Lower Fox River TMDL Technical Team Meeting

January 14, 2009, WDNR Green Bay

Technical Team Attendees: Rick Stoll –WDNR; Rob McLennan – WDNR; Ed Wilusz – WI Paper Council; Steve Jossart – Georgia Pacific; John Kennedy – GBMSD; Greg Baneck – Outagamie County LCD; Nick Vande Hey - McMahon; Matt Heckenlaible – City of Green Bay; Eugene McLeod – Calumet County LWCD; Paul Baumgart – UWGB; Melanie Leet – Winnebago County LCD; Bill Hafs – Brown County LWCD; Laura Blake – Cadmus Group; Nicki Richmond – WDNR; Erin Hanson – WDNR

Other Attendees: Bill Thacker – NCASI; Tony Kappell – McMahon; Tracy Driessen – Cellu Tissue; Jon Bechle – Brown County LWCD; Mark Haggedorn – Brown County UW-Extension

1. **Welcome & Introductions**

2. **Guest Speaker: Bill Thacker, National Council for Air and Stream Improvement (NCASI)**

Presentation slides are attached:

Adobe Acrobat Document

- NCASI is a non-profit, technical association funded by dues from forest products industries. It has a research program that covers many areas including air and water quality.
- Pulp effluents are deficient in bioavailable phosphorus needed for solid separation and phosphorus is added to wastes prior to treatment. The challenge for mills is to provide enough for solid removal while not too much (permit limits & cost).
- Wisconsin mills have a 12-month rolling average permit limit. Several mills in WI only have primary treatment and activated sludge treatment is very common. With activated sludge treatment the practical lower bound is approximately 0.1 – 0.3 mg/L TP (based on 13 North American mills).
- 42 mills in North America have long term effluent concentrations below 1 mg/L.
- Factors favoring low TP effluents and a "phosphorus minimization program implementation" were summarized – examples were included from Finland, North America, and Spokane WA (experimenting with techniques to drop TP <0.01).
- NACASI expressed it is difficult to quantify costs given that site specific details often drive the costs at a given facility. Bill Thacker cautioned that what he presented was a preliminary & rough estimate for 24 operating mill treatment plants in WI. The technical team estimated that 10-12 plants were in the Lower Fox basin.
- Estimates of statewide capital costs for tertiary clarifier & filter removal were $128 Million (based on USEPA 1979 cost curves) and $219 Million (checked with information provided by a vendor). Estimates of operation and maintenance costs at TP discharge of 0.05 mg/L were also presented – ranging from $2.5 through $11 Million/year based on the M:P ratio. Other annual expenses not considered were:

maintaining optimal pH, storage, polymers, and chemical sludge management and disposal.

Effluent treatment at Georgia Pacific - Steve Jossart

- Presentation slides are attached:

Adobe Acrobat Document

- Steve noted that it takes 2-3 months to see impact of changes in plant processes in sludge. In the last five years Biological Oxygen Demand (BOD) has decreased due to changes in the plant processes. However, as BOD drops the demand for Nitrogen increases.
- There is a temperature lag seen when looking at nutrient residuals. Sludge needs to be cooled to less than 100 deg F to be treated. At higher temperatures, more nutrients are required for sludge treatment.
- In Georgia Pacific's phosphorus reduction trials feeding a side stream of primary effluent (phosphorus free) to the end of the aeration basin to consume excess phosphorus didn't work. They now use 'flow (load) pacing nutrients'. For solids contacting clarifier and full scale tertiary clarification, a secondary clarifier will be converted to a tertiary clarifier. This eliminates iron cycling back to the basin.
- Control of filaments is a concern.
- Nine mills in the Lower Fox have river intake data, though some are estimates and phosphorus data is limited.
- Some of the mills remove phosphorus because their sludge goes to GBMSD or elsewhere. The calculated River Intake Data doesn't include non-contact cooling water.
- WPDES permit holders can't have violations, so insurance is built into treatments. If one of the treatments goes at Georgia Pacific, they will shut down plant rather than violate their permit limits.

