

## Table of Contents

	page
<b>8. Monitoring and Adaptive Environmental Management .....</b>	<b>8-1</b>
8.1 DMNP Monitoring Program.....	8-3
8.1.1 Baseline Conditions Monitoring .....	8-3
8.1.2 EA Compliance Monitoring .....	8-4
8.1.3 Environmental Performance Monitoring .....	8-10
8.2 Adaptive Environmental Management.....	8-10
8.2.1 What is Adaptive Environmental Management)? .....	8-10
8.2.2 AEM Strategy for the DMNP.....	8-11
8.2.2.1 Monitoring and Evaluation within the DMNP AEM Process .....	8-12
8.2.2.2 Adjustments, Refinements, Modifications within the DMNP AEM Process ...	8-13
8.2.2.3 Learning within the DMNP AEM Process .....	8-14
8.2.3 Operationalizing the AEM Strategy.....	8-15

## List of Figures

Figure 8-1 Relationship between Monitoring Phases and Project Implementation .....	8-3
Figure 8-2 Relationship between Project Design and AEM.....	8-12
Figure 8-3 Monitoring and Evaluation within the AEM Cycle.....	8-13

## List of Tables

Table 8-1 Minimum Design Requirements for the DMNP .....	8-2
Table 8-2 DMNP EA Commitments.....	8-6
Table 8-3 General Environmental Performance Monitoring Requirements for Biophysical Components of the DMNP .....	8-10
Table 8-4 Potential AEM Triggers and Adaptive Measures for Project Components .....	8-13

## 8. Monitoring and Adaptive Environmental Management

The DMNP has been developed to improve the ecological function of the Don River, eliminate vulnerability to flood risk and to facilitate the redevelopment of the Port Lands. Based on this opportunity assessment, a series of design alternatives were considered (see **Chapter 5**). The preferred design was selected based on its ability to best achieve project objectives and is detailed in **Chapter 6** and assessed in **Chapter 7**. The preferred design outlines the minimum design requirements<sup>1</sup> necessary to provide naturalization and flood protection (see **Chapter 6** and **Table 8-1**). The monitoring and Adaptive Environmental Management (AEM) process presented in this chapter will ensure that minimum design requirements are maintained and work to maximize ecological function of the DMNP as identified through a set of performance indicators<sup>2</sup> to be developed during detailed design.

This EA anticipates the need for a certain degree of flexibility within the outcomes throughout the life of the DMNP given the uniqueness of this project, the long construction and implementation period and the large number of adjacent planning initiatives that influence and will be influenced by this project. The monitoring and AEM process presented in this chapter, coupled with the EA amendment mechanism presented in **Chapter 9**, provide a flexible framework to help designers and project managers maximize project benefits and minimize any potential negative effects (see **Chapter 7**) after this EA has been approved. The monitoring and AEM process will be managed by TRCA with input from other DMNP co-proponents, where appropriate.

**Section 8.1** describes the monitoring program that informs both the detailed design process and the AEM process for the DMNP. The program will ensure that the objectives of the DMNP are achieved. **Section 8.2** describes the AEM process as it relates to the DMNP.

The objectives of the DMNP are to:

1. Naturalize and rehabilitate the mouth of the Don River utilizing an ecosystem based approach;
2. Provide flood protection for Spill Zone 1 – the Port Lands and Spill Zone 2 – east of the Don River and north of Lake Shore Boulevard (**Section 2.1.2**);
3. Maintain the provision for navigation and existing flood protection through sediment, debris and ice management;
4. Integrate existing infrastructure that could not be reasonably moved or removed (including road, rails, utilities, trails and power);
5. Encourage additional compatible recreation, cultural heritage opportunities and improved accessibility for the public and persons with disabilities;
6. Contribute to the revitalization and sustainability of the waterfront and co-ordinate with and inform other planning and development efforts and associated certain and foreseeable infrastructure; and,
7. Design and implement the DMNP in a manner consistent with Waterfront Toronto's Sustainability Framework and applicable provincial legislation.

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1. **Minimum design requirements** represent the minimum values for the various components of the DMNP (e.g., minimum wetland patch size). Wherever possible these values will be maximized through detailed design, but the individual project components cannot be smaller than these minimum requirements.
  2. **Performance indicators** will be developed for the DMNP through detailed design to measure the environmental performance of the DMNP (see **Section 8.1.3**). Performance indicators relate to the functional ecological attributes of the naturalized system. Performance indicators will be developed based on the monitoring of reference wetlands, baseline monitoring and ecological models.

