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February 10, 2017

Red River Basin River Watch Annual Report 2016

Red River Basin River Watch partners with K-12 and community education staff, resource management professionals, higher education institutions and other non-profits to create opportunities for citizen engagement in surface water quality issues In the Red River Watershed through data collection and field experiences.

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Introduction

This report fulfills the interim reporting requirements for the Clean Water Legacy River Watch Project from January 2016 through December 2016. The Red River Watershed Management Board is the project sponsor with lead coordination and project management provided by the International Water Institute. The purpose of this report is to provide a summary of progress towards meeting the identified outcomes within the 2016 – 2017 Clean Water Fund Work Plan.

Program Overview

The International Water Institute (IWI) River Watch (RW) program enhances watershed understanding and awareness for tomorrow's decision-makers through direct hands-on, field-based experiential watershed science. Schools throughout the Red River of the North Basin participate in a variety of unique and innovative watershed engagement opportunities suited to their school, community, and watershed needs.

Water Quality Monitoring: Collect and record conditions at local rivers and streams using state-of-the-art scientific methods and equipment.

Biological Monitoring: Macroinvertebrate monitoring provides additional insights on watershed health.

River Explorers: Guided kayak excursions on local rivers to observe and document watershed conditions.

Ongoing ***Teacher Training*** provides access to resources and experts on current watershed issues.

River Watch Forum: Annual opportunity for students to share and learn about emerging watershed issues.

Coming to River Watch 2018!

Snow Study: Students collect snow depth, snow water equivalency, and infiltration rate to help accurately forecast spring flooding.

River of Dreams: Introducing elementary students to watershed science and terminology through geography, reading, writing, and art.

The remainder of this report discusses the project progress in meeting the tasks and measureable outcomes of the River Watch activities from January 2016 through December 2016 (12 months). The budget summary provided provides financial performance information encompassing the same time period.

Project Progress

OBJECTIVE 1: Develop a standardized macroinvertebrate biological monitoring framework for program implementation to build rigor and consistency with communities currently involved in River Watch (RW), while expanding monitoring and engagement opportunities.

Work tasks/*Measureable outcomes***:**

1A Develop a standard biological monitoring process for RW teams in the Red River Basin.

1A1 Resources developed and/or adapted to connect biology with chemical and hydrological conditions for training RW leaders and teams. Completed June 2016.

1A2 Training for education staff on use of new resources and presentation techniques for biological monitoring. Completed August 2016.

1A3 14 classroom sessions (7 sessions in 2016/ 7 in 2017) presented to RW teams to review role of biological monitoring and materials, equipment and process that will be used by team with staff assistance to monitor their respective sites. Completed September 2017.

1B Establish and monitor biological reference locations at 14 stream locations in the Red River Basin.

1B1 Biological reference locations scouted and established. Where logistically feasible sites will be co-located with existing Intensive Watershed Monitoring locations. Completed September 2016 (7 sites) and September 2017 (7 sites).

1B2 Biological monitoring field collection of specimens and documentation of conditions at reference locations. Completed November 2016 (7 sites) and November 2017 (7 sites).

1B3 Classroom/Lab sessions with RW teams to identify and score collected biological specimens. Enter biological scores into RW database. Completed November 2016 (7 sessions) and November 2017 (7 sessions).

1B4 Teacher evaluation of implementation, problems, and highlights of biological reference site activities, as well as pre/post surveys of students. Completed December 2017. Results will be reported as part of Final Report due June 30, 2018.

Objective 1 Progress:

- Development/adoption of training resources and staff training was completed in 2016. Staff attending field training on September 15, 2016. Staff were trained in the use of resources that were developed/adopted for training purposes. Resources include the MPCA Stream Habitat Assessment process and worksheet, RRB River Watch Sampling Macro Protocol, Family ID Guide, Family Biotic Index Worksheet, and a Macroinvertebrate Data Portal within the River Watch Database. All referenced documents and web information is include in *Appendix A.*
- Biological reference locations were reviewed with MPCA Biomonitoring staff with a potential list of sites compiled and identified and are included in *Appendix A.* No sites were established for monitoring by River Watch teams in 2016.
- Classroom sessions and field activities did not occur in 2016. Extreme and prolonged high water levels throughout the Red River Basin did not allow for safe specimen collection or accurate site evaluations. Site evaluation, site establishment, classroom and lab sessions, and field collection activities will be priority in 2017. Field activities in 2017 will target the entire calendar period and will be completed if and when water levels permit safe stream access. Classroom/lab sessions will be completed in conjunction with field activities.

OBJECTIVE 2: Increase awareness and knowledge of local land use and watershed connections through a Red River Explorers Paddling Program to allow RW teams and community members to "water-truth" streams in the Red River Basin, documenting local watershed conditions.

Work tasks/*Measureable outcomes***:**

2A Expand capacity and structure of Red River Explorers Paddling Program to allow RW teams and community members to safely explore and document river conditions, including development of online reports to share information about river conditions.

2A1 IWI paddling staff scout rivers at different water levels to assess safety and water levels needed for safe passage by RW student exploratory teams. Ongoing through 2017.

2A2 Additional features and information that might be collected will be reviewed with watershed district managers and research scientists to maximize utility of data collection from river trips. Equipment and materials purchased for documenting field conditions. Completed July 2017.

2A3 On-line map and multimedia reports shared with the public via the IWI website and linked to the RRWMB website. Ongoing through 2017.

2B Lead six guided river ecology excursions in both 2016 and 2017 on various reaches of rivers in the Red River Basin.

2B1 Twelve guided river ecology excursions in the Red River Basin, all utilizing GPS and mapping/photo documentation of baseline geomorphology and recreation conditions. Completed November 2017.

2B2 Share information from river trips on IWI website. Based on applicability to each river reports may include the following; number of trip participants, river route and reaches covered, photo-documentation of river conditions, and a summary of observations by trip participants on river conditions and recreation suitability. Completed December 2017.

2B3 Final Report to include link to all of trip reports and responses from local resource managers and research scientists as to utility of reconnaissance information provided about watershed conditions, completed June 30, 2018.

2C Watershed Connections: Stream tables, groundwater models, and outreach.

2C1 Provide stream and ground water resource materials and equipment for eight site visits with assistance from IWI staff. Ongoing over contract period, completed January 2018.

2C2 Evaluation (self-reported) of changes in knowledge, attitude and perceptions of local rivers after stream table and/or groundwater model exposure. To be completed January 2018 and included in Final Report due June 30, 2018.

2C3 Produce and distribute a quarterly electronic newsletter that promotes watershed education and awareness in the Red River Basin. 8 newsletters developed over the contract period. Completed December 2017.

Objective 2 Progress:

- During calendar year 2016, IWI staff scouted a total of 203 river miles which included seven different rivers on seventeen separate dates. The primary purposes of the scouting trips was to document watershed conditions and assess safety for river kayaking trips planned with high school River Watch teams. General recreation suitability was assessed for some river reaches due to increased public interest in kayaking rivers in the Red River Basin. A detailed summary of river reaches covered, conditions (erosion, tree snags, fence barriers, river access), flow levels, and trip notes is included in *Appendix B.*
- River Explorer kayak trips were taken with seven schools in 2016, involving 78 total participants paddling a total of 255 river miles on seven individual reaches of six different rivers in four separate watersheds in the Minnesota portion of the Red River Basin. The schools, rivers and watersheds involved, miles and total participants are summarized in *Appendix B.*

- Trip planning documents were prepared for these trips and are included as separate documents in *Appendix B*. Most trip planners include post-trip notes and observations from students and staff. Several news releases, also included in *Appendix B*, were prepared and submitted for publication in local weekly or daily newspapers for most of the trips.
- Trip photos have been shared with resource managers in the respective watersheds but as yet no standard method or centralized location has been decided upon for ongoing sharing and access. The photos are geo-tagged and some have been developed into Google Earth kmz files but Soil and Water Conservation District offices are not allowed to use Google Earth which is an unfortunate barrier to efficient sharing of this photo documentation.
- Three stream tables and two ground water models have been made available to the River Watch schools for classroom use. IWI staff assisted the schools in their use when requested. Resources and information relating to the stream tables and groundwater models are available on the IWI website at: http://www.iwinst.org/education/resources/stream-tables-and-ground-water-models.
- 4 newsletters were published and distributed in 2016. Completed newsletters can be viewed on the IWI website at: http://www.iwinst.org/education/resources/newsletter.

OBJECTIVE 3: Assist in provision of Science, Technology, Engineering and Math (STEM) education and engagement opportunities through watershed science.

Work tasks/*Measureable outcomes***:**

3A **Provide professional teacher development through watershed inquiry and education opportunities. Regional fall kick-off events, incorporating team building skills, local watershed project presentations and data interpretation will be held for RW teachers and youth leaders. Summer training sessions will be held for teachers to provide extended learning opportunities on watershed topics such as river ecology, watershed connections, and biological monitoring.**

3A1 *2-3 regional fall kick-off events in both 2016 and 2017; and one summer teacher training session. Summary reports will be provided to document participants at regional kick-off events, topics covered, and evaluation comments from participants. A summary report will also be provided for the summer teacher training documenting participation, materials presented, and evaluation summary from participants. Completed December 2017.*

3B **Utilize the annual River Watch Forum to provide exposure to relevant research topics and an opportunity to present findings from current research involvements. Provide opportunities for youth to engage in scientific research.**

3B1 *River Watch Forum presented in March 2016 and 2017 with keynote speaker and concurrent sessions focused on emerging watershed education and research. Poster displays of assigned research topic and special investigations by RW teams in collaboration with research partners. Completed April 2017.*

3B2 *Summary report written to document participating RW teams/schools and highlighting awards and watersheds represented in research, with links to posters. To be completed by June 30, 2016 and June 30, 2017 and included in Final Report due June 30, 2018.*

Objective 3 Progress:

- Three (3) regional fall kick-off events were held across the basin in October 2016. River Watch teams were introduced to the River Watch Forum 2017 Team Challenge and the activities at each kick-off event prepared the attending teams for their poster presentations. One-hundred fifty-seven (157) students and sixteen (16) teachers attended these events. Students and teachers received training on watershed research and exploration and paddled a guided trip on the closest river with Wilderness Inquiry. All of the information related to the 2017 Forum and the 2016 kick-off events is included in *Appendix C* or can be viewed on the web at: http://www.iwinst.org/education/river-watch-forum/team-resources.
- The 21st annual River Watch Forum was held March 15, 2016 with 250 people in attendance, 203 students and teachers along with 47 public at large including resource managers. Students prepared posters for the event and

presented them throughout the day's proceedings. The posters that were at the 2016 forum can be viewed on the web at: http://www.iwinst.org/education/river-watch-forum/school-water-quality-posters.

- Highlights from the proceedings for the day were covered in our March 2016 newsletter and are included with the 2016 River Watch Forum Agenda in *Appendix D.*

OBJECTIVE 4: Project Management and Reporting

Work tasks/*Measureable outcomes***:**

4A Track project grant-related expenditures. Compile and organize invoices, pay bills and submit for expense reimbursements in a timely manner.

4A1 Grant-related expenditures tracked, bills paid and expense reimbursements submitted at least quarterly.

4B Track objectives and tasks to ensure outcomes are being met. Prepare and complete reports and results from the Red River Basin River Watch program as follows:

4B1

1. *Interim report of project status and budget to MPCA by December 31, 2016.*
2. *Interim report and initial evaluation to Commissioners of Education, MPCA and Legislative and Education Committees by February 15, 2017.*

Final report of project outcomes, budget, and final evaluation results by June 30, 2018 to all entities receiving February 15, 2017 report noted above.

Objective 4 Progress:

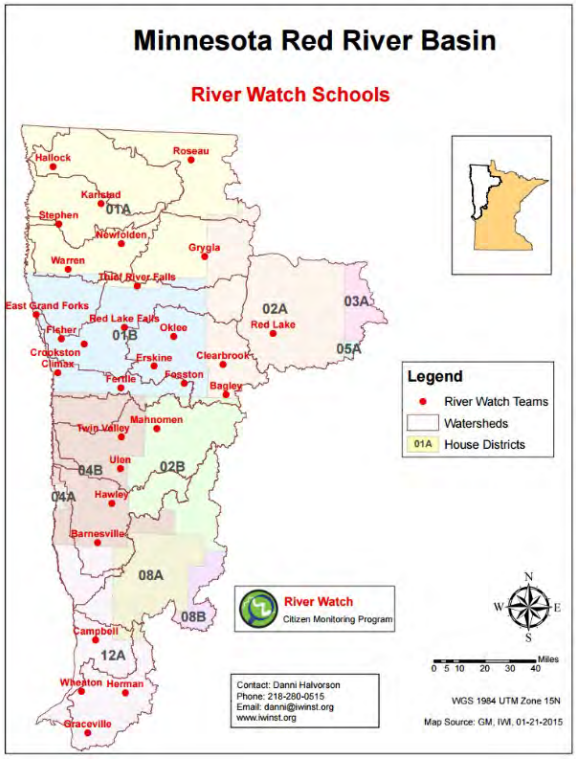
- This interim report was submitted to the MPCA project manager December 30, 2016.
- This report satisfies reporting requirement 1 listed above.
- Invoices have been submitted quarterly. Below is a summary of the project budget covering January 2016 through December 2016.

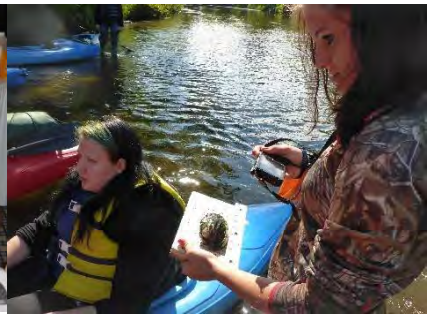
Project Budget	MPCA Grant Funds Available	Total MPCA Funds Expended	Total Remaining Balance	% Budget Expended
Objective 1: Rigor	$46,925.00	$14,106.00	$32,819.00	30%
Objective 2: River Recon	$88,365.00	$40,409.41	$47,955.59	46%
Objective 3: Educate and Engage	$52,685.00	$37,318.61	$15,366.39	71%
Objective4: Project Mgmt. & Reporting	$12,025.00	$5,440.50	$6,584.50	45%
TOTAL PROJECT BUDGET	$200,000.00	$97,274.52	$102,725.48	49%

Summary

Support for the Red River Basin RW program is provided by the Red River Watershed Management Board, local watershed districts, and other regional partners. This collaboration has built a sustainable watershed education foundation across the Red River Basin. The RW program provides training to students who monitor physical and chemical conditions of local rivers using standard operating procedures. RW teams have collected data at 150 sites totaling over 10,000 visits to rivers, streams, and agricultural ditches in the Red River Basin. Data are used by the MN Pollution Control Agency to complement the state's assessment of surface waters.

