
# Municipal Service Delivery Improvement Program

## City of Winnipeg Levels of Service Costing Methodology

MNP Consulting Services

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# 1 Executive Summary

As part of the Province of Manitoba's Municipal Service Delivery Improvement Program (MSDIP), the City of Winnipeg's (COW) Public Works Department (PWD) engaged the support of MNP to support efforts to define and cost current levels of service (LOS) in alignment with Council-approved organizational goals and objectives for four services:

I. Roadway Snow Clearing and Ice Control (RSRIC)
II. Parks and Natural Areas
III. Urban Forestry
IV. Active Transportation

An 8-step transparent and repeatable methodology was developed, including individual costing models for each service under review. The first step in the process is to define current and proposed target levels of service, largely based on Council approved Strategies and Policy. By the end of the process an estimated marginal cost to achieve target levels of service is calculated using the fiscal year 2022 as the baseline. Multiple data sources were used to develop the models, as provided by PWD.

The review has identified numerous data gaps and limitations across all services, requiring many assumptions to be made. Of note are the limitations related to the reliability of data recorded in the COW's Time Keeping and Materials Management System (TKMMS), as not all divisions record labour and equipment time in the system, and the level of task and cost detail is insufficient for a proper activity-based costing exercise. For these reasons, the cost estimates in the report cannot be relied upon for budget decision-making without further assessment and changes to the way PWD tracks and records work activities.

Specific recommendations have been grouped into 3 main categories – general, data tracking and equipment tracking. Key recommendations to improve upon the reliability and validity of the service-costing models in the future include:

- Undertake an actual activity-based costing exercise by individual PWD activity and use the results calculated by this exercise for comparative purposes.
- Complete additional years of analysis to verify results and to identify and eliminate outliers.
- Review and update overhead cost allocation tables where required based on actual activities.
- Capture capital and recoveries transactions with additional detail in Peoplesoft to reduce manual analysis processes.
- Procure a more modern and GIS-integrated work management system and ensure that all staff are tracking their time and equipment appropriately.
- Ensure all Public Works divisions record equipment usage in TKMMS (or alternate work management system), so that the true full usage and cost can be calculated.

Collectively, the implementation of these recommendations will require dedicated FTEs (full-time equivalents) for these initiatives to be sustained long-term.

# 2 Introduction

As part of the Province of Manitoba's Municipal Service Delivery Improvement Program (MSDIP), the City of Winnipeg's (COW) Public Works Department (PWD) engaged the support of MNP to support efforts to define current levels of service (LOS) and performance measures in alignment with Council-approved organizational goals and objectives for four services:

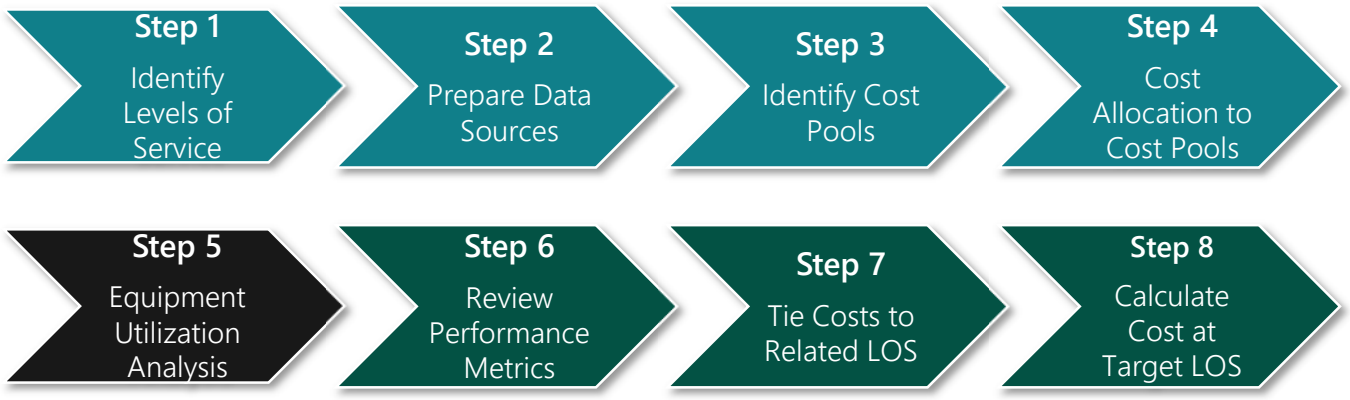
I. Roadway Snow Clearing and Ice Control (RSRIC)
II. Parks and Natural Areas
III. Urban Forestry
IV. Active Transportation

This document outlines the methodology used to develop cost models for PWD activities within each service, with the objective of defining the full cost of service delivery at current service levels and estimating the marginal cost to target service levels. The data collection methodologies and levels of service performance measures for comparable municipalities have been reviewed for best practices comparisons. Additionally, a lifecycle costing analysis has been completed for services related to underlying public assets, such as parks amenities.

# 3 Methodology

## 3.1 Steps to Complete the Costing Analysis

The costing process for each service follows the same general process:




Steps have been colour-coded to match the related analysis model (see Structure section 3.4).

I. **Identify Levels of Service:** This step specifies which levels of service will be evaluated from a costing perspective. Levels of service with a quantitative performance measure and sufficient data tracking only have been evaluated for the purposes of this exercise.

II. **Prepare Data Sources:** Each service has relevant data sources, as listed in section 3.3 – Data Sources. In this step, the relevant data sources are organized and relationships between the datasets are established.

III. **Identify Cost Pools:** Each cost model separates costs into distinct buckets known as cost pools for the primary tasks that can be attributed to the City's levels of service. A cost pool provides the total direct costs associated with any individual task prior to the allocation of shared costs.

IV. **Cost Allocation to Cost Pools:** Each cost model categorizes the costs within its respective cost centre(s) and allocates the costs to one of the identified cost pools. This results in a full cost by task, which will be distributed in the Levels of Service Analysis model.

V. **Equipment Utilization Analysis:** The Fleet Additions Analysis reviews the tracked equipment usage at the current level of accomplishment and estimates the additional equipment required for changes in levels of service. Specifically, the analysis identifies if a change to a level of service would push the utilization of related equipment over 100% and provides the additional equipment units required to meet new capacity requirements.

VI. **Review Performance Metrics:** The performance metrics review inputs the quantitative accomplishment data supplied by the relevant division into the cost models. In some cases, these accomplishments incur manual adjustments by service area to adjust for inconsistencies in the data tables.

VII. **Tie Lifecycle Costs to Related Levels of Service:** This step ties the cost pools to specific levels of service to determine the cost of delivering the underlying services at the current level of technical performance.

VIII. **Calculate Cost at Target LOS:** This step uses variable cost and step cost estimates to determine the increase or decrease in costs to deliver a service at the desired target level of service.

## 3.2 Period Reviewed

The cost models accompanying this report used actual results for fiscal 2022. The same methodology and cost model templates can be used to complete the cost analysis for other years, but the user may need to update cost drivers depending on the prevailing operating strategies and activities for each period.

## 3.3 Data Sources

Table 1 outlines the data sources used to develop the cost models for each of the services.

*Table 1: Data Sources Used for Cost Analysis*

| Data Source | Description |
|---|---|
| **Time Keeping & Materials Management System (TKMMS)** | Public Works Department's (PWD) in-house developed GIS enabled time and resource management system. It has the capability to record:<br>• Actual hours and costs incurred for labour and uploads them to PeopleSoft for payroll processing.<br>• Actual hours and costs incurred for hired equipment and upload them to PeopleSoft for AP processing.<br>• Actual hours and estimated costs incurred for City owned equipment.<br>• Actual quantity and estimated costs incurred for materials. |
| **General Ledger – Operating** | Accounting data for operating expenditures and recoveries from the Peoplesoft – Finance module. The cost models use a combination of summary trial balance exports and detailed transaction exports. |
| **Capital Costs** | Accounting data for capital costs. Capital costs are recorded separately from operating within Peoplesoft, where the type of work completed for each PO is recorded under capital accounts. |
| **Fleet Charges** | Data outlining the interdepartmental charges for the use of fleet assets from fleet management software. |

| | |
|---|---|
| **Performance & Inventory Data (by Service)** | **RSRIC:**<br>• Salt and Sand KM – A table identifying the number of accomplishment units by crew each day. This gives the total lane kilometres salt and sanded.<br>• Lane KM – An inventory list of lane KMs for streets, alleys, and sidewalks.<br>• Event Data – For each day of the snow clearing season, the following information is identified:<br>  o The amount it snowed that day, and if it falls into the 3cm+, 5 cm+ or 10 cm+ category.<br>  o If equipment was utilized, how many lane kilometres were clear, for what priority of street.<br>  o This information is combined to create a table identifying what days equipment was mobilized for a snow event.<br>• Contract data – Details from third party snow clearing contracts.<br>**Parks and Natural Areas:**<br>• Mowing Statistics – Hectares (ha) inventory requiring mowing, and ha mowed data for 2022 by service level.<br>• Amenity Inventory by Type – An inventory listing of all Parks amenities including sub-type or size. For example, the number of City playgrounds by size (tiny, small, medium, large)<br>**Urban Forestry:**<br>• Tree inventory – The City's open data tree inventory database, as of December 31, 2022.<br>• Trees planted – A transaction list of tree planting activities.<br>• Trees pruned – A transaction list of trees pruned.<br>• Trees removed – A transaction list of trees removed, with each activity specified as a Dutch Elm Disease (DED) removal or non-DED removal.<br>**Active Transportation:**<br>• Pathway Inventory by Type – List of the current inventory in kilometres (km) or lane-km for multiple active transportation pathway types.<br>• Maintenance and Repair Accomplishment Units – Tracked data for the quantity of pathway and sidewalk repairs completed. |
| **Categorization Lists** | With the help of department management, MNP added categorization lists for several datasets, including:<br>• Summarized Equipment by Type<br>• Service Task by Cost Driver<br>• Accounting Code by Cost Type (e.g., Fixed Cost, Variable Cost, Step)<br>• Equipment Capacities based on Historical Usage |

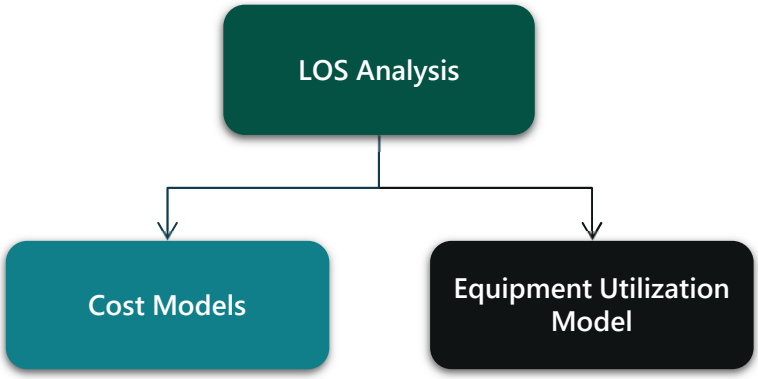
## 3.4 Analysis Model Structure

The methodology for costing levels of service required multiple models, as outlined in Figure 1. The same structure has been followed for each of the four reviewed services. Individual models include:

- **Cost Models** – Steps 1 to 4 in the process. One cost model is developed for each cost centre. These models allocate costs in the general ledger (GL) and capital costs to individual tasks completed by the department (cost pools).

- **Equipment Utilization Model** – Step 5 in the process. This model estimates the current utilization of equipment by the service division and provides weighted average cost rates for the Cost Models.
- **LOS Analysis** – Steps 6 to 8 in the process. This analysis summarizes the costs and equipment utilization from the underlying data and applies cost to the level of service technical measures.

*Figure 1: Cost Model Structure*




## 3.5 Cost Model Components

### 3.5.1 Variable, Fixed, and Step Costs

Costs have been categorized as variable, fixed, and step costs, defined as follows:

- **Variable Cost:** An expense that changes in proportion with a change in service level or output. Variable costs increase as a city's service output increases and decreases as service output decreases. For example, tree purchases from nurseries are a variable cost as purchases will increase as the number of trees planted increases.
- **Fixed Cost**: An expense that is constant regardless of a chosen service level or output. For example, the cost of manager salaries would be the same regardless of the number of trees planted in a year.
- **Step Cost**: An expense that is constant within a certain range of output but changes beyond that range to a new level. Step costs are typically treated as fixed costs while operating under a range where they are unchanged. Fleet costs are an example of step costs, as a city may not need to increase the size of its fleet to plant more trees, but at a certain level of trees planted the city must increase its fleet to create additional capacity for tree planting.

*Figure 2: Total Cost by Range of Output by Cost Type*

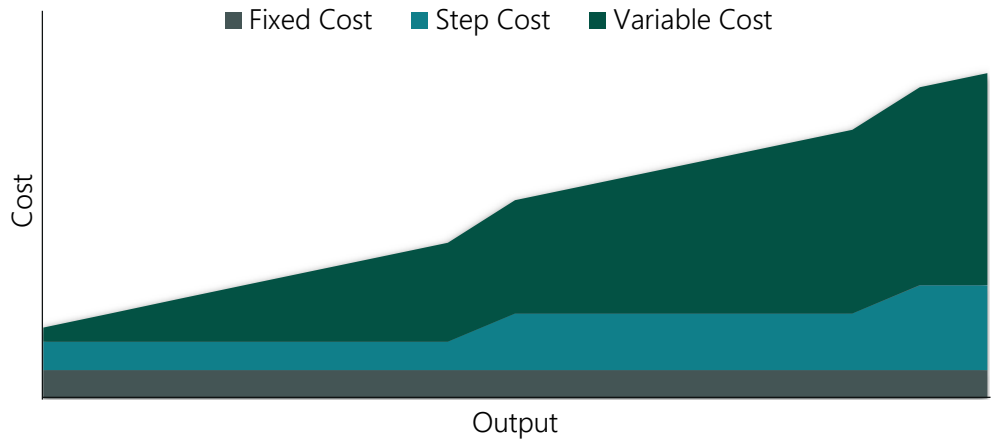



Figure 2 demonstrates the relationship between total cost and output, showing how each cost type typically increases as output increases.

The categorization of variable, fixed, and step costs is necessary to estimate the change in cost associated with a change to the City's levels of service. Minor changes to a level of service will most likely only incur marginal variable costs, whereas major changes to a level of service may require additional overhead capacity which could lead to a change in step costs.