3. Review of Point Source Phosphorus Discharge Reduction Cost Information (Strand Report) – John Kennedy

- Strand report was distributed by email in advance of the meeting. John's handout is attached:

Adobe Acrobat Document

- The Strand Report's purpose was to estimate statewide costs to Publicly Owned Treatment Works (POTW) if effluent limits drop from 1 mg phosphorus/L to 0.1 (mg/L).
- Only a few plants actually had costs. Most facilities are small and average discharge is 0.6 mg/l (flow rated). Some larger facilities operate well below their permit limits, by fine tuning the biological processes they have.
- For example, GBMSD was approached by the Green Bay Remedial Action Plan Committee to decrease its P discharge to the extent practicable under the plant's

existing conditions. Here, P reductions are driven by total solids discharge (the lower the TSS, the lower the TP, as it's bound to the solids). Ferric chloride was used to remove bioavailable P. For several years, P removal was maximized to the point where there was no measurable dissolved phosphorus (0.15 - 0.3 mg/L).

- GBMSD did encounter problems during short term events. As BOD loads lessened, P removal dropped (discharge went over 1 mg/L in less than 24 hours). They now watch for low BOD periods and add ferric chloride as needed.
- To reliably discharge at 0.1 mg/L plants need to go to tertiary treatment. What is needed will depend on plant processes and won't be known until facilities complete planning and engineering designs. Annual costs are estimated to be approximately 1% of the associated capital expenditures. WPDES permit holders design to be well under limits.
- The Strand report looked at detailed cost estimates for four facilities. CH2M Hill recommended ballasted clarification for GBMSD, which is a process that uses more energy. Of the 4 facilities, GBMSD was most expensive. This could translate into a 15% increase in user bills (which would be dramatic).
- Determining the cost per pound of phosphorus removed will vary depending on the factors considered. Ancillary costs including energy, green house gas emissions, and net environmental effects should be considered. Reducing discharge to 0.6 - 0.7 mg/L was cost effective (using existing technology), the next reductions will be much more costly.
- It was also assumed that small lagoon facilities would have to be rebuilt into mechanical plants.

Review of point source costing approaches from other efforts: Laura Blake (30 min)

- Laura provided a summary of methods used to estimate costs for point sources from work in: Chesapeake Bay, Connecticut River, University of Georgia and the Passaic River. Presentation slides are attached:

Adobe Acrobat Document

- The demonstration project had a rough estimate of costs using data from EPA (1979) and scaled to present day value. Many people are using this approach, though criticism exists that these values are outdated given changes in technology since that time.
- Chesapeake Bay collected cost information using a survey distributed to WWTPs and generated cost curves for facilities based on their design flow (1, 10, & 30 MGD). This would be ideal for the Lower Fox TMDL, but to get true costs many facilities would have to do an engineering study (they would not be likely willing to spend the money, and wouldn't be available in the timeframe needed). Chesapeake Bay also used estimates from EPA guidance documents resulting in rough estimates of $30 Million for a 30 MGD facility to achieve 0.1 mg/L.
- Connecticut River is a subbasin of Long Island Sound and didn't have actual data from facilities in their basin. They are using TN cost curves from Chesapeake Bay to develop their own. We could consider using a similar approach for the Lower Fox.

- University of Georgia used a simulation tool to develop generalized estimates of treatments needed to achieve varying TP limits and then used the EPA 1979 cost estimates guidance document updated to present dollar.
- Passaic Watershed trading study investigated the potential cost savings associated with trading amongst WWTPs using TP cost curves from the Chesapeake Bay study.

Discussion:

- It was suggested there should be a shift towards reducing mass loading to the Fox River rather than getting treatment plants to specific mg/L phosphorus discharges.
- It was questioned how costs would be factored into TMDL allocations. Laura replied that many TMDLs don't let costs drive allocations, but in many cases point sources get targeted for larger reductions because of the regulatory authority that exists for regulated dischargers. For optimization, point sources will be compared with agricultural management options. It will be critical for implementation to look at the least cost approaches for restoring water quality in the bay.
- Regulatory constraints shouldn't factor into optimization – though some point sources have imposed limits they need to meet before looking at cost reductions based on current state law (NR 151, NR 217).
- EPA has no set guidance and does not require an implementation plan for TMDLs. This project has been given some flexibility in timing to allow for implementation planning being included with this TMDL document.
- A number of questions were raised about implementation in relation to WPDES permits including:
  - Will the 'insurance factor' be considered (plants consistently operate at lower levels than their permits)?
  - How will WPDES permits incorporate TMDL allocations?
  - How will optimization results be factored in allocations?
  - How will runoff from industrial permit sites be accounted for?
  - Is there a variance process within the TMDL?
  - What happens if a company can show hardship because of costs? The economic costs of losing a business should be factored into these costs (Tracy Driessen).
  - What timeframe do entities have for compliance? MS4 stormwater permit language says that as soon as TMDL developed the allocation needs to be incorporated into permit ASAP. Point source permits can be updated as part of the next permit cycle.
  - What if the optimization shows that the majority of reductions need to come from non-regulated entities?
- The TMDL project timeline was briefly discussed. Modeling will be done in a couple of months and WDNR hopes to have the TMDL completed by the end of the calendar year (2009).

