

FURTHER TO SUSTAINABLE COMMUNITIES BOARD MEETING #3/05
To be held on Friday, October 14, 2005

FURTHER TO:

Pages

4. DELEGATIONS

- 4.1** Mr. Jim Robb, Friends of the Rouge Watershed, speaking in regards to item 7.3 - York-Durham Sanitary Sewer Projects.

5. PRESENTATIONS

- 5.2** A presentation by Mr. Bruce MacGregor, Commissioner, Transportation and Works, Regional Municipality of York, in regards to 16th Avenue Trunk Sewer – Project Update.

7. SECTION I - ITEMS FOR AUTHORITY ACTION

LISTED ON AGENDA AS REPORT TO FOLLOW

- 7.3 YORK-DURHAM SANITARY SEWER PROJECTS**
16th Avenue Phase II

19-36

TO: Chair and Members of the Sustainable Communities Board
Meeting #3/05, October 14, 2005

FROM: Carolyn Woodland, Director, Planning and Development

RE: YORK-DURHAM SANITARY SEWER PROJECTS
16th Avenue Phase II

KEY ISSUE

Recommendation for continued staff involvement in the York-Durham Sanitary Sewer projects.

RECOMMENDATION

THE BOARD RECOMMENDS TO THE AUTHORITY THAT all interested parties be advised that in the opinion of the Toronto and Region Conservation Authority (TRCA), the Environmental Management Plan and detailed works plans for the 16th Avenue Phase II York-Durham Sanitary Sewer project are being effectively implemented by York Region and their contractors;

THAT staff be directed to continue reviewing the monitoring and mitigation reports and web site data, conducting field inspections and independent monitoring, and participating in the adaptive management program associated with the implementation of the 16th Avenue Phase II York-Durham Sanitary Sewer project;

THAT staff be directed to continue working with York Region, Fisheries and Oceans Canada, and the Ontario Ministries of Environment and Natural Resources to ensure that the environmental impacts associated with the planning, design and construction of all other York-Durham Sanitary Sewer projects in TRCAs jurisdiction are minimized;

THAT staff report back to the Sustainable Communities Board in December 2005 with a detailed presentation regarding the planning, design and construction status of all other York-Durham Sanitary Sewer projects in TRCAs jurisdiction;

THAT York Region be encouraged to continue and extend their current efforts toward sustainability planning, water budgets, natural heritage planning and environmental net gain within all municipal planning and development processes;

THAT staff be directed to continue participating in activities underway in York Region to develop a sustainability plan and positive legacies for regional residents emanating from this plan;

AND FURTHER THAT staff report back to the Sustainable Communities Board in 2006 with a detailed presentation regarding mechanisms for implementing net environmental gain practices in York region's planning and development processes.

BACKGROUND

Over the past few months, considerable public criticism has been leveled at TRCA, Fisheries and Oceans Canada (DFO) and the Ministry of Environment (MOE), over the construction of the 16th Avenue Phase II sewer project and its environmental effects. Recently, the City of Toronto became concerned about the potential environmental effects of this project on the watercourses in the city. The issues raised by the public, agencies and the City of Toronto are summarized along with an assessment of conditions and potential environmental consequences.

The technical issues associated with the construction of the York-Durham Sanitary Sewer (YDSS) projects are complex. In order to fully understand these issues, background information regarding the planning history of the YDSS system, as well as an overview of the 16th Avenue Phase I project, are provided.

PLANNING HISTORY

Between 1964 and 1980, water quality of the streams and rivers in the Greater Toronto Area (GTA) was poor. One of the contributing factors was the number of small sewage treatment plants (STPs) that discharged their effluent to the streams (i.e., at one time there were 31 STPs on the Don River alone). The York-Durham Sanitary Sewer was constructed during the 1970s, and many of the STPs were taken off-line. Sewage collection was centralized into a large trunk sewer from Newmarket to Lake Ontario, outletting at the Durham STP, and water quality in the GTA's streams and rivers significantly improved.

In 1994, York Region developed their first official plan which identified substantial growth in the region. This growth was to be centred around existing urban centres of Aurora, Newmarket, Vaughan, Richmond Hill and Markham. Following this, the York Region embarked on a master servicing study to assess the requirements to provide for this growth.

In 1997, York Region approved the YDSS Master Plan which was designed to service this growth. The master plan was completed following the mastering plan provisions of the *Ontario Environmental Assessment (EA) Act*. The EA Act requires that master plans be approved by municipal council. There is no requirement for ministerial endorsement of a master plan.

Once approved by council, the *EA Act* requires that an environmental assessment be conducted for each project segment identified in the master plan. In accordance with the *Municipal Class Environmental Assessment* (formerly the *Class EA for Municipal Road, and Water and Wastewater Projects*), the assessments for individual sewer projects identified in the YDSS Master Plan commenced in the late 1990s. They are on-going.

16TH AVENUE

The YDSS Master Plan identified the construction of the 16th Avenue trunk sewer as one project. However, as part of the approval process for the Swan Lake development in Markham, a sanitary connection to the existing YDSS sewer was required in advance of the planned construction of the new 16th Avenue sewer. Thus, the project was constructed in two phases:

16th Avenue Phase I:

- 9th Line from Box Grove to almost Major Mackenzie Drive.
- 16th Avenue from 9th Line to just west of Stone Mason Drive.

16th Avenue Phase II:

- 16th Avenue from just west of Stone Mason Drive to just east of Woodbine Avenue.

