Prepared for:

**Arcadis**

# TUNNEY'S PASTURE:

# LOW IMPACT DEVELOPMENT DESIGN MEMO


Design Brief prepared by:

**Aquafor Beech Limited**

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# Foreword

In 2021, Public Service and Procurement Canada (PSPC) partnered with CLC under a collaboration project to leverage the strengths of each organization to deliver the long-term vision of Tunney's Pasture that includes the site's transition from a federal employment centre into a mixed-use, sustainable, transit-oriented community. CLC is a self-financing federal Crown corporation specializing in real estate and development with a mandate to transform former Government of Canada properties and reintegrates them into local communities while ensuring their long-term goals. Since the launch of this collaboration project, CLC has been committed to working with the community to define amendments to the TPMP and proposed upgrades to the existing roadway and servicing infrastructure that support both federal priorities and future development.

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# 1 Project Introduction

Aquafor Beech was retained by Arcadis on behalf of Canada Lands Company (CLC) and Public Service and Procurement Canada (PSPC) to complete Low Impact Development (LID) stormwater management designs for the development at Tunney's Pasture federal government campus and the adjacent road network. The LID designs will support a Draft Plan of Subdivision application to the City of Ottawa for the proposed Right of Ways (ROW) realignments, which will be the basis for redevelopment of property parcels within the campus. The designs will also serve as an integral part of the site's ability to achieve the water balance, quality, and quantity control targets in accordance with the City of Ottawa Low Impact Development (LID) Technical Guidance Report (February, 2021), the Tunney's Pasture Master Plan (September, 2014) and Tunney's Pasture Redevelopment Project Sustainability Charter (2018).

The Tunney's Pasture Re-Development project encompasses a 49-hectare federally-owned government workplace campus primarily constructed in the 1950s and 60s. The campus is located in Ottawa, Ontario, approximately 4km west of Parliament Hill, and is bounded by the Ottawa River to the north, Laroch Park to the east, Wellington West/Hintonburg to the south and Champlain Park to the west. The Tunney's Pasture Master Plan (September, 2014) detailed plans for the re-development of the site to a sustainable, transit-oriented, mixed-use community and federal employment node over the next 25 years, including transfer of the Municipal Right of Ways to the City of Ottawa. Operation and maintenance responsibilities for the Municipal Right of Ways shall also be transferred to the City.

The purpose of this memo is to summarize the design development process including design objectives, background review, site investigations and the presentation of conceptual LID designs. The proposed LID features will contribute to the achievement of the design objectives listed in **Section 3** and advancing the work to mitigate the impacts of increased runoff and stormwater pollution, while increasing climate adaption and resiliency.

# 2 Objectives of LID Implementation

Stormwater Management through LID involves treating runoff at the source and as a resource to be managed and protected. The emphasis in managing runoff at the project site will be to retain/maintain the existing infiltration of water into the ground by managing runoff through lot level (source) and conveyance (street level) LID measures using what is referred to by the Ministry of the Environment (MOE) as a "treatment train" approach to stormwater management.

The Draft Low Impact Development Stormwater Management Guidance Manual (MECP, 2022) recommends the use of lot-level controls followed by traditional end-of-pipe controls in a "treatment train" approach for maximum water quality, balance, quantity and erosion control benefits. To strengthen protection and sustainability, an increased emphasis on maintaining the natural hydrologic cycle to the greatest extent possible is required. In order to achieve this, a Runoff Volume Control Target (RVCT) is provided as a performance target in this guidance manual. A hierarchical approach is outlined within the guidance manual that stipulates prioritization of retention through infiltration, reuse and evapotranspiration, filtration through low impact development technologies, and finally conventional treatment via end-of-pipe SWM infrastructure.

Consistent with this hierarchical approach, LID measures will be implemented on individual property parcels and combined with LID measures within the ROWs to create sustainable stormwater management features that are integrated into the fabric of the re-development project. Sustainability from a Low Impact Development context in stormwater management relates to the integration of natural, renewable, and/or recyclable materials into the proposed stormwater management system of new or re-development areas with the objective of preserving or mimicking the natural hydrological cycle and water balance. These materials are used to create stormwater management features, placed upstream near the source of the urban stormwater runoff that encourage infiltration, evapotranspiration, and uptake by vegetation. From a resource sustainability perspective, LID systems improve capture and natural use of urban rainfall runoff in comparison to traditional grey infrastructure, thus promoting sustainable use. The proposed LID measures will encourage infiltration where site conditions allow, encourage evapotranspiration, improve water quality, and reduce the quantity of runoff reaching local drainage features. They will also allow the development to better manage the increased frequency of high intensity storm events associated with climate change and re-introduce natural hydrological and ecological processes that have the capacity to withstand and recover from the pressures of heatwave, drought and flood events. Many opportunities exist to implement varying types of LIDs within the project area, which are detailed further in this memo.

LID implementation, including design and selection of building materials for construction of the infrastructure, will be completed in adherence to the overarching goals of the Greening Government Strategy (Treasury Board of Canada Secretariat, June 2024). As part of the government real property portfolio strategies, the design and implementation of LID features on site will comply with the Buy Clean: Low-Carbon Construction objectives. The objectives generally relate to reducing embodied carbon of major construction projects, completing life-cycle assessments of construction materials, and minimizing use of harmful materials in construction such as volatile organic compounds.

Additional objectives of the site design approach were identified within the Technical Reference for Office Building Design (PSPC, 2017) and include the following relevant LID and sustainability focused urban design technical requirements:

1. Reduce impervious elements by designing with natural landscaping materials.
2. Parking areas and circulation routes must maximize sustainable best practices and reduce impacts on natural stormwater environment.
3. Where sustainable best practices are adopted, consider the use of green infrastructure; the reducing, recycling, and reusing of materials; and other sustainable practices and strategies.
4. Design and construction must protect and conserve water. Designed using native plants to limit maintenance and promote biodiversity

# 3 Background Information

A review of existing site conditions, policies, and relevant design standards was completed to support the development of the LID features. The following subsections outline relevant information from both review exercises.

## 3.1 Relevant Design Standards

The following design standards were referenced in the design development process for the proposed LID features:

1. City of Ottawa Sewer Design Guidelines (Second Edition, October 2012)

2. Stormwater Management Planning and Design Manual (Ministry of Environment, Conservation, and Parks, March 2003)
3. Low Impact Development Stormwater Management Guide (TRCA/CVC, 2010)
4. Draft - Consolidated Linear Infrastructure: Environmental Compliance Approval, Appendix A. in C. a. Ministry of the Environment (Ministry of Environment, Conservation, and Parks, March 2022)
5. Road Corridor Planning & Design Guidelines: Urban Village & Collectors – Rural Arterials & Collectors (City of Ottawa, 2008)
6. City of Ottawa Official Plan (City of Ottawa, 2022)
7. Technical Reference for Office Building Design (Public Services and Procurement Canada, 2017)
8. Tunney's Pasture Sustainability Charter (Public Services and Procurement Canada (prepared by Urban Equation), 2018)
9. Tunney's Pasture Redevelopment Project Sustainability Charter - Summary of Recommended Changes (PSPC (prepared by MCW Consultants Ltd.), February 2023)

## 3.2 Relevant City of Ottawa Policies

*City of Ottawa Infrastructure Master Plan (September 2024)*
One of the priority recommendations to improve Ottawa's stormwater infrastructure resiliency is to promote the implementation of LID practices to assist with maintaining the existing level of service during more frequent storm events. As detailed in the Infrastructure Master Plan, LID requirements were included in the City's Stormwater Retrofit Program as a result of the Ottawa River Action Plan. The City's CLI-ECA also includes stormwater system performance criteria requirements from the MECP, including the ability to establish area-specific runoff volume control targets through subwatershed level studies. Since there is no subwatershed study or environmental management plan, the runoff volume control target and SWM criteria is to be defined subject to MECP CLI ECA approvals.

*CLI-ECA 008-S701*
Water balance, water quality, erosion control, water quantity, and flood control stormwater management criteria are detailed in Appendix A of the City's CLI-ECA. Per the City's Infrastructure Plan, the stormwater management at Tunney's Pasture must follow the criteria outlined in the CLI-ECA. The specific requirements are outlined in **Table 4-1** of **Section 4**.

*City of Ottawa Low Impact Development Technical Guidance Report (February 2021)*
This Technical Report provides guidance on the implementation of LIDs in areas with potential hydrogeological constraints, as found at the Tunney's Pasture Site. As displayed in the mapping within this Guidance Report and confirmed by the geotechnical investigation completed by Paterson Group, this site has shallow bedrock. Therefore, LIDs proposed for this site will utilize filtration as the main control mechanism, rather than infiltration.

*Technical Bulletin IWSTB-2024-04*
This Technical Bulletin published by the City of Ottawa provides an interim policy guidance document on new development for the feasibility of infiltration-type LIDs in greenfield scenarios. As this project is a retrofit to an existing developed area that is being modified, greenfield development guidelines as discussed in this Bulletin do not apply. Additionally, as discussed above the proposed LIDs for this site will focus on filtration rather than infiltration.

## 3.3 Relevant Site Studies

The following sub sections outline the relevant site studies that were referenced in support of LID design for the Right of Way regions of the Tunney's Pasture site.

### *3.3.1 Geotechnical Investigation*

In support of detailed design, Paterson Group was retained by Arcadis Group to complete a geological investigation at the project site. The goals of the investigation were to determine the subsoil and groundwater conditions, and provide geotechnical recommendations for the design of proposed roadway and site servicing works, including construction considerations which may affect the design. This investigation was conducted between April 2, 2024 and April 5, 2024 which included the following components:

- Drilling of eighteen (18) boreholes to a maximum depth of 11.9m below ground surface (m bgs);
- Installation of ten (10) monitoring wells and groundwater level monitoring.
- Collection of soil samples from auger flights or split spoon sampler for analytical testing, and coring of bedrock to assess bedrock quality;
- Slug testing (falling and rising head testing) at six (6) groundwater monitoring well locations to establish estimated hydraulic conductivity of underlying bedrock; and
- Analytical testing of one soil sample for sulphate, chloride, resistivity and pH to assess corrosion potential for ferrous metals and potential for sulphate attacks against subsurface concrete structures.

Findings from the geotechnical investigations show the following:

- Subsurface profile was found to generally consist of fill material with an approximate thickness of 0.5 m to over 4.0 m overlaying bedrock surface or glacial till deposit consisting of silty sand with trace clay, gravel, cobbles and boulders.
- Bedrock across the majority of the site consists of limestone or limestone with dolomite interbedding and shale partings in some locations. Bedrock surface elevations range from 56 m to 64m across the site.
- Water levels were measured at a minimum of 1.98 m bgs (58.77 masl) and maximum of 6.85 m bgs (56.53 masl) on April 23, 2024. Anticipated long-term groundwater table is located within the upper 3 m of the bedrock surface, fluctuating with the depth of bedrock across the site.
- Hydraulic conductivity values of the bedrock formation range from $1.46\text{x}10^{-7}$ m/s to $4.61\text{X}10^{-5}$ m/s.

