

By Corey Hanson, Red Lake Watershed District Water Quality Coordinator. December 9, 2015.

- ✓ Sampling of the Thief River during the 2015 August-September Agassiz Pool drawdown
- ✓ Watershed Restoration and Protection Project Updates
- ✓ Findings from September sample collection



Marshall County Ditch 20 grade control structure, September 2015

Red Lake Watershed District Long-Term Monitoring Program

The month of September fell between two of the full rounds of sampling scheduled for the District's long-term monitoring program. Some samples were still collected at some key sites in the watershed, particularly at Clearwater River monitoring sites from which additional data will help with the upcoming assessment and TMDL calculations.

High E. coli concentrations were found in:

- Terrebonne Creek at Highway 92
- Lower Badger Creek at County Road 114
- Judicial Ditch 73 near Rydell National Wildlife Refuge
- Clearwater River at CSAH 2
- Ruffy Brook at CSAH 11
- Mud River in Grygla at CSAH 54 (3 days) and at the city park (2 days)
- Grand Marais Creek at 110th St. NW
- Silver Creek at 159th Ave, west of Clearbrook.
 - Cattle were in the stream, upstream of the monitoring site.
- Lost River at 109th Ave, upstream of Pine Lake



Along the downstream, south bank of the Hill River at the County Road 119 crossing north of Brooks, RLWD staff smelled and photographed effluent entering the river. The effluent was sampled on one occasion. A similar problem at this location was noticed 10 years ago and it had supposedly been fixed. County officials were notified that the problem is still occurring. The analysis of samples collected from the effluent revealed very high concentrations of total phosphorus (8.44 mg/l), orthophosphorus (3.1 mg/l), and total Kjeldahl nitrogen (6.14 mg/l). Ammonia and total suspended solids concentrations were also high relative to the concentrations that were found in the river that day.



Low dissolved oxygen levels were found in:

- Judicial Ditch 73 near Rydell National Wildlife Refuge (during every site visit throughout the month)
- Grand Marais Creek at 110th St. NW

High concentrations of total phosphorus (relative to new eutrophication standards) were found:

- Judicial Ditch 73 near Rydell National Wildlife Refuge
- Hill River at CR 119 near Brooks
- Lost River at CR 119, north of Brooks
- Grand Marais Creek at 110th St. NW
- Poplar River at CSAH 118

Clearwater River Watershed Restoration and Protection (WRAP) Project

- Objective 2 – Water Quality Sampling
 - Mid-deployment samples were collected at dissolved oxygen logger deployment sites. This data will not only provide more information for the assessment process, but will help identify pollutants of concern at sites that end up needing TMDLs written for dissolved oxygen impairments.
 - High concentrations of total phosphorus (relative to new eutrophication standards) were found:
 - Judicial Ditch 73 near Rydell National Wildlife Refuge
 - Hill River at 335th Ave
 - Poplar River at CSAH 118
 - Lost River at CSAH 28
 - High E. coli concentrations were found in:
 - Poplar River at CSAH 118
 - Terrebonne Creek at Hwy 92
 - Clearwater River at CSAH 2
 - Hill River at 335th Ave
 - Samples were also collected at sites that will aid the upcoming assessment along portions of rivers that haven't been well represented by prior monitoring efforts. High concentrations of total phosphorus and E. coli were found in the Hill River at CSAH 35.
 - Early morning (pre-9am) dissolved oxygen measurements were made at Terrebonne Bridge. All of the dissolved oxygen measurements collected there in 2015 have been good.
- Objective 4 – Continuous Dissolved Oxygen monitoring
 - Dissolved oxygen loggers were deployed at 9 sites throughout the Clearwater River watershed in September of 2015. Sondes were in the water at these sites for two-week deployment periods. After each deployment, sondes were brought back to the office for cleaning and calibration. This report includes some observations of raw (not yet corrected for fouling and calibration drift) dissolved oxygen records from August. Loggers and deployment pipes were all retrieved before the end of the month of September. The current water quality standard for dissolved oxygen requires that daily minimum dissolved concentrations are greater than 5 mg/l during 90% of the days in which data is collected.
 - Lower Badger Creek at CR114
 - Dissolved oxygen levels dropped below 5 mg/l on several occasions throughout the month – more frequently during the first deployment of the month.
 - Terrebonne Creek at Hwy 92
 - Lots of low dissolved oxygen levels. Low dissolved oxygen levels occurred on every day of the first deployment.

- Dissolved oxygen levels bottomed out for a period of time during the last deployment – indicating that the sensor was likely covered with sediment.
- Judicial Ditch 73 by Rydell National Wildlife Refuge
 - Dissolved oxygen levels dropped below 5 mg/l on every day of the first deployment in September. Dissolved oxygen concentrations were continuously low during the last deployment.



- Hill River at 335th Ave
 - Dissolved oxygen levels fell below 5 mg/l on most of the days during first deployment.
 - All of the dissolved oxygen levels recorded during the latter half of the month were greater than 5 mg/l.
- Clearwater River at CSAH 2
 - There were some days with low dissolved oxygen levels during the first deployment of the month. All of the measurements in the latter half of the month were greater than 5 mg/l.
- Lost River at CSAH 28
 - There were many days in which dissolved oxygen levels dropped below 5 mg/l
- Clearwater River at County Road 127
 - Dissolved oxygen levels fell below 5 mg/l on only one day during the first deployment of September.
 - Dissolved oxygen levels were great during the last deployment. All of the readings during the latter half of the month were greater than 6 mg/l.
- Hill River at County Road 119, north of Brooks
 - All of the dissolved oxygen readings were greater than 5 mg/l.

- Beau Gerlot Creek at CR 114
 - This site went dry at the end of August and the logger was moved to the CSAH 118 crossing of the Poplar River



- Poplar River at CSAH 118
 - Dissolved oxygen below 5 mg/l occurred frequently during the first half of the month and less frequently during the latter half of the month.



