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Urban Stream Daylighting as a Nature-based Solution (NbS): From "Consider Where Feasible" to a Deliverable Municipal Program

Waterloo Climate Institute Technical Brief

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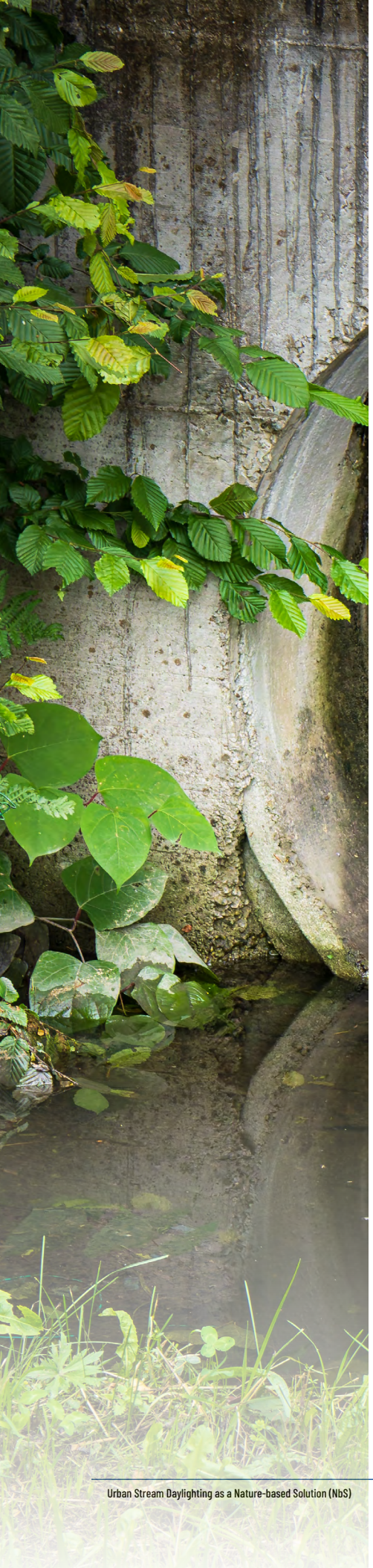


ABSTRACT

Canadian municipalities and community organizations are increasingly interested in nature-based solutions (NbS) to reduce flood risk, mitigate urban heat, restore biodiversity and improve public spaces. Urban stream daylighting, which refers to the practice of uncovering culverted streams and restoring them to the surface, is an effective NbS that can provide adaptation and mitigation co-benefits [1, 2]. Stream daylighting remains underused in Canada due to the lack of clear, dedicated and effective policy frameworks, limited implementation experience and insufficient practical tools to support feasibility assessment, design, delivery, monitoring and long-term maintenance [3]. To address this gap, this technical brief provides Canadian municipalities and community organizations with a decision-support framework to help move stream daylighting projects from interest to action.

This brief draws lessons from two international cases that highlight deliberately contrasting approaches to stream daylighting: Seoul's Cheonggyecheon and Zürich's Bachkonzept. Seoul's Cheonggyecheon was a rapid, high-profile mega-project concentrated in one part of the city. It daylighted a major urban stream corridor while simultaneously transforming transportation and public realm infrastructure, including the removal of elevated road infrastructure and the integration of subway access, bus service, pedestrian bridges, cycling lanes and linear public space. It also involved high capital and maintenance costs and provides important lessons about political leadership, infrastructure integration, ecological compromise and gentrification risk [4-7]. In contrast, Zürich's Bachkonzept represents an incremental, spatially dispersed, lower-cost program implemented over decades through many small-scale interventions across the city. Rather than relying on one iconic project, Zürich's approach gradually restored a network of streams while improving stormwater management, ecological connectivity, walkability, cycling conditions, neighbourhood public spaces and everyday human-water interactions [4, 8, 9].

Together, these cases offer implementation and policy precedents that can help address a current gap in Canadian practice. This brief organizes the lessons learned into four evaluation criteria: time, scale, cost-benefit and structure-function. These criteria are operationalized through 18 parameters that help planners, community organizations, watershed management agencies and municipal staff assess opportunities, compare delivery pathways, identify constraints and evaluate outcomes [4]. Canadian use cases in Toronto and Vancouver demonstrate how these criteria can be applied to potential and ongoing daylighting contexts, including priority flood-risk neighbourhoods such as Black Creek and Flemingdon Park, where historical watercourse mapping and flood-risk analysis can support equitable site prioritization [10-13]. The implementation pathway is framed as an adaptive cycle, namely map, assess, co-design, implement, monitor, learn and adjust, so that early daylighting pilots can inform future projects, municipal standards and eventual daylighting programs.

Keywords: urban stream daylighting, nature-based solutions, climate adaptation, municipal planning, flood risk, blue-green infrastructure, adaptive management.

Key Messages for Municipal Planners

- Canada needs a daylighting program model, not just enabling language. A successful program requires governance, triggers, standards, capital/ operations and maintenance (O&M) funding and monitoring.
- International cases provide implementation lessons that Canadian municipalities and policymakers can adapt to local governance, watershed and infrastructure conditions.
- Daylighting can enter municipal practice through two different pathways: publicly led capital works and privately initiated redevelopment. These pathways involve different feasibility, land, risk and equity considerations.
- Monitoring is not an end point. It should feed an adaptive management cycle in which project performance informs maintenance, future project selection, standards and policy refinement.
- Watershed management agencies are essential partners for flood mapping, watershed-scale prioritization, regulatory review and coordination across municipal boundaries.

