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SHOREPLAN

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Mr. Mike MacDiarmid, P. Eng.
Program Development Officer
Small Craft harbours Branch
Fisheries and Oceans Canada
P.O. Box 85120
3027 Harvester Road, Unit 506
Burlington, ON
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Dear Mr. MacDiarmid

RE: Maintenance Dredging at Wheatley Harbour
Our file 07-1087

This letter report presents our assessment of the propeller wash dredging tests carried out at Wheatley Harbour in December 2008.

Background

The entrance to Wheatley Harbour is subject to ongoing sedimentation due to the littoral drift characteristics at the site. A number of past studies by Shoreplan Engineering Limited have identified the major causes of the sedimentation problem and have examined a range of potential solutions. It was concluded that the preferred solution involves managing the size of the updrift fillet beach through an ongoing dredging and bypassing program that will keep the dredged sand within the existing littoral system. The recommended means of managing the size of the updrift beach was to excavate the beach with land based equipment and truck the sand to the Hillman Marsh. As part of that process, marine based equipment would be required to deal with the approximately 20% of the littoral drift that is expected to be transported past the beach and into the entrance channel. It was decided to test if propeller wash dredging, a form of agitation dredging, would be a suitable method of dealing with that portion of the dredging requirements.

It was originally envisioned that the propeller wash dredging would be carried out using one of the fishing boats from Wheatley Harbour. If propeller wash dredging was found to be effective it was thought that using locally available resources would be the best way of implementing that dredging when required. However, while planning the dredging test it was concluded that there was no practical means of anchoring the fishing boat during dredging. The use of temporary anchors constructed out of large cast concrete blocks was considered but judged to be impractical for only a two day dredging test.

A decision was made to carry out the test using a tug boat held in place with a spud barge. Cobby Marine, operating out of Leamington, had experience with this type of operation so they were contracted to carry out the dredging test. Photo 1 shows an example of their dredging setup at Wheatley, with the tug held in place with a spud barge.

Permits and Approvals

The Essex Region Conservation Authority was contacted as the lead agency responsible for issuing any required permits. They indicated verbally that a letter of clearance would be issued, rather than a permit, because the dredging work was considered to be an activity not an undertaking. In the end no letter was received, likely due to the short time frame over which the project was organized. There was only a small window of favourable weather conditions forecast so the dredging was carried out on the basis of the verbal clearance.

Dredging Test

Dredging was carried out on December 16 and 17, 2008. There was moderate easterly and south-westerly wave activity for a number of days preceding the dredging but the dredging was carried out under calm conditions. Turbidity, presumably caused by the preceding wave conditions, obscured the lakebed during the dredging operation. It was obvious that the dredging caused higher turbidity off the stern of the tug, but it was not possible to estimate the limits of the plume associated with the increased turbidity levels.

It was planned that the area to be dredged would be surveyed before and after the dredging using a boat-mounted echo sounder and GPS. However, adverse ice conditions prevented the use of the echo sounder so hand soundings were taken from the tug both before and after dredging. This method limited the area that could be sounded within a reasonable time frame so the pre-dredge survey covered only the area where dredging was anticipated. The effects of the propeller washing extended beyond the limits of the pre-dredge soundings, but it is believed to be only marginally beyond the survey limit.

The dredging was confined to an area within the lee of the eastern pier and generally offshore of the western pier. Figures 1 and 2 show contours of the lakebed elevations before and after dredging, respectively. Figure 3 shows contours of the lakebed elevation changes resulting from the dredging. In each figure the contours are limited to the areas surveyed.

Based on the contours shown in Figure 3 we estimated the volume of sand dredged to be approximately 850 cubic metres. The unit cost to conduct the dredging was estimated to be $\$5.80/m^3$ and was determined from the

operating costs while dredging but not while sounding. That unit cost does not include any mobilization or demobilization components.

In our 2008 dredging assessment we estimated the cost of the current practice of dredging with a barge-mounted backhoe and dump scows to be $\$8.75/m^3$ and the cost of land-based excavation with trucking to the Hillman Marsh to be $\$6.50/m^3$. While the propeller wash dredging costs appear to compare favourably to the other dredging costs it must be recognized that the propeller wash dredging does not actually move the sand away from the Wheatley area. The dredging costs of the other methods include the cost of moving the sand far enough downdrift that it will not be transported back into the harbour entrance.

Due to the nature of the sounding method used we do not have enough bathymetric data to determine where the dredged sand ended up. It is logical to assume, however, that the sand was pushed only a short distance in a southerly to southwesterly direction. That suggests that the sand would be moved back into the entrance if significant southwesterly waves were to occur prior to the next easterly storm. An easterly storm would move the sand downdrift, away from the harbour entrance. If a southwesterly storm were to move the sand back into the entrance it would have to be re-dredged which would significantly increase the unit cost associated with the dredging. That suggests that while propeller wash dredging may be a cost effective method of clearing the entrance channel it does not necessarily compare well to other methods for sand that must be moved past Wheatley Harbour.

