The Calgary Airport Authority

Parallel Runway Project
Volume I – Summary

Report

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Parallel Runway Project
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Summary

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Acronyms

Abbreviation	Full text
the Authority	The Calgary Airport Authority
AAAQOs	Alberta Ambient Air Quality Objectives
ACNCC	Airport Community Noise Consultative Committee
ACRP	Airport Cooperative Research Program
APUs	Auxiliary Power Units
ASL	Above Sea Level
ASRD	Alberta Sustainable Resource Development
ATC	Air Traffic Control
ATE	Airport Trail Extension
AVPA	Airport Vicinity Protection Area
BMPs	Best Management Practices
BRT	Bus Rapid Transit
CEA	Cumulative Effects Assessment
CEAA	*Canadian Environmental Assessment Act*
CER	Calgary Economic Region
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CPAC	Calgary Pathways & Bikeways Advisory Council
CRP	Calgary Regional Partnership
CS	Comprehensive Study
CTP	City Transport Plan
CWS	Canadian Wildlife Service
D/C	Demand and Capacity
DGR	Dangerous Goods Route
DN	Do-Nothing
DS	Do-Something
EA	Environmental Assessment
EC	Environment Canada
ECO	Environmental Construction Operations
EMS	Environmental Management Systems
ERP	Emergency Spill Response Plan
ERS	Emergency Response Services
FAA	Federal Aviation Administration
FEC	Field Electric Centre
FMA	Fedirchuk McCullough & Associates Ltd.
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
GSE	Ground Service Equipment
HHRA	Human Health Risk Assessment
HLC	High Load Corridor
HRIA	Historical Resources Impact Assessment
ICAO	International Civil Aviation Organization
IFP	International Facilities Project
INAC	Indian & Northern Affairs Canada
LRT	Light Rail Transit
LSA	Local Study Area
LTOs	Landing and Takeoff Operations
NAPs	Noise Abatement Procedures
NCWWMP	Nose Creek Watershed Water Management Plan
NMSs	Noise Monitoring Stations
NMTs	Noise Monitoring Terminals
NO_2	Nitrogen Dioxide

Abbreviation	Full text
O_3	Ozone
PM	Particulate Matter
PRP	Parallel Runway Project
RSA	Regional Study Area
RTM	Regional Transportation Model
SAGA	Sustainable Aviation Guidance Alliance
SARA	*Species at Risk Act*
SO_2	Sulphur Dioxide
SOP	Strategic Operating Plan
TC	Transport Canada
TWCG	Tenant Wildlife Control Guidelines
VCs	Valued Components
VOCs	Volatile Organic Carbons
WSRBSR	Wetland Strategy for Reducing Bird Strike Risk
YBW	Springbank Airport
YQF	Red Deer Airport
YQL	Lethbridge Airport
YXC	Cranbrook Airport
YXH	Medicine Hat Airport
YYC	Calgary International Airport

Symbol	Unit of measure
ft	Feet
ha	Hectares
km	Kilometres
m	Metres
mm/yr	Millimetres per year

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1. Key Findings of the Assessment

Air traffic at YYC is expected to increase whether or not the new runway is built. The CS compares conditions today and predicted conditions in 2015 and 2025 with and without the new runway. The differences show what the effects of increased air traffic might be and how the new runway might avoid or reduce them.

Building a new parallel runway at Calgary International Airport will enable the airport to meet increasing demand for service to 2025 and beyond. Examination of alternatives shows that adding the new runway is the most sustainable way of meeting the demand. Public attitude surveys found that a large majority of Calgarians support their airport and the Parallel Runway Project (PRP).

The new runway will be 14,000 feet (4,270 m) long and will be built to CAT III standard. It will be able to accommodate the largest aircraft in operation today under the most severe weather conditions. This means that the airport will be able to handle more long haul passenger and cargo direct flights to more destinations. The addition of the new runway will relieve congestion and eliminate delays on arrivals and departures through 2025 and beyond, a further benefit to passengers.

Directly or indirectly, YYC contributes $2.9 and $6 billion to regional GDP and generates employment for 40,000 people. Construction of the new runway is part of a $2.4 billion airport expansion program. The PRP will cost $460 million and create 890 construction jobs. Operation of the runway will enable the creation of a further 3,746 jobs. Economic modelling indicates that the PRP will enable $240 million per year in additional visitor spending.

Potential adverse effects on communities and residents near the airport, such as effects on the enjoyment of public and private property, health and safety and social services, and community character were found to be insignificant. In fact the studies indicated that the construction of the PRP will result in a net beneficial effect on community well-being.

In the 1970s, Transport Canada, the Province of Alberta and the City of Calgary had the foresight to put in place land use regulations in the vicinity of the airport that anticipated the addition of a parallel runway. As a result, there will be no changes to existing land use designations as a result of its construction and less effect on land use, communities and residents than for most other new runway projects at major North American airports. Analysis of property values in Calgary found that changes over time were independent of proximity to the airport. Construction of the new runway is not expected to significantly affect property values. The assessment concluded that there will be no effect on traditional land use.

Forecasted increases in the number of aircraft movements at YYC would be expected to increase noise levels near the airport, although the increase would be offset by the introduction into service of newer, quieter aircraft. Accommodating the additional aircraft movements without building the new runway would result in noise effects on people currently not affected. In 2015 with the PRP in operation, 86,000 people would experience less noticeable noise as a result of the new runway and none would experience more. Most people subject to high probabilities of sleep disturbance if the new runway is not built will experience lower probabilities if it is built. Many people experiencing lower probabilities of sleep disturbance without the new runway may see a small increase. Building the new runway will result in an overall decrease in the probability of sleep disturbance in communities near the airport.

No significant residual effects on air quality are expected as a result of the operation of the PRP. Therefore, no long term health effects are predicted to arise because of its development. Effects that

could result from the use of chemicals on YYC lands will be eliminated where possible by the Authority by judicious use within a sustainable chemical management framework. However, where required to maintain public safety and to protect the flying public chemical usage may still be required to some extent particularly with respect to vegetation control and habitat management.

Construction of the new runway will necessitate the closure of sections of Barlow Trail and McCall Way. The City of Calgary is improving the road network near the airport and will continue to do so as traffic increases. The assessment is based on the City of Calgary's forecasts of future traffic volumes and travel times. The road improvements incorporated into the City's forecast at the time they were made did not include the extension of Airport Trail to the east. The largest forecasted increase in travel time to any specific destination was 9 minutes at rush hour. Increases would be less during off-peak periods. Bus service and bicycle paths connecting to the airport terminal will be affected by the road closures. The Authority is working with the City of Calgary and pathway users to provide alternative routes.

Emissions of atmospheric contaminants and greenhouse gases will increase during construction of the runway and subsequently with the increased number of aircraft movements at the airport. Neither the total emissions nor the increases are predicted to be significant locally or as a percentage of provincial or national totals. Differences between future emissions with and without the runway are not predicted to be significant.

A Historical Resources Impact Assessment of the whole of YYC lands was conducted by Fedirchuk, McCullough and Associates. It identified two sites requiring remediation but only one within the footprint of the PRP. The identified archaeological sites have been mitigated to the requirements specified by Alberta Culture and Community Spirit the provincial regulatory body. From a paleontological perspective, bedrock that contains fossils was uncovered beneath YYC lands but the fossils were not found in bedrock situated beneath the footprint of the PRP.

As part of the PRP development, 136 ha of land will be paved; some of this land is overlain by black Chernozemic soils which are considered highly agriculturally productive. Those soils will be lost for the life of the runway but they constitute less than one hundredth of one percent of the black soil in Alberta so the effect is a locally significant not but not regionally significant impact on these resources. In order to mitigate the effects of topsoil loss, it will be conserved by means of a topsoil salvage program and subsequently reused in reclamation of unpaved graded areas.

When the land that will be used for the development of the PRP is prepared for grading, approximately 362 ha of vegetation will have to be removed. Much of this land will be maintained as managed grassland to prevent tree growth and to discourage large birds that could be a risk to aircraft. Within the grading plan, 21 ha of the total currently are classified as wetlands which will be infilled. Wetland infilling will be done to discourage bird usage by reducing available habitat. Such actions are entirely consistent with Transport Canada guidelines with respect to reducing the potential risk of bird strikes. In order to mitigate and compensate for wetland habitat loss and reduction that will occur as a result of the PRP, the Authority has purchased 35 ha of land near the airport that could be used for the purpose of replacing wetland functions. No rare plants or plant communities have been recorded or were observed within the PRP footprint as part of the assessment completed for the PRP.

Wildlife species that are listed as rare, endangered, or threatened either federally or provincially and nesting migratory birds will be located and identified and protected or avoided during the PRP construction period by conducting these activities outside of species specific seasonally sensitive periods. Where avoidance is not possible, other measures to protect identified species within the impact zone will

be employed. As noted above, implementation of measures to avoid bird strikes on aircraft is required by Transport Canada guidelines. The measures that will be deployed to meet these ends and to enable the PRP construction to go ahead will cause birds to be displaced from existing suitable habitat within the project's footprint that now exists or cause suitable habitat to be removed as in the case of wetlands. It is unlikely that these measures will cause a significant adverse regional effect on any wildlife population because of the availability of alternate habitat in both the LSA and RSA and because of the mitigative measures that the Authority will employ to offset habitat losses locally.

The stormwater drainage system for the PRP has been designed so that the criteria for discharges to Nose Creek will meet the criteria of the Nose Creek Watershed Water Management Plan which has been endorsed by Alberta Environment. As a result, there will be no significant effect on water quantity, water quality or aquatic biota in Nose Creek. Groundwater on YYC lands flows to the southwest which is away from wells that may remain in use after the runway is built. Those wells are not likely to be affected. Wells on expired leases within the YYC footprint will be sealed and grouted. Any contaminants that might enter groundwater from the PRP footprint would not reach Nose Creek for 600 years, so discharge of groundwater to the creek is not likely to be affected.

During the course of the assessment, a large number of sustainability and mitigation measures were identified and summarized in Table 2-1 of Volume III, Chapter 2. Application of the measures will enable the Authority to meet social, environmental and economic criteria of sustainability. The table will be used as a management tool during detailed design, construction and operation of the runway to oversee implementation of the measures.

On balance, the net effect of building the new runway will be overwhelmingly positive. The assessment also concludes that building the new runway is the most sustainable means of meeting increasing demand for service at YYC.

These conclusions have clearly been anticipated by the respondents to the public attitude survey. Responses by the public at and following public consultation meetings held in April and May 2009, through community association representatives at meetings of the Airport Community Noise Consultative Committee (ACNCC), and by means of telephone calls and email have been supportive. Even the vast majority of respondents raising specific concerns about the possible effects of the project have stated that they are not opposed to it.

2. Introduction

The Calgary Airport Authority (the Authority) proposes to construct a new 14,000 ft (4,270 m) parallel runway at Calgary International Airport (YYC) to meet increasing demand for passenger and cargo service in southern Alberta. The proposed work is referred to as the Parallel Runway Project (PRP). Figure 1 shows its location.

Canadian Airport Authorities are not currently subject to the *Canadian Environmental Assessment Act* (CEAA); however, the Authority has decided to subject all major projects to a self-directed environmental assessment (EA) which shadows the CEAA model.

The Authority's self-assessment process seeks to verify that the environmental effects of a project are fully considered and that measures designed to reduce or avoid adverse effects are implemented during design, construction and operation. Due to its size, the PRP qualifies for the Authority's Comprehensive Study (CS) level of assessment. Comprehensive Studies are reserved for projects with significant concerns requiring public consultation and further analysis and debate. They require a detailed and *comprehensive* assessment. Public consultation meetings about the PRP were held in April and May 2009. The project has also been discussed at several meetings of the ACNCC in 2009 and 2010.

The draft CS is being released for public and stakeholder comment. Public consultation meetings will be held on 7, 9 and 11 September, 2010 and comments will be accepted at the meetings or by email or letter. The final CS will include responses to every issue raised by the public, regulators and stakeholders.

This document summarizes the assessment of the potential environmental and socio-economic effects of the PRP as undertaken by the Authority's CS. The CS considers and evaluates existing conditions at and around the airport complex, and the potential environmental and socio-economic effects of the PRP both during construction and operation. The CS also compared future conditions at YYC with and without the parallel runway.

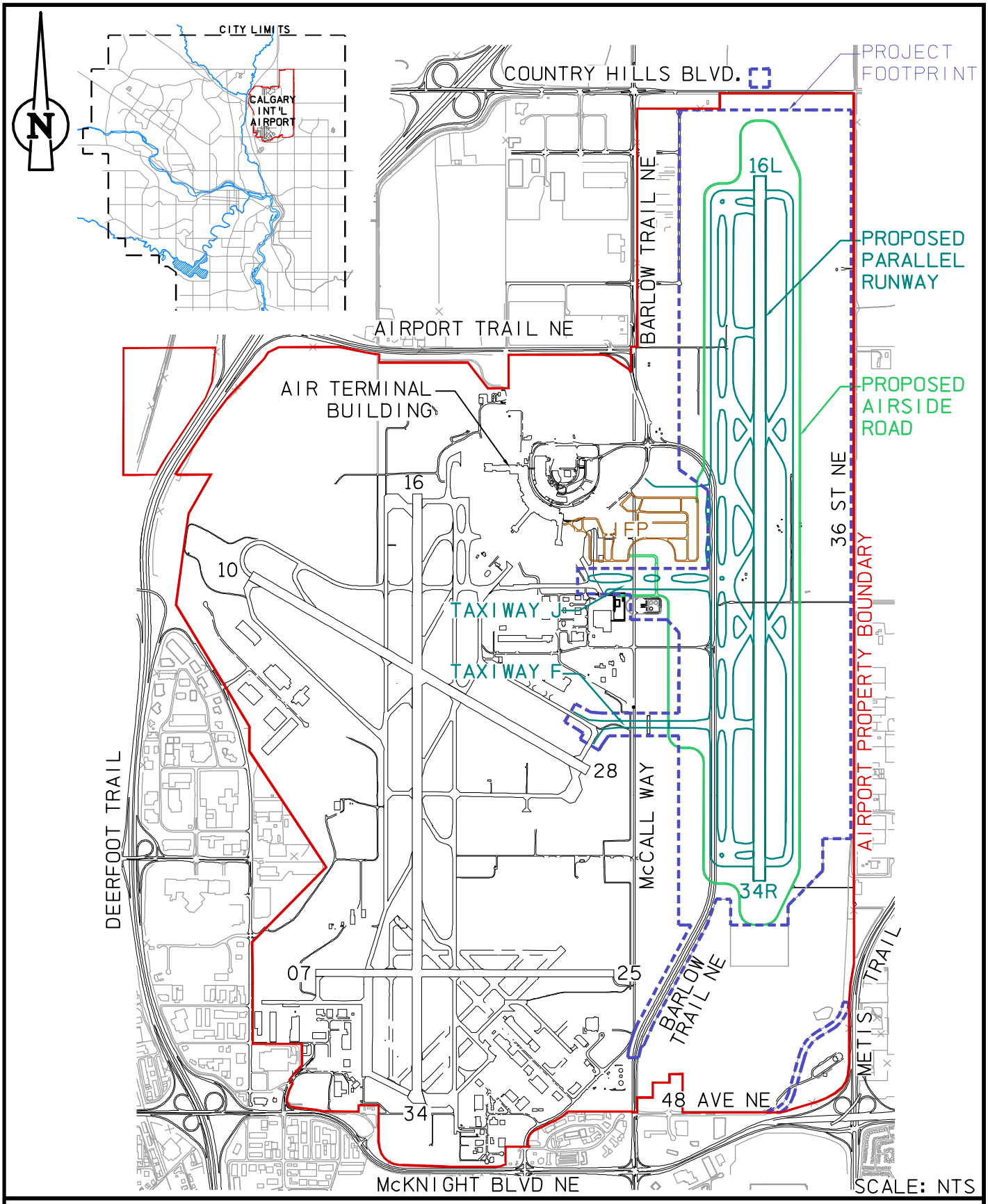
2.1 The Proponent

The Authority is a not-for-profit, non-share capital corporation incorporated under the Province of Alberta's *Regional Airports Authorities Act* 1992. It is responsible for the operation, management and development of YYC under a long term lease from the Canadian Government. In 1997, the Authority also assumed responsibility for Springbank Airport. The Authority is governed by a 15 member board appointed by the City of Calgary, the Chamber of Commerce, the Government of Canada, and Rocky View County.

The legislative mandate of the Authority under the *Regional Airports Authorities Act* is as follows:

- To manage and operate airports for which it is responsible in a safe, secure and efficient manner.
- To advance economic and community development by means that include promoting and encouraging improved airline and transportation services and an expanded aviation industry.

The Authority is responsible for funding ongoing operations, facility restorations and improvements, and air terminal or airfield expansion projects. Operations capital and expansion capital projects are funded through revenues generated via commercial operations or through the airport improvement fee. Any surplus revenue is re-invested into the airport infrastructure.



YYC CALGARY AIRPORT AUTHORITY

The Calgary Airport Authority
Runway Development Program
Parallel Runway Project

AECOM

Proposed Parallel Runway

Figure 1

A SIZE 8.5" x 11" (215.9mm x 279.4mm)
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YYC is Canada's fourth busiest airport measured by passenger volumes and is considered a vital component of Canada's civil air transportation network. As the nucleus for Alberta's passenger and cargo operations, it contributes $6 billion annually to the regional economy.

2.2 The Comprehensive Study

The CS provides an assessment of the effects of the PRP on the biological, physical and socio-economic environment, including assessment of the likely cumulative effects of the PRP in combination with other past, present or foreseeable projects and activities.

