

Impact of channel dredging on phosphorus concentrations in Cedarville Bay.

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ABSTRACT:

Phosphorus levels in Cedarville Bay were monitored during and after dredging of Les Cheneaux federal navigation channels. Data show that phosphorus levels in Cedarville Bay waters were temporarily elevated during the 2010 maintenance dredge but returned to normal concentrations upon project completion. During preparation of a barge turning basin phosphorus concentrations increased about eightfold in the turning basin area. Phosphorus concentration in this area remained three or four times higher than normal during the dredge project. Samples taken following dredge completion indicate that turning basin phosphorus levels returned to normal levels. One of the mid-bay sites closest to the turning basin had slightly elevated phosphorus during project start-up but then dropped to normal levels during the operation. Two distant control monitoring sites exhibited consistently low phosphorus concentrations throughout the dredge project.

INTRODUCTION:

Phosphorus is a plant growth nutrient that is available in limited concentrations in Great Lakes waters. Even in the presence of excess concentrations of other growth factors, aquatic plant growth will be restricted without an adequate phosphorus source. As such, an influx of phosphorus often results in algal blooms and intense weed growth. The sediment of Cedarville Bay contains high concentrations of phosphorus and for this reason the phosphorus levels were monitored to observe post dredge residual phosphorus in waters of Cedarville Bay.

METHODS:

Four sets of water samples were collected to monitor total phosphorus levels: during the time of preparing the barge landing area in Jun of 2010; Sep 2010 while dredging was underway; and in Jun and Sep 2011 following project completion at the end of 2010.

Five sampling sites were selected based upon their distance from the dredge landing and castoff area at the Cedarville launch ramp. Monitoring locations included a three-site transect in Cedarville Bay and two control sites about one mile distant from the dredge offload site as shown in Fig. 1. Samples were collected and analyzed at the University of Michigan Biological Station as previously described (Smith, 2003).

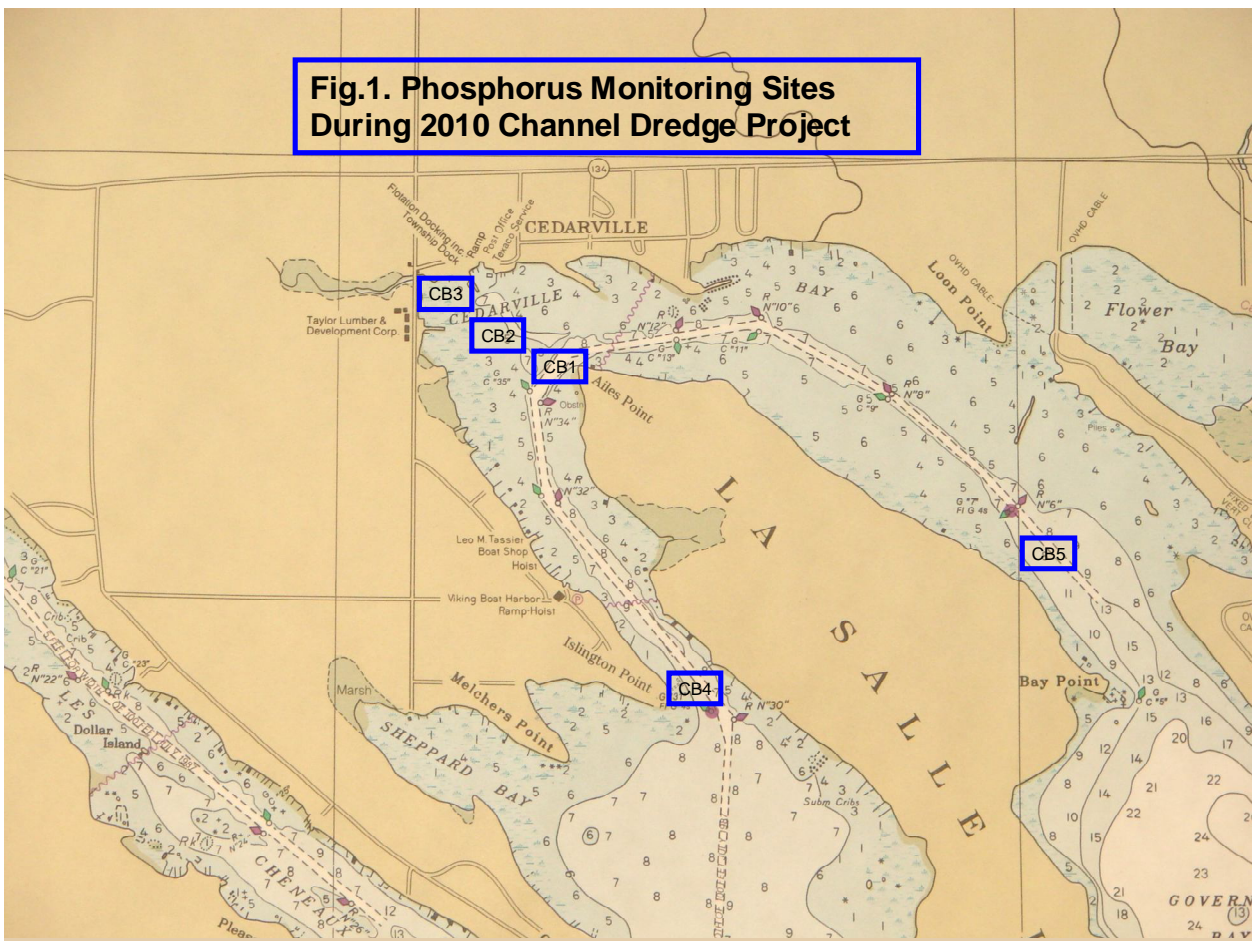




Fig. 2. Relationship of CB3 and turning basin.

