%
2023	30026	1664	1730	8405	41825	71.8%	8.1%	20.1%
2024	10938	325	343	3617	15223	71.9%	4.4%	23.8%
4-Year Average Traffic Contribution for the Waste Types Received						**69.4%**	**7.8%**	**22.8%**

On an average, approximately 69.4% of the total traffic to this facility is attributed to MSW (Garbage) with the remaining 7.8% waste contributed by clean fill and concrete and 22.8% by other miscellaneous waste types (Figure 8-2). For the estimated margin of error in the average value, it is expected that the future contribution of MSW, clean fill and concrete combined, and other waste types will be in the range of 67–72%, 4–10% and 20–24% respectively.

Figure 8-2 Distribution of Waste Types Received



8.2 Traffic Volume Projection

As shown in Table 8-1, the annual average traffic volume for the years 2021 to 2023 was 42,021. The projection is based on updated counts and expected growth consistent with current regional development trends and population growth (2.2%).

The peak hourly traffic estimates were later used for determining queuing space requirement at the weigh scale as well as number of parking bays required at the proposed public drop off area to maintain unhindered and smooth traffic flow as well as eliminate or reduce traffic stacking on the City roads (40th Avenue and 67th Street).The previous analysis of southbound and northbound traffic on 40th Avenue and 67th Street from 2014–2015 has not been repeated, as no hourly traffic breakdown was available for the 2021–2024 dataset. However, a conservative Peak Hour Traffic Factor (PHF) of 0.67 continues to be used for design planning, in line with prior assumptions (2016 Master Plan)[10].

Table 8-3 presents the traffic volume projection, using a 2025 projected annual traffic count of 42,946 and an average growth rate of 2.2%. This projection extends to 2030, 2035, 3040 and 2045 to align with the 20-year Master Plan horizon.

[10] 2016 Waste Management Facility Master Plan, City of Lloydminster, Prepared by Stantec Consulting Ltd.

Table 8-3 Traffic Volume Projection

Year	Projected Average Annual Traffic Count	Average Daily Traffic Count[1]					Estimated Peak Hourly Traffic Count[2] (20-Yr Horizon)				
		City Residents	Commercial	Out-of-Town	City Operations	Other Vehicles	City Residents	Commercial	Out-of-Town	City Operations	Other Vehicles
2025	42,946	76	41	5	12	0	13	7	1	2	0
2030	47,882	85	45	6	13	0	15	8	1	2	0
2035	53,386	95	50	7	15	0	17	9	1	3	0
2040	59,523	106	56	7	17	0	19	10	1	3	0
2045	66,365	118	63	8	19	0	21	11	1	3	0

Note:

[1] Based on average number of days of operation in a year of = 320 (according to 2016 Master plan)

[2] Based on average 8.5 hours/day of operation and Peak Hour Factor of = 0.67 (according to 2016 Master plan)

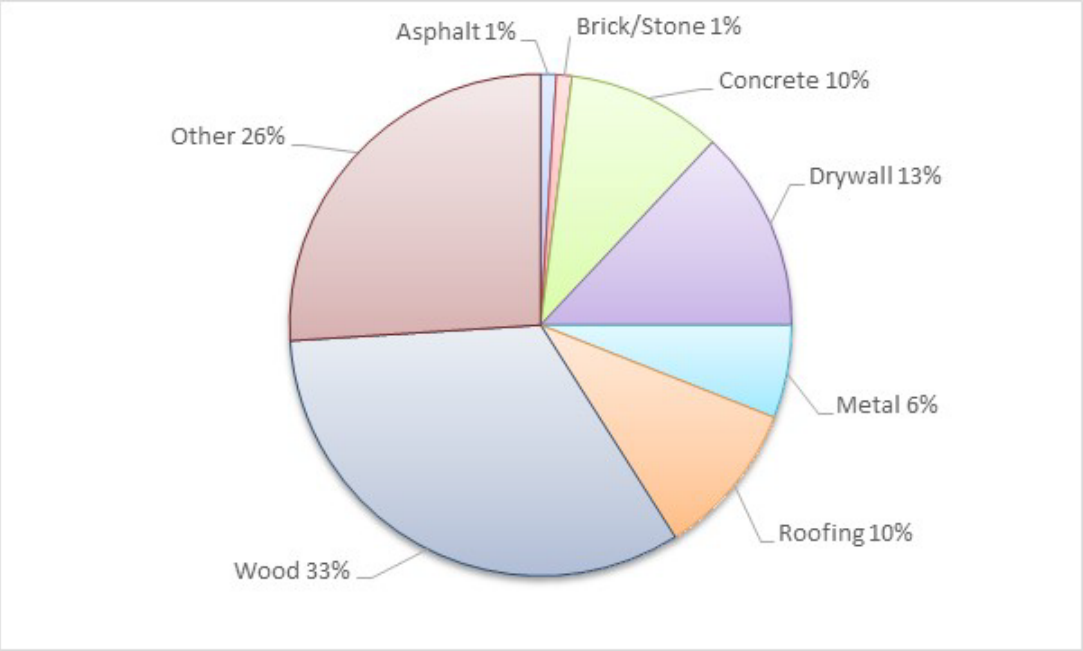
9 Operational Considerations

9.1 C&D Waste Management

Historically, C&D waste was disposed on the north periphery of the facility. Currently, the majority of C&D waste excluding wood and concrete are disposed in the landfill mixed with MSW. The 2024 waste composition study found that 4% of ICI (Industrial, Commercial, Institutional) waste contained wood and another 4% contained renovation/building material. While these percentages may appear minor by weight, C&D material is high-volume and resistant to compaction. Therefore, these materials consume a disproportionately large amount of landfill airspace compared to their weight. Currently, if C&D material enters the facility as mixed load, and is charged the standard MSW rate, the City effectively loses both the potential diversion revenue and valuable airspace. This indicates an opportunity for diversion of C&D materials from landfill disposal that helps saving landfill airspace as well as generate revenue from commercial haulers.

The actual composition of C&D waste depends on the type of construction, demolition and renovation projects in the community. Typically, the C&D waste would comprise wood, asphalt shingles, drywall, concrete, metals, bricks, glass, plastics, salvaged building materials e.g. doors, windows, and plumbing fixtures, and material from site cleanings such as trees, stumps, earth, and rock. Figure 9-1 shows an average break-down of various components of C&D waste stream. This data, although typical of Alberta, but adequately provides a general description of C&D waste across provinces.

Figure 9-1 Alberta C&D Waste Composition



(Source: Provincial Waste Characterization Framework – Redrawn for clarity)[11]

9.1.1 Recommended Strategies for C&D Waste Management

The City of Lloydminster aims to reduce landfill airspace usage and mitigate revenue loss by improving C&D waste diversion. As the City currently has C&D diversion programs in place, Stantec recommends focusing on source separation and financial disincentives rather than facility led sorting. Our recommendations include the following:

- **Implement targeted surcharge for mixed C&D:** Adjust the tipping fees to penalize the disposal of mixed waste loads containing high percentages of divertible C&D materials. To protect the City's valuable airspace and revenue, the tipping fee for these mixed loads must be set significantly higher than the general MSW rates. This establishes a financial deterrent without broadly affecting the general MSW customer base.
- **Enforce Existing Diversion Programs:** Require waste generators to utilize the City's established C&D diversion programs. Mixed loads that bypass these programs should be subject to the premium surcharge.
- **Enhance Generator Education:** Improve communication with contractors and commercial waste generators regarding the existing diversion options, the financial benefits of source-separating materials, and the strict enforcement of mixed load surcharges.

9.1.2 Market Analysis of Recoverable Materials

The following paragraphs describe potential markets for various materials typical of C&D waste stream:

1. Wood/Lumber: Currently, lumber/scrap wood received at the facility is chipped and used as daily cover. Scrap lumber also finds utility with processed wood manufacturers where they are able to use it for manufacturing of engineered wood. Lumber recovered could be used as mulch and sold to retail markets at a competitive price or used by the City. Based on data received by the City, wood may represent up to 5% of the C&D waste stream. This estimate provides a reasonable planning assumption for diversion strategies.
2. Drywall: Drywall constitutes significant portion of C&D waste besides lumber/wood. This recovered material has good application in the agriculture and cement industry. The cement industry uses approximately 5-10% gypsum for manufacturing cement. The potential for recovery depends on contamination levels and the availability of local end-markets; however, no source-segregated drywall recovery currently takes place at the facility.

[11] Provincial Waste Characterization Framework, A Joint Project of Alberta Environment, Government of Canada, Action Plan 2000 on Climate Change (Enhanced Recycling Program) and the Recycling Council of Alberta https://recycle.ab.ca/wp-content/uploads/2016/01/WasteCharFinalReport.pdf

3. Corrugated Cardboard: Corrugated cardboard does not comprise a significant portion of the C&D waste stream for its consideration for recovery. Although the market for corrugated cardboard is good given its small quantity in the C&D waste stream relative to other waste types such as lumber, drywall and asphalt shingles, it may not present lucrative opportunity for the City to recover this material for revenue generation. Diversion of cardboard is better supported through residential and commercial recycling programs.
4. Metals and Appliances: Metals/appliances account for 1-2% by weight of the C&D waste stream. The City currently has an adequate program for metal recycling at the existing facility. The market for metal, typically mills and smelters, is quite robust. The City may further want to put some effort to analyze their waste stream from the viewpoint of recovering remaining metal from their MSW stream disposed in the landfill and assess whether such recovery could be made economically viable. Stockpiled metal and white goods are periodically hauled by contracted recyclers from the public drop-off area.
5. Asphalt Shingles: Asphalt shingles are found in significant quantities in the C&D waste stream and can be recovered. These can be crushed and sold to Asphalt plants or used as a fill material in road construction. The market value of crushed shingle may not be significant, however, it is still economical as recyclers of this material may be able to collect this material for free which would be cheaper than to transport it to a landfill for disposal. Although no formal recovery program exists, the City may evaluate a pilot diversion area for asphalt shingles to support airspace conservation.

10 Environmental Monitoring

Environmental monitoring at the WMF is a core component of the City's regulatory obligations under The Environmental Management and Protection Act, 2010 (EMPA 2010), the Municipal Refuse Management Regulations (MRMR), and the facility's Permit to Operate Waste Disposal Ground (PO 25-045). The monitoring program provides the framework for assessing potential impacts of landfill operations on groundwater, leachate, landfill gas (LFG), and stormwater, and ensures that the facility continues to operate in a manner protective of human health and the environment.

The monitoring program has evolved significantly over the past decade as the facility transitioned from historical trench style waste placement to modern engineered landfill cells with composite liners, leachate collection systems, and improved stormwater controls. The commissioning of the centralized Leachate Management System (LMS) in 2020, the construction of Cell 1.4 in 2024, and the implementation of new federal methane regulations in 2025 have further shaped the monitoring requirements and the City's long-term environmental management strategy.

This chapter summarizes the current environmental monitoring programs for groundwater, leachate, and landfill gas, describes the regulatory framework governing these programs, and outlines anticipated future monitoring requirements as the landfill continues to expand vertically and laterally over the Master Plan horizon.

10.1 Leachate Management

Based on a review of the groundwater monitoring reports for 2022, 2023 and 2024, the leachate levels below the historical waste disposal area appears to be continuously mounding as shown in Table 10-1.

Table 10-1 Leachate Levels Measured in the Historical Waste Disposal Area

Leachate MW ID	Depth of Leachate in Historical Waste Disposal Area (m bag)				Rise in Leachate Levels Since 2015 (m)
	2015	2022	2023	2024	2015-2024
MW11-1	6.8	Dry	7.95	6.4	-0.4
MW11-2	2.0	1.46	1.66	0.85	-1.15
MW11-4	6.4	Blocked	9.89	8.29	-0.4

Prior to 2006, waste was disposed using a dig-and-dump approach, and no engineered leachate collection system existed beneath the historical waste area. With the development of engineered Cells 1.1 and 1.2 between 2006 and 2016, composite liners and LCRS were constructed. Operational challenges were reported in 2016, including pump reliability issues and the need to transfer leachate from the lift station to an overflow pond before hauling to the wastewater treatment facility (WWTF).

