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April 13, 2012

Fish, Crystal and Mud Lake Rehabilitation District
Attn: Dave Padley, Secretary
7167 Kippley Road
Sauk City, WI 53583

RE: Crystal Lake – Groundwater Well Review
Dane County, WI
GEC#: 1211-266A

Dear Mr. Padley:

Per your request we have reviewed the available documentation regarding the potential construction of a groundwater well to lower the water surface level of Crystal Lake located in Dane and Columbia Counties. The construction of a groundwater well to be used as a means to drawdown Crystal Lake does not appear to be a viable option.

Test wells installed by the Lakes District near the shore of the lake indicated that the geology is not suitable for a high capacity production well. In addition, the static water level measurements indicated that any production zone for a pumping well would have a very poor hydraulic connection to the lake. Sieve analyses of the native soil for two test wells drilled by Sam's Well Drilling were completed in the location of the proposed well. The results of the analyses estimated a yield of 100 – 200 gallons per minute (gpm) and a static water level of 20'. The analyses are attached for reference. If it is assumed that the well would produce the maximum yield of 200 gpm; it would require running the well continuously for nearly six years to draw the approximately 620 acre lake down three feet in elevation. That is assuming all water drawn from the well directly impacts the water level in the lake. If it is assumed that ten percent of the water drawn from well affects the lake level it would require approximately 60 years of continuous pumping to draw the lake down three feet.

More importantly, the static water levels measured in the test wells indicate the lake water is not well connected to the groundwater. The surface elevation at the location of the test wells is approximately five feet above the water surface of the lake. The static water level in the test wells is approximately 20 feet below the ground surface. Therefore the static groundwater elevation is approximately fifteen feet lower than the surface of Crystal Lake. This would suggest that the lake is not primarily a groundwater "seepage lake" but rather a "runoff lake" fed by surface runoff.

From the data available, it appears that: 1) The geology at the site would provide insufficient well pumping capacity to have any appreciable effect on lake levels; and 2) Even if a high capacity well production zone is available, the poor hydraulic connection between the groundwater and the lake water would mean that very little lake water would be induced to the production well resulting in a



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lack of drawdown of the lake and very high operating costs (included wasted electricity) for the production well.

These conclusions are not surprising given other studies that have investigated the feasibility of lower lake levels by pumping groundwater. We understand that the United States Geological Survey and the Wisconsin Department of Natural Resources investigated lowering Horsehead Lake in Oneida County through groundwater pumping. This was in an area with sands and geology much more suitable for a high capacity well. In 1982, the two agencies concluded after their study that such a project would not be a feasible alternative for lowering the lake level.

We have also been asked about the feasibility of a design utilizing a large number of low capacity production wells or horizontal boring of perforated pipes under the lakebed. Regarding the low capacity wells, the Lakes District has access to very little land for such a facility and the cost for multiple wells would be prohibitive, but even without those constraints, such a design would not be feasible given the above conclusions. Speaking with several boring contractors, the concept of boring a perforated pipe under the lakebed is not constructible for this application given several factors.

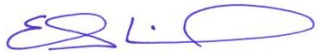
Due to the conclusions noted above, we would recommend the Lakes District investigate alternative methods to achieve a lowering of Crystal Lake other than by groundwater drawdown.

We have also attached a copy of proposed discharge path from Crystal Lake as requested.

If you have any questions please let us know.

