W.F. Baird & Associates Coastal Engineers Ltd.

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Ms. Maricris Marinas, M.Sc.
Senior Planner, Planning and Development Services | Credit Valley Conservation

via email to Maricris.Marinas@cvc.ca

Status: Final
December 10 2019

Dear Maricris,

Reference # 13012.101

RE: LAKEVIEW VILLAGE EROSION HAZARD DESIGN LIFE

Summary

Baird prepared the *Lakeview Village Shoreline Hazard Assessment* report (January 14, 2019). CVC reviewed the report and requested a separate technical summary to support acceptance of a 60-year design life for upgraded shoreline protection at the site in the determination of the shoreline erosion hazard limit. A 60-year design life for upgraded shoreline protection at Lakeview Village is reasonable and appropriate for the following reasons:

- well within internationally accepted practice guidelines
- existing Lakeview structures were professionally designed and well constructed and have remained functional for nearly 60 years demonstrating that such a design life is reasonably achievable
- there are other examples of major shoreline structures with a design life of 60 years or more
- it is consistent with CVC *Lake Ontario Shoreline Hazards* report (September 2005) and the Ontario Ministry of Natural Resources (OMNR) *Technical Guide for Great Lakes – St. Lawrence River Shorelines* (2001) for major structures
- site is a “major marine structure”, as describe by CVC (2005) and part of a substantial reach of publicly controlled artificial shoreline with well-protected adjacent shorelines at Lakefront Promenade Park to the west and Jim Tovey Lakeview Conservation Area to the east
- underlying bedrock substrate provides long-term stability and shallow nearshore depths limit wave action at the shoreline
- access for future maintenance will be provided
- site specific shoreline protection design to upgrade the existing structures will be completed by Baird in accordance with accepted practice. Baird is internationally recognized as a qualified, experienced coastal firm.

Introduction

W.F. Baird & Associates Coastal Engineers Ltd. (Baird) was retained by Lakeview Community Partners Limited to complete the required site-specific and detailed, technical shoreline hazard assessment for Lakeview Village. Terms of Reference for the shoreline hazard assessment were submitted to Credit Valley Conservation for review. Baird prepared the *Lakeview Village Shoreline Hazard Assessment* report (January 14, 2019). CVC reviewed the report and requested a separate technical summary to support acceptance of a 60-year design life for upgraded shoreline protection at the site in the determination of the shoreline erosion hazard limit.

60-Year Design Life Consistent with Accepted International Practice

The design life for all shoreline protection works at the Lakeview site will be 60 years. Structure design life is the length of time that a structure, with routine maintenance, can safely and adequately perform its function. Structures requiring replacement or significant rehabilitation have reached the end of their useful design life. Structure design life differs from the planning horizon of the project. There are no standard codes specifying design life. For the Lakeview shoreline hazard assessment, a design life of 60 years was selected for the shoreline protection based on Baird's professional opinion, consideration of the site conditions and accepted international practice.

A 60-year design life is compatible with accepted international practice guidelines (e.g., BS 6349-7:1991[1]; BS 6349-1:2000[2]; ISO 21650:2007[3]; PIANC, 2003[4]; Pullen et al., 2007[5]; ROM, 2002[6]) for works such as defense and coastal regeneration works with a small risk of loss of human life or environmental damage in the event of failure. Several examples of accepted practice to consider an expected design life of 50 to 100 years for major coastal infrastructure are provided as follows:

- BS 6349-1:2000: "*Normally a design working life of the order of 50 years or more is expected of maritime structures such as quay walls, jetties and docks but for flood protection works it is not uncommon for a 100-year life to be required*."
- ISO/DIS 21650: "*For permanent coastal structures the normal range would be 50 to 100 years*."
- EurOtop, Pullen et al., 2007: "*Majority of coast protection or sea defence walls, 30-70 years*"; "*Flood defences protecting large areas at risk, 50-100 years*"; "*Design life for structures easy to upgrade is taken as 50 years in Netherlands; in urban areas, where it is more difficult to upgrade, the design life is taken as 100 years*."
- ROM 0.2-90, 2002: "*Minimum design life for general infrastructure 50 to 100 years*".

Selection of a design life of 60 years for Lakeview is consistent with accepted international practice.

