Addendum:
WATER QUALITY MONITORING AND ASSESSMENT
HYDROGEOLOGICAL ASSESSMENT
Proposed Drainage District #88

Report to the Dodge County Circuit Court

Board of Commissioners
Lake Sinissippi Improvement District
and
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July 19, 2011

Addendum:

Re: Montgomery-Settersten Report on Proposed Dodge County Drainage District 88

This addendum includes comments regarding the June 29th report prepared by Robert Montgomery and Jay Settersten for the Dodge County Drainage Board and petitioners of proposed Drainage District 88 ("Report").

The proposed District 88 Water Quality Management Plan given in the Report represents thoughtful consideration of effective drain design, erosion control installations and implementation of best management field practices to satisfy needs of the farmer/landowners within the proposed district while reducing runoff and drain tile flow of sediment, nutrients and other non-point source pollutants. The fact that the Drainage Board has approved the recommendations of the plan is encouraging; presumably the district petitioners also endorse the plan.

While the Lake District board is encouraged by the proposed water quality management plan and subscribes to certain provisions of the plan, the board believes there are important omissions:

- Who will determine whether water quality objectives of the plan are achieved?
- How will those determinations be made?
- Who is responsible to take corrective action if plan objectives and regulatory requirements are not met?

These concerns coalesce to a need for identification of the entity responsible for monitoring and inspecting within the proposed district and enforcing those conditions to ensure that all recommendations of the plan are implemented and maintained. The Report states that the District will maintain plan conditions under the supervision of the Drainage Board. The "*District*" comprises lands within the geographical area described in the August 10, 2010 report of the Drainage Board to Dodge County Circuit Court. Assigning implementation, inspection and enforcement responsibilities to the "*District*" essentially means that no person(s) or entity will be responsible.

The statutes and administrative code grant to the Drainage Board responsibility and authority for monitoring, inspection, enforcement, repair and restoration of district drains and conditions to minimize soil erosion and protect against land use that adversely affects water quality. We believe the plan requires point 3.e., which identifies the responsibility and authority of the Drainage Board to monitor, inspect and enforce conditions of the water quality management plan.

The Report concludes that the plan "… *will provide improved runoff water quality*…." The proof of this statement will be in the proverbial pudding and can only be determined by analyzing drain water for levels of suspended solids, nutrients and other pollutants after the plan is implemented. The Lake District board would be willing to share with the Drainage Board results of future sampling tests.

We also want to address several recommendations and conclusions given in the Report.

1. The plan does not include details of drain construction and cross-section. Research indicates that certain drain designs may be especially useful in field conditions such as exist in the proposed district. (Panuska, J C *et al*, 2009; Witter, J, 2010)

The plan calls for 20-ft grass buffers on both side of drain tile centerlines. It is our understanding that tiles are installed in cultivated land to a depth that allows cropping.

Special provisions should be made to provide for protection of tile inlets. Also, there are no details of planned depth and spacing of drain tiles. Research has shown that shallow, closely-spaced tiles in land with high soil phosphorus levels tend to increase loads of soluble phosphorus in tile discharge. (Strock, J S *et al*, 2010)

Recommendations by the authors regarding drain design and tile depth and spacing would be helpful.

2. Historical Drainage in the area of the Dodge County Antique Power Club (DCAPC)

The authors of the Report indicate they "… *briefly evaluated this issue* …" and conclude that filling and development of DCAPC grounds has had minimal impact on increasing flood discharge during rain events. We believe this issue is multi-dimensional and requires a thorough examination and assessment, as opposed to the brief evaluation given by the authors, before meaningful conclusions can be reached.

As an example, the Report claims that the gravel pits "… *would also have had very small runoff storage volume compared to volume of flooding ….*" The relevant issue in this regard is not the volume of the pits to store water, but the high porosity and permeability of the gravel deposits to transmit stormwater runoff downward to subsurface connectivity to groundwater. It was reported that the pits were about 25 feet in depth. Landscape development by DCAPC closed the pits and filled them, effectively sealing off the gravel deposits and thereby destroying their functionality to absorb runoff.

