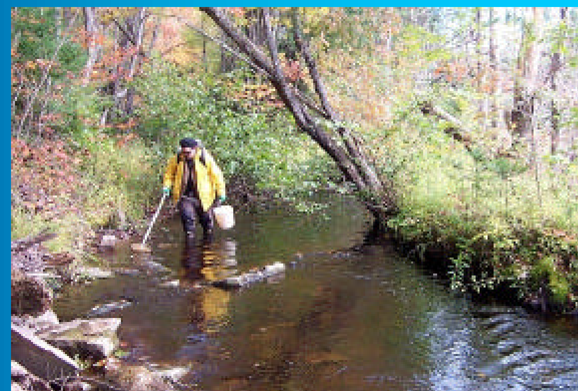
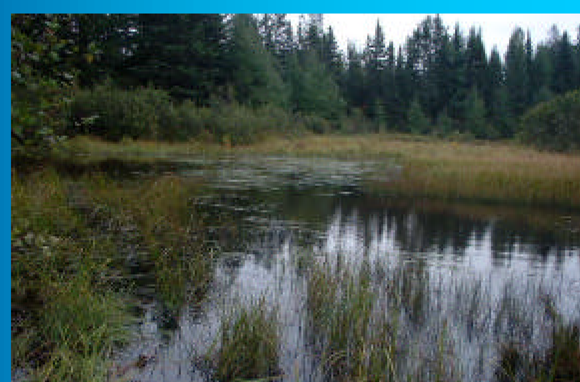
NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT
PERTH-ANDOVER TO WOODSTOCK

Final Comprehensive Study Report
Volume 1 of 2





New Nouveau Brunswick

Jacques Whitford Environment Limited

FINAL COMPREHENSIVE STUDY REPORT
NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT
PERTH-ANDOVER TO WOODSTOCK
NEW BRUNSWICK

PROJECT NO. NBF14677

FINAL COMPREHENSIVE STUDY REPORT
NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT
PERTH-ANDOVER TO WOODSTOCK
NEW BRUNSWICK

NEW BRUNSWICK DEPARTMENT OF TRANSPORTATION
PLANNING AND LAND MANAGEMENT BRANCH

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EXECUTIVE SUMMARY

Introduction

Transport Canada (TC), Infrastructure Canada, and Fisheries and Oceans Canada (DFO), the federal Responsible Authorities (RAs) under the *Canadian Environmental Assessment Act* (*CEAA*), delegated preparation of this Comprehensive Study Report (CSR) to the New Brunswick Department of Transportation (NBDOT) for the proposed development of a four-lane Trans-Canada Highway (TCH) from Perth-Andover to Woodstock.

The purpose of the CSR is to assess potential environmental effects of the proposed Project, and to identify methods of optimizing positive environmental effects and reducing adverse environmental effects that may result from the Project. The scope of the assessment includes the construction, operation, and maintenance of the proposed TCH (including interchanges and new connector roads); grade separations; secondary road modifications; stream crossings (*e.g.*, bridges and culverts); severed property access roads between Perth Andover and Woodstock; accidents, malfunctions and unplanned events.

Project Alternatives

The objective of the Project was to upgrade the Trans-Canada Highway for the purposes of fostering economic development through improved capacity and to enhance motorist safety.

Prior to consideration of highway alignment alternatives, NBDOT considered other possible ways to satisfy travel and freight transportation demands and to improve the traffic safety along the TCH between Perth-Andover and Woodstock. Three alternatives to the Project were considered:

- the Null Alternative (do nothing scenario);
- upgrading of the highway capacity along the existing route (*i.e.*, widening or twinning the existing TCH); and
- other modes of transportation (*e.g.*, rail).

These alternatives to the Project all failed to achieve the objectives of the Project. The Null Alternative did not foster economic development in the region and did not enhance motorist safety. Widening the existing TCH was rejected for reasons such as higher accident rates, poor levels of service, and limited space due to the extent of commercial and residential properties. Twinning the existing TCH was rejected primarily due to space limitations making this option not technically feasible. Other modes of transportation were rejected because they did not achieve the goal of improving the Trans-Canada

Highway through New Brunswick, they would not foster economic growth in that region, and because of high capital and operating costs.

NBDOT produced three successive alignment alternatives between 1997 and 1999 that, through an iterative process of consultations with the public and input from regulatory agencies, resulted in a fourth alternative, the preferred alignment in 2003. This iterative process included refinements to avoid or minimize potential environmental, social—cultural and economic effects.

Project Description

The Project consists of the construction, operation, and maintenance of a new four-lane divided controlled access highway, approximately 70.7 km in length, that will by-pass the existing two-lane TCH, including interchanges and watercourse crossings and structures, and required ancillary work/facilities (*e.g.*, new road connections, property access roads, and borrow and disposal areas). This new section of the TCH will be located in western New Brunswick, and will extend north/south between the Village of Perth-Andover and the Town of Woodstock. The proposed TCH alignment is located west of the existing TCH, between the Saint John River and the United States border. As such, the proposed TCH will not require/include new major bridge structures to cross the Saint John River.

The Project will require the construction of four bridge crossings along the proposed TCH and there will be 43 minor watercourse crossings that do not require bridge crossings. The Project will require the construction of 18 property access roads and 4 interchanges. There will be no rest areas constructed for the proposed Project.

The proposed TCH will be designed and constructed to RAD 120 (Rural Arterial Divided highway with design speed of 120 kph) Transportation Association of Canada (TAC) Standards, allowing the planned posted speed of 110 kph.

NBDOT plans to complete construction of the Project in four years beginning in 2004 and ending at the conclusion of the 2007 construction season. To date the Project has undergone the functional planning process to select an alignment. NBDOT preliminary pre-design construction costs of the Project are estimated at $200 million.

Environmental Effects Assessment Methodology and Scoping

The methodological approach employed in this Comprehensive Study provides an evaluation of Project-related environmental effects and is designed to address the scope of the Project and the factors to be considered as outlined in Sections 15 and 16 of *CEAA* and as determined by the responsible authorities in their scope determination (Guidelines; Appendix A) thereunder.

The environmental assessment method followed a six step process to arrive at a determination of significance for Project-related environmental effects. These are:

- identify the issues through scoping and select Valued Environmental Components ("VECs") on which to focus the environmental assessment;
- establish boundaries for the environmental assessment and residual environmental effects rating criteria ("thresholds of significance") for determining the significance of environmental effects for each VEC;
- identify environmental effects of Project activities, by Project phase and also the changes to the Project caused by the environment;
- evaluate environmental effects using the significance criteria identified in Canadian Environmental Assessment Agency guidance documentation (*CEAA* 1994) in light of proposed mitigation;
- analyze the environmental effects and predict their significance by applying the residual environmental effects rating criteria; and
- outline a monitoring and follow-up program, as required.

Public consultation was conducted with identified stakeholders, the general public and the Aboriginal community to identify additional issues for inclusion in the CSR. Consultation took place over six years (1998-2004), and includes a First Nation Traditional Ecological Knowledge Study.

Over the course of the public consultation process a number of common issues, questions and concerns were raised regarding private water supplies, increased noise levels, loss of quality of life, property access, access roads, loss of livelihood due to property severance and loss of revenue due to by-pass of businesses.

All issues raised during public consultation were reviewed and evaluated for their relevance to the Comprehensive Study, and considered during the scoping process and selection of the VECs.

Environmental Effects Assessment

Project-VEC interactions were analyzed to determine potential environmental effects associated with Project components and activities. The analysis for each VEC was carried out for each Project phase and potential accidental and/or unplanned events including fires, hazardous spills, erosion and sedimentation control failure, bridge or culvert washout, vehicular collisions, wildlife encounters, changes in land use, disturbance of archaeological or heritage resources, and changes in commercial activity. The analysis used qualitative and, where possible, quantitative information available from existing knowledge (including baseline studies) and appropriate tools, as well as considering identified measures.

Residual environmental effects were predicted for VECs following the application of proposed mitigation measures. The residual environmental effects of each Project phase were evaluated as either significant (S), not significant (NS), or positive (P), based on the significance threshold developed for each VEC. The significance of residual environmental effects, as determined for each VEC are summarized in Table 1.

Table 1 Summary of Residual Environmental Effects of the Project

VEC	Construction	Operation	Maintenance	Accidents, Malfunctions and Unplanned Events	Project Overall
Atmospheric Environment	NS	NS	NS	NS	NS
Groundwater Resources	NS	NS	NS	S*	NS
Surface Water Resources	NS	NS	NS	S*	NS
Fish and Fish Habitat	NS	NS	NS	S*	NS
Vegetation**	NS	NS	NS	NS	NS
Wetlands	NS	NS	NS	NS	NS
Wildlife	NS	NS	NS	NS	NS
Land Use	NS	NS	NS	NS	NS
Current Use of Land and Resources for Traditional Purposes by Aboriginal Persons	NS	NS	NS	S*	NS
Archaeological and Heritage resources	NS	N/A	N/A	NS	NS
Labour and Economy	NS	NS	NS	NS	NS

* low likelihood of occurrence
** includes Appalachian Hardwood Forest and rare plants

In all cases, the residual environmental effects of the Project were determined to be not significant (NS) except for in the case of accidental or unplanned events (*i.e.,* hazardous materials spills) occurring with respect to groundwater, surface water and fish and fish habitat. These effects would result in a possible significant (S) effect on the surrounding environment, however, in those cases the likelihood of occurrence is very low, and would be further reduced by development of the Project (*e.g.*, less chance of head on collision because of divided highway lanes).

Effects of the environment on the Project include those from weather-related events (*e.g.,* precipitation and erosion), seismic-related events (*e.g.*, earthquakes and rock slides), and forest fires. The Project will be planned, designed and constructed such that the identified effects of the environment on the Project were determined to be not significant, or if significant, extremely unlikely (*i.e.,* large-scale seismic event).

Compensation Measures

Compensation measures are an essential part of the mitigative strategy for minimizing the potential residual environmental effects of the Project. NBDOT will be responsible for providing compensation for fish habitat, wetland habitat, and property loss.

NBDOT will establish a habitat compensation bank in advance of ground breaking construction activities, to address the issue of habitat compensation required for full HADD authorization under the *Fisheries Act*, and will manage the compensation bank throughout the duration of construction and follow-up monitoring. The purpose of fish habitat compensation is to achieve a net gain in fish habitat productivity to offset Project-related harmful alteration, disturbance or destruction of fish habitat.

The potential loss of rare plants and AHF was minimized during the alignment selection process. Residual rare plants and AHF loss will be compensated through the acquisition and protection of high quality AHF near the RoW. In addition, rare plants will be avoided during design and construction of watercourse structures (*e.g.*, Big Presque Isle River Bridge). The loss of butternut within the RoW will be compensated for through the collection and preservation of genetic information from affected trees.

A wetland compensation plan will be developed in consultation with NBDNR and Environment Canada's Canadian Wildlife Service, in accordance with Federal Wetland Policy and Provincial Wetland Policy, will ensure that there is no net loss of wetland area.

Owners of property within the RoW will be compensated through land acquisition. Properties that are severed in such a manner that a remnant parcel precludes current land use (*e.g.*, agriculture) will be mitigated through provision of compensation and or alternate access.

Cumulative Environmental Effects Assessment

Under CEAA, a Comprehensive Study is required to consider the cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out.

The assessment of cumulative environmental effects of the proposed Project considered the following categories of past, present and future projects and activities that will be carried out:

- Existing Highways and Roads;
- Current and Future TCH Projects;
- Planned Development along Proposed TCH;

- Adjacent Land Uses; and
- Other Planned Development

The VECs and indicators considered in the cumulative environmental effects assessment are listed in Table 2.

Table 2 VECs and Indicators for Cumulative Environmental Effects Assessment

Valued Environmental Component	Indicator(s)
Fish Habitat and Water Quality	Sedimentation
Atlantic Salmon	Upper Saint John River Atlantic Salmon Returns
Appalachian Hardwood Forest	Loss of AHF Habitat
Wetlands	Loss of Wetland Area
Moose and Moose Habitat	Moose Population
Migratory Birds of Special Conservation Concern	Mature Forest Migratory Bird Habitat Loss and Fragmentation
Agricultural Land	Agricultural Land Area

The Project is not anticipated to result in substantive contributions to cumulative environmental effects due to the extensive mitigation measures and rigorous environmental management plan of the Project, and because of fish habitat, wetland habitat, AHF, rare plants, and land owner compensation measures required as a result of the Project.

Monitoring and Follow-up

A preliminary Follow-up Program, designed in consultation with the Responsible Authorities (RAs) and the New Brunswick Department of Environment and Local Government (NBDELG), is outlined in the CSR, and will be finalized and approved prior to implementation. An annual Follow-up Program report will be produced and provided to appropriate regulators for as long as follow-up activities are required. In addition, all environmental-related monitoring results (*e.g.,* pH of watercourses identified as potentially affected by sulfide bearing rock) will be provided to RAs, NBDELG, and Environment Canada at quarterly intervals, or as results become available.

The proposed monitoring and follow-up activities includes the following key activities.

- Noise monitoring, where warranted, to address any complaints from residents living near the highway, which will be conducted at specific noise sensitive areas, in accordance with methods acceptable to NBDELG.
- Groundwater monitoring program for drilled wells within 500 m of blasting activity to establish baseline conditions prior to and during construction.
- Groundwater monitoring program for dug wells located within 50 m of a major over burden cut.

- Surface water and fish and fish habitat compliance and effectiveness monitoring program.
- A follow-up monitoring plan will ensure that the created fish habitat for habitat compensation is functioning as planned.
- Compliance monitoring (*i.e*., regular inspections of culverts and bridges to ensure their effectiveness as mitigation).
- Monitoring in areas for potential environmental effects of salt spray is recommended.
- Wetlands within the Assessment Area will be monitored, within a short period after construction is completed, to visually assess wetland hydrology, introduction of invasive plant species, and use by recreational vehicles.
- Monitoring of moose and deer in the vicinity of the proposed TCH is recommended. A follow-up aerial survey involving NBDNR personnel is recommended over the next winter to fine tune and confirm the high use areas that may warrant wildlife fencing, among other mitigation.
- NBDOT will work with the Carleton-Victoria Forest Products Marketing Board to encourage the management of regenerating forest habitat near the Project footprint.
- Archaeological monitoring, by a qualified archaeologist, during initial ground breaking activities at the Lower Guisiguit River and the Little Presque Isle River (Hartland Interchange connector road) crossings.

GLOSSARY

Abbreviations

dB_A – decibels on the A-weighted scale (measure of noise)
ha – hectare
km – kilometre
kPa – kilopascals (measure of pressure)
kph – kilometres per hour
m – metre

Acronyms

ACCDC – Atlantic Canada Conservation Data Centre

AAC - Annual Allowable Cut

ARWIS – Advanced Roadway Weather Information System

ASU – Archaeological Services Unit

ATV – all terrain vehicle

BMP - Best Management Practice

CEA Agency – Canadian Environmental Assessment Agency

CEAA – Canadian Environmental Assessment Act

CCS - Census Consolidated Subdivisions

CLI – Canada Land Inventory

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

CRDC - Carleton Regional Development Commission

CSIF – Canadian Strategic Infrastructure Fund

CSR – comprehensive study report, as defined in *CEAA*

CVFPMB – Carleton-Victoria Forests Products Marketing Board

CWS – Canadian Wildlife Service

DAFA - Department of Fisheries and Aquaculture

DFO - Department of Fisheries and Oceans Canada

CEPA – Canadian Environmental Protection Act

CCME – Canadian Council of Ministers of the Environment

EA – environmental assessment

EFG – environmental field guide

EIA – environmental impact assessment

EIS – environmental impact statement

EPP – environmental protection plan

GCSI - Global Change Strategies International Inc.

GDP - Gross Domestic Product

HADD – harmful alteration, disruption or destruction (of fish habitat)

MAR - mean annual runoff

MAP - mean annual precipitation

MBCA – Migratory Birds Convention Act

MSC – Meteorological Service of Canada

LOS - level of service

NBDELG (formerly NBDOE) – New Brunswick Department of Environment and Local Government

NBDNR (formerly NBDNRE) – New Brunswick Department of Natural Resources (formerly and Energy

NBFSC - New Brunswick Federation of Snowmobile Clubs

NBDOT – New Brunswick Department of Transportation

NSA – noise sensitive area

NTNB – Nature Trust of New Brunswick

NWPA – Navigable Waters Protection Act

Parclo - Partial Clover interchange.

PID – property identification number

POL – Petroleum, Oil, or Lubricant

RA – Responsible Authority, as defined in *CEAA*

RAD 120 – Rural Arterial Divided highway with design speed of 120 kph

RCU 80 – Rural Collector Undivided highway with design speed of 80 kph

RoW – right of way

SARA – Species at Risk Act

TAC – Transportation Association of Canada

TC – Transport Canada

TCH – Trans-Canada Highway

TRC – Technical Review Committee

US – United States

VEC – Valued Environmental Component

WHMIS – Workplace Hazardous Material Information System

Terms

access road:	a road that provides a route for landowners to get to land where the previous route to the land has been eliminated as a result of the highway
alignment:	refers to the highway route in general, but does not specifically mean the actual area to be affected by construction
berm:	a small dyke intended to slow the flow of run-off water to allow heavy sediment material to drop out
borrow pit:	a source for gravel, sand and/or rock materials to be used in construction, the source of which is located outside the RoW
bridge	any structure in excess of 3 m in span length carrying vehicular and/or pedestrian traffic
centreline:	the line defined as being the centre of the proposed lane, either the westbound or eastbound lane
chainages	distance along the alignment in kilometres from northern most limits of Project
check dam:	an erosion control structure constructed of hay bales, timber or loose rock to control water flow in an erodible channel or ditch.
clover interchange:	an access onto and off of the highway that from an aerial view resembles a four-leaf clover.
cofferdam:	a temporary structure constructed around an excavation to exclude water so that work in or adjacent to a watercourse can be carried out in the dry.
consolidation:	the act of amalgamating two or more parcels of land into one larger parcel of land.
culvert:	any structure not classified as a bridge, and/or drainage system, which provides an opening for the passage of water under any roadway or driveway.

current TCH: refers to the existing two-lane Trans-Canada highway

diamond interchange: an access onto and off of the highway that from an aerial presents a four-sided diamond shape.

ditch: a small artificial channel excavated through the earth's surface for drainage, irrigation or to bury pipes, wires or cables or for various other purposes.

downstream: in the direction of the normal flow of a watercourse.

e.g.: an abbreviation meaning "for example"

electrofishing: a method of capturing fish in a freshwater body by the use of a device that emits a low voltage shock that temporarily stuns the fish

erosion: the process of soil and rock weathering caused by natural means (*i.e.*, gravity, water, wind, ice).

existing TCH: the existing Trans-Canada Highway, Route 2, through New Brunswick.

fish habitat: the spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes

footprint: the area to be affected by the activities associated with the construction of the Project.

grading: the act of altering the ground surface to a desired grade or contour by cutting, filling, levelling, and/or smoothing.

grubbing: the removal of roots and stumps after clearing, leaving topsoil to be salvaged.

highway: the whole strip of land reserved for and secured for the use of the travelling public.

hydroseed: a mixture of various grass seeds, fertilizer and water with a binding agent typically used as an erosion control methodology. This mixture, when spread on the ground grows grass very quickly relative to the planting of seeds and can be spread over large areas of ground mechanically.

i.e.: an abbreviation meaning "that is" migratory birds: birds protected in Canada under the *Migratory Birds Convention Act*, as listed in the Canadian Wildlife Service Occasional Paper No. 1, 1991 edition.

mitigation: actions to avoid or compensate for the environmental effects resulting from the proposed project activity.

(partial clover interchange): an interchange that only provides access to one side of a four-lane highway and from an area view resembles a one-leafed clover

passerine birds: birds of the order *Passeriformes* that includes over half of all living birds and consists chiefly of perching songbirds

Project: the construction, operation, and maintenance of a new four-lane divided controlled access highway, approximately 70.7 km in length, that will by-pass the existing two-lane TCH between Perth-Andover and Woodstock, including interchanges and watercourse crossings and structures, and any required ancillary work/facilities such as new road connections, property access roads, and borrow and disposal areas.

proposed TCH: refers to the proposed new four-lane highway, which if approved and completed will be referred to as the Trans-Canada Highway

remnant: typically a relatively small piece of land that is cut off from a larger piece of land by the highway RoW.

right of way (RoW): the land secured and reserved to the public for Highway purposes.

riparian: the area adjacent to flowing water that contains elements of both aquatic and terrestrial ecosystems.

salmonid: of or related to the salmonidae family of fish, including trout, salmon and char.

severance: the act of cutting off a piece of land from a larger parcel of land

severed: a piece of land that has been cut off from a larger parcel of land

silvicultural: the practice of managing a section of forest (through such activities as thinning) in order to increase the growth of trees in the area stakeholder: A member of a group or an individual who has a vested interest in the Project, beyond just owning land on the RoW. Typically an economic interest.

substrate: mineral and organic material that forms the bed of a stream.

Trans-Canada Highway: refers to the New Brunswick portion of the continuous highway that crosses the entire country of Canada.

watercourse: the full width and length, including the bed, banks, sides and shoreline, or any part of a river, creek, stream, spring, brook, lake, pond, reservoir, canal, ditch or other natural or artificial channel open to the atmosphere, the primary function of which is the conveyance or containment of water whether the flow be continuous or not.

wetland: lands transitional between terrestrial and aquatic systems where the water table is at or near the surface or the land is covered by shallow water at some time during the growing season. Wetlands are characterized by poorly drained soils and predominantly hydrophytic or water tolerant vegetation.

1.0 INTRODUCTION

This report is a Comprehensive Study Report (CSR) for the development of a four-lane Trans-Canada Highway (TCH) between Perth-Andover and Woodstock, New Brunswick (the "Project"). Transport Canada (TC), Infrastructure Canada, and Fisheries and Oceans Canada (DFO), the federal Responsible Authorities (RAs) under the *Canadian Environmental Assessment Act* (*CEAA*), delegated preparation of this CSR to the New Brunswick Department of Transportation (NBDOT), the Proponent as per Section 17 of *CEAA*. Jacques Whitford Environment Limited, with the assistance of ADI Limited, AGFOR Inc., and Hydro-com Technologies Limited, have undertaken preparation of this CSR on behalf of NBDOT. As well, the report provides responses to issues raised by reviewers of the Project registration under the New Brunswick Environmental Impact Assessment (EIA) process *Clean Environment Act—Environmental Impact Assessment Regulation (87-83)*.

1.1 Project Overview

The existing TCH (Route 2) through New Brunswick is 519 km in length from Quebec to Nova Scotia. Approximately 130 km (or 25%) of the existing TCH remains to be upgraded to a four-lane, divided, controlled access highway. On August 14, 2002, the federal and provincial governments committed to the completion of the remaining section. Completion of the TCH upgrading will occur in various segments.

The Project involves construction and operation of a 70.7 kilometre (km) fully controlled access, four-lane divided highway from Perth-Andover to Woodstock. The proposed TCH will by-pass the existing two-lane facility and will become the new TCH (Route 2), with a travel distance of approximately 5.5 km less than the existing TCH. The proposed TCH alignment begins just south of the existing TCH/Route 190 Interchange in the Village of Perth-Andover, continues past Florenceville and Hartland, and terminates near the existing TCH/Route 550 (Connell Road) intersection in the Town of Woodstock.

1.2 Purpose and Need for the Project

The purpose of the Project is to address traffic and safety concerns associated with uncontrolled highway access, and increasing level of through traffic and truck traffic on the existing two-lane TCH. The Project will be a Level I access controlled highway with a design standard of RAD 120 (Rural Arterial Divided Highway with design speed of 120 kph). Twinning of the existing TCH to current controlled access standards is not feasible primarily due to the extent and proximity of existing land use and the associated potential environmental effects on that land use. In addition to being divided and four-lane, the proposed TCH will improve highway safety by segregating through traffic from the local traffic that would continue to use the existing two-lane TCH. Wildlife management along the corridor will also be improved. The completion of the proposed TCH section will bring this segment up to the required standards that are consistent with the remainder of the TCH from the Nova Scotia border to Longs Creek. Motorists will still have the option to travel the scenic, local route through to Woodstock, Pokiok and ultimately Fredericton without having to travel the proposed TCH.

1.3 Regulatory Framework

The Project is subject to an Environmental Assessment (EA) under *CEAA* (comprehensive study) and is also subject to registration under the New Brunswick EIA process. Transport Canada is an RA for the Project under *CEAA* by virtue of federal funding (50%) being provided for the Project through the Canadian Strategic Infrastructure Fund (CSIF), administered by Infrastructure Canada. DFO is also an RA for the Project due to the requirement for approvals pursuant to section 5 (1) of the *Navigable Waters Protection Act* and section 35 (2) of the *Fisheries Act*, both of which are included in the *Law List Regulations* under *CEAA*. A CSR is required for the Project as it involves construction of an all-season public highway greater than 50 km in length and which is proposed to be located on a new RoW (RoW). The Project is not on the *Exclusion List Regulations*. The Project has not been referred directly to a mediation or panel review.

The Province of New Brunswick conducts environmental assessment of selected projects under the *Clean Environment Act—Environmental Impact Assessment Regulation (87-83)*. Under this regulation, all major highway projects involving either a significant length of new highway alignment or a major upgrading or widening of an existing highway resulting in a change in its intended use or classification are undertakings requiring registration. The Project was registered in February 2002, and the reviewers (including federal departments) through the New Brunswick Department of Environment and Local Government (NBDELG) have identified the issues they require to be addressed in the CSR. These issues have been captured in the *Guidelines for the preparation of a Comprehensive Study Report – Perth-Andover to Woodstock Twinning of Route 2 – Trans-Canada Highway, New Brunswick* (Appendix A) and are addressed in this report.

Project activities will be conducted in accordance with federal and provincial Acts and applicable regulations, including, but not limited to:

- *Canadian Environmental Assessment Act;*
- *Fisheries Act;*
- *Navigable Waters Protection Act (NWPA);*
- *Canadian Environmental Protection Act (CEPA);*
- *Migratory Birds Convention Act;*
- *Canada Water Act;*
- *Canada Wildlife Act;*
- *Species at Risk Act* (*SARA*);
- New Brunswick *Highway Corporation Act*;

- New Brunswick *Clean Environment Act*;
- New Brunswick *Clean Water Act*;
- New Brunswick *Fish and Wildlife Act*; and
- New Brunswick *Endangered Species Act*.

In addition to regulatory requirements, the Project will also be subject to the numerous applicable federal and provincial guidelines. The specific relevance of these regulations, policies and guidelines to the Project is discussed throughout this report.

1.4 Organization of the Report

The CSR is organized to reflect the process by which the assessment has been conducted. It is organized into 7 major sections. A summary of the CSR Report including conclusions from the EA is presented at the beginning of the report, in the Executive Summary.