The Authority has commissioned a qualified independent reviewer to recommend whether the CS should be accepted and what conditions, if any, should be attached to its acceptance. If the CS is not acceptable, the independent reviewer will define what should be done to render it acceptable, and the Authority will take steps to reach that goal.

All notices, documents and other information relating to the project and the CS process are posted on the Authority's registry website (http://www.yyc.com/rdp).

The CS consists of five volumes:

- Volume I – Summary
- Volume II – Information Necessary to Complete the Environmental Assessment
- Volume III – Effects Assessment
- Volume IV – Supporting Information to Volume II
- Volume V – Supporting Information to Volume III

and a brief conclusion which appears as a preface.

Volume I is a non-technical summary of the CS.

Volume II includes the information that is necessary to complete the assessment. There are six chapters describing YYC, the Authority, Airport Governance, the legislative framework within which the Authority operates, the need for the PRP, the EA process being followed, and the communications and consultation program undertaken as part of the CS, and the Project Description. The Project Description provides details on the design and construction of the various components which make up the PRP.

Volume III is the detailed assessment of adverse and beneficial effects that the construction and operation of the PRP may have on the biological, physical, social, and economic environment. It includes an assessment of the effects of the PRP on land use within the City and on the transportation network in and around YYC. Volume III also includes chapters dealing with the assessment of alternatives, accidents and malfunctions, effects on other airports, and the effects of the environment on the project. This Volume concludes with a description of the follow-up program.

Volume IV consists of the supporting information to Volume II and includes a list of all issues that were raised by stakeholders during the consultation process. Also within this section is the Airspace Model prepared by Aviation Strategies (Airbiz) that predicts future operations at YYC with and without the parallel runway.

Volume V consists of the supporting information to Volume III. In particular, this Volume contains the baseline information reports for all environmental components. Those reports describe the state of the environment before construction of the PRP. The last item in Volume V provides an outline of the Authority's Environmental Management System including a broad Environmental Construction Operations Plan (ECO Plan).

3. Need for and Purpose of the Project

3.1 Need for the Project

3.1.1 Introduction and Background

As a consequence of increasing air traffic congestion on YYC's existing airfield system, an airfield capacity assessment was undertaken in 1998 which indicated that a parallel runway could be required as soon as 2006. The assessment also identified airfield enhancements that could improve the overall efficiency and capacity of the existing airfield system including:

- additional taxiway infrastructure to improve the flow of air traffic on the ground;
- improved air traffic management on behalf of NAV CANADA;
- implementing new air traffic control technology that would assist air traffic controllers in managing the operation of the airport's existing intersecting runway configuration; and
- rationalizing the mix of aircraft operating at YYC, given that small, slow non-scheduled ("general aviation") aircraft mixed with larger, faster moving aircraft can have an adverse effect on airfield capacity.

The Authority has implemented various enhancements over the past several years; however, these enhancements will not be sufficient to prevent unacceptable delays at YYC as its aircraft traffic volume continues to increase.

The Authority's 2004 Master Plan estimated that the current airfield system should adequately meet expected growth in demand for a ten year period - beyond which the parallel runway would be required to service any additional capacity. The 2004 Master Plan indicated that the parallel runway would be necessary during the period 2013 to 2015.

In 2005, the Parallel Runway Implementation Study suggested that the overall timeline associated with the delivery of the PRP could span 8 to 11 years from the commencement of project planning to in-service operations. The actual timing of the project would be based upon the demands placed upon YYC's airfield system. A continuous monitoring of the demand/capacity of the airfield system was recommended and was implemented in 2006.

3.1.2 Historical and Projected Aircraft Movements

Transport Canada's (TC) statistics show total itinerant aircraft movements at YYC increasing from the 200,000 range in 1992 to the 250,000 range in 2008. During that time, many general aviation movements were transferred to Springbank Airport, masking the total increase in activity. Potential for further transfer of flights to Springbank is limited as almost all small aircraft movements at YYC have been diverted to Springbank. Predictions from several independent sources are for the numbers of movements at YYC to reach 400,000 annually by 2025.

3.1.3 Airfield Capacity at YYC

The Authority's 2004 Master Plan provided an overview of the capacity of the existing airfield. In this case, capacity is measured as the number of aircraft operations that can be processed during a specific period, e.g., day, hour, year, without unacceptable delay.

NAV CANADA has indicated that the nominal runway capacity for the existing YYC airfield is between 55 and 60 total hourly runway movements. As illustrated in Volume II, Chapter 2, an examination of actual aircraft movement in 2007 showed that on a typical busy day, YYC reached capacity during the afternoon peak.

When capacity is exceeded, delays ensue, causing inconvenience to the travelling public, imposing extra costs on the airlines and increasing total engine emissions due to on-ground queuing and "holds" in the air. Onerous delays will ultimately act as a disincentive for business and leisure travellers with consequential economic losses to commerce, industry and tourism.

3.1.4 Demand and Capacity Analysis

Demand and capacity (D/C) assessments were undertaken by the Authority in both 2006 and 2007 using the latest available information from TC. The 2006 D/C assessment indicated that average delays would exceed 4 minutes in 2013, and would be approaching 10 minutes by 2018. The 2007 D/C assessment concluded that due to unprecedented growth in aircraft movements at YYC, forecasted average delays would reach 4 minutes by 2008, and would exceed 10 minutes by 2013. Although there are no formal standards for unacceptable delay the United States Federal Aviation Administration's (FAA), for example, uses a 4 minute trigger for initiating new airfield enhancements.

Adding a parallel runway would reduce congestion and delays. The reduction of delays improves service, improves air quality, and enhances sustainability.

For the purposes of this assessment, demand levels for the years 2015 and 2025 (Volume II, Chapter 2, Figure 2-4) were based on forecasted passenger and aircraft movement growth rates provided by TC. Since both actual passenger and aircraft annual movements were closer to the historical TC "high" than the TC "base" forecasts, the TC "high" forecast was adopted for planning the parallel runway. The conclusion was that a parallel runway would be required by 2015 to avoid unacceptable delays.

The predictions of the potential levels of congestion and delay in the year 2015 at YYC should the PRP not be constructed were based on the assumption that all planned improvements to the existing airfield had been implemented. The outcome indicated that the existing airfield would be unable to accommodate the 2015 demand on a busy day, and delays would be at unacceptable levels (15 minutes or more). In this case a typical busy day falls at the 90^{th} percentile on a scale that ranges from quiet to busy. Predictions also suggested that without the PRP in place by 2015, average delays for arriving aircraft could be over 60 minutes and for departing aircraft, 7 minutes during afternoon and evening periods. The percentage of individual aircraft delayed for more than the 15 minute threshold was considerable.

Conditions in 2025 were not predicted since delays were already significant at 2015 demand levels. Where demand increases above a certain threshold, any delays will grow exponentially. Without the parallel runway, airport traffic growth would create a constraint to growth beyond 2015. YYC would be affected by flight rescheduling constraints and potential services would be lost.

3.2 Purpose of the Project

The purpose of the parallel runway is to accommodate current and future increased demand for passenger and cargo service at YYC. The PRP is a long term initiative, planned over 40 years ago, elaborated in the Authority's 1996 and 2004 Master Plans, and now to be implemented. It will provide sufficient capacity to meet demand well beyond the 2025 time horizon examined in this assessment.

4. Project Description

4.1 Project Scope and Schedule

4.1.1 Project Components and Scope

The parallel runway will be located on airport lands between Barlow Trail and 36 Street NE.

The design of the parallel runway meets applicable provincial and federal regulations and recommended practices of the International Civil Aviation Organization (ICAO).

Key features of the PRP are:

- Construction and operation of a new 4,267 m x 60 m (14,000 ft x 196 ft) runway located 2,170 m east of and parallel to existing runway 16-34. Included in the overall development is its associated taxiways, navigational aids, and land based access infrastructure.
- The construction will occur within the boundaries of YYC, which is federal land held under long term lease by the Authority.
- Changes to the roads and pathways leading to and from YYC will be required to accommodate the parallel runway.
- Navigational aids (including approach lighting) to be constructed at the ends of the parallel runway.
- Installation of a new Field Electric Centre (FEC) to support and operate the airfield lighting system.
- Airfield underpasses for Taxiway Juliet and Taxiway Foxtrot Extension (see Figure 1).
- The estimated cost of the PRP is approximately $460 million (2010). This includes program management, planning and engineering, construction management, insurance, airside security, and related program delivery costs and contingencies.

Volume III, Chapter 7 provides a more detailed description of the PRP.

4.1.2 Project Schedule

The schedule for the project is summarized as follows:

Construction: anticipated to commence in 2010 and be completed in 2014.

Operation: anticipated to commence in 2014 and remain in service indefinitely.

Decommissioning and Abandonment: no anticipated decommissioning works or activities are planned for the PRP as it is expected to remain in service indefinitely; any such activities would require a separate EA should they be undertaken at a later date.

4.2 Construction and Operation of the PRP

The design process is underway and it is expected that this will continue up to the start of the construction phase as the design is optimized. The environmental team will liaise with the design engineers and contractors at all stages of the design and construction process to verify the magnitude and duration of environmental effects such that they are avoided and/or mitigated.

In addition to the permanent works, temporary offices, access roads and soil stockpiling areas will be required during the construction of the PRP. Further, a traffic accommodation plan (e.g., traffic to be

accommodated on-site, dedicated routes) will be implemented to mitigate the impact of construction traffic on the surrounding road network for the duration of the construction phase.

4.2.1 Construction Activities

Scheduling of the PRP construction will follow a logical sequence of site services, earthworks, drainage, airfield lighting and FEC, pavement layers, and landscaping. Airfield electrical work and navigational aids will be coordinated throughout the construction phases to allow for buried conduits and connections necessary for the new and/or existing FEC and Air Traffic Control (ATC) tower.

The existing utilities currently crossing the PRP site will be relocated or terminated to accommodate the development. Existing vacated buildings and closed roads will be demolished and the resulting materials produced will be recycled where possible.

A detailed stormwater design has been generated to address the drainage and additional stormwater handling requirements of the PRP. This stormwater design will be incorporated into the overall YYC site drainage management plan.

A balanced earthworks model has been developed to incorporate all excavated materials from the PRP construction into the PRP design. The key landscaping objectives are to minimize earth movements, reduce the amount of surplus soil disposed of off-site and to facilitate the seeding of vegetation post construction. The topsoil must be able to support the growth of adequate vegetation for erosion control, regardless of stripping practices. Trees will be relocated rather than removed, where possible.

Earthworks will include the clearing of vegetation on both cultivated and previously disturbed land. The combined earthworks volume to complete the grading of the PRP is approximately 6.7 million cubic metres, all of which shall be placed as engineered fill to construct the runway and taxiways or placed in graded areas between the runway and taxiways and along embankment slopes. An additional 700,000 cubic metres of topsoil and organic materials will be stripped, stockpiled and reused within soft graded areas. Dust abatement and soil contouring will be integrated into construction practices while the staging of construction will take seasonal weather into account.

Pavement design for the airfield pavements is based on a combination of geotechnical site investigations and TC‘s guidelines from existing airside pavements at YYC. In addition, aircraft fleet mix, expected frequency of aircraft traffic, aircraft wheel loads, tire pressures and landing gear configurations, and local climatic conditions are taken into consideration. The airfield pavement layers construction includes subgrade preparation, installation of edge drains, granular layers, and then pavement layers.

4.2.2 Operations and Maintenance

The operational and maintenance procedures for YYC are prescribed by TC (Aviation) Manuals, TC (Airports) Manuals, ICAO Manuals, and internal airfield operating manuals which set out recommended standards and practices.

The Authority’s operations and maintenance activities including pavement maintenance and rehabilitation, snow removal, foreign object detection, spills management, lighting, environmental monitoring, noise abatement, wildlife management, and operation and maintenance of stormwater controls/systems are governed by standard operating procedures and recommended practices.

Flight operations are controlled by NAV CANADA.

4.2.3 ECO Plan

An ECO Plan (Volume V, Item 14), detailing environmental practices, mitigation and oversight measures to be employed during the construction phase has been prepared for the PRP. It includes a description of the measures the Authority will undertake during the development of the PRP. The objective of the ECO Plan is to prevent and/or minimize environmental impacts and to enhance the environmental value of the air, land and water affected by the PRP during all phases of the project (pre-construction, construction, and operations).

This ECO Plan identifies:

- the environmental setting of the PRP;
- on-site individuals responsible for addressing environmental issues;
- potential environmental issues that may result from the project;
- mitigation measures to prevent or minimize identified environmental impacts;
- implementation, monitoring, training, communication, and review of the ECO Plan;
- legislation, guidelines and standards to be met and monitored; and
- environmental emergency response procedures.

The ECO Plan is a living document. It will be developed in greater detail during the detailed design phase of the project and as preparations for the management of construction for the PRP proceeds.

5. Assessment of Alternatives

5.1 Assessment of Alternatives Methodology

As part of the CS, an assessment of various alternatives to the PRP and means of carrying it out were undertaken. Cost effectiveness, practicality, environment, and socio-economic effects were considered in examining and assessing all alternatives to the PRP that were considered.

5.2 Alternatives to the Project

The following alternatives to the project were assessed in the CS.

5.2.1 Upgrade Other Airports and Divert Air Traffic

Regional airports which surround YYC include:

- Springbank Airport (a reliever airport for YYC)
- Okotoks Air Ranch
- Airdrie Airpark
- Lethbridge County Airport
- High River Regional Airport
- Red Deer Regional Airport

These airports are not suitable alternatives for the diversion of international air traffic from YYC. Some of the airports fail to meet runway specifications or lack appropriate security measures required to support the function of an international airport. In addition, airspace limitations would preclude further development of some of these airports (i.e., Airdrie) and, in some cases, the runways are not long enough to accommodate larger commercial aircraft.

Passengers using a regional airport as an alternative to YYC may be inconvenienced by the lack of public transport between the regional airport and Calgary. The diversion of air traffic to such regional facilities would require additional supporting infrastructure, which would be costly and could have adverse environmental effects.

As most of the airports are in rural locations, if one of them were to be expanded, the effects on the surrounding socio-economic and biophysical environment would be greater than for YYC which is located within the City of Calgary. Increased emissions would also result from an increase in travel to and from the airport. Consequently, expanding YYC is preferable in terms of cost effectiveness, practicality, sustainability, minimal environmental disturbance, and optimal socio-economic effects.

5.2.2 Construct a New Airport

Land use plans to accommodate the parallel runway have been in place since 1979. If a new international airport was constructed the land would need to be purchased from either private or public landowners, planning and infrastructure would require improvement and significant consultation would be necessary. Such a process could take between 5 and 10 years before construction could begin so it would not be ready to meet increased demand when needed. Because of these factors, building a new airport to either replace or accommodate the required expansion that is dictated by the projected traffic volume increase would be much more expensive than building a new runway at YYC.

A new airport would require substantial new infrastructure and most possible locations would be "greenfield sites". Transport corridors to facilitate the transfer of passengers between the existing and new airports or between the new airport and the City of Calgary would also be required, all adding to adverse environmental effects and limiting social benefits.

5.2.3 Enhancement of the Existing Airfield

In 1998, the Authority conducted an airfield capacity assessment which highlighted several operational enhancements to improve the capacity and efficiency of the existing airfield, including:

- additional taxiway infrastructure to improve the flow of air traffic on the ground;
- changes to air traffic management by NAV CANADA;
- implementing new air traffic control technology to manage the operation of the airport's existing intersecting runway configuration; and
- rationalizing the mix of aircraft operating at YYC since small "general aviation" aircraft mixed with larger, faster aircraft creates an adverse effect on airfield capacity.

All approved upgrades will be completed by 2015 and their completion was assumed in the assessment of future effects. Consequently, there are no additional or potential upgrade alternatives to assess.

5.2.4 Controlling Access

Pricing mechanisms, e.g., peak period surcharging, were also considered as possible methods that could be used to manage the increasing demand for airport services. Increasing peak hour landing fees could for the short term (2015) accommodate future passenger movements by diverting air traffic to off-peak periods; but, pricing mechanisms such as these would likely not be effective by 2025 due to the anticipated increase in air traffic volumes at YYC. Simply put, as air traffic volume increases, it will reduce the flexibility in time shifting required to make the pricing mechanisms effective and there simply will not be enough suitable or available landing times.

The cost of congestion charging would also affect passengers directly by raising fares or indirectly by causing flight delays and inconvenience, which is contrary to the principles of the Authority's Strategic Operating Plan (SOP 2008).

In the short term, pricing mechanisms and the spread of peak operating periods would reduce the environmental effects associated with aircraft emissions (reduced takeoff and landing waiting periods) but would displace some flights into night-time periods when aircraft generated noise is more intensive. In the long term, these methods of traffic management are unacceptable in terms of their effects on cost efficiency, practicality, optimization of socio-economic benefits, and minimizing environmental effects.

There is potential for congestion at some periods of the day, week or scheduling period, which may be resolved by talks between airlines and the Authority. Access to YYC could be restricted by allocating slots to airlines at different time periods. Slot allocation would reduce environmental effects associated with aircraft emissions but would also reduce the level of service to the public, which is undesirable from a socio-economic perspective.

Constructing the PRP is the preferred solution to address the projected passenger demand levels in 2015 and 2025 in terms of cost effectiveness, practicality and environmental/socio-economic effects.

5.3 Alternative Means of Carrying Out the Project

In designing a project, engineers have to consider alternative means of achieving the objectives. Major alternative means that were considered to complete the PRP related primarily to alternative arrangements and designs for taxiways and pavement.

