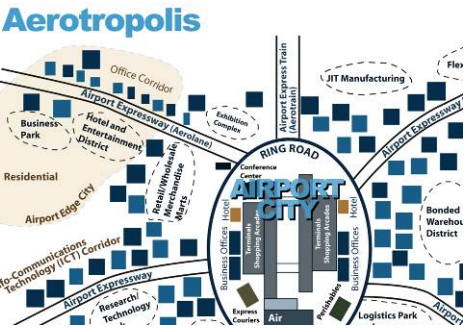
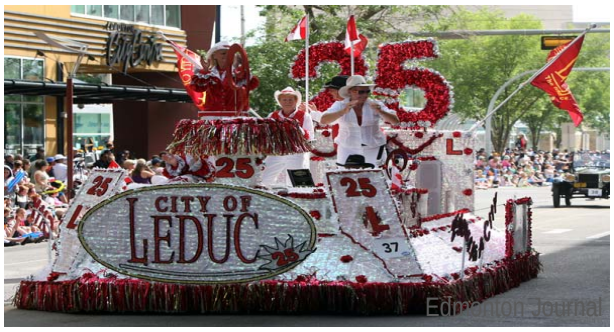
Aerotropolis Integrated Land Use Compatibility Plan





Prepared for

City of Leduc

Prepared by

Inter*VISTAS* Consulting Inc.

28 June 2011

Table of Contents

1. Introduction

From Dallas Fort Worth, Charles de Gaulle and other global hubs around the world, careful airport vicinity land use planning has emerged as a best practice. Airports that have successfully ensured a geographic buffer from noise incompatible land uses (e.g. residential areas) have been also more successful to retain options for future development of aviation services. Similarly, communities that have planned for compatible land uses have also maximized synergies with economic benefits of airport jobs, businesses and ancillary benefits – as encompassed in an Aerotropolis development.

As a growing Northern Alberta community, the City of Leduc benefits from population growth and expansion of its economic base. Within 50 years, the combined population of the City and the County is anticipated to surpass 107,000, as outlined in the 2008 *City of Leduc and Leduc County Joint Sustainable Growth Study*. This combined growth, as well as objectives for community sustainability, will result in a push for the creation of larger employment centres in and around the City of Leduc.

The location of the Edmonton International Airport (EIA) within the county's boundaries stimulates the local economy and attracts investment on and in proximity to the airport site. With Edmonton Airports' capital expansion program underway and strategies to develop as a logistics hub, the City and the County stand to become prime benefactors of associated economic run-off.

There is currently a 530 acre parcel of undeveloped land situated immediately south of EIA that can support a number of land uses and activities. The City of Leduc wishes to ensure planning for this site enables land uses that are compatible with current and future activities on adjacent land and can support longer-term regional development objectives. With proximity to the airport and major roadways, future activities on the site will be impacted by a number of external factors such as aircraft noise from arriving and departing aircraft at EIA, road noise from traffic along Queen Elizabeth II Highway and the proposed 65th Avenue arterial; and ground-based noise from the proposed Port Alberta development situated in the southern part of the airport. Defining land uses on the site that are compatible with adjacent activities as a means of ensuring sustainable and harmonious development in the area over the long-term period is therefore needed.

To better understand these issues and to provide land use planning guidance, the City of Leduc retained Inter*VISTAS* Consulting (Inter*VISTAS*) to develop an *Aerotropolis Integrated Land Use Compatibility Plan* (AILUCP) for this site. In preparing this Plan, traffic and noise analyses were prepared to provide a 50-year outlook on how the study area will be impacted by its surrounding environment. Inter*VISTAS* has retained traffic engineering services from *Delcan* for traffic impact analysis and noise modelling services from *Patching and Associates* for cumulative noise analysis. This report presents the integration of traffic and noise analyses, Aerotropolis concepts and land use recommendations for the site to best serve the City of Leduc and its constituents. Conceptual maps of compatible land uses at full build-out (in 2060) are included in this plan, and aim to provide a basis to support planning for future Aerotropolis-type development in the airport vicinity.

1.1 Methodology

The purpose of the *Aerotropolis Integrated Land Use Compatibility Plan* is to guide future development in the study area for a 50-year planning horizon. The Plan reviews current land use zoning at the site and its surrounding areas, takes into consideration relevant local and regional planning documents, considers cumulative noise pollution derived from aircraft, road-traffic and other ground-based noise activities, and input from city officials, Edmonton Airports and other stakeholders. The ultimate objective of the Plan is to provide recommendations and land use concepts for compatible land use on the site, including a consideration of Aerotropolis development principles and potential Port Alberta operations along with strategies for mitigating noise stemming from adjacent land uses.

Background and Best Practice Review

Long-range planning is an organized process for determining the most probable land use scenario for land and its surrounding environment. This is a method of understanding current land use trends and demands, and identifying a clear direction for future land uses. The overall process is commonly driven by a cohesive vision for the land and the community. Developing a comprehensive AILUCP involves the completion of a number of tasks needed to determine compatible land uses, create concepts and deliver recommendations pertaining to land use policy. These tasks include analysis of the local/regional land use vision for the study area, population growth, airport vicinity planning regulations and government regulations/guidelines for airport vicinity land use compatibility.

In this organized process, Inter*VISTAS* reviewed various indicators for understanding what the study area could potentially develop into, considering growth and development of its surrounding environment. These indicators include population growth, economic activity, airport development plans, road infrastructure upgrades and the development of the Port Alberta site, as outlined in existing planning documents. As primary inputs to the planning process, the following documents were used by *InterVISTAS*, *Delcan,* and *Patching and Associates:*

- 2005 City of Leduc Municipal Development Plan;
- 2006 Edmonton International Airport Vicinity Protection Area;
- 2007 City of Leduc Corporate Strategic Plan;
- 2008 Joint Sustainable Growth Study;
- 2009 Integrated Municipal Sustainability Plan;
- 2009 City of Edmonton Transportation Plan;
- 2010 Leduc County Draft Transportation Plan Update;
- 2010 Draft Edmonton International Airport Master Plan Update;
- Transport Canada Aerodrome Standards (TP312);
- Land Use in the Vicinity of Airports (TP1247);
- Canadian Mortgage Housing Corporation – New Housing and Airport Guidelines; and
- Federal Highway and Administration – Roadway Construction Noise Model.

Inter*VISTAS* has also reviewed noise mitigation standards from the US Federal Highway Administration and different characteristics of the Aerotropolis concept. The US Airport Cooperative Research Program was also used as a source of best practice material used in the evaluation of plan options for the City of Leduc. This provides the basis for understanding current noise mitigation measures and existing land uses relevant to the Aerotropolis concept.

Traffic and Noise Analyses

Looking into the 50-year planning horizon requires a consolidated understanding of future development potential of lands surrounding the study area. Specifically, this in regards to the long-term growth forecast for the City of Leduc, Leduc County, activity at Edmonton International Airport and the development of Port Alberta. In addition to analyzing the development potential of land surrounding the study area, a traffic and noise impact analyses is required to discern future traffic level and the associated noise generated by the different sites.

Inter*VISTAS,* in collaboration with *Delcan,* analyzed future traffic impacts associated with developments surrounding the study area. The *Traffic Impact Analysis* (TIA) used the proposed areas of growth identified in the 2008 *Joint Sustainable Growth Study* to determine the amount of vehicular traffic in the area and possible locations of interchanges. Trip generation rates were calculated using standard trip generation rates from the Institute of Transportation Engineers Handbook for the proposed land use sites, and forecast over the 50-year planning horizon. A traffic simulation model called VISUM was used to identify road network capacity and the location of highway interchanges.

Additionally, Inter*VISTAS* collaborated with *Patching and* Associates to understand the cumulative noise impacts generated from developments surrounding the study area. The *Noise Impact Analysis* (NIA) reveals the cumulative noise impacts of aircraft at the airport, vehicular traffic in the vicinity of the study area and ground-based noise generated at the future Port Alberta site. A noise simulation model developed by the US Federal Highway Administration (TNM 2.5) was used to forecast surface generated noise. Additionally, aircraft Noise Exposure Forecast (NEF) projected to the year 2040 prepared by Edmonton Airports was used in the cumulative analysis of noise sources.

Summaries of the *Traffic Impact Analysis* and the *Noise Impact Analysis* are presented in Sections 3 and 4, and their full report can be found in Appendices A and B, respectfully.

Concept Development

In developing the land use concepts for the study area, Inter*VISTAS* held three consultation meetings with stakeholders. Pertaining to the study area itself, the stakeholders involved include the City of Leduc, Edmonton Airports, Melcor and Oxford Homes, and Alberta Transportation.

A design charrette was held (as the third consultation meeting) to review compatible land uses based on preliminary analysis of traffic and noise forecasts. Participants reviewed different land uses and were presented with strategies for mitigating unwanted noise derived from vehicles and aircraft. At the end of the design charrette, participants identified the possible areas for specific land uses, ranked noise mitigation strategies and identified the need for further traffic and noise impact analyses to understand the cumulative noise impacts of the study area. The information gathered from the design charrette was analyzed and applied in determining compatible land use and developing the Aerotropolis concept.

2. Background

2.1 Study Area

The study area (see

Figure 2-1) is a 530 acre site located immediately south of the Edmonton International Airport, west of Queen Elizabeth II (QEII) Highway along the future 65th Avenue roadway. Accessible by these major roadways, the site can also be accessed via other smaller road networks, as well as via a rail line that runs parallel to the QEII highway. The proximity of the study area to different modes of transport is advantageous for rapid connectivity to regional, national and global markets. Additionally, it is within proximity for commerce connectivity with the existing Nisku Business Park (Nisku) – reputed by Leduc County as second largest industrial park in North America.

Figure 2-1: Study Area

The study site is of critical importance to realizing an Aerotropolis vision for development that other international airports have already realized. The locational advantages of a site proximate to Edmonton International Airport, Port Alberta and the Nisku Business Park are sizable for future job creation and economic activity. Already, the Nisku Business Park employs over 28,000 highly skilled trades and professional workers. To grow this further, specific Aerotropolis land uses can help formulate future development patterns in the study area. This includes the opportunity for value-added agriculture manufacturing and production to capitalize on the Provincial Food Processing Development Centre already in Leduc. Other possible Aerotropolis land uses reviewed in this study have an added advantage: consistency with compatible land use planning for aeronautical and land-based noise sources. Consequently, short and long range planning efforts for lands within and surrounding the study are vital to maximizing the locational advantages to key transportation and employment centres.

