City of Hamilton
Airport Employment Growth District
- Phase 2
Airport Zoning Preferred Option 3

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1.0 Introduction

1.1 Airport Zoning Standards

The primary purpose for having airport zoning standards is to ensure that the airport lands and surrounding areas are developed for uses that are compatible with the safe operation of aircraft on the airport. Transport Canada has established airport zoning standards and recommendations which place limits on the allowable building and obstacle height within the airport environs, ensure that airport navigational equipment are free from interference, provide guidelines concerning airport noise exposure and the mitigation of wildlife hazards.

Certified airports are required to comply with national standards for airport activities and construction. All current operations and future planning activities must be based on adherence to Transport Canada’s Aerodrome Standards and Recommended Practices (TP312). Compliance with these Standards is also mandatory in order to maintain the airport’s Operating Certificate. The Hamilton’s Airport is a certified airport.

In addition Transport Canada’s document TP1247E Land Use in the Vicinity of Airports has traditionally provided additional zoning requirements with respect to electronic zoning and noise, among other topics. TP1247E is becoming outdated with the recent passage of relevant Canadian Aviation Regulations, however NAV CANADA, who provide technical input for electronic zoning requirements, is still in the process of developing new standards. These may be more or less onerous than those prescribed in TP1247E, but will be similar in nature for most equipment. The guidelines herein are based on TP312E and TP1247E.

A numeric Reference Code is assigned to airport facilities classifying runways according to their length. In general, the higher the numeric or letter code, the greater the geometric requirements of the airport become. In addition, runways are classified according to their capability to support three types of aircraft flight approaches: Non-Instrument (NI), Non-Precision Instrument (NP), and Precision (P) instrument approaches. As approaches become more sophisticated for poor weather services, greater levels of protection are required.
Consequently the long term protection requirements for AEGD lands adjacent to the Hamilton Airport anticipate a sophisticated level of operations in the future.

1.2 Drawing Structure

LPS AVIA has prepared 12 zoning analyses for Hamilton International Airport (YHM) as summarized below. The drawings show the physical, electronic and electromagnetic zoning protection areas for the airport. Each of these zonings is then applied to each of the three options under initial analysis.

- Figure 1- shows the physical zoning for the Hamilton Airport, by means of allowable elevation contours;
- Figure 2- shows the electronic zoning for the Hamilton Airport; this zoning includes the individual zoning for the Radar, Instrument Landing System Localizer and Glide Path arrays and the VHF communications antenna array;
- Figure 3- shows the Instrument Landing System (ILS) compatibility zoning for the Hamilton Airport;
- Figure 4- shows the physical zoning overlaid on the development Option 1
- Figure 5- shows the electronic zoning overlaid on the development Option 1;
- Figure 6- shows the ILS compatibility zoning overlaid on the development Option 1;
- Figure 7- shows the physical zoning overlaid on the development Option 2;
- Figure 8- shows the electronic zoning overlaid on the development Option 2;
- Figure 9- shows the ILS compatibility zoning overlaid on the development Option 2;
- Figure 10- shows the physical zoning overlaid on the development Option 3;
- Figure 11- shows the electronic zoning overlaid on the development Option 3; and
- Figure 12- shows the ILS compatibility zoning overlaid on the development Option 3.
2.0 Legal & Regulatory Framework

2.1 Federal Laws

The Hamilton Airport is a certified aerodrome and thus has specific legal requirements to which it must comply under the Aeronautics Act. The zoning regulations are the rules used to carry out the intent of statutes (Acts) enacted by the Parliament of Canada. They are instruments of legislative power and have the force of law\(^1\).

Transport Canada is responsible for the operational safety of the national air transportation system. Part of this responsibility includes monitoring and oversight of airports supporting passenger-carrying operations to certify acceptable safety standards are being adhered to at the airport. Aerodromes that are located within the built-up areas of a city or town, which support scheduled passenger service or are for reasons of public interest require an airport certificate must be certified.