Section 1.0 provides background information on the Project including the purpose and need for the Project and the regulatory framework.

Section 2.0 provides a description and discussion of Project Alternatives including alternatives to the Project and alternate means of carrying out the Project.

Section 3.0 provides a detailed description of the Project. Construction activities are discussed as well as the location, scope and schedule for the Project.

Section 4.0 provides a description of the issues scoping exercise, including a summary of public, stakeholder, Aboriginal, and regulatory consultation efforts. The environmental assessment methodology employed for this assessment is also described in Section 4.0.

Section 5.0 provides the results of the environmental effects assessment for biophysical and socioeconomic components, including potential environmental effects of malfunctions and accidental events. Included within each component section, where appropriate, is the framework for compliance and follow-up programs to be undertaken. Also included is a discussion of the effects of the environment on the Project.

Section 6.0 provides an assessment of potential cumulative environmental effects of the Project in conjunction with past, present and likely future projects within the zone of influence of the Project..

Section 7.0 offers concluding statements and recommendations.

Section 8.0 details literature and personal communications cited in the report. A series of technical reports, mapping and other supporting information is contained in the appendices to this document.

2.0 PROJECT ALTERNATIVES

As required under section 16 (2) (b) of *CEAA*, a consideration of project alternatives is required for all comprehensive study level environmental assessments. Project alternatives are considered during the environmental assessment to demonstrate that the proponent has considered other possibilities during the planning process and project design.

Two categories of project alternatives have been considered.

- Alternatives to the Project are defined as functionally different ways of achieving the same end (CEAA 1994). Alternatives to the Project include: the "do nothing" scenario (null alternative); upgrading the existing TCH (*i.e.*, widening the existing TCH); or other modes of transportation (*i.e.*, marine, rail, air).
- Alternative means of carrying out the Project include technically and economically feasible options that can reasonably meet the Project objectives. Alternative means of carrying out the Project include alternate routes that will maintain the design objectives of constructing four-lane divided controlled access highway from Perth-Andover to Woodstock, as part of NBDOT's initiative to provide a four-lane highway system from Quebec to Nova Scotia.

The proposed Project, as indicated in Section 1.0, consists of the construction and operation of a 70.7 km fully controlled access, four-lane divided highway from Perth-Andover to Woodstock. The proposed Project will by-pass the existing two-lane facility and will become the new TCH.

2.1 Alternatives to the Project

Since the 1980's the Province has maintained an objective to upgrade the TCH through New Brunswick to foster economic development through improved capacity and enhance motorist safety (NBDOT 1989). Currently, much of the TCH in New Brunswick has been constructed to a four-lane divided standard. The objective of this proposed Project is to contribute to the Province's overall objective to upgrade the TCH.

Prior to consideration of routing alternatives, NBDOT considered other possible ways to satisfy travel and freight transportation demands and to improve the traffic safety along the TCH between Perth-Andover and Woodstock. Three alternatives to the Project were considered:

- the Null Alternative (do nothing scenario);
- upgrading of the highway capacity along the existing route (*i.e.*, widening the existing TCH); and
- other modes of transportation (*e.g.*, rail).

As defined below, these alternatives to the Project failed to achieve the Project objective and were subsequently dispelled as non-viable alternatives.

2.1.1 Null Alternative

The null alternative involves the continued operation and maintenance of the existing two-lane TCH, as it is at present. This alternative is the low cost alternative, as it would not involve new construction, or affect new lands or socio-economic activities. The null alternative, however, would be contradictory to the long-standing objective of NBDOT to upgrade the National Highway System network through New Brunswick.

According to current NBDOT plans, if this segment of the TCH from Perth-Andover to Woodstock is not upgraded to four-lane divided RAD 120 standards, it would be the only segment of the TCH in the Province that does not meet this standard after 2007 with the exception of the Pokiok to Longs Creek segment and the Grand Falls to Aroostook segment, which are presently at various stages of the regulatory approvals process. In fact, it would be the only segment of the TCH that a traveler would encounter between Halifax, Nova Scotia and the New Brunswick/Quebec border not constructed to this standard.

The existing two-lane TCH consists of a winding alignment with steep grades and few passing opportunities. Operating conditions include heavy truck traffic and vehicles entering and exiting directly into the traffic stream from local roads and private driveways. Infrequent passing opportunities along this two-lane segment of the TCH often leads to the accumulation of traffic into platoons that flow at less than posted speeds. This has resulted in risky passing manoeuvres by frustrated motorists.

The rate of fatal accidents along the existing TCH from Perth-Andover to Woodstock as seen in Table 2.1.1, is more than four times higher than would be expected with the proposed TCH standard.

Table 2.1.1 Accident by Severity, Perth-Andover to Woodstock

Highway Segment	Fatal Accident Rate (Acc./100MVK*)	Injury Accident Rate (Acc./100MVK*)	PDO Accident Rate** (Acc./100MVK*)
Existing Route 2 – Perth-Andover to Woodstock	1.37	14.10	32.22
Proposed TCH – Perth-Andover to Woodstock	0.30	9.94	24.86

* Accidents per 100 million vehicle kilometres
** Property Damage Only
Source: NBDOT (2003).

The null alternative would result in continued poor levels of service and higher accident rates. It would not satisfy the Provincial design and safety standards, or the economic objectives, set for the TCH and the National Highways System. Therefore, the "do nothing" alternative was not considered to be an acceptable alternative to the proposed Project by the Province as it does not meet the objectives of the Project to foster economic development and enhance motorist safety.

2.1.2 Upgrading Existing Alignment

The alternative to upgrade the existing TCH would involve improvements made along the existing TCH alignment. This would involve either the addition of a third lane to the existing TCH, or twinning the existing TCH.

2.1.2.1 Third Lane

This upgrade alternative is a way to increase highway capacity by adding a third lane to the existing two lanes, normally as climbing or left turning passing lanes. This provides passing opportunities on uphill grade sections and for left turn stopping at-grade intersections. Addition of a third lane can supplement the capacity of a two-lane highway at relatively low capital cost. The existing TCH presently has some sections that provide a third passing and/or turning lane.

It has been found that frequent use of the third lane approach in both directions can cause driver confusion. This has led to higher incidence of head-on collisions than would be experienced on a four-lane divided highway. This can be even more pronounced when entering a three-lane highway section from a four-lane divided highway, as would be the case if this alternative were applied to the Perth-Andover to Woodstock TCH segment.

This segment of the TCH between Perth-Andover and Woodstock consists of frequent at-grade highway accesses from private residential driveways, commercial roadside developments, farm and woodlot access, and local roads. NBDOT found that the marginal increase in highway capacity of a third lane would be insufficient to offset the additional safety risks. NBDOT did not consider this alternative along the existing TCH to be a viable upgrading option as it does not meet the Project objective of enhancing motorist safety.

2.1.2.2 Twinning

Twinning the existing TCH has been a consideration of NBDOT along all upgraded sections of the TCH throughout the Province. Twinning involves using and upgrading, if required, the existing two lanes of highway and constructing two new parallel lanes to achieve four-lane divided highway design standards.

All levels of service, capacity and safety objectives can be met with the twinning alternative. However, in order to attain full access control required to meet the Project objective, the highway twinning alternative would require that all existing at-grade access to the existing TCH be cut off. Access to the twinned highway would only be permitted at grade - separated interchanges. Twinning is a viable alternative in unpopulated areas, where there would be less property disruption or need for construction of property access roads. It would be very costly to twin the existing TCH between Perth-Andover and Woodstock, as it is highly populated (*i.e.,* hundreds of homes and businesses) with frequent private driveways and property access roads.

As described in Section 3.0, short segments at each end of the proposed Project will be twinned. Other opportunities for twinning of the existing TCH along this segment are limited due to the extent of residential and commercial development. Furthermore, it is technically difficult and economically inefficient to design by-pass segments to avoid the populated areas that would connect to minor twinned segments that could be constructed along the unpopulated areas of the existing TCH.

Due to the extent of development along most of the existing TCH from Perth-Andover to Woodstock, there would be considerable incremental cost in providing an adjacent service road network. These service roads would sever valuable farmland properties and disrupt commercial and residential land uses and, in some instances, may not be technically feasible. Whereas with a by-pass route, as proposed, the existing two-lane TCH will continue to provide the property access function with no land use environmental effects. In fact, the reduction of traffic on the existing TCH, as a result of the proposed Project, would be beneficial to land users.

The twinning alternative was not considered a reasonable alternative from an economic and technical perspective.

2.1.3 Alternative Modes of Transportation

Other potential alternative modes of transportation include marine, rail and air services. To be effective, each mode of transportation would have to serve both passenger and commercial freight demands. All three of these alternate transportation modes require an inter-modal connection with a highway network to function.

There are no commercial marine services within the proposed RoW. Historically, marine transportation services were available along the Saint John River, but with the changing economics and the construction of dams at Beechwood and Mactaquac, marine transportation between Perth-Andover and Woodstock has long since ceased in this region.

Similarly, there is no air or rail services and infrastructure available within the Perth-Andover to Woodstock region. There is a small commercial airport located near Saint-Léonard, approximately 50 km north of Perth-Andover. Most of the Region's domestic air service demands are directed through the Fredericton airport and transborder service through the Presque Isle or Bangor airports.

Historically, branch lines of CP Rail extended up the Saint John River Valley from Woodstock through Perth-Andover to the CNR lines at Grand Falls and Plaster Rock. However, these lines have been abandoned and removed over the past few decades. The CN Rail freight line that passes through Drummond is approximately 35 km north of Perth-Andover.

Although mass transport systems may alleviate or reduce certain environmental issues/concerns (*e.g.*, air emissions), implementation of these systems does not meet with the social and economic/business needs of today's society. Also, all existing transportation alternatives would require highway infrastructure and service linkages in order to function.

In light of the enormous investment required for infrastructure, the unlikely regional demand levels required for viable alternate transport services, the need of each alternate mode for highway infrastructure, and ultimately the inability of each alternate mode of transportation to fulfil the Province's economic freight movement and traffic safety objective, the Province has not considered other modes of transportation to be viable, or technically and economically feasible alternatives to the proposed Project.

2.2 Alternative Means of Carrying Out the Project

Alternative means of carrying out this Project have included the assessment of four-lane divided highway alternatives for a new TCH alignment between Perth-Andover and Woodstock. This section describes the alignment (route) selection process undertaken by NBDOT to assess the alternate means of carrying out the Project. All alternate routes were new four-lane divided, fully access-controlled RAD 120 standard highways.

The Guidelines (Appendix A), request that the discussion of alternative means of carrying out the Project should describe the process undertaken to select the most appropriate alignment and discuss the rationale/support for selecting the preferred alignment. Also the discussion should describe any deviation from the original alignment that has resulted from public and special interest group consultations.

The selection of the preferred alternative(s) must be based on a clearly described method that includes, as a minimum, the following criteria:

- the ability to meet the Project objectives;
- option must be technically, legally and economically feasible; and
- the ability to limit the scope of the adverse effects on the natural (*e.g.*, avoidance of wetland areas, environmentally sensitive areas and significant habitat for migrating birds and species of special concern) and human environment and to maximize the positive effects.

NBDOT produced three successive alignment alternatives that, through an iterative process of consultations with the public and input from regulatory agencies, resulted in a fourth alternative, the proposed alignment. This iterative process consisted of successive refinements to avoid or minimize potential environmental, social, or socio-economic effects. Where it was not possible to entirely avoid certain sensitive areas or features, the alignment was modified in an effort to reduce and limit the extent of disturbance/encroachment and potential environmental effects.

Figures 2.1 A-D (Appendix B) illustrates the three alignment alternatives and the proposed alignment, on four map sheets for Perth-Andover to Woodstock identified as follows:

- Initial Alignment (*i.e.*, the first alignment alternative);
- 1998 Alignment (*i.e.*, the second alignment alternative);
- 1999 Alignment (*i.e.*, the third alignment alternative); and
- 2003 Alignment (*i.e.*, the proposed alignment).

Note that not all of the colour-coded alignments (*i.e.*, initial, 1998, 1999, 2003) are visible in all locations. This is due to the overlap of the most recent alignment (visible) over the previous year's alignment (not visible). For a given section of highway, visibility of the earlier alignment indicates that the route was changed along that section in the following iteration.

This section provides a description of the process that led to the selected alignment, described in Chapter 3.0.

2.2.1 Overview of Alignment Selection Process

The Planning and Land Management Branch of NBDOT has an established alignment/route selection process to assess the highway geometric possibilities of successive alignment alternatives that includes consideration of topographical, environmental, and socio-economic constraints. For the proposed section of TCH, the process began as part of the overall corridor planning of the TCH through New Brunswick from Nova Scotia to Quebec in 1987.

NBDOT incorporated known environmental considerations from the regulatory agencies as well as input from municipal stakeholders and the public into the development and selection of the proposed alignment. Bio-physical environmental information (*e.g.*, wetlands, moose habitat, Appalachian Hardwood Forest) and physical constraints (*e.g.*, utilities infrastructure, topography) were initially acquired. Field studies were later conducted in support of this environmental assessment and for further input to the selection of the proposed alignment. Socio-economic issues were raised by municipal and public stakeholders and modifications were made to each successive alignment to address these issues.

The alignment selection process undertaken by NBDOT is summarized below.

- Long range corridor plans were initiated for the TCH from the Quebec border to the Nova Scotia border in 1987. It was established at that time that there were few opportunities to twin the segment of the TCH between Perth-Andover to Woodstock, and that the routing would be entirely located on the west side of the Saint John River.

- Subsequent studies to prioritize and schedule all segments of the TCH concluded that the upgrading of the Perth-Andover to Woodstock segment would wait until the period of 2004 to 2008.
- Functional route/alignment planning for the Perth-Andover to Woodstock segment of the TCH began in 1997. Two potential corridors were developed and forwarded to regulatory agencies for review and comment to identify any known environmental or physical constraints that should be considered in the alignment selection. The Initial Alignment was prepared within these limitations and presented to the public in 1998.
- Revisions were made to the Initial Alignment to accommodate input and concerns raised from the public and regulatory agencies that resulted in the 1998 Alignment.
- The 1998 Alignment was presented to the Public and further revisions were made and incorporated into the 1999 Alignment.
- The 2003 Alignment, the proposed alignment, was prepared following a third round of public consultations, and with input from environmental scoping studies and field surveys conducted in 2002 and 2003.

The following section documents the successive alignment changes made in response to the regulatory agencies, stakeholders and public, as well as the environmental background and EA Scoping surveys conducted in 2002 and 2003 for this Study. The alternative alignments and proposed 2003 alignment are presented in Figures 2.1 A-D (Appendix B). Note that the successive alignments overlay each other wherever there were no subsequent changes.

2.2.2 Route Selection

2.2.2.1 Initial Alignment

As previously indicated, the route/alignment selection process began in 1987 when NBDOT developed long range plans to upgrade all of the TCH through New Brunswick. The objective was to twin the existing TCH wherever possible. The corridors, which varied in width from approximately 400 m and 800 m, were identified and selected based on topographical, social (*i.e.*, development), traffic and design considerations. It was concluded at this time that much of the segment of the TCH from Perth-Andover to Woodstock could not be twinned without considerable social disruption due to development and land use along the existing TCH, and the associated uncontrolled access.

Although areas around Perth-Andover, River de Chute and Jacksonville/Woodstock were considered to have potential for twinning, the most significant highway section recommended for twinning was between Florenceville and Hartland. However, NBDOT later concluded that significant savings could be realized by providing a new alignment on the west side of the Saint John River between Florenceville and Hartland by avoiding the construction of two new major bridges. The choice not to cross the Saint John River and remain entirely on the west side effectively abandoned the concept of twinning over the majority of the Perth-Andover to Woodstock segment, and greatly reduced the capital cost.

NBDOT established its implementation priorities of all segments of the TCH in the Province based on two studies, *A Highway Improvement Plan for the TransCanada Highway Through New Brunswick* in 1989 (NBDOT 1989), and *Province of New Brunswick National Highways Improvement Plan* (NBDOT 1994) in 1994. The Perth-Andover to Woodstock segment of the TCH was scheduled for construction during the final five years, 2004 to 2008, of the fifteen-year TCH construction implementation plan. Therefore, further evaluation of corridors and alignments for this proposed Project was deferred.

In 1997 the functional route planning of the Perth-Andover to Woodstock TCH segment was initiated. A consultant was retained to provide potentially viable new TCH alignments on the west side of the Saint John River between Perth-Andover and Woodstock. Two alternative corridors were identified using aerial photos. The corridors, which were each approximately 1 km in width, widening to approximately 2.5 km in the area of Wark Brook to Plant Brook, were selected based principally on topographic features, but also with the intention of avoiding agricultural land to the extent possible.

In 1998, NBDOT submitted the two TCH corridor plans for Perth-Andover to Woodstock to regulatory agencies and other stakeholders for their review and comment. They were requested to provide location and technical information with respect to their areas of responsibility, to indicate potential constraints on the corridor mapping, and to provide NBDOT with their concerns related to each of the identified corridors. The regulators and stakeholders included:

- Fisheries and Oceans Canada;
- NB Department of Fisheries and Aquaculture;
- NB Department of the Environment;
- NB Department of Natural Resources and Energy;
- NB Department of Agriculture;
- NB Department of Municipalities, Culture and Heritage;
- NB Department of Economic Development and Tourism;
- NB Power;
- NB Tel;
- Nature Trust of New Brunswick;
- Trails New Brunswick; and
- University of New Brunswick Biology Department.

Table 2.2.1 summarizes the issues and constraints identified as a result of this review.

Table 2.2.1 Constraints or Issues Identified by Regulatory Agencies and Stakeholders

Affiliation	Constraints or Issues Identified
NB Department of Natural Resources and Energy	• Identified Crown land within the corridor was limited to Crown Reserve Roads. **Region 5 (Perth-Andover to River de Chute)** • Identified heavy (150+ records) moose activity, which translates into significant hunting activity, toward the west side of the proposed corridor. • Identified that potential stream crossing and waterfowl impacts increase the further Route 2 is realigned westwardly. • Identified that potential "height of land" wind and drifting snow problems increase as the realignment moves west, away from the existing location. • Identified the most significant fishery issue as being the protection of the brook trout resource of the River de Chute watershed. • Identified that a movement westward away from the existing Route 2 would traverse steep terrain resulting in several difficult and expensive stream crossings. • Identified that it does not appear that any raptors nests will be affected by the corridor.
	Region 4 (River de Chute to Woodstock) • Identified greatest concerns as moose activity and the amount of watercourses in the proposed corridor. • Identified heavy moose and deer activity on maps and that these areas may require fencing or other methods of mitigation to control wildlife/vehicle collisions. • Identified that moving the proposed corridor closer to the existing highway would lessen impacts on wildlife and aquatic habitat. Placing the highway in more of the agricultural areas would lessen slope concerns, reduce wildlife interactions, and allow better visibility. • Identified that moose concentrations are greater the closer you move in direction to the Maine/N.B. border. • Identified that the proposed corridor encompasses many wetland and bog areas where a significant amount of waterfowl hunting occurs. These areas also provide moose habitat. • Identified that there have traditionally been bald eagle nests at Riverbank and Sproulls Island, however, the nests were not occupied in 1997. • Identified a large number of potential watercourse crossings on the corridor including a number of small lakes, a half dozen or so larger streams, and the headwaters of numerous smaller brooks. • Identified that the area within the proposed corridor, from the Waterville deadwater to Connel Road (Route 550), is inundated with numerous small watercourses. • Identified that the larger streams to be crossed, including the Guisiguit, River de Chute, Big Presque Isle, and Little Presque Isle, are all salmonid streams. **Wetlands** • Identified that each wetland within the project corridor identified on the wetland atlas maps and greater than 2 hectares is considered a constraint. **Forest resources** • Identified that the proposed corridor will have minor impacts on Crown land wood supply. • Identified the locations of five Christmas tree plantations and one sugarbush within the proposed corridor and located them on an enclosed map. **Trails** • Identified that the proposed corridor would intersect with the routing of the International Appalachian Trail between Fort Fairfield, Maine and Quebec. **Sensitive Areas** • Identified sensitive areas and environmentally significant sites on NBDOT corridor maps for their information.

Table 2.2.1 Constraints or Issues Identified by Regulatory Agencies and Stakeholders

Affiliation	Constraints or Issues Identified
Fisheries and Ocean Canada	• Identified general criteria for the protection of fish habitats 1) Where possible select an alignment to avoid the need for permanent stream diversions. 2) Ideally, select an alignment that will not interfere with the natural drainage patterns to minimize subsequent erosion and sedimentation concerns. 3) Avoid watercourse crossings that will require large fills; also avoid approach alignments that will require deep or lengthy cuts. 4) Roadway interchanges should be located away from watercourses, in order to reduce the number of unnecessary stream crossings and minimize off-site erosion/sedimentation concerns associated with the placement of large volumes of fill near watercourses. 5) Culverts should be located on straight sections of streams. 6) Culverts should be located on sections of streams with straight and level banks. 7) Culverts should be located at locations where the stream channel gradient is at or near zero, and water velocity is relatively constant upstream and downstream. 8) Road alignments should be designed to cross watercourses at right angles, which will reduce the length of the overall crossing and culvert, and also minimize the need for permanent diversions. • Indicated that the westerly alignment at the commencement of the proposed alignment is preferred due to drainage patterns within the watershed. • Indicated that within the proposed alignment, the crossing of Brown Brook and Clark's Brook should be below the junction of their tributaries to limit the number of crossings • Indicated that the proposed alignment should stay between the two tributaries of the Guisiguit Brook. • Indicated that at Harper Brook, the crossing would be preferred at the upper side of the proposed alignment.

Table 2.2.1 Constraints or Issues Identified by Regulatory Agencies and Stakeholders

Affiliation	Constraints or Issues Identified
NB Department of Agriculture and Rural Development	• Indicated that it would be desirable to consume as little as possible of the wooded land classed as good or fair on the Soil Suitability maps, as this land is our greatest opportunity for expansion of the agricultural industry in that area. • Indicated that it would be preferable not to isolate potato fields from adjacent streams, ponds, swamps, etc, as there has been considerable interest in irrigation expressed by potato producers in New Brunswick. • Identified that Byron McGrath farms on properties in Upper Knoxford extending from Route 560 to the existing highway and the proposed route will have an impact on his operation. • Identified that where the proposed route crosses the Stairs Road in Knoxford, two farms (Lakeside/Tweedie and Antworth) are bisected, and that one of these farms is developing new land directly in the proposed path. Indicated that anything to minimize the impact would help. • Identified that some of the land marked as cleared in the area of A Brown Road and J Clark Road is cropland. • Identified that the land being isolated from Brian Kilpatrick has been newly developed in the last 3 to 5 years. • Identified that several farms are being bisected by the proposed route just north of the Centreville Road. • Identified that there is the potential for the proposed corridor south of the Centreville Road to split farms or cross between two farms owned by the same landowner in the St. Thomas area. **Proposed route to the east of the existing TCH from Waterville to Woodstock :** • Identified that a farm is located at the northern end of this proposed route on both sides of the existing TCH and would be bisected on both sides by the proposed route splitting the property in four. As well, a large portion of the remaining land on this property would be taken for an interchange resulting in a loss of excellent potato land. • Identified that a recently developed farmland to the south of the above property would lose a good chunk of farmland as a result of this route. • Identified that any farm in the area where the proposed route crosses the Rosedale Road until it rejoins the existing TCH in Woodstock will be impacted significantly as the farms will be crossed either diagonally or lengthwise, which would present a real problem for farmers employing 66 to 90 foot wide sprayers. **Proposed route to the west of the existing TCH from the proposed Waterville overpass to Woodstock** • Identified the existence of potato farms on both sides at the Little Presque Isle Stream and the Waterville Road. • Identified that the Waterville overpass should have little or no impact on agriculture. • Identified that several farms would be bisected as the proposed route passes from the Ore Hill Road to connect with the existing TCH at Woodstock. • Identified that potato farms would likely be impacted in the Hopkinds Road area. • Identified that several farms will be bisected in the area of the Burtt road and south to Iron Ore Hill Road.

Table 2.2.1 Constraints or Issues Identified by Regulatory Agencies and Stakeholders

Affiliation	Constraints or Issues Identified
NB Department of Environment	• Identified that the proposed corridor does not cross any watersheds used for municipal drinking water supplies. • Identified an Environmentally Significant Area (#499) within the proposed highway corridor. • Identified an area, either in or near the corridor, which contains a very rare species of plant *Dentaria laciniata*, and indicated it on an attached map. • Identified the location of an *Eleocharis* species on the map as well. • Requested that the proponent contact The Nature Trust of New Brunswick to obtain more information about the three above sites and their precise location, so as to avoid endangering these habitats.
New Brunswick Department of Fisheries and Aquaculture	• Identified that their predominant concern in Plan 1 is with the crossings in the Harper Brook, Lanes Creek area near the Wakefield Parish line. Requested to reserve the opportunity to review further engineering concepts in relation to this crossing. • Identified that their predominant concern and interest in Plan2 is in the proximity of the corridor to the Saint John River in the vicinity of Demerchant-Plant Brook, and again on the outskirts of Andover, on both sides of Wark Brook. Requested to reserve the opportunity to review further engineering and mitigation plans in relation to this portion of construction.
New Brunswick Department of Municipalities, Culture, and Housing	• Identified that the westerly option between Woodstock and Hartland seemed to pose the most constraints. • Indicated that they would prefer the route avoid, as much as possible, locations which would place the highway in close proximity to existing built-up areas and existing communities and are especially concerned with the route location around the community of Jacksonville overpass and the existing developments located adjacent to Lockart Mill, Kinney, and Ore Hill Roads. • Identified that the westerly route contains the greatest portion of agricultural lands and the greatest portion of wetlands of the two options. • Identified that the westerly option would also encounter the largest number of property acquisitions. • Identified that the westerly route would require a number of existing road crossings or fills including Iron Ore Hill, Route 560, an unnamed crossroad, Waterville Road, and the Little Presque Isle Stream at Waterville. • Identified that the easterly route option is longer and may require additional infrastructure due to increased existing road crossings and fills required, however this may be offset as there are fewer settled areas which may be impacted. • Identified that from Waterville through to Florenceville there will be only limited impacts to existing communities beyond those at the crossings of the St. Thomas and Centreville Roads.