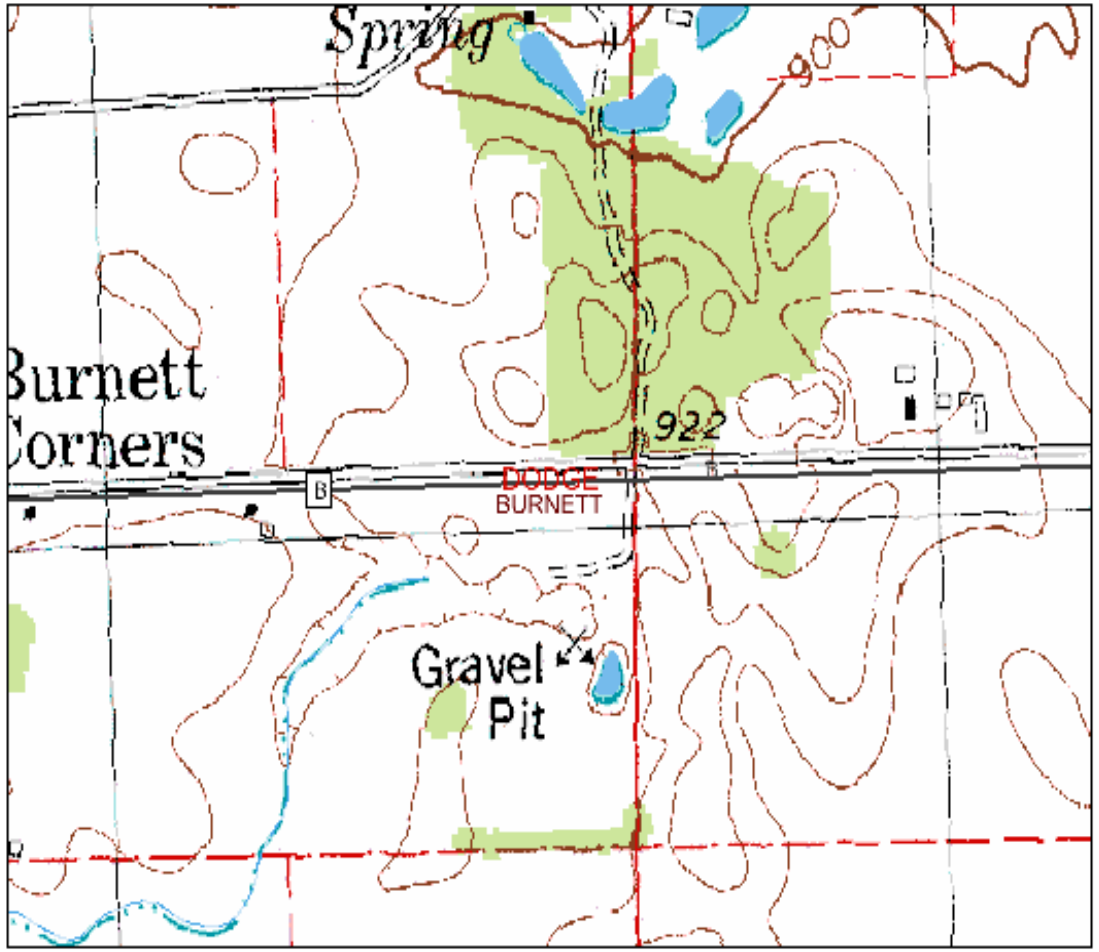
Figure 1 is an archival topographic map of the historic DCAPC site with the gravel pit area clearly identified. The area was about 5 acres in size with two large pits. The map also shows the path of overland flow terminating on site. The authors of the Report appear to have either overlooked this information or not considered its significance.

Active pit drainage is found just west of the western boundary of the proposed drainage district on Highway B before Basswood Road. On the south side of Highway B is a large field sump that receives drain tile water (Figure 2). A drainage pump conveys the drain water through PVC under the highway to a field drain. We understand the drain water then flows by gravity to a gravel pit that also receives surface runoff from the field.