Each cost model contains a listing of account codes for public works expense lines. Each account code has been categorized as variable, fixed, or step based on assumptions and discussions with management and finance staff. Step account codes, such as salaries and benefits, are further broken down into fixed and variable components based on an analysis of the underlying salary cost drivers and position activities.

### 3.5.2 Direct and Indirect Costs

Direct and indirect costs can be either variable, fixed, or step costs. Classifying costs as direct or indirect is a method of allocating costs to cost pools.

- Direct costs are expenses that have a clear tie to an activity. In a level of service context, direct costs can be attributed to a single primary activity (cost pool). For example, the cost to paid to a third-party contractor to prune trees would be a direct cost in the tree pruning cost pool.
- Indirect costs are support or shared activities that cannot be tied to any single activity. A cost driver must be identified to determine the appropriate allocation of indirect costs to each cost pool. For example, labour costs for contract administration cannot be directly attributed to planting, pruning, or removal tasks. Using contractor costs by activity as a cost driver to determine the allocation of these indirect labour costs may be appropriate if the share of contractor costs by task is proportional to the level of effort required to administer these contracts.

### 3.5.3 Capital Costs

Capital costs in the context of Winnipeg's municipal finances do not have the same accounting treatment as traditional capital costs. Rather, the municipal capital budget includes some operational expenses that have been budgeted under the City's "capital" programs. For example, the capital budget for the "Urban Forest

Enhancement" program includes additional funding for tree planting operations. These capital costs are not listed in the general ledgers of the operating cost centres, so transactions under capital accounts related to the cost pool activities have been separately identified by the Finance division and allocated appropriately.

### 3.5.4 Lifecycle Costing

Lifecycle costing is a method of estimating the total cost of owning and operating an asset over its useful life. Lifecycle costing accounts for the initial capital cost of acquiring the asset, the ongoing operating and maintenance costs, and any decommissioning costs or salvage value at the end of the asset's life. For this exercise, lifecycle costing has been used both in terms of City asset costs, such as installing a new playground or multi-use pathway, and in terms of service delivery, such as the financial impact of delivering a specified tree pruning cycle.

## 3.6 Equipment Utilization Model Components

The equipment utilization model has two primary objectives:

1) Determine an appropriate hourly cost for using equipment from each equipment category; and
2) Determine the equipment capacity usage and available capacity.

Estimates for these objectives have been created by reconciling equipment time tracking data with equipment charges from the Winnipeg Fleet Management Agency (WFMA).

### 3.6.1 Equipment Categories

The analysis categorizes all equipment by type. Classifying each equipment usage time entry by equipment type is necessary to calculate the weighted average hourly cost for each equipment type when reconciled with Fleet charges.

### 3.6.2 Equipment Capacity Assumptions and Estimates

Based on discussions with management, equipment capacity is assumed to be influenced by the following factors:

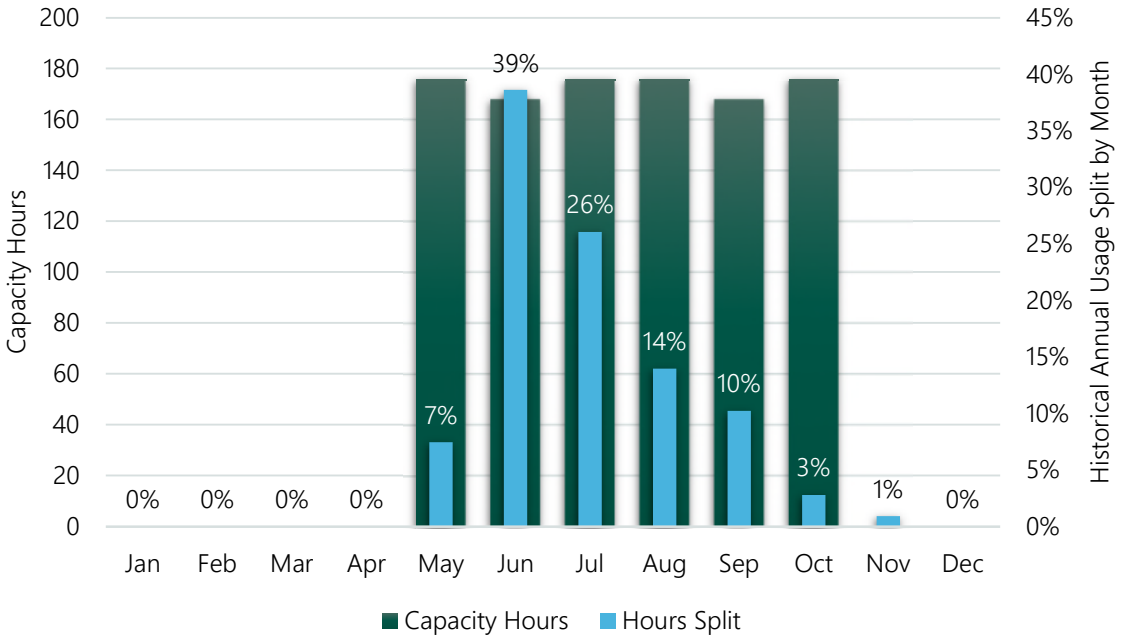
1. *Downtime for repairs and maintenance* - This factor can vary significantly based on the availability of parts for the repair of specialized equipment. For the purposes of this analysis, a base downtime rate of 20% of gross capacity has been used for repairs and maintenance.
2. *Crew availability* - True equipment capacity is calculated regardless of the availability of labour to operate the equipment. However, management has found a typical working year to be approximately 230 days, which is used as the basis for gross capacity in this analysis.
3. *Seasonality* – Not all equipment is used year-round. The analysis assumes equipment has available capacity on a monthly basis.
4. *Variability in technical levels of service* – Equipment may have downtime during historically high-capacity months due to environmental factors. For example, snow clearing equipment will sit idle during periods of low snowfall, or mowers may not need to mow grass 8 hours a day during dry months when grass is not growing as fast. This variability should be factored into decisions when reviewing equipment

utilization results, but for the purposes of this analysis no reduction in available capacity has been considered for this factor.

Estimates for maximum annual capacity for each equipment category have been determined based on average historical usage from 2018-2022, with considerations for the monthly seasonality of each category. Daily capacity for all equipment is assumed to be 8 hours, except where historical data indicates otherwise (e.g. equipment used for 12-hour shifts or day and night shifts).

For example, between 2018 to 2022 the "Trailer Stump Grinder" equipment was only used between May to October, with peak usage in June (see Figure 3 - 39% of all hours from 2018 to 2022 occurred in June), From these results it is assumed the stump grinder is required for 6 months of the year, giving each stump grinder an estimated annual capacity of 1,040 hours [(52 weeks / 12 months) x 6 months actual usage x 40 hours per week).

*Figure 3: Trailer Stump Grinder Capacity Estimate*




## 3.6.3 Equipment Usage Time Tracking

TKMMS time tracking data is used to determine the number of hours each individual piece of equipment was utilized annually. Several considerations are necessary:

1) The data export must include data for all Public Works divisions. Some equipment is shared between divisions and exporting data for any single division may not yield the full hours utilization for any individual piece of equipment.

2) TKMMS data includes pre-set hourly cost rates for equipment, but these rates were not used as they have not been updated to the current actual cost of using the underlying equipment.

### 3.6.4 Charges from the Winnipeg Fleet Management Agency

"Fleet" charges each City division for usage of fleet equipment. This data includes unit numbers which can be matched to TKMMS time tracking data.

Ideally, the total fleet charges for each equipment category could be divided by the total hours recorded in TKMMS for that category to determine the actual hourly cost incurred for each equipment type. However, due to limitations in the TKMMS data (see section 3.8), this practice may not yield a reliable cost result for every equipment category. In absence of better equipment usage tracking data, this analysis has relied on the fleet cost divided by TKMMS hours methodology to calculate the average hourly equipment cost.

### 3.6.5 Equipment Utilization Conclusion

The equipment utilization model has been developed for PWD to attempt to calculate actual equipment usage, with the objective of developing a quantitative result that could be used to determine the amount of new equipment needed for an adjustment to a technical level of service. However, due to limitations in equipment usage data (see General Gaps and Limitations section) and the high-level nature of capacity estimates, no utilization result could be reliably estimated in this analysis. This analysis provides some examples where equipment utilization is clearly near capacity, but otherwise does not provide estimates for the number of additional equipment units required to meet technical measures. It is recommended that PWD continue making improvements to the underlying data, and consider tracking available capacity for each equipment category, then develop reliable equipment utilization statistics.

## 3.7 General Assumptions

A variety of assumptions were made throughout the costing exercise that were applicable to the cost analysis for all services:

- GL account codes have been categorized as fixed, variable, or step cost based on confirmed and/or assumed activities within each code.
- Costs are based on 2022-dollar values. No inflationary adjustments or discounting of future costs have been included.
- Equipment hours for the Traffic Management and Bridge Operations branches are not recorded in TKMMS, thus for the purposes of this analysis, it is assumed these branches have not shared equipment with the reviewed services.
- Where variances between labour time recorded in TKMMS and total labour cost in the general ledger exist, the variance is assumed to be equal to the fixed cost of salaries and benefits for support wages.
- Standard gross equipment capacity is 2,080 hours per year (8 hours per day), unless the equipment is seasonal-use only, confirmed through historical usage data. Capacity for snow clearing equipment varies between 12 hours to 24 hours per day during the winter months.
- An estimate of 31.5% downtime has been used in equipment capacity calculations where applicable. This assumes equipment is unavailable for 20% of gross capacity hours due to repairs and maintenance and 11.5% due to crew unavailability.

- The amount of labour and equipment time required per unit of service at the target level of service is equal to the amount used to achieve the current level of service, i.e., there is no consideration for economies of scale.
- It is assumed that there is a linear relationship between variable cost per unit at the current performance level and the variable cost per unit at the target level of service.
- Gaps in meeting existing targets are assumed to be fillable through hiring additional third-party contractors and/or increasing City crew capacity. That is, it is assumed that additional third-party services may be obtained at the same rate where increased levels of service are required.
- When additional third-party services are acquired, it is assumed there will be an increased cost for PWD staff and equipment required for contractor supervision. Additional PWD staff are assumed to have a linear
- The cost models assume the primary reason targets are not currently met is due to financial constraints, and that by increasing the amount of funding the targets can be met.
- The models mostly ignore the interconnectedness of targets. For example, if the City increases tree inventory by an additional 51,000 trees and achieves its target canopy cover, the cost of delivering related levels of service must be recalculated, including allocating additional resources to pruning to maintain the target pruning cycles level of service for a larger tree inventory.
- Although there is a fixed cost component to most expense categories, actual fixed costs may increase on a step cost basis. For example, increasing the number of accomplishment units in any service may not require additional equipment, but it may require additional administrative staff to assist with third party contract administration with the potential for fixed cost economies of scale as the service activities increase.
- Not all technical measures in the PWD's levels of service have been included in the costing analysis due to a lack of existing technical performance data (e.g., "number of species that represent < 10% of street and park trees"), or due to additional data from other divisions not reviewed (e.g. "% of 311 calls responded to within Service Level Agreement").

## 3.8 General Gaps and Limitations

Identified gaps and limitations applicable to the analysis for all services are listed below.

- The COVID-19 pandemic had a significant impact on levels of service and costs during the period reviewed due to several factors including staff absenteeism and equipment downtime, exacerbated by lack of availability of parts. No adjusting assumptions have been made for these factors as it does not change the methodology used, but it must be noted for future years that results may vary as PWD returns to more "normal" operations.
- The size of datasets, the number of manual cost allocations, and the pairings of annual performance measures to costs make it difficult to complete multiple years of analysis simultaneously. Therefore, only 2022 was analyzed.
- There is an overall limitation with the reliability of TKMMS data due to several factors:

- Hourly cost rates for equipment are outdated and do not accurately reflect the cost being charged by Fleet.
- Not all divisions record equipment time in TKMMS, such as Transportation and Engineering. Additionally, there are branches and staff within other PWD divisions that do not have equipment time recorded in TKMMS that may be supporting the services being evaluated in this review. This limits the ability to determine full equipment utilization, as some equipment may be shared between different divisions and a full assessment of equipment hours cannot be performed.
- Not all staff record labour time in TKMMS. Salaried management and support staff do not record their time to specific tasks. This reduces the accuracy of allocating labour to certain services.
- Equipment being used by an individual for a task may not always be entered into TKMMS.
- Task descriptions in TKMMS are not necessarily specific to a level of service. The allocation of tasks to cost pools required making assumptions about the nature of work completed for each task. Costs for some tasks had to be further portioned on a best estimate basis using inventory and performance metrics.

- Costs identified as fixed costs may increase on a step cost basis. For example, if the number of trees pruned within the Urban Forestry branch is increased. This may not require additional equipment, but it may require additional administrative staff to assist with contract administration and city crew planning at multiple levels of trees pruned per year, with the potential for fixed cost economies of scale as the service activities increase.
- The equipment utilization analysis did not account for surge or on-demand usage of certain assets. For example, the City has 18 large skid steer snow blowers with an assumed 1,780 hours of capacity each during the winter months for a total capacity of 32,040 hours. These machines were only used for 20,667 hours in 2022, for total capacity utilization of 64.5%. Viewing this result in isolation could imply that the City has too many snow blowers, but on snow clearing days it is common that all 18 machines will be in use and additional machines would be needed to complete snow clearing within the target level of service timeline.
- Initial iterations of the cost models attempted to separate the variable cost of third-party (contractor) activities and city crew activities, but too many assumptions were required to determine which city expenses were driven by contractor activities and the results were unreliable. For example, determining if an hour of truck time used for Forestry Technical Services related to supporting contractor or city crew work.
- The assumption that targets are not currently met is due to financial constraints may not be valid in an operational setting, as the services could obtain additional funding but may still not be able to meet the required demand for staffing and equipment resourcing due to market supply. Challenges in meeting targets is multi-faceted and may include staffing availability, equipment availability, parts availability for repairs, private industry delivery capacity, and other environmental factors.

Gaps and limitations specific to the individual services are listed in the individual service sections.