2.2 Hamilton Airport Zoning Regulations

The federal regulations applicable to the Hamilton Airport are the “Hamilton Airport Zoning Regulations SOR/84-5\(^2\). The purpose of these regulations is to prevent the lands adjacent to the airport or airport site from being developed in a manner that is incompatible with the operation of the airport or aircraft utilizing the airport.

The Federal Zoning regulations state that:

- No person shall erect or construct on any land to which these Regulations apply, any building, structure or object or any addition to any existing building, structure or object, the highest point of which will exceed in elevation at the location of that point
  - a) any approach surface;
  - b) the outer surface; or
  - c) any transitional surface.

\(^1\) [http://www.tc.gc.ca/acts-regulations/regulations/menu.htm#H](http://www.tc.gc.ca/acts-regulations/regulations/menu.htm#H) accessed on July 2\(^{nd}\) 2009
Where an object of natural growth on any land to which these Regulations apply exceeds in elevation any of the surfaces referred to above (a) to (c), the Minister of Transport may direct the owner or occupier of the land on which that object is growing to remove the excessive growth.

No owner or occupier of any land to which these Regulations apply shall permit such land or any part of it to be used for the disposal of any waste, edible by or attractive to birds.

These regulations apply to all the lands, including public road allowances, adjacent to or in the vicinity of the Hamilton Airport as described within the text.

### 2.3 Other Zoning Requirements

The City of Hamilton’s Zoning By-Law 05-200, Section 4 General Provisions, sub-section 4.17 Airport state that: “All development in the City of Hamilton shall comply with the Hamilton Airport Zoning (Height) Regulations established by Transport Canada, which are registered at the local Land Titles Office and which may be amended from time to time.” These Transport Canada regulations are contained within the Transport Canada documents TP 312 and TP1247. In addition, these documents contain additional guidance on the use of land on and in the vicinity of airports.

### 2.4 Implementation Procedures

Development within the airport boundary must be undertaken with the approval of the airport operator, and outside the boundary with the approval of the applicable municipal authority. In both cases development also requires approval by NAV CANADA through submission of a Land Use Application. It should be noted that airport zoning restricted areas included in TP1247 are identified for specific review. However upon technical review, these may not necessarily preclude development, but might for example result in minor adaptation of development to protect the integrity of certain electronic signals at specific locations. Within areas designated in TP1247 development requires coordination with NAV CANADA requirements.

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3.0 Physical Zoning

3.1 Physical Zoning Standards

Physical zoning refers to the obstacle limitation zoning protecting airspace around the airport which must be maintained free of obstacles. Zoning criteria are described in Transport Canada’s Aerodrome Standards and Recommended Practices (TP312) and are based on runway reference codes. Runway reference codes are based on the runway dimensions. Each runway possesses its own type of physical zoning, depending on the reference code assigned.

An obstacle limitation surface establishes the vertical elevation limit to which objects may project into the airspace associated with an aerodrome yet assure that aircraft operations at the aerodrome will be conducted safely.

It includes:

- a takeoff/approach surface which is an inclined plane beyond the end of the runway and preceding the threshold of a runway;

- a transitional surface which is a complex surface sloping up at a specified rate from the side of the runway strip and from part of the take-off/approach surface;

- an outer surface which is a circle overlying the airport at a given elevation and extending outwards to a specified distance; and

- a runway strip which is an area of specified dimensions enclosing a runway, intended to reduce the risk of damage to aircraft running off a runway, and to protect aircraft flying over it during take-off and landing operations.
3.2 Hamilton Physical Zoning

The Hamilton Airport - Physical Zoning drawings (Fig 1, 4, 7, & 10) show the maximum permissible heights for structures underlying these restricted zones. The heights are shown as a series of contours of 5 metre intervals in elevations above sea level (ASL). These contours are defined from a reference elevation for the airport of 230 metres ASL. Physical zoning has been applied to the future runway lengths as suggested by Tradeport in Option 3.
4.0 Electronic Zoning

4.1 Electronic Zoning Standards

Airport developments and operations must also be compatible with a variety of electronic transmissions occurring on or near the airport, all of which are critical to the safety of airport operations. Electronic zoning is designed to protect the integrity of the electronic systems of the aerodrome.