This decision was supported by York Region Council and incorporated into the 2002 YDSS Master Plan update. In accordance with the updated YDSS Master Plan, construction of the Phase I sewer was required by 2003 and construction of the Phase II sewer by 2005.

16th Avenue Phase I

The Class EA for 16th Avenue Phase I was approved in 1998. The preferred alignment for this sewer was along 16th Avenue, and the preferred design was for a gravity sewer. These options required construction in the aquifer. Construction was completed in the summer of 2003. During the review of the Class EA and the subsequent permit applications, TRCA review included an assessment of the impacts that the sewer, or the construction of the sewer, would have on valley and stream corridors within TRCA's jurisdiction as per the policy requirements in the TRCA *Valley and Stream Corridor Management Program* (1994). As such, the only permits issued by TRCA were related to construction compounds within fill regulated areas.

While MOE reviewed the Permit to Take Water (PTTW) application required to facilitate construction of both the shafts and the tunnel, Ontario Regulation 99/380, requiring that effects to the natural environment be considered, had not come into effect. Thus, consideration for all aspects of the environment through the issuance of the PTTW was not a requirement. MOE also reviewed the detailed design of the sewer and issued a Certificate of Approval (CofA) to York Region prior to commencement of construction. It is TRCA staff's understanding that a gravity sewer is preferred over a forcemain as there is no requirement for a pumping station or emergency overflow to the creek or river. Thus the risk of environmental contamination is significantly reduced. Additionally, a pump station would consume electricity on a perpetual basis and does not facilitate sustainability goals. Associated with the issuance of the PTTW, TRCA reviewed the anticipated dewatering requirements in relation to capacities of the watercourses and stormwater management ponds, and staff determined that no TRCA permits for the associated discharge were required for Phase 1, based on these assessments.

The construction of the project began on 9th Line, with two tunnel boring machines (TBMs) simultaneously drilling the tunnel. One of the machines then turned the corner and proceeded to drill along 16th Avenue. As the drilling neared the end of the Phase I contract area, near Stone Mason Drive and Robinson Creek (at shaft C8), there was an unpredicted high permeability zone in the aquifer. Additional dewatering was required to repressurize the aquifer and to lower the water levels to facilitate construction and to ensure worker safety. As a result, the dewatering rates doubled and exceeded the limits prescribed in the PTTW in order to maintain a safe construction area. The resulting discharge rates from the pumping in spring 2003 exceeded the capacity of the Wismer Commons stormwater management pond, leading to the overflow of the pond and erosion of the Robinson Creek flood plain, streambanks and a locally significant wetland.

Without the increased dewatering, it is likely that the TBM would have been disabled or destroyed, the partially constructed tunnel and pipe would be impacted and worker safety would be compromised. The increased dewatering resulted in erosion and deposition of iron precipitates on the banks and streambed of Robinson Creek both at the dewatering site and downstream. TRCA, Ministry of Natural Resources (MNR), and DFO staff were all on site to assess the situation. DFO, MOE and Environment Canada are still investigating the incident. Private prosecution pursuant to subsection 35(2) of the *Fisheries Act* was initiated.

At their own discretion, York Region had the condition of Robinson Creek assessed both at the discharge site and downstream. York Region applied to TRCA for permits to restore Robinson Creek, its flood plain and wetland, and these permits were granted in 2004 and 2005. The restoration works will be completed this year.

As a result of the issues identified during the construction of the Phase I project, the construction of the Phase II project was substantially modified in order to better protect the natural environment. In addition, the planning and design processes related to other YDSS projects have also been substantially changed over the past two years. These changes, resulting from conditions set forth by the Ontario Minister of the Environment as well as the application of new advances in sciences, are discussed as follows.

16TH AVENUE PHASE II

The Class EA for 16th Avenue Phase II was approved in 2002. In the EA document, the impact to surficial features from the required dewatering was identified. Agency staff concluded that this issue was not adequately addressed in the EA, and required that these impacts be addressed through the detailed design and construction phases of the project. The agencies required substantial environmental mitigation and monitoring as part of the permit approval processes. This review took place in 2003 and 2004. All required permits and approvals were issued, and construction commenced in December 2004 after a substantial delay to develop the Environmental Management Plan (EMP). The following legislation was reviewed and addressed as part of the approval process for 16th Avenue Phase II:

Ontario Regulation 158

TRCA required permits for the construction of the discharge infrastructure related to the supplementation infrastructure at or near Elgin Mills Road. Five permits were issued in the summer of 2004. Through an amendment to the work plan, an additional permit for the construction of an outlet channel from Wismer Commons stormwater management pond was issued in summer 2005. Approval of these permits was based on TRCA approval of the EMP.

Fisheries Act

Approval under section 35(2) of the *Fisheries Act* is a voluntary process. TRCA has a Level 3 Agreement with DFO. As such, TRCA undertakes the fisheries review of all requests on behalf of DFO. If the project is not deemed to cause a harmful alteration, disruption or destruction (HADD) to fish habitat, TRCA issues a Letter of Advice on behalf of DFO. If a project is deemed to be a HADD, then TRCA continues to act as the agent and consults with DFO during the course of the project review. Upon request and given that the required process has been followed, DFO may issue an authorization for the project. The issuance of an authorization is a trigger for a *Canadian Environmental Assessment Act (CEAA)* review. Of significance is that subsection 35(2) of the *Fisheries Act* is a non-affirmative regulatory duty. This means that DFO does not provide an authorization unless requested by the proponent and that they are satisfied that compensation can be provided to address the harmful alteration, disruption or destruction of habitat.