**Table 8-1 Minimum Design Requirements for the DMNP**

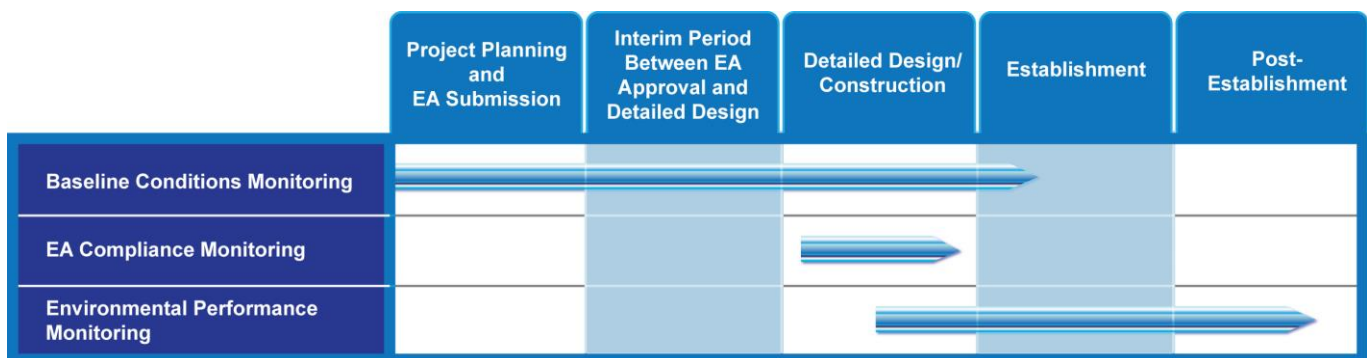
Design Component	Fixed Components of the Design (Minimum Design Requirements)
<b>Naturalization</b>	
<b>Wetlands</b>	<ul style="list-style-type: none"> <li>Wetland habitat area = 13 hectares (ha)</li> </ul>
<b>Terrestrial Habitat</b>	<ul style="list-style-type: none"> <li>Terrestrial habitat area = 4 ha</li> </ul>
<b>Aquatic Habitat</b>	<ul style="list-style-type: none"> <li>Permanent aquatic habitat area = 13 ha</li> </ul>
<b>Flood Protection</b>	
<b>All Reaches</b>	<ul style="list-style-type: none"> <li>Overall freeboard of 0.5 m for all crossings as per TRCA requirements, except Lake Shore Boulevard and Harbour Lead where physical constraints exist.</li> <li>10 m setback from the top of the valley slope as required by the Provincial Policy Statement (PPS) (MMAH, 2005) and TRCA.</li> </ul>
<b>Reach 1</b>	<ul style="list-style-type: none"> <li>Dimensions of Reach:                             <ul style="list-style-type: none"> <li>Length = approximately 315 metres (m)</li> <li>Width ranges from approximately 40 m to 120 m within the sediment trap area, measured from the top of the banks.</li> </ul> </li> <li>Existing Lake Shore Boulevard and Harbour Lead bridges will be lengthened from the two bays that currently exist to include a total of five bays, for a total length of approximately 120 m. The soffit heights for the lengthened portions of the bridges will be 78.2 m.</li> <li>Location and elevation of east bank Flood Protection Landform (FPL) and tie-off points for FPL east of Don Roadway.</li> </ul>
<b>Reach 2</b>	<ul style="list-style-type: none"> <li>Dimensions of Reach:                             <ul style="list-style-type: none"> <li>Length = approximately 300 m</li> <li>Width of the low flow channel = approximately 20 m to 70 m</li> <li>Width of the valley = approximately 150 m in the south and 200 m in the north, measured from the top of the valley slope.</li> </ul> </li> <li>Location and elevation of east bank valley wall feature (VWF).</li> </ul>
<b>Reach 2a</b>	<ul style="list-style-type: none"> <li>Dimensions of Reach:                             <ul style="list-style-type: none"> <li>Length of the channel = approximately 1,070 m</li> <li>Width of the channel = ranges from approximately 50 m to 140 m</li> </ul> </li> <li>Removal of existing Keating Channel bridge at Cherry Street.</li> </ul>
<b>Reach 3</b>	<ul style="list-style-type: none"> <li>Dimensions of Reach:                             <ul style="list-style-type: none"> <li>Length = approximately 720 m</li> <li>Width of the low flow channel = between approximately 20 m and 70 m</li> <li>Width of the valley = between approximately 100 m and 200 m, measured from the top of the valley slope.</li> </ul> </li> </ul>
<b>Reach 3a</b>	<ul style="list-style-type: none"> <li>Dimensions of spillway:                             <ul style="list-style-type: none"> <li>Length = approximately 190 m between the valley and the Ship Channel.</li> <li>Width of the valley = approximately 150 m measured from the top of the valley slope.</li> </ul> </li> </ul>
<b>Reach 4</b>	<ul style="list-style-type: none"> <li>Dimensions of Reach:                             <ul style="list-style-type: none"> <li>Length = approximately 410 m</li> <li>Width of the valley = ranges from 100 m to 170 m</li> </ul> </li> <li>Width of low flow channel = ranges from 60 m to 150 m</li> </ul>
<b>Sediment and Debris Management</b>	
<b>Reach 1</b>	<ul style="list-style-type: none"> <li>Dimensions of Sediment Trap:                             <ul style="list-style-type: none"> <li>Depth = 1.5 m deeper than the rest of the river channel, at an elevation of 70 m about sea level (mASL).</li> </ul> </li> <li>Location and function of sediment trap and Sediment and Debris Management Area will be determined during detailed design</li> </ul>

## 8.1 DMNP Monitoring Program

A comprehensive monitoring program is a critical element of the DMNP from pre-design through to post-establishment. The monitoring program serves several functions throughout the life of the DMNP:

1. Baseline conditions monitoring during pre-design and detailed design will continue to provide data that will inform detailed design elements and identify changes to the existing environment that may affect project outcomes. Any changes identified through monitoring during pre-design and detailed design can be incorporated into the detailed design and can inform the potential need for EA amendments if necessary (**Chapter 9** presents an EA amendment process for the DMNP);
2. EA compliance monitoring will ensure compliance with EA commitments made in this EA, including the approved Terms of Reference and any conditions that may be imposed as a result of the approval of the undertaking described in the DMNP. It will also ensure that the DMNP is constructed according to the minimum design requirements and final design elements. This monitoring information will be used to inform the AEM process (see **Section 8.2**). The AEM process can only begin once the first step of the DMNP is constructed, as described in **Section 6.6** (up to this point any project changes are design-related and will be subject to the amendment process described in **Chapter 9** if applicable); and,
3. Environmental performance monitoring will measure if the DMNP functions as intended during Establishment and Post-Establishment.

A standardized data collection protocol will be established for the monitoring program to ensure data consistency. The specific data that are collected will depend on the current step of the DMNP so the type of data collected will evolve as the DMNP progresses. **Figure 8-1** shows the relationship between the different monitoring phases and project implementation.



**Figure 8-1 Relationship between Monitoring Phases and Project Implementation**

### 8.1.1 Baseline Conditions Monitoring

TRCA and other agencies have been monitoring ecological conditions in the Don River and Lake Ontario for decades. The monitoring provides a robust baseline of existing conditions (see **Chapter 3**) which has informed the planning and design of the DMNP. Descriptions and mapping of existing vegetation and aquatic habitat in the Project Study Area and beyond has been assembled. Research has been conducted for the DMNP at reference

wetland sites to obtain hydrologic and ecologic measurements for existing river mouth systems on the north coast of Lake Ontario to develop a better understanding of how vegetation communities respond to changes in wetland bathymetry and topography.

