CAPITAL EXPENDITURES - NIAGARA TUNNEL PROJECT

1.0 PURPOSE

This Exhibit describes the Niagara Tunnel Project ("NTP") from its origin in studies and assessments performed by Ontario Hydro during the 1980s to its completion in 2013. The material that follows establishes that the NTP was an extremely large, complex and challenging construction project that OPG completed safely and cost effectively given the conditions encountered. The emissions free electricity produced from the water flowing through the NTP will benefit the people of Ontario into the next century.

Photo 1 - Looking out the Tunnel at the Outlet Site

The sections that follow demonstrate that the costs of the project as presented in the original Business Case Summary ("BCS") approved by the OPG Board of Directors ("OPG Board") in 2005 were a realistic estimate of the project's cost based on the information available. The evidence explains how the rock conditions encountered during tunneling proved to be extremely difficult necessitating the revised cost forecast and project schedule contained in the 2009 Superseding BCS approved by OPG Board. OPG ultimately completed the project some $100M below the approved funding with commercial service beginning nine months sooner than provided for in the Superseding BCS. In the detailed evidence that follows, OPG demonstrates that the entire $1,500M spent on this project represent prudently incurred costs that should be approved for inclusion in OPG's rate base.[1]

1.1 Introduction

The NTP is a 10.2 kilometre tunnel with an interior diameter of 12.7 metres, which will allow OPG to make better use of the available water flow in the Niagara River to produce on average an additional 1.5 TWh per year from the Sir Adam Beck ("SAB") Generating Stations 1 and 2.[2] As the project came into service in March 2013, this proceeding is the appropriate opportunity to review the prudence of the $514.8M in NTP expenditures beyond the original budget of $985.2M that was approved by OPG Board prior to the OEB's first order with respect to payment amounts for OPG's prescribed facilities under Section 78.1 of the *Ontario Energy Board Act*.[3]

[1] This figure represents the projected cost to completion as of June 30, 2013. While these amounts are subject to change due to finalization of contract costs and ongoing project closeout activities, OPG does not expect material differences between these estimates and the final figures. OPG will provide final cost figures when they become available.

[2] A discussion of how this estimate changed from the 1.6 TWh figure in the original NTP Business Case is provided in Ex. E1-1-1, section 3.6.

[3] O. Reg. 53/05, section 6(2)4 requires the OEB to ensure that OPG recovers the capital and non-capital costs of the NTP approved by OPG Board of Directors prior to the first payment amounts order and to determine the prudence of any expenditures beyond the OPG Board approved amount.

1.2 OPG's Request and Ratemaking Treatment

OPG currently estimates that the costs of the NTP will be $1,500M. Table 1 below presents, as of June 30, 2013, OPG's estimated spending at completion for each major cost category of the NTP.

Table 1 - NTP Major Cost Categories[4]

Project Cost Flow Estimate	$M
OPG Project Management	4.6
Owner's Representative	36.2
Other Consultants	6.5
Environmental / Compensation	8.7
Tunnel Contract (including Incentives)	1,140.8
Other Contracts / Costs	68.7
Interest	234.5
Total Project Capital	1,500.0

Capital costs totalling $1,424.9M were placed in-service in March 2013. An additional $49.3M of capital costs are forecast to be incurred and placed in-service by the end of November 2013. OPG requests that the gross plant and depreciation impacts of these amounts be included in rate base. As discussed in Ex. B1-1-1, the previously regulated hydroelectric rate base values for 2013 reflect these in-service amounts subject to weightings of 9.5/12 and 1/12, respectively, in order to recognize that they were or are expected to be placed in-service part-way through March 2013 or by the end of November 2013, respectively. This is shown in Ex. B2-3-1 Table 2, note 2. The rate base values for 2014 and 2015 reflect the full-year impact of the net book value of the above in-service additions as well as an additional $2M forecast to be expended on project monitoring and closeout activities in 2014.

[4] In this table and in the tables elsewhere in the document, OPG presents the full project capital costs. As detailed in this section, relatively small amounts of these costs will be incurred after June 30, 2013; have entered rate base previously; or have been or will be expensed rather than capitalized.

The rate base values also reflect $19.2M of capital cost for the Accelerator Wall (see Section 6.5.3) that closed to rate base as an in-service addition in 2007 prior to OEB regulation of OPG's payment amounts.[5]

The details of the rate base values for the NTP gross plant are shown in Ex. B2-3-1 (see Table 2, lines 2, 12 and 22). Accumulated depreciation details are presented in Ex. B2-4-1 (see Table 2, lines 2, 12 and 22). OPG also requests that the test period revenue requirement include a total depreciation expense of $31.7M for the NTP ($15.85M per year in 2014 and 2015) (see Ex. F4-1-1 Table 1, line 2).

The NTP total project cost also includes $4.6M of non-capital removal costs, which were charged to OM&A. Of this amount, $3M was associated with the Accelerator Wall and was expensed prior to OEB regulation of OPG's payment amounts. The remaining $1.6M was incurred in 2011 - 2012 to remove a dewatering structure on the Pump Generating Station canal that would have adversely impacted NTP performance had it remained. The $1.6M was captured in the Capacity Refurbishment Variance Account discussed below.

This project is covered by the Capacity Refurbishment Variance Account established, effective April 1, 2008, under Section 6(2)4 of O. Reg. 53/05. As a result, the cost impacts associated with the project prior to the effective date of the payment amounts that include the NTP are recorded in the Capacity Refurbishment Variance Account. OPG requests that the audited year-end 2013 hydroelectric balance in the Capacity Refurbishment Variance Account, which will include amounts related to the NTP, be disposed of in this proceeding, as is discussed in Ex. H1-2-1.

[5] As explained in EB-2008-0010, Ex. L-1-20(b) (Response to Board Staff IR #20 (b)):
> The accelerator wall is part of the existing International Control Dam (required primarily for ice management on the river) and is considered part of the Niagara Tunnel project because the tunnel's intake configuration required replacement of the accelerator wall. The in-service addition in 2007 was $19.2M, … and was included in the asset values that the OEB was required to accept under section 6(2)5 of O. Reg. 53/05 in setting OPG's initial payment amounts.

Amounts recorded in the Capacity Refurbishment Variance Account for the NTP are discussed in Ex. H1-1-1. As shown in Ex. H1-1-1 Table 7, these include OM&A costs of $1.6M incurred during 2011 - 2012 (that were not reflected in the EB-2010-0008 payment amounts) and depreciation expense, cost of capital and associated income tax impact for amounts placed or forecast to be placed in-service during 2013. Income tax impacts include variances between actual and forecast Capital Cost Allowance deductions.[6] The derivation of the capital cost components of the 2013 account additions is shown in Ex. H1-1-1 Table 7. The year-end 2013 balance for recovery in relation to the NTP (including interest on the account balance at the OEB-prescribed rate) is projected to be $116.8M.

1.3 Expert Report

OPG's counsel retained Roger C. Ilsley, a geotechnical and tunnel consultant as an expert to provide an independent review and assessment, based on industry standards, of the extent and quality of the geotechnical investigations conducted, the geotechnical reports issued and the relevant project specifications and drawings prepared for the NTP. Mr. Ilsley was also asked to review OPG's conduct in its dispute with the contractor over differing subsurface conditions (discussed below in Section 7.0). Mr. Ilsley prepared an independent expert report which is filed in Ex. F5-6-1.

1.4 Organization of the Evidence

The evidence is organized in three major sections. The first is the narrative contained in this Exhibit, which provides a detailed description of the project, its origins, development, and costs. Photographs and figures are included to illustrate various aspects of the project.

[6] As previously noted in EB-2010-0008, Ex. L-1-020 b, OPG elected to claim early Capital Cost Allowance ("CCA") related to the NTP. Therefore, since April 1, 2008, the approved payment amounts have reflected a forecast tax benefit to ratepayers associated with this election. For the test period, the CCA deduction with respect to the NTP is forecast at $41.3M in 2014 and $39.7M in 2015.

The second component is the three Appendices at the end of this Exhibit:

- Appendix A – timeline of the major project milestones
- Appendix B – review of the geotechnical work that preceded the project
- Appendix C – list of acronyms associated with the project

The third component is an accompanying volume of the key project documents:

- URS Corporation Qualitative Risk Report
- Project Execution Plans – 4 Major Revisions (0-3)
- URS Corporation Quantitative Risk Assessment
- OPG's Risk Assessment Update
- Full Board Approval Package for the original Business Case Summary ("BCS")
- Original Design Build Agreement ("DBA")
- Dispute Review Board Report and Recommendations
- Full Board Approval Package for the Superseding BCS
- Amended DBA ("ADBA")

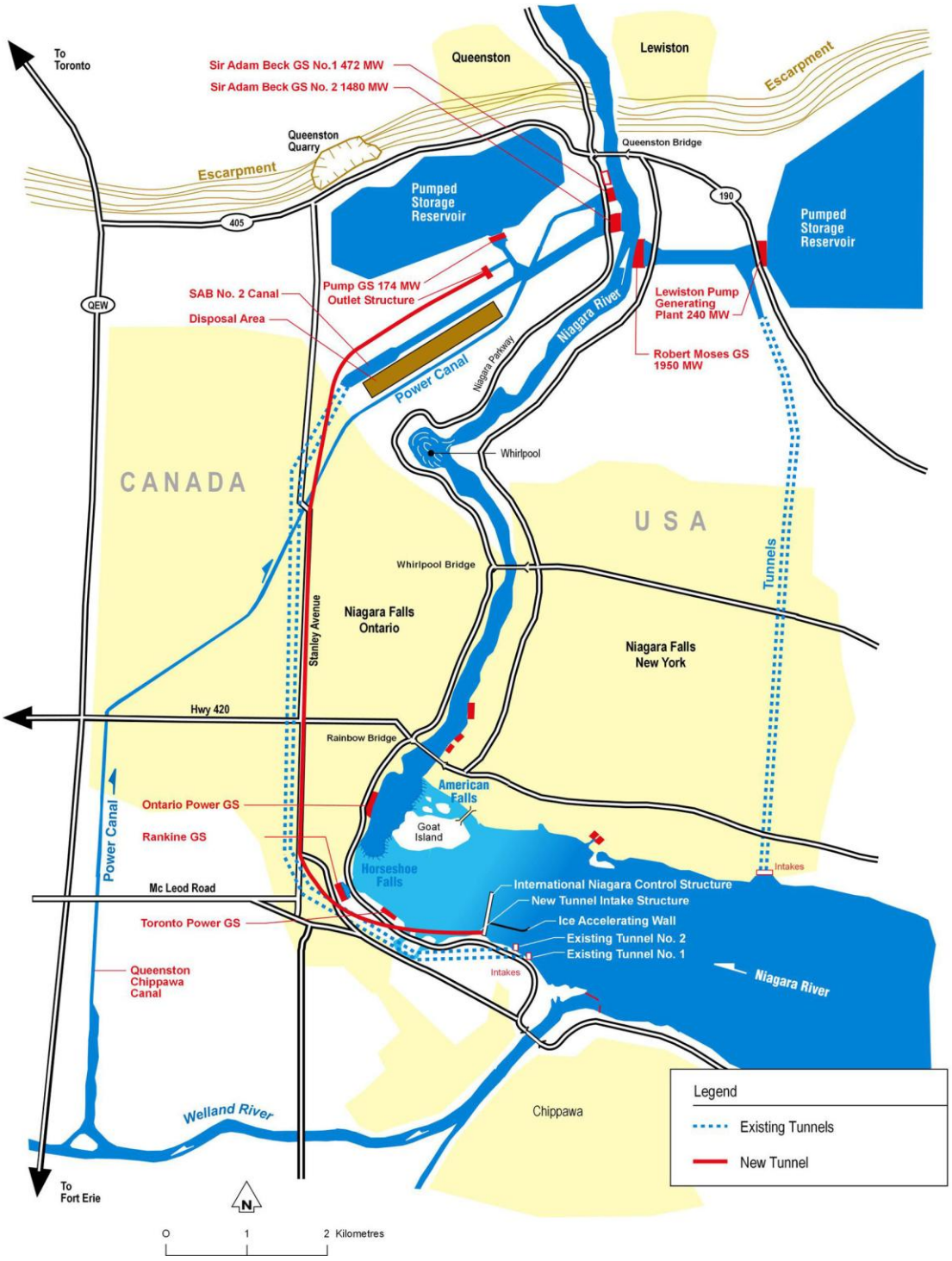
As some of these documents are quite large and contain complex graphics, these documents are included in the accompanying CD of "NTP Key Documents."

2.0 PROJECT BACKGROUND

2.1 Description

The scope of the NTP includes the design, construction and commissioning of a diversion tunnel that is 10.2 kilometres long with a 12.7 metre nominal internal diameter (14.4 metre excavated diameter) from a new intake under the existing International Niagara Control Works structure in the upper Niagara River above Niagara Falls to a new outlet canal feeding into the existing Pump Generating Station ("PGS") canal. The project also includes all required ancillary and enabling works.

Figure 1 - Project Map



This third tunnel will supplement the diversion capacity of the two tunnels and one open channel that currently bring water from the Niagara River to the SAB generating stations. The purpose of the third tunnel is to increase the flow of water available to the existing SAB stations, thereby enabling those generating facilities to produce on average an additional 1.5 TWh of electricity per year. As of March 2013, the third tunnel constructed through the NTP began bringing water to the SAB generation stations.

The new diversion tunnel and related works were delivered under a Design-Build Agreement ("DBA") with Strabag AG of Austria and its wholly owned subsidiary Strabag Inc. ("Strabag"). Strabag was the successful pre-qualified proponent in an international competitive request for proposal ("RFP") process. The tunnel has been excavated using a tunnel boring machine ("TBM") as required by the approvals given under the Environmental Assessment ("EA") process discussed below.

Strabag used a two-pass tunneling system as specified in its successful proposal. The term "two-pass" means that in the first pass the tunnel is bored and an initial lining installed; in the second pass, the permanent concrete lining is installed. The initial lining uses steel supports in the tunnel roof and a full circumference layer of shotcrete (sprayed concrete) installed after mining. The permanent lining is comprised of an impermeable membrane generally surrounding 600 mm of un-reinforced concrete locked in place by cement grout. The project was constructed to meet a minimum design life of 90 years.

2.2 Project History

2.2.1 Early Project Background

Preparation for a new Niagara Tunnel commenced over 30 years ago, in 1982, when Ontario Hydro (the predecessor company of OPG) began to study the possible expansion of its hydroelectric facilities on the Niagara River. Detailed engineering, environmental and socioeconomic studies were conducted from 1988 through 1994 with an EA submitted in 1991 for the then planned project consisting of two additional water diversion tunnels, each one capable of conveying 500 m^3/s, a three-unit underground generating station with a total capacity of 900 MW, and transmission improvements between Niagara Falls and Hamilton,

Ontario. This project was referred to as the Niagara River Hydroelectric Development ("NRHD").

Among the commitments made through the EA process was to utilize a TBM to excavate the tunnels starting from the outlet end, proceeding under the buried St. Davids Gorge and following the route of the existing SAB 2 tunnels through the City of Niagara Falls. A TBM was required in light of the development that had occurred in Niagara Falls since the original two diversion tunnels were constructed using the drill and blast method in the 1950s, and to minimize the amount of excavated materials from the project requiring disposal. Other commitments included re-use of excavated materials where feasible and an agreement to compensate the host municipalities, the Regional Municipality of Niagara, City of Niagara Falls and Town of Niagara-on-the-Lake, for forecasted project impacts on tourism, roads and municipal services.

2.2.2 1998 Decision to Pursue Third Tunnel

Early in February 1998, in anticipation of receiving EA approval, Ontario Hydro initiated a review of the viability of proceeding with the first phase of the NRHD (i.e., the construction of one additional 500 m^3/s tunnel). This review included the solicitation and evaluation of bids for the construction of the tunnel during the summer and fall of 1998 using a design-build approach.

In October 1998, the Minister of Environment provided approval under the *Environmental Assessment Act* for the complete NRHD as outlined above. The EA approval stipulated that it would "terminate if construction has not commenced within ten years from the date of this approval." This stipulation could be extended a further five years "based on the review and approval of an environmental review assessment status report." It provided Ontario Hydro with the flexibility to undertake the development in phases (i.e., initial construction of one tunnel); but did require that no construction extend "beyond twenty years following the commencement of construction."

In the fall of 1998, the bids were reviewed and a recommended bidder was identified, but the contract was never awarded. In December 1998, Ontario Hydro informed the bidders that, given the imminent reorganization of the corporation, the final decision regarding the tunnel would be deferred until the reorganization was complete. The final decision on the project was scheduled to be made in July 1999, once the new OPG Board was in place and had an opportunity to consider the matter.

In late June 1999, OPG announced that it had decided to defer construction of the tunnel indefinitely. This decision was based on OPG's limited funding capacity and the desire to proceed with the Pickering A Unit 1 Return to Service before committing to construct the new tunnel. The recommended bidder was informed that if OPG decided to resume the project within two years, it would be prepared to enter into negotiations for an updated tender offer. The recommended bidder confirmed its acceptance of this arrangement.

The cost of the definition phase activities described above was written off by Ontario Hydro prior to the formation of OPG and is not included in the NTP costs covered by this Exhibit. OPG's expenditures on engineering studies for the 1998/99 tender developed information that was subsequently used in the preparation and conduct of the 2004/05 RFP process. As such, these expenditures should have properly been included as project costs, but because they were expensed prior to the NTP, they too are not included in this Application.

2.2.3 Government Direction

In November 2002, the Province announced that it had instructed OPG to proceed with the new tunnel at Niagara to expand the production of green energy. It also introduced related tax incentives that improved the project's economics as discussed below. The Minister of Finance issued a directive to the Ontario Electricity Financing Corporation ("OEFC") to finance the project once the successful proponent had been selected and a proposed contract negotiated.

2.3 Water Rights and Flows

2.3.1 Applicable Legislation

The Niagara River is an international waterway forming part of the boundary between Canada and the United States. It is the natural and principal channel for outflow from Lake Erie to Lake Ontario. The river is about 53 kilometres in length and carries about 96 per cent of the Lake Erie discharge, on average. The Welland Ship Canal provides a secondary discharge channel between these two lakes and carries the remaining 4 per cent.

The *Boundary Waters Treaty* of 1909 between Canada and the United States governs all boundary waters between the two countries, including Lake Erie/Niagara River. The *Niagara Diversion Treaty* of 1950 between Canada and the United States, among other things, provides for the construction of the International Niagara Control Works ("INCW"), determines the priority of use for the waters of the Niagara River and Welland Canal, and sets minimum flow requirements over Niagara Falls.[7]

Each of the *Boundary Waters Treaty* of 1909 and the *Niagara Diversion Treaty* of 1950 continue in perpetuity, but are terminable by either party on 12 months written notice. Given the significance of these treaties to both countries, OPG does not expect either country to exercise its termination rights in the foreseeable future. The *Boundary Waters Treaty* of 1909

[7] Canada and the U.S. have created certain international entities to implement and monitor the *Boundary Waters Treaty* of 1909 and the *Niagara Diversion Treaty* of 1950. The *Boundary Waters Treaty* of 1909 created an international commission called the International Joint Commission ("IJC") to help prevent and resolve disputes over the use of boundary waters between Canada and the United States. The IJC established the International Niagara Board of Control in 1953. The International Niagara Board of Control provides advice on matters related to the IJC's responsibilities for water levels and flows in the Niagara River. The International Niagara Board of Control's main duties are to oversee water level regulation in the Chippawa-Grass Island Pool and the installation of the Lake Erie-Niagara River ice boom. The International Niagara Board of Control also collaborates with the International Niagara Committee, a body created by the *Niagara Diversion Treaty* of 1950 to determine the amount of water available for Niagara Falls and power generation.

and the *Niagara Diversion Treaty* of 1950 grant Canada and the United States equal rights to use Niagara River waters available for power generation.[8]

Through a series of agreements between the Government of Canada and the Province of Ontario, and federal and provincial legislation, OPG has been granted the right to exercise Canada's rights with respect to the construction, maintenance and operation of generating facilities under the *Boundary Waters Treaty* of 1909 and the *Niagara Diversion Treaty* of 1950.

2.3.2 Available Flows

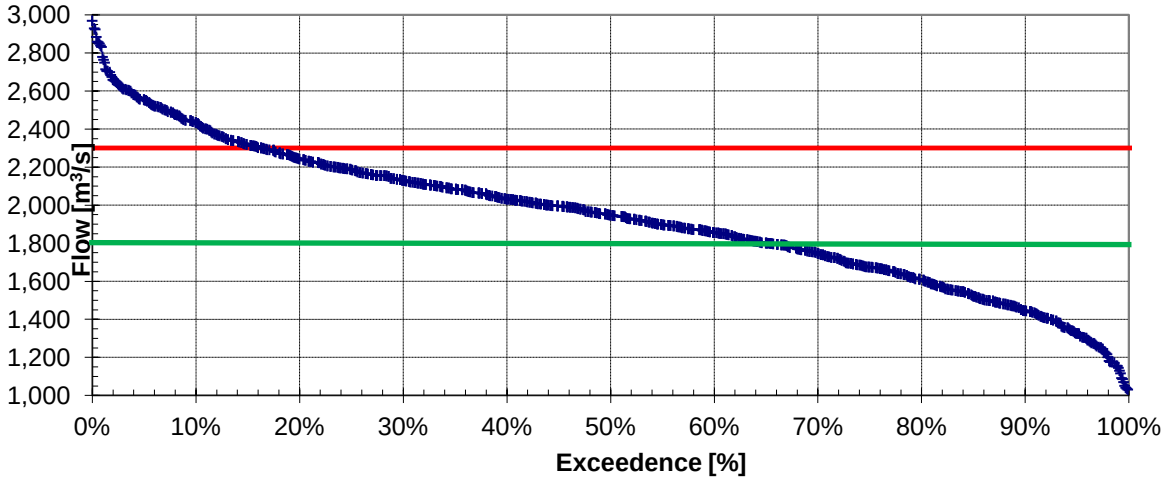
The natural regulation ability of the Great Lakes results in a relatively stable pattern of discharge from Lake Erie. Based on the historical flow record for the Niagara River at Queenston, with adjustments for diversions to and from the Great Lakes, the average Lake Erie outflow is about 6,000 m^3/s. This total outflow is comprised of an adjusted average Niagara River flow of about 5,800 m^3/s and an adjusted average Welland Canal flow of about 200 m^3/s. Lake Erie discharge is normally highest during May and June and lowest during February.

The available flows in the Niagara River for electricity generation vary depending on hydrologic conditions and the seasonal scenic requirements for Niagara Falls. The *Niagara Diversion Treaty* of 1950 states that 100,000 cfs (2,832 m^3/s) must be allowed to flow over the Falls from 8:00 am to 10:00 pm April 1 to September 15 and from 8:00 am to 8:00 pm September 16 to October 31. At all other times 50,000 cfs (1,416 m^3/s) must be allowed to flow over the Falls. Any flow in excess of these amounts is divided equally between Canada and the United States for hydroelectric production. OPG has the exclusive right to use the Canadian share of the available flow.

[8] The *Niagara Diversion Treaty* of 1950 recognizes certain diversion waters (5,000 cubic feet per second or approximately 142 cubic metres per second) which are diverted by Canada into the Great Lakes Basin as not being included in the allotment of waters under the provisions of the treaty. This water is diverted from the James Bay watershed by the Ogoki and Long Lac Diversions in northern Ontario to the Niagara system via the upper Great Lakes. This amount is therefore available solely to Canada and is used at OPG's Niagara hydroelectric facilities.

In Figure 2 below, the thick blue line shows the monthly Niagara River flows available to OPG based on historical data from 1926 through 2003. OPG's share of the Niagara River flow ranges from about 600 to 3,000 m^3/s, and averages about 2,000 m^3/s. The diversion capacity for the existing SAB diversion facilities prior to completing the new tunnel (canal and two tunnels) was about 1,800 m^3/s and is shown by the green line in Figure 2. Available flow exceeds the existing capacity about 65 per cent of the time. Completion of the NTP will increase the available diversion capacity to about 2,300 m^3/s, as shown by the red line in Figure 2. With the completion of the NTP, available flow is expected to exceed OPG's diversion capacity only about 15 per cent of the time.

Figure 2 - Niagara River - OPG Entitlement - Monthly Flow Duration Curve (1926-2003)



2.3.3 Niagara Exchange Agreement

The *Niagara Parks Act* (Ontario) assigns the Niagara Parks Commission ("NPC") the authority to grant certain rights to use the waters of the Niagara River for purposes of power generation. In 1892, the NPC granted a franchise agreement to the Canadian Niagara Power Company Limited ("CNP") for the construction and operation of the Rankine Generating Station ("Rankine GS") and for the taking of water from the Niagara River. The current owner of CNP is Fortis Ontario Inc. ("Fortis"). The franchise granted Fortis the right to generate

74.6 MW by taking approximately 283 m^3/s of water from the Niagara River for power production until April 30, 2009. The NPC also granted two other franchise agreements in 1900 and 1903 respectively for Toronto Power Generating Station ("Toronto Power GS") and Ontario Power Generating Station ("Ontario Power GS"). These two stations and their respective franchise agreements came to be owned by OPG.

When the Province approved the construction of SAB 1 and SAB 2, it gave the predecessor of Ontario Hydro the rights and authorities to build, operate and use the waters of the Niagara River under specific legislation passed in 1916, 1917 and 1951. As a result, two parallel systems now exist for the granting of rights to use water from the Niagara and Welland Rivers. The rights granted under NPC's authority are treated as having priority over the SAB rights because these rights were granted first.

Based on the two streams of water power granting authority, there existed ambiguities with regard to water rights at Niagara and the ability of third parties to gain rights to generate power at Niagara.

The negotiations regarding the Niagara Exchange Agreement ("NEA") were initiated by Ontario Hydro in 1998 with NPC and Fortis. In 2003, several agreements were reached between the NPC, Fortis, and OPG in order to secure and protect OPG's water rights on the Niagara and Welland Rivers through 2056. As part of these agreements, OPG was required to transfer ownership of the Toronto Power GS and the Ontario Power GS to NPC to develop the structures for purposes other than hydroelectric generation, including as a visitor attraction. As conditions of the transfer, OPG was required to conduct environmental assessments, perform required environmental remediation and make specific structural improvements to the buildings including removal of equipment, filling of the inner forebay at Toronto Power GS and sealing of the conduits at the Ontario Power GS gatehouse. In accordance with the agreements, Fortis' Rankine station reverted to the NPC at the expiration of the franchise agreement on April 30, 2009.

In consideration of Fortis relinquishing its rights and future claims to water from the Niagara River, Fortis was given access to 74.6 MW of production from OPG, which is equivalent to the permitted output of the Rankine GS, through April 30, 2009 and was to be allowed to purchase three OPG hydroelectric stations on the Trent River: Sills Island GS (2 MW), Frankford GS (3.2 MW) and Sidney GS (4.5 MW).

In order to facilitate this arrangement, on May 1, 2003, the Province issued an Order in Council ("OIC") approving a policy directive for NPC to participate in the above agreements. The policy directive required NPC to:

- not grant or permit any person other than OPG the right to take water from the Niagara River and Welland River for the period beginning on April 22, 2003 and ending in 2056;
- grant OPG rights or interests in lands as are necessary for the construction of the SAB Tunnel on terms and conditions having regard to the Commission and its programs;
- consent to the transfer of Fortis' right to take water from the Niagara River to OPG; and
- accept the transfer of Toronto Power GS and Ontario Power GS in the condition specified in the OIC.

The Province also issued another OIC under which the Lieutenant Governor-in-Council expressly waived its option to extend the Fortis water franchise beyond April 30, 2009.

The parties converted the policy directives into contractual agreements, but these contracts failed to win governmental approval prior to the provincial election in October 2003. Following the election, provincial policy no longer supported the sale or lease of generating assets.

With the option of a sale or lease no longer on the table, the Province and Fortis entered into a series of negotiations, which resulted in a Ministry of Energy direction to OPG to negotiate fair compensation with Fortis for its participation in the NEA. These negotiations resulted in OPG paying $10M as fair compensation on February 18, 2005.

OPG issued an RFP for the environmental, remediation and structural work necessary for the transfer of Toronto Power GS and Ontario Power GS to NPC. While the original budget for the work was estimated at about $10.4M plus a contingency of $2M based on engineering estimates provided by an external consultant, responses to the RFPs came in higher than the estimate due to construction market conditions at that time and the respondents' pricing of the risk allocation in the RFP. Nine companies initially indicated they had a desire to participate in the RFP process and to receive RFP packages, but only two companies submitted proposals. OPG determined that the lack of response from the other contractors was a reflection of the strength of the marketplace, the unique nature of the work, and the perceived risk profile associated with the work.

Following negotiations, OPG ultimately selected Peter Kiewit Sons Co. as the contractor and approved a contract cost of up to $20M. Klohn Crippen Berger Ltd. was selected as the Owner's Representative. Work on the two sites was completed in July 2007 and they were turned over to NPC on August 1, 2007. At $17.8M, the final cost of the work completed by Peter Kiewit Sons Co. was below the approved budget.

The total cost of the NEA was estimated in the original business case summary ("BCS") for the NTP at approximately $32.4M. This amount included all assessment work, the remediation work on the Toronto Power GS and Ontario Power GS and the settlement payment to Fortis, as well as interest and contingency. Table 2 below shows the original budgeted amounts for the NEA work and the amounts ultimately spent.

As shown in Table 2, the ultimate cost of the NEA work was $43.9M. The higher than anticipated costs are found in three areas:

- engineering and project management due to the increased scope and duration of the project;
- construction and remediation because of higher than anticipated bids from contractors due to market conditions at the time of the RFP and allocation of risk to contractor; and

- interest as a result of the additional costs and longer duration of this component and the entire NTP.

Table 2 - Niagara Exchange Agreement Costs

Niagara Tunnel Project Niagara Exchange Agreement Analysis					
	Orginal BCS	**Act'l June 30/13**	**Delta**	**% Diff**	**Variance Explanation**
NPG Support	202,129.53	162,466.99	(39,662.54)	-20%	Reduced requirement for NPG Contract Monitor
Enviro Consultant	225,000.00	198,508.38	(26,491.62)	-12%	Reduced scope (i.e. eliminated filing Record of Site Condition)
OR/Eng	726,000.00	1,178,116.95	452,116.95	62%	Additional scope and extended duration for the OR/Eng Services
Construction	10,394,858.00	17,826,058.50	7,431,200.50	71%	Market conditions at the time the RFP was issued resulted in higher than estimated proposals.
Remediation	1,000,000.00	500,627.49	(499,372.51)	-50%	Reduced requirement for remediation
Fortis	10,000,000.00	10,000,000.00	0	0%	
Interest	7,777,135.62	14,001,260.42	6,224,124.80	80%	Increased costs associated with Niagara Exchange Agreement work and longer duration for NTP.
Contingency	2,040,304.28	0	(2,040,304.28)	-100%	All contingency spent. Additional variance was funded from other elements of the NTP.
Total	**32,365,427.43**	**43,867,038.73**	**11,501,611.30**	**36%**	

OPG entered into the NEA to assure its exclusive right to use the water from the Niagara River and Welland Canal for power generation through 2056. This assurance contributes to the economic viability of the NTP. As such, all costs associated with the NEA are project development costs because they were incurred to ensure water availability for the NTP. These costs have been capitalized as part of the overall costs of the NTP and are included in the overall amount sought for recovery in this application.