Contrary to the authors' contention, gravel pits do indeed function to reduce the amount of surface water flowing from a mini-basin.

The Report also concludes that it "… *is unlikely that the club property, including area surrounding the former gravel pits, would have had substantial impact on flood discharge ….*" We believe a more through examination of the evidence supports the conclusion that filling and development of DCAPC grounds eliminated the natural retention basin and reduced substantially infiltration of storm water flowing to the site. Significant alteration of the natural hydrologic pattern within lands up-gradient as a result of agricultural production and ditching has caused an increase in runoff to

Figure 1. Gravel Pits at Historic DCAPC Site



Legend

- Dams
- Analysis Points
- Flood Insurance Study
- Letter of Map Revision
- Case By Case Analysis
- Bridge
- OTHER
- Analysis Lines
- Flood Insurance Study
- Letter of Map Revision
- Case By Case Analysis
- Bridge
- OTHER
- Base Flood Elevations
- Digital Cross Sections
- Major Highways
- Interstate
- State Highway
- U.S. Highways
- County Roads
- Local Roads
- 24K County Boundaries
- Civil Towns
- Civil Town
- Digital Flood Boundaries
- 100 Year Floodplain
- 500 Year Floodplain
- Floodway
- 24K Open Water
- 24K Rivers and Shorelines
- Intermittent
- Fluctuating

Scale: 1:6,999

0 700 1400 2100 ft.

This map is a user generated static output from an Internet mapping site and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION.

Notes: Map contours with designated gravel pit area and waterway ending on pre-development site.

Figure 2. Field sump with drainage pump and PVC transfer pipe on the south side of Highway B, Town of Beaver Dam.

the DCAPC site. The cumulative effects have resulted in an increased discharge flow northward through the culvert at Highway B, overland through the farmland north of Highway B and finally to the spring ponds and downstream waterways.

Reports from two engineering firms (Burse Engineering and Quam Engineering) and the report on a hydrogeological assessment of the proposed district attest to the change of hydrologic function of DCAPC grounds from primarily an internally drained mini-basin to one that is externally drained as a result of filling and development. The impact of this change on downstream water quality has been significant.

We believe the authors have treated this important issue in a superficial manner. We agree with conclusions in the Burse and Quam Engineering reports that the pre-development land now occupied by DCAPC functioned historically as a ponding and sediment trapping area. The clock will not be turned back to transform DCAPC grounds to the pre-development condition, obviously. However, the recommendations of Quam Engineering to construct wet sediment and infiltration ponds on the DCAPC grounds are designed to partially restore the natural retention and infiltration capacities of the land.

The spring ponds at Spring Brook Farm supported a trout fishery up to the mid 1990s. Beginning with development of DCAPC grounds in the mid 1990s, northward flow of runoff increased and the deleterious effects of polluted runoff entering the spring ponds became evident. The spring ponds today are covered with algae mats, continue to fill with sediment and nutrients and do not support even a warm water fishery.

Disappointingly, the Report regarding District 88 omits any reference to the reality of this situation.

3. Water Quality Sampling Results-Phosphorus and Nitrogen Concentrations

The Report is correct that an error was made in final editing of the Lake District water quality monitoring report. Three data values of phosphorus should have been reported in the text with the less-than inequality sign ("<").

Within the context of properly interpreting water quality data, it is instructive to review the definition of an analytical detection limit. The authors of the Report state that the actual levels of phosphorus at three sampling sites "… *could be of any concentration between 0 and the MDL*." Although this is a true statement, it is also misleading and not a correct interpretation of Method Detection Limit (MDL).

Method Detection Limit is defined in a procedure established by the US Environmental Protection Agency (40 CFR 136) as the "*minimum concentration of a substance that can be measured and reported with 99 % confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte*." The MDL is a statistical, rather than a chemical, concept and a substance can normally be detected at concentrations below the MDL with a more sensitive test procedure (WDNR, 1996).

