Managing the environment in infrastructure projects through Environmental Management Plans

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ABSTRACT
Within the Greater Toronto Area, Toronto and Region Conservation (TRCA) manages nine watersheds under federal and provincial environmental legislation. TRCA reviews infrastructure projects through its Environmental Assessment Section with input of the specialized technical team. Where there is high potential for environmental impacts to integrated terrestrial, aquatic and groundwater conditions, impacts mitigation can be addressed through a variety of complex Environmental Management Plans (EMPs). Since 2004 TRCA has required EMPs for infrastructure projects.

RÉSUMÉ
Dans la région Grand Toronto, l'Office de protection de la nature du Toronto et régions (TRCA) contrôle neuf bassins versants sous la législation environnementale fédérale et provinciale. Le TRCA évalue les projets d'infrastructure par sa section d'évaluation environnementale avec le participation d'un équipe spécialisée en techniques. Là où il existe un potentiel élevé pour des incidences environnementaux sur les écosystems terrestres et aquatiques et des eaux souterraines, les impacts peuvent être atténués par une série complexe des plans de gestion environnementale (EMPs). Depuis 2004 TRCA ont exigé les EMPs pour les projects d'infrastructure.

1 THE TORONTO AND REGION CONSERVATION AUTHORITY

In 1946, the Province of Ontario enacted the *Conservation Authorities Act*, permitting municipalities in a watershed to form a conservation authority. In the Toronto Region, four conservation authorities were subsequently formed: Etobicoke Valley, Humber Valley, Don Valley, and Rouge-Duffins-Highland-Petticoat.

On October 15, 1954 Hurricane Hazel struck the Toronto region with winds of 110 kilometres per hour (68 mph). According to the *Hurricane Hazel website* in 48 hours, 28.5 centimetres (11.23 inches) of rain fell. It remains the strongest hurricane on record to reach so far inland. Bridges and streets were washed out, thousands were left homeless, and 81 people in southern Ontario were killed. After Hazel, the provincial government amended the Conservation Authorities Act to enable an authority to acquire lands for recreation and conservation purposes and to regulate that land for the safety of the community. The province developed flood plain management policies and delegated the responsibility for implementing these policies to the authorities.

In 1957, the Metropolitan Toronto and Region Conservation Authority formed, replacing the four smaller authorities. Since its formation, Toronto and Region Conservation Authority (TRCA) proudly manages its nine watersheds (Figure 1) by continuing to develop and update programs and policies, and to include integrated ecosystem management in watershed planning. The *Conservation Authorities Act* provides the legal basis for TRCA's mandate to prevent, eliminate, or reduce the risk to life and property from flooding and erosion, and to encourage the protection and regeneration of natural systems. Since its formation, the TRCA has acquired more than 13,377 hectares (33,055 acres) of land in the watersheds of the Toronto region, making it one of the largest landowners in the Greater Toronto Area.

Figure 1. Little Rouge Creek within the GTA is a major tributary of Rouge River and part of the TRCA's nine watersheds.

TRCA is regarded as a leader in watershed management in Ontario. The success of the TRCA over the past 50 years is attributed to the dedication and commitment of staff, and the support of national, provincial and local levels of government.

2 PLANNING AND DEVELOPMENT

Through its Planning and Development Division, TRCA uses provincial legislation to regulate development in valley and stream corridors, wetlands and along the Lake Ontario shoreline. Staff reviews and comments on development and infrastructure proposals and applications within or adjacent to these natural areas. By doing so, TRCA aims to prevent, eliminate, or reduce the risk to life and property from flooding, erosion and slope instability, and to encourage the protection and enhancement of natural systems.

Through its Valley and Stream Corridor Management Program (VSCMP) and the Lake Ontario Shoreline Management Program, staff integrates public safety responsibilities with ecosystem planning and management. TRCA works with municipalities and public stakeholders to ensure that its watershed ecosystems become an important component of growth management plans, official plans, master plans, development plans, environmental assessments, and related projects.