## 3.9 Comparative Analysis

Winnipeg's levels of service were compared with Regina and Edmonton as comparative western prairie municipalities. Interviews were secured with management from Regina and Edmonton that focused on key components of the levels of service performance tracking and costing exercise, including data analytics tools and methods, operational processes, and performance metrics.

These cities were selected due to general similarities in size and public works requirements, but it should be noted that each city has its own unique challenges related to service delivery and data collection. Environmental factors, such as tree composition, will contribute to differences in performance targets and cost results.

### 3.9.1 Data Collection and Analysis

**Edmonton**

- Uses SAP Enterprise Resource Planning (ERP) software for data management across all departments, including finance, operations, and asset management.
- Some staff report time through SAP's time tracking system, while in-scope (unionized) staff do not track time and instead have their time billed to their relevant department.
- GPS installed on all fleet, including mowers. GPS tracking of mowing progress is not yet automated, but the Edmonton's Open Space Division is reviewing and testing automated capabilities.

**Regina**

- Employs multiple software solutions, including Oracle for financial needs, ArcGIS for geographic needs and asset tracking, and an in-house telematics system that draws information from the other platforms for fleet management.
- Time tracking has been automated. Service staff don't report anything on a timecard as all operational activities are tracked through the GIS system.
- The telematics systems records all operational actions for each piece of Regina's equipment, including time and location of use, engine performance, fuel usage, and other relevant data. When a truck activates its power take off, the system's timer starts and data tracking begins. Management and data analysts can tell which units conducted which work, for example which trucks pruned which trees during a shift.
- Allied with Bloomberg as part of a 22-city data alliance project focusing on advanced uses of data in local governments. Regina conducted a capacity building exercise with Bloomberg which further resulted in both cost and performance efficiencies for its operations.

### 3.9.2 Performance Tracking

**Edmonton**

- **Snow Clearing**: Council voted for a 45% service level improvement to road clearing and a 65% service level improvement to active pathway clearing in 2022[1]. However, only 20% of the proposed $42 million requirement to fund these improvements was approved in the 2023-2026 budget.
- **Parks**: Edmonton is currently developing its Sports Field Strategy to ensure equal access to amenities for the public, with plans to have "15-minute districts" where each district will have a larger recreation centre and transit centre. Edmonton's cost per hectare of maintained and natural parkland in 2019 was $4,033.[2] More recent figures have not yet been made public.
- **Mowing**: Edmonton mowing standards include varying the frequency based on park or field type, ranging from once per week for Premier Sports Fields, 7-10 days for high profile parks, and 10-14 days for standard parks and open spaces. Undeveloped areas are mowed every 5 to 6 weeks.
- **Urban Forestry**: Edmonton foresters calculated the current average cost per tree planted at $1,588 (average cost between internal and external contractors). This cost is a caliper tree and is inclusive of on-street construction and maintenance (OSCAM) costs, staff time, equipment costs, hydrovac expense as applicable, 3-years of watering for establishment, and a 20% overhead allocation. Edmonton calculated its average cost of a tree removal at $226, which includes 20% overhead allocation. Costs per tree pruned were not provided by Edmonton's Foresters.
- **Active Transportation**: Edmonton is actively retooling its priority bike network, emphasizing a comprehensive ring-road approach. Collaborations with Safe Mobility indicate a data-driven approach to tailoring pathways based on ridership numbers, aligning with the city's commitment to fostering active transportation. Edmonton has a dedicated active pathways team separate from its roadways team. Edmonton's calculated cost to maintain 1,000 square metres of Priority 1 Cycle Path (cleared to bare pavement within 24 hrs) is $16,490 per year. The cost to clear the same amount of pathway to P2 standard (safe passable distance within 3 days) is $1,860.

**Regina**

- **Snow Removal:** To help ensure long-term success, the goals are continually reviewed throughout the year. Any deviations from the set goals are thoroughly analyzed and reported on. This is typically done by reviewing the number of service requests, telematics data and any other data sources relevant to the specific service level.
- **Urban Forestry**: A strategic fleet transition in July 2023 redesigned and reduced the size of fleet. Fleet now targets equipment up time of 85%, at one point during the pandemic this metric was near 40%. The telematics system guides crews for watering new trees. Prior to implementing the system, watering costs were $18 per tree. Using performance management with the telematics system, Regina dropped its watering costs to $10.23 per tree, while increasing litres watered and meeting its target level of service.

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[1] City of Edmonton Parks and Road Services, Snow and Ice Control Options to Enhance Service Standards, May 9, 2022. https://pub-edmonton.escribemeetings.com/filestream.ashx?DocumentId=142547

[2] City of Edmonton Office of the City Auditor, City Productivity and Performance Audit, November 5, 2020. https://www.edmonton.ca/public-files/assets/document?path=20466_City_Productivity_and_Performance_Audit_Part_2.pdf

During the pandemic, Regina transitioned to a 7-day per week pruning schedule for its lift trucks to ensure they stay operational during the busy months. Efficiency has improved, achieving a 10-year cyclical pruning result, but operating on a 7-day weekly schedule in the summer has been difficult on team morale.

- **Active Transportation**: The telematics system is also used for pathway snow removal. After each snow event, the pathway map turns red and individual pathways turn green as snow is cleared. Regina's target is to have all pathways cleared within 72 hours of a sufficient snow event.

# 4 Roadway Snow Removal and Ice Control Levels of Service

Table 2 outlines the technical measures reviewed and costed for the RSRIC service:

*Table 2: Reviewed RSRIC Levels of Service Technical Measures*

| Technical Measures | 2022 Technical Performance | Target Technical Standard |
|---|---|---|
| Average % of P1 streets plowed within 36 hours of a 3cm+ snow event | 92.09% | 100.00% |
| Average % of P2 streets plowed within 36 hours of a 5+ cm snow event | 100% | 100% |
| Average % of P3 streets plowed within 5 working days of a 10+ cm snow event | 81.75% | 100.00% |
| Average % of alleys plowed within 5 working days of a 5+ cm snow event | 88.64% | 100.00% |
| Average # of hours used to complete P1 & P2 sidewalks & pathways plow | 89.7 | 36.0 |
| Average # of hours used to complete P3 sidewalks & pathways plow | 130.0 | 120.0 |

## 4.1 Assumptions

Assumptions guiding the RSRIC levels of service costing include:

- Snow clearing crews are assumed to work 12-hour day shifts and 12-hour night shifts after a snow event.
- Third party contractors are assumed to complete their assigned snow clearing zones within contract targets. Only zones that City crews are responsible for have been included in the costing analysis.
- Marginal annual cost estimates are calculated by multiplying the per snow clearing event cost by the number of relevant events in a year. Mobilizations are defined as the number of times snow clearing crews were put into action for each street type. The number of mobilizations in the 2022 calendar year was as follows:
    - P1 Streets – 16
    - P2 Streets – 14
    - P3 Streets – 4
    - Alleys – 9
- Sidewalk clearing costs are assumed to be split proportionally based on the percentage of sidewalk lane-km inventory that city crews are responsible for clearing:
    - P1 Sidewalks: 483.1 lane-km – 23.0% of sidewalk inventory

- P2 Sidewalks: 669.7 lane-km – 31.8% of sidewalk inventory
- P3 Sidewalks: 951.5 lane-km – 45.2% of sidewalk inventory

- Both sidewalk completion targets can be combined for marginal costing purposes since the target to complete P1 and P2 sidewalks (36 hours) provides sufficient time afterwards to complete P3 sidewalks (120 hours). It is assumed the estimated percentage increase in fleet size can be used to estimate the total marginal cost for both targets.

## 4.2 Cost Pools

The RSRIC cost models use the following cost pools based on the underlying operational tasks completed by the department:

*Table 3: RSRIC Cost Pools*

| Cost Pool | Description |
|---|---|
| **P1 Streets** | Costs associated with plowing and snow removal activities on priority 1 streets |
| **P2 Streets** | Costs associated with plowing and snow removal activities on priority 2 streets |
| **P3 Streets** | Costs associated with plowing and snow removal activities on priority 3 streets |
| **Alleys** | Costs associated with plowing and snow removal activities on alleys |
| **Salt/Sand** | Costs associated with salting and sanding the streets |
| **P1 Sidewalks** | Costs associated with snow removal activities on priority 1 sidewalks |
| **P2 Sidewalks** | Costs associated with snow removal activities on priority 1 sidewalks |
| **P3 Sidewalks** | Costs associated with snow removal activities on priority 1 sidewalks |
| **Salt/Sand Sidewalks** | Costs associated with salting and sanding the sidewalks |
| **Other Activities** | Costs not associated with any of the technical level of service cost pools. For example, snow disposal site operations, curb repairs, thawing of culverts. |

Any costs that did not fall into the above categories were assigned a cost pool of "Other Activities". It is noted that costs of snow dump site operations and curb repair are a direct result of providing the reviewed services, but there is no identified way to allocate those costs to the reviewed levels of service in this analysis as noted in the Gaps and Limitations section.

## 4.3 Fleet Usage Analysis

### 4.3.1 Street Clearing Fleet

RSRIC related equipment is unique in that it is mainly used for snow clearing after a snow event, and otherwise sits idle. Crews work 12-hour day and night shifts for 24-hour road clearing until all snow is cleared. Thus, analyzing overall capacity does not reflect actual requirements, as equipment is only needed during short

windows. For example, a wheel loader may have total seasonal capacity of 2,600 hours, but if there are only 6 snow events requiring clearing in a year, 100% utilization would be 216 hours (6 events x 36-hour level of service target). Determining if additional equipment is needed requires an analysis of an individual snow event, as well as the amount of additional work that will be conducted by city crews or contracted to third-parties.

An analysis of a snow event between January 17 and 18, 2022 was completed to develop an understanding of the equipment hours required to clear streets after a single snow event. Approximately 11.6cm of snow fell between January 17 and 18, and crews were mobilized starting with P1 streets on January 18 (Table 4). This event met the target levels of service for P1 (completed under 36 hours), P3 (completed within 5 working days), and alleys (completed within 5 working days). However, crews were still conducting P2 street clearing outside the 36-hour target, and the City recorded 87% of P1 sidewalks, 7% of P2 sidewalks cleared, and no P3 sidewalks cleared during the 5-day timeframe from Jan 18th – 22nd.

*Table 4: Snow Clearing Equipment Hours by Date*

| Date | P1 Street Clearing | P2 Street Clearing | P3 Street Clearing | Alley Clearing | Sidewalk Clearing |
|---|---|---|---|---|---|
| 18/01/2022 | 1,916.0 | 247.0 | - | 18.0 | 458.0 |
| 19/01/2022 | - | 2,556.5 | - | 396.0 | 499.0 |
| 20/01/2022 | - | 1,601.0 | 1,795.0 | 280.0 | 639.0 |
| 21/01/2022 | 534.5* | - | 4,942.5 | 14.0 | 515.0 |
| 22/01/2022 | - | - | 6,754.5 | 62.0 | 679.0 |

**Unrelated to January 18 snowfall. An additional 4.8cm of snow fell on January 21 and P1 clearing crews were mobilized.*

Analyzing the equipment types used for P1 and P2 street clearing provides insight as to why the P2 target was not met. P1 street clearing on Jan 18th recorded 870 hours of Wheel Loader (100-135 HP) use. These wheel loaders are also the main equipment used for P2 street clearing (1,838 hours recorded between Jan 18-20th). There was insufficient Wheel Loader capacity for city crews to clear both P1 and P2 streets within the 36-hour timeframe. The main equipment used for snow clearing P2 streets on Jan 20th included:

- Wheel Loaders - 628.5 hours – Assuming the full fleet of wheel loaders was in use, an additional 26 wheel loaders with crew would be needed to push this snow clearing time into the first 36 hours.
- Motor graders – 867 hours – No motor grader time was recorded on Jan 18th, as city crews were driving wheel loaders to clear P1 streets and then some crews switched to motor graders for P2 on Jan 19th and 20th.

At an estimated cost of approximately $125,000 per loader, an additional 26 loaders would require a capital budget of $3.25 million.

The primary conclusion from examining this lone event would be that the PWD required additional crew and fleet vehicles to meet the timeliness targets for both P1 and P2 streets. An additional 125 crew members working 12-hour shifts would have been needed to push the 1,495 hours worked on P2 streets on Jan 20th to an earlier date. Alternatively, the City could contract additional P2 streets to third-parties or extend the timeliness target

for P2 streets similar to other cities, such as Edmonton, which aims to clear snow on P2 streets within 3 days following the end of snowfall.

### 4.3.2 Sidewalk Clearing Fleet

For sidewalks, a complete clearing of all P1, P2, and P3 sidewalks was reported by the City between Jan 8th to 16th, 2022. This clearing required 4,037 hours of equipment time, mainly from the following equipment:

- IND Tractor Sidewalk – 1,514 hours
- Snow Blower Skid Steer – 807 hours
- Trackless Tractors – 544 hours

Table 5 provides the estimated equipment hours required for 100% sidewalk snow clearing completion by priority level. For the combined P1 and P2 LOS, 2,211 equipment hours are needed. These hours must be done within the first 36 hours to meet the LOS.

*Table 5: Equipment Hours Estimate by Sidewalk Priority for 100% Completion*

| Sidewalk Priority | Inventory (lane km) | Completion Hours Estimate per City | Weighted Cost Share | Weighted Equipment Hours |
|---|---|---|---|---|
| **P1** | 483.5 | 67.8 | 23.0% | 927 |
| **P2** | 669.7 | 131.9 | 31.8% | 1,284 |
| **P3** | 951.6 | 188.1 | 45.2% | 1,825 |
| **Total** | **2,104.8** | | **100%** | **4,037** |

Equipment hours by equipment type required to complete sidewalk clearing are provided in Table 6. In 2022, the Ind Tractor Sidewalk equipment category achieved a maximum daily output of 429 hours. To completely clear P1 and P2 sidewalks in 36 hours the equipment must be operated for 829.51 hours at maximum output, which would require a total fleet size of 70 tractors (an increase of 34 vehicles). Repeating the same calculation results in an estimate of an additional 6 snow blower skid steers and 8 trackless tractors. The additional equipment will be sufficient to meet both the P1 and P2 target and the P3 target as the hours required for the P3 LOS target are less than the P1 and P2 target, and equipment can be re-allocated to P3 streets after the initial 36-hour target has been met. On a weighted basis, this results in a 72.7% increase in sidewalk clearing equipment needed to meet the target level of service.