Table 2.2.1 Constraints or Issues Identified by Regulatory Agencies and Stakeholders

Affiliation	Constraints or Issues Identified
	• Identified that an interchange at the Waterville and Centreville crossings is extremely important as it would provide access to the only other international border crossing between Woodstock and Limestone (other than River de Chute which is seasonal). • Identified that there are no direct community concerns about the route in northern Carleton and Victoria counties, however, there is a general concern regarding the amount of cut and fill required for the route in that area. Identified that the area is known for its ravines and hardwood ridges, therefore, route locations that chose to minimize the extent of the cuts would be preferable. • Identified that there are no local land use planning Regulations in effect for the proposed corridor. • Identified that all municipalities have municipal plans and zoning by-laws in effect, which may need to be amended, should the proposed corridor cross their respective boundaries.
Nature Trust of New Brunswick	• Identified that as many as nine Appalachian Hardwood Forests (AHF) may lie in whole or in part within the proposed corridor and marked the boundaries of the nine forest sites on a map. • Indicated that one of the sites has been rated as having a very high priority for protection.
Environment Canada	• Recommended that the highway corridor avoid all protected areas, and that Ducks Unlimited be contacted in order to ensure that the proposed road does not impact their sites in the area. • Recommended that the highway corridor avoid all environmentally significant areas. • Recommended that Dr. Harold Hines and Jim Goltz be contacted in order to ensure that rare plants in the area are not impacted by the proposed highway. • Suggested that the New Brunswick Department of Natural Resources and Energy be contacted for information on raptor nests in the area and appropriate mitigation measures. • Recommended that the proposed highway avoid all wetlands in the area. • Assumed that the TCH right-of way would veer west of the current TCH (Route 2) and avoid any flood plain areas. • Identified that the current Canada-NB Flood Damage reduction Agreement, the federal and provincial governments have agreed to ensure that its departments and agencies do not engage in undertakings in designated areas and that no further financial assistance will be given to undertakings vulnerable to flood damage in the designated areas. • Requested that selection of stream crossings take into account the need to ensure flood risks are not increased due to loss of flood plain storage or river ice constrictions. • Requested that bridge designs and approaches incorporate above requirements.

In consideration of the issues and constraints summarized in Table 2.2.1, NBDOT developed a single alignment (the Initial Alignment) for presentation to the general public. The Initial Alignment also considered technical highway design elements and topographic features. Where environmental and socio-economic constraints could not be entirely avoided by the alignment, NBDOT attempted to limit the environmental effects of the proposed TCH on these features to the extent possible through design modification.

NBDOT held meetings with the towns of Woodstock and Hartland and the villages of Florenceville and Perth-Andover, and organized four public information sessions to present functional plans of the Initial Alignment of the TCH in 1998 (Figures 2.1 A-D, Appendix B). This Initial Alignment was also provided to the regulatory agencies and stakeholders for further review.

Overall, there was strong support for the Project, as it would result in substantial improvement in the transportation network and traveler system. The expected benefits would be time savings and improved safety for those using the proposed TCH, as well as for local traffic that would remain on the existing TCH. The removal of much through traffic, passenger vehicles and trucks, from the existing TCH will enhance the development of the River Valley as a scenic route for touring, hiking and biking. This will also benefit farmers of the region who, due to increasing concentration of small farms into larger farms, increasingly use the existing TCH as a local access road connecting their fields and operations.

The issues raised by the public and stakeholders included:

- The need for realignment to avoid severance of active farmland;
- The need for realignment to avoid the severance of the community of Jacksonville (Figure 2.1 D, Appendix B);
- Modifications required to the Lockhart Mill Road and Connell Road connections to the proposed TCH (Figure 2.1 D, Appendix B);
- The need for additional interchange access along the new TCH, particularly at Route 560 (River de Chute) (Figure 2.1 B, Appendix B);
- The commercial environmental effects of highway traffic by-passing existing businesses located along the existing TCH and the potential for future commercial development and public infrastructure to gravitate to the proposed TCH corridor (at the expense of communities located along the existing TCH);
- The severance of properties from future development plans, such as woodlots, subdivisions and business expansions; and
- The environmental effect of the proposed TCH on adjacent residential property access and values, and resident livelihood.

2.2.2.2 1998 Alignment

NBDOT prepared a new alignment in 1998 with changes from the Initial Alignment. Realignments or other design mitigation measures were accommodated, where feasible, to address the concerns of the public and regulatory agencies. The majority of alignment changes made were related to avoidance of as much farmland as possible. In addition, moose habitat, Appalachian Hardwood Forest lands, residential and commercial properties, and recreational trails and hunting camps, as provided in Figure 2.1 A-D

(Appendix B), were avoided to the extent possible. Other changes to the Initial Alignment were made to avoid streams that ran parallel to the alignment.

Specific changes made in 1998 to the Initial Alignment, as a result of public input, are summarized in Table 2.2.2 and illustrated in Figures 2.1 A-D (Appendix B).

Table 2.2.2 Summary of Key Changes to Initial Alignment Based on Regulatory, Stakeholder and Public Input

Constraint	Alignment Modification
Agricultural Land	• Alignment shift to the west to avoid or limit encroachment on valuable agricultural land between Perth-Andover and Beaconsfield Road (Figure 2.1 A, Appendix B). • Alignment shift to the west of agricultural lands north of Scott Road. The resulting change in approach to Scott Road required some modifications to accommodate a new Scott Road grade separated overpass (Figure 2.1 A, Appendix B). • The routing at Backland Road was moved west to improve the alignment and structure location, and reduce the encroachment upon agricultural lands (Figure 2.1 B, Appendix B). • Alignment shift to the west between Lanes Creek to Route 560 (south) to improve the location of the alignment passing through farmland. It also avoided some residential properties (Figure 2.1 D, Appendix B).
Sensitive/Critical Habitat	• Alignment shift to the west to avoid/limit encroachment on moose habitat area between Scott Road and Route 560 (Figure 2.1 A, Appendix B).
Residential Property / Property Severance	• The alignment at B. Smith Road was moved west to avoid residential properties. The previously planned grade separation to overpass the highway at J. Clarke Road was moved to B. Smith Road (Figure 2.1 B, Appendix B). • The alignment between Big Presque Isle Stream and Raymond Road shifted slightly east and west to reduce the extent of property severances (Figure 2.1 C, Appendix B). • Alignment shift to the east between the Hartland Interchange to about 1.5 km south of Estey Road to avoid some properties. This alignment also conformed with the highway geometric changes associated with the relocation of the Hartland Interchange to the east (Figure 2.1 D, Appendix B). • Most residential areas were avoided by the proposed alignment. Where residences were unavoidable, NBDOT has or will negotiate fair compensation with property owners.
Cost	• The River de Chute/Route 560 crossing structure was replaced by two separate smaller structures in each direction over the stream and the road (Figure 2.1 B, Appendix B).
Social/Socio-Economic	• NBDOT's proposed new alignment and interchange connections were chosen to parallel and to interconnect with the existing alignment to continue to serve existing developments and communities (*e.g.*, the Hartland Interchange was moved east to be somewhat closer to the town).

2.2.2.3 1999 Alignment

In 1999, a series of public meetings were held to present the 1998 Alignment to the public for comment and input. In general, the 1998 Alignment was well received by the public, although some farmers still expressed concern with the alignment across their farmland. Most of the residential property owners and business operators directly affected by the proposed TCH requested that property ownership negotiations be finalized immediately. Concerns, especially from the business community, were expressed regarding the lack of an interchange between Perth-Andover and Florenceville. Residents of J. Clark Road, B.

Smith Road and Backland Road expressed concerns with the proposed grade separation crossing locations.

Residents of Jacksonville and surrounding areas expressed concerns related to the close proximity of the alignment to their area. Representatives of the Town of Woodstock were concerned with the proposed elimination of the southbound off-ramp located at the northwest quadrant of the TCH/Route 550 (Connell Road) Interchange.

Other comments included concerns related to property access and wildlife management, as the 1998 Alignment was in the vicinity of areas known for deer and moose activity. Refer to Section 4.2.1 for a complete summary of stakeholder consultation efforts, issues and resolution.

As a result of the 1999 public meetings, a new alignment was developed in consideration of the comments and issues raised. This alignment, referred to as the "1999 Alignment" is illustrated in Figure 2.1 A-D (Appendix B). This alignment was not formally presented to the general public for further review.

2.2.2.4 2003 Alignment

On several occasions, NBDOT was contacted by stakeholders and the general public requesting an opportunity to review the revised alignment (*i.e.,* 1999 Alignment). This resulted in a number of alignment adjustments. For example, the 2 km section north of Palmer Road was realigned to the east and the 2 km section south of Palmer Road was realigned to the west (Figure 2.1 D, Appendix B). These changes were in response to comments made by local, affected farmers who indicated/provided a preferred alignment that would reduce the extent to which the proposed TCH would affect agricultural land in this area. This realignment also avoided two stream crossings over a tributary of the Little Presque Isle Stream.

Landowners in the area between the Big Presque Isle Stream and Raymond Road indicated the presence of poorly drained soils and moose habitat that were not obvious from available mapping. As a result, the 10 km section was realigned to the west of the 1999 alignment (Figure 2.1 C, Appendix B). Although not all of the moose habitat was completely avoided, the 2003 realignment minimizes disruption to these habitats. This realignment also took into account the engineering and economic considerations of moving from a fill section to a cut section. The relocation to the west along the Big Presque Isle Stream bridge also avoided a cottage and a new pottery kiln.

NBDOT commissioned a number of background environmental data surveys in 2002 and additional surveys in 2003 in support of this environmental assessment. A number of realignments were made as a result of the issues identified during these surveys and subsequent consultation with regulatory agencies. The 2003 Alignment was presented to the public in June of 2003. Table 2.2.2 summarizes the realignments made to the 1999 Alignment. Additional information related to the alignment changes summarized in Table 2.2.3 are included in the discussion of the respective Valued Environmental Component in Section 5.0.

Table 2.2.3 Summary of Key Changes to Initial Alignment Based on Regulatory, Stakeholder and Public Input

Constraint	Alignment Modification
Rare Plants	• Alignment shift to avoid rare plants and Appalachian Hardwood Forest habitat characteristics between Hillandale (north of Beaconsfield Road) and south of River de Chute (shift to the west from Hillandale to Plant Brook; shift to the east from Plant Brook to Brown Brook/Scott Road; shift to the east from Scott Road to Graham Brook and River de Chute area) (Figure 2.1 A, Appendix B). • The median was reduced to the minimum width of 30 m between Guisiguit Brook and B. Smith Road to avoid/minimize encroachment on rare plants (Figure 2.1 B, Appendix B). • Alignment shift to the east for 1.5 km north of Palmer Road to avoid rare plants (Figure 2.1 D, Appendix B). • Hartland Interchange shifted to the south to avoid rare plants (Figure 2.1 D, Appendix B).
Project Cost	• The bridge at River de Chute and the overpass at Route 560 were combined to a single structure, in each direction, similar to the proposed Initial Alignment (Figure 2.1 B, Appendix B).
Watercourses	• The median was reduced to the minimum between Guisiguit Brook to B. Smith Road to avoid/minimize encroachment on watercourses (Figure 2.1 B, Appendix B).

2.2.2.5 Summary of Alignment Selection Process

Selection of the preferred/proposed TCH alignment was an iterative process with many opportunities for public, stakeholder and regulatory participation. The proposed alignment avoids or minimizes environmental effects to the extent that is technically and economically feasible in consideration of known or identified environmental constraints.

2.2.3 Watercourse Crossing Alternatives

Inherent in the installation and operation of any watercourse crossing structure is the potential for adverse environmental effects. They are briefly summarized for the construction phase as follows:

- blasting in or near water has the potential to have significant impacts on fish and fish habitat;
- potential increase in erosion and run-off to watercourses;
- increased water temperatures in the downstream cleared area;
- decreased vegetation resulting in decreased food and cover for fish;
- noise and vibration disturbance during construction activities could cause fish avoidance;
- direct fish mortality could result from accidental spills;
- potential exposure of acid generating rock can lower pH in watercourse; and
- water control structures could effect water hydraulics.

Potential effects identified in the watercourse crossing structure operation phase include chronic soil erosion, increased water temperature, destruction of fish habitat and changes in watercourse hydraulics, which could impede fish passage (DFO 1999a). Improper structure installations can compound the effects. Higher velocities, compared to natural waters, can develop in crossing structures because they have lower roughness coefficients or steeper slopes. High velocities above and below a crossing structure caused by culvert hydraulics and elevated outlets can also block passage. Oversized structures or structures with steep gradients can produce shallow water conditions which can block fish passage. Potential soil erosion and sediment control are also a major factor associated with crossing structure placement and operation, particularly for proposed stream crossings located downslope of cut and fill areas. These areas can remain as long term problematic erosion sites if not properly designed in the initial planning stages (DFO 1999a).

Understanding the potential effects associated with watercourse crossing structure operation activities is important so that design criteria can be incorporated into the planning and design phases to minimize or avoid potential adverse effects of the project (DFO 1999a).

For the Project, each watercourse crossing will be considered on a case by case basis to determine the type of structure to be installed. A number of considerations will be taken into account when detailing the design of each crossing. This will include characteristics such as drainage area, size of streambed, fill height, soil conditions, rare plant presence, wildlife crossings, minimal fish habitat alteration, disruption or destruction and maintaining navigable waters where applicable. However, foundation permitting, the larger crossings may use an approved open-bottom structure. Open-bottom structures will only be used where stream diversion is minimal. The need for, and the extent of, HADD compensation will be decided on a case by case basis.

In consultation with Coast Guard (Navigable Waters) representatives, determination of navigable waters has been completed for all 43 watercourses crossed by the Project. The following five watercourses were determined to be navigable.

- WC18 – River de Chute
- WC33 – Big Presque Isle
- WC35 – Tributary to Little Presque Isle
- WC36 – Little Presque Isle
- WC37 – Little Presque Isle

The watercourses that were determined to be navigable are not used for any known commercial trafficking of goods, or for transportation purposes. They may be used during open water months for light recreational and sporting use (*i.e.*, canoe or small jon boat). Table 2.2.4 presents some key characteristics of each of the watercourses that were determined to be navigable. The channel width is presented, however actual wet width at the time of survey (*i.e.,* late summer 2002) was approximately 25% less than channel width for each watercourse. The average channel depth was also recorded in late summer, and is reflective of low water conditions. The percentage of the substrate that is composed of rubble or larger sized clasts is presented to provide an indication of potential obstacles to motorized propeller use, or deep hulled boats. In all cases except for Tributary to Little Presque Isle, depth and substrate composition preclude the use of outboard motors or deep hulled watercraft. The Tributary to Little Presque Isle, although sufficiently deep with a soft substrate, has a very small channel width of 2.5 m, and is blocked by beaver dams above and below the area crossed by the proposed RoW.

Table 2.2.4 Characteristics of Navigable Waterways

Watercourse Name	Channel Width (m)	Average Channel Depth (m)	Percentage of Substrate Composed of Rubble, Rock, or Boulder
River de Chute	9	0.25	75%
Big Presque Isle	47.1	0.20	65%
Tributary to Little Presque Isle	2.5	>1	0%
Little Presque Isle	16.1	0.17	85%
Little Presque Isle	15	0.50	30%

During the course of the *CEAA* review process, the public have an opportunity to comment on navigational use of the watercourses crossed by the Project. No navigational use was identified during the NBDOT alignment selection public consultation process. During the advertisement period for the approval process under *Navigable Waters Protection Act* subsection 5(1), the public will again have an opportunity to comment on the potential of the Project to affect navigation. The watercourse crossing structures at these 5 locations will be designed in consultation with Navigable Waters Protection officers, and in consideration of issues raised during public consultation, to ensure that there are no adverse impacts to known and/or identified navigability.

Design of watercourse crossing structures will be conducted in consultation with DFO and Navigable Waters Protection Program (NWPP) officers to ensure HADD and navigable waters issues are addressed in the planning stages. Watercourse crossing structures for fish-bearing watercourses will be selected in order to minimize HADD and comply with the *Guidelines for the Protection of Fish and Fish Habitat – Placement and Design of Large Culverts* (DFO 1999a). These guidelines include provisions to ensure fish passage is not impeded throughout the year by accommodating the high velocities associated with high flows as well as, the shallow flows associated with low flows, into the overall culvert design.

Figures 2.2 and 2.3 provide generic outlines of temporary water control structures for an open channel option and a generic plan for a typical watercourse crossing, respectively.

The watercourse crossing structure for each crossing will be one of four potential structures including: pipe culvert; box culvert; arch; and bridge. As per the NBDOT Standard Specifications (2003) these structures can be classed into two large categories: culverts and open bottom structures (arch and bridge). Figure 2.4 illustrates typical sections for each of the box culvert, pipe culvert and arch. A generic profile of a conventional bridge is presented in Figure 2.5. The NBDOT Standard Specifications (2003) refers to a bridge as "any structure in excess of 3 m in span length carrying vehicular and/or pedestrian traffic"; and a culvert as "any structure not classified as a bridge, and/or drainage system, which provides an opening for the passage of water under any roadway or driveway".

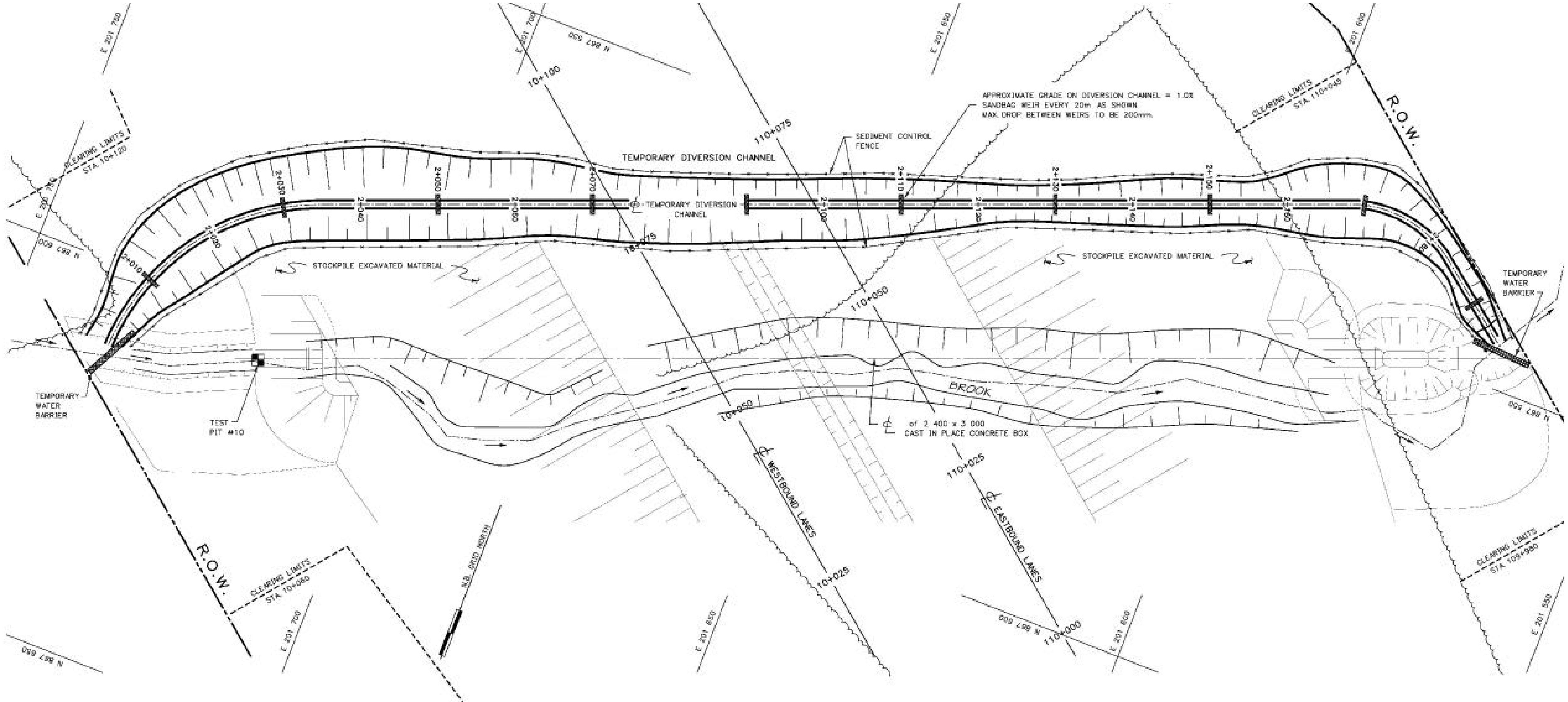
General guidelines that will be used by NBDOT (or the developer) in the selection of watercourse crossing types are listed below.

Culverts

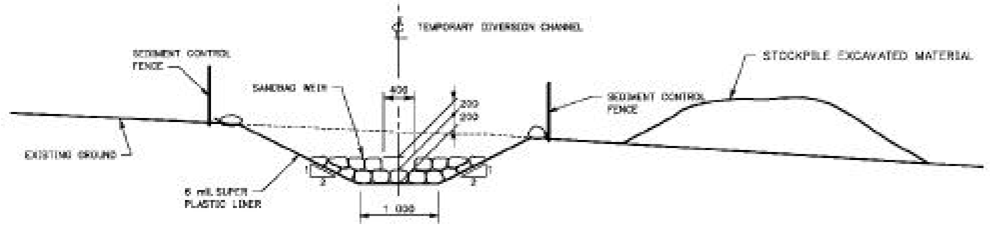
- For higher fills (greater than 9 m), round concrete culverts are preferred because they can utilize a cost effective induced trench design.
- For lower fills (less than 9 m), precast box culverts are preferred.
- Aluminum multiplate pipe (round) is a viable option assuming that bedload abrasion is accounted for (plates of excess thickness on the bottom half).
- Aluminized Type 2 culverts (round) are also viable options but are only available with a maximum diameter of 3.3 m.
- Drainage areas amenable to culvert installation are generally less than 100 km^2.

Arches

- Arches are used for relatively large waterways under deep fills, if rock or favourable soil conditions exist for footings. Arches that are not founded on rock tend to have large footings, which often result in the destruction of the natural streambed.



DRAINAGE AREA = XX km²



TYPICAL SECTION THRU TEMPORARY DIVERSION CHANNEL

N.T.S.

TYPICAL CONSTRUCTION SEQUENCE

The following sequence of work shall be followed, unless otherwise directed by the Engineer. The Owner shall be receptive to alternative approaches to temporary water and sediment control procedures.

1. Mulch al exposed soils as work progresses.
2. Construct Temporary Diversion Channel complete with sandbag weirs, then install Sediment Control fence in as shown.
3. Install Temporary Water Barriers and divert stream flow, and rescue fish from bypassed channel.
4. Installnew culvert and construct Downstream Pool and Upstream Channel, Plant Trees.
5. Remove Temporary Water Barriers to open new channel, and rescue fish from Temporary Diversion Channel.
7. Fill and Mulch areas which have been disturbed.
8. Place remainder of fill to design grade, Hydroseed areas which have been disturbed.

REFERENCE:
DEPARTMENT OF TRANSPORTATION
TEMPORARY WATER CONTROL OPEN CHANNEL OPTION

TYPICAL WATERCOURSE - OPEN CHANNEL OPTION
NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT
PERTH-ANDOVER TO WOODSTOCK

Date:	Scale:
2004 02 04	N.T.S.
Job No.: 14677	Fig. No.: 2.2

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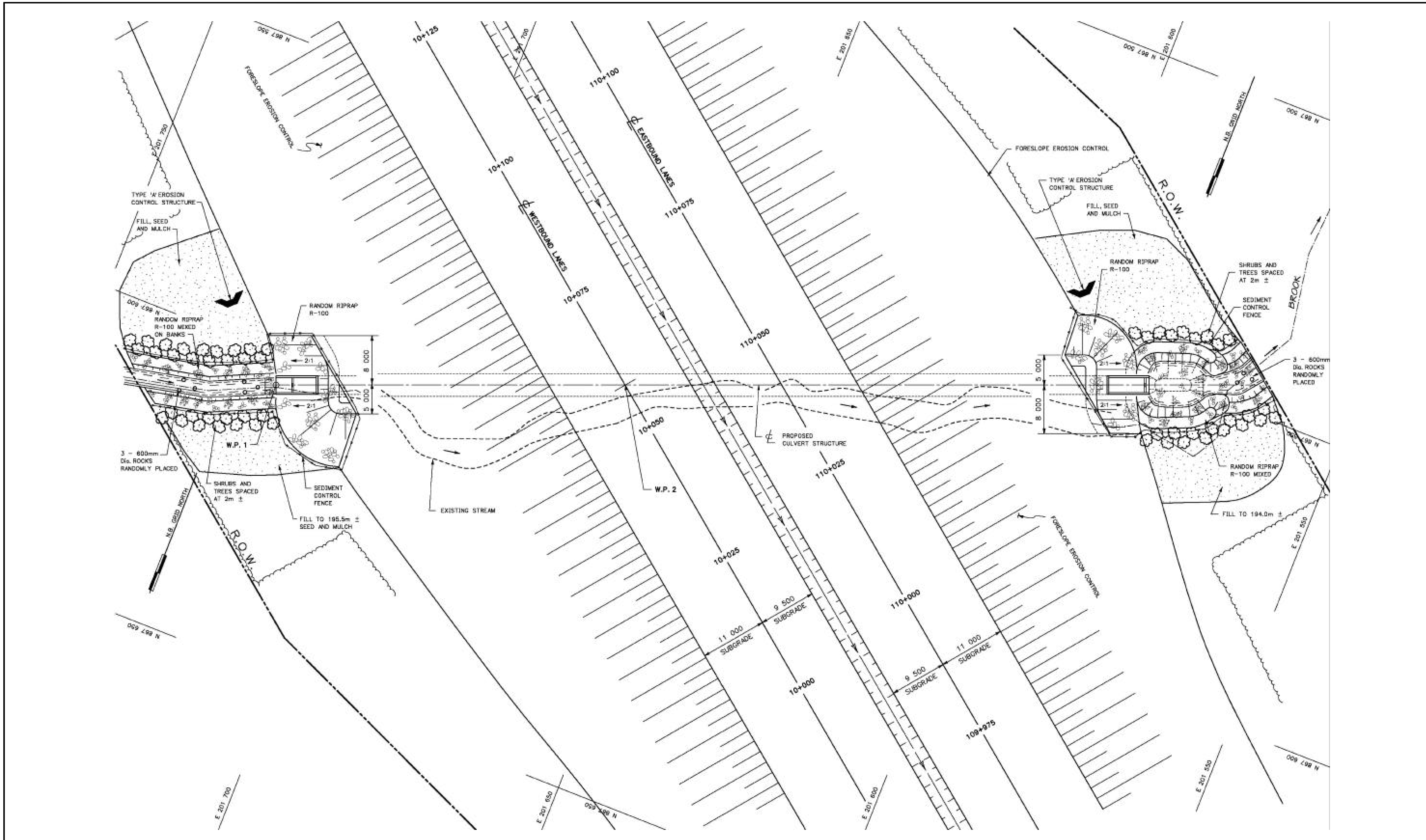
Environmental Scientists

