MEMORANDUM

TO: Peg Peterson, Institute for Water Quality Research
FROM: Tom Kelly

The following is a summary of the phosphorus analyses done for us by Prein and Newhof Laboratories in Grand Rapids. I have attached their original letter and result sheet to this memo.

I. Shanty Creek Area Streams (See Kelly, 1983. A Survey of the Lake Bellaire Tributary Streams in the Shanty Creek Area).

<table>
<thead>
<tr>
<th>Station:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 Oct 83:</td>
<td>45.0*</td>
<td>6.0</td>
<td>63.0</td>
<td>18.0</td>
<td>3.0</td>
</tr>
<tr>
<td>25 Oct. 83:</td>
<td>90.0</td>
<td>15.0</td>
<td>31.8</td>
<td>9.0</td>
<td>9.0</td>
</tr>
<tr>
<td>1 Nov. 83:</td>
<td>18.0</td>
<td>3.6</td>
<td>12.0</td>
<td>6.0</td>
<td>9.6</td>
</tr>
</tbody>
</table>

The highest P concentrations correspond with the highest turbidity and discharge values.


<table>
<thead>
<tr>
<th>Station:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>5-1m</th>
<th>5-Bottom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass Cr.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int. R.</td>
<td></td>
<td></td>
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<tr>
<td>at M-620</td>
<td></td>
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</tr>
<tr>
<td>at mouth</td>
<td></td>
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</tr>
<tr>
<td>Lake Bellaire, Central Basin</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>15 May:</td>
<td>6.0</td>
<td>8.4</td>
<td>6.0</td>
<td>9.6</td>
<td>--</td>
</tr>
<tr>
<td>15 June:</td>
<td>9.0</td>
<td>10.8</td>
<td>6.0</td>
<td>7.2</td>
<td>12.0</td>
</tr>
<tr>
<td>16 July:</td>
<td>3.6</td>
<td>9.0</td>
<td>11.4</td>
<td>29.4</td>
<td>5.4</td>
</tr>
<tr>
<td>15 Aug.: &lt;3.0</td>
<td></td>
<td></td>
<td></td>
<td>6.0</td>
<td>&lt;3.0</td>
</tr>
<tr>
<td>15 Sept.:</td>
<td>6.0</td>
<td>9.6</td>
<td>6.6</td>
<td>8.4</td>
<td>13.8</td>
</tr>
<tr>
<td>15 Oct.:</td>
<td>6.0</td>
<td>4.8</td>
<td>8.4</td>
<td>6.6</td>
<td>13.8</td>
</tr>
<tr>
<td>20 Nov:</td>
<td>5.4</td>
<td>&lt;3.0</td>
<td>6.0</td>
<td>&lt;3.0</td>
<td>20.4</td>
</tr>
<tr>
<td>18 Dec:</td>
<td>12.0</td>
<td>12.6</td>
<td>11.4</td>
<td>12.6</td>
<td>12.0</td>
</tr>
</tbody>
</table>

P values for 1984 are similar to those found during 1982-83 (Canale, Peterson, Weiss, 1983). The range of values is greater, reflecting the greater number of samples taken in 1984. The one value of 29.4 cannot be given too much weight without replication.

*All concentrations as ug/l P
REPORT OF LAKE BELLAIRE SAMPLING

15 MAY 1984

The following is a transcription of my field notes of 15 May 1984:

Station 1. (Grass Creek at County Road 620 culvert) Time: 1212 EDT
Air temp: 12.2 C Sunny
Water temp: 6.6 C
Water clear
BOD & P samples taken at surface
BOD= 1.6 mg/l.

Station 2. (Intermediate R. at Riverside Marina dock) Time: 1150
Air temp: 13.3 C Sunny
Water temp: 9.5 C
Water clear
BOD & P samples taken at surface
BOD= 1.6 mg/l.

Station 3. (Intermediate R. just above outlet to L. Bellaire) Time: 1057
Air temp: Sunny, wind westerly at 12 mph
Water temp: 9.5 C
Water Clear
BOD & P samples taken at surface
BOD= 1.7 mg/l.

Station 5. (Lake Bellaire at approx. L44° 57.2'N, L85°13.5'W) Time:1120
Air temp: 11.7 C
Water temp, 1m: 9.2 C
bottom: 7.6 C
Station depth: 96 feet.
BOD and P sample at bottom, P sample at surface.
BOD at bottom= 1.7 mg/l.

Notes: The phosphorus sampling bottles supplied by Prein & Newhof (disposable type) proved to be unsatisfactory. About 50% of the samples taken with this type of bottle were lost when the bottles split when the samples were frozen. Fortunately I took duplicate samples at most stations and only the Station 5 bottom sample was lost. In future I will be using Nalge 250 ml bottles for P sampling. These bottles are more robust and can take freezing w/o cracking.

No BOD sample was taken at the Lake Bellaire station at the surface. This can be done in future if desired. Please advise.