2.2 Aerotropolis Development

The Edmonton region, which includes the City of Leduc, has opportunities to capitalize its positive business climate, geographic location and build upon its expanding transportation, distribution and logistics systems. The overarching vision for the Edmonton region is to become one of North America's premier warehousing, distribution, and multi-modal hubs. EIA is expected to play a key role in meeting these goals.

Edmonton International Airport, with over 5 million enplaned and deplaned passengers in 2010 is a key transportation gateway for the province and is continually evolving and expanding to meet air service demands to, from and through the region. To evolve with the airport and support the region's future growth, political, economic and community leaders are considering adoption of Aerotropolis development principles in the region, with a particular focus on land at and around the airport as key supporting elements.

Over the past two decades the activities of Nisku Business Park have benefited from the economic synergies of its proximity to Edmonton International Airport and connection to the regional road

network. Further development over the long-term horizon of a multi-modal hub and energy super-hub (Port Alberta) can potentially be leveraged for its expansion and the development of other industrial parks in the area. Applying Aerotropolis principles to the study area could allow for a number of synergies with existing concentration of industrial activities in the Nisku area -- particularly those that are more aviation-related or air-truck-related.

At a very broad level, an Aerotropolis can be defined as the diversification of the airport's activities and the multiplication of the economic benefits these provide to the city beyond those typically associated with aviation activities. The vision for an Aerotropolis in the Edmonton region draws upon the city's role as a Northern Alberta and Northern Canadian gateway supporting natural resource industries, with the aim of enshrining the airport and the region as a transportation, distribution and logistics centre for North America; and an entry point for global trade and economic development.

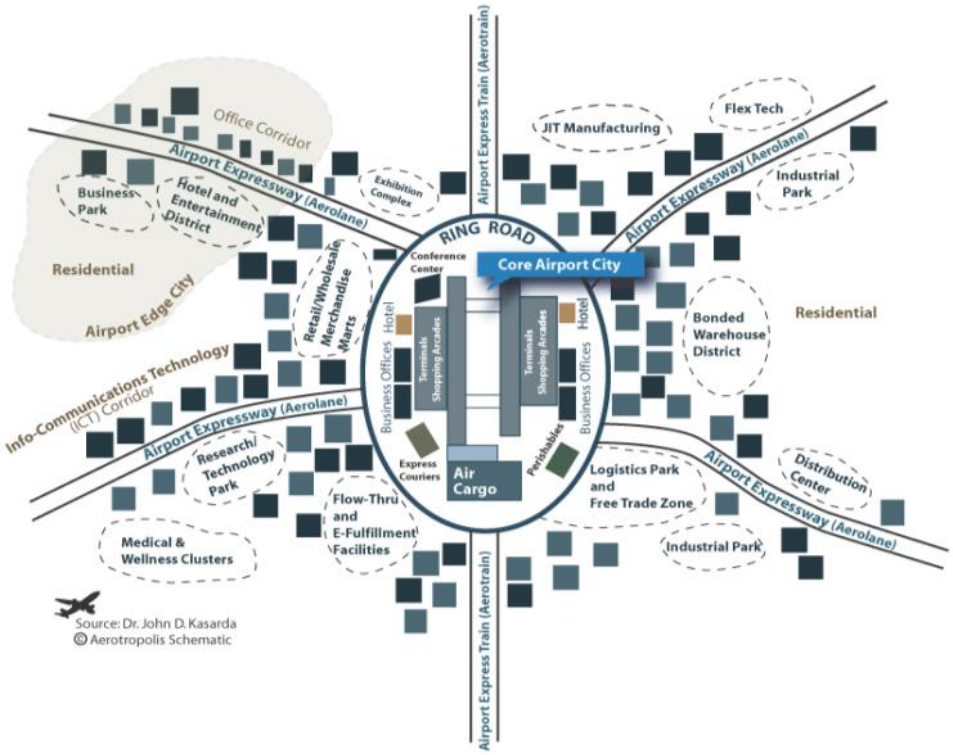
A number of airports around the world have advanced or are advancing various Aerotropolis concepts, depending on the level and type of air traffic the airport's primary catchment area can sustain. Aerotropolis can generally be categorized according to three broad areas of focus:

- 'People' Centres – focusing primarily on on-site or proximate people-related services that aim to enhance the passenger and community experience through integrated transportation, hotel, conference, offices, and entertainment/recreation activities. Examples of these airports would include Frankfurt-Main and Kuala Lumpur.
- 'Logistics' Centres – focusing primarily on logistics and complementary industrial activities through integration of foreign trade zones, intermodal transportation or derived regional gateway initiatives. These airports are predominately cargo-based and include, for example, Memphis (FedEx), Louisville (UPS) and Rickenbacker, Ohio.
- 'Integrated' Centres – merging key aspects of 'people' and 'logistics' concepts that involve even broader zones of influence. Singapore Changi, Hong Kong and Amsterdam-Schiphol are prime examples of a fully integrated Aerotropolis. Note that airports characterized as 'People' Centres can also evolve into 'Integrated' Centres as growth is leveraged to create synergies for broader international trade through the airport.

Varieties of different Aerotropolis types of uses have been reviewed and are described in Appendix C.

While large-scale Aerotropolis development involves considerable efforts to create an appropriate investment environment through policy and infrastructure initiatives, implementation at a municipal level requires supporting land use planning initiatives to enable and guide development around compatible land uses and transportation networks. This involves integrating land uses typically found around airports with non-airport related land uses commonly found around suburban neighbourhoods. Examples of land uses found around airports include logistics and distribution centers, light manufacturing and office complexes. Alternatively, examples of non-aeronautical uses include research and development facilities, lifestyle town-centres with retail and commercial space, entertainment facilities, recreational centers/athletic gyms and big-lot retail centers. The successful union between these uses and the supplication of road, rail, transit and alternative transportation networks can encompass a comprehensive Aerotropolis development. Figure 2-2 below conceptually represents different activity clusters that feed into a regional Aerotropolis development.

Figure 2-2: Aerotropolis Concept Schematic



Source: Dr. John D. Kasarda

For the City of Leduc, the County of Leduc and EIA, consideration of Aerotropolis objectives to the planning of the study area and adjacent land is prudent given the supporting nature the land can provide to associated activities. In addition, the exercise provides an opportunity for all associated stakeholders to work collaboratively in advancing regional economic development initiatives.

2.3 Port Alberta

Port Alberta is a proposed development located within the boundaries of the Edmonton International Airport. The 700 acre site was selected by Edmonton Airports to support the development of a multi-modal transportation hub. The strategically located site can take advantage of its proximity to the airport, Queen Elizabeth II Highway and major rail freight services. This multi-modal transportation hub would allow convenient global connectivity via international airline services, the CANAMEX Trade Corridor and the Asia-Pacific regions through the Port of Prince Rupert in British Columbia.

The proposed uses at Port Alberta would primarily compose of industrial and commercial uses to support the potential development of logistics-related businesses and industries. Specifically, the land uses planned would be relevant to manufacturing, production, supply, distribution and storage activities.

In relation to this report, Port Alberta is located directly north of the study area. The development potential, activities and the proposed land uses at Port Alberta are considered in the traffic and

noise impact analysis (Sections 3 and 4, respectfully) and used to determine compatible Aerotropolis uses for the study area.

2.4 Nisku

Nisku represents one of Canada`s largest and North America`s second largest energy park. The site is within Leduc County and is home to 600 major businesses in five key economic sectors. These sectors are key economic drivers for the region and they include the Agri-business, Advanced Manufacturing, Energy and Utilities, Environmental Services, and Transportation and Logistics sectors. Since inception Nisku has grown from a 2,200 acre site to one that is over 8,000 acres in size. Businesses located at Nisku employ over to 28,000 employees with about 75% of the businesses established in their respective international trade markets.

Nisku is located east of the study area, across the Queen Elizabeth II Highway. Its proximity is a major advantage for potential synergies with the objectives of this study. Nisku is a prominent economic player for the County and the City. Nisku employs local professionals and the businesses that exist at Nisku diversifies Alberta's economic portfolio stemming from the oil and gas industry. Programming Aerotropolis compatible land uses that is conducive to the surrounding land uses and regional economy will help generate employment and further progress industries in the international market.

2.5 West Leduc Industrial Reserve

Parcels of land west of the study area are industrial land outlined by the City and County Joint Sustainable Growth Study and Draft Intermunicipal Development Plan (IDP). The land reserve currently abuts the current city boundary and is within the Draft 2011 IDP. Protecting industrial land will secure space available for economic growth for the City and Leduc County.

In relation to the study area, industrial reserves are land available for future Aerotropolis types of development and can expand the synergies between the study area, Port Alberta, Nisku and the airport. Consideration of key land uses identified in this report will be important in future planning efforts for City/County industrial land reserves.

2.6 Land Use Planning & Airports

Under the *Municipal Government Act*, every municipality must possess a Land Use Bylaw. The Land Use Bylaw represents an organized system for regulating land development within the community. Moreover, this bylaw subdivides community districts or land parcels by prescribing specific permitted and discretionary uses for land and buildings. The Land Use Bylaw should be expressed in Municipal Development Plans, outlining the vision, goals and policies in relation to the Land Use Bylaw.

For this study area, the land of interest is in close proximity to Edmonton International Airport and is governed by a number of regulations adopted by the Federal, Provincial and Municipal Governments. The uses allowed within the study area are mandated at a high level by the provincial *Edmonton International Airport Vicinity Protection Area (AVPA) Regulation*[1], with building height on the site being controlled by Federal Aeronautical Zoning Regulations. Transport Canada's *Land Use in Vicinity of Airports*[2] document also provides other guidelines with respect to land use activities and structural materials used in the airport vicinity.

The current 2006 AVPA Regulation, as Appendix E of the *Municipal Government Act,* prescribes land uses on the study area based on the Noise Exposure Forecast. This regulation does not take into consideration long-term development potentials of surrounding sites nor does it prescribe complimentary compatible land uses. In those regards, land uses in the vicinity of the Edmonton International Airport requires more than the AVPA Regulation and local zoning bylaws to regulate uses within and surrounding the site.