5.3.1 East-West Taxiway Alternatives

Aircraft have to cross from the east to the west side of the airfield and vice versa. The existing east-west taxiways are insufficient to handle projected future traffic volumes. One-way taxi paths would eliminate head-to-head aircraft conflicts. Alternatives for a second cross-field taxiway have been developed by the project design team taking into account technical, functional (practicality), economic (cost effectiveness and optimization of socio-economic benefits), and environmental issues.

5.3.1.1 At-Grade Crossing

An at-grade crossing scenario is regarded as “unacceptable” in terms of cost effectiveness, practicality, environmental effects, and the optimization of socio-economic benefits. Although the capital cost would be low, it would result in increased congestion, thereby increasing delays for aircraft and passengers, generation of Green House Gas (GHG) emissions, and aircraft operating costs.

5.3.1.2 New Parallel Taxiway Romeo

The construction of a new parallel Taxiway Romeo (R) as an alternative was determined to be “unacceptable”. This alternative failed because of the implications in terms of both its cost effectiveness and practicality. This strategy imposes the highest capital costs for the PRP redevelopment and would result in possible conflicts over head-to-head aircraft movement and associated safety issues. However, this alternative is “acceptable” in regards to socio-economic and environmental effects since congestion/gridlock would be mitigated by the parallel taxiway which would in turn result in a lowering of GHG emissions.

5.3.1.3 New Taxiway Foxtrot Extension

The new Taxiway Foxtrot (F) extension is the “preferred” alternative for an east-west taxiway in terms of its cost effectiveness and practicality. This preferred alternative was selected because the risks associated with the congestion forecast without the taxiway will be successfully mitigated by its completion along with the safety issues relating to head-to-head aircraft movements. Capital costs for the Taxiway F expansion are also moderate. Further, both the environmental and socio-economic effects related to this taxiway alternative were determined to be “acceptable”. In spite of the extra land requirement to complete the Foxtrot expansion, since traffic congestion would be mitigated for airlines and passengers this alternative would result in the lowest GHG emissions generation by any of the alternatives examined during operation.

5.3.2 Taxiway Juliet Underpass

Taxiway Juliet (J) Underpass was recommended in the 2004 Master Plan to provide a direct north/south link between the proposed air cargo terminals at McCall North and South, and the passenger aircraft aprons. In light of the Authority’s objective to develop the McCall North Trade Park (and McCall Central) into an aviation support facility, the need for a strong north/south connection between the McCall Trade Park and the terminal apron will increase in importance as YYC expands.

Factors considered in the analysis of alternatives to Taxiway J included the evaluation of traffic volumes for ground handling and airport equipment, expected traffic volumes, lane capacity requirements, horizontal and vertical alignment, regulatory and safety requirements, and underpass dimensions.

5.3.2.1 At-Grade Crossing

An at-grade crossing for a Taxiway J alternative is regarded as “unacceptable”. Firstly, this option does not meet TC’s agenda to ensure that airside service vehicles do not cross runways or taxiways. Despite there being no initial capital costs or construction related to this alternative, aircraft congestion it was determined would increase, and this would result in severe delays in the transfer of air cargo between aircraft and terminals. The net result of the alternative on the generation of GHG emissions was a predicted increase and a significant increase in operating costs.

5.3.2.2 Construction of Underpass for Taxiway J

In terms of cost effectiveness, practicality and the optimization of socio-economic effects, the underpass for Taxiway J was determined to be the “preferred” option since it complies with TC’s strategy (airside service plans should not cross runways or taxiways), benefits the safety of passengers and employees, alongside the efficient operational transfer of cargo between aircraft and the terminal. Furthermore, despite initial capital costs associated with the construction of the underpass, long term operating costs at the airport will result in substantial financial savings (time, labour and fuel) due to the optimization of services/routing efficiencies that would result from its use. Environmental effects that are associated with the underpass alternative were determined to be “acceptable” since its use would result in a reduction of GHG emissions in comparison to alternative taxiway scenarios that were considered.

In summary, YYC’s long term development plans will be better serviced by the development of the underpass for Taxiway J. The alternative to not constructing Taxiway J was considered and found capable of accommodating conflicting traffic in the short term. However, it was found that the Taxiway J underpass would provide greater functionality and control based on the forecasted growth that is predicted to occur at YYC in aircraft and aviation support movements. Based on operating costs, functionality, ground works, traffic operations, and the generation of GHG emissions, the underpass was determined to be the preferred option for taxiway improvements as part of the overall PRP development plan. Any additional adverse environmental effects that would be associated with the underpass development were considered as less significant than the long term effects of the alternative taxiway routing scenarios that were evaluated. As part of the overall project evaluation, the cost-benefit analysis indicates that should the taxiway underpass be built, it should be done at the same time as the construction of Taxiway J.

5.3.3 Pavements - Rigid vs. Flexible Pavement

Pavement design relies on a combination of geotechnical site investigations and TC’s historical pavement bearing values from existing airside pavements at YYC. Further, aircraft fleet mix, expected frequency of air traffic, aircraft wheel loads, tire pressures and landing gear configurations, and local climatic conditions are all factors that must also be considered when evaluating the appropriate pavement type for an airport development such as the PRP.

Rigid and flexible pavement designs have been developed as options for the PRP. Flexible pavement structures are between 52 to 72% thicker than rigid pavements. This increase in pavement thickness will affect any earthworks balancing and the quantity of materials that will be required to be delivered to site

during the construction phase. A cost comparison for both flexible and rigid pavements was based on the cost/m^2 for the centre area of the runway and a section of the parallel taxiway.

5.3.3.1 Rigid Pavements

The cost effectiveness and practicality of rigid pavements for runway and taxiway construction are "preferred" by airport operators over other types of pavement because of their lower requirements for maintenance. A reduction in maintenance results in less disruption to airfield operations and despite the higher initial construction costs of rigid pavement, cost savings related to ongoing operations and maintenance result in rigid pavement being considered more cost effective than other alternative pavement types. Typically, 50% less maintenance will be required by rigid pavement in comparison to flexible pavement types over a 40 year life cycle. Rigid runway and taxiways may also accommodate unlimited aircraft tire pressures and provide them with better surface friction characteristics. Despite the initially high CO_2 (carbon dioxide) emissions that result from concrete manufacture, the environmental effects that could result from utilizing rigid pavement were determined to be "acceptable" since concrete may be recycled and reused. The minimal overheads and increased operational efficiency associated with rigid pavement structures for runway and taxiway construction will also optimize any socio-economic benefits derived or resulting from their use.

5.3.3.2 Flexible Pavements

All considerations relating to flexible pavements are regarded as "acceptable" since asphalt permits greater design capability regarding surface water discharge management and may be laid more quickly which permits early trafficking. Furthermore, asphalt paving is only 10% more expensive than concrete paving for runway and taxiway construction over a 40 year life cycle (despite greater material cost risks through the import of greater material quantities onto the site).

The decision whether to implement a rigid or flexible pavement for the PRP has been made based on life cycle cost analysis. A comparison of the environmental and socio-economic differences between the rigid and flexible paving alternatives indicated that the differences were insignificant. Based on this assessment the rigid pavement structure has been approved as the pavement option for the PRP.

6. Public, Stakeholder and Government Consultation

Communications and consultation activities and events are critical components of the PRP CS. The aim of the Communications and Consultation Program is to provide information to, and solicit opinions from, stakeholders who are interested in, or who could potentially be affected by, the PRP. Further, it allows for an explanation and discussion of the context, decision making, and conclusions of the CS process.

6.1 Communication and Consultation

Public and regulatory communications and notifications commenced in January 2009 and have included notification of the project to the Canadian Environmental Assessment Agency (the Agency), establishment of a Project Registry Website (modelled on the CEAA Public Registry), publication of Baseline Reports, and letters to all parties on the project contact list, i.e., the public, stakeholders and government agencies. A Participant Funding Program has also been established by the Authority for individuals and non-profit organizations which expressed an interest in participating in the CS process.

Consultation has also been sought with the following groups as part of the CS process - Airport Community Noise Consultative Committee (ACNCC); YYC Stakeholders (NAV CANADA, Air Transportation Advisory Council); Municipal engagement with the City of Calgary, City of Airdrie, Rocky View County; Federal and Provincial engagement with Government of Alberta, Environment Canada (EC), TC, Alberta Sustainable Resource Development (ASRD), Health Canada (HC), Alberta Culture and Community Spirit, Community Associations, and First Nations (Tsuu T'ina, Siksika, Kainaiwa and Stoney, Nations), and the Métis Association of Alberta.

Public consultation meetings on the Project Description and Scoping document were held in April and May 2009. Over 300 comments have been received from the public. Public consultation meetings on the draft CS will be undertaken during the week of September 6, 2010. This will provide a further opportunity for stakeholders to participate in the completion of the CS. The final CS will address all the issues raised and will be released to the public in October 2010.

6.2 Issues and Concerns

Concerns and issues that were raised during the consultation meetings, and the subsequent actions taken or decisions made, have been tracked and published on the YYC Registry website. A list of issues and responses are provided in Volume IV, Item 1.

Key concerns that were raised during the public consultation meetings included effects of the PRP on:

Transportation/roads/access to YYC	Approx. 40%
Noise related effects as a result of the parallel runway	Approx. 20%
Air quality and greenhouse gas emissions	Approx. 5%
Economic effects due to reduced access to YYC	Approx. 5%
Public transport [Light Rail Transit (LRT)]	Approx. 5%
Miscellaneous concerns	Approx. 25%

Concerns about access to YYC mainly centred upon the potential effects upon businesses in the airport vicinity and how workers and travellers would access the airport from northeast Calgary. Most noise concerns related to new flight paths and how noise levels would change.

7. Assessment Methods

7.1 Introduction

An EA examines the effects of a project on the biological, physical, social, and economic environment. It identifies potential adverse effects and mitigation measures that may be implemented to avoid or reduce identified effects and it considers the significance of any residual effects that may remain after the application of mitigation. Assessments of cumulative effects consider the effects of a project in combination with other projects that are underway or are reasonably foreseeable. An EA is normally carried out during the planning stages of a project before decisions are made to which environmental matters may contribute.

The current process is a detailed and comprehensive form of EA and is termed a Comprehensive Study or CS. This CS follows Canadian Federal EA practice in focusing on issues raised by the public and other stakeholders. Every issue that was raised during the preparation of the CS was documented and addressed during its formulation. A list of issues that were raised and the responses provided can be found in Volume IV, Item 1.

An EA generally follows a sequence of steps: scoping, baseline studies, effects assessment, mitigation, significance of residual effects, review of acceptability of the net effects and follow-up. Detailed methods followed for each of the evaluated components vary slightly and these are outlined in each chapter of the CS.

7.2 Scoping

Scoping means defining the project to be assessed and determining how it will be assessed. The project is defined in Volume II, Chapter 5 and described in detail in Volume II, Chapter 7. Determining how a project will be assessed means identifying how a project might affect the environment, which components of the environment might be affected, the area in which effects might be experienced, and the periods of time during which affects may be detectable. Scoping also evaluates methods that might be used to analyze effects and to determine their significance. Identification of possible effects and of components of the environment that might be affected is carried out by a combination of issues raised by stakeholders including the public and from the professional experience of the team conducting the assessment.

Valued components (VCs) are any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. An EA cannot analyze in detail every possible effect of a project. Concentrating on representative VCs and issues selected by participants is one way to conduct an assessment efficiently without neglecting possible effects that could be significant. VCs were selected to represent key components in each discipline area that could be affected by PRP activities and are identified in each assessment chapter.

7.3 Baseline Studies

Baseline data were collected to describe the state of the environment in areas that might be affected before construction of a project begins. In this CS, most chapters consider two such areas: Local Study Areas (LSA) in which readily observable effects may be expected and Regional Study Areas (RSA) which encompass a wider area that generally surrounds the LSA. Information from the larger areas helps place the effects in a broader context which is helpful in discussing significance and cumulative effects. Baseline studies for this CS are presented in Volume V.

7.4 Assessment of Effects

The effects assessment of the PRP compared present to predicted future environmental and socio-economic conditions, with and without the parallel runway, using the following scenarios:

Baseline - The state of the environment before construction begins.

Future Scenarios -

- 2015 Do-Nothing (DN) - describes YYC and the proposed project area without the parallel runway in place in 2015.
- 2015 Do-Something (DS) - describes YYC and the proposed project area with the parallel runway in place in 2015.
- 2025 Do-Nothing (DN) - describes YYC and the proposed project area without the parallel runway in place in 2025.
- 2025 Do-Something (DS) - describes YYC and the proposed project area with the parallel runway in place in 2025.

The DN scenarios assumed that any currently planned improvements to the existing airfield will be implemented before any operation of the parallel runway. Predicted future conditions under the four scenarios distinguish between construction effects and operational effects of the PRP.

The causal relationship between PRP activities and potential effects was analyzed for each VC. Results were quantified using modelling techniques where possible. Elsewhere, qualitative assessments based on professional judgement were used.

7.5 Mitigation Measures

Evaluation of potential effects included the consideration of mitigation measures. Design changes to the PRP, Best Management Practices (BMPs), and other measures intended to prevent or reduce potential environmental effects of the project were identified as follows:

- **Mitigation by Design** - mitigation measures, such as stormwater retention ponds that have been incorporated into project design.
- **Construction and Operations Management** - BMPs and specific mitigation measures identified by the environmental assessment team to reduce anticipated or identified adverse environmental effects.

7.6 Residual Effects and Significance

Residual effects are the effects remaining after the implementation of any mitigation measures that are designed and intended to reduce or avoid them. In most cases, the assessment addresses the magnitude, frequency, duration, and likelihood of occurrence of any potential effect. Rationales are provided to explain conclusions about the significance of residual adverse effects. In many cases, this includes a discussion of the effects in both a geographical and historical context.

Indicators and thresholds have been used to assess effects on VCs. An indicator measures the condition of a VC and a threshold is the level of change to a VC beyond which unacceptable adverse affects occur. Indicators were used to quantify change where possible and thresholds, such as regulatory guidelines, were used to determine the degree of significance of the change. Elsewhere, professional judgement was

used to determine the magnitude and other characteristics of the anticipated effect and an explanation of the rationale used to make the determination was provided.

7.7 Monitoring and Follow-Up

Monitoring will be used to measure the accuracy of predicted effects, particularly when there is a low level of confidence in the data that was used to make those predictions. Follow-up is the adaptive management that may be required if the applied mitigation measures are found to be ineffective and residual effects are unacceptable.

YYC is committed to communicate with and seek feedback from potentially affected parties. Further, the Authority will continue to seek feedback from community residents and leaders, government and stakeholders throughout the life of the PRP.

7.8 Cumulative Effects Methodology

Cumulative effects are “changes in the environment that are caused by an action in combination with other past, present and future human actions” (Hegmann et al 1999).

The objective of cumulative effects assessment is to determine whether the residual effects associated with the PRP will result in an unacceptable level of change when considered in combination with the effects of other projects or activities. In this CS, cumulative effects are assessed separately in each assessment chapter.

8. Effects Assessment

8.1 Soils and Terrain

Volume III, Chapter 3 examines effects that construction, operation and reclamation of the PRP may have on soils and terrain.

YYC lies in the Thin Black Soil Zone of south-central Alberta. YYC lands consist of a highly modified landscape that has been significantly altered by development. Some lands to the northeast are dominated by agricultural (cultivated, fallow, pasture) lands but the rest of the surrounding area has been developed as part of the City of Calgary.

Chernozemic soils in Alberta are some of the richest Canadian agricultural soils and are typically rated as fair to good for reclamation purposes. These soils normally demonstrate physical and chemical soil properties suitable for reclamation at end land use. Approximately 360 ha of soil classified as Chernozemic occur within the footprint of the PRP. Conversely, some soils with clayey textures and poor drainage characteristics are saline or sodic and not valuable for either agriculture or suitable for reclamation.

The composition of the soil landscape within the LSA is detailed in Table 3-2, Volume III, Chapter 3.

8.1.1 Issues and Effects Hypotheses

The majority of construction effects on soil and terrain resulting from the PRP will be directly related to the removal of vegetation and surface disturbance. It is anticipated that approximately 536 ha of soil will be exposed, of which approximately 400 ha will be contoured, restored and seeded after construction by replacement of topsoil and related mitigation measures. The remaining 136 ha of stripped soil will be paved, removing it from potential agricultural production for the life of the PRP.

Physical works resulting from the development of the PRP may affect soil quantity and quality in the LSA as a result of the alteration, degradation and loss of arable soils suitable for reuse. Soils and soil resources are also vulnerable to wind and water erosion as a result of exposure following the removal of vegetation , to compaction, and rutting during construction, or to increased salinization or a reduction in soil function due to increased handling.

8.1.2 Effects Assessment

The construction of the PRP will result in the permanent loss of 136 ha, of which 96 ha is currently classified as productive agricultural land. However, no further adverse effects on agricultural lands will result once construction of the PRP is completed since the end use of lands in the project footprint after the operational and reclamation phases will not include agriculture.

The majority of soils within YYC lands are vulnerable to wind and water erosion should vegetation be cleared. If not properly mitigated, exposed topsoil and the underlying soil horizons may be lost. If not controlled, transport of dust and sediment may adversely affect air and water quality .

PRP related construction activities will result in the unavoidable disturbance of potentially affected sodium rich soil areas, particularly as a result of the infilling of wetlands within the area. If not mitigated, the geographical extent and severity of salinization may increase. Furthermore, if sodium rich and non-

sodium rich soils are not separated and replaced like-for-like during reclamation, the PRP footprint area covered by unsuitable soils may increase.

8.1.3 Mitigation

To optimize sustainability, in situ soil conservation and reclamation opportunities will be pursued during all phases of the PRP.