Introduction

Urbanization has buried and culverted many small streams, reducing or eliminating their ecosystem services and increasing vulnerability to extreme rainfall, flooding, heat and ecological fragmentation. Stream daylighting can restore hydrological and ecological functions while creating public realm, recreational, educational and health co-benefits. For municipal planners, however, the central challenge is not whether daylighting is conceptually valuable; it is how to identify feasible sites, sequence interventions, align projects with capital works and redevelopment processes and manage trade-offs related to cost, land, flood protection, equity and long-term maintenance.

This technical brief serves as both an informational and practical resource for municipal planners, municipal engineers, watershed management authorities, landscape architects, urban designers, provincial and federal policy staff, Indigenous partners and community organizations. It explains why daylighting matters as a nature-based solution (NbS) and offers a practical framework for moving from policy interest to successful municipal action.

The brief is intended to help municipalities and community partners identify feasible daylighting opportunities, prioritize them equitably and move selected sites into technical study, capital planning, redevelopment review or pilot implementation.

Technical Background: What is Stream Daylighting as a Nature-Based Solution?

Urban stream daylighting restores buried or culverted streams to open channels, typically coupled with riparian planting, public realm improvements and stormwater management measures [1, 2]. As a nature-based solution (NbS), daylighting can deliver adaptation benefits (peak flow attenuation, storage, infiltration and safer flood pathways) alongside co-benefits (urban cooling, carbon sequestration via riparian vegetation, habitat connectivity, recreation and public health) [4].

International Lessons for Canadian Municipalities

Canadian experience with stream daylighting remains limited. Canada does not yet have a well-established policy framework or enough completed projects to draw lessons about implementation. Toronto, for example, recognizes historical watercourses and the possibility of restoration or daylighting where feasible, but this

does not yet constitute a funded, standards-based daylighting program. Vancouver's Still Creek offers important Canadian lessons [12-14], but is not sufficient on its own to build a national decision framework.

International examples can therefore provide valuable lessons for planning, funding, implementing and maintaining daylighting over time. Rather than copying these approaches directly, Canadian municipalities can adapt the lessons they offer to fit local governance structures, regulatory frameworks, watershed conditions and community priorities.

Seoul's Cheonggyecheon and Zürich's Bachkonzept were selected because they represent two fundamentally different but successful approaches to stream daylighting. Seoul demonstrates the opportunities and risks of a rapid, centralized, high-cost mega-project concentrated in one corridor and integrated with major transportation and public realm transformations. Zürich demonstrates the value of a long-term, incremental, lower-cost, spatially dispersed program that improves hydrology, ecology, walkability, cycling and neighbourhood public spaces through many smaller interventions [4].

Together, these cases illustrate a range of implementation options, from large-scale corridor transformation to distributed restoration programs, and enable Canadian municipalities to compare the risks and opportunities of project-based versus program-based daylighting.

Table 1. Two international approaches to stream daylighting (sources [4-14])

Characteristic	Seoul: Cheonggyecheon	Zürich: Bachkonzept
Implementation model	Single flagship project	Distributed city-wide program
Timeframe	Rapid implementation	Incremental implementation over decades
Spatial pattern	One major corridor	Multiple stream segments across the city
Scale	Approximately 5.8 km restored corridor	More than 20 km restored and continuing
Governance approach	Centralized project delivery	Long-term institutional program
Cost profile	High capital investment	Incremental long-term investment
Key lesson for Canada	Daylighting can catalyze major urban transformation	Small projects can accumulate watershed-scale benefits over time

The difference between the two implementation models is also spatial. As Figure 1 shows, Seoul's intervention is concentrated along one major corridor, while Zürich's daylighted streams are distributed across the city.