As part of the TRCA Level 3 Agreement with DFO that was adopted in 2002, staff undertook a fisheries review under the auspices of the Level 3 Agreement for 16th Avenue Phase II. Prior to the development of the environmental management plan that is now in place, TRCA staff identified significant concerns with respect to the potential impact on fish or fish habitat if the project proceeded without mitigation. As mitigation was not proposed at that time, staff referred the project to DFO. As a result of agency requests, an environmental management plan was developed. This was followed by detailed work plans for each of the eight effected watercourses. The work plans outline the operational procedures, and have been in effect since March 2005. It should be noted that York Region did not request DFO to authorize the impacts to fish or fish habitat arising from the 16th Avenue Phase II project. As a result, a review under CEAA was not triggered. However, DFO staff was involved in the review of the EMP and work plans and provided advice to York Region in this regard.

Canadian Environmental Assessment Act

There are a number of triggers for a project review under the CEAA. One of these triggers is authorization of a project under the Federal *Fisheries Act*. Because York Region did not request such an authorization for this project, CEAA was not triggered. The project therefore remains solely in the planning domain of the *Ontario EA Act* and as such, approvals and conditions are mandated by the Minister of the Environment for Ontario.

Permit To Take Water

In 2003, York Region applied for a PTTW for the 16th Avenue Phase II project. The original application was not accompanied by a dewatering needs assessment, a monitoring plan or a mitigation plan. As required through Ontario Regulation 99/380, the effects to the natural environment had to be considered in the application. Concerns with respect to a number of issues associated with dewatering were raised by TRCA, MOE, DFO and MNR. These issues included the following:

- long term impacts of dewatering;
- size of the zone of influence;
- groundwater and wells;
- groundwater and fish habitat (including reduced baseflow, water temperature changes, and increased water volume and velocities at discharge locations);
- groundwater and wildlife habitat;
- federal EA triggers;

- comprehensive environmental planning;
- alternative methods, alignments and design.

The agencies, York Region and their contractors worked together to develop the EMP. In the meantime, the Minister of the Environment received a request for a Part II Order for a number of the YDSS projects, including 16th Avenue Phase II. Typical of environmental assessment planning in the late 1990s and early 2000s, sewers were generally considered to be appropriate projects for review under the *Municipal Engineer's Association, Class EA for Municipal Infrastructure* document. As stipulated in the EA Act, however, any individual or agency can request the Minister review the class designation of a particular project and if appropriate, order an Individual EA to be conducted.

While this request was denied, the Minister did establish additional conditions for approval of a number of the YDSS projects as outlined in a letter dated October 1, 2004. In terms of 16th Avenue Phase II, the following is a summary of the conditions which were applied:

- That monitoring and mitigation measures be developed and applied to the natural features and wells that could be impacted by the dewatering activities associated with the project.
- That public consultation be undertaken regarding the monitoring and mitigation plan.
- That a well complaint review committee be maintained.
- That all technical studies, reports and other documents be made available for review by the public.
- That a habitat improvement plan be developed and implemented for each section of a stream where water is discharged for the purpose of this project.
- That an annual report be submitted to the MOE.

These conditions have been, or will be, addressed as requirements of the PTTW. The EMP developed by York Region includes a comprehensive mitigation and monitoring plan. This plan was reviewed by TRCA, MOE, MNR and DFO. MOE subsequently issued the required PTTW and construction of the project was allowed to proceed in December 2004.

Certificate of Approval

MOE has issued a Certificate of Approval for this project which permits the construction of a gravity sewer in the aquifer, as recommended in the EA and as supported by the Minister of the Environment in her response to the request for a Part II Order related to this EA. It is staff's understanding that gravity sewers are environmentally safer than forcemains. The pressure of the aquifer works to contain any leaks in the pipe. Thus, there is a greater chance of the groundwater leaking into the pipe than there is of sewage leaking out into the aquifer. With forcemains and pumping stations, emergency overflows to the streams and rivers are a design requirement to prevent surcharge into basements. These options are reviewed as part of the EA review.

PROJECT DELAYS AND IMPACTS TO THE ENVIRONMENT

The phasing of the Phase I and Phase II projects was not based on environmental factors. It was based largely on timing of development and financial implications and synergies. Environmental issues associated with dewatering of the Phase I project included not only the aforementioned impacts on Robinson Creek, but impacts on private wells, stream baseflow and possibly forests and wetlands. The full impact that this project had on the natural environment will likely never be known because the collection of baseline information was not a requirement of any agency's approval process for either the EA or their permits, nor was detailed monitoring required during construction.

The original PTTW application for Phase II did not take into account the surficial environmental impacts that were associated with the required dewatering or discharge. Discussions between York Region, their contractors, and the agencies (MOE, MNR, DFO and TRCA) ensued. However, from August 2003 when the tunneling required for Phase I ended, to April 2005 when tunneling required for Phase II commenced, the TBM remained in the ground and dewatering continued at a rate of approximately 15,000 L/m. Potential impacts that this dewatering may have had on the environment while construction was stopped and the environmental management plan was developed are not known. MOE granted a one year extension to the Phase I PTTW to allow this dewatering to occur. Had it been stopped, the pressure in the aquifer would have likely caused the completed Phase I tunnel to collapse.