2.4 Geology

The Niagara Gorge, the largest existing river gorge in southern Ontario, is the dominant geologic feature in the area of the NTP. The gorge is 11 kilometres long stretching from Niagara Falls to Queenston. On average, the gorge is more than 80 metres deep and 150 metres wide. An ancient river ancestral to the present Niagara River cut a gorge similar to that of the current Niagara Gorge. This ancient gorge diverges from the current gorge near the Whirlpool area and cuts through the escarpment considerably to the west of the current gorge, near St. Davids. This part of the ancient gorge, known as the buried St. Davids Gorge (or “St. Davids Gorge”), is estimated to have been 350 to 600 metres wide and up to 200 metres deep. The subsequent glacial period resulted in the plugging of the gorge with sediments and glacial till, leaving little evidence of its presence on the surface. The need to

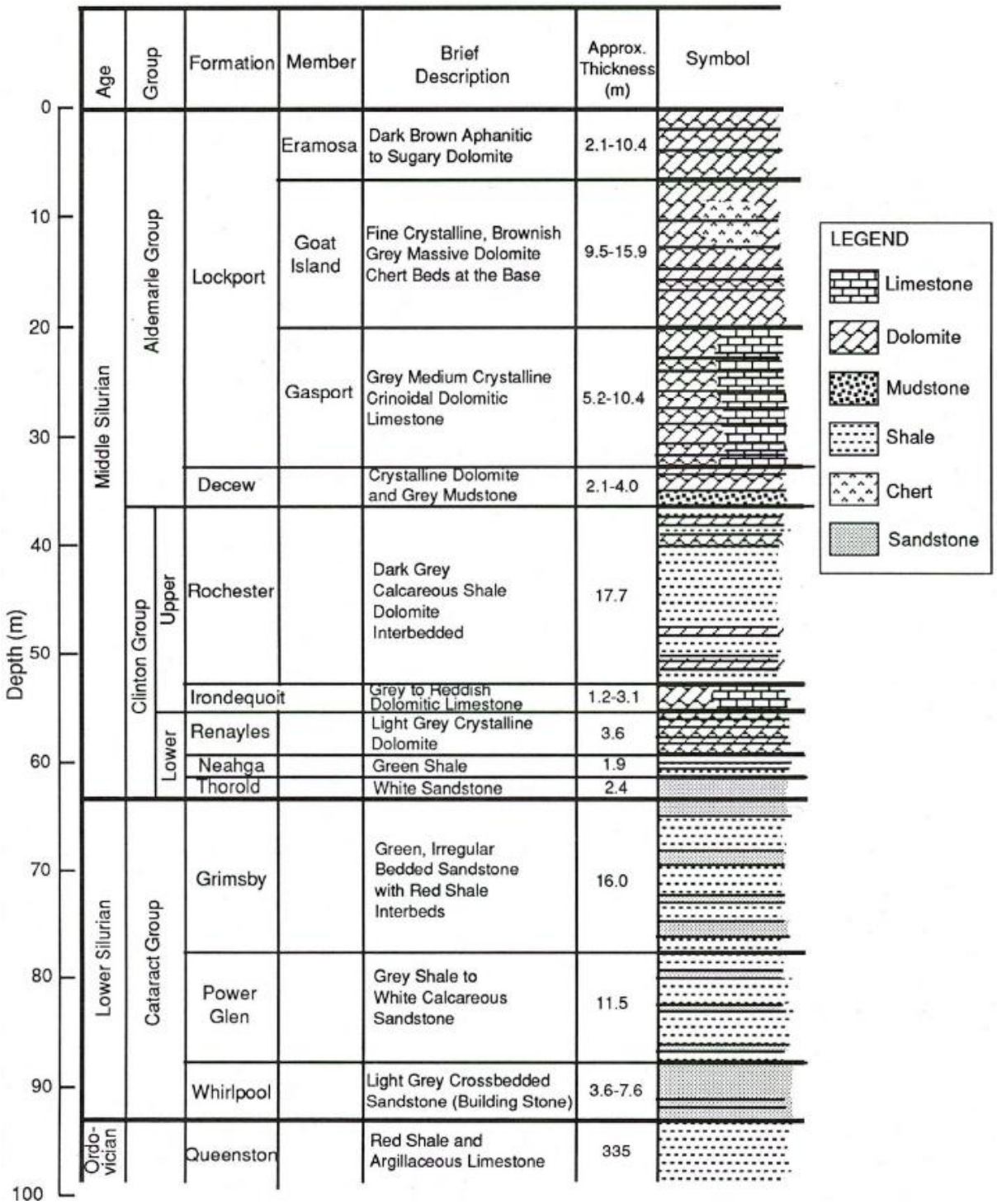
successfully traverse the St. Davids Gorge was a primary determinant of the planned depth of the NTP.

The bedrock underlying the project area and exposed in the Niagara Gorge is a succession of sedimentary rocks of Middle and Lower Silurian and Upper Ordovician age (approximately 400 million years old). The Silurian beds typically have a thickness of about 90 metres, whereas the Ordovician beds are much thicker. The bedrock strata are largely undeformed and dip slightly in a southerly direction. The rocks include dolostones, limestones, sandstones and shales. A typical bedrock sequence as exposed in the Niagara Gorge is shown in Figure 3 below.

The Lower Silurian rocks are of the Cataract Group. The Grimsby formation consists of sandstone interbedded with shale. The Power Glen consists of shale interbedded with sandstone. The Whirlpool formation consists of sandstone with occasional thin shale partings. The lowest strata involved in the NTP are the Upper Ordovician rocks belonging to the Queenston formation.

The Queenston formation, commonly called “shale”, but actually a muddy siltstone, consists of bedded clay with a few argillaceous limestone and sandstone layers. It is characterized by alternating layers of stronger and weaker rock. This red shale layer can reach a thickness of over 300 metres. It weathers readily upon exposure to atmospheric conditions, is prone to slaking and is easily eroded. Queenston shale is commonly used for brick manufacturing in Ontario. The Queenston shale is subject to swelling when exposed to fresh water and contains groundwater that is highly corrosive and aggressive to concrete, containing both chloride and sulphate.

Figure 3 - Simplified Rock Strata Information from Figure 5.4 of the Environmental Assessment



2.5 Environment

As noted earlier, the EA conducted was for the entire NRHD project as conceived by Ontario Hydro in the early 1990s, which included two new tunnels, an underground generating station and new transmission facilities between Niagara Falls and Hamilton. Thus, many of the environmental impacts considered in the EA and the mitigation measures proposed have little relevance to the current NTP. This section discusses the environmental impacts that are related to the tunnel and the mitigation measures adopted for those impacts.

Disposition of excavated materials from the tunnel, particularly non-inert materials containing potentially significant levels of BTEX (Benzene, Toluene, Ethylbenzene and Xylene) was a significant environmental concern. Due to the planned depth of the proposed tunnels and underground powerhouses contemplated at the time of the EA, Ontario Hydro estimated that some 60 per cent of the rock brought to the surface would be Queenston shale that could be reused for brick manufacture. Of the remaining rock, a portion was composed of limestone and dolostone that could be used as aggregate and the rest was to be disposed of in a nearby quarry. The EA approval required Ontario Hydro to develop plans for the management of excavated materials and for the management of any contaminants (i.e., BTEX) prior to commencing the project.

Ontario Hydro also was required to monitor groundwater flows along the tunnel route as a condition of EA approval. Other approval conditions included:

- a study of potential impact on the Welland River and suggested mitigation;
- a study of run-off and sedimentation impacts on the Niagara River;
- a study of impacts on fisheries and aquatic habitat and mitigation as necessary; and
- a requirement to control the noise emitted from the project.

All of these studies and any resulting mitigation measures found necessary had to be accepted or approved by the responsible agencies before construction could commence.

2.6 Community Impact Agreement

In December of 1993, Ontario Hydro reached a Community Impact Agreement with the Regional Municipality of Niagara ("Regional Municipality"), the Town of Niagara-On-The-Lake ("NOTL") and the City of Niagara Falls (collectively, "the municipalities") to mitigate the predicted impacts of the construction of the NRHD on tourism, roads, domestic water supply, and sewage treatment. This agreement was negotiated pursuant to Ontario Hydro's commitment to mitigate the impacts identified in the EA.

The agreement provided that the municipalities would grant all local permits necessary for construction of the NRHD. In exchange, Ontario Hydro was required to:

- consider local planning requirements in developing the NRHD;
- consult with the municipalities on an ongoing basis;
- address complaints from residents impacted by the project;
- fund improvements and maintenance for roads impacted by construction traffic;
- provide funds to mitigate impacts on sewage treatment facilities;
- procure emergency services from the municipalities where practical and cost effective; and
- seek opportunities to enhance local economic benefits including provisions for engagement of local contractors, suppliers and labour.

The agreement also required Ontario Hydro to compensate the municipalities for the costs of monitoring the agreement.

In August 2005, OPG negotiated certain amendments to the agreement. These amendments confirmed that OPG was the successor to Ontario Hydro and modified the parties' obligations in recognition of the fact that the project would be constructed in phases, with Phase One consisting of the NTP. OPG's compensation payments related to sewage services were cut in half to reflect the reduced scope of Phase One. Pursuant to the original agreement, OPG applied escalation at the Ontario Consumer Price Index to the original compensation amount

less the negotiated reductions. The resulting payments totaling $7.87M were made in October 2005 after the project received final approval.[9]

On June 19, 2013, OPG and the municipalities agreed to a further amendment to the agreement to allow the Regional Municipality to apply the remaining funds toward the rehabilitation of Stanley Avenue from Thorold Stone Road north to Whirlpool Road. No additional money was paid by OPG as a consequence of this amendment.

3.0 CONTRACTING PROCESS

3.1 Design Build

Undertaking the NTP required OPG to obtain specialized external expertise in tunnel design and construction because such activities are not part of OPG's normal business activities. The two major approaches for contracting large complex projects, such as the NTP, are Design-Build and Design-Bid-Build. In basic terms, under Design-Build, the project owner hires a single firm to design and construct a project that meets the owner's pre-established requirements. Under Design-Bid-Build, the owner, using internal or external design expertise, prepares detailed design and construction specifications and then hires a firm to construct the project according to the approved design and specifications.

OPG selected the Design-Build approach for the NTP as the preferred risk management strategy to:

- minimize project duration;
- capture tunnel contractor experience and innovations;
- fully integrate construction methods and constructability into the design;
- appropriately allocate project risks; and
- obtain as much upfront price certainty as possible.

[9] Some earlier payments had been made by Ontario Hydro in the mid-1990s, but these were written off prior to the formation of OPG and do not form part of the project costs sought for recovery.

The Design-Build approach also provided OPG with single-point accountability for project execution because the Design-Build team provides all required services including coordination, design, permitting, procurement and construction. OPG had previously selected the Design-Build approach in the 1998 - 1999 RFP process for design and construction of the Niagara Tunnel.

In contrast, under the Design-Bid-Build approach, OPG would have first needed to engage a firm to design the NTP. By hiring separate contractors, initially for design and subsequently for construction, OPG would have foregone the schedule and communication interface benefits of having an integrated team execute both the design and construction. Bidding and award of the construction contract would have been delayed while OPG first held a competitive process to engage a design contractor and then had that contractor prepare the design, drawings and specifications necessary to put the project out to construction bids. In addition, under this approach, the ability of the construction contractor to innovate with respect to construction methods would have been constrained by the need to adhere to the independently prepared design.

Not only would the Design-Bid-Build approach have been slower due to the sequential procurement and execution of the design followed by a second procurement and execution of the construction, but engaging in two separate procurement processes likely would have increased overall cost. Under Design-Bid-Build, OPG also would have retained the risks associated with ongoing management of the interface between the design contractor and the construction contractor.

3.2 Pre-qualification

On June 24, 2004, OPG Board approved the recommendation to proceed with the NTP including a preliminary release of $10M to conduct a RFP process and to carry out such pre-construction activities as OPG deemed necessary. On June 25, 2004, the Province of Ontario endorsed the decision by OPG Board to proceed with the NTP. Based on OPG Board's approval, OPG commenced a RFP process in July 2004 by inviting submission of

expressions of interest for pre-qualification, which were due in September 2004. Seven submissions were received, evaluated and ranked, following which OPG invited the five highest ranked firms to meet. The invited proponents were:

- Niagara Tunnel Constructors
- Peter Kiewit Sons
- Niagara Tunnelers
- Strabag AG
- Ed. Zublin AG

These five proponents were provided with the following documents:

- a summary of work on the project;
- Instructions to Proponents;
- Draft Contract Terms & Conditions; and
- Geotechnical Baseline Report.

They were then invited to present their views on these documents, their proposed project team, qualifications and their risk management approach to an OPG evaluation team. Members of the OPG evaluation team included the Major Projects Committee ("MPC") of the OPG Board, OPG management and a member of Hatch Mott MacDonald ("Hatch"), the firm that OPG retained to act as its Owner's Representative ("OR"). Both the Chairman of OPG Board and the President of OPG were present at each meeting. Proponents were encouraged to give candid feedback on various aspects of OPG's proposed approach.

The five proponents met with OPG in Toronto in late fall 2004. Each proponent was allowed 3 hours to present its team and to provide initial comments on the documents previously provided to them by OPG. These documents were selected to describe the project, the proposed contracting approach and OPG's proposed allocation of risk.

All proponents generally accepted the contracting approach proposed by OPG including risk allocation, although they qualified this acceptance because they had not seen the specific

form of contract (i.e., Terms & Conditions). All proponents believed, based on what they had seen to-date, that sufficient geotechnical investigation had been undertaken by OPG and requested that all related documentation be provided to them at the proposal stage. All proponents generally endorsed the proposed three-part Geotechnical Baseline Report ("GBR") approach for establishing a contractual baseline for sub-surface hydro-geological conditions. Under this approach, the RFP would include OPG's GBR ("GBR A"); the respondents would include their proposed modifications to the GBR as part of their proposals ("GBR B"); and the final GBR ("GBR C") would be negotiated as part of the contract.

Four of the proponents endorsed the general configuration of the project and stated that a tunnel of the size contemplated (about 12.5 metres internal diameter), although at the upper end of then current technology, was achievable. The remaining proponent (Ed. Zublin AG) was of the opinion that, considering other site factors, building such a large tunnel would be a significant challenge. In a subsequent memo, all proponents were invited to identify items that they wish to see addressed or clarified in the contract documentation.

Following the presentations, OPG reviewed the strengths and weaknesses of the various proponents. Consensus was reached that four proponents should be invited to submit proposals. The OPG Evaluation Team recommended, and the OPG Board approved, inviting all of the respondents except Ed. Zublin AG to submit proposals. Based on its qualifications and responses at the proponents' meeting, OPG concluded that Ed. Zublin AG had insufficient experience compared to the other proponents in the areas of tunnel design and construction.

OPG determined that having at least four proponents in the next phase was desirable because of the likelihood that not all of them would submit a proposal. At least two, and preferably three, proposals would be necessary to ensure sufficient competitiveness and to enable an effective negotiation phase. OPG also approved payment of a $600k honorarium to each unsuccessful firm submitting a conforming proposal. Such honorariums are frequently used on large complex projects such as the NTP to partially defray the cost of

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preparing proposals. Proposal preparation for a project of this size and complexity requires a significant investment of time to properly complete the necessary design drawings and engineering specifications. OPG concluded that offering an honorarium to the unsuccessful firms would likely result in receiving more and better quality responses to the RFP.[10]

3.3 Risk Assessment

In November of 2004, OPG retained URS Corporation ("URS") to perform both qualitative and quantitative risk assessments of the NTP. The scope of the URS work included identification, assessment and presentation of NTP risks in a way that provided the groundwork for the risk management methods used as the NTP proceeded. URS analyzed the NTP within an overall risk management framework provided by the Code of Practice for Risk Management of Tunnel Works.[11]

The initial URS report covered qualitative risk assessment, and included identification and assessment of project risks. This work was undertaken jointly with OPG and Hatch subject matter experts drawn from the NTP project team. A three-day workshop was conducted to validate the list of identified risks and assess their likelihood and consequences.

URS assembled the resulting information into an initial high-level risk register, which collected and organized the risks identified. The risk register also indicated the party responsible for control and management of each risk, as well as contingency plans and measures for risk mitigation that had been identified, but not yet implemented. The risks and consequences are first presented as "inherent risks" without mitigation and then shown as "residual risks" remaining after mitigation. The risk register was designed and implemented

[10] The Ontario contractors industry, including the Ontario Association of Architects, the Ontario General Contractors Association and the Canadian Design Build Institute, have strongly endorsed the practice of honorariums when procurement of complex projects are done through the Design Build process. The Government of Ontario's Infrastructure Ontario has included this process in its project tenders.

[11] This code was issued by The International Tunnelling Insurance Group "to promote and secure best practice for the minimisation and management of risks associated with the design and construction of tunnels." It can be found at http://www.imia.com/downloads/external_papers/EP24_2006.pdf.

as a living document that would be frequently updated as the project moved from conceptualization to completion.

Following the completion of the qualitative risk assessment, URS undertook the quantitative assessment. The quantitative assessment was performed using a Monte Carlo simulation based analysis. The methodology consisted of identifying the conceivable hazards that could occur during the project, and assessing a probability of occurrence for each hazard as well as their potential cost and schedule impacts. The probabilities and consequences were then combined to identify potential outcomes in 5,000 scenarios for the project and to obtain probability distributions of possible outcomes. Based on these distributions, the probability, cost and schedule values were established by members of an expert panel, which included NTP team members from OPG and Hatch. The expert panel's efforts were facilitated by URS. The analysis only addressed the costs and risks impacts for the project (i.e., to the time of commissioning) and did not include risks associated with post-project operation.

As both the qualitative and quantitative risk evaluations undertaken by URS were done prior to completing the solicitation for a design-build contractor, OPG recognized the need to update the quantitative risk evaluation once the final proposals were received from the design-build proponents. This update was undertaken by an expert panel of NTP team members consisting of personnel from OPG, Hatch and Torys LLP ("Torys"), OPG's external legal counsel. It was completed on July 27, 2005, the day before the selection of the successful proponent was approved by the OPG Board. OPG used the model that had been developed by URS and updated it to:

- confirm analytical assumptions and numerical inputs;
- add any additional hazards identified and remove any that were no longer relevant; and
- reflect any differences among the proposals submitted.

In the OPG update, the top two contributors to potential cost increases were: 1) "Dispute Review Board interpretation of Agreement unfavourable" and 2) "DSC [Differing Subsurface Conditions] claim due to rock strength." These same two factors, in reverse order, were also

identified as the top two contributors to potential schedule delay for which OPG, rather than the contractor, would be responsible. Based on the results of the updated quantitative risk assessment model, OPG estimated that for the tunnel construction portion of Strabag's proposal, a $96M cost contingency and a 36 week schedule contingency were required to achieve a 90 per cent probability that the project would remain within its budget and schedule.[12] OPG then determined the overall cost contingency to be $112M for the project as a whole.

3.4 Invitation to Submit Design-Build Proposals

In late December 2004 invitations to respond to the RFP were sent to the four firms identified in the preceding section with the proposals due on April 15, 2005. The RFP consisted of three volumes: the first contained the invitation letter, instructions, the draft DBA and various appendices; the second volume contained concept drawings; and the third contained construction labour agreements from the Electrical Power Systems Construction Association ("EPSCA"). The RFP requested that the proponents return a form indicating whether they would be submitting a proposal.

Three of the four invitees, namely Niagara Tunnel Constructors, Niagara Tunnelers and Strabag AG, indicated that they would submit a proposal. In January 2005, these three proponents participated in a mandatory site visit. In association with the visit, the proponents also reviewed background documents in a data room that had been established by OPG near the project site.

Amendments to the invitation documents were distributed starting February 2005. In total, five amendments were issued reflecting changes made in response to questions or issues raised by the proponents. Based on a request from all three proponents, the deadline for

[12] As noted in the OPG risk update (page 2): "The schedule contingency only took into consideration OPG-accountable schedule risks, as the DBA compensated OPG for contractor-accountable delays through the payment of Liquidated Damages. Moreover, the schedule contingency assumed that the project schedule, which was set by the contractor, included some contingency as determined by the contractor."

submitting proposals was extended from April 15 to May 13, 2005 on the understanding that no further extensions would be authorized.

3.5 Proposal Evaluation and Negotiation

OPG prepared a detailed evaluation process as described in the first sub-section below. The second sub-section discusses the actual evaluation of the proposals received and the negotiations with the various proponents to refine the proposals prior to selecting the successful firm.

3.5.1 Evaluation/Negotiation Process Overview

OPG used a structured evaluation process developed jointly with the OR to evaluate the three proposals submitted. The Evaluation Team consisted of experienced personnel from OPG, Hatch and Torys. The team used evaluation criteria and scoring that were established for this project based on input from the both OPG and external members of the project team and documented before the proposals were received. A summary of the evaluation categories and their relative scoring is shown in Table **3** below.

Table 3 - Evaluation Categories and Scoring

Summary Evaluation Categories	**Score (#)**	**Percent (%)**
Compliance with Owner's Mandatory Requirements	Yes/ No	Yes/ No
Design & Construction Approach	80	16%
Response to GBR	45	9%
Price/Schedule/Flow Guarantee	150	30%
Adherence to Invitation and Agreement	45	9%
Risk Management Approach/Impact on OPG Risk Profile	65	13%
Project Team & Key Personnel	45	9%
Preliminary Project-Specific Safety/Security/Emergency Plans	35	7%
Environmental Compliance Plan and QA/QC Program	35	7%
Total	**500**	**100%**

The technical aspects of the proposal were scored by the Technical Evaluation team whose members were experienced in areas such as construction, hydraulics, tunneling and geotechnical analysis. The proposals' commercial aspects were scored by the Commercial Evaluation team whose expertise included procurement, risk analysis, legal and financial analysis. Each team had a lead responsible for coordinating activities and ensuring adherence to the evaluation process. Each team worked independently so that the technical and commercial issues were evaluated on their own merits. The two teams together comprised the Evaluation Team.

The evaluation process was designed to ensure that all proposals received a complete, fair and unbiased review. During the initial evaluations, the proposals were given code names [Fox (Niagara Tunnel Constructors), Bear (Niagara Tunnelers) and Moose (Strabag)] so that the evaluators did not know which company's proposal they were reviewing.[13] Legal advice regarding the evaluation process was obtained from both OPG internal counsel and Torys on an ongoing basis.

A Steering Committee was established to provide oversight of the Evaluation Team. The Steering Committee consisted of the Project Sponsor (OPG Senior Vice President), the Project Director (OPG Vice President) and the OR Project Manager. The Steering Committee's role was to oversee the evaluation process by reviewing Evaluation Team activities and discussing the evaluations with the team. This process served as an additional check that the evaluations were comprehensive and conducted in a fair and unbiased manner. The Steering Committee worked in parallel with the Evaluation Team and reviewed key areas of the proposals identified by the Evaluation Team. The Steering Committee was responsible for recommending the successful proponent to the MPC, which, after reviewing

[13] The proponents were as follows:

- Niagara Tunnel Constructors made up of Hochtief (50%), Aecon (20%) and Vinci (30%) with engineering by Hochtief & Klohn Crippen
- Niagara Tunnelers made up of Obayashi (80%) and Kenaidan (20%) with engineering by Jacobs, Black & Veatch and Golder Associates
- Strabag AG made up of Strabag (100%) with Dufferin as subcontractor and engineering by ILF and Morrison Hershfield

and confirming the selection, sought approval of the recommendation from the full OPG Board.

During the evaluation process OPG met with the various proponents in order to clarify the proposals. Once the initial evaluations were complete, OPG negotiated separately with each of the proponents in order refine the proposals so as to obtain the 'best value' proposal from each proponent. Additional information and proposal modifications produced during the negotiations were used to re-tabulate the evaluation scores. The evaluation criteria used during the negotiation phase were those used in the evaluation phase. A Negotiating Team comprised of OPG staff from the Evaluation Team and the Steering Committee, the OR Project Manager and legal counsel represented OPG in the negotiations.

3.5.2 Proposal Evaluation/Negotiation

A chronology of the evaluation/negotiation process is presented in Table 4 below.

Table 4 - Evaluation / Negotiation Process Chronology

Activity	Date
Proposals received by OPG	May 13, 2005
Proposals received by evaluation team	May15, 2005
Clarification meetings with Proponents	May 24 to 26, 2005
Decision to negotiate with three Proponents	May 29, 2005
Negotiation meetings with all Proponents	June 15 to July 9, 2005
Negotiation meetings with two leading Proponents	July 14 to 15, 2005
Final scoring of two leading proposals	July 17, 2005
Recommendation for Award (to MPC)	July 28, 2005
Recommendation for Award (to OPG Board)	July 28, 2005

In the initial stages of the evaluation, each member of the Technical and Commercial Evaluation teams performed his or her evaluations independently without consulting with other team members. The OR Project Manager ensured that the same Evaluation Team

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member evaluated the same areas in each proposal. The OR Project Manager also obtained additional information from each proponent as required by the Evaluation Team and Steering Committee and distributed this additional information to all members of the Evaluation Team.

After completion of independent evaluations, the OR Project Manager convened separate meetings of the Technical and Commercial Evaluation teams to discuss scoring of the proposals. The OR Project Manager reviewed the scoring criteria and then asked attendees to present and discuss their scoring in the key areas of concern in an attempt to reach a consensus score. The OR Project Manager recorded the consensus score for each of the evaluation criteria on a consolidated evaluation form.

The Steering Committee reviewed the evaluation results and requested justification from members of the Evaluation Team as appropriate. Once the Steering Committee was satisfied that the evaluation procedure was followed, well documented and that each proposal was evaluated fairly and without prejudice, the Steering Committee recommended proceeding to negotiations with all three parties. The Steering Committee also kept the MPC apprised of the negotiations through verbal updates.

Between May 29 and July 17, 2005, the evaluation scores were tabulated several times as additional information became available in the course of the negotiations. The scoring at the end of the July 12th tabulation had Strabag and Niagara Tunnel Constructors within 2 per cent of each other (with Niagara Tunnel Constructors in the lead) and Niagara Tunnelers about 8 per cent behind. Based on these standings, the Evaluation Team agreed to restrict the final round of negotiations to Strabag and Niagara Tunnel Constructors, the two highest scoring proponents.

Final negotiation meetings were held on July 14 and 15, 2005 with Niagara Tunnel Constructors and Strabag, respectively. At these meetings the two proponents were required to respond to a number of questions on details of their proposals and also to ensure attendance of the key individuals who would work on the project. Each of these key people was interviewed by the Negotiating Team. Following these meetings, the Evaluation Team

met to re-tabulate scores. The results of the re-tabulation had Strabag and Niagara Tunnel Constructors with virtually the same score. The two were separated by less than 0.4 per cent, with Strabag leading.

To break this virtual tie, the Evaluation Team agreed that each of the eight core team members who were present at the final scoring meeting would be polled on which proponent should be awarded the contract. The eight members were asked to write their recommendations on a slip of paper that was provided to the OR Project Manager. The OR Project Manager then randomly selected the slips of paper representing each member's selection at which point each in turn was asked to explain his or her choice of proponent.
The results of the polling yielded a 5 to 3 margin in favour of Strabag. After the polling was complete, members of the Evaluation Team were asked individually if they had any significant reservations about recommending Strabag. None of the members, including the three who voted for Niagara Tunnel Constructors, expressed any concerns about selecting Strabag.

On this basis, the Evaluation Team recommended that Strabag be awarded the contract for the NTP. The Steering Committee concurred with this recommendation and presented it to the MPC on July 28, 2005. The MPC discussed this recommendation with the Steering Committee before deciding to endorse it to the entire OPG Board. The OPG Board approved the award of the contract to Strabag subject to OPG arranging satisfactory financing. OPG then proceeded to enter into contract negotiations with Strabag.[14]

3.6 Contract Approval

Between late July and mid-August 2005, OPG and Strabag undertook an intensive period of negotiation to finalize contract details. During this period, OPG and Strabag agreed on all contract provisions including the final details of the GBR, financial security and contract pricing. Once the negotiations were concluded, OPG waited for final confirmation of project financing from the Ontario Government before the agreement was signed. On August 18,

[14] Per the terms of the RFP, the two unsuccessful bidders were each paid $600k in October 2005.

2005, the Minister of Finance issued a Directive to the OEFC to lend OPG up to $1B for construction of the NTP. The DBA was signed that same day.

4.0 PROJECT BUSINESS CASE AND BUDGET

As part of its approval process for the project, OPG prepared a Full Release Business Case that was reviewed and approved by OPG Senior Management and OPG Board in August 2005. The Business Case package presented to the OPG Board contained:

- a recommendation and executive summary;
- a Business Case Summary ("BCS"), which discussed the project history, issues, risks execution and management, alternatives, and financial analysis; and
- Appendices including a Release Quality Estimate ("RQE") showing a detailed project budget from inception to conclusion; financial modelling assumptions and a tabular risk profile including consequences and mitigation measures.

These documents are all included in the CD of NTP Key Documents accompanying this Exhibit.

Prior to presenting this material to the full OPG Board, the MPC had undertaken a more detailed review of the financial analysis underlying the project. This review involved several presentations on:

- financial assessment of the project including the impact of rate regulation;
- the model used to analyze the project including the assumptions underlying the model and its operation;
- the modeling used to develop the estimate of incremental energy production from the project;
- the risk matrix developed for the project including risks, consequences and mitigation; and
- the Project Definition Rating Index ("PDRI") developed by the Construction Industry Institute.

To confirm the results of the financial analysis, management obtained an independent third-party assessment. This assessment, done by Access Capital, was presented to the MPC prior to recommending approval of the project to OPG Board. The assessment concluded that OPG's financial analysis team was proficient, and that the financial model produced accurate, verifiable results and correct calculations of various costs. The Access Capital report noted that the 90-year life of the project was longer than would be typically used for evaluating power projects, but that it was consistent with the project's design life, and, in any event, OPG's model allowed for analyzing shorter lives. The report also noted that the potential variability in available water would make private financing of this project difficult without mitigation or a significant reserve, but noted that the existence of rate regulation with a variance account to recognize the impacts of both favourable and adverse water conditions would mitigate this risk.

The BCS also included the results of the sensitivity analyses, which were undertaken to test the impacts of alternative assumptions. Among the assumptions tested were:

- periods of high and low water availability (based on the upper and lower quartiles of historical water availability, respectively) during the project's first five years of operation;
- an overall five per cent decline in available water from historical levels throughout the 90-year life of the NTP;
- ten percent higher cost;
- a service life of 30 years; and
- elimination of the 10-year Gross Revenue Charge ("GRC") payment holiday.

Under most of these scenarios, the project remained competitive with the 8 cents/kWh price, then used as a proxy for the price of renewable energy alternatives.