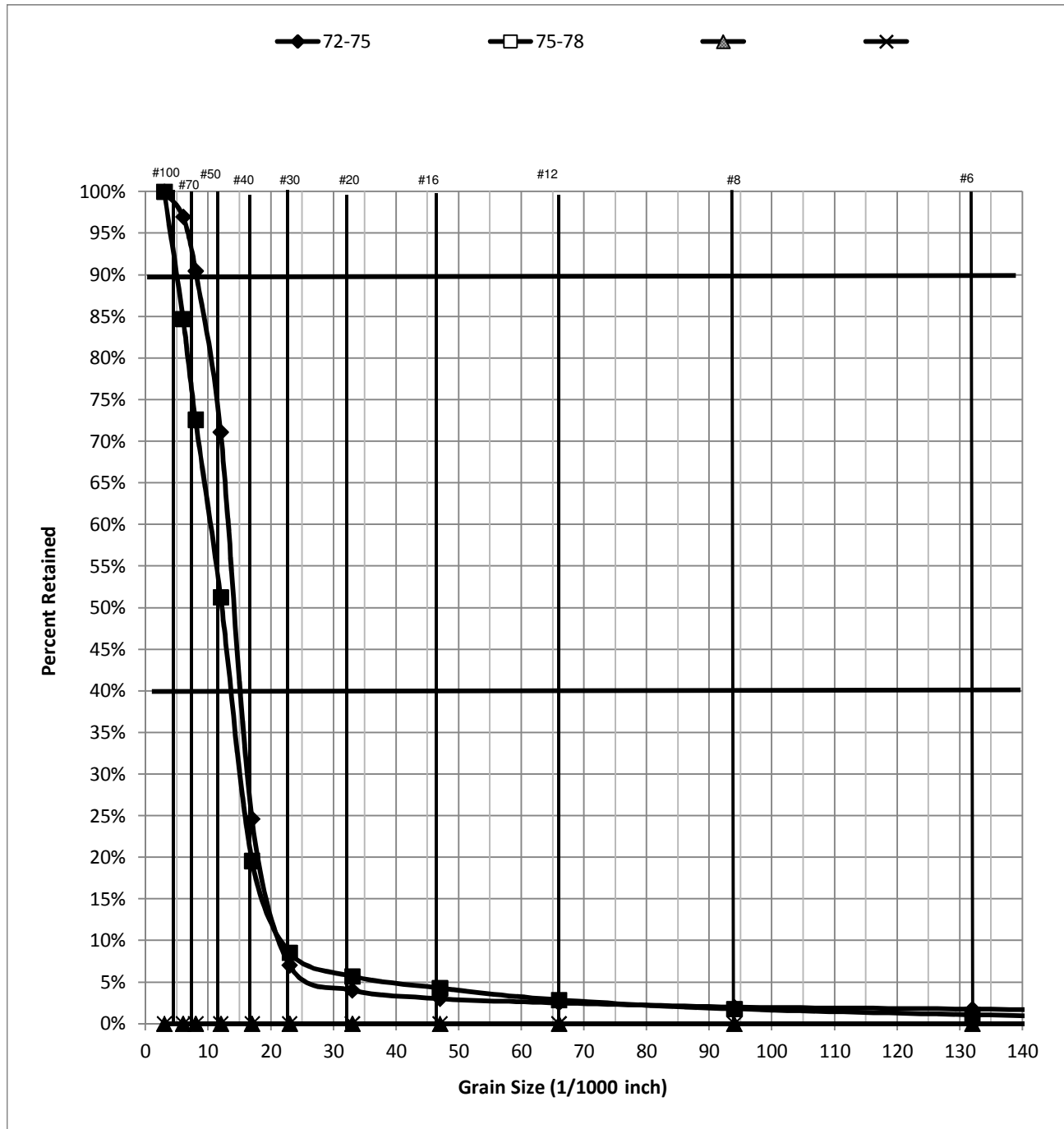
Sincerely,

GENERAL ENGINEERING COMPANY



Erik D. Henningsgard, P.E.
Project Engineer

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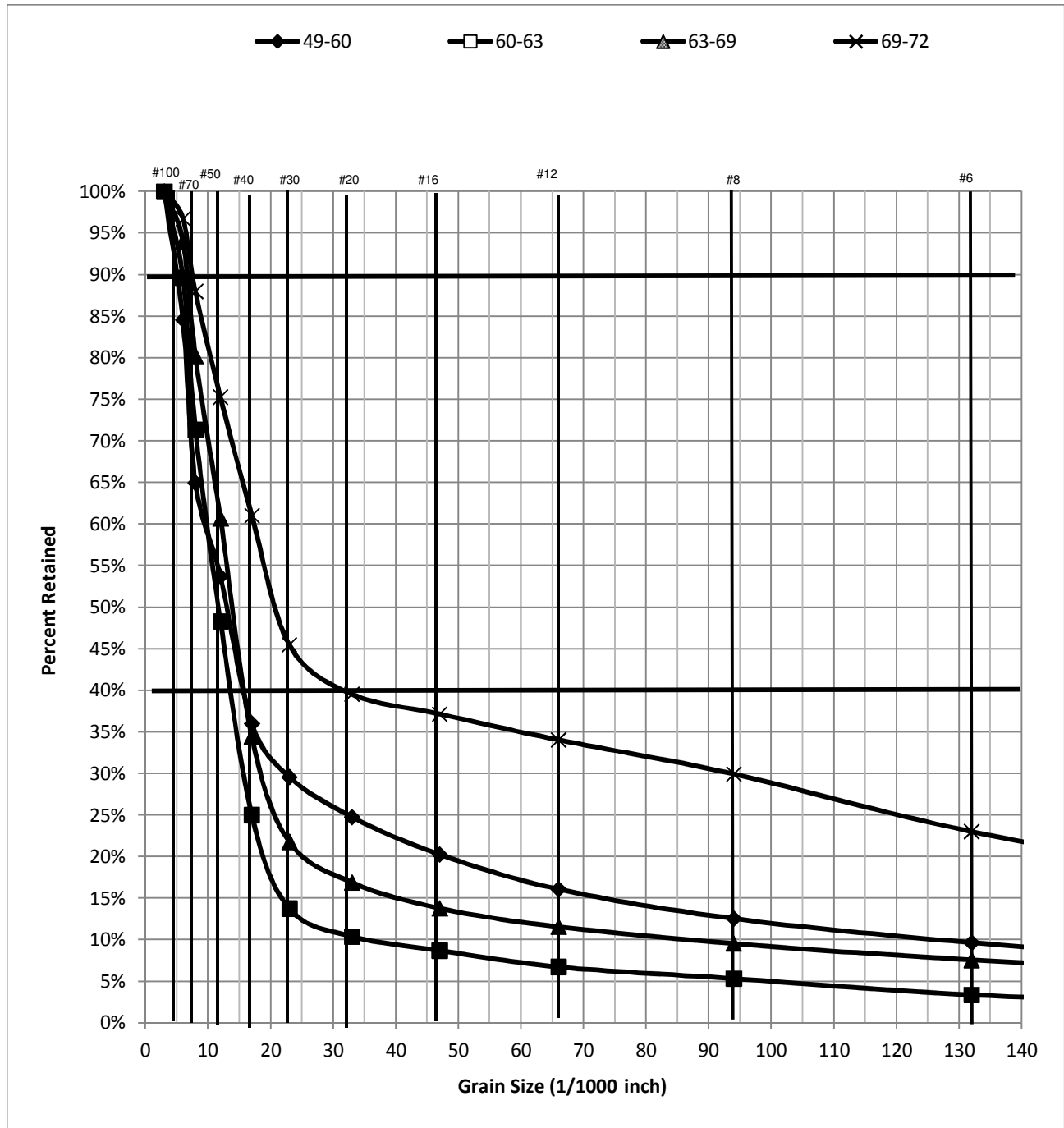


Sieve Analysis ID # 111411-2

Project: Fish Crystal Mud Lake Rehab
Engineer: Foth Infrastructure.

Well:
Contractor: Sam's Well Drilling
Estimated Yield - 100 - 200 GPM, SWL - 20'
Sample 49' - 60' (Mostly Clay)

Proposed Screen Diameter: 18" Telescope Size
Recommended Slot Size: 12 Slot 63' - 66', 15 Slot 66' - 75'
Recommended Gravel Pack:



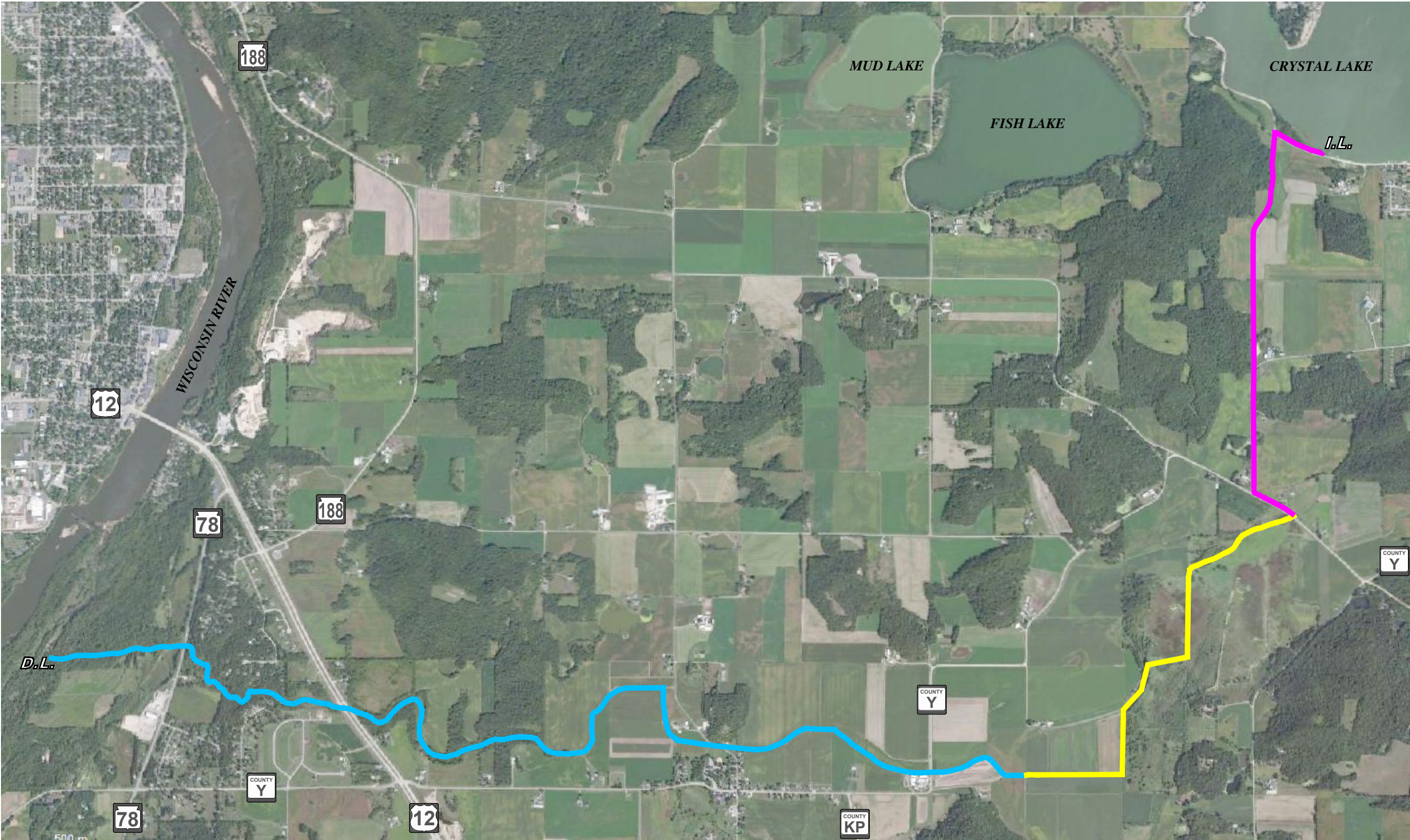
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


Proposed Screen Diameter: 18" Telescope Size
Recommended Slot Size: 12 Slot From 63' - 66', 15 Slot 66' - 75'
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Sieve Analysis ID # 111411-2

Well:

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CRYSTAL LAKE INTAKE LOCATION

WISCONSIN RIVER DISCHARGE LOCATION

FORCEMAIN PIPE (~9,550 FT.)

AGRICULTURAL DRAINAGE DITCH (~9,600 FT)

ROXBURY CREEK (~24,850 FT)



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LAKE DISCHARGE PATH

Fish, Crystal & Mud Lake Rehabilitation District

Town of Roxbury
Dane County, WI

REVISIONS	NO.	BY	DATE



DRAWN BY

DATE

GEC FILE NO.

SHEET NO.

SRR

04-04-12

1211-266B

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