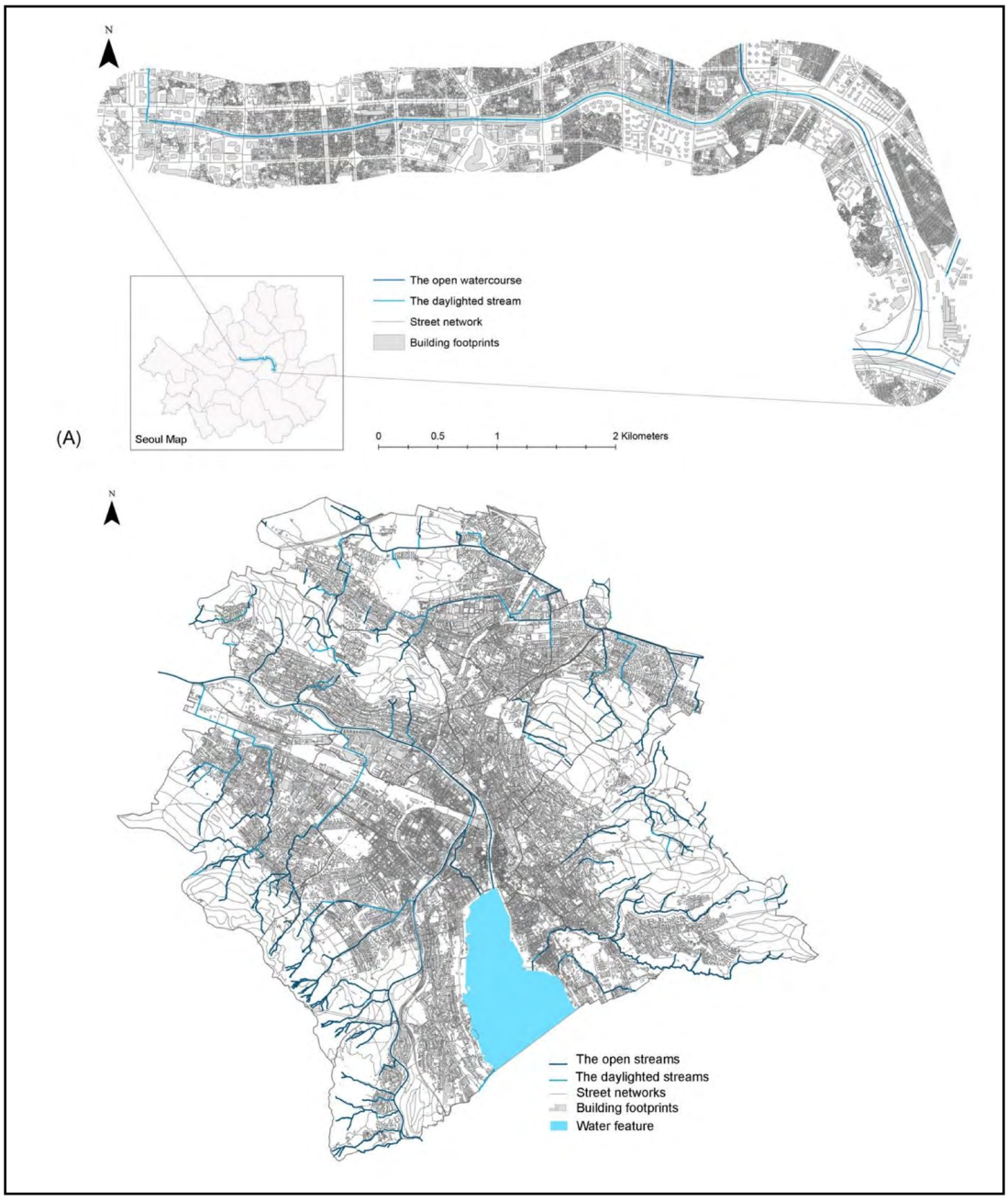


Figure 1. Contrasting spatial patterns of stream daylighting in Seoul and Zürich: (A) the Cheonggyecheon as a single corridor-scale intervention in central Seoul and (B) multiple daylighted stream segments distributed across Zürich. Maps: Dr. Luna Khirfan.

This spatial contrast illustrates two possible municipal approaches: a concentrated project that transforms a major urban corridor and a long-term program that incrementally restores multiple stream segments across diverse neighbourhood settings.

Canadian Takeaway from Seoul's Cheonggyecheon

Seoul's Cheonggyecheon demonstrates how stream daylighting can be integrated with transportation restructuring, public realm renewal and economic revitalization. The project removed elevated roadway infrastructure, restored a major urban stream corridor and created extensive pedestrian and recreational amenities. While the project generated significant visibility and public support, it also required substantial capital investment and raised concerns regarding ecological authenticity, long-term maintenance requirements and displacement pressures. For Canadian municipalities, its greatest relevance may be in situations where major infrastructure renewal creates an opportunity for corridor-scale transformation [4-7].

Figure 2. Cheonggyecheon, Seoul: Corridor-scale stream daylighting integrated with a dedicated cycling lane, a pedestrian bridge, streamside walkways and active-mobility wayfinding. Photographs: Dr. Luna Khirfan.

Canadian Takeaway from Zürich's Bachkonzept

Zürich's Bachkonzept demonstrates a fundamentally different model. Rather than relying on a single transformative project, the city has restored streams incrementally through coordinated planning, policy support and integration with infrastructure upgrades. The program illustrates how numerous small interventions can collectively improve hydrology, ecological connectivity, neighbourhood amenities and climate resilience. For many Canadian municipalities, this long-term programmatic approach may be more transferable than a high-profile flagship project [4, 8, 9].

Figure 3. Zürich's Bachkonzept: Distributed stream daylighting integrated with residential areas, pedestrian routes, green spaces and recreational waterfronts. Photographs: Dr. Luna Khirfan.

Canadian Municipal Context and Policy Framework

Canadian municipalities can build on existing policy and regulatory frameworks to advance daylighting projects, even in the absence of dedicated daylighting policy. These include federal protections related to fish and aquatic habitat, provincial environmental and water-related legislation, watershed management authority regulations and floodplain mapping, municipal official plan policies, stormwater management plans, climate adaptation plans, asset management plans, park and ravine strategies and redevelopment/site plan processes. These frameworks can support daylighting, but they do not automatically produce implementation. The missing piece is often the translation of broad policy support into a funded, governed and monitored municipal program.

Watershed management agencies, such as conservation authorities in Ontario, should be positioned as central partners rather than peripheral consultees. They can help municipalities prioritize candidate corridors using floodplain mapping, watershed planning, hazard regulation, ecological data and cross-boundary coordination. Their role is especially important because stream systems do not follow municipal boundaries, and because daylighting projects affect flood risk, erosion, aquatic habitat and stormwater performance at watershed scales.

Policy Takeaways: from "Consider Where Feasible" to an Implementable Daylighting Program

Moving from general policy support to implementation requires more than identifying daylighting as something to "consider where feasible." Municipalities need a clear program structure that assigns responsibility, identifies delivery triggers, establishes design expectations, secures funding for both capital and long-term operations and uses monitoring to improve future projects. The following takeaways identify the institutional and procedural elements needed to turn enabling language into an implementable daylighting program.