In addition to providing municipalities with advice and approvals on applications made under the *Ontario Planning Act* and the *Ontario Environmental Assessment Act*, TRCA reviews applications made pursuant to the *Fisheries Act*, the Lakes and Rivers Improvement Act, the Niagara Escarpment Planning and Development Act, the Oak Ridges Moraine Conservation Act, the Greenbelt Act, and other applicable legislation. Working with the Ecology Division, staff in the Planning and Development Division provides technical and scientific expertise to support the environmental planning function of municipalities, providing recommendations on how development should proceed and how to maintain, and enhance or restore the natural environment.

3 ENVIRONMENTAL ASSESSMENTS

TRCA staff is responsible for providing technical clearance on applications made under the *Environmental Assessment Act* and recommendations to TRCA's Executive Committee regarding any associated *Ontario Regulation 166/06* permit applications. Staff comments and recommendations are based on TRCA's commitment to integrating the principles of sustainable planning into city building within the nine watersheds of its jurisdiction.

To provide comments on an Environmental Assessment (EA) or permit application, TRCA requires submission of technical studies and reports. The review of such reports is coordinated by the planner, and undertaken by technical staff in the Ecology division, including water resource engineers, geotechnical engineers, ecologists and hydrogeologists, as well as staff in other divisions including Conservation Lands and Property Services staff, Restoration Services (including Archaeology) and Watershed Management.

EA review is project managed by planning teams that work within municipal geographical boundaries. Teams work within each of the Regional Municipalities of York, Peel and Durham; the City of Toronto; and with all lower tier and utility servicing agencies in the jurisdiction. Conversely, in the Ecology Division, staff works within watersheds. In managing projects in this way, TRCA is able to respect the political boundaries of the municipality and deliver effective customer service through the planning team, while ensuring that the natural resources of the watersheds are managed by the technical experts.

TRCA staff manages EA projects through the implementation of service delivery standards; project deliverables are tracked through a specialized database; processes for reviewing each aspect of the project available through a web-based database; and project information is spatially integrated through a complex GIS system.

4 INFRASTRUCTURE DEVELOPMENT

Within the GTA, there is tremendous population growth, and hence the need for a commensurate amount of infrastructure development and maintenance. In fact, based on *Census 2006 data*, the Greater Toronto Area remains an attractive destination for external and internal migrations. Since 1996, the GTA has grown at an annual rate of approximately 10 per cent.

Infrastructure development, repair, replacement and augmentation are predicated upon the requirements to service growth. In Ontario, the development or maintenance of public infrastructure requires review in accordance with the *Ontario Environmental Assessment Act.* If federal infrastructure is involved, then the Canadian Environmental Assessment Act is used.

For projects which are deemed reoccurring, the respective agency may develop a class EA process which is then approved by the Ministry of the Environment, such as the Municipal Engineers Association has developed the Municipal Class EA process. In a Class EA, projects are classified into different categories, or schedules, based on potential environmental impacts and dollar costs. These projects are considered self-approved, once all of the provisions of the Class EA process have been met.

Approximately 90 per cent of the EA applications which TRCA reviews fall under the Municipal Class EA process. Largely, these processes include road widenings and road maintenance, and new watermains and sewers. Projects which do not fall into a class process are subject to an Individual Environmental Assessment and subsequent approval by the Minister of Environment.

Through the EA process, the proponent is required to determine the preferred alternative and the preferred alignment based on a complex evaluation of three factors: social, economic and natural environment. TRCA's focus of concern is the natural environment, and through diligent review of the EAs, staff endeavours to ensure that impact to the natural environment is minimized

Challenges to avoiding, mitigating or compensating natural resources impacts relate to the surface resources of terrestrial and aquatic systems, water quantity and quality, flood control and landform management. While the mandate of TRCA does not include management of the groundwater resource, TRCA does manage the interaction between the groundwater resource and the surficial natural environment.

