



"Changing our World One Drop at a Time"
Waterford Waterway Management District
www.waterfordwwmd.com

2018 Navigation and Hydrology Committee Annual Report
September 22, 2018

This is the annual report of the Waterford Waterway Management District (WWMD).
Navigation and Hydrology (NAH) Committee for 2018.

For close to 15 years, the district has been working to improve the waterway with numerous projects to stop the infiltration of materials that become sediment over time. This included erosion projects such as the Grand Drive rip rap work and the installation of rock drainage beds along highway 164.

Dredging Project

Over the last 9+ years, the Ecosystem Restoration subcommittee (ESR) committee has worked with Graef Engineering to find a way to remove ~500,000 cubic yards of excessive sediment from the navigation channels within the impoundment as overseen by the district. To put this in scale, the sediment removed would fill the seating bowl of Lambeau Field $\frac{3}{4}$ full.

Over 300 location tests were taken, numerous samples were collected and analyzed for hazardous materials. The good side is that there is no serious contamination other than a high level of nitrates.

Specifically, over the last couple of years, we have looked closely at solutions to the disposal of the materials, after getting the necessary permits. These include a wetland permit, one to dredge the materials and one to return excess water to the river after dewatering. The lone permit needed was a Low Hazard Waste Exemption (LHWE) permit for the permanent disposal of the sediment.

It is at this point we are reporting on the current state of our efforts. While our efforts were to have a final plan in place by the end of July, that date slipped a month to the end of August. This plan has been presented to the WWMD's Board, but no action has been taken on it. We are now releasing this report and Graef's plan, as part of this report.

The follow are the gateways that we have moved though in the last year.

Plan development

The Department of Natural Resources (DNR), University of Wisconsin and other academia sources, public or private entities, have given us usable solutions or guidance. Several companies have tried but could not find acceptable results. Thus, WWMD has been completely on its own to do the research, develop, and financing this project.

Gravel Pit Disposal / Low Hazard Waste Exemption (LHWE)

Several years ago, our efforts shifted to depositing the material in a gravel pit along Hy 20 where it was to be used for the reclamation of the site. The DNR does not allow us to simply dump it, but rather develop a plan for managing it. It requires moving thousands of tons of

materials to shape the pit, installation of a 2-foot-thick liner covered by a plastic membrane, installation of monitoring wells with a long-term effort to monitor the ground water and properly dispose of any leachate. This alone would cost at a cost of over \$2,500,000 before the first yard of sediment was dredged.

This option has reached a dead end.

Currently, the sample average for ammonia/nitrate/nitrite compounds in the sediment (material) is about 13.5 g/L. State law requires the number to be under 1.0 for a LHWE to be issued for disposal in the gravel pit. The law allows the DNR to provide some administrative relief if it is shown that that number cannot be economically reached, and then sets an upper limit at 10 g/L. Testing has shown that the addition of chemicals, aeration and other manipulations of the material to achieve an average of 5 ppm did not work. The DNR has no solution and no other avenues are known.

During the latest conference call in July, the DNR rejected our liner proposals and stated we need get it within limits or seek to build a regular landfill. Landfill option would take many, many years and is not practical financially, nor would it be acceptable to the community. Thus, we cannot meet the requirements for obtaining the LHWE permit and will spend no more resources on trying to pursue this.

Wisconsin Department of Transportation (DOT)

The DOT initially told us that they were interested in using our material, but did not indicate when and how much, because that is regulated by the scope and timing of their projects. They did rule out the work along the I-94 corridor and the Foxconn projects. Because there will be no LHWE, the DOT will not be able to use any of the material.

Foxconn

We briefly looked at the needs of the Foxconn project. Unfortunately, there will be a reported surplus of 400,000 cu/yards topsoil generated in the building of their campus.

Landfill

We worked extensively with Waste Management to put materials into their landfills. Once dredged and dewatered, the material would require over 15,000 truckloads to move it all to one of several locations where it could be used for daily cover or site reclamation. Amounts beyond those needs would be buried as straight landfill. This option is financially prohibitive, as Waste Management estimated costs of between \$30 & \$50 Million.

Sale of dewatered sediment

Illinois currently dredges approximately 60,000 cubic yards of material a year, dewateres it and sells it. This effort is funded by state monies.

We have looked at this, but find that the effort to create a market, were none exists now, dredge, dewater and sell our volume of material is impractical. The district responsibilities lie in the restoration of the waterway by state law and it is not in our abilities to develop and own a business of this type or scale. We believe that if someone steps forward with a long-term proposal, we would consider it.

Agricultural Disposal

The only remaining option standing is agricultural disposal.