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[1] British Standards Institution, BS 6349-7: 1991. Maritime Structures – Part 7: Guide to the Design and Construction of Breakwaters.
[2] BS 6349-1:2000, Maritime structures - Part 1: Code of practice for general criteria
[3] ISO, 2007. Actions from waves and currents on coastal structures. International Organisation for Standardisation. ISO Standard 21650:2007.
[4] PIANC, 2003. Breakwaters with Vertical and Inclined Concrete Walls. Report of Working Group 28 of the Maritime Navigation Commission
[5] Pullen, T., Allsop, N. W. H., Bruce, T., Kortenhaus, A., Schüttrumpf, H., & Van der Meer, J. W., 2007. EurOtop wave overtopping of sea defences and related structures: assessment manual.
[6] ROM, 2002. ROM 0.2-90 General procedure and requirements in the design of harbor and maritime structures. Spanish Ministry of Public Works and Urban Development.

Examples of Shoreline Structures with Design Life of 60-Years or More

The shoreline protection at Lakeview has been in place for about 60 years and it remains functional, clearly demonstrating that a 60-year design life is reasonably achievable. Other local examples can be found in Mississauga and elsewhere on Lake Ontario. Construction of the St. Lawrence Cement Co. (now CRH Canada Mississauga Cement) pier began in 1955 in the Clarkson area (CVC, 2011, Lake Ontario Integrated Shoreline Strategy Background Review and Data Gap Analysis); the pier has been in operation for over 60 years. The east breakwater at Port Credit Harbour marina was constructed in two sections in 1958 and 1961; although the crest is low and required some repairs in 1975, 1977 and 1980 to address low spots, the breakwater has remained functional for about 60 years. The Whitby Harbour outer west breakwater was constructed in 1959 and has remained functional for 60 years. The Oshawa outer east breakwater was constructed prior to 1932 and remained functional for more than 80 years until 2015 when it was incorporated into Oshawa Harbour east wharf expansion project; some repairs were required in 1958.

In CIRIA, C. CETMEF (2007) it was reported that a review of 265 existing coastal projects in the United States showed that 77% of the structures were more than 50 years old and about 40% of breakwaters and jetties originated in the 19th century, meaning that many were built before "rudimentary design guidance and armour stability" formulae were available (Pope, 1992). Since that time coastal engineering design practices have advanced considerably. The design of the Lakeview shoreline protection structures will be in accordance with accepted engineering practices.

Examples of projects with design life of 60 years or more demonstrates that it is achievable.

Consistent with CVC Lake Ontario Shoreline Hazard Report and OMNR Technical Guide

The 60-year design life for the shoreline protection at Lakeview is consistent with the CVC *Lake Ontario Shoreline Hazards* report (September 2005) and the Ontario Ministry of Natural Resources (OMNR) *Technical Guide for Great Lakes – St. Lawrence River Shorelines* (2001).

The 2005 CVC *Shoreline Hazards* report identified the Lakeview Village site as being comprised of "major marine structures" and assigned a life span of 50 years to the structures in their existing condition (i.e., not upgraded and/or rehabilitated as is now proposed). An "effectiveness factor" of 75% was applied because a detailed, site-specific review was not completed at the time (e.g., "*Structure appears to be in excellent shape and performing properly but the authors are not specifically familiar with the structure*"). The CVC report recommended that a detailed engineering review of the major structures should be completed, and a site-specific assessment of the shoreline hazards be undertaken. Baird's *Lakeview Village Shoreline Hazard Assessment* report presented a detailed engineering review of the major structures and a site-specific assessment. In discussing the typical application of the hazard mapping, the CVC report (2005) notes that it was the intention of the CVC study to be conservative, implying that with a full engineering assessment and structure upgrading, it can reasonably be expected that a design life greater than 50 years would be acceptable. Lakeview shoreline structures are undergoing a full engineering assessment and the necessary upgrades will be designed by qualified professional engineers experienced in coastal engineering.

This approach is fully consistent with the recommendations in the Ontario Ministry of Natural Resources (OMNR) *Technical Guide* (2001)[7] for "artificial shorelines". The "major marine structures" at Lakeview Village are part of a large artificial shoreline system that will extend approximately 2.7 kilometres along the Lake

[7] Ontario Ministry of Natural Resources, 2001. Technical Guide for Great Lakes – St. Lawrence River Shorelines

Ontario waterfront from Lakefront Promenade Park to the west and to Jim Tovey Lakeview Conservation Area lakefilling project presently under construction to the east.

