Comments to White Lake Stakeholders **July 7th Annual Meeting 2007**

Dr. R.L. Wallace, Department of Biology, Ripon College

1. **White Lake Management Plan.** I recommend that you incorporate the perspectives held by all stakeholders into a formal Management Plan to protect White Lake. These perspectives are diverse (see list of interests, below), and you will have to compromise to achieve a successful plan.

   > Stakeholders[1] are "…defined as any group that affects or is affected by management decisions…." Moreover, this is usually a diverse group of individuals, families, and corporations that do not always share cultural perspectives on environmental issues. This lack of common perspectives will make honest dialog critical.

   Interests of White Lake stakeholders include, but are not limited to, the following: your primary home, your family legacy, an investment property, means of your livelihood or at least augmenting your income, fishing & other sports, esthetic enjoyment. If there are others, they need to be examined careful and integrated in the management plan.

2. **White Lake as a Commons.** Simply put, the interests listed above put pressure on the lake. Thus, as stakeholders you must realize that the way you all have been managing your personal property is similar to that of a commons[2] (i.e., White Lake is the commons), and this may not be in the lake's best interest for its long-term health.

3. **White Lake is an ecosystem with normal aquatic ecosystem processes.** White Lake is an ecosystem with important processes associated with it. These processes include:
   - Decomposition of natural organic carbon inputs (e.g., leaves, domestic and wild animal wastes);
   - Filling-in of the basin with organic and inorganic sediments;
   - Primary production (algal growth) that proceeds via a bottom-up trophic cascade to fish;
   - Growth of algae and large aquatic plants that provide food for invertebrates and shelter to young-of-the-year fish;
   - Water recharge to subsurface aquifers.

4. **White Lake provides Ecosystem Services.** Think of the ecosystem processes of this lake as providing certain ecosystem services. I am sure that these services are important to you; they are, in fact, the list of stakeholder interests (point 1). The problem is that some activities undertaken by stakeholders degrade ecosystem processes and as a result degrade the ecosystem services provided by the lake to other stakeholders (this is the *Tragedy of the Commons*[3]). Consider the following examples as discussion points for a best practicies management plan for White Lake.
   - A beautiful lawn achieved by the inappropriate application of fertilizer (especially those that contain phosphorus[4]) can load the lake with extra phosphate[5]. All stakeholders should avoid using lawn fertilizer containing phosphorous. Moreover, I recommend that a barrier strip of at least 20 feet from the shore not be mowed. Inadequate septic systems also can increase P loading of a lake. White Lake stakeholders must employ the best septic handing system possible.
   - Running prop motors close inshore so that the sediments are disturbed releases phosphate directly into the water. These are absorbed by algae and aquatic plants, permitting additional growth. No-wake ordinances should be observed.
   - Burning leaves along the shore and allowing the ash to wash into the lake is nearly the same thing as allowing the leaves to drift into the lake. The ash contains nutrients that fertilize the lake. Whole leaves contain organic matter that will decompose at the bottom of the lake, thereby reducing the level of dissolved oxygen in the lake (see below). Leaves should be raked and brought to the landfill or disposed of in some other way.
   - Animal waste, either from cats and dogs that are allowed to roam free or human wastes from leaking sewage systems, including gray water, can fertilize the lake with phosphate. Avoid allowing any of this stuff from getting into the lake.

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[1] – Eisenhauer & Nicholson 2007. Do you see what I see? Diverse perspectives in environmental communications. *Frontiers in Ecology and the Environment* 5(3): 161–162.

[2] – The commons is an old, but still appropriate, concept that comes out of English & subsequently New England traditions. This view is that a property may be owned by all & thus exploited by all. Yet all stakeholders do not treat the commons in the same way. Some may at conserve it; others abuse it. In this context the commons is White Lake. Individuals & corporations may own shoreline & your activities along that shoreline & in the lake have a benefit to you, but those activities any impact all stakeholders. This impact can be positive or negative.

[3] – Harden, G. 1968. The Tragedy of the Commons. *Science* 162:1243–1248.

[4] – O'Connor 2007. Statewide ban on phosphorus in lawn fertilizer and increased runoff controls proposed. *The Lake Connection*. 16(2): 1, 4.