Mitigation measures focus on the maintenance of topsoils for in-situ replacement during reclamation. Mitigation for construction effects include the identification of PRP areas where specific soils handling measures are required, the development of an ECO Plan, adherence to the Authority's Earthworks Management Plan and the use of established soil management BMPs, e.g., erosion, dust and sediment control, spills and waste containment, revegetation. An Environmental Inspector will be assigned to oversee soil stripping, salvage and stockpiling in an attempt to minimize potential effects. A detailed account of mitigation measures may be found in Volume III, Chapter 3.

8.1.4 Residual Effects and Significance

96 ha of productive agricultural land will be lost for the life of the parallel runway. The land is situated within the City of Calgary and was set aside for airport development over 40 years ago. In a regional context, its loss is not significant. Approximately 400 ha of land within the PRP footprint, previously classified as agriculturally suitable, will be maintained as grassed areas outside the new paved areas. Such reclamation will act to maintain the potential of these lands so that they may be more easily returned to agricultural use in the future should that be desired.

PRP construction, vehicle and equipment traffic may degrade natural vegetative cover and expose large areas of topsoil. These actions could potentially lead to soil loss via wind and water erosion. Sediment transport and soil loss is, however, likely to be negligible due to soil textural properties, the lack of relief in the local terrain, and the rapid deployment of mitigation measures designed to reduce soil loss by these mechanisms.

Minor changes to the distribution and aerial extent of saline affected soils are predicted to occur due to site disturbance resulting from the development of the PRP. Any such residual soil effects are rated as minor and are addressed in the Earthworks Management Plan. Adverse effects on soils sensitive to salinization as a result of the PRP are not anticipated beyond YYC lands.

8.1.5 Cumulative Effects

Where mitigation is appropriately applied, the PRP is not expected to result in any significant residual effects on soils and terrain within the LSA. However, any residual effects in combination with the effects of future developments may result in consequences to soils and soil resources within the City of Calgary, surrounding municipalities and Alberta as a whole. Nevertheless, the cumulative environmental effects of the PRP on soils, combined with past, existing and future developments are rated as insignificant.

8.1.6 Sustainability

The focus for conservation and sustainability measures is the protection of soil characteristics to maintain a resource which supports agriculture. The long term land use of airport lands supports a focus on the soil management objectives identified in the Authority's Earthworks Management Plan. Mitigation and sustainability practices include stockpiling and conserving all Chernozemic soils and reusing them within

the PRP footprint. Soil diversity and quality will, therefore, be maintained within contoured and landscaped areas of the PRP.

The ECO Plan will include provisions to train personnel undertaking PRP construction activities with regard to the proper and appropriate soil conservation principles to be followed and how to recognize issues before they become problems. Long term considerations for agricultural and commercial soil uses have been incorporated into soil disposition plans.

8.2 Vegetation

8.2.1 Introduction

Volume III, Chapter 4 examines the effects that construction, operation and reclamation of the PRP may have on vegetation.

The PRP will be built in a highly modified landscape that has been significantly altered by development. Half of the area that will be affected by project development is either currently under cultivation or is maintained as pasture. Rural residential development, roads and utilities and some airport development activity has also disturbed approximately one third of the area. The remaining one sixth of the area is occupied by semi-natural vegetation. Wetlands occupy approximately 21 ha or 4% of the PRP footprint.

8.2.2 Issues and Effects Hypotheses

A field survey of the project footprint conducted as part of the baseline data collection process did not find any species of vegetation that are listed under the *Species at Risk Act* (SARA). However, should such species be present, removal of vegetation for construction of the parallel runway could result in the loss of plants belonging to SARA species or rare vegetation communities.

Wetlands provide habitat for bird species that pose a safety risk to aircraft. Wetlands within the PRP footprint will be filled in as required in TC's airport wildlife management regulation and the Authority's Wetland Strategy. The removal of the wetlands will result in loss of certain kinds of vegetation and will result in a reduction in the diversity of vegetation communities and species present

Invasive weeds and non-native species of concern may be introduced on cleared and graded land.

Trees planted in the 1970s and 1980s by the Devonian Foundation may be removed or transplanted.

8.2.3 Effects Assessment

The LSA is 536 ha in size, 361.5 ha of this area is currently vegetated. All of this vegetation cover will be removed at the pre-construction stage. Post construction during the PRP operational phase these areas will either be replaced with pavement for runways and associated infrastructure or reclaimed into managed grasslands. Of the 361.5 ha of vegetation to be removed, 66 ha was considered semi natural grassland with a stand of remnant aspen and 21 ha was wetlands. These natural and semi-natural communities will be permanently lost as a direct result of the PRP which will result in a local decrease in biodiversity at the species and community levels. Wetland functions and the vegetative communities and species they support will also be disturbed by the development of the project.

One SARA species has been reported to occur on YYC lands but not within the PRP footprint. Western Blue Flag (*Iris missouriensis*) is not likely to occur within the PRP footprint and no adverse effects to its

distribution are anticipated. Clearing and grading for the PRP will afford noxious weeds and other undesirable plant species the opportunity to invade large areas of land.

8.2.4 Mitigation

Should any SARA listed plant species be encountered, they will be avoided and protected if possible. If not, in consultation with EC, the individual plants will be transplanted to suitable habitat elsewhere on YYC lands.

The Authority has purchased 35 ha of land adjacent to existing YYC lands, west of Deerfoot Trail at Airport Trail NE which could be used to restore and replace wetland function and to support Alberta's Water for Life Strategy. As a part of its wetland strategy, the Authority has established a stakeholder consultation group to discuss conservation measures that will be implemented on the purchased land. The stakeholder group includes the City of Calgary, AE, DU, and others.

BMPs will be employed during construction and operation of the runway to prevent weed infestations and to control them should they occur. Further details are provided in Volume III, Chapter 4 and in the ECO Plan, Volume V, Chapter 14.

8.2.5 Residual Effects and Significance

No effects on SARA species are expected as a result of the PRP since, based on field surveys, they are considered unlikely to be encountered. Removal of semi-native grassland and the remnant aspen stand and their replacement by managed grassland will not have a significant adverse effect on biodiversity at a regional or greater scale because no rare or uncommon species, vegetation communities or landscape types are likely to be affected. The vegetation communities of value that will be affected by the development of the PRP are those inhabiting wetlands. As described above, the Authority is advancing plans to replace wetland functions by following a policy that is consistent with the Federal Wetland Strategy so that effects on wetland plant communities within the RSA should not be significant.

Although substantial effort will be made to prevent infestations by noxious weeds or other invasive species, complete success is not expected. It is recognized that seed sources exist on lands surrounding the airport and seed dissemination through wind and wildlife is likely. However, the use of ongoing supplementary measures to eradicate identified weed infestations will be undertaken such that the net adverse effects of noxious plant invasions are not expected to be significant.

8.2.6 Cumulative Effects

The surrounding area is already developed for residential, commercial or industrial land use or is being held for future development. The present conditions of the undeveloped lands including vegetation cover are similar to present conditions in the PRP footprint. Disturbance of these lands, individually or in combination is unlikely to contribute to cumulative effects on vegetation on a regional scale unless populations of rare species are affected. As no rare plant species were found on the PRP footprint, it is not expected to contribute to cumulative effects on rare plants.

8.2.7 Sustainability

To foster the sustainability of natural resources, the Government of Canada has put forward a Canadian Biodiversity Strategy. The Strategy proposes that sustainable development will not adversely affect ecosystem, landscape, genetic or species diversity. Disturbance of the already heavily disturbed lands in

the footprint of the PRP will not significantly affect the prairie and aspen parkland ecosystems that would naturally occupy the area nor will it significantly affect any regional landscape units. No species will be extirpated or put at significantly elevated risk by the actions of building and operating the parallel runway so species diversity will not be significantly affected. No populations of rare species will be lost or significantly reduced in numbers so there will be no significant effect on species diversity. Therefore, the PRP can be considered sustainable in terms of the effects its development will have on natural resources both locally and regionally.

8.3 Surface Water and Aquatic Resources

8.3.1 Introduction

Volume III, Chapter 5 examines effects that construction, operation and reclamation of the PRP may have on surface water and aquatic resources. A detailed description of the YYC stormwater management system and plans may be found in Volume V, Item 3.

Within the PRP footprint, there are no active storm runoff drainage channels or streams. There are four stormwater retention ponds and several wetland areas. Stormwater discharges from YYC lands directly or through the City of Calgary stormwater drainage system. Stormwater discharges that result from runoff within YYC pass to Nose Creek and must comply with both the volume and water quality criteria established to control outfalls to the creek under the Nose Creek Watershed Water Management Plan (NCWWMP). The PRP area is currently covered with grasses but, despite poor drainage characteristics, runoff generally infiltrates with the remainder accumulating within the wetland areas.

8.3.2 Issues and Effects Hypotheses

Site preparation and removal of vegetation that will result as the footprint for the PRP is readied for construction may result in increased sedimentation from exposed soils and soil stockpiles. Additionally, during the operational phase accidental releases of hazardous materials, entry into surface water of glycol used for de-icing aircraft and chemicals used for de-icing paved surfaces, herbicide/pesticide applications used to control vegetation, and the discharge of saline groundwater as a result of excavation all have the potential to adversely affect surface water quantity and quality.

Surface compaction and the increase in paved areas for the runway and taxiways, etc., will reduce surface permeability, and increase both peak runoff and the frequency of peak discharge into the stormwater system. Changes in discharge quantity or velocity and increases in sediment and contaminant loads could adversely affect water quality in Nose Creek.

Ponds and wetlands in the PRP footprint will be filled in to facilitate construction or to reduce the risk of bird strikes on aircraft (see Volume III, Chapter 6). This will result in the loss of wetland function.

8.3.3 Effects Assessment

Stormwater drainage from airport lands is managed by a set of drainage structures such as swales, pipes, treatment facilities, and retention ponds.

The facilities enable the Authority to control the quantity and quality of water discharged directly and indirectly (through City of Calgary NCWWMP stormwater drains) to Nose Creek. These stormwater control structures are designed so that discharged waters will comply with watershed criteria which have been accepted by Alberta Environment. Because of the effectiveness of the stormwater management

system at YYC to which the PRP drainage will be connected, essentially no change to current water quality or quantity will occur.

Infilling of wetlands will affect wetland function including changes in evaporation, infiltration and alteration of wetland habitat.

8.3.4 Mitigation

The addition of 136 ha of new paved and impermeable surfaces will be mitigated by changes to the design of the Stormwater Drainage Management System so that discharge from YYC lands to Nose Creek will be consistent with the NCWWMP.

The Authority has purchased 35 ha of land adjacent to existing airport lands, west of Deerfoot Trail at Airport Trail NE. The land could be used to restore and replace wetland function lost as a result of the projects' development and to support Alberta's Water for Life Strategy. The Authority has established a stakeholder consultation group as a part of their wetland strategy including the City of Calgary, AE, DU and others. This group will discuss and help direct the wetland conservation measures that will be implemented by the Authority on the purchased land.

Most of the glycol used for de-icing is recovered and contained for treatment from areas where the majority of de-icing occurs. A small amount of de-icing fluids may enter the YYC stormwater drainage system where it is treated or lost by evaporation from retention ponds. Furthermore, with the future development of a central de-icing facility, glycol containment and control will prevent the discharge of glycol off YYC property.

Water quality mitigation measures that will be implemented during construction and operation will also consist of BMPs to counter increased sedimentation, the implementation of YYC's Emergency Spill Response Plan (ERP), the implementation of an Earthworks Management Guidance Document, and the refinement of pesticide/ herbicide application plans. Further details of these mitigation plans are outlined in the ECO Plan, Volume V, Item 14.

8.3.5 Residual Effects and Significance

Implementation of the mitigation measures described above will maintain the level of quantity and quality of water entering Nose Creek. The stormwater drainage system will be designed so that the quantity of water discharged to Nose Creek complies with the NCWWMP. Therefore, there will be no significant residual effects on water quantity or quality entering Nose Creek.

The consultations underway with the City of Calgary, Alberta Environment and other stakeholders will lead to wetland mitigation consistent with the Federal Wetland Conservation Strategy.

8.3.6 Cumulative Effects

Development of the lands in the Nose Creek watershed is expected to continue. The NCWWMP was instituted to manage cumulative effects on Nose Creek. Stormwater drainage from the PRP will comply with the Agreement so it will not contribute to cumulative effects.

8.3.7 Sustainability

PRP mitigation measures for water quantity and quality are primarily directed to stormwater management and control. Mitigation efforts aim to maintain the quality of water discharged from site and towards having no net increase in the discharged water quantity, even under conditions of increased runoff. Opportunities exist within the PRP to improve the sustainability of water use by integrating other measures with stormwater management systems to reduce potable water demand by using non-potable water for dust control and fill mixing and to reuse stormwater and wastewater. These are discussed in further detail in Volume III, Chapter 2 of the CS.

8.4 Wildlife and Wildlife Habitat

8.4.1 Introduction

Volume III, Chapter 6 examines the effects the construction, operation and reclamation of the PRP may have on wildlife and wildlife habitat.

Burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus excubitoroides*), long billed curlew (*Numenius americanus*), peregrine falcon (*Falco peregrinus*), piping plover (*Charadrius melodus*), rusty blackbird (*Euphagus carolinus*), Sprague's pipit (*Anthus spragueii*), and northern leopard frog (*Rana pipiens*) are listed under Schedule 1 of the *Species at Risk Act* as "Special Concern", "Threatened" or "Endangered" and may occur on YYC lands.

Thirty-seven bird, 11 mammal, and one amphibian species were observed during the surveys as part of the baseline assessment completed for the CS. Five of the species documented during the surveys, the American badger (*Taxidea taxus*), bald eagle (*Haliaeetus leucocephalus*), lesser scaup (*Aythya affinis*), Swainson's hawk (*Buteo swainsoni*), and sora (*Porzana carolina*) are listed provincially as Sensitive. The long-tailed weasel (*Mustela frenata*), was documented as being present within the area covered by the PRP footprint during the winter tracking survey. The long-tailed weasel is listed provincially as a species that May Be At Risk.

During the baseline assessment, migratory birds were observed to occur frequently within the LSA. In total, 37 species of migratory birds were observed nesting within the LSA. The site provided a number of important habitat features that supported these species including wetlands and aspen stands that provided nesting resources. These birds and their habitat are protected by provisions of the *Migratory Birds Convention Act*.

The three natural areas that are present in the region of the PRP provide a diversity of habitat types and movement corridors for wildlife in the area. These habitat types are scarce on a regional scale in the Calgary area, with some provincially listed species depending on the natural areas for reproduction and survival. Disturbance of these habitats or any listed species associated with them is a concern and efforts should be made to minimize adverse effects.

8.4.2 Issues and Effects Hypotheses

The construction and operation of the PRP will remove existing habitat for wildlife and the presence of infrastructure and disturbance by human activity during construction, operation, closure, and post-closure may cause direct and indirect (functional) loss of wildlife habitat. Loss of habitat may affect the behaviour, distribution and abundance of existing wildlife resources.

Wildlife mortality rates within the PRP may increase as a result of collisions with buildings, road vehicles and aircraft.

8.4.3 Effects Assessment

Clearing of vegetation as part of the PRP development process may result in death or loss of habitat for species listed under Schedule 1 of SARA. Construction activities could also have effects on other listed species, migratory birds and small mammals. Grading will result in the infilling of wetlands that provide potential critical habitat.

The operation of the PRP is expected to have similar effects on wildlife to those of the current operation of the airport, which could result in a larger cumulative effect. Without the implementation of appropriate mitigation measures to counteract these affects, this may include wildlife deaths relating to increases in road traffic and bird strikes.

8.4.4 Mitigation

Mitigation for PRP construction related effects on wildlife and wildlife habitat will be consistent with the regulations that apply to federal land but do not compromise the Authority's duty to provide safe operation of YYC. Clearing will occur outside the breeding period (15 April to 31 July) for species listed under Schedule 1 of SARA and migratory birds. If a wildlife species listed under Schedule 1 of SARA is observed, the Canadian Wildlife Service (CWS) will be notified and the appropriate permits obtained or action taken. For highly adaptable species such as small mammals that do not represent threatened populations, no mitigation is proposed.

The Authority has purchased 35 ha of land adjacent to existing airport lands, west of Deerfoot Trail at Airport Trail NE. The land could be used to restore and replace wetland function and to support Alberta's Water for Life Strategy. As a part of its wetland strategy, the Authority has established a stakeholder consultation group to discuss conservation measures that will be implemented on the purchased land. The group includes the City of Calgary, AE, DU, and others.

During the operation of the PRP, the Authority's existing wildlife management practices will be extended to cover the PRP footprint. This includes the mitigation of bird strikes and vehicle strikes through exclusion fencing and the Authority's Wildlife Management Plan.

8.4.5 Residual Effects and Significance

Following mitigation, no significant residual effects are expected on wildlife and wildlife habitat. Species that are listed either federally or provincially will be protected and avoided through construction outside the breeding season. Effects on more highly adaptable species are considered insignificant given there are better resources in the city that have areas larger and less disturbed which animals can migrate to.

8.4.6 Cumulative Effects

The area that surrounds the PRP is already developed for residential, commercial or industrial land use or is being held for future development. The present condition of the lands not already built on and the habitat present is similar to the present condition on the PRP footprint. Disturbance of these lands, individually or in combination is unlikely to contribute to cumulative effects on wildlife and wildlife habitat on a regional scale unless federally listed species are found and affected. As no rare species were found

on the PRP footprint, it is unlikely that its development will contribute to cumulative effects on wildlife and wildlife habitat.