- **Assign program ownership and governance:** designate a lead municipal unit and establish a cross-department steering group with conservation authority participation. Stream daylighting cuts across planning, engineering, parks, transportation, finance, climate adaptation and watershed management. Without a clear program owner, daylighting opportunities may be missed or delayed because no single department is responsible for screening, coordinating, funding or maintaining projects. A cross-department steering group can clarify roles, align capital planning with land use and public realm objectives and ensure that watershed management agency expertise informs flood risk, erosion, watershed-scale prioritization and regulatory considerations from the outset.
- **Define delivery triggers:** require daylighting screening during sewer separation, road reconstruction, park renewal, ravine works, flood mitigation projects and major redevelopment applications. Daylighting is most feasible when it is integrated into planned changes to land, infrastructure or public spaces. Embedding daylighting screening into existing municipal processes helps shift implementation from opportunistic to systematic. These triggers allow municipalities to ask, at the right time, whether a buried or constrained watercourse could be restored, partially opened, reconnected or supported through complementary blue-green infrastructure.
- **Adopt standards and typical details:** prepare design guidance for channel form, top-of-bank setbacks, flood protection, vegetation, public access, safety, maintenance and monitoring. Standards and typical details reduce uncertainty for municipal staff, consultants, developers, community partners and watershed management authorities. They also help ensure that daylighting projects are not treated only as public realm improvements, but as interventions that must perform hydrologically, ecologically and socially over time. Design guidance

should therefore address both technical performance and everyday usability, including safe access, maintenance requirements, habitat objectives, water quality considerations and monitoring expectations.

- **Budget for both capital and operations and maintenance (O&M):** identify who maintains vegetation, sediment, water quality, signage, safety infrastructure and public realm assets. Daylighting projects require long-term care after construction. Vegetation establishment, sediment management, water quality monitoring, debris removal, signage, public safety features, trails, seating and other public realm assets all require assigned responsibilities and budgets. If operations and maintenance (O&M) is not addressed early, projects may underperform or become burdensome for departments that were not involved in planning. A viable daylighting program should therefore include lifecycle costing and clear maintenance roles from the beginning.
- **Track performance and equity outcomes:** use monitoring data to refine standards, prioritize future sites and avoid inequitable outcomes such as green gentrification. Monitoring should not be treated as a final reporting exercise. It should be used to learn whether projects are delivering intended hydrological, ecological, public realm and equity outcomes. Performance data can help municipalities refine design standards, adjust maintenance practices, improve future site selection and justify continued investment. Equity monitoring is also important because high-quality blue-green public realm improvements may increase neighbourhood desirability and contribute to displacement pressures if not paired with appropriate safeguards.

Decision-Support Framework: Rationale and Use

The four evaluation criteria (i.e., time, scale, cost-benefit and structure-function) are derived from the comparative literature on transformative and incremental adaptation and from the systematic comparison of Seoul and Zürich [4]. They were selected because they capture the key decisions municipalities must make: when and how quickly to intervene; whether to pursue a single project or a portfolio; how to evaluate costs, benefits and avoided damages; and how daylighting changes policy, hydrology, infrastructure, ecology, urban form, economic activity and socio-cultural relationships with water. The criteria are intended to be flexible rather than prescriptive. Municipalities can adapt them to local capacity and data availability while preserving the underlying logic of assessing feasibility, performance, trade-offs and long-term adaptability.

Table 2. The four criteria and 18 parameters: significance, practitioner prompts and monitoring links

Criteria	Parameters	Why it matters	Questions for practitioners	Monitoring link
Time	Historic context; implementation timeline.	Explains why the stream was buried, what current risks/ opportunities justify action, and whether delivery is best as a rapid project or phased program.	What is the trigger: asset failure, flood risk, redevelopment, park renewal or community priority?	Implementation schedule; post-project monitoring milestones.
Scale	Footprint; number of segments; total length; spatial distribution/ connectivity.	Determines whether benefits are isolated or networked and whether interventions restore watershed-scale connectivity.	Is this a single showcase reach or a connected portfolio? What land is required for grading, flood protection, revegetation and public access?	Segment length restored; connectivity; access/walkshed; habitat continuity.
Cost-benefit	Capital cost; operations and maintenance (O&M); avoided damage/grey upgrades; non-monetary benefits/trade-offs.	Clarifies affordability, long-term maintenance, avoided costs, public health, equity and displacement risks.	What costs are avoided? Who benefits? Who may face rent or displacement pressures?	Operations and maintenance (O&M) costs; avoided treatment/culvert costs; flood performance; rent/displacement signals.
Structure-function	Policy fit; inclusion; hydrology; infrastructure; ecology; urban form; economy; socio-cultural outcomes.	Assesses how daylighting changes municipal systems, built form, governance and human-nature relationships.	Does the design improve hydrology and ecology, or is it primarily aesthetic? Who participates in design and stewardship?	Hydrology, water quality, habitat, public use, stewardship, socio-cultural indicators.

Delivery Pathways: Capital Works versus Redevelopment

Stream daylighting can be advanced through two distinct municipal implementation pathways: publicly led capital works and privately initiated redevelopment. Each pathway creates different opportunities and constraints related to land ownership, financing, governance, technical feasibility, public benefit and long-term maintenance. Separating these pathways helps municipalities identify appropriate triggers, clarify roles and responsibilities and tailor feasibility criteria to the specific conditions under which daylighting may be delivered.

Table 3. Two municipal delivery pathways for daylighting

Pathway	Typical triggers	Advantages	Constraints	Planning response
Municipal capital works	Road reconstruction, sewer separation, culvert renewal, park/ravine projects, flood mitigation works	Public ownership; easier coordination with asset management; can prioritize equity and public benefit; often more feasible for pilots	Limited budgets; constrained rights-of-way; utility conflicts; need operations and maintenance (O&M) assignment	Prioritize extensions from existing open/ naturalized channels, parks, ravines, schoolyards and high-risk neighbourhoods.
Redevelopment projects	Large sites, brownfields, station areas, mall/industrial redevelopment, comprehensive site plans	Can secure land, corridor width, density transfers and public realm improvements through approvals	Requires large sites; development rights; grading and flood protection; density trade-offs; transparency; displacement risk	Require daylighting feasibility screening early; identify minimum site/corridor requirements; integrate anti-displacement and public benefit measures.