The interpretation of a result <u>at the MDL</u> with a 99 % confidence level is that if 100 samples were taken under identical conditions at the same location and analyzed, 99 of the results would meet or exceed the MDL value and one result would fall below.

The interpretation of a test result reported as being <u>below the MDL</u> does not mean the value is zero. It means that one is not 99 % confident that the true value is at the MDL or greater. However, for environmental monitoring such as that conducted in the proposed drainage district, it is perfectly acceptable to assess where a value below the MDL might be if other, comparable samples in the area are measured and test values are found to be above the MDL.

The relevance of MDL in assessing water quality may be demonstrated by Figure 3. Shown on the Y axis with phosphorus concentration in µg/L are the Method Detection Limit of < 200 µg/L and the Wisconsin standard for phosphorus in surface water of ≤ 75 µg/L. The vertical dashed line covers the range of phosphorus values that are less than 200 µg/L. Note that the federal definition of MDL with 99 % confidence means that a sample with phosphorus assay as high as 199 µg/L must be reported as < 200 µg/L.

Phosphorus values given in the Lake District water quality report on District 88 are shown in Figure 4, along with the range of phosphorus concentrations in the Rock River and Lake Sinissippi as reported by the US Geological Survey and the Lake District. Sampling site 7a is the spring water (ground water) that flows into the first pond at Spring Brook Farm. The MDL indicates that the value of phosphorus in a sample reported as < 200 µg/L is likely to exceed the state standard, since the probability of the true value exceeding the state standard (red zone) is greater than the probability of the value being at or below the standard (green zone).

The data clearly demonstrate that there is a phosphorus problem in district drain waters. The sample from Site 1 is in excess of 1,100 % of the state standard. Additionally, the magnitude of the reportable values (*i.e.*, those values greater than the MDL) strongly suggest that the true value of samples reported as being below the MDL would likely fall very close to the MDL, especially since the lowest reportable datum of 260 µg/L is 347 % greater than the state standard.