8.4.7 Sustainability

To foster the sustainability of natural resources, the Government of Canada has put forward a Canadian Biodiversity Strategy. The Strategy proposes that sustainable development will not adversely affect ecosystem, landscape, genetic or species diversity. Disturbance of the already heavily disturbed lands in the footprint of the PRP will not significantly affect the prairie and aspen parkland ecosystems that would naturally occupy the area nor would it significantly affect any regional landscape units. No species will be extirpated or put at significantly elevated risk by the actions of building and operating the new runway, so species diversity will not be significantly affected. No populations of rare species will be lost or significantly reduced in numbers, so there will be no significant effect on species diversity. Therefore, the PRP can be considered sustainable in terms of effects on wildlife.

8.5 Groundwater

8.5.1 Introduction

Volume III, Chapter 5 examines the effects the PRP may have on groundwater quantity and quality.

Groundwater in the PRP footprint includes the amount of groundwater recharge that flows to deeper bedrock aquifers used for water supply or laterally to Nose Creek. A layer of low permeability glacial till consisting mostly of clay covers YYC lands and overlies low permeability claystone. During the dry summer months, evapotranspiration exceeds the amount of precipitation and there is a moisture deficit. Periods in the winter when the temperature rises above freezing result in snow melt but if the ground remains frozen, then this melt water runs off and does not infiltrate into the ground.

The average annual groundwater recharge rate for YYC lands is 3 mm/yr or less. This refers to groundwater recharge that moves downward through the deeper clay till and recharges the deeper bedrock. This recharge may then either be used by local water wells or flow laterally to the southwest towards Nose Creek. Wells within the PRP footprint will not be used after construction but wells to the northeast of YYC lands may continue to be used.

Groundwater sampling indicates that the natural groundwater within the clay till in the upper 4 m to 10 m is mineralized, predominantly by sodium and sulphate ions. Water quality in the claystone bedrock below the till is also mineralized but the level of total dissolved solids generally decreases with depth. Chloride concentrations were elevated above the Drinking Water Criteria in several monitoring wells located in close proximity to Barlow Trail. The elevated chloride levels may be related to use of de-icing salts on the roads.

No evidence was found of contamination with petroleum or other manmade organic chemicals. Due to the low permeability of the upper clay till soils, there is minimal potential for movement of contaminated groundwater from potential up-gradient sources.

8.5.2 Issues and Effects Hypotheses

The principal issues that were examined with respect to groundwater included how the PRP would affect the quantity and quality of groundwater recharge to the deeper aquifers used by local water supply wells and the effects of groundwater discharge to receiving watercourses, i.e., Nose Creek.

8.5.3 Effects Assessment

Infiltration of runoff will decrease in the PRP area due to the increased hard surfaces, improved stormwater drainage and construction of two underpasses which intersect the groundwater table. Consequently, the quantity of available groundwater for local water wells and discharge to Nose Creek may be affected.

During both construction and operation of the PRP, groundwater quality may be affected by leakages, accidents and malfunctions (refer to Volume III, Chapter 19). The use of de-icing chemicals, dust suppressants and herbicides/pesticides as part of operations and maintenance activities may affect groundwater quality if these substances enter the groundwater through infiltration. However, due to the low permeability of the clay till and claystone bedrock that is beneath the LSA, the potential for contaminant movement as a result of infiltration is considered minimal. In addition, there is a low potential that water quality in local supply wells will be affected because the groundwater flow direction is to the southwest, which is away from the area in which they are located.

8.5.4 Mitigation

To mitigate against reductions in groundwater infiltration to aquifers that may be drawn on by domestic wells or that discharge to Nose Creek, drainage systems will incorporate BMPs including retention ponds, overland flow paths, porous pavement and infiltration structures, and storage facilities to retain runoff and control release rates.

Prior to construction, all existing water wells, gas wells and boreholes in the PRP site that cannot be preserved will be identified, inspected and sealed. During construction and operation, BMPs will be applied to prevent or remedy release of potential contaminants which could penetrate to the deeper bedrock aquifer. The restriction on aircraft refuelling, de-icing and maintenance within the PRP footprint will further protect groundwater quality.

8.5.5 Residual Effects and Significance

Due to the low permeability of the clay till and claystone bedrock beneath the LSA and the relatively dry climate of the area, only a small amount of groundwater recharge occurs on YYC lands. The decrease in groundwater recharge caused by PRP construction and operations will be partly offset because groundwater extraction from existing residential and agricultural wells in the PRP area will cease. Stormwater management BMPs will be used to increase groundwater recharge below the proposed stormwater retention facilities. The net reduction in groundwater recharge as a result of the development of the PRP is predicted to be low on YYC lands and have a negligible effect on water quantities available to water supply wells or for discharge to Nose Creek. Active wells to the northeast of airport lands are not likely to be affected as groundwater flow is primarily to the southwest.

The PRP will not have any significant residual effects on groundwater quality after mitigation. The identified effects during construction and operations will be mitigated using BMPs for fuel and chemical handling. During operations, BMPs for de-icing practices and herbicide applications will be used to mitigate potential effects.

8.5.6 Cumulative Effects

Increasing urbanization with more hard surfaced areas and storm drainage systems tends to have a cumulative effect on reducing recharge volumes. However, if BMPs for stormwater management are

implemented by the Authority and the City of Calgary, any adverse effects should be minimal. Further, as the area is urbanized and serviced with municipal water, groundwater extractions from wells in the area will decrease, potentially counteracting the effect of reduced infiltration. Similarly, adverse cumulative effects on groundwater quality will be insignificant should BMPs for fuel/chemical usage be implemented.

8.5.7 Sustainability

Groundwater quantity sustainability measures that will be deployed as part of the PRP will include BMPs for stormwater management to maximize the amount of groundwater recharge below stormwater retention facilities in areas where geologic conditions and land use allow beneficial infiltration of runoff. Site specific BMPs will also be used to assist in sustaining groundwater elevations and recharge to deep aquifers.

The use of low impact, biodegradable herbicides and runway de-icing chemicals will reduce the potential for groundwater quality degradation while maintaining appropriate safety standards for the PRP.

8.5.8 Follow-Up and Monitoring

A follow-up and monitoring program will be established for the PRP that includes additional monitoring of groundwater elevations in selected wells within the vicinity of YYC.

8.6 Transportation

8.6.1 Introduction

Volume III, Chapter 8 examines effects that construction, operation and reclamation of the PRP may have on the existing transportation network in the vicinity of YYC.

Access to YYC from the west is via Airport Trail which connects to Deerfoot Trail, a major north-south expressway. Access from the north and south is via a connection to Barlow Trail north (Figure 1, Volume V, Item 6).

The City of Calgary designates certain roads or areas for use by trucks. The LSA is an Unrestricted Truck Zone that includes all public roadways as truck routes. Barlow Trail is designated as a Dangerous Goods Route (DGR) and High Load Corridor (HLC), while Deerfoot Trail is a designated DGR.

YYC is served by two bus routes: the North Crosstown Route 430 and the Airport/Erin Woods Route 57. Route 57 is the only one that will be affected by the PRP between 48 Avenue and Airport Road. YYC is also served by a number of charter bus and tour operators, some of which provide scheduled service to destinations outside Calgary. There is also a pedestrian and cyclist pathway that runs along Barlow Trail and accesses the airport terminal south of Airport Road.

Current traffic volumes on roads and pathways near YYC are provided in Volume III, Item 6.

8.6.2 Issues and Effects Hypotheses

Journeys by vehicles, pedestrians and cyclists beginning or ending at YYC are expected to be affected by road network changes, in particular the closures of Barlow Trail (between 48 Avenue and Airport Road) and McCall Way. The construction of access roads and truck traffic related to construction may temporarily disturb and/or change existing traffic patterns.

Travel times, particularly from YYC to downtown, hotels south of the airport and Peter Lougheed Hospital could be extended as a result of road closures as travellers are required to use alternative routes. People using the Route 57 bus to reach the YYC terminal may be affected. The pedestrian and bicycle pathway running alongside and its users may also be affected.

8.6.3 Effects Assessment

The City of Calgary's Regional Transportation Model (RTM), which was developed and is run by the City of Calgary Forecasting Division, provides a tool to review and compare present and future roadway network scenarios. The 2010 RTM provides information for the existing road network, taking into account currently ongoing and/or completed roadway projects such as the opening of Stoney Trail.

RTM's predictions for future traffic volumes took into account road closures and expected upgrades to the surrounding road network. With the upgrades in place, no road near the airport is expected to be over capacity by 2025.

The PRP will require more than 900,000 cubic metres of granular aggregates, equating to approximately 145,000 truck loads using tandem trucks. We anticipate aggregate will be sourced from nearby gravel pits. Two construction traffic routes are available - Stoney Trail, Deerfoot Trail, Country Hills Boulevard, 36 Street or Stoney Trail, Deerfoot Trail, Airport Trail, Barlow Trail. Truck traffic to and from YYC may affect haul routes.

The PRP development will alter the current bus service along McCall Way.

As a result of the new runway and the closure of Barlow Trail, the adjacent pedestrian and cycle pathway will be redesigned. The pathway from the south will no longer reach the terminal since it will be severed by Taxiway J and its apron.

8.6.4 Mitigation

PRP construction traffic will increase traffic volumes by approximately 2% for both morning and evening peak hours. The Authority is in the process of commissioning construction of a temporary haul route that will decrease the impact construction traffic will have on the Airport Trail/Road intersections with Barlow Trail north. There will be no significant effect on congestion and further mitigation will not be required.

Road network upgrades including 36 Street and Métis Trail and the widening of Country Hills Boulevard are expected to take place regardless of whether the parallel runway is in place. As a result, the effects of the PRP will have already been partially mitigated. Without the new upgrades, 2020 travel times would be higher and this effect would be compounded with the presence of the new runway and the closure of Barlow Trail. With the parallel runway in place, much of the overall road network will remain the same with the exception of Barlow Trail which will be closed south of Airport Road to 48 Avenue. As demand grows, it is predicted that Airport Trail and Airport Road will be upgraded to three lanes in each direction by 2020.

The City and the Authority are in the process of determining an alternative route that will allow Route 57 buses access to the terminal.

Calgary Transit also plans to provide regional Bus Rapid Transit (BRT) to YYC within the next couple of years via Airport Trail. There are also plans for train and/or LRT service to YYC in the long term.

Plans to modify and improve the pathway network are being developed by the Authority, with input and consultation from the Calgary Pathways & Bikeways Advisory Council (CPAC). The redesign of McCall Way will also determine whether the pathway will still reach businesses south of the terminal.

8.6.5 Residual Effects and Significance

Increases in peak hour travel times between various locations in Calgary and YYC are detailed in Table 8-14 of Volume III, Chapter 8. Travel times during off peak periods will be less.

The largest increase in travel time from the air terminal building to any one location is 9 minutes. None of the forecasted increases in travel time were determined to be significant.

Traffic currently using Barlow Trail will be redistributed to Métis Trail, 36 Street NE and Deerfoot Trail. With the development of the PRP, 36 Street NE is the only road that is expected to experience a noticeable increase in traffic volume as the current volume is small. The expected increase in traffic on this road will be mitigated by the planned upgrades to be undertaken by the City. Consequently, 36 Street NE will not experience congestion problems due to the PRP.

Although rerouting of Route 57 will increase travel times, this may be kept to a minimum when choosing a route option. The effect is, therefore, not considered as significant.

The number of pedestrians and cyclists who use the Barlow Trail pathway is small but modifications, improvements and the relocation of the pathway may encourage increased future utilization. PRP effects on the pathway will not be significant.

8.7 Land Use

8.7.1 Introduction

Volume III, Chapter 9 examines effects that construction, operation and reclamation the PRP may have on land use.

Land use in the vicinity of YYC is regulated by the Airport Vicinity Protection Area (AVPA) Regulation, introduced in 1979 and reviewed every five years. It is designed to control land use in areas affected by airport noise and is based on noise levels that were projected to occur when the parallel runway is operational. Land use in the cities of Calgary, and Airdrie and in Rocky View County is controlled by land use plans and bylaws which comply with the AVPA Regulation.

Land uses on YYC lands are related to the operation of an airport and include industrial and commercial uses. The Airport Master Plan (2004) provides a framework for development within this area which addresses the PRP. The PRP has been planned for 30 years and in response, the federal, provincial and municipal governments have been making appropriate planning decisions thereby mitigating the impact of the operation on YYC and sensitive land uses.

8.7.2 Issues and Effects Hypotheses

Development of the PRP could potentially affect land use on and off YYC lands. Property values within the airport vicinity could be affected by the construction and operation of the new runway.

8.7.3 Effects Assessment

The future development of YYC land is governed by the Authority's land use plan which accommodates the parallel runway and any commercial and light industrial development that will follow. There will be changes in land use including:

- The purchase of approximately 1.2 ha of (formerly) agricultural land directly north of the PRP to accommodate approach lights.
- The purchase of 1.77 ha, not currently owned by the Government of Canada.
- Use of land on which agricultural and commercial leases have expired for the airfield associated with the new runway.

Land use near YYC will not be altered as a result of the PRP. Development will continue as guided by the AVPA and Land Use Plans. Construction of the PRP does not necessitate any change to the Regulation or the Plans. Any non-conforming land uses will remain as is until landowners decide to develop, at which time, the proposed use will have to conform to existing land use plans.

Analysis of sale prices in Calgary communities near to and distant from YYC showed that changes in price were independent of proximity to the airport (Figure 9.7, Volume III, Chapter 9), which suggests that aircraft noise is not a significant determinant of property values. Factors such as population growth, job creation, infrastructure investment, and supply of housing units appear to be more important. For example, demand for growth and housing units might have a beneficial influence on property values.

8.7.4 Traditional Land Use

YYC lands were used for traditional purposes prior to the existence of the City of Calgary. Growth of the City and establishment of YYC as a passenger airport in 1939 displaced traditional use. There have been no traditional land uses on the lands since that time.

According to information received from Indian & Northern Affairs Canada (INAC), the proposed project location is part of a much larger area which is the subject of litigation filed by the Tsuu T'ina and the Kainaiwa Nations. The Métis Nation of Alberta has also asserted a right to harvest across the Province.

There is no evidence that the PRP would impact traditional land uses.

8.7.5 Mitigation

Mitigation for effects of the PRP on land use was put in place when the AVPA was enacted in 1979 and incorporated into the Authority's 2004 Master Plan. As no effect on property values, land use classification and traditional land use is anticipated, no mitigation is required.

8.7.6 Residual Effects and Significance

Changes in land use on YYC lands will be consistent with the Authority's land use plan. Land use plans for lands outside the boundaries of YYC will not have to change to accommodate the runway. Therefore, there will be no significant adverse effects on land use.

8.7.7 Cumulative Effects

As the PRP will not affect land use beyond YYC lands and YYC lands are reserved for airport and airport related development, it will not contribute to cumulative effects on land use.

8.7.8 Sustainability

Volume III, Chapter 18 indicates that building the parallel runway at YYC is the most sustainable means of servicing additional demand. This conclusion is supported by existing land use plans whereby development of land around YYC will continue as it would if the parallel runway were not built. There will be some minor changes to land use on YYC lands but these are concerned with where developments occur rather than whether or not they will occur. Finally, the analysis of changes in property values suggests that proximity to YYC does not influence changes in property values in Calgary communities. Consequently, there would be no adverse contribution to the economic component of sustainability on that account.

8.8 Noise

8.8.1 Introduction

Plans and regulations that were put in place in 1979 to control land use around YYC took into account airport operations, including those expected to result from the development of the PRP(see Section 7.7, Land Use).

The Authority operates a network of 14 noise monitoring terminals (NMTs) in communities around the airport. For the purposes of this assessment, the network was supplemented by an additional 15 noise monitoring stations (NMSs). Data from the monitors provides an understanding of the distribution of noise around YYC as it is now operated. Noise levels were found to be higher in communities closer to the airport and highest in communities nearest to the ends of runways and under the most frequently used flight paths.

8.8.2 Issues and Effects Hypotheses

When the new runway is in use, aircraft movements will be redistributed among the existing and new runways. This will mean that noise generated by aircraft will also be redistributed. Some locations and communities may experience less noise and some may experience more.

Increased aircraft noise levels may annoy people, may disturb sleep, may affect the cognitive development of school children, and may affect the amenity of outdoor spaces.

The new runway will affect ground traffic flow near YYC, which could increase road noise near some roads and decrease it near others.

8.8.3 Effects Assessment

AECOM developed a model to predict the distribution of aircraft noise in 2015 and 2025 with and without the parallel runway. The model was validated by predicting present noise levels and comparing them with data from the NMTs and NMSs. Predicted noise levels were based on assumptions about how aircraft movements will be assigned to runways in the future. As expected, predicted future noise levels differed from those experienced today. Without the new runway, the increase in air traffic in the future would increase noise levels, although this would be offset to some extent by changes in the fleet to quieter

aircraft. The new runway would substantially reduce the additional noise, especially at locations currently experiencing higher noise levels. Overall, in 2025, approximately 86,000 people would experience less noticeable noise with the new runway in operation than without it and none would experience more. The expected distribution of noise is described in more detail in Volume III, Chapter 15.

The likelihood of sleep disturbance depends on the number of events noisy enough to wake people. The model predicts the number of events likely to occur in the area around YYC based on the assumptions about airport operations that were used. The results suggested that in 2015 and 2025, there would be a reduction in the number of people most adversely affected, the number least affected would decline, and the number slightly or moderately affected would increase.

Predictions of future noise levels sufficient to interfere with speech or recreational activities, both indoors with windows open and windows closed or outdoors, showed similar results to those predicted for sleep disturbance. With the new runway in place as opposed to without it, it was found that the number of facilities and people exposed to higher noise levels would decrease but the level of exposure of those persons currently subjected to lower levels of noise would increase slightly. These effects are discussed further in the socio-economic assessment, Volume III, Chapter 14.