5.0 DESIGN-BUILD AGREEMENT

The DBA between OPG and Strabag was signed on August 18, 2005. An electronic copy of the DBA is included in the CD of NTP Key Documents accompanying this Exhibit. It remained in effect until December 1, 2008, the effective date of the Amended Design Build

Agreement ("ADBA") as discussed below. The DBA consisted of a main agreement and numerous appendices, which together set out the terms that governed Strabag's construction of the project and OPG's requirements and payment for this work. This section summarizes the major provisions of the DBA.

The main body of the DBA specified that the intake canal and structure, tunnel, outlet canal and structure, and associated facilities comprise the project. It provided that Strabag will construct these facilities in accordance with the DBA (including the Owner's Mandatory Requirements, the Contractor's Proposal Documents, Final Submittals, Applicable Law and other terms of the agreement) and good industry practices. It contained a date for Substantial Completion of the project, which is defined as the date the tunnel is ready for its intended use with water flowing through it. GBR C formed part of the DBA and is the basis on which any claims for differing subsurface conditions ("DSC") were to be assessed. The DBA explicitly allocated risk between OPG and Strabag in a manner that both parties accepted on an informed basis. It also specified that OPG would not supervise or direct Strabag's means and methods of completing the project.

The DBA (Section 11.1) provided for the establishment of a Dispute Review Board ("DRB") to assist OPG and Strabag in resolving any performance disputes that were not resolved by good faith negotiation. Once a dispute was referred to the DRB, it was charged with preparing fully reasoned written recommendations on an appropriate resolution. The parties could either accept the recommendations or either party could indicate its rejection by giving the other party notice of its intent to take the matter to arbitration under the Rule of Arbitration of the International Chamber of Commerce.[15] Recommendations not rejected by notice within 30 days were to be deemed accepted by both parties.

In the DBA, Strabag warranted that it had the requisite experience and qualifications to successfully complete the project and that it would only engage competent and qualified sub-

[15] The DBA originally provided that a dissatisfied party could seek judicial review rather than arbitration, but this was changed in Amendment 1 made on March 15, 2006. Amendment 1 also substantially modified the operation of the DRB.

contractors. Strabag also represented that it prepared its proposal documents with the same care and skill that would be applied by leading professional engineers in Canada and the United States for a similar type of project. The DBA named certain key project personnel that could not be changed without OPG's approval. Furthermore, the DBA identified that worker and public safety are primary goals of the project. It also required Strabag to protect the environment and to meet all of the conditions of approval in the project's EA.

In terms of financial security, the DBA required that Strabag provide one or more letter(s) of credit in a total amount of not less than $70M. Strabag was also required to provide parental indemnities guaranteeing its performance and indemnifying OPG for any damages resulting from a breach by Strabag. Prior to Final Completion of the project as determined under the DBA, Strabag was required to deliver a maintenance bond of 10 per cent of the contract price. This bond remains in force until the end of the warranty period, which is one year following the date of Substantial Completion, but may be extended if any defects require correction during the warranty period.

The DBA additionally required Strabag to procure and maintain the following insurance: worker's compensation coverage, motor vehicle liability ($5M), errors and omissions ($10M), and, as required, marine watercraft hull and liability ($25M). Strabag was required to self-insure for construction equipment. OPG was required to procure and maintain builders' all risk insurance ($80M), wrap-up liability insurance ($25M) and, as required, marine cargo insurance.

Finally, the DBA contained certain bonus and liquidated damages clauses that recognized the benefits of early completion and the costs of delay, respectively, and the possibility that the tunnel would deliver greater or lesser flow than the contract required. The DBA provided Strabag an incentive of $125,000 during the period November to March inclusive and $90,000 during the period April to October inclusive for each complete day that actual Substantial Completion occurred before the contracted date. For each complete day that actual Substantial Completion occurred after the contracted date Strabag was obligated to

pay OPG liquidated damages of $250,000, from November to March inclusive, and $180,000, from April to October inclusive. If flow testing revealed that the tunnel delivered more than the contracted flow (500 m^3/s $\pm$2 per cent for measurement error), OPG was to pay a bonus based on a sliding scale established in the contract. Similarly, if the tunnel delivered less than the contracted flow, Strabag was obligated to pay graduated liquidated damages. The liquidated damages amounts are twice the bonus amounts. In any event, the total liquidated damages or bonus from all provisions could not exceed 20 per cent of the contract price.

The DBA contained numerous appendices that form part of the agreement. Among the most significant were:

- Appendix 1.1 (j), which established the contract price of $622.6M by major components, the major items being a) the diversion tunnel at $406.9M, b) the TBM at $78.2M, and c) the Intake Channel, Accelerating Wall and Approach Wall at $54.9M;
- Appendix 1.1(t), which contained the specifications for the TBM;
- Appendix 1.1 (vv), which set out the Owner's mandatory requirements, including that the primary elements of the Niagara Tunnel Facility Project were required to be designed and constructed for a service life of 90 years with no tunnel outages during that time, and that Strabag was required to install, test and commission a new high-powered TBM suitable for safely excavating in the ground conditions as described in the GBR;
- Appendix 1.1 (sss), which summarized all of the work that the contractor is expected to perform;
- Appendix 2.2(a), which presented an organization chart of the contractor's personnel showing the key personnel that require OPG approval for changes;
- Appendix 2.4(d), which presented the safety and security plans;
- Appendix 2.12(c2), which showed an outline of Strabag's Quality Assurance/Quality Control programs;
- Appendix 5.4, which was the GBR underlying the contract; and
- Appendix 11.1(a), which was the Dispute Review Board Agreement.

6.0 CONSTRUCTION UNDER THE DESIGN-BUILD AGREEMENT

6.1 Project Documentation

6.1.1 Project Charter

The Project Charter sets out at a high level the need and justification for the project, as well as its objectives, deliverables, budget, management approach and the authority of the OPG Project Director. It is included as Appendix A to the Project Execution Plan, which is found in the CD of NTP Key Documents accompanying this Exhibit. The Project Charter was signed by the Project Sponsor, the OPG Project Director and the Manager of the Niagara Plant Group ("NPG") as the ultimate customer for the project.

6.1.2 Project Execution Plan

The Project Execution Plan ("PEP") is OPG's guiding document for the NTP. Its purpose is to identify, define and categorize the issues that are key to project success as early as possible, and to provide the project team members, end users and line authority with a common understanding of the project and how it will be executed. The PEP was developed in consultation with the project team members. It identifies project objectives, scope, responsibilities, strategies, constraints, processes and mechanisms to be employed in management of the project.

The PEP has been regularly reviewed and updated as necessary during the execution of the NTP. Version 0 was prepared and signed during Phase One of the NTP, the planning and procurement phase, which covered the development and release of the RFP, the evaluation of proposals, negotiation with proponents, the negotiation of the DBA with Strabag and the approval of the project by OPG Board. Phase One commenced in June 2004 and was completed in August 2005 when the contract with Strabag was signed.

PEP Revision 1 incorporates the activities in Phase Two of the NTP, the construction and commissioning phase, which covers detailed design, the construction of all elements of the NTP under the DBA, and the work necessary to place the facility into service. PEP Revision 2 covers construction of the NTP under the Amended Design Build Agreement, discussed

below, which was negotiated with Strabag following release of the Dispute Review Board recommendations. Revision 3 addresses the strategies and procedures that will be employed for the completion, closeout and turnover of the project. It also incorporates changes as a result of the revised OPG Risk Management Plan (discussed below) and the execution of the first amendment under the ADBA. Organizational changes at OPG are also reflected in the third revision of the PEP. Included in the CD of NTP Key Documents accompanying this Exhibit are the four full revisions of the PEP.

The OR, as Project Manager, is responsible for developing and maintaining the PEP in consultation with the project participants. Each section of the PEP has an owner (listed in PEP Appendix B) who is responsible for recommending updates to that section for submission to the OR. Project execution is periodically audited against the PEP by the Project Director to ensure that the plan is being followed and updated as necessary.

The PEP establishes the following objectives for the project:

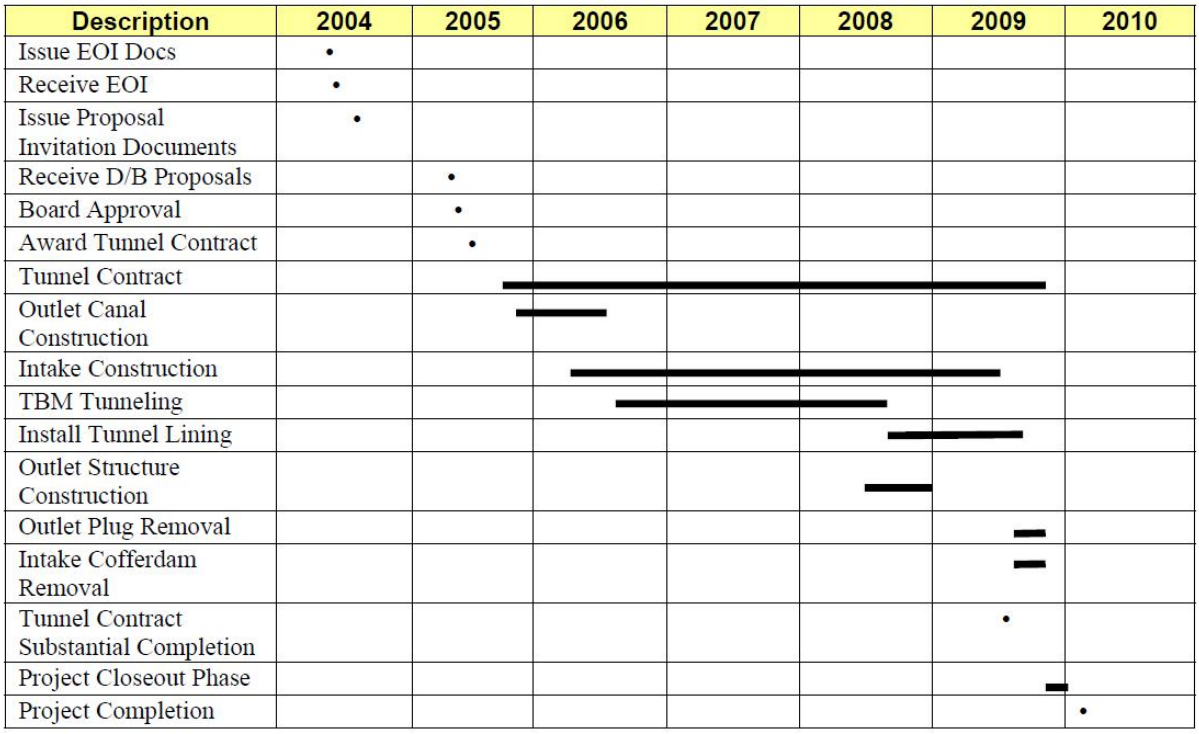
- Safety – The project's primary objective is safety, with the goal being to complete the Project without fatalities, critical injuries and lost time injuries, and to maintain public safety.
- Environmental Protection – The NTP must meet the commitments contained in the EA, the conditions of the EA approval, and all legislated environmental and mitigation requirements.
- Quality – The design and construction must meet all specified performance requirements, including a 90-year service life without any outages for key elements of the facility including the tunnel, intake structure and outlet structure. The project must also deliver the Guaranteed Flow (500 m^3/s) or the contractor will have to pay liquidated damages.
- Cost and Schedule – the project is to be maintained within the approved schedule and budget.

The PEP contains a project scope (shown in Section 3 of the PEP) that organizes all the activities of the project. The major breakdown is:

- Third Party Requirements, which includes work on environmental commitments, permits and community impact agreement elements;
- Tunnel Contract, which refers to the selection of the design-build contractor and negotiation of the contract;
- Tunnel Construction, which encompasses the construction of the intake structure and channel, the tunnel and the outlet structure and canal;
- Enabling Activities and Miscellaneous Construction, which covers work on sub-surface rights, rights of way, road improvements and associated survey activities; and
- Project Management, which relates to plans, schedules, approvals and other project management activities performed by the OPG Project Director or the OR Project Manager.

The PEP also contains a summary schedule which presents a breakdown of the project milestones and major construction activities. Figure 4 below shows the schedule from the PEP Revision 1, as of March 27, 2006.

Figure 4 - Schedule from PEP Revision 1 (March 27, 2006)

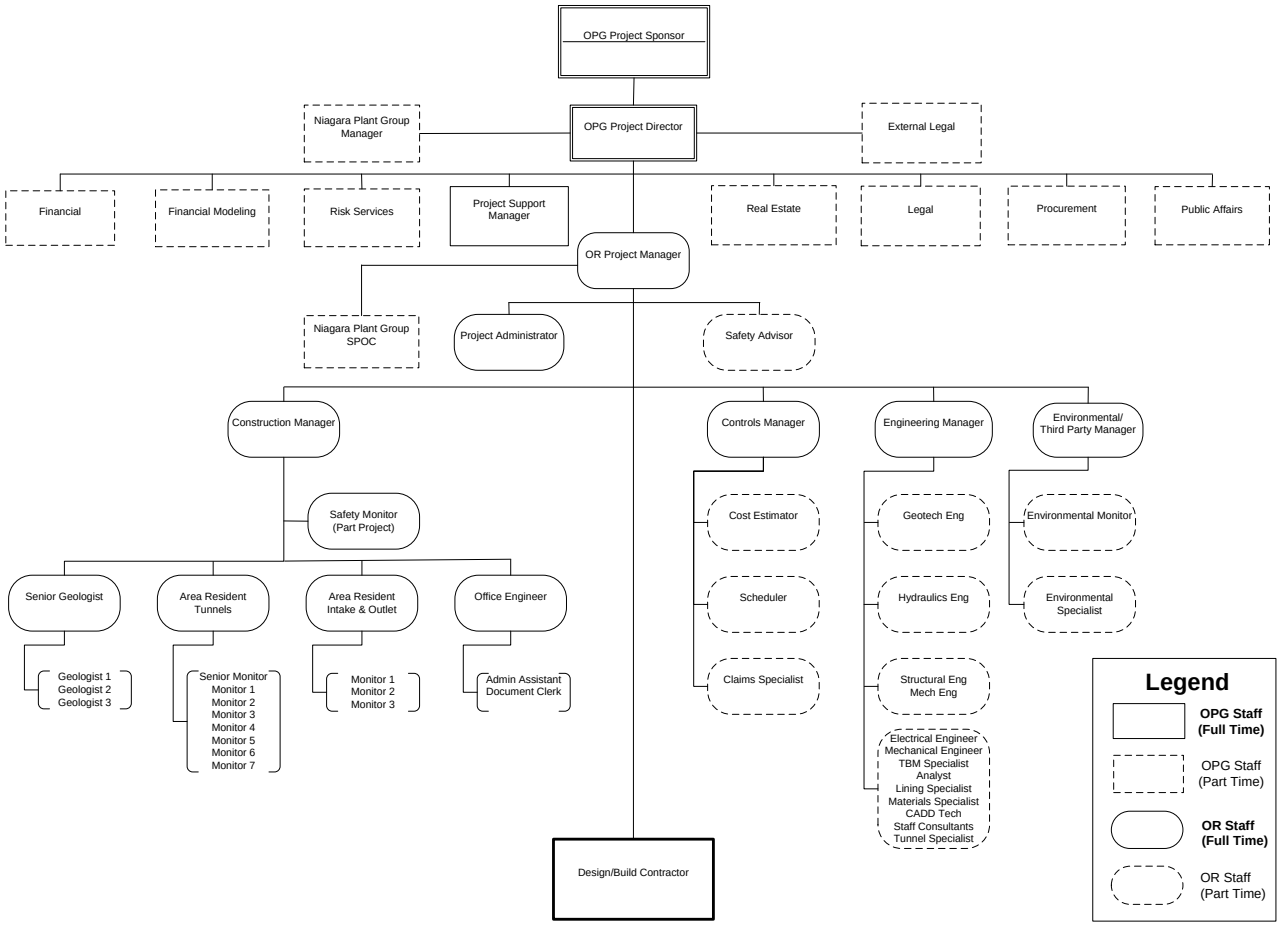


Description	2004	2005	2006	2007	2008	2009	2010
Issue EOI Docs	•						
Receive EOI	•						
Issue Proposal Invitation Documents	•						
Receive D/B Proposals		•					
Board Approval		•					
Award Tunnel Contract		•					
Tunnel Contract							
Outlet Canal Construction							
Intake Construction							
TBM Tunneling							
Install Tunnel Lining							
Outlet Structure Construction							
Outlet Plug Removal							
Intake Cofferdam Removal							
Tunnel Contract Substantial Completion						•	
Project Closeout Phase							
Project Completion							•

6.2 Project Management

This section discusses the management of the project under the DBA. The Organization Chart in Figure 5 below summarizes the project management structure during construction (Phase 2).

Figure 5 - Niagara Tunnel Project – Phase 2 (Construction)
Summary Organization Chart



6.2.1 OPG Project Sponsor

The Project Sponsor is the OPG senior executive directly responsible for the project and provides senior management oversight. The Project Sponsor reports to the Senior Vice President, Hydro-Thermal Operations. The Project Sponsor is the chief liaison between the project team and OPG Board and other OPG senior executives including the Risk Oversight Committee ("ROC") and Enterprise Leadership Team ("ELT"). Among the Project Sponsor's other responsibilities are to issue the Project Charter, review the project Risk Management Plan for adequacy, and review and endorse the Project Execution Plan and Project

Communication Plan. The Project Sponsor also reviews the weekly and monthly progress reports prepared by the OR and facilitates necessary funding approvals for the project.

6.2.2 Project Director

The Project Director is the OPG employee directly responsible for the overall execution of the NTP and is accountable for meeting the safety, environmental, cost, schedule, and quality objectives of the project. He directs the OR, supervises the internal OPG groups working on the project, liaises with the NPG and keeps the Project Sponsor informed about the project's progress and any issues with respect to it.

The Project Director integrates OPG's work activities with those of all other project participants. He is responsible for reviewing and facilitating approval of project cost estimates, budgets and timelines. The original negotiation of the DBA, renegotiation of the ADBA and any subsequent amendments were all overseen by the Project Director. He is the key point of contact between OPG and Strabag.

One of the Project Director's main activities is to oversee the working relationship between OPG and the OR. The Project Director manages the OR contract and is the primary contact between OPG and the OR. He approves the OR's project delivery team, ensures that the project reporting from the OR, including weekly progress and construction reports, meets OPG's needs and that necessary OPG resources are available to the OR. Working with the OR, the Project Director also approves contractor invoices for payment.

In terms of project documentation, the Project Director oversees preparation and updates of key project documents such as the Project Charter, Business Cases and the PEP. He ensures that information about the project is communicated to OPG senior management and within OPG on a regular basis. The Project Director reviews all external communications about the project and is the liaison with external parties about the project.

6.2.3 Owners Representative

The Owner's Representative ("OR"), Hatch Mott MacDonald in association with Hatch Acres ("Hatch"), provides independent monitoring, review, auditing, testing, and reporting of the contractor's designs, activities and products. Hatch administers the contract, performs continuous review of contract performance and coordinates project meetings and documents. Hatch has a full-time onsite organization whose main objective is to ensure the contractor's compliance with the DBA/ADBA and to facilitate achievement by OPG of the project's safety, cost, schedule and quality objectives.

OPG chose Hatch to be the OR for the following reasons:

- Hatch Mott MacDonald is one of the top tunneling firms worldwide.
- Hatch, working with Acres Bechtel, acted as the Owner's Representatives when this project was tendered in 1998 and OPG was very positive about Hatch's performance.
- Acres had provided engineering support on Beck 3 and the tunnel design since 1991. Hatch purchased Acres in June 2004.
- The sub-surface risks of this project were investigated and analyzed by Acres and Hatch. As a result, Hatch has considerable knowledge about the project, including geological risks, permitting and costs. To transfer this information to another firm would have required substantial time and effort.
- Hatch is Canadian owned and headquartered in Mississauga. As a result, OPG has excellent access to senior personnel at Hatch.

Hatch has acted as the OR through both phases of the NTP. In Phase One, the planning and procurement phase, the OR was active in all aspects of the solicitation including pre-qualification of bidders and the RFP process. At the pre-qualification stage, the OR developed the evaluation criteria, reviewed submissions and made recommendations to OPG as to which entities should be pre-qualified. In collaboration with OPG and external legal counsel, the OR prepared the RFP documents provided to prospective bidders, including the proposed contract and the GBR, and administered the bidding process.

Hatch worked with OPG's procurement function to evaluate the bids received, including the design drawings and the proposed means and methods, for consistency with the RFP requirements. Hatch organized the RFP evaluation process. The OR Project Manager served on the Evaluation Steering Committee. Other Hatch staff members served on the Technical and Commercial Evaluation teams.

The OR and OPG staff negotiated with the bidders to obtain their best proposals. Once Strabag was selected as the successful firm, the OR continued to participate in the negotiations to finalize the terms of the DBA.

In Phase Two, detailed design, construction and commissioning, the OR provided oversight and monitoring to facilitate achievement of OPG's safety, cost, schedule and quality objectives. OR monitoring staff provided full-time coverage on construction shifts during tunneling and final lining production shifts. The OR performed on-site quality oversight of tunnel construction and reviewed actual construction against project drawings and specifications to ensure compliance with the Contractors Construction Quality Plan, Contract Drawings, Method Statements and Specifications. The OR recorded daily work activities, performed quality audits of Strabag's operations and maintained detailed records showing the progress of work activities.

In instances where construction deviated from the provisions of the contract, the OR took steps to remedy the matter. Where additional engineering studies and investigations were required, the OR either conducted them or arranged for them to be performed. The OR also reviewed notices, drawings and other documentation from Strabag and responded appropriately after consulting with OPG. The OR maintained the administrative systems that it established and prepared budget and weekly and monthly progress reports on design and construction and facilitated and recorded various project meetings. Finally, the OR reviewed third party invoices and Strabag's applications for progress payments prior to submitting them to OPG for payment.

With respect to safety, where Strabag is the "constructor" (as that term is defined under the *Occupational Health and Safety Act*, Ontario), the OR monitored and audited Strabag's safety performance. At the intake area, when OPG is the constructor (explained more fully in Section 6.5.3), the OR was responsible for managing project site safety on OPG's behalf in accordance with OPG's policies and procedures.

6.3 Project Risk Management

In addition to the PEP, OPG periodically updated the OPG Risk Management Plan ("RMP"). The RMP was prepared at the onset of the project by building on and extending the risk assessment work initially developed by URS prior to contract award as discussed above in Section 3.3. It documented how risk management is performed for the NTP, as well as the roles and responsibilities of the project team members, the methodology and tools to be used, and the schedule for risk management activities. The RMP summarized the NTP risk management process as consisting of the following activities: risk identification, risk assessment, risk response planning, risk monitoring and control, and risk reporting.

Strabag independently conducted risk assessments as part of its proposal preparation and submitted a summary risk register with its proposal. Both OPG and Strabag continued independent risk management initiatives during the design/construction phase of the NTP so as to protect their proprietary information. However, OPG and Strabag were required to adopt significant portions of the "Code of Practice for Risk Management of Tunnel Works" (referenced above in Section 3.3 as a condition of obtaining insurance coverage for the project). These provisions required OPG and Strabag to share details of their respective risk assessments and to systematically coordinate construction phase risk management efforts to identify risks and mitigate them to the extent possible.

As a result of these requirements, two risk registers are discussed in the OPG Risk Management Plan: the OPG Qualitative Risk Register ("OPG Risk Register"), which later evolved into the NTP Key Risk Register as discussed below, and the Construction Phase Qualitative Risk Register ("Combined Risk Register").

Until June 2009, the OPG Risk Register was reviewed by OPG and the OR periodically and was maintained by the OR on OPG's behalf. The OPG Risk Register listed and managed overall risk from an OPG perspective. It included the hazards giving rise to each risk, the causes of these hazards and their potential consequences. A tracking number and priority level was provided for each hazard. The OPG Risk Register also addressed mitigation measures, and evaluated the residual risks remaining after mitigation. For each risk, a responsible individual, known as the risk champion, was identified.

OPG took over maintenance of the OPG Risk Register in June 2009, when the ADBA was signed. The OPG Risk Register was renamed the NTP Key Risk Register to reflect the new project risk management approach adopted in the context of the Superseding Business Case Summary contingency assessment whereby top priority risks from the Combined Risk Register and the OPG Risk Register were grouped into key project risks.

Under the new process, OPG and the OR assessed each key project risk using selected attributes such as probability and financial impact. Based on the assessment, they developed risk response actions. If an identified project risk was to be mitigated, the mitigation activities reducing the probability and/or impact were documented and mitigation plans were revisited, as required, to align with any updates identified in the Combined Risk Register. A remediation plan was developed for each key risk to identify the actions that would be taken if the risk occurred. Actions taken to monitor the risk were also identified and updated as necessary.

OPG and the OR reviewed the NTP Key Risk Register Summary on a monthly basis. In addition, under the revised risk management approach, OPG's Project Risk Management ("PRM") group held schedule and cost risk workshops to estimate the worst, most likely and best case durations for the remaining key construction activities.

The OR, on OPG's behalf, and Strabag jointly prepared the Combined Risk Register based on input from both parties' standalone risk registers. It followed the same format as the OPG Risk Register, but identified only those risks specific to the design and construction of the

NTP. OPG and Strabag met approximately every 6 weeks to review the Combined Risk Register. At these meetings, the parties identified new risks, tracked mitigation measures and evaluated the impact of such measures on existing risks. Items that were viewed as no longer representing a hazard were marked as closed, but were kept in the register for reference.

6.4 Oversight

6.4.1 OPG Management

Given the size and scope of the NTP and the importance that OPG places on its successful completion, the project has received significant management attention since its inception. The OPG executives directly responsible for managing the NTP, the Project Sponsor and Project Director, have been discussed above. This section discusses the additional oversight provided by OPG's senior executives.

The senior executive for hydroelectric matters, historically the Executive Vice President, Hydro ("EVP Hydro") and now the Senior Vice President Hydro-Thermal Operations ("SVP Hydro-Thermal"), is responsible for all of OPG's regulated and unregulated hydroelectric activities.[16] He oversees the execution of all hydroelectric development projects including the NTP. The NTP Project Sponsor reports to him. Since 2005, the EVP Hydro was directly involved in all significant decisions with respect to the NTP.[17] The SVP Hydro-Thermal sits on the Steering Committee established under the ADBA to resolve any disputes between OPG and Strabag that arise during the construction of the NTP.

Since the beginning of NTP construction, the status of the project and issues associated with it have been discussed at the standing OPG senior management meetings that address matters significant to the overall operation of the company.

[16] In January 2012, these responsibilities were incorporated into the newly created position of Senior Vice President Hydro-Thermal.

[17] Prior to December 2005, the Senior Vice President, Energy Markets was responsible for the NTP.

The EVP Hydro (now the SVP Hydro-Thermal) was the primary liaison between the NTP team and the MPC, which provided OPG Board oversight of the project throughout most of its history.[18] In addition, SVP Hydro-Thermal develops materials and recommends items for the CEO to submit to the OPG Board in relation to the major approvals necessary for the NTP.

During the period of the dispute with Strabag over differing sub-surface conditions, discussed below, OPG also created a Contract Litigation Oversight Committee ("CLOC") to provide independent oversight of OPG's strategy for contract dispute resolution and negotiations and to advise the CEO on the conduct of the dispute. The CLOC was chaired by OPG's Chief Financial Officer and included external members Norman Inkster, former head of the RCMP, and Barry Leon, a lawyer then at Torys who specialized in international litigation and arbitration. Both men have significant experience in investigating and resolving complex disputes.

The CLOC also obtained independent technical advice from John Hester, an expert on tunnel construction and the tunneling industry. In the period leading to presentation of the dispute between OPG and Strabag to the DRB, the CLOC provided independent review of the strategy OPG employed and the presentations OPG made. After the DRB rendered its decision, the CLOC continued to advise the company on negotiations with Strabag until an agreement was reached.

[18] In mid-2010, the Risk Oversight Committee (ROC) assumed responsibility for OPG Board oversight of major projects and the MPC was disbanded.

6.4.2 OPG Board

OPG's Board of Directors is actively engaged in overseeing management's actions with respect to the NTP and has been since the beginning of the project. As discussed below, review and direction of the project has been undertaken by a committee of the OPG Board. Currently, it is the Risk Oversight Committee ("ROC"); previously, it was the Major Projects Committee ("MPC"). For major decisions, the entire OPG Board was involved in approving the actions previously reviewed and recommended by the ROC or the MPC.

The MPC and full OPG Board were involved in reviewing and approving the pre-qualification and RFP processes discussed above, which led to the selection of Strabag. In fact, MPC members participated in the meetings used to determine which of the pre-qualified firms would be invited to submit proposals. The MPC also reviewed and recommended the final list of invited firms to the full OPG Board, which approved it.

Following receipt of proposals, the MPC was kept apprised of the evaluations and negotiations with proponents. The MPC reviewed and accepted management's selection of Strabag and endorsed management's recommendation that the project be approved to the full OPG Board.

Once construction began, the MPC was regularly informed of its progress and visited the site. When it appeared that the project would be delayed beyond the contracted completion date, the MPC requested and received weekly progress reports. Throughout OPG's DSC dispute with Strabag, the MPC was actively involved in reviewing OPG's positions and assessing the impact of alternative resolutions.

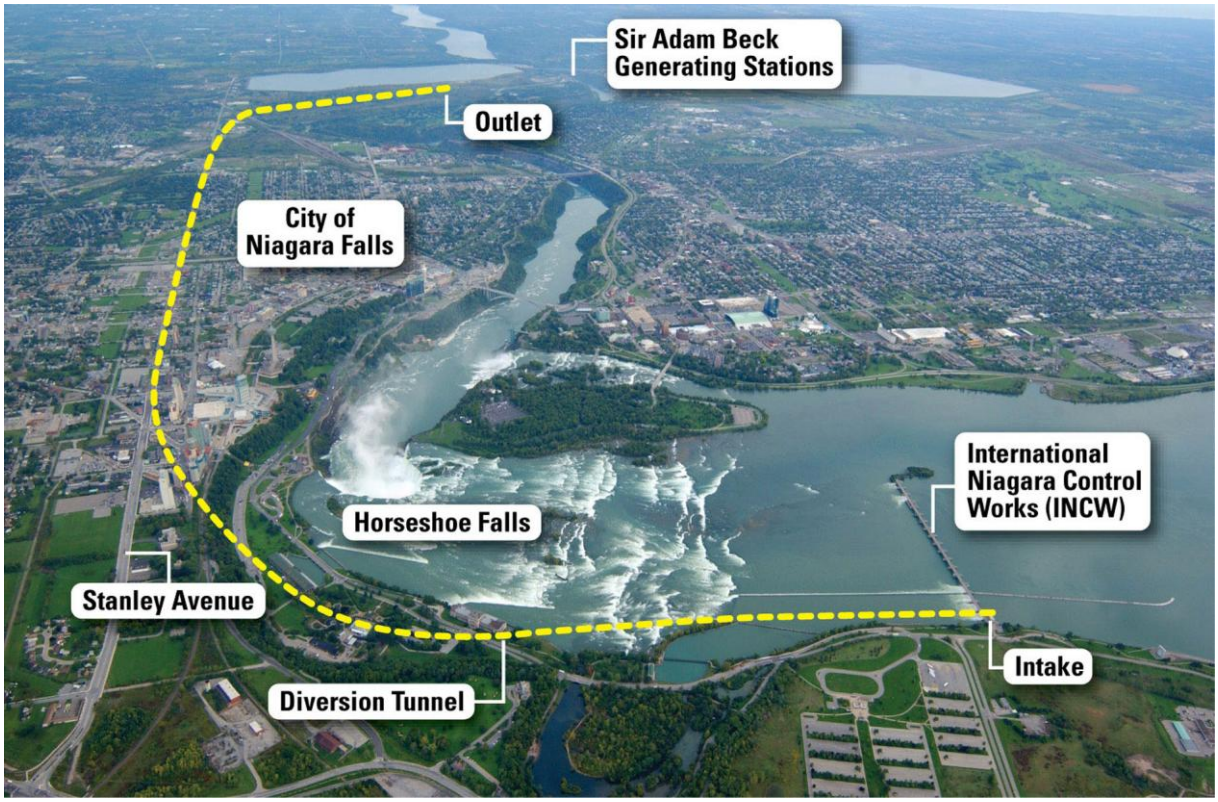
Once the DRB rendered its decision, the MPC reviewed the available alternatives with management and endorsed the approach of negotiating a revised contract with Strabag. The MPC monitored the negotiations and upon their successful completion, recommended the Amended Design Build Agreement ("ADBA") to the full OPG Board for approval along with the Superseding Business Case supporting the new project budget.