Recommendations and conclusions drawn from these findings from an LID feature design perspective included:

- Conventional infiltration-based LID measures are not generally considered suitable due to shallow depth and relative impermeability of bedrock across the site. While small amounts of groundwater recharge and discharge may occur, conditions are overall not suitable for recharge and discharge on a large scale. As such, partial infiltration-based LIDs are proposed and are anticipated to utilize filtration as the main control mechanism.
- Hydrostatic pressures and groundwater influx is not expected to impact service design due to low permeability of the bedrock.

- Effective control of ground water and surface water during construction is considered essential to maintaining the integrity of the bearing strata as well as maintaining the stability of excavation side slopes.
- The subgrade soils are considered to be frost susceptible, therefore care and adequate protection during winter construction will be required. 2.2 m of soil cover is recommended for protection of watermain services, and 1.8 m for storm and sanitary sewer services.
- All side slopes in overburden materials should be cut back at 1H:1V or shallower to maintain stability, or trench boxes should be used where this is not suitable.
- Bedrock stabilization measures may be required within trenches where weathered bedrock or seams/joints are observed.

### *3.3.2 Existing Conditions Memo*

Arcadis IBI Group was retained by Canada Lands Company (CLC) and Public Service and Procurement Canada (PSPC) to complete an Existing Conditions Report (December, 2022) reviewing existing municipal infrastructure within the Tunney's Pasture federal government campus and the adjacent road network. This review of existing conditions and summary of key background information formed part of the Scoping component for the Master Servicing Study in support of a Draft Plan of Subdivision application to for the conveyance of the municipal services within newly created Right of Ways (ROW) to the City of Ottawa, and to inform the Infrastructure Upgrade and Divestiture Strategy Report. The report included a review of water network, sanitary, and stormwater infrastructure, assessing existing infrastructure as well as anticipated works, and also reviewed high level utilities (hydro, natural gas and telecommunications). Stormwater management design-related findings from the report included the following:

- **Sanitary Infrastructure:** Sanitary sewers will need to be realigned to suit the proposed ROW alignment, and some sewers need to be extended to service parcels without fronting sewers. Various sanitary sewers may also need to be removed and replaced to suit municipality approved cross sections. LID feature layouts shall adhere to City of Ottawa horizontal vertical clearances and consider locations of realigned sanitary sewers at the detailed design stage.
- **Water Network Infrastructure:** The on-campus distribution network is generally adequate in capacity, but will require relocation and extension at various locations to suit the incorporation of municipal ROWs. LID feature layouts shall adhere to City of Ottawa horizontal vertical clearances and consider locations of realigned water mains at the detailed design stage.
- **Stormwater Infrastructure:** While there is not a history of concerns regarding surface ponding during rainfall events, the Infrastructure Overview indicated that most of the local sewers do not have sufficient capacity to meet current City of Ottawa design guidelines. Many segments of existing storm sewer will need to be realigned to suit the proposed ROW cross section or extended where none currently exist to service fronting buildings.
- **Hydro Ottawa:** Hydro Ottawa has advised the existing Hydro Ottawa distribution system in the vicinity of the Tunney's Pasture Campus has ample spare capacity to accommodate the redevelopment of the Campus. Proximity of hydro infrastructure to the proposed LID features will be reviewed at the detailed design stage.
- **Natural Gas:** Once the new Municipal ROW network has been finalized, a review of the underground natural gas network will be undertaken and if required, relocations coordinated with Enbridge Gas. Proximity of the current and realigned gas mains to the proposed LID features will be reviewed at the detailed design state.

- **Telecommunications:** All existing telecommunications services will be relocated to the new Municipal ROW network for ease of maintenance. Proximity of telecommunications infrastructure to the proposed LID features will be reviewed at the detailed design stage.

#### *3.3.3 Topographic Survey*

Existing topographic survey data was provided to Aquafor Beech via Arcadis as part of the background data gathered for the site. This existing condition topographic survey was referenced as a general outline of future Right of Way corridor grading when determining drainage patterns to all proposed LID locations.

#### *3.3.1 LID Constraints Memo*

Aquafor completed an LID Site Servicing Constraints Memorandum in 2023 to identify site servicing constraints associated with implementing LIDs in the project area, as well as overall design requirements. Selection of LID features and function within this memo are developed in conjunction with the findings of this memo. A summary of key findings is provided under **Section 5.1** of this memo.

# 4 Applicable Stormwater Management Criteria

**Table 4-1** below outlines the applicable stormwater management criteria for the site, including LID/green infrastructure design.

*Table 4-1: Summary of Applicable Stormwater Management Criteria.*

| Criteria | Sustainability Charter (Tunney's Pasture, 2018) | City of Ottawa[1] | Rideau Valley Conservation Authority[2] | MECP Stormwater Management and Planning Design Manual (2003) | MECP Draft 2022 & CLI ECA Appendix A (MECP, 2022) | Federal (PSPC, 2017) | Applicable Criteria |
|---|---|---|---|---|---|---|---|
| **Flooding / Volume Control** | n/a see Water Balance criteria | Site discharge controlled to pre-development rates<br>Build resilience to flood risks and stormwater runoff by:<br>- Restricting development in flood plains and mitigating risks in areas vulnerable to flooding under future climate conditions<br>- Implementing SWM practices and infrastructure that is resilient to future climate conditions<br>- Using LID SWM features where feasible to manage smaller rainfall events (City of Ottawa, 2022)<br>Site- level measures should be used to reduce and control volume and rate of runoff<br>Assess impact of 100-year event outlined in the City's Sewer Design Guidelines (2012) with a 20% increase of rainfall intensity for climate change sensitivity.<br>Maximum depth of flow under static or dynamic conditions less than 0.3m.<br>Provide adequate emergency overflow conveyance off-site.<br>For further storm sewer design, refer to City of Ottawa (2012) | n/a | Peak flows must not exceed pre development values for 2–100 year return period storms.<br>Ensure that there will not be any increase in flood damage potential<br>For specific control design guidance criteria see MECP (2003) | Development<br>Manage peak flow control as per watershed/subwatershed plans. Municipal criteria of a minimum 100-year return storm, other plans (Master SWM Plan, Class EA, etc.,) as appropriate.<br>Retrofit:<br>If 'development' approach not feasible, improve level of flood control currently provided to Maximum Extent Possible based on environmental site feasibility studies.<br>Regulate water quantity as per municipal standards, Master Stormwater Management Plan, or Class EA e.t.c., as appropriate for the project<br>End-of-pipe control is 3rd priority. | See infiltration section:<br>All surface runoff must be addressed on site ("Addressed" assumed to mean control) Site planning must include strategy to minimize volume of stormwater and snowmelt runoff going into municipal systems based on historical ecosystem conditions of the region.<br>Gravity-based system must have as a minimum:<br>• Pipe flow velocity 0.6 m/s to 3 m/s under full flow conditions<br>• Optimization of on-site water detention<br>• The following SWM components:<br>○ 200 mm minimum diameter catch basin leads<br>○ 1200 mm diameter maintenance holes<br>○ Sumps in maintenance holes and catch basins<br>○ Safety platforms in maintenance holes >5m deep.<br>Major drainage system must be designed to address 1:100 year storm event<br>• Where a minor drainage system is required, must address 1:5 year storm event | (City of Ottawa)<br>Site discharge controlled to pre-development rates<br>**OR**<br>*Discharge rate set by city based on existing system capacity limits (TBD)*<br>Assess impact of 100-year event outlined in the City's Sewer Design Guidelines (2012) with a 20% increase of rainfall intensity for climate change sensitivity.<br>**Road ROIW:** Major/ Minor system design.<br>(MECP, 2022) Development<br>Manage peak flow control as per watershed/subwatershed plans. Municipal criteria of a minimum 100-year return storm, other plans (Master SWM Plan, Class EA, etc.,) as appropriate.<br>*City to confirm if watershed/ subwatershed study exists<br>Retrofit:<br>If 'development' approach not feasible, improve level of flood control currently provided to Maximum Extent Possible based on environmental site feasibility studies.<br>Regulate water quantity as per municipal standards, Master Stormwater Management Plan, or Class EA etc., as appropriate for the project<br>(PSPC, 2017)<br>Where a minor drainage system is required, must address ("addressed" assumed to mean control) 1:5 year storm event |

| Criteria | Sustainability Charter (Tunney's Pasture, 2018) | City of Ottawa[1] | Rideau Valley Conservation Authority[2] | MECP Stormwater Management and Planning Design Manual (2003) | MECP Draft 2022 & CLI ECA Appendix A (MECP, 2022) | Federal (PSPC, 2017) | Applicable Criteria |
|---|---|---|---|---|---|---|---|
| **Water Quality** | Best Management Practices must be capable of removing 80% average annual post-dev TSS load via capture of 95th percentile of regional or local rainfall events runoff managed on site using LID and green infrastructure | Reference not found, assumed 80% TSS removal required. City to confirm. | n/a | End of pipe facility (w/ 24hr drawdown)<br>removal dependant on the downstream<br>aquatic habitat sensitivity, from most<br>sensitive to least:<br>*Enhanced Protection*<br>- 80% removal of TSS<br>*Normal Protection*<br>- 70% removal of TSS<br>*Basic Protection*<br>- 60% removal of TSS<br>See table 3.2 in MECP (2003)<br>Bacteria:<br>If no downstream recreational water activities (swimming), wet SWM facilities adequately control bacteria. If yes downstream swimming, additional considerations req'd.<br>If development >= 10% of drainage area discharging to swimming area, undertake subwatershed plan.<br>Temperature<br>SWM facilities will always raise temperatures. Ways to reduce water temperature include:<br>- Pond configuration, Riparian planting in the shoreline fringe, bottom draw outlet e.t.c.,<br>If temperature is a significant concern, consult with DFO and OMNR (nat. resources).<br>Ensure that water quality will be protected | Development:<br>Generally:<br>• Characterize water quality to be protected and stormwater contaminants<br>• Watershed/sub watershed plan to minimize or prevent contaminant loads<br>Suspended Solids (SS):<br>• Control 90th percentile storm event and, if conventional methods are necessary, aim for 80%/70%/60% S.S. removal.<br>Retrofit:<br>Improve level of water quality currently provided on site<br>**AND**<br>Follow 'development' criteria for SS **OR**<br>design a treatment train to achieve 'development' criteria within 10 years<br>**OR**<br>Control as per 'Maximum Extent Possible'. | All surface runoff must be addressed on<br>site ("Addressed" assumed to mean control)<br>Site drainage plan include development of<br>a strategy to improve water quality based<br>on historical ecosystem conditions of the<br>region.<br>Minimize volume of stormwater and snowmelt going to municipal systems, improve water quality<br>Control stormwater and sanitary sewage<br>to meet discharge standards of authority<br>having jurisdiction<br>Proper drainage to eliminate standing water | (Tunney's Pasture, 2018)<br>Best Management Practices must be capable of removing 80% average annual post-dev TSS load<br>Runoff from 95th percentile (27mm event) of regional or local rainfall events runoff managed on-site using LID and green infrastructure, including **Road ROW**. (MECP, 2003)<br>If water temperature is a significant concern, consult with DFO / OMNR<br>Ensure that water quality will be protected<br>Development:<br>Generally:<br>• Characterize water quality to be protected and stormwater contaminants<br>• Watershed/sub watershed plan to minimize or prevent contaminant loads<br>Retrofit:<br>Improve level of water quality currently provided on site<br>**AND**<br>Follow 'development' criteria for SS **OR**<br>design a treatment train to achieve 'development' criteria within 10 years<br>**OR**<br>Control as per 'Maximum Extent Possible'.<br>(PSPC, 2017)<br>All surface runoff must be addressed on-site ("Addressed" assumed to mean control)<br>Minimize volume of stormwater and snowmelt going to municipal systems, improve water quality<br>(MECP, 2022)<br>The Runoff Volume Control Target (RVCt) hierarchy:<br>1. Priority 1 Retention – Infiltration, Re-use and Evapotranspiration<br>2. Priority 2 – LID Filtration<br>3. Priority 3 – Conventional Treatment<br>Where management/ control of the 95th percentile isn't possible due to Site Restrictions (Constraints) using Priority 1 and Priority 2, achieve control to the Maximum Extent Possible (MEP). |

