Kiggavik Project
Final Environmental Impact Statement

Tier 3 Technical Appendix 2O:
Mine Site Airstrip Report

September 2014

Table of Contents

1 Preamble

Environmental Assessments are an invaluable tool to analyze and improve the quality of a proposed project. During the Environmental Assessment process the Project evolves through continual improvement and the integration of new information that results from the cooperation of the proponent, government agencies, non-government agencies, and the community.

As a result of these efforts, information originally submitted in the draft Environmental Impact Statement (DEIS) may require clarifications to the draft submission, the addition of new information, or changes to the Project design. Where these improvements do not affect the analysis included in the DEIS and the significance determination of Project effects, it may not be necessary to revise the original report.

The purpose of this update is to provide the reader with the Project changes, clarifications, and new information that have resulted through the Environmental Assessment process such that this addendum combined with the original report comprise the complete technical submission and analysis of the subject.

2 Updates to Report

2.1 Aircraft Refuelling and Deicing

The following EBA Engineering Consultants Ltd. (EBA) report states that there will be no refuelling at the Pointer Lake airstrip. Consistent with Tier 2, Volume 2, Section 10.6.2 an emergency supply of jet fuel will be kept at the Pointer Lake airstrip. The fuel to be stored at the airstrip will be contained in double walled steel EnviroTanks or equivalent. This type of tank meets the requirements for secondary containment within its own structure. Further protection against spills will be provided by high level alarms, overfill preventers, and catch basins around each fill pipe. The fuel storage area will be inspected on a regular basis to promptly identify any leaks or spills. In addition, spill kits and fire suppression equipment will be available at the fuel storage area and other strategic locations at the airstrip.

Aircraft refuelling and de-icing will occur on the apron in a designated area that will be designed such that spills will be confined to the apron and be directed towards a catchment area to allow for collection. Petroleum hydrocarbon contaminated soils will be excavated and transported to the Kiggavik landfarm for reclamation. Liquids contained in the catchment area will be collected with a vacuum truck and transferred to appropriate containers and stored at the designated hazardous materials storage area for shipment to a licensed recycling facility. Upon decommissioning, environmental sampling of soils will be conducted in the vicinity of potentially impacted areas at the airstrip. Any contaminated materials will be transferred to a tailings management facility (TMF) for disposal. All hazardous materials generated as a result of aircraft maintenance (e.g. used oils, grease, glycols) will be stored in appropriate drums or suitable containers and transferred to the Kiggavik designated hazardous materials storage area.

2.2 Regulation Updates

Section 2.3.2 notes that the Wide Area Augmentation System (WAAS) GPS instrument approach is due to be approved by Transport Canada in 2010. The WAAS navigation system has since been approved by Transport Canada.

2.3 Weather Data

The installation of a weather station was noted in Section 2.2. At the time the report was written, weather data was not available. Weather data has since been collected and is presented in Tier 3, Technical Appendix 4A Climate Baseline. As stated in section 2.2, runway alignment and length requirements will be re-evaluated based on weather data at the detailed design stage.

2.4 Figure Updates

Figure 1.0-2 is outdated and does not reflect the currently envisioned access roads. For an updated project overview map, refer to Tier 2, Volume 2 Project Description, Figure 2.3-1.

3 References

AREVA Resources Canada (2014). Kiggavik Environmental Impact Statement – Tier 2 Volume 2 – Project Description and Assessment Basis, September, 2014.

AREVA Resources Canada (2012). Kiggavik Environmental Impact Statement Addendum, April 2012.

AREVA Resources Canada (2014). Kiggavik Environmental Impact Statement – Tier 3 Technical Appendix 4A- Climate Baseline, September, 2014.

CREATING AND DELIVERING BETTER SOLUTIONS

www.eba.ca

AREVA RESOURCES CANADA LTD.

ISSUED FOR USE

KIGGAVIK PROJECT
MINE SITE AIRSTRIP REPORT

V33101016

October 2010

EBA Engineering Consultants Ltd.
p. 604.685.0275 • f. 604.684.6241 • Oceanic Plaza, 9th Floor
1066 West Hastings Street • Vancouver, British Columbia V6E 3X2 • CANADA

PAGE

APPENDICES

1.0 INTRODUCTION

The Mine Site Airstrip Report is one of a group of studies performed by EBA of various aspects related to access and infrastructure for the proposed Kiggavik Mine Project. The other studies include:

- Northern and Southern All Season Road Report
- Physical Environment Within the DEIS Report
- Haul Road Report
- Port Facility Report
- Andrew Lake Dyke Report
- Winter Road Report
- Mine Site Building Foundations Report

Figure 1.0-1 below shows the general location of the Kiggavik Project.