For YHM the following electronic systems are currently installed:

- a radar site located to the south of the intersection of Runways 06-24 and 12-30;
- a VHF air-ground communication system located near Runway 12 to the west of the control tower;
- an ILS glide path antennae array located approximately 150 metres from the centreline of Runway 12 and 330 metres from the threshold of Runway 12; and
- an ILS localizer antenna array located approximately 300 metres from the threshold of Runway 30.

Future extensions of Runway 06-24 including upgraded navigational capability necessitate the electronic zoning protection for a glide path antenna located at the Runway 06 end and a localizer antenna located at the Runway 24 end.

Also the future extension of Runway 12-30 would mean the relocation of the glide path antenna array. We have assumed that standard siting distances for these systems will apply.

4.2 Hamilton Electronic Zoning

4.2.1 Radar

Radar measurement of range, or distance, is made possible because of the properties of radiated electromagnetic energy. This energy normally travels through space in a straight line, at a constant speed, and will vary only slightly because of atmospheric and weather conditions. The energy is transmitted to and reflects from the reflecting object. The minimization of spurious returns because of obstacles in the radiated beam path, are of the utmost importance.
The radar on the airport has a 300 metre zone in which no building or other structure should be allowed to exceed a height of 5 metres below the geodetic height of the antenna platform. The antenna platform height is approximately 25 metres. The antenna platform geodetic height is 257.8 metres ASL. This 300 metre exclusionary zone is represented on the drawing by the solid red circle.

Range rings extend at intervals of 100 metres horizontal distance. Each range ring has a corresponding elevation. This elevation is the allowable obstacle height at the specified range from the antenna.

From 300 to 1000 m from the radar site, the upper limit on the height of an allowable structure is increased at a rate of approximately 0.007 m per metre. Thus at a distance of 1000 m from the site, the structure can be as high as the geodetic height of the antenna tower platform.

In general, the terrain within 1 Km of the radar is most important. Large aircraft should not be parked within 500 m of the radar antenna, since their tail structures are large enough to provide a beam reflection. Any structure that blocks the line-of-sight to the approach path or critical airspace should not be permitted. This includes both man-made and trees.

It should also be noted that Transport Canada/NAV CANADA consultation and approval would be required if any large structure is to be constructed within 10 Km of the radar site. Large structures include warehouses, aircraft hangars and powerlines. The consultation would be regarding, the location and orientation of the structure with respect to the radar, as well as the building materials being used in construction.

The RAMP radar site limits development but does not preclude expansion of commercial land on the east side of the airport.
4.2.2 VHF/UHF Radio Communication System

The (VHF/UHF) communication system permits voice and data communication between the aircraft and ground over line-of-sight distances. The VHF system operates in the VHF aeronautical frequency range of 118.000 MHz to 136.975 MHz. Transport Canada Regulations state that VHF/UHF transmitters and receivers must be located in an environment as free as possible from sources of electrical noise.

This noise can be caused by engine ignitions, electric motors, electrical switching gear, high tension line leakage, diathermic and industrial heating generators and many household appliances. Such electrical noise generators should be kept at least 1.6km from the radio antennae; in no circumstance should they be closer than 500m.

To prevent the screening of airspace, all structures shall not subtend a vertical angle of more than 1.2° within 1.5km of the radio antenna or extend more than 1.2° above the horizontal. The red area on the drawings represents the 300 metre radius in which metallic structures, which may cause reflection of communication signals, should not be constructed. The range rings extend out to 1,600 metres at 100 metre intervals.

Each range ring shows the allowable obstruction height at the distance from the installation. The maximum allowable height for an obstacle is equal to 0.021 x the distance from antenna.

It should be noted that for VHF transmitters the following land uses should also be observed:

- Less than 45m: ground should be level ±1 degree;
- Less than 90m: clear of trees, masts metal fences and vehicles;
- Less than 180 m: clear of buildings, car parks and small metal structures; and
- Less than 365 m: Clear of built up areas, hangars, railways and other metallic structures
- Intermodulation problems which can be caused by high powered AM, FM and TV stations can be avoided by locating such equipment at least 8 km from the transmitters and receivers.
The VHF transmitter and receiver site is located at the western edge of the airport property.