We're calling this phase 6. It would start with a 2-year pilot study to prove proof of concept (can we do it) for dredging and dewatering material. Dredged and dewatered in year 1, it would be spread in on farmland in year 2. Information collected in this pilot study would determine feasibility for the practicality of the entire project, and if successful, form the basis for engineering, plans, permits, bidding, and funding needed for the removal and disposal of the remaining material. The pilot study would cost \$1.6 to \$2 Million. More on this is detailed in the attached Graef Report.

If phase 6 were successful, we would expand the dredging, dewatering and disposal to the rest of the project areas.

Ideally, we will need about 1,000 acres of farmland to achieve a 4 to 5-year project timeline. Yearly limits on nutrients and crop uptake generally mean spreading the material ~1" thick. It cannot be used to fill in low spots.

We do not yet have this amount of acreage, so the time line could stretch out to 10 years. Increasing the acreage or thickness could shorten the project timeline, but not necessarily the cost.

There is also the possibility that with DNR permission, we might be able to stockpile the materials with subsequent land spreading. This could entail dredging over a 2-4-year period, dewatering and storing it, and then trucking it to farms where it could be spread over subsequent years. This has the benefit of a quicker material removal schedule and possibly a lower cost. Again, the time line is dependent on available acreage.

This option requires close coordination with the state and the farmers receiving the material. They are concerned about nutrient content; debris and things like weed seeds. There are costs for trucking the material to the disposal sites. Currently, it is uncertain whether there is a market to sell the material.

The current cost of the entire project is estimated to be \$14-21 million without further changes or contingencies.

Current efforts

The board approved at its August 23, 2018 meeting to shut down phase 5 for the LHWE permit and to proceed with phase 6 pilot study, to the limit of funding in the FY 2109 budget.

On August 24, 2018, the Committee submitted an agricultural disposal plan to the DNR. We outlined what we were going to do based upon state law regulating such activities. We asked them, not to approve, but to provide guidance and requirements to make this happen.

The attached report from Graef details the work involved and the timelines for phase 6 and beyond.

Fiscal Year 2019 Budget

As stated in the WWMD SPENDING AND PROPOSED FY 19 BUDGET, the committee is estimating \$155,000 in expenses:

Graef - Phase 6 - final design, contracts, etc.	\$115,000
Legal – permit, contract and bid reviews	<u>\$40,000</u>
Total	\$155,000

The FY19 funding is intended to take the project through the bidding portion of Phase 6.

WDNR Submittals and Approvals	September – October 2018
Draft Preliminary Application Plan	October 2018
Prepare Bid Documents	October – November 2018
Bidding	Late November – January 2019

Any expenses to begin implementation of the Dredging, Dewatering and Land Spreading portions of Phase 6 beyond bidding will come from new project funding.

Project Funding

This committee is working with other committees to raise the money to fund the project after the bidding is complete. The sources we have require that detailed plans, costs and timelines are developed. That information is scheduled to be in place by January 2019 for Phase 6.

There is a built-in pause in the work while funding is solicited and secured. This could involve such sources as grants, bonds, loans, or assessments. There is a proportionate delay in the Graef timetable until funding and approvals are secured.

Approval to spend the new project funding will be presented to the District before work can begin on the remainder of Phase 6.

In Conclusion

The committee thanks everyone who has contributed to this project. It is our intent to see it thought to the end.

Additional information on the activities of the ESR commit is available at <http://waterfordwwmd.com/committees/ecosystem-restoration-project>

Respectfully submitted

The ESR Committee

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Fox River Ecosystem Restoration

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Project Purpose and Need, and Expected Outcomes:

The proposed project will remove an estimated 500,000 cubic yards of sediments from the Fox River, where they cause noxious weed growth and inhibit navigation, and restore the sediments to agricultural fields within the watershed, where they will fertilize and enrich soils. Additional details on the proposed objectives and outcomes are as follows:

- Recycle and conserve valuable agricultural soils within the watershed;
- Recycle nutrients: ammonia nitrogen, organic nitrogen and phosphorus contained in sediments – conserving energy and chemical resources;
- Reclaim sand and gravel facilities and productively use lands reserved for future sand and gravel;
- Reestablish the Fox River main navigational channel from north to south through the waterway at a reasonable depth and reestablish and maintain access to and from bays on and around the Fox River;
- Reduce overall sediment volume and reduce resuspension of sediment from boat traffic as a result of the increased channel depths;
- Reduce the nutrient content in the waterway by removing approximately 1,000,000 pounds of legacy phosphorous. This will help reduce aquatic plant and cyanobacteria growth, and removing and recycling phosphorus in this way can be much less expensive than removal at a waste water treatment plant;
- Reduce the nutrient content in the waterway by removing approximately 1,400,000 pounds of ammonia. Ammonia reduces the oxygen supply in the water as it is oxidized to nitrate, thereby reducing the oxygen supply for fish, and it also contribute to heavy plant growth;
- Improve the overwintering habitat for fish species which is currently limited in depth. Deeper water will provide for better overwinter habitat, and a better winter connection of the main stem of the river when ice extends deeper than two feet;
- Maintain economic value in the local and regional community; and
- Manage with sustainable methods and local resources -
 - The sediments largely came from the fields and we are putting them back on the fields.
 - The dollars spent on the project will for the most part come from the community and stay within the community.

Proposed agricultural fields are shown on the attached map.

Project eligible for Institute for Sustainable Infrastructure Envision Gold Level Rating (description attached), and would likely be one of the few, if not the only, dredging project in the nation that could obtain such a rating.

Beneficiaries and Target Population

The populations that are targeted and will benefit include the riparian residents and the surrounding community of the Town and Village of Waterford with a combined population of 11,751 as well as the broader population of Racine County which will benefit through the enhanced economic value of the waterway.

Organization Special Qualifications

In addition to the WWMD, the following proposed partner organizations will contribute their expertise:

- Racine County
- University Wisconsin Extension - Racine
- Western Racine Sewer District
- Gateway Technical College
- Local Sand and Gravel Operators
- WDNR/WDNR Agricultural Specialists
- Local Farmers
- Local Contractors
- South Eastern Wisconsin Fox River Commission
- Southeastern Wisconsin Regional Planning Commission
- Village of Waterford
- Town of Waterford

Preliminary Project Work Plan - Phase 6 Pilot Study: Scope of Work

The purpose of the first phase of work is to evaluate various operational parameters needed for development of the full-scale dredging project including sediment dewatering rate, handling and spreading methods, loading rates for fields, optimal crops, and timing for spreading the material. The data collected from Phase I will be used to design and develop bidding documents for the full-scale project.

Dredging and Dewatering

- Prior to dredging, survey the type and depth of the sediments in the area of the proposed sediment trap and select northern bays, collect and analyze samples for TKN, ammonia and phosphorus, moisture content and grain size distribution and map the results.
- Construct dewatering ponds on the WDNR properties located east and west of Marsh Road (shown on attached Figure 3). Details on the ponds and associated dewatering facilities are as follows:
 - The ponds will be lined with 16 inches of clay from the eastern site. Additional clay will be brought in, as needed.
 - Pond design and construction will be reviewed by a geotechnical engineer.
 - The base elevation of the ponds will be two feet above the groundwater table.
 - Up to four groundwater monitoring wells will be installed between 50 and 75 feet from the outside perimeter of each pond.
 - An outlet control structure will be installed with each pond so that the water levels in the ponds can be lowered and the sediments dewatered.

- Piping from the outlet control structure will conduct the pond water to the wetlands to the north east or directly to the river.
- The pond locations are within the locational limits specified under Wisconsin Administrative Code NR 502.05(4).
- Complete a bathymetric survey immediately before and after dredging.
- Based on the survey, dredge between 17,500 and 20,000 cubic yards of sediment as measured in place in the river from the area of the sediment trap and mix with enough material from the northern bays to form a representative mix of material. The sediment will be dredged in any period between the beginning of May and end of August. Note that the dredging period may change to optimize the timing and cost of both the dredging and sediment application.
- Dewater continuously from the time the dredging starts to the time of field application in the following year. Carriage water from the pond will be discharged to the adjacent wetland or to the river through the sediment influent pipes once the dredging has stopped for the season, so additional discharge piping will not be required.
- Monitor the discharge from the ponds for suspended solids and ammonia/ammonium as required by the discharge permit.
- Monitor groundwater elevations in the wells every two months from the time of installation until the sediments are removed from the dewatering ponds.
- Collect quarterly samples from the groundwater wells for laboratory analysis for ammonia/ammonium and nitrate-nitrite starting three months before the start of dredging until six months after the sediments are removed from the ponds for land spreading.
- When the dredging is complete, remove the pipelines from the river for storage until the next dredging season and keep the on-shore piping in place for discharge to the river.
- After the sediments have time to dewater through the winter, stockpile the sediments within the ponds in an area from which they can be readily loaded onto a truck or directly to an agricultural spreader using a small dozer or backhoe.
- Upon removal of the sediments, inspect the clay thickness and banks of the ponds and implement repairs, as needed, so the ponds are ready for the next dredging season.