*Table 6: Additional Sidewalk Clearing Fleet to Target Level of Service*

| Equipment Type | Maximum Daily Hours (2022) | Required Hours for P1 & P2 to Target | Required Hours for P3 to Target | Fleet Size (2022) | Additional Fleet Required to Target |
|---|---|---|---|---|---|
| **Ind Tractor Sidewalk** | 429 | 829.51 | 684.49 | 36 | 34 |
| **Snow Blower Skid Steer High Flow -Max 60"** | 338 | 442.15 | 364.85 | 18 | 6 |

| Equipment Type | Maximum Daily Hours (2022) | Required Hours for P1 & P2 to Target | Required Hours for P3 to Target | Fleet Size (2022) | Additional Fleet Required to Target |
|---|---|---|---|---|---|
| **Trackless Tractors Snow Blade Max 60", Min.75 H.P.** | 180 | 297.78 | 245.72 | 12 | 8 |

## 4.4 Snow Clearing Levels of Service

The Snow Clearing analysis summarizes performance and cost results related to the following levels of service:

- Average % of P1 streets plowed within 36 hours of a 3 cm+ snow event
- Average % of P2 streets plowed within 36 hours of a 5 cm+ snow event
- Average % of P3 streets plowed within 5 working days of a 10 cm+ snow event
- Average % of alleys plowed within 5 working days of a 5 cm+ snow event

It is assumed that cost per lane kilometre plowed is the main cost driver of these levels of service. The cost per lane kilometre plowed is summarized in Table 7. The total costs depend on the street type and priority, and range from $323 for an alley, to $1,290 for priority 3 streets. For each scenario, variable costs make up the majority of the total costs, while fixed costs made up 18 - 28% of the total costs.

*Table 7: Cost per Lane KM Plowed Calculation, 2022*

| Cost per Lane KM plowed | Total |
|---|---|
| **P1** | $668.43 |
| **P2** | $486.86 |
| **P3** | $1,253.09 |
| **Alleys** | $311.19 |

The method of calculating the marginal variable costs required for each of the four snow clearing metrics to achieve their target follows the same steps:

1. The variable cost per snow event is calculated by multiplying the variable cost to plow one lane kilometre by the lane kilometre inventory.
2. The required percent of performance improvement is found by calculating the change from the current performance level compared to the target performance level.
3. The marginal variable cost to target per event is calculated by multiplying the variable cost per event (1) by the performance improvement requirement (2). This gives the additional variable cost required to meet the target for one snow event.
4. The total marginal variable cost is found by multiplying the total number of equipment mobilizations in the year by the marginal variable cost (3).

### 4.4.1 Target P1 Lane Kilometres Plowed

In 2022, the target was to clear, on average, 100% of P1 streets withing 36 hours of a 3 cm or more snow event, and the city achieved an average of 92.1%. Based on these KPIs, RSRIC needed to clear an additional 8.59% of P1 streets to meet their target, resulting in a marginal variable cost of $1,188,270 (Table 8).

*Table 8: P1 Street Marginal Cost to Target*

| Measure | Value |
|---|---|
| Lane KM Inventory | 1,676 |
| **Variable cost per event** | $865,631 |
| **Performance improvement requirement** | 8.59% |
| **Marginal variable cost to target per event** | **$74,267** |
| Mobilizations | 16 |
| **Total marginal variable cost** | **$1,188,270** |

To calculate the marginal variable cost required to meet the target:

1. The variable cost to plow one P1 lane kilometre is $516, multiplied by the P1 lane kilometre inventory of 1,676 results in a variable cost per snow event of $865,631.
2. The performance improvement percent is calculated as 8.59%, which is the change from the target (100%) compared to the current performance (92.1%).
3. Multiplying the variable cost to plow one P1 lane kilometre by the required performance improvement percent results in a marginal variable cost to target per event of $74,267.
4. Finally, the total marginal variable cost is calculated by multiplying the equipment mobilizations (16) by the marginal variable cost of $74,267, resulting in a total marginal variable cost of $1,188,270.

### 4.4.2 Target P2 Lane Kilometres Plowed

In 2022, the target was to clear, on average, 100% of P2 streets withing 36 hours of a 5 cm or more snow event, and the City reportedly achieved their target.

### 4.4.3 Target P3 Lane Kilometres Plowed

In 2022, the target was to clear, on average, 100% of P3 streets withing five working days of a 10 cm or more snow event, and the city achieved an average of 81.8%. Based on these KPIs, RSRIC needed to clear an additional 22.32% of P3 streets to meet their target, resulting in a marginal variable cost of $3,381,370 (Table 9).

*Table 9: P3 Street Marginal Cost to Target*

| Measure | Value |
|---|---|
| Lane KM Inventory | 3,693 |

| Measure | Value |
|---|---|
| Variable cost per event | $3,786,671 |
| Performance improvement requirement | 22.32% |
| **Marginal variable cost to target per event** | **$845,342** |
| Mobilizations | 4 |
| **Total marginal variable cost** | **$3,381,370** |

### 4.4.4 Target Alley Lane Kilometres Plowed

In 2022, the target was to clear, on average, 100% of alley lanes within five working days of a 5 cm or more snow event, and the City achieved an average of 88.6%. Based on these KPIs, RSRIC needed to clear an additional 12.8% of alley lanes to meet their target, resulting in a marginal cost of $257,818 (Table 10).

*Table 10: Alley Marginal Cost to Target*

| Measure | Value |
|---|---|
| Lane KM Inventory | 934 |
| **Variable cost per event** | $223,523 |
| **Performance improvement requirement** | 12.82% |
| **Marginal variable cost to target per event** | **$28,646** |
| Mobilizations | 9 |
| **Total marginal variable cost** | **$257,818** |

## 4.5 Sidewalk Clearing Levels of Service

The Sidewalk Clearing analysis summarizes performance and cost results related to the following levels of service:

- Average # of hours used to complete P1 & P2 sidewalks & pathways plow.
- Average # of hours used to complete P3 sidewalks & pathways plow.

As noted in the assumptions, determining the marginal cost to achieve the target for both LOS can be determined by multiplying the estimated percentage increase in fleet size with the current cost of service delivery. Per section 4.3.2, an estimated weighted increase in fleet size of 72.7% is required to achieve both targets. The 72.7% increase in fleet size is assumed to be the cost driver for all additional costs needed to meet the sidewalk LOS targets as additional labour and overhead is required to operate these machines. The total

cost of sidewalk clearing service delivery in 2022 was $6.79 million, thus the marginal cost to target is $4.94 million (Table 11).

*Table 11: Marginal Cost to Target for Sidewalk Clearing Technical LOS*

| Activity Type | Total Units (lane-km) | Total Cost |
|---|---|---|
| P1 & P2 sidewalks & pathways plow | 1,153 | 5,038,271 |
| P3 sidewalks & pathways plow | 952 | 1,749,938 |
| **Total** | **2,104** | **$6,788,209** |
| Cost increase estimate to target | | 72.7% |
| **Marginal cost to target** | | **$4,936,879** |

## 4.6 Gaps and Limitations

Several gaps and limitations were identified that should be considered when using the RSRIC LOS cost analysis results for decision making purposes:

- Calendar year 2022 was an unusually high snow year. On average from 2018 to 2021, RSRIC cleared P1 streets 6 times per year, but in 2022 P1 streets were cleared 16 times. Resulting total costs for 2022 were high, but no adjusting assumptions have been made as it does not change the methodology used. However, the analysis in future years should be compared to 2022 to determine how levels of service and average costs may differ in an outlier year.
- The "Other Activities" cost pool has multiple activities that could be considered overhead and further allocated to individual technical levels of service but have not been allocated due to lack of a clear tie to individual technical measures. For example, costs associated with thawing of culverts and gutter inlets do not have a clear tie to snow clearing technical measures.
- Granular accomplishment units for work in Snow Contract Areas are not tracked. Data in TKMMS only provides a partial picture of performance since third parties do not provide time and equipment data.
- Sidewalk clearing activities completed by city crews are not tracked at the P1, P2, and P3 levels.
- The fleet analysis attempted to identify equipment capacity utilization, but current TKMMS tracking makes it difficult to determine the number of available fleet units after an event. For example, TKMMS data shows entries for 138 Loaders (100-135HP, 2.25-3 Cubic Yards) in 2022. The January 18, 2022, snow clearing event for P1 streets shows only 52 units in use. Closer inspection of the TKMMS data shows multiple units which could be double counted due to unit number errors and typos, such as recording a unit code as "4", "04", or "04.".
- No consideration has been given to potential operational efficiencies. There could be other operational improvements that improve the efficiency of existing clearing routes or reduce required equipment hours which would reduce the number of new vehicles required to meet targets.

- PWD's calculation for streets cleared within a certain timeframe could be left to interpretation. Analysis of the January 17-18, 2022, snow event shows that P2 street clearing was not completed within the 36-hour target, but performance tracking states the target was met for the year.

# 5 Parks & Natural Areas Levels of Service

Table 12 outlines the technical measures reviewed and costed for Parks and Natural Areas.

*Table 12: Parks & Natural Areas Reviewed Levels of Service Technical Measures*

| Technical Measures | 2022 Technical Performance | Target Technical Standard |
|---|---|---|
| People within 5-km distance of skatepark/spot (%) | 91% | 90% |
| People within 2-km distance of tennis or pickleball court (%) | 64% | 90% |
| Number of tennis/pickleball courts per 5,000 people | 0.9 | 1.0 |
| People within 0.6-km distance of basketball court (%) | 67% | 90% |
| Number of basketball courts per 2,000 people | 1.0 | 1.0 |
| People within 2-km distance of baseball or softball diamond (%) | 94% | 90% |
| Number of baseball/softball diamonds per 5,000 people | 1.7 | 1.0 |
| People within 2-km distance of rectangular athletic field (%) | 96% | 90% |
| Number of rectangular athletic fields per 5,000 people | 3.4 | 1.0 |
| People within 2-km distance of outdoor skating area (%) | 90% | 90% |
| People within 1.2-km distance of a multi-use greenspace (%) | 98% | 90% |
| Number of multi-use greenspaces per 2,000 people | 0.4 | 1.0 |
| People within 0.6-km walking distance of a playground (%) | 96% | 90% |
| Number of playgrounds per 1,000 people (incl. school-owned) | 1.0 | 1.0 |
| People within 2-km distance of a picnic or gathering space (%) | 83% | 90% |
| Number of picnic and gathering spaces per 2,500 people | 1.2 | 1.0 |
| Winnipeggers within walking distance of a natural feature (%) | 64% | 90% |
| Average weekly total of park and boulevard area mowed in season (hectares) | 653 | 850 |

## 5.1 Assumptions

- Amenity costs only include city-owned and operated amenities, for example basketball courts on school grounds are included in the current and target level of service but are excluded from the City's costs.

- The cost of basketball court and skatepark maintenance has been assumed to be the same as tennis court maintenance. There are currently no codes directly tracking basketball court or skatepark maintenance.
- Capital costs to add an amenity exclude consideration for land. It is assumed the City will place new amenities on existing City land inventory.
- The mowing technical measure for weekly total area mowed only counts the weeks from the first week when more than 100 hectares were mowed to the last week when more than 100 hectares were mowed. The "prep" weeks prior to full mowing operations, when training and equipment preparations record some minimal hectares mowed, are excluded from the technical measure.
- The mowing level of service only includes service levels A (regional parks), B (community and neighbourhood parks), and C (nature parks, linkages, boulevards). Mowing service levels NA (temp parks and other) and IPM (Integrated Pest Management) are excluded from the technical measure.
- The only difference between mowing service levels is the frequency of service. Mowing a hectare of service level A requires the same labour, equipment, and materials as a hectare in service level B.
- There are multiple cost pools used throughout the Parks and Natural Areas analysis which have not been used for cost allocation as they were deemed unrelated to the reviewed levels of service activities. These cost pools should be included in the overall cost of parks maintenance, but should not be included in the cost allocation to technical measures for amenities and mowing:
    - Boulevard maintenance costs
    - Parks snow clearing costs
    - Weed control costs
    - Public gardens and landscaping costs
    - Litter control costs
    - Spraying costs

## 5.2 Cost Pools

The Parks and Natural Areas cost models use the following cost pools based on the underlying operational tasks completed by the department:

*Table 13: Parks & Natural Areas Cost Pools*

| Cost Pool | Description |
|---|---|
| **Amenities - Athletic Fields** | Costs associated with the installation, maintenance, operations, and decommissioning of athletic fields. |
| **Amenities - Baseball/Softball** | Costs associated with the installation, maintenance, operations, and decommissioning of baseball and softball diamonds. |
| **Amenities - Natural Areas** | Costs associated with the naturalization and maintenance of natural areas and features. |

| Cost Pool | Description |
|---|---|
| **Amenities - Outdoor Skating** | Costs associated with the installation, maintenance, operations, and decommissioning of outdoor skating surfaces. |
| **Amenities – Pleasure Rinks** | Costs associated with the installation, maintenance, operations, and decommissioning of outdoor skating surfaces and hockey pens. |
| **Amenities – Skating Ponds** | Costs associated with the installation, maintenance, operations, and decommissioning of skating ponds. |
| **Amenities – Knockdown Rinks** | Costs associated with the installation, maintenance, operations, and decommissioning of knockdown skating rinks. |
| **Amenities - Picnic/Gathering Space** | Costs associated with the installation, maintenance, operations, and decommissioning of picnic and gathering spaces. |
| **Amenities - Playgrounds** | Costs associated with the installation, maintenance, operations, and decommissioning of playgrounds. |
| **Amenities - Tennis/Pickleball** | Costs associated with the installation, maintenance, operations, and decommissioning of tennis and pickleball courts. |
| **Mowing** | Costs associated with field and boulevard mowing. |
| **Shared Costs - Amenities** | Includes indirect costs related to park amenities, such as turf and fence repairs and supervision. Shared costs in this category are allocated across all amenity cost pools. |
| **Shared Costs - Parks** | Includes indirect costs for park planning and development activities and park pathway maintenance. Shared costs in this category are allocated across all cost pools. |
| **Amenities not included in Level of Service Calculations** | |
| **Amenities – Bowling Greens** | Costs associated with the installation, maintenance, operations, and decommissioning of bowling greens. Bowling green costs have not been included in the reviewed levels of service. |
| **Amenities - Other** | Costs association with other Parks amenities that have not been included in the City's current levels of service. |

## 5.3 Cost Allocation Summary

The cost allocation process for Parks and Natural Areas identified fixed and variable costs, but also classified costs into the following categories:

1. Costs for one-time installations or removals of parks amenities; or
2. Annual operating costs including repairs and maintenance.