Baseline conditions monitoring will allow the co-proponents to identify ecological changes that may occur between EA approval and project implementation, as well as changes that may occur as external influences exert their pressure on the enhanced conditions and newly formed channel. Continued monitoring of the baseline conditions following EA approvals will allow the co-proponents to determine whether:

- Significant changes in the existing environmental conditions have occurred that would influence the form and function of the DMNP, as described in **Chapter 6**, prior to detailed design and / or during construction;
- The DMNP is performing as anticipated during establishment (i.e., it is anticipated that some areas will be completed and undergoing establishment while other reaches are still under construction); and,
- The completed DMNP is sustainable and functioning under the range of future stressors that cannot be comprehensively defined at this time (i.e., due to climate change, new invasive species, changes in population and land use and unpredictability of natural functions, etc.).

The baseline monitoring and modelling work will continue through the period between EA approval, and detailed design as required, to ensure that the most up-to-date and relevant information is used to develop the detailed design for the DMNP.

### 8.1.2 EA Compliance Monitoring

EA compliance monitoring is a standard condition of approval for most projects subject to the *Environmental Assessment Act* in Ontario (Ontario *EA Act*). The purpose of EA compliance monitoring is to ensure compliance with all EA and other commitments made during project planning and ensure that the DMNP is constructed and operates as described within the range of predicted effects. The MOE typically requires ongoing monitoring and documentation to demonstrate proponent compliance with any conditions imposed as a condition of EA approval.

EA compliance monitoring will take place during the detailed design, construction and establishment periods for the DMNP and perhaps longer. This potentially represents a significant temporal period with respect to the implementation of the various project components. EA compliance monitoring will ensure adequate environmental protection throughout the extended construction period, document compliance with the EA and monitor the implementation of the approved design using standard Best Management Practices (BMPs) for construction (see **Appendix G**). The EA compliance monitoring program will be managed by TRCA. A detailed compliance monitoring plan will be developed as part of the overall environmental management plan to guide compliance monitoring during construction and beyond.

EA compliance monitoring will include, but may not be limited to, the following issues and potential effects:

- Ensure compliance with all commitments made in the EA, including the implementation of mitigation measures identified in the EA and conditions of approval;
- Ensure compliance with erosion and sediment control plans;
- Ensure compliance during fish salvage and release activities;
- Ensure the implementation of fisheries mitigation measures (e.g., fisheries windows, maintenance of passage, etc.);

- Ensure the implementation of Waterfront Toronto's Environmental Management Plan (or similar Environmental Management Plan) and BMPs during construction (e.g., air quality mitigation measures such as dust suppression, vehicle emissions management and noise management) (refer to **Appendix G**);
- Ensure compliance with all provincial and federal permits, licenses and approvals (e.g., Environmental Compliance Approvals, Permit to Take Water (PTTW), etc.);
- Ensure compliance with fuel storage and handling and spill response protocols;
- Ensure compliance with waste management plans;
- Ensure provision of safe navigation during construction;
- Continue monitoring of river discharge and upstream regional weather to provide early flood warnings to construction crews (this will be undertaken as part of existing flow monitoring programs which will continue through construction); and,
- Document the as-built channel features and adjacent corridor conditions immediately following construction completion.

Annual compliance reports will be required for submission to the MOE, once detailed design has commenced, to report on compliance with any commitments or conditions. Similarly, annual compliance reports will also be required for submission to the MOE within a year of EA approval. EA compliance monitoring will continue for each step of construction described in **Section 6.6**, until all conditions and commitments are fulfilled. Once final grading is complete, the environmental performance monitoring program (see **Section 8.1.4**) will begin and continue through the life of the DMNP.

**Table 8-2** below provides a summary of EA commitments resulting from the DMNP which will, in part, be the basis for compliance monitoring.



**Table 8-2 DMNP EA Commitments**

Timing	EA Commitment	EA Report Reference
<b>Detailed Design</b>	▶ Obtain all required authorizations and approvals.	Section 1.5
	▶ Prior to the start of works, ongoing discussions between Ministry of Natural Resources (MNR), Ministry of Municipal Affairs and Housing (MMAH), City of Toronto, TRCA and Waterfront Toronto will be required to determine the appropriate approach and timing for modification or removal of the Special Policy Area (SPA) designation for Spill Zone 1 and Spill Zone 2.	Section 1.5
	▶ The Adaptive Management of Stream Corridors in Ontario Natural Hazards Technical Guides (MNR, 2002) will be consulted to ensure that all flood protection features are in accordance with the Ministry of Natural Resources' natural hazard policies as they relate to the Provincial Policy Statement (PPS).	Section 6.1.1
	▶ The DMNP will involve a wide range of operational and maintenance refinements that likely will involve a wide range of different agencies (e.g., TPA and Toronto Parks), requiring a co-ordinated approach to understanding and developing operational modifications and agreements following EA approval.	Section 6.4
	▶ Quantities of groundwater requiring management will be estimated during the development of a Risk Assessment/Risk Management (RA/RM) approach. At that time, the need for a Permit to Take Water will be confirmed.	Section 6.5.6.1
	▶ Develop a project-specific Environmental Management Plan (EMP) in accordance with the Waterfront Toronto Environmental Management Plan for Project-Related Activities (Waterfront Toronto, 2009b) during detailed design to describe specific mitigation and management measures, including drainage and erosion / sediment management and spill response to avoid any effects on the environment during construction.	Section 6.6
	▶ During each phase of construction, undertake a RA/RM approach for the management of soils that are excavated from the site.	Section 6.6 and Section 7.3.7
	▶ Continue to meet with utility providers, including HONI, to confirm that these utilities may be removed, retrofitted, relocated or extended, explore cost sharing opportunities and to develop an approach to maintain servicing during construction.	Section 6.6.2.5, Section 7.3.4 and Section 10.3.2
	▶ Confirm conveyance of the Regulatory Flood, plus required 0.5 metre freeboard, without affecting areas beyond the new river valley system, including ensuring that channel configuration in the trap area is such that any impacts to the adjacent areas are acceptable to the regulator.	Section 7.3.2 Appendix N-1
	▶ The construction phasing strategy will provide continued dockwall and waterlot access for Lafarge at their current location until they no longer operate on the property.	Section 7.3.3 and Section 7.3.6
	▶ Arrangements will be made with TPA and other long-term leaseholders in the area for lost mooring revenue (i.e., negotiations regarding compensation).	Section 7.3.3 and Section 10.1.2.10
	▶ Enter into discussions with TPA to ensure that the new location for the works yard addresses their requirements and to determine operational responsibility for sediment and debris management in its new location.	Section 7.3.3
	▶ Enter into discussions with TPA and other long-term leaseholders in the area to understand available remaining dockwall and identify alternative mooring locations for vessels.	Section 7.3.3 and Section 10.1.2.10
	▶ Discuss with TPA the need for: <ul style="list-style-type: none"> <li>- Installation of aids to navigation, such as wayfinding signage for recreational users to encourage them to avoid areas used for commercial purposes; and,</li> <li>- Implementation of communication systems, such as a website or telephone service that provide recreational users with information on pending movements of commercial vessels.</li> </ul>	Section 7.3.3
	▶ Prepare a cultural heritage evaluation report(s) or a municipal Heritage Impact Assessment for the Marine Terminal 35, Atlas Crane site and one storey brick warehouse at 242-292 Cherry Street in collaboration with the City's Heritage Preservation Services unit and other heritage stakeholders, which will assess the property's cultural heritage value, the impacts to the property and potential conservation and mitigation options which would include conserving, relocating, raising or commemorating the resource.	Section 7.3.5