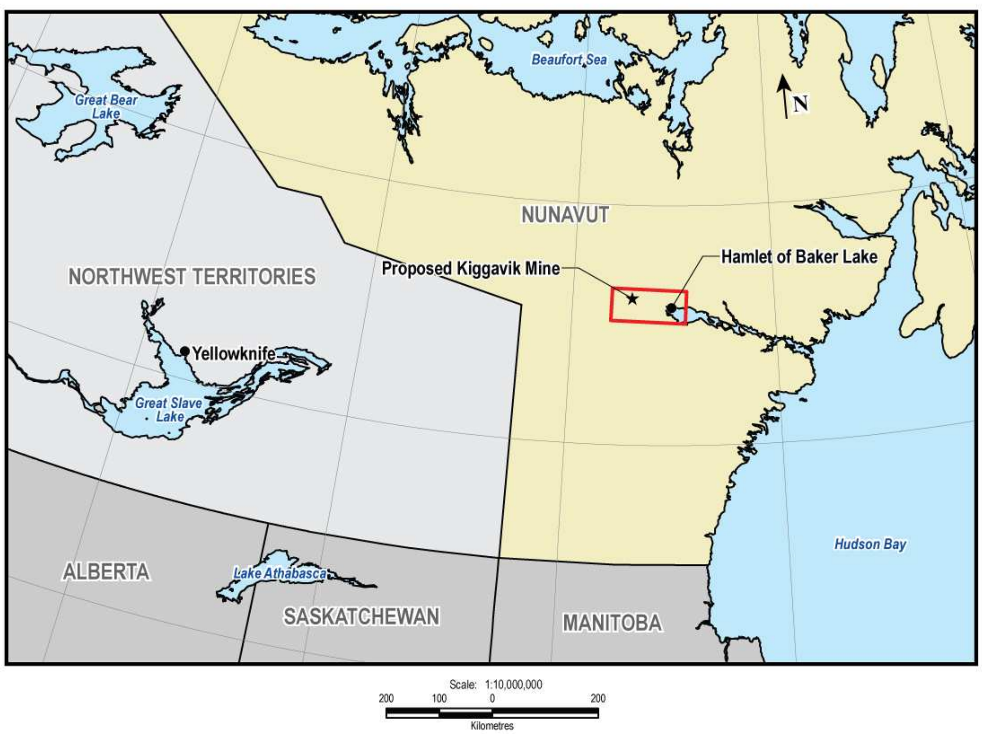
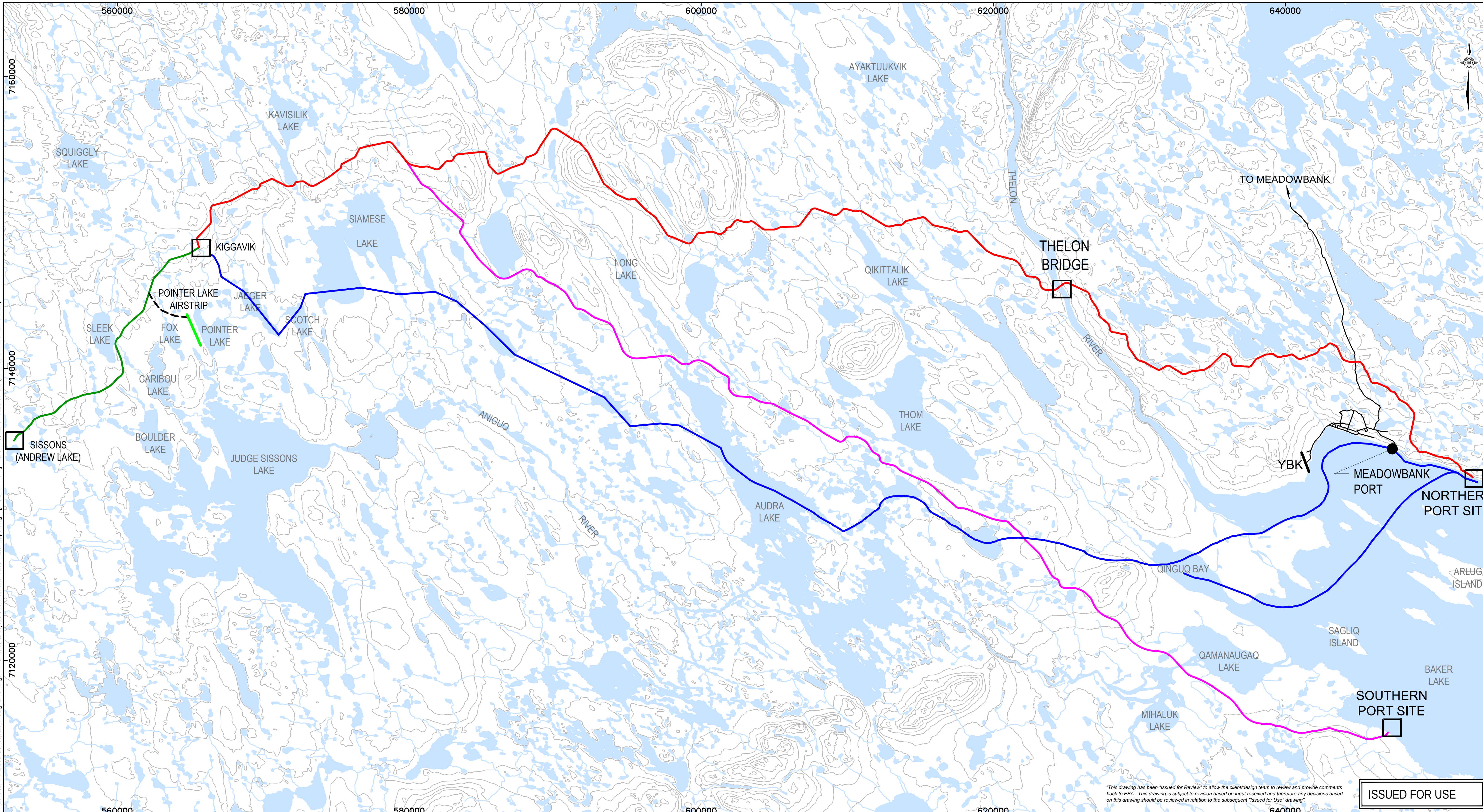