Costs associated with installations and removals have been excluded from the levels of service cost analysis, as full cost estimates for new amenities were provided by the PWD.

The full operating cost of each service activity in 2022, after allocation of shared costs, is used as the basis for determining the lifecycle cost of each amenity in the following sections.

## 5.4 Amenity Lifecycle Costing

Lifecycle cost estimates for core Parks amenities are calculated in Table 14, and estimates for secondary and tertiary amenities are included in Table 15. The capital cost and disposal cost for each amenity have been provided by the PWD and are considered a full cost estimate (planning and engineering, construction, and labour cost included). The annual operating and maintenance cost for each amenity has been estimated from the total cost in the cost pools divided by the number of city amenities in each category in 2022. These lifecycle costs will be used to determine the total cost of adjusting the associated levels of service targets.

*Table 14: Core Amenity Lifecycle Cost Estimates*

| Core Amenity | Lifecycle (Years) | Capital Cost | Annual Operating & Maintenance Cost | Lifecycle Operating & Maintenance Cost | Demolition / Disposal Cost | Total Lifecycle Cost |
|---|---|---|---|---|---|---|
| **Playgrounds** | | | | | | |
| Small | 20 | $150,000 | $1,934 | $38,685 | $2,500 | $191,185 |
| Medium | 20 | $300,000 | $3,869 | $77,371 | $3,000 | $380,371 |
| Large | 20 | $500,000 | $6,448 | $128,951 | $4,000 | $632,951 |
| **Picnic/ Gathering Space** | | | | | | |
| BBQ Pit | 40 | $8,500 | $449 | $17,976 | $1,500 | $27,976 |
| Small Shelter | 40 | $150,000 | $7,931 | $317,222 | $2,500 | $469,722 |
| Medium Shelter | 40 | $200,000 | $10,574 | $422,963 | $5,000 | $627,963 |
| Large Shelter | 40 | $400,000 | $21,148 | $845,925 | $10,000 | $1,255,925 |
| Small Bike Stop | 20 | $50,000 | $2,644 | $52,870 | $2,500 | $105,370 |
| **Multi-use Greenspaces** | | | | | | |
| Small (0.2 ha to 0.4 ha) | 40 | $85,000 | $1,000 | $40,000 | $0 | $125,000 |
| Medium (0.4 ha to 0.8 ha) | 40 | $175,000 | $2,000 | $80,000 | $0 | $255,000 |
| Large (>0.8 ha) | 40 | $225,000 | $4,000 | $160,000 | $0 | $385,000 |

*Table 15: Secondary and Tertiary Amenity Lifecycle Cost Estimates*

| Core Amenity | Lifecycle (Years) | Capital Cost | Annual Operating & Maintenance Cost | Lifecycle Operating & Maintenance Cost | Demolition / Disposal Cost | Total Lifecycle Cost |
|---|---|---|---|---|---|---|
| **Tennis/Pickleball** | 20 | $100,000 | $2,279 | $45,577 | $10,000 | $155,577 |
| **Basketball** | 20 | $249,362 | $2,279 | $45,577 | $10,000 | $304,939 |
| **Baseball/Softball** | | | | | | |
| Adult | 40 | $300,000 | $2,927 | $117,069 | $5,000 | $422,069 |
| Youth / Mini | 40 | $200,000 | $1,951 | $78,046 | $5,000 | $283,046 |
| **Athletic Fields** | | | | | | |
| Sport Field-Mini | 40 | $100,000 | $2,930 | $117,214 | $1,500 | $218,714 |
| Sport Field-Full | 40 | $250,000 | $7,326 | $293,034 | $1,500 | $544,534 |
| Sport Field- ¾ / Other | 40 | $150,000 | $4,396 | $175,820 | $1,500 | $327,320 |
| Rugby-Full | 40 | $250,000 | $7,326 | $293,034 | $1,500 | $544,534 |
| Open Field-3/4 | 40 | $150,000 | $4,396 | $175,820 | $1,500 | $327,320 |
| **Outdoor Skating** | | | | | | |
| Hockey Pen | 40 | $250,000 | $3,752 | $150,067 | $10,000 | $410,067 |
| Pleasure Rink | 40 | $10,000 | $23,317 | $932,675 | $0 | $942,675 |
| Knockdown Rink | 40 | $100,000 | $29,124 | $1,164,964 | $0 | $1,264,964 |
| Skating Pond | 40 | $0 | $23,317 | $932,675 | $0 | $932,675 |
| **Skateparks** | | | $0 | $0 | $50,000 | $1,050,000 |
| Extra Large | 20 | $1,200,000 | $6,837 | $136,732 | $50,000 | $1,386,732 |
| Large | 20 | $800,000 | $4,558 | $91,155 | $40,000 | $931,155 |
| Medium | 20 | $400,000 | $2,279 | $45,577 | $25,000 | $470,577 |
| Small / Mini | 20 | $200,000 | $1,139 | $22,789 | $10,000 | $232,789 |

# 5.5 Adjusted Levels of Service

## 5.5.1 Mowing

Table 16 outlines the inventory and total annual mowed performance metric tracked by the PWD in 2022. A cost weighting has been calculated for each service level based on the total annual hectares mowed. Allocating cost based on total hectares mowed accounts for the frequency differences between classes. For example, service level A is only 16.6% of total inventory, but receives 24.8% of total cost because it is mowed more frequently.

*Table 16: Mowing Inventory and Performance by Service Level, 2022*

| Mowing Service Level | Inventory (ha) | % of Total Inventory | Total Annual Mowed (ha) | Cost Weighting |
|---|---|---|---|---|
| A - Mowed every 7 days | 354 | 16.6% | 3,184 | 24.8% |
| **B - Mowed every 10 days** | 963 | 45.1% | 5,407 | 42.2% |
| **C - Mowed every 14 days** | 743 | 34.8% | 3,814 | 29.8% |
| **Subtotal – Included in LOS** | **2,059** | **96.4%** | **12,405** | **96.8%** |
| NA – Mowed every 30 days | 76 | 3.6% | 141 | 1.1% |
| IPM – Mowed on request | - | 0.0% | 270 | 2.1% |
| **Subtotal – Excluded from LOS** | **76** | **3.6%** | **411** | **3.2%** |
| **Total** | **2,135** | **100.0%** | **12,816** | **100.0%** |

The allocation of fixed and variable mowing costs by service level is provided in Table 17. Mowing one hectare of grass in service level A cost $6,197 annually in 2022, while service levels B and C were $3,865 and $3,533, respectively. On a weighted basis, the average hectare cost $4,146 to mow in 2022.

*Table 17: Allocated Cost by Mowing Service Level*

| Service Level | Total Cost | Per Hectare |
|---|---|---|
| A | $2,191,110 | $6,197 |
| B | $3,720,447 | $3,865 |
| C | $2,624,353 | $3,533 |
| **Total / Weighted** | **$8,535,910** | **$4,146** |

Parks and Natural Areas must increase the average weekly area mowed by 197 hectares (30.2% increase from current) to hit the target level of service of 850 hectares mowed per week. With 96.4% of inventory included in the technical LOS measure, and a 30.2% cost increase, the estimated cost to meet the target level of service is $2.57 million annually.

*Table 18: Marginal Mowing Cost to Target*

| Metric | Value |
|---|---|
| Total Cost | $8,818,765 |
| % Inventory included in LOS | 96.4% |
| % increase to target LOS | 30.2% |
| **Estimated cost to target LOS** | **$2,565,754** |
| *Portion Service Level A* | *$440,606* |
| *Portion Service Level B* | *$1,199,420* |
| *Portion Service Level C* | *$925,728* |

### 5.5.2 Amenity Levels of Service

The Parks and Natural Areas service's 2022 technical performance met the target level of service standard for multiple amenity types. There is no increase in service required for these amenities, thus further analysis of the cost impact of adjusting the inventory level of these amenities has been excluded from this report:

- Playgrounds
- Baseball / Softball diamonds
- Athletic Fields
- Outdoor Skating
- Skateparks

The lifecycle cost estimates provided above could be used to determine the marginal cost to the City should a future increase (or decrease) in the number of these amenities be deemed required.

#### *5.5.2.1 Picnic & Gathering Space Levels of Service*

The technical measure for percentage of people within a 2-km distance of a picnic or gathering space had an 83% technical performance in 2022, and a target standard of 90%. Based on current inventory of 215 picnic and gathering spaces this would imply an additional 17 amenities required to attain the target standard. These additional 17 spaces would incur a total capital cost of $2.7 million, a marginal annual operating cost of $142,353, and add a marginal total lifecycle cost of $8.4 million to the Parks and Natural Areas service (Table 19).

*Table 19: Marginal Costs to Target Standard – Picnic & Gathering Spaces Level of Service*

| Space Type | Lifecycle (Years) | Marginal Amenities to Target | Marginal Capital Cost | Marginal Annual Operating Cost | Marginal Total Lifecycle Cost |
|---|---|---|---|---|---|
| BBQ Pit | 40 | 5 | $42,500 | $2,247 | $139,880 |
| Small Shelter | 40 | 4 | $600,000 | $31,722 | $1,878,888 |
| Medium Shelter | 40 | 4 | $800,000 | $42,296 | $2,511,851 |
| Large Shelter | 40 | 3 | $1,200,000 | $63,444 | $3,767,776 |
| Small Bike Stop | 20 | 1 | $50,000 | $2,644 | $105,370 |
| **Total** | | **17** | **$2,692,500** | **$142,353** | **$8,403,765** |

### *5.5.2.2 Tennis and Pickleball Levels of Service*

The two technical measures related to tennis and pickleball are below target standard:

*Table 20: Marginal Tennis or Pickleball Courts Required to Target Level of Service*

| Technical Measures | 2022 Technical Performance | Target Standard | Marginal amenities required |
|---|---|---|---|
| People within 2-km distance of tennis or pickleball court (%) | 64% | 90% | 38.0 |
| Number of tennis/pickleball courts per 5,000 people | 0.9 | 1.0 | 13.0 |

Location optimization of new tennis and pickleball courts through spatial analysis could result in a lower number of new courts that could satisfy both technical LOS targets. However, based purely on linear analysis, the targets vary between needing 38 new courts (measure of distance to population) and needing 13 new courts (measure of population only).

Based on the 2-km distance from a tennis or pickleball court technical measure, the City would incur an additional $3.8 million to construct courts, and annual operating costs of $86,597 to hit the target LOS.

*Table 21: Marginal Costs to Target Standard – People within 2-km distance of tennis or pickleball court (%)*

| Space Type | Lifecycle (Years) | Marginal Amenities to Target | Marginal Capital Cost | Marginal Annual Operating Cost | Marginal Total Lifecycle Cost |
|---|---|---|---|---|---|
| Tennis / Pickleball | 20 | 38 | $3,800,000 | $86,597 | $5,911,941 |

Based on the number of tennis or pickleball courts per 5,000 people technical measure, the City would incur an additional $1.3 million to construct courts, and annual operating costs of $29,625 to hit the target LOS.

*Table 22: Marginal Costs to Target Standard – Number of tennis/pickleball courts per 5,000 people*

| Space Type | Lifecycle (Years) | Marginal Amenities to Target | Marginal Capital Cost | Marginal Annual Operating Cost | Marginal Total Lifecycle Cost |
|---|---|---|---|---|---|
| Tennis / Pickleball | 20 | 13 | $1,300,000 | $29,625 | $2,022,506 |

#### *5.5.2.3 Basketball Levels of Service*

The technical measure for percentage of people within a 0.6-km distance of basketball court had a 67% technical performance in 2022, and a target standard of 90%. Based on current city-owned inventory of 78 courts this would imply an additional 20 courts to attain the target standard. These additional 20 courts would incur a total capital cost of $5 million, a marginal annual operating cost of $45,577, and add a marginal total lifecycle cost of $6.1 million to the Parks and Natural Areas service (Table 23).

*Table 23: Marginal Costs to Target Standard – Basketball Courts Level of Service*

| Space Type | Lifecycle (Years) | Marginal Amenities to Target | Marginal Capital Cost | Marginal Annual Operating Cost | Marginal Total Lifecycle Cost |
|---|---|---|---|---|---|
| Basketball | 20 | 20 | $5,000,000 | $45,577 | $6,098,780 |

## 5.6 Gaps and Limitations

Gaps and limitations that should be considered when using the Parks and Natural Areas LOS cost analysis results for decision making purposes include:

- Not all activities have a task code for time tracking, mainly due to minimal time requirements. For example, there are no activity codes for basketball court maintenance or skatepark maintenance. The cost of basketball court maintenance has been assumed to be the same as tennis court maintenance based on discussions with Parks management.
- The AVL dashboard for tracking mowing still requires some work for accurate data reporting. The mowing analysis relies on the assumption that the PWD is currently mowing to approximately 70% of the target service level.
- Land costs have not been considered in this analysis. Optimizing the geographic locations of additional amenities may require the City to purchase land. Depending on the location, new land purchases could be cost prohibitive and not economically optimal for the City to install parks amenities.
- The multi-use greenspace level of service costing could not be calculated. Detail for existing multi-use greenspace inventory was unavailable.
- LOS with a geographic requirement (e.g. number of people within "x"-km of an amenity) may require a different number of marginal amenities than calculated based on linear analysis. Spatial analysis could

determine the optimal location of new amenities to reduce the total number of amenities required to meet the geographic targets.

- Several Parks sub-services did not have equipment hours recorded in TKMMS. For example, no equipment hours were recorded for tasks related to natural areas management, yet $81,100 in Fleet costs were allocated to this service.

# 6 Urban Forestry Levels of Service

Table 24 outlines the technical measures reviewed and costed for Urban Forestry.