**Table 8-2 DMNP EA Commitments**

Timing	EA Commitment	EA Report Reference
	<ul style="list-style-type: none"> <li>▶ Incorporate heritage aspects into the design of the DMNP where feasible.</li> <li>▶ Through consultation with Aboriginal communities, opportunities were identified to incorporate heritage aspects, such as using specific vegetation communities (e.g., wild rice) and the need for carp controls to allow for the establishment of wild rice, into the design of the DMNP. Further consultation with the Aboriginal groups, as requested, will occur during the final design and construction of the DMNP.</li> </ul>	Section 7.3.5
	<ul style="list-style-type: none"> <li>▶ Continue to engage the Mississaugas of the New Credit First Nation, the Métis Nation of Ontario and other Aboriginal communities, as requested.</li> </ul>	Section 7.3.5
	<ul style="list-style-type: none"> <li>▶ Update and provide to MOE for review the noise assessment related to Sediment and Debris Management Area once dewatering technology has been selected to confirm effects on receptors near Reach 3a.</li> </ul>	Section 7.3.6
	<ul style="list-style-type: none"> <li>▶ Undertake baseline conditions monitoring and modelling work to ensure that the most up-to-date and relevant information is used to develop the detailed design for the DMNP.</li> </ul>	Section 8.1.1
	<ul style="list-style-type: none"> <li>▶ Prepare and submit to MOE an annual report on the status of compliance with EA commitments and conditions of approval.</li> </ul>	Section 8.1.2
	<ul style="list-style-type: none"> <li>▶ Develop a detailed compliance monitoring plan as part of the overall specific EMP to guide compliance monitoring during construction.</li> </ul>	Section 8.1.2
	<ul style="list-style-type: none"> <li>▶ TRCA will work in consultation with Waterfront Toronto, the City of Toronto and other relevant stakeholders to develop monitoring objectives and performance indicators and measures during the detailed design process for the DMNP.</li> </ul>	Section 8.2.3
	<ul style="list-style-type: none"> <li>▶ In the event that there are amendments to the design, prepare a technical memo to document the proposed modifications and their potential effects identified through the AEM process.</li> <li>▶ The technical memo will be drafted by the TRCA in consultation with Waterfront Toronto and City of Toronto and will be circulated to appropriate stakeholders.</li> </ul>	Section 9.2
	<ul style="list-style-type: none"> <li>▶ Establish an advisory committee of local stakeholders who will be involved during detailed design and construction, particularly as it relates to soils and groundwater management issues relating to public health and risk.</li> </ul>	Section 10.4
	<ul style="list-style-type: none"> <li>▶ Host a Public Forum to review the detailed design of the DMNP and seek public input on any new information that is available to feed into the process, including similar engagement with other agencies and landowners.</li> </ul>	Section 10.4
	<ul style="list-style-type: none"> <li>▶ DMNP newsletter updates to be provided summarizing progress on detailed design and construction-related work.</li> </ul>	Section 10.4
	<ul style="list-style-type: none"> <li>▶ Post regular project updates to the project webpage co-ordinated between TRCA, Waterfront Toronto and City of Toronto.</li> </ul>	Section 10.4
<b>Construction</b>	<ul style="list-style-type: none"> <li>▶ Ensure that all backfill material brought onto the DMNP lands from off-site sources has engineering characteristics suitable for its intended use and meets the soil quality standards, as provided in O.Reg. 153/04 and described in the Soils Management Master Plan.</li> </ul>	Section 6.5.4
	<ul style="list-style-type: none"> <li>▶ Manage groundwater in accordance with the RA/RM and the requirements of Waterfront Toronto's draft Groundwater Management Master Plan.</li> </ul>	Section 6.5.6
	<ul style="list-style-type: none"> <li>▶ Continue dredging of the Keating Channel to maintain its current hydraulic capacity until the new river valley is connected to the lake.</li> </ul>	Section 6.6
	<ul style="list-style-type: none"> <li>▶ Manage soil in accordance with the RA/RM.</li> </ul>	Section 6.6
	<ul style="list-style-type: none"> <li>▶ Apply the project-specific EMP to avoid any effects on the environment during construction.</li> </ul>	Section 6.6
	<ul style="list-style-type: none"> <li>▶ Construction of the proposed floodplain will not worsen existing flooding conditions and will be timed to minimize flood risk wherever possible.</li> </ul>	Section 6.6
	<ul style="list-style-type: none"> <li>▶ Phasing of the river valley will be co-ordinated to minimize impacts and to accommodate continued use by vehicles, cyclists and pedestrian movement, where appropriate and possible.</li> </ul>	Section 6.6
	<ul style="list-style-type: none"> <li>▶ Construction related to removal of soils will occur "in the dry" (i.e., isolated from the lake and river) wherever feasible and infrastructure will be installed concurrently as excavation of the new river valley proceeds to minimize environmental implications during construction and maximize construction efficiencies.</li> </ul>	Section 6.6
	<ul style="list-style-type: none"> <li>▶ Nuisance effects, including noise, dust and combustion emissions, will be minimized to the extent possible through the application of BMPs.</li> </ul>	Section 6.6