| Criteria | Sustainability Charter (Tunney's Pasture, 2018) | City of Ottawa[1] | Rideau Valley Conservation Authority[2] | MECP Stormwater Management and Planning Design Manual (2003) | MECP Draft 2022 & CLI ECA Appendix A (MECP, 2022) | Federal (PSPC, 2017) | Applicable Criteria |
|---|---|---|---|---|---|---|---|
| **Erosion Control** | n/a | Reference not found, assumed defer to MECP (2003). City to confirm. | n/a | Follow Detailed or Simple Erosion Design<br>Plan as given by Section 3.4.<br>Ensure that the watercourse will not<br>undergo undesirable and costly geomorphic change | Follow erosion assessment in watershed/subwatershed plan<br>OR<br>Follow MECP (2003) detailed or simplified design approaches based on proponent preference or size of drainage area.<br>In the absence of a study, detain at a minimum, runoff volume generated from 25mm event over 24 to 48 hours. | Plan and design must include strategy to control and minimize erosion, waterway sedimentation and airborne dust.<br>Must conform to erosion and sediment requirements of provinces/municipalities.<br>Mitigate risk of erosion of embankments/slope areas especially those that could impact riparian zones, waterways and stormwater retention ponds. | (Tunney's Pasture, 2018)<br>Runoff from 95th percentile (27mm event) of regional<br>or local rainfall events runoff managed on-site using LID and green infrastructure, including **Road ROW**. (MECP, 2022)<br>Follow erosion assessment in watershed/subwatershed plan<br>OR<br>Follow MECP (2003) detailed or simplified design approaches based on proponent preference or size of drainage area.<br>In the absence of a study, detain at a minimum, runoff volume generated from 25mm event over 24 to 48 hours. |
| **Water Balance/ Infiltration Retention – Infiltration** | 95th percentile of regional or local rainfall events runoff managed on site using LID and green infrastructure | Use of dual drainage principle (City of Ottawa, 2012)<br>Site discharge controlled to pre-development rates | n/a | Pre-development water balance should be maintained or restored via water balance on a site-by-site basis (modelling or calculation)<br>Ensure that groundwater and baseflow characteristics are conserved<br>Lot-level infiltration controls are also suggested such as:<br>Reduced grading to allow ponding or<br>directing roof leaders to rear yard ponding areas or cisterns (for more examples see p. 4-3 of MECP (2003)) | New Development:<br>• Complete assessment to control pre- and post- development water balance changes using site level strategies (see document)<br>• Assessment study NOT completed:<br>○ Control recharge to meet pre development **OR** control runoff from 90th percentile event<br><br>Retrofit Scenarios:<br>• Complete assessment to control pre- and post- development water balance changes using site level strategies<br>• Assessment study not completed:<br>○ Control recharge to meet pre development **OR** control runoff from 90th percentile event | Design of site drainage must minimize impacts of site grading strategies to municipal infrastructure among other items<br>All surface runoff must be addressed on site ("Addressed" assumed to mean control)<br>Storm drainage systems must rely on gravity flow wherever possible.<br>Minimize volume. | The more stringent of:<br>1) (MECP, 2022)<br>• Complete assessment to control pre- and post- development water balance changes using site level strategies (see document)<br>OR<br>2) (Tunney's Pasture, 2018)<br>• 95th percentile of regional or local rainfall events runoff managed on-site using LID and green infrastructure<br>Retrofit Scenarios (MECP, 2022):<br>• Complete assessment to control pre- and post- development water balance changes using site level strategies<br>• Assessment study not completed:<br>○ Control recharge to meet pre development |

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|---|---|---|---|---|---|---|---|
| **Retention - Water Re-use** | Site-wide distribution system to utilize river water for toilets and irrigation. No potable water in flush toilets. No potable water irrigation<br>Install Greywater reuse in all multi unit residential buildings more than six storeys in height. | Reference not found, assumed defer to MECP (2003). City to confirm. | n/a | Lot-level storage controls as a starting point for treatment train include methods such as:<br>- Rooftop, parking lot, superpipe and rear yard<br>All with the intention of detaining stormwater and reducing peak runoff rates. | LID Retention (with water re-use features) is a 1st priority control and must be utilized to the maximum extent possible before going to 2nd control | Integrated stormwater retention and detention system for the roof in order to reduce runoff and, where applicable, provide irrigation<br>Eliminate use of potable water for irrigation and using where required grey water irrigation systems and plantings.<br>e.g., rainwater harvesting strategy<br>Provision of grey water irrigation to assist on-site vegetation growth. | (Tunney's Pasture, 2018)<br>Site-wide distribution system to utilize river water* for toilets and irrigation. No potable water in flush toilets.<br>No potable water irrigation<br>**: to be amended to rainwater only*<br>Install greywater reuse in all multi-unit residential buildings more than six storeys in height.<br>(PSPC, 2017)<br>Integrated stormwater retention and detention system for the roof in order to reduce runoff and, where applicable, provide irrigation<br>Eliminate use of potable water for irrigation and using where required grey water irrigation systems and plantings e.g., rainwater harvesting strategy<br>Provision of grey water irrigation to assist on-site vegetation growth |
| **Retention - Evapotranspiration** | n/a | Protect and enhance tree canopy and protect wetlands and other nature-based solutions by:<br>- Protecting, enhancing and managing trees, shorelines wetlands and other natural areas<br>- Considering and mitigating impacts of climate change on the environment<br>- Managing risks of wildland fire.<br>The City of Ottawa has a target of 40 percent urban canopy cover by 2050 (City of Ottawa, 2022) | n/a | Potential for increase in evapotranspiration based on lot-level control selection. | LID Retention (with evapotranspiration features) controls is a 1st priority control and must be utilized to the maximum extent possible before going to 2nd control | Planned with trees placed to provide shaded rest areas, reducing heat via canopy.<br>Conservation and enhancement of natural areas and restoration of damaged areas.<br>Two new trees reinstated for every tree removed. | (City of Ottawa, 2022)<br>The City of Ottawa has a target of 40 percent urban canopy cover by 2050<br>(PSPC, 2017)<br>Planned with trees placed to provide shaded rest areas, reducing heat via canopy.<br>Conservation and enhancement of natural areas and restoration of damaged areas<br>Two new trees reinstated for every tree removed |

**N/a indicates that the relevant source document does not have information available**

# 5 LID Feature Selection

## 5.1 Site Constraints

Site specific constraints within the project area include the following:

- Conventional LID measures that adopt infiltration of stored runoff into the underlying subsoils for groundwater recharge are generally not considered suitable for the subject site from a geotechnical perspective due to the shallow bedrock. This also aligns with Appendix A-2 of CLI-ECA 008-S701. Some techniques, such as catchbasins and amended topsoil finishes used in conjunction with soak-away pits, may be considered suitable due to the presence of the impermeable bedrock. LID measures featuring filtration practices are generally considered to be feasible.
  - As such, Aquafor Beech has developed preliminary LID designs that utilize partial-infiltration and adopt runoff filtration as the primary mechanism to achieve the required water quality target of the site, as outlined in **Section 6** below. Infiltration of the captured runoff is anticipated to occur on a limited basis and will be value added.
- Dense utility corridors identified as part of the background review may limit LID feasibility and implementation within the site rights-of-way over their full extents. Localized constraints may require use of alternative cross-sections, mitigation measure, additional infrastructure and/or alternative LID approaches (i.e. filtration vs. infiltration etc.).

## 5.2 Proposed LID Features

Low impact development comprises a set of naturalized design features that minimize runoff and distributed, small scale structural practices that mimic natural or predevelopment hydrology through processes such as infiltration, evapotranspiration, harvesting, filtration and detention of stormwater. The proposed LID practices for the Tunney's Pasture realigned ROW design are listed below.

1. **Permeable Pavements and Pavers** – Collective terms for a variety of surface treatments including pervious concrete, porous asphalt, permeable interlocking pavers, rubberized granular surfaces, and plastic or concrete grid systems. These systems contain pore spaces that allow stormwater to pass through into a stone base for treatment. Emission impacts and embodied carbon have not been quantified as part of this LID assessment. At the detailed design stage, embodied carbon and emissions impacts will be considered when looking to select the preferred permeable surface typology (permeable unit pavers/permeable concrete/ permeable asphalt etc.). Climate Positive Design's Pathfinder Tool 3.0 will assist in this decision-making process. Per the tool, precast permeable unit pavers have an emboddied carbon value of 0.28 kg$CO_2$e per kg, permeable concrete is 0.14 kg$CO_2$e per kg while standard cast-in-place concrete is 0.236 kg$CO_2$e per kg. The Pathfinder Tool will be utilized at the detailed design stage to inform material selection alongside other economic, environmental and urban design criteria.
2. **Dry Swale Filtration Facilities** – Designed to mimic the tributaries of the Ottawa River using a limestone creek bed typology at the surface that will meander through medians and boulevards, widening at bump out locations. Stormwater will be directed to the creek bed from road, sidewalk and cycle track surfaces via curb cuts and will drain from the surface into a subsurface filtration trench below. The filtration trench is composed of a rectangular trench lined with geotextile fabric and filled with a sand media to encourage filtration and cooling of runoff while omitting organic matter or mulch to discourage plant establishment and reduce operation and maintenance needs. The creek bed at the surface will be composed of limestone aggregate and boulders ranging in size and shape to mimic natural tributary form and aesthetic. Where these facilities intersect with

key amenity nodes, plazas and parks, the creek bed can be hardened to activate these spaces by keep runoff at the surface. This can be accomplished by grouting joints between the stones or installing an impermeable liner between the limestone creek bed and filtration gallery in specific locations. At the downstream end of these 'hardened' zones, runoff will again be permitted to drain into the galleries below where it will be filtered and cooled before being directed back to the storm sewer. The meandering form of the creek bed will create pockets for integration of street trees and plant material to allow for enhanced stormwater treatment, urban cooling and habitat integration.