Federal Aeronautical Zoning Regulations

Under the *Aeronautics Act*, the Federal Government may take action to prevent lands adjacent to or in the vicinity of an airport or an airport site from being used or developed in a manner that, in the opinion of the Minister:

- Is incompatible with the operation of an airport;
- Is incompatible with the safe operation of an airport or aircraft; and

[1] *Edmonton International Airport Vicinity Protection Area Regulation*, found in Appendix E of Alberta's Municipal Government Act (Alberta Regulation 55/2006), 2006.

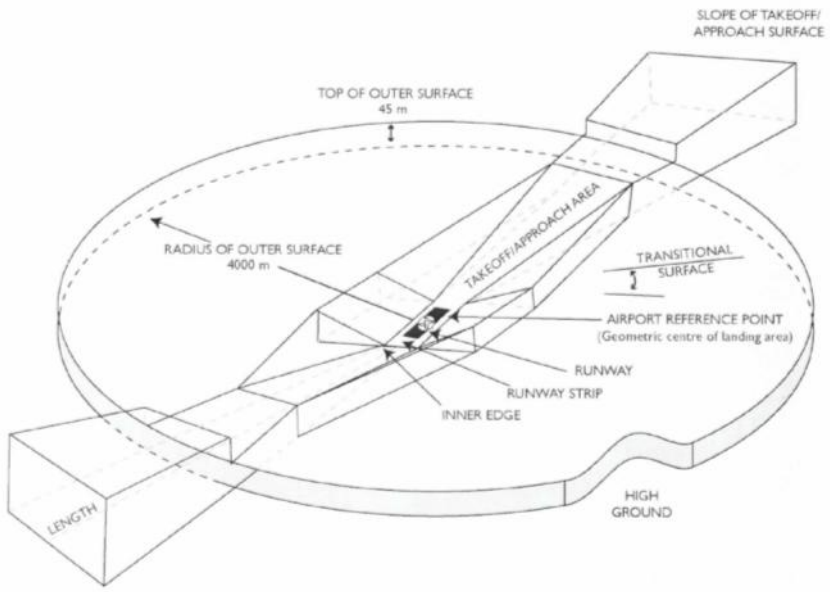
[2] *Land Use in the Vicinity of Airports (TP1247),* Eighth Edition; Transport Canada, 2005

- Causes interference with signals or communications to and from aircraft or to and from those facilities.

The related regulations that emanate from the *Aeronautics Act* prevent physical obstruction of flight approaches, outer surfaces or transitional surfaces around airport sites.[3] The *Edmonton International Airport Zoning Regulations*[4] is an example of the application that addresses the operational safety and communication interference concerns of the *Aeronautics Act*.

While the Federal Government may intervene directly on matters that it considers to interfere with aviation safety or with navigation/communications signals, it cannot intervene directly on general land use incompatibility matters. Consistent with the Conditions Precedent of the *Aeronautics Act*, the Federal Government may only intervene through provincial authorities, who hold ultimate jurisdiction in these areas. Figure 2-3 on the following page illustrates the *Obstacle Limitation Surfaces* that reflect Transport Canada's *Aeronautical Standards and Recommended Practices (TP312)*.

Figure 2-3: Sample Runway Obstacle Limitation Surfaces



Source: Aeronautical Standards and Recommended Practices (TP312), 1993.

[3] Definitions and standards for approach paths, outer surfaces and transitional surfaces are found in Transport Canada's *Aeronautical Standards and Recommended Practices (TP312)*, 1993.

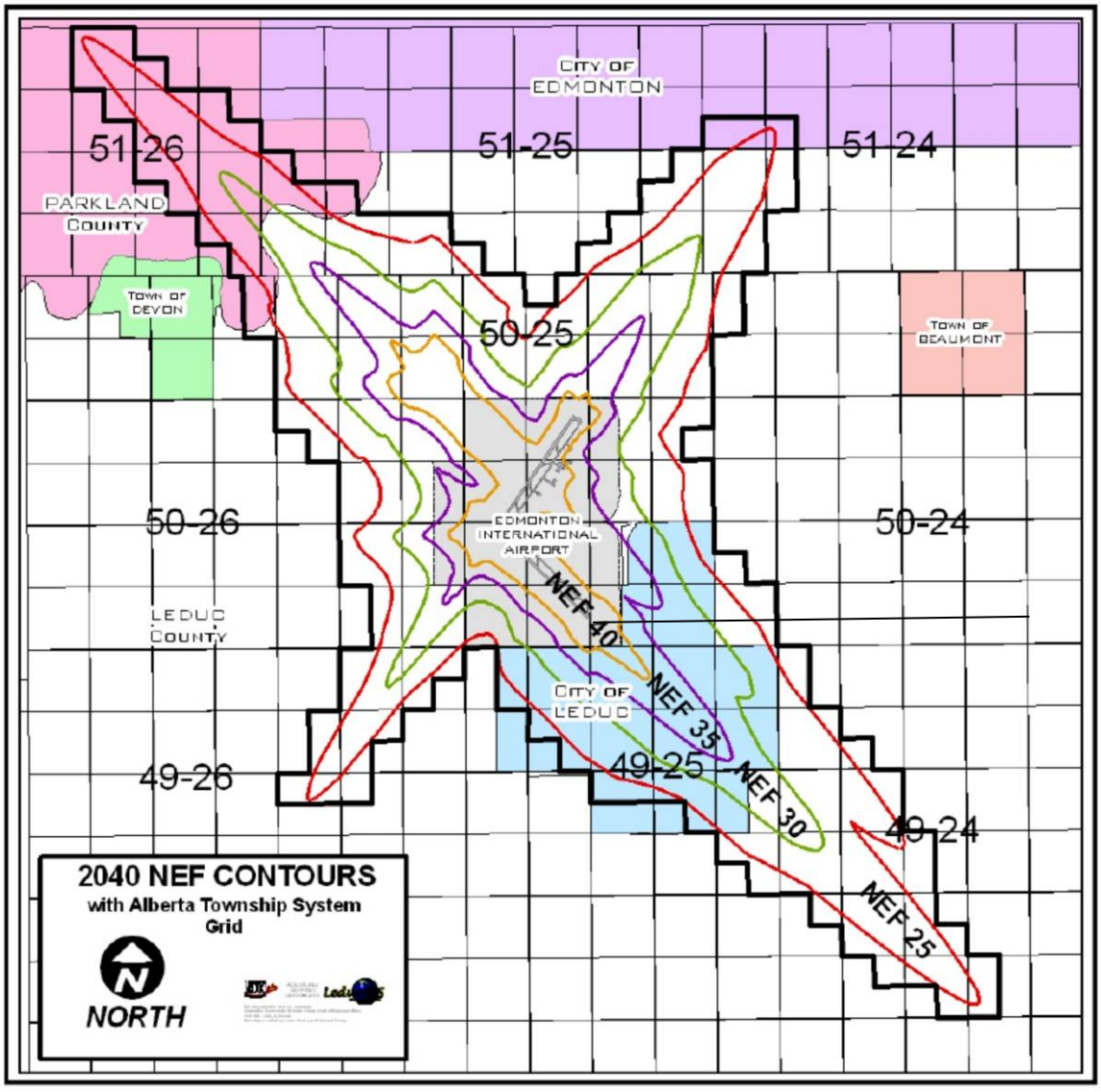
[4] A copy of the *Edmonton International Airport Zoning Regulations* can be found at: http://laws.justice.gc.ca/en/A-2/SOR-80

Edmonton International Airport Vicinity Protection Area (AVPA)

Provincial *Airport Vicinity Protection Areas* (AVPA) legislation was first developed in the 1970s at the Calgary International Airport (YYC) as a series of provincial regulations governing land use around the airport and to address common issues between different local municipalities. Similar regulations were applied to Edmonton International Airport (YEG) in 1981 under a separate AVPA.

The most recent update to the EIA was adopted in 2006. Figure 2-4 below and Table 2-1 on the following page outline the permitted land uses in the study area.

Figure 2-4: 2040 EIA AVPA Noise Exposure Forecast Contour Map



Source: EIA AVPA Regulation, 2006.

Table 2-1: EIA AVPA Compatible Land Use by NEF levels

EIA Airport Vicinity Protection Area – Compatible Uses				
Land Uses *Note: PR-Prohibited*	**NEF 40+**	**NEF 35-40**	**NEF 30-35**	**NEF 25-30**
Commercial Uses				
Billiards, Bowling and Arcades	PR	-	-	-
Cinemas	PR	-	-	-
Eating and Drinking Establishments	PR	-	-	-
Funeral Homes	PR	-	-	-
Gambling Facilities	PR	-	-	-
Hotels/Motels	PR	-	-	-
Office and Retail Facilities	PR	-	-	-
Private Clubs and Lodges	PR	-	-	-
Public and Semi-Public Uses				
Churches	PR	PR	-	-
Day Care	PR	PR	-	-
Emergency Response Services	PR	-	-	-
Exhibition and Fairgrounds	PR	PR	-	-
Halls/Auditoriums	PR	PR	-	-
Hospitals	PR	PR	PR	-
Clinics	PR	-	-	-
Libraries	PR	PR	-	-
Nursing Homes	PR	PR	PR	-
Outdoor Recreation Facilities	PR	-	-	-
Schools	PR	PR	PR	-
Spectator Entertainment Facilities				
Outdoor	PR	PR	PR	-
Indoor	PR	PR	-	-
Spectator Sports Facilities				
Outdoor	PR	PR	PR	PR
Indoor	PR	PR	PR	-
Residential Uses				
Campgrounds	PR	PR	PR	PR
Residences	PR	PR	PR	-

Source: EIA AVPA Regulation, 2006.

Transport Canada Land Use in the Vicinity of Airports

While the Federal Government exercises relatively limited powers over municipal land uses, Transport Canada strongly encourages municipalities to adopt compatible land uses in the vicinity of airports and provides guidelines for this purpose through its *Land Use in the Vicinity of Airports*[5] document. The guidelines tabulate sixty-three different land uses with regards to their appropriateness within different NEF contours zones (see Appendix D).

Transport Canada's objective is to provide guidance with regards to controlling the development of new activities within areas exposed to high levels of aircraft noise. Overall, the guidelines recommend that no new residential construction occur in areas situated within the 30 NEF contour and above in the vicinity of existing airports.[6] If a municipality should choose to permit residential development within the 30-35 NEF contour, through infill for example, Transport Canada recommends that appropriate acoustic insulation features be considered in the building design. Neither the Airport Authority nor Transport Canada can enforce these guidelines, as their implementation remains a provincial responsibility.