- During site visits, low dissolved oxygen levels were recorded at
 - Judicial Ditch 73 by Rydell National Wildlife Refuge (every site visit)
 - Lost River at CSAH 28

**Red Lake River Watershed Assessment Project
(Watershed Restoration and Protection - WRAP)**

- Task 3 – Continuous Dissolved Oxygen Monitoring
 - MPCA staff suggested collecting some additional continuous dissolved oxygen data at sites in the Red Lake River watershed to create a better understanding of the extent of some of the dissolved oxygen impairments that were identified in the watershed. There was enough money left in the budget to monitor two sites for half of the monitoring season (5 deployments). Dissolved oxygen loggers were deployed in Burnham Creek at CSAH 45 and the Black River at CR 58.
 - Black River at the County Road 58 crossing
 - Due to the low flow at the site, there was a lot of low dissolved oxygen measurements and a lot of daily fluctuation in the readings.
 - Burnham Creek at CSAH 45
 - Some low dissolved oxygen levels were recorded. Low dissolved oxygen levels occurred more frequently during the early part of the month and less frequently later in the month of September.
- Task 5 – Flow Monitoring
 - Flow has been high in the Red Lake River upstream of Thief River Falls. It has been too high to reach the HOBO deployment pipe or to measure flow with a wading rod.

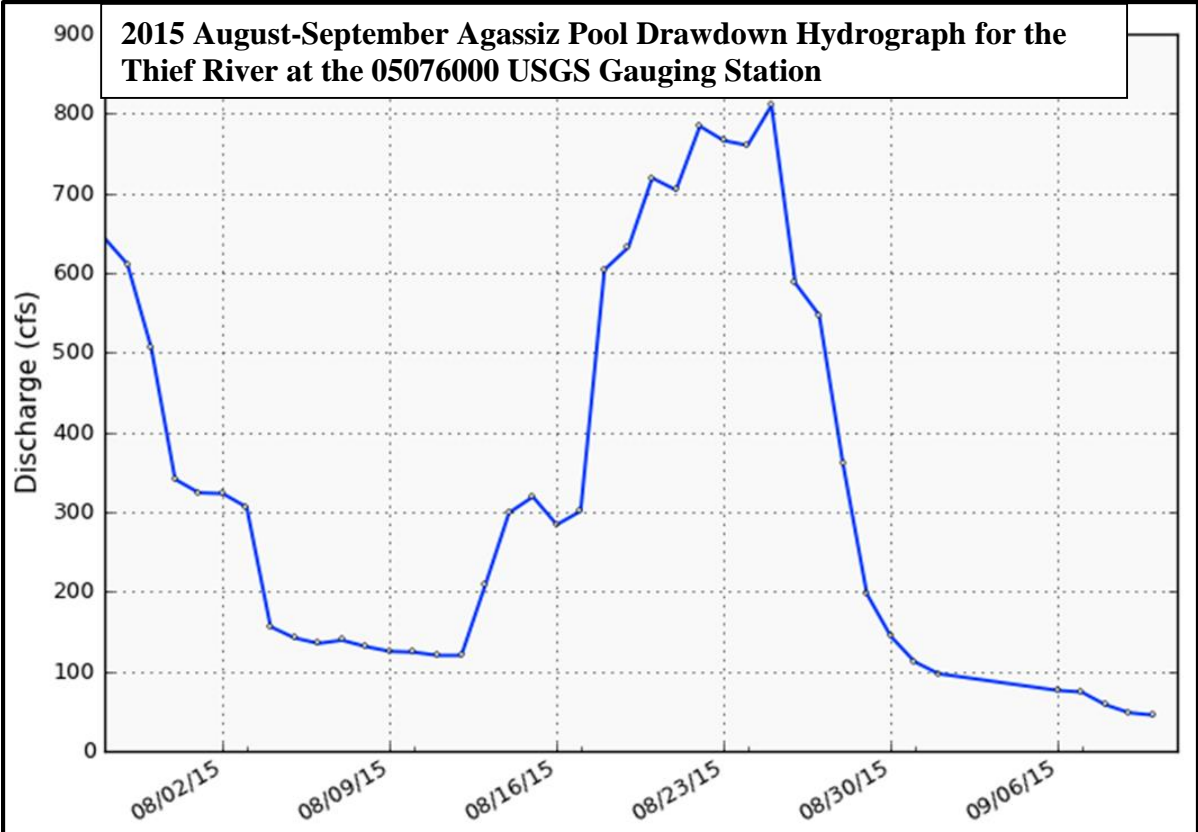


Thief River Watershed Restoration and Protection (WRAP) Project

- Task 2 – Water Quality Monitoring

During a review of previously collected monitoring data, Agassiz Pool drawdowns were identified as periods of time in which low dissolved oxygen levels have been recorded. Sulfates were identified as the only water quality parameter that had any semblance of a relationship with dissolved oxygen levels. Sulfates are the product of oxidation of pollutants. It would be preferable to write a TMDL for a pollutant that is negatively affecting dissolved oxygen levels rather than a product of the oxidation of pollutants. In the late summer of 2015, the RLWD began an intensive monitoring effort during the annual August drawdown of Agassiz Pool to characterize the effect that the drawdown has upon water quality and to hopefully identify a pollutant that has a negative correlation with dissolved oxygen concentrations during this time period.

RLWD water quality staff collected frequent early morning dissolved oxygen data and samples from the lower Thief River (downstream of Agassiz National Wildlife Refuge) before and during the 2015 late-summer drawdown of Agassiz Pool. Samples were analyzed for the basic parameters of total suspended solids, total phosphorus, orthophosphorus, total Kjeldahl nitrogen, ammonia nitrogen, nitrates + nitrites, and E. coli bacteria. The samples were also analyzed for additional parameters like sulfates, total organic carbon, and chlorophyll-a.



RED LAKE WATERSHED DISTRICT MONTHLY WATER QUALITY REPORT

September 2015

Flows peaked in late August. When the river was sampled on August 31 and in early September, flows had decreased, but turbidity and total suspended solids levels increased. Turbidity levels in the Thief River at CSAH 7 rose to 100 NTRU and dissolved oxygen levels fell below 5 mg/l. As flows decreased during the latter stages of the drawdown, concentrations of pollutants increased.