3. **Tree Pits -** located to take advantage of available space in the boulevard to enhance stormwater capture and filtration and provide passive irrigation of street trees. They can be designed to take runoff from the sidewalk or street and are composed of engineered soils such as biomedia and an underdrain to direct overflow to the storm sewer.
4. **Rain Pockets and Enhanced Micro-pools -** small engineered grassy basins that incorporate engineered soil such as biomedia and an optional perforated underdrain pipe designed to mimic natural depressions in upland forests, meadows and prairies that capture, filter and slow runoff, provide topographic interest and support biodiversity. These basins may be planted with more elaborate landscaping, and allow for enhanced filtration and storage of runoff in comparison to enhanced grass swales.
5. **Bioswale** – vegetated open channels designed to convey, treat and attenuate stormwater runoff. Check dams and vegetation in the swale slows water to allow filtration of sediments, evapotranspiration, and infiltration into underlying soils to occur where site conditions allow. Additionally, a biomedia channel bed encourages filtration of runoff through this soil-based layer and into a perforated subdrain below for conveyance into the storm sewer system as treated runoff.

# 6 LID Feature Design

The following subsections outline the design development process used in sizing the LID SWM facilities.

## 6.1 Tree Pits

**Table 6-1** below outlines the basic design parameters adopted for the proposed tree pit LID features, further used to determine overall capacity of the ROW LID systems by Block throughout the site.

*Table 6-1: Tree Pits Design Parameters*

| Design Parameter | Value (or Range Where Applicable) |
|---|---|
| Width (m) | 4-5 |
| Length (m) | Varies by location |
| Subsurface Media Depth - includes stone layers (m) | 0.5 |
| Surface Ponding Depth (m) | 0.1 |
| Storage (m3) | TBD at detailed design |
| Underdrain Size (mm) | TBD at detailed design |

## 6.2 Bioswales

**Table 6-2** below outlines the basic design parameters adopted for the proposed bioswale LID features, further used to determine overall capacity of the ROW LID systems by Block throughout the site.

*Table 6-2: Bioswale Design Parameters*

| Design Parameter | Value (or Range Where Applicable) |
|---|---|
| Width (m) | 3.45 |
| Length (m) | Varies by location |
| Subsurface Media Depth - includes stone layers (m) | 0.5 |
| Surface Ponding Depth (m) | 0.05 |
| Storage (m3) | TBD at detailed design |
| Underdrain Size (mm) | 100 |

## 6.3 Dry Swale Filtration Trenches

**Table 6-3** below outlines the basic design parameters adopted for the proposed dry swale LID features, further used to determine overall capacity of the ROW LID systems by Block throughout the site.

*Table 6-3: Dry Swale Design Parameters*

| Design Parameter | Value (or Range Where Applicable) |
|---|---|
| Width (m) | 4.5-6 |
| Length (m) | Varies by location |
| Subsurface Media Depth - includes stone layers (m) | 0.5 |
| Surface Ponding Depth (m) | 0.05 |
| Storage (m3) | TBD at detailed design |
| Underdrain Size (mm) | 150 |

## 6.4 Enhanced Micro-pools/Rain Pockets

**Table 6-4** below outlines the basic design parameters adopted for the proposed enhanced micro-pool/rain pocket LID features, further used to determine overall capacity of the ROW LID systems by Block throughout the site.

*Table 6-4: Enhanced Micro-pool/Rain Pocket Design Parameters*

| Design Parameter | Value (or Range Where Applicable) |
|---|---|
| Width (m) | 5 |
| Length (m) | Varies by location |
| Subsurface Media Depth - includes stone layers (m) | 0.5 |
| Surface Ponding Depth (m) | 0.2 |
| Storage (m3) | TBD at detailed design |
| Underdrain Size (mm) | TBD at detailed design |

## 6.5 Permeable Pavements

**Table 6-5** below outlines the basic design parameters adopted for the proposed permeable pavement LID features, further used to determine overall capacity of the ROW LID systems by Block throughout the site.

*Table 6-5: Permeable Pavement Design Parameters*

| Design Parameter | Value (or Range Where Applicable) |
|---|---|
| Width (m) | 2-2.4 |
| Length (m) | Varies by location |
| Subsurface Media Depth - includes stone layers (m) | 0.4 |
| Surface Ponding Depth (m) | 0.1 |
| Storage (m3) | TBD at detailed design |
| Underdrain Size (mm) | 100-200 |

## 6.6 Stormwater Management Facilities Summary

Contributing catchments were delineated within the site area using existing conditions topographic survey data under the assumption that general grading patterns will be respected in the proposed grading design. Should any catchments require refinement based on proposed grading once developed, re-delineation of catchments and revised LID design shall be undertaken as required.

**Table 6-6** below outlines the key hydrologic parameters produced from catchment delineation for each LID feature location.

*Table 6-6: Hydrologic Parameters of LID Feature Locations*

| Block Number | Catchment Size (ha) | Impervious Area (m2) | Total LID Footprint Area (m2)* | I:P Ratio | Water Quality Target – 27mm (m3) | Total Design Storage (m3) |
|---|---|---|---|---|---|---|
| Block 1 | 0.27 | 2,740 | 345 | 7.0:1 | 74 | 94 |
| Block 2 | 0.41 | 3,650 | 493 | 7.4:1 | 112 | 130 |
| Block 3 | 0.29 | 2,911 | 270 | 9.8:1 | 79 | 92 |
| Block 11 | 1.20 | 10,146 | 1,870 | 5.4:1 | 324 | 608 |
| Block 12 | 0.69 | 5,784 | 1,108 | 5.2:1 | 186 | 310 |
| Block 13 | 0.25 | 2,078 | 424 | 4.9:1 | 68 | 119 |
| Block 15 | 2.24 | 17,470 | 4,965 | 3.5:1 | 606 | 1,061 |
| Block 17 | 0.77 | 6,660 | 1,001 | 6.7:1 | 207 | 263 |
| Block 18 | 0.64 | 5,597 | 763 | 7.3:1 | 172 | 202 |
| Block 19 | 0.39 | 3,289 | 604 | 5.4:1 | 105 | 205 |
| Block 20 | 0.24 | 2,142 | 269 | 8.0:1 | 65 | 90 |
| Block 21 | 0.38 | 3,188 | 595 | 5.4:1 | 102 | 198 |
| Block 22 | 0.17 | 1,376 | 335 | 4.1:1 | 46 | 134 |
| Block 23 | 0.40 | 3,394 | 637 | 5.3:1 | 109 | 215 |
| Block 24 | 0.40 | 3,369 | 634 | 5.3:1 | 108 | 217 |
| Block 26 | 0.25 | 2,118 | 415 | 5.1:1 | 68 | 141 |
| Block 27 | 0.22 | 1,821 | 421 | 4.3:1 | 61 | 143 |
| Block 28 | 0.64 | 4,730 | 1,661 | 2.8:1 | 173 | 676 |
| Eglantine Driveway | 0.33 | 2,663 | 600 | 4.4:1 | 88 | 168 |

**includes 50% factor of safety reduction in consideration of future driveway access points, utilities, and other surface features limiting available space for LID features*

The overall storage values reported in **Table 6-6** indicate that the preliminary LID feature design and layout within the proposed site right-of-way areas is sufficient to capture and control the 90th percentile storm event runoff. A detailed breakdown of storage by LID type will be developed as part of the detailed design stage. As such, the water quality and erosion control SWM criteria outlined in Table 4-1 can be effectively met. Benefits to water balance and quantity control will be quantified at the detailed design stage. Conceptual design cross sections of the standard LID Right of Way layouts are provided in **Appendix A**.

# 7 Operation and Maintenance Considerations

A number of operation and maintenance (O&M) practices should be considered by the site owner to ensure the features maintain their as-designed function in future years. The considerations outlined in **Tables 7-1** to **7-4** are summarized from previous industry experience of Aquafor Beech and the TRCAs' Low Impact Development Stormwater Management Practice Inspection and Maintenance Guide.

*Table 7-1: Operation and Maintenance Considerations for Bioswales and Dry Swales.*

| Design Component | O & M Description | Frequency |
|---|---|---|
| **Contributing Drainage Area** | CDAs should be free of point sources of pollutants (e.g., leaking waste containers, spills, failing ESCs). Trash, sediment and debris should be removed regularly from pavements and other stormwater conveyances (e.g., gutters, eavestroughs) draining to the BMP. | Biannual visual inspections. |
| **Inlet Conveyance System** | Inlets must remain unobstructed to ensure that stormwater enters the BMP as designed. Scour protection features (e.g., stone cover, flow spreader) may also be needed for curb-cut or pipe inlets to prevent erosion of the filter bed from concentrated flow. | Visual Inspection – biannual<br>Flushing & CCTV – when clogging/damage suspected. |
| **Pretreatment** | Proper pretreatment extends the operating life cycle of the BMP by reducing the rate of accumulation of coarse sediment in the BMP. Devices include vegetated filter strips, gravel diaphragms, forebays, check dams, oil and grit separators and manholes containing baffles or filters and sumps. Pretreatment devices require frequent (e.g., annual or bi-annual) trash, sediment and debris removal. | Biannual visual inspections.<br>. |
| **Perimeter** | Inspection of the perimeter: confirm dimensions of the BMP are acceptable, ensure the structural integrity of side slopes or vertical walls is maintained and confirm that the BMP continues to provide the designed surface ponding water storage capacity. Periodic maintenance of side slopes may be needed to repair erosion rills or damage from vehicle or foot traffic. | Annual visual inspections. |
| **Filter Bed** | Filter beds should be checked for presence of standing water. Trash should be removed from the filter bed regularly. Mulch or stone cover should be maintained on non-vegetated areas to prevent weed growth and soil erosion. Accumulated sediment should be periodically removed to maintain surface draining function. Repair of animal burrows, sunken areas, erosion rills or damage from vehicle or foot | Annual visual inspections.<br>Flushing & Vac Truck – when drawdown exceeds 92hrs **OR** sediment accumulation |

| | | |
|---|---|---|
| | traffic may also be needed to prevent short circuiting of flow through the filter media soil. Maximum ponding depth should be checked to ensure designed water storage capacity is maintained. | impeding inlet/outlet function. |
| **Vegetation** | Routine maintenance of vegetation is the same as a conventional planting bed (i.e., weeding, mowing, pruning, irrigation during droughts). In the first 2 months of establishment, plantings need to be irrigated frequently (e.g., bi-weekly). As bioretention practices are intended to retain nutrients from inflowing stormwater, applying fertilizer to the filter bed should not be a part of routine maintenance. | Routine maintenance, varies with plantings |
| **Overflow Outlets** | Overflow outlet structures must be kept free of obstructions to ensure stormwater is safely conveyed during major storm events. | Biannual visual inspections. |
| **Sub-drain** | Sub-drains may be included where the permeability of the underlying native sub-soil is low or, due to other constraints, an impermeable liner is required. The perforated pipe must be kept free of obstructions to ensure that the subsurface water storage capacity of the BMP drains within a specified time period. A maintenance port standpipe may be connected to the perforated pipe to provide a means of flushing and inspecting it. Perforated pipes should be routinely flushed with water to remove sediment. If the sub-drain is equipped with a flow-restrictor (e.g., orifice plate, ball valve) to attenuate flow rates, the flow restrictor must be inspected and cleaned regularly. | Biannual visual inspections. |
| **Monitoring well** | Monitoring wells are needed to determine if the BMP drains within an acceptable time period and to track drainage performance over its operating lifespan. Standpipes should be securely capped on both ends and remain undamaged and free of sediment which may require periodic flushing. | Biannual access function inspections. |