Implementation Pathway as an Adaptive Cycle

The implementation pathway should be understood as iterative rather than linear. Monitoring results should inform maintenance, redesign, future site selection, standards, policy and funding. This is especially important for nature-based solutions (NbS), where performance evolves as vegetation establishes, hydrological conditions change and community use patterns emerge.

Figure 4 presents the pathway as an adaptive implementation cycle. The cycle begins with mapping and assessment, moves through co-design and implementation, and then uses monitoring and learning to adjust both individual sites and the broader municipal daylighting program. In this way, each project becomes a source of evidence for improving future projects, design standards, funding decisions and policy development.

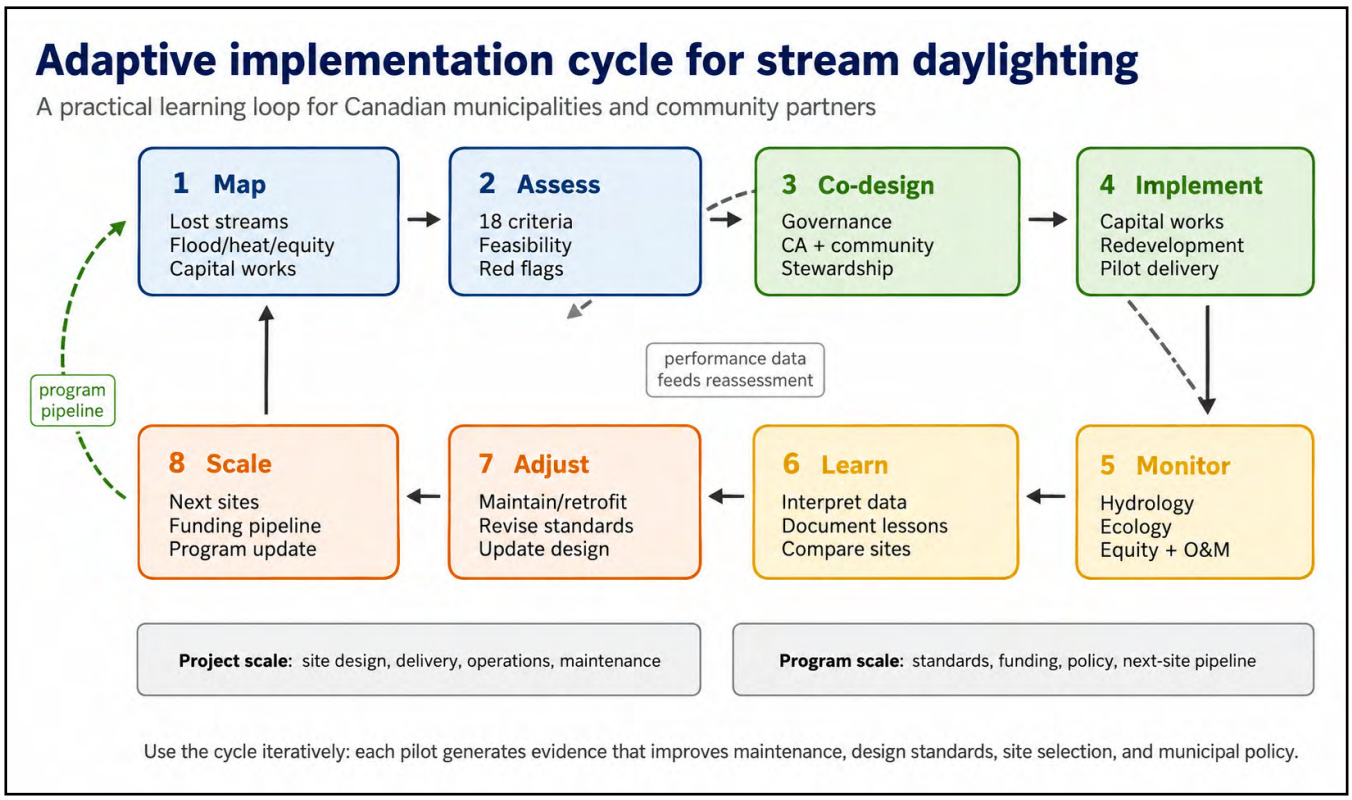


Figure 4. Adaptive implementation cycle for municipal stream daylighting. Monitoring and learning feed both site-level management and program-level standards, funding, policy and future site selection.

1. **Map opportunities:** Combine culvert inventories, lost-stream mapping, flood/heat risk, equity indicators, watershed management authority mapping, land ownership, redevelopment pipelines and capital works schedules. This step creates the spatial evidence base for identifying where daylighting may be

physically possible, socially beneficial and strategically aligned with planned municipal investments.

2. **Assess feasibility and priority:** Apply the 18-parameter checklist to identify feasibility, benefits, red flags, required studies and data gaps. Assessment should distinguish between sites that are ready for further technical study, sites that require additional data or coordination and sites where daylighting may not be feasible under current conditions.

3. **Co-design and govern:** Establish departmental roles, watershed management authority involvement, community/Indigenous engagement and stewardship responsibilities. Early governance and engagement help clarify who is responsible for decision-making, implementation, long-term maintenance, monitoring and community stewardship.

4. **Implement through the appropriate pathway:** Determine whether the opportunity is best pursued through capital works, redevelopment or a hybrid partnership, then design and deliver the project accordingly. Implementation should prioritize eco-hydrological integrity, safe-to-fail flood pathways, water quality, habitat, public realm and maintenance access. It should also be aligned with the most realistic delivery mechanism, such as road reconstruction, sewer separation, park renewal, ravine restoration, flood mitigation or large-site redevelopment.