**Table 8-2 DMNP EA Commitments**

Timing	EA Commitment	EA Report Reference
	▶ Provide advance notice to TPA and other long-term leaseholders in the area in order to inform users of potential dockwall removal/modification.	Section 7.3.3
	▶ Provide TPA and other long-term leaseholders (e.g., Lafarge) with advanced notification of anticipated high flow events via the TRCA Storm Advisory System.	Section 7.3.3
	▶ Provide TPA and other long-term leaseholders (e.g., Lafarge) with real-time access to TRCA's Don River stream gauge information.	Section 7.3.3
	▶ Consult with emergency services (i.e., Toronto Fire Service, Emergency Medical Service (EMS) and police) in advance of any road closures so that alternative emergency dispatch protocols can be implemented if required.	Section 7.3.4
	▶ Provide advanced notification to Toronto Fire Service prior to construction works associated with municipal water flow to any fire hydrants and / or buildings.	Section 7.3.4
	▶ Provide alternate access and re-routing signage to businesses as required and maintain emergency access to adjacent structures and buildings.	Section 7.3.4
	▶ Ensure a professional archaeologist is on-site at regular intervals to monitor excavation in areas of archaeological potential, including in the vicinity of LDP-1, 2, 3 and 4 and other areas cited in Waterfront Toronto's Archaeological Conservation Management Strategy (ACMS) (2008b) which form part of the study area.	Section 7.3.5 and Section 10.1.3.6
	▶ If artifacts are found, the Ministry of Tourism, Culture and Sport (MTCS) will be notified and construction in the area of the find will cease until the significance of the resource can be evaluated by a professional licenced archaeologist.	
	▶ If Aboriginal artifacts are encountered, the City of Toronto's protocol for engaging Aboriginal communities will be followed.	
	▶ LDP-1, LDP-2, LDP-3 and LDP-4 will be documented by a professional archaeologist monitoring construction in the site areas as required by the ACMS. LDP-5 and LDP-8 will be recognized through signage or other interpretive material or programs as required by the ACMS.	
	▶ All features cited in the ACMS are worthy of site commemoration and interpretation.	
	▶ Where property is under ownership by the City of Toronto or its agents (i.e., Toronto Port Lands Company), lessees will be given proper notice and leases will be terminated or not renewed prior to commencement of construction activities as per the terms of the leases.	Section 7.3.6
	▶ Where property is privately held, is subject to longer-term leases or is owned by the TPA, arrangements will be made for loss of property and / or activity (i.e., negotiations for potential relocation and / or compensation).	Section 7.3.6
	▶ Undertake baseline conditions monitoring during construction to determine whether significant changes in the existing environmental conditions have occurred that would influence the form and function of the DMNP.	Section 8.1.1
	▶ Establish an advisory committee of local stakeholders who will be involved during detailed design and construction, particularly as it relates to soils and groundwater management issues relating to public health and risk.	Section 10.4
	▶ Host a Public Forum to provide construction details and schedules when the information is available.	Section 10.4
	▶ DMNP newsletter updates to be provided summarizing progress on detailed design and construction-related work.	Section 10.4
	▶ Establish a mechanism to ensure the reporting and investigation of complaints arising from construction activities.	Section 10.4
<b>Establishment / Post-Establishment</b>	▶ All operational considerations including any design refinements of naturalization components will require discussion between the appropriate parties following EA approval.	Section 6.4
	▶ Ensure regular dredging of sediment trap and management of sediment and debris management area.	Section 7.3.1, 7.3.3 and 7.3.5
	▶ Ensure long-term maintenance of connecting feeder channels to eliminate infilling with sediments and effectively maintain wetlands.	Section 7.3.3 and Appendix N-2
	▶ Conduct regular maintenance of upstream and sideflow weirs to ensure proper operation during flood events.	Section 7.3.3
	▶ Ensure regular inspection maintenance of slurry pipe along the Don Roadway to minimize clogging and maintain conveyance of sediment, if required.	Section 7.3.4
	▶ Monitor environmental performance to measure desired outcomes related to naturalization, flood protection (including management of the impacts of more frequent flooding events) and sediment, debris and ice management; determine if they have been achieved; trigger adaptive measures where necessary; and inform the refinement of the as-built features.	Section 8.2.3

**Table 8-2 DMNP EA Commitments**

Timing	EA Commitment	EA Report Reference
<b>Commitments Affecting Other Projects</b>	▶ New development areas as defined within the PPS will be required to be set back from the top of valley slope of the new river valley by 10 metres horizontally.	Section 6.1.1.2
	▶ All vehicular traffic / fixed bridges will be designed to meet flood conveyance requirements as well as the requirements for the continued navigation of small watercraft (e.g., canoes, zodiacs).	Section 6.2.1
	▶ All crossings will be designed to span the floodplain and to pass the Regulatory Flood with 0.5 metre freeboard (with the exception of the Lake Shore Boulevard and Harbour lead crossings).	Section 6.2.1
	▶ Co-ordinate with infrastructure construction to ensure utility conduits and bridge crossings proceed in conjunction with construction of new river valley.	Sections 6.6.2.5 and 6.6.3.4

### 8.1.3 Environmental Performance Monitoring

The purpose of environmental performance monitoring is to measure desired outcomes related to naturalization, flood protection (including management of the impacts of more frequent flooding events) and sediment, debris and ice management; determine if they have been achieved; trigger adaptive measures where necessary; and, inform the refinement of the as-built features. Environmental performance monitoring will commence at the completion of each construction step, following final grading and as-built documentation. **Table 8-3** provides examples of general environmental performance monitoring requirements for biophysical components of the DMNP.