*Table 7-2: Operation and Maintenance Considerations for Permeable Pavements and Pavers*

| Design Component | O & M Description | Frequency |
|---|---|---|
| **Contributing Drainage Area** | CDAs should be free of point sources of pollutants (e.g., leaking waste containers, spills, failing ESCs). Trash, sediment and debris should be removed regularly from pavements and other stormwater conveyances (e.g., gutters, eavestroughs) draining to the BMP. | Biannual visual inspections. |
| **Pavement surface** | Surface should be inspected for damage, deformation (e.g. ruts), unevenness, open joints and sediment accumulation. Should not allow ponding of water on the surface to occur when functioning acceptably so any observation of surface ponding indicates that a problem exists. Trash and natural debris should be periodically removed. Surface needs to be swept and | Biannual visual inspections and routine maintenance. |

| | | |
|---|---|---|
| | vacuumed regularly to remove fine sediment from joints and pores, and plowed of snow and spread with de-icing salt as needed during winter. Sand should not be spread as an anti-slip agent as it will clog the joints or pores. Grid systems with topsoil and grass fill are maintained like lawns. | |
| **Vegetation** | Permeable interlocking grid systems may be filled with topsoil and planted with grass. Routine maintenance of grid system grass cover is the same as conventional lawns (i.e., weeding, mowing, watering during droughts). In the first 2 months of establishment, plantings need to be irrigated frequently (e.g., bi-weekly). Where compost amended topsoil is used to fill grid cells, periodic top dressing with compost should be all that is needed to maintain healthy vegetation cover (i.e., application of chemical fertilizers should not be a part of routine maintenance). | Routine maintenance, varies with plantings |
| **Overflow outlets** | Flows exceeding the storage capacity of the BMP are conveyed to an adjacent drainage system via an overflow outlet structure (e.g., flush curb, curb-cut, catch basin). Overflow outlet structures must be kept free of obstructions to ensure stormwater is safely conveyed during major storm event. | Biannual visual inspections. |
| **Sub-drain** | Sub-drains may be included where the permeability of the underlying native sub-soil is low or where an impermeable liner is required. The perforated pipe must be kept free of obstructions to ensure that the subsurface water storage capacity of the BMP drains within a specified time period. A maintenance port standpipe may be connected to the perforated pipe to provide a means of flushing and inspecting it. Perforated pipes should be routinely flushed with water to remove sediment. If the sub-drain is equipped with a flow-restrictor (e.g., orifice plate, ball valve) to attenuate flow rates, the flow restrictor must be inspected and cleaned regularly. | Biannual visual inspections. |
| **Monitoring well** | Monitoring wells are needed to determine if the BMP drains within an acceptable time period and to track drainage performance over its operating lifespan. Standpipes should be securely capped on both ends and remain undamaged and free of sediment which may require periodic flushing. | Biannual access function inspections. |
| **Control structure** | The manhole or catchbasin which provides access to the sub-drain and flow restrictor device, if present. Inspect for damage and sediment accumulation. | Biannual visual inspections. |

*Table 7-3: Operation and Maintenance Considerations for Rain Pockets and Enhanced Micro-pools*

| Design Component | O & M Description | Frequency |
| --- | --- | --- |
| **Contributing Drainage Area** | CDAs should be free of point sources of pollutants (e.g., leaking waste containers, spills, failing ESCs). Trash, sediment and debris should be removed regularly from pavements and other stormwater conveyances (e.g., gutters, eavestroughs) draining to the BMP. | Biannual visual inspections. |
| **Inlet Conveyance System** | Inlets must remain unobstructed to ensure that stormwater enters the BMP as designed. Scour protection features (e.g., stone cover, flow spreader) may also be needed for curb-cut or pipe inlets to prevent erosion of the filter bed from concentrated flow. | Visual Inspection – biannual<br>Flushing & CCTV – when clogging/damage suspected. |
| **Pretreatment** | Proper pretreatment extends the operating life cycle of the BMP by reducing the rate of accumulation of coarse sediment in the BMP. Devices include vegetated filter strips, gravel diaphragms, forebays, check dams, oil and grit separators and manholes containing baffles or filters and sumps. Pretreatment devices require frequent (e.g., annual or bi-annual) trash, sediment and debris removal. | Biannual visual inspections.<br>. |
| **Perimeter** | Inspection of the perimeter: confirm dimensions of the BMP are acceptable, ensure the structural integrity of side slopes or vertical walls is maintained and confirm that the BMP continues to provide the designed surface ponding water storage capacity. Periodic maintenance of side slopes may be needed to repair erosion rills or damage from vehicle or foot traffic. | Annual visual inspections. |
| **Filter Bed** | Filter beds should be checked for presence of standing water. Trash should be removed from the filter bed regularly. Mulch or stone cover should be maintained on non-vegetated areas to prevent weed growth and soil erosion. Accumulated sediment should be periodically removed to maintain surface draining function. Repair of animal burrows, sunken areas, erosion rills or damage from vehicle or foot traffic may also be needed to prevent short circuiting of flow through the filter media soil. Maximum ponding depth should be checked to ensure designed water storage capacity is maintained. | Annual visual inspections.<br>Flushing & Vac Truck – when drawdown exceeds 92hrs **OR** sediment accumulation impeding inlet/outlet function. |
| **Vegetation** | Routine maintenance of vegetation is the same as a conventional planting bed (i.e., weeding, mowing, pruning, irrigation during droughts). In the first 2 months of establishment, plantings need to be irrigated frequently (e.g., bi-weekly). As | Routine maintenance, varies with plantings. |

| | | |
|---|---|---|
| | bioretention practices are intended to retain nutrients from inflowing stormwater, applying fertilizer to the filter bed should not be a part of routine maintenance. | |
| **Overflow Outlets** | Flows exceeding the storage capacity of the BMP are conveyed to an adjacent drainage system via an overflow outlet structure (e.g., pipe, standpipe, curb-cut, swale, catchbasin). Overflow outlet structures must be kept free of obstructions to ensure stormwater is safely conveyed during major storm events. | Biannual visual inspections. |
| **Sub-drain** | Sub-drains may be included where the permeability of the underlying native sub-soil is low or where an impermeable liner is required. The perforated pipe must be kept free of obstructions to ensure that the subsurface water storage capacity of the BMP drains within a specified time period. A maintenance port standpipe may be connected to the perforated pipe to provide a means of flushing and inspecting it. Perforated pipes should be routinely flushed with water to remove sediment. If the sub-drain is equipped with a flow-restrictor (e.g., orifice plate, ball valve) to attenuate flow rates, the flow restrictor must be inspected and cleaned regularly. | Biannual visual inspections. |
| **Monitoring well** | Monitoring wells are needed to determine if the BMP drains within an acceptable time period and to track drainage performance over its operating lifespan. Standpipes should be securely capped on both ends and remain undamaged and free of sediment which may require periodic flushing. | Biannual access function inspections. |

*Table 7-4: Operation and Maintenance Considerations for Tree Pits*

| Design Component | O & M Description | Frequency |
|---|---|---|
| **Contributing Drainage Area** | CDAs should be free of point sources of pollutants (e.g., leaking waste containers, spills, failing ESCs). Trash, sediment and debris should be removed regularly from pavements and other stormwater conveyances (e.g., gutters, eavestroughs) draining to the BMP. | Biannual visual inspections. |
| **Inlet Conveyance System** | Inlets must remain unobstructed to ensure that stormwater enters the BMP as designed. Scour protection features (e.g., stone cover, flow spreader) may also be needed for curb-cut or pipe inlets to prevent erosion of the filter bed from concentrated flow. | Visual Inspection – biannual<br>Flushing & CCTV – when clogging/damage suspected. |
| **Pretreatment** | Proper pretreatment extends the operating life cycle of the BMP by reducing the rate of accumulation of coarse sediment in the BMP. Devices include vegetated filter strips, gravel diaphragms, forebays, check dams, oil and grit | Biannual visual inspections. |

| | | |
|---|---|---|
| | separators and manholes containing baffles or filters and sumps. Pretreatment devices require frequent (e.g., annual or bi-annual) trash, sediment and debris removal. | |
| **Perimeter** | Inspection of the perimeter: confirm dimensions of the BMP are acceptable, ensure the structural integrity of side slopes or vertical walls is maintained and confirm that the BMP continues to provide the designed surface ponding water storage capacity. Periodic maintenance of side slopes may be needed to repair erosion rills or damage from vehicle or foot traffic. | Biannual visual inspections. |
| **Filter Bed** | Filter beds should be checked for presence of standing water. Trash should be removed from the filter bed regularly. Mulch or stone cover should be maintained on non-vegetated areas to prevent weed growth and soil erosion. Accumulated sediment should be periodically removed to maintain surface draining function. Repair of animal burrows, sunken areas, erosion rills or damage from vehicle or foot traffic may also be needed to prevent short circuiting of flow through the filter media soil. Maximum ponding depth should be checked to ensure designed water storage capacity is maintained. | Annual visual inspections. Flushing & Vac Truck – when drawdown exceeds 92hrs **OR** sediment accumulation impeding inlet/outlet function. |
| **Vegetation** | Routine maintenance of vegetation is the same as a conventional planting bed (i.e., weeding, mowing, pruning, irrigation during droughts). In the first 2 months of establishment, plantings need to be irrigated frequently (e.g., bi-weekly). As bioretention practices are intended to retain nutrients from inflowing stormwater, applying fertilizer to the filter bed should not be a part of routine maintenance. | Routine maintenance, varies with plantings. |
| **Overflow Outlets** | Flows exceeding the storage capacity of the BMP are conveyed to an adjacent drainage system via an overflow outlet structure (e.g., pipe, standpipe, curb-cut, swale, catchbasin). Overflow outlet structures must be kept free of obstructions to ensure stormwater is safely conveyed during major storm events. | Biannual visual inspections. |
| **Sub-drain** | Sub-drains may be included where the permeability of the underlying native sub-soil is low or where an impermeable liner is required. The perforated pipe must be kept free of obstructions to ensure that the subsurface water storage capacity of the BMP drains within a specified time period. A maintenance port standpipe may be connected to the perforated pipe to provide a means of flushing and inspecting it. Perforated pipes should be routinely flushed with water to remove sediment. If the sub-drain is | Biannual visual inspections. |