Significant upgrades have been implemented since 2016. Cell 1.3 was constructed in 2019 with a composite liner and LCRS. In 2020, the City commissioned a centralized Leachate Management System (LMS) that consolidates leachate from Cells 1.1 through 1.3 and from stormwater ponds. The LMS includes

a lined leachate storage pond located east of the active landfill area. Leachate is pumped from the collection sumps into the leachate storage pond and then conveyed via forcemain to the WWTF. The 2024 Annual Landfill Report confirms that 3,303 m³ of leachate and contact water were discharged to the WWTF in 2023. No overflow events or unauthorized discharges occurred. Cell 1.4, constructed in 2024, is tied into the centralized LMS. Leachate wells MW11-1, MW11-2, and MW11-4 continue to be monitored annually during the spring monitoring event. Review of 2022, 2023, and 2024 monitoring data indicates that leachate elevations remain controlled within the lined containment system, and no exceedances or uncontrolled releases have been reported. Continued annual sampling and routine leachate removal are recommended to prevent accumulation and maintain compliance. Future cells (1.5 through 1.8) will also integrate with the LMS.

10.2 Groundwater Monitoring

Groundwater monitoring has been conducted at the WMF for more than two decades, beginning with the installation of the first monitoring wells in the late 1990s. The monitoring network expanded substantially between 1997 and 2005 as AMEC and Conestoga-Rovers & Associates (now GHD) installed additional wells to characterize groundwater flow patterns, assess potential impacts from historical waste disposal, and establish baseline conditions.

The hydrogeological setting is typical of the Lloydminster region, consisting of clay till with localized sand lenses and generally low hydraulic conductivity. Groundwater quality in the region is naturally poor, with elevated sodium and sulphate concentrations. Chloride has historically been used as the primary indicator of potential landfill impact due to its conservative behavior in groundwater.

Between 2009 and 2015, groundwater elevations increased modestly, with an average rise of approximately 0.52 m. This trend corresponded with a shift in the Palmer Drought Severity Index (PDSI) from prolonged drought conditions in the 1990s and early 2000s to near normal and very wet conditions between 2004 and 2015. The increase in groundwater levels was therefore attributed primarily to regional climatic conditions rather than landfill operations.

As of 2024, the groundwater monitoring network consists of 20 active monitoring wells located upgradient, downgradient, cross-gradient, and within the historical waste disposal area. The network provides comprehensive spatial coverage of the engineered landfill Cells, the historical waste area, the snow disposal area, and the impacted soil management zone.

The 2024 Annual Monitoring Program provided by AECOM, confirmed that groundwater elevations recorded in 2024 are consistent with historical groundwater elevations. Review of the 2022, 2023, and 2024 Annual Monitoring Programs confirms that groundwater elevations have remained generally stable with seasonal fluctuations only, and no sustained long-term upward or downward trends have been identified.

In the portion of the site north of the creek (across the groundwater divide), the apparent direction of shallow lateral groundwater flow was to the southeast during the June 2024 monitoring event and to the south/southeast during the October 2024 event. In the portion of the site south of the creek, the apparent direction of shallow lateral groundwater flow was to the northeast during both monitoring events. The creek functions as a groundwater discharge location for both the northern and southern portions of the site,

forming a groundwater divide. These results are consistent with historical groundwater flow directions. Groundwater flow directions observed in 2022 and 2023 were consistent with the 2024 results, confirming that the hydrogeologic regime at the site remains stable and predictable.

Upgradient wells south of 67th Street continue to serve as background/reference wells, with chloride concentrations typically ranging from 60 to 135 mg/L. Downgradient wells near the historical waste area continue to show elevated chloride concentrations, consistent with long-standing trends. Table 10-2 lists the key wells used for groundwater quality assessment.

Table 10-2 List of Select Monitoring Wells for Analysis

Upgradient Monitoring Wells	On-Site/Cross Gradient Monitoring Wells	Downgradient Monitoring Wells
MW07-12-9	MW07-01-7	MW02-09
MW07-13-9	MW07-02-7	MW07-09-12
MW03-12	MW07-03-7	MW07-08-12
	MW07-04-40	
	MW07-05-12	
	MW07-11-12	

The Saskatchewan Ministry of Environment accepted in September 2024 that MW07-04-40 and MW07-05-12, which have been blocked and not sampled since 2012, are to be decommissioned without replacement. MW07-01-7, MW07-02-7, and MW07-03-7 will be formally classified and sampled as background wells beginning in the 2025 monitoring program. MW03-11B exhibited unusual geochemistry in 2023; however, results returned to historical ranges in 2024. It has been recommended that MW03-11B be decommissioned without replacement, with continued monitoring at MW03-11A.

Groundwater monitoring requirements are established under:

- Permit to Operate Waste Disposal Ground (PO 25-045): Requires routine sampling of groundwater for parameters including chloride, sodium, sulphate, and other indicators of leachate impact.
- Municipal Refuse Management Regulations (MRMR): Require monitoring to detect potential impacts to groundwater and ensure that waste disposal operations do not cause pollution.
- EMPA 2010: Prohibits the discharge of substances that may cause adverse environmental effects and requires operators to implement monitoring programs to demonstrate compliance.

Sampling frequency is defined in the Operations Plan and typically ranges from semi-annual to annual depending on well location and historical trends.

Monitoring results from the 2023 Annual Landfill Report indicate that chloride concentrations remain elevated in several downgradient wells, particularly MW07-9-12, which has consistently reported chloride levels exceeding 1,500 mg/L. This pattern has remained stable for more than a decade and continues to be attributed to historical waste disposal activities and the proximity of the snow disposal area. Upgradient wells continue to show stable chloride concentrations within the expected background range.

Groundwater elevations have remained relatively stable since 2015, exhibiting seasonal fluctuations but no long-term upward or downward trends.

Table 10-3 Groundwater Elevations Change in the Monitoring Wells

Monitoring Well ID	Location	2015	2022	2023	2024	Change (2015-2024)
MW03-12	Upgradient	629.45	636.43	632.6	636.43	6.98
MW07-12-9	Upgradient	626.82	635.27	631.17	635.27	8.45
MW07-13-9	Upgradient	633.47	640.04	635.88	640.04	6.57
MW01-4	On-Site/Cross Gradient	619.24	620	619.11	620	0.76
MW01-5	On-Site/Cross Gradient	628.38	634.41	631.7	634.41	6.03
MW01-6	On-Site/Cross Gradient	627.84	630.93	628.45	630.93	3.09
MW02-7	On-Site/Cross Gradient	634.92	640.28	637.56	640.28	5.36
MW03-10	On-Site/Cross Gradient	626.60	631.39	626.75	631.39	4.79
MW03-11A	On-Site/Cross Gradient	633.54	634.86	633.8	634.86	1.32
MW03-11B	On-Site/Cross Gradient	633.78	634.22	633.3	634.22	0.44
MW07-10-7	On-Site/Cross Gradient	620.22	621.02	620.03	621.02	0.8
MW07-11-7	On-Site/Cross Gradient	622.97	623.92	622.66	623.92	0.95
MW0-1	On-Site/Cross Gradient	627.26		631.03		
MW02-9	Downgradient	618.82	621.16	618.61	618.6	-0.22
MW07-01-7	Downgradient	621.03	624.61	620.61	620.46	-0.57
MW07-02-7	Downgradient	621.93	624.77	620.86	620.52	-1.41
MW07-03-7	Downgradient	620.83	623.03	622.08	620.62	-0.21
MW07-07-7	Downgradient	619.10	620.41			
MW07-08-12	Downgradient	622.54	623.42	622.91	622.65	0.11
MW0-09-12	Downgradient	618.54	619.14	618.44	618.12	-0.42
MW11-1	Leachate Well	629.98	635.8	635.8	635.8	
MW11-2	Leachate Well	633.96	635.9	635.9	635.9	
MW11-4	Leachate Well	630.76	634.49	634.49	634.49	

As shown in Table 10-2 and Table 10-3 Groundwater monitoring results from 2022 through 2024 indicate that groundwater elevations across upgradient, on-site, cross-gradient, and downgradient wells remain stable and exhibit only seasonal variability, with no evidence of sustained mounding or long-term decline. Statistical differences between upgradient and selected monitoring wells continue to reflect established, long-standing groundwater quality patterns, with chloride, cadmium, manganese, and uranium concentrations remaining within the same historical order of magnitude. A localized increase in manganese at MW02-09 was observed in 2024 but remains consistent with historical trends. Methane was not detected in 2022 or 2023; limited detections occurred in select wells in 2024 without indication of widespread subsurface gas migration. Field pH measurements remain generally compliant with guidelines, with only

minor and isolated deviations recorded in June 2024. Overall, monitoring data confirm continued hydrogeologic stability and regulatory compliance at the WMF.

Table 10-4 Groundwater Monitoring Data Comparison

Category	Parameter	2022	2023	2024	Change/Trend Interpretation
Statistical Comparison – Upgradient vs On-Site / Cross-Gradient	Chloride	Differences identified	Differences identified	Differences identified	Stable long-term pattern
	Cadmium	Within historical range	Within historical range	Differences identified (MW03-11A)	No increasing trend
	Manganese	Within historical range	Within historical range	Differences identified (MW-1, MW02-7)	Stable
	Uranium	Within historical range	Within historical range	Differences identified	Stable
Upgradient vs Across GW Divide	Sulphate	Differences identified	Differences identified	Differences identified	Wells across divide; not landfill influenced
	Uranium	Differences identified	Differences identified	Differences identified	Stable
	Manganese	Differences identified	Differences identified	Differences identified	Stable
Upgradient vs Downgradient	Cadmium	Elevated but stable	Elevated but stable	Differences identified (MW02-09, MW07-09-12)	Consistent since 2011
	Manganese (MW02-09)	Stable	5.31 mg/L avg	7.27 mg/L avg	Increase in 2024; same order of magnitude
Methane Detection	Methane (>0% vol)	Not detected	Not detected	Detected in select wells	First detection in 2024
Carbon Dioxide	CO_2	Detected	Detected	Detected	No trend change
Oxygen	O_2	Within normal range	Within normal range	Within normal range	Stable
Field pH	pH compliance	Within guideline	Within guideline	Minor exceedance (2 wells June only)	Isolated deviation

Surface water monitoring results from 2022 through 2024 indicate that exceedances at the Surface Water Pond have remained limited to field pH, chloride, sulphate, TDS, and fluoride, consistent with historical trends. Monitoring of the Unnamed Creek shows periodic exceedances (primarily TDS and fluoride) without evidence of sustained increasing trends. In 2024, the Naturalized Pond was sampled for the first time, with exceedances noted for pH, chloride, sulphate, TDS, and uranium. The Naturalized Pond has been recommended for inclusion in future annual monitoring programs.

10.3 Landfill Gas Management

The WMF does not currently operate an active landfill gas (LFG) collection system, nor does it have a network of subsurface gas monitoring probes. Historically, the site's geological conditions, characterized by low permeability clay till, have limited the potential for significant lateral gas migration.

However, the introduction of the Federal Landfill Methane Regulations (SOR/2025-279) has created new monitoring and reporting requirements for landfills of this size. These regulations require:

- Qualification of methane emissions
- Monitoring of methane concentrations at the landfill boundary
- Implementation of control measures if thresholds are exceeded

At present, LFG monitoring is limited to surface observations and qualitative assessments. No exceedances of methane have been reported in subsurface environments. The GHG Assessment reports indicate that methane generation is occurring at levels typical for a landfill of this size and age, but not at volumes that would justify active gas collection at this time.

As the landfill expands vertically and approaches its maximum design elevation, LFG generation will increase. The City will need to do the following:

- Install perimeter gas probes
- Conduct quarterly methane monitoring
- Evaluate the need for passive or active gas collection systems
- Prepare for potential regulatory triggers under SOR/2025-279

These requirements have been incorporated into the implementation plan in Chapter 12.