Municipal Land Use Zoning Bylaws

As an Integrated Land Use Compatibility Plan, this report supplements the above standards and regulations and provides more clarity for developments in the study area and around the airport.

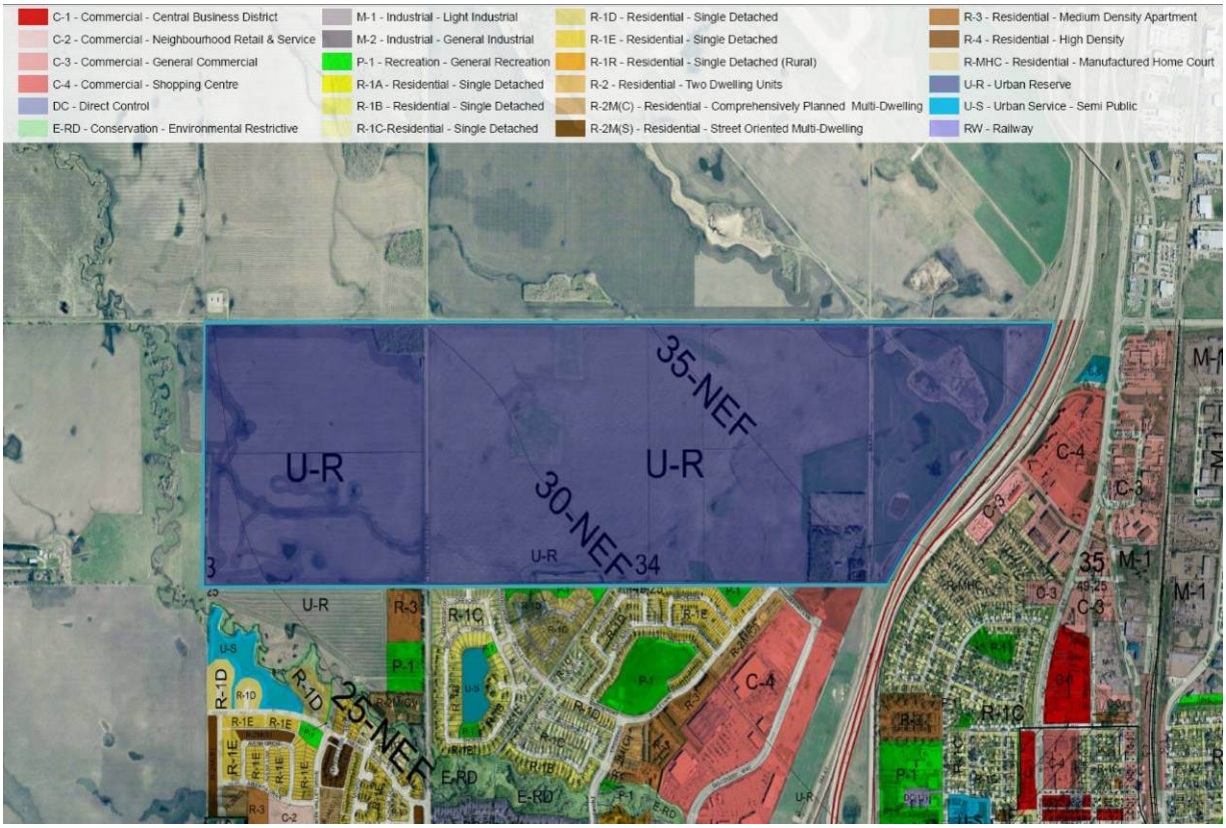
Municipal Zoning Bylaw regulations supplement the above standards and provide more clarity for development on land affected by Federal Aeronautical Zoning Regulations and provincial AVPA legislation. Figure 2-5 (below) shows current land use zoning bylaw permissions set by the City of Leduc. Section 5 – Land Use Analysis of this report will review compatible land uses for the study area and provide recommendations, if any, to amend the current land use regulatory system.

Under the City of Leduc's Land Use Bylaw, the study area, illustrated on Figure 2-5, is presently districted as U-R - Agricultural - Urban Reserve. The Urban Reserve district is a generally intended to reserve those lands within a Municipality which are rural in character until they are needed and/or redistricted to another land use district for urban purposes. The redistricting of land normally occurs subsequent to the preparation of an Area Structure Plan or a Land Use Study. The purpose of the Aerotropolis Integrated Land Use Compatibility Plan is to guide the redistricting of these lands within the Study Area shown on Figure 2-5 based on the cumulative noise impacts and the aerotropolis planning concept.

[5] *Land Use in the Vicinity of Airports (TP1247),* Seventh Edition; Transport Canada, 1996.

[6] For new aerodrome facilities developed on green field sites, Transport Canada recommends that no new residential should occur in areas of 25 NEF or greater.

Figure 2-5: City of Leduc Zoning Bylaw Map



Source: City of Leduc Land Use Bylaw 516-2002

2.7 Long-term Planning Parameters (Assumptions)

With the aim of developing a long-term vision for compatible land development on the study area, understanding stakeholder objectives for the land surrounding the land parcel is paramount. Specifically, these involve review and consideration of future development plans for the Edmonton International Airport, the Port Alberta initiative, the City and County of Leduc. The following highlights key elements of stakeholder reference documents used for baseline assumptions regarding long-term development around the study area and as inputs to the traffic impact analysis and noise study.

- Draft Edmonton International Airport 2010-2035 Master Plan Update (2010). This report provides information pertaining to future development at the airport, identifying land parcels for cargo facilities (north and south), airport south hangar development, future hotel site, car rental facility and the extension of Runway 12-30. Additionally, the report identified a future site for an aviation business park and the potential location of a third runway. Information in this report was used during the noise and land use impact analysis in developing the Aerotropolis land use concept.

- Excerpts from Port Alberta Transportation Study (2009). A section for this report provides information pertaining to the Port Alberta site located adjacent to the study area. The document identifies substantial amounts of new aviation-related industrial park uses south of Edmonton International Airport, representing approximately 1,400 acres of developable land. Additionally, the study provides context to forecasted traffic volumes at 65th Avenue and QEII for comparison (to the Traffic Impact Analysis completed for this report).
- The City of Leduc & County of Leduc Joint Sustainable Growth Study 2008-2060 (October, 2008). This report provides a regional framework for long-term planning over 50 years. The study identified future land use development types (residential, industrial and commercial) for the study area surroundings, as well as the approximate area of development in quarter sections (approximately 160 acres). Population and employment forecast information for the city and county were obtained from this document to perform the Traffic Impact and Noise Analysis. These are highlighted as an increase of population of 72% (107,605) by 2060, from 29,755 in 2006 and an increase of employment of 74% (80,809) by 2060, from 21,319 in 2006.
- City of Leduc 2009 Census Study Official Report (August 14, 2009). This report provides information on the place of work for Leduc residents, and summaries showing the distribution of population by neighbourhood.
- City of Leduc Transportation Study (June, 2009). The report reviews short-term growth and development to 2016, identifying key transportation infrastructure requirements.
- West Leduc Lot Limit Study (February, 2010). This report provides the development capacity of 50th Avenue, comparing its current and future improved road traffic capacity. The widening of 50th Avenue to Queen Elizabeth Highway II can provide 1,100 additional residential dwelling units. The report was used to provide the baseline traffic counts for peak hour traffic along 50th Avenue.
- Excerpts from the QEII Functional Planning Study Ellerslie Road to South Leduc (2009). This report provides the base concepts for ultimate interchange entry and exit point configurations along the QEII corridor from Ellerslie Road in Edmonton to South Leduc. Interchange concepts and elevations were used for traffic and noise impact analysis.

3. Traffic Impact Analysis

The impact of certain planned developments can generate unprecedented traffic and noise that can be a nuisance to Leduc residents. A *Traffic Impact Analysis* (TIA) was completed to understand the traffic impacts of potential development over the 50-year timeframe with emphasis on the traffic and road network capacities around the study area and in and around the City of Leduc.

The TIA provides a high level traffic forecast, recognizing regional population and employment forecast and the full build-out of lands identified by the 2008 *Joint Sustainable Growth Study*. In addition, the traffic forecast will be used as input into the noise impact analysis and in the consideration of compatible land uses for study area. The following summarizes the traffic impact forecast completed and the circulation network surrounding the study area. The full TIA can be found in Appendix A of this report, and includes maps that illustrate traffic distribution, roadway lane assessments, interchange analysis and a set of recommendations.

3.1 Traffic Impact Forecast

A traffic impact forecast is a long-term projection of vehicle traffic for roadways surrounding the study area. To determine the basis for future traffic around the study area, potential developments surrounding the study area requires careful analysis. For the purpose of this study, an ultimate 50-year scenario was used, setting the ultimate scenario for noise impacts and later to determine compatible land uses for the study area.

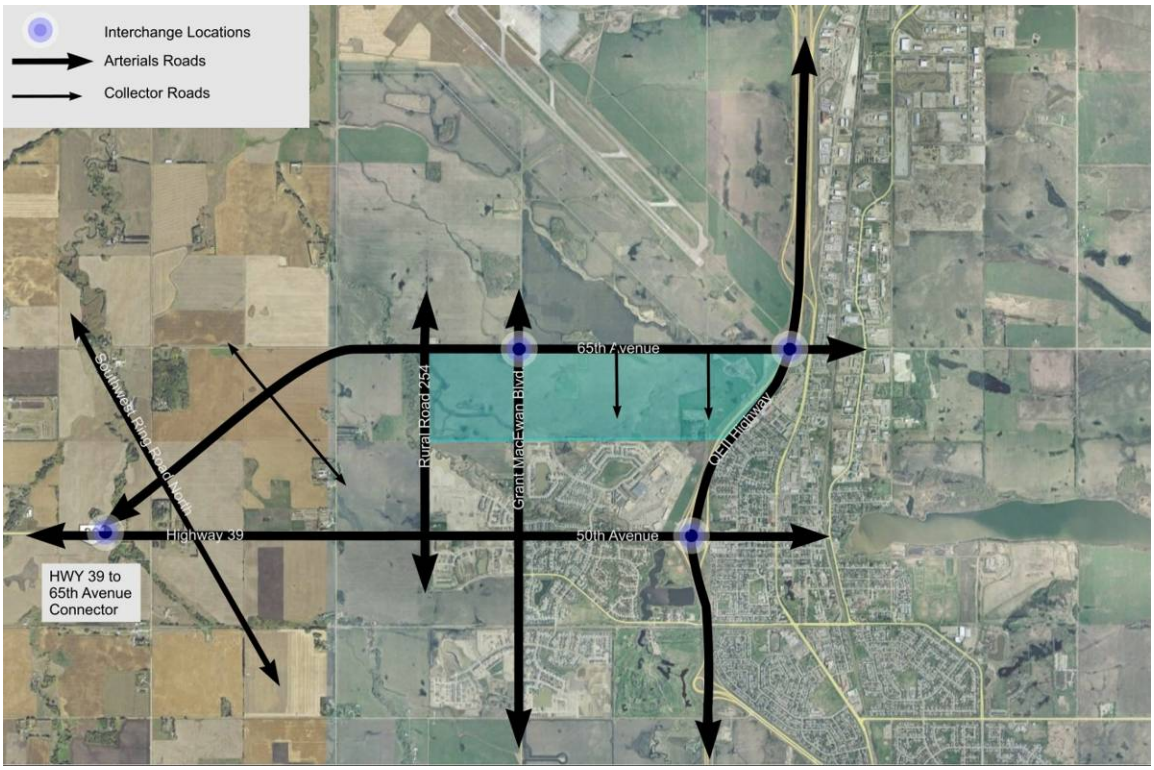
In line with the 2008 *Joint Sustainable Growth Study*, long-term trip generation was determined using the trip generation rate standards (ITE Handbook) for proposed lands developed within the vicinity of the study area. Two methods for trip generation were used. The first method approximates trips by development types (industrial, residential or mixed residential/industrial) and the second method uses the total amount of forecast jobs and employment. In total, 81 quarter sections (13,000 gross acres) of land were used in determining vehicular traffic around the study area.