| | | |
|---|---|---|
| | equipped with a flow-restrictor (e.g., orifice plate, ball valve) to attenuate flow rates, the flow restrictor must be inspected and cleaned regularly | |
| **Monitoring well** | Monitoring wells are needed to determine if the BMP drains within an acceptable time period and to track drainage performance over its operating lifespan. Standpipes should be securely capped on both ends and remain undamaged and free of sediment which may require periodic flushing. | Biannual access function inspections. |
| **Trees** | Tree pruning should be completed by a qualified forestry crew for safety concerns, tree health & vitality, and disease control. Standard tree pruning involves removing all dead, dying, diseased, decayed, interfering, noticeably weak or crowded branches, the removal of lower branches and stem suckers, clearing stop signs to a minimum of 25 metres clear view, clearing traffic signals to a minimum 25 metres clear view and reporting any other defects to the Forestry Coordinator for inspection and action. | Tree pruning is required approximately every 7–10 years. |

# 8 Conclusion

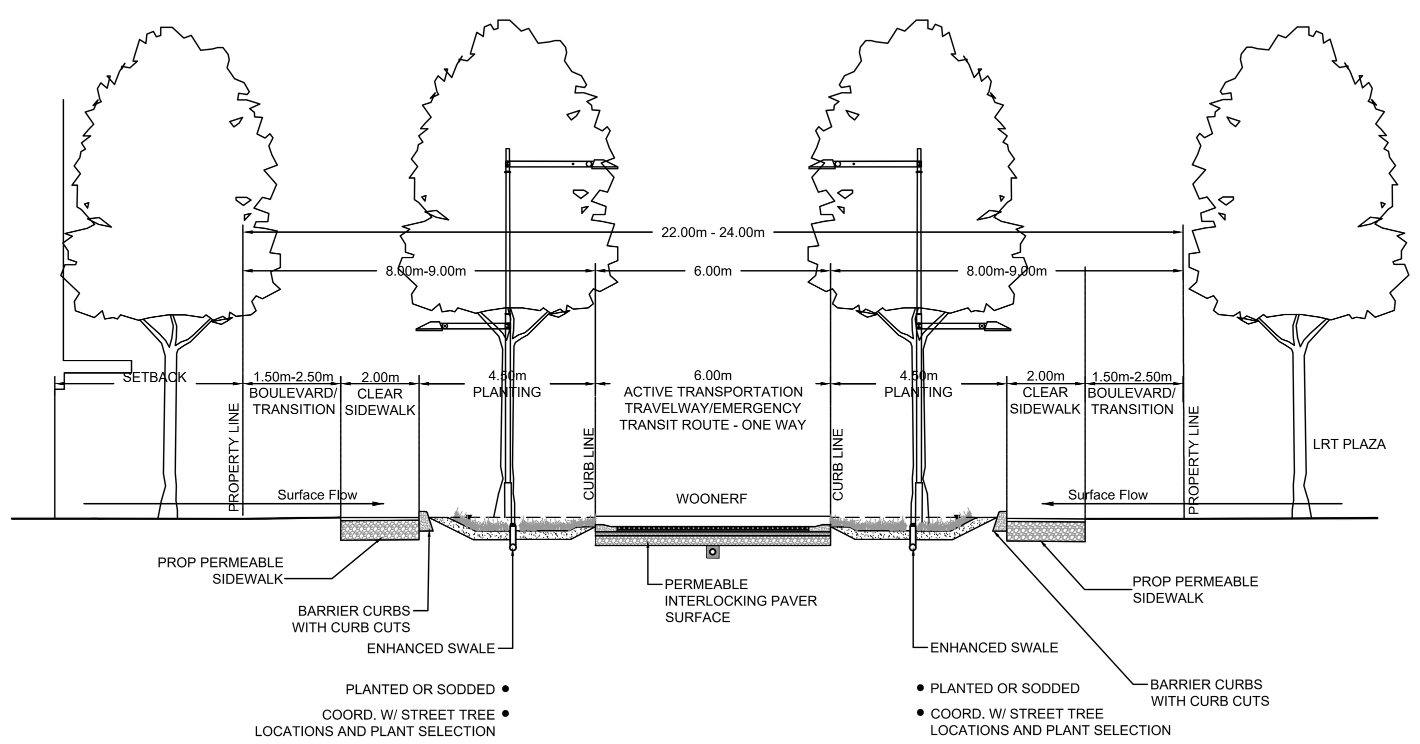
An LID treatment train approach was designed for the proposed Right of Way realignments within the Tunney's Pasture study area as part of the proposed stormwater management system that considers a number of technical site constraints, provides an aesthetic finish to the proposed right of ways, adheres to the recommended SWM Criteria and considers incorporation that compliments the layout of the proposed shared-use transportation corridors. The proposed LID features vary by location throughout the site and include bioswales, enhanced micro-pools/rain pockets, permeable pavements, dry swale filtration trenches, and tree pits. These LID designs adopt a number of general design features to meet existing site constraints, effective LID design per the relevant design standards outlined in **Section 3.1**, and the SWM criteria outlined in **Section 4.0** of this memo. **Table 8-1** below outlines the various notable design features and the relevant guideline or criteria. The LID strategy will be further advanced as part of subsequent detailed design tasks.

*Table 8-1: Summary of Design Features and Relevant Guidelines/Criteria*

| Design Feature | Relevant Guideline/Criteria | Justification |
|---|---|---|
| Partial-infiltration included in any LID feature (all contain subdrains). | Patterson Group Site-Specific Geotechnical Investigation | Investigation determined that conventional infiltration only LID measures that adopt infiltration only as the primary mechanism are not generally considered suitable due to shallow depth and relative impermeability of bedrock across the site. |
| Maximum depth of facility of 0.5m | Patterson Group Site-Specific Geotechnical Investigation | Depth of LID measures considers the minimum bedrock depth of the site to ensure that excavations for LID features do not extend into bedrock. |

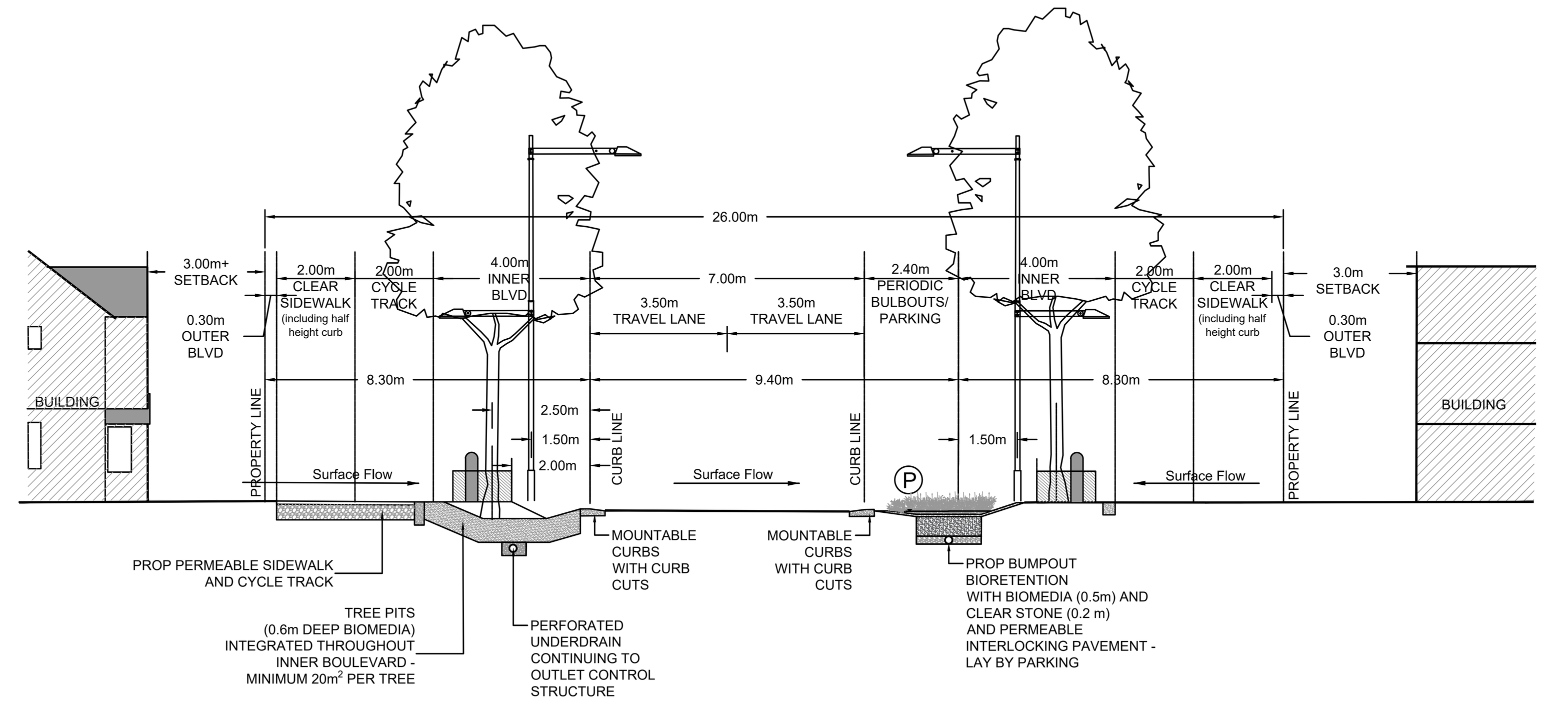
| | | |
|---|---|---|
| | | LID feature preliminary layouts and footprints have been designed to accommodate this limitation with preliminary sizing provided in **Table 6-6**. |
| Impervious to Pervious Ratio: does not exceed 10:1 | Low Impact Development Stormwater Management Guide (CVC, 2010) | Typical recommended range for I:P ratio to a bioretention facility is 5:1 to 15:1. For filtration trenches, a maximum of 10:1 is recommended when runoff from roadways or parking lot contributes to the facility. |
| Maximum Allowable Ponding Depth: does not exceed 0.3m | Low Impact Development Stormwater Management Guide (CVC, 2010) | Limits ponded standing water time to under the mosquito breeding cycle and supports vegetation health. |
| Total Storage Volume > $95^{th}$ Percentile Storm Event Runoff Volume | Table 4-1, LID/green infrastructure design | Ensures complete capture and treatment of the $95^{th}$ percentile event runoff. |