5. CONSTRUCTION CHALLENGES

The implementation challenges to mitigating impacts to aquifers, fish and fish habitats, and forests and wetlands related to groundwater withdrawals and discharges, that must be planned for are:

Fish and Fish Habitat (Figure 2):

- reduced groundwater upwellings and its effects on reduced baseflow, potential to alter spawning, rearing and over-wintering habitats;
- dispersal of dewatering and construction discharges has the potential to cause water temperature changes; increased water volume and velocities; impair water quality.

Forests and Wetlands:

- changes in the soil moisture regime - reduction in standing water; lower of water table; loss of soil moisture; changes in soil temperature;
- changes in vegetation community composition; loss of amphibian habitat; and loss of wetland dependent birds.

Figure 2. Redside Dace fish protected by the Species At Risk Act is present in some streams across the TRCA's jurisdiction.

TRCA acknowledges that private or municipal water production wells may be affected through continuous groundwater pumping causing reduced availability of water to well users; but that this impact is specifically addressed by MOE in accordance with the provisions in the *Water Resources Act*.

As infrastructure is designed, it is imperative that each issue identified during the planning stage is addressed, and that mitigation and monitoring plan is developed to ensure that as the project proceeds to construction, there is plan to apply adaptive best management practices during construction.

Over the past four years of reviewing complex, underground infrastructure development projects with associated impacts on the groundwater system, TRCA has worked with the proponents to refine an approach for ensuring the impacts of the project on the natural system are mitigated. This approach requires that the proponent develops an Environmental Management Plan (EMP) as part of the TRCA's approval process under the *Fisheries Act* and Lakes and River Improvement Act, and the *Conservation Authorities Act.*

6. ENVIRONMENTAL MANAGEMENT PLANS (EMPs)

Infrastructure development projects, which may cause impacts to the geo/environmental components of the environment, require EMPs. TRCA has developed EMP Guidelines (*TRCA, Environmental Management Plan Guidelines, draft*) to provide the proponent with detailed requirements for completing the plan. The guidelines include:

- Collection or identification of background data;
- Identification of potential environmental impacts based on an analysis of the data;
- Development of potential mitigation scenarios and adaptive management techniques, including construction methodologies;
- Development of monitoring programs and communication protocols.

The TRCA EMP Guidelines were based on the EMP that was completed for the Red Hill Creek Expressway Project by the City of Hamilton. According *the Red Hill Creek website,* the planning for the expressway began in 1967, and after decades of public opposition to the many environmental issues associated with the site, construction was initiated once an EMP was developed.

Learning from the Red Hill Creek Expressway Project, in 2004 TRCA first requested that an EMP be developed for a complex infrastructure project. The potential stresses were identified, monitoring plans for each stressed environment were initiated, triggers to identify stressed conditions were developed, and mitigation plans were developed.

It is important that all possible effects to natural features within the area of potential impact caused by a project are identified, monitored and as required, mitigated. However, as the project proceeds there may be unpredicted impacts. As such, it is imperative that the EMP be designed as a living document, and using the principles of adaptive management, be amended accordingly.

Communication is the key to the successful implementation of the EMP. Once project construction has been initiated, TRCA has dedicated staff (Coordinator of Monitoring and Mitigation Review) responsible for coordinating the review of the monitoring and mitigation reports between TRCA and other regulatory agencies (Department Fisheries and Oceans Canada, Ministry of natural Resources, Ministry of Environment) and for advising on adaptive management requirements.

Each EMP includes specific communication protocols including the submission of regular monitoring updates

and reports; planning regular site meetings; conducting site visits; providing for emergency and contingency response contacts; and completing project summary reports.

7. IMPLEMENTING ENVIRONMENTAL MANAGEMENT PLANS

Since 2004, TRCA evolved its requirement for an EMP from a model that tested potential methods for ensuring appropriate environmental management to a tool for ensuring implementation of best management construction practices for environmental mitigation. Following are a few examples of most recent large infrastructure projects.

8.1 Bathurst Langstaff Trunk Sewer

One of the first EMPs required by TRCA was related to York Region's Bathurst-Langstaff trunk sewer project. According the *York Region's Dewatering Environmental and Ecological Impact Assessment report*, this sewer has been built as a tunnel more than 3 metres in diameter along Bathurst Street in south–north direction, and along Langstaff Road in a west-east direction to connect existing sewers.