Figure 1.0-1 Key Plan

Figure 1.0-2 on the following page shows the various project elements discussed within this Report and the other Reports listed above.



Q:\Vancouver\Transportation\V331\Projects\V33101016 - Areva\CADD\2009 Conceptual Design\Drawings\DEIS Report\Project Overview and Base Data Maps.dwg [FIGURE 1.0-2] March 26, 2010 - 2:00:07 pm (BY: ANDREW DEEPWELL)

PROPOSED
- Northern All Season Road
- Southern All Season Road
- Haul Road
- Winter Road
- Pointer Lake Airstrip

EXISTING
- Roads
- 20m Contour - NTS Base Data
- YBK Airport

SCALE 1:250,000

2 0 2 6 10km

PROJECTION: UTM Zone 14
DATUM: NAD 83

CLIENT

AREVA

EBA Engineering Consultants Ltd.

KIGGAVIK PROJECT
CIVIL INFRASTRUCTURE REPORT

PROJECT OVERVIEW MAP

PROJECT NO.	DWN	CKD	REV
V33101016	AJD	DCD	-
OFFICE	DATE		
VANC	March 26, 2010		

Figure 1.0-2

2.0 MINE SITE AIRSTRIP

2.1 INTRODUCTION

In the 2007 Pre-Feasibility Study, EBA outlined conceptual design parameters, site assessments, necessary infrastructure, material quantities, cost forecasts and site layouts for four possible airstrip sites. The intent was to evaluate four possible sites to provide a 2,000m x 45m gravel aerodrome for the Kiggavik – Sisson Project approximately 80km west northwest of Baker Lake, NU. Areva has since used this information to select the Pointer Lake site as the preferred location for further investigation. This section of the Civil Infrastructure Report furthers the conceptual design submitted in 2007 based on a specific site selection; Pointer Lake, and updated site and survey data.

This report details the following:

- design parameters;
- site description and layout;
- required infrastructure;
- construction operations, constraints and impacts;
- aerodrome operational requirements;
- material quantities and cost forecasts.

2.2 DESIGN PARAMETERS

All design parameters for this evaluation are based on Transport Canada's Aerodrome Standards and Recommended Practices TP312E 4th Edition.