Land Spreading

- With input from the local farmers and agricultural specialists, identify crop types and rotations for the WDNR fields to be used for land spreading (a minimum of 140 acres will be required). The proposed WDNR properties are shown on the attached Figure 3.
- Sample the fields proposed for land spreading on a five-acre grid for soil nutrient content and other conditions.
- Based on selected fields and cultivation history, develop baseline for measuring sediment effectiveness.
- Prepare a preliminary application plan based on existing sediment data and nutrient loading rates for selected crops.
- Collect one sample of the dewatered sediment for approximately every 4,000 cubic yards of sediment as measured in the river (four samples minimum) and analyze the sediments for potassium, ammonia nitrogen, nitrate, Total Kjeldahl Nitrogen and pH.

- Collect one sample of the dewatered sediment for approximately every 4,000 cubic yards for sediment as measured in the river and analyze for fecal coliform. This is like the sampling requirement under Wisconsin Administrative Code NR 502 for a Class A Compost.
- Based on the results of the analyses, the dewatered sediments physical characteristics, the crop types, and rotations, prepare a final application plan. The thickness and timing of the land application will be varied to evaluate the optimal application rates.
- Remove the sediments from the ponds and spread on the fields using a slurry spreader.
- Assess the physical characteristics of the dewatered sediment, crop conditions and effectiveness of the sediments from the early spring through the fall and apply results to the design of a full-scale project.

Phase 6 Pilot Study: Schedule

Design and Contracting

WDNR Submittals and Approvals	September – October 2018
Draft Preliminary Application Plan	October 2018
Prepare Bid Documents	October – November 2018
Bidding	Late November – January 2019

Secure Funding

The funding sources we have require that detailed plans, costs and timelines are developed. Those should be in place by January 2019.

Should those resources be secured and approved in time, the following time table can be implemented. There is a proportionate delay if it is not available.

Dredging and Dewatering

Groundwater Monitoring	Late Winter/Early Spring 2019
Construct ponds	Spring 2019
Sediment sampling (in-situ)	Spring 2019
Dredging	Spring/summer 2019
Dewatering	Summer 2019 thru Spring 2020

Land Spreading

Baseline sampling of fields	Spring and fall of 2019
Preliminary Application Plan	Fall 2019
Sediment Sampling Ponds	Early Spring 2020
Final Application Plan	Early Spring 2020
Land Application and Evaluation	Spring thru fall of 2020

Phase 6 Pilot Study: Opinion of Cost ¹.

Our opinion of the cost for the Phase 6 Pilot Study is as follows:

Pond Construction and Earthwork	\$720,000 to \$900,000
Dredging, Dewatering and Application	\$800,000 to \$1,000,000
Consulting Services	<u>\$80,000 to \$100,000</u>
Total	\$1,600,000 to \$2,000,000

(This will be solidified once the bidding is complete)

Phase 7 Full Scale Project: Scope of Work

Using the data from Phase I, the project will be scaled up to manage 60,000 to 250,000 cubic yards per year depending on the land available for both dewatering and land spreading. The dredging could take place over a two to three-year period at up to 250,000 cubic yards per year depending on the dewatering sites that are available and storage capacity. Dewatering and land spreading could potentially continue over an extended period of three to five additional years at a rate of 60,000 to 120,000 cubic yards per year depending on the farm land available. Significant economies of scale are anticipated for both dredging and dewatering. Approximately 5,000 cubic yards of sediment contains elevated arsenic levels and this material is not included because the material may be left in place.

Dredging and Dewatering

- Complete a bathymetric survey of remaining areas to be dredged and spot check physical characteristics of sediments throughout the area proposed for dredging.
- Complete modifications to dewatering ponds on WDNR property, if indicated.
- Complete easements for conveyance piping to Super Mix site.
- Construct dewatering ponds on the Super Mix site located on Highway 20. Details on the ponds and associated dewatering facilities are as follows:
 - The ponds will be lined with 20 inches of imported clay.
 - Pond design and construction will be reviewed by a geotechnical engineer.
 - The lowest base elevation of the ponds will be three feet above the groundwater.
 - Up to four groundwater monitoring wells will be installed between 50 and 75 feet from the outside perimeter of each pond.
 - An outlet control structure will be installed with each pond so that the water levels in the ponds can be lowered and the sediments dewatered.
 - The number and design of the ponds will depend on the results of the Phase I Pilot Study and the amount of land available for land spreading.
 - The pond locations are within the locational limits specified under Wisconsin Administrative Code NR 502.05(4).
- Install sediment conveyance piping from the river to the dewatering pond and include bypass piping at the booster pumps to allow reverse flow back to the river during dewatering on weekends and after dredging is complete.
- Dredge approximately 475,000 cubic yards of sediment as measured in place in the river. Approximately 40,000 to 50,000 cubic yards will be dewatered at the Marsh Road ponds and 425,000 to 435,000 cubic yards will be dewatered at the Super Mix site.

