Peer Review

of

Porter Airlines Runway Extension Proposal Review
Coastal Processes and Environments

by

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Disclaimer

This peer review represents my own personal assessment of the preliminary review report on Coastal Processes and Environment related to the proposed extension of the runway at Billy Bishop airport. The report is dated August 26, 2013 and is posted on the City of Toronto web site related to the Billy Bishop Toronto City Airport Review. The review is based on my professional experience as a coastal geomorphologist, including my research and consulting work in the Great Lakes. I am not associated with any group or organisation that is involved in the consultation process or with any organisation either in favour of the proposal or objecting to it.

Introduction

The report prepared by CH2M Hill Canada Limited is, as is clearly stated in the beginning, based on available information and assesses the effects of the proposed runway extension only in a 'cursory and preliminary manner'. The report is a useful starting point but its limitations mean that it cannot provide a substantial enough assessment of the potential environmental impacts and thus should not be used as the basis for making a final decision on whether the expansion of the runway should be permitted. It should be noted that the report assesses the proposal for a runway extension of 168 m at both ends of the current runway.

There are two general issues which do not appear to be addressed substantially in the report - 1) The Provincial Policy Statement issued under Section 3 of the Planning Act which was enacted in 2005; and 2) an assessment of cumulative environmental impacts with respect to the historical changes that have occurred on the barrier spit that forms the Toronto Islands and the associated bay that forms the harbour. I will address these two issues first and then comment on the report itself.

Provincial Policy Statement

The provincial Policy Statement (PPS) provides policy direction on matters of provincial interest related to land use planning and development and is therefore an important consideration for any examination of the potential impact of the proposed runway extension on the natural environment. This is exemplified in the first paragraph on page 3 of the PPS which reads:

The Province's natural heritage resources, water, agricultural lands, mineral resources, and cultural heritage and archaeological resources provide important environmental, economic and social benefits. The wise use and management of these resources over the long term is a key provincial interest. The Province must ensure that its resources are managed in a sustainable way to protect essential ecological processes and public health and safety, minimize environmental and social impacts, and meet its long-term needs.

In particular, there are several portions of Section 2.1 of the PPS, which addresses Natural Heritage, that need to be considered as part of the review of coastal processes and environment, including: 2.1.3c which states that *Development* and *site alteration* shall not be permitted in: significant coastal wetlands; 2.1.4d which relates to significant wildlife habitat, and section 2.1.5

which relates to fish habitat. Additionally, with relation to the potential impact on Hanlan's Point beach, Section 3.1.2 states that development shall not be permitted within those hazard zones designated as Dynamic Beach.

The Technical Guides for the Great Lakes - St. Lawrence River System and Large Inland Lakes prepared for the Ontario Ministry of Natural Resources provides a wealth of material that is relevant to the implementation of the PPS with regard to dynamic beaches and wetlands on the Great Lakes shoreline. Of particular relevance here are Sections A 'Beach and Dune Management Guide', Section E part 5 'Dynamic Beach Hazard', and Section E Part 8 'Environmentally Sound Hazard Management'.

Cumulative Environmental Impacts

The potential environmental impacts of the proposed runway extensions into the harbour and into the lake are addressed largely in isolation within the Preliminary Review Report. However, it is now generally recognised that due diligence with respect to the assessment of the environmental impact of an individual project requires that this be carried out within the context of the past history of impacts on the broader biotic and abiotic components of the ecosystem. In a worst case scenario a relatively small impact associated with an individual project may result in the crossing of a threshold for some component of the ecosystem that results in, for example, the extinction of a key species of fish or animal. In general, however, it is recognised that assessment of the impact of an individual project should be considered within a framework of what level of total impact is acceptable under a strategy for management of the larger environment.

Two hundred and fifty years ago Toronto Islands was a barrier spit fed by sand and gravel from erosion of the Scarborough Bluffs enclosing a large bay which forms the harbour today. On the north shore of Lake Ontario comparable features are found only at the Burlington Bar and at the east end of the lake at Presqu'ile and the Sandbanks complex in Prince Edward County. Elsewhere similar barrier ecosystems are found, for example, in Lake Erie at Pt. Pelee, Pointe-aux-Pins (Rondeau) and Long Point. The beaches, dune ridges and interdune slacks and ponds, and the extensive wetlands in the protected bays are of particular importance for fish, turtles, waterfowl and migratory birds. This is particularly the case for the downdrift end of a spit where the dune recurves provide a high degree of topographic complexity (see Figure 1). Since 1800 the bay has been reduced in size by filling of most of the landward shoreline, eliminating any wetlands there and the whole shoreline is now hardened. Sediment supply to the spit (island) has been reduced over time and essentially eliminated with the building of the Leslie Street Spit. There is now extensive protection along most of the outer shoreline, except on the west side, and there has been considerable alteration and hardening of the shoreline within the harbour and reduction of protected wetlands. All of this has reduced the natural functioning of the ecosystem and greatly limits the scope of potential remediation and restoration. The proposed runway extension will reduce the size of the water body in the bay and increase the proportion of hardened shoreline, and the assessment of whether these are acceptable should be carried out in the context of what has happened in the past and the vision for future management of the Toronto Island Ecosystem and the shoreline within the boundaries of the city.