Lunch Break

5. Overview of the optimization model: Laura Blake & Group Discussion

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- Optimod is a customized model created in AIMS, a software package with a reasonably priced user version that could be purchased by a university or other entity. The model was government funded, so it's available to anyone, but AIMS is needed to run it. Previous plans to build an Excel based model were dropped due to the amount of resources it would take and a lack of capacity within DNR to run SWAT models to generate input.
- Optimod has 4 components, one of which is constraints which set realistic limits on the optimization. TMDL targets are the constraints, and the model will be asked to meet the targets at least cost (optimal is least cost). TMDL targets and final baseline data are needed before the model can be run.
- Agriculture: The demonstration project (Phase 1) showed that reductions from traditional BMPs were not sufficient to meet TMDL targets, so the model was told to maximize phosphorus reductions. Innovative solutions will be needed to meet water quality goals in the LFR Basin.
- Point sources: a cost curve is needed to use in Optimod. Ideal would be estimate for different plants to get to different permit limits.
- MS4s: considered only modeling TSS reductions greater than 40% specified by stormwater permits. May need to look at phosphorus reductions.
  - Nick Vande Hey suggested including MS4 cost reductions regardless of permit limits (i.e. those to reach <40%) to get a true optimization. Composites of similar communities, or information from individual communities can be used to generate cost curves for Optimod.
- Potential to add a propensity optimization to look at what BMPs agricultural producers might be more likely to implement, using ranking of BMPs from Dairy survey or facilitated stakeholder discussions.
  - Bill Hafs discussed the history of the priority watershed program and suggested that the time for voluntary action has passed. Landowners that have yet to implement BMPs are either unwilling or unable. Brown County can aggressively seek cost-sharing money through trading or other means and require landowners to implement these practices.
  - It was noted that the last year of the Duck-Apple priority watershed is 2009 and that Outagamie staff will be lost at year end.

6. Update on TMDL Development: Laura Blake and Paul Baumgart

- Paul explained how urban areas have been broken down into 3 density categories. He has also overlaid the MS4 areas (SLAMM boundaries) and broken out urban MS4 areas and non-urban MS4 areas. An approach for modeling the MS4s would be to use this cookie-cutter approach to determine the MS4 loads. Austin Straubel airport was discussed – noting that it is included in Brown County's MS4 permit and also has a WPDES & Industrial permit too.

- SWAT model recalibration will begin next week to check if simulated numbers are correct. October 2004 land use maps will be used for the SWAT model.
- Municipal sludge spreading data was compiled from 2004& 2005. Industrial land spreading permit holders are not required to report phosphorus results to the DNR.
  - The team estimates packing plants in Brown County produce 600-700 Million gallons of animal waste, and that there's another 100 Million gallons of industrial waste. If it was known how much was spread, one could use literature values from the extension office to estimate how much phosphorus is applied.

7. Update on Agricultural BMP Costing: Mark Hagedorn

Each BMP proposed for the optimization model was discussed.

BMP #1 - Nutrient Management (reduce phosphorus in dairy cow feed ration by 25%)

- This is a reasonable BMP is likely to be where largest gains in reducing phosphorus can be made since research indicates that supplemental phosphorus in heifer rations is not necessary on a majority of farms. A 20% drop in dietary P has been seen between 1995 & 2007 (from 0.5 % to 0.39%) at the ag source lab in Bonduel.

BMP #2 - Manure Incorporation (increase proportion of applied manure that is incorporated within 72 hours)

- This BMP assumes there is enough storage capacity for the manure. Mark is continuing to collect data about permitted farms, though farmers are sensitive about sharing this information. Several smaller scale operations have winter spreading plans. Given the current economy, we may see a decrease in smaller farms as they retire or sell out.