Continued

The Traverse City WWTP is charging me $8.00/BOD sample instead of $20.00 as originally quoted. This is a considerable savings to the project. Perhaps some of the savings could be put toward the boat and motor rental at Riverside Marina ($6.00 per monthly trip).

I expect to make my next sampling on 15 June 1984.

Submitted 5 June 1984

[Signature]

P.S.: I have never received a contract for this work.
REPORT OF LAKE BELLAIRE SAMPLING
14 JUNE 1984

The following are the results of field work done on 14 June 1984:

**Station 1.** (Grass Creek) Time: 1230 EDT
Air temp: 13.9 C
Water temp: 11.5 C
Water clear
Sky overcast, wind variable
BOD and P samples taken at surface
Brook lamprey (*Lampetra appendix*) observed on spawning redd.

**Station 2.** (Intermediate River at Riverside Marina) Time: 1154 EDT
Air temp: 12.2 C
Water temp: 17.5 C
Sky overcast, wind calm at river surface
Water has slight brown tint
BOD & P samples taken at surface.

**Station 3.** (Intermediate River at mouth) Time: 1055 EDT
Air Temp: 12.8 C
Water temp: 17.6 C
Sky overcast, wind 337 degrees true, 6-8 mph.
Snapping turtle almost got my sample bottle and fingers!
P & BOD samples taken at surface.

**Station 5.** (Lake Bellaire, Main basin) Time: 1110 EDT
Air temp: 13.3 C
Sky overcast, wind 354 degrees T, 10-12 mph.
Water temp: 1 m: 17.8 C
Bottom: 9.1 C
Station depth: 96.5 ft. (29.4 m)
BOD & P samples taken at 1m and 0.5m above bottom.

BOD Results: (Analyses done by Traverse City WWTP)
- Station 1: 0.8 mg/l
- 2: 0.9
- 3: 0.9
- 5: 1m: 0.3
- Bot: 0.7

My next sampling is planned for July 16 (Monday).
REPORT OF LAKE BELLAIRE SAMPLING

16 JULY 1984

The following are the results of field work done on 16 July 1984. Field work by T. Kelly, A. Weber, assisting. BOD analyses were done by the Traverse City Wastewater Treatment Plant laboratory.

Station 1. (Grass Creek) Time 1009 (all times are local time, EDT)
Weather: Heavy overcast. Air temp: 21.7 C
Wind 2-5 mph from 257 degrees T
Water temp: 15.0 C Water clear
BOD: 2.2 mg/l P sample taken and frozen

Station 2. (Intermediate River at Riverside Marina) Time: 1157
Weather: Broken overcast. Air temp: 22.5 C
Wind variable
Water temp: 21.0 C Water clear, slight brown tint.
BOD: 2.0 mg/l P sample taken and frozen.

Station 3. (Intermediate River at mouth) Time: 1100
Weather: Heavy overcast. Air temp: 22.8 C
Wind 347 at 8-10 mph.
Water temp: 21.0 C Water clear. light brown tint.
BOD: 1.9 mg/l P sample taken and frozen.

Station 5. Lake Bellaire, central basin) Time: 1115
Weather: Broken cumulus. Air temp: 19.2 C
Wind 317 T at 10-15 mph.
Lake surface choppy
Water temp: 10 C (Bottom), 22.2 C (1m)
Water has slight green tint
BOD: 2.1 mg/l (bottom), 2.3 mg/l (1m)
Station depth: 87 feet
P samples taken and frozen

My next sampling trip is scheduled for August 14 (Friday).

Thomas M. Kelly
Limnologist
REPORT OF LAKE BELLAIRE SAMPLING

14 SEPTEMBER 1984

Station 1. Grassy Creek at M-620
Time: 0950 EDT
Air Temp: 16.7 C
Sky: Broken strato-cumulus Wind: calm
Water Temp: 12.0 C Water clear
BOD: 1.5 mg/l
Note: Since the parking area here has been blocked off the stream bank has stabilized and good vegetation cover has grown up.

Station 2. Intermediate River at Riverside Marina, Bellaire
Time: 1120
Air Temp: 19.4 C
Sky: Overcast Wind: Light and variable
Water Temp: 16.9 C Water clear, slight brown-green tint
BOD: 1.5 mg/l

Station 3. Intermediate River at mouth
Time: 1030
Air Temp: 19.4 C
Sky: Overcast, broken strato-cumulus Wind: Calm
Water Temp: 16.8 C
BOD: 1.4 mg/l
Note: Lots of minnows here.

Station 5. Lake Bellaire, Central Basin
Time: 1045
Air Temp: 16.7 C
Lake surface rippled. Water has slight green tint.
Water Temp: 1m: 18.3 C Bot: 9.3 C
Station depth: 93 feet (28.3 m)
BOD: 1m: 0.8 mg/l Bot: 1.5 mg/l

The next sampling trip is scheduled for October 15 (Monday). I have run out of room to store the frozen phosphorus samples.