Figure 1: Oblique aerial view of the distal end of Long Point with Lake Erie on the left and Long Point Bay on the right. Two hundred years ago the distal end of Toronto Islands and harbour would have been characterised by a similar complex series of dune ridges, interdune ponds, wetlands and shallow protected areas with aquatic vegetation.

Comments on Report

Section 2.2 Fish and Fish Habitat.

Within the bay submergent and emergent vegetation is found primarily in shallow, gently sloping areas with a fine substrate (sand, silt and clay). The extension of the runway on the harbour side into water depths of 8 m or more essentially rules out the possibility of any significant areas where submergent and emergent aquatic vegetation can establish in the vicinity of the runway extension. On the west side wave conditions are too energetic to permit this, especially given the sandy substrate.

Section 2.3 Birds

The bottom line here is that the runway extension does not provide bird habitat, any extension of sandy shoreline through accumulation against the western extension is minor and useful for shorebirds only and the area of the bay which can be used by waterfowl is decreased. In addition, the possibility of restoration of the larger ecoasystem is reduced.

Section 3.1 Historic Shoreline change

The results for shoreline change over the period 2002-2009 presented here are based on shorelines extracted from 'aerial images' taken from Google Earth Pro. The report states that: 'The total error due to image placement and shoreline digitization is estimated to be 1.0 m in all images'. I suspect that the aerial images are from satellite rather than air photos and thus the pixel size is likely to be much greater than the 1 m assessed for error. More important, the wet dry line is used as the basis for digitizing the shoreline. This is relatively easy to distinguish, but its location varies with the extent of wave run-up on the previous day/s, with topographic changes in the beach resulting from periods of low and high wave action, and more importantly it varies with lake level. Because no data are given on the day on which the images were taken it is not possible to correct for either the seasonal lake level change or for wave activity on the previous day. Given that the beach slope is on the order of 2-3 degrees the potential error is actually likely to be on the order of 10-20 m.

In effect, all that can be said from this exercise is that erosion is taking place at Gibraltar Point and sand transported northward with accretion and progradation of Hanlan's Point Beach, but volumes of sediment accretion and rates of progradation cannot be extracted.

Section 3.2.4 Sediment Transport and Future Shoreline Change

The report presents data on sediment erosion and accretion near the beach and further offshore, primarily from a Shoreplan study from 2007, including the area of Gibraltar point and Hanlan's Beach. The data are consistent with accretion at the north end of Hanlan's Beach but differences in rates and even changes from erosion to accretion illustrate some of the difficulties of using historical bathymetric surveys to carry out this assessment. Thus panel 16 (Table 3.1) shows an annual average erosion of 5700 m^3 for the period 1981-1993 and accretion of 5500 (i.e. about the same amount) for the period 1993-2005.

Section 3.2.5 Beach and Dune Environment

The treatment of the beach dune environment in this section is best described as cursory. It is likely that the runway extension will act as a barrier to northward transport and thus sand will accumulate against it and there will be some progradation in this area. The potential increase in the total dune environment will at most be very small. What is neglected here is the potential impact on beach and nearshore sand transport and thus on the long-term stability of the Hanlan's beach system.

The report does recommend at the end of section 3.2.4 that a detailed numerical modelling study be carried out in order to quantify the sediment transport path with and without the extension. This is in fact **critical** because of the potential impact of such a large structure on the adjacent sandy beach system. There are several concerns here: 1) that the presence of the runway extension, which terminates in quite deep water, might loss of sand from the system completely through removal towards the NW; 2) that the rate of net sand transport towards the north on Hanlan's beach will increase as a result of reduced southward transport during periods of N and NW winds. The potential effect of this will be to increase the rate of erosion of the area at the south end of the beach and Gibraltar Point; and 3) that the runway extension will essentially form an artificial headland and that this may lead to a reorientation of the shoreline to produce a new

stable configuration, possibly a log spiral form, which again would have the effect of increased erosion at the south end of the beach and a possible breach into the waterway adjacent to Gibraltar Point.