*Table 24: Urban Forestry Reviewed Levels of Service Technical Measures*

| Technical Measures | 2022 Technical Performance | Target Technical Standard |
|---|---|---|
| Pruning cycle for street trees (years) | 15.0 | 7.0 |
| Pruning cycle for park trees (years) | 20.0 | 12.0 |
| Street and park trees replaced after removal (%)* | 83.00% | 100.00% |
| American Elms lost annually (%) | 2.90% | <2% |
| Annual street and park tree loss (%) | 1.80% | 1.50% |
| Canopy cover city-wide (%) | 17.0% | 20.0% (by 2045)<br>24.0% (by 2065) |

*Council's Strategic Priorities Action Plan has identified a 200% (2:1) replacement rate which includes all trees planted by PWD (street, park, and natural area plantings). However, only street and park trees have been included in the level of service target technical standard.

## 6.1 Assumptions

Assumptions guiding the Urban Forestry levels of service costing include:

- Tree planting / cost per tree planted is used as the main cost driver for the following levels of service:
    - Percentage of street and park trees replaced after removal.
    - Percentage city-wide canopy cover. Canopy cover is impacted by multiple factors, including tree removals (DED and non-DED) as replacement trees are required. Street and park trees make up only 10% of total population of urban forest that contribute to the canopy cover metric. For the purposes of this analysis, cost per tree planted is assumed to be an adequate measure of the total cost for trees planted by Urban Forestry needed to meet canopy cover targets.
- The 2.9% result for American Elms annual loss is calculated based on the number of DED trees marked in 2022 divided by the total estimated number of American Elms on all properties (public and private). A large portion of Elms are on private properties and natural areas which are not accounted for in the public tree inventory. An inventory of elms on private properties and in natural areas was completed in 2015. American elms removed since that are deducted annually, and a 1% annual natural regeneration rate is also applied to estimate the current American elm population. It is assumed the 2.9% rate is accurate.
- The number of trees planted to achieve the target canopy cover LOS is assumed to match the target in the Urban Forest Strategy (6,500 net new tree plantings per year).

- Tree removals are driven by cost per DED removal (including DED surveillance costs) and cost per non-DED removal for the following levels of service:
    - Percentage of American Elms lost annually.
    - Percentage of street and park tree loss.

## 6.2 Cost Pools

The Urban Forestry cost models use the following cost pools based on the underlying operational tasks completed by the department:

*Table 25: Urban Forestry Cost Pools*

| Cost Pool | Description |
|---|---|
| **Tree Planting** | All vertically integrated tasks to plant and support a new tree in its infancy, including procurement of nursery stock, nursery operations, planting, watering, stump removals, and data collection activities, including assessment of potential planting sites. |
| **Tree Pruning** | All tree pruning activities, including aerial and ground pruning for both park and street trees. |
| **Non-DED Tree Removals** | All tree removal activities for non-DED (Dutch Elm Disease) trees, including aerial and ground removals, stump removals, hazardous tree clean-up, and other-disease and infestation removals. |
| **DED Tree Removals** | All DED tree removal activities, including costs for both public and private DED tree removals |
| **DED Surveillance** | All activities related to DED surveillance. The cost of DED surveillance is combined with the cost of DED tree removals to determine the total cost per DED tree removal. |
| **Shared costs** | Overhead and other costs that could not be directly allocated to any of the above tasks. Shared costs are allocated as overhead based on appropriate cost drivers for each cost type. |

Costs within each cost pool can be further classified into categories such as direct and indirect costs, variable and fixed costs, and capital costs.

## 6.3 Cost Allocation Summary

The full cost of each service activity in 2022, after allocation of shared costs, was calculated as follows:

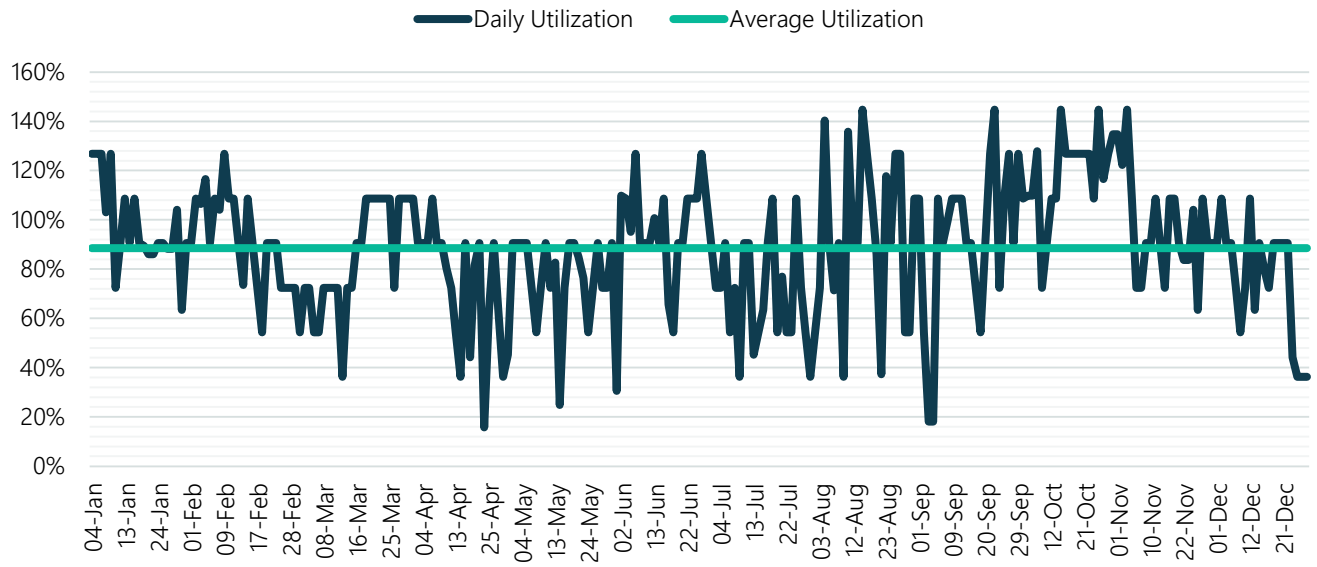
| Cost Pool | Fixed Costs | Variable Costs | Total Cost |
|---|---|---|---|
| Tree planting | $1,121,082 | $3,044,148 | $4,165,230 |
| Tree pruning | $1,530,685 | $3,077,462 | $4,608,147 |
| Non-DED removals | $903,853 | $946,409 | $1,850,263 |
| DED removals | $1,888,333 | $5,083,870 | $6,972,203 |
| DED surveillance | $291,155 | $394,725 | $685,880 |

The cost models also categorize each cost by category, specifically labour, services, fleet (equipment), and material. This provides an additional level of analysis to understand which cost categories drive specific activities. Cost pools include capital costs for forestry renewal and enhancement, and exclude a $1 million grant that reduced the actual cost of DED Control services in 2022 and other program recoveries.

## 6.4 Fleet Usage Analysis

Crew cab pick-up trucks (listed as "Cargo Vans" in TKMMS) had the highest average annual utilization at 90.4%. However, when analyzing the results during peak periods, certain equipment types exceed capacity on several dates. Figure 4 shows the daily utilization of crew cab trucks in 2022 when factoring in total assumed downtime of 31.5% of capacity.

*Figure 4: Urban Forestry "Cargo Van" Fleet Utilization by Day*




Most equipment types used for Urban Forestry activities are used for multiple activities, and several of these trucks also show shared hours with other divisions, so determining the number of additional units needed at peak times requires scenario analysis for additional pruning, planting, and removal at peak times.

## 6.5 Performance Metrics

Table 26 provides a summary of the accomplishments for the Urban Forestry Branch in 2022 that will be used for determining levels of service costs.

*Table 26: Urban Forestry Accomplishment, 2022, Estimate*

| Activity | Total |
|---|---|
| Trees planted | 4,333 (including 15 which were planted by individual homeowners at their cost via homeowner agreement) |
| Trees pruned | 17,675 |
| Non-DED trees removed | 3,001 |
| DED trees removed (excluding private removals) | 2,233 |

## 6.6 Planting Levels of Service

The Planting analysis summarizes performance and cost results related to the following levels of service:

- Percentage of street and park trees replaced after removal.
- Percentage city-wide canopy cover.

It is assumed that cost per tree planted is the main cost driver of these levels of service. The cost per tree planted for 2022 is summarized in Table 27, based on the costs from the class cost models and tree planting performance data. The average total cost was $961. A newly planted tree requires an additional 2 years of water and maintenance. An estimate of $100 has been added, for a total average cost of $1,061 per tree.

This cost is the weighted average cost per tree planted in 2022. The actual cost will vary depending on the type of tree planted. For example, a large caliper tree will be higher than the weighted average, whereas container trees are on the lower end of tree cost.

*Table 27: Cost per Tree Planted Calculation, 2022*

| | Total |
|---|---|
| Total cost | **$4,277,373** |
| Number of trees planted | **4,178** |
| **Average cost per tree planted** | **$961** |
| Additional watering cost | $100 |
| **Average cost per newly planted tree over 3 years** | **$1,061** |

### 6.6.1 Target Replacement Rate

The estimated cost for the target replacement rate is equal to the marginal trees planted to target multiplied by the cost per tree planted. In 2022, the target was 100% but the City achieved 83%. Based on these KPIs, the City

needed to plant an additional 901 trees, so the variable cost to the target LOS would be $866,114, A marginal lifecycle cost of $956,214 to the City (includes watering costs). This amount can fluctuate dependent upon the number of trees removed in a given year, and thus a more reliable estimate could be completed by reviewing cost on a 3- or 5-year cycle.

*Table 28: Target Replacement Rate LOS Calculation, 2022*

| Measure | Value |
|---|---|
| Target Replacement Rate | 100% |
| Target Number of Trees Planted | 5,234 |
| **Marginal trees planted to target LOS** | **901** |
| Marginal cost to target LOS (tree planting) | **$866,114** |
| **Marginal cost to target LOS (tree planting + water)** | **$956,214** |

### 6.6.2 Target Canopy Cover

Calculating the City's canopy cover is an involved process involving spatial analysis. In absence of additional spatial analysis, the 2065 canopy cover targets from the City's Urban Forestry Strategy have been used to determine the number of new trees required. To achieve target, the City must plant an additional 6,500 net new trees per year. The Urban Forestry Branch's share of these 6,500 trees is estimated to be 1,475 trees, as developers, Parks, and natural regeneration will account for approximately 5,025 trees per year.

*Table 29: Canopy Cover Target New Tree Calculation*

| Land Use | Approximate # of New Trees Required | Approximate Annual Planting Rate (net new) |
|---|---|---|
| Right-of-way | 140,000 | 3,200 |
| Parks | 139,000 | 3,200 |
| Downtown | 4,000 | 100 |
| **Total** | **283,000** | **6,500** |
| Less: Right-of-way plantings from developers | (80,000) | (2,000) |
| Less: Parks planting on riverbanks and natural areas and natural regeneration | (118,000) | (2,950) |
| Less: Downtown plantings from developers | (3,000) | (75) |
| **Net new tree planting by Urban Forestry** | **82,000** | **1,475** |

Using the same methodology as the target replacement rate calculation results in marginal annual planting costs of $1,417,889. Over 43 years, the City would incur an additional $60,969,243 to hit the 2065 canopy cover target.

*Table 30: Canopy Cover Marginal Cost Calculation*

| Measure | Value |
|---|---|
| **Net new tree planting by Urban Forestry (for Canopy Cover Target)** | 1,475 |
| **Marginal Cost to Target LOS (Marginal Trees x Cost per Tree)** | **$1,417,889** |
| Including water | $1,565,389 |
| **Marginal Cost to hit Canopy Cover Target by 2065 (43 years)** | **$60,969,243** |

## 6.7 Pruning Levels of Service

The Planting analysis summarizes performance and cost results related to the following levels of service:

- Pruning cycle for street trees (years).
- Pruning cycle for park trees (years).

It is assumed that cost per tree pruned is the main cost driver of these levels of service. The cost per tree pruned for 2022 is summarized in Table 31, based on the costs from the class cost models and tree planting performance data. The total cost was $261. Cost will vary depending on the size of tree and difficulty of the pruning job.

*Table 31: Cost per Tree Pruned Calculation, 2022*

| | Total |
|---|---|
| Total cost | $4,608,147 |
| Number of trees pruned | 17,675 |
| Cost per tree pruned | $261 |

### 6.7.1 Target Pruning Cycles

Table 32 outlines the results of calculating the additional variable cost required to hit the target LOS for street and park tree pruning. The target number of trees pruned is based on the 2022 year-end inventory count of street and park trees, divided by 7 years and 12 years, respectively, to determine the number of trees that must be pruned annually. Essentially, an additional 18,386 trees must be pruned annually to hit LOS targets. At a variable cost of $174 per tree, it would cost an additional $3.2 million annually to achieve the target pruning cycles ($2.6 million for street trees and $600,000 for park trees, rounded).

*Table 32: Marginal Statistics to Target Pruning Levels of Service*

| Tree Type | Street | Park | Total |
|---|---|---|---|
| Target Prune Cycle | 7.0 | 12.0 | 8.1 |
| Target Number of Trees Pruned | 28,438 | 7,623 | 36,061 |
| **Marginal Trees Pruned to Target LOS** | **14,978** | **3,408** | **18,386** |
| **Variable Cost to Target LOS (Marginal Trees x Variable Cost per Tree)** | **$2,607,852** | **$593,336** | **$3,201,189** |

# 6.8 Removals Levels of Service

The Removals analysis summarizes performance and cost results related to the following levels of service:

- Percentage of American Elms lost annually.
- Percentage of street and park tree loss.

Cost drivers for these LOS are assumed to be cost per DED removal and cost per non-DED removal.

## 6.8.1 Target Percentage of American Elms Lost

The technical performance measure for the percentage of American Elms lost annually is costed based on the cost per DED removal, which includes the cost pools for DED removals and DED surveillance. In 2022, this result is calculated as $1,252 per tree ($896 variable), based on 6,117 DED trees removed (Table 33).