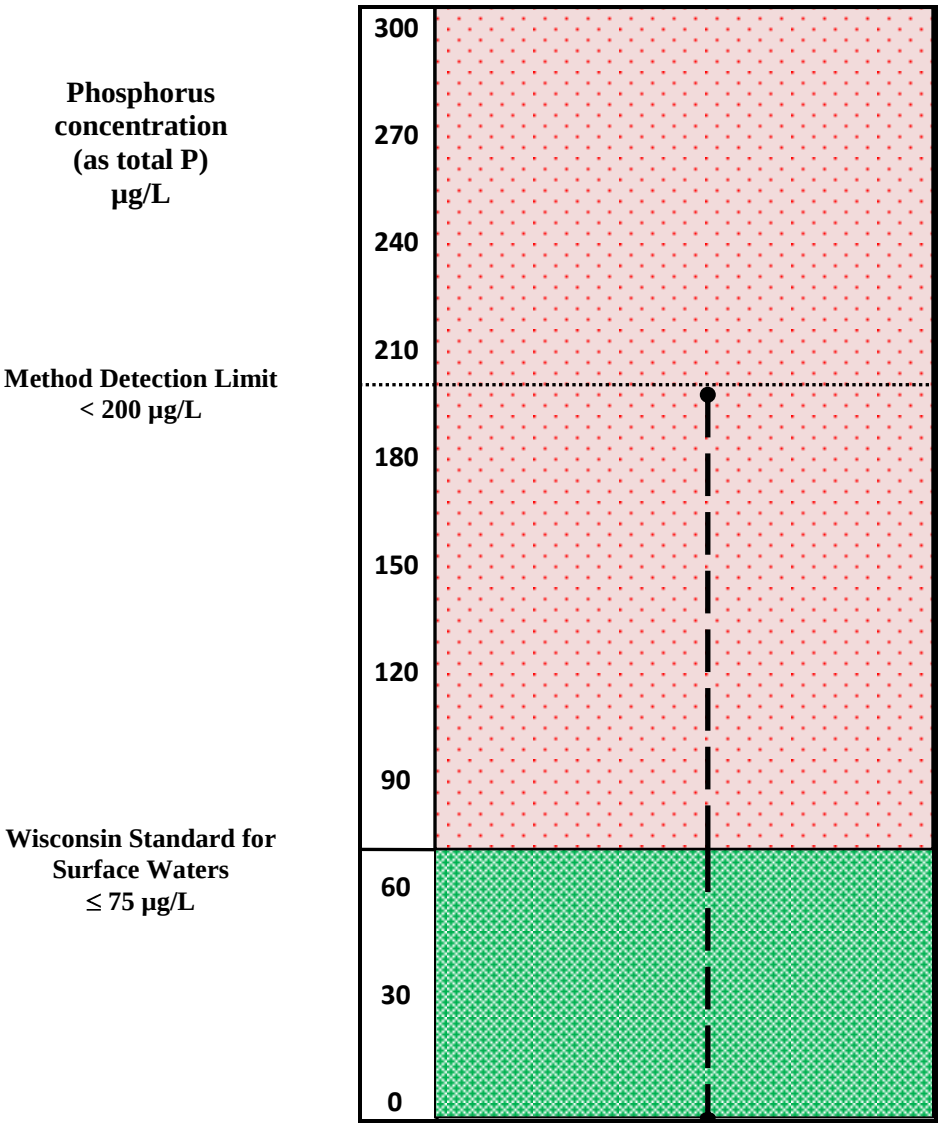
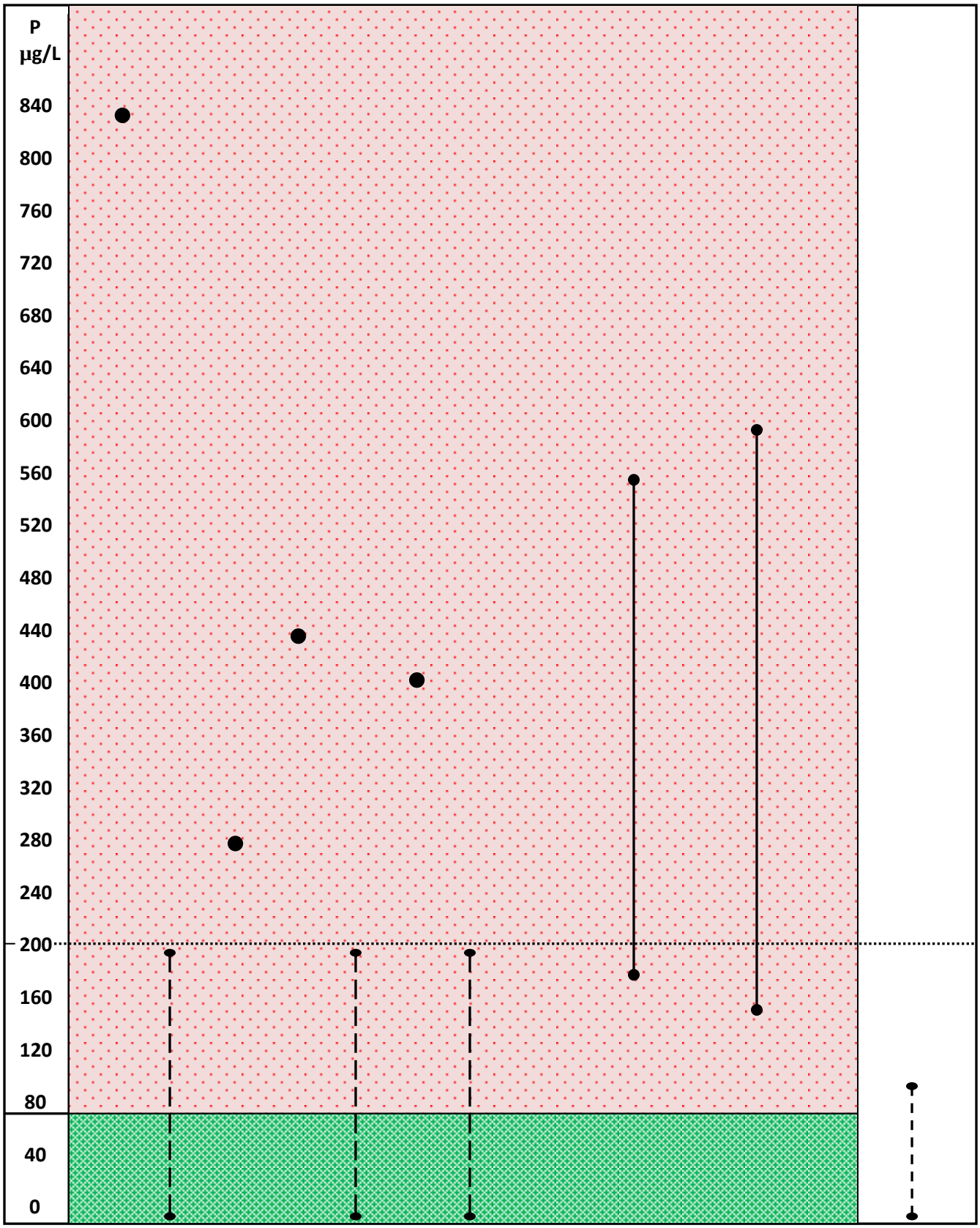