In addition to the trip generation forecast, the TIA employed a traffic simulation model to evaluate roadway capacities, to distribute vehicular traffic across the road network and to determine the number of lanes required from each corridor around the study area. Moreover, the TIA evaluated turning movements that can be used to determine future locations for infrastructure upgrades (scale of interchange required).

3.2 Circulation Network

The following are summary excerpts from the TIA, covering key roadways and interchanges near the study area required to balance traffic demands from future development areas. The identified roadways below were used in modelling the distribution of traffic (by using VISUM) in understanding roadway network capacity. It is important to note that access to the study area and Port Alberta site off 65th Avenue are only assumptions based on preliminary long-term concepts for land surrounding the study area. Figure 3-1 (following page) illustrates the circulation network possible, based on the traffic impact analysis and long-term concepts from the 2008 *Joint Sustainable Growth Study* and EIA Draft *Master Plan*.

Figure 3-1: Circulation Network



There are nine vehicle road corridors surrounding the study area. These nine corridors are composed of highways, major arterials and collector roads. They consist of:

- Highway 39 (50 Avenue). Currently a four-lane divided arterial with a posted speed of 50 km/h. The arterial provides connection to downtown Leduc and a QEII interchange to the east with rural areas of Leduc County to the west. In the future, it could be upgraded into a six-lane arterial between Bridgeport Cross and QEII.
- 65th Avenue. This future road provides direct access points to the study area, adjacent to potential Port Alberta development, as well as further developments west of Port Alberta. It is currently identified as a Township Road 500 right-of-way west of the QEII corridor. The proposed road is planned as an arterial or freeway standard with a full interchange connection at QEII. In addition to potentially providing an access point for arterial and collector streets within development areas, it may serve as an alternative alignment for Highway 39 once 50th Avenue reaches practical capacity.
- Discovery Way. This road currently connects with Highway 39, but as growth continues it will extend north to connect with 65th Avenue, approximately 700 m west of the QEII interchange.
- Collector Road. A road not yet named, this future collector road will extend from the Bridgeport Cross/Bridgeport Boulevard area north through to 65th Avenue, approximately 800m west of Discovery Way.
- Grant MacEwan Boulevard. The form and function of this proposed arterial road is pending review of connectivity to the Port Alberta development. The proposed arterial would connect north-south between the Port Alberta site and the current study area.

- Black Gold Drive. An east-west arterial, with potential for widening into four lanes, primarily services east-west trips across Leduc because it does not have direct connections to QEII Highway.
- Western Arterial Boundary Road. Approximately 800m to the west of Grant MacEwan, this road will temporarily serve as the western boundary for the City of Leduc and is parallel to Grant MacEwan Boulevard.
- Southwest Ring Road. This facility, identified in the City of Leduc Transportation Study (2006-2016) and the 2008 *Joint Sustainable Growth Study*, will connect an alternative alignment of QEII / Highway 2A with Highway 39, and north to the City of Edmonton (Terwillegar Drive).
- Highway QEII. One of the busiest freeways in Alberta, QEII is a four-lane divided highway that runs north-south through Leduc with a full interchange at Highway 2A and Highway 39 (50 Avenue). A partial interchange is available for 50 Street and 65 Avenue. However it is planned to become a full interchange with the extension of 65 Avenue west. The posted speed is 110 km/h.

With Nisku area touted as the second largest industrial park in North America, its continued growth and commerce-relations to the study area will drive up the magnitude of traffic impact to the nine roadway corridors described above. Further traffic study should be considered in understanding this impact.

4. Noise Impact Analysis

Noise pollution is an unwanted and displeasing sound that disrupts the balance of community life. The source of noise pollution can be attributed to human, animal or machine-generated sounds. Specific to the study area, noise generated by aircraft, roadways and ground-based industrial activities were reviewed. Through computer simulation, the *Noise Impact Analysis* (NIA) modelled the noise disturbance of each noise source to arrive at a cumulative noise model for the ultimate scenario (2060). The NIA is used in this report as input in determining compatible land uses for the study area.

The cumulative noise simulation completed is measured using L_{DN} and NEF (Noise Exposure Forecast) noise metrics. Sound is commonly measured as L_{eq} dBA, and represents the measured sound level over a given period. L_{DN} as another noise metric is used in measuring traffic noise, and is derived from calculating daytime and night time L_{eq} values; with a 10 dBA penalty for night time traffic. For this project, all L_{eq} dBA is calculated over 24-hours, with the assumption for 24-hour activity from the airport and Port Alberta site, and higher ratios for heavy trucks during the night time versus passenger vehicles during day time for road networks in the vicinity of the study area. NEF in comparison is a noise measurement based on a compendium of variables such the frequency of aircraft movements, daytime versus night time occurrences and noise sound footprints of varying aircraft types, specific to each airport runway configuration. As outlined earlier in this document, the NEF model is used as a base to the provincial AVPA governing land uses around EIA.

To address both planning needs for mitigating non-aircraft noise and building treatments to mitigate aircraft noise, the NIA presents results in L_{DN} and NEF noise metrics adapted to also include ground-based (Port Alberta site) noise sources. Ultimately, the cumulative noise index in NEF noise metrics will be used as a guideline in this document for prescribing compatible land use given the relationship with the existing AVPA matrices. Alternatively, the cumulative noise forecast in L_{DN} will be used in applying noise mitigation measures, since the outputs relate more closely to audible sound levels.

The full NIA report can be found in Appendix B. The following summarizes the individual and cumulative noise source analysis used in determining compatible land uses.

4.1 Aircraft Noise

The Noise Exposure Forecast (NEF) is the official metric in Canada for the assessment of airport noise. NEF contours are modelled using software provided by Transport Canada using such inputs as: the mix of aircraft types, the number of day and night aircraft movements, runway layouts and distribution of aircraft on individual runways as well as arrival and departure procedures. It is important to note that the NEF cannot be measured using noise monitoring equipment as it is derived from a compendium of factors.

The NEF system is designed to assist with land use planning decisions by correlating aircraft noise exposure with the anticipated subjective response from exposures to different NEF values. For example, NEF values greater than 40 denote areas with high noise exposure, while NEF values

below 25 indicate relatively low aircraft noise exposure. Its use as a land use planning tool is based on an extensive review of the subjective response to aircraft noise.

Table 4-1: Response to Aircraft Noise

Response Area	Response Prediction*
1 (over 40 NEF)	Repeated and vigorous individual complaints are likely. Concerted group and legal action might be expected.
2 (35-40 NEF)	Individual complaints may be vigorous. Possible group action and appeals to authorities.
3 (30-35 NEF)	Sporadic to repeated individual complaints. Group action is possible.
4 (below 30 NEF)	Sporadic complaints may occur. Noise may interfere occasionally with certain activities of the resident.
* It should be noted that the above community response predictions are generalizations based upon experience resulting from the evolutionary development of various noise exposure units used by other countries. For specific locations, the above response areas may vary somewhat in accordance with existing ambient or background noise levels and prevailing social, economic and political conditions.	

Source: Land Use in the Vicinity of Airports – Transport Canada (TP1247), 2005.

The NEF for Edmonton International Airport (EIA) takes into its consideration the potential development of a third runway north of the air terminal complex. It is necessary to note that the NEF modelled only projects to the year 2040 and includes the potential third runway alignment. It is missing however the rationalization for a third runway at the airport.

No further runways are formally envisioned in the foreseeable future. An analysis by the project team confirms the significantly low probability that any other runways would be needed at EIA. This analysis was further benchmarked against other leading international airports around the world, and reduction in aircraft noise footprints that continue to result from introduction of new aircraft technologies. A review of aircraft noise contour trends and aircraft technology is included in Appendix E.

4.2 Vehicle-generated Noise

Traffic noise generated by vehicles is derived by using trip forecast to 2060, distributed along the roadway network identified in the TIA and previously in Section 3.2 (Circulation Network). Specifically, the traffic noise analysis reviewed day and night traffic volumes for passenger vehicles and heavy truck vehicles. Night time traffic covers the period between 10 pm and 7 am while day time traffic covers the period between 7 am and 10 pm.

The following are assumptions used to model vehicle-generated noise:

- The daytime noise modelling exercise accounted for a ratio of 75% passenger vehicles and 25% heavy truck vehicles (85% of total daily traffic),
- The night time noise modelling exercise accounted for 25% passenger vehicles and 75% heavy truck vehicles (15% of total daily traffic); and,
- Traffic speeds along 65th Avenue are 80 km/h and all adjacent roads have a speed limit of 60 km/h.