Clean Water funds enable the IWI to build on this watershed education foundation by providing learning opportunities not afforded with traditional funding, specifically Biological Monitoring, River Explorers, Teacher Training, and River Watch Forum activities. Additional funds will be sought in 2018 to expand River Watch offerings to include River of Dreams and the Snow Study. These new activities will expand the educational opportunities and provide a more comprehensive understanding of watersheds, promoting land and water stewardship to protect and improve Minnesota's valuable natural resources.





APPENDICES

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Minnesota Pollution Control Agency

Biological Monitoring Program

MPCA STREAM HABITAT ASSESSMENT (MSHA) PROTOCOL FOR STREAM MONITORING SITES

I. PURPOSE

To describe the methods used by the Minnesota Pollution Control Agency's (MPCA) Biological Monitoring Program to collect qualitative physical habitat information at stream monitoring sites for the purpose of assessing water quality and developing biological criteria.

II. SCOPE/LIMITATIONS

This procedure applies to all river and stream monitoring sites for which an integrated assessment of water quality is to be conducted. An integrated assessment involves the collection of biological (fish and macroinvertebrate communities), physical habitat, and chemical information to assess stream condition.

III. GENERAL INFORMATION

Sites may be selected for monitoring for a number of reasons including: 1) sites selected for condition monitoring as part of Intensive Watershed Monitoring (IWM), 2) sites randomly selected as part of the Environmental Monitoring and Assessment Program (EMAP), 3) sites selected for the development and calibration of biological criteria, and 4) sites selected for stressor identification. Although the reasons for monitoring a site vary, the MSHA protocol described in this document applies to all monitoring sites unless otherwise noted.

IV. REQUIREMENTS

A. Qualifications of crew leaders: The crew leader must be a professional aquatic biologist with a minimum of a Bachelor of Science degree in aquatic biology or closely related specialization. He or she must have a minimum of six months field experience in physical habitat sampling methodology. Field crew leaders should also possess excellent map reading skills and a demonstrated proficiency in the use of a GPS (Global Positioning System) receiver and orienteering compass.

B. Qualifications of field technicians/interns: A field technician/intern must have at least one year of college education and coursework in environmental and/or biological science.

C. General qualifications: All personnel conducting this procedure must have the ability to perform rigorous physical activity. It is often necessary to wade through streams and/or wetlands, canoe, or hike for long distances to reach a sampling site.

V. RESPONSIBILITIES

A. Field crew leader: Implement the procedures outlined in the action steps and ensure that the data generated meets the standards and objectives of the Biological Monitoring Program.

B. Technicians/interns: Implement the procedures outlined in the action steps, including maintenance and stocking of equipment, data collection and recording.

VI. QUALITY ASSURANCE AND QUALITY CONTROL

Compliance with this procedure will be maintained through annual internal reviews. Technical personnel will conduct periodic self-checks by comparing their results with other trained personnel.

In addition to adhering to the specific requirements of this sampling protocol and any supplementary site specific procedures, the minimum QA/QC requirements for this activity are as follows:

A. Control of deviations: Deviation shall be sufficiently documented to allow repetition of the activity as performed.

B. QC samples: Ten percent of sites sampled in any given year are resampled as a means of determining sampling error and temporal variability.

C. Verification: The field crew leader will conduct periodic reviews of field personnel to ensure that technical personnel are following procedures in accordance with this SOP.

VII. TRAINING

A. All inexperienced personnel will receive instruction from a trainer designated by the program manager. Major revisions in this protocol require that all personnel be re-trained in the revised protocol by experienced personnel.

B. The field crew leader will provide instruction in the field and administer a field test to ensure personnel can execute this procedure.

VIII. ACTION STEPS

A. Equipment list: Verify that either a form and pencil, or a field computer is present before commencement of this procedure.

B. Data collection method: The location and length of the sampling reach is determined during site reconnaissance (see SOP--"***Reconnaissance Procedures for Initial Visit to Stream Monitoring Sites***"). Unless otherwise instructed, observations of physical habitat characteristics should be limited to the sampling reach. Sampling is conducted during daylight hours within the summer index period of mid-June through mid-September. Sampling should occur when streams are at or near base-flow. The habitat evaluation is conducted immediately after fish sampling in order to provide the evaluator a perspective of the fish habitat within the reach.

Habitat characteristics are recorded using a qualitative, observation based method (modified from: Rankin 1989. The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application. Ohio EPA, Division of Water Quality Planning and Assessment, Ecological Analysis Section, Columbus, Ohio.). The Ohio QHEI is a physical habitat index designed to provide an empirical evaluation of the lotic macrohabitat characteristics that are important to fish communities and which are generally important to other aquatic life. Although similar to the Ohio QHEI, the MSHA has been modified to more adequately assess important characteristics influencing Minnesota streams. The MSHA incorporates measures of watershed land use, riparian quality, bank erosion, substrate type and quality, instream cover, and several characteristics of channel morphology.

Observations are recorded on the **MPCA Stream Habitat Assessment Worksheet**. A copy is attached and guidelines for filling out this data sheet are described in the following pages.

C. MPCA Stream Habitat Assessment Data Sheet

This data sheet describes the presence and abundance of instream and riparian characteristics within the sampling reach. The variables recorded are as follows:

C.1. Stream Documentation

a) *Field Number* – A seven-digit code that uniquely identifies the station. The first two digits identify the year of sampling, the second two identify the major river basin, and the last three are numerically assigned in sequential order (example: 02UM001).

b) *Stream Name* – The name of the stream as shown on the most recent USGS 7.5" topographic map. Include all parts of the name (i.e. South Branch Wild Rice River).

c) *Date* – The date habitat sampling is conducted in month/day/year format (MM/DD/YY).

d) *Person Scoring* – The personnel completing the MSHA. This person(s) should have walked or boated the entire stream reach paying particular attention to habitat features.

e) *Water Level* – An estimation of water level as it relates to summer base flow expectations. In most streams, the "normal" water level can be determined with relative ease by observing channel characteristics.

C.2. Surrounding Land Use or Floodplain Quality: Record the predominant land use on each bank within approximately 2 to 3 square miles (streams) or within the adjacent and surrounding floodplain (rivers). For streams the emphasis should be on the upstream surrounding land use. For rivers the emphasis is on the area of land adjacent to the stream channel that experiences flooding during periods of high discharge. Check either the most predominant land use, or choose two and average the scores. A land use or aerial map can be used for this assessment if available. Land use categories are as follows:

Forest, Wetland, Prairie, Shrub: Land that is dominated by trees, low-lying areas saturated with water, grasses and forbs, or woody vegetation less than 3 m. in height (i.e. natural land uses).

Old Field/Hay Field: Land that is used for agricultural purposes other than row crops or pasture.

Fenced Pasture: Land that is regularly grazed by livestock, but is fenced to prevent livestock from entering streams.

Residential/Park: Land that has been modified for residential use (housing, residential lawns, city parks).

Conservation Tillage, No Till: Land that is currently in agricultural production, but retains the vegetative material from the previous year's crop to protect the soil.

Diked Wetland: Areas that have been diked from the main stream channel and are wetland in nature. A dike is an embankment constructed of earthen or other suitable material to protect land against overflow or to regulate water. It is more common to see this land use activity on very large rivers.

Urban/Industrial: Land that has been modified for commercial or industrial use (parking lots, malls).

Open Pasture: Land that is regularly grazed by livestock, but is not fenced to prevent livestock from entering streams.

Mining/Construction: Land affected by mining and/or current construction activity (open pits, tailings).

Row Crop: Land that is currently in intensive agricultural production, and doesn't use any conservation tactics (corn, soybeans, sugar beets, potatoes).

C.3. Riparian Zone (check the most appropriate category for each bank)

a) *Riparian Width* – Estimate the width (m) of the undisturbed vegetative zone adjacent to the stream. Beneficial vegetation types include stable grasses, trees, and shrubs with low runoff potential. Disturbed vegetation is not included in the riparian width (i.e. mowed grass). For channelized streams, estimate the width of the grass buffer from the water's edge, along the angle of the ditch bank to the top of bank, and beyond to the point where the grass buffer is disturbed.

b) *Bank Erosion* – Estimate the percentage of the stream bank that is actively eroding. Consider only the portion of the left and right bank that are likely or have the potential to be eroded (i.e. outside bends and high banks but not naturally occurring depositional point bars along inside bends). To be considered as erosion, the banks must be actively eroding through break down, soil sloughing, or false banks. False banks are natural banks that have been cut back, usually by livestock trampling.

c) *Shade* – Estimate the percentage of overhead canopy cover that is shading the stream channel. Canopy cover can be from trees, shrubs or tall grasses that provide shade to the stream at different times of the day. Professional judgment may be required to rate stream shading characteristics in larger streams and rivers as 100% shade cover would not be expected in these systems even in the absence of disturbance. The general intent of the rating is to evaluate the condition of stream canopy characteristics.

C.4. Instream Zone

a) *Substrate* – Document the two predominant substrate types for each channel type present within the reach. One substrate type may be recorded where > 80% of the channel is dominated by a single substrate type. For each channel type present within the reach, estimate the percent of the stream channel represented by that channel type. The percentages should add up to 100. For example, if the majority of your reach was a run, with a few pools and one riffle, the percentage could be 75% run, 20% pool, and 5% riffle. Lastly, note the presence of all substrate types observed within the reach in a significant amount (>5%) in the space provided. The definitions for each channel and substrate type are as follows:

Channel Types

Pool: Water is slow and generally deeper than a riffle or run. Water surface is smooth, no turbulence. A general rule that can be used to distinguish a pool from a run or riffle is if two or more of the following conditions apply; the stream channel is wider, deeper, or slower than average.

Riffle: Higher gradient areas where the water is fast and turbulent, water depths are relatively shallow, and substrates are typically coarse. Water surface is visibly broken. In prairie streams, riffles can be comprised largely of gravels and coarse sands.

Run: The water may be moderately fast to slow but the water surface typically appears smooth with little or no surface turbulence. Generally, runs are deeper than a riffle and shallower than a pool.

Glide: Similar to a run, but where there is no visible flow and the channel is too shallow for a pool. Examples include a channelized stream with a uniform depth and flow. This term should not be used in conjunction with pools, riffles, and runs in a natural stream setting.

Substrate Types

Boulder: Large rocks ranging from 250 mm to 4000 mm in diameter (basketball to car size).

Cobble: Rocks ranging in diameter from 64 mm to 250 mm (tennisball to basketball).

Gravel: Rocks varying in diameter from 2 mm to 64 mm (BB to tennisball).

Sand: Inorganic material that is visible as particles and feels gritty between the fingers, .06 to 2.0 mm in size.

Clay: Very fine inorganic material. Individual particles are not visible or are barely visible to the naked eye. Will support a person's weight and retains its shape when compacted.

Bedrock: A solid slab of rock, > 4000 mm in length (larger than a car).

Silt: Fine inorganic material that is typically dark brown in color. Feels greasy between fingers and does not retain its shape when compacted into a ball. A person's weight will not be supported if the stream bottom consists of silt.

Muck: A fine layer of black, completely decomposed vegetative organic matter.

Detritus: Decaying organic material such as macrophytes, leaves, finer woody debris, etc. that may appear similar to silt when very fine.

Sludge: A thick layer of organic matter of animal or human origin, often originating from wastewater.

b) *Embeddedness* – Indicate the percentage to which coarse substrates are surrounded by or covered with fine sediments throughout the reach. Coarse substrates consist of gravel, cobble, and boulders of sizeable extent and consistency to be viable for spawning and habitat for certain species. A few scattered coarse substrates intermixed with sand does not constitute enough viable coarse substrate to be considered for embeddedness. An embeddedness rating of 0% corresponds to very little or no fine sediments surrounding coarse substrates. Check if coarse substrates are overlain with fine sediment by inserting your fingers into the substrate and pulling up the first inch or so of fine material. Coarse substrate material completely surrounded and covered with sediment is considered 100% embedded. If coarse substrates are not present in the reach, check "no coarse substrate".

c) *Siltation* – Indicate the extent that substrates are covered by a silt layer. Silt cover differs from the embeddedness metric in that it considers silt deposition over the entire stream bed and pertains only to fine silt size particles whereas embeddedness evaluates the degree to which sand and other fines are covering coarse substrates only. Low gradient streams often naturally have a high silt load. When evaluating low gradient streams do not penalize the score for siltation unless the condition is exacerbated by anthropogenic sources. The ratings of siltation are as follows:

Silt Free: Substrates are exceptionally clean of silt.

Silt Normal: Silt is deposited in small amounts along the stream margin or is present as a light covering in expected areas that appears to have little functional significance. Low gradient streams where siltation is not exacerbated by anthropogenic sources should be rated as normal.

Silt Moderate: Extensive covering by silts, but with some areas of cleaner substrates (riffles and fast runs).

Silt Heavy: Nearly the entire stream bottom is layered with a significant covering of silt (pools/glides and all but the fastest areas of riffle/runs).

d) *Substrate Types* – Record the number of substrate types present within the reach; either greater than or equal to 4, or less than 4.

e) *Cover Type* – Indicate the types of cover available to fish within the reach (check all that apply). Cover for fish consists of objects or features that provide complete or partial shelter from the stream current or concealment from predators or prey. In order to be considered cover, the water depth must be at least 10 cm where the cover type occurs and the amount of cover should be in sufficient quantity to support associated fish species. Cover types are as follows:

Undercut Banks: Stream banks where the stream channel has cut underneath the bank. The bank could overhang the water surface when water levels are low. The undercut bank must overhang (horizontally) the wetted stream channel a minimum of 15 cm and the bottom of the undercut bank must be no more than 15 cm above the water level in order to be considered cover for fish.

Overhanging Vegetation: Terrestrial vegetation overhanging the wetted stream channel. Vegetation must be no more than 15 cm above the water level to be considered cover for fish.

Deep Pools: Area where the channel is particularly deep, often near a bend. Deep pools are judged relative to the stream size being assessed. As a general rule, a deep pool is at least four times deeper than the shallowest part of the thalweg.

Logs or Woody Debris: Logs, branches, or aggregations of smaller pieces of wood in contact with or submerged in water.

Boulders: Large rocks as described under *Substrate Type* and providing shelter from stream current.

Rootwads: Aggregation of tree roots that extend into the stream and provide concealment or shelter from current.

Oxbows, Backwaters: Remnant of a former channel meander within the floodplain or other adjacent and connected area with little or no current.

Shallows (in slow water): Habitats in shallow slackwater that provide nursery areas for small fish. These areas are often apparent when walking the stream or electrofishing by the presence of small and young of year fish.

Macrophytes: Check the box for macrophytes if the amount or density of plants is sufficient to provide cover for fish and check the box for each type present (i.e. emergent, floating leaf, submergent).

Emergent Macrophytes: Vascular plants that typically have a significant portion of their biomass above the water surface. Examples include cattail, bulrush, and wild rice.

Floating Leaf Macrophytes: Vascular plants with a significant amount of their biomass floating on the water in the form of leaves and flowers. Examples include duckweed and water lily.