FILE: 14677\WORKING\FIG2-2_OPEN



REFERENCE:
DEPARTMENT OF TRANSPORTATION
PLAN - TYPICAL WATERCOURSE CROSSING

PLAN VIEW OF TYPICAL WATERCOURSE CROSSING
NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT
PERTH-ANDOVER TO WOODSTOCK

Date:	Scale:
2004 02 04	N.T.S.
Job No.: 14677	Fig. No.: 2.3

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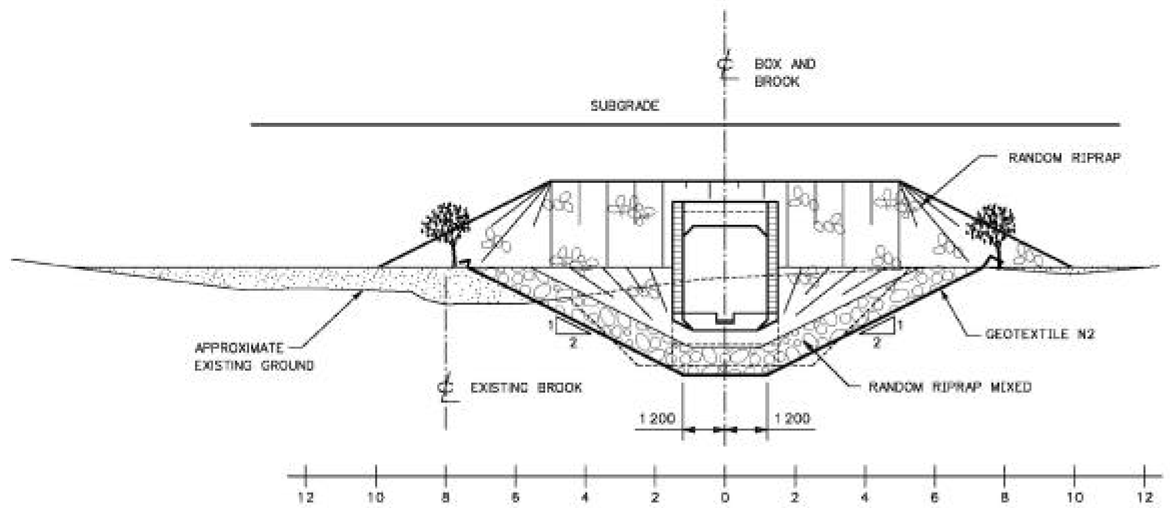
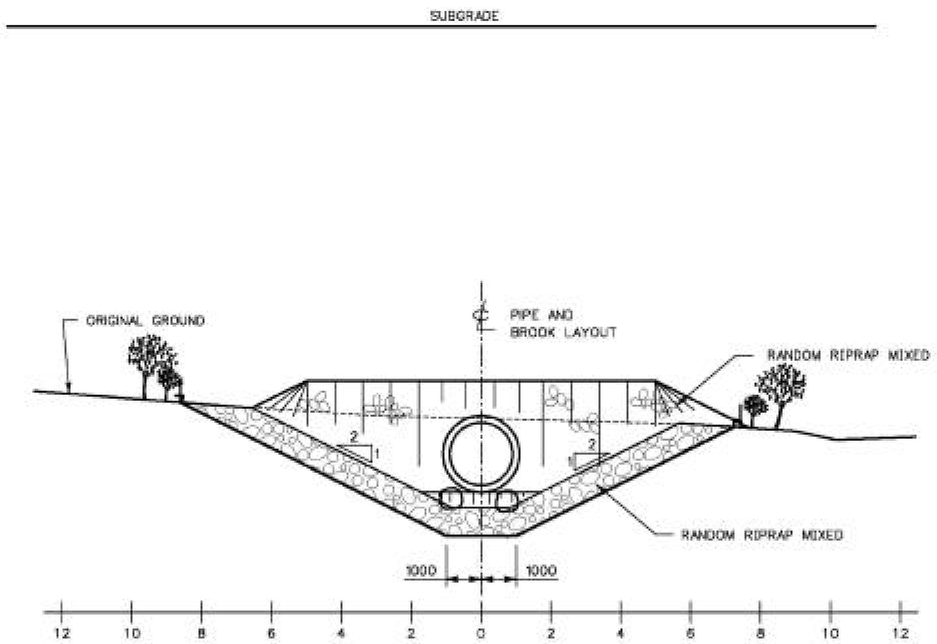
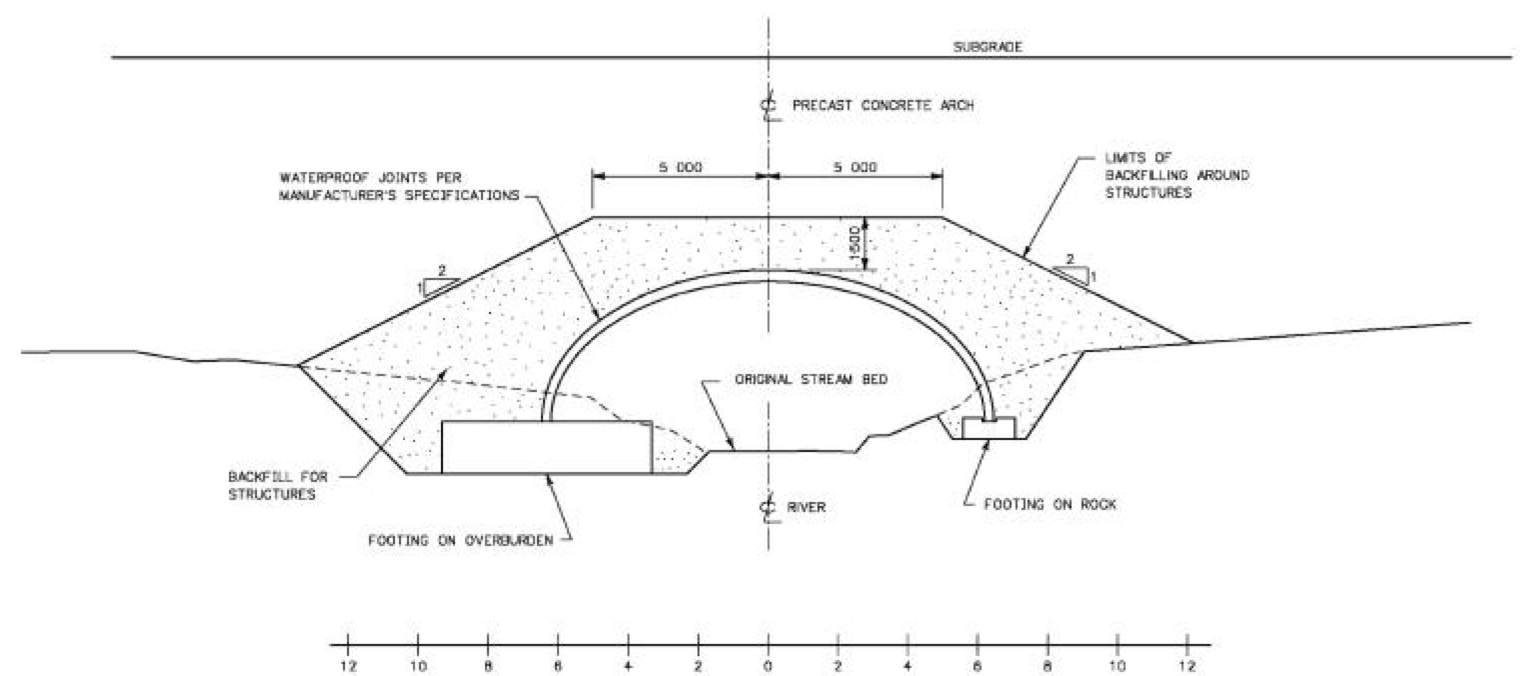


SECTION THRU OUTLET POOL
BOX CULVERT OPTION



SECTION THRU OUTLET POOL
ROUND PIPE OPTION



SECTION
ARCH OPTION

FILE: 14677\WORKING\FIG2-4_SECTIONS

REFERENCE:
DEPARTMENT OF TRANSPORTATION
TYPICAL SECTIONS

PROFILE OF TYPICAL WATERCOURSE CROSSINGS
NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT
PERTH-ANDOVER TO WOODSTOCK

Date:	Scale:
2004 02 04	N.T.S.
Job No.: 14677	Fig. No.: 2.4

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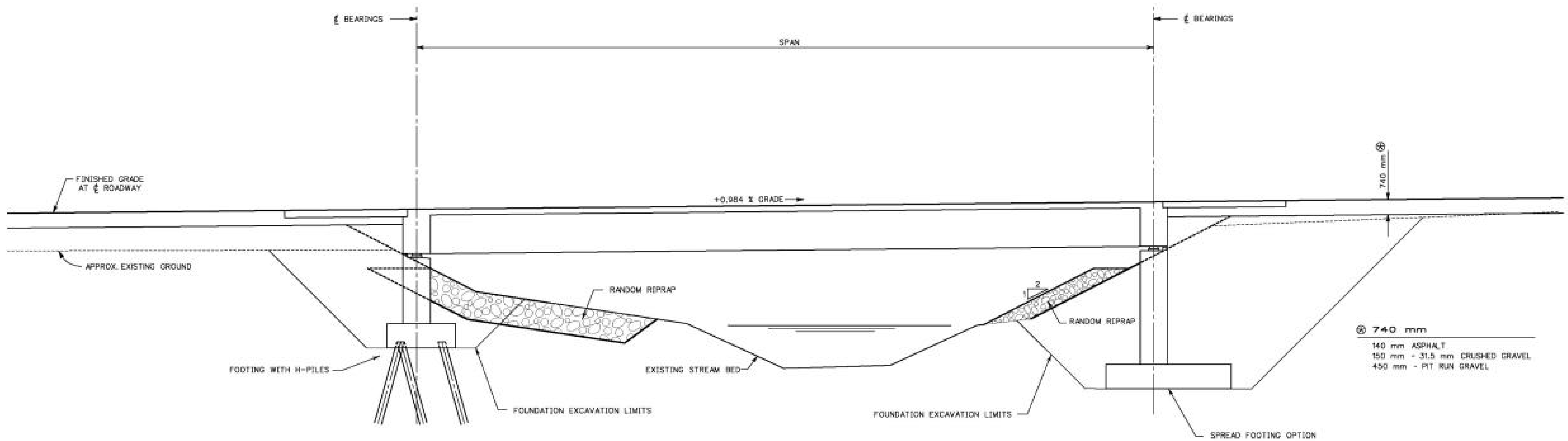

℄ PROFILE OF STRUCTURE

FILE: 14677\WORKING\FIG2-5_BRIDGE

REFERENCE:
DEPARTMENT OF TRANSPORTATION
℄ PROFILE OF CONVENTIONAL BRIDGE

PROFILE OF A CONVENTIONAL BRIDGE
NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT
PERTH-ANDOVER TO WOODSTOCK

Date: 2004 02 04	Scale: N.T.S.
Job No.: 14677	Fig. No.: 2.5

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Bridges

The need for a conventional bridge crossing is generally dictated by larger drainage areas and navigable waters issues.

In the design stage, DOT will also take into consideration the types of materials to be used for construction and the crossing layout. The following general guidelines will be considered in the Project design stage.

In accordance with DFO (1999), NBDOT has committed to consideration of the following guidelines during watercourse crossing planning and design. Where possible:

- highways will cross streams at right angles to minimize the length of a crossing and minimize the need for permanent stream diversions;
- watercourse crossings will be located on straight stream segments;
- watercourse crossings will be located at sites where the channel gradient is at or near zero and water velocity is relatively constant upstream and downstream;
- crossing locations will be avoided that will require large permanent stream diversions;
- roadway interchanges near watercourses will be avoided as these will normally require multiple crossing structure installations and the placement of large amounts of fill adjacent to the watercourse;
- areas with erodible soils will be avoided;
- areas with acid-generating rock will be avoided;
- watercourse crossings at sites where culvert installation will involve large fills or approaches with deep or lengthy cuts will be avoided; and
- natural drainage patterns will be retained.

In addition, structure designs will be based on established watercourse conditions (*e.g.,* stream diversions should mirror stream gradient, substrate, meander, sequence, depth, and riparian vegetation). Specific watercourse conditions can be found in Section 5.3 (Surface Water VEC).

2.2.4 Ancillary Facilities Alternatives

The exact locations of ancillary facilities have not been determined at this time. The following subsections provide information regarding the process for selection of suitable sites.

2.2.4.1 Waste Disposal Areas

Waste disposal areas will be selected in accordance with:

- Guidelines for the Siting and Operation of a Construction and Demolition Debris Disposal Site; and
- Item 947 of the NBDOT Standard Specifications, January 2003.

2.2.4.2 Borrow Pits and Quarries

The developer must apply for a permit (Application Form Requesting the Approval of a Source) with the Department of Environment and Local Government for approval to operate the facility. Section 4.9 of the EPP indicates that the location and suitability must be approved by the engineer and must be developed and operated in accordance with all applicable provincial guidelines, policies, acts, and regulations, including:

- Items 922, 941, 936, 947, and 948 of the NBDOT Standard Specifications (January 2003);
- Draft Provincial Land Use Policy Pits and Quarries;
- Draft Provincial Performance Standards for Development, Operation, and Closure of Pits and Quarries in New Brunswick; and

2.2.4.3 Removal or Modification of any Existing Structures

Residential wells located on the property are decommissioned as per the NBDELG Guidelines for decommissioning (abandonment) of Water Wells. Septic tanks must be pumped clean and backfilled or completely removed and backfilled.

2.2.4.4 Asphalt Plant(s) (Construction, Installation and Operation)

The location of an asphalt plant is chosen by the developer prior to construction and must be approved by the Engineer. The plant and its components will be in compliance with ASTM D995-95b (Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures) and the contract documents. In addition, the developer must apply for a Request for Approval of a Source from the Department of Environment and Local Government. Generally the developer would already have acquired such a permit however if the asphalt plant were portable the developer would have to apply for an amendment to locate the portable plant at a new location each time the plant is moved. Asphalt plants are generally located outside the RoW as they take up too much space during construction.

3.0 PROJECT DESCRIPTION

This section of the report provides an overview of the proposed Project, its purpose and location, and describes the elements and activities to be undertaken as part of the Project, including a description of potential malfunctions and accidental events that may occur throughout the life of the Project. This section of the report also provides a description of the proposed environmental management practices to be employed for each of the proposed Project phases.

3.1 Project Overview

3.1.1 Project Definition and Location

The Project consists of the construction, operation, and maintenance of a new four-lane divided controlled access highway, approximately 70.7 km in length, that will by-pass the existing two-lane TCH, including interchanges and watercourse crossings and structures, and required ancillary work/facilities including new road connections, property access roads, and borrow and disposal areas. This new section of the TCH will be located in western New Brunswick, and will extend north/south between the Village of Perth-Andover and the Town of Woodstock, as shown in Figure 3.1 and Figure 3.2 (Appendix C). The proposed TCH alignment is located west of the existing TCH, between the Saint John River and the United States border. As such, the proposed TCH will not require/include new major bridge structures to cross the Saint John River.

The northern portion of the Project is located in Victoria County, and the remaining southern portion is located in Carleton County. The proposed TCH will originate at a point just south of the new Route 190 Interchange at Perth-Andover (presently under construction) and continue in a southerly direction west of the existing TCH, by-passing Florenceville and Hartland, and will terminate at the Route 550 (Connell Road) Interchange at Woodstock. Figures 3.2 A-D (Appendix C) present the proposed TCH alignment from Perth-Andover to Woodstock. With the exception of short twinned sections at each end (a 2.8 km segment from the Route 550 Interchange to a point about mid-way between Lockhart Mill Road and Route 560 in Jacksonville, and a 1 km segment extending south from the Route 190 Interchange), the proposed TCH will be constructed over a new alignment that will by-pass the existing TCH.

The proposed Project footprint is the minimum area within which all construction activities associated with the proposed TCH will take place. The Project footprint includes the area for the main lanes and interchanges of the proposed TCH, all new and modified secondary roads and all new woodlot or property access roads required by the Project, as well as the potentially affected areas surrounding streams at watercourse crossings.

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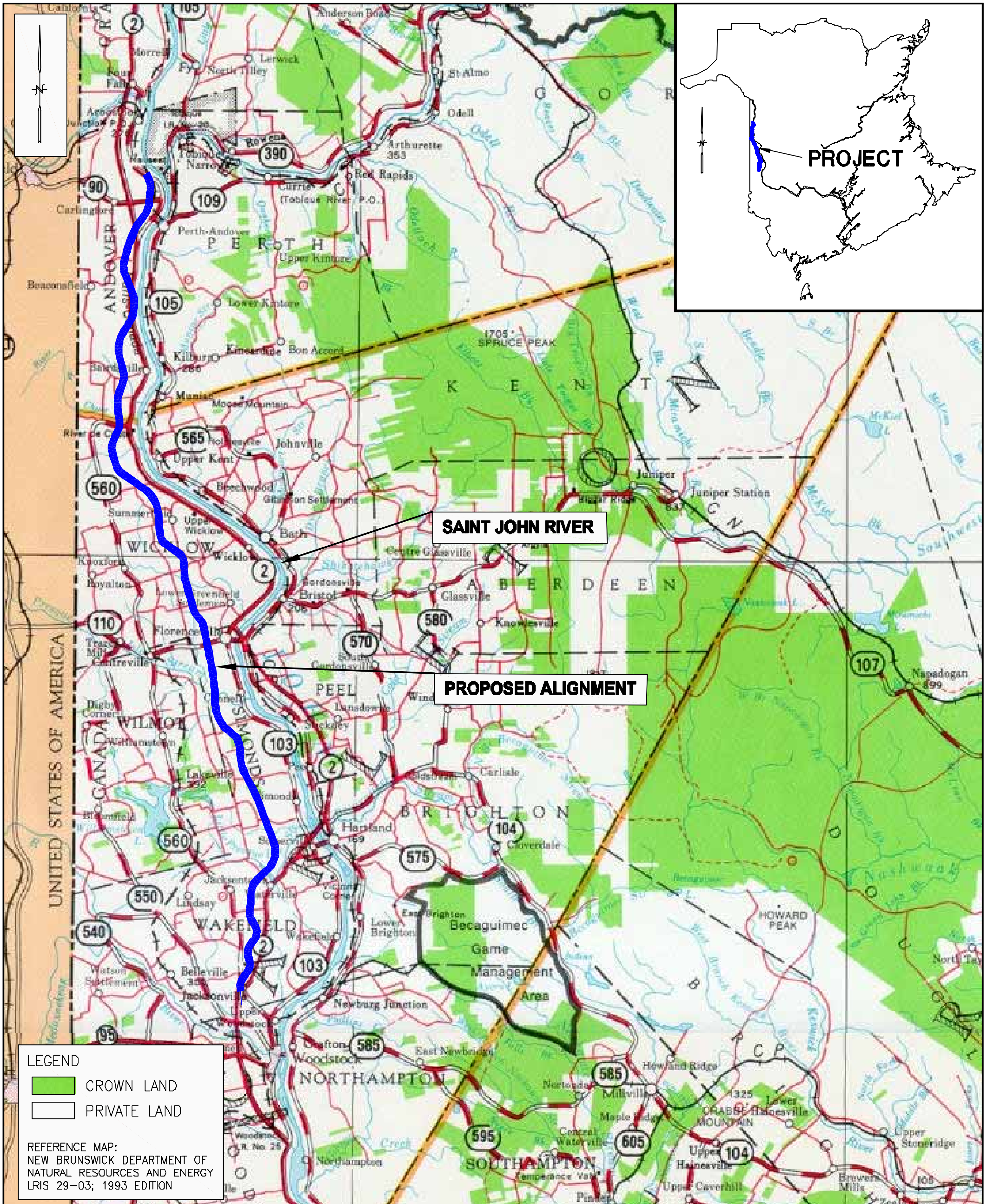

PROJECT LOCATION
NEW ROUTE 2 TRANS-CANADA HIGHWAY
PROJECT PERTH-ANDOVER TO WOODSTOCK

Date:	Scale:
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Job No.:	Fig. No.:
14677	3.1

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NBDOT plans to complete construction of the Project in four years beginning in 2004 and ending at the conclusion of the 2007 construction season. To date the Project has undergone the functional planning process to select an alignment as described in detail in Section 2.2 of this report. NBDOT preliminary pre-design construction costs of the Project are estimated at $200 million.

3.1.2 Proposed Highway Design

The proposed TCH will be designed and constructed to RAD 120 (Rural Arterial Divided highway with design speed of 120 kph) Transportation Association of Canada (TAC) Standards, allowing the planned posted speed of 110 kph. Typical cut and fill cross-sections are illustrated in Figure 3.3. The typical design defines the lane and shoulder width, and ensures drainage from the roadway surfaces to the median and side ditches for both cut and fill sections. The widths and thickness of the subgrade, subbase, base and asphalt layers are also specified in the typical cross-section design drawing.

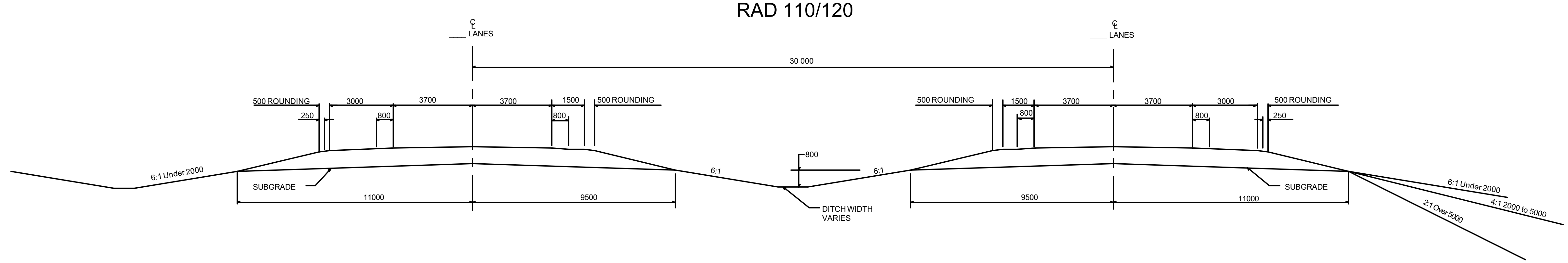
The centrelines of each of the two eastbound and westbound lanes will be separated by a median of minimum 30 m width (measured between the centre lines of the two lanes in each direction, as shown in the typical section drawing in Figure 3.3) and up to 82.5 m. The median width along any section of the proposed TCH alignment has been determined by a combination of factors including topography and design standards, land uses, and various environmental considerations. The minimum median width is typically applied where constraints such as valuable agricultural and forest lands, wetland and other sensitive areas, and/or residential and commercial development are being avoided, or to limit the extent of disturbance in these areas. A wider median can offer more cost-effective design opportunities, and is therefore preferred.

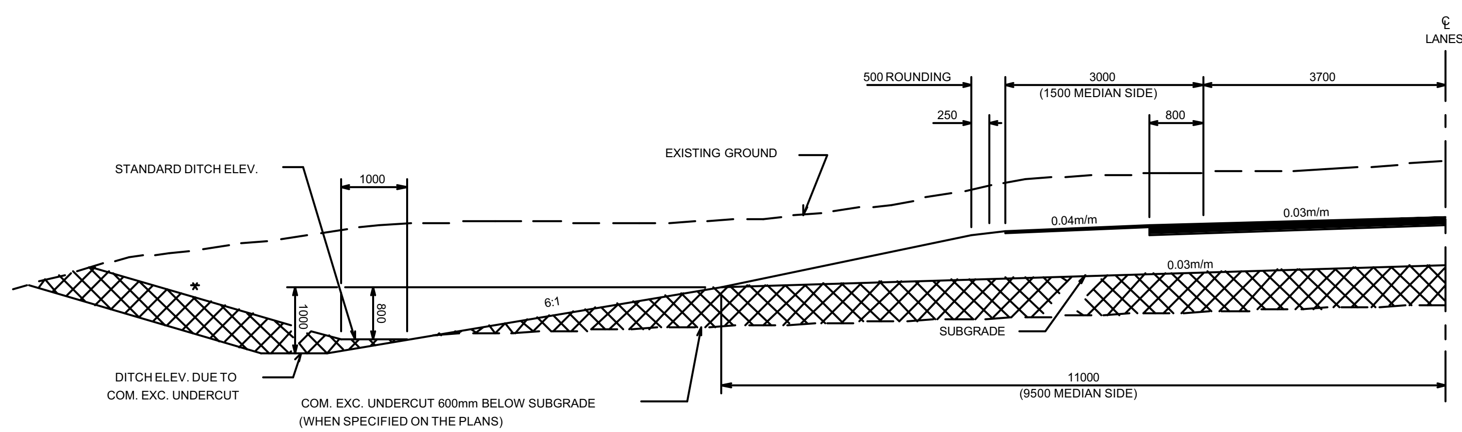
3.2 Purpose, Rationale, and Need

In the late 1980's the Province of New Brunswick set out its objective to upgrade the TCH, Route 2, from Nova Scotia to Quebec, to a four-lane access-controlled highway. Since that time the entire portion of the TCH from the Nova Scotia border to Fredericton, as well as other segments of Route 2 (*e.g.*, Edmundston to Saint-Léonard and the Woodstock By-pass), have been upgraded to four lanes. Other segments of the TCH (*e.g.*, Woodstock to Pokiok and Perth-Andover By-pass) are nearing completion. The portion of the TCH from Perth-Andover to Woodstock is the largest remaining segment to be upgraded to meet the Provincial objective.

The TCH through New Brunswick not only serves the transportation needs of New Brunswickers, but also provides the main east-west link between the Atlantic Provinces and the rest of Canada, and the link to the north-south Atlantic Canada - USA corridor. The segment of the TCH from Perth-Andover to Woodstock connects the northwest region of New Brunswick to southern parts of the Province, the other Atlantic Provinces, and the US Interstate Highway network.