11 Financial Plan

The cost estimates presented in this Master Plan are preliminary, order-of-magnitude values used to support long-term financial planning. Assumptions related to unit costs, service life, and phasing are included where appropriate, with final costs to be refined through detailed design, procurement, and the City's capital planning process. Since the City currently operates a landfill, in accordance with Section 28 of the Waste Control Regulation (AR 192/1996), financial security must be sufficient to ensure completion of conservation and reclamation as required by Environmental Protection and Enhancement Act and its regulations. The Public Sector Accounting Board (PSAB) Section PS 3280 outlines the requirements for estimating solid waste landfill closure and post-closure liability. The landfill liability is a sum of the closure and post-closure liability. Landfill closure activities are defined as:

- Compaction and grading of the landfill surface area
- Final cover and vegetation
- Completing facilities or infrastructure for:
    - Surface water/stormwater management
    - Leachate monitoring
    - Landfill gas monitoring

Landfill post-closure care activities are defined as:

- Acquisition of any additional land for buffer zones
- Leachate monitoring
- Water quality monitoring
- Landfill gas monitoring
- Ongoing maintenance of various control systems, drainage systems and final cover

11.1 Assumptions

11.1.1 Operations

In the estimation of the landfill liability, it has been assumed that the landfill will continue to operate as it currently does. Additional assumptions are as follows:

- City continues its residential collection for single-family, semi-detached and duplex dwellings
- City will maintain and upgrade the existing landfill until 2080 (expected landfill life)
- The City's curbside collection program diverts organics and recyclables from the landfill
- ICI waste is collected by private haulers and is brought to the landfill for disposal
- The proportion of recyclable materials within the ICI waste stream remains undetermined, and the diversion rate for organic waste is minimal to non-existent
- There will be no changes to current operations at the landfill or existing service levels

- There are no changes to existing capital and operating costs
- All facility upgrades will proceed as planned

11.1.2 Liability Analysis

The following has been assumed in the estimation of the landfill liability:

- The landfill closure date has been set to 2080 based on the estimated available airspace/waste tonnages.
- A 10% contingency rate has been applied to both the closure and post-closure estimates.
- Inflation Rate is the Bank of Canada's estimated inflation rate for 2024 – 2.67%.
- Discount (Interest) rate is the Bank of Canada's Overnight Repo Rate (CORRA) – 4.53%.
- Post-Closure Period is assumed to be 25 years (minimum period stated in the Standards or Landfills in Alberta). Government of Saskatchewan does not specify a minimum post-closure care period.
- Liability (closure and post-closure estimates) is calculated up to the closure year. We have assumed that the funds to cover the closure and post-closure will all be available for the first year of closure. Values after the closure year are set to zero.
- More intensive environmental monitoring will likely occur during the first 10 years after closure, with monitoring frequency decreasing thereafter. The estimates assume progressive reductions of environmental monitoring requirements 10 years after closure, and a further reduction 20 years after closure with acceptable water quality results.

11.2 Liability Estimates

A summary of the assumptions and closure and post-closure costs used for the liability estimates, are presented in Table 11-1 below.

Table 11-1 Assumptions and Inputs Used to Estimate the Landfill Liability for Closure and Post-Closure

Assumptions	Value
Landfill Closure Date	2080
Year "0"	2024
Remaining Life (Years)	56
Closure Cost (2024 Dollars)	$10,982,871
Annual Post-Closure Costs Year 1-10 Post Closure (2024 Dollars)	$411,593
Annual Post-Closure Costs Year 11-20 Post Closure (2024 Dollars)	$246,956
Annual Post-Closure Costs Year 21-25 Post Closure (2024 Dollars)	$164,637
Inflation Rate	2.67%
Discount Rate (Interest Rate)	4.53%

As presented in Table 11-2, the 2025 present value landfill closure and post-closure liability for the Landfill is estimated at $6,552,992, expressed in 2025$. The 2025 liability is the required investment today, to ensure sufficient funding at closure. The closure and post-closure costs were estimated in 2024 and are presented in Table 11-1, above. Considering inflation, the cost of closure and post-closure is estimated to $74,936,247 at the time of closure in 2080. The amortization on asset, accretion on liability and total expense recognized as per PS3280 are also presented in Table 11-2 below. Refer to Appendix C for additional details.

Table 11-2 Summary of Landfill Liability Under PS3280

Description	Total (2025)	Total (2080
Total Present Value Liability at Year End	$6,552,992	$74,936,247
Amortization on Asset	$111,947	$111,947
Expense Recognized for Following Year (Accretion of Liability)	$283,986	$3,247,500
Total Expense Recognized	$395,933	$3,359,447
Cost Per Tonne (Based on Tonnes Already Landfilled)	$10	$27

11.3 Funding of Transfers to Closure and Post-Closure Reserve

Stantec understands that the City is planning to build a reserve fund to address future costs associated with closure and post closure care through gradual increase of tipping fees, as cash funding of over $6M investment is not available in 2026. The estimates presented below are based on the assumption that the City currently has $600,000 in reserve.

The City can either increase tipping fees based on equal annual transfers, or gradual increase of tipping fees.

Equal Annual Transfers to Reserve City may choose to fund the reserve through annual equal payments of $328,569, however this would require an initial increase of the tipping fee by approximately $12/tonne in 2027. As the annual reserve transfers are kept constant while the disposed tonnes are expected to increase over the landfill life, the required tipping fee increase (relative to the 2026 rate) is lower closer to closure. This means that the City either would increase the tipping fee by $12/tonne in 2027 and then gradually decease the tipping by $6/tonne over the life of the landfill, or keep the tipping constant at 2026 rate plus $12/tonne and overfund the reserve.

Gradual Increase of Tipping Fees Stantec recommends a staggered approach to tipping fee increases over a 10-year period. An annual increase of $1.14/tonne over the next 10 years is enough to fund the closure and post-closure reserve. The annual contributions funded through tipping fees, along with the compound interest, will result in a balance of $74,936,247 by the end of 2079. Without the initial reserve balance of $600,000 the annual increase of tipping fees would be $1.25/tonne over the next 10 years.

Refer to Appendix C for additional details and below for a short explanation and discussion of some of the main cost categories presented in Appendix C.

Inflated Closure Cost: Cost of closure considering inflation. Closure was estimated to $11M in 2024, but the cost increases with inflation and is expected to cost $48M at the time of closure.

Present Value Closure Cost: Closure cost considering discount rate. In order to have $48M in the bank in 2080, a one-time investment of $4.2M is required in 2025 to take full advantage of compound interest. The closer to closure the more money needs to be invested to ensure funding at the time of closure.

Inflated Post-Closure Cost: Post-closure cost considering inflation. E.g. cost for annual post-closure for year 1-10 is $400K, which with inflation will cost $1.8M at the time of closure.

Present Value Post-Closure Cost: The total post-closure cost considering inflation and interest is $26M at the time of closure. In order to have $26M in the bank in 2080, a one-time investment in 2025 of $2.4M is required to take full advantage of compound interest. The closer to closure the more money needs to be invested to ensure funding at the time of closure.

Present Value Liability: The total liability for closure and post-closure in each given year.

Annual Reserve Payments: Investing over $6M in 2025 to fund closure and post-closure is not realistic. Instead, the City may want to make annual contributions to reserve starting as soon as possible.

11.4 Cost Analysis

A summary of the annual landfill cost, as well as the cost per tonne is provided in Table 11-3 below. Detailed cost estimates are provided in the Appendix C.

11.4.1 Operations Costs

The operations costs include the following:

- Staffing and Labour salaries and benefits
- Building and equipment supply and maintenance
- Cost of utilities – hydro, gas and fuel usage on site
- Administrative and Consulting charges

11.4.2 Capital Costs

The capital projects planned include the following:

- Design and construction of new facility entrance ~$500,000
- Design and construction of a maintenance building ~ $2,300,000
- Supply and Installation of the south weigh scale, scale house and office ~ $1,200,000
- Design and construction of the snow disposal area ~$1,500,000
- Design and construction of future landfill cells ~$3,700,000 per cell

- Equipment Purchases ~$400,000 per year. This includes:
    - 1x Loader
    - 1x Compactor
    - 1x Dozer and
    - 4x ¾ ton trucks

11.4.3 Closure Costs

Landfill closure activities are defined as:

- Compaction and grading of the landfill surface area
- Final cover and vegetation
- Completing facilities or infrastructure for:
    - Surface water/stormwater management
    - Leachate monitoring
    - Landfill gas monitoring

11.4.4 Post-Closure Costs

Landfill post-closure care activities are defined as:

- Acquisition of any additional land for buffer zones
- Leachate monitoring
- Water quality monitoring
- Landfill gas monitoring
- Ongoing maintenance of various control systems, drainage systems and final cover

11.4.5 Annual Landfill Operating Cost

A 10% contingency has been applied to both the capital and operations costs. Inflation rate, as provided by the Bank of Canada, is 2.67%. Note that although the analysis in this report assumes closure in 2080 for the landfilling (status quo) option, the 2080 closure date could be extended depending on the population trend, tonnage of waste received, diversion rates, and landfill operations.

Table 11-3 Annual Cost of Operating the Landfill

Year	Capital Cost (Annualized)	Annual Operations Cost	Total Annual Cost	Tonnage	Cost Per Tonne
2025	$1,658,207	$1,304,337	$2,962,544	27,189	$109
2030	$1,891,718	$1,488,017	$3,379,735	28,697	$118
2035	$2,158,113	$1,697,562	$3,855,675	30,347	$127
2040	$2,462,023	$1,936,615	$4,398,638	32,152	$137

Year	Capital Cost (Annualized)	Annual Operations Cost	Total Annual Cost	Tonnage	Cost Per Tonne
2045	$2,808,729	$2,209,333	$5,018,062	34,133	$147
2050	$3,204,260	$2,520,455	$5,724,715	36,308	$158
2055	$3,655,489	$2,875,390	$6,530,880	38,700	$169
2060	$4,170,262	$3,280,308	$7,450,570	41,335	$180
2070	$5,427,489	$4,269,237	$9,696,726	47,454	$204
2080	$7,063,738	$5,556,302	$12,620,040	54,943	$230

11.4.6 Discussion

Owning and operating the landfill requires substantial land space and has potential environmental impacts, including groundwater contamination and greenhouse gas emissions. These impacts can be mitigated through engineering best practices but may come with an increase in capital investment. As the City's population grows, the need for sustainable landfill management practices will become increasingly important. In general, landfilling remains the most economical waste disposal method in Canada.

The table below highlights the relationship between the liability (on a cost-per tonne basis) and the planned life of the landfill. It is observed that with continued operation of the landfill and extension of its life, the liability gradually decreasing with the expected landfill life. As shown in Table 11-4, the 2025 liability per tonne is $11 per tonne in place at closure if the landfill is closed in 2040, compared to $2 per tonne in place at closure if the landfill is closed in 2080. Keeping the landfill affords the City an opportunity to build the landfill’s closure and post-closure reserves, by charging the appropriate tipping fees and through the interest that is generated on the reserve funds.

Table 11-4 Cost per Tonne Variation at Different Closure Years

Closure year	Tonnes Landfilled at Closure	Present Value Closure Cost (2025)	Present Value Post-Closure Cost (2025)	Total Liability (2025)	Liability (2025) per Tonne Landfilled at Closure
2040	1,080,504	$7,883,457	$4,415,075.62	$12,298,533	$11
2060	1,814,168	$5,505,147	$3,083,119.65	$8,588,267	$5
2080	2,774,629	$4,200,520	$2,352,472.26	$6,552,992	$2

Each of the parameters are outlined in the table below with considerations for each parameter.

Table 11-5 Summary of Landfill Cost

Parameter	Considerations
Risk Management	
Liability and Expenses ($ Total)	Landfill closure (2080): $48,034,729 Post-closure (2080): $26,901,518 Liability (2080): $27 / tonne
Environmental Risks (Current & Future)	Groundwater contamination, GHG emissions
Stability	Stable due to being in control of the future disposal, materials that can be accepted and quantity of materials.
Cost	
Disposal Cost (2025)	$109 / tonne disposed in 2025
Liability cost (2025)	$10 / tonne disposed in 2025*
Annual disposal cost including liability (2025)	$119 / tonne disposed in 2025
Capital Investment ($/Year) or total $ (Life of Facility)	$40,955,011 $1,615,084 (annual)
Operational Cost ($/Year) or Total $ (Life of Facility)	$1,270,417
Revenue Potential	Revenue generated from tipping fees. Current estimate about $2.5M per annum

** Assuming lumpsum transfer to closure and post-closure reserve in 2025.*

12 Recommendations and Implementation Plan

The implementation plan provides a structured, phased roadmap for the development of the Waste Management Facility from 2025 through 2045. The plan aligns capital investments with projected waste generation, airspace consumption, regulatory requirements, and operational needs. It is designed to ensure that the facility continues to operate safely, efficiently, and in full compliance with provincial and federal regulations throughout its remaining life.