THIEF RIVER AT CSAH 7
AUGUST 27, 2015



THIEF RIVER AT CSAH 7
SEPTEMBER 1, 2015



THIEF RIVER AT CSAH 7
SEPTEMBER 1, 2015



THIEF RIVER AT CSAH 7
SEPTEMBER 3, 2015

High *E. coli* concentrations (>126 CFU/100ml) were found at the CSAH 7 crossing of the Thief River on 6 days during this effort (every sample collected from 8/31/2015 through 9/10/15) and at the 140th Ave NE crossing of the Thief River (twice).

E. coli concentrations at the CSAH 7 crossing, near Agassiz National Wildlife Refuge were several times higher than the concentrations found at the 140th Ave crossing near Thief River Falls in all of the days that were sampled in September.

High Total Phosphorus concentrations were found at the CSAH 7 on 5 days (every sample in September) and 140th Ave NE (on 3 days) crossings of the Thief River.

High total suspended solids concentrations (>30 mg/l) were found at the CSAH 7 crossing of the Thief River on 6 days during this effort (every sample collected from 8/31/2015 - 9/10/15).

Low dissolved oxygen levels (<5 mg/l) were found at the CSAH 7 crossing of the Thief River on 2 days and another day was only 5.48 mg/l at 9:45 AM, so it is reasonable to assume that the true daily minimum was less than 5 mg/l early in the morning.

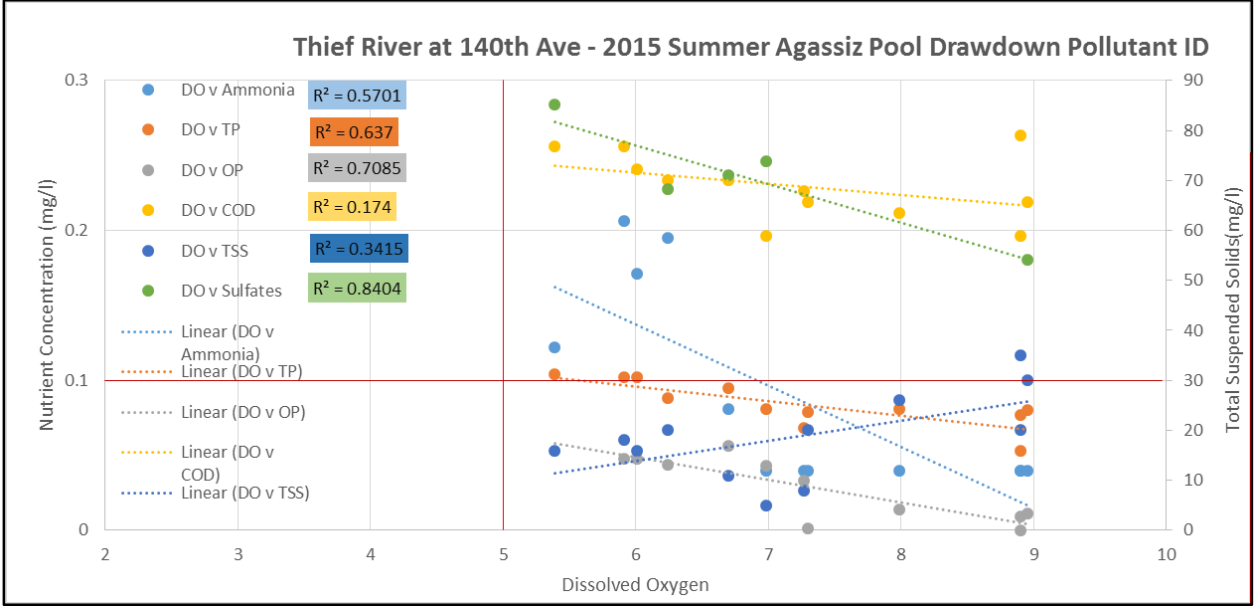
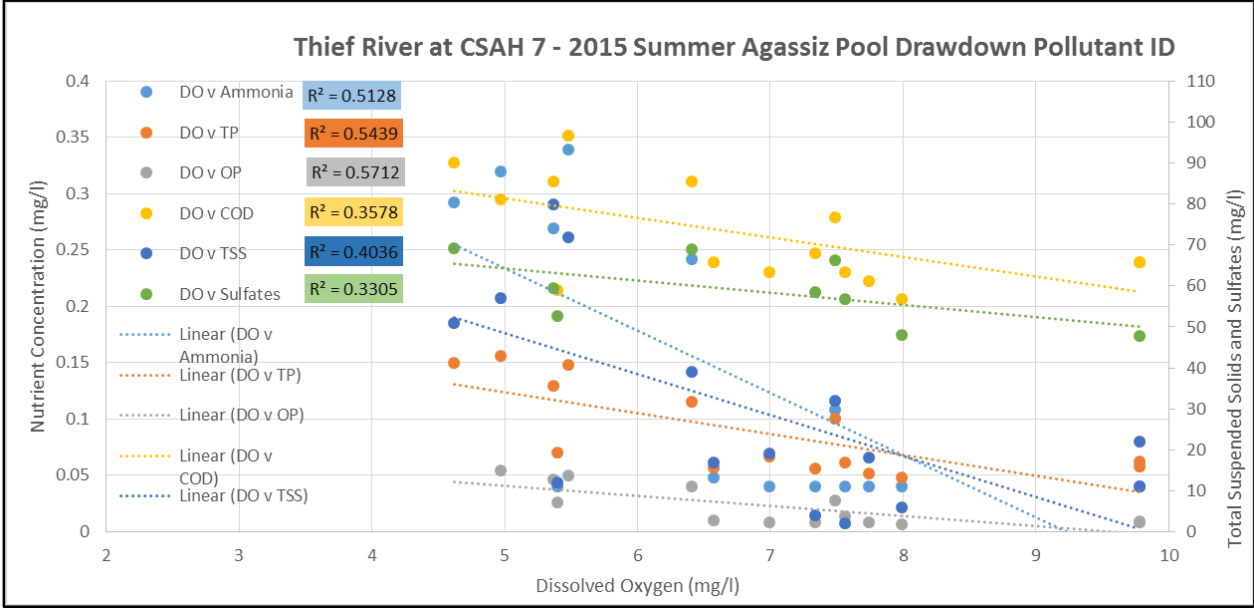
Receding water levels revealed deep, freshly deposited sedimentation along the banks of the river. The dark, organic sediment was over 2.5 feet deep in some places.