The design aircraft selected for this evaluation is the Boeing 737-200 (Code C Aircraft). We anticipate that for northern airports with gravel runways, the 737-200 will continue to be the commercial jet aircraft of choice. Boeing has indicated it will not be seeking approval for equipment required to protect new generation aircraft for use on gravel runways. Some of the alterations required to allow the 200 series to operate on gravel surfaces include:

- rock deflectors on the nose landing gear;
- a reinforced and protected main landing gear
- epoxy coated fuselage bottoms;
- reinforced navigation, avionics and sensor antennas on the aircraft exterior;
- vortex generators for the engine nacelles designed to deflect rocks and dust;

We believe that aircraft operators in the north will continue to seek out and find useable 200 series aircraft and it has been reported that there is a sufficient supply available for the future.

The other most likely large aircraft to provide service at Areva would be the Lockheed C-130 Hercules. The runway requirements for the 737-200 exceed those for the C-130.

The runway length requirements for the 737-200 vary with standard required lengths depending on load, aerodrome altitude, maximum air temperature and the runway longitudinal slope. Based on available information, a 2000m long runway is sufficient for the proposed aerodrome site.

EBA installed a weather station at Pointer Lake in August 2009. Recording of data began in August and the first download of the data will occur during the 2009-2010 winter season. This will aid in the development of a wind rose (identify prevailing winds), the analysis of temperatures and weather patterns. Once additional weather data is available, runway alignment and length requirements should be re-evaluated.

The runway width will be 45m, as recommended in TP312E for Code C aircraft, and an aircraft turning D has been included on the south end of the runway. The runway reference code would be Code 3C Non-Precision (depending on the final design and operational limits of GPS based instrument approaches and departures). Although technically the runway would be considered Code 4C Non-Precision, since the runway is longer than 1,800m as referenced in TP312E, the design aircraft would suggest the Code 3C designation is more suitable and in line with pending regulation changes. For comparison, the runway at Ekati Diamond Mine, NWT is 1950 m long and 45 m wide and handles the same design aircraft. Runway length and width requirements for other aircraft that may typically utilize a northern airport are given in Table 2.2-1.

TABLE 2.2-1 RUNWAY REQUIREMENTS FOR VAIOUS AIRCRAFT

Aircraft Type	Runway Length Required	Runway Width Required
Skyvan	610 m (2,000 ft)	22.5 m (75 ft)
Dash 7	762 m (2,500 ft)	30 m (100 ft)
Buffalo	915 m (3,000 ft)	22.5 m (75 ft)
C-130 Hercules	1500 m (5,000 ft)	45 m (150 ft)
Boeing 737-200	2000 m (6,560 ft)	45 m (150 ft)

TP312E requires that a graded area capable of supporting an aircraft that leaves the side of the runway, be constructed to a width of 45m either side of runway centreline. The graded areas are included on the drawings and quantity calculations. The graded area regulations are intended to provide a margin of safety for aircraft operating in slippery, winter conditions. With Transport Canada and air operator approval and once cross wind data is received, the graded area could be reduced to a width of 30m either side of centreline, greatly reducing the amount of imported fill, associated costs and the project footprint. Any reduction in graded area widths will be determined at the preliminary design or design stage.

To ensure aircraft and passenger safety, Transport Canada will shortly be introducing regulations that will require a 150m long Runway End Safety Area (RESA) at each end of the runway. The RESA must be the full width of the graded area and also must be capable of supporting an aircraft that leaves the end of the runway. We have included a RESA at both runway ends.

Typical configurations of the take-off/approach Obstacle Limitation Surfaces (OLS) are detailed on the Figure 2.3-1. The OLS parameters for Code 3C Non-Precision Runway include:

- Minimum Descent Altitude (MDA) of 76.5m (251 ft) Above Aerodrome Elevation (AAE).
- An outer surface with a 4000m radius at 45m AAE. This can be mitigated by further defining the outer surface should some of the mine equipment or buildings project through this plane.
- A 3,000m long take-off/approach surface starting at 150m wide 60m from the end of the runway diverging outward at 15% at an upward slope of 2.5%.
- Transitional surfaces along each side of the runway starting at the edge of the strip (75m from runway centreline) and rising upward and away from the strip at a grade of 14.3% (7 to 1) to a height of 45m.