The plan is divided into four major development periods:

- **2025–2030:** Foundational infrastructure upgrades, including the new facility entrance, weigh scales, interim public drop-off area, maintenance building, design and construction of Cell 1.5. Preparation for infrastructure of the remaining horizontal cells (Cells 1.6 to 1.8).
- **2031–2035:** Design and construction of Cells 1.7, 1.8 and 1.6. Preparation for lined snow melt holding pond, prepare for initiation of vertical expansion (Cell 2.1), and upgrades to the stormwater, leachate, and landfill gas systems.
- **2036–2040:** Design and construction of Cell 2.1, expansion into the Ridgeline site (i.e. public drop off area is intended to be relocated north of the facility, major stormwater and leachate upgrades, and significant expansion of the landfill gas management system in response to federal methane regulations.
- **2041–2045:** Design and construction of Cell 2.2 and 2.3, full build-out of the landfill gas system, and final stormwater and leachate infrastructure expansions.

Equipment replacement cycles, environmental monitoring enhancements, and regulatory compliance upgrades have been included where applicable.

The tables that follow summarize the capital activities, costs, and justifications for each development period. It should be noted that these are preliminary estimates with accuracy in the range of +/- 20%. For budget planning, an additional allowance of 15% for engineering and design and an additional 20% contingency should be considered.

12.1 Current Conditions: Year 2024

Appendix A, Figure A-1 represents the existing conditions at the facility and the location of various current infrastructure as per the survey plan provided by the City. Cell 1.4 is the current active cell and is being used for the disposal of household waste. The remaining active life of the active Cell 1.4 is approximately 2 years based on current waste and cover requirements.

12.2 Development Plan: 2025 to 2030

The following infrastructure development activities are proposed for the first five years of the plan, i.e., 2025 - 2030.

Table 12-1 Infrastructure Development Activities, 2025-2030

Year of Activity	Plan Period I: 2025-2030	Preliminary Capital Budget Estimate	
		2025	Basis
2026	**New facility Entrance from 40th Avenue:** Construct new facility entrance from 40th Avenue – South of the existing entry and scale house.	$500,000	Assume 2,500 m^2 of roadway at $200/$m^2$
2026	Supply and install of two new weigh scales	$700,000	$300,000 per scale plus $100,000 civil works
2026	Construct new scale house and office	$500,000	Assume 500 sqft at $1000/sqft
2026	**Interim Closure of Cell 1.3:** An interim cover should be applied to Cell 1.3 now that the design elevation of approximately 640 masl is reached and filling has begun in 1.4.	No Capital Budget provision required	
2026	**Interim upgrades to the existing Public Drop Off area**	$100,000	City provided estimate
2025-2030	**Daily Cover Stockpile:** Treated soils and other fill material for daily cover can continue to be stockpiled at the current location west of Cell 1.1 during this period (2025-2030). However, such stockpile volumes should be just sufficient to meet the demand until 2030.	No Capital Budget provision required	
2027	**Vehicle Maintenance Building:** Construct a new equipment/maintenance building on the southwest corner of the facility as shown in Appendix A, Figure A-1. 6,500 sqft	$2,275,000	$350/sqft including all site works and servicing
2027	**Demolition of existing shop, foundation and other structures**	$120,000	
2027	**Stormwater Management Upgrades:** Minor upgrades should be performed when new cells are constructed. This allowance covers significant upgrades should as the ditch from West to East. Upgrade to be completed before Cell 1.5 construction	$500,000	

Year of Activity	Plan Period I: 2025-2030	Preliminary Capital Budget Estimate	
		2025	**Basis**
2027/2028	**Cell 1.5 Design and Construction**	$4,500,000	Similar cost to Cell 1.4, $3.5M for cell construction. $1M contingency added for geotechnical work for overliner system
2025-2028	**Concrete/Crushed Concrete Stockpile:** All the stockpiled concrete/crushed concrete should be consumed from this location. Any future stockpiling of concrete should take place within the 100 m setback available towards 40th Avenue.	No Capital Budget provision required	
2028	**Cleaning of Leachate Collection system (5-year cycle)**	$20,000	$5,000 per cell for 4 cells
2028	**Allowance for Environmental Monitoring Upgrades:** Covers new well installations, Landfill gas monitoring and other monitoring expenses	$150,000	
2028	**Gas testing and compliance upgrades in response to the new federal GHG regulations**	$200,000	Gas quantification and reporting
2030	**Equipment Purchases:** Compactor, Loader, Dozer, 4x pickup trucks	Cost of replacing equipment ($2,800,000) – Timeline based on an assessment by Fleet services	City estimates

12.3 Development Plan: 2031-2035

The following development activities are proposed for the 5-year short-term (2031 through 2035).

Table 12-2 Infrastructure Development Activities, 2031-2035

Year of Activity	Plan Period II: 2031-2035	Preliminary Capital Budget Estimate	
		2025	Basis
2031	**Design and Construction of Snow Disposal Area:** Estimate includes the design fees, site preparation, construction of a lined pond, stormwater management and other site upgrades required for the construction of the snow disposal area	$1,500,000	Based on other municipal estimates 10,000m2 pad @$50/m2 = $500,000 3,500m2 Snow melt pond @ $200/m2 = $700,000 Roads, ditches, berms etc @300,000
2032	**Existing White Goods/Metal Pile Clean-Up:** This location will not be functional anymore. It is recommended that existing pile should be cleaned up/salvaged prior to construction of Cell 1.8.	No Capital Budget provision required	
2032	**Design and Construction of Cell 1.7 and 1.8**	$4,500,000	$3.5M for cell construction. $1M contingency added for geotechnical work for overliner system
2033	**Design and Construction of Cell 1.6**	$4,500,000	$3.5M for cell construction. $1M contingency added for geotechnical work for overliner system
2034	**Design and Construction of Interim Stormwater Drainage for Cell 1.8:** This stormwater system comprises drainage swales as shown in Appendix A, Figure A-2. with two culverts one near the weigh scale and another near existing wet cell no. 1.	$300,000	Accounts for significant upgrades required near Cell 1.8
2034	**Landfill gas control system installation -** Includes the supply and install of gas probes, header, monitoring equipment and vertical/horizontal collection systems	$1,500,000	Based on similar project size

Year of Activity	Plan Period II: 2031-2035	Preliminary Capital Budget Estimate	
		2025	Basis
2035	**Manholes for Leachate Transport:** Construction of Cell 1.8 will require constructing piping from MH-1 to MH-08 as well as construction of manholes from MH-01 to MH-08 to facilitate leachate transport to leachate holding pond. Estimate includes all trenching and tie-ins	$400,000	Assume 500m HDPE piping at $800/m
2031-2035	Environmental allowance for Cells 1.7 and 1.8 expansion	$200,000	
2031-2035	Stormwater upgrades for Cells 1.7 and 1.8	$300,000	
2031-2035	Landfill gas control system upgrades for Cells 1.1 to 1.5, 1.8	$1,500,000	
2031-2035	Access road upgrades for Cells 1.6 to 1.8 and Phase 2 – Includes regrading and gravelling as required	$500,000	
2031-2035	**Provide Interim Cover for Completed Cell 1.5, 1.7 and 1.8:** Cells 1.5, 1.7 and 1.8 are expected to have been filled to design elevation and should be provided with an interim cover. The intermediate cover is assumed to be applied as part of normal facility operation.	No Capital Budget provision required	
2035	Cleaning of Leachate Collection system (5-year cycle)	$25,000	$5,000 for 5 cells
2035	**Prepare for Phase 2.1 (Overliner System):** It is expected that Cells 1.5 to 1.8 would be near completion. The City should prepare for the vertical expansion of Phase 2.	No Capital Budget provision required	
2035	Allowance for Environmental Monitoring Upgrades: Covers new well installations, Landfill gas monitoring and other monitoring expenses	$150,000	Assume 3 to 4 wells at $40,000 each plus reporting

12.4 Development Plan: 2036-2040

The following development activities are proposed for the 5-year short-term (2036 through 2040).

Table 12-3 Infrastructure Development Activities, 2036-2040

Year of Activity	Plan Period I: 2036-2040	Preliminary Capital Budget Estimate	
		2025	Basis
2036-2040	Provide Interim Cover for completed Cell 1.6. All Phase 1 cells are expected to have been filled to design elevation and should be provided with an interim cover.	No Capital Budget provision required	

Year of Activity	Plan Period I: 2036-2040	Preliminary Capital Budget Estimate	
		2025	Basis
2036-2040	Access road upgrades for Phase 2 – Includes regrading and gravelling as required	$500,000	
2036-2040	Environmental allowance for Phase 2 cells	$200,000	
2036-2040	Public Drop-Off Area: Develop new public drop-off facility at the southeast corner of the facility including wet cell development with protective material for metals/tires as per the concept shown in the Drawings (Assumed existing bins will be used).	$800,000	Assume a 4,000 m^2 PDO area at $200/$m^2$

12.5 Development Plan: 2041-2045

The following development activities are proposed for the 5-year short-term (2041 through 2045).

Table 12-4 Infrastructure Development Activities, 2041-2045

Year of Activity	Plan Period I: 2041-2045	Preliminary Capital Budget Estimate	
		2025	Basis
2041-2045	Provide Interim Cover for completed Cells 2.1 and 2.2	No Capital Budget provision required	
2041-2045	Landfill gas control system upgrades for Phase 2	$1,500,000	

12.6 Next Steps

The Master Plan establishes a long-term framework for the development and operation of the Waste Management Facility. The following next steps outline the immediate and medium-term actions required to initiate implementation of the plan and ensure alignment with regulatory requirements, operational needs, and capital planning cycles.

Immediate Priorities (2025 to 2027)

The first phase of implementation focuses on foundational infrastructure upgrades and planning activities. The City will finalize and adopt the Master Plan, initiate detailed design for the new facility entrance and weigh scale system, and advance design of the new public drop-off facility. During this period, the City should also start preparations for Cell 1.5 design and update the Operations Plan and Emergency Response Plan to reflect new site infrastructure, and monitoring requirements.

Medium term priorities (2028 to 2035)

The second phase of implementation focuses on the construction of Cells 1.7, 1.8 and 1.6, expansion of stormwater management infrastructure, and upgrades to environmental monitoring systems. The City will also prepare for the transition to vertical expansion by completing a feasibility assessment for underliner or overliner construction and initiating design for Cell 2.1.

During this period, the City will begin implementing landfill gas monitoring and control upgrades in response to federal methane regulations.