Submergent Macrophytes: Vascular plants that have all of their biomass (except flowers) at or below the surface of the water and are of a sufficient density to provide cover for fish. Examples include: coontail, and potamogeton species. Filamentous algae is also included if it is dense enough to provide cover for small fish.

f) *Cover Amount* – Estimate the total percentage of fish cover within the reach. This metric is also assessed relative to stream size. If the channel is completely filled with aquatic vegetation, check the "choking vegetation only" option. Note: A stream that has at least a small raceway or path adequate for fish to navigate through aquatic vegetation is not considered "choking vegetation only."

C.5. Channel Morphology (check the most appropriate category for each)

a) *Depth Variability* – The difference in thalweg depth between the shallowest stream cross section and the deepest stream cross section. The thalweg depth is the deepest point along a stream cross section. Indicate the degree to which the thalweg depths vary within the stream reach. Please note: for very shallow streams that are moderate in width (8 to 10 m), consider whether or not the depth variability is less than what you would expect to find. For example, if the water depth is only 4 inches at the shallowest thalweg point and 20 inches at the deepest, but the stream is overwidened with excess sedimentation, do not score as >4 times.

b) *Channel Stability* – The ability of a stream channel to maintain its bed and banks, without eroding or moving particles downstream. A riffle that forms diagonally across the channel and has a high amount of fine substrates that change location is indicative of an unstable stream bed. Channelized streams often have high bank stability but low bed stability as the substrate is typically comprised of fine materials that are susceptible to moving downstream. The ratings of channel stability are as follows:

High: Channel with stable banks and substrates, little or no erosion of the banks, and little or no bedload within the stream. Artificial channels (i.e. concrete) exhibit a high degree of stability even though they typically have a negative effect on biological communities.

Moderate/High: Channel has the ability to maintain stable riffle, run, and pool characteristics. A minor amount of bank erosion and/or bedload is present in a slightly higher degree than would be expected for natural streams in the region.

Moderate: Channel that exhibits some instability characterized by erosion, bedload, or shows the effects of wide fluctuations in water level.

Low: Channels that have a high degree of bedload and severely eroding banks. A homogenous stream bed characterized by shifting sand substrates has low stability. To score low, the stream has to demonstrate both bank erosion and high bedload.

c) *Velocity Types* – Indicate which flow types are present within the reach (check all that apply). Velocity types are as follows:

Fast: Mostly non-turbulent flow with small standing waves in riffle-run areas, water surface may be partially broken.

Moderate: Non-turbulent flow that is detectable (i.e. floating objects are visibly moved downstream).

Slow: Water flow is detectable, but barely perceptible.

Eddies: Areas of circular motion within the current, usually formed in pools immediately downstream of riffles/runs.

Torrential: Extremely turbulent and fast flow; water surface is broken, usually limited to gorges and dam spillways.

None: Water flow is not detectable.

Interstitial: Water flow that infiltrates a streambed, and moves through gravel substrates in riffle-run areas.

Intermittent: No flow is present, with standing pools separated by dry reaches.

d) *Sinuosity* – Indicate the degree to which the stream meanders. Sinuosity is defined as the ratio of stream channel distance to straight line distance between two points on a stream. For wide streams or rivers it may be necessary to consider a longer stream reach, as the true meander cycle is often not adequately represented in these systems within the sampling reach. The ratings of sinuosity are as follows:

Excellent: Streams exhibiting a high degree of meandering. Presence of 2 or more well defined bends (deep areas outside and shallow areas on the inside of the bend).

Good: Stream with more than 2 bends, with at least one well defined bend.

Fair: Channel with 1 or 2 poorly defined outside bends, or slight meandering within a modified reach. Channelized reaches that demonstrate some degree of meandering are considered fair.

Poor: Straight channel with no bends in the reach. Channelized streams or ditches are often rated as poor.

e) *Pool Width/Riffle Width* – Indicate the ratio of pool width to riffle width within the reach. If there is no riffle or pool within the sampling reach, select "no riffle" and/or "no pool". If the sampling reach is predominantly impounded by an anthropogenic structure (i.e. dam) select "impounded". Impounded characteristics within the sampling reach caused by beaver dams or other natural occurrences are not penalized.

f) *Channel Development* – Indicate the complexity of the stream channel or the degree to which the stream has developed different channel types, creating sequences of riffles, runs, and pools. Consider the stream size when evaluating the channel development of a stream reach. In small streams; riffles, runs, and pools should occur more frequently within the sampling reach. For large streams or rivers it may be necessary to consider a longer stream reach, as the true meander cycle is often not adequately represented in these systems within the sampling reach. Additionally, complex channel development on a large river may not be as distinct or pronounced as on a smaller riverine system. The ratings of channel development are as follows:

Excellent: Well defined riffles present with gravel, cobble, or boulder substrates; pools vary in depth, and there is a clear transition between pools, riffles, and runs. Multiple sequences of riffles, runs, and pools are present within the reach. In prairie streams, riffles can be comprised only of gravels and coarse sands.

Good: Riffles, runs, and pools are all present, but with less frequency, and are less distinct. Riffles have large substrates (gravel, rubble, or boulder), and pools have variation in depth.

Fair: Riffles are absent or poorly developed (shallow with sand and fine gravel substrates). Some deeper pools may exist, but transitions are generally not abrupt.

Poor: Riffles are absent; pools if present are shallow or lack variation in depth. Channelized streams generally have poor channel development. Some wetland streams without riffles can be rated as "poor" even if the condition is natural.

g) *Modifications* – Indicate any modifications made within or along the stream or river reach (check all that apply). Modification types are as follows:

Leveed: A stream or river reach in which a levee or levees have been constructed. A levee is an embankment or floodbank that is an artificially constructed fill or wall, which regulates water levels. It is usually earthen and often parallel to the course of a river in its floodplain. They are often constructed to prevent flooding or to slow natural course changes in a waterway.

Dredged: Excavation activity or operation usually carried out at least partly underwater with the purpose of gathering bottom sediments and disposing of them at a different location. This technique is often used to keep waterways navigable or facilitate the movement of water.

Bank Shaping: Excavation activity that involves the removal of soil to reduce the slope of stream banks to a more stable angle.

Railroad Ties: Railroad beds and other railroad infrastructure are common along many waterways, especially larger navigational rivers. Railroad ties have also been commonly used as waterfront retaining walls or for stream bank stabilization.

Cemented: A stream bed or bank that has been reinforced with cement. Typically this type of modification only occurs in very urbanized areas where any movement of the stream bed or bank is greatly discouraged.

Bulkheads: Sheet steel used for erosion control, seawall construction, soil stabilization, construction, bridge foundations and cofferdams, and to armor stream banks. Often used as a retaining wall along a waterfront or in large navigational rivers to allow barges or freighters adequate shore-to-shore navigation.

Rip Rap: Stream reaches that have rock material used to armor streambanks, bridge abutments, pilings and other shoreline structures against scour, water or ice erosion. Rip rap is made from a variety of rock types and occasionally concrete rubble from building and paving demolition.

Const. Island: Constructed island(s) - in large navigational rivers man-made islands are often created or re-created to provide habitat or dispose of dredge material.

Wood Pilings: A column of wood or logs that have been driven into the stream bed or bank. Typically this was done to provide support for a structure or bank protection.

C.5. Aquatic Vegetation: Indicate presence and abundance of aquatic vegetation present within the wetted width of the stream channel as follows: Abundant=[3]; Moderate=[2]; Sparse=[1].

a) *Beneficial Aquatic Vegetation* – Indicate the presence and abundance of beneficial aquatic vegetation including; pond lilies (*Nymphaea*/*Nuphar*), sedge (*Cyperaceae*), wild celery (*Vallisneria*), wild rice (*Zizania*), pond weed (*Potamogeton*), bulrush (*Scirpus*), waterweed (*Elodea*), coontail (*Ceratophyllum*), and water Cress (*Nasturtium*).

b) *Invasive and Negative Aquatic Vegetation* – Indicate the presence and abundance of invasive and negative aquatic vegetation including; Eurasian milfoil (*Myriophyllum*), purple loosestrife (*Lythrum*), reed canary (*Phalaris*), cattails (*Typha*), duckweed (*Lemna*), algae (floating mats), algae (planktonic), and algae (benthic).

If no aquatic vegetation is present, or not in sufficient density or quantity to provide cover, check the box for "no vegetation noted". Provide any additional comments regarding quantity and quality of vegetation in the space provided.

D. Scoring the MSHA

Following are instructions on how to score the completed MSHA form. The maximum score is 100.

D.1. Surrounding Land Use: Average the scores of the two banks. For example, if residential/park was the land use selected on the left bank, and forest, wetland, prairie, shrub was selected on the right bank, then the land use score would be (2+5)/2=3.5. In the case of two land uses selected for one bank, the two scores are averaged together, and then averaged with the score of the other bank. The maximum land use score is 5.

D.2. Riparian Zone: Average the scores of the two banks for Riparian Width, Bank Erosion, and Shade; then add the three scores. For example, if moderate riparian width (3) was chosen for the left bank and very narrow (1) on the right bank; little bank erosion (4) on the left bank, and moderate (3) on the right bank; heavy shade (5) on the left bank, and substantial (4) on the right bank; the riparian zone score would be: [(3+1)/2] + [(4+3)/2] + [(5+4)/2] = 10. The maximum riparian score is 14.

D.3. Instream Zone

a) *Substrate, Embeddedness, Siltation, and Substrate Types* – Add the scores of substrate, embeddedness, siltation and substrate type. The substrate score is calculated by adding the two substrate scores for each channel type, multiplying by the percentage of the channel type, and adding the scores for each channel type present. If only one substrate type is chosen because it makes up more than 80% of the channel type, multiply the one substrate score by 2 before multiplying it by the percentage of the channel type. The maximum substrate score is 28.

b) *Cover Type and Cover Amount* – Add the scores of cover type and cover amount. The cover type score can range from 0 to 9. The highest macrophyte score is 1, even if all three macrophyte types are present. The maximum cover score is 18.

D.4. Channel Morphology: Add the scores of Depth Variability, Channel Stability, Velocity Types, Sinuosity, Pool Width/Riffle Width, Channel Development, and Modifications. The modifications score can range from -8 to 3. The maximum channel morphology score is 35.

D.5. Total Score: Add the Surrounding Land Use, Riparian Zone, Instream Zone, and Channel Morphology scores together to get the total MSHA score for the site. The maximum MSHA score is 100.

MPCA STREAM HABITAT ASSESSMENT (MSHA)

(revised April 2014)

1. Stream Documentation

Field Number: _____ Stream Name: _____ Date: _____

Person Scoring: _____ Water Level (circle one): Flood / High / Normal / Low / Interstitial

MSHA SCORE _____ **Max=100**

2. Surrounding Land Use (Streams) or Floodplain Quality (Rivers)

(check the most predominant or check two and average scores) **[L=left bank/R =right bank, facing downstream]**

L	R			L	R		
☐	☐	Forest, Wetland, Prairie, Shrub	[5]	☐	☐	Diked Wetland	[2]
☐	☐	Old Field/Hay Field	[3]	☐	☐	Urban/Industrial	[0]
☐	☐	Fenced Pasture	[2]	☐	☐	Open Pasture	[0]
☐	☐	Residential/Park	[2]	☐	☐	Mining/Construction	[0]
☐	☐	Conservation Tillage, No Till	[2]	☐	☐	Row Crop	[0]

Land Use _____ **Max=5**

3. Riparian Zone (check the most predominant)

A. Riparian Width

L	R			
☐	☐	Extensive	> 100 m	[5]
☐	☐	Wide	50-100 m	[4]
☐	☐	Moderate	10-50 m	[3]
☐	☐	Narrow	5-10 m	[2]
☐	☐	Very Narrow	1-5 m	[1]
☐	☐	None		[0]

B. Bank Erosion

L	R			
☐	☐	None		[5]
☐	☐	Little	5-25%	[4]
☐	☐	Moderate	25-50%	[3]
☐	☐	Heavy	50-75%	[1]
☐	☐	Severe	75-100%	[0]

C. Shade

L	R			
☐	☐	Heavy	>75%	[4]
☐	☐	Substantial	50-75%	[3]
☐	☐	Moderate	25-50%	[2]
☐	☐	Light	5-25%	[1]
☐	☐	None		[0]

Riparian _____ **Max=14**

4. Instream Zone

A. Substrate (check two for each channel type)

	[10] Boulder	[9] Cobble	[8] Gravel	[6] Sand	[5] Clay	[5] Bedrock	[2] Silt	[1] Muck	[1] Detritus	[0] Sludge	Channel Type %
Pool	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	_____
Riffle	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	_____
Run	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	_____
Glide	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	_____
Note	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Presence

B. Embeddedness

☐	None	[5]
☐	Light 25-50%	[3]
☐	Moderate 50-75%	[1]
☐	Severe 75-100%	[-1]
☐	No coarse substrate	[0]

C. Siltation

☐	Silt Free	[1]
☐	Silt Normal	[0]
☐	Silt Moderate	[-1]
☐	Silt Heavy	[-2]

D. Substrate Types

☐	≥4	[2]
☐	<4	[0]

Substrate _____ **Max=28**

E. Cover Type (check all that apply)

☐	Undercut Banks	[1]	☐	Oxbows, Backwaters [1]
☐	Overhanging Vegetation	[1]	☐	Shallows (in slow water) [1]
☐	Deep Pools	[1]	☐	Macrophytes [1]
☐	Logs or Woody Debris	[1]	☐	Submergent
☐	Boulders	[1]	☐	Emergent
☐	Rootwads	[1]	☐	Floating Leaf

F. Cover Amount (check one)

☐	Extensive >50%	[9]
☐	Moderate 25-50%	[7]
☐	Sparse 5-25%	[3]
☐	Nearly Absent	[0]
☐	Choking Vegetation only	[-1]

Cover _____ **Max=18**

5. Channel Morphology

A. Depth Variability

☐	Greatest Depth >4X Shallow Depth	[4]
☐	Greatest Depth 2-4X Shallow Depth	[2]
☐	Greatest Depth <2X Shallow Depth	[0]

B. Channel Stability

☐	High	[9]
☐	Moderate/High	[6]
☐	Moderate	[3]
☐	Low	[0]

C. Velocity Types (check all that apply)

☐	Fast	[1]
☐	Moderate	[1]
☐	Slow	[1]
☐	Eddies	[1]
☐	Torrential	[-1]
☐	None	[-1]
☐	Interstitial	[-1]
☐	Intermittent	[-2]

D. Sinuosity

☐	Excellent	[4]
☐	Good	[3]
☐	Fair	[2]
☐	Poor	[0]

E. Pool Width/Riffle Width

☐	Pool Width > Riffle Width	[2]
☐	Pool Width = Riffle Width	[1]
☐	Pool Width < Riffle Width	[0]
☐	No Riffle	[0]
☐	No Pool	[0]
☐	Impounded	[-2]

F. Channel Development

☐	Excellent	[9]
☐	Good	[6]
☐	Fair	[3]
☐	Poor	[0]

G. Modifications (check all that apply)

☐	Leveed	[-1]	☐	Rip Rap [1]
☐	Dredged	[-1]	☐	Const. Island [1]
☐	Bank Shaping	[-1]	☐	Wood Pilings [1]
☐	Railroad Ties	[-1]		
☐	Cemented	[-2]		
☐	Bulkheads	[-2]		

Channel _____ **Max=35**

Aquatic Vegetation (indicate as follows for observed abundance: Abundant=[3]; Moderate=[2]; Sparse=[1])

A. Beneficial Aquatic Vegetation

____ Pond Lilies (*Nymphaea*/*Nuphar*)	____ Sedge (*Cyperaceae*)	____ Wild Celery (*Vallisneria*)
____ Wild Rice (*Zizania*)	____ Pond Weed (*Potamogeton*)	____ Bulrush (*Scirpus*)
____ Waterweed (*Elodea*)	____ Coontail (*Ceratophyllum*)	____ Water Cress (*Nasturtium*)

B. Invasive and Negative Aquatic Vegetation

____ Eurasian Milfoil (*Myriophyllum*)	____ Purple Loosestrife (*Lythrum*)	____ Reed Canary Grass (*Phalaris*)
____ Cattails (*Typha*)	____ Duckweed (*Lemna*)	____ Algae (Floating Mats)
____ Algae (Planktonic)	____ Algae (Benthic)	

No Vegetation Noted ☐

Comments: _____

Red River Basin River Watch

Adapted MPCA Stream Monitoring Protocol

Stream Reach Determination: To obtain the reach length multiply the mean stream width (MSW) by 35, round to the nearest meter. Divide by 4 to determine the distance to proceed upstream and downstream from the x-site. The minimum and maximum reach length is 75 m and 250 m, respectively.