6.5 Construction Progress

6.5.1 Introduction

Mobilization of the workers and equipment needed to begin the project started soon after the contract was signed in August 2005. Construction began with site preparation activities, which commenced in September 2005. Site preparation covered three primary areas: the outlet site, the intake site and the site offices. This work consisted of clearing, grading, road construction and the erection of fences and gates.

Photo 2 - Aerial View of Project



The project construction offices were located off of Stanley Avenue in close proximity to the outlet. Temporary trailers were used until the project site offices were installed and occupied in January 2006. Both the OR ("Hatch") and Strabag occupied offices on the site.

The three major activities associated with the project were:

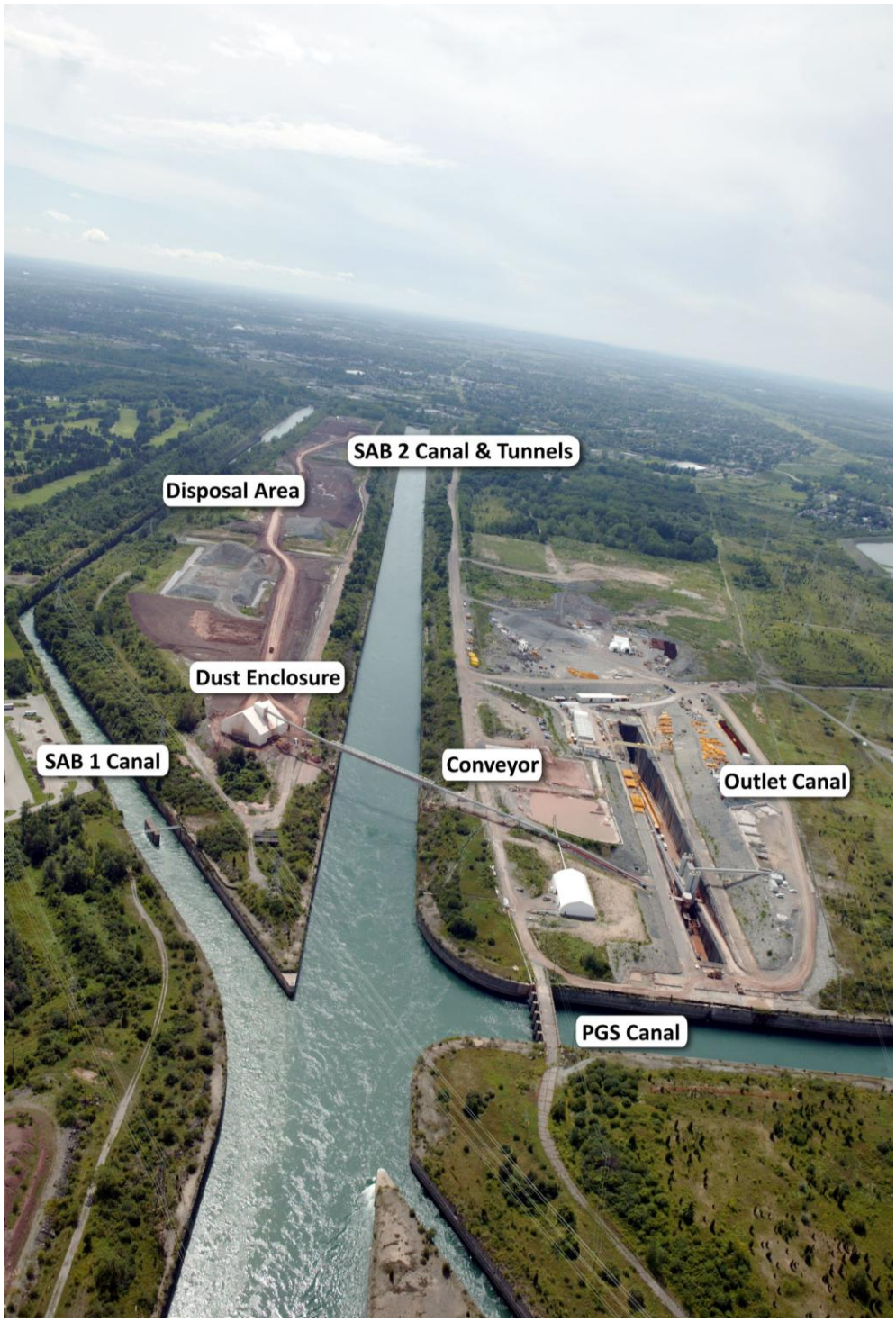
- outlet construction, which included the canal that connects the project to the PGS canal as well as the outlet structure;
- intake construction, which included the intake channel in the Niagara River, the intake structure, building a new accelerating wall and demolishing the old one, and building an approach wall along the shore of the Niagara River; and
- tunnel construction, which included the TBM, the tunnel drive, invert concrete, profile restoration, arch concrete and grouting operations.

These activities are discussed in detail in the following sections.

6.5.2 Outlet

NTP construction began at the outlet. The project offices, materials and equipment storage area and concrete batch plant were all located close to the outlet. The rock excavated from the NTP was transported by a series of conveyors from the TBM through the outlet to the storage area between the SAB 1 and the SAB 2 canals. Queenston shale was segregated from other rock types for re-use by Ontario brick manufacturers as required by the EA Conditions of Approval.

Photo 3 - Aerial View of Outlet Site



Outlet work was carried out in two stages. The first stage involved the construction of the outlet canal and tunnel opening for the commencement of TBM operation. Site preparation, overburden removal and excavation started at the outlet in September 2005. This was followed by drilling, blasting, and excavation to create the outlet canal. A ramp was built to enable workers and equipment to access the outlet. To protect the exposed Rochester shale, Strabag applied shotcrete within the outlet canal excavation. Strabag also installed geotextile mesh on the canal walls to control loose falling rocks. The resulting outlet canal is 350 metres long, 23 metres wide and between 30 and 40 metres deep. During the construction of the tunnel, the outlet canal served as the entry point for the TBM and as the staging site for the transfer of materials to and from the TBM. With the NTP in operation, this canal delivers water from the tunnel into the current PGS canal connecting the PGS reservoir to the crossover where the existing tunnels and canal meet.

Photo 4 - Outlet Site "Crossover"

The second stage of the outlet work was undertaken after the TBM finished boring the tunnel, and consisted of the construction of the reinforced concrete outlet structure, installation of the control gate and removal of the rock plug to complete the connection to the existing PGS canal. The outlet structure was completed in March 2012. It incorporates the transition between the round tunnel and the rectangular steel gate. Guides for the permanent gate and for a sectional service gate (stop logs) are embedded in the concrete of the outlet structure. A surge shaft designed to contain any surge that occurs during gate closure and to provide future access into the tunnel was also incorporated into the structure.

The articulated outlet gate was completed in December 2012, and the dry-testing and commissioning of the outlet gate was completed by February 2013. Outlet gate testing was also carried out in March 2013 after the tunnel was watered to ensure the gate functioned properly under wet conditions.

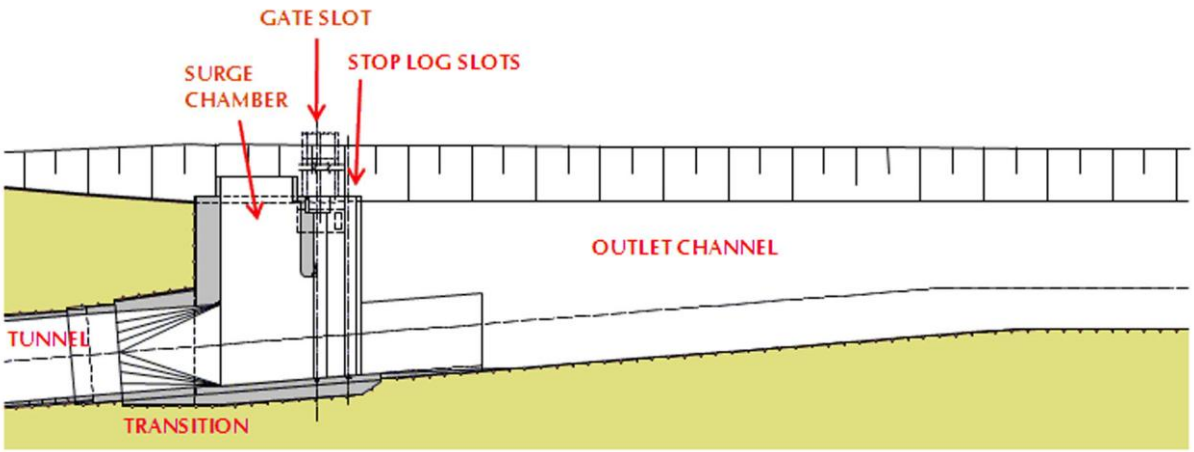
Both the intake and outlet gates were originally expected to be installed and commissioned on a fixed price basis. Due to the delay in the project, installation of the gates did not begin until late 2012, some four years later than originally anticipated. By that time, the estimated cost for the installation and commissioning of the gates had increased. To recognize this increase, the original fixed price contract was restructured as a time and materials contract.

Photo 5 - Outlet Gate

Rock plug removal work began in November 2012. Stage 1 of the work, line drilling along the sides of the plug, was completed at the end of November 2012. Stage 2, blasting to thin the plug from 44 metres to 12 metres, began in early December 2012 and was completed by the end of the month. The vehicle ramp, which was built to enable workers and equipment to access the outlet, was excavated during Stage 3. The fourth and final stage consisted of removing the remaining 12 metres thickness of the rock plug by in-water blasting. This work was conducted after the outlet gate had been closed and the outlet canal had been flooded with water from the PGS canal. A five week outage of the PGS was required to complete Stage 4 of the rock plug removal. This outage took place from February 6 to March 8, 2013. The final rock plug blast was successfully conducted on February 12, 2013.

The extension of the project schedule also impacted the rock plug removal schedule, resulting in additional costs being incurred by Strabag's subcontractor, Dufferin Construction Company ("DCC"), because the removal work was performed during the winter rather than the summer as initially contemplated. Consequently, the parties agreed to modify the original fixed price contract and proceed with this work on a time and materials basis. DCC work records were submitted daily to Strabag and the OR, and costs were tracked to determine the actual cost of the work.

Figure 6 - Outlet Diagram



Between March 3 and 4, 2013, controlled water inflow was used to fill the tunnel. As the water level is higher at the intake, valves at the intake gate were used to complete the initial filling process. Once the tunnel was full of water and the wet testing of the gates had been completed, the intake gate sections were removed, the outlet gate was raised and water started flowing through the tunnel.

6.5.3 Intake

Work on the intake proceeded in three phases. The first phase began with marine work. This consisted of in-river replacement of the ice accelerating wall, which is used to control the flow of water and ice,[19] and the construction of the cofferdam erected to keep the intake area dry. This work was completed in October 2007. The second phase was the work on the intake structure carried out within the cofferdam, as explained more fully below. The third phase was removal of the cofferdam and ice groyne.[20]

The initial plan was that OPG would maintain an "owner-only" status for the entire project with Strabag being responsible for all "constructor" obligations under *Occupational Health and Safety* (Ontario) legislation. However, as OPG operates the water diversion structure and control gates pursuant to the *Niagara Diversion Treaty* of 1950, a significant aspect of maintaining marine safety rested with OPG. Furthermore, it was not until the second phase, when Strabag operated within the area isolated by the cofferdam, was Strabag practically able to operate free from the influence of OPG's use of the control gates and any ongoing OPG operations. As a result, in June 2005, OPG applied to the Ministry of Labour ("MOL") and received approval to designate a discrete portion of the NTP as a separate part project ("INCW Part Project"). For the first and third phases of intake site work, OPG was designated as the constructor. Separating out the discrete INCW Part Project was an important part of

[19] This structure is also sometimes referred to as the Accelerator or Acceleration Wall.

[20] The ice groyne was constructed upstream of the INCW structure to enhance ice flow in the intake channel and to provide ice protection for the cofferdam during the NTP's construction phase. It consisted of a large rock base with build-up of granular material. Once the sectional gates for the intake were put in place and the cofferdam was removed, the ice groyne had fulfilled its purpose and was removed.

maximizing safety and was necessary due to the physical and legal constraints involved with these portions of the work.

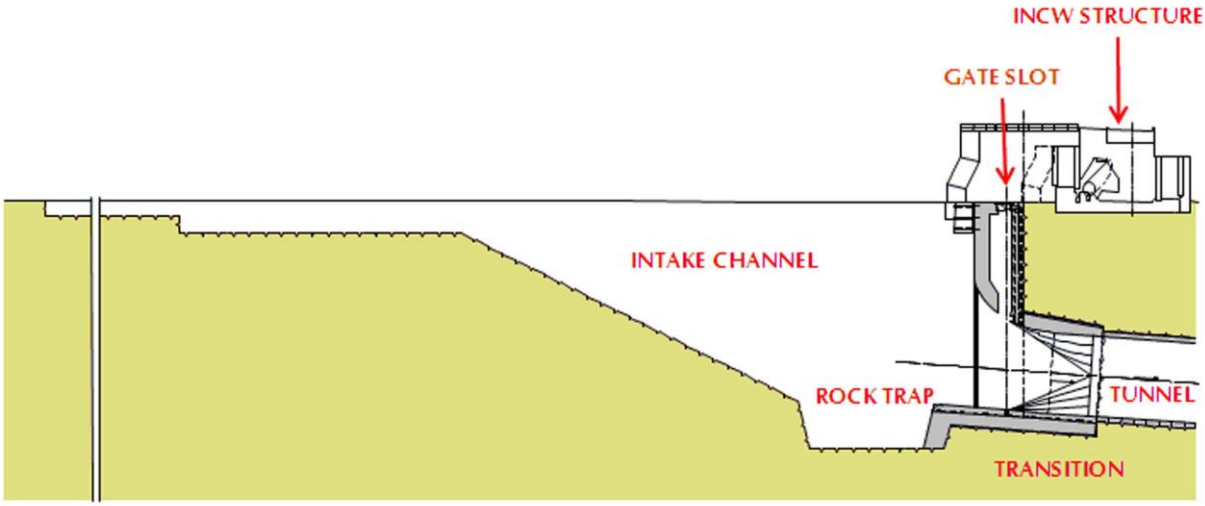
6.5.3.1 Facilities

The intake portion of the work consisted of the following elements:

- excavation of a 140 metre long underwater approach channel in the riverbed;
- construction of a submerged bell-mouth intake structure in the Niagara River beneath Bay 1 of the existing INCW;
- construction of a new accelerating wall and the demolition of the existing one; and
- construction of a new approach wall.

Each of these elements is discussed below.

Figure 7 - Intake Diagram



The underwater channel was constructed in two stages. Underwater blasting was used to initially shape the channel in the river bottom. Then a 61 metre by 122 metre area upriver from and surrounding gate #1 was enclosed by a cofferdam consisting of steel sheet piles used to frame the cells, with a concrete seal at the riverbed and gravel fill. Pattern grouting through the cells was used to fill in any voids in the underlying limestone rock.

Upon completion of the cofferdam, the water was removed by pumps to create a dry area where the channel could be completed using the drill and blast method. This area contains the tunnel intake where water is drawn into the tunnel and served as the exit and disassembly point for the TBM, Backup Unit ("BU") and other tunnel equipment.

Photo 6 - Aerial of Intake Site Surrounded by Cofferdam

The intake structure is designed to allow water to access the tunnel at a flow rate that is sufficiently slow to prevent a surface vortex and air entrainment, and to allow surface water and ice to continue to flow through the INCW Bay 1. It includes guides for sectional service gate, a removable guide structure, ten 13.3 metre wide gate sections, handled by mobile crane, and a square to round transition from gate slot to tunnel. The sectional gate allows for closure of the tunnel to enable dewatering when and if required. The intake also includes a rock trap along the bottom of the channel to capture rocks and other debris moving along the

.

river bottom before they enter the tunnel. The intake structure was constructed within the cofferdam.

To connect the intake with the main tunnel, a pilot grout tunnel about 300 metres long was excavated and surrounding rock was grouted to reduce the groundwater inflow impact on the TBM drive through the final section of the tunnel under the Niagara River. The grout tunnel consisted of a 7 metre by 8 metre excavation accomplished by drilling and blasting. The grout tunnel was constructed to allow high pressure grout injection into all the rock cracks and crevices surrounding the tunnel to form a 26 metre diameter watertight envelope to prevent flooding from the river above as the TBM surfaced. As the TBM moved toward the surface it ascended by boring along the grout tunnel.

The 530 metre accelerating wall in the Niagara River begins at Pier 5 of the INCW. The accelerating wall is used to control the flow of water and ice. It was built of large precast concrete boxes with a newly developed locking system to withstand the forces of ice, water and debris in the Niagara River. In-water blasting as well as tremie concrete (concrete placed directly in water) pads were used to form the level bed on which the precast boxes sit. They are anchored with concrete and filled with gravel. A cast in place concrete slab caps the wall.

Photo 7 - Aerial View of New Accelerating Wall

The pre-existing accelerating wall was located about 30 metres closer to shore than the new wall. It was constructed of creosoted timber cribs filled with rocks, which were demolished and removed during the course of constructing the new wall.

The 360 metre intake approach wall is located upstream of the INCW structure and runs along the south shore of the Niagara River. The approach wall is a combination of a training and a retaining wall replacing the previously sloped river bank. It extends from the INCW to the SAB Tunnel No. 2 intake. It was constructed using the same method as described above for the accelerating wall. The intake approach wall and the accelerating wall work together to

optimize the water flow and ice-flushing capability of the INCW structure inside the accelerating channel.[21]

6.5.3.2 Scheduling

Mobilization of marine equipment (barges, tugs, cranes, etc.) started in April 2006. In-water blasting for the new intake channel started in May 2006. Replacement of the accelerating wall started in June 2006 along with construction of the cofferdam. Accelerating wall replacement was essentially completed in December 2006. Cofferdam foundation grouting and dewatering were completed in July 2007.

6.5.3.3 Intake DSC Dispute

Starting in May 2006 a series of project change notices were filed by Strabag on behalf of its sub-contractors based on claims of DSC and other changes to the work required at the intake. The intake DSC disputes alleged various differences between the actual conditions experienced during construction of the intake channel, accelerating wall and approach wall and those presented in the GBR. Specific DSC claims included the discovery of a greater amount of overburden on the riverbed, a difference in the riverbed elevation and the presence of boulders within the riverbed.

Disputes also arose with respect to other aspects of the work at the intake site. These included the identification of "fractured rock seams" found in the intake channel, inefficiencies claimed to have resulted from the schedule acceleration requested by Strabag, the re-alignment and lengthening of the new acceleration wall, and obstructions encountered while installing the grout curtain for the cofferdam.

[21] In addition to freezing water from the Niagara River itself, masses of ice can form in Lake Erie and float down the river. This situation may create blockages, ice damage, or reduction of flow into the power plant intakes. Chunks of ice may even enter intake tunnels causing potentially serious damage, unless ice-flushing measures are taken.

OPG and Strabag could not agree on the scope of the changes in work that resulted from these differences or on the appropriate change in contract price to reflect the additional work. OPG requested documentation supporting the claimed amount of about $19.3M in extra costs. After reviewing the documentation, OPG estimated the cost of these changes at roughly $5M and provided a change directive increasing the value of the contract by this amount. Eventually, one of the sub-contractors, McNally Construction, filed a lien and commenced a lien action against OPG and others.

OPG and the parties negotiated a compromise in settlement of all issues, claims and actions relating to the disputes over work at the intake, and any other potential claims related to intake work performed prior to July 25, 2007. Under this settlement, OPG agreed to change the contract price by a total of $7.5M, which represented an additional $2.5M above the $5M contract change already agreed to by OPG. A settlement agreement and a full and final release to this effect were signed on September 20, 2007. A court order was subsequently registered to vacate the lien and the lien action.

6.5.3.4 Intake Completion

Following the removal and disassembly of the TBM and BU from October 2011 to March 2012, work at the intake focused on the completion of the concrete pour for the intake structure. This was achieved by the end of April 2012.

Once the intake structure was completed, the work associated with the installation of the intake gate commenced. The intake gate consists of a sectional steel service gate and guide tower. However, unlike the outlet gate which is a permanent structure, the intake gate sections and guide tower are installed only when the tunnel is to be dewatered, and will be stored at a nearby location when not in use. The intake gate underwent dry fit testing, and installation and removal of the guide tower to ensure it functioned as designed.

While the intake gate was installed and commissioned during much of 2012, tunnel equipment (i.e., invert bridge system) continued to be disassembled and removed using a

550 tonne crane. The scrap steel leftover from the equipment removed was sold for approximately $800k.

The last intake gate section was installed on November 13, 2012. MOL was on site the same day to discuss the transfer of control from Strabag to OPG for the purposes of completing the third phase of intake work: the removal of the cofferdam and ice groyne, and the placement of approach wall blocks. On November 15, 2012, OPG resumed the role of constructor at the intake and the intake channel (area within the cofferdam) was flooded.

Cofferdam removal work commenced on November 19, 2012 and was completed on February 3, 2013. The ice groyne was then removed by excavation in still water commencing February 23, 2013 and was completed on March 3. As of March 8, the third phase of intake site work was complete and OPG was no longer the constructor at the intake site. The MOL was then informed on March 11 that Strabag was the constructor until the end of the project.

6.5.4 Tunnel Construction

6.5.4.1 Tunnel Boring Machine

When the Tunnel Boring Machine ("TBM") used for the NTP was put into service, it was the largest open gripper main beam TBM in the world with a diameter of 14.44 metres.[22] The TBM and back-up was 150 metres long and weighed about 4,000 tonnes. It was named "Big Becky," the winning entry from a naming contest among local schools. The name reflects the contributions of Sir Adam Beck in hydroelectric development and the size of the TBM.

[22] There are two main types of TBMs: open (unshielded) and closed (shielded). Open TBMs require systematic rock-support behind the cutter head because the final lining is installed later. They use a gripper system that pushes against the tunnel side walls to advance. Where a concrete liner is required, it is installed by means of second pass operation after the TBM has completed mining. Closed TBMs are equipped with a shielded body under which supporting operations, including installation of a precast concrete lining system, are carried out. They advance via thrust cylinders that push off against the tunnel lining segments installed behind the machine. The entire tunnel is excavated and lined in one-pass.

Use of an open TBM was designed to allow for the installation of Strabag's proposed pre-stressed cast in place concrete liner with an impermeable waterproof membrane.[23] With an open TBM, the initial lining consists of rock bolts, friction anchors, wire mesh, steel channels, and shotcrete, which are used in various combinations depending on the conditions encountered.[24] This initial lining is intended to support the rock until the waterproof membrane is placed and the final concrete lining is cast. The TBM was configured to permit initial support adjustments as required during construction based on the rock conditions encountered.

Strabag's construction methodology was scored higher by the Evaluation Team because Strabag was the only contractor that proposed a cast-in-place liner with an impermeable membrane to protect it from water egress or ingress. This was an important feature not only because it enhanced the life expectancy of the tunnel liner, but also because geological tests indicated that the Queenston shale has the potential to swell if exposed to fresh water. The waterproof membrane proposed by Strabag increased the Evaluation Team's confidence that Strabag's tunnel design would be able to meet the required 90-year lifespan. The cast-in-place liner also reduced the potential for voids to develop between the liner and the surrounding rock as could have occurred with a closed (shielded) TBM and a precast liner. Finally, with fewer construction joints, a cast-in-place concrete liner is smoother than a precast concrete liner, which leads to increased water flow because of reduced friction.

[23] During the 1998 bidding process, all of the qualified contractors had proposed a closed TBM with a precast concrete segmental lining. For this reason, the 2005 Invitation to Submit Design/Build Proposal anticipated a closed TBM with a one-pass concrete liner. Unlike the other respondents, however, Strabag considered both open and closed TBMs before arriving at their proposed approach of using an open TBM with a cast-in-place concrete lining as the most effective method of meeting the requirements of the project including the 90 year life, impermeability and target flow.

[24] The initial lining was installed in two stages using the two primary areas for installing rock support behind the TBM cutterhead, which were known as L1 and L2. Initial support in the tunnel crown was installed immediately behind the TBM cutterhead in the L1 position, and shotcrete was placed about 40 metres behind the face at the L2 position. Initial support was generally comprised of 4 metre-long Swellex friction anchors, 150 mm C-channels, and welded wire mesh. As the TBM progressed and overbreak increased, shotcrete was placed between approximately the 10 o'clock and 2 o'clock locations in the tunnel crown from additional portable sprayers at the L1 position. A shotcrete layer was sprayed in a full circle at the L2 position.

Strabag considered three TBM manufacturers in its proposal. Ultimately, it selected The Robbins Company ("Robbins") of Solon, Ohio, which is one of the preeminent TBM manufacturers in the world. The design of the NTP TBM involved experienced tunnelers and an experienced TBM manufacturer working together to develop a machine suitable for the project. Extensive geotechnical information was made available to designers. Strabag and Robbins jointly developed the schedule for manufacturing, assembling, testing and commissioning the TBM to meet the rock conditions anticipated during NTP construction. Ancillary equipment for use with the TBM was ordered from specialized firms selected by Strabag including Rowa Tunnelling Logistics of Switzerland, which supplied the back-up unit, and H&E Systems of Germany, which manufactured the conveyor belt system used to remove the excavated material.[25]

To reduce the overall duration of the project, and thereby its cost, TBM components were manufactured in North America and Europe and shipped to the site for assembly and testing. This approach eliminated the time and cost required to have the TBM components shipped to the Robbins factory in Ohio, assembled and tested, disassembled for shipment to the site and then reassembled and re-tested on site, as was initially envisioned in the DBA.

[25] The back-up unit is a 125 metre long series of trailers that moves along behind the TBM. It contains the computerized controls for the TBM and supports ancillary functions such as dust suppression, drilling, shotcrete application and removal of rock.

Photo 8 – "Big Becky" Assembled in the Tunnel Outlet Site Prior to Tunneling

Prior to agreeing to on-site TBM assembly and commissioning, OPG assessed the risks associated with Strabag's proposal against the potential schedule advantages. To mitigate these risks, representatives of Robbins, Rowa Tunnelling Logistics and other firms supplying ancillary TBM equipment were on site during assembly and commissioning. Based on this mitigation, the residual risk was considered to be low. Moreover, since the DBA contained a fixed price for the TBM and allocated all TBM related risks to Strabag, OPG accepted the TBM delivery and commissioning schedule created by Strabag and Robbins.

TBM assembly began in April 2006 within the outlet canal excavation. Assembly of the TBM and ancillary equipment was completed in August and the TBM began mining in September 2006.

During the course of the tunnel excavation, Strabag performed numerous modifications to the TBM to allow it to operate more effectively and to safely address the rock conditions being encountered. Many of these modifications occurred in the L1 area of the TBM, where rock support is first installed. These changes included removing the ring erector, modifying existing rock drills to provide more articulation, installing a new forward drill for advance rock support, replacing fixed work platforms with manlifts to improve worker access, implementing various actions to improve cutterhead reliability, and adding a conveyor for muck removal from the tunnel invert.

Ultimately, while challenging rock conditions delayed the progress of the TBM, it successfully bored one of the largest diameter hard rock tunnels ever undertaken and it did so safely.

6.5.4.2 The Tunnel Drive

Based on Strabag's baseline schedule, boring of the tunnel or the tunnel drive, was expected to begin on September 1, 2006 and conclude on August 15, 2008. This schedule anticipated average progress of 14.55 metres per day over 715 days of tunneling. The tunnel drive began as scheduled on September 1, 2006, but it did not conclude until March 30, 2011. The average daily progress achieved was 6.06 metres per day and the tunnel drive lasted 1,671 days. This delay and the costs associated with it account for the majority of the NTP's

increased cost above the original project budget. This section discusses the progress of the tunnel drive and the conditions and issues that Strabag faced and ultimately overcame. The related matter of the dispute between OPG and Strabag over differing subsurface conditions ("DSC") is discussed below in Section 7.0.

Start-up issues related to TBM crew training, ancillary equipment commissioning (e.g., ring erector and rock drills, shotcrete applicators), groundwater incursion and issues with cutterhead performance caused tunnel boring progress to be slower than projected from the very beginning of TBM operation. Strabag initially indicated that these were "start-up" issues and it could make up the lost time once these matters were resolved, but after a few months of slower than expected progress that position could no longer be sustained.

By the end of 2006, after four months of tunneling, Strabag indicated that it intended to begin installing the permanent tunnel lining (impermeable membrane and concrete) for the tunnel arch before the completion of TBM excavation rather than waiting until the end of the tunnel drive. This change was aimed at reducing the impact of the tunnel drive on the project's overall critical path and increasing the likelihood of completing the project on schedule.

In March 2007, Strabag produced a revised schedule showing the anticipated completion date for tunnel boring as March 12, 2009, some seven months later than the original schedule. The scheduled completion date for the project as a whole, however, remained unchanged because of the decision to undertake the tunnel lining concurrently with TBM boring.

TBM progress improved for a time in spring 2007 as start-up issues were resolved and the machine moved through less challenging rock layers above the Queenston shale. In May 2007, however, as Strabag was mining in the top layer of the Queenston shale immediately below the interface with the Whirlpool sandstone, a large rock block (approximately 30 tonnes) fell and damaged the TBM. TBM progress was stopped for more than three weeks, while the rock was removed and the damage repaired. Strabag filed its first claim for DSC

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based on this incident.[26] Strabag also used the stoppage to make other modifications to the TBM, including installation of a forward drilling rock drill, which were necessary to enable the installation of the new rock support measures.