Long Term Priorities (2036 to 2045)

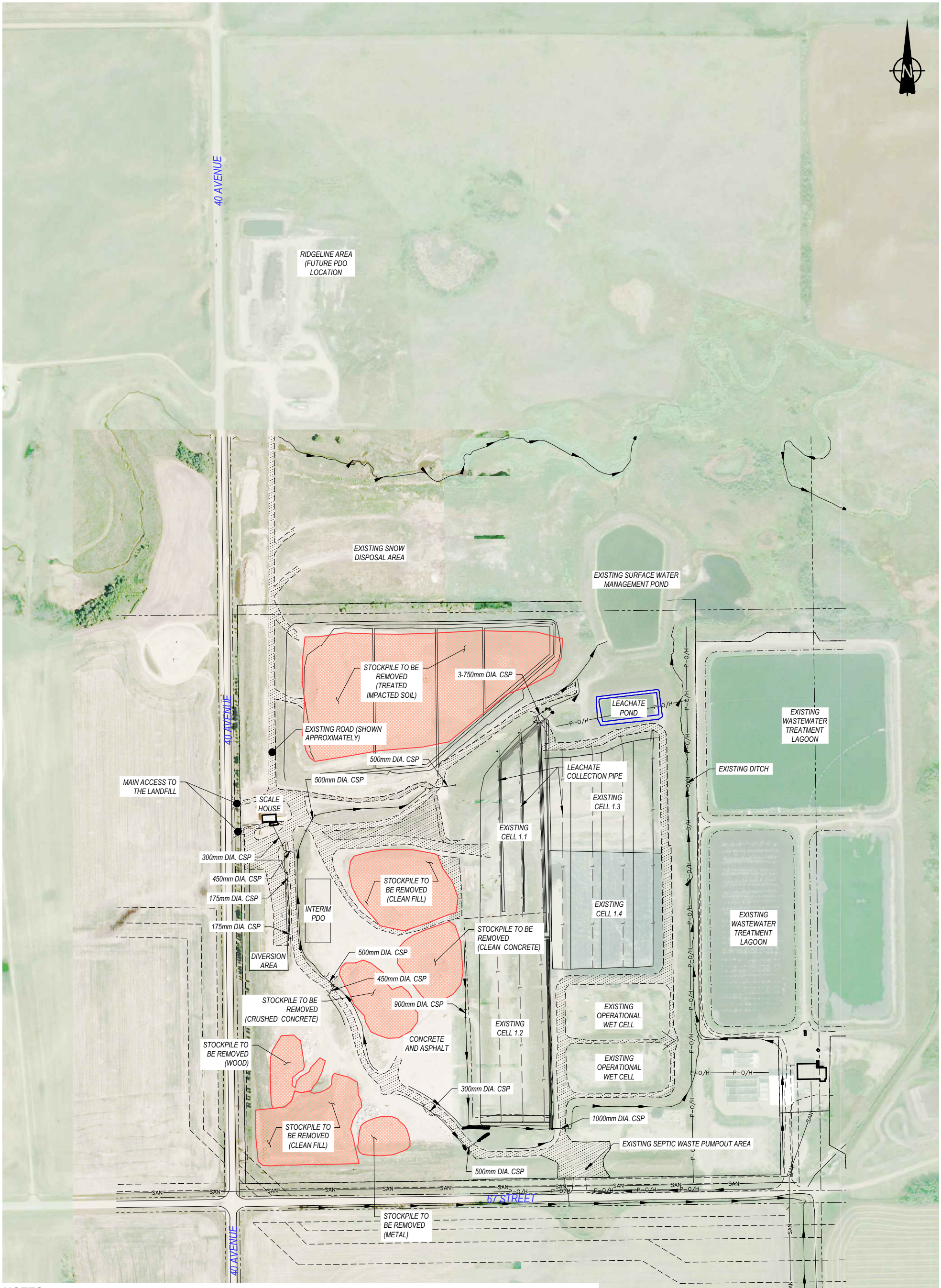
The final phase of implementation focuses on the construction of vertical expansion phases (Phases 2 through 5), expansion of landfill gas control systems, and continued upgrades to stormwater and leachate infrastructure. Equipment replacement cycles will continue, and the City will begin preliminary closure planning as the landfill approaches its maximum design elevation.

Ongoing Requirements

Throughout the implementation period, the City will maintain compliance with all regulatory requirements, update the Master Plan every five years, and continue to refine waste projections and airspace assessments. Environmental monitoring and reporting will continue, supported by ongoing communication with regulatory agencies and integration of monitoring results into operational decision-making.

Appendices

Appendix A Proposed Conceptual Development Plan



NOTES:

1. EXISTING ROAD EDGES AND STOCKPILE LIMITS ARE EXTRACTED FROM AERIAL IMAGE AND GROUND SURVEY.
2. ALL ROADS AND STOCKPILES ARE TO BE FIELDS VERIFIED BEFORE PROCEEDING WITH ANY DESIGN WORK.
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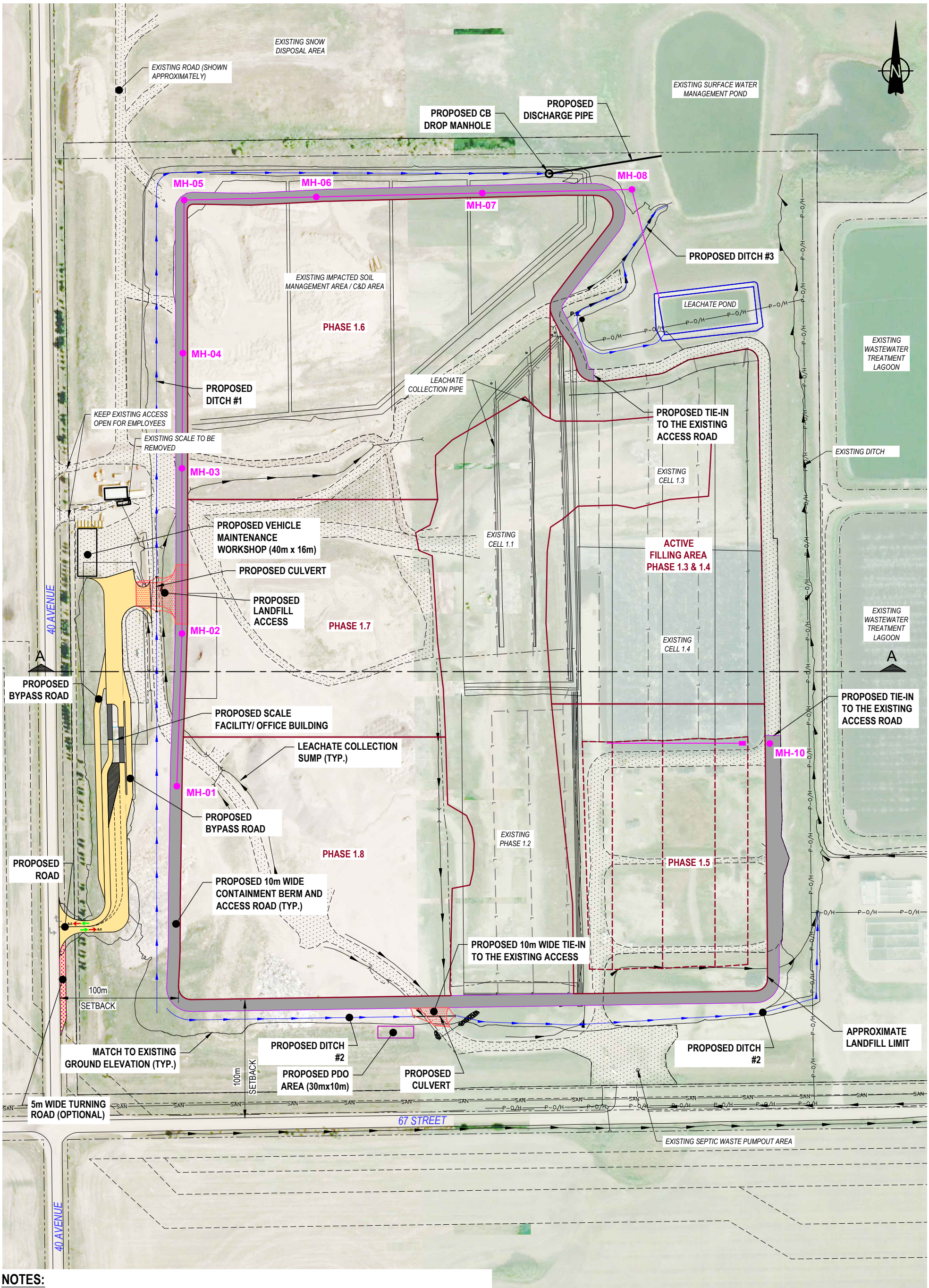
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2025 WMF MASTER PLAN

EXISTING SITE LAYOUT PLAN

FIGURE-01

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2025 WMF MASTER PLAN

PHASE 1 - CELL BASE LAYOUT PLAN
FIGURE-02

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EXISTING ROAD (SHOWN APPROXIMATELY)

EXISTING SNOW DISPOSAL AREA

EXISTING SURFACE WATER MANAGEMENT POND

PROPOSED CB DROP MANHOLE

PROPOSED DISCHARGE PIPE

MH-05

MH-06

MH-07

MH-08

PROPOSED ACCESS TO PHASE-2

PROPOSED DITCH #3

PHASE 2.7

LEACHATE POND

EXISTING WASTEWATER TREATMENT LAGOON

MH-04

PROPOSED DITCH #1

KEEP EXISTING ACCESS OPEN FOR EMPLOYEES

PROPOSED TIE-IN TO THE EXISTING ACCESS ROAD

PHASE 2.5

PHASE 2.6

EXISTING DITCH

MH-03

EXISTING SCALE TO BE REMOVED

PROPOSED VEHICLE MAINTENANCE WORKSHOP (40m x 16m)

PROPOSED PHASE-2 PERIMETER ROAD @ ELE. 634m

PROPOSED CULVERT

40 AVENUE

PROPOSED LANDFILL ACCESS

MH-02

EXISTING WASTEWATER TREATMENT LAGOON

A

A

PHASE 2.3

PHASE 2.4

PROPOSED BYPASS ROAD

PROPOSED SCALE FACILITY/ OFFICE BUILDING

PROPOSED TIE-IN TO THE EXISTING ACCESS ROAD

MH-10

MH-01

PROPOSED BYPASS ROAD

PROPOSED ROAD

PROPOSED 10m WIDE CONTAINMENT BERM AND ACCESS ROAD (TYP.)

PHASE 2.1

PHASE 2.2

100m SETBACK

MATCH TO EXISTING GROUND ELEVATION (TYP.)

PROPOSED DITCH #2

PROPOSED PDO AREA (30mx10m)

PROPOSED CULVERT

PROPOSED ACCESS TO PHASE-2

PROPOSED 10m WIDE TIE-IN TO THE EXISTING ACCESS

PROPOSED DITCH #2

APPROXIMATE LANDFILL LIMIT

5m WIDE TURNING ROAD (OPTIONAL)

67 STREET

EXISTING SEPTIC WASTE PUMPOUT AREA

40 AVENUE

NOTES:

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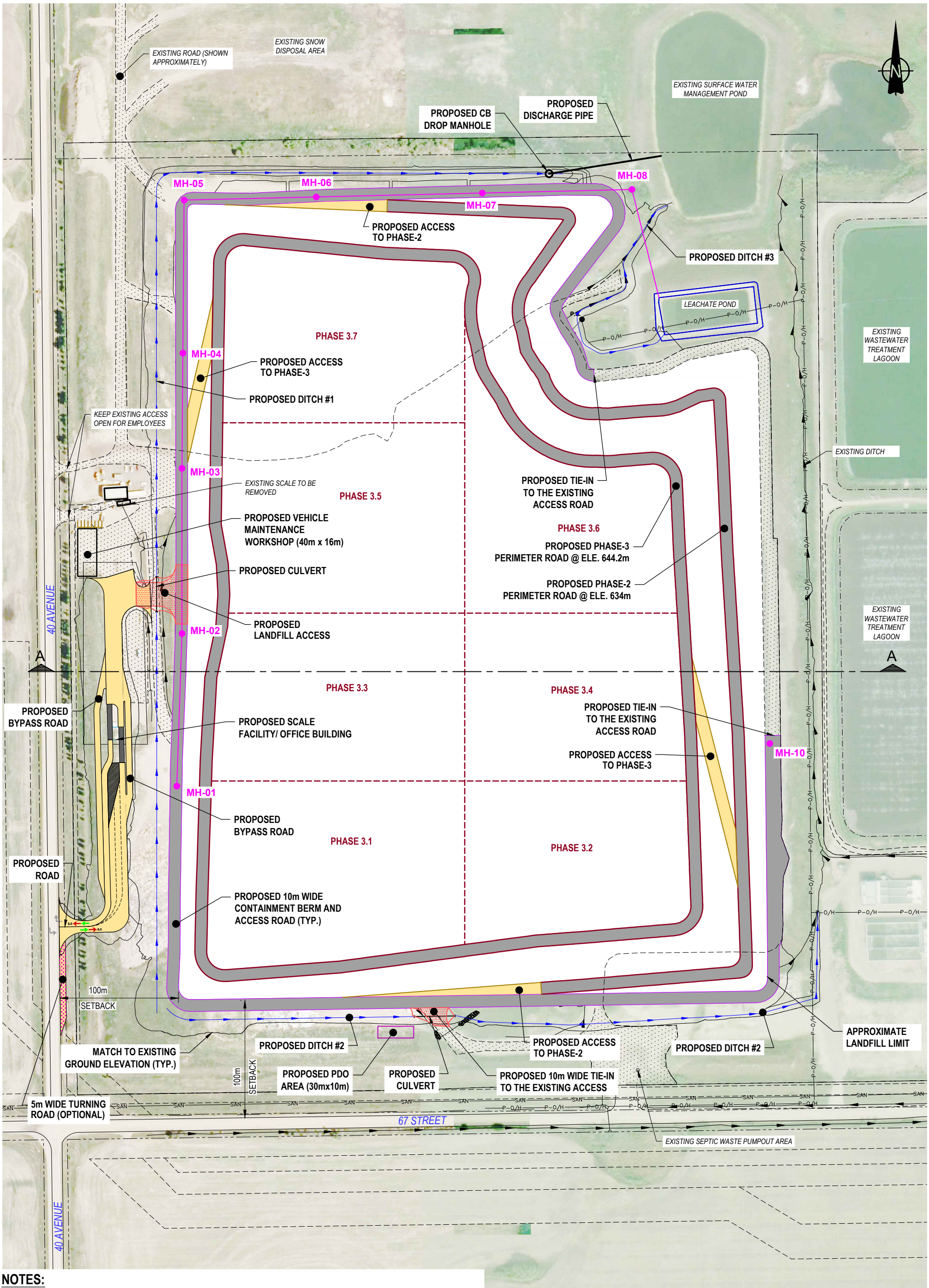
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2025 WMF MASTER PLAN