Supplies (Per Group)

D-frame dipnets with 500 micron mesh nets
Cloth tape
Forceps (plastic)
Toilet scrub brush
Large plastic funnel
Flags
A bucket with 500 micron sieves
A 5 gallon bucket
Pencil (no ink)
Rite-in-the-rain paper for labels
95% Ethanol
Plastic wide-mouth one liter screw top jar
Rain-gear (optional)
Chest-high waders (optional)

Method: Collect a composite sample from up to five different habitat types such that it is representative of the invertebrate community for a particular reach. The method is qualitative and does not require a rigorous sampling design, but rather good judgment. Target 50 animals per habitat. Each group will end up with a single composite sample ideally packed in one jar for processing. Depending on the size of the class, students should work in groups of three (fewer if small class or up to four for large classes).

1. Walk from upstream to downstream identifying how many of the following five habitats exist: hard bottom, macrophytes, undercut banks, snags, and leaf packs. Place a flag at the upstream, midstream, and downstream starting area.

2. Each group will take 10 samples, divided equally among however many habitats exist. Start sampling downstream and work upstream. The way a sample is taken will differ depending on the habitat type as listed below. Always work to not take excess materials (e.g., sand, leaves, wood, rocks, and etc.).

3. Once all 10 samples have been collected, thoroughly rinse them into the plastic jar. Drain and squeeze out as much water as you can being careful not to lose animals. Add a label inside of the jar on Rite-in-the-Rain paper with pencil. Add Ethanol to a final concentration of between 70-80%. Students can eyeball about 1 part sample to four parts EtOH. If they need more room they may need to use more than one jar.

Habitat Descriptions & Sampling Methods

Hard bottom (riffle/cobble/boulder): This category is intended to cover all hard, rocky substrates, not just riffles; however, the surfaces of large boulders and areas of flat, exposed bedrock are generally quite unproductive, avoid including these habitats in the sampling area if possible. The D-net should be placed firmly and squarely on the substrate downstream of the area to be sampled. Ideally, if the water is shallow enough, the area directly in front of the net should be disturbed with the hands, taking care to scrub large rocks off directly into the net. If the water is too deep for this, kicking the substrate in front of the net is adequate.

Aquatic Macrophytes (submerged/emergent vegetation): Include all submerged vegetation but only submersed portions of emergent vegetation. Plants should be sampled sweeping them horizontally and vertically until sampler feels like they have sampled representatively. The idea is to knock invertebrates off the plants. You do not want to take plant material home. If the net fills with weeds, the weeds should be hand washed vigorously or jostled in the net for a few moments and then discarded.

Undercut Banks (undercut banks/overhanging veg): This category is meant to cover in-bank or near-bank habitats, shaded areas away from the main channel that typically are buffered from high water velocities. Sampling should consist of upward thrusts of the net, beating the undercut portion of the bank or the overhanging vegetation, so as to dislodge any clinging organisms.

Snags (snags/rootwads) Snags include any piece of large woody debris found in the stream channel. Given their variable nature, there is not one best method for sampling snags. Using something like a toilet brush or kitchen brush works well for large pieces of wood, whereas kicking and beating with the net works best for masses of smaller branches. The person taking the sample must determine the best method for each particular situation.

Leaf Packs: Leaf packs are dense accumulations of leaves. They are found in deposition zones, generally near stream banks, around logjams, or in current breaks behind large boulders. One square foot of leaf pack surface area that has two cubic feet of leaf underneath should be sampled near the surface. In most situations leaf packs will not be dominate enough to be included in a sample. If leaf packs are sampled, it is suggested that time be spent streamside washing invertebrates off of leaves and discarding the leaves, as a leaf pack sample can easily become overwhelmingly large.

Macroinvertebrate Family Identification

Common Name	Family Name	Tolerance Value	Identification	Photo
Dobsonflies	Corydalidae	0	• large head • filaments on sides of body • forked claws on end of legs • two pairs of claws on end of abdomen	
Stoneflies	Perlidae	1	• Two tails • Bushy gills on underside of thorax • Long antennae	
Dragonfly Darner	Aeshnidae	3	• No tails • No visible gills • Large eyes • Long cylindrical body	
Craneflies	Tipulidae	3	• Worm-like • No legs • Head usually concealed • Terminal gill filaments	
Minnow mayflies	Baetidae	4	• Antennae at least 2x length of head • Lateral oval-shaped gills • 2 or 3 tails	
Flathead mayflies	Heptageniidae	4	• Flat head and body • Lateral gills • 2 or 3 tails	
Net-spinner caddisflies	Hydropsychidae	4	• Never has a case • Branched gills on underside of abdomen • Brush of hairs at end of abdomen • All three thoracic segments sclerotized (brown shell)	
Long-horned Case-maker Caddisflies	Leptoceridae	4	• Antennae length at least 6x width • Only first 2 thoracic segments sclerotized (brown shell) • Cone-shaped case of stones or wood • Usually stripes on head	

Photo credits: Chironomidae Research Group, University of Minnesota, St. Paul

Riffle Beetles	Elmidae	4	• Single claw at the end of each leg • Antennae shorter than head • Body cylindrical	
Scuds	Gammaridae	4	• Freshwater shrimp • 7 pairs of segmented legs • White/grayish color	
Broad-wing Damselflies	Calopterygidae	5	• Long antennae • Gills on end of body • Large scoop-mouth	
Aquatic moths	Pyralidae	5	• Dark head and fleshy body • 6 legs plus 8 hook rings on underside • With or without filaments on sides of body	
Non-biting midges	Chironomidae (other)	6	• Worm-like • Tiny • Head visible • Not blood-red (see below) • Two tiny front legs	
Black flies	Simuliidae	6	• Long fans on mouth • Tiny • Circle of hooks on end of body • Two tiny front legs	
Square-gilled mayflies	Caenidae	7	• Square-shaped gills on abdomen • Three tails • Antennae longer than head	
Bloodworm	Chironomini	8	• Blood-red body • Worm-like • Tiny • Head visible • Two tiny front legs	
Narrow-winged damselflies	Coenagrionidae	9	• Feather-like gills on end of abdomen • Spoon-shape mouth underneath body • Tiny antennae	
Skimmer Dragonflies	Libelluidae	9	• No gills visible • Spoon-shape mouth underneath body • Tiny antennae • Wide body and head	

Photo credits: Chironomidae Research Group, University of Minnesota, St. Paul

Hilsenhoff Family Biotic Index (FBI)

The FBI is calculated by multiplying the number in each family by the tolerance value for that family (Table 1), summing the products, and dividing by the total arthropods in the sample (Hilsenhoff 1988).

Use the numbers from Table 1 and Table 2 to complete the equation below.

$$\textbf{HBI} = \frac{\textbf{Total}^{(nxa)}}{\textbf{Total}^{(n)}} : \quad \_\_\_\_ = \_\_\_\_ \_\_\_\_ \_\_\_\_$$

Family Biotic Index | Water Quality | Degree of Organic Pollution

Table 1. Tolerance values for families of stream arthropods in the western Great Lakes region (Hilsenhoff 1988).

Order	Family	Tolerance Value (a)	Tally (n)	Product (n x a)
Plecoptera	Perlidae	1		
Ephemeroptera	Baetidae	4		
	Caenidae	7		
	Heptageniidae	4		
	Leptophyphidae	4		
Odonata	Aeshnidae	3		
	Calopterygidae	5		
	Coenagrionidae	9		
	Libelluidae	9		
Trichoptera	Hydropsychidae	4		
	Hydroptilidae	4		
	Leptoceridae	4		
Megaloptera	Corydalidae	0		
Lepidoptera	Pyralidae	5		
Coleoptera	Elmidae	4		
Diptera	Ceratopogonidae	6		
	Chironomini (blood-red)	8		
	Chironomidae (other)	6		
	Empididae	6		
	Psychodidae	10		
	Simuliidae	6		
	Tabanidae	6		
	Tipulidae	3		
Amphipoda	Gammaridae	4		
Isopoda	Asellidae	8		
			Total$^{(n)}$:	**Total$^{(nxa)}$:**

Table 2. Evaluation of water quality using the family-level biotic index.

Family Biotic Index	Water Quality	Degree of Organic Pollution
0.00-3.75	Excellent	Organic pollution unlikely
3.76-4.25	Very Good	Possible slight organic pollution
4.26-5.00	Good	Some organic pollution probable
5.01-5.75	Fair	Fairly substantial pollution likely
5.76-6.50	Fairly poor	Substantial pollution likely
6.51-7.25	Poor	Very substantial pollution likely
7.26-10.00	Very poor	Severe organic pollution likely

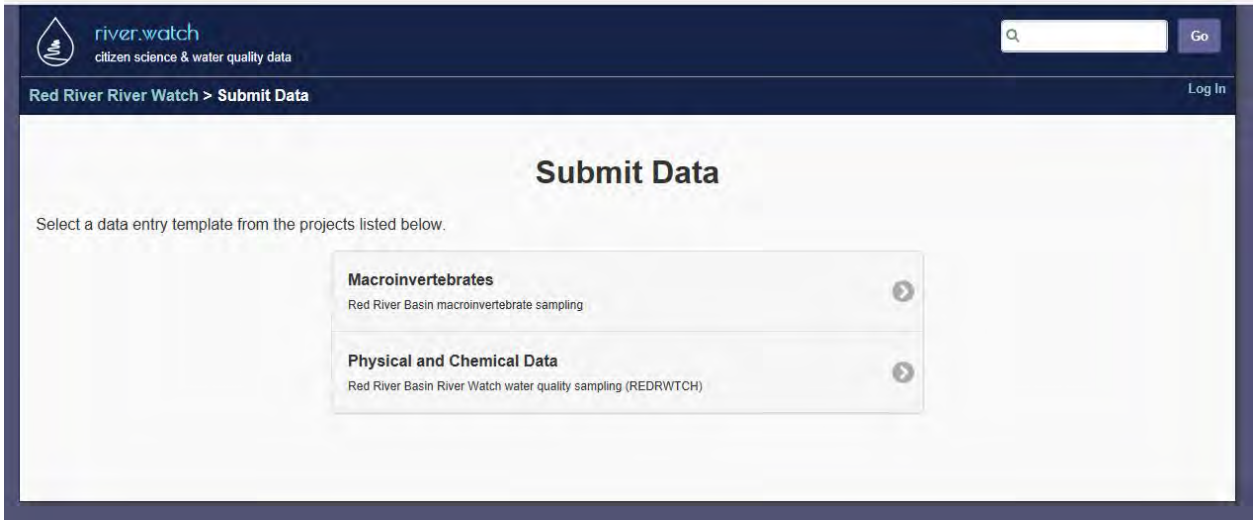
Hilsenhoff, William L. 1988. Rapid Field Asessment of Organic Pollution with a Family-Level Biotic Index. Journal of the North American Benthological Society, Vol. 7, No. 1, pp. 65-68.

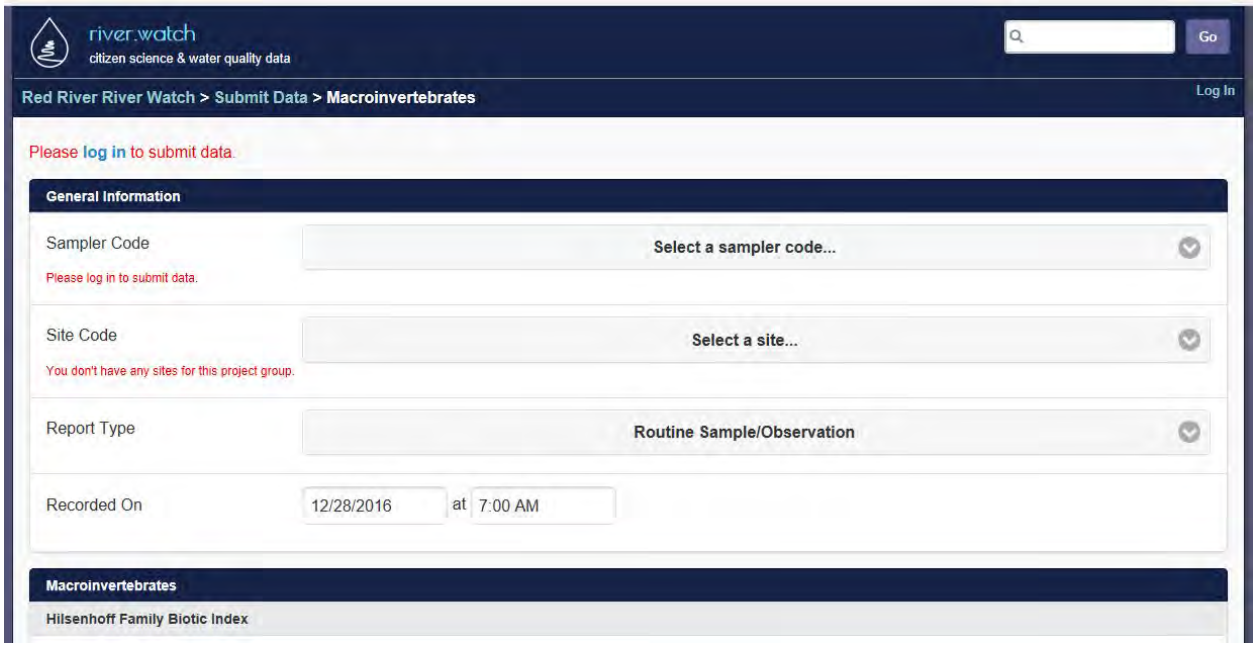
River Watch Macroinvertebrate Data Portal