In summer 2007, with the TBM now completely in the Queenston shale, the overbreak above the TBM cutterhead increased substantially and progress was slow.[27] Strabag began installing forward raking pipe spiles ("spiles") in an umbrella formation above the areas to be mined in an effort to limit the magnitude of the overbreak and to safely advance the TBM (see Photo 9 below).[28] Rock support measures behind the cutterhead including shotcrete, wire mesh, steel channels and rock bolts continued to be installed. As a result of the slow progress, Strabag submitted a revised schedule in June 2007 showing that completion of the NTP project would be delayed about five months beyond its original schedule. Given the contingency approved by OPG Board, however, the revised completion date remained within the OPG-approved schedule.

[26] This claim, contained in Project Change Notice ("PCN") 17, was eventually included in the matters that went to the DRB. The details of this notice and related dispute notices are all discussed below in Section 7.0, "Differing Subsurface Conditions Dispute."

[27] Overbreak is the cracking and loosening of rocks above the TBM cutterhead. It has the effect of distorting the circular profile created by the TBM.

[28] The spiles used in the NTP are pipes up to 9 metres long that are drilled nearly horizontally into the rock over the cutterhead in an umbrella pattern to help keep the rock in place as the TBM advanced.

Photo 9 - Installation of Spiles in an Umbrella Formation

In autumn 2007, the TBM continued mining within the Queenston shale and progress remained slow. The TBM's advance rate increased somewhat in late September as rock conditions slightly improved, allowing Strabag to cease installing spiles. During this time, Strabag first indicated that it was considering a realignment of the tunnel to allow the TBM to exit the Queenston shale sooner and thereby increase the boring rate. Strabag requested that OPG evaluate whether realignment was possible and what issues it would raise. OPG agreed to consider the implications of realignment including the need to acquire new subsurface rights and to seek an EA amendment.

In mid-October 2007, Strabag issued a progress schedule which showed a further delay in final completion to almost nine months beyond the contracted date. This was the first schedule revision that put project completion outside the date approved by OPG Board. On OPG's behalf, the OR requested Strabag to provide a Recovery Plan to mitigate the anticipated schedule overrun. Strabag's response was that the schedule delays were entirely attributable to the DSCs previously raised in various Project Change Notices ("PCN"s). Strabag also stated that it had taken whatever actions possible, so far uncompensated, in an attempt to keep the project on schedule. Strabag closed its response by indicating that the path forward required a resolution of its outstanding DSC claims.

At the end of November 2007, senior executives from OPG and Strabag met and agreed that the two parties would try to resolve their differences based on realigning the tunnel. They further agreed that if the issues pertaining to the new alignment and the DSC claims raised in the PCNs were not resolved within three months, the matter would go to the DRB for resolution as soon thereafter as possible.

By the end of November 2007, the tunnel drive reached the beginning of the area under the buried St. Davids Gorge.[29] Over the next few months, while tunneling under the gorge, overbreak increased and Strabag resumed installing spiles. Progress slowed.

At the end of December 2007, the OR received a letter from Strabag with a new realignment proposal that superseded the realignment options previously discussed. This proposal involved both a horizontal realignment, that placed the tunnel mainly underneath Stanley Avenue and reduced its distance by approximately 200 metres, and a vertical realignment to a considerably higher elevation in order to reduce boring in the Queenston shale. The proposal envisioned the completion of tunnel boring on August 27, 2010, more than two

[29] The DBA (section 5.5 (e)) defined an 800 metre area under the buried St. Davids Gorge (from approximately 1,400 to 2,200 metres) where Strabag could not claim differing subsurface conditions. This provision was included because Strabag's RFP response proposed raising the low point of the tunnel some 50 metres higher than shown in the RFP's conceptual design. Strabag made this proposal in order to reduce the tunnel's slope, which shortened the tunnel, improved its water flow characteristics and allowed Strabag to use rubber tired vehicles rather than rack and pinion rail transports.

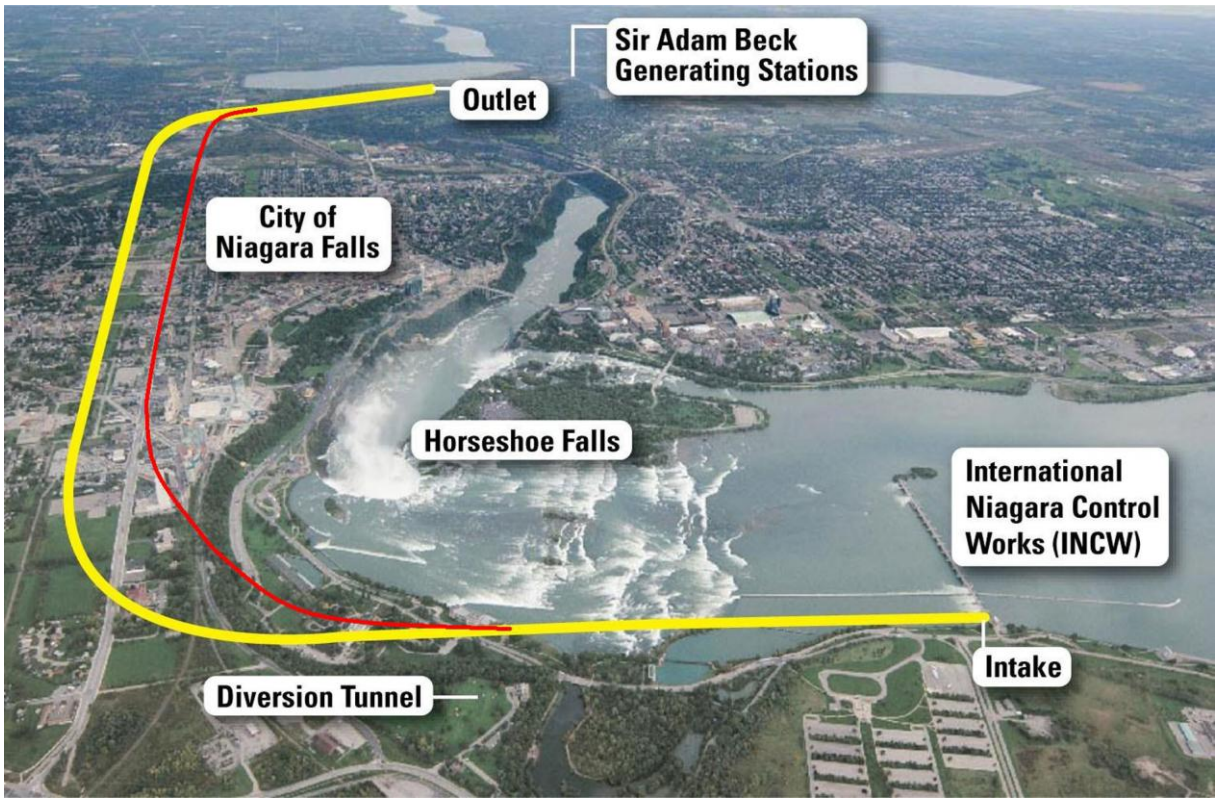
years later than the contracted schedule. The forecasted substantial completion date was June 18, 2011, some 20 months later than contracted.

OPG began exploring the issues associated with the proposed realignment. These issues included the additional subsurface property rights expropriation that would be required, the potential impacts on groundwater and BTEX rock quantities, and the potential impact on the existing tunnels. OPG submitted an application for the minor EA amendment required by the realignment, which was approved on March 31, 2008.

Throughout the early months of 2008, slow progress continued as the TBM worked under the buried St. Davids Gorge. Strabag continued to install measures to reduce overbreak and used spiles where the amount of overbreak warranted. Talks between OPG and Strabag continued in an effort to reach an agreement on a new alignment and to resolve ongoing disputes over the rock conditions and the resulting slow progress of the project. In early February, Strabag submitted a proposal for recovery of the additional costs it claimed due to DSC. By mid-February 2008, the parties agreed that they had reached an impasse and determined to take their dispute to the DRB.

During the spring of 2008, TBM progress continued to be slow, although advance rates improved as the TBM emerged from the zone of influence of the buried St. Davids Gorge. In May, OPG and Strabag agreed on horizontal realignment; vertical realignment was put on hold pending resolution of the dispute by the DRB.

Photo 10 - Aerial View of Horizontal Realignment

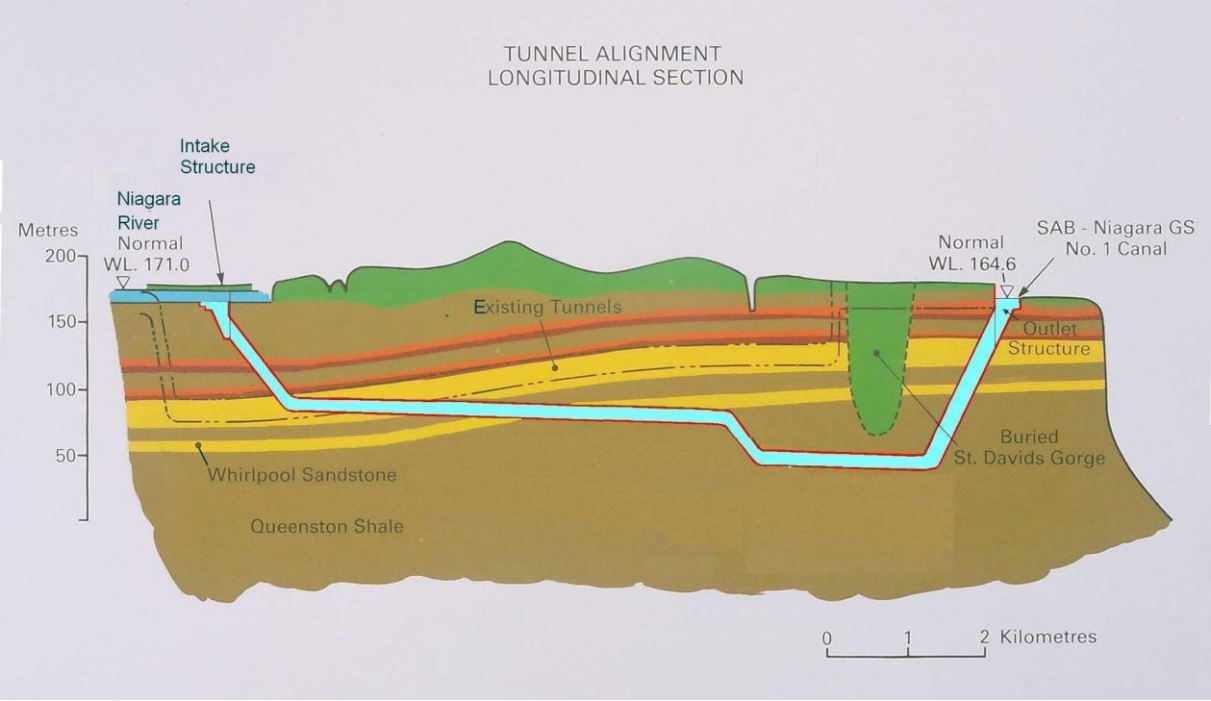


Although the TBM made relatively steady progress in the summer of 2008, averaging more than 250 metres per month from June through September, advance rates remained below plan and the schedule continued to slip. While Strabag began tunneling along the realigned horizontal route in early September, it maintained its position that vertical realignment would be addressed only in the context of an overall resolution of outstanding issues. Discussion of this overall resolution began after the DRB issued its decision in late August as discussed in Section 7.0, below.

While OPG and Strabag renegotiated the contract, tunnelling proceeded. In the fall of 2008, Strabag resumed spiling to address the substantial overbreak (greater than three metres) being experienced. In light of these conditions, Strabag determined, with OR concurrence, to begin the vertical realignment to exit the Queenston shale as soon as the horizontal realignment moved the tunnel route out from below the existing tunnels. In late October,

Strabag took a planned outage lasting almost five weeks to improve and modify TBM equipment and extend and improve the conveyor system. When Strabag resumed mining in late November, it continued advancing along the horizontally realigned route, which permitted vertical realignment to begin in late December 2008.

Figure 8 – Vertical Tunnel Realignment



Throughout the first part of 2009, TBM boring sloped up through the Queenston shale and continued along the new horizontal alignment. The TBM reached the Whirlpool formation in July and by the end of that month was one day ahead of the ADBA target schedule (discussed later in Section 9.2). In August, the arch of the tunnel reached the Power Glen shale formation and overbreak increased. Nevertheless, the TBM continued to progress ahead of the ADBA schedule.

On September 11, 2009, about 100m^3 of Queenston shale and temporary tunnel lining (shotcrete, wire mesh and steel channels) fell from the right side of the tunnel between 3,605 metres and 3,625 metres, about two kilometres behind where the TBM was then located.[30] Work was stopped immediately. There were no injuries and all workers were safely evacuated from the tunnel. The Ministry of Labour ("MOL") subsequently issued a Stop-Work Order stopping all tunnel work beyond 3,500 metres pending an investigation, remedial work and verification of the adequacy of the tunnel crown support.

Photo 11 - Fall of Ground 2009

[30] Measurements used to describe locations in the tunnel represent the distance from the outlet where tunnel boring began. This fall of ground occurred approximately 3.6 kilometres from the outlet. These measurements are often referred to as "chainage" or "station" measurements.

Remedial work involved installing a rock-fill ramp to gain access to the fall area and scaling and installation of new rock support measures in the area of the fall. In accordance with the remediation plan reviewed and accepted by the MOL, Strabag began clean up and repair of the primary rock support and lining on September 20, and continued to install wire mesh, steel channel ribs, rockbolts and shotcrete until October 12. The MOL lifted the Stop-Work Order on October 16 and the contractor proceeded to scale loose shotcrete from the tunnel crown (from 3,700 metres to the TBM) and began applying a precautionary layer of wire mesh to prevent falling shotcrete and enhance worker safety.

A full investigation of the fall of ground was conducted by Strabag and the OR. The investigations concluded that a loosening of the rock support dowels put more pressure on the face plates for the dowels than they could hold, which led to the fall. The investigations also concluded that Boreholes NF-4 and NF-4A contributed to the loosening of the dowels by allowing relatively fresh water to penetrate and degrade the rock surrounding the dowels. These boreholes were drilled in 1984 and 1990, respectively as part of the geotechnical investigation for the NRHD. Owing to the horizontal realignment, the tunnel excavation had intersected with the borehole on February 27, 2009. The boreholes were a source of groundwater inflow before being plugged with grout in March 2009.

The investigation also revealed that Strabag needed to improve monitoring procedures, protocols and frequency, as there were indications that excessive movement was detected on September 10, 2009 at a monitoring point just five metres from where the fall occurred, and that no alert was sounded and no action was taken to check on the stability of the area. Following the fall of ground incident, Strabag reported to the OR that it implemented new monitoring software, installed additional measuring stations and tunnel support enhancements, established tighter trigger levels and adopted more rigorous procedures to monitor and respond to ground movements. Strabag also noted that some of these measures either had been planned or were initiated prior to the fall of ground incident.

Due to the fall of ground and associated remedial work, tunnel boring was suspended for a total of 46 days, from September 11 to October 26, 2009. Once the remedial work was completed, Strabag undertook a planned TBM maintenance shutdown, primarily to overhaul the cutterhead, which lasted until December 8, 2009.

While the TBM was stopped due to the fall of ground, remedial work and planned maintenance shutdown, work continued on other aspects of the tunnel. This work included lining and profile restoration in the area before 3,500 metres, construction at the intake and outlet, equipment modifications, and work on the conveyor and dust enclosure.

Ultimately the fall of ground in 2009 only set back the schedule for overall NTP completion by approximately 17 days because the parties agreed under Appendix 5.3C of the ADBA that a one day delay to TBM mining translated into 0.375 days delay to the critical path.

At the time of this event, a decision was made to forego a claim under the Builder's All Risk ("BAR") insurance because Strabag's estimate to execute the remedial work was comparable to the $2M insurance deductible. Strabag's subsequent request for a Target Cost increase of $4.5M could not be substantiated by the OR records that valued the actual costs for the remedial work at $2.1M. Based on the decision to forego a BAR insurance claim, OPG offered, and Strabag accepted, a Target Cost increase by $2M. Altogether, the final impact of the 2009 fall of ground was an increase to the target schedule by 17 days and an increase to the Target Cost by $2M.

In the first part of 2010, tunnelling progress improved, but the advance rate remained below the target established in the ADBA. Strabag took measures to remove loose shotcrete and install protective wire mesh. Overbreak amounts varied, but were generally less than what had been experienced while tunnelling in the Queenston shale.

By spring 2010, the TBM was making good progress and the gap between targeted and actual performance began to significantly decrease. Progress improved further in the

summer of 2010 such that by the end of August, mining was ahead of the ADBA schedule by 15 days. Mining during this period was in the Power Glen and Grimsby formations.

At the end of 2010, tunnel boring was on track with the ADBA schedule. Progress in the later part of 2010 had continued to exceed anticipated rates, but repairs to fix the cracked TBM main beam in December required a shutdown of more than three weeks. In the beginning of 2011, excellent progress resumed such that by the end of January 2011, boring was 21 days ahead of schedule. No overbreak was experienced during this month. By the end of March 2011, tunnel boring was essentially complete. For purposes of the ADBA, TBM mining was certified as substantially complete as of March 30, 2011.

6.5.5 Tunnel Lining

6.5.5.1 Invert Lining

The invert is the bottom portion of the tunnel covering roughly the lower one-third of its circumference. As with the rest of the tunnel, the invert was initially lined with shotcrete. In early December 2008, once the TBM advanced sufficiently far into the tunnel, Strabag began installing the permanent waterproof membrane and concrete lining in the invert.

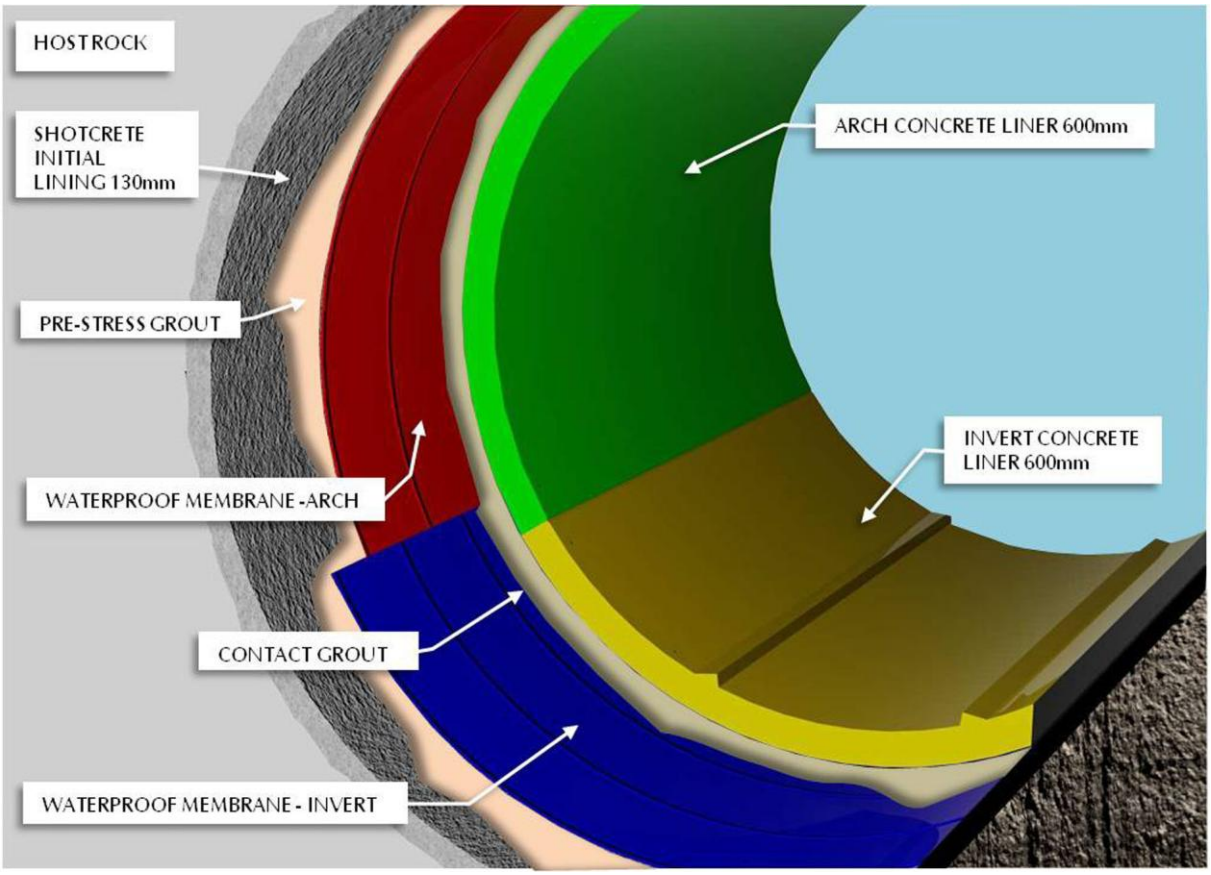
The permanent lining consists of multiple layers. A protective fleece is laid over the initial shotcrete lining.[31] Then a two-layer, impermeable waterproof membrane (a total of 3.5 mm of flexible polyolefin) is laid over the fleece.[32] The integrity of the dual-layer membrane is verified by withdrawing trapped air and creating a vacuum between the layers to ensure the membrane is impermeable. The welds which form the seams between each sheet of membrane are also tested by inflation with air to ensure their integrity. Once testing is

[31] The geotextile protective fleece consists of woven fabric material which is compatible with the waterproofing membrane material. It is backed by a thin plastic membrane on the surface facing the initial lining shotcrete, which facilitates the flow of interface grout. The geotextile fleece material and Velcro disks are attached to the shotcrete with nails. In the invert, gravity holds the membrane in place prior to pouring the concrete. In the arch, the Velcro disks hold the polyolefin membrane in place to facilitate seam welding, testing and concrete placement.

[32] The waterproof membrane is a durable and dense synthetic material. The membrane material is designed to meet high standards regarding the resistance to chloride ion diffusion.

complete and the membrane and seams are approved, a concrete liner approximately 600mm thick is poured over it and allowed to cure. The lining is illustrated in Figure 9 below.

Figure 9 - Tunnel Lining Details



The concrete lining was installed in 12.5 metre sections. Two 12.5 metre forms permitted daily advance of up to 25 metres. A purpose-built self-propelled bridge structure enabled the installation and testing of the membrane, and the pouring and curing of the invert concrete sections with minimal disruption to vehicle access through the tunnel. Invert concrete lining was completed on July 30, 2012.

Photo 12 - Testing of the Invert Lining

6.5.5.2 Profile Restoration

Profile restoration is the process of recreating the tunnel's circular shape. In some parts of the tunnel, considerable overbreak in the arch along the tunnel's top significantly altered the circular shape produced by the TBM. Profile restoration on the scale required for the NTP is not typical in tunnel construction, but was required because of the amount of overbreak experienced. As neither party anticipated this scale of restoration work, it was not included in the DBA. The amount of restoration work required the development of specialized equipment during the execution of the project.

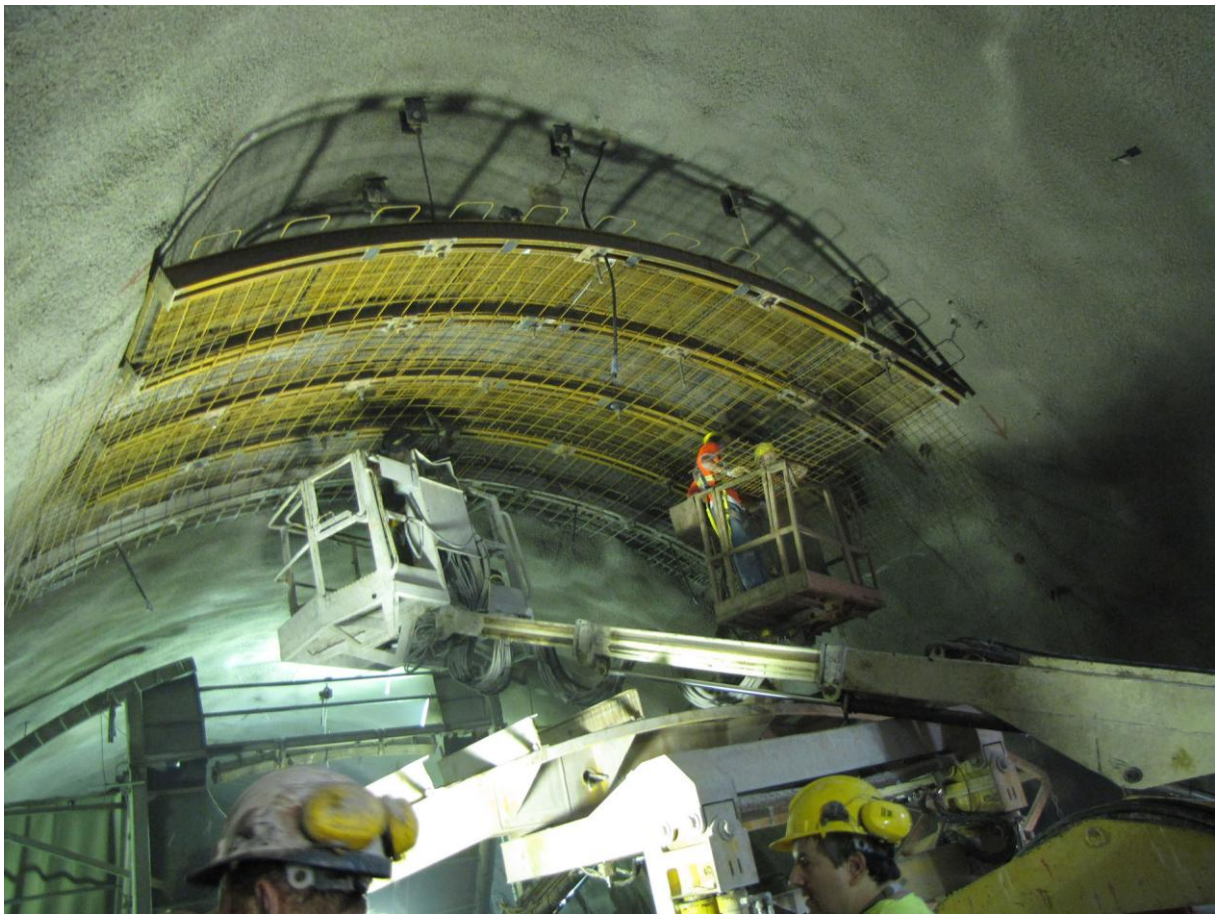
Overbreak in the invert along the tunnel bottom was much less significant than in the crown. Where necessary, shotcrete also was used to restore the invert profile. Crown profile restoration work began in September 2009.

Photo 13 – Overbreak of more than 4 metres

In areas of overbreak, profile restoration is accomplished through the application of wire mesh, shotcrete, rock dowels, sacrificial steel forms and concrete with the particular approach selected depending on the extent and shape of the overbreak. As discussed above, the amount of overbreak varied significantly in different rock formations, reaching a maximum of over four metres in some areas. In areas with little or no overbreak, profile restoration only involved grinding to remove excess shotcrete applied as part of the initial

lining. This was necessary to prevent reduction in the arch concrete thickness or radius, and to remove sharp surfaces that could damage the impermeable membrane. The circular shape and uniform concrete liner thickness are essential to facilitate specified compression of the concrete lining when injecting the pre-stress grout.

Photo 14 - Profile Restoration (Type 2)

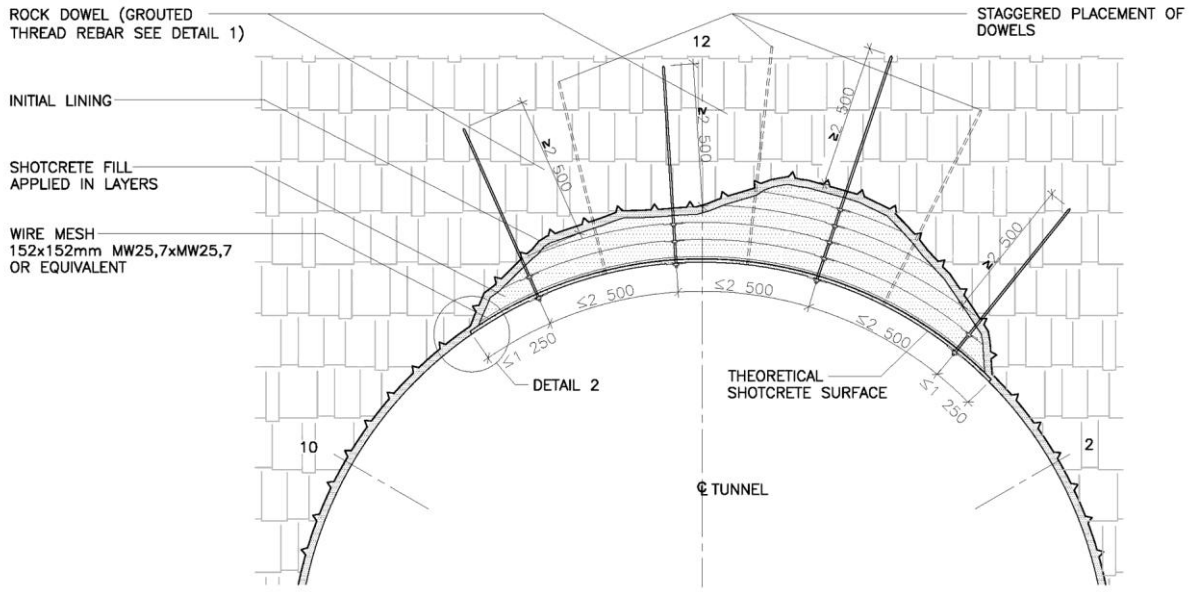


The following categories of profile restoration were employed:

- Type 1 for overbreak infill up to 1.5 metres, which requires drilling and installation of grouted anchors into the overlying rock, hanging threaded rods and wire mesh from the anchors, applying shotcrete to the required profile, and grouting to fill any voids; and

- Types 2a and 2b for overbreak infill over 1.5 metres, which requires drilling and installation of anchors into the overlying rock, hanging adjustable rods from the anchors, hanging prefabricated structural steel arches incorporating wire mesh and expanded metal, applying shotcrete to embed the steel arches, creating a form at the required profile, infilling the overbreak zone above the sacrificial form with shotcrete (Type 2a) or with concrete (Type 2b), and grouting to fill any voids.

Figure 10 - Restoration of Overbreak of Limited Depth/Volume (Type 1)



To accomplish profile restoration, Strabag initially used three different elevated work platforms:

- Carrier 1, for shotcrete grinding and installation of rock anchors, wire mesh and structural steel arch forms;
- Carrier 2, for applying shotcrete to infill Type 1 overbreak areas up to 1.5 metres, to coat structural steel arch forms used where overbreak exceeds 1.5 metre, and to infill above the arch forms; and
- Carrier 3, for cavity grouting to fill voids in the overlying rock and the interface between the initial shotcrete and the infill material.

To augment the capability of Carrier 1 and increase the pace of profile restoration, a fourth carrier (Carrier 0) was added in the summer of 2010 and began operation later that year. To further expedite profile restoration, the operation described above was augmented with additional mobile equipment including unique long boom drills and shotcrete robots.