Assessment of changes in road traffic volume that might result from construction of the PRP showed that any increases in noise would be negligible.

8.8.4 Mitigation

ICAO's approach to noise mitigation at airports consists of reduction at source, land use planning and management, noise abatement operational procedures, and operating restrictions. It is a balanced approach and considers global issues of noise reduction at source through noise certification and compatible land use planning over operational procedures.

Designers and manufacturers of aircraft engines and aircraft as a whole have made significant improvements in reducing noise at source. Further improvements may occur but they are not under the control of the Authority. As noted earlier and in Section 7.7 above, the AVPA regulation and municipal land use plans that take into account expected airport noise have been in place since 1979.

As described in Section 8.8.3 above, building the new runway would be an effective way of mitigating the effects of noise at YYC. With the addition of options provided by the parallel runway, design of runway utilization offers the potential to optimize noise mitigation while maintaining safe operation.

NAV CANADA manages aircraft movements at YYC. Its noise abatement procedures include specific direction with regard to arrival and departure procedures and preferential runway use (day and night). It is expected that NAV CANADA will institute arrival and departure procedures for the new runway similar to those for the existing runways. As stated earlier, subject to weather constraints, assigning aircraft to particular runways offers further opportunity to mitigate effects of noise.

8.8.5 Residual Effects and Significance

Residual effects of aircraft noise and their significance are discussed in detail in the Human Health Assessment (Volume III, Chapter 15). As noted earlier, the general effect of the PRP on aircraft noise near YYC is to redistribute the noise. Based on the runway utilization assumed for future operations, the redistribution of noise if the new runway is built (as opposed to if it is not) will result in many people experiencing less noticeable noise and none experiencing more. That is a significant beneficial effect.

Changes in the number of noise events likely to result in sleep disturbance and the number of people likely to be highly annoyed by noise generated from the combined facility in the future were determined to be beneficial on balance, in others words conditions are predicted to improve with the PRP in place.

The following should be considered in understanding the conclusions about significance. Assumptions used in the noise forecasting were generally conservative, i.e., they would tend to overestimate noise. Actual effects may be less. Increases in noise at particular locations may be significant, as discussed in Volume III, Chapters 14 and 15, even if the overall effect of the runway is to reduce noise levels in communities and at sensitive facilities. Finally, the future runway utilization was selected to be feasible from an operational perspective and, at the same time, to show that the new runway could be an effective mitigator of noise.

8.9 Climate and Greenhouse Gases

8.9.1 Introduction

Volume III, Chapter 11 examines the effects the PRP may have on climate and GHGs.

Climate is an important variable in the atmospheric environment. It affects the fate and transport of air contaminants and is, in turn, affected by them. The PRP will emit GHGs, thereby contributing to national and provincial GHG emission totals.

Calgary has a continental climate with long, cold winters, and short, mild summers. Its dry, sunny, highly variable conditions are due to the City's high elevation (approximately 1,048 m above sea level), prevailing atmospheric circulation and regional topography. GHG emissions may affect future climate.

YYC’s GHG emissions currently account for a small fraction of one percent of provincial and national emissions, respectively.

8.9.2 Issues and Effects Hypotheses

The PRP has the potential to affect existing GHG levels during both construction and operations. Emissions generated by PRP construction will arise from operation of gasoline and diesel powered vehicles and equipment. Land clearing activities will also affect GHG emissions due to a reduction in carbon sinks. Construction activities involved in the PRP, which have the potential to contribute to GHG emissions include:

- construction of and use of temporary facilities and construction staging areas;
- general earthworks for site preparation, construction, and landscaping;
- installation of site services; and
- paving of runway, taxiways, and aprons.

PRP operations may affect GHG emissions via changes in aircraft operations, changes in local road traffic patterns, increased fuel consumption from an increased number of vehicles and machinery, and changes in airplane and road traffic volumes.

8.9.3 Effects Assessment

YYC’s GHG emissions inventory calculations for the PRP operations take into account the following sources:

- landing and takeoff operations (LTOs);
- road vehicles including both visitors' and employees' trips;
- airside movements, which include aircraft use of auxiliary generators, mobile generators, aircraft manoeuvring, air start compressors, ground vehicles, and equipment;
- stationary power generation plants;
- heating and air conditioning for buildings; and
- aircraft maintenance, engine testing, stationary emergency power generation units, airfield vehicles, aircraft de-icing and anti-icing fluid use, and fire training exercises.

The assessment projects this inventory into the future and compares predicted emissions in 2015 and 2025 with and without the new runway with current emissions and with each other.

Aircraft movements account for approximately 52% to 56% of the operational GHG emissions generated at YYC, followed by GHG emissions from Ground Service Equipment (GSE), and Auxiliary Power Units (APU). APU's that are used at YYC account for approximately 27% to 31% of the GHGs emitted. APUs are small, portable generators which provide hot air, hydraulic or electrical power to other equipment, e.g., parked aircraft. CO_2 emissions from aircraft activities are the major source of GHG emissions from the PRP.

GHG emissions from PRP operations will gradually increase over time due to increased aircraft traffic and associated GSE and APU operations. The total GHG emissions in 2015 with the PRP are predicted to be slightly higher than without the parallel runway. However, in the long term (by 2025) the total emissions with the PRP are slightly lower than would be the case without it. The PRP is expected to reduce GHG emissions in the future. These GHG reductions are predicted based on the substantial changes in aircraft movement times at the facility that will result because of the development of the new runway and taxiway system.

8.9.4 Mitigation

Construction phase mitigation measures will focus on reducing fuel consumption and increasing fuel efficiency. Mitigating the effect on GHG, APU and road traffic emissions from the operation of heavy diesel vehicles and equipment may include:

- minimization of vehicle idling and turning off equipment when not in use;
- implementation of BMPs to ensure vehicles and construction equipment are properly tuned and maintained;
- on-site speed limits; and
- careful selection of truck routes and vehicle movements to minimize travel distances.

Furthermore, land disturbance and land clearance will be minimized with efforts to revegetate areas as quickly and effectively as possible. These mitigation measures will be implemented as deemed appropriate by the construction contractor.

Mitigation measures for aircraft operations may include reduced engine power during taxi and idle stages, runway utilization to reduce taxiing distances, de-rated takeoff power, and the reduced use of reverse thrust. Mitigation measures for aircraft operations may not be feasible in all weather conditions and at times where safety considerations are a priority. Airlines and NAV CANADA manage flight operations and will determine what mitigation measures can be safely employed.

The purpose of the PRP is to alleviate future air traffic congestion. By implementing the PRP, future air traffic congestion is expected to be reduced, hence the PRP is a mitigation measure that is expected to help alleviate air traffic congestion and mitigate GHG emissions in the long term.

8.9.5 Residual Effects and Significance

Increases in GHG emissions will mirror PRP construction activities, i.e., they will be for a short - medium duration and of low magnitude. No significant adverse residual effects on GHG and climate change are expected.

Significant residual effects on GHG levels from PRP operations are unlikely as they are not expected to generate GHG emissions that are more than 10% of the baseline scenarios. Additionally, the project is expected to only contribute a small fraction of one percent of provincial and national GHG emissions by 2025.

8.9.6 Cumulative Effects

Although the effects of the PRP may be determined not to be significant, the cumulative effects of the PRP and other reasonably foreseeable projects could be significant.

The effects of past and existing projects or activities have been assessed including future development of airport lands. The GHG emissions from these projects may overlap spatially and temporally resulting in residual cumulative adverse effects. However, such effects will be low in magnitude and are not considered significant.

8.9.7 Follow-Up and Monitoring

The continued maintenance of an annual inventory of GHG emissions for both internal management and potential external reporting will be continued.

8.10 Air Quality

8.10.1 Introduction

Volume III, Chapter 12 examines the effects the PRP may have on air quality.

Air quality is important to the health and well-being of humans, wildlife and vegetation. Air is a key pathway for the transport of contaminants to environmental and human receptors.

Ambient air quality near the airport is typical of that found in other urban neighbourhoods. Atmospheric concentrations of carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and volatile organic carbons (VOCs) at air quality monitoring sites were found to be below Alberta Ambient Air Quality Objectives (AAAQOs). However, CO, NO_2, ozone (O_3), and particulate matter (PM) occasionally exceeded the AAAQOs.

There are several industrial sources of emissions in the LSA. PM emissions are largely attributable to open sources including agriculture, construction activities, landfill sites, mine tailings, paved and unpaved roads, forest fires, and prescribed burning. SO_2, NO_2, and VOCs are emitted by industrial sources, while CO emissions are from transportation sources.

8.10.2 Issues and Effects Hypotheses

The PRP has the potential to affect air quality during both its construction and operational phases. Construction phase effects will relate to the airborne PM and diesel emissions generated by construction activities. Following construction, the main effects on air quality will result from the change in emissions of local air quality pollutants, in particular NO_2 and PM caused by changes in airport operations and road traffic flows on routes to and from YYC.

8.10.3 Effects Assessment

The PRP may result in the increased discharge of several gaseous and particulate emissions into the atmospheric environment which, in turn, may result in possible changes to ambient air quality.

During construction, diesel exhaust and dust will be the primary emissions. Construction activities that may affect local air quality include:

- Construction of and use of temporary facilities and construction staging area.
- General earthworks for site preparation, construction, and landscaping.
- Installation of site services and paving of runway, taxiways, and aprons.

Operational phase emissions will be from aircraft, GSE, APUs, stationary sources within the airport facility, and airport related vehicle movements along local roads.

Predicted benzene and CO concentrations for the operational phase with the PRP are lower than those that would occur without it, while predicted PM concentrations are slightly higher. However, predicted maximum naphthalene concentrations for 2015 and 2025 with and without the runway do not differ.

Predicted NO_2 concentrations for the operational phase with the PRP are slightly lower than those that are predicted to occur without the new runway. It is expected that NO_2 levels in surface air beyond the airport property will be slightly lower if the PRP is completed than if not completed. PM emissions, on the other hand, are expected to increase slightly due to PRP operations.

The maximum predicted concentrations of air pollutants at the project boundary during the PRP operational phase are expected to have an insignificant effect on air quality in neighbouring residential communities.

8.10.4 Mitigation

Mitigation of effects from the operation of heavy diesel vehicles and equipment may include:

- minimization of vehicle idling and turning off equipment when not in use;
- on-site speed limits and implementation of BMPs to ensure vehicles and construction equipment are properly tuned and maintained; and
- careful selection of trucking routes and vehicle movements to minimize travel distances.

Dust mitigation measures will be managed collaboratively by YYC, the City of Calgary, the construction manager, and Alberta Environment. Mitigation measures may include:

- installation of temporary fencing and implementing street sweeping during construction;
- application of water to loosen materials and expose earth during construction;

- prevention of erosion to minimize the extent and duration of bare ground surface exposure; and
- development of a balanced earthwork management plan and keeping as much excavated earth on-site as possible to reduce off-site hauling.

Additionally, following land clearing, efforts will be made to revegetate appropriate areas quickly.

Mitigation of emissions from the operation of the GSE fleet and APUs may include:

- minimization of vehicle idling and turning off equipment when not in use;
- using electric driven APUs and ensuring GSEs are properly tuned and maintained; and
- implementation of on-site speed limits.

Mitigation measures for aircraft operations may include the following:

- reduced engine power during taxi and idle reduces the associated emissions substantially; and
- de-rate takeoff power and reduce use of reverse thrust.

8.10.5 Residual Effects and Significance

The effects of construction activities related to the PRP on air quality will be of a short to medium term duration and will likely be of low magnitude for the LSA. Operational effects of the PRP on air quality will be low in magnitude and have a local geographical extent. No significant residual effects on ambient air quality are expected.

8.10.6 Cumulative Effects

Although the effects of the individual interaction of the PRP with air quality may be determined to be not significant, the combined effects of various other activities with project activities may be significant.

Emissions from other current and future planned projects may overlap spatially and temporally with those from the PRP resulting in residual cumulative adverse effects. Such effects will have a local geographical extent, be low in magnitude and are not considered significant.

8.10.7 Follow-Up and Monitoring

The maintenance of an air emissions inventory for both internal management and potential external reporting will be continued.

8.11 Cultural Resources

8.11.1 Background and Baseline

In 2001, under the *Alberta Historical Resources Act* (1980), the Authority commissioned Fedirchuk McCullough & Associates Ltd. (FMA) to conduct an Historical Resources Impact Assessment (HRIA) and Cumulative Effects Assessment (CEA) of YYC. If the HRIA had not been previously undertaken on the PRP footprint, an identical assessment would have been performed as part of the CS.

FMA discovered that YYC property possesses few archaeological sites (historical or paleontological), and those present were not considered to be unique historical resources in a regional context. Only a small number of sites commonly found were represented. The report indicated that YYC sites have, for the

most part, already been removed or substantially disturbed, or are of low interpretive value. The report recommended mitigation measures for two of the sites which were implemented by FMA in 2006 under the Authority's direction.

The Cultural Resources Baseline Report for the CS may be found in Volume V, Chapter 11. It includes the FMA reports in their entirety as appendices.

8.11.2 Potential Effects and Significance

As no sites require further mitigation, one may conclude that the PRP will have no significant adverse effects on cultural resources. This conclusion is based upon the comprehensiveness of the HRIA, which was deemed acceptable by Alberta Culture and Community Spirit.

Cumulative effects were also considered by FMA. They concluded that, individually or collectively, the historical or paleontological sites within the airport property were of no significance in a regional context. Consequently, it is concluded that the PRP will have no significant adverse cumulative effects on cultural resources.

8.11.3 Inspection

An ECO Plan has been prepared for the PRP by the Authority, and is attached to the CS as Volume V, Chapter 14. The Plan includes a map showing the sites identified by FMA. The ECO Plan will be provided to all contractors grading or excavating the site, and during construction, the Authority will deploy environmental inspectors.

Should evidence of cultural resources be discovered anywhere, except at sites identified by FMA, the contractors will report their findings to the environmental inspectors. The inspectors will examine the evidence and, if appropriate, summon a qualified archaeologist to investigate the site. A report will be presented to Alberta Culture and Community Spirit if the qualified archaeologist determines that the site should be recorded, and the Authority will undertake any mitigation recommendations.

8.12 Socio-Economics

8.12.1 Introduction

Volume III, Chapter 14 examines the effects the PRP may have on the socio-economic environment or "community wellbeing", defined by AECOM as:

> *"a state of Economic, Physical, Human, Social and Natural Assets (Community Assets) possessed or desired by a community which enables its residents, organizations and institutions to support each other in performing all the functions of life and in developing their maximum potential"*

The City of Calgary, City of Airdrie and Rocky View County are characterized as having a reasonably healthy balance of Community Assets that contribute to the well-being of their residents.

Local municipalities have and will continue to experience population growth. Most communities near YYC are well established urban neighbourhoods. Both local and regional residents provide high ratings of the feelings of personal health and safety, overall community satisfaction and high levels of confidence in ongoing YYC operations. YYC operations are not considered as an adverse influence on people's

feelings of health, safety or their community satisfaction. Rather, YYC is an important contributor to the well-being of Calgarians and residents of the Calgary Economic Region (CER).

In 2007, YYC was associated with approximately 3.8% of total employment within the CER, generated over $1 billion in labour income and directly contributed approximately $2.9 billion to the annual Gross Domestic Product (GDP). The total value added GDP contribution of YYC (including direct, indirect and induced labour income and other expenditures) is approximately $6 billion annually. Further, spending by non-resident visitors (i.e., visitors, tourists and cabin crews) arriving by air through YYC generated an additional $159 million in labour income in the Calgary area. YYC helped to attract approximately 4.85 million person-visits to the Calgary area. In 2009, the Authority paid approximately $4.72 million in taxes to the City of Calgary.

8.12.2 Issues and Effects Hypotheses

The PRP is expected to result in both beneficial and adverse socio-economic effects through direct, indirect or induced means. Most importantly, the PRP will enable other socio-economic effects. The term “enable” refers to those effects that are likely to occur because of the new capacity that the PRP provides during its operations phase. These “enabled” effects are the result of the increased landings, enplaning/ deplaning passengers and visitor spending that will likely occur but would not be possible without the new runway.

8.12.2.1 Human Assets

Effects on population levels and demographics, skills and labour supply may occur due to the need for construction labour, including skilled trades people and the potential for new residents to be attracted to the study areas due to the employment opportunities enabled by the PRP. Changes in a community’s natural assets (air quality, noise), increased traffic or changed traffic patterns may disrupt operations at schools, health and safety facilities and change people’s feelings of health, safety or community satisfaction. People may choose to change their community if widespread changes in their attitudes result.

8.12.2.2 Economic Assets

PRP construction and operation may generate new employment opportunities and business activity due to project requirements and spending, enable further employment and business activity, thereby positively affecting GDP. Increased visitor spending may result in beneficial effects for accommodation providers and tourist-related businesses. Changes in a community’s natural assets (air quality, noise), increased traffic or changed traffic patterns may affect individual business operations and property values. An expanded airport will serve to increase economic development opportunities and facilitate the implementation of the City’s economic development strategy.

8.12.2.3 Physical Assets

The PRP may place additional direct and indirect demands on municipal infrastructure and service (e.g., housing, water supply, sewage, and conventional waste management). The presence and operation of an expanded airport may have both beneficial and adverse effects on the character of local communities, particularly if the pattern of aircraft overflights changes substantially.

8.12.2.4 Social Assets

Public access to recreational trails on the YYC site may be affected. Changes in a community's natural assets, increased traffic or changed traffic patterns may affect the use and enjoyment of recreational facilities / property and ultimately community cohesion. Both beneficial and adverse effects are possible.