With some of the direct impacts of Phase I identified (i.e., the impacts to Robinson Creek), none of the agencies were prepared to issue approvals for the Phase II project without an environmental management plan. York Region and their contractors applied for the required PTTW for Phase II in 2003, and the Ontario Regulation 158 permits in 2004. York Region committed to mitigating all adverse impacts to fish and fish habitat, and as such did not apply for *Fisheries Act* authorization.

ISSUES ASSOCIATED WITH DEWATERING

There are two fundamental aspects of the dewatering which concern TRCA staff: the rate and duration of dewatering, and the impacts of the dewatering on the surficial environment.

The current dewatering rate for the sewer brings between 15,000 and 20,000 litres per minute of 9.5°C groundwater to the surface to be discharged. This groundwater has a significantly different temperature than that of the ambient watercourses in the summer and winter, as well as different chemistry (e.g., higher iron content). The rate and duration of groundwater withdrawals can be mitigated, in part, through construction methodologies. Staff spent considerable time researching and discussing the potential for changing the construction methods associated with the 16th Avenue Phase II pipe.

Agency staff recognized that:

- the pipe was over half built;
- the TBM was in the ground;
- the elevations had been determined; and
- the shaft construction had been applied or the design had been finalized based on conditions in the aquifer.

As such, agency staff concurred that changing the construction methodologies associated with the construction of the Phase II was not practical given that the Phase I project was complete. As such, the completion of an effective mitigation and monitoring plan, the EMP, became the primary requirement of agency staff during the review and approval of the required PTTW and Ontario Regulation 158 permits, as well as the review of DFO and MNR staff regarding their respective interests.

ENVIRONMENTAL MANAGEMENT PLAN

The main issues addressed in the EMP are:

- interference to existing water wells;
- loss of groundwater contributions to natural streams, wetlands and ESAs; and
- discharge of excess volumes of water and its potential to change the natural regime of the receiving watercourses.

The EMP predicts zones of effect and identifies targets to be maintained (e.g., baseflow). The EMP is divided into two major parts:

- a proactive well mitigation and monitoring plan to address adversely affected private wells and specialized groundwater uses, including golf courses and farms; and
- an EMP to manage stress to the natural features and functions of the ecosystem during the dewatering operation and associated recovery period of the aquifer.

The proactive well mitigation and monitoring plan was reviewed by MOE as part of the region's PTTW application. The EMP was reviewed by TRCA staff for permits under Ontario Regulation 158; MOE for the PTTW; and MNR and DFO. Only MOE and TRCA formerly approved the plan.

Key considerations associated with the EMP included:

- complexity of the natural ecosystem;
- deficiency in historic baseline information;
- deficiency of documented effects from projects of this type and scale; and
- flexibility to address conditions not anticipated or predicted through the EMP process.

To assess the potential zone of impact (ZOI) associated with the water-takings during the dewatering operation, a three-dimensional groundwater flow model developed as part of the York-Peel-Durham-Toronto (YPDT) Groundwater Model was used. The results obtained from this modelling were used to define an area where a 0.5 metre drawdown in the shallow aquifer would occur. Because unimpaired baseline data was not available at a comprehensive level, the use of this model, which became available in 2002, was considered acceptable by all agencies. The YPDT Groundwater Model has been developed in partnership with the City of Toronto, York Region, Peel Region, Durham Region and conservation authorities.

The predicted ZOI defines the cone of potential groundwater level decrease. Within this cone some surficial features may be affected depending on soil permeability properties. The shallow aquifer zone of influence was modelled to predict the impact on shallow aquifer wells. A conservative buffer zone was added to the predicted ZOI in order to reduce the level of uncertainty associated with the predicted ZOI. Because the definition of the ZOI was based on a model versus baseline data, a buffer was deemed essential for this project. The YPDT Groundwater Model was also used to predict sections of streams which may be impacted through the anticipated reductions in shallow aquifer levels.

Within the predicted ZOI and its buffer, all environmentally significant areas (ESA), wetlands and watercourses were identified and an analysis of these ecosystem receptors was carried out for fish and fish habitat, wetlands and ESAs, critical stream erosion rates and capacity, woodlots, and agriculture. A comprehensive monitoring and mitigation plan was developed for all of these features, including recognition that adaptive management must be used as required due to the complexities of the system. The systems that have been defined are being mitigated and monitored as required. They include:

Fish and Fish Habitat

- Piping dewatering discharge upstream to supplement stream baseflows within the ZOI.
- Releasing the discharge through splash pads and channels to remove iron.
- Establishing holding tanks within the ZOI to supplement stream baseflows within the ZOI.
- Dispersing dewatering discharge to alternate waterbodies.
- Thermal regulation of dewatering discharge.
- An extensive temperature, flow and groundwater monitoring system.

Wetlands and ESAs

- An extensive species and groundwater monitoring system in select areas.
- Piping water to supplement soil moisture.
- Plant additional species.

Critical Stream Capacity

- A fluvial geomorphological assessment of creeks that may be physically impacted was conducted to determine maximum discharge velocities.

Woodlots

- Soil moisture conditions and tree growth is monitored in sample plots.

All rates and triggers are established in the EMP and are intended to be adjusted through the adaptive management process if appropriate. It is recognized that because sufficient baseline data was unavailable, the triggers were based on modelled conditions. Inaccuracies in the modelling will occur due to the input data and conservative nature of such models, and as a result adjustments to the EMP are expected. The rates and triggers established in the EMP were considered conservative enough to mitigate adverse impacts to the environment. This approach is essential to ensuring that environmental impacts are minimized and effectively mitigated. There have been some issues in the implementation of the EMP. These issues are currently being reviewed by the agencies and addressed by York Region and their contractors.