PHASE 2 - CELL BASE LAYOUT PLAN

FIGURE-03

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2025 WMF MASTER PLAN

PHASE 3 - CELL BASE LAYOUT PLAN
FIGURE-04

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EXISTING ROAD (SHOWN APPROXIMATELY)
EXISTING SNOW DISPOSAL AREA
EXISTING SURFACE WATER MANAGEMENT POND
PROPOSED CB DROP MANHOLE
PROPOSED DISCHARGE PIPE
MH-05
MH-06
MH-07
MH-08
PROPOSED ACCESS TO PHASE-2
PROPOSED DITCH #3
LEACHATE POND
EXISTING WASTEWATER TREATMENT LAGOON
PROPOSED DITCH #1
MH-04
PHASE 4.7
PROPOSED ACCESS TO PHASE-3
PROPOSED TIE-IN TO THE EXISTING ACCESS ROAD
KEEP EXISTING ACCESS OPEN FOR EMPLOYEES
EXISTING DITCH
MH-03
EXISTING SCALE TO BE REMOVED
PROPOSED VEHICLE MAINTENANCE WORKSHOP (40m x 16m)
PHASE 4.5
PROPOSED PHASE-3 PERIMETER ROAD @ ELE. 644.2m
PHASE 4.6
PROPOSED PHASE-2 PERIMETER ROAD @ ELE. 634m
PROPOSED CULVERT
PROPOSED PHASE-4 PERIMETER ROAD @ ELE. 654.4m
PROPOSED LANDFILL ACCESS
40 AVENUE
MH-02
A
A
PROPOSED BYPASS ROAD
PHASE 4.3
PHASE 4.4
PROPOSED SCALE FACILITY/ OFFICE BUILDING
PROPOSED TIE-IN TO THE EXISTING ACCESS ROAD
MH-10
PROPOSED ACCESS TO PHASE-3
MH-01
PROPOSED BYPASS ROAD
PHASE 4.2
PHASE 4.1
PROPOSED ROAD
PROPOSED 10m WIDE CONTAINMENT BERM AND ACCESS ROAD (TYP.)
PROPOSED ACCESS TO PHASE-4
PROPOSED ACCESS TO PHASE-2
100m SETBACK
APPROXIMATE LANDFILL LIMIT
MATCH TO EXISTING GROUND ELEVATION (TYP.)
PROPOSED DITCH #2
PROPOSED DITCH #2
100m SETBACK
PROPOSED PDO AREA (30mx10m)
PROPOSED CULVERT
PROPOSED 10m WIDE TIE-IN TO THE EXISTING ACCESS
5m WIDE TURNING ROAD (OPTIONAL)
67 STREET
EXISTING SEPTIC WASTE PUMPOUT AREA
40 AVENUE

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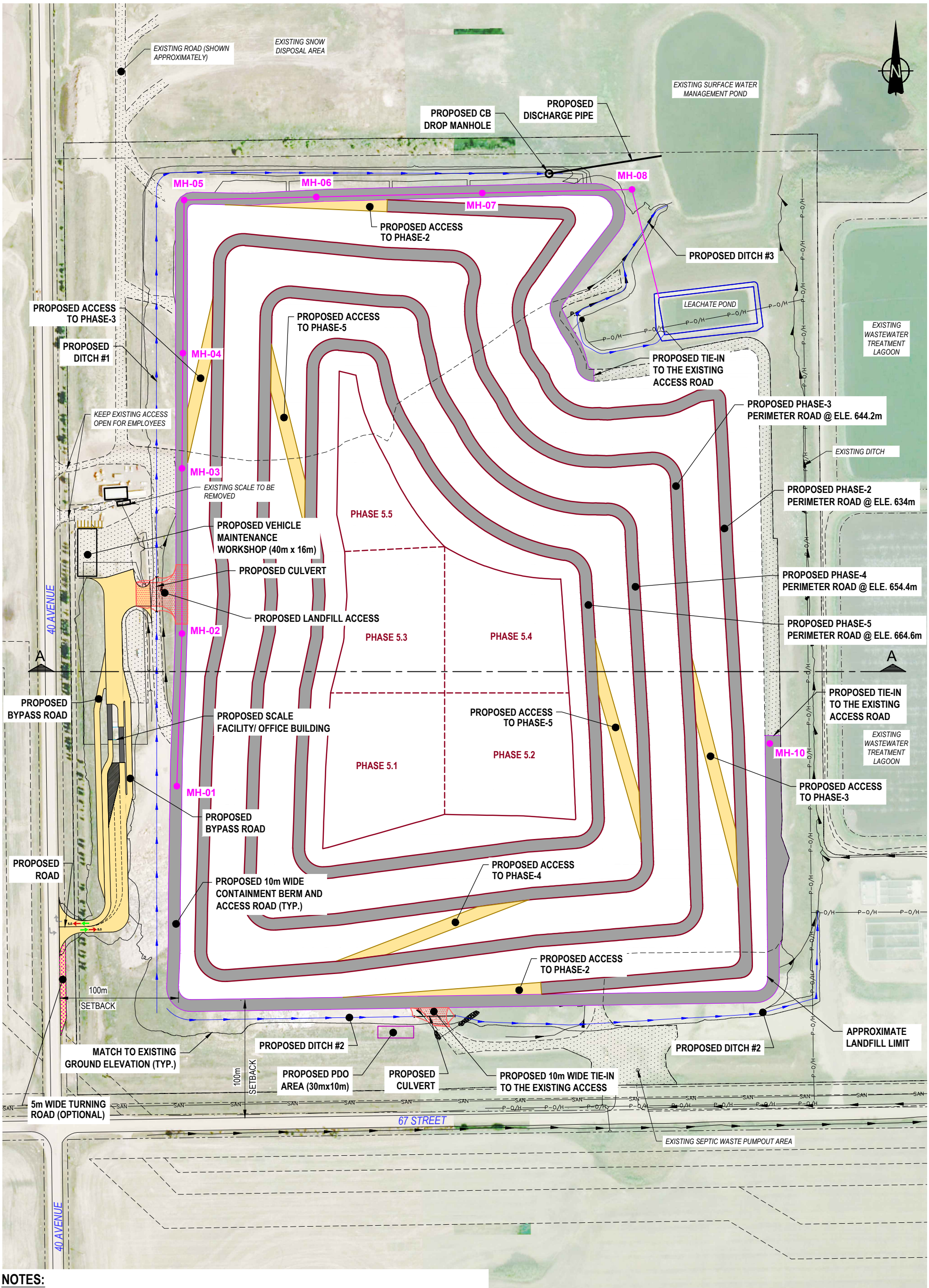
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2025 WMF MASTER PLAN

PHASE 4 - CELL BASE LAYOUT PLAN
FIGURE-05

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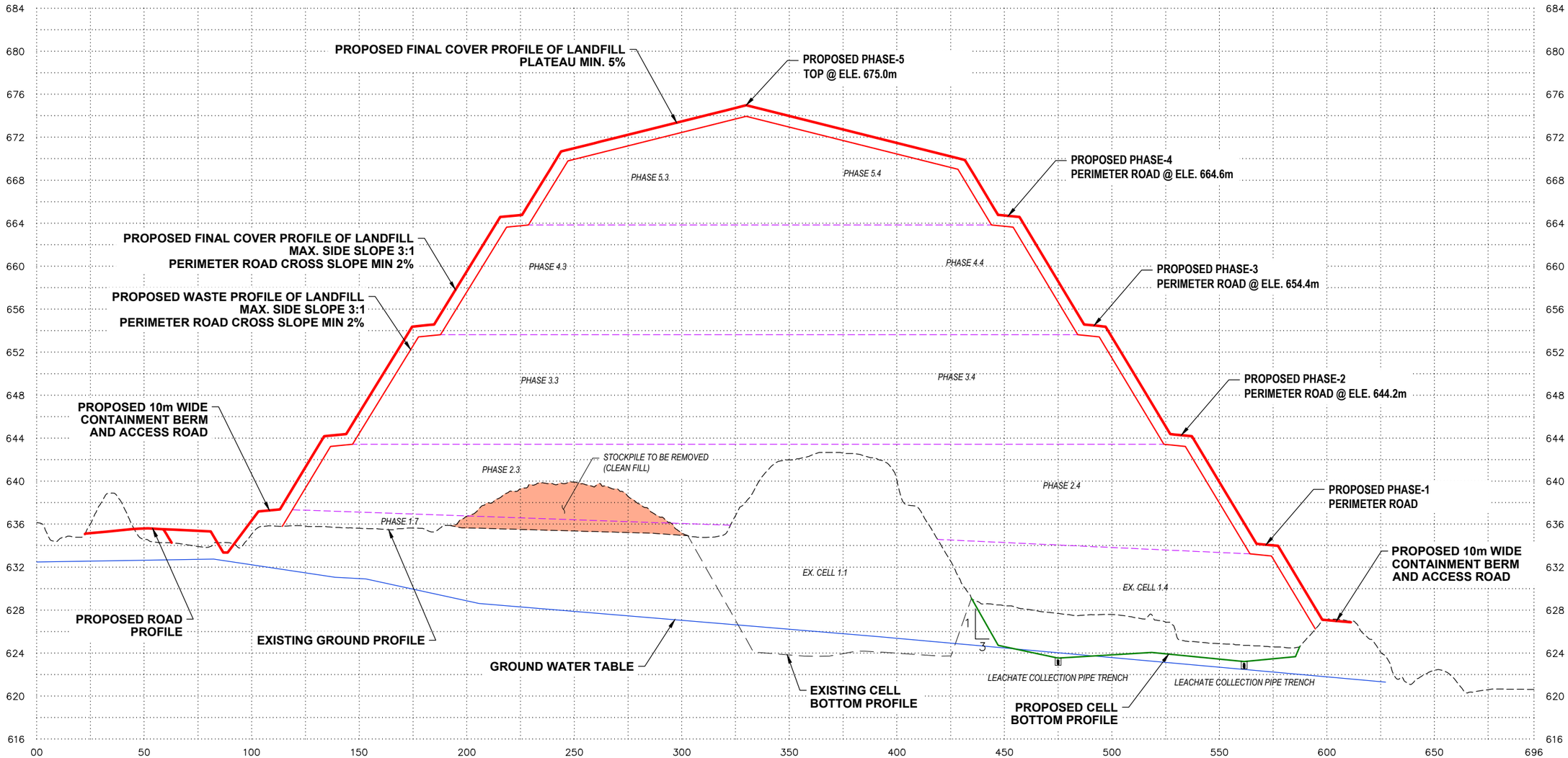
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2025 WMF MASTER PLAN

PHASE 5 - CELL BASE LAYOUT PLAN
FIGURE-06

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2025 WMF MASTER PLAN
LANDFILL CONCEPTUAL PLAN
SECTION A-A

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Appendix B Breakdown of Annual Soil Requirement for the Master Plan Period

Table B-1 2026-2045 Soil Balance Estimation by Phase (To Estimate Daily Cover, Interim Cover, and Final Cover, Needs per Phase)