The macroinvertebrate data portal was created to provide students access to monitoring and identification tools and to allow for data entry. The portal can be accessed at:

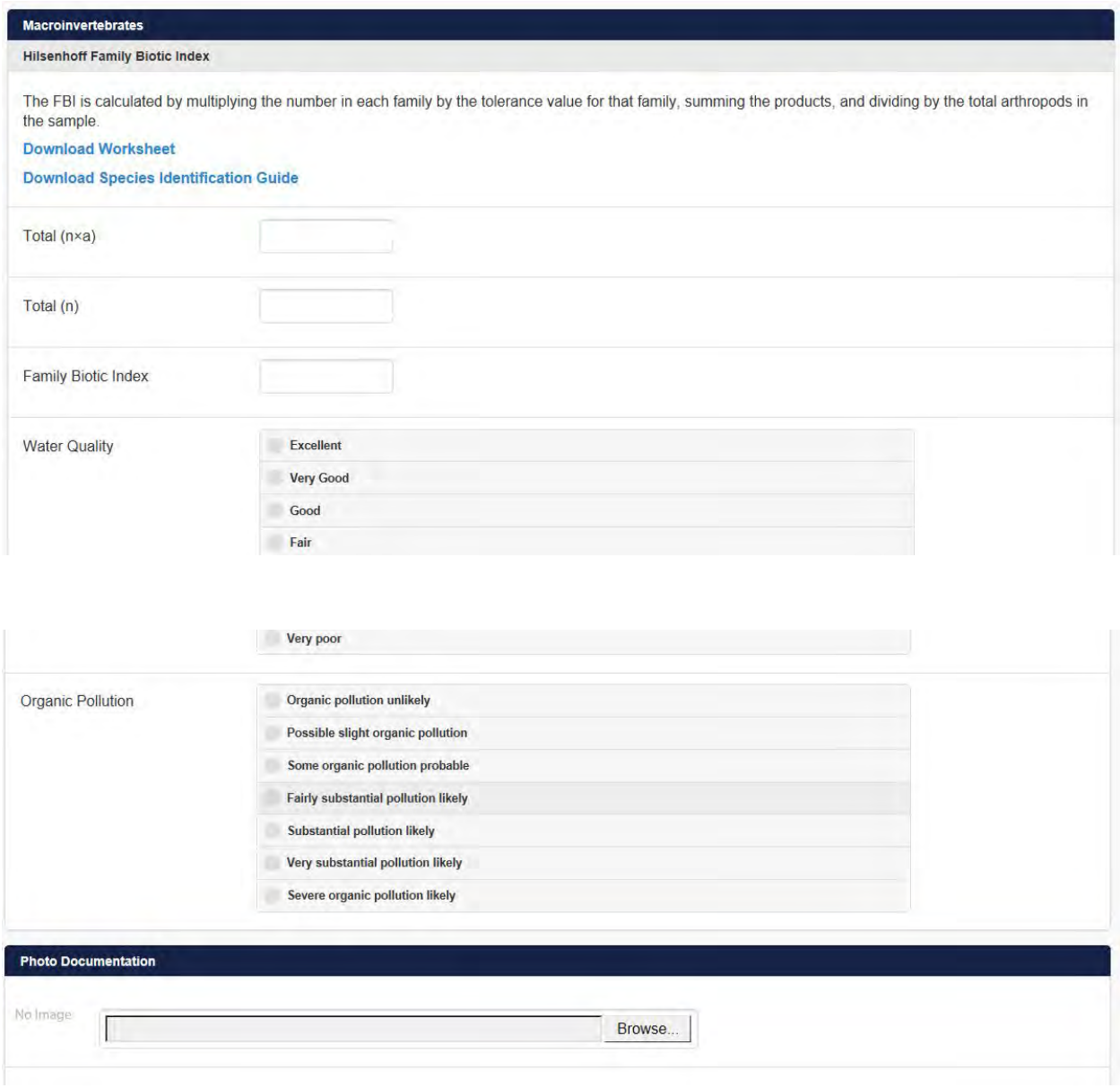
https://river.watch/red-river/projects?target=/reports/new

Screen Shot Portal Overview





Screen Shot Portal Overview Continued



Bio Ref Site Research_RW Macro Project 2016

FieldNum	WBName	Location	HUC8_name	Drain Area (Sq. Mi.)	Gradient (m/km)	Channel Status	LAT8xDD	LON8xDD
05RD005	Unnamed trib. to Wild Rice River	Downstream of County Route 31, 1/4 mile N of Fossum	Wild Rice River	59.7	2.2	natural	47.24283388640	-96.18150628180
05RD115	Wild Rice River	Upstream of CR29, NE side of Twin Valley	Wild Rice River	926.3	1.2	natural	47.26451942870	-96.24462129190
05RD101	Ruffy Brook	5 miles SE of Clearbrook, upstream of CR 79	Clearwater River	26.1	2.6	natural	47.66835144300	-95.33515947060
05RD013	Rabbit River	upstream of CR 158, ~10 miles SE of Breckenridge	Bois de Sioux River	319.1	0.0	natural	46.12574371560	-96.52817627720
05RD080	Red Lake River	1.5 mi. W. of Crookston, MN; downstream of Alt. 75	Red Lake River	5354.6	0.2	natural	47.77645129410	-96.64861307710
05RD110	Buffalo River	In Hawley just upstream of the Hwy 10 Bridge	Buffalo River	315.9	0.4	channelized	46.87927658710	-96.31126412330
05RD097	Mud River	Downstream of 360th Ave NE, 4 mi. NW of Grygla	Thief River	157.4	0.5	natural	48.32421980980	-95.70371258610
05RD119	Whiskey Creek	1 mi. downstream of CR 21, 6.5 mi W of Barnesville	Buffalo River	84.4	0.4	channelized	46.67707648780	-96.54575338200
05RD125	Mustinka River	Just W of Wheaton	Mustinka River	793.0	0.6	channelized	45.79493964560	-96.54068752990
07RD012	Hay Creek	Upstream of 150th St, 2 mi. S of Downer	Buffalo River	87.8	0.8	channelized	46.72333000000	-96.48253000000
09RD003	Hay Creek	Downstream of 265th St N, 3.5 mi. NE of Hawley	Buffalo River	44.2	2.3	natural	46.89855000000	-96.24940000000
09RD021	Whiskey Creek	Upstream of CR 56, 2 mi. NW of Barnesville	Buffalo River	69.1	1.7	channelized	46.66166667000	-96.46120000000
09RD022	Spring Creek	Downstream of 170th St S, 2 mi SE of Downer	Buffalo River	9.2	3.1	natural	46.73660000000	-96.44240000000
09RD023	Hay Creek	Upstream of 110th Ave S, 1.5 mi. SE of Downer	Buffalo River	75.2	1.4	channelized	46.73288333000	-96.46080000000
09RD039	Buffalo River	Downstream of 28th Ave N, 5.5 mi. NE of Hawley	Buffalo River	257.2	0.2	natural	46.90295000000	-96.24581667000
09RD040	Buffalo River	Downstream of 240th St N, 0.5 mi E of Hawley	Buffalo River	308.6	1.8	natural	46.88115000000	-96.30461667000
09RD042	Buffalo River	Downstream of County Hwy 23, 4.5 mi. SW of Hawley	Buffalo River	360.1	3.6	natural	46.86076667000	-96.40885000000
09RD028	Trib. to Buffalo River	Upstream of CR 115, 1 mi. NE of Hawley	Buffalo River	6.5	2.3	channelized	46.89271667000	-96.29623333000
94RD002	Rabbit River	Upstream of 480th St, 2.25 mi W of River Center	Bois de Sioux River	116.3	0.0	natural	46.07846000000	-96.35468000000
10RD005	Rabbit River	Upstream of Hwy 75, 5 mi. NW of Campbell	Bois de Sioux River	303.4	0.2	natural	46.11101000000	-96.48918000000
10RD032	Mustinka River	Upstream of Hwy 75, 1 mi. N of Wheaton	Mustinka River	761.3	0.1	channelized	45.82189000000	-96.48749000000
10RD036	Mustinka River	Upstream of CR 11, 3.5 mi. E of Norcross	Mustinka River	171.3	0.1	natural	45.87294000000	-96.12934000000
10RD045	Eighteen Mile Creek	Upstream of CR 7, 2 mi. SW of Wheaton	Mustinka River	50.1	0.6	natural	45.78863000000	-96.53017000000
10RD050	Trib. to Five Mile Creek	Upstream of 320th Ave, 3.5 mi W of Herman	Mustinka River	65.0	0.5	channelized	45.80345000000	-96.21206000000
10RD078	Judicial Ditch 4	Upstream of 750th Ave, 2 mi. W of Graceville	Mustinka River	16.8	0.9	channelized	45.56890000000	-96.47502000000
11RD060	Mud River	Upstream of 390th Ave NE, 1 mi. W of Grygla	Thief River	135.9	0.9	channelized	48.30527000000	-95.63455000000
12RD004	Red Lake River	Downstream of Hwy 75, 0.5 mi W of Crookston	Red Lake River	5352.6	0.2	natural	47.77666000000	-96.63169000000
12RD013	Red Lake River	Downstream of CSAH 11, 5.5 mi. E of Crookston	Red Lake River	5274.6	0.3	natural	47.78680000000	-96.49015000000
12RD108	Red Lake River	1 mi. upstream of Crookston	Red Lake River	5347.9	0.1	natural	47.76732000000	-96.57914000000
12RD112	Red Lake River	1.5 mi. downstream of Crookston	Red Lake River	5355.1	0.0	natural	47.78514000000	-96.65227000000
94RD513	Red Lake River	Downstream of Woodland Ave, in Crookston	Red Lake River	5351.4	0.0	natural	47.77768000000	-96.60789000000
12RD013	Red Lake River	Downstream of CSAH 11, 5.5 mi. E of Crookston	Red Lake River	5274.6	0.3	natural	47.78680000000	-96.49015000000
12RD108	Red Lake River	1 mi. upstream of Crookston	Red Lake River	5347.9	0.1	natural	47.76732000000	-96.57914000000
14RD234	Ruffy Brook	Downstream of 480th St, 3 mi. NE of Clearbrook	Clearwater River	42.5	3.0	natural	47.71777000000	-95.37674000000
14RD235	Silver Creek	Upstream of CR 74, 1 mi. W of Clearbrook	Clearwater River	16.3	2.1	natural	47.68739000000	-95.45124000000
14RD011	Unnamed creek	Upstream of CR 31, 4 mi. SE of Twin Valley	Wild Rice River	59.1	3.0	natural	47.23714000000	-96.17810000000
14RD015	Coon Creek	Upstream of CR 28, 3 mi. W of Twin Valley	Wild Rice River	45.9	2.6	natural	47.26363000000	-96.34169000000
14RD041	Wild Rice River	Downstream of Hwy 32, in Twin Valley	Wild Rice River	931.7	0.8	natural	47.28065000000	-96.27982000000
14RD044	Coon Creek	Upstream of 355th St, 3.5 mi. SW of Twin Valley	Wild Rice River	25.1	2.1	natural	47.23780000000	-96.32618000000
14RD080	Coon Creek	Upstream of 170th Ave, 3 mi. W of Twin Valley	Wild Rice River	32.6	2.1	natural	47.25197000000	-96.32817000000
05RD115	Wild Rice River	Upstream of CR29, NE side of Twin Valley	Wild Rice River	926.3	1.2	natural	47.26451942870	-96.24462129190
14RD303	Ruffy Brook	Upstream of CR 3, 3 mi. NE of Leonard	Clearwater River	33.6	4.2	natural	47.67088000000	-95.33768000000
14RD015	Coon Creek	Upstream of CR 28, 3 mi. W of Twin Valley	Wild Rice River	45.9	2.6	natural	47.26363000000	-96.34169000000
14RD014	Mashaug Creek	Upstream of CR 160, 1 mi. NE of Heiberg	Wild Rice River	68.2	0.7	natural	47.29863000000	-96.25765000000
15EM098	Silver Creek	Downstream of CSAH 6, 1 mi. SW of Clearbrook	Clearwater River	14.2	3.1	natural	47.67766090410	-95.44739832900

International Water Institute River Explorers 2016 Summary Report

During calendar year 2016, IWI staff scouted a total of 203 river miles which included seven different rivers on seventeen separate dates as identified in the table below. The primary purposes of the scouting trips was to document watershed conditions and assess safety for river kayaking trips planned with high school River Watch teams. General recreation suitability was assessed for some river reaches due to increased public interest in kayaking rivers in the Red River Basin. A more detailed summary of river reaches covered, conditions (erosion, tree snags, fence barriers, river access), flow levels, and trip notes is included as a separate document.

River Explorers Scouting Trips Summary - 2016		
Watershed	**Waterbody**	**Miles**
Middle Snake Tamarac	Middle R	9.5
Middle Snake Tamarac	Tamarac R	6.0
Red Lake	Clearwater R	32.1
Red Lake	Lost R	8.4
Red Lake	Red Lake R	64.8
Sand Hill	Sand Hill R	42.5
Wild Rice	Wild Rice R	39.7
TOTAL		**203.0**

Several reaches were paddled more than once to assess conditions at different water levels. It was an unusual year in that many of the rivers had low spring runoff and spring peak flows compared to higher flows later in the year due to higher than normal rain events from June into the fall.

Contact was made primarily with Watershed District and Soil and Water Conservation District personnel when river trips were planned to determine if there were any particular conditions to be aware of to look for or document. It was found that the best opportunity for documenting conditions was during the scouting trips by IWI staff rather than when student trips were actually taken due to the ability of staff to focus on conditions on scouting trips versus needing to focus more on safety and paddling skill development when student trips were taken. Trip photos have been shared with resource managers in the respective watersheds but as yet no standard method or centralized location has been decided upon for ongoing sharing and access. The photos are geo-tagged and some have been developed into Google Earth kmz files but Soil and Water Conservation District offices are not allowed to use Google Earth which is an unfortunate barrier to efficient sharing of this photo documentation. An example of a Google Earth kmz file link is included as example of geo-tagged photo documentation. Photo sharing via Flickr accounts, ESRIs story maps, and cloud storage are some of the options also being considered.