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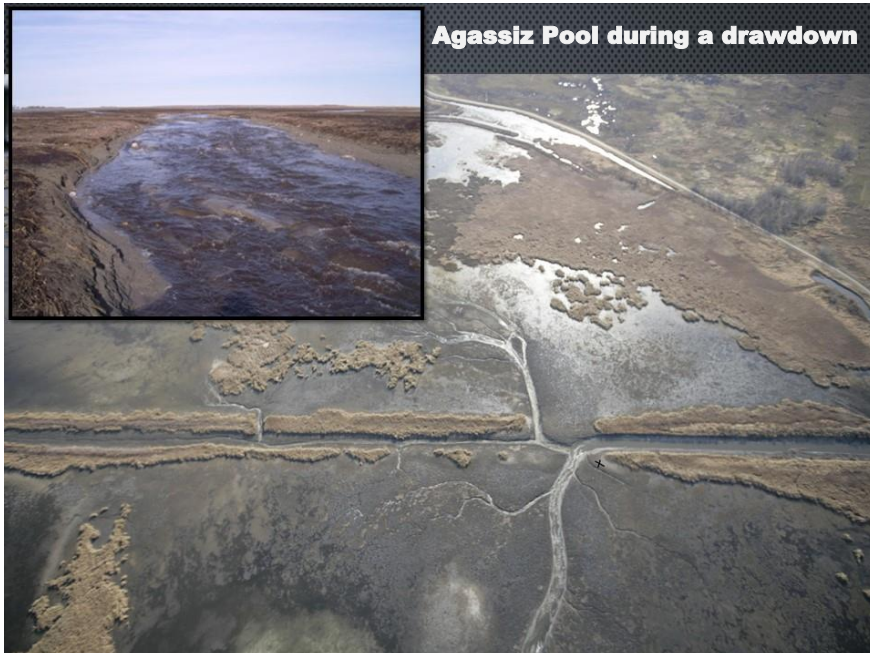
The data from this intensive monitoring effort was analyzed in September. The monitoring effort was successful in improving our understanding of how the drawdown of Agassiz Pool negatively affects downstream water quality. It also successfully discovered negative correlations between pollutants and dissolved oxygen levels. The way that the correlations differed in the upstream end of the reach versus the downstream end of the reach also shed light upon what happens to nutrients and other pollutants as they travel downstream.



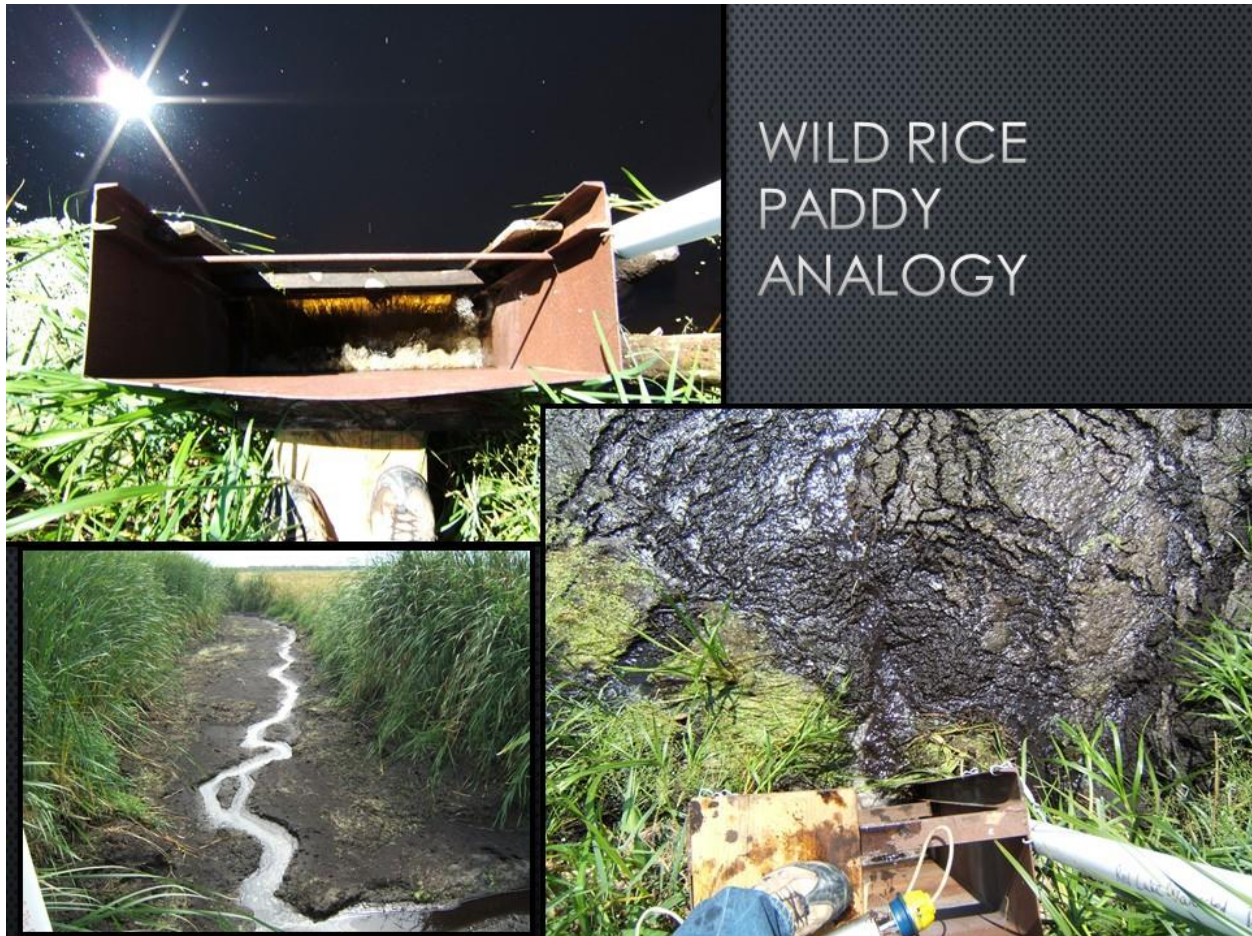
Normally, the water leaving natural outlets of large bodies of water is relatively clean. The outlet of Clearwater Lake has consistently had very low concentrations of pollutants. In most cases, surface water needs to flow over something in order to leave a pool, pond, or lake. Clearwater Lake happens to be a lake in which water levels are maintained by a dam. Pollutants from the Clearwater River are deposited into the lake at the inlet and the clean water on the surface of the lake is the water that leaves the lake through the outlet. The outlet of Agassiz Pool along JD11 is different in that it uses a radial gate, which opens from the bottom. This allows more movement of water along the bottom of the pond and the remains of Judicial Ditch 11.