The adaptive management approach allows York Region or the contractors to react in a timely manner to results from continuous monitoring of environmental trigger parameters and values, and operational rules. Any adjustments to the EMP are to be done in consultation with the YDSS Environmental Mitigation and Monitoring Coordinator and the respective agency staff. For example, the McCowan Road shaft has been added in order to reduce the rates and duration of withdrawals. By adding this shaft, access will be provided to the tunnel to the east of C8. As a result, the contractors will be able to proceed with lining the tunnel and Shaft C8 ahead of schedule. Once lined, the area will be secured and the wells can be decommissioned. It is anticipated that dewatering at this critical location can be stopped about six months ahead of schedule, thus conserving about 10 million litres of groundwater.

The adaptive management program will continue to be in effect for at least three years after the works are completed, or until the aquifer has rebounded to 80 per cent and shows a steady rate of gain as stipulated in the approved PTTW. As construction activities are completed, there will be less need to continue dewatering and the flow supplementation will be adjusted or discontinued in consultation with the agencies. To coordinate the inter-agency review of the monitoring program, TRCA has hired a staff person on behalf of ourselves, MNR, DFO and MOE. Funding for this position has been committed by York Region.

ISSUES ASSOCIATED WITH CONSTRUCTION OF THE 16TH AVENUE PHASE II PROJECT

A variety of public statements have been made over the past few months regarding the impacts of the project. These issues mirror those considered by agency staff in the development and review of the EMP. They are summarized as follows:

Cease Project to Apply for Authorization

In accordance with conditions in the PTTW, the proponent was able to begin taking water for the project in December 2004, and increase pumping capacities as of April 1, 2005, thus enabling the TBM to commence drilling. The requirements set forth for mitigation and monitoring had been installed, and the tunnel boring machine began to move toward McCowan Road. Pumping rates have been substantially less than those permitted in the PTTW (the dewatering rate allowed is 38,000 litres per minute while the actual rate is between 15,000 and 20,000 litres per minute).

Shaft C8 continues to be the point of greatest dewatering requirements and therefore the greatest impact to the environment. Efforts to complete the required tunneling and lining of the tunnel and shaft, and therefore decommission the wells and stop or reduce dewatering at or near Shaft C8 are underway. It is anticipated that this will be done by January 2006, thus significantly reducing the groundwater withdrawal rates and duration at this sensitive location by approximately six months.

Should the project be stopped again, dewatering would still be required to maintain the system that has been constructed to date. Any delays to the construction timing will cause continued impacts to the aquifer, and to the surficial environmental features. At this point in the construction process the best alternative to reduce environmental impacts is to minimize the duration and rates of groundwater withdrawals through modifications to the detailed design of the project, such as the construction of an additional shaft at McCowan Road.

Sewage Pipes in Aquifers

The issue has been raised that the pipe should not be located in the aquifer in order to protect drinking water supplies. TRCA staff understand from discussions with York Region staff that long term contamination of the aquifer through the construction of a gravity sewer in the aquifer is highly unlikely. The pressure of the groundwater against the pipe is greater than the pressure within the sewer. Therefore there is little potential for an outward leakage of sewage. Thus the issue of potential contamination of the drinking water resource is minimal. Inward leakages of groundwater into the pipe may occur. However, TRCA staff are of the understanding that in the existing sewers, (also located in the aquifer) this is monitored and maintained through a comprehensive operational program at York Region and this would be extended to deal with the new YDSS system as well. Additionally, the 16th Avenue sewer features thick, continuous concrete walls that are far superior to the regular open cut sewers which are constructed of smaller jointed pipe sections.. The only joints are at the shafts.

Long Term Impacts of Dewatering

The aquifer impacts from dewatering are anticipated to last for approximately 18 months post construction. Monitoring and mitigation will continue for up to three years or until the aquifer has rebounded to 80 per cent and is showing a steady rate of increase.

Staff calculate that there are approximately 1.3 trillion litres of water in the Thorncliffe aquifer within the impact and buffer zone, and that the total volume of extracted water will be between 32 billion and 53 billion litres (15,000 to 25,000 L/min for 4 years). Therefore, this project will extract about 2-4% of the water in the Thorncliffe Aquifer in this area.

This calculation is conservative, since it does not allow for aquifer recharge, which is a combination of groundwater inflow from the aquifer outside of the buffer zone (5.5 billion L/yr), vertical leakage downward through the Newmarket Till (8.5 million L/yr), and vertical flow upwards through the Sunnybrook Aquitard (1.2 million L/yr).

The time required for the aquifer to recover to pre-pumping levels will depend on the average rate of recharge from all sources and has been estimated at 0.4 to 1.4 years, depending on the actual total volume of water extracted over the estimated four year construction period and the actual recharge rates from all sources. It is anticipated that there will be a short exponential (i.e., rapid) recovery period initially after the pumping ceases, followed by a longer, linear recovery to pre-pumping conditions. Recovery of the aquifer around the 9th Line has already been noted.

The groundwater in the Thorncliffe Aquifer in this area comprises some young (i.e., less than 50 years) water from leakage through the Newmarket Till, a small fraction of very old (i.e., thousands of years) water from upward vertical movement through the Sunnybrook Aquitard, and mostly middle aged (i.e., hundreds of years) water from lateral movement within the aquifer itself.