Figure 3. Method Detection Limit (MDL) and Wisconsin standard for surface waters for phosphorus (as total P). Phosphorus values within the red zone exceed the state standard of 75 µg/L, while values within the green zone are at or below the state standard.

Figure 4. (below) Phosphorus Concentrations (µg/L) at Drainage District 88 Sampling Sites, Spring, Pond, River and Lake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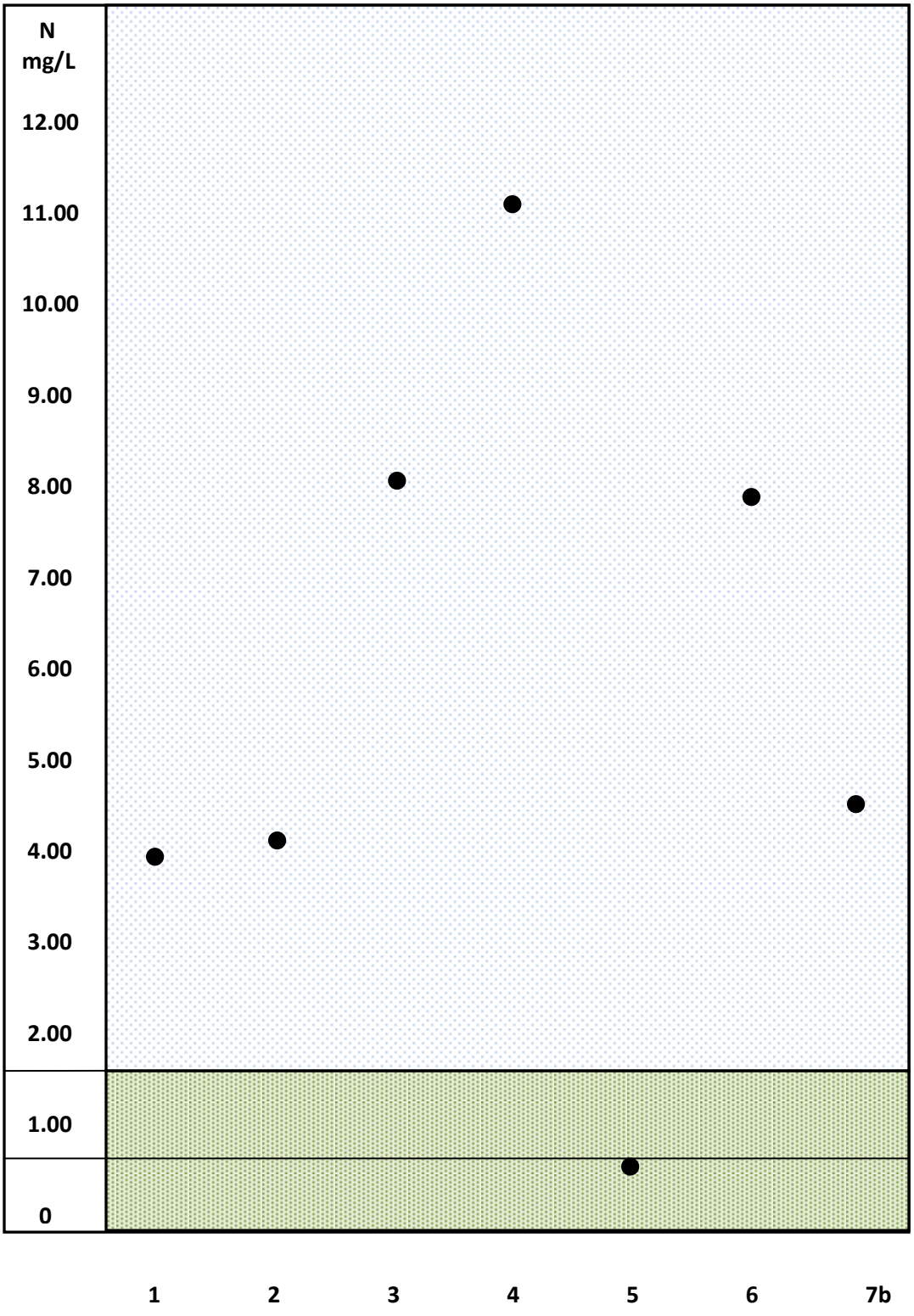