4.3 Ground-based Noise

Understanding that the Port Alberta development would be located south of EIA and north of the study area, a noise analysis of industrial and warehousing complexes was used to typify noise generated from the Port Alberta site. Specifically, the following assumptions were used to model ground-based noise at Port Alberta:

- 24-hour operation;
- Buildings would consist of warehouse and industrial type of complexes;
- Activities would be similar to those found near industrial plant buildings, involving metalwork;
- Aircraft ground movements within the Port Alberta site were not considered; however, high-frequency noise typical of jet aircrafts taxiing were considered in this analysis; and,
- Operations at the airport and Port Alberta site are assumed to run continuously, with 37.5% of operations occurring during the night.

Land areas west of the study area as indicated in the Draft 2011 Intermunicipal Development Plan and the 2008 City of Leduc and Leduc County Joint Sustainable Growth Study are planned for industrial reserve. These industrial land areas were assessed in the traffic impact analysis; and traffic forecast were consequently used to generate future ground based noise contours westward along the 65th Avenue corridor. These noise contours are illustrated in Figures 4-1 and Figure 4-2 in the following section.

4.4 Cumulative Noise

To deliver a comprehensive NIA, the noise sources were combined to fully understand the amount of noise pollution expected at and within the vicinity of the study area. The cumulative noise impact analysis would determine compatible land uses for the study area. Figure 4-1 and Figure 42 on the following pages depict the cumulative noise impact of EIA aircraft operations, vehicle-generated noise and ground-based noise (Port Alberta), based on L_{DN} and NEF noise metrics. The cumulative L_{DN} noise values were derived by calculating the day and night time L_{eq} values over a 24-hour period (7AM to 10PM – day time and 10PM to 7AM – night time) from each noise sources (air, road and ground-based) and combining them together using decibel math. The cumulative NEF noise values were derived by calculating noise sources over a 24-hour period and combined all together; whereby the NEF values for road and ground-based noises are equivalent to L_{DN} values minus 35 dBA.

Under typical conditions, as recommended by US Housing and Urban Development (HUD) Agency, and enacted by City of Regina, Saskatoon and Winnipeg policies, residential neighbourhoods should not be exposed to noise levels above 65 dBA L_{DN} (for traffic noise), equivalent to approximately 62 dBA L_{eq} over a 24-hour period. For Leduc, the Engineering Noise Standard of 55 dBA L_{eq} (24-hours) is much stringent than the aforementioned standards and the Alberta Building Code. It is important to note that the Engineering Noise Standard for Leduc is for road and rail noise only.

Since the study area is in proximity to EIA, the *Airport Vicinity Protection Act* takes precedence over the Engineering Design Standard of 55 dBA 24-hour L_{eq}. This act prohibits any new residential development within the NEF 30 contour and above.

In relation to L_{eq} dBA noise levels, this metric can only be used when looking at developments abutting the road network around the study area. For planning and noise mitigating purposes, the Leduc Engineering Design Standards from the City of Leduc, residential developments abutting the road and rail network around the study area should not be exposed to noise threshold greater than 55 dBA L_{eq} (or approximately 23 NEF contours).

Figure 4-1: Combined L_{DN} Noise Forecast

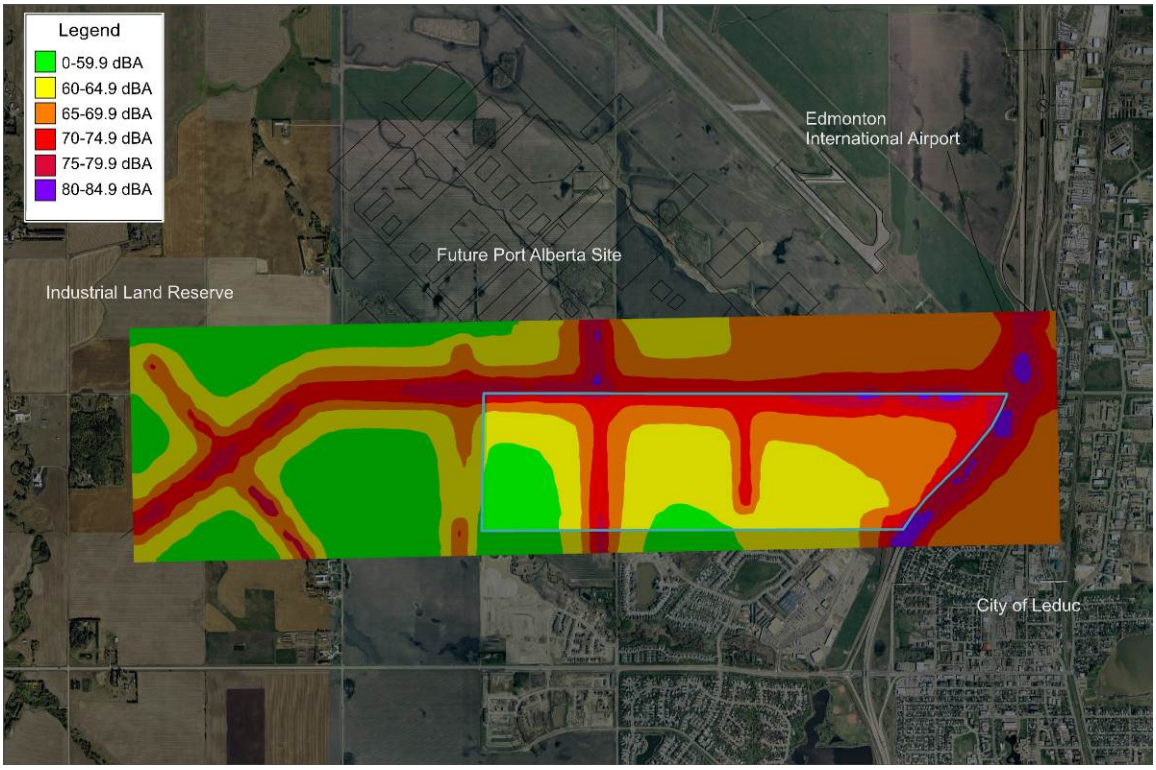
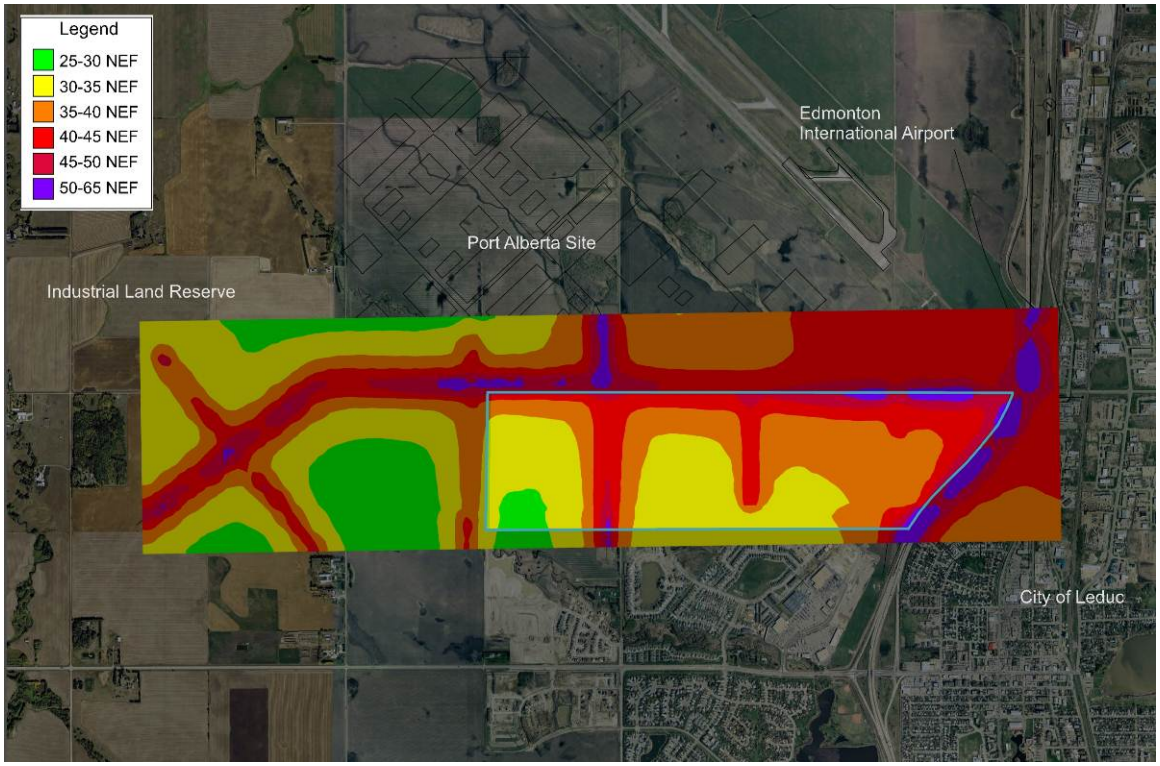


Figure 4-2: Combined NEF Noise Forecast



5. Land Use Analysis

Looking forward 50 years, through to 2060, requires a clear vision and an understanding of the long-term economic growth potential for Leduc and Leduc County. Substantial growth opportunities exist within the City of Leduc and the County of Leduc. Population and employment through to 2060 are anticipated to continue to grow, supplemented by strong economic growth in the region. The expansion of the Edmonton International Airport and the proposed development of the Port Alberta site are two strong indicators for growth in the region.

The study area analyzed in this report has the potential to become part of a master planned Aerotropolis development, taking advantage of its proximity to air, road and rail transit corridors. In that regards, this section reviews land use within and surrounding the study area, and provides for opportunities to integrate onto a long-term Aerotropolis development vision over the 50-year planning horizon. The compatible land uses determined in this section capture the regional vision for stakeholders involved during a consultation processes for this study, and incorporates the 2060 traffic and noise impact analysis completed.

The following represents the compatible land uses for the study area, accompanied by a land use concept map that integrates Aerotropolis uses for the study area. The analyses completed to arrive at the land use concept and compatible uses derives from our expertise in land use and urban planning; with experience evaluating the highest and best land use in vicinity of airports. Additionally, stakeholder inputs from three consultation sessions were considered in developing the land use concept. Examples of noise mitigation measures are discussed. A best practices review for Aerotropolis development was analyzed in completing this land use analysis. This review can be found in Appendix C.