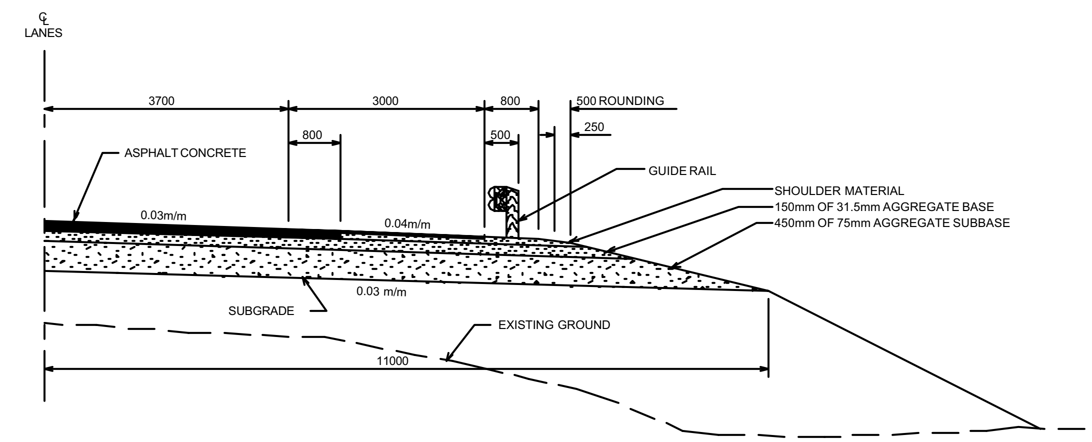
RAD 110/120



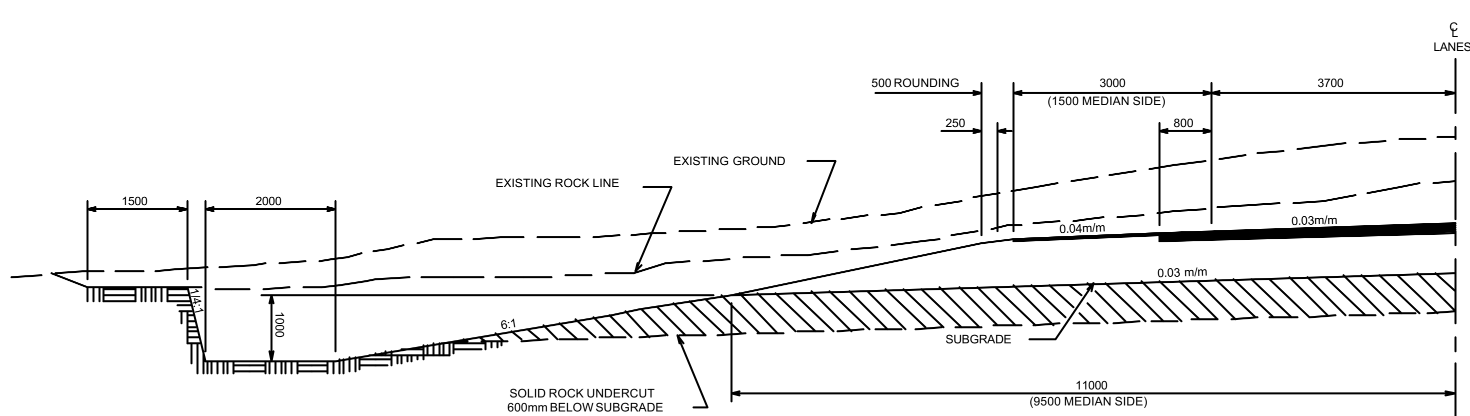


NOTE: * BACKSLOPE TYPICALLY 3:1
** CE DITCH DEPTH AND WIDTH SHALL MATCH SRE DITCH AT TRANSITIONS TO ROCK CUT

CUT SECTION - COMMON EXCAVATION (CE)

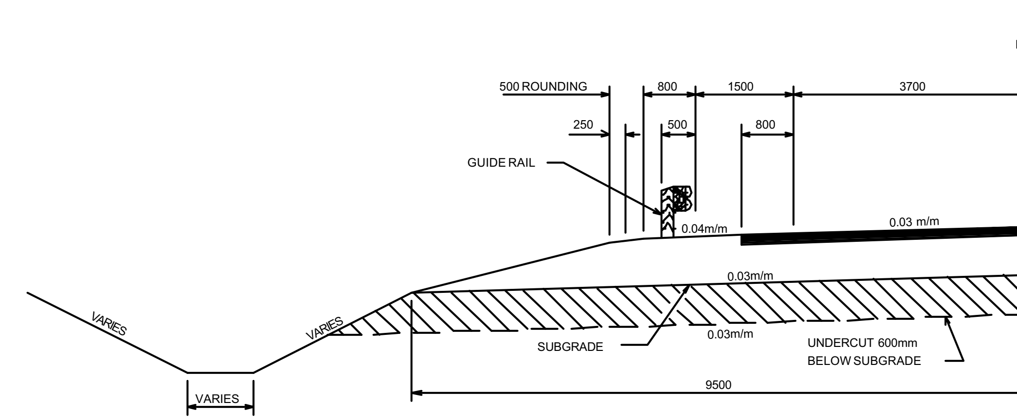


FILL SECTION



NOTE: * BACKSLOPE TYPICALLY 3:1
** 3000 WHEN HEIGHT OF ROCK BACKSLOPE > 10m

CUT SECTION - SOLID ROCK EXCAVATION (SRE)



MEDIAN SECTION - CUT OR FILL

THE BASIC UNIT OF DIMENSIONING IS MILLIMETRES

REFRENCE DRAWING: ADI LIMITED; DWG: 16100271_7	TYPICAL SECTIONS - FOUR LANE HIGHWAY NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT PERTH-ANDOVER TO WOODSTOCK	Date: 2003 10 03 Job No.: 14677	Scale: N.T.S. Fig. No.: 3.3

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Environmental Scientists

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NBDOT traffic counts along the existing TCH from Perth-Andover to Woodstock indicate that it carries traffic volumes in the range of 4,200 to 8,800 vehicles per day. Trucks make up 27% to 34% of the total traffic stream within the Project limits.

Much of the traffic along this segment of the TCH is pass-by traffic (it originates and is destined outside of the Perth-Andover to Woodstock area). However, a considerable portion of the traffic mix between Perth-Andover and Woodstock is local, serving homes, businesses, and farms with driveway access that enters and exits directly into the traffic stream.

The existing TCH is typically hilly and winding with few passing opportunities. The existing traffic conditions, which includes heavy truck traffic, vehicles entering and exiting directly into the traffic stream, and infrequent passing opportunities, often lead to the accumulation of traffic into platoons. As a result, traffic often flows at less than posted speeds, which encourages risky passing manoeuvres by frustrated motorists. The fatality rate experienced along this segment of the TCH over the five year period from 1997 to 2001 was reported in the *2002 CSIF Program Prospective Analysis of Route 2 - Grand Falls to Longs Creek Project* report for NBDOT to be over twice that of the typical rate for National Highways in Canada.

The four-lane, divided, controlled access design of the proposed TCH will allow for high speed uninterrupted flow over the Project limits. All level crossing intersections will be grade separated, replaced with interchanges or eliminated. The proposed TCH will by-pass the existing two-lane facility from Perth-Andover to Woodstock and will divert all pass-by trucks and traveller traffic, and some of the local traffic, from the existing TCH. It will, therefore, enhance the safety of all motorists, including those remaining on the existing TCH, the scenic route.

The additional highway capacity and freer flowing traffic conditions offered by the proposed TCH will reduce travel time and costs of freight and passenger transportation through New Brunswick. This, in turn, will contribute to the fulfillment of the Province's long-standing objective to foster economic development growth.

3.3 Proposed Project Elements

Proposed Project elements include:

- the alignment of the main lanes (eastbound and westbound) from Perth-Andover to Woodstock;
- interchanges and new connector roads;
- grade separations;
- secondary road modifications;

- stream crossings (*i.e.*, bridges and culverts); and
- property access roads.

These are shown in Figure 3.2 A-D (Appendix C), and described in detail below.

3.3.1 Proposed TCH Alignment

Following Figures 3.2 A-D (Appendix C) north to south, the proposed TCH will begin in Perth-Andover south of the Route 190 Interchange of the Perth-Andover By-Pass, and will terminate at the Route 550 Interchange in Woodstock. The proposed TCH is aligned more directly north-south, not following the Saint John River, and, as a result, measures a distance of 70.7 km versus the 76.2 km of the existing TCH that essentially parallels the Saint John River.

As described in section 2.2, the proposed alignment was selected in consultation with the various stakeholders including local property owners and regulatory agencies with care to avoid agricultural lands, or to locate the alignment at the back end of properties or in less (agricultural) valuable areas. Other environmentally sensitive areas, such as wetland areas, moose areas, and the rare plant communities (Figure 2.1 A-D, Appendix B) were avoided to the extent possible.

3.3.2 Interchanges

Access to the proposed TCH will be limited to four Route 2 (*i.e.*, existing TCH) interchanges as presented in Figures 3.2 A-D (Appendix C) and described below. There will be no at-grade intersections with minor roads, private driveways or property access roads permitted anywhere along the proposed TCH.

The proposed Route 110 Interchange at Florenceville, located approximately 2 km west of Route 103 in Florenceville, will be constructed to a full diamond design configuration (Figure 3.2 C, Appendix C).

The Hartland Interchange will be constructed to a full diamond design and will be located less than 2 km west of the existing TCH at Somerville (Figure 3.2 D, Appendix C). A new 1.8 km connector road will be constructed from the proposed TCH to the existing TCH.

Design of the Lockhart Mill Road Interchange (Jacksonville) is a half parclo - button-hook interchange configuration. The eastbound lanes will be served by the parclo ramps, and will intersect with the Lockhart Mill Road. The westbound lanes will be served by the button hook ramps that will connect to Route 560 on the east side of the proposed TCH (Figure 3.2 D, Appendix C). An environmental screening of this interchange has been previously undertaken and approved. Work is already underway to construct the four-lane structure and the interchange ramps to serve the existing two-lane TCH at this location. The upgrade to the final four-lane TCH configuration for this Project will require minor modifications to the interchange ramps.

Route 550 Interchange (Connell Road, Woodstock) will be a full diamond four-lane interchange of the proposed TCH, and will involve the upgrade of the existing two-lane diamond interchange (Figure 3.2 D, Appendix C). A parallel structure and reconfigured ramps will be constructed.

The Perth-Andover By-Pass Project (Route 190 Interchange) presently under construction, will require modification to the existing TCH and construction of a new 1.0 km connector road from the modified TCH to the Perth-Andover Bridge (Figure 3.2 A, Appendix C). These will be done as part of this Project and will be constructed to typical RCU 80 (Rural Collector Undivided highway with design of 80 kph) standards. Figure 3.4 depicts a typical cross-section for these connector roads and modified secondary roads.

3.3.3 Grade Separations

In addition to the four interchanges described above, grade separations (overpasses and underpasses) of the proposed TCH over and under secondary roads will be constructed at 13 locations along the proposed alignment. Grade separation structures will allow traffic on secondary roads continued passage across the proposed TCH, but will not provide access to it. One or two structures, depending on the configuration and the width of the median, will be constructed at each of the following locations (Figures 3.2 A-D, Appendix C):

- Beaconsfield Road - TCH overpass;
- Scott Road - TCH underpass;
- Dean Road - TCH overpass;
- Route 560 (north at River de Chute) - TCH overpass;
- Stairs Road – TCH underpass;
- B. Smith Road - TCH underpass;
- Backland Road - TCH underpass;
- Sipprell Road - TCH underpass;
- Dryer Road - TCH overpass;
- Raymond Road - TCH underpass;
- Estey Road - TCH underpass;
- Palmer Road - TCH underpass; and
- Route 560 (south at Jacksonville) - TCH overpass.

3.3.4 Secondary Road Modifications

As a result of the interchanges and grade separations, modifications will be required to realign several of the existing secondary roads to line up to the proposed TCH structures. The following six secondary roads will require modification in the vicinity of the proposed TCH (Figures 3.2 A-D, Appendix C):

- Scott Road;
- Stairs Road;
- Backland Road;
- Sipprell Road;
- Dryer Road; and
- Raymond Road.

3.3.5 Bridges and Stream Crossings

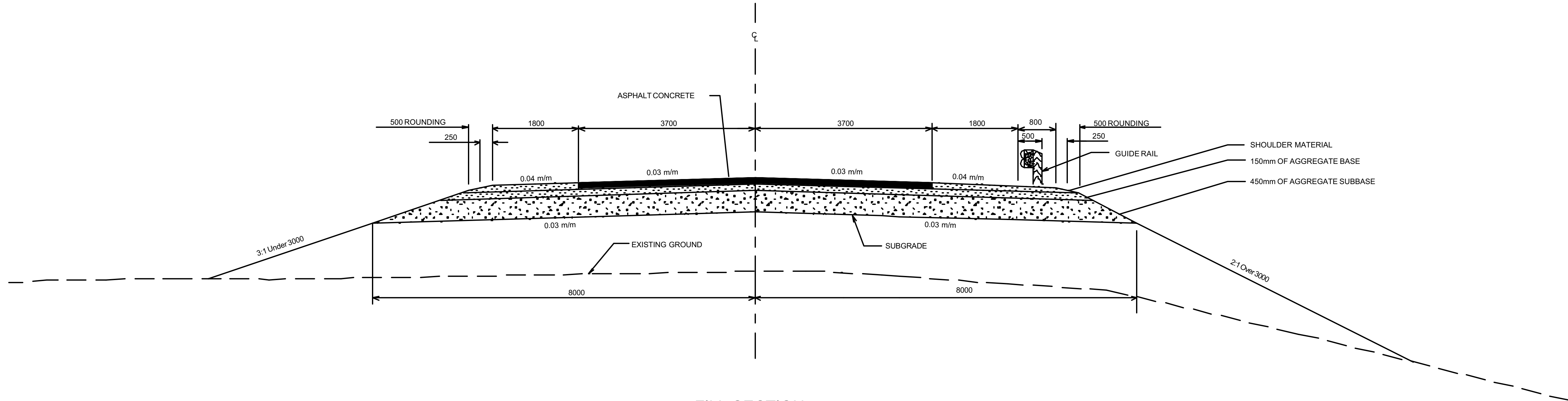
Three bridge crossings will be constructed along the proposed TCH. They include bridges over River de Chute, Big Presque Isle Stream, and Little Presque Isle Stream (Figures 3.2 B-D, Appendix C). In addition, a two-lane bridge will be constructed over the Little Presque Isle Stream, as part of the new connector road between the new Hartland Interchange and the existing TCH at Somerville (Figure 3.2 D, Appendix C).

There will be 43 minor watercourse crossings that do not require bridges. Culverts of various size and configuration will be installed at each of these locations. See Section 5.3 (Surface Water) for additional information related to culvert sizing.

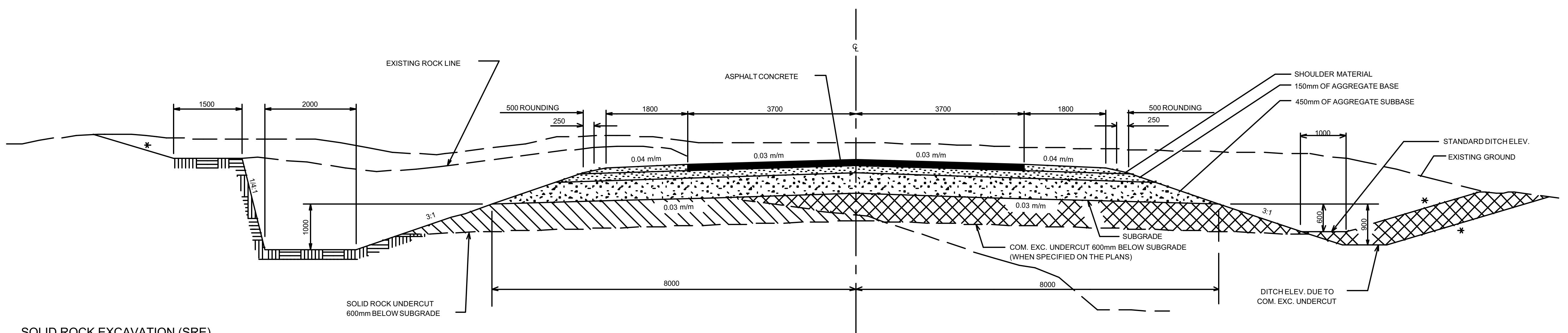
3.3.6 Property Access Roads

Property access roads will be constructed to provide continued access to properties that have been severed or cut off from their existing access by the proposed TCH. Figure 3.5 presents the three typical standards of property access roads constructed by NBDOT to retain access to private properties.

RCU 80



FILL SECTION



SOLID ROCK EXCAVATION (SRE)

COMMON EXCAVATION (CE)

NOTE: DITCH WIDTH TO BE 3000 WHEN DEPTH OF SOLID ROCK CUT IS GREATER THAN 10 metres.

CUT SECTION

NOTE: * SLOPE TYPICALLY 3:1

THE BASIC UNIT OF DIMENSIONING IS MILLIMETRES

REFRENCE DRAWING: ADI LIMITED; DWG: 16100271_7	TYPICAL SECTIONS CONNECTOR ROADS NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT PERTH-ANDOVER TO WOODSTOCK	Date: 2003 10 03	Scale: N.T.S.
		Job No.: 14677	Fig. No.: 3.4

Jacques Whitford
Consulting Engineers
Environmental Scientists

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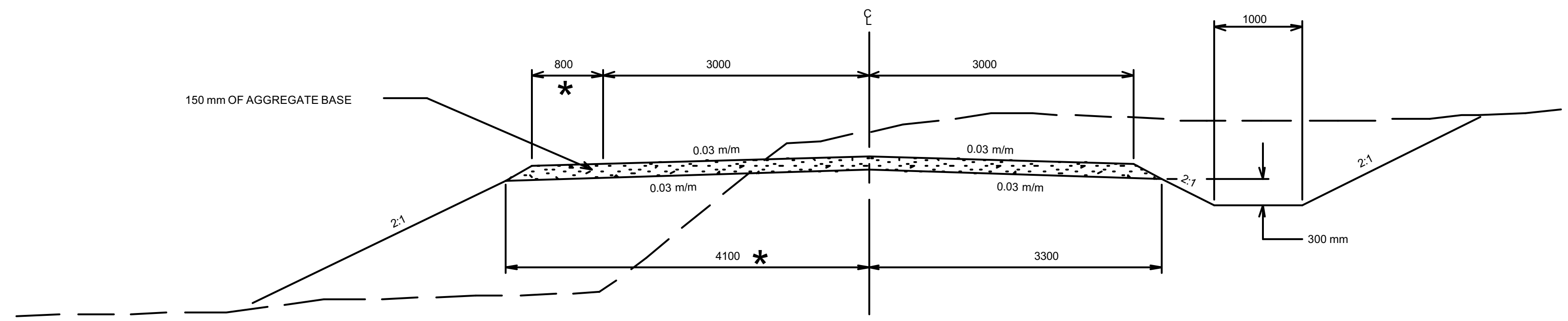
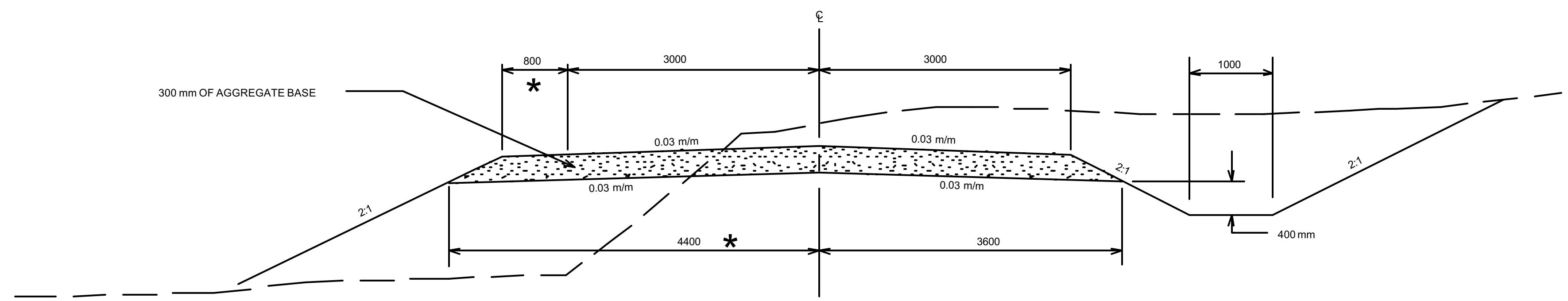
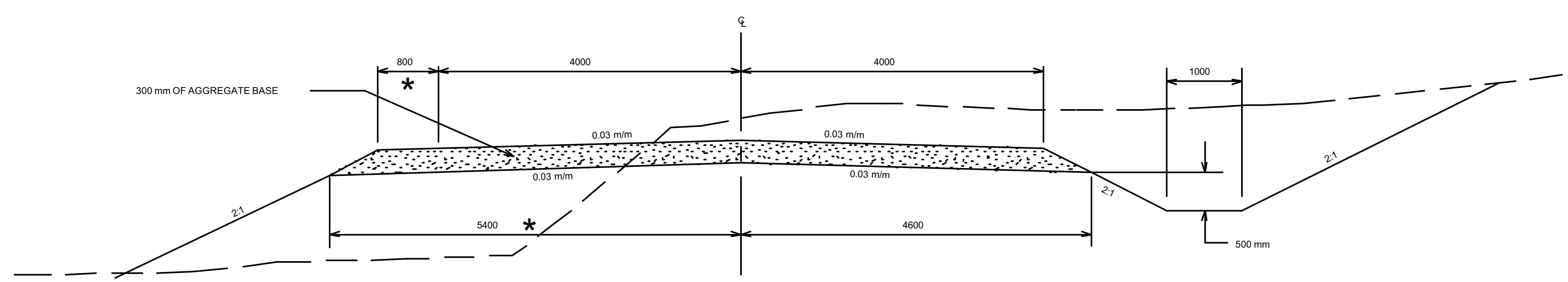


PROPERTY ACCESS ROAD
STANDARD #1



PROPERTY ACCESS ROAD
STANDARD #2



PROPERTY ACCESS ROAD
STANDARD #3

NOTES: 1 BACKSLOPES IN SOLID ROCK CUTS ARE 1/4:1 WITH A 1000 mm BENCH AND THEN A 2:1 BACKSLOPE IN COM. EXC.

2 * EXTRA 800mm WIDTH WHERE GUIDE RAIL IS REQUIRED IN FILLS OVER 3 m.

THE BASIC UNIT OF DIMENSIONING IS MILLIMETRES

FILE: 14677\WORKING\JW-16100271_7

REFRENCE DRAWING:
ADI LIMITED; DWG: 16100271_7

TYPICAL SECTIONS PROPERTY ACCESS ROAD
NEW ROUTE 2 TRANS-CANADA HIGHWAY PROJECT
PERTH-ANDOVER TO WOODSTOCK

Date:	Scale:
2003 10 03	N.T.S.
Job No.: 14677	Fig. No.: 3.5

Jacques Whitford
Consulting Engineers
Environmental Scientists

The Project will require the construction of 18 property access roads. The following list of property access roads provides the planned standard level and lengths. Property Access Road Standard Levels are chosen according to the expected level and use of the road. They are referenced in Figures 3.2 A-D (Appendix C) by assigned letters below.

- Access Road A: Level 2, 2200 m south at Perth-Andover, west of proposed TCH;
- Access Road B: Level 3, 3391 m south from Beaconsfield Road, west of proposed TCH;
- Access Road C: Level 1, 78 m north from Beaconsfield Road, west of proposed TCH;
- Access Road D: Level 1, 667 m east turning north from Scott Road, west of proposed TCH;
- Access Road E: Level 1, 352 m south from Access Road "F", west of proposed TCH;
- Access Road F: Level 3, 1463 m east turning north from Browning Road, west of proposed TCH;
- Access Road G: Level 1, 191 m north from Brown Road, east of proposed TCH;
- Access Road H: Level 1, 145 m east from Back Greenfield Road, west of proposed TCH;
- Access Road J: Level 3, 2252 m south from Upton Road, west of proposed TCH;
- Access Road K: Level 3, 2398 m north from Dryer Road, east of proposed TCH;
- Access Road L: Level 1, 182 m north from Sprague Road, west of proposed TCH;
- Access Road M: Level 1, 838 m north from Raymond Road, east of proposed TCH;
- Access Road N: Level 1, approximately 150 m north from Hartland Interchange Connector Road, east of proposed TCH;
- Access Road O: Level 1, approximately 180 m south from Hartland Interchange Connector Road, west of proposed TCH;
- Access Road P: Level 1, 324 m north from Palmer Road, east of proposed TCH;
- Access Road Q: Level 1, 214 m south from Palmer Road, east of proposed TCH;
- Access Road R: Level 1, 650 m south from Lockhart Mill Road, west of proposed TCH; and
- Access Road S: Level 1, 629 m south from Route 560 near Lockhart Mill Road Interchange, west of the proposed TCH.

3.3.7 Other Proposed Project Elements

Presently, NBDOT has no plans to construct rest areas or weigh stations within the Project limits. Preliminary conceptual plans for an ARWIS (Advanced Roadway Weather Information System) network for the TCH through New Brunswick are presently under consideration. Although there is no commitment to the system at this time, if implemented, there may be one or two installations within the Project limits. The ARWIS installations would be located roadside, within the proposed footprint, so there will be no need to extend the proposed RoW to accommodate this system.

Although concerted efforts were made to select an alignment that would avoid deer and moose habitat, the proposed TCH will pass through, and/or run alongside ungulate habitat areas. NBDOT and the NBDNR are investigating the possibilities and potential locations of deer/moose fencing and/or wildlife crossings along the proposed alignment. These installations would, however, be located within the proposed RoW.

Other ancillary facilities required to construct the proposed TCH include material storage areas, temporary access roads, gravel pits and aggregate quarries, and asphalt plants. The locations of these ancillary facilities will be identified as part of the developers' bid proposals, and have not as yet been established. The locations and operations of these facilities will be subject to the approval of NBDOT, the Department of Environment and Local Government (NBDELG), and all applicable regulations (*i.e., Watercourse and Wetland Alteration Regulation, Air Quality Regulation*) and guidelines (*i.e., Draft Guidelines for Pits and Quarries*, NBDELG 2000).

3.4 Project Activities

3.4.1 Construction Activities

The following is a description of construction activities typical for controlled-access highway construction projects of this nature in New Brunswick. The description of construction activities has been divided into five categories:

- **Site Preparation** includes activities associated with preparing the site for road and structure development (including access roads and interchanges) such as surveying, clearing, and removal of obstructions;
- **Roadbed Preparation** includes the activities associated with construction of the roadbed including access roads and structures) such as blasting, cuts and fills, and drainage culverts;
- **Watercourse Crossing Structures** includes installation of culverts and bridges;
- **Surfacing and Finishing** which includes activities such as paving, line painting, and installation of signs, guide rails and wildlife crossings and fencing; and
- **Ancillary Structures and Facilities** includes development of temporary site access roads, borrow areas, storage areas, disposal sites, and asphalt plants.

3.4.1.1 Site Preparation

3.4.1.1.1 Surveying and Geotechnical Investigations

Surveying includes the cutting of a centreline for each lane and cross-section offsets, wide enough to provide unobstructed sight lines as well as to allow access along the RoW for vehicles and/or geotechnical equipment. Clearing for surveying activities will take place outside of the breeding season for birds (*i.e.,* no clearing between May 1st and August 31st). The survey crew will carry out their garbage, retain access roads unobstructed, maintain ascribed tree cutting and felling and removal practices and take all the necessary precautions to prevent pollution or obstruction of watercourses.