How can it be that sediment concentrations increase as flows decrease? As the water levels drop in the pool, the movement of water becomes more concentrated within the channels and gullies within the pool. There will be less dilution from ponded water. There will be an ample supply of loose sediment within the channels that has been deposited throughout the summer.



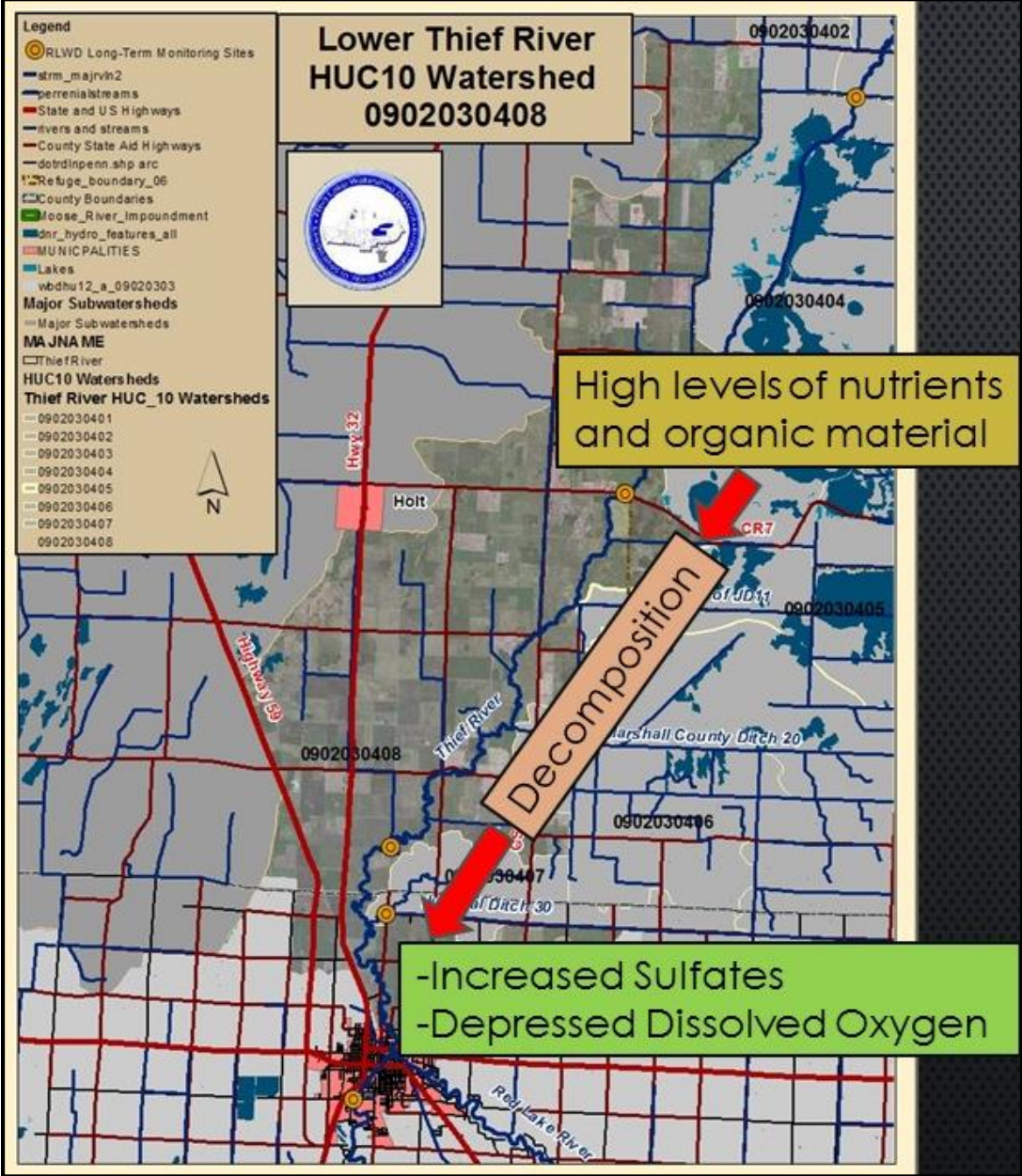
This process was observed during a study that monitored outlets of wild rice paddies. Some of the wild rice paddies that used internal surfaced ditches to move water. During the pre-harvest draining of the ponds, sediment concentrations would be relatively low at the beginning of the drawdown when most of the water leaving the paddy is the water that was ponded above the “ground level” in the paddy. Sediment concentrations increased extremely as a greater and greater percentage of water was flowing within the surface ditches. Total suspended solids concentrations peaked at extremely high levels as the loose sediment that had been deposited within the ditches by wave action and other processes throughout the summer began being carried out of the pool with a lessening dilution factor from water that was pooled. In the case of Agassiz Pool, this also includes sediment deposited by the Mud River and Thief River. The concentrations eventually decreased toward the end of the drawdown, likely because of lower flow velocities, a depleted supply of easily moveable sediment, or a combination of those two factors.