**Table 8-3 General Environmental Performance Monitoring Requirements for Biophysical Components of the DMNP**

Biophysical Component	Environmental Performance Monitoring Requirements
<b>Aquatic Habitat and Species</b>	<ul style="list-style-type: none"> <li>Identify trends of aquatic habitat and species targets through post-establishment</li> <li>Evaluate aquatic habitat and species against intended modelled outcomes and historical conditions</li> </ul>
<b>Wetland Function</b>	<ul style="list-style-type: none"> <li>Evaluate wetland function against intended modelled outcomes</li> </ul>
<b>River Form and Function</b>	<ul style="list-style-type: none"> <li>Observe impact of major flow events on river form and the effectiveness of river management features</li> <li>Observe major flow events to evaluate effectiveness of flood protection measures</li> </ul>
<b>Terrestrial Habitat and Species</b>	<ul style="list-style-type: none"> <li>Evaluate the trajectory of newly created terrestrial habitat against intended outcomes</li> </ul>
<b>Surface and Groundwater Quality</b>	<ul style="list-style-type: none"> <li>Evaluate the effectiveness of on-site stormwater controls</li> <li>Observe the effectiveness of contaminated groundwater isolation measures</li> </ul>
<b>Flow and Precipitation</b>	<ul style="list-style-type: none"> <li>Document changes in flow and precipitation patterns over time to inform the need for management adjustments</li> </ul>

TRCA monitoring frameworks (e.g., Tommy Thompson Park Cell 1 Capping and Port Union) provide examples of performance monitoring that could be adapted specifically for the DMNP. These existing monitoring frameworks will be augmented with additional performance indicators that address ecological, social and economic aspects of DMNP objectives. Monitoring results will be compared against the performance indicators developed during detailed design. The comparison of performance indicators against monitoring results is the key driver of the AEM process described in **Section 8.2**. Monitoring results are compared to performance indicators to determine if AEM measures are required to achieve desired outcomes. The performance monitoring framework will be finalized by the co-proponents during detailed design in conjunction with the MOE and other appropriate agencies.

## 8.2 Adaptive Environmental Management

To ensure that the preferred design functions as desired based on the information presented in **Chapter 6**, an approach to ongoing management is required to continually fine tune project components and ensure long-term project success. AEM provides a clear process for ongoing management of the DMNP to ensure project objectives continue to be achieved through positive feedback mechanisms.

### 8.2.1 What is Adaptive Environmental Management)?

AEM is defined as a systematic process for continually improving environmental management practices by learning about their outcomes and applying that knowledge to improve the outcome. AEM allows for flexibility in project management so modifications and refinements can be incorporated throughout the project life cycle (Canadian

Environmental Assessment Agency, 2009). AEM is fundamentally a way of incorporating learning through monitoring into a feedback loop that enhances project outcomes. Undesirable environmental effects are identified early so that management interventions can be implemented promptly to avoid major problems before they occur and to maximize the fulfillment of the project objectives.

### 8.2.2 AEM Strategy for the DMNP

The DMNP AEM strategy incorporates the Ontario Ministry of Natural Resources' (MNR) document Adaptive Management of Stream Corridors in Ontario and Natural Hazard Technical Guides (MNR, 2002). This document provides a guideline for adaptive management for streams in Ontario in order to minimize adverse effects to species at risk and their habitat. The document outlines the five stages of the adaptive management framework as:

1. Problem formulation;
2. Preliminary planning and assessment;
3. Detailed analysis for planning or design;
4. Implementation; and,
5. Monitoring, evaluation and long-term adaptive management.

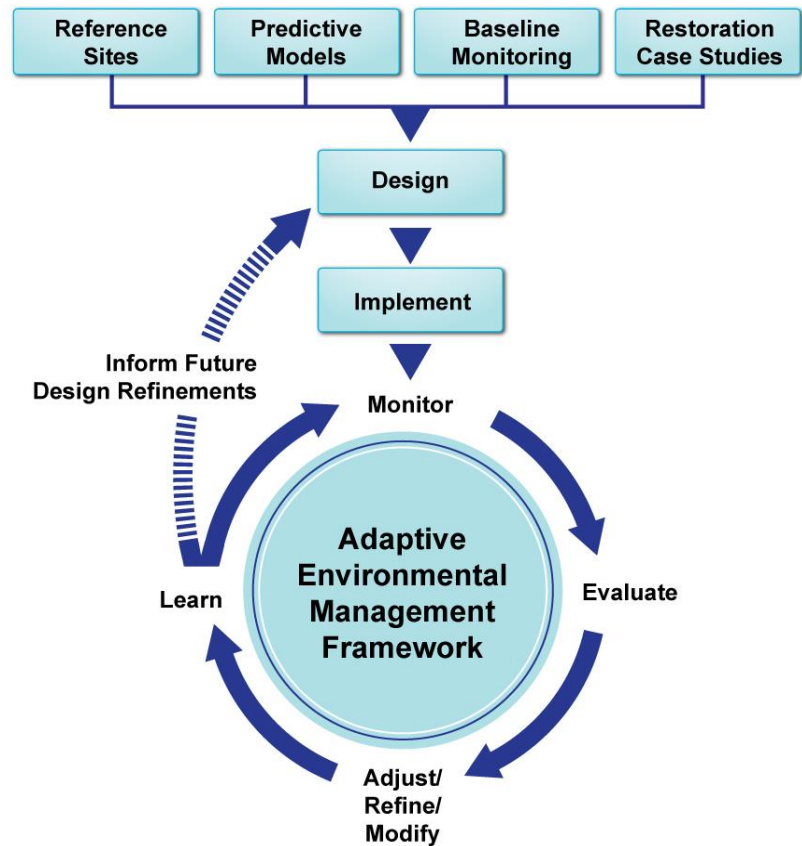
The outcome of naturalization projects depends on the interaction between the biological components with the underlying physical components that are created, (terrain, soils and hydrology which can all be modified by changes in climate) and how people use the DMNP area and the surrounding areas.