Description of Item	Unit		Available Soil Volume (m^3)	Required Soil Volume (m^3)
Stockpile Material				
a) Unprocessed white wood	m3		5,790	
b) Wood chips	m3		1,100	
c) Crushed concrete and asphalt	m3		18,885	
d) Raw concrete/asphalt (pre-crushing)			32,290	
e) Additional soil/material stockpile	m3		54,500	
f) Near Impacted Soil Management Area 18,045 Tonnes per communication with the City (Assume Density of Stockpiled Soil = 1/3 tonnes/m^3)	m^3		54,136	
g) Soil Treatment Pad (129 Tonnes)	m^3		99	
h) **Average Annual Requirement of Treated Soil (2026-2045)**	**m^3**	**(50,215)**	(1,004,305)	
Berm Construction				
a) Phase 1 (Length = 2,440 m)				(78,080)
b) Phase 2 (Length = 2,300 m)				(59,800)
c) Phase 3 (Length = 2,111 m)				(54,886)
d) Phase 4 (Length = 1,600 m)				(41,600)
e) Phase 5 (Length = 1,300 m)				(33,800)
Annual Requirement				
Daily, Intermediate, and Final Cover				
Projected Waste Disposal (2026-2045)	m^3	1,333,196		
Daily Cover @ 20%				(226,639)
Intermediate Cover	m^2			(636,300)
Final Cover (Assumed No Final Cap Required by 2045)	m^2			
	Total		**166,800**	**(1,171,105)**

Appendix C Liability Estimates

LIABILITY CALCULATION USING PS 3280

ASSUMPTIONS	
Current Year	2024
Landfill Closure Date	2080
Remaining Life (Years)	56
Closure Cost (2024 Dollars)	$10,982,871
Annual Post-Closure Costs (2024 Dollars)	$411,593
Inflation Rate	2.67%
Discount Rate (Interest Rate)	4.53%

Post-Closure Costs		
Years 1-10	Years 11-20	Years 21-25
$411,593	$246,956	$164,637

Post-closure costs from years 1-10, years 11-20 (40% decrease), and years 21-25 (60% decrease)

Landfill Data						Closure Costs		Post-Closure Costs					Liability and Expenses					Reserve Transfers (Equal Transfers)			Proposed Reserve Transfers & Tipping Fee Increases		
Liability Operating Year	Number of Years from Current Year	Year	Tonnes Landfilled Annually	Cumulative Tonnes	Airspace Consumed Annually	Cumulative Airspace (m3)	Inflated Closure Cost	Present Value Closure Cost	Inflated Post-Closure Cost (Year 1-10)	Inflated Post-Closure Cost (Year 11-20)	Inflated Post-Closure Cost (Year 20-25)	Present Value Post-Closure Cost	Present Value Liability	PV Liability Cost per Tonne in Place	Amortization on Asset	Accretion of Liability	Total Expense Recognized	Tangible Capital Asset Recognized	Equal Annual Reserve Payments	Impact on Tipping Fees (compared to 2026 rate)	Accumulative Reserve	Annual Transfers to Reserve	Proposed Annual Tipping Fee Increase (compared to 2026 rate)	Accumulative Reserve
0	0	2024	26,903	607,439	53,806	1,214,878	$10,982,871	$4,018,483	$411,593	$246,956	$164,637	$0 $2,250,524	$6,269,006	$10										
1	**1**	**2025**	**27,189**	**634,628**	**54,378**	**1,269,255**	**$11,276,113**	**$4,200,520**	**$422,582**	**$253,549**	**$169,033**	**$0 $2,352,472**	**$6,552,992**	**$10**	**$111,947**	**$283,986**	**$395,933**	**$6,157,060**						
2	2	2026	27,480	662,108	54,960	1,324,215	$11,577,186	$4,390,804	$433,865	$260,319	$173,546	$0 $2,459,039	$6,849,843	$10	$111,947	$296,851	$408,797	$6,045,113			$600,000			$600,000
3	3	2027	27,776	689,884	55,553	1,379,768	$11,886,297	$4,589,707	$445,449	$267,270	$178,180	$0 $2,570,434	$7,160,141	$10	$111,947	$310,298	$422,244	$5,933,167	$328,569	$12	$955,749	$31,725	$1	$658,905
4	4	2028	28,078	717,962	56,156	1,435,924	$12,203,661	$4,797,621	$457,343	$274,406	$182,937	$0 $2,686,874	$7,484,495	$10	$111,947	$324,354	$436,301	$5,821,220	$328,569	$12	$1,327,614	$64,140	$2	$752,894
5	5	2029	28,385	746,347	56,770	1,492,694	$12,529,498	$5,014,953	$469,554	$281,732	$187,822	$0 $2,808,590	$7,823,543	$10	$111,947	$339,048	$450,994	$5,709,274	$328,569	$12	$1,716,324	$97,262	$3	$884,262
6	6	2030	28,697	775,044	57,395	1,550,089	$12,864,036	$5,242,130	$482,091	$289,255	$192,836	$0 $2,935,819	$8,177,949	$11	$111,947	$354,406	$466,353	$5,597,327	$328,569	$11	$2,122,642	$131,110	$5	$1,055,429
7	7	2031	29,016	804,060	58,031	1,608,120	$13,207,506	$5,479,599	$494,963	$296,978	$197,985	$0 $3,068,812	$8,548,411	$11	$111,947	$370,461	$482,408	$5,485,381	$328,569	$11	$2,547,367	$165,704	$6	$1,268,944
8	8	2032	29,339	833,399	58,679	1,666,799	$13,560,146	$5,727,825	$508,178	$304,907	$203,271	$0 $3,207,829	$8,935,654	$11	$111,947	$387,243	$499,190	$5,373,434	$328,569	$11	$2,991,332	$201,064	$7	$1,527,491
9	9	2033	29,669	863,068	59,338	1,726,137	$13,922,202	$5,987,295	$521,747	$313,048	$208,699	$0 $3,353,143	$9,340,439	$11	$111,947	$404,785	$516,732	$5,261,488	$328,569	$11	$3,455,408	$237,211	$8	$1,833,898
10	10	2034	30,005	893,073	60,010	1,786,146	$14,293,925	$6,258,520	$535,677	$321,406	$214,271	$0 $3,505,041	$9,763,560	$11	$111,947	$423,122	$535,068	$5,149,541	$328,569	$11	$3,940,507	$274,166	$9	$2,191,139
11	11	2035	30,347	923,420	60,693	1,846,839	$14,675,573	$6,542,031	$549,980	$329,988	$219,992	$0 $3,663,819	$10,205,850	$11	$111,947	$442,289	$554,236	$5,037,594	$328,569	$11	$4,447,581	$311,951	$10	$2,602,348
12	12	2036	30,695	954,114	61,389	1,908,229	$15,067,410	$6,838,385	$564,664	$338,799	$225,866	$0 $3,829,790	$10,668,175	$11	$111,947	$462,325	$574,272	$4,925,648	$328,569	$11	$4,977,626	$350,588	$11	$3,070,822
13	13	2037	31,049	985,164	62,098	1,970,327	$15,469,710	$7,148,164	$579,741	$347,845	$231,896	$0 $4,003,280	$11,151,443	$11	$111,947	$483,268	$595,215	$4,813,701	$328,569	$11	$5,531,681	$354,636	$11	$3,564,567
14	14	2038	31,410	1,016,574	62,820	2,033,148	$15,882,752	$7,471,975	$595,220	$357,132	$238,088	$0 $4,184,628	$11,656,603	$11	$111,947	$505,160	$617,107	$4,701,755	$328,569	$10	$6,110,835	$358,760	$11	$4,084,802
15	15	2039	31,778	1,048,352	63,556	2,096,704	$16,306,821	$7,810,456	$611,112	$366,667	$244,445	$0 $4,374,192	$12,184,648	$12	$111,947	$528,044	$639,991	$4,589,808	$328,569	$10	$6,716,225	$362,960	$11	$4,632,803
16	16	2040	32,152	1,080,504	64,305	2,161,008	$16,742,213	$8,164,269	$627,429	$376,457	$250,972	$0 $4,572,343	$12,736,612	$12	$111,947	$551,965	$663,911	$4,477,862	$328,569	$10	$7,349,040	$367,237	$11	$5,209,907
17	17	2041	32,534	1,113,038	65,068	2,226,076	$17,189,230	$8,534,111	$644,181	$386,509	$257,673	$0 $4,779,470	$13,313,581	$12	$111,947	$576,969	$688,915	$4,365,915	$328,569	$10	$8,010,520	$371,595	$11	$5,817,510
18	18	2042	32,923	1,145,961	65,845	2,291,921	$17,648,183	$8,920,706	$661,381	$396,829	$264,552	$0 $4,995,980	$13,916,686	$12	$111,947	$603,105	$715,052	$4,253,969	$328,569	$10	$8,701,966	$376,034	$11	$6,457,077
19	19	2043	33,318	1,179,279	66,637	2,358,558	$18,119,389	$9,324,814	$679,040	$407,424	$271,616	$0 $5,222,298	$14,547,112	$12	$111,947	$630,426	$742,372	$4,142,022	$328,569	$10	$9,424,734	$380,556	$11	$7,130,138
20	20	2044	33,722	1,213,001	67,444	2,426,002	$18,603,177	$9,747,228	$697,170	$418,302	$278,868	$0 $5,458,868	$15,206,096	$13	$111,947	$658,984	$770,931	$4,030,076	$328,569	$10	$10,180,243	$385,163	$11	$7,838,296
21	21	2045	34,133	1,247,134	68,266	2,494,268	$19,099,882	$10,188,778	$715,785	$429,471	$286,314	$0 $5,706,154	$15,894,932	$13	$111,947	$688,836	$800,783	$3,918,129	$328,569	$10	$10,969,977	$389,856	$11	$8,583,227
22	22	2046	34,552	1,281,685	69,103	2,563,371	$19,609,849	$10,650,329	$734,896	$440,938	$293,959	$0 $5,964,643	$16,614,972	$13	$111,947	$720,040	$831,987	$3,806,182	$328,569	$10	$11,795,487	$394,639	$11	$9,366,687
23	23	2047	34,978	1,316,664	69,956	2,633,327	$20,133,431	$11,132,789	$754,518	$452,711	$301,807	$0 $6,234,842	$17,367,631	$13	$111,947	$752,658	$864,605	$3,694,236	$328,569	$9	$12,658,391	$399,513	$11	$10,190,510
24	24	2048	35,413	1,352,077	70,826	2,704,153	$20,670,994	$11,637,105	$774,664	$464,798	$309,865	$0 $6,517,280	$18,154,384	$13	$111,947	$786,754	$898,700	$3,582,289	$328,569	$9	$13,560,385	$404,479	$11	$11,056,619
25	25	2049	35,856	1,387,933	71,712	2,775,866	$21,222,910	$12,164,265	$795,347	$477,208	$318,139	$0 $6,812,513	$18,976,778	$14	$111,947	$822,394	$934,340	$3,470,343	$328,569	$9	$14,503,240	$409,540	$11	$11,967,025
26	26	2050	36,308	1,424,241	72,616	2,848,481	$21,789,561	$12,715,307	$816,583	$489,950	$326,633	$0 $7,121,119	$19,836,426	$14	$111,947	$859,648	$971,595	$3,358,396	$328,569	$9	$15,488,806	$414,699	$11	$12,923,830
27	27	2051	36,768	1,461,009	73,536	2,922,017	$22,371,343	$13,291,310	$838,386	$503,031	$335,354	$0 $7,443,706	$20,735,016	$14	$111,947	$898,590	$1,010,537	$3,246,450	$328,569	$9	$16,519,018	$419,956	$11	$13,929,235
28	28	2052	37,237	1,498,246	74,475	2,996,492	$22,968,657	$13,893,406	$860,771	$516,462	$344,308	$0 $7,780,906	$21,674,312	$14	$111,947	$939,296	$1,051,243	$3,134,503	$328,569	$9	$17,595,898	$425,315	$11	$14,985,545
29	29	2053	37,716	1,535,961	75,431	3,071,923	$23,581,921	$14,522,778	$883,753	$530,252	$353,501	$0 $8,133,381	$22,656,159	$15	$111,947	$981,846	$1,093,793	$3,022,557	$328,569	$9	$18,721,562	$430,778	$11	$16,095,168
30	30	2054	38,203	1,574,164	76,406	3,148,329	$24,211,558	$15,180,659	$907,349	$544,410	$362,940	$0 $8,501,823	$23,682,483	$15	$111,947	$1,026,324	$1,138,271	$2,910,610	$328,569	$9	$19,898,217	$436,346	$11	$17,260,625
31	31	2055	38,700	1,612,865	77,400	3,225,729	$24,858,007	$15,868,343	$931,576	$558,945	$372,630	$0 $8,886,956	$24,755,299	$15	$111,947	$1,072,816	$1,184,763	$2,798,664	$328,569	$8	$21,128,176	$442,023	$11	$18,484,554
32	32	2056	39,207	1,652,071	78,414	3,304,143	$25,521,715	$16,587,179	$956,449	$573,869	$382,579	$0 $9,289,535	$25,876,714	$16	$111,947	$1,121,415	$1,233,362	$2,686,717	$328,569	$8	$22,413,851	$447,811	$11	$19,769,716
33	33	2057	39,723	1,691,795	79,447	3,383,590	$26,203,145	$17,338,578	$981,986	$589,192	$392,794	$0 $9,710,351	$27,048,929	$16	$111,947	$1,172,215	$1,284,162	$2,574,771	$328,569	$8	$23,757,768	$453,712	$11	$21,118,996
34	34	2058	40,250	1,732,045	80,501	3,464,090	$26,902,769	$18,124,016	$1,008,205	$604,923	$403,282	$0 $10,150,230	$28,274,246	$16	$111,947	$1,225,317	$1,337,263	$2,462,824	$328,569	$8	$25,162,564	$459,729	$11	$22,535,416
35	35	2059	40,787	1,772,833	81,575	3,545,665	$27,621,073	$18,945,034	$1,035,124	$621,074	$414,050	$0 $10,610,035	$29,555,069	$17	$111,947	$1,280,823	$1,392,770	$2,350,877	$328,569	$8	$26,630,997	$465,865	$11	$24,022,135
36	36	2060	41,335	1,814,168	82,671	3,628,336	$28,358,556	$19,803,244	$1,062,762	$637,657	$425,105	$0 $11,090,670	$30,893,914	$17	$111,947	$1,338,845	$1,450,791	$2,238,931	$328,569	$8	$28,165,950	$472,122	$11	$25,582,459
37	37	2061	41,894	1,856,062	83,788	3,712,124	$29,115,729	$20,700,331	$1,091,137	$654,682	$436,455	$0 $11,593,077	$32,293,408	$17	$111,947	$1,399,494	$1,511,441	$2,126,984	$328,569	$8	$29,770,437	$478,503	$11	$27,219,847
38	38	2062	42,464	1,898,526	84,927	3,797,051	$29,893,119	$21,638,056	$1,120,271	$672,163	$448,108	$0 $12,118,244	$33,756,300	$18	$111,947	$1,462,891	$1,574,838	$2,015,038	$328,569	$8	$31,447,607	$485,010	$11	$28,937,917
39	39	2063	43,045	1,941,570	86,090	3,883,141	$30,691,265	$22,618,260	$1,150,182	$690,109	$460,073	$0 $12,667,200	$35,285,460	$18	$111,947	$1,529,160	$1,641,107	$1,903,091	$328,569	$8	$33,200,752	$491,648	$11	$30,740,452
40	40	2064	43,638	1,985,208	87,275	3,970,416	$31,510,722	$23,642,867	$1,180,892	$708,535	$472,357	$0 $13,241,024	$36,883,891	$19	$111,947	$1,598,431	$1,710,378	$1,791,145	$328,569	$8	$35,033,315	$498,418	$11	$32,631,413
41	41	2065	44,242	2,029,450	88,484	4,058,901	$32,352,058	$24,713,889	$1,212,422	$727,453	$484,969	$0 $13,840,843	$38,554,732	$19	$111,947	$1,670,840	$1,782,787	$1,679,198	$328,569	$7	$36,948,894	$505,324	$11	$34,614,940
42	42	2066	44,859	2,074,309	89,718	4,148,619	$33,215,858	$25,833,428	$1,244,793	$746,876	$497,917	$0 $14,467,833	$40,301,261	$19	$111,947	$1,746,529	$1,858,476	$1,567,252	$328,569	$7	$38,951,248	$512,369	$11	$36,695,366
43	43	2067	45,488	2,119,798	90,977	4,239,595	$34,102,722	$27,003,682	$1,278,029	$766,818	$511,212	$0 $15,123,226	$42,126,908	$20	$111,947	$1,825,647	$1,937,594	$1,455,305	$328,569	$7	$41,044,308	$519,556	$11	$38,877,222
44	44	2068	46,130	2,165,928	92,261	4,331,856	$35,013,264	$28,226,949	$1,312,153	$787,292	$524,861	$0 $15,808,308	$44,035,257	$20	$111,947	$1,908,349	$2,020,295	$1,343,359	$328,569	$7	$43,232,185	$526,889	$11	$41,165,249
45	45	2069	46,785	2,212,713	93,571	4,425,426	$35,948,119	$29,505,630	$1,347,187	$808,312	$538,875	$0 $16,524,424	$46,030,054	$21	$111,947	$1,994,797	$2,106,744	$1,231,412	$328,569	$7	$45,519,172	$534,370	$11	$43,564,406
46	46	2070	47,454	2,260,167	94,907	4,520,334	$36,907,933	$30,842,235	$1,383,157	$829,894	$553,263	$0 $17,272,980	$48,115,216	$21	$111,947	$2,085,161	$2,197,108	$1,119,465	$328,569	$7	$47,909,759	$542,004	$11	$46,079,877