*Table 33: Cost per DED Removal Calculation, 2022*

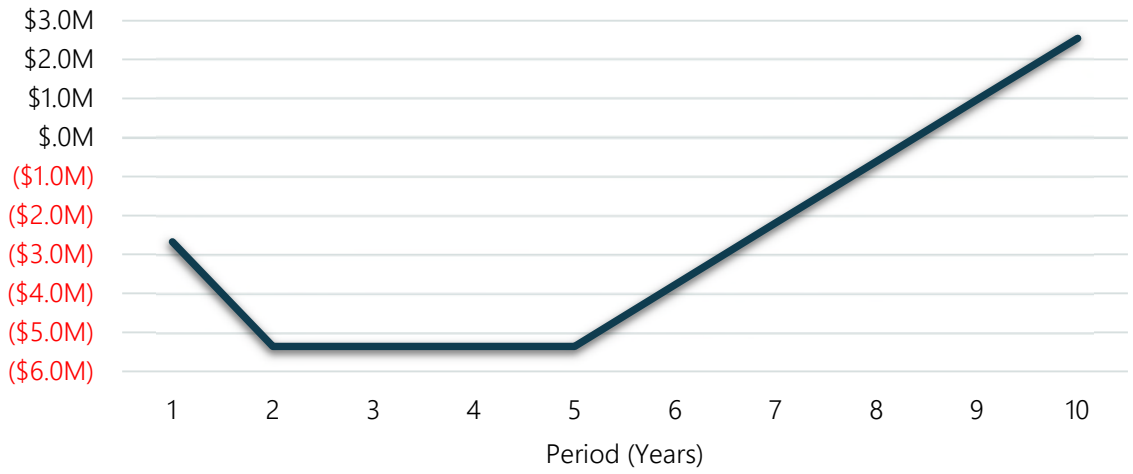
| | Total |
|---|---|
| Total cost | $7,658,083 |
| Number of DED removals | 6,117 |
| Cost per DED removal | **$1,252** |

In this case, the target LOS is a *reduction* in trees lost, which would result in less trees removed and cost savings for the City. Improving from the current 2.9% loss rate to the 2.0% target would result in 1,898 less DED removals annually, for a cost savings of $1.7 million (1,898 trees x $896 variable cost per tree).

Reducing the number of DED removals to achieve this savings would not be proper forestry management, as the number of DED removals is dictated by the incidence of disease and outcomes of city-wide DED surveillance. To achieve a lower loss rate of American Elms in the long-term, the Winnipeg Urban Forest Strategy recommends the implementation of the Prioritized Rapid Removal Program. The cost of this program is estimated to be $5.36 million, which includes $1.36 million additional operating primarily for enhanced DED surveillance with in-house priority removals and $4 million in capital for contracted services.

Figure 5 shows that assuming the annual estimated cost savings is achieved 5 years after implementation of the program, the City could achieve a net cost savings of $2.5 million over 10 years (undiscounted). The program would achieve payback (cost savings greater than implementation cost) midway through year 9.

*Figure 5: Cumulative Savings (Cost) of Implementing Prioritized Rapid Removal Program*




## 6.8.2 Target Annual Street and Park Tree Loss

The percentage of street and park tree loss technical measure is costed based on the cost per non-DED removal. In 2022, this result is calculated as $617 per tree ($315 variable), based on 3,001 non-DED removals.

| | Total |
|---|---|
| Total cost | $1,850,263 |
| Number of non-DED Removals | 3,001 |
| Cost per non-DED Removal | **$617** |

To simplify the calculation and avoid double counting DED removals, this technical measure is considered secondary to the percentage of American Elms lost. That is, the reduction of 1,898 DED removals considered above is excluded from the costing of this measure.

To achieve the target of 1.5% the City would only remove 4,362 trees per year (based on current inventory levels). Considering the 1,898-tree reduction in elm loss, this leaves a target of 2,463 non-DED removals per year, or 538 less removals from current levels. Achieving this target would result in a cost reduction of $196,576 annually (538 less removals x $315 variable cost).

| Measure | Value |
|---|---|
| Target Rate | 1.5% |
| Target Number of Trees Lost | 4,362 |
| Less marginal elms lost | (1,898) |
| Target non-DED tree loss | 2,463 |

| Measure | Value |
|---|---|
| **Marginal trees lost** | **(538)** |
| **Variable Cost to Target LOS (Marginal Trees x Variable Cost per Tree)** | **($169,576)** |

## 6.9 Gaps and Limitations

Gaps and limitations specific to the Urban Forestry levels of service costing that should be considered when using these results for decision making purpose include:

- The type of tree planted is tracked for performance purposes, but not within TKMMS. Determining the labour and equipment time required for planting trees by type would require a manual reconciliation of Urban Forestry's crew assignments with TKMMS equipment usage data.
- The analysis of percentage of American Elms lost annually and the percentage of annual street and park tree loss calculates the cost reduction associated with the recommended loss rates. Reaching the recommended pruning cycles contributes to reaching the street and park tree loss rates as pruning cycles significantly contribute to maintaining the health of the urban forest. Actual costs can fluctuate over time based on weather events and biological factors (including DED) influencing demands for service and population dynamics and influencing the number of trees being removed from year to year.
- The analysis assumes that the wage variance between time recorded in TKMMS (plus estimated benefits) and the GL is equal to the fixed cost of salaries and benefits for urban forestry services. It was also assumed that variable wages are the best indicator to use as basis of expectation for fixed wage cost allocations while it may be that they are more closely corelated to external contract administration or to the total overall mix of forestry work performed both by internal staff and external contractors. Through the analysis performed questions were raised regarding non-hourly or fixed wage cost allocations as the ratio of fixed wages to variable wages varied significantly between services. Support wages are allocated based on service-based allocation tables. It was discussed with the PWD finance and identified that there was an isolated known issue resulting from operational reorganizations of budgets to allow for more effective management of the previously separated Forestry and DED operational branch budgets in 2022. In 2023 it was identified that through the restructuring the service allocations were not re-weighted to reflect these consolidations. PWD finance has advised that allocations were adjusted in 2023 to be reflective of impacts of the consolidated operational budgets. Table 34 summarizes the variable and fixed wage costs calculated for each class as recorded. Tree planting has a ratio of 43.9%. On the other extreme, DED Control had a variable-to-fixed cost ratio of 175.4%, With the understanding that the 2022 service allocations were impacted by the restructuring of the operational budgets and that adjustments were made in 2023, it is still recommended that the service-based allocation tables be re-assessed on a regular interval to ensure an appropriate support wage cost is allocated to each task and to revise the allocations if required. Determining the appropriate allocation will involve analyzing a list of individuals with time not recorded in TKMMS and estimating how much of their time is dedicated to each primary task in Urban Forestry.

*Table 34: Variable and Fixed Wages by Account Group*

| Class | Variable Wage Cost (TKMMS + Benefits) | Fixed Wage Cost | Total (Salaries and Benefits Account Group) | Variable-to-Fixed Cost Ratio |
|---|---|---|---|---|
| Tree Planting | $319,220 | $727,578 | **$1,046,798** | 43.9% |
| Pruning & Removal | $1,180,543 | $1,414,990 | **$2,595,533** | 83.4% |
| DED Control | $2,158,396 | $1,230,341 | **$3,388,736** | 175.4% |

- There were no capital costs identified for pruning or non-DED removals but there are several capital transactions related to Urban Forestry with no defined task. These transactions were reallocated on a proportional basis to identified capital tasks (DED Removals, Tree Planting, and Insect Control), but additional detail could be recorded with capital transactions to improve cost allocations. It is possible that some of this should have been allocated to pruning or non-DED removals, but there is no evidence directly tying these overhead capital costs to these tasks.
- Determining the number of new vehicles required to hit LOS targets requires an operational analysis that considers labour and equipment needs based on activity. This analysis has not been conducted as part of the Winnipeg Urban Forest Strategy recommendations.
- Not all Urban Forestry equipment has time recorded in TKMMS. For example, trucks used by Permanent Technician 2s are not recorded as these employees enter their time in Peoplesoft.

# 7 Active Transportation Levels of Service

Table 35 outlines the technical measures reviewed and costed for Active Transportation (AT):

*Table 35: Active Transportation Reviewed Levels of Service Technical Measures*

| Technical Measures | 2022 Technical Performance | Target Technical Standard |
|---|---|---|
| Length (km) of sidewalks | 2,851 | 3,000 |
| Length (km) of all ages and abilities cycling facilities | 524 | 1,600 |
| Length (km) of all bicycle facilities | 824 | 1,600 |
| # km of neighbourhood greenways | 32 | 40 |
| % of multi-use path length with benches every 400m | 27% | 100% |

## 7.1 Assumptions

- Existing fleet capacity is assumed to be sufficient for changes to AT levels of service, as current equipment tracking shows minimal use of equipment for AT maintenance and repairs (see section 7.4).
- All AT pathways and sidewalks are assumed to have a lifecycle of 50 years.
- Reconstruction costs of existing sidewalks and AT pathways are assumed to be equal to the cost of newly constructed sidewalks and AT pathways.
- New sidewalks and AT pathways are assumed to have the following widths for costing purposes:
    - Bike paths – 1m wide per direction - new facilities are multi-directional, where 1 geographic km of bike path will be 2m wide (1m per direction) and provide 2km of pathway (1km per direction).
    - Multi-use paths – 3.5m wide.
    - Local sidewalks – 1.5m wide.
    - Regional sidewalks – 3m wide.

## 7.2 Cost Pools

The AT cost models use the following cost pools based on the underlying operational tasks completed by the department:

*Table 36: Active Transportation Cost Pools*

| Cost Pool | Description |
|---|---|
| Sidewalk Maintenance | Includes all costs for spot work, grinding, and ornamental sidewalk maintenance. |
| AT Pathway Maintenance | Includes all costs for Active Transportation pathway maintenance and repairs. |

## 7.3 Cost Allocation Summary

In addition, the cost of installing and renewing sidewalks and AT pathways were provided by the PWD's Engineering division:

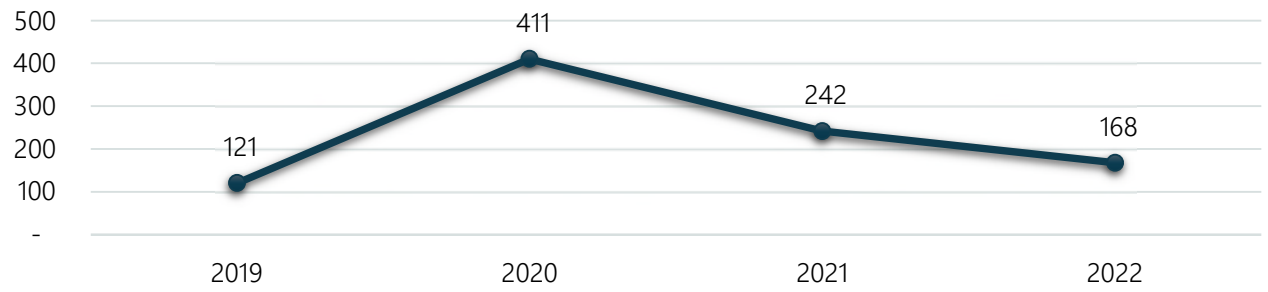
*Table 37: Construction Costs per $m^2$ by Pathway Type*

| Pathway Type | Construction Type | Cost per $m^2$ (2022) | Cost per $m^2$ (2023) |
|---|---|---|---|
| Bike Paths | Resurface | $85 | $88 |
| | Rehabilitate | $130 | $134 |
| | Reconstruct | $225 | $232 |
| Multi-Use Pathways (Asphalt) | Resurface | $80 | $83 |
| | Rehabilitate | $120 | $124 |
| | Reconstruct | $205 | $211 |
| Sidewalks – Regional | Rehabilitate | $360 | $371 |
| Sidewalks – Local | Rehabilitate | $240 | $247 |

## 7.4 Fleet Analysis

Fleet equipment used for AT operational activities is minimal, with total equipment hours dropping from a high of 411 hours in 2020 to 168 hours in 2022 (Figure 6). Equipment mainly consisted of pick-up trucks, and no type of equipment exceeded 100 hours in any year for this service. Per the above assumptions, fleet costs are considered immaterial in the AT levels of service costing.

*Figure 6: TKMMS Equipment Hours Coded to AT Pathway Maintenance and Repair, 2019 - 2022*



## 7.5 Performance Metrics

Relevant performance metrics for costing the AT levels of service include inventory by pathway type, and units of sidewalks and pathways repaired.

### 7.5.1 Inventory by Pathway Type

Inventories for each tracked pathway type are included in Table 38.

*Table 38: Pathway and Sidewalk Inventory by Type*

| Measure | Value |
|---|---|
| Length (lane-km) of multi-use path | 479 |
| Length (lane-km) of all ages and abilities cycling facilities | 524 |
| Length (lane-km) of all bicycle facilities | 824 |
| Length (km) neighbourhood greenways | 32 |
| Length (km) of sidewalks along regional streets | 549 |
| Length (km) of sidewalks along non-regional streets | 2,306 |
| Length (km) of all sidewalks | 2,855 |

### 7.5.2 Maintenance and Repair Units

The following maintenance tasks were tracked in TKMMS for 2022:

- AT Pathway Maintenance & Repairs (Person Hours) – 219.
- Sidewalk Grinding (Occurrences) – 134.
- Concrete Sidewalk Spot Work and Ornamental Sidewalk Maintenance ($m^2$) – 5,496.

## 7.6 Cycling Facilities Levels of Service

Current levels of service related to bicycle facilities (dedicated cycling lanes and pathways) are listed in Table 39. The City's target standard is to have all bicycle facilities be all ages and abilities cycling facilities, thus the number of kms required to target is 1,076, and the secondary length (km) of all bicycle facilities technical measure is redundant for the costing analysis.

*Table 39: AT Bicycle Pathway Levels of Service*

| Technical Measures | 2022 Customer Performance Grade | 2022 Technical Performance | Target Standard | To Target |
|---|---|---|---|---|
| Length (km) of all ages and abilities cycling facilities | Poor | 524 | 1,600 | 1,076 |
| Length (km) of all bicycle facilities | Fair | 824 | 1,600 | 776 |

Multiplying 1,076km to target by the $232 cost per $m^2$ to construct bike paths results in a capital cost of approximately $250 million to meet the service level target. Annual repairs and maintenance costs on these additional kms would incur an estimated $238,484 per year, resulting in a 50-year lifecycle cost of $11.9 million in maintenance costs, and a total marginal lifecycle cost of $261.56 million.