8.12.2.5 Natural Assets

Nuisance effects of the PRP during construction (e.g., noise and dust) and operational aircraft noise may affect a variety of community assets.

8.12.3 Effects Assessment

8.12.3.1 Human Assets

Population and Demographics

Growth in the Calgary region is expected to continue, resulting in increased population densities, intensification and urbanization. Although the PRP construction phase has the potential to attract new people to the RSA, no measurable effects on local or regional demographics, social structure and stability are likely since the majority of construction jobs will be filled by existing residents. During operations, the employment generated by the PRP will mean that more local residents will be associated with or dependent on the presence of the airport due to their economic links. Should some people choose to move from their communities as a result of changed attitudes toward their community and/or YYC, measurable effects on population levels are not likely.

Skills and Labour Supply

A sufficient supply of skilled workers will be available for PRP construction. Because labour mobility and supply is of great importance to the regional and provincial economies, the PRP will facilitate the movement of skilled labour over the long term.

Education

PRP construction will not place any direct demands on schools and direct environmental effects are unlikely to disrupt school activities during construction. However, school bus travel times may potentially be affected by increased traffic on arterial roads. It is not anticipated that activities at existing schools will be disrupted because the PRP will result in a net decrease in the exposure of schools to aircraft noise. The AVPA regulations will serve to avoid having new schools constructed too close to the parallel runway.

Health and Safety Facilities and Services

YYC will be self-sufficient during the construction phase in terms of fire, policing and emergency health care. The availability of these services to nearby communities shall not be affected. It is not anticipated that the closure of Barlow Trail between 48 Avenue and Airport Road will affect levels of service. Increased aircraft noise is not expected to disrupt health care facility operations, including the Peter Lougheed Centre.

Social Services

The PRP is not expected to directly or adversely affect social services but beneficial effects on other Community Assets may produce indirect beneficial effects on social services.

Economic Development Services

The PRP will directly contribute to increased local and regional economic development throughout each project phase. Local and regional economies will be stimulated by greater employment, income and business opportunities leading to more investment and increased economic development opportunities. The PRP will support the successful implementation of the City of Calgary's economic development strategies and initiatives via increased international awareness, visitation, mobility of goods and labour, and creating business connections.

8.12.3.2 Economic Assets

Employment

The PRP construction phase will generate direct, indirect and induced employment and the operational phase will enable YYC and others to generate employment across the RSA. The PRP construction is expected to generate approximately 890 jobs per year across the RSA and its operations will enable the creation of a further 3,746 jobs per year.

Business Activity

PRP construction will create direct business activity due to project related spending of $452 million on goods and services. The added direct annual contribution to GDP is expected to average $30 million per year with a peak of $49 million in 2012. The total annual GDP contribution will average $102 million per year. Changes in the road network necessitated by the PRP are not anticipated to adversely affect access to most commercial and industrial business operations at YYC or off-site.

The PRP will enable an increase in the number of landings, embarking and disembarking passengers and visitor spending enabling businesses located at YYC to grow. Increased revenue enabled by the PRP is expected to average $988 million per year. Between 2015 and 2025, the PRP is predicted to generate $263 million per year in direct GDP within the region and will enable YYC to double its contribution to the regional economy within the first few years of operation. The total annual GDP contribution is expected to grow to $1.4 billion by 2025. The PRP will also positively affect business activity via the opening of new markets, facilitation of communication between companies and clients, and the improved capacity and reliability of product delivery.

Tourism

The PRP will enable the growth in passengers at YYC from approximately 17.4 million in 2015 to 24 million in 2025. Growth in visitor spending will also be enabled, increasing from $40 million per year in 2015 to over $453 million per year in 2025. This is expected to result in the improved economic viability of tourism-related businesses, and increased investment in hotels and motel operations and tourist-related businesses. The small increase in travel time to hotels and motels nearest YYC is not expected to have a measureable effect on people's choice of hotels nor occupancy. There is the potential for increased costs for those accommodation providers that operate airport shuttle services that utilize Barlow Trail or McCall Way and for those travelling to/from airport hotels and areas immediately south of YYC.

Income

PRP construction will generate direct, indirect and induced employment resulting in increased labour income. PRP operation will enable YYC and others to generate labour income. PRP construction is expected to generate approximately $101 million in direct labour income and $265 million in total enabled income.

Municipal Finance and Administration
The PRP is not likely to directly affect the municipal finances or administration of the City of Calgary, but the growth that it enables will serve to increase revenues to the City.

Property Values
Residential property values are also considered as Economic Assets. Volume III, Chapter 9 demonstrates that the PRP is unlikely to affect property values in the vicinity of the airport.

8.12.3.3 Physical Assets

Housing
PRP construction is not expected to result in a substantial increase in demand for permanent housing.

Municipal Infrastructure and Services
Modifications to YYC's existing water distribution system will not disrupt potable water supply on or off-site. PRP operations will increase the demand for potable water and sewage treatment. Effects on the City's available supply and treatment capacities are unlikely. PRP construction will generate conventional wastes which will be reused and recycled where possible. The increase in demand for municipal waste management services will be negligible.

Community Character
Community character refers to the unique or distinctive qualities of a community. The PRP represents a strengthening of an existing, planned and growing industrial presence in northeast Calgary. A fundamental change in community character is not expected from increased traffic or changed traffic patterns. Overall, the number of overflights in LSA communities will increase over time. The adverse effects on the few communities that may experience increased numbers of noticeable overflights will be more than offset by the substantial reduction of noticeable overflights in many other communities in northeast Calgary.

Other Physical Assets (Air Transportation)
The PRP is expected to reduce airport congestion and improve air transport infrastructure, hence operating costs for transport operators may be reduced. Furthermore, it is estimated that the PRP will result in overall savings of $108 million per year in avoided air travel delays. The PRP will be a positive influence on community well-being as a result of improved airport operations and travel.

8.12.3.4 Social Assets

Community and Recreational Facilities and Programs
Individuals using the Airport Path leading from Pegasus Road NE to the terminal will lose this amenity due to the PRP. Construction noise, dust and traffic are also expected to affect outdoor activities undertaken at recreational facilities south of the airport. Overall, noise conditions in the LSA would worsen without the PRP. During operations, the potential adverse effects on a few community and recreational features that may experience more noise will be more than offset by the substantial reduction of noise at many other features. No measureable changes in the demand for recreational facilities are expected as a result of the PRP.

Residents' Use of and Enjoyment of Private Property
The ability to use and enjoy one's property is considered a major determinant of a person's community satisfaction. The PRP will not limit how people use their property. Overall, noise conditions would worsen across the LSA without the PRP. During operations, the potential adverse effects on a few local residents

that may experience increased noise will be more than offset by the substantial number of people that will experience a reduction of noise levels in their communities. The closure of Barlow Trail between 48 Avenue and Airport Road will disturb people's day-to-day travel patterns during the construction phase. Planned improvements to the local road network will serve to mitigate this effect during PRP operation.

Community Cohesion
Community cohesion maintains and generates relationships and community pride via a common vision. More people will work at YYC, in its vicinity and in the general aviation industry as a result of the PRP. Therefore, the PRP will increase opportunities or enable YYC to strengthen its role as an economic driver and corporate citizen. Measurable adverse effects are consequently considered unlikely.

8.12.3.5 Natural Assets

Socio-economic environmental effects primarily relate to Noise (Volume III, Chapter 10) and Air Quality (Volume III, Chapter 12).

Public Attitudes towards Health and Safety, Community Satisfaction, YYC and Community Well-Being
Widespread or severe changes in people's feelings of personal health and safety, people's overall satisfaction with community or their confidence in operations at YYC are not anticipated. People are likely to continue to feel healthy, safe and satisfied living in their communities.

8.12.4 Mitigation

8.12.4.1 Human Assets

The Authority will continue to share information and cooperate with government, labour groups, local and regional land use planners, and economic development officials regarding the timing and extent of its on-site labour demand and YYC planned development projects. A Traffic Management Plan will be implemented to maintain safe traffic conditions and minimize disruption to school buses and other road users within the vicinity of YYC during construction.

During construction, security fences, gates, locks and access restrictions will be implemented around the construction site. Site personnel will also facilitate the flow of vehicles entering and leaving the construction site.

8.12.4.2 Economic Assets

A Traffic Management Plan will be implemented to maintain safe traffic conditions and minimize disruption road users within the vicinity of YYC during construction. The Authority will continue to share information with local and regional tourism organizations with regard to the timing and extent of its on-site labour and the expected growth in passenger numbers.

8.12.4.3 Physical Assets

The Authority is working with the City of Calgary to address water supply and sewage treatment needs. Regarding conventional waste management, the Authority will implement a waste reduction, reuse and recycling program for the wastes generated during construction.

8.12.4.4 Social Assets

To address the permanent closure of the Airport Path, safe bicycle lanes and paths for access to and from YYC has been designed with input from the Calgary Pathways & Bikeways Advisory Council. The Authority will continue to communicate with its neighbours and stakeholders with respect to activities at YYC.

8.12.5 Residual Effects and Significance

Tables 14-22 and 14-23 in Volume III, Chapter 14 summarize the assessment of significance of the residual beneficial and adverse effects of the PRP. Table 14-24 indicates that the PRP will result in a net beneficial effect on community well-being.

8.12.5.1 Human Assets

No residual adverse effects on human assets are anticipated. The PRP will have both minor and major beneficial effects on skills and labour supply, and on economic development services, respectively.

8.12.5.2 Economic Assets

The PRP will result in major beneficial effects on employment, business activity and visitor spending. Other beneficial effects of the PRP will be experienced by the tourism sector and other businesses due to increased visitor spending, improved air service capacity and reduced congestion at YYC. The PRP will increase total income and enable increased property tax revenues for the City. These are considered minor beneficial effects. The potential for increased costs for some accommodation providers and others travelling to and from the airport is considered to be a minor adverse effect.

8.12.5.3 Physical Assets

No residual adverse effects on housing, municipal infrastructure and services, and air transport are anticipated due to the PRP. The major beneficial effects of the PRP on the character of several communities more than offset the minor adverse effects on a few communities.

8.12.5.4 Social Assets

The major beneficial effects of the PRP on the use and enjoyment of community and recreational features and private property more than offsets the minor disruption that is likely to occur. Some residents will experience disruption to their day-to-day travel patterns. This is considered to be a minor adverse effect largely mitigated by planned improvements to the road network during PRP operations. No residual effects on community cohesion are likely to result from the development and operation of the PRP.

8.12.6 Cumulative Effects

In order to accommodate the extraordinary growth in passenger levels that has occurred and is anticipated to continue into the future, YYC has prepared plans to construct additional facilities to meet the predicted demand in passengers and aircraft movements. As described in Volume II, Chapter 7, the most significant of the planned facilities are the International Facilities Project (IFP), an air traffic control (ATC) tower to be built by NAV CANADA, an emergency response services (ERS) / satellite fire hall, and a de-icing facility. In addition, lands at YYC and in the vicinity will continue to develop. Finally, there are several planned improvements to the City of Calgary’s road network.

Given that most adverse effects of the PRP are unique to airport operations, there are few interactions between these effects and other projects and activities. Other projects at YYC and ongoing land development will likely result in increased traffic on arterial roads nearest YYC. Concurrent construction activities at YYC will contribute to the magnitude of nuisance effects within areas in close proximity to YYC during the PRP construction phase. No cumulative effects are likely during the operations phase. Ongoing land development will contribute to existing community noise and traffic levels during the operations phase.

8.12.7 Sustainability

The Calgary Airport Authority has embraced sustainable development as an important aspect of its business. With respect to community well-being, the Authority's commitments to sustainability were considered in the planning and design of the PRP by:

- ensuring that on-site health and safety facilities and services are available for workplace accidents and injuries, and that acceptable response times to the east airfield are maintained;
- timing of the construction phase during a period of time where there exists excess labour supply in Alberta and the commencement of operations in time to adequately service the anticipated growth in visitation to the Calgary area; and
- maximum utilization of excavated material at YYC, concrete and asphalt recycling on airport lands, and the reuse and recycling of salvaged materials.

The Authority's commitment to community involvement was demonstrated by the open and transparent manner in which this EA and the Socio-economic Assessment in particular was conducted, providing various opportunities for community members, organizations and institutions to share their views and perspectives regarding the beneficial and adverse effects of the PRP on community well-being. These opportunities included PRP specific public open houses, meetings, stakeholder interviews, public attitude research, and the Authority's outreach program and stakeholder interviews.

Overall, the PRP will result in a net beneficial effect on community well-being. It is anticipated that people are likely to continue to feel healthy, safe and satisfied living in their communities during PRP construction and its ongoing operation. The PRP and its enabled development is expected to improve the state of the community assets possessed by local and regional communities and will support their residents, organizations and institutions in achieving their maximum potential.

8.12.8 Follow-Up and Monitoring

As follow-up and monitoring to this Socio-economic Assessment, the Authority intends to:

- Undertake Public Attitude Research to verify predictions made in the EA regarding changes in public attitudes and behaviours during the PRP construction and operations phases. Focus of the research should be on the LSA and those communities where the greatest beneficial and adverse effects were anticipated.
- Conduct a field survey of key stakeholders (e.g., airport visitors, taxi / limousine operators, hotel / motel operators) to verify the predictions contained in the CS regarding the effects of the PRP on tourism.
- Undertake a detailed economic analysis of YYC following the completion of the PRP and IFP to verify the beneficial effects of these projects on Human and Economic Assets.

8.13 Human Health

8.13.1 Introduction

Volume III, Chapter 15 examines the effects that the construction, operation and reclamation of the PRP may have on human health.

A Human Health Risk Assessment (HHRA) has been completed as part of the CS. The HHRA relies on conclusions about effects on Noise and Air Quality presented in Volume III, Chapters 10 and 12, because those predicted effects may, in turn, affect human health. The HHRA also considers the possible health effects that may result from the use of chemicals on YYC lands for vegetation control, runway maintenance and de-icing and others specified in the report.

8.13.2 Issues and Effects Hypotheses

The potential for health effects arising from the PRP may arise from the following factors:

- aircraft noise, traffic noise and airport ground noise and vibration;
- air quality changes resulting from aircraft and other emissions; and
- changes in the amounts and mode of chemical use.

Noise may affect human health by increasing annoyance, disturbing sleep, interfering with speech, and impairment of cognitive development in children.

8.13.3 Effects Assessment

8.13.3.1 Aircraft Noise

Annoyance
The noise assessment (Volume III, Chapter 10) reports current (i.e., baseline) noise levels in the vicinity of the airport and predicts noise levels in 2015 and 2025 with and without the new runway. The number of people likely to be annoyed was estimated using a method developed by Health Canada(HC). The method uses weighted average daily noise levels which incorporate a larger contribution from night-time noise. Differences between baseline noise levels and predicted future levels provide the basis for estimates of the number of people who will be annoyed. The assessment indicated that in 2025, 86,000 community residents would experience less noticeable noise with the new runway as opposed to without and none would experience more.

Sleep Disturbance
It is predicted that by 2025, building the new runway would result in a significant decrease in the number of people exposed to higher probabilities of sleep disturbance. Some people exposed to a low probability of sleep disturbance if the runway is not built would experience a small increase if it were built.

Childhood Cognitive Development
Epidemiological evidence indicates a link between certain community noise sources and the impairment of cognitive development. However, the relationship between aircraft noise and cognitive development cannot be defined with any confidence based upon any numeric model due to degrees of uncertainty among individuals.

No adverse effect on cognitive development within formal learning institutions is predicted with the operation of the PRP. While no schools are predicted to experience unacceptable effects either currently

or in the future, building the new runway is nonetheless expected to have a strong beneficial effect by reducing noise levels that would be in the 55 to 70 dBA range without the runway.

Possible Effects on Other Sensitive Populations

Five health centres are expected to benefit from reduced noise levels or experience little change based on completion of the PRP, while one other health centre may experience an increased probability of sleep disturbance to overnight patients. The predicted changes in the likelihood of awakening were considered to be a minor change. By 2025, 55 community centres are predicted to experience less noise if the runway is built and five are predicted to experience more.

8.13.3.2 Traffic Noise

The closure of Barlow Trail between 48 Avenue and Airport Road will cause the majority of road traffic to be diverted onto Métis Trail and Deerfoot Trail, and a smaller amount to 36 Street NE. Traffic on McKnight Blvd. will decrease. The estimated change in traffic noise along Deerfoot Trail, Métis Trail and 36 Street NE during the operational phase of the project is likely to be negligible.

8.13.3.3 Airport Ground Noise and Vibration

Engine test run-up, mobile and fixed power generation plants at or near YYC all have the potential to produce noise and vibration. Due to the large separation distances (normally over 1,000 m) from PRP sources of noise and ground vibration to sensitive receptors and premises beyond the airport perimeter, there is very low potential for these types of disturbances to be felt beyond YYC lands. Engine test run-up noise is currently intermittently audible beyond the YYC perimeter but the development of the PRP is not predicted to affect these noise intensities.

8.13.3.4 Aircraft Emissions and Airport Air Quality

With the exception of NO_2, airborne contaminant concentrations are expected to be lower with the PRP than without it.

With one exception, predicted air emissions from PRP operations are predicted to be lower than ambient air quality criteria, indicating no significant adverse effects and no requirement for mitigation. The exception is NO_2, concentrations of which may occasionally exceed air quality criteria at the edge of YYC lands. Overall, predictions for naphthalene, benzene, CO, and NO_2 concentrations are that they will generally be lower for the LSA in 2015 and 2025 with the development of the PRP than they would be without it.