Unfortunately, there are always uncertainties with the application of numerical models and in this area, because of the shallow water, rapid depth changes and very short fetches towards the west and north-west, these uncertainties are likely to be enhanced. A numerical model can be calibrated against measured transport rates but, as noted above, the available data are for relatively long time periods and have a high degree of uncertainty in them. An alternative, and probably the best approach, is to measure waves and currents (both wave- and wind-generated currents) in the area under a range of conditions and then calibrate the model using these data. This is neither simple nor cheap but it would greatly enhance the reliability of any modelling exercise.

It should also be noted that if recycling of sediment from the north end of Hanlan's Beach is eventually adopted as a solution to the erosion at Gibraltar Point, this can be carried out using a simple groyne that would likely need to be on the order of 30-40 m long. Unlike the runway extension works, if this produces an unexpected problem with regard to shoreline evolution its effect can be reversed simply and rapidly through removal.

Section 4

This section simply summarises some of the available information of water levels in Lake Ontario, winds and waves. As noted above, in terms of environmental impact the key issue is the modelling of changes to waves, currents and sediment transport in the vicinity of the proposed extensions and these data are simply background to such an endeavour.

Section 5

The potential environmental impacts of the actual construction phase are addressed in a very cursory way in a single, short paragraph at the end of Section 5.1. In fact the runway extension would require a very large quantity of fill that must be sourced, transported to the waterfront and then transported over to the island. I assume that the impacts associated with this are being addressed by another panel. The potential impacts on water quality in the harbour and on birds and fish during construction are also dealt with in a very cursory manner.

Section 6

As noted at the beginning of this assessment, the Ministry of Natural Resources will need to assess the proposed runway extension with regard to a number of elements contained in the Provincial Policy Statement in addition to any possible impact on endangered species.

Section 7

There are several points made in this section that I will address in my own conclusions.

Conclusions

Overall, the preliminary report pulls together some useful material and is a starting point for a detailed evaluation of potential environmental effects of the propose runway extension.

The report correctly identifies some of its limitations and in particular identifies the need for detailed modelling of the effects of the proposed extension on waves, currents and sand transport in the vicinity of the western extension. In my opinion, however, it plays down the potential environmental impacts on the beach and dune environment of Hanlan's Beach. As recognised within the PPS dynamic beaches such as this are highly sensitive to any changes in waves, currents and resulting sediment transport and this is why it is so important to carry out the detailed numerical modelling recommended in the report before any final decision on the runway extension is made. This is not a simple task and there is considerable uncertainty in the results of such modelling even if reasonable site calibration is carried out. One of the problems here is that once the extension is built it will not be possible to undo the action. If it does result in increased shoreline erosion at the south end of the beach and Gibraltar Point then this will likely require further intervention. Such intervention is not cheap, as has been noted by the Gibraltar Point Erosion Control Project jointly sponsored by the TRCA and the City of Toronto, and this should be factored into any decision on the proposed runway extension.

The report does conclude that there will be an impact on the existing aquatic habitat. Again it does downplay one important feature and that is the physical reduction in the surface area - water column and lake bed - resulting from the lake fill. This is estimated to be 87,500 m^2 within the harbour. As noted at the beginning of my report, this type of impact should be considered not only on its own, but also in the context of the cumulative impact of all such changes on the environment of the terrestrial and aquatic habitats.

There are several places in the report where it is suggested that the runway extension will produce enhanced habitat creation and this featured prominently in the display boards at the public meeting I attended on September 9. A number of people quite rightly complained that this painted the wrong picture of what the actual effects were. This arises primarily from the possibility of using a sloped rock revetment in contrast to vertical sheet piles that are characteristic of much of the present runway boundary in the harbour and lake. The enhancement to fish habitat over the sheet pile is small, and the overall quality is low by comparison with a sheltered, gently sloping shoreline with emergent and aquatic vegetation that was typical of the natural environment. Moreover, all of these measures can be carried out (and probably should be carried out) on the walls of the existing runway. The reality is that it may be possible with creative design to reduce some of the negative impact on the aquatic habitat, but it will always be negative.

In conclusion, the proposed runway extension at Billy Bishop Airport will have some negative impact on both the biotic and abiotic elements of the natural environment of the Toronto Islands and harbour. Determination of the magnitude of that impact will require further study and should be considered in light of the Provincial Policy Statement and the cumulative environmental impacts on that environment to date. Construction of the runway extensions will further constrain

our ability to restore and enhance what remains of the island system and therefore the decision as to whether to permit the project to go ahead should only be made when all of the potential impacts have been identified and the magnitude of them determined to the best of our ability. Ideally, such a decision should be made within the context of a plan or vision for the future of the Toronto Islands and waterfront as a whole.

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