Figure 5. Total nitrogen concentrations (mg/L) at Drainage District 88 Sampling Sites and Spring Pond.

Nitrogen values in samples collected in the proposed district are shown in Figure 5. On the Y axis are values of total nitrogen (total Kjeldahl nitrogen plus nitrate and nitrite nitrogen) in mg/L at each sampling site. Also shown are the reference concentrations for total nitrogen in national level III ecoregion 53 (1.59 mg/L) and environmental phosphorus zone 2 (0.63 mg/L) (Sources: US Environmental Protection Agency 2000 and Robertson, D M *et al*, 2006). Nitrogen values in drain water of the proposed district dramatically exceed federal reference conditions. The sample from Site 4 is 700 % of the reference value. (Given the high nitrogen values in the other samples, the low value at site 5 is probably an anomaly; however, there was an insufficient volume of water available for a re-test.)

The Rock River and Lake Sinissippi are on the EPA 303(d) list of impaired waters for reason of nutrient enrichment and both are under state management plans to correct deficiencies and reduce phosphorus and nitrogen values. The message of Figures 4 and 5 is that unless and until nutrient loads in watershed runoff, such as that from proposed District 88, are reduced substantially, the Rock River, Lake Sinissippi and other surface waters will remain seriously impaired.

The objective of the water quality management plan for District 88 should be to have phosphorus and nitrogen values in drain water at or below the state standard and federal reference conditions.

4. Runoff from Agricultural Lands

The Report concludes that nutrient and sediment levels in runoff from proposed District 88 are typical of levels in runoff from other agricultural lands. This would be expected and is precisely the problem that is faced by agencies and lake districts with responsibilities to protect surface waters from polluted runoff.

The authors of the Report seem to suggest that because the level of pollution from one source is similar to pollution levels from other sources, then runoff from that particular pollution source is acceptable. Extending that logic would turn back the calendar on efforts to protect our environment to a time that predates the federal Clean Water Act of 1973.

Such a suggestion by the authors is unacceptable.

5. The plan for protection of surface water is predicated on district landowners having soil erosion control plans, nutrient management plans, etc in place by 2015. The Report also states that landowners will be encouraged to not row crop within 20-ft corridors on either side of drainage ways, tiles or ditches and to place the corridors into permanent grass or vegetative cover.