[5] – The element phosphorus (P) & the compound, phosphate (PO_4^{-3}) are sometimes used interchangeably in casual speech, but with different molecular formulas their mass is different. In our calculations we report the phosphate concentrations in µg/L.

- Adding sand to re-grade a beach will erode into the lake, reducing its depth, as will building or grading for landscaping purposes without effective soil erosion barriers. In my opinion new sand should not be added to landscape beaches.
- Plastic and glass tossed into the lake will not decompose during your lifetime or that of your grandchildren. Paper, wood, and cotton rope acts as if they were extra leaves. Do not treat your lake as if it were a landfill.

Repeated many times over, the activities listed above (and others) will result the reduction of the Ecosystem Services for all stakeholders. Your Management Plan must account for this understanding.

5. **Statement of the problem as I see it.** Several years ago White Lake Management Group (WLMG) asked for information on, and my opinion about, the ecological status of White Lake. For two summers in a row (2002 & 2003) I directed a student working on this question. (By the way Sarah is now living and working in Oregon. She is a middle school science teacher. She credits this research experience as providing her with great insight to her teaching.) In the first year (funded by WLMG) we addressed the question of how much phosphate was cycling in the lake and how much decomposition was occurring at depth within the lake. We followed that up in the second year (funded by Ripon College) by looking at population densities of coliform bacteria in the surface waters. Our conclusions were provided to the WLMG.

   The spike in the concentration of P in the surface waters of White Lake observed by the WLMG last fall (ca. 10x above average levels) is disturbing. I suggested that this spike might be due to one of three things.

   (1) It could be an error, perhaps produced by dirty glassware or a laboratory error. This is not likely, but it should be considered.

   (2) If the samples were taken soon after an intense storm, it could be from resuspended sediment.

   (3) It could represent a new significant input of phosphate into the lake. I was asked to undertake an investigation of the P levels in the lake, the sediment, and groundwater.

   While it might be comforting to assume that the first case to be the reason for the elevated levels of P, it is prudent to examine the lake in some detail to ascertain as best we can the real reason. *Ad hoc* hypotheses based on anecdotal information also may be comforting, but they add little to the discussion.

   My student collaborator in this effort is Ryan deRegnier, a rising senior with considerable experience in ecology that includes study in northern Minnesota, Texas, Mexico, and Australia. On fieldtrip occasions, two students who are supported on a different grant of mine, and who work on their own project, aid Ryan in his work.

6. **Status of the investigation.** The research team has undertaken three field trips. Ryan also has re-organized previous data to develop a way to determining whole lake [PO_4^{-3}]. From these preliminary data I offer the following conclusions.

   (1) Thus far the Secchi disk values have been very good. On 5 June the Secchi disk depth (= lake clarity) was 5.75 m. On 26 June lake clarity was ≈9 m, which is within 2.5 m of the maximum depth in the East and West basins. On 3 July lake clarity was ≈8.5 m. These data represent the good news, but in my opinion, they only indicate that the lake passed through the late spring clear water phase. At this point we can expect to see the establishment of the summer plankton community and with that Secchi depth should decrease. The months of July and August will provide important data to evaluate this working hypothesis.

   (2) The Oxygen concentration below the thermocline is dropping very fast this summer! The following data come from samples taken from near the bottom in the East and West basins. On 6 June the oxygen concentration was about 42% saturation; on 26 June the level was <25% of saturation; this past Tuesday (3 July) the level was about 10% of saturation. Continued at this rate the hypolimnion will become anoxic driving fish from the deep cooler water. The drop in oxygen at depth in the lake indicates that there is a lot of organic material that bacteria are decomposing. The nature of this material is unknown. We will compare this drop with Sarah found a few years ago.

   (3) On 5 & 26 June, and 3 July, mean, whole-lake Phosphate concentrations were 40, 100, & 90 µg/L, respectively. The last values are of concern, as they are below that detected for the lake during fall circulation in the fall of 2006.

   (4) The best estimate that I can make at this point is that the bulk of the phosphate is in the sediments. And that any disturbance of the sediments or the addition of phosphate into the lake will be detrimental to the ecosystem and thus those ecosystem services that make White Lake such a valuable resource for all stakeholders.

   (5) To test this working hypothesis we will take sediment cores in the East and West basins and analyze that material for P. We also will determine the P in samples from standpipes, as they are provided.