Size of the Zone of Influence

There are two zones of influence that need to be considered - the shallow aquifer and the deep aquifer. The shallow aquifer ZOI is more limited, and modelled predictions show that there could be impacts as far north as almost 19th Avenue and as far south as almost 14th Avenue. The predicted ZOI for the shallow aquifer does not extend into the City of Toronto. All impacted natural features are being mitigated.

The deep aquifer ZOI has been combined with the ZOI for the production wells for the Town of Stouffville, and thus extend to that area. These impacts are being mitigated. The southern limit of the predicted deep ZOI extends to approximately Highway 7. This aquifer outcrops in the Rouge and Little Rouge rivers just north of Finch Avenue in the City of Toronto. However, because these aquifer outcrops are outside of the ZOI, no effects to baseflow, fish or fish habitat, or forests and wetlands are anticipated in the City of Toronto. Because there are no noted impacts within the buffer zone, the assumption that there are no impacts outside of the buffer zone is presumed correct. This has been supported by an analysis of stream flow data at 14th Avenue which show summer volumes within the normal range.

35 years of Urban Sprawl

The Rouge Watershed Task Force is currently looking at growth projection scenarios for the watershed which take into account the Greenbelt Plan and Oak Ridges Moraine Conservation Plan boundaries, the Rouge Park and Rouge Park North boundaries, and the Terrestrial Natural Heritage System Strategy boundaries. The YDSS Master Plan and its updates are required to include areas identified as potential developable land, as determined by the policies of the federal, provincial and regional governments. Areas of urban growth are determined as set forth in the municipal official plan.

The 16th Avenue project services growth that was approved in the 1995 official plan. This plan is updated every five years, as are the municipal servicing plans. When the servicing plans are next reviewed, TRCA staff will request that a regional water budget be prepared. It is anticipated that with the Lake Ontario water servicing to be provided to Aurora and Newmarket from the York Peel Feedermain, and the decommissioning of the municipal production wells in these municipalities, that there will be an increase in groundwater and that this increase could result in improved baseflow to the TRCA watersheds. The form of growth is also prescribed in the municipal official plan. York Region has initiated development of a sustainability plan and it is anticipated that this plan will also address issues related to the form of development and protection of the environment.

Groundwater and Wells

Groundwater and wells are addressed through a comprehensive well mitigation program that York Region administers. The approval and management of this program is done under the auspices of the PTTW and guidance is provided at the discretion of MOE.

Groundwater and Fish Habitat

Three issues have been identified by the public: reduced baseflow; water temperature changes; and effects on fish.

Reduced Baseflow

The EMP set triggers for stream baseflow to be maintained in the various creeks, should stream flow be reduced due to pumping. The trigger levels were based on calculations, as there was no baseline information available at the time the EMP was developed (due to the construction of the Phase I project, the conditions in some of the creeks were considered to be already impacted). TRCA, MOE and DFO reviewed this information and with the proposed adaptive management plan, assumed that the triggers levels were a reasonable approach.

The shallow aquifer is experiencing draw down due to pumping of the deep aquifer. As a result, it is expected that the streams are experiencing some reductions in flow. The EMP includes a flow dispersion plan at 26 points throughout the potential impact zone and its buffer. The plan supplements flow in the creeks from the headwaters and at points downstream, provides water to mitigate potential effects at ESAs or wetlands, provide contingency to address flow loss where none it expected, and distributes water to two golf courses to reduce their ground water taking. A portion of the flow is directed into storm ponds and into ditches for eventual discharge into the creeks to allow it to come to ambient temperature and reduce the infrastructure needed for discharges. Some of the excess water is discharged to the YDSS pipe. Of the eight discharge points to streams, the August data finds that baseflow targets were met always at 6 streams, about half of the time at one and does not meet the target for minimum flow at the Little Rouge River at Elgin Mills Road. These targets were not based on measured values however and were determined by calculation, which may account for the difference from target.

TRCA has historic flow data in the Little Rouge River at Locust Hill (around 14th avenue). This data shows that flows in the Little Rouge River over the summer of 2005 are among the lowest recorded over the period of record (1968 - 2005), but lower water flows have been measured in 1991 and 1999, before construction of the 16th Avenue Sewer began. Geologic survey of Canada baseflow data from 1996/97 can be used to provide a picture of summer stream flows in the Rouge Watershed pre-construction. The headwaters of Robinson Creek were found to be dry up to 16th Avenue, with minimal flows (<5 L/s) below 16th Ave. Mount Joy Creek was also dry above Mount Joy pond north of 16th Avenue.

The flow supplementation plan is important to continuing to maintain stream flow and habitat in the streams in the study area.

Water Temperature Changes

The EMP requires that temperature in the creeks at the discharge points be maintained within three degrees of the average mean daily temperature 100 metres downstream of the discharge points, as compared to the immediate upstream conditions. It is expected that there will be a range of temperature within a given day, and this occurs in a natural system as well. Fish have the ability to move from unsuitable areas, and over time, will adapt to changes in condition. Regardless, York Region and their contractors have acknowledged being out of compliance with this aspect of the EMP on some days, and have filed incident reports with the MOE. Enforcement staff at MOE and DFO are investigating this issue.