Geotechnical investigations involve the drilling of boreholes or excavation of test pits along the centreline and offsets to determine the subsurface conditions. This may require some further clearing. Equipment used includes a backhoe or drill rig with tracks.

Access across watercourses and wetlands during these activities will be conducted in accordance with applicable permits (*e.g.*, Watercourse Alteration Permit) and/or applicable regulations (*i.e., Watercourse and Wetland Alteration Regulation*) and guidelines (*i.e., Watercourse Alteration Technical Guidelines*). Appropriate environmental protection procedures for these activities are included in Sections 3.2.2 and 3.2.3, respectively, of NBDOT's Environmental Protection Plan (EPP) (NBDOT 1998a). Section 4.7 of NBDOT's Environmental Field Guide (EFG) (Washburn & Gillis 1998) provides environmental protection measures for temporary watercourse crossings.

3.4.1.1.2 Clearing and Grubbing

The limits of clearing are flagged prior to/in advance of clearing activity (*i.e.*, during surveying) to limit the amount of clearing to that which is required for construction of the main lanes (including interchanges and structures), secondary and connector roads, and property access roads. The clearing width for the main lanes will vary depending on the toe of slope of the embankments. Merchantable timber remaining on private lands is harvested and sold to mills, while that remaining on Crown land under license goes to the licensee. Landowners may harvest the merchantable timber from lands being acquired by NBDOT prior to or as a condition of their sale. Harvesting would be conducted using conventional harvesting techniques and equipment typically used in New Brunswick, with NBDOT developers following guidelines set out in the Section 4.1 of the EPP.

The NBDOT Standard Specifications (NBDOT 2003) outline procedures for clearing. Trees will be cut to within 0.5 m of the ground. Merchantable timber (minimum top diameter of 80 mm and a length of 2.44 m) will be delimbed and removed from the site, while non-salvageable material will be chipped, burned or shredded within the RoW and left in place.

The primary environmental concern during clearing is to minimize ground disturbance that may result in the erosion and sedimentation of wetlands and watercourses. Clearing activities will take place outside of the breeding season for birds (*i.e.,* no clearing between May 1st and August 31st) and, when possible, clearing operations will be conducted during winter months as frozen ground provides the necessary bearing capacity for heavy machinery, protecting the underlying vegetative mat and minimizing the potential for erosion and sedimentation. Working on frozen ground makes the work site more accessible, reduces the cost of access road development, and increases the speed at which skid trails can be used.

Hand clearing will be conducted where ground conditions are not suitable for access by heavy equipment, such as near watercourses.

Grubbing for roadway construction involves the removal of all organic material and unsuitable soil above the underlying soil. It also consists of the removal and disposal of all stumps, roots, downed timber, embedded logs, humus, root mat and topsoil from areas of excavations and embankments or other areas as directed by the Resident Engineer. All areas where fills are less than 2.5 m or where excavation is planned, must be grubbed. Grubbing is usually not required under fills greater than 2.5 m in depth, unless a structure (bridge, culvert or retaining wall) is to be constructed, or where a significant layer of compressible soil exists that could cause a future settlement problem. To minimize environmental risks associated with erosion and sedimentation, a 30 m buffer of undisturbed vegetation will be maintained between the construction area and watercourses until culverts are installed and required erosion and sediment controls (*e.g.*, sediment fence, settlement ponds) are in place.

Bulldozers are typically used to scrape the organic material off the underlying soil and to pile the material. If the grubbed material is to be removed from the site, track-mounted excavators are sometimes used to load the material on to dump trucks. Where grubbing involves the removal of extensive organic deposits (*i.e.*, peat), the material is usually removed by an excavator and loaded directly to dump trucks. If the unsuitable material cannot be removed with a track-mounted excavator, a drag-line excavator can be used.

Topsoil will be salvaged for use in medians and on side slopes as per NBDOT (2003) Standard Specifications (Item 613). Other grubbed material will be disposed of in accordance with Section 4.18 of the EPP.

3.4.1.1.3 Modification, Relocation, or Removal of Existing Structures

Following and/or during clearing and grubbing activities, removal, relocation, or modification of existing structures (*e.g.*, buildings, wells) will be undertaken as required to prepare the RoW for grading. Modification, relocation, or removal of structures will be conducted in accordance with landowner agreements and all applicable regulations, standards, and guidelines. Disposal of construction and demolition waste will be conducted in accordance with NBDOT Standard Specifications (2003), the EPP, the *Guidelines for the Siting and Operation of a Construction and Demolition Debris Disposal Site* (NBDELG 2002a), and any provisions included in site specific contracts. There are approximately 30 residences, 1 apartment building, 1 church parsonage, 2 commercial establishments, and 1 home business that will be removed or relocated.

3.4.1.2 Roadbed Preparation

3.4.1.2.1 Subgrade

Following grubbing, the subgrade will be accomplished by cutting the high areas and using the material to fill in the low areas to provide an appropriate vertical alignment. Subgrade is the soil upon which the road is built, providing strength and stability. It may be undisturbed or it may require modification. If the existing grade is a specified cut location then the soil is excavated to the specified subgrade elevation. If the exposed subgrade is of suitable material, then it is compacted until firm and stable. If the exposed subgrade consists of unsuitable material (*e.g.*, organics), then the unsuitable material is excavated and replaced in specified lift thicknesses with suitable material to the specified subgrade elevation. Each lift is compacted to the specified moisture and density. Similarly, in specified fill locations, the subgrade is constructed by placing acceptable fill, either from cuts or borrow sources, spreading it in layers of specified thickness and, using moisture control procedures, compacting each lift to a specified density. Subsequent layers are added until the desired elevation is reached, and the subgrade is firm and stable.

The vertical alignment of a highway consists of straight grades, and crest (hill tops) and sag (valleys) vertical curves. The limiting design criteria for vertical curves are based on user comfort and safety. The design of vertical curves must also consider provision of adequate stopping sight distance and headlight visibility. Changes in vertical alignment involving cut and fills are also required on the approaches to highway overpasses or underpasses of other roads, and watercourses. Cuts and fills will be accomplished using earth moving machinery such as bulldozers, excavators, graders, loaders and articulated haulers. Compaction is accomplished using rollers, soil compactors or both.

3.4.1.2.2 Excavation, Blasting and Ripping

The removal of material for the construction of subgrade may involve one or more methods of excavation including common excavation, rock excavation, and unclassified excavation. Common excavation is the removal of overburden, including till, smaller boulders, and topsoil. Rock excavation is the excavation of rock that is considered to be bedrock or single pieces greater than one cubic metre in size. Cuts in "soft" rock can be accomplished using ripper blades attached to the back of larger bulldozers, breaking up the rock so that it can be loaded on to dump trucks with an excavator or loader. This procedure tends to be successful in softer rock such as shales and sandstones, and in areas where the bedrock surface is highly weathered and/or fractured.

Excavated soils unsuitable for use as fill or dressing slopes are disposed of at a site approved by the Resident Engineer and in accordance with Section 4.18 of the EPP.

The use of blasting for rock excavation is dependent upon the competency of the rock. The developer will determine whether or not blasting will be required for the construction of the proposed TCH. Wherever possible, rock excavation will typically be performed by ripping rather than blasting, due to the lower costs involved.

If blasting is deemed to be necessary, blasting operations will be conducted in accordance with Section 4.4 of the EPP and all applicable regulations and guidelines. Blasting operations are governed by provincial regulations throughout New Brunswick. Blasting in or near watercourses will require approval from Fisheries and Oceans Canada, and shall be conducted in accordance with the *Guidelines for Use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998). Blasting shall also be conducted in accordance with the applicable laws, regulations, orders of the Workplace Health, Safety and Compensation Commission of New Brunswick, NBDNR, Natural Resources Canada, and the New Brunswick *Transportation of Dangerous Goods Act*. The developer performing the blasting will have a valid license and will ensure that a pre-blast survey of any nearby wells and structures (*i.e.,* within 500 m) has been conducted prior to blasting.

Where feasible, as determined by suitability of the material and hauling costs, material excavated from the RoW is used for fill. If the excavated material is determined to be unacceptable for use as road building material, materials will be obtained from nearby approved borrow sources. Borrow pits will be developed outside of, but in close proximity to, the RoW. Borrow material will be free of contaminants and must be approved for suitability for the Project prior to use. Borrow pits will be located away from areas suspected as having potential for sulfide bearing rocks or aggregate resources. Erosion control measures will be employed at these sites, where required, to prevent siltation of watercourses and wetlands. Section 4.9 of the EPP and the *Draft Guidelines for Pits and Quarries* (NBDELG 2000) will be followed.

Cut and fill volumes, found in Table 3.4.1, are divided into five stretches of the Route 2, Perth-Andover to Woodstock highway which represent the way in which the design engineers have divided up the proposed work. The cut and fill sources of these volumes are shown on four maps (Figure 3.6-A to 3.6-D). The estimated values indicate an overall surplus volume of 7,448,827 m^3 of excavated material. It should be noted that estimated cut and fill volumes are based on grade levels, may contain overburden in addition to bedrock, and consider the excavation of the entire purchased RoW which in many cases will not be required. Also, cuts were assumed to be all common excavation with 3:1 backslopes, which exaggerate quantities. As a result, values in the table are conservative estimates. These estimated quantities will be significantly reduced when the rock line is defined. A reasonable quantity balance should be achievable on all sections.

In the case of the Wark Brook to Scott Road Section imbalance, hilly terrain requires substantially larger cuts and fills than the other sections. Minor changes in grade in this section will significantly affect cut and fill quantities. For example, during a preliminary cut and fill balance exercise, raising the grade a couple metres resulted in 500,000 m^3 change in quantity balance.

Table 3.4.1 Cut and Fill Volumes: Route 2, Perth-Andover to Woodstock

	Cut (m3)	Fill (m3)	Surplus/Deficit
Wark Brook to Scott Road (Fenco)	8,927,909	2,606,064	+6,321,845
Scott Road to J. Clark Road (Hillside)	2,140,522	1,462,553	+677,969
J. Clark Road to Route 110 (N & G)	1,632,256	1,278,104	+354,152
Route 110 to Hartland Interchange (Comtrac)	1,347,039	984,063	+362,976
Hartland Interchange to Route 560 (Geoplan)	1,819,474	2,087,589	-268,115
Totals	15,867,200	8,418,373	+7,448,827

During the design and construction phase of the project, an ongoing effort will be made to balance the cut and fill volumes. In particular, attention to balancing measures will be taken in areas where potential acid or sulfide-bearing rock is located. Balancing the cut and fill can be achieved by altering the grade and making slight alignment adjustments within the RoW.

Excavated material will be stored, or used as fill, as much as possible within the RoW. Material will also be used for dressing slopes created by the grade cuts. Materials unsuitable for such uses will be disposed of within the RoW at a site approved by the Resident Engineer and in accordance with Section 4.18 of the EPP, or outside the RoW as per Guidelines for the Siting and Operation of a Construction and Demolition Debris Disposal Site. Transportation required for the cut and fill process has not yet been determined. Due to issues such as compaction and final grade requirements, the amount of transportation required to dispose and/or utilize excess material cannot be determined. However, the transportation of material will be self-regulated, as it will be in the developer's best interest to minimize costs to transport this material.

Where sulfide bearing rock is identified, excavation will be avoided or minimized by adjusting the alignment horizontally (within the RoW) and/or vertically where possible. If acid rock were identified during the construction phase, NBDOT's Acid Rock Committee will be immediately contacted and site-specific protection measures will be implemented as identified in section 7.11 of the EPP, section 4.8.2 of the EFG and/or as recommended by the Committee. Environment Canada will also be contacted for advice. The extent and quantity of acid rock will be determined through testing and the necessary mitigation will be developed. If the material cannot be avoided, its excavation and disposal are subject to a pre-approved plan by the Acid Rock Committee. The material may be disposed of either within the RoW or an approved area located off-site. Should marine environment disposal of sulfide bearing rock be required (which is very unlikely) the private developer will obtain a Disposal At Sea Permit.

3.4.1.2.3 Subbase and Base Construction

Once the subgrade has been prepared, a granular graded structural base known as the subbase and base course is prepared. The subbase gravel is placed over the subgrade and generally consists of material superior in quality to that used for the subgrade. The base course is placed over the subbase and consists of a series of layers, graded to provide structural integrity and good drainage beneath the asphalt concrete surface. The materials used to construct the subbase and base are typically obtained from borrow areas as previously described.

3.4.1.2.4 Structures (Overpasses/Underpasses)

Construction of structures (*e.g.*, overpasses, underpasses) will begin with the installation of properly designed erosion and sediment control measures followed by clearing and grubbing, excavation, and embankment fills as required. The foundations for abutments and piers will typically be cast-in-place reinforced concrete on either spread footings or piles. The prefabricated girders, either of pre-stressed concrete or steel construction, are then put into place using cranes. The deck is constructed of cast-in-place reinforced concrete, a waterproofing membrane is then applied and the surface is paved to match the design grade of the road surface at that point.

3.4.1.2.5 Work Progression

The progression of construction activities, as described in the NBDOT (2003) Standard Specifications and Section 4.16 of the EPP, will be carried out in a manner such that work in any work area proceeds continuously and diligently so as to ensure an orderly progression of work and effective protection of the environment. The Work Progression Clause (Item 946.2.1, NBDOT (2003) Standard Specifications) states that grade work must be completed within 30 days in a given work area. That work area would then be temporarily stabilized, and left alone for an extended period (up to a year) until the developer returns to pave the area, and provide final stabilization. In any given work area, the time between grubbing/cut/fill constructions to completion and stabilization of excavations must be no greater than 30 days. Exposed soils near watercourses will require immediate temporary stabilization measures as per Sections 948.1.1, 948.1.2, 948.2.1.5, and 948.2.1.9 of the NBDOT (2003) Standard Specifications, and will require contingency measures for rain events. Stabilization refers to hydroseeding and/or mulching, and includes completion of ditches and shaping of slopes as well as installation and maintenance of erosion and sediment control structures.

3.4.1.3 Watercourse Crossing Structures

There are 47 watercourse crossings for the Project limits. Most of the watercourse crossings will be accomplished using culverts, with the exception of the bridge structures to be constructed at River de Chute, Big Presque Isle Stream, and Little Presque Isle Stream. In addition, a two-lane bridge will be constructed over the Little Presque Isle Stream, as part of the new connector road between the new Hartland Interchange and existing TCH at Somerville. Excavation for foundations in a watercourse will be conducted in a manner that minimizes siltation. This will require the use of cofferdams, silt screens, special pumping procedures, special excavation equipment, watertight barges, and watertight trucks. Excavation is normally not permitted in the flowing stream. A Watercourse Alteration Permit and a *Navigable Waters Protection Act Permit* are required prior to commencement of any bridge construction activity. Bridge construction will be conducted in accordance with these permits, NBDOT (2003) Standard Specifications, Section 5.4 of the EPP, and Section 7.0 of the EFG.

The remaining 43 crossings will be constructed using culverts. They include Harper Brook, Hunters Brook, Whitemarsh Creek, Lower Guisiguit Brook, Gallop Brook, Graham Brook, Brown Brook, Bryson Brook, Demerchant Brook, Plant Brook, Ward Brook, Tibbetts Brook, and a number of unnamed streams.

Culvert installations at watercourse crossings are normally accomplished by constructing temporary stream diversions, allowing the culvert to be bedded "in the dry" and backfilled prior to conveying the stream through the culvert. All instream work will be conducted during low-flow periods (June 1 - September 30) to avoid interference with fish spawning, incubation and hatching activities, where possible. Applicable erosion and sediment control practices as outlined in the EPP (Section 4.3 to 4.7) and the EFG (Section 4.2 and 6.0) will be adhered to during this process. Culverts requiring fish passage will be designed so as not to interfere with use of the stream by fish. A Watercourse Alteration Permit will be required prior to any construction activities within 30 m of a watercourse. Where it is determined that there will be harmful alteration, disruption or destruction of fish habitat, an authorization pursuant to Section 35 (2) of the Fisheries Act would be obtained from DFO.

Ditching, side slopes, and drainage channels are designed and constructed to avoid erosion problems and ponding over and along roadways from surface water runoff. Ditches, culverts, and drainage channels are constructed where natural drainage and surface runoff flows are disrupted by the new roadway. Drainage channels are directed away from natural watercourses and into surrounding vegetation. Erosion control structures, mulching or hydroseeding, and/or the use of riprap are measures applied to ditches, side slopes, and channels in an effort to minimize or prevent siltation of watercourses or wetlands and prevent erosion.

All watercourse crossings are designed to accommodate the precipitation levels of a one in 100 year peak discharge event for the local region as defined by data from the Meteorological Service of Canada.

An active re-vegetation program will be implemented after construction using site-appropriate methods to maximize soil support. Re-vegetation of all disturbed/exposed areas will be undertaken. All ditches and side slopes will be stabilized not only by technical means, but also by applying a mixture of grass seed and mulch, as specified in Section 4.8 of the EPP and in accordance with the NBDOT (2003) Standard Specifications.

3.4.1.4 Surfacing and Finishing

Paving

Conventional asphalt concrete has been used for nearly all provincial highways in New Brunswick in the past and will be used in the construction of this proposed section of the TCH. It will also be applied to all new and modified collector and local roads of the Project. This material is made by mixing petroleum based liquid asphalt with sand and crushed stone in an asphalt plant. The hot mix is easily transported, spread and rolled to provide a smooth surface that can be used almost immediately. Note that property access roads, constructed as part of the Project, will not be paved.

Appropriate erosion control measures will be employed during paving operations to minimize runoff from the construction site, where warranted. Paving will be conducted in accordance with NBDOT (2003) Standard Specifications and Section 4.15 of the EPP.

Signage and Guiderails

Signage and guiderails will be installed once most construction activities have been completed. Signage installation involves very localized disturbances within the finished RoW, and will require small amounts of excavation and poured concrete footings for the erection of the signposts and signs. Guiderail installation involves posthole drilling, post installation and attachment of metal guiderails to the posts. Environmental protection procedures for signage and guide rail installation are included in the Section 6.1.9 of the EPP.

Painting

The painting of pavement markings (or striping) will also be performed after most construction activities have been completed. Striping a highway consists of painting yellow and white longitudinal and transverse lines and other symbols and words as required on road surfaces to ensure the travelling public receives direction and guidance. The arrangement of these markings will be in accordance with TAC's *Manual of Uniform Traffic Control Devices* (TAC 1998) and NBDOT policies. In New Brunswick, NBDOT stripes approximately 13,000 kms of road annually using 560,000 litres of paint. This program is achieved mostly with the use of two 3 ton striping vehicles and a smaller towed paint unit called the

"Road Laser". The paint applied down by these vehicles is known as "Hot Applied Alkyd Traffic Paint". As the paint is applied on the highway, a layer of spherical glass beads is sprayed on top. These beads render the paint reflective thus improving the safety of night time driving. Environmental protection procedures for painting are included in the EPP (Section 6.1.14).

Wildlife Crossings

Wildlife crossings/underpasses and fencing will be constructed in consultation with NBDNR to minimize potential environmental effects of habitat fragmentation and wildlife mortality (road kill), as well as increase safety to the travelling public. The design and construction of these structures will coincide with planned culvert/bridge crossings and will draw upon experience and observation of the effectiveness of established wildlife crossings on existing highways in New Brunswick.

3.4.1.5 Ancillary Structures and Facilities

Temporary Access Roads

The activities described above will require provision of access to and along the RoW. Existing logging roads and access roads will be used to the extent possible; however, temporary access roads may be necessary. Temporary access roads will be constructed in accordance with landowner agreements.

Borrow Areas

As previously indicated, borrow pits will be developed outside of, but in close proximity to, the RoW. Borrow material will be free of contaminants and must be approved for suitability for the Project prior to use. Borrow pits will be located away from areas suspected as having potential for acid-generating rocks or aggregate. Erosion control measures will be employed at these sites, where required, to prevent siltation of watercourses and wetlands. Section 4.9 of the EPP and the *Draft Guidelines for Pits and Quarries* (NBDELG 2000) will be followed.

Petroleum Storage Areas

Sites for machinery and fuel storage will be selected by the developer. The site will be selected in accordance with the EPP, particularly as they relate to the potential risk of accidental release of petroleum, oils and lubricants (EPP Sections 4.17, 4.19 and 8.1). During fuelling and maintenance of construction equipment, proper environmental protection control measures to prevent the release of fuels to the environment will be taken. Spills will be handled in accordance with environmental contingency plan (EPP Sections 4.19 and 8.1, and EFG Sections 5.5 and 5.7). The developer will be responsible for obtaining the appropriate permits as set out in the Petroleum Product Storage and Handling Regulations for any on-site temporary fuel storage tanks.

Materials and Equipment Transportation

Vehicles used in subgrade construction typically include excavators, bulldozers, rollers, trucks, and graders. Most of these vehicles operate on diesel fuel and require some form of daily maintenance. Truck traffic generated by the Project on the existing highway network during subgrade construction is largely dependent upon the amount of imported fill material required. It is expected that most, if not all, of the subgrade fill material will be available from the excavation operations within the RoW. Off-site truck traffic will consist primarily of hauling various materials to approved disposal sites, and/or the movement of construction equipment to and from the Project site. Therefore, trucking operations during the subgrade construction phase will mainly involve on-site transportation activities of materials for cut and fill operations.

Off-site truck traffic will be generated during the construction of the proposed TCH subbase and base layers. The volume of truck traffic will depend upon the quantities of crushed stone aggregates and other borrow materials that need to be imported to the site versus that which can be produced on-site from cut sections along the RoW. In addition, specific borrow and disposal sites will not be known until they are identified by the developers in the bidding process.

Specific information on trucking operations is unknown at this time, as the highway design profile and quantity estimates, the geotechnical investigations and the developer selection have not been completed. As previously indicated in Section 3.4.1.2, all borrow and quarry operations will be conducted at approved sites in accordance with applicable laws and regulations, and Section 4.9 of the EPP.

Vehicles used in base and pavement construction include steel drum rollers, graders, trucks, and asphalt concrete pavers. If the asphalt concrete plant is located on-site and a suitable source of aggregate used for the asphalt concrete and road base construction can be found on-site, truck traffic during this phase of construction will be limited to the delivery of prime, tack coat, asphalt cement and diesel fuel. If the asphalt concrete plant is not located on-site and/or aggregate must be obtained from off-site sources, the amount of truck traffic on the access roads will increase accordingly. On-site aggregate material resources will be identified in the geotechnical survey. The location of imported aggregates will be determined by the developers.

Highway trucking of construction equipment and off-site imported and exported materials will be routed along the existing TCH, an all-weather Provincial truck route. Use of local and collector highways for access between the existing TCH and the proposed TCH will be subject to applicable Provincial gross vehicle weight maximums and spring weight restrictions.

Materials and Equipment Storage and Handling

Where appropriate, excavated material will be stored for later use. This material will be stored along the RoW or in a borrow site in such a way as to prevent sedimentation at any adjacent watercourses or wetlands. Section 4.9 and 4.17 of the EPP, Section 4.5 of the EFG, and the *Draft Guidelines for Pits and Quarries* (NBDELG 2000) will be followed.

In agricultural areas, excavated materials will be temporarily stockpiled along the RoW in accordance with the EPP (Section 4.13), separate from any topsoil or other material to be used in RoW reclamation. This material will be managed in critical areas to prevent erosion and the transport of sediment into watercourses. Delayed timing of vegetation removal and excavation of buffer zones at watercourse crossings will limit the duration of soil exposed to erosion in these areas.

Aggregates will be stored in such a way as to prevent their erosion or loss to watercourses or wetlands. The runoff from aggregate piles will be directed to a settling basin to be constructed to EFG specifications (Section 4.3.2 of the EFG).

Disposal Areas

The most desirable use of material excavated from the RoW during construction is use within the RoW (*e.g.*, buried in the toe of the slope), assuming it conforms with technical standards. Disposal of waste materials from the construction of the proposed undertaking will be in accordance with NBDOT (2003) Standard Specifications and the EPP, the *Guidelines for the Siting and Operation of a Construction and Demolition Debris Disposal Site* (NBDELG 2002a), and any provisions included in site-specific contracts. Existing approved construction and demolition debris disposal sites may be used for disposal outside of the RoW.

Non-salvageable material from the clearing operations, such as limbs and timber, are typically chipped within the RoW and left in place except within buffer zones for watercourses and wetlands. Excavated organics, overburden and rock (where their use as fill material is impractical) must be disposed of properly. The disposal of surplus and unusable grubbed materials must follow NBDOT Specifications. Section 4.18 of the EPP indicates that waste disposal areas must be located such that they do not interfere with any stream or drainage facility (*i.e.*, >30 m away), do not contribute to erosion and/or siltation, and are left in a neat appearance.

Asphalt Plants

Asphalt plants will be required for the manufacture of hot mix asphalt for paving. Nearby off-site quarries, or rock crushing sites within the RoW, may be used as asphalt plant locations to reduce the haulage and storage of materials. Asphalt plants will be operated in accordance with applicable regulations (*i.e., Air Quality Regulation*) and appropriate mitigation will be applied (EPP, Section 4.15). The developer will be required to obtain the necessary permits for the operation of the asphalt plant, such as an Approval to Operate under the New Brunswick *Air Quality Regulation* and Petroleum Storage Approval under the *New Brunswick Petroleum Product Storage and Handling Regulation*.

3.4.1.6 Decommissioning of Temporary Facilities

Decommissioning involves the removal of temporary access roads and construction equipment and materials storage sites. The *Guidelines for the Siting and Operation of a Construction and Demolition Debris Disposal Site* (NBDELG 2002a), and the EPP, will be followed during decommissioning of all temporary facilities required for construction.

3.4.2 Operations Activities

Winter Safety

Winter highway operations activities generally involve snow removal and ice control to reduce traffic disruptions and safety hazards. Snow removal involves plowing services provided by, or contracted out and supervised by, local NBDOT Maintenance Depot employees. When snow banks build up along the highway, the snow is removed and dumped at a suitable site, not in wetlands or environmentally sensitive areas.

Road ice is controlled by the application of salt and sand. Salt is applied to roads to retain clear driving lanes within a reasonable time after a storm. Sand is applied to road surfaces to provide traction on snow-packed or icy roads. Currently the EPP (Section 6.2.1) identifies salt application protection measures. Application rates identified in the *Highway Maintenance Management System Field Manual* (NBDOT 1992a) will be used to maximize the efficiency of salting and sanding and minimize the potential environmental effects.

Environment Canada recently completed an assessment of road salt under the *Canadian Environmental Protection Act, 1999* (CEPA). Road salts that contain inorganic chloride salts are considered "toxic" as defined in Section 64 of CEPA. Recognizing that a total ban of road salt could potentially compromise human safety, the focus is on implementation measures that optimize winter road maintenance practices so as to not jeopardize road safety while minimizing the potential environmental effects (Environment Canada 2001c). Therefore, Environment Canada has categorized road salt as a Track 2 substance, requiring Life-Cycle Management.