River Explorer kayak trips were taken with seven schools in 2016, involving 78 total participants paddling a total of 255 river miles on seven individual reaches of six different rivers in four separate watersheds in the Minnesota portion of the Red River Basin. The schools, rivers and watersheds involved, miles and total participants are summarized in the table below. Trip

planning documents were prepared for these trips and are included as separate documents. Most trip planners include post-trip notes and observations from students and staff. Several news releases, also included separately, were prepared and submitted for publication in local weekly or daily newspapers for most of the trips. The trips with representative photos were included in the June and October 2016 IWI River Rendezvous newsletters, available online at http://www.iwinst.org/education/resources/newsletter.

IWI River Watch Team Participants in River Explorer Kayak Trips - 2016

Date	Group Name	Total Participants	Watershed	Water Body	Miles	Total Miles
4/29/2016	WarrenAlvaradoOslo RW	11	Snake	Snake R	4.4	48
5/20/2016	Marshall Co.Central RW	11	Red Lake	Thief R	5	55
6/6/2016	Clearwater-Gonvick RW	9	Red Lake	Clearwater R	3.8	34
7/19/2016	Red Lake Falls RW	7	Red Lake	Red Lake R	4.8	34
8/1/2016	Fisher RW	7	Sand Hill	Sand Hill R	3.3	23
9/19/2016	Norman Co. East RW	9	Wild Rice	Wild Rice R	3.6	32
9/28/2016	Crookston RW	7	Red Lake	Red Lake R	4.0	28
	TOTAL	**78**			**28.9**	**255**

Photos and notes from scouting and student trips were also shared on the IWI Facebook page, https://www.facebook.com/InternationalWaterInstitute/, to raise awareness of river conditions and recreation potential of rivers in the Red River Basin. The Red Lake Watershed District also shared student trips on their Facebook page and the Sand Hill Watershed District set up a separate Facebook page, https://www.facebook.com/SandhillRiverKayaking/?fref=ts, for Sand Hill River kayaking due to its rapidly expanding popularity in the Fertile, MN area.

Clearbrook-Gonvick River Explorers ~ Clearwater River

Date: June 6, 2016

Time: 10:00 a.m. to 1:30 p.m. plus follow-up lunch (on-water paddling time of approx. 2 hours)

Location: Clearwater River from just below outlet of Clearwater Lake to Clearwater CoRd 14.

Participants/Phone Contact: Clearbrook-Gonvick RW Team (Nathanael Dahl, Mike Gray, Austin Kindem, and Katherine Knutson); Sara Goudge, CG Science Teacher and River Watch Advisor-218-766-1326; Ashley Hitt, Red Lake Watershed District River Watch Coordinator-573-321-0109; Marissa Newton (RLWD intern); Wayne Goeken (IWI)-218-280-0516; Asher Kingery(IWI)-701-331-9259; (Total on river trip: 9)

Emergency Contacts: Clearwater Co. Sherriff Office: 218-694-6226; Sanford Bagley Clearbrook Clinic: 218-776-3124; Ambulance services in Fosston, Bagley, and Bemidji

Boats/Gear: Use 9 kayaks, paddles, and life jackets available through the IWI River Explorers Program. Safety kit(medical kit, tow line, floating rescue throw line) will be in staff boat. 2-3 hand bilge pumps and sponges.

Weather Conditions:) Overcast and drizzling at start with intermittent drizzle and light rain for first part of trip. Sunny by end of trip. Overall pleasant conditions.

Things to Bring—Individuals): Footwear that will likely get wet and perhaps muddy—old tennis shoes work well, or sandals that stay secure on your feet—**NO FLIPFLOP SANDALS**! Clothing that can get wet (fast drying fabric a plus, i.e. preferably not cotton) hat, sunscreen, bug repellent, water/beverage, snacks (all refuse is packed out). Also consider: dry set of clothes/towel in dry bag or left in transport vehicle. IWI will have several waterproof digital cameras with geo-tagging features for the River Explorers team to use in documenting the trip. If participants want to bring their own camera, IWI staff will have some extra drybags that can be used for protection in between use, but if personal electronic gear is used, it is at the risk and responsibility of the individual owner/user. Leave personal valuables such as wallets, cell phones, keys, and other electronics at home/school/car or put in dry bag at start of river trip.

Things to Bring—Leaders/group (not all of following will be included on all trips): Trip planner with all emergency contact information, maps, etc.; cell phone(s); extra water bottles; extra food; dry bags; garbage bags; electronic gear for trip documenting; mussel collection kit (bags, sharpie marker, ruler, Write-In-Rain logbook, pencil or waterproof pen); macroinvertebrate “tools”; identification field guides (birds, plants, fish, macros, mussels, insects, trees…); secchi tube; YSI sonde…

A basic medical kit will be brought on each trip, but if individuals have anaphylactic reactions, they should bring their own bee sting kit~EpiPen. Also, participants that have asthma or may require use of an inhaler should make sure they bring their inhaler along as well.

Drivers of school or personal vehicles may want to consider bringing extra towels, blankets, plastic, or some type of seat covering in case paddlers are wet and/or muddy at end of river trip.

Route Notes/Planning Considerations: Beginning access at Clearwater River just downstream of the outlet of Clearwater Lake—turn south off of Clearwater CoRd into parking area on north side of river. Good access for unloading and launching. Goudge family paddled reach in mid-May, reporting no tree snag obstructions. One beaver dam is present and some sand bars and low spots that may require need to get out to drag through. River bottom is generally firm. Very clear water allows easy viewing of river bottom, fish, and excellent recreation. Will come off river at Clearbrook Co Rd 14 road crossing, approximately 3.8 river miles downstream. There are no nearby gaging stations to provide stage or flow information. It is estimated that it will take approximately 2 hours to paddle the reach to allow for photo documentation, macroinvertebrate, and mussel observations.

Documentation:

Will use waterproof digital cameras with geo-tagging features to document river conditions, plants, wildlife, mussels, etc. to share with natural resource managers and others.

Post paddle: develop news release to raise awareness of River Explorers program and RW teams exploring local waterways, documenting conditions, and in general raising watershed awareness. Evaluate mix of paddle time, exploration, documentation as well as trip planning/preparation. Get feedback from trip participants on trip experience, expectations, results, attitudes, interest in further trips, next steps to investigate more information about rivers explored, etc.

Other…
Review if there are any DNR/MPCA assessments of this reach of river. Also RLWD and RW water quality information.

Logistics DRAFT: Clearwater River from Clearwater Co Rd 4 at outlet of Clearwater Lake to Clearwater Co Rd 14 approx 2.4 miles (straight line) nearly straight west of put-in.

Approx. 13.3 road miles from Clearbrook school to put-in location off Clearwater CoRd 4 just downstream of Clearwater Lake outlet.
Approx. 3.3 road miles between put-in and take-out locations via, Clearwater county roads 4 and 14.

9:00 IWI staff arrive at put-in site to get boats/lifejackets/gear laid out and shuttle vehicle with trailer to ending take-out site (Clearwater CoRd 14).

10:00 All meet at put-in access at Red Lake CoRd 4 by Clearwater Lake outlet. Meet with IWI staff; fit lifejackets and adjust footpegs in kayaks; camera distribution/set-up; basic kayak tips and instructions for trip documentation. Shuttle vehicles as needed to take-out before start of paddling.

10:30 (all timing moved up-actual start time of ~9:25) Begin paddling on river trip. Total of 3.8 river miles

~Photo documentation, observations, exploration for macroinvertebrates, mussels, etc.

12:30+/- (actual end time of ~11:45) Reach endpoint-Clearwater CoRd 4. If shuttle of school vehicle not done at start of trip, will do this while others clean/load kayaks/gear. Trip review, evaluation, thoughts at take-out or at follow-up lunch planned for at Goudge property (white house) across road from put-in.

1:30 (approximate) Post-trip lunch at Goudge property (white house) on Clearwater Lake on east side of Clearwater CoRd 4 across from put-in location.

Post trip notes:

Low water, had to scooch through in spots, some got out and drug kayak through low spots. Several trees down but generally not covering entire channel. One beaver dam that was able to scooch over/down. Fence across stream at start that were able to get under. Another fence further down—fortunately not electric so were able to work under it also. Clear water—easily see bottom (shallow). Good macroinvertebrates under rocks. Eagle (possibly Golden) along reach plus waterfowl and songbirds. Very scenic reach of river. Some erosion from grazing cattle accessing the river. Overcast at start and had some drizzle, light rain, but sunny by end of trip. Warm enough that getting wet not a problem. One student capsized when got sideways/hung up on log. Excellent group and trip as well as follow-up BBQ lunch.

Clearbrook-Gonvick River Explorers Trip on Clearwater River 5/31/2016

Trip Distance: 3.8 river miles Straight line miles of 2.4 miles Sinuosity=1.56

Start elevation=1263’ End elevation=1242’ Slope of 5.5 ft/mile

Estimate two hours paddling time (10:30-12:30)

Road miles between put-in and take-out=3.3 miles

Crookston River Explorers Trip Planner ~ Red Lake River

Date: September 28, 2016

Time: 12:15 a.m. to 3:15 p.m. (Total RW team time: on-river time plus pre/post trip travel and logistics)

Location: Red Lake River from approx. 2 mile East of Crookston near junction of US Hwy 2 and MN Hwy 102. 3.6 river miles.

Participants/Phone Contact: Wayne Goeken (IWI)-218-280-0516; Andy Ulven (IWI)-701-429-4518; Jessica Hanson-Crookston HS Science Teacher/River Watch Advisor-218-281-2144(school)/218-686-7464(cell); Crookston RW Team members: Anna Huck, Emily Gillette, Sawyer Bernd, Joey Rodriguez, Katherine Geist. (Total on river trip: 8)

Emergency Contacts: Polk Co. Sherriff Office: 218-281-0431; Riverview Hospital-218-281-9200.

River Conditions: 1,180 cfs/6.25 ft. as of 1:00 p.m. on 9/28/16 as per USGS gaging station on Red Lake R at Crookston-Sampson Bridge: http://waterdata.usgs.gov/mn/nwis/uv/?site_no=05079000&PARAmeter_cd=00065,00060 (median flow is 665 cfs and mean flow of 894 cfs at this site for 9/28 based on 115 years of records). River level is rising but fairly stable, should be very good for paddling.

Boats/Gear: Use 8 kayaks, paddles, and life jackets provided by the IWI River Explorers Program. Safety kit(medical kit, tow line, floating rescue throw line) will be in staff boats. 2-3 hand bilge pumps and sponges. IWI will have several waterproof digital cameras with geo-tagging features for the River Explorers team to use in documenting the trip. If participants want to bring their own camera, IWI staff will have some extra drybags that can be used for protection in between use, but if personal electronic gear is used, it is at the risk and responsibility of the individual owner/user.

Weather Conditions: Forecast for Wed. 9/28/16 as of 9:30 p.m. 9/28/16: Mostly sunny, with a high near 61. North northeast wind 3 to 6 mph.

Things to Bring—Individuals: Footwear that will likely get wet and perhaps muddy—old tennis shoes work great, or water shoes/sandals that stay secure on your feet—**NO FLIPFLOP SANDALS**! Clothing that can get wet (fast drying fabric a plus, i.e. preferably not cotton) hat, sunscreen, bug repellent, water/beverage, snacks (all refuse is packed out). Also consider: dry set of clothes/towel in dry bag or left in transport vehicle. Leave personal valuables such as wallets, cell phones, keys, and other electronics at home/school/car or put in a dry bag at start of river trip.

Things to Bring—Leaders/group (not all of following will be included on all trips): Trip planner and personal health information forms for each participant with all emergency contact information; maps; cell phone(s); extra water bottles; extra food; dry bags; garbage bags; electronic gear for trip documenting; mussel collection kit (bags, sharpie marker, ruler, Write-In-Rain logbook, pencil or waterproof pen); macroinvertebrate “tools”; identification field guides (birds, plants, fish, macros, mussels, insects, trees…); secchi tube; YSI sonde…

A basic medical kit will be brought on each trip, but if individuals have anaphylactic reactions, they should bring their own bee sting kit~EpiPen. Also, participants that have asthma or may require use of an inhaler should make sure they bring their inhaler along as well.

Drivers of school or personal vehicles may want to consider bringing extra towels, blankets, plastic, or some type of seat covering in case paddlers are wet and/or muddy at end of river trip.

Route Notes/Planning Considerations: Beginning access off of US Hwy 2 approx. 2.2 miles E of Crookston at landing north of Hwy 2 near junction with MN Hwy 102. Take-out at Central Park boat ramp in Crookston. Total route is 3.6 river miles. Estimated time on river at 2-2.5 hours depending on time available, conditions encountered, and stops taken for documentation, discussion, or other purposes.

Documentation:

Will use waterproof digital cameras with geo-tagging features to document river conditions, plants, wildlife, mussels, etc. to share with natural resource managers and others.

Post paddle: develop news release to raise awareness of local rivers, River Explorers program, and RW teams exploring local waterways, documenting conditions, and in general raising watershed awareness. Evaluate mix of paddle time, exploration, documentation as well as trip planning/preparation. Get feedback from trip participants on trip experience, expectations, results, attitudes, interest in further trips, next steps to investigate more information about rivers explored, etc.

Other…
Review if there are any assessments of this reach of river (DNR/MPCA/RW/Red Lake WD), projects underway, cultural, historic sites/uses, etc.

Logistics DRAFT: Red Lake River from near US 2/MN 102 junction to Crookston, approx 3.6 river miles

Approx. 30 minutes from Wayne Goeken place to put-in location at US Hwy 2 east of Crookston. Approx. 2.2 road miles between put-in and take-out locations.

11:15 IWI staff arrive at US Hwy 2 put-in site to unload boats/gear and set-up. Shuttle vehicle/trailer to take-out at Central Park.

12:00-12:15 Crookston RW team arrive at US Hwy 2 put-in site. Introductions and overview of river trip. Fit lifejackets and adjust footpegs in kayaks; camera distribution/set-up; basic kayak tips and instructions for trip documentation.

12:25+ Begin paddling on river trip. Total of 3.6 river miles. (Estimate 2.0 - 2.5 hrs on-river)

~Photo documentation, observations, exploration for macroinvertebrates, mussels, etc.

2:45+/- Reach endpoint-Central Park. Shuttle back to get Crookston HS vehicle at put-in while others clean/load kayaks/gear. Trip review, evaluation, thoughts on trip.

3:15 Done loading and leaving for respective home bases. Crookston RW team may leave before all loading done as per time constraints.