- Dewater continuously from the time the dredging starts to the time of field application in the following year. Carriage water from the pond will be discharged to the river through the sediment influent pipes on weekends and once the dredging has stopped for the season, so additional discharge piping will not be required. Depending on the amount of agricultural land available and the thickness at which the dewatered sediments are spread on the land, the sediments may be stored in the ponds for up to four years.
- Monitor the discharge from the ponds for suspended solids and ammonia/ammonium as required by the discharge permit.
- Monitor groundwater elevations in the wells every two months from the time of installation until the sediments are removed from the dewatering ponds.
- Collect quarterly samples from the groundwater wells for laboratory analysis for ammonia/ammonium and nitrate-nitrite starting three months before the start of dredging until six months after the sediments are removed from the ponds for land spreading
- When the dredging is complete for the year, remove the pipelines from the river for storage until the next dredging season and keep the on-shore piping in place for discharge to the river.
- After the sediments have time to dewater through the winter, stockpile the sediments within the ponds into an area from which they can be readily loaded onto a truck or directly to an agricultural spreader using a small dozer or backhoe.

Land Spreading

- Based on the results of the Phase I Pilot Study, develop land spreading plans for the additional fields shown on the attached Figure 2 as well as fields for other interested parties, and adjust the land spreading plans, as needed, for the WDNR fields included in the Phase I Pilot Study.
- Sample the fields proposed for land spreading on a five-acre grid for soil nutrient content and other conditions.
- Prepare an application plan for the new fields based on existing sediment data and nutrient loading rates for selected crops.
- Collect one sample of the dewatered sediment for approximately every 12,000 cubic yards as measured in the river (four samples minimum) and analyze the sediments for potassium, ammonia nitrogen, nitrate, Total Kjeldahl Nitrogen and pH. The frequency of sampling will be reduced if there is not significant variation in results.
- Collect one sample for approximately every 4,000 cubic yards for sediment as measured in the river and analyze for fecal coliform. This is like the sampling requirement under Wisconsin Administrative Code NR 502 for a Class A Compost. The frequency of sampling will be reduced if there is not significant variation in results.
- Based on the results of the analyses, the dewatered sediments physical characteristics, the crop types, and rotations, prepare a final application plan. The thickness and timing of the land application will be varied to evaluate the optimal application rates.
- Remove the sediments from the ponds and spread on the fields using a slurry spreader or other type of agricultural applicator.
- Assess crop conditions and effectiveness of the sediments throughout the summer and fall and continue to adjust, as needed.

Phase 7 Full Scale Project: Schedule

Design and Contracting

Enroll Additional Farmland	Fall 2020
WDNR Submittals and Approvals (New fields for land spreading)	Fall 2020
Draft Preliminary Application Plan	November 2020
Prepare Bid Documents	January – February 2021
Bidding	Spring 2021

Secure Funding

The funding sources we have require that detailed plans, costs and timelines are developed. Those should be in place by the end of the pilot study - phase 6.

Should those resources be secured and approved in time, the following time table can be implemented. There is a proportionate delay if it is not available.

Dredging and Dewatering

Construct pipeline and ponds	Summer 2021
Dredge to WDNR Ponds (Option)	Summer 2021
Dredge to Super Mix Site and WDNR	Spring 2022 – Fall of 2023

Land Spreading

Baseline Sampling of Fields	Spring 2021
Sediment Sampling of Ponds	Fall 2022
Land Application	Spring 2022 to Fall 2027

Phase 7 Full Scale Project: Opinion of Cost ¹.

Our opinion of the construction cost for the Phase II Full Scale Project is \$14,750,000 to \$19,750,000.

(Note - The cost variance is based upon the unknown market value of the material and trucking costs. This will be solidified once the bidding is complete)

1. Since GRAEF has no control over the cost of labor, materials, equipment or services furnished by others, the contractors means of determining prices or over the competitive bidding process or market conditions; GRAEF's opinions of probable construction costs are made on the basis of GRAEF's experience and qualifications and represent GRAEF's best judgements as an experienced professional with the construction industry: but GRAEF cannot and does not guarantee that the proposals, bids or actual project costs will not vary from the opinions of probable construction costs prepared by GRAEF.