

Memorandum

September 12, 2005

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Baird

To: Wendy Leger

From: 

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W.F. Baird & Associates Coastal Engineers Ltd.

Re: Task 8 – Model Verification for Erosion PI

IJC Contract Number: IJC-5-0003

Task 8 of the above referenced contract between Baird and the IJC pertains to model verification and stamp of approval for the Flood and Erosion Prediction System (FEPS). At the request of the Plan Formulation and Evaluation Group, we have completed a comparison between actual measured bluff recession and the predictive ability of the Erosion PI Algorithm for the same input water levels and wave conditions. The results are summarized below.

Study Site 8 – East Bay Park, Wayne County

Study Site 8 is located in Reach 860, along the south-east shore of Lake Ontario, in the County of Wayne. Figure 1 below presents a plan view map of the site conditions. The bluffs are extremely steep, devoid of vegetation and eroding. Some of the buildings are located very close to the bluff crest and in immediate danger from further bluff recession. In fact, some of the homes have been condemned since the aerial photograph was captured in April of 2002.

A ground level photograph of the site is presented in Figure 2, while Figure 3 is an oblique photo from August 2003.

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Figure 1 Aerial Map of Reach 860 and the 2002 Bluff Crest Mapping

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Figure 2 Ground Level Photograph of Reach 860, April 2002



Figure 3 Oblique Aerial Photograph of Reach 860, August 2003

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Measure Bluff Recession – 1973 to 2002

Historical bluff conditions for Reach 860 were captured with an 1973 aerial photograph, which was geo-corrected by Baird to create an orthophotograph. The 1973 bluff crest line was then digitized in ArcGIS. The 2002 bluff crest line was digitized from the 2002 orthophotograph by another contractor working for the IJC.

A custom ArcGIS extension known as Baird ShoreTools was applied to calculate a long term erosion rate for Reach 860. First, a baseline is created parallel to the shoreline. Then, the tool measures individual transects perpendicular to the baseline at a user specified interval, such as 10 m, between the historic and current bluff crest line. The measured erosion from the individual transects is averaged to calculate an AARR (Average Annual Recession Rate) for the Reach. The bluff lines, baseline and individual transects for a portion of Reach 860 are presented in Figure 4.

The AARR for the 1973 to 2002 bluff crest lines in Reach 860 is 0.30 m/yr.

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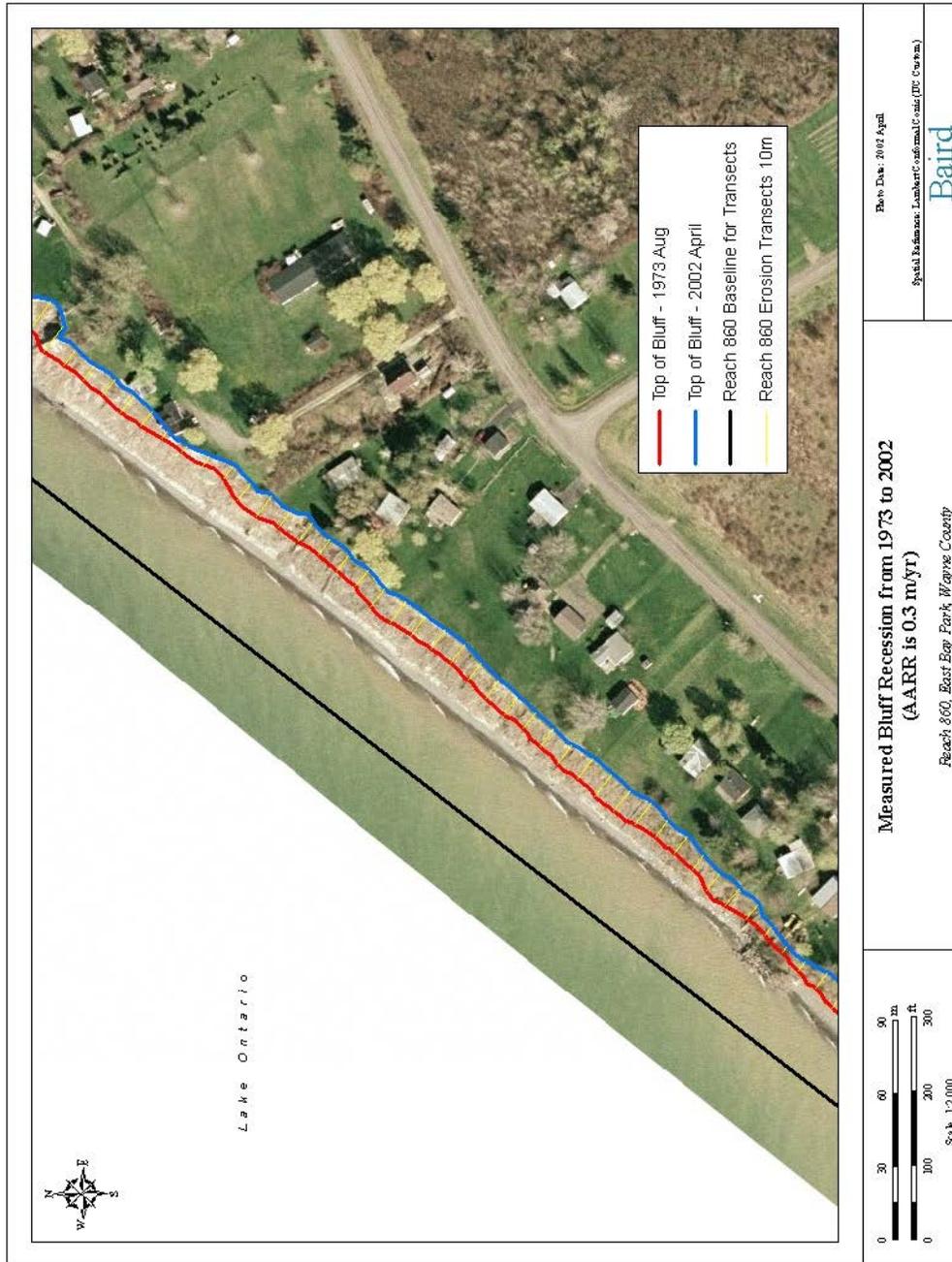