In areas where inspection identified loose or cracked shotcrete in the tunnel arch, Strabag scaled the initial lining to remove the loose or cracked material and then repaired these areas with wire mesh, rock bolts and shotcrete. Convergence monitoring surveys and periodic visual inspections of the initial lining were used to detect rock movements in order to identify areas requiring remedial action including enhancement of the rock support where needed.

Profile restoration was completed on September 19, 2012.

6.5.5.3 Arch Lining

Arch lining is the process of installing the impermeable waterproof membrane and pre-stressed concrete liner in the upper two-thirds of the tunnel (the “arch”). The arch lining is similar to that used in the invert with the major difference being that the arch is lined with a single layer electrically testable membrane rather than the dual layer membrane used in most of the invert. This membrane is tested by passing an electric current through it. The test equipment measures the conductivity of each section. Damaged membrane results in “hot spots”, which are located visually or with the help of an infrared camera and repaired. The membrane is then retested to ensure no holes remain before concrete placement.

The membrane was installed using an Arch Membrane Carrier which positioned the membrane panels so that they could be attached by a Velcro system to the geotextile nailed to the initial shotcrete lining. After testing, the polyolefin panels were heat welded together and the seams tested. This process ensured that there were no leaks in the membrane before the arch forms were set and filled with concrete.

Photo 15 - Installation of Arch Membrane

The Arch Concrete Carrier has two moveable forms that are each 12.5 metres long. They are positioned and then the concrete is pumped above them and allowed to cure. The concrete is installed in alternating sections. Arch concrete was completed on November 6, 2012.

Photo 16 - Arch Concrete Carrier

6.5.5.4 Grouting

To ensure a uniform connection between the membrane and the concrete lining and fill any voids in the exterior curve of the concrete lining, low pressure contact grout is used. Contact grouting started in April 2011 and was completed on November 10, 2012.

The final concrete liner is then pre-stressed through the use of high pressure interface grouting injected between the initial shotcrete lining and the membrane through the use of pre-installed hoses. While the pre-stress grouting is being applied sensitive instrumentation is used to ensure that compression of the concrete liner is uniform around the tunnel. Pre-stress grouting started in August 2011 and was stopped for approximately a month starting

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on December 7, 2012 to facilitate the removal of the grouting and arch concrete carriers in the tunnel. Pre-stress grouting was completed on February 4, 2013, almost two months ahead of the ADBA target schedule.

6.5.5.5 July 2011 Fall of Ground

On July 2, 2011, a portion of the tunnel roof partially collapsed between 6,033 metres and 6,080 metres, resulting in about 1,200 m^3 of fallen rock and initial lining and rock support materials. No one was injured. The tunnel was initially shutdown from 5,933 metres to 6,130 metres to prevent access to the area. Strabag's consulting engineer and the MOL inspected the site along with the OR and Strabag staff. Following the MOL inspection, a Stop-Work Order was issued for the area between 5,983 metres and 6,130 metres, pending Strabag's submission of its engineering assessment and plans for safe remediation of the area. The Stop-Work Order for this area of the tunnel was in effect from July 5 to September 27, 2011.

The upper limit of the failure occurred in the Grimsby formation between 6,050 metres and 6,060 meters to a depth of approximately seven metres above the tunnel crown. Most of the failure was within a thinning wedge of the Power Glen shale/sandstone layer, which is comparatively stiffer than the overlying Grimbsy shale rock mass and the underlying Power Glen shale. Horizontal stresses concentrate in this formation because the surrounding rock does not have the stiffness to withstand such stresses. Strabag's consulting engineer cited the overload of the initial support systems caused by these rock conditions as the primary cause of this fall of ground.

Photo 17 - Fall of Ground 2011

During the original excavation of the area in March 2010, stress-induced deformation occurred in the form of a small notch at about the 11:30 position. Rock support installed at the time consisted of the following elements:

- 4 metre friction anchors;
- steel channels in crown ("C-channels");
- welded wire mesh;
- shotcrete, with a "slot" left in the shotcrete arch to allow deformation to occur without causing spalling, as had been a problem in other areas of the tunnel; and
- additional 4 metre field bolts.

3D monitoring arrays were also installed through this portion of the tunnel in March 2010. In association with these arrays, the following three threshold "trigger" levels were established to assess the stability of the excavation:

- at the "design" level, deformations were within the expected level and no action was required.
- at the "review" level, Strabag was to evaluate the specific situation and assess if any further action was required.
- at the "action" level, the stability of the tunnel excavation was jeopardized and immediate action was required to install additional support.

In November 2010, analysis of the survey monitoring data indicated that deformations in the fall of ground area were at the "review" trigger level. As a result, Strabag reviewed the situation and installed additional Swellex anchor bolts and mesh as a remedial measure. In December 2010, Strabag's routine inspection revealed that there was more convergence in the tunnel roof and monitoring data indicated accelerating movement. In addition, shotcrete cracking was observed on the crown. As a result of this deformation, additional review and geotechnical assessment of the rock reinforcement requirements was undertaken. Following this review, Strabag developed a supplemental construction drawing for the installation of additional support between 5,690 and 5,710 metres and between 6,000 and 6,160 metres. The drawing indicated that six metre long grouted "hollow bar dowels" on a two metre staggered pattern with an additional 130mm shotcrete layer and wire mesh were to be installed.

Areas approaching the "action" trigger level and areas showing acceleration were given priority for the installation of additional support. Before the fall of ground occurred, the additional support shown in the supplemental drawings was installed between 5,690 metres and 5,710 metres. By January 2011, monitoring data revealed movement between 6,000 metres and 6,160 metres, the area where the fall ultimately occurred, had decreased. This data was interpreted as indicating stabilization. Consequently, Strabag determined that, unless new movement occurred, installation of additional support in this area was not

immediately required. The additional support work was scheduled for a planned shutdown starting on July 4, 2011.

Monitoring frequency for this area changed according to the rate of deformations recorded. Before the fall occurred, monitoring frequency had increased to twice a week and the area was kept under frequent visual observation. The last few readings at some arrays did indicate some acceleration of movement, but the established “action” trigger level was never reached before the fall occurred.

Bolts removed from the fall of ground area were tested in December 2011, and results indicated that the breakage was not an installation or manufacturing issue. Based on the information available, Strabag concluded that the most probable cause of the July 2, 2011 fall was the unique geological conditions at the local boundary between the Grimsby and Power Glen formations, in particular, the thickness, relative stiffness and redistribution of high horizontal stresses in the rock immediately above the tunnel excavation. This conclusion is supported by the fact that the bolts broke close to the Grimsby shale and Power Glen shale/sandstone interface. However, inadequate rock support measures and response to visual and survey monitoring signs of instability may have also contributed to the incident.

Strabag divided the required remediation into phases. Phase 1 involved stabilization of the tunnel on both sides of the fall between 5,900 metres and 6,170 metres. Phase 2 was rehabilitation and replacement of the tunnel rock support where it was damaged by the fall. Work on the two phases overlapped with the remediation being completed at the end of December 2011.

An insurance claim was submitted under the Builder’s All Risk policy to recover the cost of remedial work associated with the July 2011 fall of ground. The claim was subject to a $2M deductible.

In May 2012, the OR submitted a summary of the costs associated with the fall of ground work to the adjuster. The costs totalled approximately $17.6M, and included work done outside of the MOL mandated area, where reinforcement of the rock support was considered necessary to ensure the safety of the workers and equipment before entering and repairing the MOL mandated and fall of ground areas.

OPG received a letter from the insurance adjuster on August 13, 2012, which noted that, on the basis that the fall of ground itself did not exceed 100 metres, there is a $10M limit to the loss at hand. The adjuster's evaluation report attached to the letter found that substantiated costs based on the documentation received by the OR were only about $7.5M. In June 2013, after several information exchanges with the adjusters, the OR submitted a final revised cost summary, which reduced the claim amount to approximately $12.1M. Regarding the $10M limit, the OR pointed out that although the fall of ground may have been less than 100 metres, the area of damage associated with this loss significantly exceeded 100 metres. Ultimately, however, the insurers rejected this position, invoked the $10M limit and are expected to pay this amount by October 2013. This amount is relatively close (within $400k) to the amount by which the Target Cost in the ADBA was increased due to the July 2, 2011 fall of ground.

6.5.5.6 Swelling at Low Point

In the fall of 2009, it was noted that water from construction activities and surface water from the outlet portal was migrating under the invert concrete at the low point in the tunnel. The ingress of water had caused the invert liner to float, and created a concern for the potential swelling of the rock, a phenomenon that occurs when rocks of the Queenston formation come into contact with fresh water. A Notice of Defective Project and a Disallowed Cost Notice[33] were consequently issued to Strabag in November 2009 by OPG. As a temporary measure, Strabag installed sumps at the low point to remove the water.

[33] Under s. 1.1(O)(1)(ii) of the ADBA, any cost arising from or incurred as a result of repair or remediation of the Work to be carried out prior to Substantial Completion and due to the previous or ongoing presence of fresh water outside the impermeable membrane liner in any part of the tunnel contained in the Queenston, is a Disallowed Cost, and is not payable by OPG.

A program of testing and analyses was implemented to assess the extent of fresh water infiltration into the Queenston shale, the effects of swelling, the capacity of the liner to resist swelling loads and the effectiveness of the grouting process to seal any potentially damaged membrane. Since it was impossible to see below the invert concrete, testing and analyses considered worst case scenarios as well. In 2010, OPG retained Dr. K. Y. Lo of the University of Western Ontario to investigate the situation. A year later, in 2011, Dr. Lo's tests concluded that fresh water was present and that swelling had occurred at the low point. Strabag's design consultant, ILF, then proceeded to assess the effect of swelling and the capacity of the concrete liner to resist the swelling loads over the design life of the structure. ILF models demonstrated that the unreinforced concrete liner had sufficient structural capacity to resist all short-term and long-term loading, including the swelling loads caused by chloride ion diffusion due to water already trapped in the rock and water that would infiltrate into the rock through a damaged membrane over the life of the tunnel. An independent analysis carried out by the OR also confirmed that the as-built concrete liner had sufficient structural capacity to resist all applied loads including the swelling loads under all loading conditions for the life time of the tunnel.

In 2012, MFPA Leipzig Lab in Germany was contracted through ILF to further conduct independent testing of membrane integrity to confirm the as-built liner system's capacity to meet the design requirements and assess the effectiveness of grouting to seal any potential damage and restore the watertight barrier. The first series of tests showed that the membrane prevented water passage when it was intact, but also revealed that aggregate debris could damage the membrane under the invert concrete. A second round of tests with improved grouting and using as-built invert concrete samples were successfully concluded in November 2012. The tests were repeated to confirm the results.

Ultimately, the tests concluded that the liner system with the membrane damaged by debris and loading during construction and then grouted with contact and interface grout as per the construction specifications would effectively prevent water penetration into the rock and,

therefore, prevent chloride ion diffusion from the rock for all loading conditions for the design life of the tunnel.

The OR prepared an additional report in February 2013 summarizing all the investigations conducted with respect to the low point swelling issue. It concluded that although the Queenston shale below the invert at the low point of the tunnel was exposed to infiltration of fresh water during construction, efforts to extract the water, repair the cracks in the concrete liner, and the application of contact and interface grouting effectively sealed any damaged membrane and prevented further water penetration into the rock. The OR determined that the as-built tunnel liner complied with the Owner's Mandatory Requirements and applicable code requirements.

7.0 DIFFERING SUBSURFACE CONDITIONS DISPUTE

7.1 Overview

The contract between OPG and Strabag provided for the establishment of a Dispute Review Board ("DRB") to assist the parties in dispute resolution as discussed in Section 5.0 above. Pursuant to those provisions, a DRB chaired by Peter Douglass, with P.E. Sperry and Dennis McCarry as members, was created. The DRB established procedures on how it would interact with the owner and contractor, keep informed of project progress through periodic meetings and offer informal advice when requested by both parties. The DRB also set the framework for formally resolving any matters presented through Dispute Requests. This framework required written materials, presentations at a hearing and a decision rendered in the form of written recommendations.

In May 2007, after almost nine months of tunneling, Strabag issued a Notice of Differing Subsurface Conditions ("DSC") pursuant to section 5.5(a) of the DBA. Strabag followed up by issuing Project Change Notice ("PCN") 17, which claimed that the actual rock conditions encountered were significantly more adverse than those described in the GBR between 806.50 metres and 839.70 metres. This notice was triggered by the fall of a large rock onto the TBM on May 16, 2007, which stopped tunneling for more than three weeks. PCN 17

claimed an unspecified increase in contract costs, to be determined once technical solutions to address the new rock conditions were developed and implemented.

Over the next six months, while tunneling continued, Strabag and OPG (through the OR) exchanged letters and other documentation about the existence of DSC with little agreement. On November 7, 2007, Strabag issued Dispute Notice 001, which sought to resolve this outstanding issue using the claims procedure in section 5.7 of the DBA or through an immediate referral to the DRB. OPG replied, stating that the dispute must be held in abeyance until tunnel boring is complete because it is covered by DBA section 5.5(c), which addresses rock support changes stemming from DSC. Strabag disagreed with this interpretation of the contract and urged OPG to allow this matter to be put before the DRB forthwith.

As mentioned above, at the end of November 2007, senior management at OPG and Strabag agreed to spend a maximum of three months attempting to resolve the dispute informally and develop a new tunnel alignment. These efforts proved unsuccessful and in mid-February 2008, the parties agreed that they had reached an impasse and would refer the matter to the DRB for a hearing as soon as possible.

On February 27, 2008 Strabag issued Dispute Notice 002 reiterating the position it took previously regarding PCN 17. This second notice continued to assert that the conditions encountered constituted DSC and further asserted that the financial responsibility for them rested with OPG as the owner.[34] The notice requested that the dispute be resolved pursuant to Section 11 of the DBA, which covers the DRB.

In early March the parties met with the DRB to establish the procedures and timing of the hearing. Both Strabag and OPG submitted questions in advance to the DRB to guide the discussion. Strabag's questions were as follows:

[34] Dispute Notice 002 actually states that financial responsibility rests with the OR, but this is best viewed as either a typo or a shorthand reference to the owner.

- Does the amount of overbreak encountered in the tunnel exceed the baseline conditions described in the GBR, Sections 1.7, 8.1.2.6 and 8.1.2.7, and thereby constitute a Differing Subsurface Condition?
- Does spiling as it is being employed by STRABAG improve the rock conditions and thus reduce the amount of overbreak that would otherwise occur?
- Based on the Rock Mass Rating ("RMR") values described in the GBR Table 6.8 and the GBR referenced 1976 Proceedings by BIENIAWSKI, Z. T., STRABAG expected a stand-up time of the crown of at least one day for the Queenston Formation to be encountered in the tunnel. Was this expectation reasonable?

OPG proposed that the dispute first address the issue of whether Strabag's decision to employ different means and methods than those described in the DBA precluded a claim for DSC. The second issue that OPG proposed to be addressed, if necessary, was whether the dispute could be properly characterized as a claim for differing rock support under DBA section 5.5 (c), in which case it would not be considered until tunneling was complete and the rock conditions along the entire tunnel were assessed.

Based on this view, OPG submitted the following questions to the DRB:

- Pursuant to Section 5.4 of the DBA, to what degree is the behaviour of the geotechnical subsurface conditions attributable to a change or deficiency in Strabag's designs, means, methods, sequences, timing and level of workmanship? For greater clarity, to what extent is Strabag's inability to achieve the agreed TBM advance rates and any "excessive" overbreak the result of Strabag's own designs, means and methods of construction?
- To the extent that the behaviour of the geotechnical subsurface conditions is not attributable to a change or deficiency in Strabag's designs, means, methods etc. under Section 5.4, is Strabag's residual claim covered by the procedure agreed by the Parties as set out in Section 5.5(c) of the DBA?
- Are the Rock Conditions set out in Geotechnical Baseline Report ("GBR") Section 8.1.3.7, (Rock Conditions 1,2,3,4, 4Q, and 5, with Rock Condition 6 expressly covering

"any other rock condition not covered") an exhaustive catalogue of the types of rock conditions agreed to by the Parties as their geotechnical baseline?

- Is Strabag precluded from requesting an adjustment in the contract price or contract schedule for any differing subsurface conditions in respect of its work under the St. Davids Gorge by the provisions of DBA Section 5.5(e)?
- Is Strabag precluded from requesting an adjustment in the contract price or contract schedule for rock overbreak in excess of the baseline 30,000 m^3 set out in Section 8.1.2.7 of the GBR, other than for amounts pre-agreed to be reimbursed for disposal of rock overbreak and for application of shotcrete at unit rates set out in DBA Appendix 1.10?

The DRB discussed the possibility of establishing whether Strabag's means and methods were the source of the overbreak as a threshold issue as OPG proposed, but ultimately decided to hear the issues of Strabag's means and methods and the existence of DSC concurrently. The DRB established the type and order of presentations for the hearing that was held in June 2008.

7.2 Dispute Positions

7.2.1 Strabag

Strabag's fundamental position was that OPG remained responsible for the consequences of the geologic conditions different from those enumerated in the GBR and that the conditions actually experienced in tunnelling were different. Strabag claimed that DSC were evidenced by large block failures, excessive overbreak and inadequate "stand-up" time (i.e., insufficient time to install rock support prior to rock failure). Strabag further claimed that the Table of Rock Conditions and Rock Characteristics in the GBR failed to adequately describe the rock conditions encountered and either represented a DSC on its own, or alternatively confirmed the presence of DSC. Strabag's position was that any changes that it made to the means and methods of rock support were the result of DSC, rather than the cause of DSC. Finally, Strabag claimed that it was entitled to relief from DSC anywhere they were encountered, including under the buried St. Davids Gorge.

7.2.2 OPG

OPG's position was that no DSC existed. Subsurface conditions were as described in the GBR and Strabag's proposed design reflected these conditions. During the course of construction, Strabag substantially modified its TBM design and rock support by abandoning the use of a ring erector and full perimeter steel sets in the Queenston formation. Strabag stopped using full perimeter steel sets, as shown in its design, not because of ground conditions, but because it could not make the ring erector work. OPG also claimed that, to the extent any DSC existed, the DBA required that these be addressed after the tunnel was completed and that Strabag was solely responsible for conditions under the buried St. Davids Gorge.

7.3 Hearing

The hearing was held from June 23 through 26 in Niagara Falls, Ontario. It opened with presentations by Strabag, its design consultant ILF, and its three external experts. The external experts included the President of Robbins, the TBM manufacturer. The DRB asked questions during and after these presentations. With questions, the presentations took the entire first day of the hearing.

OPG's presentations were made by the various personnel from Hatch, including the OR Project Manager. In addition, OPG had four external experts present on geotechnical and design issues. OPG's presentation and the DRB questions on them occupied the entire second day of the hearing.

The third and fourth hearing days were taken up with rebuttal presentations and DRB questions. The hearing was closed at the end of the fourth day.

7.4 DRB Decision

The DRB issued its Report and Recommendations on August 30, 2008, some two months after the hearing concluded. While OPG's position was adopted on most issues, the DRB did find that excessive overbreak constituted a DSC and that the Table of Rock Conditions and

Characteristics was defective. Table 5 below shows the specific issues identified by the DRB and its findings on each issue.

Table 5 - DRB Conclusions and Recommendations

Issue	Finding
Large Block Failures	There is no DSC. The actual conditions were adequately described in the GBR.
St. Davids Gorge	Given the provision of the DBA Section 5.5 (e), the Contractor has no claim for any DSC in this section of the tunnel.
Insufficient Stand-Up Time	There is no DSC based on insufficient stand-up time, as the Contractor's reliance on Rock Mass Rating values stated in the GBR was inappropriate.
Excessive Overbreak	"There is a DSC with respect to the excessive overbreak, provided the defective provisions of the GBR are overlooked, because the GBR contained potentially misleading statements that make the Contractor's position reasonable. Any substantial changes in the designs, means and methods of the support (i.e., Type 4S) were the result of DSCs encountered and not vice versa. Since the development of the GBR was the mutual responsibility of both Parties, we recommend that the Parties negotiate a reasonable resolution based on a fair and equitable sharing of the cost and time impacts resulting from the overbreak conditions that have been encountered and the support measures that have been employed. Both Parties must accept responsibility for some portion of the additional cost, but at the same time the Contractor must have adequate incentives to complete the Work as soon as possible." DRB Report, pages 18-19
Inadequate Table of Rock Conditions and Rock Characteristics	"The Table of Rock Conditions and Rock Characteristics is inadequate to define the subsurface conditions that were encountered. More importantly, the classification of support types based on the "closest match" to rock conditions and rock characteristics given in this Table, together with rock characteristics defined as "all other conditions", renders the concept of DSCs essentially meaningless and the GBR defective. The DRB recommends that the Parties jointly revise the Table of Rock Conditions and Rock Characteristics in such a manner that it describes the rock characteristics to be assumed in terms that are mappable (or otherwise quantifiable) so that it can serve as a clear basis for defining DSCs throughout the remainder of the tunnel excavation. The DRB also recommends that the terms 'closest match' and 'all other conditions' be removed from the GBR." DRB Report, page19

The DRB's conclusions were unanimous. At the end of the document the DRB added the following additional finding:

> The DRB members have rarely experienced such an excellent, cooperative atmosphere between the Parties on a tunnel project. This is especially impressive considering the pioneering nature of the Work and the problems and issues encountered. The Board is confident that the Parties can negotiate an amendment(s) to the DBA that, while not commercially optimum for either Party, will allow the Project to proceed to optimum completion. DRB Report, page 19.

8.0 RESPONSE TO DRB DECISION

8.1 Identification and Assessment of Options

In response to the DRB Report, OPG in consultation with the OR concluded that four options were available:

- Negotiate changes to the existing DBA based on cost sharing as recommended by the DRB including revising the Table of Rock Conditions and Rock Characteristics and GBR as required.
- Settle all outstanding disputes with Strabag and negotiate a new target cost contract for project completion including incentives and disincentives based on cost and schedule to completion.
- Reject the DRB recommendations and pursue arbitration under the Rules of Arbitration of the International Chamber of Commerce as provided in the DBA (Section 11.5, as amended).
- Seek to replace Strabag with a new contractor to complete the tunnel.

These options are discussed in more detail below in Section 10.0, "Superseding Business Case."

OPG quickly concluded that the fourth option should only be considered as a last resort because of the cost and schedule consequences of locating, hiring and mobilizing a replacement contractor. While OPG remained concerned about schedule delays and Strabag's claimed cost overruns, OPG was generally satisfied with the quality of work

Strabag was doing on the project and with Strabag's continuing commitment to operate safely in the face of challenging rock conditions.

OPG also rejected arbitration as an initial approach. OPG concluded that there was no advantage in pursuing arbitration unless attempts at negotiation failed. Arbitration was seen to entail greater risk, require additional time and provide a less certain outcome than negotiation.

Ultimately OPG concluded that negotiation with Strabag toward a resolution of outstanding disputes and a path forward to complete the tunnel on a target price basis with risk/reward incentives was the preferred option to explore, as it encouraged continuing efforts to achieve or exceed targets. Strabag continued to perform well despite the fact that during this period rock conditions were particularly challenging and Strabag had to resume installing spiles to contain the overbreak, as discussed above in Section 6.5.4.2, "The Tunnel Drive."

The fact that Strabag continued working safely in these challenging rock conditions and continued to cooperate with OPG to complete the tunnel further supported OPG's view that negotiation was the preferred approach. OPG assessed that keeping Strabag engaged in completing the project would likely lead to the best result in terms of cost and schedule. Both OPG's senior management and OPG Board supported continued negotiations with Strabag rather than exploring the option of replacing Strabag with a new contractor. OPG also asked the external experts on the CLOC for their views and they too supported continuing to negotiate a revised agreement with Strabag.

8.2 Discussions with Strabag

After receiving the DRB Report, both OPG and Strabag filed arbitration notices, but each confirmed that the notices were filed only to preserve their respective rights under the

agreement.[35] Both parties agreed that their joint focus over the next few months would be on negotiating a mutually satisfactory resolution of their disagreements and a path forward to project completion. To this end, Strabag agreed to bring forward two proposals to resolve existing disputes and move the project forward.

In early October 2008, Strabag submitted two options to OPG for resolving the current dispute and moving forward. Option A involved continuing the fixed priced approach in the DBA with additional cost included to reflect the rock conditions encountered and anticipated going forward. The bulk of the cost increase came from the addition of two new rock support types (4R and 4S) to reflect areas of substantial overbreak. Option A included per metre costs and estimated quantities (in metres) for each of these new rock support types. In addition, Strabag included its claimed cost for modifications to the TBM and a contingency amount for future TBM risks. Finally, this option included compensation for the extension of the project schedule. Taken together these costs were estimated at approximately $190M.

Strabag also estimated that the cost of pending claims, profile restoration and other future modifications would total an additional $90M, but indicated that this figure was only a preliminary estimate. Strabag proposed the elimination or renegotiation of the liquidated damage and early completion bonus provisions. All told, Strabag estimated the revised fixed price of the tunnel at approximately $910M under Option A.

In Option B, Strabag proposed converting the contract to a target price and reducing the overhead fee from 19 per cent to 12 per cent. OPG and Strabag would agree on a target price and schedule under this approach with the benefits of any cost savings and early completion to be shared equally between Strabag and OPG. This option also included two disincentives: the overhead fee would decrease as contract cost increased reaching zero per

[35] The DBA provided that a party who was dissatisfied with one or more DRB recommendations had 30 days to notify the other party in writing of its intent to commence arbitration (DBA section 11.1 (f) as amended). In order to preserve its right to seek arbitration if necessary, OPG provided the required notice of intent to commence arbitration because it disagreed with the DRB recommendations concerning excessive overbreak and the need to revise the Table of Rock Conditions and Rock Characteristics. Strabag similarly notified OPG in writing that it rejected all 5 DRB recommendations and intended to pursue arbitration.

cent at $1B; and the overhead fee would also be reduced for late completion reaching zero per cent if the project was six months late. The target price under this option would be $856M, a figure derived by reducing the price estimated for Option A to account for the reduction in overhead fee from 19 per cent to 12 per cent.

Strabag saw the following benefits from adopting Option B:

- It eliminates ongoing concerns about deficiencies in the GBR.
- It includes sufficient incentives to encourage the contractor to complete the project as quickly and cost effectively as possible.
- It allows all available resources, including the expertise of the OR, to be fully dedicated to optimizing project execution and developing innovative solutions to emerging issues.

Strabag's proposals were thoroughly considered by OPG, the OPG Board and the CLOC. OPG, in consultation with the OR, noted that neither of Strabag's proposals adequately captured the notion of a "fair and equitable sharing of the cost and time impacts" as recommended by the DRB. However, OPG also noted that as Strabag continued to do a good job and work safely on the project despite the difficult rock conditions in the tunnel, it was in OPG's interest to attempt to settle with Strabag. To that end, OPG's management recommended adopting a three-part negotiation strategy and counter-proposal:

- a lump sum payment to be made by OPG to settle Strabag's costs and claims to November 30, 2008;
- a revised contract effective from December 1, 2008 forward with a negotiated target price and schedule (similar to Strabag's proposal B); and
- incentives and disincentives to ensure completion of work.

Strabag and OPG had a number of meetings throughout October and early November of 2008. At these meetings the various options tabled by Strabag and OPG were discussed. Ultimately, the parties agreed to the approach reflected in the Principals of Agreement that captured both the advantages of Strabag's proposal B as well as OPG's attempt to

incorporate a fair cost-sharing approach. The Principles of Agreement and the process of negotiating the ADBA are discussed in the following sections.

9.0 CONTRACT RENEGOTIATION

9.1 Agreed Approach

9.1.1 Principles of Agreement

OPG and Strabag ultimately developed a Principles of Agreement ("Principles") document which was based on a hybrid approach that included resolution of Strabag's claim for DSC in the Queenston formation and renegotiation of the DBA going forward. Both parties committed to complete the project in a safe, environmentally sound and expeditious manner and to reflect the DRB recommendations as they worked toward a revised agreement.

OPG agreed to pay Strabag $40M to resolve all issues to November 30, 2008. This figure reflected an effort to share Strabag's claimed losses of $90M. As a good faith gesture, OPG committed to make the $40M payment within 15 days of the Principles signing, but Strabag was required to provide OPG with a $40M letter of credit to cover the possibility that a final agreement would not be reached. OPG also had the right to audit Strabag's losses and to the extent that the full $90M was not substantiated in the audit, the $40M payment could be reduced proportionately.

Going forward, the tunnel would incorporate revised horizontal and vertical alignments to minimize boring in the Queenston shale.[36] The renegotiated contract would be based on a target cost and schedule. The target cost would be developed on an "open book" basis to reflect the reasonably estimated cost to complete the project. It would not include any profit, but would include a negotiated 5 per cent overhead fee (a reduction from Strabag's 12 per cent proposal) on allowed project costs and also would provide incentives and disincentives, as discussed below in Section 9.2.

[36] As noted above, the horizontal realignment had already begun in early September 2008, some two months before the Principles of Agreement were signed.

The Principles further provided for the development of project management processes that would facilitate greater OPG involvement in project decisions, recognizing that Strabag would continue to direct and be responsible for the design and construction of the tunnel. The document also required that the future design build agreement be supported by adequate financial security and that Strabag maintain the existing design and construction team throughout the duration of the project except where Strabag provides substitute personnel acceptable to OPG. Finally, the document made clear that it was not the parties' intent to have the Principles affect existing performance warranties and guarantees.

In term of next steps, the Principles required that the parties negotiate a Term Sheet further delineating the provisions above.

9.1.2 Term Sheet

The Term Sheet envisioned in the Principles was signed on February 9, 2009. It confirmed and elaborated on the approach outlined in the Principles by making clear that:

- The cost and revenues of all claims for work conducted prior to December 1, 2008 are Strabag's in exchange for OPG's payment of $40M.
- The cost and schedule impact from claims arising from work conducted after December 1, 2008, shall be dealt with under the provisions of the amended agreement, which is to be based on a target cost approach.
- The cost of claims that bridge December 1, 2008, are to be apportioned between the parties in accordance with the first two bullets.

The Term Sheet detailed that the DBA provisions would remain in effect until the amended agreement was signed and that the new agreement would be retroactive to December 1, 2008. For the period between the signing of the amended agreement and December 1, 2008 ("the interim period"), OPG would pay Strabag the amounts necessary to reflect the difference between payments made under the DBA and those due under the amended agreement plus interest at the rate set out in the DBA.

The Term Sheet required that Strabag provide OPG with detailed cost information starting from December 1, 2008 and that it unconditionally open its books to OPG. The Term Sheet also required that Strabag continue its fixed price arrangements with its current sub-contractors and that Strabag obtain OPG's approval for any new subcontracts above a threshold amount.

Under the Term Sheet, the DBA was to be the starting point for the amended agreement and its terms would only be changed to reflect the target cost approach contained in the Principles. The Term Sheet also embodied the parties' agreement to develop protocols on how they will work together to complete the project as well as develop a target cost and target schedule. An important principle agreed in the Term Sheet was that to the extent applicable, the cost and schedule for project activities other than tunnel boring, rock support and profile restoration would not exceed the cost and schedule in the DBA for these other project activities (e.g., work on the intake, outlet and tunnel lining).