5. **Monitor and evaluate:** Track hydrology, water quality, ecology, public realm, equity and economic indicators. Monitoring should be feasible within municipal capacity and should capture both biophysical outcomes and social outcomes, including who benefits from the project and whether unintended equity impacts emerge.

6. **Learn:** Interpret monitoring results, document lessons and compare performance across sites. This converts monitoring into actionable knowledge for future project delivery.

7. **Adjust:** Use those lessons to revise maintenance practices, modify design standards, update site prioritization and refine municipal policy.

8. **Scale the program:** Use lessons from pilots to identify the next sites, strengthen the funding pipeline and update municipal standards, policies and implementation triggers. Scaling does not necessarily mean pursuing larger projects; it can mean building a connected portfolio of smaller interventions that cumulatively improve watershed function, public realm quality and climate resilience.

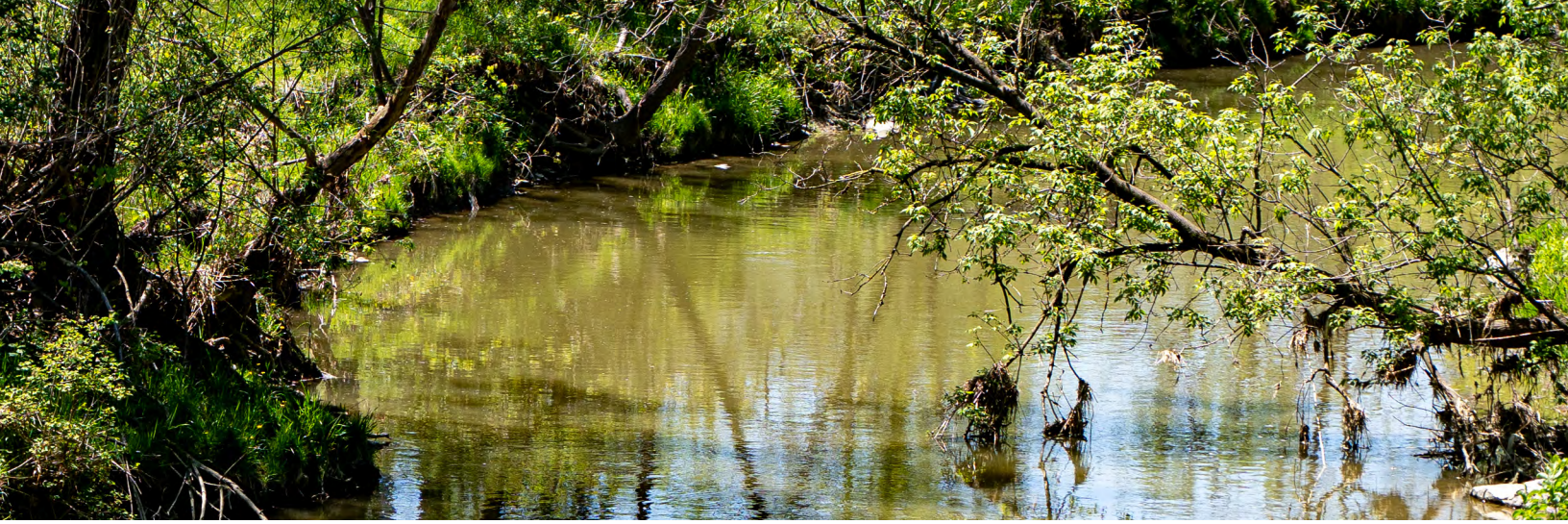
Adaptive management cycle

Map → Assess → Co-design → Implement → Monitor → Learn → Adjust → Scale.

This cycle should be repeated at both the **project scale** (i.e., site management, maintenance and redesign) and the **program scale** (i.e., policy, funding, standards and future site selection).

Table 4. Monitoring indicators linked to the 18-parameter planning framework

Domain	Suggested indicators	Related criteria/parameters
Hydrology	Peak flow attenuation; inundation frequency at known low points; infiltration/soil moisture proxy; diversion from combined sewers where feasible	Scale; Cost-benefit; Hydrology performance
Water quality	Temperature; turbidity/ suspended solids; E. coli risk management and advisories where relevant	Hydrology; Ecology and water quality integrity; Public realm safety
Ecology	Riparian vegetation establishment; habitat connectivity proxies; indicator species observations where feasible	Scale/connectivity; Ecology; Socio-cultural outcomes
Public realm and health	User counts; shade/thermal comfort proxy; perceived safety and accessibility	Urban form; Socio-cultural outcomes; Non-monetary benefits
Equity	Distribution of access; engagement participation; displacement/rent pressure signals; benefits to priority neighbourhoods	Public inclusion; Economic impacts; Equity trade-offs
Economics	Avoided culvert rehabilitation; avoided treatment costs where applicable; operations and maintenance (O&M) costs tracked consistently	Cost-benefit; operations and maintenance (O&M) burden; Avoided damages



Canadian Use Cases

The following Canadian use cases illustrate how the framework can be applied in two different ways: first, as a potential/pilot-oriented application in a city that recognizes historical watercourses but does not yet have a mature daylighting program; and second, as an implemented and ongoing restoration precedent that demonstrates how incremental daylighting-related interventions can unfold over time. Together, the cases show how municipalities and community organizations can use mapping, risk analysis, capital works, redevelopment opportunities and stewardship to move from interest to implementation.

Use Case 1 — Toronto: Priority Flood-Risk Neighbourhoods and Lost Rivers (Black Creek and Flemingdon Park)

Status: potential/pilot-oriented application. Toronto does not yet have a mature daylighting program. This use case therefore demonstrates how municipalities can use historical watercourse mapping and flood-risk/equity analysis to identify priority pilot areas rather than documenting a completed daylighting project.