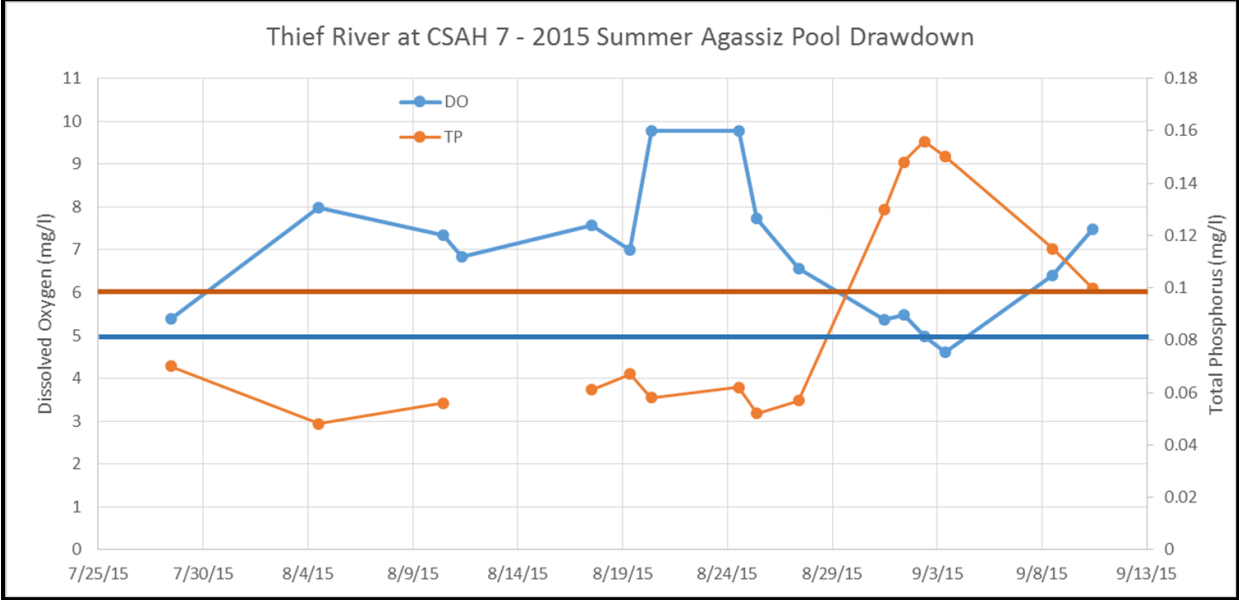
The data from this intensive monitoring effort shows that the nutrients contained in that sediment that is being transported out of Agassiz Pool seem to have relatively strong correlations with dissolved oxygen concentrations during the drawdown period. The strength of the correlation between daily minimum dissolved oxygen levels and parameters like sulfates, total phosphorus, orthophosphorus, and ammonia nitrogen increase greatly from CSAH 7 to 140th Ave. The correlation between dissolved oxygen and sulfates is very strong. The correlation increases from an R2 of 0.33 at CSAH to and R2 of 0.84 at 140th Ave. A possible explanation about why this change occurs is that decomposition/oxidation of pollutants occurs along the reach and the pollutants have had more time to affect dissolved oxygen concentrations by the time the water reaches the downstream monitoring site.

RED LAKE WATERSHED DISTRICT MONTHLY WATER QUALITY REPORT

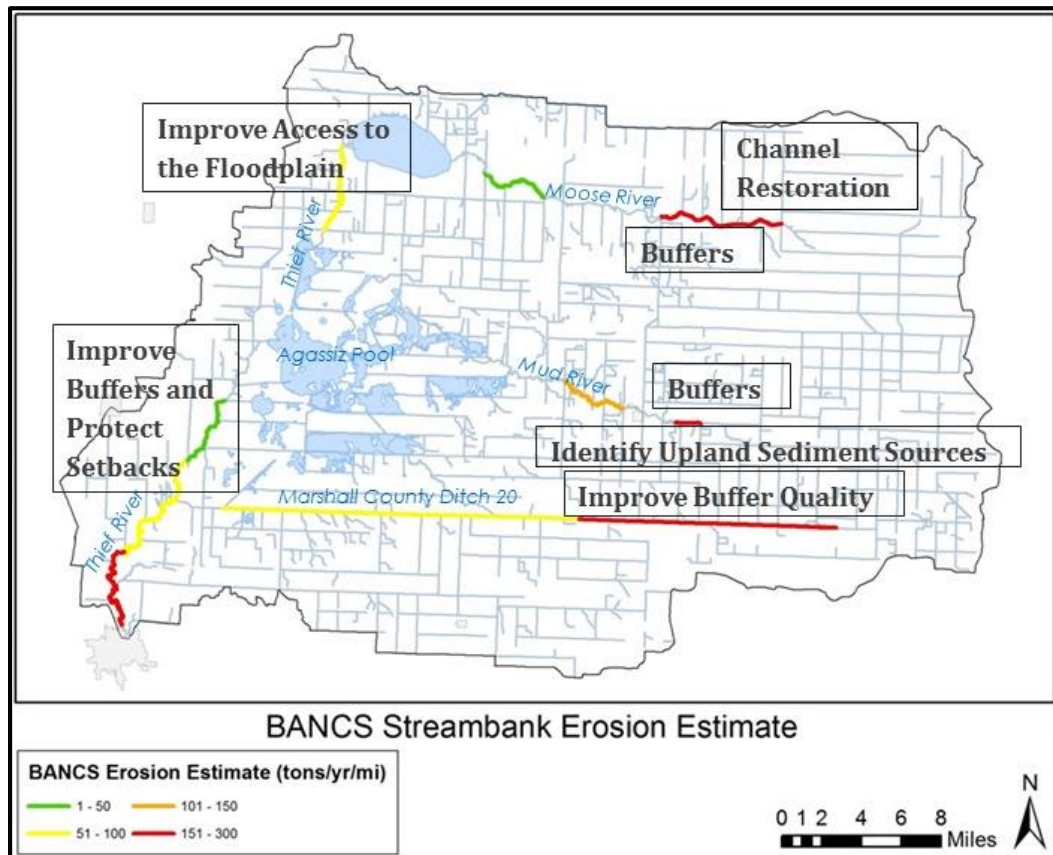
September 2015



Of the pollutants with decent correlations with dissolved oxygen during this sampling effort, total phosphorus is the pollutant for which there is an existing eutrophication-related water quality standard. There is a water quality standard related to ammonia, but it is for the toxic, un-ionized form and not total ammonia. Total Maximum Daily Loads have to be written for a pollutant that is causing an impairment. This sampling effort has provided evidence that regular condition failed to provide about which pollutant can be used. Total phosphorus now appears to be a pollutant that can be used to write a TMDL for the Thief River dissolved oxygen impairment. Even a time-series chart of the data shows that dissolved oxygen levels decrease when total phosphorus levels increase and vice-versa.