An AEM strategy is desired for the DMNP for a number of reasons including:

1. The need for a flexible strategy to address ecosystem response to changing environmental conditions and human use stressors during sequential construction of the new river reaches and adjacent wetland and terrestrial habitat;
2. The need to create the opportunity to maximize project benefits and minimize negative effects throughout the life of the DMNP;
3. The need to adjust sediment trap management in response to unexpected downstream ecological responses, unusual weather conditions, sudden widespread changes in watershed land use conditions, long-term climate change and to adjust debris and ice management as appropriate;
4. The need to respond to changes in local weather patterns and long-term climate change that may alter lake water levels and the frequency and duration of inundation of the naturalized features and/or the severity and frequency of extreme flood events; and,
5. The need to respond to changes or benefits related to future projects and planning initiatives in the general project area and elsewhere in the Don River watershed and to take advantage of enhancements that those projects may provide to this system.

**Figure 8-2** outlines the AEM cycle. The AEM cycle will be applied once construction of each phase of the DMNP is completed and will inform ongoing management activities, future construction activities and future projects through a feedback mechanism from lessons learned. AEM is the ongoing cycle of monitoring, evaluation, adaptation and learning.

In the face of such complexity, the ability to affect the outcome through monitoring and adaptation in response to unforeseen events is paramount. The AEM process offers the best process by which to achieve this flexibility. The purpose of AEM and associated monitoring programs is to increase the likelihood of meeting project goals despite uncertainty surrounding various project elements.



**Figure 8-2 Relationship between Project Design and AEM**

**8.2.2.1 Monitoring and Evaluation within the DMNP AEM Process**

Monitoring is a key component of the adaptive management framework since it establishes conditions pre- and post-construction and helps determine what effects are occurring as a result of project activities. It also identifies environmental changes that are occurring at various spatial scales that may affect project outcomes. Monitoring allows for the systematic testing of different actions to assess their ability to achieve a desired outcome. The key is to develop an understanding of not only which actions work and which do not, but also which stressors are creating an impact to the system and how. The monitoring data that feeds into the AEM process will be robust and scientifically defensible, providing information that will maximize opportunities to achieve desired outcomes.

The achievement of project objectives is assessed by monitoring the system and evaluating the data against pre-defined performance indicators. If the desired outcomes are not achieved, the project implementation may need to be adapted. The objective is to maximize benefits in relation to the performance indicators (i.e., AEM will seek to maximize measured values related to indicators wherever possible).

An advantage of the extended “build-out” period for the DMNP is that techniques and designs can be monitored and evaluated as they are installed to identify adaptations that will better fulfill the project objectives.

The evaluation component of AEM will include specific triggers that will determine when management interventions will be examined and implemented (see **Figure 8-3**). Evaluation of monitoring data provides the foundation for learning from the DMNP. These lessons will inform required modifications to the monitoring program (i.e., increase or decrease in monitoring frequency; changes in performance indicators; identification of new objectives or better techniques) and modifications to the ecological models used for project design.

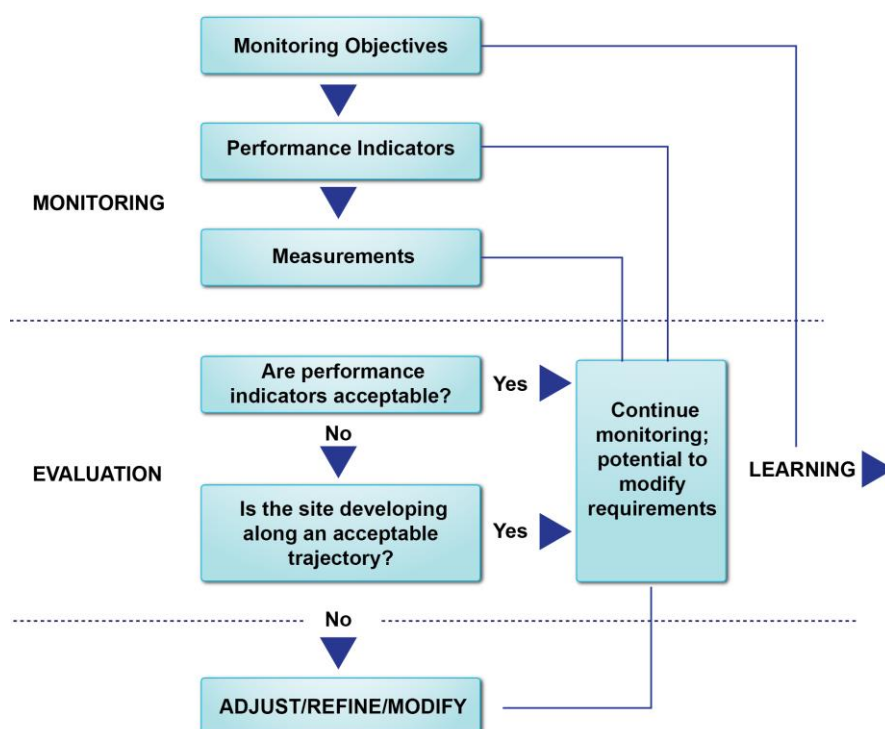


Figure 8-3 Monitoring and Evaluation within the AEM Cycle

**8.2.2.2 Adjustments, Refinements, Modifications within the DMNP AEM Process**

Adaptation (adjust, refine and / or modify) is about taking action to increase the likelihood of achieving project objectives. The purpose of an AEM strategy is to identify undesirable environmental effects early so management interventions can be implemented to avoid major problems before they occur. The environmental performance monitoring described in Section 8.1.3 will provide clear evidence of project outcomes during establishment. Results from monitoring and evaluation will inform the need for adjustments, refinements or modifications to project design or operations. Table 8-4 provides examples of potential AEM triggers and possible adjustments, refinements or modifications that could be implemented to address any identified problems. The specific triggers for adjustments, refinements or modifications and the specific management options will be refined during detailed design and included in an AEM work plan.