Spatial analysis of Toronto's flood risks identifies Black Creek and Flemingdon Park among priority neighbourhoods where social vulnerability, flood exposure and low adaptive capacity are significant. The Lost Rivers mapping provides an opportunity layer for identifying buried watercourses [10]. Overlaying lost-stream corridors with priority neighbourhoods, public lands, parks, schoolyards, ravine edges and capital works schedules can help planners identify feasible pilot segments [11].

For Toronto, the first task is to move from general recognition of historical watercourses to a spatially explicit opportunity map that can guide feasibility screening and project prioritization. The following actions show how municipalities and community partners could begin translating mapped watercourses into a practical daylighting pipeline:

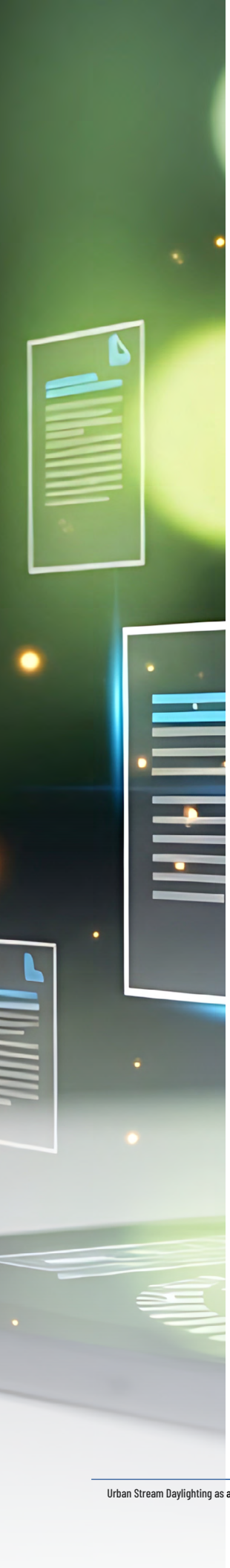
- **Recommended first step:** based on the "Lost Rivers of Toronto" map (https://www.lostrivers.ca/disappearing.html) create a Toronto daylighting opportunity map combining lost rivers, culvert inventories, conservation authority flood mapping, capital works schedules, redevelopment sites and equity indicators. This map would help identify where historical watercourses align with current flood-risk priorities, public land ownership, infrastructure renewal schedules and redevelopment opportunities. It would also allow planners to distinguish between locations that may be technically feasible in the near term and those that require longer-term land assembly, infrastructure coordination or further hydrological study.
- **Capital works pathway:** prioritize publicly owned lands and extensions from open or naturalized stream/ravine conditions where feasibility is highest. Publicly owned lands, such as parks, ravine edges, schoolyards and rights-of-way, may provide the most realistic starting points because they reduce land acquisition barriers and can be coordinated with planned municipal works. Where daylighting can extend existing open or naturalized stream conditions, municipalities may also be able to build on existing ecological function and reduce the complexity of reconnecting buried segments.
- **Redevelopment pathway:** require early daylighting feasibility screening for large sites where land dedication, density transfer, corridor widening and flood protection can be negotiated transparently. Redevelopment sites may create opportunities to secure the land area required for daylighting, including channel space, floodplain benches, top-of-bank setbacks, maintenance access and riparian revegetation. However, these opportunities need to be identified early in the planning approvals process, before site layouts, density expectations and infrastructure designs become fixed. Early screening can also clarify whether daylighting is technically feasible or whether alternative blue-green infrastructure interventions are more appropriate.
- **Equity safeguard:** pair public realm investment with anti-displacement measures, community benefits and ongoing monitoring of rent pressure and access. Because daylighting can improve neighbourhood amenities, public realm quality and environmental conditions, it may also contribute to rising land values or displacement pressures if not planned carefully. Equity safeguards should therefore be built into the project from the outset. These may include community benefits, affordable housing protections where applicable, support for local organizations, inclusive engagement and monitoring indicators that track who benefits from the investment over time.

Use Case 2 — Vancouver: Still Creek as an Incremental Canadian Precedent

Status: implemented and ongoing restoration precedent. Vancouver's Still Creek illustrates how incremental restoration and daylighting-related interventions can proceed over time through watershed planning, municipal action, redevelopment opportunities and community stewardship. It is not identical to Zürich's Bachkonzept, but it provides a Canadian example of how a long-term portfolio approach can be more realistic than a single large project [12-14].

The following lessons translate Still Creek's incremental approach into considerations for other Canadian municipalities:

- **Transferable lesson:** publish and maintain a pipeline of candidate segments so opportunities can be seized when land, redevelopment or capital timing align. A long-term pipeline helps municipalities move beyond opportunistic decision-making. By identifying candidate segments in advance, municipalities can respond when road reconstruction, park renewal, redevelopment or infrastructure upgrades create windows for implementation. A published or internally maintained pipeline also makes it easier to coordinate across departments and communicate priorities to community organizations, developers, conservation authorities and elected officials.
- **Implementation lesson:** prioritize segments where wastewater conflicts are lower or separable, then build evidence and public support through early wins. Some buried stream segments may be technically difficult to daylight because of combined sewer connections, utility conflicts, contaminated soils, insufficient baseflow or constrained corridors. Beginning with segments where these conflicts are more manageable can help municipalities demonstrate feasibility, test design standards, estimate maintenance needs and generate public confidence. Early wins can then support more complex projects by creating evidence, political support and institutional learning.
- **Governance lesson:** combine municipal planning with community stewardship and watershed-scale ecological objectives. Incremental restoration depends on continuity over time. Municipal planning can provide the policy, capital planning and development review mechanisms needed to secure space and funding, while community stewardship can support public awareness, monitoring and long-term care. Watershed-scale ecological objectives help ensure that individual segments do not remain isolated improvements but contribute to broader goals such as habitat connectivity, flood mitigation, water quality improvement and access to blue-green infrastructure.