*Table 40: Cycling Facilities Lifecycle Cost Calculation*

| Measure | Value |
|---|---|
| Cost per $m^2$ | $232 |
| Marginal km to target LOS | 1,076 |
| **Total capital cost** | **$249,632,000** |
| Marginal annual maintenance estimate | $238,484 |
| Estimated lifecycle (years) | 50 |
| **Lifecycle maintenance cost** | **$11,924,197** |
| **Marginal lifecycle cost** | **$261,556,197** |

## 7.7 Number of Neighbourhood Greenways

Neighbourhood greenways are existing streets that have implemented traffic calming measures, including reduced speed and a variety of new signage, barricades, speed jumps, and enhanced pedestrian crossings. The City currently has 32 neighbourhood greenways and an additional 8 greenways are required to meet its target level of service. There is no dedicated tracking for neighbourhood greenway operational costs in PWD's data, and the length and variety of traffic calming measures makes the capital estimate different for each greenway. An average cost of historical implementations has been used to estimate future greenway costs.

In March 2023, Council approved the permanent designation of 27 neighbourhood greenways at a capital cost of $692,969[3]. This results in an average cost per greenway of $25,666. Table 41 outlines the calculation showing an additional $205,328 would be required to convert an additional 8 streets to neighbourhood greenways.

[3] Neighbourhood Greenway Reduced Speed Pilot Results and Recommendations. https://clkapps.winnipeg.ca/DMIS/ViewPdf.asp?SectionId=687591&time=1695427200072

*Table 41: Neighbourhood Greenways Level of Service Marginal Capital Cost*

| Measure | Value |
|---|---|
| Historical average capital cost per neighbourhood greenway | $692,969 |
| Neighbourhood greenways required to hit service target | 8 |
| **Marginal capital cost to target** | **$205,328** |

## 7.8 Multi-Use Path Benches Levels of Service

The technical measure for "percentage of multi-use path length with benches every 400m" had a technical performance result of 27% in 2022. The City has approximately 479,000 metres of pathways classified as multi-use, which implies only 129,330 metres of pathways have sufficient benches to meet the service standard, and 349,670 metres of pathway require benches. The cost of a standard Tache bench including installation per City estimates is $2,000. The calculation in Table 42 shows that an estimated additional capital cost of $1.75 million would be required to meet the service target for this level of service.

*Table 42: Multi-Use Path Benches Capital Cost Calculation*

| Measure | Value |
|---|---|
| Multi-use path requiring benches (metres) | 349,670 |
| Number of benches requires (path metres / 400) | 875 |
| Cost per bench, installed | $2,000 |
| **Additional capital cost to target level of service (benches x cost per bench)** | **$1,750,000** |

## 7.9 Gaps and Limitations

- Active Transportation has only recently been separated as a distinct service for reporting purposes within the service-based budget. As such, work is underway to improve methodologies for tracking and analyzing these costs moving forward.
- AT Pathway maintenance and repairs have accomplishment units tracked as person hours in TKMMS. There is no way to identify the length of path serviced or the type of repair conducted.
- The capital cost estimate for neighbourhood greenways does not account for the availability or capacity to convert other existing streets into greenways. The existing 32 greenways may have been implemented on the most easily convertible streets, requiring additional cost for traffic calming measures on future implementations.

# 8 Recommendations

After the development of the cost models, and identifying the current limitations, recommendations have been prepared for future consideration.

## 8.1 General Recommendations

- This exercise reviewed multiple levels of service costing through a review of existing data sources which in some cases were limited or missing pertinent information. Future analysis should include an actual activity-based costing exercise by individual PWD activity and use the results calculated by this exercise for comparative purposes. This information could then be used to apply a specific percent overhead.
- Additional years of analysis should be completed by the PWD to verify results and to identify and eliminate outliers.
- Allocation tables (999 allocations) should be reviewed and updated where required.
- Capital transactions and recovery transactions should have more detail in the G/L for future analysis so that finance staff do not have to manually check POs and recovery requests. Cost pool titles could be used in the description to identify the activity type being charged.

## 8.2 Data Tracking Recommendations

- Implement a more modern and GIS-integrated work management system and ensure that everyone is tracking their time and equipment appropriately:
    - A review of TKMMS should be undertaken because of significant advancements in asset/work maintenance systems that integrate with geographic information systems.
    - Discussions have been had in the past about implementing GPS tracking to automate tracking of equipment and vehicle usage.
    - A system that includes time for all divisions that share equipment should be identified. If that system is TKMMS, divisions not recording equipment usage should start doing so.
    - Ensure sufficient full-time equivalent (FTE) staff are in place to effectively record, track and report on work activities.
- Equipment and material rates in TKMMS should be updated on an annual basis after reconciling charges from fleet with hours of usage from TKMMS.
- Review task descriptions currently in TKMMS to see if there is room to add greater detail. This would allow for more detailed future analyses. For example, further separation of P1, P2, and P3 sidewalk clearing.
- Create process standards and related training materials and programs for the time tracking system that would ensure users inputting data into TKMMS are doing so consistently. For example, there are "accomplishment units" associated with each task, but some of the assigned units leave room for

ambiguity, resulting in inaccurate numbers. One example is the number of loads completed with snow clearing. Individuals may have different interpretation to what "one load" is.

- Utilize equipment lists and apply regular data cleaning processes to ensure formatting and consistent entry methods are used, which should limit errors resulting from inconsistent data (harmonize equipment naming and unit number conventions, remove leading zeros, no extra punctuation, etc.)
- There are identified variances between equipment charges as recorded in TKMMS and costs in the general ledger. The most significant example is employees recorded a higher percentage of equipment utilization to DED Control, but the GL allocations recorded more costs to Pruning and Removals. As referenced in 5.9 it was discussed with PWD finance and identified as a known issue mainly resulting from operational reorganizations of budgets to allow for more effective management of the previously separated Forestry and DED operational branch budgets in 2022. In 2023 it was identified that through the restructuring the service allocations were not re-weighted to reflect these consolidations at the time. PWD finance has advised that allocations were adjusted in 2023 to be reflective of impacts of the consolidated operational budgets. The same recommendation to revisit the fixed salary allocations applies to the equipment allocations. Table 43 demonstrates the percentage of allocated cost to each division under the weighted average cost method compared to the actual GL allocations. Based on time entered in TKMMS, approximately 61% of total Fleet costs should be allocated to DED Control, but only 11% were allocated in the GL, while Tree Planting and Tree Pruning and Removal received a higher share of Fleet costs.
  PWD could review fleet service allocations and compare to TKMMS hours recorded. It may be more appropriate to review equipment rates based on recorded usage on a 3-to-5 year rolling average and update the service-based allocation tables based on the results as making changes based on any one year's fluctuation may lead to additional complications. In order to apply this recommendation, it may first be required to review how fleet utilization is recorded in TKMMS. As noted earlier in the report various instances were observed when comparing equipment data to the associated fleet charges where there were unmatched units on both sides, and it is known that non-hourly staff would not be recording equipment utilizations through TKMMS.

*Table 43: Total Urban Forestry Fleet Cost Allocation – Weighted Average Cost Method vs. Actual GL Allocation*

| | Weighted Cost Method Allocation | Actual GL Allocation | Variance |
|---|---|---|---|
| Tree Planting | 6.0% | 25.0% | 18.9% |
| Tree Pruning & Removal | 32.7% | 64.1% | 31.4% |
| DED Control | 61.3% | 10.9% | -50.3% |
| **Total** | **100.0%** | **100.0%** | **0.0%** |

## 8.3 Equipment Tracking Recommendations

- PWD identified instances of equipment being used but not tracked in TKMMS. For example, the TKMMS summary data excludes hours for the Traffic Management and Bridge Operation branches. The only

proposed solution for untracked data is to have all Public Works divisions record equipment usage in TKMMS, so that the true full usage and cost can be calculated.

- Various instances were observed when comparing equipment data to the associated fleet charges of unmatched units on both sides (some equipment on fleet charges could not be identified in the time tracking data, and some equipment with time recorded could not be matched to fleet charges). It is recommended the City perform a reconciliation of the two databases, ensuring the unit number or other unique identifier for each piece of equipment matches in both systems.
- It is known that TKMMS equipment rates are out of date and do not align with fleet costs charged to Dept IDs. Comparing the total TKMMS cost to the weighted average cost shows that the weighted average rates were 20.7% higher than the TKMMS rates in 2022 (Table 44). It is recommended the TKMMS rates be updated annually to simplify cost analysis and provide more accurate real-time cost for management decision making. Rates should reflect a 3-to-5 year rolling weighted average of fleet costs to actual hours. This will ensure anomalies in a single year are absorbed into a weighted rate.

*Table 44: Reconciliation of Weighted Average Equipment Cost to TKMMS Cost*

| Urban Forestry Cost Centre | Weighted Average Cost | TKMMS Cost | Variance ($) | Variance (%) |
|---|---|---|---|---|
| Tree Planting | $141,899 | $111,721 | $30,179 | 27.0% |
| Tree Pruning & Removal | $767,182 | $593,466 | $173,716 | 29.3% |
| DED Control | $1,438,017 | $1,238,956 | $199,061 | 16.1% |
| **Total** | **$2,347,098** | **$1,944,142** | **$402,955** | **20.7%** |

# 9 Appendix A: Summary of Limitations

The below table summarizes the limitations associated with each of the levels of service:

| Report Section | Limitations |
|---|---|
| **Overall** | • The size of available data created difficulties comparing multiple years simultaneously, so only 2022 was analyzed – considerations should be made for the COVID-19 pandemic when interpreting results.<br>• The models assume labour and equipment drive fixed costs, but in reality, these costs may be a step costs that only increase at certain thresholds of service delivery.<br>• Equipment utilization did not account for surge or on-demand usage of some assets.<br>• It was too difficult to separate variable costs from contractor activities vs city crew activities.<br>• The assumption is that targets are not being met due to financial constraints, but in reality, there may be operational and market supply limitations TKMMS Limitations<br>• Hourly rates are outdated and do not reflect current charges.<br>• Not all divisions record equipment time in TKMMS, resulting in missing equipment hours. There are branches and staff within other PWD divisions that do not have equipment time recorded in TKMMS that may be supporting the services being evaluated in this review. This limits the ability to determine full equipment utilization.<br>• Task descriptions are not always specific to one level of service, resulting in assumptions and estimations. |
| **RSRIC** | • Calendar year 2022 was an unusually high snow year.<br>• The "Other Activities" cost pool has multiple activities that could be considered overhead and further allocated to individual technical levels of service but have not been allocated due to lack of a clear tie to individual technical measures.<br>• Granular accomplishment units for work in Snow Contract Areas are not tracked. Data in TKMMS only provides a partial picture of performance since third parties do not provide time and equipment data.<br>• The number of lane km salt and sand was applied to could not be determined.<br>• General limitations with the accuracy of TKMMS data.<br>• Data entry errors may result in units being double counted.<br>• Lack of clarity around how current performance measures are being calculated. |

| Report Section | Limitations |
|---|---|
| **Parks** | • Some activities do not have a task code for time tracking<br>• Additional land could be prohibitive<br>• The AVL dashboard for tracking mowing still requires some work for accurate data reporting.<br>• Equipment capacity estimates for mowing at peak times are unreliable<br>• Multi-use greenspaces are missing key details on the existing inventory<br>• Levels of service around spatial analysis may require a different number of marginal amenities<br>• Land purchases is not included in the costs<br>• Some services do not have equipment hours recorded in TKMMS, but there are costs in charged from fleet |
| **Urban Forestry** | • Cost reduction calculations associated with tree loss are related to lowering the loss ratios and reducing trees removed, where in reality it may not be that simple.<br>• Support wages which are allocated based on PWD's tables may be overallocated based on historical data.<br>• No capital costs were specifically identified for pruning or non-DED removals, but there is a significant amount of capital transactions with no defined task.<br>• Potential cost allocation issues related to accounting practices.<br>• Determining the number of new vehicles required to hit LOS targets requires an operational analysis with detailed activity planning by vehicle type and activity.<br>• Not all Urban Forestry equipment has time recorded in TKMMS. |
| **Active Transportation** | • Active Transportation has only recently been separated as a distinct service for reporting purposes within the service-based budget. As such, work is underway to improve methodologies for tracking and analyzing these costs moving forward.<br>• AT Pathway maintenance and repairs have accomplishment units tracked as person-hours in TKMMS. There is no way to identify the length of path serviced or the type of repair conducted.<br>• The capital cost estimate for neighbourhood greenways does not account for the availability or capacity to convert other existing streets into greenways. |

# 10 Appendix B: Summary of Cost Estimates

| RSRIC | Annual Marginal Cost (Reduction) Estimate |
|---|---|
| Average % of P1 streets plowed within 36 hours of a 3 cm+ snow event | $1,188,270 |
| Average % of P2 streets plowed within 36 hours of a 5 cm+ snow event | $0 |
| Average % of P3 streets plowed within 5 working days of a 10 cm+ snow event | $3,381,370 |
| Average % of alleys plowed within 5 working days of a 5 cm+ snow event | $257,818 |
| Average # of hours used to complete sidewalks & pathways plow (P1, P2, P3 combined) | $4,936,879 |
| **Parks** | **Lifecycle or Marginal Annual Cost** |
| People within 2-km distance of tennis or pickleball court (lifecycle cost of marginal amenities) | $5,911,941 |
| Number of tennis/pickleball courts per 5,000 people (lifecycle cost of marginal amenities) | $2,022,506 |
| Basketball Courts Level of Service (lifecycle cost of marginal amenities) | $6,098,780 |
| Picnic & Gathering Spaces Level of Service (lifecycle cost of marginal amenities) | $8,403,765 |
| Mowing Level of Service (annual) | $2,565,754 |
| **Urban Forestry** | **Marginal Cost Estimate** |
| Pruning cycle for street trees (annual marginal cost) | $2,607,852 |
| Pruning cycle for park trees (annual marginal cost) | $593,336 |
| Prioritized Rapid Removal Program (One-time Capital Cost) | $5,360,000 |
| American Elms lost annually (annual reduction once target achieved) | ($1,700,000) |
| Annual street and park tree loss (annual reduction once target achieved) | ($169,576) |
| Canopy cover city-wide (%) & Replacement Rate (Tree Planting) (annual marginal cost) | $1,565,389 |
| **Active Transportation** | **Marginal Cost Estimate** |
| Length (km) of all ages and abilities cycling facilities (lifecycle cost) | $261,556,197 |
| # km of neighbourhood greenways | $205,328 |
| % of multi-use path length with benches every 400m | $1,750,000 |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