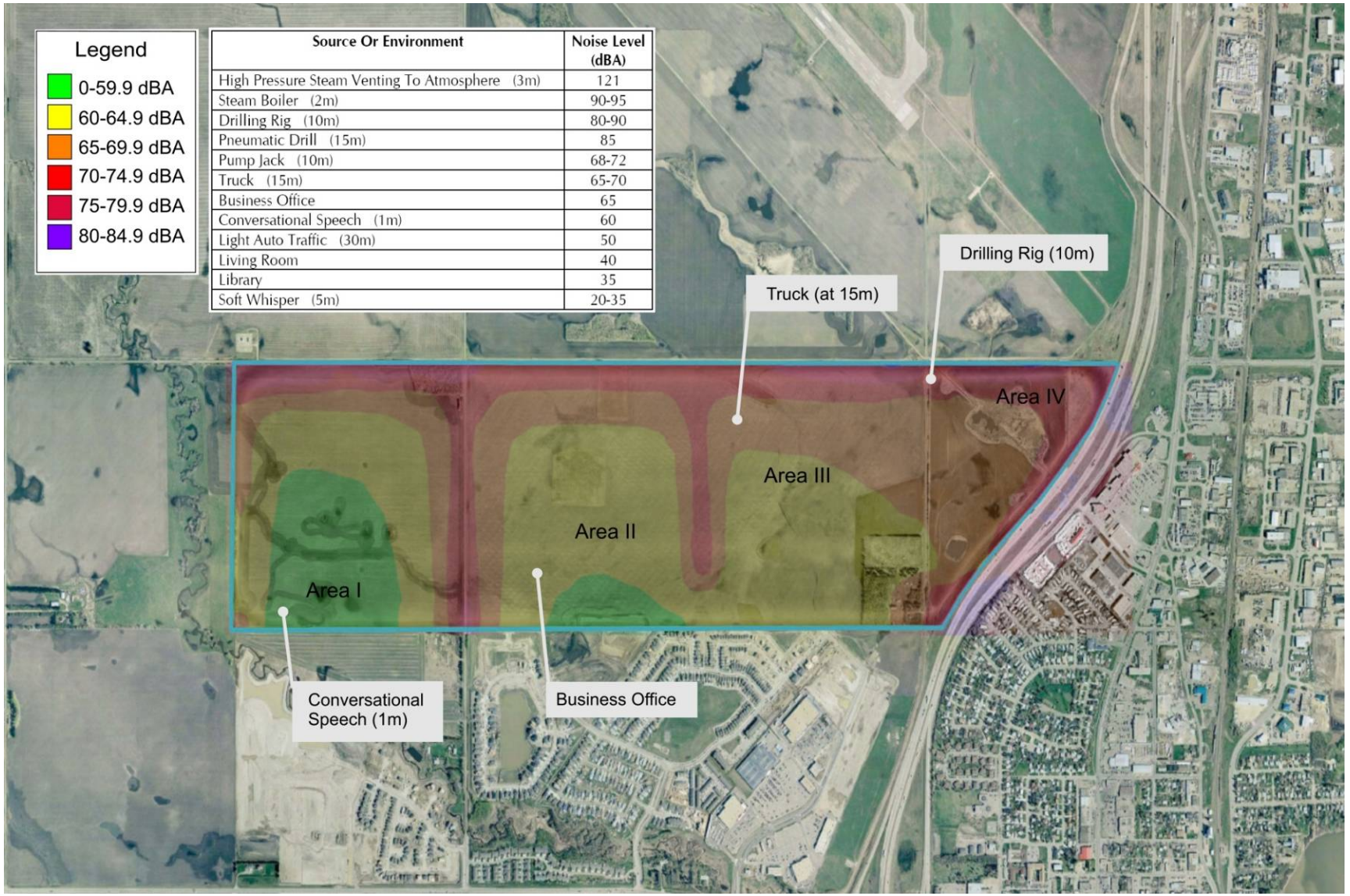
5.1 Compatible Land Uses

Under the current AVPA regulation, the site can be sub-divided into four areas and their respective compatible uses (see Figure 5-1, following page). Over the span of 50 years, development planned around the area will contribute to the increase in ground- and air-based noise. The increase in noise renders the current list of compatible uses listed under the EIA AVPA and the current municipal zoning bylaws relatively weak in guiding future land uses for the site.

As outlined earlier in this document, two cumulative noise forecasts, measured in L_{DN} and NEF noise metrics, were completed. One represents the cumulative noise (air, traffic, ground) measured in L_{DN} and the other measured in NEF. The cumulative noise forecast in L_{DN} is a noise metric for measuring traffic noise and can be compared to common noise sources in dBA noise metric (i.e. explosions, car engine, construction site...etc). Figure 5-2 (page 26) relate dBA levels to day-to-day noise events, and should be referred to when reviewing the cumulative noise forecast ($L_{DN)}$ map. This noise forecast should be used for the planning and definition of noise mitigation barriers.

Figure 5-1: Current Compatible Land Uses

Figure 5-2: Noise Levels of Familiar Sources (Cumulative Noise Forecast L_{DN})



The cumulative noise forecast measured through the NEF model can be associated with the indices used in the AVPA regulation. The cumulative noise forecast (NEF) completed in the *Noise Impact Analysis* is used therefore to prescribe compatible land uses for the study area.

In reviewing compatible land uses, using cumulative noise forecast (NEF), three areas have been created in subdividing land within the study area. Figure 5-3 on the following page represents the initial outline of land uses designated within the three subdivisions (Areas I, II and III). Note for zoning purposes, it is difficult to follow the boundaries of noise contours generated by the cumulative noise forecast as they do not easily relate directly to logical land subdivision layouts.

Figure 5-4 (page 28) represents a more feasible land use subdivision within the study area from the cumulative noise forecast (NEF) based on logical land subdivision pattern. Future Aerotropolis Compatible land use areas will be described as Areas A, B and C.

Figure 5-3: Long Term Compatible Uses

Figure 5-4: Future Aerotropolis Compatible Uses

Area A

Area A is located on the southwest quadrant of the site and is approximately 10 gross acres in size. This area represents the only site at the study area with the least amount of cumulative noise pollution (airplane noise, Port Alberta and vehicle traffic noise). Noise forecasting modelling suggests that this area would be subject to the equivalent of 25 NEF. This site can be serviced by future Rural Road 254, Grant MacEwan Boulevard and internal site circulation roadways. Following current AVPA regulation and Alberta Building Code, as well as Aerotropolis concept, the following uses are considered compatible in this area:

Commercial

- Billiards, Bowling and Arcades
- Cinemas
- Eating and Drinking Establishments
- Funeral Homes
- Gambling Facilities
- Hotels/Motels
- Office and Retail Facilities
- Private Clubs and Lodges

Residential

- Campgrounds
- Residences

Public / Semi Public

- Churches
- Day Care
- Emergency Response Services
- Exhibition and Fairgrounds
- Halls/Auditorium
- Hospitals
- Clinics
- Libraries
- Nursing Homes
- Outdoor Recreational Facilities
- School
- In/Outdoor Spectator Entertainment Facilities
- In/Outdoor Spectator Sports Facilities

Recommended Aerotropolis Uses

- Medical Clusters / Medical Offices / Rehabilitation Centres: can offer surrounding neighbourhood south of the study area a facility for health services. This use is recommended as it could support medical and health needs of future workers employed in and around identified growth areas (i.e. Port Alberta site) and current residents south of the study area.
- Community Center / Recreation Facility: is a place of community gathering. This use was chosen as it can offer local residents and future workers in the vicinity of the study area, indoor and outdoor recreational facility during day- and night-time; thus maximizing this compatible use. This recreational facility, space permitting, could include playing fields for community gatherings or other county fair-types of events.

Area B

This area spans across east-west, along the middle portion of the study area. It is approximately 180 acres in size (gross), with expected noise levels of 30 NEF. This site can be serviced by future Grant MacEwan Boulevard, collector roads from 65th Avenue and other internal collector roadways. The following represents compatible uses for this site, as they relate to current AVPA regulations and Aerotropolis concept.

Commercial

- Billiards, Bowling and Arcades
- Cinemas
- Eating and Drinking Establishments
- Funeral Homes
- Gambling Facilities
- Hotels/Motels
- Office and Retail Facilities
- Private Clubs and Lodges

Public / Semi Public

- Churches
- Day Care
- Emergency Response Services
- Exhibition and Fairgrounds
- Halls/Auditoriums
- Clinics
- Libraries
- Outdoor Recreational Facilities
- Indoor Spectator Entertainment Facilities
- Indoor Spectator Sports Facilities

Recommended Aerotropolis Uses

- Office and Retail Facilities: can be in the form of flex spaces, as business parks which incorporates commercial retail uses that act as a mixed-use of space between work and community lifestyle needs. Depending on the demand for the region and community, office and community commercial retail can be interchanged over time. Examples of this function are lifestyle centres that provide space for small offices, grocery stores, restaurants, café, day-care, post-office and retail shopping stores.
- World Trade Complex / Exhibition / Convention Centres: are large conference centres capable of hosting and entertaining guests from around the world. With close proximity to Edmonton International Airport, road and rail network, the study area is a prime location for convention centres from small meetings to large exhibition events.
- Research and Technology Park: are large facilities for research and development in various industrial sectors. The form of research and technological parks are similar to sites for businesses, but larger in scale, with ease of access to road and air-mode of transport. The close proximity of the study area to the highway and the airport is conducive for biotech and high-tech research parks similar to South San Francisco Biotech Park and Silicon Valley. Depending on the regional need at the time, this compatible use can be a vision and driver for the future home of research and development for green-industries, and/or Alberta's petroleum-related industries.

Area C

This area represents the largest area of land on the study area, approximately 280 acres in size. This area is adjacent to 65th Avenue, with road connections to Queen Elizabeth II Highway. This area is also closest to the proposed Port Alberta site via Grant MacEwan Boulevard. The cumulative noise forecast expected for this area ranges between 30-50 NEF. Because this area has the highest range in noise pollution, only light and general industrial use is suggested for this site –mimicking land use at the Port Alberta site.

This area should complement the Port Alberta site for cargo, warehousing, logistics types of activities.