Those streams that have minimal flow (e.g. Robinson and Eckhardt) will receive more discharge water than they are capable of assimilating from a temperature perspective. For these streams, boilers and chillers have been purchased to further mitigate the temperature differential. Although there were some initial issues with the temperature and water volumes noted in Robinson Creek at the beginning of August, they have been corrected through monitoring and modifications. The temperatures downstream of the discharge points are matching upstream temperatures very closely.

Fish and Fish Habitat

The issue then becomes, has the change in temperature or baseflow affected the fish communities present in the various streams along 16th Avenue? No incidents of dead fish have been reported. The effects on the fish community may be more subtle and include shifts from certain species to others more tolerant of warmer or colder conditions. Fishing to assess community composition has been undertaken by the consultants for York Region as well as DFO and MNR as part of their enforcement investigations. The results are comparable. The fish community present at each of the 15 sites sampled by DFO are essentially the same as that present in earlier sampling dates (pre-construction of the 16th Avenue Project). Those species that are indicative of cold water (e.g. rainbow trout) or known to be sensitive (e.g. redbreasted dace) have been located where they were previously. Therefore, it is our assessment, that the mitigation plan has protected the fish communities. Additional analysis is required to identify shifts effects on reproduction.

Increased Water Volume and Velocities at Discharge Locations

In June, the Town of Markham was cleaning the ditches along Elgin Mills Road and broke the supplementation pipe at Elgin Mills Road and the Little Rouge River. The flow went unchecked to the river through an unplanned route. There was some ditch erosion and the sediments were transported to the creek. The YDSS Coordinator investigated the site and worked with the agencies and York Region/contractors to fix the problem. The dispersal system has been changed so that a perforated pipe now discharges into the river.

Groundwater and Wildlife Habitat

The wetlands mitigation via sprinkler system on Robinson Creek Local ESA south of 16th Avenue continued up to June 30, 2005 to cover the most critical period. This measure was undertaken in discussion with the TRCA and the MNR and is documented in the work plan for Robinson Creek, as well as the monthly monitoring reports. No impacts to the wetlands in the study area have been observed and there is currently no active mitigation system in any wetlands.

Federal EA Triggers

There are four main triggers for a federal environment assessment: the need for federal permits; the development of federal Land; the investment of federal funding; or other areas of federal interest e.g. native land claims. Since none of these triggers applied to 16th Avenue, there was no trigger for CEAA and a federal assessment was not required.

Comprehensive Environmental Planning

Once the YDSS Master Plan was approved by York Region Council, the next step in the process was to commence the environmental assessment for each of the project components identified in the plan. The first project to go through this assessment was 16th Avenue. While one of the lessons learned in this project has been effective communication with the public, it is important to recognize that each stage of the project – from the OP Review to the EA review, required and offered considerable opportunity for public input. Once the EA was approved, the next steps were detailed design and permitting, followed by construction, mitigation and monitoring. When issues arose with the Phase I project, the Phase II project was not permitted until the issues were addressed in a comprehensive, \$30 million, mitigation and monitoring plan – the EMP. This plan and its work plans are now being implemented.

Alternative Methods, Alignments and Design

For 16th Avenue Phase II, there was very little opportunity to change the alternative methods, alignments and design that had been identified in the EA because the project was already half built (Phase I was completed). However, there was opportunity to modify the design by adding the shaft at McCowan Road, and thus reduce the dewatering requirements substantially. In terms of other projects, the EAs are underway for sections north of the Oak Ridges Moraine, and for the Southeast Collector. Design details have been substantially modified for the Interceptor sewer in order to decrease or eliminate the need for dewatering when this project moves to the construction phase.

Overall, all issues that have been identified by York Region, the agencies and the contractors have been effectively addressed.

OTHER YDSS PROJECTS

There are several other YDSS projects proceeding through the planning and approvals. There are three projects that are of specific note: King City Sewer, Interceptor Sewer and Southeast Collector. Each project was identified in the YDSS Master Plan. Each has a comprehensive baseline monitoring program, public consultation and agency review consultation forums. Each will require that a comprehensive dewatering impact assessment be conducted and that environmental impacts be minimized, mitigated and monitored. To preclude that a project cannot be in an aquifer will circumvent the purpose of the *EA Act* and the Minister's October 1, 2004 letter regarding the request for a Part II Order. The *EA Act* and the letter require that an unrestricted assessment of alternatives be conducted to determine the preferred alignment and design. Each of these projects is briefly discussed below.

King City

The Class EA was completed and a request for a Part II Order was denied, with conditions, by the Minister of the Environment. One of the conditions was that the sewer be constructed in compliance with the Oak Ridges Moraine Conservation Plan. This report has been completed and submitted to the MOE. Permits from TRCA to construct two sections of the sewer have been issued and staff understand that the work is nearly complete. This sewer is designed as a gravity sewer, however in order to connect with existing subdivision elevations the use of a forcemain system is also required. This pipe is being built near the ground surface, and little or no groundwater dewatering is anticipated. To date there has been no requirement for a PTTW to dewater during construction, although MOE has issued a CofA. The need for this sewer, as stipulated in the EA, was to eliminate contamination to the East Humber River from poorly maintained private septic systems. During the review of the EA, MNR expressed concern that the removal of the septic effluent would disrupt the baseflow contributions to the creek. MNR referred this issue to DFO for their review. To address MNR's concerns, York Region commissioned a study to examine the effects on baseflow and the resulting impacts to fish habitat. The study concluded that sewage effluent should not be considered baseflow and that the amounts to be removed were insignificant. DFO and MNR reviewed this report and supported its findings. At that time TRCA was not responsible for fisheries review and therefore did not review the documents. However, all agencies did concur that the water quality impairments to the East Humber River from the septic systems would be eliminated if they were discontinued, resulting in an overall environmental benefit.