The maximum NO_2 levels associated with aircraft emissions and related sources following the completion of the PRP are predicted to exceed estimated background concentrations by 13 to 20 fold. However, while risks to residents immediately beyond the YYC lands associated with NO_2 are likely to be minimal, the measured and predicted concentrations support the need for follow-up measures to ensure that NO_2 concentrations do not exceed threshold concentrations that could potentially lead to chronic or acute exposure.

8.13.3.5 Chemical Use

Chemical use at YYC includes aircraft and runway de-icing agents, herbicides and solvents for aircraft tire rubber removal. Potential for human exposure of residents near the airport to these chemicals is negligible since application areas are all contained to the YYC and these are closed to the public. The

possibility of human exposure to these chemicals through their introduction into surface waters or to groundwater is considered minimal. Runoff water leaving YYC lands either by means of storm drainage or through infiltration into the soils beneath the airport, does not reach any known human drinking water source. Further, the stormwater management program effectively contains and treats any releases of these types of compounds; while the low permeability of aquitards beneath the airport will effectively prevent the contamination of regional groundwater

8.13.4 Mitigation

Health risk management may be achieved by reducing the levels of a recognized stressor, pathogen or toxicant at its source, reducing the amount of exposure experienced by a potential receptor by altering the nature of the exposure route(s), and/or by removing humans from areas of high exposure potential.

8.13.4.1 Noise

Mitigation strategies to address changes in noise exposure are described in Volume III, Chapter 10 and include the design of airspace operations with the objective of reducing noise exposures to acceptable levels, while maintaining the primacy of operational safety considerations. Collective actions and adaptive management are known as Noise Abatement Procedures (NAPs) for YYC. NAPs are a set of published rules outlining how aircraft are to be operated on arrival and departure. For YYC, this also considers preferential runway use. Continued implementation of these NAPs following the completion of the PRP is expected to substantially reduce the number of persons that could potentially be exposed to noise effects thresholds.

8.13.4.2 Emissions and Air Quality

Proposed mitigation measures for construction phase activities related to air quality are set out in Volume III, Chapter 12. They include dust control measures.

8.13.4.3 Chemicals Use

Mitigation against chemical effects will be achieved by the implementation of sustainable chemicals management programs, such as the YYC Glycol Mitigation Plan and the application of BMPs.

8.13.5 Residual Effects and Significance

There will be some redistribution of effects on individuals corresponding to changes in the distribution of noise near the airport when the new runway is in operation. Overall, the net effect of changes on noise levels attributable to the new runway on the percentage of people highly annoyed is considered beneficial. With the new runway in operation, most people subject to high probabilities of sleep disturbance caused by aircraft generated noise will experience a reduction in the effect in comparison with what would be expected if it were not built. Although many people experiencing lower probabilities of awakening will experience a slight increase, the net effect is considered beneficial. No significant effect of the project on the cognitive development of children is predicted and other sensitive populations are not expected to be significantly affected.

No significant residual effects on air quality are anticipated. As a result no significant health effects are predicted to arise from the construction and operation of the PRP as a result of changes to air quality.

Any residual effects of chemicals use at the PRP may be minimized or eliminated by their judicious use within the guidelines of a sustainable chemicals management framework which is based on adaptive management approaches and supplemented with adequate ongoing monitoring. A chemical management plan that meets these criteria is in effect at the YYC and will be expanded to include the PRP when it becomes operational.

9. Accidents and Malfunctions

9.1 Introduction

Airport operations may cause serious accidents or malfunctions resulting in adverse effects. Construction activities may give rise to accidents or malfunctions. In the course of airport operations, the risk of accidents may be increased with an increase in aircraft traffic (including runway crossings) and other activities.

Accidents and malfunctions associated with the construction and operation of the PRP include:

- Aircraft accidents;
- Aircraft - wildlife collisions;
- Vehicle accidents;
- Vehicle - wildlife collisions;
- Major leaks or spills of hazardous substances; and
- Accidental fires.

9.2 Aircraft Accidents

The most severe potential effect of an aircraft accident or malfunction is human casualties. Aircraft accidents also have local economic effects, both spatially (on industry surrounding the PRP) and temporally (delays to operations). The likelihood of such an occurrence is low.

The Authority has an Emergency Procedures Manual which details response measures for any incident or accident.

9.3 Aircraft - Wildlife Collisions

The Authority has developed a Wildlife Management Plan, including Tenant Wildlife Control Guidelines (TWCG) to mitigate through structure and landscape design the potential for bird strikes to occur.

The Wetland Strategy for Reducing Bird Strike Risk (WSRBSR) is another component of YYC's Wildlife Management Plan whereby the activity of waterfowl is restricted through habitat modification and exclusion, use of repellents, wildlife harassment, and removal. The continued use of these management plans following the completion of the PRP is not expected to have any significant long term effects upon wildlife populations in either the LSA or RSA.

9.4 Vehicle Accidents

Collisions between ground vehicles and between ground vehicles and aircraft could occur during construction and operation. The ECO Plan and other construction management documents adopted for the PRP construction stage will outline the best management practices for on-site and off-site ground traffic.

The underpasses that are planned for Taxiway Juliet and Taxiway Foxtrot as part of the PRP would eliminate the risk of aircraft vehicle/ground vehicle interaction.

9.5 Vehicle - Wildlife Collisions

Although increased traffic during construction will increase the risk of vehicle-wildlife collisions, this risk level will still be low and any wildlife loss would not be regarded as significant to overall regional wildlife populations.

9.6 Leaks and Spills of Hazardous Substances

During the construction and operation of the PRP, numerous hazardous materials will be employed which possess the potential to cause adverse effects to the environment.

Spills management in the PRP will be dealt with by the Authority's Environmental Emergency Contingency Plan. The handling and storage of hazardous substances and any reporting procedures are regulated by existing Authority practices (Volume V, Item 14). These practices will be expanded to include the PRP.

9.7 Accidental Fires

The construction and operational phases of the PRP could cause accidental fires. Refuelling of aircraft and vehicles poses the most notable fire risk.

Fire control measures for the PRP will be designed and implemented for the construction and operational phases, complying with federal and provincial regulatory requirements. Fire control systems will be integrated into the Authority's existing systems and will conform to current industry accepted best management practices and standards. Fire and emergency drills alongside cooperation with municipal fire services will also ensure a ready state of preparedness and a contingency should a fire spread beyond YYC lands.

10. Effects of the Environment on the Project

Environmental conditions that have the potential to affect the PRP during its construction and operation include extreme weather conditions, climate change, wild fires, and seismic events. The effects of such conditions may vary from minor delays to catastrophic failure.

10.1 Extreme Weather

The primary effects of extreme weather would be delays in construction and operational activities plus any associated economic costs. Torrential rain, heavy snowfall and ice storms may cause disruption to utilities, transport infrastructure and alternative services, while extreme weather events including tornados or blizzards possess the potential to seriously damage the PRP.

Mitigation of weather events has been incorporated into the best practice construction management techniques and existing airport operating procedures. Consequently, the risk of extreme weather having an adverse effect on the PRP is low.

10.2 Climate Change

Because of the timeframe over which significant changes to precipitation and temperature are forecast to occur, the effects of these types of changes upon the PRP are considered as minor, i.e., there will be no immediate effects. Any potential effects of this kind may be mitigated by the implementation and adjustment of the YYC's adaptive environmental management practices.

10.3 Wild Fire

The potential effects of wild fire on the PRP could range from minor (construction delays and operation interruption) to substantial (damage to infrastructure, vehicles). Mitigation measures (including a fire and emergency response plan) already operational under the Authority's Environmental Management Plan will be extended to the PRP.

10.4 Seismic Events

The magnitude of seismic activity in Alberta is low. Nevertheless, the Authority adheres to National Building Code Standards on seismic risk. Seismic events that could affect the project in any detectable manner are very unlikely.

11. Effects on Other Airports

The operational effects of the PRP upon the following surrounding airports were assessed:

- Springbank Airport (YBW);
- Olds/Didsbury;
- Beiseker;
- Airdrie;
- Strathmore (Murray Airfield);
- Okotoks Air Ranch; and
- High River.

The potential socio-economic effects of the PRP upon the following regional airports were also assessed:

- Springbank Airport (YBW);
- Cranbrook (YXC);
- Lethbridge (YQL);
- Red Deer (YQF); and
- Medicine Hat (YXH).

11.1 Operational Effects

NAV CANADA defines the airspace associated with YYC as a “Terminal Area”, a 35 nautical mile radius around the airport which extends to an altitude of 25,000 feet (7,620 m) above sea level (ASL). The Terminal Area is used to stage arrivals and departures thereby maintaining a controlled inflow and outflow of air traffic.

The Calgary Terminal Area covers a large area and volume of airspace, and it directly affects many airports within its vicinity due to the operational requirements for air traffic control. The parallel runway will result in the reconfiguration of the Calgary terminal airspace due to the requirements of air traffic operations with parallel runways e.g., entry and exit waypoints to the Terminal Area may need to be altered. Aircraft operations at other airports may consequently be affected due to aircraft having to fly alternative routes than those currently defined. The most affected airports are those located within the Calgary Terminal Area, including those which interact with the Terminal Area on a daily basis, i.e., Springbank, Airdrie, Okotoks, and Strathmore.

NAV CANADA will change the way the Calgary Terminal Area is operated once the parallel runway comes into service including changes to flight paths in and out of local airports. Potential adverse operational effects on other local area airports are considered insignificant.

11.2 Socio-Economic Effects

Airports contribute to quality of life and, therefore, to community well-being by providing people with the opportunity to travel to distant destinations benefiting businesses and adding to personal enjoyment. They are also important to a local economy by virtue of employment, labour income, value-added gross GDP, and other non-fiscal social benefits. Increased activity and consequent socio-economic benefits at one airport may lead to increased activity and benefits at another. For example, Springbank Airport functions as a general aviation airport and reliever airport for YYC; it is tied to the growth of YYC, thereby receiving potential benefits from growth at YYC.

The socio-economic effects of YYC on regional airports are significant. Calgary is considered as being the regional “hub” for the surrounding airports and, therefore, it offers residents of such areas the opportunity to access domestic and international destinations normally unavailable at their local airport. Calgary, being Alberta’s financial centre, acts as a direct financial link to regional business centres, thereby encouraging investment via the provision of scheduled flights.

The installation and operation of the parallel runway at YYC will create an opportunity for the airport to grow, with potential benefits to regional airports. Capacity constraints would be detrimental to any regional airports that rely on YYC.

Alterations in service and operations at YYC will potentially affect other airports with connecting flights to YYC. For instance, the new runway will provide for direct long haul flights and service new larger aircraft that would otherwise be unable to arrive and depart in the region without load restrictions. Connecting passengers would constitute additional business at the airports from which they travel - an economic benefit for the airport, while being able to utilize the new direct long haul flights - a social benefit for the passengers. As the new direct long haul flights will not be accommodated at the surrounding regional airports, it is anticipated that there will not be any loss of flights at these airports. Any adverse socio-economic effects from the PRP are perceived as negligible.

12. Sustainability Framework

12.1 Sustainability and Sustainable Development

The Canadian Environmental Assessment Agency Guide (2003) explains that:

> *"Sustainable development recognises that social, economic and environmental issues are interconnected and must be equally integrated into the decision-making process, both with regard to when they are considered and how they are balanced against each other."*

With respect to the management of airports, the Airport Cooperative Research Program (ACRP) defines sustainability as "*practices that ensure:*

- *Protection of the environment, including conservation of natural resources.*
- *Social progress that recognizes the needs of all stakeholders.*
- *Maintenance of high and stable levels of economic growth and employment".*

12.2 Sustainability Regulations and Strategies

The Authority used the following strategies and regulations as guidance for incorporating sustainability issues into the PRP.

Subsection 16(2) of CEAA requires that a CS shall consider "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". TC's 2007 - 2009 Sustainable Transport Strategy has also been of relevance to the Authority's PRP as it sets out aviation and airport regulatory standards, monitors compliance and enforces all airport safety/security standards.

The Sustainable Aviation Guidance Alliance (SAGA) has undertaken an effort to consolidate existing guidelines and practices into a comprehensive, searchable resource that can be tailored to the unique requirements of individual airports. This database provided a long list of sustainability measures that were considered for the PRP.

The Canadian Environmental Assessment Agency's 2004 - 2006 Sustainable Development Strategy is applicable to the PRP and the development of the CS since the Agency is responsible for administering the EA process, provides leadership and serves as a centre of EA expertise.

12.3 Parallel Runway Project Sustainability Framework

The sustainability framework for the PRP at YYC has been guided by the Authority's policies in that the actions and initiatives have been developed at workshops and through consultation between the project design and construction engineers, the EA consultants, and the stakeholders who participated in the public consultation process.

The sustainability measures incorporated within the PRP EA process were developed in the context of a sustainability program for the entire airport operation, in conjunction with SAGA documentation, and a Triple Bottom Line approach to sustainable decision making. These processes and measures are used alongside those which have already been implemented at other large airport developments around the world.

Within its 2004 - 2006 Strategy, the Agency identified several stages for the advancement of a sustainable development strategy (formulated along the lines of the Federal EA process), which have been implemented into the CS that was prepared for the PRP, as follows:

- Project Registry Website - provides the public with complete, accurate and timely information regarding the PRP CS;
- Participant Funding Program - provides financial assistance to members of the public and organizations to prepare for, and participate in, the PRP CS; and
- Follow-Up Program Repository - available on the Project Registry Website, contributes to building the knowledge base to improve future predictions, and identifies situations where mitigation measures need to be adopted to meet unforeseen circumstances.

The Authority has a well established policy of incorporating sustainability principles into its operations and projects. For example, the Authority's Strategic Environmental Assessment of their 2004 Master Plan included an assessment of the parallel runway, the result of which was analyzed in the CS. The PRP sustainability program commenced with a definition of how sustainability principles were to be incorporated into the project as it develops.

The four main sustainability objectives (and related topics) for the PRP that were identified during the EA process are set out as follows:

Effective Protection of the Environment
Air Quality
GHG Production
Water Quality
Land Use and Soil Conservation
Ecological Resources
Ecological Diversity

Prudent Use of Natural Resources
Use of Water
Energy Efficiency
Waste Minimization
Materials

Social Progress
Health
Air Traffic Safety
Education and Training
Quality of Life of Neighbours

Economic Growth and Employment
Economic Growth
Efficient Delivery of Services
Employment

The concept of sustainability extends beyond basic mitigation whereby additional measures may be applied that surpass the potential reduction of adverse effects. These additional measures have evolved from an attitude or outlook that actively investigates smarter and more effective procedures and operations (e.g., reducing resource consumption, maximizing social and economic benefits) to facilitate net sustainability.

The parallel runway is the most sustainable of the alternative means of meeting additional demands for service at YYC that have been evaluated. The sustainability measures identified to be implemented as part of the development of the PRP will be integrated into the Authority's existing Environmental Management System (EMS) and its broader air campus-wide sustainability program.

12.4 Capacity for Renewable Resources

The CS has examined the capacity of renewable resources present within both the LSA and RSA with a view to how they may be affected by the PRP. The capacity for renewable resources refers to the quantity which may be consumed, harvested or removed in any period of time without reducing the stock of the resource available in the next time period.

The renewable resources of most concern in the context of the PRP are as follows: Wildlife Populations (Volume III, Chapter 6), Soils (Volume III, Chapter 3), Vegetation (Volume III, Chapter 4), Water (Volume III, Chapters 5 and 7), Wind Power and Solar Power (Volume III, Chapter 2).

The PRP's effect on the sustainability of renewable resources has been considered for the construction and operational phases. A long term perspective was considered as it implies intergenerational equity. Generally, the development of the PRP will not reduce the carrying capacity for the above resources, e.g., topsoil will be reused and a Stormwater Management Plan will ensure that water quantity and quality will not adversely affect Nose Creek or the Bow River.

13. Environmental Management System and ECO Plan

13.1 Environmental Management System (EMS)

The Airport Authority has a well established EMS which includes a wide range of effects minimization programs and BMPs dealing with specific issues including land use, planning and development, wildlife control, noise management, air and water quality management, aircraft de-icing, and the management of underground storage tanks. Furthermore, it undertakes flight tracking, noise monitoring and chairs the ACNCC as part of its overall environmental program. Any sustainability measures identified or committed to the PRP will be integrated into the Authority's existing EMS and sustainability program. The Authority has also developed a Site Management Plan which contains information on all known contaminated sites, petroleum facilities and site-specific environmental studies.

13.2 ECO Plan

An ECO Plan consists of written procedures and drawings to identify and mitigate potential environmental issues that may occur as a direct or indirect result of construction activities being performed on a specific project site (ECO Plan Policy 2009).

The objective of this ECO Plan is to prevent or minimize environmental impacts and to enhance the environmental values that may be affected by the PRP during its construction or operation.

This ECO Plan identifies:

- the environmental setting of the project;
- the on-site individual responsible for addressing the environmental issues;
- potential environmental effects on the project;
- mitigation measures to prevent or minimize environmental impacts;
- implementation, monitoring, training, communication, and review of the ECO Plan;
- legislation, guidelines and standards to be met and monitored; and
- environmental emergency response procedures.

The ECO Plan will be a living document. It will be developed in detail as the Authority, its consultants and contractors, and other regulators work together to execute the project. The contractor shall communicate any required changes to employees and relevant subcontractors, and will provide the necessary training before implementation. All changes to the ECO Plan will be documented.

14. Monitoring and Follow-up

A monitoring and follow-up program was prepared as part of the CS. The program is designed to determine whether or not the effects identified in the CS occur as predicted, as well as to confirm whether or not the proposed mitigation measures are effective. The program will based on these evaluations also determine whether or not new mitigation measures will be required should the initial measures not prove to be as effective as they might be.