Appendix C: PS 3280 Landfill Liability Calculations

Landfill Data							Closure Costs		Post-Closure Costs						Liability and Expenses				Reserve Transfers (Equal Transfers)			Proposed Reserve Transfers & Tipping Fee Increases		
Liability Operating Year	Number of Years from Current Year	Year	Tonnes Landfilled Annually	Cumulative Tonnes	Airspace Consumed Annually	Cumulative Airspace (m3)	Inflated Closure Cost	Present Value Closure Cost	Inflated Post-Closure Cost (Year 1-10)	Inflated Post-Closure Cost (Year 11-20)	Inflated Post-Closure Cost (Year 20-25)	Present Value Post-Closure Cost		Present Value Liability	PV Liability Cost per Tonne in Place	Amortization on Asset	Accretion of Liability	Total Expense Recognized	Tangible Capital Asset Recognized	Equal Annual Reserve Payments	Impact on Tipping Fees (compared to 2026 rate)	Accumulative Reserve	Annual Transfers to Reserve	Proposed Annual Tipping Fee Increase (compared to 2026 rate)	Accumulative Reserve
47	47	2071	48,136	2,308,303	96,271	4,616,605	$37,893,375	$32,239,388	$1,420,087	$852,052	$568,035	$0	$18,055,446	$50,294,835	$22	$111,947	$2,179,619	$2,291,566	$1,007,519	$328,569	$7	$50,408,640	$549,794	$11	$48,717,089
48	48	2072	48,832	2,357,134	97,663	4,714,268	$38,905,128	$33,699,833	$1,458,004	$874,802	$583,202	$0	$18,873,358	$52,573,191	$22	$111,947	$2,278,356	$2,390,303	$895,572	$328,569	$7	$53,020,721	$557,743	$11	$51,481,716
49	49	2073	49,542	2,406,676	99,084	4,813,352	$39,943,895	$35,226,435	$1,496,933	$898,160	$598,773	$0	$19,728,321	$54,954,756	$23	$111,947	$2,381,566	$2,493,512	$783,626	$328,569	$7	$55,751,129	$565,855	$11	$54,379,692
50	50	2074	50,267	2,456,943	100,533	4,913,885	$41,010,397	$36,822,193	$1,536,901	$922,140	$614,760	$0	$20,622,014	$57,444,207	$23	$111,947	$2,489,450	$2,601,397	$671,679	$328,569	$7	$58,605,224	$574,134	$11	$57,417,227
51	51	2075	51,007	2,507,949	102,013	5,015,898	$42,105,375	$38,490,238	$1,577,936	$946,762	$631,174	$0	$21,556,191	$60,046,429	$24	$111,947	$2,602,223	$2,714,169	$559,733	$328,569	$6	$61,588,610	$582,585	$11	$60,600,812
52	52	2076	51,762	2,559,711	103,524	5,119,422	$43,229,588	$40,233,846	$1,620,067	$972,040	$648,027	$0	$22,532,687	$62,766,533	$25	$111,947	$2,720,103	$2,832,050	$447,786	$328,569	$6	$64,707,143	$591,210	$11	$63,937,239
53	53	2077	52,533	2,612,244	105,065	5,224,487	$44,383,818	$42,056,439	$1,663,323	$997,994	$665,329	$0	$23,553,418	$65,609,857	$25	$111,947	$2,843,324	$2,955,270	$335,840	$328,569	$6	$67,966,945	$600,015	$11	$67,433,611
54	54	2078	53,320	2,665,563	106,639	5,331,126	$45,568,866	$43,961,596	$1,707,733	$1,024,640	$683,093	$0	$24,620,387	$68,581,983	$26	$111,947	$2,972,127	$3,084,073	$223,893	$328,569	$6	$71,374,417	$609,003	$11	$71,097,357
55	55	2079	54,123	2,719,686	108,246	5,439,372	$46,785,555	$45,953,056	$1,753,330	$1,051,998	$701,332	$0	$25,735,691	$71,688,747	$26	$111,947	$3,106,764	$3,218,710	$111,947	$328,569	$6	**$74,936,247**	$618,180	$11	**$74,936,247**
56	**56**	**2080**	**54,943**	**2,774,629**	**109,886**	**5,549,259**	**$48,034,729**	**$48,034,729**	**$1,800,144**	**$1,080,086**	**$720,057**	**$26,901,518**	**$26,901,518**	**$74,936,247**	**$27**	**$111,947**	**$3,247,500**	**$3,359,447**	**$0**	**$0**	**$0**	**$0**		**$11**	
57	57	2081							$1,848,207	$1,108,924	$739,283	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
58	58	2082							$1,897,555	$1,138,533	$759,022	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
59	59	2083							$1,948,219	$1,168,932	$779,288	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
60	60	2084							$2,000,237	$1,200,142	$800,095	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
61	61	2085							$2,053,643	$1,232,186	$821,457	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
62	62	2086							$2,108,475	$1,265,085	$843,390	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
63	63	2087							$2,164,772	$1,298,863	$865,909	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
64	64	2088							$2,222,571	$1,333,543	$889,028	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
65	65	2089							$2,281,914	$1,369,148	$912,765	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
66	66	2090							$2,342,841	$1,405,704	$937,136	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
67	67	2091							$2,405,395	$1,443,237	$962,158	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
68	68	2092							$2,469,619	$1,481,771	$987,847	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
69	69	2093							$2,535,558	$1,521,335	$1,014,223	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
70	70	2094							$2,603,257	$1,561,954	$1,041,303	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
71	71	2095							$2,672,764	$1,603,658	$1,069,106	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
72	72	2096							$2,744,127	$1,646,476	$1,097,651	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
73	73	2097							$2,817,395	$1,690,437	$1,126,958	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
74	74	2098							$2,892,619	$1,735,572	$1,157,048	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
75	75	2099							$2,969,852	$1,781,911	$1,187,941	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
76	76	2100							$3,049,147	$1,829,488	$1,219,659	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
77	77	2101							$3,130,559	$1,878,336	$1,252,224	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
78	78	2102							$3,214,145	$1,928,487	$1,285,658	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
79	79	2103							$3,299,963	$1,979,978	$1,319,985	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
80	80	2104							$3,388,072	$2,032,843	$1,355,229	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
81	81	2105							$3,478,534	$2,087,120	$1,391,413	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
82	82	2106							$3,571,410	$2,142,846	$1,428,564	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
83	83	2107							$3,666,767	$2,200,060	$1,466,707	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
84	84	2108							$3,764,670	$2,258,802	$1,505,868	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
85	85	2109							$3,865,187	$2,319,112	$1,546,075	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
86	86	2110							$3,968,387	$2,381,032	$1,587,355	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
87	87	2111							$4,074,343	$2,444,606	$1,629,737	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
88	88	2112							$4,183,128	$2,509,877	$1,673,251	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
89	89	2113							$4,294,817	$2,576,890	$1,717,927	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
90	90	2114							$4,409,489	$2,645,693	$1,763,796	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	
91	91	2115							$4,527,222	$2,716,333	$1,810,889	$0	$0	$0		$0	$0	$0	$0	$0	$0	$0		$11	

With every community, we redefine what's possible.

Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

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