A turning basin for barges was prepared prior to beginning the dredge operation. Sample station CB3 was located about 50 meters (M) from the barge landing and was expected to exhibit highest levels of total phosphorus in the water column (Fig 2).

Sample sites CB2 and CB1 were located ca 400 M and 800 M from CB3, respectively. Phosphorus levels at both of these sites were expected to be less than levels found at CB3.

Two control sample sites were located outside of the active dredge zone about one mile from the barge landing site. Station CB4 was located at buoy 31 off Islington Point and CB5 station was located midway between buoys 7 and 5 on the west end of Government Bay. GPS coordinates are shown in the legend of Table 1.

RESULTS and DISCUSSION

Phosphorus levels in the water column were highest at CB3 where the sediment was constantly churned in shallow water by tugboat propwash (Table 1.). Phosphorus levels decreased within the bay as a function of distance from CB3.

Table 1. Total phosphorus concentration (mcg/L) during and post-dredge of Les Cheneaux channels. Dredge was completed in fall of 2010.

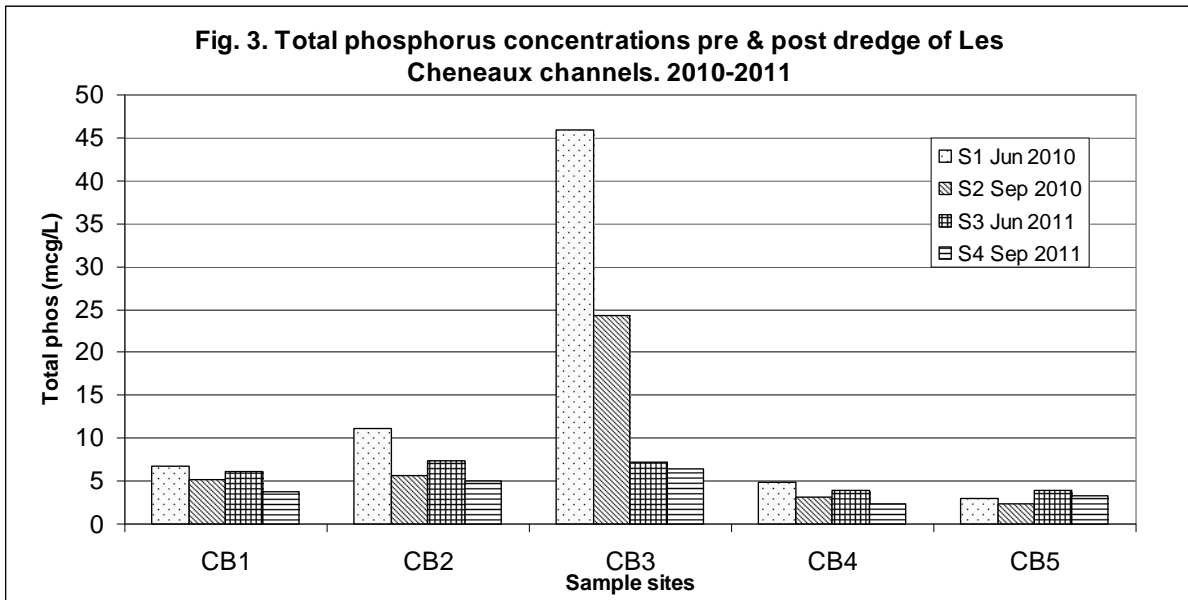
Site	Jun 10	Sep 10	Jun 11	Sep 11	Range
CB1	6.7	5.2	6.1	3.8	3.8 - 6.7
CB2	11.2	5.7	7.4	5.0	5.0 - 11.2
CB3	46	24.3	7.2	6.5	6.5 - 46
CB4	4.9	3.2	3.9	2.3	2.3 - 4.9
CB5	3	2.3	3.9	3.3	2.3 - 3.9

GPS coordinates for test sites:						
					Depth (ft)	Site description
CB1	N 45 59.556	W 84 21.350	WP 17(a)		8.5	Off Ailes Pt
CB2	N 45 59.587	W 84 21.458	WP 18		6.5	Middle of Cedarville Bay
CB3	N 45 59.717	W 84 21.661	WP 20		3.5	Off town dock
CB4	N 45 58.850	W 84 20.918	WP 21		9.5	Inside Islington Pt Buoy
CB5	N 45 59.207	W 84 20.022	WP 22		7.5	Off J. Daniels' Dock

(a) Waypoint number entered in field log on 28 Jun 2010, pages 4-6.

Phosphorus levels were also elevated at CB2 while the turning basin was being prepared but then returned to what might be considered normal levels for that site by Sep 2010 even though dredging activity continued (Table 1.). Phosphorus concentrations in the samples from CB4 and CB5 were consistently low throughout the study.

Data from Table 1 are shown graphically in Fig. 3. As noted above, elevated phosphorus levels observed for CB3 in Jun, 2010 are believed to be due to activities associated with preparing a turning basin at the landing site. Phosphorus levels observed for Sep 2010 at CB3 are considered to be normal concentrations in that area throughout the dredge project. Phosphorus levels at CB3 dropped to the range of other samples sites upon project completion at the end of 2010 as shown by Jun and Sep 2011 data. It does not appear that elevated phosphorus loading occurred on a long term basis at any sample sites.



CONCLUSION:

A temporary elevation of phosphorus at the Cedarville Bay offload point due to disturbed sediment returned to normal concentrations when dredge activity ceased. It is expected that phosphorus levels in Cedarville Bay will remain at their pre-dredge low levels.

CITATION:

Smith, R.A. 2003. Phosphorus dynamics in Cedarville Bay.