# Appendix A: LID Right of Way Cross Section Concept Drawings



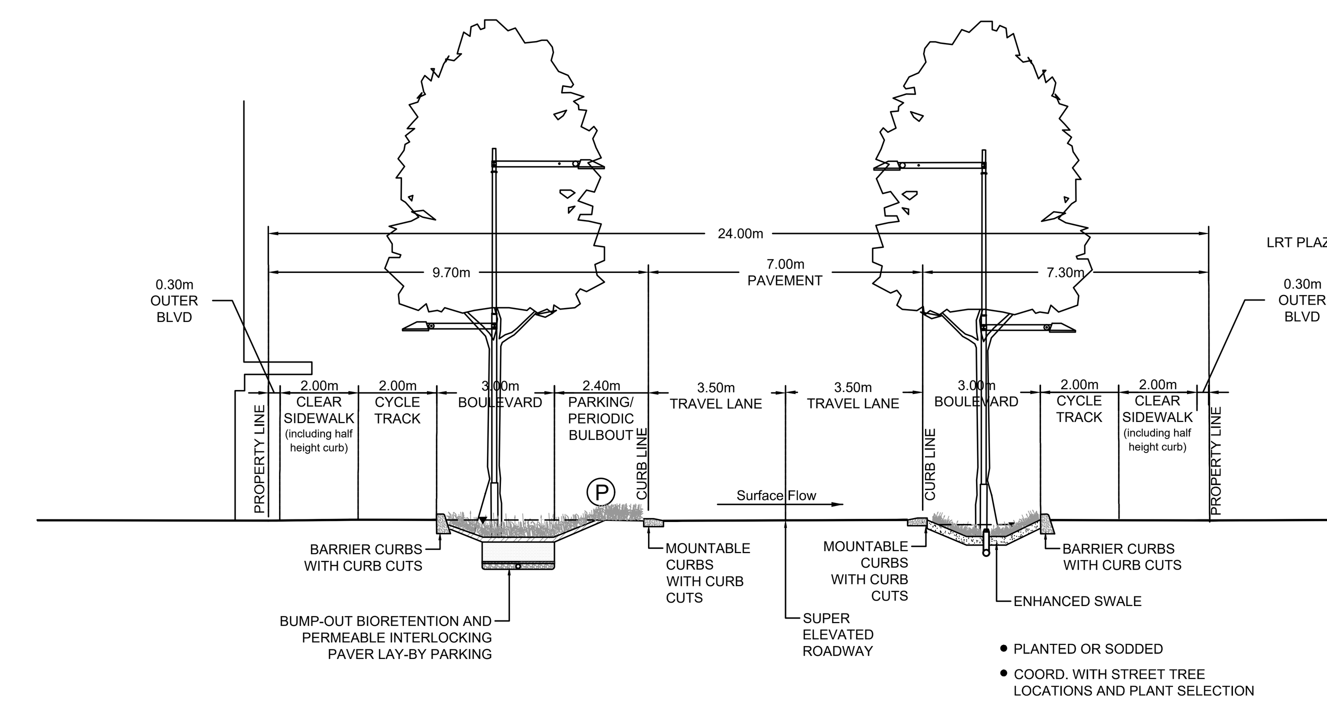

## 22.0 - 24.0m ROW
### YARROW DRIVEWAY
### (from BUS LOOP EMERGENCY ACCESS to TUNNEY'S PASTURE)
### WOONERF

TARGETED PERCENTAGE OF ROW WIDTH ALLOCATED FOR NON-AUTO USES (URBAN DESIGN MANUAL 2018): 40%
NON-AUTO PERCENTAGE ACHIEVED FOR THIS TYPICAL CROSS SECTION: 100%



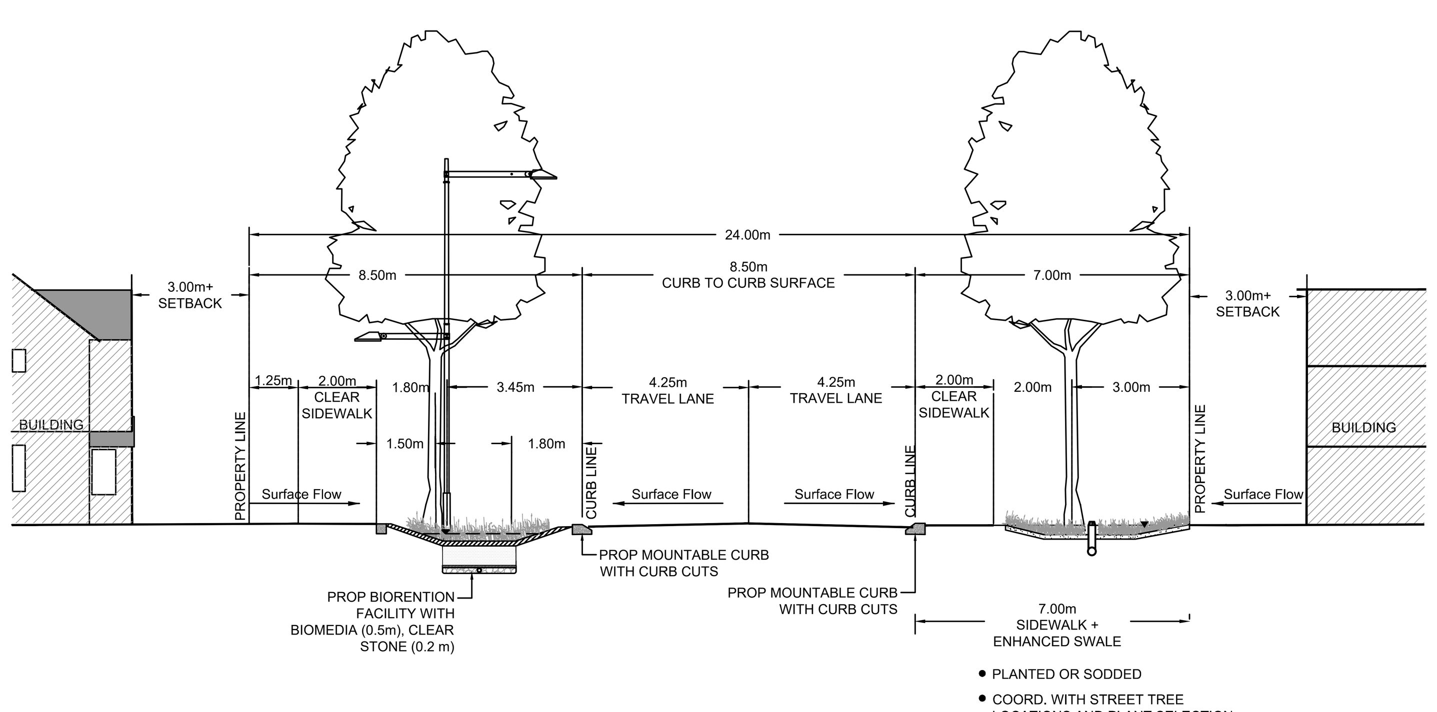

## 26A TREED BOULEVARDS
### 26m ROW COLLECTOR STREETS

TARGETED PERCENTAGE OF ROW WIDTH ALLOCATED FOR NON-AUTO USES (URBAN DESIGN MANUAL 2018): 40%
NON-AUTO PERCENTAGE ACHIEVED FOR THIS TYPICAL CROSS SECTION: 64%



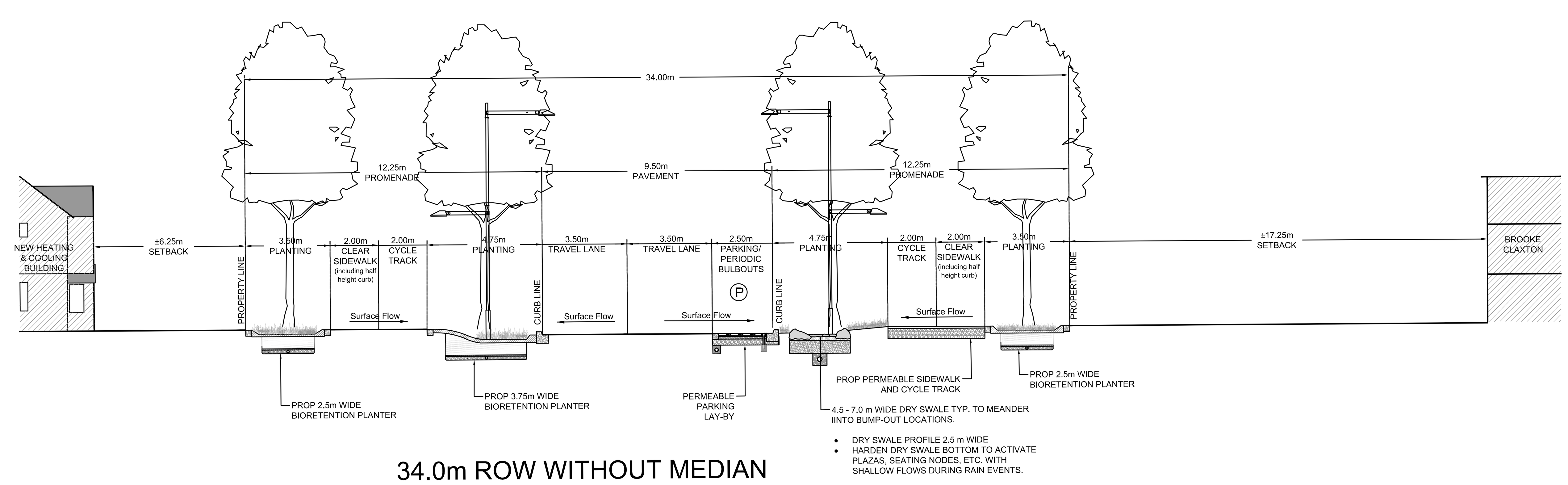

## 24.0m ROW
### YARROW DRIVEWAY
### (from GOLDENROD to BUS LOOP EMERGENCY ACCESS)

TARGETED PERCENTAGE OF ROW WIDTH ALLOCATED FOR NON-AUTO USES (URBAN DESIGN MANUAL 2018): 40%
NON-AUTO PERCENTAGE ACHIEVED FOR THIS TYPICAL CROSS SECTION: 60%