4.2.3 Instrument Landing System- Localizer

The Instrument Landing System (ILS) provides precision guidance to the runway in low/zero visibility conditions. The localizer portion of the instrument landing system provides lateral guidance to the pilot during an approach to the runway. The localizer antenna broadcasts radio beams which are interpreted by the onboard aircraft equipment. Distortion of these beams by interference or obstructions can cause erroneous position information to be displayed in the aircraft. Consequently the localizer antenna array has to be protected for each approach direction to the runway.
The current and future localizer locations at Runway 30 and Runway 24 respectively, have the same restriction requirements. These are as follows:

- A circle 75m radius is centred on the localizer array. No objects higher than 1.2 m are permitted within this area. This is represented on the drawings by solid red circle, and is labelled as ILS Localizer Area ‘A’

- A rectangular area of 365m x 610m is centred on the localizer array. No metallic objects higher than 1.2m, and no non-metallic objects higher than 2.5m are permitted within this area. This is represented by the solid lighter red rectangle on the drawing and is labelled as ILS Localizer Area ‘B’.

- An area of further restriction originates at the centre of the localizer array covering an arc of 36° in the direction of the runway and terminating 6100m from the localizer array. Within this arc:
  - No metal-walled structure should subtend a total vertical angle greater than 0.8º
  - No structural steel work should subtend a total vertical angle greater than 1.6º
  - And no non-metallic object should subtend a total vertical angle greater than 2.4°. Trees are included in this latter category.

This arc is represented on the drawing for both approach directions. It is labelled as ILS Localizer Area ‘C’. The permissible elevations for metal walled structures and structural steel work are shown on each arc interval in the drawing (the smaller elevation being the metal walled structure height allowance). The arc is shown for both approach directions to each respective runway.

4.2.4 Instrument Landing System- Glide Path

The other major component of the instrument landing system is the glidescope or glide path antenna. This antenna provides vertical guidance to the pilot and aircraft systems during low/zero visibility conditions. The glidepath also uses a radio beam system to provide the vertical guidance.
The current and future glide path locations at Runway 12 and Runway 06 respectively have the same siting requirements. These are as follows:

- In an area originating at the glide path antenna covering an arc of 30 degrees and extending 1500 m in the approach direction, no metallic fences, power lines, telephone lines, buildings, roads or railroads are permitted. This area is labelled as ILS Glide Path Area ‘D’ in the drawing.

- Two triangular areas each with a base of 150 m wide extending from the glide path antenna in the direction away from the runway with the apex intersecting Area ‘D’ at approximately 570 m in the approach direction. They have the same siting requirements mentioned in the previous bullet point. The composite of these two areas is labelled as ILS Glide Path Area ‘E/F’ in the drawing.
5.0 ILS Electromagnetic Compatibility

5.1 Electromagnetic Zoning Standards

The electromagnetic energy radiated by power lines, substations and industrial, scientific and medical apparatus must not interfere with the proper reception of ILS guidance signals in the approach path.

Transport Canada Regulations list the following siting requirements:

- power lines with voltages greater than 100 kV should be no closer than 1.8 km from the runway centre line and no closer than 3.2 km from the ends of the runway;
- AC electrical substations for voltages greater than 100 kV should be no closer than 3.2 km from the centre line of the runway and no closer than 16 km from the ends of the runway;
- power lines and substations should be designed, constructed and maintained using state of the art techniques to minimize radiated EMN in the ILS frequency bands; and
- ISM apparatus should be limited from operating within the rectangular area extending 1.5 km on either side of the centre line of the runway to the outer markers.

5.2 Hamilton ILS Electromagnetic Compatibility

These are represented on the drawings as the red, green and blue rectangles as per the stated regulations. The blue dashed line rectangle represents the area where 100 KV power lines are not permitted. The area bounded by the red rectangle depicts the area in which industrial, scientific and medical restriction would apply. The areas within the green rectangle (full rectangle is not shown) are those in electrical substation activity is restricted.