OMNR *Technical Guide* (2001) outlines requirements for the protection works standard including protection works, stable slope allowance and erosion hazard allowance. The *Technical Guide* indicates that for well designed, constructed and maintained protection structures, a design life greater than 50 years can be considered with evidence of the long-term stability of underlying material, that proper measures have been taken to address flanking of the protection and the subsequent owners will undertake necessary future repairs and/or rehabilitation. These required conditions are met for Lakeview:

- The shoreline protection will be well designed by a professional engineer with experience and qualifications in coastal engineering.
- The underlying substrate is bedrock and provides long-term stability. The shallow nearshore depths limit wave action at the shore.
- The adjacent shorelines are fully protected as part of a larger publicly controlled, artificial shoreline.
- Unobstructed access to and along the publicly controlled Lakeview shoreline for future maintenance and repairs will be available.

The 60-year design life for the shoreline protection at Lakeview is consistent with the CVC *Shoreline Hazards* report and OMNR *Technical Guide*.

Design by Qualified, Experienced Coastal Engineers in Accordance with Accepted Practice

Baird is a fully qualified and experienced coastal engineering firm and we will be responsible for the design of the shoreline protection at Lakeview with a design life of 60 years and in accordance with accepted practice.

Baird & Associates, established in 1981, is the largest Canadian firm specializing in shoreline, river, coastal and marine engineering projects and have successfully completed projects on the Great Lakes and around the world. Baird has the requisite engineering, technical, scientific and support resources to provide engineering services for all stages of waterfront, marine, coastal and river engineering projects. These services include field data collection and site investigations, planning and feasibility studies, numerical modelling, preliminary and detail design, preparation of construction drawings, technical specifications and documents, cost estimating, assistance during tendering, regulatory permitting and environmental assessments, stakeholder consultations and public meetings, on-site review and administration services during construction, project close-out and post-construction monitoring. Baird is committed to quality; we have a Quality Management System that has been certified by Bureau Veritas against the requirements of ISO 9001:2015.

Baird has extensive coastal, marine and river engineering experience in Mississauga, the Greater Toronto Area, the wider Great Lakes and around the world. We have worked closely with the City of Mississauga on previous coastal engineering projects. Our world-class coastal engineering design experience includes involvement with major waterfront projects such as: Port Lands Flood Protection and Enabling Infrastructure, Toronto; Gibraltar Point Erosion Control Project, Toronto; Rosewood Park Beach Restoration, Highland Park, Illinois (selected by the American Shore & Beach Preservation Association as one of America's Best Restored Beaches in 2015). We have designed and constructed thirty-eight breakwater projects in the Great Lakes and worldwide totaling over 27 km in length and over twenty-three additional breakwaters assessed and planned (approximately 31 km total length). Some of the projects include: Western Beaches Breakwater, Toronto ($18M), Ashland Breakwater, Wisconsin ($7M), Racine Harbor Breakwater Repair, Wisconsin ($7M), McKinley Harbor Improvements, Wisconsin ($5M), Port of Ehoala, Madagascar ($20M), Matane Breakwater Rehabilitation, Quebec ($12M), Lajes Field Harbour, Azores ($60M), and Keflavik POL Harbour Facility, Iceland ($14M).

The shoreline structure design will include be in accordance with accepted coastal engineering practice (e.g., CIRIA, C. CETMEF, 2007; USACE, 2006) and the protection works standard (OMNR, 2001). The design will include analysis of water levels, wave modelling, frequency of storms, ice cover and protection structure stability. Climate change effects will be included. New data will be included where appropriate. For example, the 100-year flood value for this project was increased to account for 30 years of additional recorded water level data, including the high water levels in 2017 and record levels in 2019, since the last value was provided by OMNR (1989), the new lake regulation Plan 2014 and the potential effects of climate change. Climate change effects on wind/wave and ice conditions will be assessed. It is noted that because of the depth-limited nature of the wave heights at the site, any increase in deep water wave heights will have limited impact on the wave height at the shoreline beyond the increase already accounted for in the increased 100-year flood level.

The design will include technical specifications for quality materials and execution using good construction practices. The design and installation of protection works will allow for access to the protection works for appropriate equipment and machinery for regular maintenance and/or repair purpose. Maintenance access will be available through the public open space adjacent to the shoreline.

The shoreline protection design will be undertaken in accordance with accepted practice with a design life of 60 years by Baird, a fully qualified and experienced coastal engineering firm.

References

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Sincerely,

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