2.3 POINTER LAKE AERODROME

2.3.1 Site Description

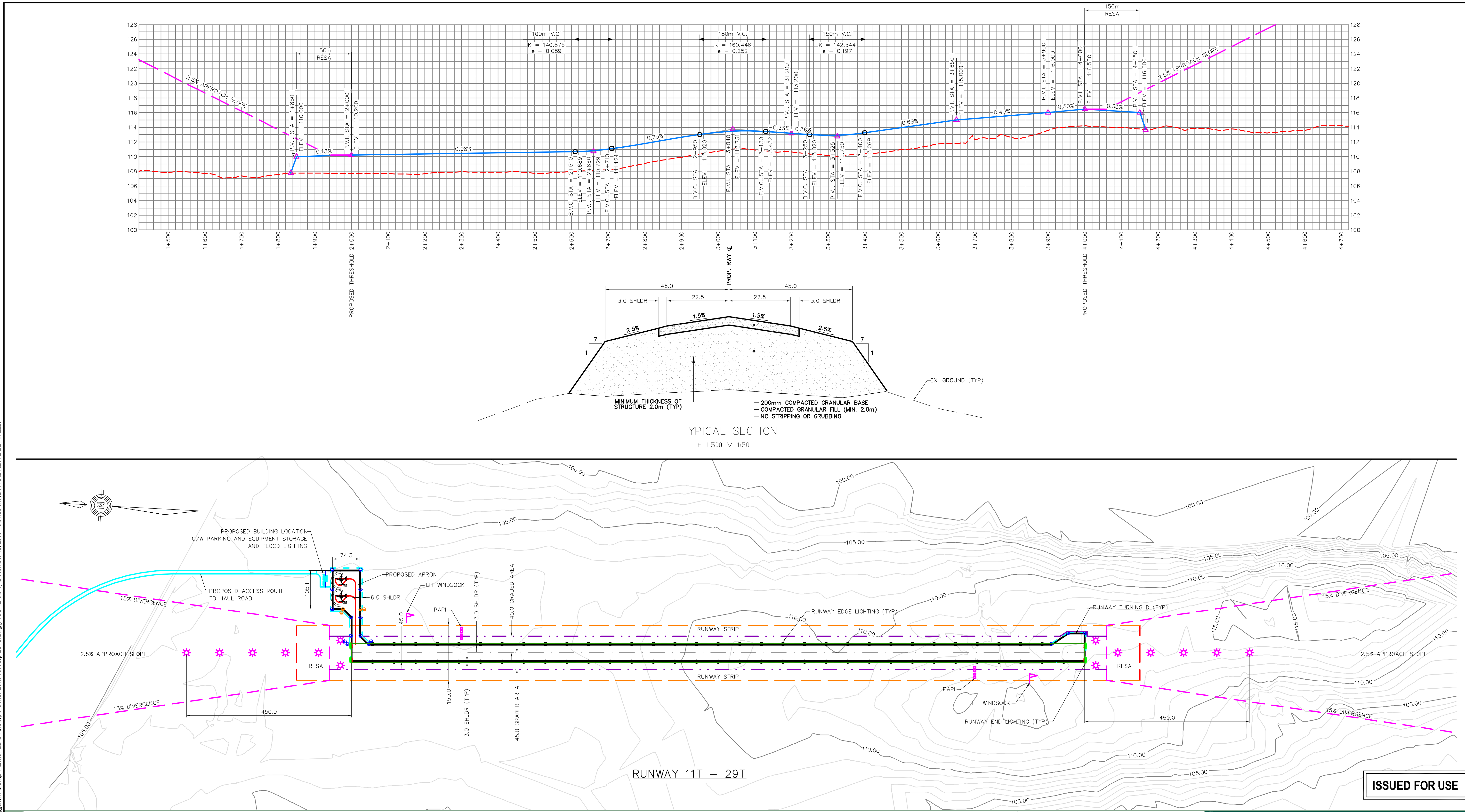
The proposed runway will be 2,000m in length and 45m in width as described above. An additional 3.0m wide graded shoulder on each side of the runway is included as recommended in TP312E for runways serving large turbo-jet aircraft.

A 23m wide taxiway complete with 6m wide graded shoulders as well as an apron sized to park two B737-200s with sufficient space to be serviced and arrive/depart independently, have been provided.

The site will not be stripped or grubbed. The total embankment structure will be a minimum of 2.0m thick to protect permafrost. The structure will be constructed primarily from quarried rock and gravel mine waste. The runway, taxiway, apron, and ground vehicle parking areas will be surfaced with 200mm of crushed granular base materials. Surface runoff should not be a concern considering the runway is be constructed on high ground adjacent to Pointer Lake (east) and a low lying area (west).