Respectfully submitted.

Box 186
Suttons Bay, Michigan 49682
616 271-6637

THOMAS M. KELLY
Limnologist

Member of the American Fisheries Society and the International Association for Great Lakes Research
REPORT OF LAKE BELLAIRE SAMPLING

15 OCTOBER 1984

Station 1. Grassy Creek at M-620
Time: 0930 EDT
Air temp: 16.0 C
Sky: Heavy overcast
Water Temp: 13.6 C
Wind: Light and variable
Water clear
BOD: *

Station 2. Intermediate River at Riverside Marina
Time: 1025
Air temp: (thermometer broke!) Wind: Less than 5 mph
Sky: Heavy overcast from 0-65 degrees T
Water temp: 13.6 C
Water: Clear
BOD: *

Station 3. Intermediate River at Mouth
Time: 1021
Air temp: 
Water temp: 13.6 C
Wind: 2-3 mph, variable
Water: Clear
BOD: *

Station 4. Lake Bellaire, Central Basin
Time: 1053
Air temp: 
Wind: 5-10 mph, 145 deg. T
Sky: Overcast, occasional bright periods
Sea state: Small wavelets
Secchi disc depth: 14.8 feet
Water temp: 1m. 15.3 C
Bot. 10.0 C
Station depth: 87 feet
Water has slight green tint
BOD: 1m.
Bot. *

The next sampling is scheduled for 15 November (Thursday).

Respectfully Submitted,

THOMAS M. KELLY
Limnologist

*BOD samples lost in lab procedural problem.

THOMAS M. KELLY
Limnologist

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Michigan 49682
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REPORT OF LAKE BELLAIRE SAMPLING

20 NOVEMBER 1984

Station 1. Grassy Creek at M-620
Time: 1011 EST
Air temp: 29.3°F (-1.5°C)
Water Temp: 2.0°C
Water clear
Sky: Overcast  Wind: Light and variable
BOD: 6.5 mg/l*

Station 2. Intermediate River at Riverside Marina, Bellaire
Time: 1120
Air temp: 0.4°C
Sky: Overcast, occasional snow flurries
Wind: Light and variable
Water temp: 2.8°C
Water clear
BOD: 6.5 mg/l*

Station 3. Intermediate River at mouth.
Time: 1042
Air temp: 0.2°C
Sky: Overcast, light snow
Wind: NNW at 6 mph
Water temp: 2.2°C
Water clear, Some ice at river banks.
BOD: 6.7 mg/l*

Station 5. Lake Bellaire, central basin.
Time: 1058
Station depth: 29.9 m (98 ft.)
Air temp: 0.4°C
Sky: Stratus cover, few breaks in clouds
Wind: NW at 9 mph
Sea state: Slight chop
Water temp: 1m: 5.5°C
27.4m: 4.5°C
Secchi disc depth: 12.5 ft. (3.8m)
BOD: 1m: 6.6 mg/l*
27.4m: 0.7 mg/l

* BOD concentrations are several times higher than expected. Discussion with laboratory personnel indicate error possible in oxygen instrument.

My next (and final) sampling will be made on 17 December 1984.

Respectfully submitted:

THOMAS M. KELLY, Limnologist
REPORT OF LAKE BELLAIRE SAMPLING
18 DECEMBER 1984

Station 1. Grassy Creek at M-620 crossing.
Time: 1122 EST
Air temp: -3.7 C (25.3 F)
Sky: Overcast, snow shower Wind: West, 6-8 mph
Water: Clear, more suspended organic particles than usual
Water temp: 2.0 C
BOD: 5 mg/l

Station 2. Intermediate River at Riverside Marina, Bellaire
Time: 1315
Air temp: (no data-thermometer got wet)
Sky: Overcast, snow shower Wind: Light & variable
Water: Clear
Water temp: 2.0 C
BOD: 3 mg/l

Station 3. Intermediate River at mouth.
Time: 1154
Air temp: -3.2 C
Sky: Overcast Wind: Gusty, variable
Water: Clear
Water temp: 2.0 C
BOD: 3 mg/l
Lots of ducks (mallards & goldeneyes) on the River. One muskrat seen.

Station 5. Lake Bellaire, Central Basin.
Time: 1215
Air temp: -2.3 C
Sky: Overcast Wind: NNW, 8-12 mph
Sea state: Choppy, some white caps
Secchi disc depth: 4.1m (13.5 ft)
Station depth: 27.8m (94 ft)
Water temp: Surface: 3.1 C
Bottom: 2.7 C
BOD: 1m: 3 mg/l
Bot.: 2 mg/l

This report completes the 1984 sampling. A final summary report will be submitted in Mid January, 1985. Phosphorus samples will be shipped this week

Respectfully submitted.

Thomas M. Kelly
Limnologist

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Member of the American Fisheries Society, the International Association for Great Lakes Research
and The American Boat and Yacht Council