Interceptor (19th Avenue) Sewer

The Class EA is complete, however the Minister's letter of October 1, 2004 regarding the request for a Part II Order that was denied with conditions required that the preferred route and design alternatives be re-evaluated. TRCA has reviewed and commented on the draft report which details a comprehensive review of route and design alternatives; peer review by an external team of experts is being undertaken as per the Minister's letter; and an extensive public consultation process is underway. York Region has selected construction methodologies that virtually eliminate dewatering requirements such that the potential for impacts to the environment will be significantly reduced. Extensive baseline data has been collected, and an extensive monitoring program has been initiated. Staff understand that the final report has been submitted to MOE. MOE will consult with the Ministry of Municipal Affairs and Housing regarding compliance with the Oak Ridges Moraine Conservation Plan. This decision has not yet been made.

Southeast Collector

York Region chose to upgrade the EA for this project from a Schedule C to an Individual EA. The Terms of Reference for the EA is final, and is in the Minister's office for review and approval. The study area, as per the Minister's letter has been expanded beyond that proposed in the master plan to encompass areas within the Region of Durham, and Durham is now a partner in the project. At this time it is the intent of York Region to coordinate the provincial and federal EA processes. Baseline data is being collected in both York and Durham regions to ensure that an assessment of impacts can be undertaken. Extensive monitoring is occurring, and will be tied to the TRCA Regional Watersheds Monitoring Network in the long term.

CONCLUSION

The approval process for the permits associated with the 16th Avenue Phase II project required that the project be stopped for 18 months while a comprehensive mitigation and monitoring plan was developed, and contingency measures were installed. During this time dewatering continued in order to secure the partially constructed pipe associated with the 16th Avenue Phase I project. Approximately 15,000 L/min of water was removed from the aquifer during this time.

The most sensitive area in terms of groundwater withdrawals and surface connections is at or near Shaft C8, located near Stone Mason Drive and Robinson Creek. Through the current construction of an additional shaft at McCowan Road, York Region and their contractors will be able to line the tunnel and seal Shaft C8, thus enabling the pumping at these sensitive wells to stop in advance of initially proposed timelines. This will result in a decreased rate and duration of pumping of the aquifer by approximately 6 months, and correspondingly less impacts to the surficial environment.

A comprehensive mitigation and monitoring program has been developed -- the Environmental Management Plan. This document has been approved by MOE and TRCA. *Fisheries Act* and *CEAA* approvals are not required for this project. MOE has issued a PTTW and has considered a request for a Part II Order on the EA.

Because Phase I of the project had been completed, the design details (vertical and horizontal alignments, shaft depths and construction technologies) for the Phase II section of the 16th Avenue pipe were predetermined. These were discussed in the development of the EMP, and agency staff understood from York Region staff and their contractors that such changes were not practical. Staff therefore concentrated on ensuring that monitoring and mitigation mechanisms were in place before construction was allowed to continue.

Other YDSS projects have been redesigned to take into account the lessons learned through the 16th Avenue project. These lessons include the following:

- Choose the right planning process (e.g., the Southeast Collector project is being planned as an Individual EA).
- Choose the right study area (e.g., the Southeast Collector project has been expanded into Durham Region to avoid a phased construction of this system).
- Collect baseline data of all natural features, including detailed geotechnical and hydrogeological studies, within a large study area using current science and technologies (e.g., Interceptor Sewer and Southeast Collector have extensive monitoring programs and have been collecting data on the surface and subsurface environments for over a year).
- Evaluate all potential environmental impacts for each route and construction methodologies and select the alternative and design accordingly (e.g., the Interceptor Sewer project has re-evaluated the preferred alternative and design that was selected through the Class EA process based on extensive data collection and public consultation).
- Use an ecological approach and strive toward sustainability (e.g., the Terms of Reference for the Southeast Collector stipulates that alternative measures for sewage treatment and disposal must be evaluated).

- Set realistic triggers based on science and baseline monitoring (e.g., for the Interceptor Sewer project there is recognition that construction activities may result in impacts to the natural environment. As such, design details must ensure that the impacts are minimized and there must be a mitigation and monitoring program established).
- The importance of provincial and federal governments to fund and maintain their monitoring systems (e.g. ongoing discussions to maintain monitoring stations at the TRCA level are occurring). Municipal support would be of benefit.
- Tie the project monitoring to the TRCA Regional Watersheds Monitoring Network in the long term (e.g. discussions with York Region regarding the long term maintenance and integration of data and system into the monitoring network are ongoing).
- Meet with the agencies and the public on a regular basis to present project details and solicit advice (e.g., meetings occur at least monthly).

As such, in TRCAs opinion the projects are proceeding using the best available and practical sciences and technologies. The implementation of the 16th Avenue Phase II EMP has a total estimated cost of \$30 million. While implementation of the plan has its challenges, it has been designed to monitor and mitigate adverse environmental impacts. With few exceptions , staff find that the plan is effective at mitigating predicted effects. In the long term, the Thorncliffe aquifer will rebound; the water table, baseflows and discharges will be re-established; and provincial growth objectives as identified in York Region's OP will be achieved. TRCA will continue to ensure through regulatory and consultative processes that environmental impacts that may occur through the design and implementation of sewer infrastructure will be addressed.

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