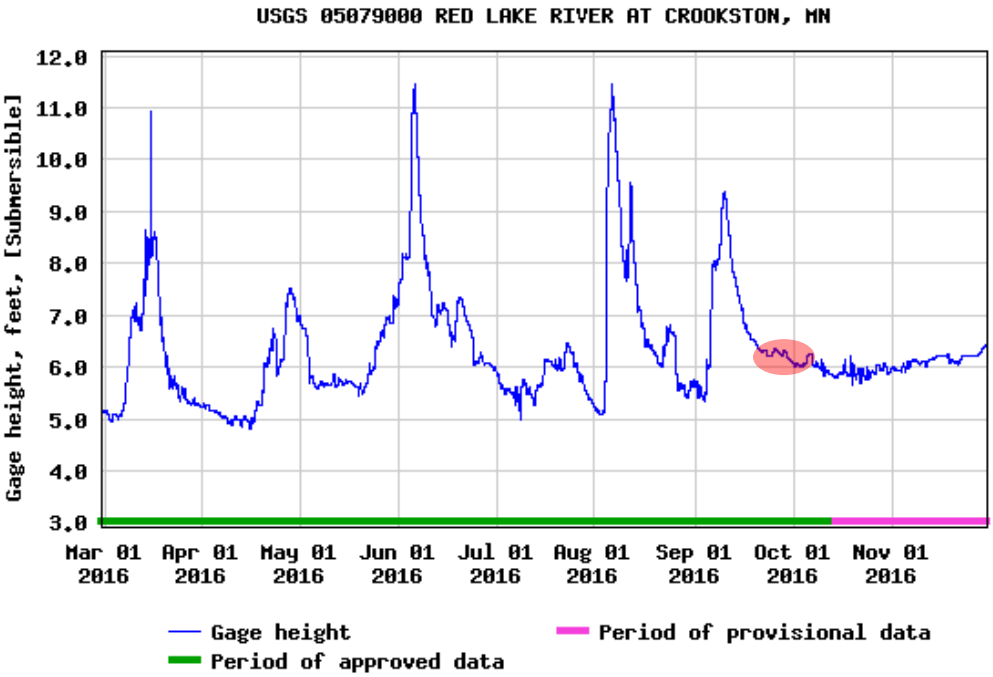
Post trip notes:

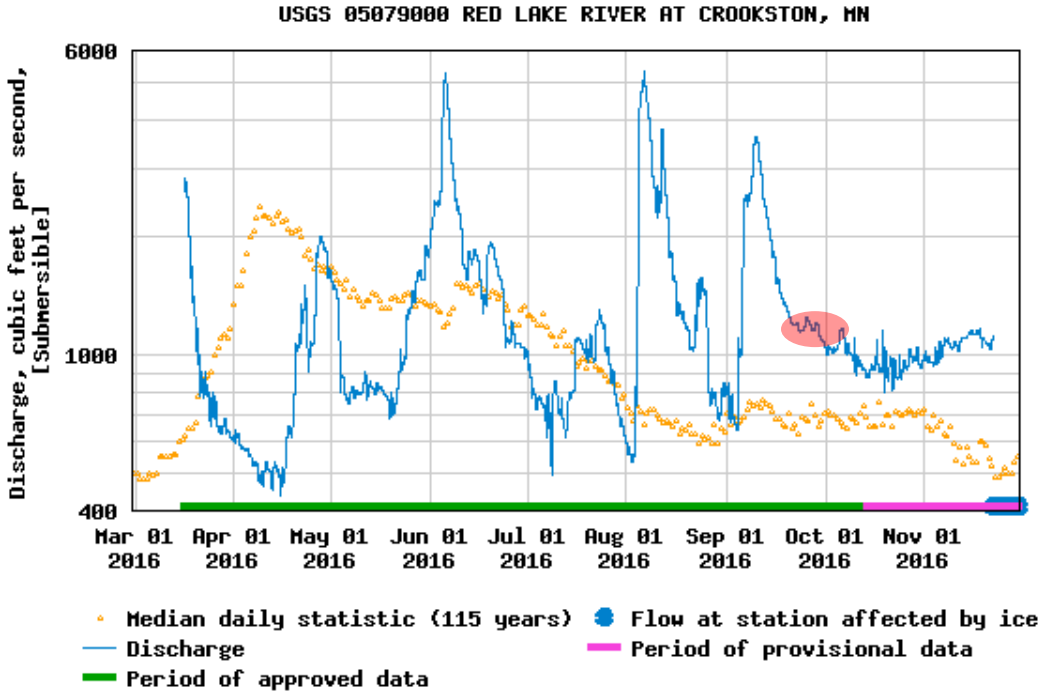
Had issue at start of trip with one of students being too heavy for IWI kayaks available. He capsized immediately after getting him in and on the water. IWI staff got him out of river. He was willing to try again but IWI staff deemed that it was too unstable and would likely have further capsizes on trip. Thought pleasant day, eventually cold water temps would likely result in potentially dangerous condition. W.Goeken (IWI) took student to his home to change into dry clothes and then back to school. Rest of group proceeded on trip with A.Ulven (IWI) leading the trip. W.Goeken went back to start and loaded kayaks and met group at Central Park endpoint, paddling upstream to meet the group from Central Park. Group had good trip with eagle, heron, and other observations along the way. Had time at end to paddle a bit further downstream and then paddled back upstream to Central Park take-out.

Crookston HS River Explorers Kayak Trip on Red Lake River: September 28, 2016

Slope: elevation change of 2 ft (start-851' to end-849') over 3.6 miles for average slope of 0.5 ft/mile.

Sinuosity = 1.8. [River mile distance of 3.6 miles/straight line distance from start to end of 1.83 miles.]

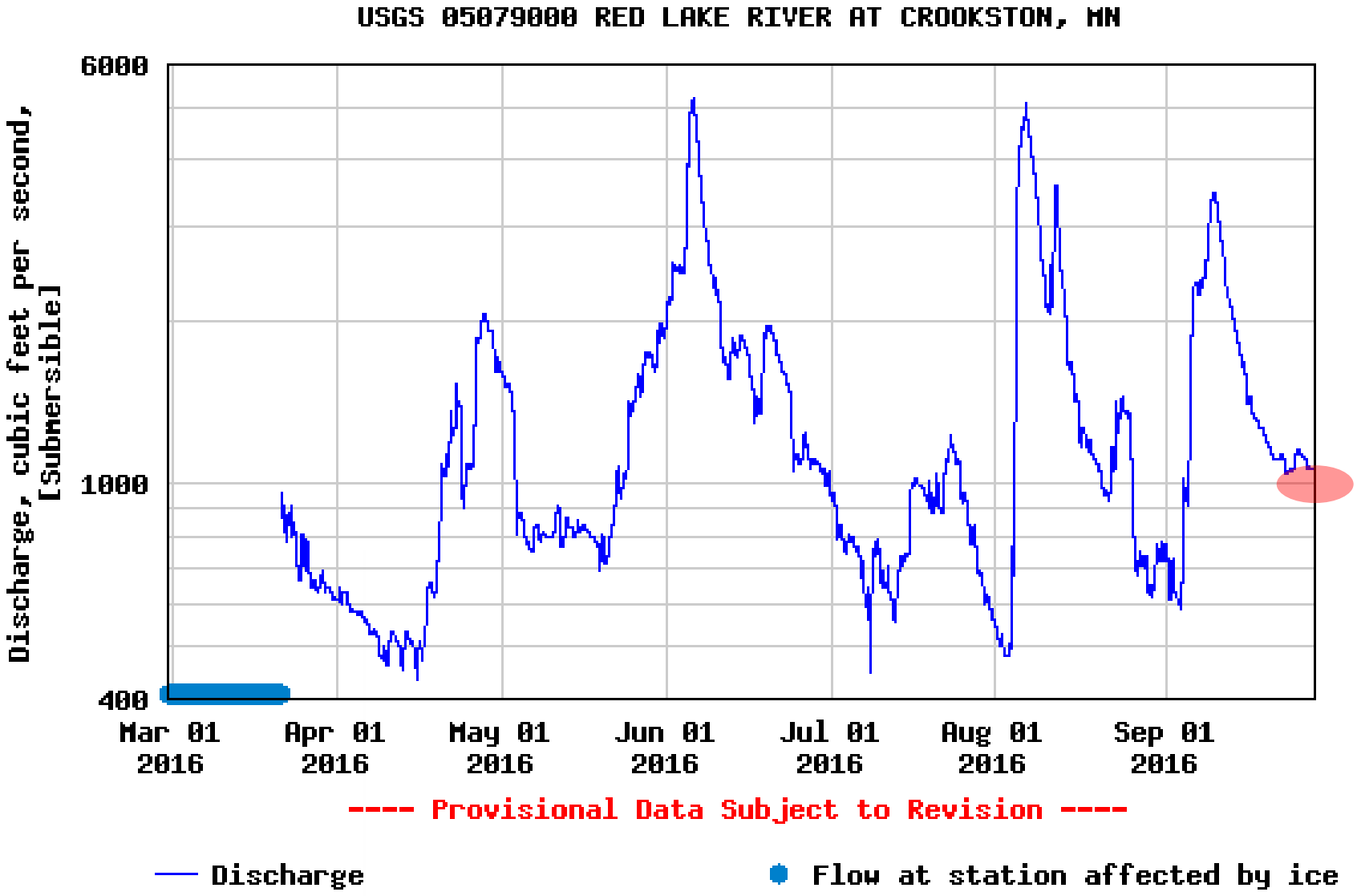

USGS 05079000 RED LAKE RIVER AT CROOKSTON, MN
Gage height, feet, [Submersible]
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
Mar 01 2016
Apr 01 2016
May 01 2016
Jun 01 2016
Jul 01 2016
Aug 01 2016
Sep 01 2016
Oct 01 2016
Nov 01 2016
Gage height
Period of provisional data
Period of approved data


USGS 05079000 RED LAKE RIVER AT CROOKSTON, MN
Discharge, cubic feet per second, [Submersible]
6000
1000
400
Mar 01 2016
Apr 01 2016
May 01 2016
Jun 01 2016
Jul 01 2016
Aug 01 2016
Sep 01 2016
Oct 01 2016
Nov 01 2016
Median daily statistic (115 years)
Flow at station affected by ice
Discharge
Period of provisional data
Period of approved data

Red Lake R at Crookston: USGS Daily Mean Values based on 115 years of records (1900-2016)

Daily discharge, cubic feet per second – statistics for Sep 28 based on 115 years of record

Min (1936)	25th percen-tile	Median	Mean	Most Recent Instantaneous Value Sep 28	75th percen-tile	Max (2010)
3.5	250	665	894	1070	1230	7720



Red Lake River at Crookston: USGS Daily Mean Values based on 115 years of records (1908-2016)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	557	514	646	2,510	2,540	1,920	1,670	965	953	843	975	621
2	561	513	637	2,700	2,470	1,870	1,640	950	924	868	959	631
3	552	515	622	2,670	2,390	1,830	1,700	927	902	859	952	628
4	555	513	615	2,610	2,290	1,810	1,740	929	918	845	949	641
5	548	511	609	2,700	2,250	1,730	1,760	906	933	826	935	636
6	545	510	607	2,860	2,220	1,700	1,730	889	941	803	910	630
7	547	511	619	3,130	2,230	1,730	1,660	883	937	813	883	619
8	549	507	650	3,270	2,150	1,820	1,670	846	924	803	895	620
9	550	510	663	3,290	2,090	2,010	1,680	853	907	810	896	619
10	545	505	662	3,270	2,110	2,130	1,640	898	881	834	865	621
11	542	509	656	3,370	2,140	2,120	1,610	884	865	834	828	631
12	536	510	680	3,430	2,250	2,080	1,530	857	857	834	803	628
13	534	510	787	3,390	2,350	2,010	1,470	848	838	848	779	626
14	530	510	894	3,420	2,350	1,920	1,400	843	829	869	784	625
15	532	507	1,050	3,550	2,250	1,870	1,340	847	819	857	790	620
16	533	510	1,120	3,600	2,200	1,870	1,320	856	820	848	804	615
17	532	512	1,130	3,590	2,200	1,850	1,320	886	832	845	795	610
18	532	512	1,170	3,630	2,210	1,820	1,370	922	836	882	793	614
19	529	512	1,160	3,590	2,220	1,770	1,350	921	833	915	774	616
20	525	512	1,140	3,490	2,210	1,740	1,330	898	839	924	742	616
21	524	513	1,200	3,390	2,130	1,750	1,300	860	834	920	708	607
22	527	513	1,270	3,330	2,060	1,750	1,260	859	826	914	674	600
23	525	518	1,350	3,240	2,010	1,770	1,240	859	822	897	655	599
24	523	521	1,490	3,080	2,010	1,730	1,190	859	845	894	654	593
25	522	535	1,660	3,000	2,040	1,710	1,160	871	906	885	665	595
26	521	553	1,700	2,970	2,040	1,730	1,130	859	929	881	668	593
27	520	581	1,750	2,890	1,990	1,770	1,120	846	914	896	669	591
28	524	596	1,830	2,780	1,900	1,840	1,090	835	894	929	660	590
29	524	576	1,880	2,750	1,830	1,830	1,050	855	858	925	643	591
30	523		1,990	2,650	1,810	1,760	999	829	837	929	632	590
31	522		2,080		1,900		979	878		968		584

InternationalWaterInstitute
Flood research and watershed education for the Red River Basin

For Immediate Release: September 29, 2016

Crookston River Watch Team Explores Red Lake River

Beautiful river and weather conditions were enjoyed by the Crookston River Watch (RW) team on their September 28th Red Lake River kayak outing. The team paddled a scenic 3.6 mile reach from the Highway 2 put-in east of Crookston to Central Park in Crookston. Abundant wildlife was seen along the river corridor including mature and immature bald eagles, a variety of hawks, Canada Goose, great blue herons, and many songbirds. Beaver signs were also evident.

Students from the Crookston High School RW team and their advisor and Science Teacher Jessica Hanson explored the reach using kayaks provided through the International Water Institute's (IWI) River Explorers program. The students were accompanied by staff from the IWI, who helped point out river features along the way such as cutbanks and depositional areas on inside river bends.

The team found easy access both on and off the river and the river level perfect for a fun paddle. Colorful fall foliage provided a great backdrop for the outing. Paddlers can readily find real-time water level and flow information at an online U.S. Geological Survey gaging station based on river flow at the Sampson bridge in Crookston. There are several river segments through Crookston that can be paddled depending on length of trip desired.

The local team regularly monitors water quality of the Red Lake River and its Burnham Creek tributary through participation in the River Watch program. For more information on monitoring results, the River Explorers Program, and access to the online flow and stage levels contact Andy Ulven, IWI Monitoring and Education Specialist at 701-429-4518.

River Explorers is a program of the International Water Institute that promotes discovery by high school River Watch students of conditions and recreation opportunities of local rivers in the Red River Basin. Program supporters include the Minnesota Clean Water Legacy Fund, the Red River Watershed Management Board, and the Wild Rice Watershed District.

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For more information about this article/activity contact Wayne Goeken, International Water Institute Special Projects Coordinator at 218-280-0516 or wayne@iwinst.org or Andy Ulven at 701-429-4518 or andy@iwinst.org.

Photos to consider for use can be found at the Flickr link below. If names of people in the photos are needed contact Andy Ulven or Jessica Hanson (jessicahanson@isd593.org, 218-686-7464) All photos by Andy Ulven.

https://www.flickr.com/photos/127571157@N06/sets/72157671133393513/

Marshall County Central River Explorers ~ May 20, 2016

Date: Friday, May 20, 2016

Time: Meet Marshall County Central (MCC)RW team at put-in point by 9:00 a.m.