Any of the above requirements may potentially be waived upon detailed review by NAV CANADA, as already appears to be the case with certain power lines located close to the airport.
Several power lines cross the approach path to Runway 12 in an area where the runway will ultimately be extended. The ILS Localizer may also be seen in the photo.
6.0 Bird Hazards

6.1 General

Bird Hazards to aviation have been well documented. Birds can cause structural damage and power plant failure and can contribute to aircraft accidents. TP 1247 has been the traditional regulatory document for guidance on zoning conditions to minimize bird hazards. Transport Canada has been developing a new approach to minimize airport vicinity bird hazards. This new approach has been designated as airport bird-hazard risk analysis process (ABRAP)\(^4\).

6.2 Zoning Guidance

TP 1247 states that provisions should be made for the prohibiting the location of the location of garbage dumps, food waste landfill sites, coastal commercial fish processing plants, and/or the planting of crops, that may either attract birds or adversely affect flight visibility, within 8 KM of an aerodrome reference point. It should be noted that the expert advice of a bird hazard specialist is required before enacting any such provisions. Further guidance is provided by the Airport Bird Hazard Risk-Assessment Process. This process has rated a range of airport-area land-uses in terms of related risks that could be posed to aircraft. The risk categories are listed below.

- **High Risk Land Uses**: putrescible waste landfills, food waste hog farms, Fish processing/packing plants, horse racetracks, wildlife refuges, waterfowl feeding stations.
- **Moderate Risk Land Uses**: open or partially enclosed waste transfer stations, cattle, paddocks, poultry factory farms, sewage lagoons, marinas/fishing boats/ fish cleaning facilities, golf courses and municipal parks picnic areas.
- **Low Risk Land Uses**: dry waste landfills, enclosed waste transfer facility, wet/dry recycling facility, marshes, swamps & mudflats, storm water management ponds, ploughing/cultivating/haying, commercial shopping, mall/plazas, fast-food restaurants, outdoor restaurants, school yards, community & recreation centers.

- **Limited Risk Land Uses**: vegetative compost facilities, natural habitats, inactive agricultural fields, inactive hay fields, rural ornamental & farm ponds, and residential areas.
7.0 Aircraft Noise

7.1 Airport Noise Issues
Annoyance is the typical response to excessive aircraft noise in a community. Certain people are more sensitive to aircraft noise than others and are more likely to suffer from its effects. Transport Canada uses noise exposure contours and noise exposure projections to aid in planning for compatible land uses.

7.2 Hamilton Airport Noise
The Hamilton Airport Master Plan made recommendations for the airport. These are listed below:

- For lands currently identified as Residential under official plans: that no residential or other noise sensitive land uses be permitted in areas identified as NEF 30 or greater;
- For lands currently designated as Agricultural: that no new rural residential subdivisions or other noise sensitive uses be permitted in areas identified as NEF 25 or greater; and
- That the existing Airport Influence Area be expanded to include those lands identified under the NEF 25 contour or greater, based on the 1996 NEF contours.

More recent noise exposure forecasts have been developed for the Hamilton based on data from 2005. The results of this study are contained in the draft report “Noise Impact and Evaluation Study John C. Munro Hamilton International Airport”. This study concluded that the noise exposure contours would expand until 2015 and then shrink considerably from 2015 to 2025 as more older and noisier aircraft are replaced by quieter and more efficient aircraft.
It should be noted that currently the City of Hamilton has municipal zoning By-laws in place which restrict the development of properties surrounding the airport. The development surrounding the airport is also subject to Ontario Provincial Policy Statement (PPS). Section 1.6.7 of the PPS states the following:

Planning for land uses in the vicinity of airports shall be undertaken so that:
   a) the long-term operation and economic role of airports is protected; and
   b) airports and sensitive land uses are appropriately designed, buffered and/or separated from each other to prevent adverse effects from odour, noise and other contaminants.