- Task 6 – Stream Channel Stability Assessment
 - The Thief River Watershed Fluvial Geomorphology Report was in the process of being reviewed and revised during the month of September. Here is a map of the watershed with some of the recommendations from the draft report:



- Task 13 – Reports
 - Progress continued on the Thief River Watershed Restoration and Protection Strategy (WRAPS) and Total Maximum Daily Load reports.
 - The majority of the report writing work focused upon the Restoration and Protection Strategy section of the WRAPS report. A table of strategies for each HUC10 subwatershed and for the watershed as a whole. Each strategy will have an overall timeline for completion and a 10-year interim goal. A draft outline for the restoration and protection strategy tables was completed and sent to the Thief River WRAP Technical Advisory Committee.
 - Recommendations from the Thief River Watershed Fluvial Geomorphology Report were incorporated into the Thief River WRAPS Report.
 - A draft of the Thief River WRAPS Report was shared with the Technical Advisory Committee.

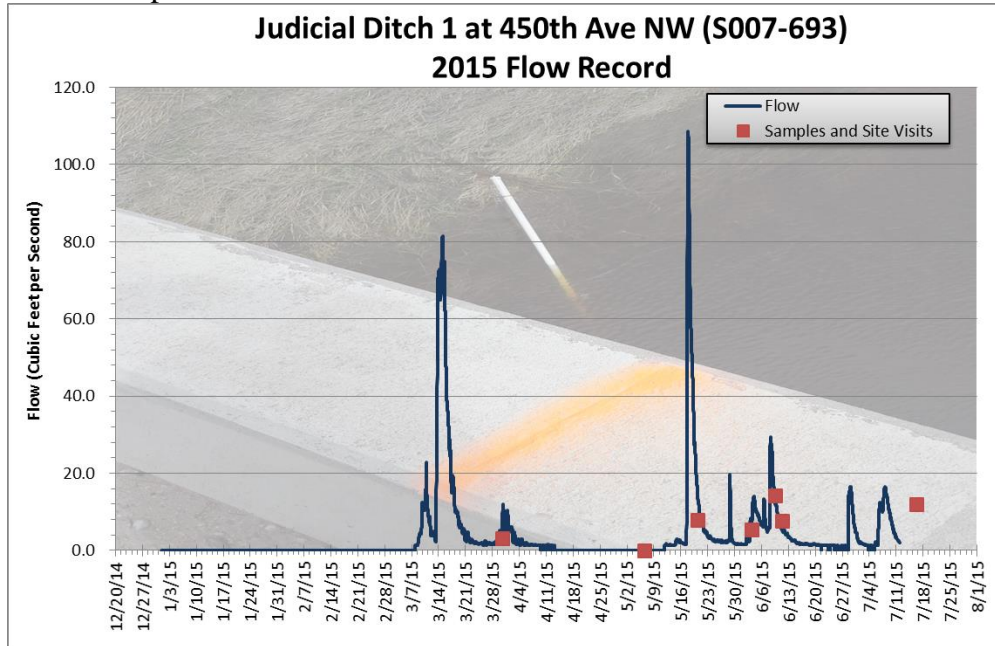
Grand Marais Creek Watershed Restoration and Protection Project

Emmons and Olivier Resources, Inc. staff worked on semi-annual reporting and reviewed HSPF modeling outputs.

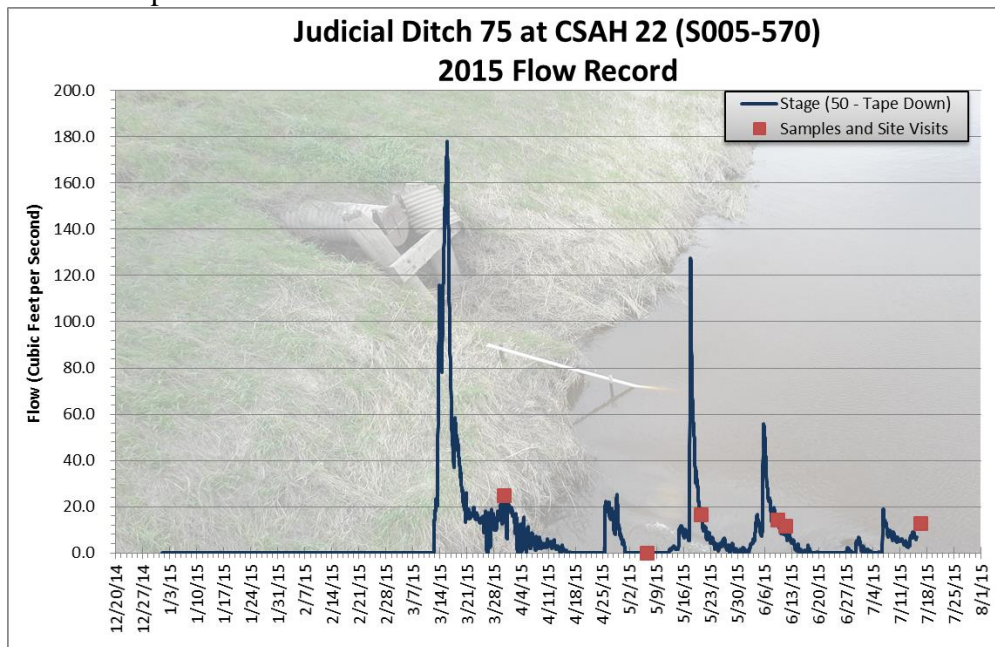
RED LAKE WATERSHED DISTRICT MONTHLY WATER QUALITY REPORT

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Judicial Ditch 1 stage data from 2013 through mid-2015 was compiled, converted into a flow record and plotted.