BMP #3 - Nutrient Management (stabilize soil-test phosphorus averages at current average of 40 ppm [Bray P1])

- Questions for tech team –
  - Which P levels and manure production figures should be used UWEX or NRCS Tech notes?
  - Do we try and account for imported/exported manure?
  - What to use for actual basis for implementation? Setbacks are not accounted for.
- Current numbers indicate that more phosphorus is being removed by crops than is being produced (no setbacks). Estimate 7,655,482 lbs removed annually by crops and manure quantity of 6,718,318 from 105,000 head of cattle in Brown County. There is a difference in available P (value=5) and total P (value = 9). Stephanie Schneider used a value of 7. Mark is currently using NRCS planning guidelines for nutrient management plans based on diluted manure that sits in lagoons (value =9)

BMP #4 - Conservation Tillage (mulch tillage and zone tillage)

- Tentative implementation costs of $17.40/acre mulch till, $27.00/acre zone till. There's not much zone tillage in NE WI, perhaps 2 farmers with equipment.
- Need to clarify the amounts of residue associated with each practice. For example:

Conventional	Mulch Till	No Till
Under 15%	15-30%	Over 30%

- Need to establish planting delays per practice.

BMP #5 - Cover Crops (on low residue fields)

- Implementation cost estimated at $61.63/acre.

- Assumptions include: Cost of no-till drill (per 2007 Custom rate guide) $15.50, Cost of Custom Spray application (per Agri-Partners) $7.50 per acre, Generic Glyphosate - 1 ½ qts per acre $43.00 per gallon, Rye Seed – 1 ½ bu per acre (per Deer Creek Seed) $8.00 per bu, Production loss – 5 days at .5 bu per day – 2.5 bu at $3.80 per bu
- Collecting average first planting date for region may help substantiate the "5 days"
- This does reflect a significant difference between cost share $$ and actual cost.

BMP #6 - Vegetative Buffer Strips

- No cost share in Brown County, other county's would have cost share available. Mark is working on developing comparison of actual cost of implementation compared to cost share amounts. Now it's just the cost to the farmer, but since urban stormwater BMPs include costs for staff these County LCD staff time should be included in these numbers.

BMP #7 - Decrease Soil Phosphorus Levels from 40 ppm to 25 ppm (Bray P1)

- Mark created a spreadsheet estimating acres in each crop and the pounds removed by these crops for Brown County. Should Calumet & Outagamie Counties be estimated the same way?
- It may be impossible to reach 25 ppm. Mark used an area of 165,000 acres which assumes all acreage available is being used and doesn't include set backs. To reach 25 ppm it would take nearly 6 years with no manure and no starter fertilizer applied on corn in Brown County. If manure was the only phosphorus source then it could take 47 years for crops to remove enough phosphorus to reach 25 ppm.
- Using Mark's spreadsheet, one can estimate the time necessary to reach 25 ppm if manure was removed from the basin (by using innovative manure management techniques).
- 1/3 of land in any given year is in alfalfa and not receiving animal waste. Mark suggested an alternative BMP of using alfalfa every 3rd or 4th year and getting a nitrogen credit for the following year.

BMP #8 - Biofuel Crops (add switchgrass to typical cash-crop rotation of alternating years of soybean and corn-grain

- Mark questioned the use of switch grass and what soil sample type should be used? It was included as a BMP for harvesting to use in ethanol (mention of Kaukauna power plant).

BMP #9 – WASCOB (sediment detention ponds on farms)

- Mark questioned what % of farm fields should be included & how many potential applications/mile.

BMP #10 – Innovative Techniques

- Land application with anionic polyacrylamide technology is new & getting firm estimates relating to application rates and cost of the product are not available. This could have a positive impact on erosion, however acrylamides getting back into the water could be a problem. This technology is used in construction sites.

8. Other TMDL activities update: Nicki Richmond & Erin Hanson (15 min)

- Jim Baumann gave a presentation of proposed phosphorus criteria presented at 'Lower Fox Partners' meeting. His tentative timeline included: advisory committee meetings in the next 1-2 months, public hearings in spring 2009, Natural Resources Board in 2009, followed by legislative oversight and EPA approval.

- TMDL targets need to be chosen by March. There may be a change to TSS target for tributary streams. Targets won't be set in stone, if the statewide phosphorus criteria are more stringent than the TMDL the DNR might have to revisit the TMDL.
- Roger Bannerman estimated the potential phosphorus reductions associated with a ban in phosphorus lawn fertilizers is 6% in the Lake Wingra watershed-an established urbanized watershed. Well-established lawns apply less phosphorus, lawns that don't fertilize have 50% less phosphorus than those that do.
- A potential special project for the DNR could be to evaluate changes in phosphorus concentrations in runoff with various leaf collection methods (P can leach out of leaves), wet ponds, and lawn fertilization methods for a better estimate of P loading in SLAMM modeling.