



## CONCLUSIONS

Generally, conventional tile drainage in the Red River Basin (no surface inlets) should have a positive impact on the problems of high turbidity, total suspended solids, and total phosphorus in the Red River Basin. Unfortunately, there are "side effects" of high nitrate and conductivity levels.

The wild rice paddies were an exception in that the wild rice paddy main-line tile water had all the water quality benefits of conventional agriculture tile, but without the high nitrate levels.

There are plans to continue the monitoring efforts of this study, particularly the flow monitoring and runoff event sampling. Monitoring and research efforts should also be targeted at evaluating what happens to the concentrated discharges of nitrates after they enter a river system. Also, extra monitoring could be done in the lower red river valley, closer to the Red River where soils have higher clay content.

Please visit the Red Lake Watershed District website ([www.redlakewatershed.org](http://www.redlakewatershed.org)) for the quality assurance project plan, reports, presentations, and more..



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## PROJECT SUPPORTERS

**\$17,500 Grant for the Tile Water Quality Study:**



**Financial Support for Flow Monitoring:**



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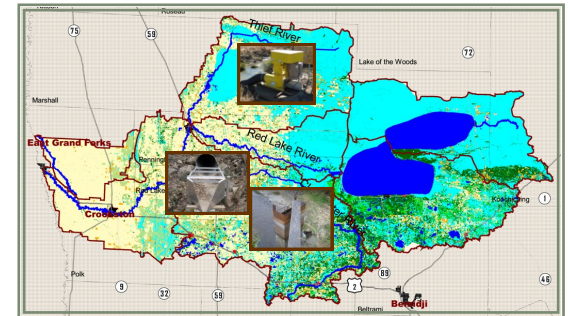
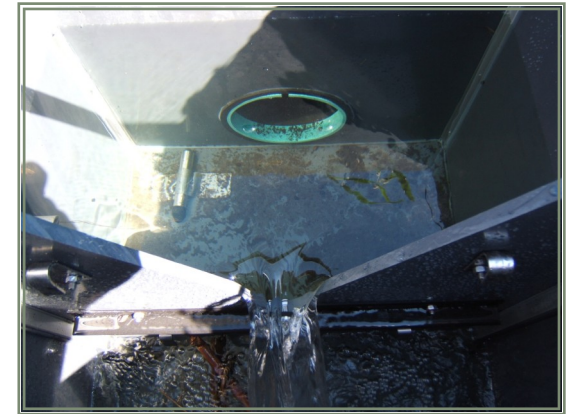
- \* Marshall-Beltrami County SWCD
- \* Red Lake Nation Wild Rice Farms
- \* Red Lake Nation Dept. of Natural Resources
- \* Bachand, Stanley, Yaggie, and Sparby Farms
- \* HDR Engineering, Inc.
- \* Field Drainage, Inc

# Red Lake River Watershed Farm to Stream Tile Drainage Water Quality Study



RED LAKE WATERSHED DISTRICT

**Investigating the effects of agricultural drainage upon water quality in the Red River Basin.**



2005 - 2006 Summary

<http://www.redlakewatershed.org/projects.html#Tile>

# Collecting Water Quality and Quantity Data from Tile Drainage in the Red Lake River Watershed

## Data Collected

- ◆ Total Suspended Solids (TSS)
- ◆ Turbidity (Nephelometric Turbidity Units—NTU)
- ◆ Total Phosphorus (TP)
- ◆ Orthophosphorus (OP)
- ◆ Nitrates (NO<sub>3</sub>)
- ◆ Total Nitrogen (Total Kjeldahl N + NO<sub>2</sub> + NO<sub>3</sub>)
- ◆ Dissolved oxygen, temperature, conductivity, pH
- ◆ Continuous rain, barometric pressure, temperature
- ◆ Continuous water level in flumes (surface drainage) and a tile water control structure



## Introduction

Prior to this project, there were a lot of theories about how the increasing amount of tile drainage in the Red River Basin would affect water quality. However, there was a lack of actual water quality data from tile drainage within the basin.

This study was designed to provide actual data from tile drainage in several different areas throughout the Red Lake Watershed District. In each area, tile drainage water quality has been compared with surface drainage water quality. The study also compares flow (sfc. v. tile) and different methods of tile drainage.

## General Results

- \* Tile drainage turbidity levels normally <1 NTU
- \* Minimal Phosphorus and TSS from tile drainage
- \* Nitrates levels from tile ranged from 1.5 up to 4 times the water quality standard of 10 mg/L
- \* Tile water had good dissolved oxygen concentrations (in Red Lake Co.), but high conductivity levels.
- \* Surface drainage had higher turbidity levels—sometimes extremely high.
- \* Surface drainage had higher OP concentrations
- \* Surface drainage had lower total N due to lower nitrates, despite higher TKN concentrations vs. tile.
- \* The median and geometric mean concentrations of TSS at the gravity tile sites are actually lower than the lab's minimum detection limit

## Red Lake County

Flow and water quality data were collected from a gravity tile drained field and a surface drained field east of the town of Brooks.

- \* Runoff from the surface drained field had much higher turbidity, TSS, and TP levels compared to tile drainage
- \* Flow from tile drains had barely measurable (if at all) TSS levels (1 mg/L min. detection limit)
- \* Tile nitrates ranged from 16.8 to 28 mg/L.
- \* The water quality at the Red Lake Co. tile site was better, on average, than the water quality at the Marshall Co. tile monitoring sites.
- \* Extra samples taken during low flow indicate that, even with a 1 mg/L reduction in nitrate levels after tile water has traveled over 260 yards toward the Hill River in a small creek, there can still be a measurable impact upon conductivity and nitrate levels within the river.



Surface drained field, Surface drainage from a tiled field, and tile drainage water samples, respectively (L to R).

## Marshall & Beltrami Counties

Near the town of Grygla, water quality samples were collected to compare gravity tile drainage, pumped tile drainage, surface drainage, and natural background drainage. Most of this sampling was conducted by the Marshall-Beltrami SWCD.



- \* Pumped tile nitrates 1/2 as high as gravity tile nitrate concentrations
- \* TSS more measurable from pumped tile



## Wild Rice Paddies

Wild rice growers along the Clearwater River have begun installing tile drainage in their paddies. This practice provides numerous benefits to the farmer including even quality, even maturity, less ditch maintenance, fewer ruts during harvest, more control over drainage, and less soil loss. Main-line tile drained paddies also release clean water. This study has found that main-line tile not only has all the same benefits of conventional agricultural tile drainage, but also has low nitrate concentrations.



To achieve these benefits, the tiling system must be a main line tiling system that exits the paddy through the dike and into a stable ditch. The peat soil in the paddies is highly erodible. Even clean water from the end of a tile line will be laden with sediment by the time it leaves the paddy through an internal drainage ditch.

Efforts should be made to provide financial support to wild rice farmers who wish to install main-line tile. Switching to main-line tile drainage should work to lessen the negative impact of wild rice paddy drainage upon water quality in the Clearwater River.

## Flow Data Collection

Monitoring sites with definable watersheds and homogenous land use in Red Lake County are being used for this ongoing part of the study. Surface and tile water flow are measured separately at the tile drained field.



More data and analysis will be conducted in coming years for this part of the project. The data will be used to compare peak flows and total flow volumes from surface drainage and tile drainage.