Environmental diligence during construction should be taken considering proximity to the lake and mitigation assessments are recommended. Silt fences and/or other erosion deterrents could be explored to mitigate contamination of site surroundings.

The plan and profile of the proposed Pointer Lake Airstrip is provided on Figure 2.3-1.



ISSUED FOR USE

LEGEND

- PROP. ODALS
- PROP. WHITE RUNWAY EDGE LIGHT
- PROP. BLUE TAXIWAY EDGE LIGHT
- PROP. YELLOW APRON ENTRANCE LIGHT
- PROP. RUNWAY THRESHOLD LIGHT

ABBREVIATIONS:
RESA – RUNWAY SAFETY END AREA
ODALS – OMNI-DIRECTIONAL APPROACH LIGHTING SYSTEM

SCALE 1:10,000

100 0 100 200 400m

CLIENT

AREVA

EBA Engineering Consultants Ltd.

KIGGAVIK PROJECT
CIVIL INFRASTRUCTURE REPORT

PROPOSED POINTER LAKE AIRSTRIP
PLAN AND PROFILE

PROJECT NO.	DWN	CKD	REV
V33101016	GW/TJ	HJW	B
OFFICE	DATE		
KEL	March 26, 2010		

Figure 2.3-1

2.3.2 Required Infrastructure

A single storey pre-fabricated Air Terminal Building (ATB) should be included to provide passenger/cargo shelter as well as space for the Field Electrical Centre (FEC). The ATB would have an area for ground vehicle parking associated with it.

It is assumed that 3 phase electrical power will be provided to the aerodrome site from the mine site. The FEC would require electrical controls and regulators to be contained in a separate room from the ATB lighting/heating systems. The ATB would also contain the Aircraft Radio Control of Aerodrome Lighting (ARCAL) antenna, aerodrome beacon, aircraft ground power units and apron flood lighting controls. The ARCAL will allow pilots to control the aerodrome lighting with no assistance from the aerodrome personnel.

The aerodrome lighting system recommended should consist of the following:

- FEC;
- Aerodrome Beacon;
- ARCAL;
- Ground to Air Communications (air radio);
- Automated Weather Observation Station (AWOS including altimeter settings);
- Apron Flood Lighting and ground power units (2 each);
- Apron, taxiway and runway edge lighting;
- Runway end lighting;
- Backlit runway exit signs and hold signs;
- Precision Approach Path Indicators (PAPIs) for both ends of the runway;
- Lighted wind direction indicators at both runway ends;
- Omni Directional Approach Lighting Systems (ODALS) at both ends of the runway. This could be upgraded to a SSALR (Category I approach lighting system) if the weather data shows it is justified.

An aircraft fuel facility has not been included.

Snow clearing, cargo handling, passenger assistance, baggage handling, surface maintenance and electrical maintenance shall be provided by mine site equipment and personnel. It is assumed that snow clearing equipment for the aerodrome would be the same as that to clear haul roads and mining roads.

Security and wildlife fencing has not been included.

De-icing facilities will be required for the aerodrome. Boom truck(s) will be required for de-icing fluid application. De-icing fluid will likely be delivered in totes or drums so a pump to transfer to the boom truck(s) will be required.

Anticipated navigational and instrument approach considerations for the Pointer Lake aerodrome are as follows.

We envision the Pointer Lake Aerodrome would be serviced with a non-precision Wide Area Augmentation System (WAAS) GPS instrument approach. This could allow the approach limits or Minimum Descent Altitude (MDA) to be as low as 76.5m (251 ft) above aerodrome elevation AAE. This instrument approach system is due to be approved by Transport Canada in 2010 and does not require on-airport equipment. Once the approach criteria has been defined and tested, confirmation that the system will work north of 60 will be required. WAAS procedures for approaches and departures for both runway ends will have to be designed, approved, flight checked and published. This process often takes 1-2 years.

Alternately, a Local Area Augmentation System (LAAS) could be utilized. This would require ground based GPS error reduction/transmitting equipment on site and specialized equipment in the aircraft. This system would require the same design and approval procedures as the WAAS.

We have not examined Category I approach systems due to the likelihood that administration, calibration, flight checking and operating the Cat I systems at a remote restricted site, would be onerous and would only reduce the approach limits by 50 ft.