Recommended Aerotropolis Uses:

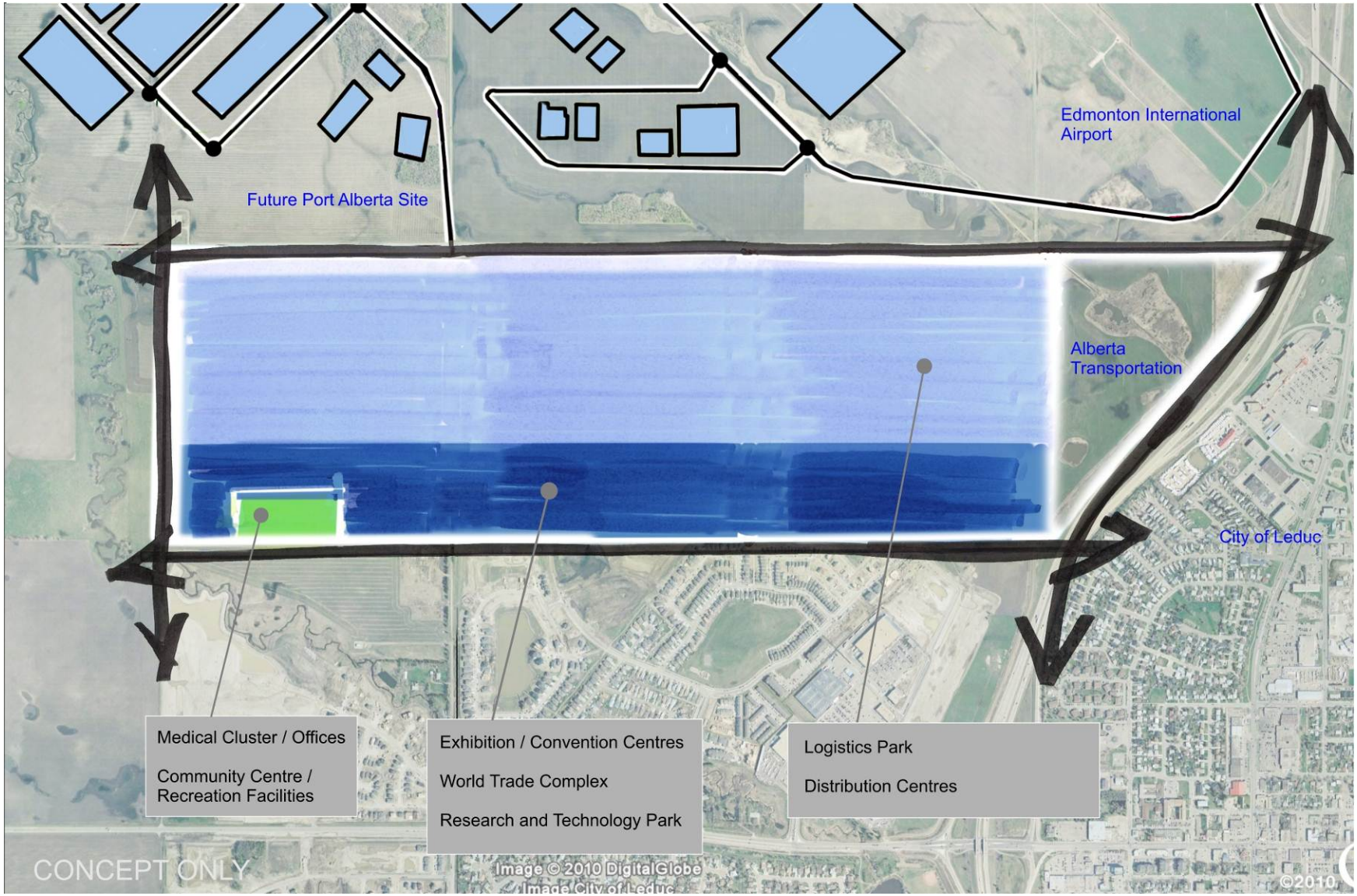
- Logistics Park: are large buildings that take the form of warehouses with the least ratio of workers to building square footage. The function for a logistics park is a combination of goods storage, distribution, processing, logistics organization and management of goods movement. A logistic park in this part of the study area is ideal, as it is adjacent to 65th Avenue and QE II, offering quick access for truck movements onto large arterial roads and highways. Additionally, the location is also ideal for air transport or cargo movement, as it is across the street from the future Port Alberta site.
- Distribution Centres / Export Distribution Centres: are similar in form and function of warehouses, and serve as a storage facility for goods movement and/or trade during the transit from source to destination. Export distribution centres similarly allow for value-add opportunities for particular products as a last step of product development before it is transported to various markets. Distribution centres at the study area can serve as expansion for Port Alberta activities and/or service business that support cargo activities or goods movement via road and rail networks in Leduc.

5.2 Land Use Concept

The study area, being in close proximity to Edmonton International Airport, Queen Elizabeth II Highway and rail corridors, makes it an advantageous site for light industrial and varied commercial use that complement the activities of the proposed Port Alberta site and Edmonton International Airport. The context set over the 50-year planning horizon is for the Leduc region to be the multimodal transportation hub and logistics super center. This multimodal transit hub represents Edmonton International Airport offering international airline service, the CANAMEX trade corridor via QEII Highway, and the Asia-Pacific Gateway via rail at the Port of Prince Rupert, British Columbia. For the study area, land use should be limited to a mix of light, medium and heavy industrial uses with some mixed commercial types to support the growing community in Leduc.

Within the context of the Aerotropolis vision, the land use concept is consistent with best practices of similar land uses reviewed for other airport cities. Implementation of the Aerotropolis uses defined for the study area will support other types of Aerotropolis developments surrounding the study area. Ultimately, the development of the site would support the regional vision in becoming a world-class transportation hub and logistics center. Figure 5-5 on the following page represents the Aerotropolis uses for the three areas defined after stakeholder consultation processes, reviewing planning documents and traffic and noise impact analysis.

Figure 5-5: Aerotropolis Concept Map



5.3 Noise Mitigation Measures

There are three strategies for noise mitigation, as presented during the design charrette for this project. The three strategies are (A) land use planning, (B) urban design and (C) building design. After presenting noise mitigation measures for each of the above strategies, the 12 participants at the design charrette rated each noise mitigation measure on a scale of 1 to 5, where 1 is least effective and 5 is most effective. Table 5-1 summarizes the results.

Table 5-1: Noise Mitigation Strategies

Strategies	Effectiveness
A: Land use planning	
1. Noise barrier types along QEII and 65th	4.0
2. Landscape treatment along site perimeter	2.9
3. Noise mitigation setbacks / easements	3.9
4. Building codes to apply to Areas I, II, and III	3.8
B: Urban design	
1. Site planning / Massing	4.6
2. Concrete / landscaped noise barriers	3.7
3. Earth barrier (berm)	3.8
4. Mixed-use barrier	4.0
C: Building design	
1. Insulation materials	4.6
2. Central A/C	3.3
3. Glazing windows	4.1
4. Ambient sound technology	2.5

In relation to the study area, and identified compatible land uses, the following are suggested noise mitigating measures as extrapolated from the choices participants viewed as most effective at the design charrette.

- Noise Barriers. Natural or man-made noise barriers can be effective at reducing the noise by 10-20 dBA, depending on the noise barrier material and distance from the noise source. Specific to the study area, noise barriers can be placed along road corridors with the highest identified noise levels.
- Buffer Space. Providing buffer space between land uses can create transitional space between compatible uses for the study area. Easements and setbacks provide the city with an opportunity to protect lands within the study area.
    - Easements. Land easements are right-of-ways generally for access to other properties or public utilities. Additionally, they can be identified as buffer space used to protect buildings from other buildings or objects. For the study area, the purpose of an easement is to develop a protected corridor away from noise-pollution.
    - Setbacks. Similar to easements, setbacks most often describes the distances required between buildings/structures, road infrastructures, landscaping, fences and other sources

of nuances. For the study area, the purpose of a setback is to develop reasonable distances from noise-pollution.

- Building codes. This is a strategy where strict enforcement must be met under the Alberta Building Code and AVPA Regulations. As recommended in the Noise Impact Analysis, noise assessment is required for building within the NEF 25 contours and no new residential development within the NEF 30 contours.
- Site planning/massing. During the planning phase of certain development types (i.e. multi-family residential dwelling units, commercial retail centers, industrial and office business parks), building orientation and architecture can be strategically designed and situated where the least amount of noise pollution would affect building inhabitants.
- Insulation materials. This is a building design strategy whereby proper insulation materials for building construction should be in place; considering indoor noise quality for building inhabitants.

6. Key Findings / Conclusion

The land use concept, identified in this report, reflects and supports the regional overarching vision for this area to become one of North America's premier warehousing, distribution, and multi-modal hubs. In-line with the growth direction for EIA, Leduc and County of Leduc, the study area can shape into a world class Aerotropolis, offering not only economic support for long-term economic growth, but local community needs supplying sufficient land for commercial, recreational and office space. Depending on future needs, careful attention to community needs south of the study area and east of QE II is important in harnessing land use that supports Leduc constituents. As a multi-modal hub, the study area as identified in this report is a seed for Aerotropolis type of uses for Leduc and Leduc County.

The following identifies key findings of the *Aerotropolis Integrated Land Use Plan*. The most pertinent of next steps, in envisioning the Aerotropolis concept, is to amend the municipal land use bylaw to prescribe certain land uses with the aim of protecting inhabitants from noise pollution forecast for the study area. In addition to this amendment, the Municipal Development Plan can be a powerful planning tool in defining specific districts east of Queen Elizabeth II Highway.

- Develop a working group of stakeholders to harness the long-term regional vision and determine potential growth opportunities that can better guide future developments.
- Amend the current municipal land use bylaw from UR – Urban Reserve to reflect the compatible Aerotropolis types of land uses stated in Section 5.
- Update the Municipal Development Plan to reflect Aerotropolis types of uses for districts east of Queen Elizabeth II Highway.
- Develop an Area Structure Plan for parcels of land in the vicinity of the study area to define development guidelines and standards or guidelines to implement the Aerotropolis vision aesthetically.
- Develop a noise mitigation strategy to implement noise measures for high-noise polluted areas (Area C of the Aerotropolis Concept Map).

It is important to note that the land use concept defined in this report is for a 50-year planning horizon. Advancements in technology for transportation modes or in building construction and design will have cost implications for attenuating noise to a level of comfort. The cost for noise mitigation could be passed onto the community and developers who distribute their costs to the buyer of each dwelling unit.

The City of Leduc and the County of Leduc, in anticipating growth and developments around the study area, have adopted good long-range planning practice in protecting their constituents from unwanted noise pollution and associated cost for mitigating noise. This report identifies the expected growth, developments and cumulative onset of noise pollution for the City and County. The summation of our analysis, as an Aerotropolis land use concept, should be followed in reference to developing the study site and its surroundings for the benefit of the community.