The post dredging soundings showed that the propeller washing was capable of removing sand down to a depth of almost 2.5 metres below chart datum (elevation 171 metres). That is an adequate depth under normal water level conditions but may not be sufficient during times of significant wind set-down. It must be recognized, however, that the dredging depth that can be achieved by propeller wash dredging is dependent upon the vessel used and it is possible that a different vessel could dredge to a deeper depth.

Overall, this suggests that propeller wash dredging could be used to open the entrance to Wheatley Harbour when it fills in. Although it is not expected to be the most effective dredging method for bypassing littoral drift, it could play a valuable role as a short term immediate response to a sedimentation problem at the entrance. Even with a proper sediment bypassing operation in place it should be assumed that there will be instances when a severe storm will move sand into the entrance channel. Ideally that sand would be removed from the channel entrance and taken downdrift, but it cannot be assumed that such an operation will be mobilized immediately. Propeller washing, however, could be initiated quickly, particularly if it is done with one of the local fishing boats.

If a fishing boat is capable of dredging to the same depth as the tug used during this test, then it might be a more logical vessel to use if a satisfactory method of anchoring the boat can be found. Given that the propeller wash dredging would be used for immediate needs it is possible that a suitable tug may not be available when required. It could also provide the quickest

means of clearing the entrance if it has filled in to the extent that the boats cannot exit the harbour.

For budgeting it should be assumed that any sand cleared from the entrance with propeller washing will have to be re-dredged and moved downdrift as part of the permanent bypassing operation. This is possibly a conservative assumption but it would be prudent to assume that there is a high probability that the sand moved by propeller washing will be transported back into the entrance channel.

Conclusions

We conclude that the propeller wash dredging tests demonstrated that propeller washing is capable of clearing the entrance to Wheatley Harbour. This type of dredging is not the preferred method for bypassing littoral drift at Wheatley Harbour but it could be a useful tool as part of the overall dredging solution. It is expected that a local fishing boat would be the preferred vessel for propeller wash dredging but an adequate anchoring system would need to be constructed.

We trust that this review meets your current needs. Please feel free to contact the undersigned if you have any questions or comments about this letter report.

Yours truly,

Shoreplan Engineering Limited

Bruce Pinchin, P.Eng.

Photo 1 and Figures 1 to 3 follow:

Photo 1
Propeller Wash Dredging within the Entrance Channel
December 17, 2008

Figure 1
Pre Dredging Soundings

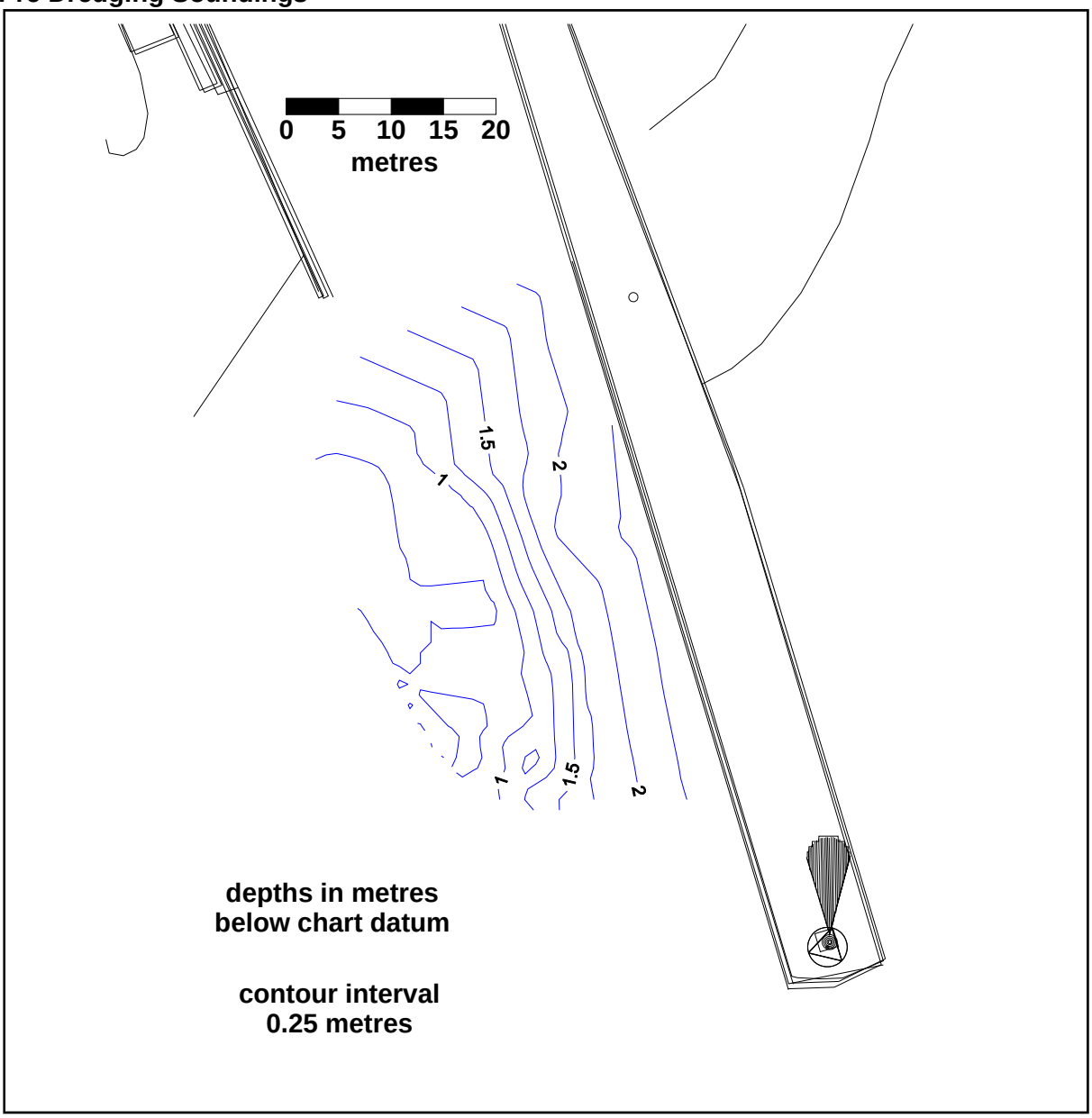

Figure 2
Post Dredging Soundings

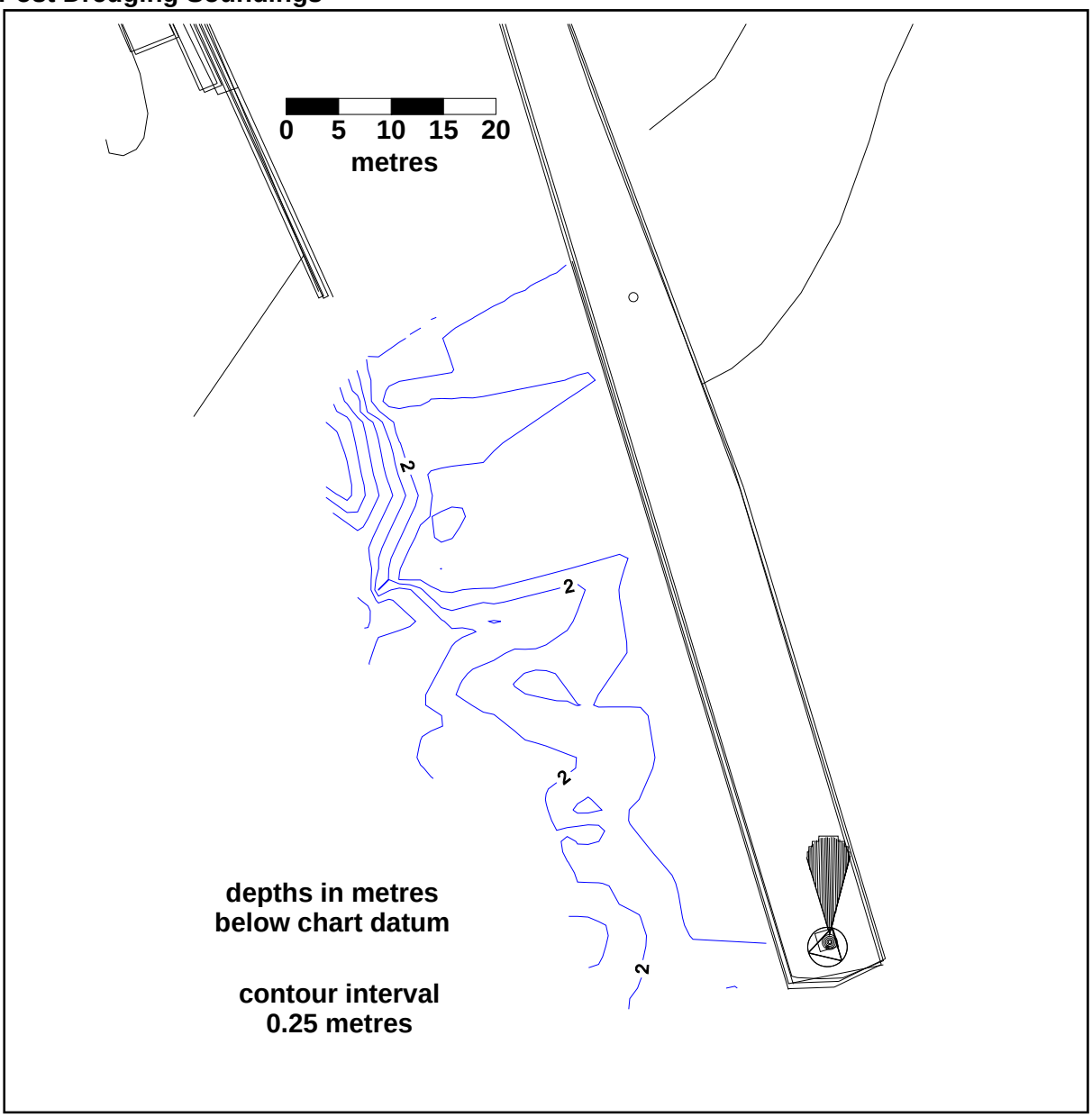

Figure 3
Contours of Lakebed Elevation Change from Dredging