2.3.3 Aerodrome Construction

No stripping or grubbing will be executed at the aerodrome. A 2.0m thick (min) compacted granular fill is required for the embankment structure as noted above. The sub base should be constructed in lifts to ensure proper compaction of each layer. Thicknesses of each lift will depend on the characteristics of the material being placed. The embankment structure will transition down to the existing ground at a slope of 7 horizontal to 1 vertical (14.3%). This should prevent blowing snow from drifting excessively.

A 200mm lift of crushed granular base will form the surface of the runway, shoulders, taxiway, apron, parking and equipment storage. This material will also be crushed on site or be waste material from the mine site.

Equipment used to construct the embankment shall be standard road building equipment; i.e. excavators to load and place material, dump trucks (or larger alternatives) for hauling material, dozers or loaders to move material in place and lastly, rollers to provide compaction.

We assume that the aerodrome will be constructed upon completion of the access road and will utilize the equipment on site constructing an access road to Pointer Lake followed by the airstrip. We also assumed that this would occur at the same time as mine site facilities are being constructed. This estimate should be re-examined at the preliminary design stage. The airstrip could also be built before completion of the access road with equipment and materials brought in by winter road/trail or potentially an Ice Airstrip.

Construction of the airstrip would take between 8 months to one year of on site construction time. This estimate could vary greatly dependant on the amount of equipment and material available, potential deep winter shutdown, and supply logistics.

2.3.4 Aerodrome Operational Considerations

It is understood that aircraft will not be re-fuelled at Pointer Lake. This should allow the site to operate without providing fuel/water separators or facilities for the containment of fuel spills. This should be confirmed by the environmental engineering team.

De-icing of aircraft will be required at this site. To ensure contamination of the surrounding lakes does not occur, containment or immediate removal of de-icing fluids spilled on the ground will be required. This could be accomplished with vacuum equipment or providing a perimeter drain and storage tank. This task would be less difficult if a concrete hard stand was constructed large enough to contain one aircraft. This would permit easier containment and removal of the excess de-icing fluids.

Dust is a year round problem on gravel surfaced runways but it is more prevalent during the summer months. It is especially problematic if the airport is serviced by jet aircraft. Dust clouds can linger or shift over the surrounding terrain and adjacent lakes. In order to reduce fugitive dust, application of an appropriate dust suppressant is recommended. Most northern airports utilize Midwest Industries' EK35 for dust suppressant.

Procedures for detection and removal of animals and birds from the manoeuvring areas will be necessary to ensure the safety of the aircraft and passengers. This may include pre-landing and pre-take-off runway inspections by ground personnel prior to each flight.

As detailed previously, snow clearing, cargo handling, passenger assistance, baggage handling, surface maintenance and electrical maintenance will be provided by mine site equipment and personnel. It is assumed that snow clearing equipment for the aerodrome would be the same as that to clear the roads in the area.

Maintenance of the gravel runway, taxiway and apron surfaces will be required on a regular basis. It is assumed that graders, loaders, trucks, compaction equipment and personnel from the mine site will be utilized. Additional granular base material should be stockpiled near the site to allow easy access for maintenance crews. Stockpiles must be located so as not to project through the OLS.

2.3.5 Material Quantities

The quantities for the aerodrome at the Pointer Lake site are based on LIDAR topographical data and should be re-confirmed at the time of preliminary design. Estimated costs are based on historical prices for other northern sites. Please see Table 2.3-1 for the quantity/cost forecasts.

TABLE 2.3-1 FORECAST QUANTITIES AND COSTS FOR POINTER LAKE AERODROME			
Item	**Cost Forecast Summary**		**Total**
1.0	General Construction Items		$160,000
2.0	Earthworks		$14,562,000
3.0	Aerodrome Lighting and Navigational Aids		$1,610,000
4.0	Air Terminal Building, FEC Building		$180,000
	Sub-Total Construction Costs		**$16,512,000**
5.0	Project Engineering	10.0%	$1,651,200
6.0	Project Contingencies	25.0%	$4,128,000
	Total Project Cost Forecast - Excluding G.S.T.		**$22,291,200**

The cost breakdown of Items 1 to 4 listed in Table 2.3-1 are shown in the following sub-tables:

TABLE 2.3-1(A) FORECAST QUANTITIES AND COSTS FOR GENERAL CONSTRUCTION ITEMS					
1.0	**General Construction Items**	**Unit**	**Quantity**	**Unit Price**	**Total**
1.1	Mobilization / Demobilization / Survey / Site Safety	l.s.	1	$160,000	$160,000
	Total Section 1.0				**$160,000**