Management instruments to reduce the potential environmental effects of road salts are being developed through a multi-stakeholder group (which involves representation from NBDOT) working in conjunction with Environment Canada. Proposed control measures will likely be presented in July of 2004. In accordance with Environment Canada's policy on road salt, all road agencies (*e.g.*, NBDOT) must develop a Salt Management Plan. NBDOT is committed to developing "best salt management" practices in a continued effort to minimize and manage the potential environmental effects of road salts on the environment.

3.4.3 Maintenance Activities

Proposed TCH Maintenance

Highway maintenance activities retain roadways at a reasonable level of service, comfort and safety and typically take place during the summer months. The rate of degradation of the pavement surface will be determined by the volume of traffic, proportion of heavy trucks, certain vehicle characteristics (*i.e.*, radial tires), structure and quality of pavement. The repair of the asphalt concrete surface may involve excavation or removal of the existing pavement and subgrade, patching and levelling, grading and gravelling, surface treatment and asphalt concrete overlays. Disruption to the public from these repairs would be temporary and infrequent in nature.

Periodic maintenance of roadway drainage systems may be required. This may involve the replacement or repair of culverts and re-establishment of the drainage ditches.

Other highway maintenance activities include shoulder grading, localized pavement repair, and line repainting. Again, disruption to the public from these repairs will be temporary and infrequent in nature.

The gravel surfaced property access roads will be graded during the summer season to retain cresting and to level potholes, ruts and bumps. Periodic application of liquid or flake calcium chloride may be required as a dust control measure.

Section 6 of the EPP contains the appropriate mitigation to be employed during these activities.

Maintenance of Vegetation and Wildlife Crossings

Regrowth of vegetation within the RoW may interfere with the lines of sight required for safe use of the highway. Clearing along the RoW is part of NBDOT's regular maintenance to maintain sight lines and may involve both manual and mechanized cutting. NBDOT does not use herbicide application for the control of vegetation. Maintenance of wildlife crossings and fencing will be conducted as required.

3.5 Accidents, Malfunctions, and Unplanned Events

All necessary precaution will be taken to prevent the occurrence of malfunctions and accidental events that may occur throughout all phases of the Project and to minimize any environmental effects should they occur. Accidental events with the greatest potential for environmental effects include:

- spills of hydrocarbons or other hazardous materials;
- failure of erosion and sediment control measure;
- bridge or culvert washout;
- fires;
- vehicular collisions;
- wildlife encounter; and
- disturbance of archaeological or heritage resource.

It is difficult to predict the precise nature and severity of these events. However, the probability of serious accidental events or those causing significant adverse environmental effects is low, particularly when construction and operation procedures incorporate contingency and emergency response planning. Construction and operation procedures will be conducted in accordance with the EPP, the EFG, and NBDOT (2003) Standard Specifications as well as all relevant regulations, guidelines and accepted industry procedure.

3.5.1 Hazardous Material Spill

Spills of petroleum, oils, or lubricants (POLs) may occur during construction during refuelling of machinery or through breaks in hydraulic lines. These spills are usually highly localized and easily cleaned up by onsite crews using standard equipment. In the unlikely event of a large spill, soil, groundwater, and surface water contamination may occur, thereby potentially adversely affecting the quality of groundwater, fish and fish habitat, and wetland habitat, and resulting in the ingestion/uptake of contaminants by wildlife. Depending on the nature of the spill, it could also potentially affect residential, commercial, agricultural, and other land uses.

The EPP and EFG contain best management procedures to minimize the likelihood of a spill. POLs and other hazardous materials will be handled in accordance with applicable regulations (*i.e.,* the *Petroleum Product Storage and Handling Regulation*) and procedures as noted in the EPP (Section 4.19) and EFG (Section 5.0). Construction equipment will be frequently inspected to detect possible fuel and hydraulic system leaks. Any leaks will be repaired immediately. Refuelling and equipment maintenance will be conducted at designated sites, away from residential and known cultural or heritage properties, and not within 30 m of a wetland or watercourse. A Spill Contingency Plan is also included in the EPP (Section 8.1) and the EFG (Section 5.7).

In the unlikely event of larger contaminant spills (*i.e.*, tanker accidents during operation), local and provincial emergency response procedures will be invoked to minimize potential environmental effects. Emergency response and contingency planning are accepted and effective means to limit the severity of environmental effects. These plans and procedures will be implemented through the EPP and supported through training programs.

3.5.2 Erosion and Sediment Control Failure

A potential exists for failure of erosion and sediment control structures due to precipitation events. Such a failure could result in the release of a large quantity of sediment-laden runoff to receiving watercourses with potential adverse effects on fish and fish habitat. Erosion and sediment control measures will be implemented according to the EPP (Section 4.5), the EFG (Section 4.2 and 4.3) and the NBDOT (2003) Standard Specifications and will be monitored by an environmental inspector, particularly after a heavy precipitation event or snow melt that results in the visible overland flow of water. Remedial action will be taken as necessary.

3.5.3 Bridge or Culvert Washout

A potential exists for a bridge or culvert structure to washout during a precipitation or storm event that substantially exceeds the design criteria for these structures, or as a result of culvert blockage by ice jams or debris. Current design standards are for 100 year peak discharge events. Mitigation would include closing down large structures to traffic during events of this magnitude and periodic inspection and maintenance of structures (*e.g.*, clearing debris from culverts). Maintenance of culverts will be done as per Section 6.1.5 of the EPP and maintenance of bridges will be done as per Section 6.3 of the EPP. Remedial action will be taken as necessary.

3.5.4 Fire

Fires may result in habitat loss, sensory disturbance, direct mortality to wildlife, loss or damage of property, and loss or damage to archaeological and heritage resources. Material management (*i.e., f*uel and other hazardous materials) and operational procedures (*i.e.,* storage, handling and transfer) will reduce the potential for and extent of accidental fires related to the Project. In the unlikely event of a fire, local emergency response and fire fighting capability will be able to reduce the severity and extent of damage. A Fire Contingency Plan and fire prevention procedures are included in the EPP (section 8.4 and 7.4 respectively) to reduce the potential for fires.

3.5.5 Vehicular Collision

While traffic collisions are inevitable, the proposed TCH is expected to have a significantly improved collision rate compared with the existing TCH. Since this will be a new controlled access four-lane divided highway with a wide median, collision rates are expected to be considerably lower than those on the existing two-lane highway without access control. Diversion of through traffic, as well as part of the local traffic, to the proposed TCH, will improve the ease and safety of access for the remaining local traffic using the numerous road and driveway entrances within the zone of influence of the Project. Public concerns for safety will be further reduced since most of the heavy trucks will divert to the proposed TCH. Vehicular collision with wildlife is also possible and is included in this accident type.

3.5.6 Wildlife Encounter

There is the potential for workers to come into contact with wildlife during the construction and maintenance phases of the Project. This could have adverse environmental effects on both worker (*e.g.*, disruption of work activity, or bodily harm) and wildlife (*e.g.*, disturbance of critical life cycles). In case of persistent wildlife encounters, NBDOT personnel shall notify NBDNR of the situation (Section 8.2, EPP).

3.5.7 Disturbance of Archaeological or Heritage Resources

There is the potential for the unplanned disturbance or discovery of archaeological or heritage artifacts. A significant archaeological resource is defined as a site that contains features (non-removable indications of past human use and activity, such as a fire hearth, a living floor, or a burial site) in addition to artifacts. The likelihood of an accidental discovery of a significant site containing features is considered low due to the intensity of the subsurface testing at the major watercourse crossings and other potentially high risk areas. While it is possible that an individual artifact was missed during this survey, it is very unlikely that any archaeological features were not detected. The disturbance of an individual artifact is not considered significant. In the event of an unplanned encounter, all personnel will act in accordance with Section 8.3 of the EPP.

3.6 Environmental Management

3.6.1 Design and Construction

Environmental protection measures have been developed by NBDOT as a result of legislative requirements and a desire to improve highway design and construction methods and procedures, and to minimize the interaction between the NBDOT activities and the environment.

The original EPP was prepared by NBDOT after reviewing the EPP produced by NB Power (1991). Information included in the original EPP was compiled by various branches of NBDOT. The EPP is now in its third revision (NBDOT 1998a). The EFG is currently in its second revision (Washburn and Gillis 1998). These current editions of the EPP and EFG incorporate revisions and contributions provided by the following regulatory agencies:

- Environment Canada;
- Department of Fisheries and Oceans;
- Department of Fisheries and Aquaculture;
- New Brunswick Department of the Environment (now NBDELG); and
- New Brunswick Department of Natural Resources and Energy (now NBDNR).

The current EPP and EFG are endorsed by these agencies as the mitigation contained therein is intended to ensure that the potential environmental effects of NBDOT projects are managed and minimized so that significant environmental effects do not occur.

Environmentally responsible design elements of the proposed Project, such as culvert design and installation techniques, slope stability, and wildlife control will be made during the design stage following the guidance of this environmental assessment and implemented during construction. Technically and economically feasible methods for achieving standards and meeting regulatory requirements will be implemented for each construction activity.

NBDOT highways are constructed under contract through a public tendering process. The contract documents contain a description of the work, the standards under which it is to be carried out, and the results expected to be attained. Construction specifications not only provide design details, but also refer to management practices and contain environmental protection measures, as outlined in the EPP. Site specific protection measures are detailed in the Plans and Particular Specifications of the contract. The developers who are awarded NBDOT construction contracts will be qualified to do the work and will receive environmental awareness training. Construction developers will be responsible for following the contract specifications and complying with all requirements of the EPP, the EFG, and all applicable standards, guidelines and regulations during all phases of construction.

Construction will follow the EFG and the EPP, as well as the environmental section within the NBDOT (2003) Standard Specifications, which will provide mitigation on a number of design and construction related environmental concerns normally associated with roads and highways in New Brunswick. Other applicable standards and guidelines to be employed during construction include:

- *Geometric Design Guide for Canadian Roads*, Transportation Association of Canada (TAC) 1999;

- *Guidelines for the Protection of Fish and Fish Habitat - The Placement and Design of Large Culverts, Fisheries and Oceans Canada, Maritimes Region* (DFO 1999a)

- Schedule A - Provincial Performance Standards for Development, Operation & Closure of Pits and Quarries in New Brunswick;

- *Draft Guidelines for Pits and Quarries*, NBDELG (2000); and

- *Watercourse Alteration Technical Guidelines*, NBDELG (2002b).

To ensure compliance with environmental standards and regulations, regular inspections and monitoring will be performed through consultation with the appropriate regulatory authority on the proper environmental practices.

Environmental protection control measures employed during construction will be inspected regularly. NBDOT will provide inspectors, or employ an independent agent for inspection and supervision services. Improperly installed or damaged environmental controls will be corrected immediately upon discovery. Inspections of the construction site to ensure compliance with the EPP will be conducted before and after major rain storm events.

Machinery will be inspected regularly to ensure they are properly maintained and minimize petroleum, oil, or lubricant (POL) leaks and drips. Employees and subcontractors will be required to implement appropriate control measures to minimize POL leaks during construction activities.

Emergency situations involving the accidental release of hazardous materials to the environment, accidental wildlife encounters, discovery of potentially sulfide bearing rocks or aggregate, discovery of historic resources, discovery of contamination, and fires will follow the contingency and emergency response procedures provided in Section 8.0 of the EPP.

3.6.2 Operations and Maintenance

Environmental protection procedures and measures will be observed and employed throughout the life of the proposed TCH, as outlined in Section 6.0 of the EPP. NBDOT will be responsible for installation, maintenance, and inspection and monitoring of environmental protection control measures during the operation and maintenance phase.

3.7 Project Schedule

The proposed four year construction schedule for the proposed TCH from Perth-Andover to Woodstock is of relatively short duration in comparison to most NBDOT highway development projects, and is more comparable to the schedule of the Route 2 - Fredericton to Moncton Highway Project. Some of the initial clearing and grubbing work could begin in the fall of 2004, but no other construction work is planned to commence prior to the 2005 construction season.

The project is tentatively planned to proceed over four years as prescribed in Table 3.7.1.

Table 3.7.1 Proposed Project Schedule

Activity	Schedule
Engineering Surveys	2004
Clearing and Grubbing	2004-2005
Grading	2005-2006
Gravel Subbase	2006-2007
Bridge and Grade Separation Structures	2005-2007
Paving and Shoulders	2007

The proposed construction schedule will afford very few phasing opportunities to open sections prior to completion of the entire Project. Most activities/phases of construction will be conducted simultaneously at various locations within the Project limits.

Earlier plans by NBDOT had considered constructing the interchange and the connector road to Hartland and phasing in the 13 km section from Woodstock to Hartland prior to completion of the Perth-Andover to Hartland segment. However, there is no commitment to this phased-in approach at this time. The Lockhart Mill Road interchange at Jacksonville (near Woodstock) is presently under construction, and will be opened for the existing two lanes in 2004. Its construction to a twinned four-lane configuration will coincide with the rest of Project in 2007.

A benefit of this accelerated schedule will be that it will place a limit on the length of time local area residents will be exposed to any potential environmental effects that may arise during the construction phase, such as increased truck traffic, dust, and noise from blasting activities. It will also provide users the full travel savings and safety benefits at an earlier date.

4.0 ISSUES SCOPING AND ENVIRONMENTAL ASSESSMENT METHODOLOGY

4.1 Environmental Assessment Methodology

The methodological approach employed in this EA provides an evaluation of Project-related environmental effects following the methodological framework described by Barnes *et al.* (2000). The approach is designed to address the scope of the Project and the factors to be considered as outlined in Sections 15 and 16 of *CEAA* and as determined by the responsible authorities in their scope determination thereunder (Guidelines, Appendix A).

The approach follows six basic steps to assess environmental effects. These are:

1. Identify the issues through scoping and select Valued Environmental Components ("VECs") on which to focus the environmental assessment;

2. Establish boundaries for the environmental assessment and residual environmental effects rating criteria ("thresholds of significance") for determining the significance of environmental effects for each VEC;

3. Identify environmental effects of Project activities, by Project phase and also the changes to the Project caused by the environment;

4. Evaluate environmental effects using the significance criteria identified in Canadian Environmental Assessment Agency (the "Agency") guidance documentation (*CEAA* 1994) in light of proposed mitigation;

5. Analyze the environmental effects and predict their significance by applying the residual environmental effects rating criteria; and

6. Outline a monitoring and follow-up program, as required.

The following describes the above noted steps that are followed for this EA.

4.1.1 Step 1—Scoping of Issues and Selection of Valued Environmental Components

Scoping involves consultation with all stakeholders, including the general public, responsible authorities under *CEAA*, regulatory authorities and the Aboriginal community to identify the issues that need to be addressed in the environmental assessment. It also involves the application of professional judgement by the authors of the environmental assessment report, including the consideration of baseline studies undertaken for the Project.

A key objective during the issues scoping process is to identify the best way to organize or "package" issues into VECs that make sense for the focused analysis of potential environmental effects. Importantly, scoping is also a useful tool for the responsible authorities to exercise their discretion to determine the scope of the environmental assessment pursuant to Sections 15 and 16 of *CEAA*.

For the biological and physical environment, VECs may represent "key" or "indicator" species, communities, species groups, or ecosystems, as well as, "pathways" (*e.g.*, air, water), which act as media for the transfer of environmental effects. VECs may also reflect issues that are socially, culturally or economically of value. The ultimate decision on what should be the VEC or VECs must reflect an informed understanding of the potential Project-environment interactions, the importance of components to ecological integrity, their sensitivity to the planned perturbations, and the values of society. Regardless, practitioners must use their good professional judgement in consideration of all or many of these factors, including the opinions expressed to them by the various participants during the scoping process.

4.1.2 Step 2—Establish Boundaries and Residual Environmental Effects Rating Criteria

4.1.2.1 Boundaries

An important aspect of the environmental assessment process is the determination of boundaries because they focus the scope of work, allowing for a meaningful analysis of potential environmental effects associated with a project. The setting of boundaries also aids in determining the most effective use of available study resources. There are two distinct types:

- temporal and spatial boundaries of the project and the VEC; and
- administrative and technical boundaries of the assessment.

The first type of boundary is defined by the temporal and spatial characteristics of the project and various VECs. For example, ecological, socio-cultural, economic, health, heritage, traditional land use, and project boundaries are of this type. These boundaries encompass those periods and areas during, and within which, the VECs are likely to interact with, or be influenced by, the project. These boundaries may extend well beyond physical project limits, even the limits of potential direct interactions between the project and the VECs, particularly in the case of migratory species, or regional or national socio-cultural and economic systems.

The second type of boundary addresses the limitations on the scope of, or approach to, work during the assessment of environmental effects. These boundaries are referred to as administrative boundaries and technical boundaries to the assessment, and are imposed by such factors as finite resources of data, time, cost, and labour, as well as technical, political, or administrative reasons or jurisdictions.

Administrative boundaries refer to the temporal and spatial dimensions imposed on the environmental assessment for political, socio-cultural, and economic reasons. Technical boundaries represent the technical limitations on the ability to evaluate or predict potential environmental effects of the project. For example, it may be difficult to measure or predict the number of individuals of any particular species that might be affected by a project. Where such technical boundaries exist, it is important that they be acknowledged, and alternative strategies used to characterize the VEC and/or environmental effects be described.

4.1.2.2 Residual Environmental Effects Rating Criteria

Fundamental to the approach described by Barnes *et al.* (2000) is the determination of significance. Under *CEAA*, the determination of significance is central to decision-making. Rating criteria are specifically defined for each VEC to provide the threshold for determining the significance of residual environmental effects. These "residual environmental effects rating criteria" or "significance thresholds" are established based on information obtained during issues scoping, available information on the status and characteristics of the VEC, and professional judgement.

The evaluation criteria recommended by the Agency (*CEAA* 1994) to assist in the determination of significance are used to frame specific definitions for the determination of significance, as appropriate. These significance thresholds determine at which point the VEC would experience environmental effects of sufficient geographic extent, magnitude, duration, frequency and/or reversibility to affect its integrity (each of these are described in more detail in Step 5). These Agency evaluation criteria help to frame significance thresholds that reflect the sensitivity of the VEC to perturbation and its ability to recover.

In developing residual environmental effects rating criteria, one first needs to define which population, stock, community, or ecosystem is represented by the VEC, or in the case of abiotic biophysical components like air quality, which airshed(s) are affected. For socio-cultural and economic VECs, one must determine the people, groups of people or communities that are affected.

The challenge in determining whether or not environmental effects are significant is that some considerable degree of professional judgement is normally needed to evaluate whether the predicted environmental effects, (*e.g.*, loss of habitat, mortality, change in land use) will exceed the designated threshold of significance. In most cases the significance is obvious when compared to the criteria in light of the various data and information contained in the analysis. However, in some instances, lack of previous experience, insufficient data, or the use of predictive tools may cast sufficient uncertainty that it may be difficult to apply the criteria with a high degree of certainty. This is a technical limitation or boundary of the environmental assessment. A precautionary approach to mitigation or the crafting of significance criteria that incorporate some appropriate margin of safety to compensate for the level of uncertainty can assist in dealing with this potential methodological challenge should it arise.

4.1.3 Step 3 - Identification of Project Environmental Effects

This step involves the identification of VEC-specific Project related environmental effects (*i.e.*, Project-VEC interactions) and a description of issues and concerns regarding key interactions. Table 4.1.1 presents a breakdown of the Project activities required to complete each of the Project phases as described in Section 3.0.

Table 4.1.1 Description of Project Activities and Physical Works

Project Phase	
Category	**Project Activities and Physical Works**
Construction	
Site Preparation	Includes all Project-related activities associated with preparing the proposed TCH* for roadbed preparation. Project-related activities include: • surveying; • clearing; • grubbing; and • modification, relocation, or removal of obstructions.
Roadbed Preparation	Includes all Project-related activities associated with preparation of the proposed TCH roadbed to the stage where it is ready for paving. Project-related activities include: • blasting; • excavation; • placement of fill; and • grading.
Watercourse Crossing Structures	Includes all Project-related activities that are required wherever the proposed TCH crosses a watercourse. Watercourse crossing structures include a variety of culvert types and bridge designs. Project-related activities include: • site preparation; • stream diversion (as applicable); • installation; and • site restoration.
Surfacing and Finishing	Includes all Project-related activities that are required to make the proposed TCH roadbed suitable for public use. Project-related activities include: • paving; line painting; installing guiderails; installing signage; and installing wildlife fencing, crossings, and other deterrents (e.g., vegetation).

Table 4.1.1 Description of Project Activities and Physical Works

Category	Project Activities and Physical Works
Project Phase	
Ancillary Structures and Facilities	Includes all Project-related activities that are required for the construction, operation, and removal of temporary ancillary structures and facilities. Removal may require site restoration. Temporary ancillary structures and facilities include: • temporary site access roads; • borrow areas; • petroleum storage areas; • equipment receiving areas; • handling and storage areas; • disposal sites; and • asphalt plants.
Operation	
Winter Safety	Includes all Project-related activities that are required for the safe operation of the proposed TCH during adverse winter weather conditions, including: • salting; • sanding; and • plowing.
Proposed TCH Presence	Includes all Project-related aspects that will be present for the life of the Project, including: • presence of the paved roadway within RoW; • presence of vehicular traffic; • presence of watercourse crossings and bridges; • presence of ancillary structures and facilities; and • presence of wildlife fencing and crossings.
Maintenance	
Proposed TCH Maintenance	Includes all Project-related activities that are required to maintain the following: • pavement; • lines; • signage, guiderails and reflectors; and • watercourse crossing structures.
Vegetation and Wildlife Maintenance	Includes all Project-related activities that are required to maintain the following: • vegetation; and • wildlife fencing and crossings.

* proposed TCH refers to all permanent roadbed and structural features including the four-lane highway, interchanges, existing road improvements, and remnant property access roads.

In order to standardize this step and in keeping with standard practice, a project activity-environmental effects interaction matrix is used for each VEC (Table 4.1.2). It describes the scope of the environmental assessment for each VEC and is limited to only those interactions identified through scoping. Although not identified in the table, at this step, the changes of the Project caused by the environment (*e.g.*, extreme natural events such as floods or earthquakes) is assessed.

Table 4.1.2 Project Activity – Environmental Effects Interaction Matrix for [Name of Environmental Component]

Potential Interactions Between Project Activities and Environmental Effects Valued Environmental Component: NAME OF ENVIRONMENTAL COMPONENT			
Project Activities and Physical Works †	**Potential Environmental Effects**		
	Effect 1	**Effect 2**	**Effect 3**
Construction			
Site Preparation			
Roadbed Preparation			
Watercourse Crossing Structures			
Surfacing and Finishing			
Ancillary Structures and Facilities Construction			
Operation			
Winter Safety			
Proposed TCH Presence			
Maintenance			
Proposed TCH Maintenance			
Vegetation and Wildlife Management			
Accidents, Malfunctions and Unplanned Events*			
Accident #1			
Accident #2			

† Table 4.1.1 for list of specific activities and works)
* Only those accidents that are relevant to the VEC are included. Section 3.5 provides a list and description of possible accidents, malfunctions, or unplanned events.

4.1.4 Step 4 – Evaluation of Environmental Effects

The next step in the assessment process consists of the evaluation of potential residual environmental effects of the Project, by Project phase, in light of proposed specific mitigation and the evaluation criteria for determining significance described by the Agency (*CEAA* 1994). The purpose of this step is to evaluate the interactions between project activities and the VECs and to determine the nature and extent of residual environmental effects, *i.e.*, those environmental effects that may persist after all mitigation strategies have been implemented. As most projects involve at least some kind of environmental effect, it has become practice to evaluate the significance of those. The significance of environmental effects is determined in Step 6, on the basis of the evaluation conducted in Steps 4 and 5.

The evaluation of environmental effects takes into consideration:

- the potential interaction between project activities, for each of the project phases, and their environmental effects (as described in Step 4);
- the mitigation strategies applicable to each of the interactions; and

- the Agency's evaluation criteria for determining significance (*CEAA* 1994) and any other evaluation criteria established by the study team to further characterize the nature and extent of the environmental effects, where required.

An environmental effects assessment matrix template is used to summarize the analysis of environmental effects by project phase, including malfunctions, accidents and unplanned events (Table 4.1.3). This allows for a comprehensive analysis of all project-VEC interactions in a matrix format. Supporting discussion in the accompanying text highlights particularly important relationships, data, or assessment analysis, but does not necessarily address all items noted in the table.

Table 4.1.3 Environmental Effects Assessment Matrix for [Name of Environmental Component]

Environmental Effects Assessment Matrix **Valued Environmental Component: NAME OF ENVIRONMENTAL COMPONENT**							
Project Activity (See Table 4.1.1 for list of specific activities and works)	**Potential Environmental Effects** **(A = adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**
Construction							
Site Preparation							
Roadbed Preparation							
Surfacing and Finishing							
Watercourse Crossing Structures							
Ancillary Structures and Facilities Construction							
Operation							
Winter Safety							
Proposed TCH Presence							
Maintenance							
Proposed TCH Maintenance							
Vegetation and Wildlife Management							
Accidents, Malfunctions and Unplanned Events							
Accident #1							
Accident #2							

Table 4.1.3 Environmental Effects Assessment Matrix for [Name of Environmental Component]

Environmental Effects Assessment Matrix Valued Environmental Component: NAME OF ENVIRONMENTAL COMPONENT							
Project Activity (See Table 4.1.1 for list of specific activities and works)	**Potential Environmental Effects** **(A = adverse; P = Positive)**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological/Socio-Cultural and Economic Context**

Key:

Magnitude*:
1 = Low: *e.g.,* employment and business opportunities are affected for eighteen months.
2 = Medium: *e.g.,* employment and business opportunities affected for more than eighteen months but less than the life of the Project.
3 = High: *e.g.,* employment and business opportunities affected for longer than the life of the Project or irreversibly.

Geographic Extent:
1 = <1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101 - 1,000 km^2
5 = 1,001 - 10,000 km^2
6 = >10,000 km^2

Duration:
1 = <1 month
2 = 1 - 12 months
3 = 13 - 36 months
4 = 37 - 72 months
5 = >72 months

Frequency:
1 = <11 events/year
2 = 11 - 50 events/year
3 = 51 - 100 events/year
4 = 101 - 200 events/year
5 = >200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity.
2 = Evidence of adverse environmental effects.

N/A = Not Applicable
(A) = adverse
(P) = positive

*these magnitudes definitions are typical for socio-economic VECs.