To determine whether it is realistic to assume that all landowners will be motivated to satisfy the requisites of the Plan, it is illuminating to compare current land use practices on three fields within the district in 2010 and 2011.

The Water Quality Report of the Lake District includes a July 2010 photograph of cropland lying east of the Butternut Road culvert, with corn planted directly in the drainage way that is to be part of the proposed district drain system. Another 2010 photograph of cropland lying west of the Road I culvert shows that corn was planted within a 20-ft corridor on either side of the drain ditch and no erosion control measures were in place to protect against land use that adversely affects water quality. These practices appear to be violations of requirements in §§ ATCP 48.24 and 48.30.

A recent drive through the watershed of the proposed district revealed that the same cropping practices are still being implemented by the landowners. Figure 6 is a photograph looking east from the Butternut Road culvert showing that land designated as the district drainage way was cultivated and planted with corn, an apparent violation of Chapter ATCP 48 provisions.

Figure 6. Looking east from Butternut Road showing that land designated as the drainage way for District 88 is planted in corn.

Figure 7 is a photograph taken at the culvert on Highway I, looking west, showing that corn is planted within a 20-ft corridor along the drainage ditch and with no evidence of erosion control measures to protect water quality. These practices do not comply with provisions of Chapter ATCP 48.

Figure 7. Looking west from Highway I showing corn planted less than 20 feet from the drainage ditch and with no erosion control measures.

In addition, a portion of the field lying north of the Highway B culvert within the proposed drainage way has large unplanted areas on either side of what appears to be an herbicide-treated zone (Figure 8). The unplanted areas remain as bare soil with no cover vegetation, highly susceptible to erosion from rainfall, runoff from the corn acreage and drain water flowing through the culvert down gradient to the spring ponds.

Figure 8. Looking north from culvert at Highway B showing the drainage way with an herbicide-treated zone near the centerline of the drainage way and bare, exposed soil with no cover vegetation on either side of the centerline.

Land use practices shown in Figures 6-8 appear to violate provisions of Chapter ATCP 48 and would not be permitted under the water quality management plan envisioned in the Report. The fact that landowners within the proposed district have implemented such practices reinforces our belief that monitoring, inspection and enforcement of conditions in any approved plan are essential.

The Lake District board is not opposed in principle to establishment of Drainage District 88. The current situation with uncontrolled conveyance of polluted runoff from district farmlands to Spring Brook creek, Rock River and Lake Sinissippi is a serious water quality problem. Formation of a drainage district with effective drain design, erosion controls, grassed waterways, etc and with active oversight and management by the Drainage Board holds the promise of an improved watershed condition. However, district formation needs to be done correctly and carefully or it will simply exacerbate an already unacceptable water quality situation.

For the Board of Commissioners
Lake Sinissippi Improvement District

Gregory M. Farnham
Commissioner

Ruth C. Johnson, Hydrogeologist
Commissioner

Date July 19, 2011

References:

Panuska, J C *et al.* 2009. Tile Drainage in Wisconsin. Fact Sheets 1 and 2. UW Discovery Farms. UW Extension publication number GWQ 056.

Witter, J. 2010. Alternative approaches to drainage ditch design. Ohio State University, Department of Food, Agriculture and Biological Engineering publication.

Strock, J S *et al.* 2010. Drainage water management for water quality protection. *Journal of Soil and Water Conservation*. 65(6): 131-136.

Title 40: Protection of Environment, 40 CFR 136, Appendix B, Definition and Procedure for the Determination of the Method Detection Limit - Revision 1.11

Wisconsin Department of Natural Resources. 1996. Analytical Detection Limit Guidance and Laboratory Guide for Determining Method Detection Limit. PUBL-TS-056-96.

US Environmental Protection Agency. 2000. Ambient Water Quality Criteria Recommendations for Rivers and Streams in Nutrient Ecoregion VII. US EPA, Washington, DC, EPA 822-B-00-018.

Robertson, D M *et al.* 2006. Nutrient concentrations and their relations to biotic integrity of wadeable streams in Wisconsin. US Geological Survey Professional Paper 1722.