Tunnel construction was initially proposed as a conventional double pass concrete lining structure built with a tunnel boring machine (TBM). This technology normally requires lowering of groundwater levels to safely construct the project "in-the-dry". In addition, there were initially six shafts proposed to facilitate the construction and a variety of dewatering techniques.

TRCA's technical review identified that at least at one location, the proposed dewatering requirements would result in significant impacts to the environment. Specifically, the groundwater storage in a shallow aquifer that was directly connected to the nearby stream would be reduced to almost none.

TRCA required that an EMP be prepared, including detailed monitoring and mitigation programs. The proponent changed the construction methodology from a TBM to an earth pressure balance machine (EPBM). Shaft construction was changed to require sealable construction techniques. These approaches significantly minimized dewatering and the potential stresses to the surficial environmental. TRCA approved the EMP as part of its *Conservation Authorities Act* and *Fisheries Act* mandate.

The Bathurst-Langstaff project has been under construction since 2006. The most recent monitoring has confirmed that there has been no stress to the surficial environment from project construction. In other words, all potential impacts have been mitigated through changing the construction techniques to minimize dewatering and this has been verified through an extensive monitoring program. Based on these findings, and that the EMP is considered a living document, TRCA has approved a significant reduction in the monitoring requirements, as well as a less frequent reporting schedule.

8.2 Finch and Morningside Avenues CPR Bridge reconstruction

The City of Toronto's overpass structure construction projects require both construction and post-construction dewatering. During TRCA's review of the EA, staff identified environmental concerns with the associated dewatering and advised that an EMP would be required at the detailed design and permitting stage.

Staff was concerned that the dewatering could affect streams fed by groundwater and wetlands with numerous seepage areas; there was a hydraulic connection between ground and surface water, as confirmed through field tests; and that the creek channel was historically prone to erosion.

The permit application and associated EMP (*Ecoplans for the City of Toronto*) addressed each of these concerns and provided detailed monitoring of the environmental receptors. Appropriate mitigation provided in the EMP was triggered by levels based on comprehensive analysis of background data. A detailed communication plan with the TRCA's Coordinator was also provided.

The EMP requires that all groundwater seepage areas and sensitive creeks are monitored along with the evaluation of minipiezometre data. The minipiezometre data is analyzed to determine if there is water table drawdown related to the project dewatering. The dewatering water is released into surface receptors in proportions that will not cause erosion, and through a stormwater management pond to again minimize potential stresses to the environment.

Phase I of this project (figure 3) was completed at the end of 2007. Groundwater levels have recovered to pre-construction levels. Phase II of the project continues in the spring of 2008. The EMP that was approved for both project phases will be reviewed and adapted, if required, based on information collected during the monitoring of Phase I.

Figure 3. Phase I of the Finch & Morningside Avenues CPR Bridge reconstruction.

8.3 YDSS Interceptor Sewer

The York Region Interceptor Sewer project is being built along 19th Avenue in west–east direction between Leslie Street and Yonge Street, and south from 19th Avenue on Leslie Street to connect existing Regional trunk sewers (*York Region, YDSS Interceptor Sewer Study, Environmental Management Plan*). The project was initially approved through the EA process using open cut construction methodologies. However, it was later identified that significant groundwater dewatering and depressurization would be required, and that the impacts on the groundwater and surficial environmental resources would be significant. The Minister of the Environment required additional studies.

Through these studies, it was determined that while the route selection was satisfactory, the construction methodologies would need to be changed. A combination of EPBM tunnel and open cut construction technologies with all shafts being constructed using sealed shaft methodologies meant there was no need to pump down the groundwater. Although a Permit To Take Water was obtained by the Region, it has not been required beyond maintenance and process water pumping.