Pursuant to the Term Sheet, the parties negotiated a Memorandum of Understanding ("MOU") on the target schedule, signed on February 24, 2009, which established a new Substantial Completion date for the project of June 15, 2013. Based on the target schedule, an MOU on target cost was also negotiated and signed on April 7, 2009, which established a target cost of $985M for Strabag's work.

While the Term Sheet was prepared to facilitate the creation of an amended agreement, it was not itself a complete agreement. Many significant issues remained to be negotiated, such as the target cost and schedule details, the operation of the Steering Committee created to resolve disputes, and whether the occurrence of DSC should lead to a change in the target cost and schedule. Ultimately, these matters were all addressed and resolved in the Amended Design Build Agreement.

9.2 Amended Agreement

The original DBA was used as the base for the Amended Design Build Agreement ("ADBA"). Most DBA provisions were retained unchanged except as necessary to convert the agreement to a target cost contract.[37] Under the ADBA, OPG and Strabag agreed on a Target Cost of $985M, a contract schedule with Substantial Completion by June 15, 2013 and changes to the allocation of risk. Strabag will be entitled to its costs to complete the project and incentives will apply if it completes the project for less than the Target Cost or before the agreed Substantial Completion date. Conversely, disincentives will apply if the costs exceed the Target Cost or the project is late.

The ADBA defines Actual Cost as the $302M paid to Strabag prior to December 1, 2008 plus the accumulated Allowed Costs (defined below) from December 1, 2008 onwards, minus any proceeds from the sale of assets and any insurance payments received by Strabag. Actual Cost will be used to calculate the applicable cost incentives and disincentives which apply to Strabag. Strabag will be reimbursed for all costs it incurs to complete the project ("Allowed Costs") that are not specified to be Disallowed Costs in the ADBA. Disallowed Costs include items such as costs arising from Strabag's negligence, wilful misconduct or breach of Applicable Law, head office costs, interest costs, certain insurance deductibles, costs for warranty work, costs to correct or remove a defective part of the project and third party liability. Strabag also will be entitled to apply an overhead recovery fee of 5 per cent to Allowed Costs from December 1, 2008 onwards to cover the costs of head office support. OPG is to make monthly payments under the contract based on anticipated Allowed Costs for the coming month and true up the prior month's payments.

The Target Cost will be adjusted to reflect changes in costs for certain items, as baseline assumptions were included in the calculation of the Target Cost with the expectation that the Target Cost would be adjusted up or down to reflect actual circumstances such as, for example, changes in the baseline inflation assumption or diesel fuel costs.

[37] Capitalized terms in this section are defined in the ADBA, which is included in the CD of NTP Key Documents accompanying this Exhibit.

The Contract Schedule is based on a Substantial Completion date of June 15, 2013 and will be adjusted for certain events set out in the ADBA. The schedule is premised on the horizontal realignment that reduced the tunnel length by approximately 200 metres, and a vertical realignment which allowed the tunnel to exit the Queenston shale and move to the overlying rock formations where tunnelling conditions were expected to, and did in fact, improve. Certain incentive and disincentive payments described below are based on the Target Cost and Substantial Completion date.

Under the ADBA, if OPG's actions impact cost or schedule, then Strabag will be entitled to an adjustment in the Target Cost and Contract Schedule. This is to address provisions in the ADBA that either require Strabag to obtain OPG's consent for certain matters or that impose obligations on OPG, which may impact the Target Cost or Contract Schedule.

In addition to the payments described above, Strabag received an Interim Completion Fee of $10M upon completion of TBM mining activities on March 30, 2011 and was also entitled to a Substantial Completion Fee of $10M on March 9, 2013 upon achieving Substantial Completion. A Cost Performance Incentive/Disincentive will be calculated as 50 per cent of the difference between Actual Cost and the Target Cost as adjusted. A Schedule Performance Incentive of $200,000 per day is due for each day that Substantial Completion occurred before the June 15, 2013 date for Substantial Completion set out in the contract, unless this date is adjusted through a contract amendment.[38] If the project had exceeded the contract schedule, Strabag would have been required to pay OPG a Schedule Performance Disincentive of $67,000 per day for each day that the project exceeded the contract's Substantial Completion date, as adjusted. The agreement limits the maximum aggregate cost and schedule incentives to $40M and the maximum cost and schedule disincentives to $20M.

[38] The Substantial Completion date has been extended by ADBA amendments. ADBA amendments are discussed below in Section 11.3.

Consistent with the original DBA, an incentive or disincentive will be applied to the extent measured flow deviates from the Guaranteed Flow Amount ("GFA") of 500 cubic metres per second by an amount which exceeds the plus or minus two per cent dead band. Strabag also continues to provide the warranties and financial guarantees contained in the DBA, including a parental indemnity, a Letter of Credit and a Maintenance Bond.[39]

The ADBA provides for adjustment to the Target Cost and Contract Schedule should a Major Risk Event occur. The adjustment mechanism is set out in the Major Risk Table in Appendix 5.3C of the ADBA. The Major Risk Events are as follows:

- main TBM bearing failure, except due to negligence;
- conveyor belt damage greater than 1 kilometre, not due to negligence;
- gas concentration above Ontario *Occupational Health and Safety Act* limits;
- water ingress greater than 100 litres/second;
- BTEX levels greater than threshold accepted by Ministry of the Environment
- unexpected subsurface geotechnical conditions requiring a material change to means and methods or having a material impact on cost and schedule;
- measured crown overbreak depth and volume greater than baseline only if progress slower than planned;
- critical marine work at intake area affected by operational constraints at the International Niagara Control Works; and
- unknown subcontractor claims.

The ADBA provides that disputes not settled at the project level are to be brought to a Steering Committee consisting of a senior representative from each of OPG and Strabag. The Steering Committee may resolve the matter itself or seek advice or non-binding recommendations from experts. As was the case in the original DBA, all unresolved disputes go to arbitration under the Rules of Arbitration of the International Chamber of Commerce ("ICC"), with arbitration normally occurring only after Substantial Completion unless the

[39] In the ADBA the amount of the Maintenance Bond is set at up to 10 per cent of the Target Cost. Strabag and OPG have agreed to a Maintenance Bond of $50M, or approximately 5 per cent of the Target Cost.

Steering Committee members mutually agree to submit a dispute to ICC arbitration at an earlier date.

10.0 SUPERSEDING BUSINESS CASE AND REVISED PROJECT BUDGET

While the ADBA was being finalized, OPG began preparing a Superseding Business Case Summary ("Superseding BCS") to seek approval from the OPG Board for the target cost and schedule.[40] OPG management had kept OPG Board apprised of the status of negotiations through updates to the OPG Board's Major Projects Committee ("MPC"). The MPC had reviewed the Principles of Agreement prior to their adoption and endorsed management's decision to negotiate a revised agreement with Strabag based on a target cost and schedule. The Superseding BCS was the vehicle to seek formal OPG Board approval of the new contracting approach and the resulting target cost and schedule.[41]

The Superseding BCS included a summary of progress on the project and the difficulties encountered in tunneling, leading to the DSC dispute before the DRB. It then summarized how the project will be executed under the ADBA.

Schedule and cost variance explanations were also provided in the Superseding BCS. Some of the primary drivers cited for the schedule variances are:

- Slower than planned TBM progress due to worse than expected conditions in the Queenston shale once the tunnel passed the St. Davids Gorge.
- Expectation of continuing challenges as the tunnel ascends to higher rock strata and undertakes more mixed-face mining.[42] Some of the rock types in the upper formations are harder and more abrasive, causing greater cutterhead wear and requiring more frequent cutter replacement. The mixed face conditions also produce "eccentric loading"

[40] The full OPG Board approval package for the Superseding BCS is contained in the accompanying CD of NTP Key Documents.

[41] The ADBA was signed in mid-June, after OPG Board had reviewed and approved the cost and schedule variances for the project based on the Superseding BCS.

[42] Mixed-face mining occurs when the TBM is boring different rock types at the same time. For example, as the tunnel elevation increased, the top of the TBM was mining Whirlpool Sandstone while the bottom was in Queenston shale. When these rock types differ in hardness, it causes uneven loading on the TBM cutterhead.

on the cutterhead that necessitated reducing the penetration rate to less than 1.5 m/hr in order to avoid damaging the TBM main bearing.

- Restoring the tunnel to a circular profile ("profile restoration") is an additional task that was not included in the original schedule. Profile restoration must be completed prior to installing the arch membrane and concrete lining. Undertaking this operation concurrent with the mining, invert lining and arch lining operations added significant complication and risk to project logistics.
- Additional time to allow for removal of tunneling equipment before removal of the cofferdam at the intake structure.

The forecast cost changes between the DBA and the ADBA are shown in Table 6 below. The bulk of the increase is attributable to the tunnel contract (including contingency), but the longer schedule also increases the cost of maintaining the OR on site and interest cost.

Table 6 - Cost Changes between the DBA and the ADBA

Project Cost Flow Estimate ($M) (including Contingency)	Original Approval (DBA)	Revised Estimate (ADBA)	Variance	Variance (%)
OPG Project Management	4.4	6.0	1.6	36
Owner's Representative	25.4	40.4	15.0	59
Other Consultants	4.0	5.9	1.9	48
Environmental / Compensation	12.0	9.6	(2.4)	-20
Tunnel Contract (including Incentives)	723.6	1,181.7	458.1	63
Other Contracts / Costs	78.9	69.8	(9.1)	-11
Interest	136.8	286.6	149.8	110
Total Project Capital	985.2	1,600.0	614.8	62

There were four alternatives presented in the Superseding BCS. In addition to the recommended alternative of proceeding under the target cost and schedule approach negotiated in the ADBA, the following three alternatives were considered and rejected:

- Continue under the DBA – This alternative was rejected because OPG concluded that it would lead to Strabag abandoning the project based on projected costs of over $300M more than the contract price under the DBA. Under this approach, Strabag would have been expected to continue tunneling under difficult conditions and to experience an ongoing revenue loss in the hope of receiving some unspecified additional compensation

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upon project completion. This approach would have also ignored the DRB recommendation that OPG and Strabag work toward finding an equitable solution to resolve the dispute between them. Were Strabag to have abandoned the project, the result would be an extensive delay to obtain a new contractor, additional cost and protracted litigation, as discussed in Alternative 2 below.

- Engage Another Contractor to Complete the Project – This alternative was not recommended. The market for contractors with suitable experience in two pass tunneling with waterproof membrane and pre-stress concrete lining technology and installation techniques is very limited. Thus, there was no guarantee that a suitable contractor would be found to take over the project using the existing methods and equipment. OPG estimated that if a suitable replacement contractor could be found, it would take 18 - 24 months to engage this new contractor and bring them up to speed. Engaging a new contractor would also result in higher costs because a new contractor would require actual cost plus markup to complete the project. Under this approach, OPG also would lose the benefit of the substantial knowledge gained by Strabag in constructing the tunnel. Finally, OPG would need to expend considerable legal resources in an attempt to recover damages from Strabag with no guarantee of success.
- Cancel the Project – This approach was not recommended because it would result in a total expenditure of $563M with nothing to show for it. This figure consisted of $463M that had already been expended plus an additional $100M to secure the site in a safe and environmentally acceptable state. Adopting this alternative would cause Ontarians to forego at least 90 years' worth of additional clean renewable energy at the Sir Adam Beck generating stations. OPG also recognized that there would be a low likelihood of recovering the $563M of project costs in rates if it were cancelled.

The Superseding BCS updated the financial analysis contained in the original BCS for the project's increased cost and new completion date. This is shown in Table 7 below.

Table 7 - Superseding BCS Financial Analysis

Financial Measure	Original Approval July 28, 2005 ($985M; June 2010 In-Service)		Superseding Release May 21, 2009 ($1.6B; Dec. 2013 In-Service)	
		in 2009 $		in 2009 $
LUEC (¢/kWh)	(2005$) 4.8	5.2	(2009$) 6.8	6.8
PPA (¢/kWh)	(2011$) 6.7	6.7	(2014$) 9.5	9.4
Revenue Requirements (¢/kWh)	(2011$) 5.8	5.6	(2014$) 8.7	7.9
Revenue Requirements Post GRC Holiday (¢/kWh)	(2021$) 9.4	7.4	(2025$) 13.0	9.5

Based on the information in Table 7, the Superseding BCS evaluated the cost of the NTP against various metrics including the price being paid for hydroelectric energy under the Feed-in-Tariff contracts and the projected impacts on the payment amounts for regulated hydroelectric production. Based on these comparisons, the Superseding BCS concluded that the project remains an attractive source of clean energy. The sensitivity analysis included in the Superseding BCS confirms that this conclusion remains valid across a broad range of scenarios.

Based on the Superseding BCS, OPG Board approved a revised maximum budget of $1,600M and an in-service date of no later than December 31, 2013 for the project and authorized management to execute the ADBA on behalf of the corporation. OPG Board also authorized the request for an increase of the credit facility with the OEFC to $1,600M to reflect the new project budget.

11.0 CHANGES UNDER THE ADBA

11.1 Cost and Schedule Tracking Under the ADBA

While many aspects of project management and controls that existed under the DBA were retained for the ADBA, certain changes were introduced to reflect the target cost and schedule approach in the ADBA. Changes were made in cost and schedule management procedures by OPG, the OR and Strabag to facilitate timely tracking of allowed expenditures relative to the Target Cost and progress against the target schedule. As there is significant interrelationship between cost and schedule, slippage in the schedule was seen to provide an early warning of potential cost increases. Thus, schedule control was viewed as key to controlling cost because significant deviations in project costs were most likely to result from schedule deviations.

To manage the schedule, the location of each principal tunnel construction activity (TBM mining, invert concrete, profile restoration, arch concrete, contact grouting, and pre-stress grouting) was tracked as it progressed through the tunnel. This tracking allowed for timely reporting of progress and variation from the target schedule.

Strabag developed and submitted a computerized version of the baseline target schedule that aided in the identification, tracking and monitoring of critical path activities. Strabag updated this schedule monthly to document progress against the baseline, to recalculate the critical path and to forecast Substantial and Final Completion dates. This schedule was reviewed by the OR and any necessary revisions were made before it was accepted. The Schedule Performance Incentive/Disincentive in the ADBA also worked to encourage timely completion of the project and helped ensure that the interests of OPG and Strabag were always aligned.

Cost for each of the key tunnel construction activities listed above (and later on for specific critical path activities such as cofferdam removal and rock plug removal) were also tracked by Strabag, the OR and OPG. Strabag agreed to upgrade its financial software package to a

more robust system that facilitated enhanced reporting, analysis and audit. Key elements of ongoing cost management included:

- 24/7 on-site presence by the OR;
- ongoing monitoring for Disallowed Costs;
- a Request for Expenditure ("RFE") process covering any project expenditures over $100k;
- an "Open Book" approach whereby Strabag's books and accounts were available for review on an ongoing basis;
- OR review of Strabag's books and records;
- monthly detailed review of invoiced amounts conducted by a third party accounting firm engaged by OPG; and
- a supplemental review of the monthly invoices by the OPG project management team and OPG Finance.

The following metrics were used to analyze schedule and cost progress:

- Budgeted Cost of Work Scheduled ("BCWS") based on the monthly breakdown for key tunnel construction activities from the agreed target schedule and Target Cost;
- Actual Cost of Work Performed ("ACWP") based on contractor invoices and actual month-end progress for the key activities; and
- Budgeted Cost of Work Performed ("BCWP") based on estimated cost to achieve the actual month-end progress for the key activities.

For each of the principal tunnel construction activities the following index ratios were used to indicate progress. The Schedule Performance Index ("SPI") is the ratio of the dollar value of the work performed to the dollar value of the work scheduled to be performed (SPI = BCWP/BCWS). These figures indicated, based on value, how much of the work schedule was actually accomplished. The Cost Performance Index ("CPI") is the ratio of budgeted cost to the actual cost for work performed (CPI = BCWP/ACWP). This indicated how the forecast cost of work performed compared to the actual cost of completing this work. These ratios

were reported to OPG senior management on a monthly basis to enable them to track schedule and cost performance for each major activity on the project.

11.2 Audits Under the ADBA

11.2.1 2009 Audit

OPG's internal audit group conducted an audit of the 2009 project costs that Strabag invoiced OPG for the NTP. The purpose of this audit was to independently assess Strabag's compliance with the provisions of the ADBA relating to Allowed Costs. For the twelve month period, Strabag invoiced OPG approximately $144M related to project costs incurred in 2009. The audit examined approximately 30 per cent of the total costs billed including costs incurred for both suppliers and labour.

The audit found that with one exception, the 2009 project costs reviewed were in compliance. The one exception was some $5,000 in interest charges resulting from late payment of monthly utility bills that were incorrectly invoiced to OPG. These charges are a Disallowed Cost under the ADBA. Strabag typically reversed these charges from the next month's invoice, but in a few instances did not do so, which led to the Disallowed Costs remaining in the invoices to OPG. This was promptly corrected.

The audit also found that the roles and responsibilities of the various parties reviewing the project costs needed to be clarified. The OR, OPG's local accountants and OPG staff all needed to have a better understanding of their respective roles in reviewing Strabag's invoices so that this task could be accomplished in a comprehensive and efficient fashion. To accomplish this, the audit recommended that these parties document the oversight accountabilities and associated processes and controls that are in place. Based on this documentation, any identified gaps should be addressed. The audit also recommended that OPG's audit group not take part in the invoice verification process in a management capacity because of a conflict with the group's mandate to maintain independence from management processes.

OPG management accepted and implemented the audit recommendations.

11.2.2 2010 Audit

In 2010, OPG's audit group conducted a second audit to independently assess OPG's processes to manage the more significant execution phase risks of the NTP such as schedule, cost, scope and change control, reporting, quality and safety. Overall, the audit found the processes and controls to manage these risks to be generally adequate and it assessed the enterprise-level risk implications of the findings from the audit as moderate. The rating of "generally adequate" is defined by OPG's audit group to mean that sufficient controls are in place and generally operating effectively with some improvements required.

The areas identified for improvement were noted as:

- instances where OPG did not properly exercise project oversight because it did not review and comment on key documents, did not enforce the requirement that Strabag perform an environmental audit on its environmental construction activities, and did not audit the OR against the Project Execution Plan;
- reporting of permanent works deficiencies from the OR to OPG is inconsistent and insufficiently transparent; and
- the calculation of the overall project Schedule Performance Index ("SPI"), when initially reported, did not sufficiently reflect the importance of critical path activities.

The audit recommended that the OPG Project Director review and provide input to key documents and procedures on a timely basis and ensure that required audits of Strabag and the OR are performed. While noting that the OR had effective controls in place to monitor non-conformance and deficiencies for permanent construction work, the audit recommended that the OPG Project Director and the OR work together to establish a structured reporting format that identifies recurring problems, trends, corrective and preventative actions, and cost implications. The audit also recommended improvements to the SPI calculation, but noted that the recommended change had already been made before the audit was complete.

OPG management accepted the recommendations and undertook actions to address them.

11.2.3 2011 Audit

In 2011, another audit was undertaken to assess the effectiveness of contract management processes and controls established by OPG to monitor costs under the ADBA. This audit report began by acknowledging a number of actions that OPG had taken to mitigate the financial risk arising from the ADBA. These include:

- structuring the ADBA as a target price contract with incentives and disincentives related to cost and schedule performance;
- maintaining the OR on site to provide contract administration, design review and construction monitoring; and
- retaining a local accounting firm to verify that Strabag's invoiced amounts are supported by Strabag financial records for items such as payroll, subcontractor costs and materials.

The audit concluded that, while the above measures provide some assurance, controls over cost management and procurement, including supporting documentation, required improvement. The audit found that there was a lack of documentary evidence that the OR's monitoring and analysis of Strabag's performance and progress was being used to critically evaluate project costs. The audit confirmed that the OR's field monitoring reports demonstrate that the OR has detailed knowledge gained from daily presence on the job site. However, due to the lack of formality and documentation of the OR invoice review process, the audit was not able to confirm the control effectiveness of the OR's cost management oversight. The audit recommended that the OR's cost control procedure be formalized by providing documentation and that the OR retain evidence of its detailed review of the actual charges. The audit also recommended that OPG staff increase their on-site presence through participation in monthly invoice review meetings with the OR and Strabag.

OPG management accepted the recommendations and agreed that the OPG Project Director would work with the OR to improve the monthly invoice review process. The agreed-on improvements included documenting both the revised procedures for the OR and the actual

monthly reviews conducted for each Strabag invoice. The monthly review process would also address the reasonableness of estimated amounts, and the reasonableness and accuracy of reconciled amounts relative to independent progress records maintained by the OR. Additionally, any variances would be explained, as necessary. OPG management also committed to having an OPG representative regularly participate in monthly invoice review meetings.

The audit also noted that procurement documentation maintained by Strabag for major project expenses required improvement. Under the Request for Expenditure ("RFE") provision of the ADBA, Strabag was required to seek pre-approval of all expenditures above $100k. While the audit acknowledged that the RFE process was designed to ensure sound procurement decisions, it found a lack of sufficient documentation to confirm that the process was consistently applied. It recommended that Strabag create and retain formal files to provide assurance that procurement activities were effective and supportive of OPG's cost management objectives.

OPG management accepted this recommendation and agreed that the OPG Project Director would work with the OR to ensure that documentation associated with past and future RFE procurement activities complies with the agreed documentation standard. OPG Management also committed to confirming that the previous RFE procurement decisions were valid. To this end, the OPG Project Director worked with the OR to implement a system to track and document all RFE expenditures relative to the approved amounts and vendors. Finally, the OPG Project Director also committed to confirming that all Strabag expenditures requiring RFE approval under the ADBA have been accepted by OPG and that no associated expenditures exceed the approved amount. All agreed actions were completed.

11.2.4 2012 Audit

The objective of the 2012 Audit was to independently assess OPG, the OR and Strabag project management processes and controls and to provide reasonable assurance about their effectiveness. The audit scope included a review of the management processes and

controls for risk, cost, and schedule management as well as a review of organizational roles and responsibilities related to these processes. It also included an assessment of the 2011 Audit findings to ensure all recommendations had been effectively implemented.

OPG's audit group again rated the project management processes and controls to be "generally adequate" with an enterprise level impact of "moderate". The audit concluded that all action plans in the 2011 Audit had been successfully implemented, and that the project had made substantial progress in dealing with the overbreak and fall of ground conditions that had posed significant schedule challenges for the project in the past. Having made substantial progress to recover project schedule, the 2012 Audit recommended that the NTP team focus on planning its remaining commissioning and close-out activities, and capture these remaining tasks in detail within the project's schedule and forecasts to continue supporting the objectives of on-schedule and on-budget completion.

A number of work elements were identified by the 2012 Audit as requiring more detailed planning in order to demonstrate with high confidence that the project will meet its final cost and schedule objectives:

- Intake Gate
- Outlet Gate and Hoist
- Approach Wall Completion
- Tunnel Cleanout
- Cofferdam Removal
- Rock-Plug Removal
- Demobilization Efforts
- Site Restoration Work

In addition to the above, the audit noted that detailed planning must also be expanded to include all administrative project closeout activities, such as, for example, tracking of as-built drawings, test data sheets, operation manuals, maintenance manuals, and transfer to OPG of all records and submittals required to successfully close-out the project.

Furthermore, the audit found that the project lacked a formalized process for the recovery of costs associated with the disposal of surplus goods. The NTP has an asset listing detailing approximately $19.1M (book value) in major equipment (vehicles, cranes, heavy equipment, temporary buildings, etc.) and the ADBA required all proceeds from the sale of surplus goods be credited back to the project as cost recoveries.

OPG management accepted the recommendations of the 2012 Audit and developed and implemented an action plan to address them.

11.3 ADBA Amendments

11.3.1 Amendment No. 1

The first ADBA Amendment was executed on July 25, 2012. It incorporated most, but not all, of the Project Change Directives ("PCD"s) that have been issued since the contract was renegotiated. It also recognized changes to the Target Cost resulting from a number of PCD Deemed Amendments,[43] and transfers of funds between items within the Target Cost that do not change the overall scope of the work or the Target Cost.

ADBA Amendment No. 1 increased the Target Cost by approximately $9M and revised the cost allocation outlined in Appendix 1.1 (TTT) of the ADBA for the purposes of cost control, cost projection and cost performance indices. The revised Target Cost is about $994M. Moreover, Amendment No. 1 increased the Substantial Completion date by 17 days from June 15, 2013 to July 2, 2013. This change was a result of an adjustment for crown overbreak, determined in accordance with the Major Risk Table at Appendix 5.3C of the ADBA.

[43] Section 5.1(d) of the ADBA states that any PCD that does not direct, or provide OPG's consent to, a material change to the Work, the Target Cost or the Contract Schedule, will be deemed to be an Amendment.

11.3.2 Amendment No. 2 (Pending)

ADBA Amendment No. 2 will formalize any PCDs issued subsequent to Amendment No. 1 and disposition Strabag's claims for adjustment of the Target Cost and target schedule due to:

- agreed scope changes,
- fall of ground impacts,
- escalation exceeding the baseline,
- diesel fuel costs exceeding the baseline, and
- incremental sub-contractor costs for gate installation, cofferdam removal and rock plug removal.

12.0 PROJECT COMPLETION

12.1 Disposal of Surplus Goods

Under the ADBA, OPG became the owner of all goods that were purchased by Strabag to construct the NTP, with the exception of the TBM and TBM accessories. Since the ADBA is a Target Cost contract, Strabag's and OPG's interests are aligned in maximizing the value of any recovery from the sale of surplus goods because any amounts recovered lower the final Actual Cost, which benefits both parties.

Strabag initially made an offer to purchase some surplus equipment for about $4.8M. After consideration, OPG and the OR decided to reject the offer because it was unclear that the offer captured fair market value for the equipment. Instead, OPG directed Strabag to submit a plan for disposing the surplus goods in the most cost effective, competitive and transparent manner. A number of options were considered:

- restocking or supplier buy-back;
- sell to specific buyer;
- auction;
- sell at scrap price; and
- disposal.

In order to ensure that the project received the best value for the surplus goods, Strabag employed different disposal strategies for different categories of goods. For each type of surplus good, the above disposal methods were ranked in order of their likelihood of providing the maximum credit to the project. The disposal method with the highest rank is to be employed first and if unsuccessful, a method with a lower rank would be employed. For example, stock items were to be restocked with the vendor/supplier if the restocking fee was determined to be reasonable and likely to produce the highest recovery. For standard construction equipment, structures, and items not restocked, it was determined that an unreserved auction would likely produce the best price. All items would be sold as scrap if they cannot be sold otherwise, and items would be disposed of as a last resort.

Strabag issued an RFP on March 26, 2013 for proposals seeking an auctioneer with an extensive network for buyers of construction equipment on the global market. On April 25, 2013, after having conducted site visits with multiple proponents, OPG accepted Strabag's recommendation to retain Ritchie Brothers Canada Ltd. ("Ritchie Brothers") to auction the surplus goods. Under the contract between Ritchie Brothers and Strabag, Ritchie Brothers received a straight commission rate of 10 per cent on the realized proceeds. All proceeds from the sale, less the commission, would be a credit to the project.

The auction was successfully completed on June 17 and June 18, 2013. The equipment was sold "as is" and "where is". The inventory was sold for a total of about $5.6M for a net return to the project of about $5M. A further auction will take place in September 2013 for the disposal of site offices.

12.2 Site Restoration

Under the ADBA, Strabag is obligated to restore all areas of the site it has disturbed to pre-project conditions, and to provide restoration plans to OPG for review.[44] Sites to be restored were the intake and outlet construction areas and locations where concrete drop shafts were installed (3,369 metres, 5,318 metres, and 8,002 metres). As the intake construction area is located on lands leased from the NPC, Strabag worked with the NPC to develop the intake restoration plan.

All site restoration activities are expected to be complete by the fall of 2013.

12.3 Flow Verification

Under section 8.3 of the ADBA, a flow verification test is to be conducted within two weeks of the Substantial Completion date to determine the as-constructed flow capacity rating for the tunnel and any variance to the Guaranteed Flow Amount ("GFA") of 500 m^3/s. The flow test was conducted using an ultrasonic flow meter system that determined the flow rate by sending pulses between transducers located on the walls of the tunnel near the outlet structure.

The flow verification test was executed under the Chief of Test, Alden Labs, and witnessed by representatives from Strabag, the OR and OPG. The flow verification test was originally scheduled for March 2013, but was aborted due to unsuitable ice conditions at the intake site. The test was rescheduled for the week of July 22, 2013. On July 23 and July 24, the flow test was successfully completed. Alden Labs confirmed that the flow capacity for the tunnel was 495.1 m^3/s, which is within the $\pm$2 per cent allowed for measurement error under the ADBA. Consequently, no incentive or disincentive applied.

[44] Sources of the restoration obligations are: s. 2.2.5 of Appendix 1.1 (vv) – Owner's Mandatory Requirements of the ADBA; s. 1.2.1(bbb) of Appendix (rrr) –Summary of Work of the ADBA; s. 1.3.1 of Appendix (rrr) –Summary of Work of the Draft Design/Build Agreement which refers to EA Approval Condition Number. 7.2(c); s. 12.3 of the Environmental Assessment.

12.4 Asset Turnover

The OPG Project Director developed an asset turnover summary to provide an overview of the physical assets and other materials to be transferred to the Niagara Plant Group ("NPG") in order to facilitate operation and maintenance activities. It also outlined the securities and warranties that are available to OPG during the warranty period.

On March 9, 2013, after Substantial Completion of the NTP was achieved, the NPG accepted transfer of operating control over the tunnel, including the intake and the outlet gate and hoist. OPG expects that the transfer of operating control to the NPG over the outlet and intake sites will occur prior to Final Completion. Documentation and records will be transferred to the NPG in accordance with the NTP Documentation Turnover Plan.

12.5 Schedule

The NTP's Substantial Completion occurred on March 9, 2013, well in advance of the revised target schedule date.

Strabag continues to be engaged in site restoration, disposal of surplus goods and preparation for documentation turnover. Final Completion, when Strabag's activities are done, is now expected to occur by October 31, 2013, at which point Strabag's contract will be complete. The OR's activities will then be complete by the end of 2013. A complete project close-out is projected for July 31, 2014 following the completion of groundwater monitoring obligations and the sealing of boreholes and wells.

12.6 Estimated Project Cost to Completion

Table 8 below presents the estimated costs to completion for the NTP as of June 30, 2013 and compares them to the costs in the Superseding BCS. As explained above, due to ongoing project close-out activities, these costs will change slightly. If the cost changes are material, OPG will update this estimate. In any event, cost changes will be captured in the Capacity Refurbishment Variance Account as discussed above in Section 1.2.