4.1.4.1 Classifying Potential Environmental Effects

The concept of classifying environmental effects simply means determining whether they are adverse or positive. This is indicated in Table 4.1.3 by the simple use of a bracketed ("A") or ("P"). The following includes some of the key factors that can be considered for determining adverse environmental effects, as per the Agency guidelines (*CEAA* 1994):

- Negative environmental effects on the health of biota;
- Loss of rare or endangered species;
- Reductions in biological diversity;
- Loss or avoidance of critical/productive habitat;
- Fragmentation of habitat or interruption of movement corridors and migration routes;
- Transformation of natural landscapes;
- Discharge of persistent and/or toxic chemicals;
- Toxicity effects on human health;
- Loss of, or detrimental change in, current use of lands and resources for traditional purposes;
- Foreclosure of future resource use or production; and
- Negative effects on human health or well being.

4.1.4.2 Mitigation

Mitigation includes Project design, environmental protection strategies, and mitigation specific to the minimization or control of potential adverse environmental effects on a particular VEC. As required by *CEAA*, these measures must be technically and economically feasible. In the case of beneficial environmental effects, enhancement opportunities (*e.g.*, maximize opportunities for local suppliers and developers) are considered. The environmental effects analysis will be undertaken in consideration of the proposed mitigation and environmental effects predictions. Environmental effects remaining after mitigation will be determined to be residual environmental effects. Current NBDOT environmental management practices will be factored into the overall mitigation strategies that will be specifically included for the proposed Project. Table 4.1.3 summarizes specific mitigation for each environmental effect.

4.1.4.3 Application of Evaluation Criteria for Assessing Environmental Effects

Several criteria are taken into account when evaluating the nature and extent of environmental effects. These criteria include, as stated previously (*CEAA* 1994):

- magnitude;
- geographic extent;
- duration and frequency;
- reversibility; and
- ecological, socio-cultural, and economic context.

Each criterion has a numeric descriptor in the key of the environmental effects assessment matrix (Table 4.1.3) to simplify the presentation of results of the environmental assessment and reflect different levels at which the criterion applies. The key is modified as appropriate for each VEC.

4.1.5 Step 5 – Analysis and Prediction of the Significance of Environmental Effects

The analysis and prediction of the significance of environmental effects encompasses the following:

- determination of the significance of residual environmental effects for each phase of the project and for the project overall; and for any predicted significant environmental effects;
- establishment of the level of confidence for predictions; and
- determination of scientific certainty and probability of occurrence of the predicted residual environmental effects.

Upon completion of the evaluation of environmental effects in Step 5, the residual environmental effects are assigned an overall rating of significance for each of the project phases (*e.g.*, construction, operation, decommissioning, and malfunctions, accidents, and unplanned events) and for the project overall.

These are presented in the residual environmental effects summary template (Table 4.1.4). This table provides a phase-by-phase and a Project overall residual environmental effects rating. Where significant adverse or positive residual environmental effects are predicted, a level of confidence and likelihood of occurrence rating are also given to each prediction.

Table 4.1.4 Residual Environmental Effects Summary Matrix for [Name of Environmental Component]

Residual Environmental Effects Summary Matrix
Valued Environmental Component: NAME OF ENVIRONMENTAL COMPONENT

Phase	Residual Environmental Effects Rating	Level of Confidence	Likelihood	
			Probability of Occurrence	Scientific Certainty
Construction				
Operation				
Maintenance				
Accidents, Malfunctions and Unplanned Events				
Project Overall				

Key
Residual Environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Level of Confidence
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgement
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgement
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence
N/A = Not Applicable
*As determined in consideration of established residual environmental effects rating criteria.

4.1.5.1 Significance Rating

Taking into consideration the analyses conducted in Steps 4 and 5, a phase-by-phase and an overall rating of significant or not significant is assigned. A rating of positive may also be applied where the environmental effects are found to be positive rather than adverse. Specific thresholds for determining significance are developed for a VEC to reflect the distinction between those environmental effects that should or should not be collectively considered significant (Step 2).

The rating of significance is determined by the aggregate consideration of project-related environmental effects against the thresholds that have been established for the specific VEC, and within the defined environmental assessment boundaries established for that VEC. Significant environmental effects are those which are considered to be of sufficient magnitude, duration, frequency, geographic extent, and/or reversibility to cause a change in the VEC that will alter its status or integrity beyond an acceptable level.

Establishment of the criteria is based on professional judgement, but is transparent and in consideration of public, regulatory and Aboriginal consultation. The capacity of renewable resources(*i.e.*, those that are likely to be affected by the Project) to meet the needs of the present and those of the future is considered during the determination of significance.

4.1.6 Step 6 – Monitoring and Follow-up

As part of the environmental effects analysis, appropriate monitoring and follow-up are described. In developing a follow-up program, the results of Steps 1 through 6 are helpful in focusing on important interactions, where there is a high level of uncertainty about environmental effects predictions, where significant environmental effects are predicted, or in areas of particular sensitivity.

4.1.6.1 Changes to the Project that may be caused by the Environment

In addition to the seven-step process for evaluating the environmental effects of the Project it is also necessary to consider those changes to the Project that may arise as a result of the environment. For example, natural phenomena like severe weather, forest fires, floods and earthquakes can result in environmental effects as defined in *CEAA*. These effects of the environment on the Project are addressed in a separate section at the end of the environmental effects analysis.

4.2 Issues Scoping and Selection of Valued Environmental Components

The issues scoping process began with the review of the Environmental Impact Assessment Registration review by the Province. The Project was registered by NBDOT in February 2002. NBDELG responded to the registration with a list of questions/concerns and request for additional information from the EIA Technical Review Committee (TRC), requesting that they be addressed prior to issuing a Determination on the Project. In an effort to respond to the TRC's questions/concerns and requests in a timely manner and in advance of the CSR, NBDOT commissioned a number of consultants to conduct and report on the environmental/baseline conditions within the zone of influence of the Project. Dillon Consulting Limited conducted field studies and reported on the Woodstock to Florenceville section (Dillon 2003), ACER Environmental Services Ltd. on the Florenceville to River de Chute (Route 560) section (ACER 2003), and Jacques Whitford Environment Limited on the River de Chute (Route 560) to Perth-Andover section (JWEL 2003). The reports were submitted to the TRC in May 2003.

Consultation with regulatory agencies, other stakeholders, and the public, in relation to the proposed Project has been ongoing for a number of years. This consultation and subsequent negotiations and compensation has contributed substantially to corridor and route selection and adjustments and ultimately to selection of the proposed alignment. In addition, these consultations were considered during the development of the Guidelines (Appendix A), and during the subsequent selection of VECs (Section 4.2).

4.2.1 Consultation

Consultation is the process by which interested parties are provided opportunity to contribute to the scoping of the project and the assessment as per Section 16 (1)(C) of *CEAA*, and/or to contribute local knowledge or expert advice useful for conducting the environmental assessment. This process includes consultation with members of the public, stakeholders, Aboriginal persons, and regulatory agencies and experts.

4.2.1.1 Consultation with the Public

Consultation with the public regarding the proposed Project has been ongoing for a number of years. Members of the general public comprised mainly of those affected or likely to be affected by the proposed Project, as well as the media, have participated in meetings hosted by NBDOT since 1998. During the Public Information Sessions, attendees were greeted and invited to view the displays of the proposed alignment and speak with NBDOT personnel on-hand.

The NBDOT distributed information bulletins to landowners directly affected by the proposed Project to alert them of the upcoming public information sessions. Announcements of the sessions were also made on radio and television, and published in local newspapers. Posters announcing the sessions were also erected in various businesses and public places within the nearby communities. Regulatory agencies and other stakeholders were also advised of the sessions.

NBDOT kept a record of those who attended the various Information Sessions. Issues, questions and concerns raised were addressed by NBDOT staff and tracked as they developed during the public consultation process. Most of the questions and issues brought forth by the attending public were answered to the satisfaction of the attendees.

Members of the public have also contacted the NBDOT on a number of separate occasions, either by mail, fax, or phone, with additional questions, comments, and concerns related to the Project.

Over the course of the public consultation process a number of common issues, questions and concerns were raised regarding private water supplies, increased noise levels, loss of quality of life, property access, access roads, loss of livelihood due to property severance and loss of revenue due to by-pass of businesses.

A general summary table presenting the highlights of the public consultation is presented at the end of Section 4.2.1. A brief summary of the key issues raised during the public consultation process is presented thereafter.

4.2.1.1.1 Public Open Houses

A number of public information sessions have been held by the NBDOT to allow the general public to view the proposed alignment plans and to allow the public to voice any issues that they had concerning the proposed alignment. This information was used in the determination of the final alignment, and is presented in Section 2.2.

In addition to issues regarding the alignment of the proposed TCH, a variety of other issues were raised during public consultation that were determined to be relevant to the environmental assessment. These are described in the following sections.

Public Open Houses - June 1998

The first sessions were held over four consecutive nights: at Woodstock on June 22, 1998, Hartland on June 23, 1998, Florenceville on June 24, 1998, and Perth-Andover on June 25, 1998. The TCH alignment was presented. Landowners whose land would be directly affected by the proposed alignment were advised of the upcoming meetings. Overall the comments at the information sessions were positive, especially from landowners along the existing TCH and by those who agreed with the need for a four-lane highway to improve highway safety and reduce travel time. Major non-alignment related issues included: increased noise; access to severed property; environmental effects on water supply; loss of income due to businesses being by-passed; loss of agricultural/farmland and woodlots; and environmental effects on watercourses and wildlife. Also raised was the need for an interchange between Perth-Andover and Florenceville.

Public Open Houses – March and April 1999

Changes were made to the initial alignment due to comments received during the June 1998 meetings, and follow-up public information sessions were held at the Carleton Civic Centre in Woodstock on March 18, 1999 and at the Florenceville Middle School on April 13, 1999 to present these changes. Approximately 200 people attended each of these sessions. Reaction was mixed with many in favour of the changes to the alignment.

The issues raised at these meetings were predominantly related to effects on property caused by the proposed TCH. There remained a number of people that wanted an interchange between Perth-Andover and Florenceville.

Public Open Houses – June 2003

The third series of public information sessions were held June 24th through 26th, 2003 to present the latest modifications to the alignment due to recommendations made by the public and due to the identification of rare plants in the River de Chute area. Only minor changes and adjustments were made to the alignment.

A number of non-alignment related issues were raised again during the 1998 public open houses. Issues raised during the open house and on exit questionnaire forms included water supplies (both groundwater and spring fed), highway drainage, access to remnant portions of divided properties, loss of wildlife (particularly moose) habitat, possible destruction of watercourses, decrease of property value, noise, and safety.

4.2.1.1.2 Communication with Affected Landowners

NBDOT has advised landowners that would be directly affected by the proposed Project. Alignment related issues are discussed in Section 2.2, and the compensation measures for relocation are presented in Section 5.8.

4.2.1.2 Consultation with Aboriginal Persons

Consultation with First Nation is required to assess any potential environmental effects of the Project on current use of land and resources for traditional purposes by Aboriginal Persons. There are six First Nations communities in the Saint John River Valley. These communities are: Madawaska, Tobique, Woodstock, Kingsclear, Oromocto, and St. Mary's First Nations. All of these communities needed to be included, or given opportunity to participate in the consultation process.

A Traditional Ecological Knowledge (TEK) study funded by NBDOT was undertaken by the Tobique Economic Development Corporation (TEDCO) on behalf of the Chiefs of the six Maliseet First Nations communities. .. The report resulting from this study, while completed, has not been made available to NBDOT to date. Representatives of TEDCO (C. Cameron, pers. comm.) have provided a brief summary of issues raised in this study. The TEK study involved the soliciting of relevant information from elders, traditionalists, and resource users (*e.g.*, hunter, fishers, gatherers) within each community to determine if the proposed Project has the potential to interact with current use of traditional resources for traditional purposes by Aboriginal Persons. Selected site visits may have been conducted as a result of the information gathered during the review. This process included a presentation of the results to the leadership of each Maliseet community.

In addition to the TEK study there has been a Maliseet Nation consultation initiative. This activity consisted of a series of open houses, one at each Maliseet community. Information such as the proposed alignment and results of any environmental studies that have taken place were presented at the open houses and copies of all environmental reports related to the Project were made available in each community. Feedback sought and obtained during this consultation process is incorporated into the Comprehensive Study Report. More details of this consultation process and the TEK study methodology are provided in Section 5.9.2.2.

4.2.1.3 Consultation with Stakeholder, Regulatory Agencies and Experts

During the scoping process and for purposes of conducting the environmental assessment, a number of stakeholders and provincial and federal government agency experts were contacted and provided with the opportunity to express issues regarding the Project or to offer expert advice of knowledge for the purpose of assessing the environmental effects of the Project in respect of their mandate. Table 4.2.1 presents a comprehensive list of those contacted and their affiliation. Section 4.2.1.4 presents a summary of issues raised.

Table 4.2.1 List of Stakeholder and Regulatory Contacts

Contact	Affiliation
Agriculture	
Jean-Louis Daigle	Eastern Canada Soil and Water Conservation Centre (Université de Moncton)
Brian DuPlessis	Professional Agrologists of NB Carleton Co Local Chapter
Peter Brennan	Dept. of Agriculture, Fisheries and Aquaculture
Betty Brown	New Brunswick Partners in Agriculture (formerly NB Farm Women's Organization)
Katrina Nicholls	Agriculture Producers Association of NB
Joe Brennan	Agriculture Producers Association of New Brunswick
Susannah Banks, Henk Tepper, and Gerard Pickard	Soil and Crop Improvement Association of New Brunswick
Jacques Laforge	NB Dairy Producers Association
Kevin Antworth	NB Cattle Marketing Agency
Roy Culberson	Potato Shipper's Association
Erica Fava	Agricultural Producers Association of New Brunswick
Robert Kee	Department of Agriculture, Fisheries and Aquaculture, Finance
Patton McDonald	Potato New Brunswick
George Maicher	Department of Agriculture, Fisheries and Aquaculture
Emery Bernard	Department of Agriculture, Fisheries and Aquaculture
Lynn M. Moore	Department of Agriculture, Fisheries and Aquaculture
Wayne O'Brien	Enterprise Carleton Region
Gary Melanson	Enterprise Carleton Region
John Russel	Agricultural Producers Association of New Brunswick
Loretta Mikitzel	Department of Agriculture, Fisheries and Aquaculture (Wicklow)
Colleen Brown	Department of Transportation
Raymond John	Department of Transportation
Ed Crandlemier	Dairy Producers Association
Archaeological And Heritage Resources	
Patricia Allen	Culture and Sports Secretariat
Albert Ferguson	Culture and Sports Secretariat

Table 4.2.1 List of Stakeholder and Regulatory Contacts

Contact	Affiliation
Gilles Bourque	Culture and Sports Secretariat
Allan Seaman	NBDNR
Reg Wilson	NBDNR
Fish And Fish Habitat	
Ted Currie	DFO
Emile Arseneau	DFO
Kim Dickenson	DFO
Ross Jones	DFO
Pam Seymour	NBDNR
Joey Garnett	NWPA
Rick Cunjak	Canadian Rivers Institute
Allen Curry	Canadian Rivers Institute
Stephen Wilson	Meduxnekeag River Association
Forestry	
Tim Fox	Carleton Victoria Forest Products Marketing Board
Simon J. Mitchell	Falls Brook Centre
Alfred Watson	Infor (Forest Information)
Donald Crabbe	H.J. Crabbe and Sons Ltd.
Jamie Simpson	Nature Trust of New Brunswick
Dale Wilson	NBDNR
Genevieve MacRae	Infor (Forest Information)
Peter Demarsh	New Brunswick Federation of Woodlot Owners
Groundwater Resources	
Michelle Paul-Elias	NBDELG
Gina Guidice	NBDELG
Karen White	NBDELG
Wendy Barner	NBDELG
Land Use	
Bea Giberson	Woodstock Chamber of Commerce
Ken Harding	CAO, Town of Woodstock
Diedre McLatchy	Village of Florenceville
Nancy Shaw	Village of Bristol
Christa Walton	Village of Bath
Judy Dee	Town of Hartland
John Craig	Central Business Association, Hartland
Teresa Burtt	Village of Centreville
Dan Dion	Tourism and Business Development, Village of Perth-Andover
Tony Desjardins	Town of Grand Falls
Darlene Francoeur	Village of Aroostook
Jennifer Griffiths	Rural Planning District Commission
Gerret Hoekman	Woodstock Rural Planning District Commission
Michael Lang	Director, La Vallee District Planning Commission
Gérard Lévesque	Victoria - Madawaska South Business Development Centre
Carl Peterson	Simonds Local Service District
Francois Picard	Enterprise Grand Falls Region
Dale Clark	Outfitter, Knoxford Lodge
Alton Morrison	Outfitter, Deerville Camps Ltd.
Julius Tarjan	Operations, Mount Carleton Provincial Park
Ross Antworth	New Brunswick Federation of Snowmobile Clubs
Rino Martin	New Brunswick ATV Federation Inc.
Steve Fenety	New Brunswick Trails Council Inc.

Table 4.2.1 List of Stakeholder and Regulatory Contacts

Contact	Affiliation
Ralph Boyd	Atlantic Provinces Trucking Association
Bill Thompson	NB Tourism and Parks
Jane Garbutt	NB Tourism and Parks
Joel Richardson	NB Tourism and Parks
Eddie Van Dam	NB Tourism and Parks
Jean Finn	NB Tourism and Parks
Kathy Wyrwas	NB Finance
Marie-Josée Hodgert	Statistics Canada
Rod Cumberland	NB Department of Natural Resources
Janet Higgins	NB Department of Natural Resources
Gregory Thompson	NB Department of Training and Employment Development
Peter Kavanagh	NB Environment and Local Government
Wendy Barner	NB Environment and Local Government
Samantha Schaffer	NB Environment and Local Government
Other Projects for Cumulative Environmental Effects Analysis	
Dave Maguire	NBDELG
Bernie Doucet	NBDELG
Surface Water Resources	
Matthew Dickson	NBDELG
Vegetation	
Maureen Toner	NB Department of Natural Resources
Stephen Gerriets	ACCDC
Sean Blaney	ACCDC
Jamie Simpson	Nature Trust of New Brunswick, Appalachian Hardwood Forest
Dr. Jim Goltz	
Wetlands	
Al Hanson	Canadian Wildlife Services
Todd Byers	NB Department of Natural Resources
Danny Crain	NB Department of Natural Resources, Wetland Inventory
Andrew MacInnis	Ducks Unlimited
Wildlife	
Dan Busby	Canadian Wildlife Services, Migratory Birds
Cade Libby	NB Department of Natural Resources, Fur Bear Biologist
Norman Prentice	NB Department of Natural Resources, Region 4, Moose and Deer
Environmentally Significant Area	
Jamie Simpson	Nature Trust of New Brunswick
Stephen Gerriets	ACCDC

4.2.1.4 Summary of Consultation Issues

A summary of key issues raised during the public and stakeholder consultation is provided in Table 4.2.2. The issues are separated into three categories (Land Use, Employment and Business, and Environmental) and the location in the CSR where this issue is considered/addressed is indicated.

Table 4.2.2 Summary of Key Public and Stakeholder Issues*

Issue	Location in CSR
Land Use	
Access to divided property	Section 5.8
Decrease of property value	Section 5.8
Direct environmental effect on houses	Section 5.8
Increased noise levels	Section 5.1, 5.8
Loss of community, as proposed TCH will divide the village of Jacksonville	Section 2.2, 5.8
Loss of quality of life due to proximity to home	Section 5.8
Increased local traffic in Jacksonville	Section 5.8
Employment and Business	
Loss of business due to bypass	Section 5.11
Loss of livelihood	Section 5.8, 5.11
Environmental effects on and/or loss of agricultural/farmland	Section 5.8, 5.11
Environmental effects on and/or loss of woodlot (sugar maplery)	Section 5.8, 5.11
Environmental	
Air quality problems from highway traffic	Section 5.1, 5.8
Drainage of highway	Section 5.3
Loss of fish habitat	Section 5.4
Loss of wildlife habitat	Section 5.7
Environmental effects on water supply	Section 5.2
Environmental effects on watercourses	Section 5.3, 5.4

*This summary does not include issues related to the proposed alignment (See Section 2.2)

All issues raised during public consultation were reviewed and evaluated for their relevance to the environmental assessment, as per the guidance of the Guidelines (Appendix A). This information was considered during the scoping process and selection of the VECs.

4.2.2 Scope of the Project and Assessment

Transport Canada and Fisheries and Oceans Canada have prepared *Guidelines for the Preparation of a Comprehensive Study Report for the Perth-Andover to Woodstock Twinning of Route 2 – Trans-Canada Highway Project* (Appendix A) pursuant to their authority as responsible authorities under the *CEAA*. The Guidelines detail the scope of the Project and of the assessment and have been accepted by the RA. It was based on issues and concerns articulated by provincial and federal regulatory authorities (the TRC) following the review of the EIA registration, and any subsequent meetings and correspondence with the regulators and the proponent (NBDOT).

The following are mandatory factors to be considered for a comprehensive study level assessment as described in section 16(1) and (2) of *CEAA*:

16 (1)

(a) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
(b) the significance of the effects referred to in paragraph (a);
(c) comments from the public that are received in accordance with this Act and the regulations;
(d) measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project; and
(e) any other matter relevant to the screening, comprehensive study, mediation or assessment by a review panel, such as the need for the project and alternatives to the project, that the responsible authority or, except in the case of a screening, the Minister after consulting with the responsible authority, may require to be considered.

16(2)

(a) the purpose of the project;
(b) alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means;
(c) the need for, and the requirements of, any follow-up program in respect of the project; and
(d) the capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future.

This comprehensive study considers the potential environmental effects of the proposed Project within spatial and temporal boundaries which encompass the periods and areas during and within which the Project may potentially interact with, and have an environmental effect on, components of the environment.

4.2.2.1 Scope of the Project

The scope of the project refers to the various components of the proposed undertaking that will be considered as the Project for the purpose of the environmental assessment. Specifically, the scope of the Project determined and approved by Transport Canada and Fisheries and Oceans Canada (Appendix A) pursuant to their authority under Section 15(1) of *CEAA* is the construction, operation and maintenance of the 70.7 km highway to be constructed between Perth-Andover and Woodstock and any required ancillary works associated with those phases. Ancillary works includes construction, operation and maintenance of all required interchanges, new road connections, modifications to existing roads to ensure proper integration with the new highway, watercourse crossings and bridges, modification, relocation or removal of any existing structures, operation/closure/restoration of borrow areas, waste rock and storage areas, and if required, the construction and operation of rest areas and weigh stations.

The scope of the Project does not include consideration of the following (Appendix A):

- decommissioning (with the exception of temporary structures during construction) of the highway as this is not currently contemplated;
- the transportation of personnel or materials to the Project location for either construction or operation; and
- the manufacture of Project materials (e.g., culverts, pre-cast bridge elements, etc.) that are manufactured at existing facilities that exist or operate irrespective of this Project.

It should be noted that any decommissioning/abandonment activities would be subject to future examination under the *CEAA*, as appropriate. However, there are no plans for these activities, and therefore are not part of the Project.

4.2.2.2 Scope of the Assessment

The scope of the factors that were considered/assessed in relation to the Project was determined by Transport Canada and Fisheries and Oceans Canada pursuant to Section 16(3) of the *CEAA*, and is included in the Guidelines (Appendix A). The scope of the assessment was based on issues raised by the public, government departments and agencies, other interested parties and stakeholders, as well as the professional judgement of NBDOT and Jacques Whitford, ADI and AGFOR ("Study Team"). The issues scoping process focused the environmental assessment on components of the environment (biophysical, socio-cultural, and economic) that are valued by society, termed Valued Environmental Components or VECs. The Guidelines provided a preliminary list of VECs/issues of concern that should be considered in the environmental assessment. The Study Team expanded the suggested list to address additional issues raised during consultation, and to reflect the professional opinion of the Study Team. Section 4.2.3 presents the final list of VECs that were assessed for this CSR.

As stated in the Guidelines, to the extent that is possible, the discussion of these environmental effects and their proposed mitigation has given full consideration to community knowledge of the environment and of appropriate and effective mitigation measures.

The environmental assessment boundaries (*i.e.*, spatial, temporal and administrative boundaries) included the Project footprint, zones of influence, and schedule as well as the distribution of the affected population in time and space. The boundaries are defined for each VEC.

4.2.3 Selection of Valued Environmental Components for Environmental Effects Analysis

Considering the issues identified during the scoping process, the Study Team identified eleven (11) VECs. The relationship between VECs and the issues identified during the scoping process that were assessed is illustrated in Table 4.2.3.

Table 4.2.3 Valued Environmental Components Proposed for the CSR

VECs Suggested in the Guidelines	List of VECs Assessed in the CSR	Issues That Were Considered Within the Overall VEC Recommended by JWEL
Fish and Fish Habitat	Fish and Fish Habitat	• Fish and fish habitat • Navigable waters
Moose and Moose Habitat; Migratory Birds; Animal Species of Special Conservation Concern	Wildlife	• Ungulates (including Moose) and their habitat • Migratory birds • Rare animal species
Plant Species of Special Conservation Concern; Appalachian Hardwood Forest	Vegetation	• Rare plant species • Appalachian Hardwood Forest
Wetlands	Wetlands	• Wetland functional attributes and significance (note, rare plant considerations are addressed above)
Atmospheric Quality	Atmospheric Environment	• Noise • Air quality including gaseous and particulate emissions • Greenhouse gas emissions and global climate change • Local climate effects (microclimate and meteorology) • Weather patterns as they relate to construction, operation, and maintenance, including extreme conditions
Water Quality	Surface Water	• Hydrology • Flooding • Water quality and quantity, including road salt loadings and effects • Acid rock drainage • Sensitive slopes and stream banks • Areas of instability and flood zones
	Groundwater	• Bedrock geology and hydrogeology including potentially acid generating rock • Water wells • Groundwater contamination • Change in groundwater quantity
Agricultural Land	Land Use	• Forest resources • Agricultural land • Residential or commercial use of land • Recreational use of land • Dumps and landfills, sewage discharges • Environmentally sensitive or protected areas, special or sensitive landform features
N/A	Labour and Economy	• Social, economic and cultural setting of the project area • Population and community distribution • Local, regional and provincial economy • Agriculture • Forestry and forest inventory • Tourism and recreation, including use of wildlife species of recreational or commercial value, and Appalachian Trail.
N/A	Heritage and Archaeological Resources	• Archaeological Resources • Architectural and other heritage resources
N/A	Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons	• Current Use of Lands and Resources for Traditional Purposes by Aboriginal Persons

These VECs were selected by the Study Team based on their professional judgement to reflect the nature of the issues and concerns, the Project, and the receiving environment. This provided an appropriate context for the efficient analysis of the environmental effects. The specific rationale for the selection of each VEC is presented in the introduction of the VEC sections in Section 5.0.

The CSR also includes an analysis of the potential effects of the environment on the Project.