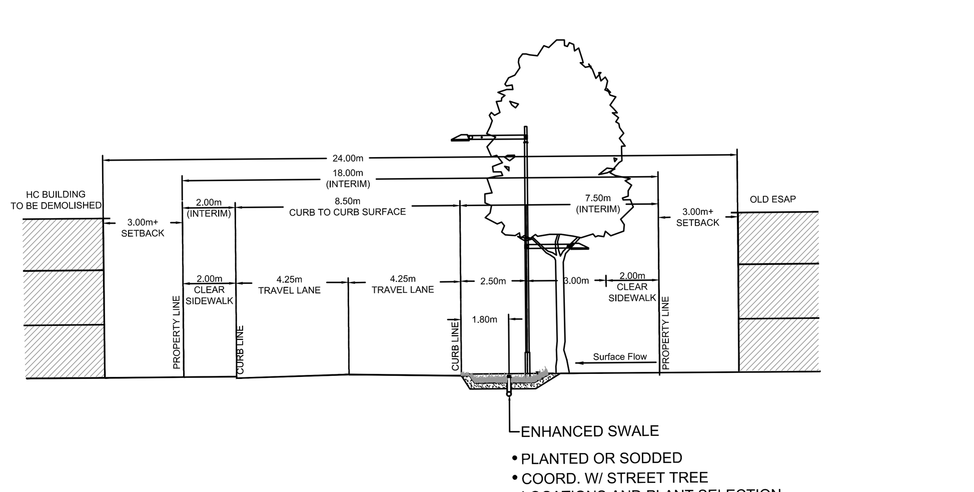

## 24.0m ROW
### LOCAL ROAD WITH LID

TARGETED PERCENTAGE OF ROW WIDTH ALLOCATED FOR NON-AUTO USES (URBAN DESIGN MANUAL 2018): 40%
NON-AUTO PERCENTAGE ACHIEVED FOR THIS TYPICAL CROSS SECTION: 65%




## 34.0m ROW WITHOUT MEDIAN
### COLOMBINE DRIVEWAY (FROM GOLDENROD TO PARKDALE)

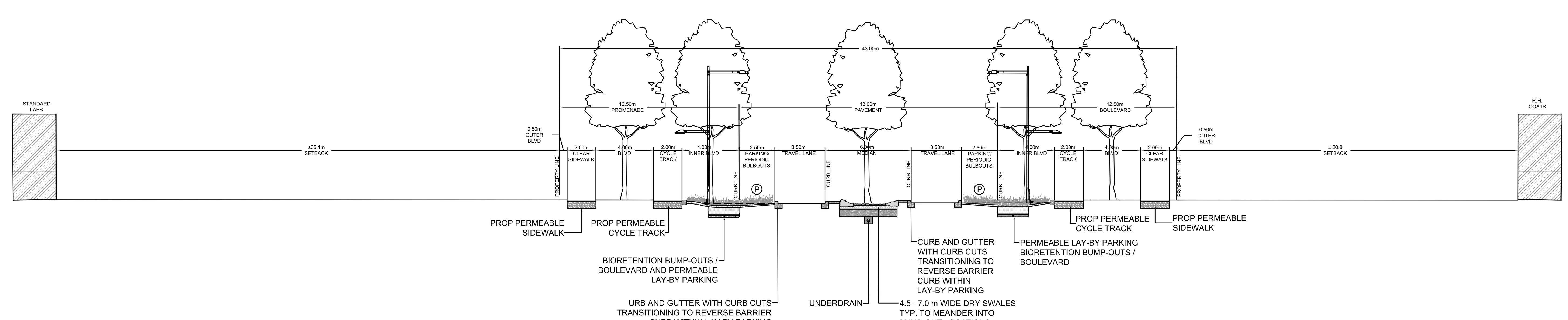
TARGETED PERCENTAGE OF ROW WIDTH ALLOCATED FOR NON-AUTO USES (URBAN DESIGN MANUAL 2018): 40%
NON-AUTO PERCENTAGE ACHIEVED FOR THIS TYPICAL CROSS SECTION: 72%




TARGETED PERCENTAGE OF ROW WIDTH ALLOCATED FOR NON-AUTO USES (URBAN DESIGN MANUAL 2018): 40%
NON-AUTO PERCENTAGE ACHIEVED FOR THIS TYPICAL CROSS SECTION: 53%

NOTE:
STAGE 1 IMPLEMENTATION: 18.0m + 3.0m + 3.0m = 24.0m
EFFECTIVE WIDTH BETWEEN BUILDINGS = 24.03m TO 24.12m
ON STREET ALTERNATING PARKING

## 18.0m ROW
### STAGE 1 IMPLEMENTATION - CHARDON
### (FROM SORREL TO EGLANTINE)




TARGETED PERCENTAGE OF ROW WIDTH ALLOCATED FOR NON-AUTO USES (URBAN DESIGN MANUAL 2018): 40%
NON-AUTO PERCENTAGE ACHIEVED FOR THIS TYPICAL CROSS SECTION: 72%

DRY SWALE PROFILE 4.5 m WIDE. HARDEN DRY SWALE BOTTOM TO ACTIVATE PLAZAS, SEATING NODES, ETC. WITH SHALLOW FLOWS DURING RAIN EVENTS.

## 43.0m ROW
### WITH LID IN MEDIAN
### TUNNEY'S PASTURE DRIVEWAY
### (FROM COLOMBINE TO YARROW)

NOTES: SET-BACK FROM BUILDINGS IS CALCULATED FROM DISTANCE

1. BETWEEN FRONTAGE OF STANDARDS LAB AND EXTENSION OF FRONTAGE OF R.H. COATS BUILDING. ROW WIDTH CAN BE FURTHER REDUCED BY KEEPING
2. SINGLE-ROW OF TREES ON EITHER SIDE.
3. MEDIAN MAY RESULT IN SIGHT LINE ISSUES AT INTERSECTIONS ALONG TUNNEY'S PASTURE DRIVEWAY, ESPECIALLY IF THERE IS VEGETATION/PLANTINGS WITHIN CLOSE PROXIMITY TO THESE JUNCTIONS.
4. ONE-WAY VEHICLE LANES SEPARATED BY A MEDIAN ARE LIKELY TO ENCOURAGE HIGHER OPERATING SPEEDS AND MAY NOT BE COMPATIBLE A WITH 40KM/H POSTED SPEED WITHOUT SIGNIFICANT TRAFFIC CALMING MEASURES.
5. LID EFFICIENCY IN MEDIAN IS NOT OPTIMAL. LID IS RECOMMENDED BEHIND THE CURB.

# PUBLIC ROAD REDEVELOPMENT

TUNNEY'S PASTURE
OTTAWA, ON



KEY PLAN - N.T.S.


DRAFT PLAN LANDS
OTHER LANDS OWNED BY APPLICANT

INFORMATION REQUIRED
UNDER SECTION 51 (17) OF THE PLANNING ACT, R.S.O. 1990. c.P.13 AS AMENDED
(a) - AS SHOWN
(b) - AS SHOWN
(c) - AS SHOWN
(d) - AS LISTED
(e) - AS SHOWN
(f) - AS SHOWN
(g) - AS SHOWN
(h) - MUNICIPAL WATER
(i) - URBAN, NA
(j) - AS SHOWN
(k) - MUNICIPAL SANITARY AND STORM SEWERS
(l) - AS SHOWN

SURVEYOR'S CERTIFICATE
I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

SIGNED ____________
V ANDREW SHELP, O.L.S.
ANNIS, O'SULLIVAN, VOLLEBEKK LTD
DATE ____________

OWNER'S CERTIFICATE
I HEREBY CONSENT TO THE FILING OF THIS PLAN BY IBI GROUP, IN DRAFT FORM.

SIGNED ____________
CANADA LANDS COMPANY
DATE ____________

LAND USE SCHEDULE

| BLOCKS | DESCRIPTION | AREA (ha) |
|---|---|---|
| 1 | MIXED-USE | 2.019 |
| 2 | MIXED-USE | 2.425 |
| 3 | MIXED-USE | 2.326 |
| 4 | MIXED-USE | 0.625 |
| 5 | MIXED-USE | 1.545 |
| 6 | TRANSIT (TO BE CONVEYED TO CITY) | 0.636 |
| 7 | OPEN SPACE | 0.092 |
| 8 | OPEN SPACE | 0.107 |
| 9 | OPEN SPACE | 0.420 |
| 10 | OPEN SPACE | 0.156 |
| 11 | PUBLIC ROW (Goldenrod Driveway) | 0.953 |
| 12 | PUBLIC ROW (Goldenrod Driveway) | 0.687 |
| 13 | PUBLIC ROW (Goldenrod Driveway) | 0.304 |
| 14 | PUBLIC ROW (Goldenrod Driveway) | 0.179 |
| 15 | PUBLIC ROW (Colombine Driveway) | 1.282 |
| 16 | PUBLIC ROW (Colombine Driveway) | 0.952 |
| 17 | PUBLIC ROW (Sir Frederick Banting Driveway) | 0.743 |
| 18 | PUBLIC ROW (Sir Frederick Banting Driveway) | 0.691 |
| 19 | PUBLIC ROW (Sorrel Driveway) | 0.342 |
| 20 | PUBLIC ROW (Sorrel Driveway) | 0.153 |
| 21 | PUBLIC ROW (Sorrel Driveway) | 0.378 |
| 22 | PUBLIC ROW (Eglantine Driveway) | 0.153 |
| 23 | PUBLIC ROW (Eglantine Driveway) | 0.378 |
| 24 | PUBLIC ROW (Chardon Driveway) | 0.435 |
| 25 | ROW WIDENING - FUTURE (Chardon Driveway) | 0.063 |
| 26 | PUBLIC ROW (Chardon Driveway) | 0.190 |
| 27 | PUBLIC ROW (Chardon Driveway) | 0.304 |
| 28 | PUBLIC ROW (Yarrow Driveway) | 0.631 |
| 29 | PUBLIC ROW (Tunney's Pasture Driveway) | 2.051 |
| 30 | ROW WIDENING (Parkdale Avenue) | 0.175 |
| | | |
| | TOTAL: | 21.395 |

| # | DATE | BY | DESCRIPTION |
|---|---|---|---|
| 1 | 2025-06-09 | JS | Preliminary Draft LID Concept Plan |

DRAWING ISSUE RECORD

APPROVALS

ARCADIS

Aquafor Beech Limited
#6-202-2600 SKYMARK Ave,
MISSISSAUGA, ONTARIO, L4W 5B2
PHONE: (905) 629-0099, FAX: (905) 629-0089

BENCHMARK
1. Elevations shown are geodetic and are referred to the CGVD2013 geodetic datum.
2. It is the responsibility of the user of this information to verify that the job benchmark has not been altered or disturbed and that it's relative elevation and description agrees with the information shown on this drawing.

SCALE 15 0 10 20 40
1:1000 (m)

PROJECT NO: 139833
DRAWN BY: SD
CHECKED BY:
PROJECT MGR: SA
APPROVED BY:

SHEET TITLE
DRAFT PLAN OF SUBDIVISION

SHEET NUMBER 2
ISSUE 1.8

File Location: J:\139833_TunneyPasture\7.0_Production\7.03_Design\17_Planning\Draft Plan of Subdivision

SCALE CHECK 1 in 10mm