TABLE 2.3-1(B) FORECAST QUANTITIES AND COSTS FOR EARTHWORKS					
2.0	**Earthworks**	**Unit**	**Quantity**	**Unit Price**	**Total**
2.1	Runway Granular Sub base	m^3	510,000	$20	$10,200,000
2.2	Runway Granular Base – 200mm thick	m^2	110,000	$30	$3,300,000
2.3	Apron/Taxiway Granular Sub base	m^3	30,000	$20	$600,000
2.4	Apron/Taxiway Granular Base – 200mm thick	m^2	11,000	$30	$330,000
2.5	ATB & Parking Granular Subbase	m^3	3,200	$20	$64,000
2.6	ATB & Parking Granular Base – 200mm thick	m^2	1,600	$30	$48,000
2.7	Granular Base Maintenance Stockpile	m^3	1,000	$20	$20,000
	Total Section 2.0				**$14,562,000**

TABLE 2.3-1(C) FORECAST QUANTITIES AND COSTS FOR AERODROME LIGHTING & NAVIGATIONAL AIDS					
3.0	**Aerodrome Lighting and Navigational Aids**	**Unit**	**Quantity**	**Unit Price**	**Total**
3.1	Runway Edge/End Lights	l.s.	1	$400,000	$400,000
3.2	Taxiway/Apron Edge Lights	l.s.	1	$75,000	$75,000
3.3	ODALS	ea.	2	$250,000	$500,000
3.4	PAPIs	ea.	2	$45,000	$90,000
3.5	Windsocks	ea.	2	$15,000	$30,000
3.6	Backlit Signs	ea.	3	$10,000	$30,000
3.7	FEC	l.s.	1	$150,000	$150,000
3.8	Aerodrome Beacon	l.s.	1	$15,000	$15,000
3.9	Apron Flood Lighting	l.s.	1	$30,000	$30,000
3.10	AWOS	l.s.	1	$150,000	$150,000
3.11	Air/Ground Communication	l.s.	1	$30,000	$30,000
3.12	Spare Parts	l.s.	1	$50,000	$50,000
3.13	WAAS Approach Procedures	l.s.	1	$60,000	$60,000
	Total Section 3.0				**$1,610,000**

TABLE 2.3-1(D) FORECAST QUANTITIES AND COSTS FOR AIR TERMINAL BUILDING, FEC BUILDING					
4.0	**Air Terminal Building, FEC Building**	**Unit**	**Quantity**	**Unit Price**	**Total**
4.1	Pre-fabricated Building	m^2	90	$2,000	$180,000
	Total Section 4.0				**$180,000**

Notes:
1. Costs associated with the access road and power supply are not included.
2. The estimate of construction costs is provided for budgetary purposes only. This is not to be interpreted as a guarantee by EBA of the actual project cost. The final cost of the project will be determined by the tendering and construction process.
3. These prices do not include the G.S.T.

3.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

Yours truly,
EBA Engineering Consultants Ltd.

Graham Wilkins, P.Eng.
Project Director, BC Transportation
Direct Line: 604.685.0017 Ext. 317
gwilkins@eba.ca

Kevin Jones, P.Eng.
Senior Project Director, Arctic Practice
Direct Line: 780.451.2130 Ext. 271
kjones@eba.ca

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.

Signature

Date OCT. 5, 2010

PERMIT NUMBER: P 018
NWT/NU Association of Professional
Engineers and Geoscientists

APPENDIX A

APPENDIX A REFERENCE DRAWINGS AND SUPPORTING DOCUMENTATION

List of Data in Appendix A:

A1 – LiDAR Survey Report

A2 – Baker Lake Sonar Report

A3 – Mill Site and Sik Sik Lake Geophysics Survey

A4 – Andrew Lake Dyke Geophysics Survey

A5 – Thelon Crossing – Geophysics Survey

A6 – Winter Road Geophysics Survey

A7 – North Port Site Bathymetric Data

A8 – 2009 Mill Site Borehole Logs

A9 – Summary of Activities Thelon ice Observations

A10 – Project Photo Log

Note:

Appendix A is a large compilation of reference drawings and documents that contains information common to all of the other Reports as well. To avoid unnecessary duplication, it has not been attached to each Report, but has been submitted as a separate document.