Table 8-4 Potential AEM Triggers and Adaptive Measures for Project Components

Project Component	Potential AEM Triggers	Potential Adjustments, Refinements or Modifications
<b>Aquatic Habitat and Species</b>	<ul style="list-style-type: none"> <li>Undesired fish species composition</li> <li>Underperformance of species recruitment to the area (as predicted by the various habitat models)</li> <li>Undesired spatial distribution of riparian or wetland Ecological Land Classification (ELC) communities</li> <li>Impairment of habitat features (sedimentation, ice scour, etc.) that significantly affects performance as intended / designed</li> <li>Over representation of undesirable species (e.g., carp)</li> <li>Impacts to created habitat and / or wildlife by people and / or pets</li> </ul>	<ul style="list-style-type: none"> <li>Adjust / enhance aquatic habitat features and habitats to promote desired species composition</li> <li>Expand monitoring to identify root causes of low species recruitment</li> <li>Adjust weir management to adjust plant community</li> <li>Repair / re-establish habitat features</li> <li>Refine invasive species (e.g., carp) management program</li> <li>Reconfigure / manage human use patterns (e.g., adjust public access to habitat areas, by-law changes, enforcement, education, signage, etc.)</li> </ul>



**Table 8-4 Potential AEM Triggers and Adaptive Measures for Project Components**

Project Component	Potential AEM Triggers	Potential Adjustments, Refinements or Modifications
<b>Wetland Function</b>	<ul style="list-style-type: none"> <li>Excess sedimentation of wetland areas</li> <li>Ineffective hydraulic connection to the river</li> <li>Undesired hydroperiod in wetlands</li> <li>Undesired species composition</li> </ul>	<ul style="list-style-type: none"> <li>Revise sediment management; implement corrective action for accumulated sediment</li> <li>Adjust artificial levees (e.g., to avoid excess sedimentation, to retain water in flood events)</li> <li>Modify frequency and volume of sediment management upstream</li> <li>Modify flooding frequency, depth and / or duration</li> <li>Modify vegetation composition using appropriate methods</li> <li>Adjust weir management</li> </ul>
<b>River Form and Function</b>	<ul style="list-style-type: none"> <li>Flooding occurring in unanticipated areas within the new river valley system</li> <li>Flooding occurring at different frequency / intensity than predicted</li> <li>Bank stability engineering controls not functioning as expected</li> <li>Sediment trap not collecting sediment as expected</li> <li>Ice management system not functioning as designed</li> </ul>	<ul style="list-style-type: none"> <li>Change weir management in response to observed levels</li> <li>Modify bank stability controls to address erosion problems</li> <li>Reconfigure sediment trap design or modify sediment removal schedule as appropriate</li> <li>Reconfigure debris trap design as appropriate</li> <li>Reconfigure ice management design as appropriate</li> </ul>
<b>Terrestrial Habitat and Species</b>	<ul style="list-style-type: none"> <li>Undesired species composition</li> <li>Undesired spatial distribution of ELC communities</li> <li>Inadequate species diversity</li> <li>Cover not effectively controlling erosion</li> <li>Recreation / human use causing degradation of habitat</li> <li>Inadequate species diversity and abundance utilizing habitats as project desired</li> </ul>	<ul style="list-style-type: none"> <li>Conduct vegetation management (herbicide application, manual removal, re-seeding, etc.)</li> <li>Re-vegetate or adjust cover management system to control erosion</li> <li>Reconfigure / manage human use patterns (e.g., adjust public access to habitat areas, by-law changes, enforcement, education, signage, etc.)</li> <li>Adjust / enhance wetland and terrestrial habitats as required to attract desired species or abundance</li> </ul>
<b>Surface and Groundwater Quality</b>	<ul style="list-style-type: none"> <li>Contamination from adjacent Port Lands area migrating into the naturalized area</li> </ul>	<ul style="list-style-type: none"> <li>Review engineering controls for contamination isolation and adjust as appropriate</li> </ul>

### 8.2.2.3 Learning within the DMNP AEM Process

One of the greatest benefits of the proposed AEM strategy is that it will allow for ongoing learning related to the outcomes of the DMNP and future projects. Learning involves systematically documenting the results of monitoring, evaluation and adaptive measures and providing lessons learned to a wide audience. TRCA, Waterfront Toronto, the City of Toronto, academia, other agencies and organizations and the global urban renewal community will benefit from an improved understanding of effective naturalization techniques established through the AEM strategy for the DMNP. Monitoring programs will determine if predictive models provided accurate information to appropriately inform design. Where monitoring reveals any inaccuracies within the predictive models, adjustments can be made for future designs. It is important to recognize that projects of this magnitude and complexity are rare and should be documented for communication to a wide audience.

Documentation of the monitoring, evaluation and adaptive measures described in this chapter will be used to inform similar projects that are undertaken in the future. By applying the monitoring and adaptive management process outlined in this chapter, a robust database will be created that can be drawn upon for future projects related to Toronto’s waterfront revitalization and other naturalization efforts.

This cycle of monitoring, evaluation, learning and adaptation will be applied to the DMNP in order to respond to uncertainties and external influences related to the DMNP and the environment, such as climate change. Climate change is expected to influence management of the DMNP into the future given the duration of the build-out period and the fact that the DMNP will establish a new ecological system that will exist and evolve in perpetuity. Climate change may result in lower water levels in Lake Ontario, influencing recharge capabilities or inundation levels in the constructed wetlands. To address these potential changes, the wetlands and feeder channels will be designed with a diverse range of bathymetries to ensure that vegetation can adapt appropriately. Monitoring the conditions over time following completion of construction and establishment will allow TRCA to respond to change by implementing appropriate AEM measures.

Further complications could arise as a result of the build-out period for the DMNP that may extend over a number of years. This may trigger a management response to address changes to the environmental, social or economic context of the DMNP. It can also be anticipated that the performance of sediment, debris and ice management components will also potentially require refinement throughout the life of the project.

### **8.2.3 Operationalizing the AEM Strategy**

The sections above outline the AEM strategy and how it relates to project objectives and monitoring. However, the details of the strategy will be defined during detailed design as project details become more concrete. Using existing monitoring frameworks developed for Tommy Thompson Park and Port Union as a template, TRCA, working in consultation with Waterfront Toronto, the City of Toronto and other relevant stakeholders, will develop monitoring objectives and performance indicators and measures during the detailed design process for the DMNP. The timing of this activity will be determined by the availability of funding and how quickly the detailed design proceeds.

As the first phase of construction is complete, the AEM strategy will start to be applied and refined as necessary as information is collected and assessed. As long as the naturalized and flood protection systems are functioning as anticipated there will be no need to identify adaptations, modifications or refinements to either system elements and/or operational systems.