Limitations, Risks, Readiness and Investment Considerations

Stream daylighting can generate multiple benefits, but it is not appropriate or feasible in every location. Municipalities should therefore use the following considerations to guide early screening rather than to rule out daylighting opportunities. These constraints help identify where additional study, design work, interdepartmental coordination, community engagement or funding is needed before a project can advance.

- **Policy gap:** enabling language exists in many places, but few municipalities have a funded daylighting program, standards or implementation pipeline. Many municipalities may support restoration, green infrastructure, climate adaptation or watershed health in principle, but this does not automatically create a deliverable daylighting program. A mature program requires defined responsibilities, project triggers, design guidance, funding mechanisms, monitoring expectations and long-term operations and maintenance commitments. Without these elements, daylighting may remain an aspirational policy idea rather than an implementable municipal practice.
- **Data gaps:** culvert inventories, baseflow quality/quantity, utility conflicts, contamination and long-term monitoring data may be incomplete. Daylighting feasibility depends on knowing where buried streams are located, how they interact with storm and sanitary infrastructure, whether sufficient water quantity and quality exist and what physical constraints are present underground. Missing or fragmented data can slow decision-making and increase uncertainty. Municipalities may need to begin with data consolidation, utility investigations, hydrological assessments and targeted field studies before selecting priority sites.
- **Technical constraints:** buried streams may lie under buildings or deep infrastructure; daylighting requires grading, flood protection, top-of-bank space, revegetation and maintenance access. Not all historical watercourses can be restored to the surface in their original alignment. In dense urban areas, buried streams may be located under roads, buildings, transit infrastructure or utility corridors. Even where daylighting is possible, projects require sufficient horizontal and vertical space to create a safe and

functional channel, accommodate flood flows, establish vegetation, provide maintenance access and protect adjacent development. These constraints should be assessed early to avoid advancing infeasible concepts.

- **Redevelopment constraints:** daylighting may require large sites, density transfers and transparent negotiation about land value and public benefit. Redevelopment can create important opportunities because it may allow municipalities to secure corridor space, reshape grading, relocate infrastructure or integrate public realm improvements. However, daylighting may also affect developable area, infrastructure costs and site design. Transparent negotiation is therefore needed to determine how land dedication, density allocation, flood protection, public access and long-term maintenance responsibilities will be handled.
- **Equity risks:** high-quality blue-green public realm investment can trigger green gentrification if not paired with anti-displacement measures. Daylighting can improve access to nature, recreation, cooling and public space, but these improvements may also increase neighbourhood desirability and development pressure. Municipalities should therefore consider who benefits, who may be burdened and how benefits can be distributed equitably. Anti-displacement measures, community benefits, inclusive engagement and monitoring of rent or redevelopment pressures can help ensure that daylighting contributes to climate justice rather than deepening inequities.
- **Readiness conditions:** mapped opportunities, watershed management authority collaboration, feasible hydrologic concept, governance plan, funding/operations and maintenance (O&M) pathway and monitoring protocol. A municipality is more likely to advance daylighting successfully when it has both technical and institutional readiness. This includes a clear opportunity map, early involvement from watershed management authorities, a plausible hydrological and water quality concept, cross-department governance, identified funding sources, O&M responsibilities and a monitoring framework. These readiness conditions help move a project from conceptual interest to practical implementation.

These considerations also point to the importance of timing and funding strategy. In Canadian municipalities, stream daylighting is most likely to become financially feasible when bundled with planned capital works, such as culvert renewal, sewer separation, road reconstruction, park upgrades, ravine restoration, flood mitigation projects or large redevelopment approvals. Stand-alone daylighting projects may be difficult to fund; whereas programmatic integration into existing capital cycles can reduce marginal costs, improve implementation readiness and make long-term O&M responsibilities easier to assign.

Conclusion

Urban stream daylighting can be a high-value nature-based solution (NbS) for Canadian municipalities when implemented as a policy-enabled, monitored and adaptive program. Because Canadian policy and practice remain limited, international cases provide essential implementation evidence. By distinguishing capital works from redevelopment, elevating watershed management agencies, linking planning criteria to monitoring indicators and framing implementation as an adaptive cycle, municipal planners can move from "consider where feasible" to a deliverable daylighting program.

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Appendix A: 18-Parameter Scoring Sheet (Workshop-Ready)

Use this sheet in cross-department workshops to compare candidate sites and delivery models. Score each parameter (e.g., 1-5) and document evidence/notes. Flag "red lines" early to avoid investing in infeasible options.

Table A1. Daylighting option scoring sheet

Criteria	Parameter	Score (1-5)	Evidence / notes
Time	Historic context and drivers	-	-
Time	Execution timeline / phasing feasibility	-	-
Scale	Total corridor footprint	-	-
Scale	Number of daylighted segments	-	-
Scale	Total length daylighted	-	-
Scale	Spatial distribution / connectivity	-	-
Cost-benefit	Capital costs (incl. utilities/land/ contamination)	-	-
Cost-benefit	Operations and maintenance burden	-	-
Cost-benefit	Avoided damages / avoided grey upgrades	-	-
Cost-benefit	Monetary + non-monetary benefits and trade-offs (incl. equity)	-	-
Structure-function	Politics and policy fit	-	-
Structure-function	Public inclusion and governance	-	-
Structure-function	Hydrology performance	-	-
Structure-function	Infrastructure integration		-
Structure-function	Ecology and water quality integrity	-	-
Structure-function	Urban form impacts	-	-
Structure-function	Economic impacts	-	-
Structure-function	Socio-cultural outcomes	-	-

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