In addition to the changed construction techniques, York Region also completed an EMP. The EMP was developed using information collected in the additional studies noted above. In addition to fulfilling all requirements of the TRCA EMP Guidelines, York Region also trained all contractors, consultants and sub consultants involved in the project to ensure compliance. This training model was based on the Red Hill Creek example, where an extensive training program for EMP implementation has also been employed.

Figure 4. Shaft 4 at the YDSS Interceptor Sewer constructed through till deposits provides a conjunction for the south and west tunnels.

The Interceptor Sewer project is underway (figure 4). To date, there has been one unpredicted environmental issue with the project construction. As the tunnelling machine passed under two creeks, the air used for grouting of the annular spaces caused air bubbles to occur and be released to the surface. The result was that fine sediments were released and /or re-suspended into these creeks.

While geo/hydrological concerns were discussed at prior stages, the potential for sediment to be released as a result of the tunnel passing underneath had not been considered. There were no specific contingency plans in the EMP. However, the EMP did allow 48 hours to address issues related to a sediment release, and the proponent was able to install adequate mitigation measures well within this time period. A subsequent ecological study revealed that no long term impacts to fish or fish habitat was incurred by this incident.

TRCA has continued to review the monitoring reports. There have been no other environmental concerns although the EPBM passed under other creeks. Staff is currently working with the proponent to reduce the monitoring requirements that were stipulated in the EMP.

8.4 South East Collector Trunk Sewer

The York and Durham Regions' South East Collector Trunk Sewer is proposed as a twining of the existing sewer that was built in the 1970s (*EarthTech, for York and Durham Regions, South East Collector Trunk Sewer Environmental Assessment, Draft*). This project is still being reviewed as an Individual Environmental Assessment (IEA), and detailed design and permitting will not commence until 2009.

In developing the IEA, the Regions are collecting extensive background environmental data, reviewing construction methodologies and their associated impacts, and developing mitigation strategies. During detailed design and permitting, the Regions will be required to prepare an EMP.

8. FUTURE PROVISIONS FOR ENVIRONMENTAL MANAGEMENT PLANS

Based on the experience from implementation of EMPs to various projects across GTA, TRCA learned that the EMP methodology is a proven constructive approach to complex projects, where some potential environmental impacts are hard to predict and adequately assess in a planning stage. Application of EMP may be the only solution in order to avoid, minimize and proper mitigate these impacts as they occur during construction. In addition, EMP is a "living" document and can be adopted based on new findings during project implementation, which helps proponent to ensure most fulfilled protection to the environment at effective cost.

By promoting EMPs, TRCA encourages best management construction practices including implementation of adaptive management tools. It becomes more and more important as the headwaters of the TRCA watersheds develop, there may be issues associated with local infrastructure servicing and basement construction. It is foreseeable that EMPs may soon be required to assist larger scale developments

seeking approvals under the *Planning Act* to ensure that all potential environmental impacts and possible negative cumulative effects that not foreseen at planning stage are fully avoided and/ or proper mitigated during construction.

TRCA has jurisdiction over the development of infrastructure projects within seventeen (17) municipalities in the GTA. In addition, TRCA provides comments on provincial and federal infrastructure projects. It is our goal to establish and continually improve partnership relations through effective communication and implementation of most successful project management techniques that has been well proven through implementation of EMPs.

Beyond the jurisdiction of TRCA, it is also foreseeable that as growth occurs in sensitive areas, there may be a need for other jurisdictions to apply the practice of requiring EMPs to ensure effective watershed management. TRCA is willing to share knowledge and expertise obtained on various complex projects where EMPs helped to avoid and/or proper mitigate environmental impacts, and also encouraged proponents to implementation of best management construction practices.

ACKNOWLEDGEMENTS

We would like to acknowledge the contribution of a number of individuals to the paper, such as Carolyn Woodland for directing and leading our writing and supporting all our work, Deborah Martin-Downs for providing great technical support with her tremendous experience on various environmental projects across GTA and beyond; Adrian Coombs for providing technical editing and also as a great project manager that always looks for an innovative management approaches and Andrew Taylor for translating the abstract into French and also as always willing to help. Without all these great people input this work would not be accomplished.

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