Judicial Ditch 75 stage data from 2013 through mid-2015 was compiled, converted into a flow record and plotted.



Investigation of the Blue-Green Algae Problem in the Mud River in Grygla

The Mud River in Grygla continued to be monitored for blue-green algae and the conditions that may allow a bloom to occur. Sondes were deployed July through September to monitor dissolved

oxygen levels. Increased fluctuation in dissolved oxygen levels may be an indicator of greater concentrations of algae. The deployed dissolved oxygen logging sondes will provide a record of that fluctuation. Abraxis test strips are being used to test for the presence of algal toxins. Those strips will also give a rough estimate of the concentration in the sample. Chlorophyll-a samples are being collected to record the overall concentration of algae in the river.

Despite some lower flows and warm weather, all of the weekly tests from for blue green algae were negative (zero blue-green algae present). The flows may not have been as low as they were when dogs were poisoned in previous years.

Other Notes

- The Upper/Lower Red Lakes Watershed Restoration and Protection Project is underway. The Red Lake DNR is the local agency that will be doing most of the work for that project.
- Water quality related topics from the September 10, 2015 RLWD Board of Managers meeting minutes:
 - Dan Svedarsky, University of Minnesota-Crookston appeared before the Board to give a progress report on cattail management on the Parnell Impoundment and other areas of interest. Svedarsky discussed the desired end products of cattail management and various partners and their roles in the study.
 - The Board reviewed and approved a funding request from the Red Lake SWCD for the Duden Grade Stabilization Project, located in Section 31, Emardville Township.
 - The Board reviewed and approved a funding request from the Red Lake SWCD for the Brule Grade Stabilization Project and installation of four water and sediment basins, located in Section 3, Terrebonne Township.
 - The Board reviewed and approved a funding request from the Red Lake SWCD for the Weiss Water & Sediment Basins Project for the installation of five water and sediment basins, located in Section 8 and 9, Lake Pleasant Township.
- Water quality related topics from the September 24, 2015 RLWD Board of Managers meeting minutes:
 - The Board reviewed correspondence from Dan Svedarsky, University of Minnesota-Crookston, congratulating the District on the installation and appearance of the District's rain garden.

- Photos of the Burnham Creek Watershed Restoration Project:



September Meetings and Events

- **September 9, 2015** – Red Lake River One Watershed One Plan Technical Advisory Committee Meeting.
- **September 14, 2015** – Pennington County Water Resources Advisory Committee mtg.
- **September 16, 2015** – Pennington County Outdoor Education Day
- **September 22-23, 2015** – Northwest Minnesota Water Festival in Fertile and Warren
 - RLWD and International Water Institute staff worked together to run the Water Quality Station



- **September 29, 2015** – Red Lake River 1 Watershed 1 Plan planning group meeting in Red Lake Falls.
- **September 30, 2015** – Thief River Watershed Restoration and Protection Project Technical Advisory Committee Meeting – 9:30 am at the RLWD office

Upcoming Meetings/Events

- **October 2015** – Creation and distribution of a Red Lake River newsletter.
- **October 23, 2015** – Red River Basin Monitoring Advisory Committee Meeting in Fertile (9:30 am at the Sand Hill Watershed District Office)
- **November 4, 2015** – Marshall County Water Resources Advisory Committee Meeting
- **December 2015** – Thief River Watershed Restoration and Protection Project Open House Meeting
- **December 16, 2015** – Red Lake River One Watershed One Plan Technical Advisory Committee meeting

- **December 18, 2015** – Red River Basin Monitoring Advisory Committee Meeting at the Sand Hill Watershed District Office in Fertile
- **December 31, 2015** – Target date for draft Thief River TMDL and WRAPS reports
- **December 31, 2015** – Deadline for the Clearwater River Surface Water Assessment Grant Project’s final report
- **June 30, 2016** – End date for the Red Lake River Watershed Restoration and Protection Project (extended from June 30, 2015)

Plans for late 2015

- Thief River Watershed Restoration and Protection Project.
 - Creating Stream Power Index maps.
 - Maps of HSPF model results
 - Flow characterization and load calculations
 - Pollutant identification for reaches with dissolved oxygen impairments
 - Complete the Restoration and Protection Strategy Tables
 - Complete a draft Thief River Watershed TMDL Report
 - Edit TMDL and WRAPS reports based on comments during the review process.
- Red Lake River Watershed Assessment Project
 - Creating Stream Power Index maps.
 - Flow characterization
 - Provide input during the assessment process
 - Complete a draft Red River Watershed TMDL Report
 - Complete a draft Red River Watershed Restoration and Protection Strategy Report
 - Technical Advisory meeting to review TMDL and WRAPS reports
- Clearwater River Watershed Restoration and Protection Project
 - Write a short report on existing data, conditions, and knowledge of the watershed (summarizations of existing reports).
 - Stage and flow measurements at sites where HOBO water level loggers are deployed.
 - Continuous dissolved oxygen data collection at a minimum of 9 sites. Consider moving sondes to new sites midway through the monitoring season if aquatic life support is verified.
 - Move dissolved oxygen loggers to new sites if aquatic life support is proven during the first half of the monitoring season.
 - Water quality sampling.
 - Dissolved oxygen data compilation after the monitoring season.
 - Continuous dissolved oxygen data will be summarized and submitted to the MPCA so that it can be used in the upcoming water quality assessment.
 - Data entry and submittal to EQuIS
 - Stage and flow data compilation.
- Grand Marais Creek Watershed Restoration and Protection project

- Technical advisory committee and public open house meetings.
- Emmons and Olivier Resources staff will work on writing the TMDL and WRAPS reports.
- The fourth round of the District's long-term monitoring program will be conducted in October.
- Data entry and submittal of all monitoring data to EQIS

Quote of the Month:

“Keep trudging, or you’ll never reach the top.”

– Anonymous

Red Lake Watershed District Monthly Water Quality Reports are available online at:
<http://www.redlakewatershed.org/monthwq.html>.

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