Section 1.6.7.2 also states that:
Airports shall be protected from incompatible land uses and development by:
   a) prohibiting new residential development and other sensitive land uses in areas near airports above 30 NEF/NEP, as set out on maps (as revised from time to time) that have been reviewed by Transport Canada;
   b) considering redevelopment of existing residential uses and other sensitive land uses or infilling of residential and other sensitive land uses in areas above 30 NEF/NEP only if it has been demonstrated that there will be no negative impacts on the long-term function of the airport; and
   c) discouraging land uses which may cause a potential aviation safety hazard.
8.0 Option 3- Summary

8.1 Physical Zoning

The planned extensions of Runway 06 and Runway 12 will result in physical zoning conflicts with the preferred Option 3 Hybrid. (Refer to Fig 10.) The following physical zoning issues were noted in the analysis:

- Parts of Runway 06 extension, fall outside the current airport boundary and within lands designated as light industrial; and
- Parts of the proposed Runway 06 extension and approach lighting fall outside the current airport boundary.

Additional airport land has to be reserved for runway extension purposes. The area allocated for Runway 06 expansion is definitely inadequate and needs to be expanded to include some of the light industrial land area.

8.2 Electronic Zoning

From a review of the Figure 11 of the preferred Option 3 Hybrid, the following electronic zoning issues can be observed:

- Part of the light industrial lands area is within the electronic protection zone area “D” for the Glide path antenna array for Runway 12 and extended Runway 06. Transport Canada recognizes that this is the "ideal" situation and that in practice, compromise may be necessary at existing airports. However it should be noted that the glidopath area E/F and the first 900m of area D are particularly sensitive areas and exemptions in these areas are unlikely;
- Part of the prestige business park falls within the electronic protection zone area “B” of the localizer antenna array of Runway 24. This area would have to be adequately protected from incompatible development;
- Parts of the airport related business lands fall within the protection zone of the radar array. At 1000 metres from the radar the allowable obstruction elevation is 247 m ASL, and at the boundary of the AEGD approximately 500 metres from radar, the allowable
obstruction height is 244 m ASL. NAV CANADA and Transport Canada would have to be consulted if aircraft hangars or warehouses etc. are constructed in the area between Runway 30 R and the main terminal; and

- Parts of the light industrial lands fall within the 500 metre restricted zone of the VHF communications system. For these areas, electrical noise sources cannot be permitted. Other areas would have the height limitations as indicated by the elevation contours.

### 8.3 ILS Compatibility

Significant areas of the light industrial area fall within the ILS electromagnetic compatibility zoning of both runways (Figure 12). Potential scientific, industrial and medical equipment conditions may apply. Any zoning concerns should be addressed during refinement of the preferred option land use plan and recommended zoning. Consultation with NAV CANADA and Transport Canada would be necessary in order to get exemptions to these regulations.

### 8.4 Bird Hazards

The preferred option attempts to maintain as much green space as possible as part of the design and vision for the site. The Transport Canada document TP 8240 wildlife management bulletin no. 38 has indicated that there are many natural habitats that attract birds that pose little threat to aircraft safety unless the habitat and its birds are located close to airport runways. These habitats include forests and woodlots, and hedgerows. Several of the option 3 core green areas are located close to the Runways 12 and 06 future runway extensions. It is recommended that guidance from a bird hazard specialist be sought concerning the species and habits of birds in this area. The 8km from the airport prohibition on refuse and putrid waste facilities should be adhered to.

### 8.5 Aircraft Noise

The current noise exposure forecast are valid for 5 year planning horizon. In the long term planning horizon, the advances in technology in terms of aircraft noise, removal of older noisier aircraft and replacement of existing cargo/passenger aircraft with quieter models will require updated forecasts to be performed. It can be expected however that given the technological trends, the current noise footprint of the airport should not grow appreciably and may actually reduce in size.
9.0 Appendix - Option 3 Zoning Drawings

The following illustrations are provided as a reference:

- Option 3 Physical Zoning;
- Option 3 Electronic Zoning; and
- Option 3 ILS Compatibility Zoning.