Table 8 - Total Project Capital

Item	Original Release	Superseding Release BCS	Actual Costs to June 30, 2013	Estimated Cost at Completion (as of June 2013 forecast)	Delta To Superseding	% Difference
OPG Project Management	4.4	6.0	4.4	4.6	-1.4	-23%
Owner's Representative	25.4	40.4	35.2	36.2	-4.2	-10%
Other Consultants	4.0	5.9	6.2	6.5	0.6	10%
Environmental / Compensation	12.0	9.6	8.7	8.7	-0.9	-9%
Tunnel Contract (including Incentives)	723.6	**1,181.7**	**1,095.4**	**1,140.8**	**-40.9**	**-3%**
Mobilize/Demobilize	*31.7*	*31.0*	*30.4*	*32.1*	*1.1*	*4%*
Maintenance Bond	*2.2*	*0.7*	-	*0.7*	-	*0%*
Performance LC	*1.0*	*5.4*	*6.8*	*7.2*	*1.7*	*32%*
Insurance Premium	*2.7*	*4.3*	*2.6*	*2.7*	*(1.6)*	*-37%*
Design	*5.9*	*9.7*	*11.7*	*11.6*	*1.9*	*20%*
Intake Channel and Walls	*54.9*	*64.8*	*67.4*	*67.4*	*2.6*	*4%*
Diversion Outlet Canal	*12.7*	*12.9*	*15.4*	*15.4*	*2.5*	*20%*
Dewatering Shafts	*3.8*	*3.6*	*3.8*	*3.8*	*0.1*	*4%*
Intake Structure	*5.3*	*8.6*	*6.1*	*6.1*	*(2.5)*	*-29%*
Intake Gates	*2.3*	*2.5*	*4.7*	*4.7*	*2.3*	*91%*
Outlet Structure	*7.2*	*12.8*	*11.7*	*11.7*	*(1.1)*	*-9%*
Outlet Gates and Hoist	*6.0*	*3.6*	*4.7*	*4.7*	*1.1*	*31%*
Diversion Tunnel	*406.9*	*689.4*	*687.3*	*687.3*	*(2.2)*	*0%*
Tunnel Boring Machine	*78.2*	*78.2*	*78.2*	*78.2*	-	*0%*
Flow Verification Test	*0.1*	*0.6*	*0.3*	*0.4*	*(0.2)*	*-34%*
Demolish Dewatering Structure	*1.5*	*1.5*	*0.1*	*0.1*	*(1.4)*	*-96%*
DRB Estimated Cost	*0.2*	*0.4*	*0.3*	*0.3*	*(0.0)*	*-9%*
Scope Changes		*0.7*	*0.7*	*0.7*	*0.0*	*0%*
Provisional Sum		*0.2*	*0.2*	*0.2*	*(0.0)*	*0%*
Changes in Applicable Law		*0.2*	*0.1*	*0.1*	*(0.1)*	*-50%*
Warranty Administration Fee		*0.1*	-	-	*(0.1)*	*-100%*
Office and General Cost		*54.1*	*72.5*	*77.7*	*23.6*	*44%*
Overhead Recovery		*35.3*	*36.0*	*36.4*	*1.1*	*3%*
Interim Completion fee		*10.0*	*10.0*	*10.0*	-	*0%*
Substantial Completion fee		*10.0*	*10.0*	*10.0*	-	*0%*
Cost Performance Disincentive		*(20.0)*			*20.0*	*-100%*
Schedule Incentive			*33.0*	*40.0*	*40.0*	*0%*
One Time Settlement Interest			*1.4*	*1.4*	*1.4*	*0%*
Allowance for Proposed ORST Rebate		*(7.9)*		-	*7.9*	*-100%*
Contingency	101.0	*169.0*		*29.8*	*(139.2)*	*-82%*
Other Contracts / Costs	78.9	69.8	70.6	68.7	(1.1)	-2%
Interest	136.9	286.6	234.5	234.5	(52.1)	-18%
TOTAL PROJECT CAPITAL	**985.2**	**1,600.0**	**1,455.1**	**1,500.0**	**(100.0)**	**-6%**

12.7 Incentive Payments Under the ADBA

Based on the project's Substantial Completion relative to the contract's Substantial Completion date as amended, OPG expects to pay Strabag the maximum incentive of $40M under Section 8.6 of the ADBA. As shown in Table 8 above, OPG has included this amount in its estimate of project costs at completion.

13.0 CONCLUSION

As the discussion above demonstrates, numerous challenges emerged during the course of constructing this extremely large and complex project. These challenges derived primarily from tunnelling conditions which were substantially more difficult than those reasonably anticipated. As discussed above and further elaborated in Appendix B, extensive studies and other investigation of geologic conditions were conducted by Ontario Hydro and others well in advance of the NTP. No amount of preparation however, can provide perfect knowledge of subsurface conditions more than 100 metres underground over the course of a tunnel route more than 10 kilometres long. When challenges to the project schedule and cost emerged, OPG addressed them in a reasonable manner and, working with Strabag and the OR, ultimately overcame every obstacle to deliver a project that will provide substantial value for the people of Ontario into the next century. On this basis, the entire amount of project costs detailed above was prudently incurred and should be recovered.

APPENDICES

13.1 Appendix A – Chronology of Major Milestones / Events

Date	Milestone / Event
1982-1987	**Comprehensive Conceptual Analysis** • Potential development alternatives analyzed • Geotechnical investigations conducted • Recommended the development of additional diversion and generation capacity at the Sir Adam Beck complex
08-Aug-1988	**Ontario Hydro Board Authorized Project Definition Activities** • Included preliminary engineering and an environmental assessment
Mar-1991	**Ontario Hydro Submitted Environmental Assessment ("EA") for Niagara River Hydroelectric Development ("NRHD")** • Proposed NRHD included two new tunnels, a three-unit 1050 MW underground generating station (referred to as Beck 3), and transmission improvements in the Niagara Peninsula • Allowed for staging of the project (i.e. the diversion facilities, one or both tunnels, could proceed in advance of the generation and transmission facilities)
22-Dec-1993	**Community Impact Agreement ("CIA") Signed** • CIA signed between Regional Municipality of Niagara, Town of Niagara-on-the-Lake, City of Niagara Falls and Ontario Hydro for tourism, road upgrades and facility improvements that would be necessary if the NRHD were to proceed • CIA was based on the full NRHD with estimated construction duration of 7 years and estimated peak construction workforce of 800
Feb-1998	**Ontario Hydro Initiates Review of Phase 1 of NRHD** • Decision to initiate Phase 1 (construction of one new tunnel)
Apr-1998	**Ontario Hydro Retains the Beck Diversion Group ("BDG") as the Owner's Representative for Project** • Acres International Limited, Bechtel Canada and Hatch Mott MacDonald comprised BDG
Jun-1998	**Ontario Hydro Solicits Bids for Phase 1 of NRHD** • Solicited bids for detailed design and construction of one new tunnel • Bids received in Sept-1998 and analyzed in Oct-1998 resulting in a recommendation for award
14-Oct-1998	**Complete NRHD receives EA Approval** • EA approval provided Ontario Hydro with the flexibility to undertake the development in phases
Dec-1998	**Ontario Hydro Delays Award of Contract** • Ontario Hydro informs bidders that given the imminent reorganization of the Corporation, the final decision regarding the tunnel would be deferred until after April 1999
Jun-1999	**OPG Decides to "Defer Indefinitely" the Project** • OPG decided to focus on other major projects (e.g., return to service of Pickering A) before committing to construct the new tunnel

Nov-2002	**Province States It Will Direct OPG to Proceed with New Water Diversion Tunnel** • The Province subsequently indicated a strong desire to have the project completed in the shortest possible timeframe
24-Jun-2004	**OPG Board of Director's Approve Preliminary Release** • Preliminary release of $10M to conduct a Request for Proposal ("RFP") process and to carry out such other preconstruction activities as OPG deems necessary
Jul-2004	**OPG Engages Hatch Mott MacDonald ("HMM")** • HMM, an international tunnelling/mining expert consultant company, was engaged as OPG's Owner's Representative ("OR") for the Project • HMM to work in association with Hatch Acres
13-Aug-2004	**Request for Expressions of Interest ("EOI") Issued** • Request for EOIs for prequalification of potential proponents issued • Responses received by 09-Sep-2004 from seven (7) companies and consortiums
Dec-2004	**Invitation to Submit Design/Build Proposals Issued** • Invitations issued to four pre-qualified proponents • Final Amendment (#5) issued on 26-Apr-2005
18-Feb-2005	**Agreement Signed Between the Niagara Parks Commission ("NPC") and OPG** • Agreement forms part of the larger Niagara Exchange transaction concerning the long term disposition of water rights on the Niagara River • Committed OPG to undertake remedial work at the retired Ontario Power and Toronto Power generating stations for reversion of these stations to the NPC and secured the agreement of the NPC that until 2056 it would grant water rights to no party other than OPG • Associated $10M settlement with Fortis Ontario, approved by the OPG Board on 08-Feb-2005, secured an irrevocable assignment of the water associated with Rankine generating station. These costs are included in the release estimate for the Project
13-May-2005	**Design/Build Proposals Received** • Three (3) proposals received • Proposals evaluated by separate commercial and technical teams
Jun-2005 to Jul-2005	**Proposal Evaluation and Negotiations with Proponents** • Based on evaluation scores, it was determined that negotiations should proceed initially with all three proponents to determine the "best value" proposal • When the proposals were re-scored after additional information was received and preliminary negotiations occurred, OPG began negotiating solely with the top two proponents • At the conclusion of the process, OPG chose Strabag AG as the successful proponent
28-Jul-2005	**OPG Board of Director's Approve NTP Execution Phase** • Niagara Tunnel Project approved with a budget of $985M and an in-service date of June-2010. • OPG Board approval subject to obtaining Provincial financing, through Ontario Electricity Financial Corporation, which was authorized on 18-Aug-2005

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18-Aug-2005	**Design Build Agreement ("DBA") Signed with STRABAG AG**
Sept-2005	**STRABAG occupied site and started NTP construction**
17-May-2006 and 19-Jun-2006	**STRABAG Issues Claims for Differing Subsurface Conditions ("DSC") for Underwater Construction at the Intake Channel and Acceleration Wall** • Initiation of a dispute regarding a DSC for excessive overburden on the river bed encountered during construction of the intake channel that was claimed to differ materially from the subsurface conditions described in the Geotechnical Baseline Report ("GBR") • DSC claim related to work at the acceleration wall where conditions (i.e. bedrock elevation and the presence of large boulders) were claimed to differ materially from the GBR
01-Sep-2006	**TBM Excavation Commences** • TBM was acquired and assembled within 12 months according to the schedule proposed by STRABAG and incorporated into the DBA
23-May-2007	**STRABAG Claims DSC for Adverse Conditions in the Queenston Shale** • On or about 16-May-2007 near 840 m, immediately below the Whirlpool sandstone formation, a large block of Queenston shale dropped from the tunnel crown • STRABAG claimed DSC relative to the GBR
20-Sep-2007	**Settlement and Release Agreements Covering the Intake Channel DSC Signed** • Addressed DSC for the Intake Channel and Acceleration Wall underwater construction • Settlement Agreement signed by OPG and STRABAG • Release Agreement signed by OPG, STRABAG, Dufferin Construction and McNally Construction
24-Oct-2007	**STRABAG Initially Proposes a New Tunnel Alignment** • STRABAG suggested a number of benefits of realignment including an improved tunneling process
05-Nov-2007	**STRABAG Delivers Dispute Notice 001** • Dispute Notice 001 delivered to OPG concerning STRABAG's DSC claim associated with "Collapse in the Tunnel Crown," signaling their intent to refer this matter to the Dispute Review Board ("DRB") as a complex dispute triggered by a DSC, under the process contained in DBA s 5.5(a) • OPG countered on 12-Nov-2007 by requesting that Strabag agree to have the DRB first decide whether DBA s 5.5(c) applies. That section states settlement of DSC's concerning differing rock support requirements should be addressed only upon completion of the tunnel excavation
04-Feb-2008	**STRABAG Submits an Optimized Alignment & Revised Schedule Proposal** • Proposal also included information on alleged DSCs, efforts to mitigate DSCs, and implications to TBM drive and costs
14-Feb-2008	**OPG and STRABAG Senior Management Decide to Obtain a Determination from the Dispute Review Board ("DRB")** • Determination requested from DRB concerning the merits and materiality of DSCs alleged by STRABAG • DRB response would be considered by both OPG and STRABAG to pursue further negotiations including finalization of commercial terms of the realignment

31-Mar-2008	**Ministry of Environment ("MOE") Accepts the Proposed Tunnel Realignment** • MOE accepts OPG request for a minor amendment to the approved EA regarding the proposed tunnel realignment
04-Apr-2008	**STRABAG's DSC Position Summary Delivered to the DRB and OPG** • Initiated the DRB Hearing Process • OPG and STRABAG position papers, including expert reports, were subsequently exchanged and delivered to the DRB on 23-May-2008. • OPG and STRABAG rebuttal papers were exchanged and delivered to the DRB on 13-June-2008.
23-Jun-2008 to 26-Jun-2008	**DRB Hearing Held** • Due to the volume of materials to be considered and the complexity of the dispute, the DRB advised that their deliberations and written recommendations would likely require 60-90 days
30-Aug-2008	**DRB Report and Non-binding recommendations Received** • Report presents the DRB's unanimous conclusions and recommendations under five topics
09-Sep-2008	**STRABAG Commences Horizontal Realignment of Tunnel** • Started at approximately CH2+980
Oct-2008	**OPG Management Recommend Pursuing a Negotiated Settlement with STRABAG** • OPG evaluated options including engaging another Contractor to complete the Project and proceeding under the existing Design Build Agreement • Negotiated settlement was determined to provide the greatest likelihood of completing the project at the lowest cost in the shortest duration
11-Nov-2008	**Principles of Agreement Signed** • Negotiations were held from 15-Oct-2008 to 17-Oct-2008 and 03-Nov-2008 to 05-Nov-2008 • Outlined how the Parties would reach a final resolution of STRABAG's claim of Differing Subsurface Conditions in the Queenston Formation
31-Dec-2008	**STRABAG Starts Vertical Realignment of Tunnel** • Started at approximately CH3+300
09-Feb-2009	**Term Sheet Signed** • Negotiated Term Sheet required as part of the Principles of Agreement in order to further elaborate how the Parties would finalize the Revised Agreement to complete the Niagara Tunnel Project
24-Feb-2009	**Agreement on Revised Contract Schedule** • Substantial Completion date of 15-Jun-2013 with incentives and disincentives relative to target in-service date
07-Apr-2009	**Agreement on Target Cost** • Negotiations resulted in a Target Cost of CAD $985M with incentives and disincentives relative to the target cost
21-May-2009	**OPG Board Approval** • Board approves the revised schedule and cost, and the amendment and execution of the Amended Design Build Agreement with STRABAG
04-Jun-2009	**Amended Design Build Agreement ("ADBA") Signed** • Effective date of ADBA is December 1, 2008
11-Sep-2009	**Fall of Ground between 3,605m and 3,625m** • Approximately 100 m^3 of Queenston Shale and temporary tunnel lining

	(shotcrete, wire mesh and steel channels) fell from the right side of the tunnel crown • Investigations concluded that a loosening of the rock support dowels put more pressure on the dowels' face plates than they could hold, which led to the fall. Boreholes NF-4 and NF-4A contributed to the loosening of the dowels by allowing relatively fresh water to penetrate and degrade the surrounding rock • Set back the schedule for NTP completion by approximately 17 days based on one day of delay to TBM mining translating into 0.375 days of delay to the critical path • Final cost impact of the 2009 fall of ground was estimated at $2 M, which is equal to insurance deductible, so no claim was made
30-Mar-2011	**TBM Mining Completed** • Boring of tunnel complete • TBM disassembly and removal follows
02-Jul-2011	**Fall of Ground between 6,033m to 6,080m** • Approximately 1,200 m^3 of shotcrete, steel ribs, wire mesh and loose rock fell from the tunnel crown • Remediation costs initially estimated $17.6 M, including work done outside of the MOL mandated area, but later revised to $12.1 M. Insurer took the position that since the actual fall of ground area was less than 100 metres, a $10M claim limit applied and will pay this amount • ADBA Target Cost will be increased by $10.4M
25-Jul-2012	**ADBA Amendment No. 1** • Incorporated a number of Project Change Directives ("PCD"s), and recognized a number of PCD Deemed Amendments • Recognized budget transfers that have occurred without change to the Target Cost or to the scope of the Work • Amended Appendix 1.1(TTT)—Target Cost: o aggregate change of $9,0003,566.91 to the Target Price resulting from the incorporated and recognized PCDs o the revised Target Cost is about $994 M o revised allocation of the Target Cost for the purposes of cost control, cost projection and cost performances indices only. • Amended the Substantial Completion date to 02-July-2013 • Amended Appendix 1.1(hhh)—Project Change Directive Form • Amended Appendix 2.2(a)—Organizational Chart
30-Jul-2012	**Invert Concrete Lining Completed** • Decommissioning of invert shutter was completed by 15-Aug-2012
19-Sep-2012	**Profile Restoration Completed** • Decommissioning of restoration carrier/bridges was completed by 05-Oct-12
06-Nov-2012	**Final Concrete Lining Completed** • Arch concrete carriers were moved to the outlet for disassembly and removal by 31-Dec-2012
04-Feb-2013	**Grouting Operations Completed** • Contact grouting was completed on 10-Nov-2012, and the contact grout carrier was moved to the outlet for disassembly and removal by 30-Dec-2012 • Pre-stress grouting was completed on 04-Feb-2013, and the mobile pre-stress grout carrier was removed from the tunnel by 22-Feb-2013
09-Mar-2013	**Substantial Completion**

	After 24 hours of uninterrupted flow, the Substantial Completion milestone was achieved on 09-Mar-2013
31-Oct-2013	**Forecast Final Completion Date** The date forecasted for the completion of site restoration, disposal of surplus goods and documentation turnover. At this point, STRABAG's contract and activities will be complete.
31-July-2014	**Forecast Complete Project Close-out Date** The date forecasted for complete project close-out, following the completion of groundwater monitoring obligations and sealing up of boreholes and wells. Final reports will be issued and internal documentation will be completed.

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13.2 Appendix B – Summary of Geologic Investigations

Beginning in 1983, extensive geotechnical investigations were undertaken during concept and definition phases for the expansion of OPG's Niagara hydroelectric facilities, which at that time contemplated two additional tunnels and a new underground generating station ("Beck 3"). These investigations were heavily focused on the Queenston shale formation because drilling in this formation was required by the plans to excavate the new tunnels under the existing Sir Adam Beck No. 2 tunnels with sufficient separation to allow the use of the existing rights of way (i.e., tunnel at greater depth in the same corridor). Because the plan also involved tunneling under the buried St. Davids Gorge (to reduce excavated material disposal relative to an open canal) and constructing the planned underground powerhouse, the investigations also focused on the buried St. Davids Gorge area and the planned powerhouse area.

As indicated in Table 1 below, the geotechnical investigations were carried out in stages and included a total of 59 boreholes and a geotechnical test adit (small test tunnel). Rock cores were retrieved from the boreholes to determine physical and engineering properties (chemical composition, strength, in-situ stress, joints, swelling potential, etc.). This investigation work involved internal staff, experienced engineering consultants (i.e., Acres, Golder), geotechnical engineering faculty from the University of Western Ontario, University of Toronto, Laurentian University, University of Michigan, and other international geotechnical engineering and construction experts from universities in Florida and Germany who participated through technical review panels (see Table 2 below).

Twenty of the 59 boreholes were along the 10 kilometre tunnel route with the remainder in the area of the proposed powerhouses, along other potential tunnel alignments and around the Pump Generating Station reservoir. Besides core retrieval for testing, in-situ stress measurements were conducted in some boreholes to assess the magnitude and orientation of the horizontal stress regime. Piezometers were also installed in many of the boreholes to assess groundwater conditions.

The geotechnical adit was originally 580 metres long and three metres in diameter. It was subsequently enlarged on a trial basis to 12 metres in diameter over its last 30 metres. The adit was excavated at the Sir Adam Beck complex by Thyssen Mining Corporation of Canada Ltd (subcontractors to Acres Bechtel Canada). Excavation occurred between August 1992 and July 1993 (see Figure 1 below). The adit was tested and observed as part of the investigation program, and monitoring continued through March 1994.

Construction of a geotechnical adit is not typically done for tunnel projects because of the associated time and cost. The trial enlargement was specifically designed and constructed to simulate the excavation of the planned diversion tunnels in the Queenston shale formation using a full-face tunnel boring machine. In consultation with engaged experts on the Specialist Consulting Board, the adit helped OPG conclude that rapid, full-face tunnel excavation in the Queenston shale formation on the planned scale was technically feasible and cost-effective.

The relevant geotechnical parameters were summarized in the draft Geotechnical Baseline Report ("GBR") and included in OPG's Design Build Request for Proposal documents. The contractor, Strabag, refined the GBR to incorporate its interpretation of the data and rock behaviour expected relative to its planned means and methods of construction. The collaboratively negotiated 3-stage GBR was included in the Design Build Agreement as the agreed baseline for expected geotechnical conditions.

After contract award, Strabag drilled seven additional boreholes to verify the rock conditions in the vicinity of the buried St. Davids Gorge. These boreholes confirmed that the Queenston shale was intact and that Strabag's proposed alignment (which was higher than the concept alignment in the RFP) was feasible.

At 14.4 metres in diameter, the Niagara Tunnel is precedent setting for excavation by an open full-face tunnel boring machine in rock. Rock is not a uniform material and subsurface conditions can vary considerably over a short distance. Despite extensive investigations, rock behaviour during tunneling cannot be precisely predicted from boreholes and adits that provide representative data for only a small percentage of the rock to be excavated. Consequently, tunnel designs are based on experience and interpretation of the geotechnical parameters. Actual rock conditions and its behaviour during tunnel construction cannot be fully known before the excavation is complete. Sub-surface conditions always remain a significant risk to both design and construction of tunneling projects.

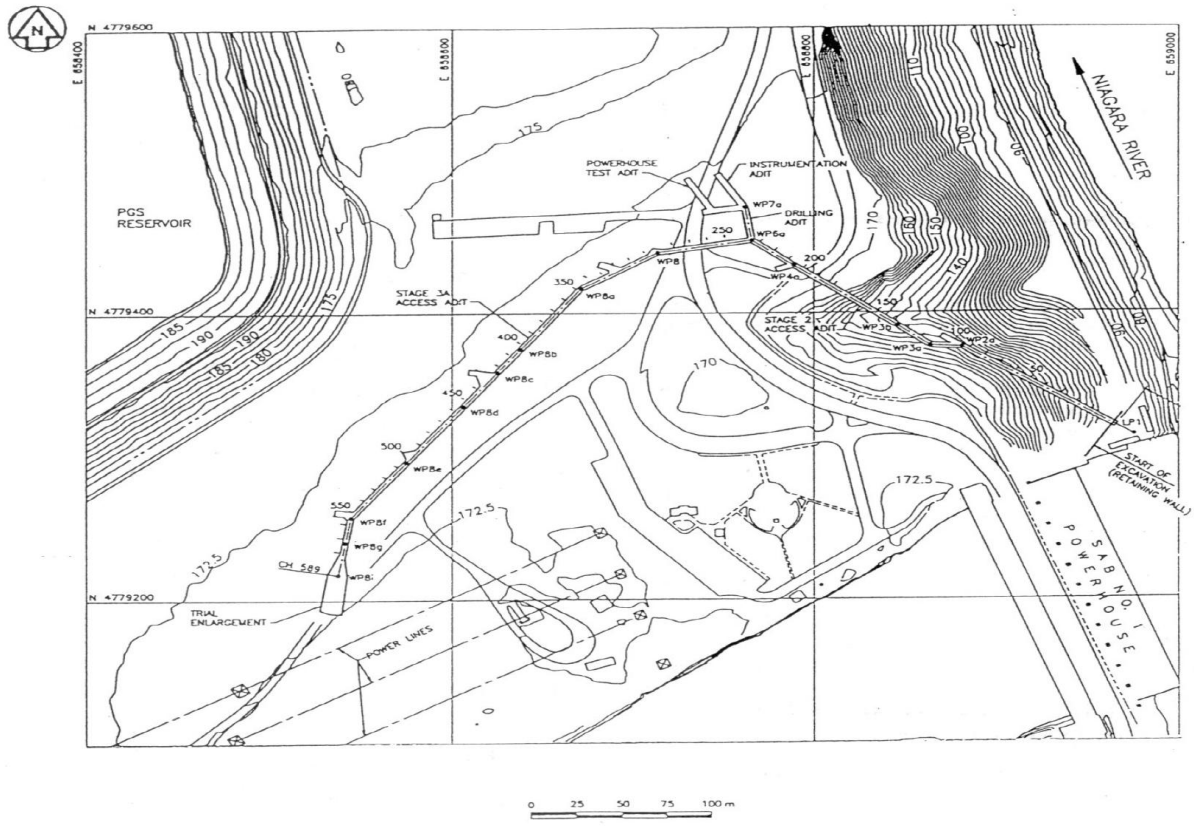
Table 1 - Work Completed During Various Stages of Geotechnical Investigations

Stage / Work Completed	Timeline
Concept Phase • Drilled 5 boreholes (SD-1 to SD-5) in buried St. Davids Gorge • Drilled 25 boreholes (NF-1 to NF-26, excluding NF-16 – was not drilled) along potential tunnel alignments, surface and underground powerhouse locations and around the PGS reservoir	1983 - 1989
Definition Engineering Phase 1 • Drilled 16 boreholes. Five in the Diversion Facilities area (NF-4A, NF-28, NF-30, NF-32 and NF-33), four in the St. Davids Gorge area (SD-6 to SD-9), and seven in the Generation Facilities area (NF-27, NF-29, NF-31, NF-34 to NF-37)	1990
Definition Engineering Phase 2 • Drilled 13 boreholes (NF-38 to NF-50) • Exploratory adit program	1992-1993

Table 2 - Roles of Experts / Consultants

Expert / Engineering Consultant	Role / Area of Expertise
Dr. K.Y. Lo – University of Western Ontario	Swelling Potential in Queenston Shale
Dr. E. Hoek – University of Toronto	Rock Mechanics
Dr. D. McCreath – Laurentian University	Rock Mechanics
Dr. B. Haimson - University of Wisconsin-Madison	In-situ Stress / Hydraulic Fracturing
Dr. Don U. Deere	Member of the Geotechnical Specialist Consulting Board
Dr. Walter Wittke – Beratende Ingenieure fur, Germany	Member of the Geotechnical Specialist Consulting Board
Acres Bechtel Canada ("ABC")	Engineering Procurement Construction Management ("EPCM") Consultant
Golder Associates	EPCM Consultant (worked in conjunction with ABC)
Clair. H Murdock Consultants Inc.	Estimating
MultiVIEW Geoservices Inc.	Seismic Survey of St. Davids Gorge

Figure 1 - Geotechnical Adit – Layout and Survey Control



13.3 Appendix C – Acronyms and Definitions

ACWP	Actual Cost of Work Performed
ADBA	Amended Design Build Agreement
BAR	Builder's All Risk Insurance
BCS	Business Case Summary
BCWP	Budgeted Cost of Work Performed
BCWS	Budgeted Cost of Work Scheduled
BDG	Beck Diversion Group
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
BU	Backup Unit
CofA	Certificate of Approval
CBS	Cost Breakdown Structure
CCA	Capital Cost Allowance
CCB	Change Control Board
CI	Change Initiation
CIA	Community Impact Agreement
CLOC	Contract Litigation Oversight Committee
CNP	Canadian Niagara Power Company Limited
CPI	Cost Performance Index
CT	Contractor Transmittal (from OR)
DBA	Design Build Agreement
DCC	Dufferin Construction Company
DFO	Fisheries and Oceans Canada (Department of Fisheries and Oceans)
DRB	Disputes Review Board
DS	Document Submittal
DSC	Differing Subsurface Condition
DT	Document Transmittal (to OR)

EA	Environmental Assessment
ELT	Enterprise Leadership Team
EOI	Expression of Interest
EPSCA	Electrical Power Systems Construction Association (Union)
FIT	Feed-In-Tariff (Green Energy Act)
GBR	Geotechnical Baseline Report
GDR	Geotechnical Data Report
GFA	Guaranteed Flow Amount
GIP	Grass Island Pool
GRC	Gross Revenue Charge
H+E	H+E Logistics (subcontractor to Strabag)
H&S	Health and Safety
HDS	High Definition Survey
HMM	Hatch Mott MacDonald Ltd.
ICC	International Chamber of Commerce
IESO	Independent Electricity System Operator
ILF	ILF (Strabag's Tunnel Designer)
IJC	International Joint Commission
INBC	International Niagara Board of Control
INCW	International Niagara Control Works
INCW Part Project	Part of the Niagara Tunnel Project where OPG is the "constructor" (as defined in OH&SA) for a limited period
JSA	Job Safety Analysis
LRIA	Lakes and Rives Improvement Act
LTI	Lost Time Injuiry
LUEC	Levelized Unit Energy Cost
M&S	Monteith and Sutherland
MHL	Morrison Hershfield Limited (Surface Works Designer for Strabag)

MNR	Ministry of Natural Resources
MOE	Ministry of the Environment
MOL	Ministry of Labour
MOM	Minutes of Meeting
MOU	Memorandum of Understanding
MPC	Major Projects Committee
MRPH	Maximum Reasonable Potential for Harm
NCN	Nonconformance Notice
NCR	Nonconformance Report
NEA	Niagara Exchange Agreement
NOTL	Niagara on the Lake
NPC	Niagara Parks Commission
NPCA	Niagara Peninsula Conservation Authority
NPG	Niagara Plant Group
NRCC	Niagara River Control Centre
NRHD	Niagara River Hydroelectric Development
NRP	Niagara Region Police
NTP	Niagara Tunnel Project
OCIP	Owners Controlled Insurance Program
OEFC	Ontario Electricity Financing Corporation
OMR	Owner's Mandatory Requirements
OH&SA	Occupational Health and Safety Act
OIC	Order-in-Council
OPG	Ontario Power Generation
OR	Owner's Representative, Hatch Mott MacDonald Ltd. with Hatch Acres
ORST	Ontario Retail Sales Tax
PCD	Project Change Directive
PCN	Project Change Notice

PDRI	Project Definition Rating Index, developed by the Construction Industry Institute
PEP	Project Execution Plan
PFD	Personal Flotation Device
PIR	Post Implementation Review
PKS	Peter Kiewit Sons Ltd.
PGS	Pump Generating Station
PPE	Personal Protective Equipment
PRM	Project Risk Management
Project	Niagara Tunnel Project
PTTW	Permit to Take Water
RFE	Request for Expenditure
RFI	Request for Information
RFQ	Request for Quotation
RMP	Risk Management Plan
RMR	Rock Mass Rating
ROC	Risk Oversight Committee
ROWA	ROWA (TBM Backup System Manufacturer)
RFP	Request for Proposal
RQE	Release Quality Estimate
SAB	Sir Adam Beck
SBA	Self Breathing Apparatus
SCI	System Classification Index
SPI	Schedule Performance Index
SPOC	Single Point of Contact
TBM	Tunnel Boring Machine
TCP	Traffic Control Person
VFD	Variable Frequency Drive

WBS	Work Breakdown Structure
WSIB	Workplace Safety Insurance Board
WTP	Water Treatment Plant
WUL	Wrap-Up Liability Insurance

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