Figure 4 1973 and 2002 Bluff Crest Mapping for Reach 860

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FEPS Bluff Recession Prediction for 1973 to 2002

In order to test the robustness of the Erosion PI algorithm in the FEPS, it was applied to the same temporal period as the historical bluff crest data for Reach 860, 1973 to 2002. The actual recorded water levels (from a gage) were utilized to calculate the required monthly means for the Erosion PI calculations. Since the wave data in the FEPS only covered 1973 to 2000, a sensitive analysis was run with actual data from 1982 and 1997 to represent the years of 2001 and 2002. These two years featured average wave energy when compared to the other years in the 1961 to 2002 hindcast.

The results of the analysis are summarized in Table 1. The measured transect erosion rate between 1973 and 2002 was 8.70 m or 0.30 m/yr, as discussed earlier. When the 1982 hindcasted wave data was used for 2001 and 2002, the FEPS Erosion PI predicted 7.87 m of bluff recession at Reach 860 for an AARR of 0.27 m/yr. When the 1997 wave data was used for the missing years of 2001 and 2002, the predicted recession increased slightly to 7.91 m/yr for an AARR of 0.27 m/yr.

Table 1 Measured Bluff Recession for Reach 860 versus FEPS Prediction

| Year | Measured Recession (m) | Predicted Recession (FEPS) | AARR (m/yr) | Percent Error in FEPS | 2001-2002 Waves |
|--------------|------------------------|----------------------------|-------------|-----------------------|-----------------|
| 1973 to 2002 | 8.70 | n/a | 0.30 | n/a | actual |
| 1973 to 2002 | n/a | 7.87 | 0.27 | 9.5 % | 1982 |
| 1973 to 2002 | n/a | 7.91 | 0.27 | 9.1 % | 1997 |

Summary

In summary, the predictive ability of the Erosion PI was tested at Reach 860 in Wayne County. The actual measured bluff recession between 1973 and 2002 was compared to the recession predicted with the FEPS algorithm. The Erosion PI under

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predicted the actual recession by 9.1 to 9.5 %, depending on what years were used to represent the waves for 2001 and 2002, which were not included in the wind-wave hindcast. Overall, we are satisfied with the predictive ability of the Erosion PI based on this comparison for Reach 860.

It is worth mentioning that the predictive ability of the Erosion PI was built around the results of the 2D COSMOS profile model, which simulates long term shoreline erosion rates. When calibrating the COSMOS model to actual measured data, such as the 1973 to 2002 bluff recession data, the target error for the model coefficients was 5 % (or less). Therefore, since the predicted ability of the Erosion PI is based on the COSMOS results, an error of at least 5 % would be expected for the above analysis at Reach 860.

enc: n/a

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