Location: Thief River in southeast Marshall County.
Starting point—put-in at Marshall CR12 crossing of Thief R approx. 9.5 miles NNE of Thief River Falls
Ending point—take-out at Marshall CR2 crossing of Thief R approx. 6.0 miles NNE of Thief River Falls

Nearest USGS Gaging Station: Thief R approx. 4.5 miles (straight line) north of TRF. USGS 05076000, http://waterdata.usgs.gov/mn/nwis/uv/?site_no=05076000&PARAmeter_cd=00065,00060. Station is just downstream of reach to be paddled. Provisional data for 5/20/2016: stage of **5.50 ft** and discharge of **178 cfs**. Median flow for 5/20 is 194 cfs (mean flow of 500 cfs; 25th-30 cfs; 75th-703). Historic minimum flow for this date was 0.9 cfs in 1939 with maximum flow of 5180 cfs in 1950—based on 99 years of record. Paddled this reach in August 2012 at 45 cfs, so should be good water levels for 5/20/16 trip.

Weather Forecast: As of 5/20/16 forecast for Thief River Falls area on Friday, 5/20/16 is: "Mostly sunny, with a high near 74. South southeast wind 8 to 14 mph, with gusts as high as 20 mph." Expected to be about 60°F in the morning at the start of the trip.

Participants/Phone: Marshall CC RW team-7 students (Russia Eurek, Daltyn Loftsrom, Sam Huang, Morgan Skeim, Mariah Nelson, Nolan Nelson, and Kim Minoh) and MCC Science Teacher and River Watch Advisor Katie Melgaard-218-874-7225x116-school or cell-651-238-9823; Wayne Goeken-218-280-0516, Andy Ulen-701-429-4518 and Dylan Heschle—all IWI. (TOTAL: 11)

Emergency Contacts: Marshall Co. Sheriff Office: 218-745-5411; Pennington Co. Sheriff Office: 218-681-6161. Sanford Hospital/Clinic Thief River Falls: 218-681-4240

Boats/Gear: Use 11 kayaks, paddles, and life jackets available through the IWI River Explorers Program. Safety gear (medical kit, tow line, floating rescue throw line) will be in staff boat. 2-3 hand bilge pumps and sponges.

Things to Bring—Individuals: Footwear that will likely get wet and perhaps muddy—old tennis shoes work well, sandals that stay secure on your feet—**NO FLIPFLOP SANDALS**! Clothing that can get wet (fast drying fabric a plus, i.e. preferably not cotton) hat, sunscreen, bug repellent, water/beverage, snacks (all refuse is packed out). Also consider: dry set of clothes/towel in dry bag or left in transport vehicle. IWI will have several waterproof digital cameras with geo-tagging features for the River Explorers team to use in documenting the trip. If participants want to bring their own camera, IWI staff will have some extra drybags that can be used for protection in between use, but if personal electronic gear is used, it is at the risk and responsibility of the individual owner/user. Leave personal valuables such as wallets, cell phones, keys, and other electronics at home/school/car or put in dry bag at start of river trip.

Things to Bring—Leaders/group (not all of following will be included on all trips): Trip planner with all emergency contact information, maps, etc.; cell phone(s); extra water bottles; extra food; dry bags; garbage bags; electronic gear for trip documenting; mussel collection kit (bags, sharpie marker, ruler, Write-In-Rain logbook, pencil or waterproof pen); macroinvertebrate "tools"; identification field guides (birds, plants, fish, macros, mussels, insects, trees…); secchi tube; YSI sonde…

A basic medical kit will be brought on each trip, but if individuals have anaphylactic reactions, they should bring their own bee sting kit~EpiPen. Also, participants that have asthma or may require use of an inhaler should make sure they bring their inhaler along as well.

Drivers of school or personal vehicles may want to consider bringing extra towels, blankets, plastic, or some type of seat covering in case paddlers are wet and/or muddy at end of river trip.

Route Notes/Planning Considerations: Good staging area at put-in along Marshall CoRd 12 on downstream, north side of bridge crossing. Take-out at Marshall CoRd2 is also very manageable with good road shoulders for parking and gear loading. Both roads are paved. Accesses can be muddy but manageable by taking our time with IWI staff helping to load and unload participants from rocks along shoreline.

This reach is a total of 5.0 river miles with straight line distance of 3.39 miles for sinuosity of 1.47. Starting elevation is estimated at 1136 ft. and ending elevation of 1125 ft., a drop of 11 ft. or 2.2 ft/mile. It took 3 hrs 5 min to paddle inclusive of lunch break at Marshall CD 20, observations and photo documentation.

Documentation:

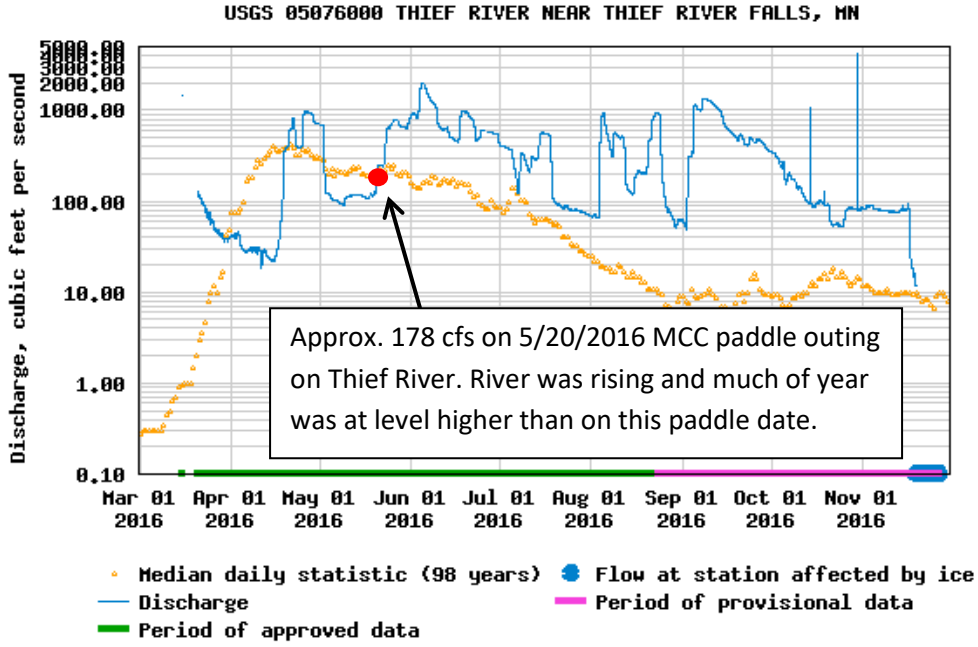
Will use waterproof digital cameras with geo-tagging features to document river conditions, plants, wildlife, mussels, etc. to share with natural resource managers and others.

Post paddle: develop news release to raise awareness of River Explorers program and RW teams exploring local waterways, documenting conditions, and in general raising watershed awareness. Evaluate mix of paddle time, exploration, documentation as well as trip planning/preparation. Get feedback from trip participants on trip experience, expectations, results, attitudes, interest in further trips, next steps to investigate more information about rivers explored, etc.

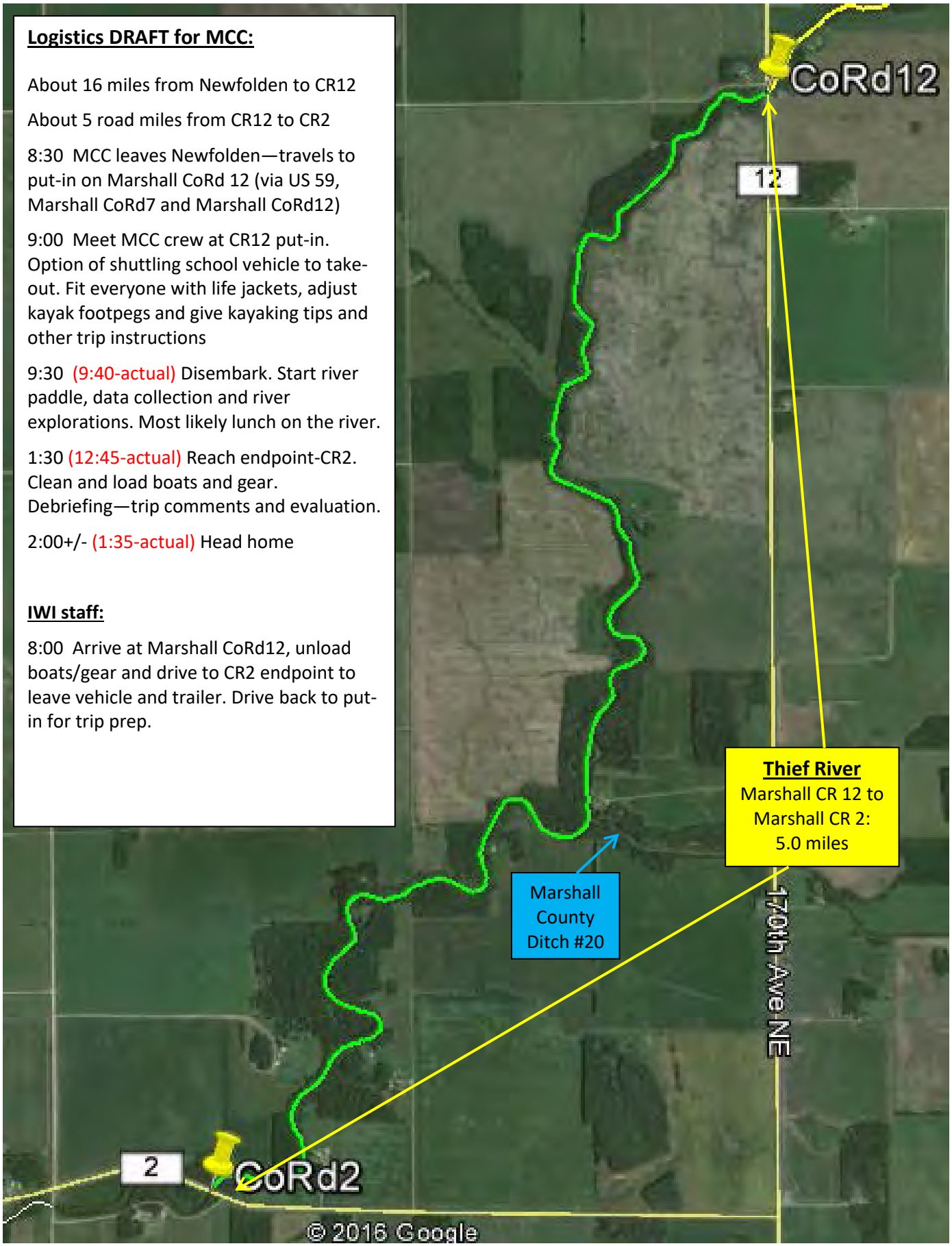
Other…
Thief River is managed as State Ditch 83, extensive ditching and alterations have occurred. Flow can be quite variable due to regulation of controlled discharge from the Agassiz National Wildlife Refuge upstream of this reach. Factors influencing managed discharge include flood control and waterfowl nesting at the Agassiz NWR. A recent report and related current information about the Thief River can be found here, http://www.rlwdwatersheds.org/tr-watershed-info, as part of a detailed Watershed Restoration and Protection project (WRAP) project currently in progress.

Marshall County Ditch 20 enters the Thief River approx. 2.75 river miles from the put-in starting location at Marshall CoRd 12—entering from the east. Depending on water levels, this may be a spot to get out and explore variations between these two water bodies. Also a good location for lunch.

There are no River Watch monitoring sites currently being monitored on the Thief River. Grygla RW monitors several tributary sites to the Thief River. The RLWD and the IWI conduct regular water quality monitoring of the Thief River.



Marshall County Central River Explorers ~ May 20, 2016



Logistics DRAFT for MCC:

About 16 miles from Newfolden to CR12

About 5 road miles from CR12 to CR2

8:30 MCC leaves Newfolden—travels to put-in on Marshall CoRd 12 (via US 59, Marshall CoRd7 and Marshall CoRd12)

9:00 Meet MCC crew at CR12 put-in. Option of shuttling school vehicle to take-out. Fit everyone with life jackets, adjust kayak footpegs and give kayaking tips and other trip instructions

9:30 (9:40-actual) Disembark. Start river paddle, data collection and river explorations. Most likely lunch on the river.

1:30 (12:45-actual) Reach endpoint-CR2. Clean and load boats and gear. Debriefing—trip comments and evaluation.

2:00+/- (1:35-actual) Head home

IWI staff:

8:00 Arrive at Marshall CoRd12, unload boats/gear and drive to CR2 endpoint to leave vehicle and trailer. Drive back to put-in for trip prep.

Norman County East River Explorers Trip Planner ~ Wild Rice River

Date: September 19, 2016

Time: 11:30 a.m. to 2:40 p.m. (Total RW team time: on-river time plus pre/post trip travel and logistics)

Location: Wild Rice River from Norman CoRd 29 approx. 1 mile NE of Twin Valley to MN Hwy 32 (north edge of Twin Valley at Heiberg Dam). 3.6 river miles.

Participants/Phone Contact: Wayne Goeken (IWI)-218-280-0516; Andy Ulven (IWI)-701-429-4518; Kara Eken-NCE Science Teacher/River Watch Advisor-218-584-5151(school)/218-415-0506(cell); NCE RW Team members: Shanna Bennefield, Mariah Stuenes, Savanna Hoekstra, Brooke Miller, Vincent Wasfaret, and Milo Winter. (Total on river trip: 9)

Emergency Contacts: Norman Co. Sherriff Office: 218-784-7114; Sanford Twin Valley Clinic-584-5142.

River Conditions: 210 cfs/2.57 ft. at time of paddle on 9/19/16 at USGS gaging station on Wild Rice R at Twin Valley--Norman CoRd 29: http://waterdata.usgs.gov/mn/nwis/uv/?site_no=05062500&PARAmeter_cd=00065,00060 (median flow is 48 cfs and mean flow of 92 cfs at this site for 9/19 based on 90 years of records). River level is dropping but very good for paddling.

Boats/Gear: Use 9 kayaks, paddles, and life jackets provided by the IWI River Explorers Program. Safety kit(medical kit, tow line, floating rescue throw line) will be in staff boats. 2-3 hand bilge pumps and sponges. IWI will have several waterproof digital cameras with geo-tagging features for the River Explorers team to use in documenting the trip. If participants want to bring their own camera, IWI staff will have some extra drybags that can be used for protection in between use, but if personal electronic gear is used, it is at the risk and responsibility of the individual owner/user.

Weather Conditions: Forecast for Monday, 9/19 as of 9:00 a.m.: Sunny, with a high near 73. Breezy, with a west wind 10 to 20 mph, with gusts as high as 30 mph.

Things to Bring—Individuals: Footwear that will likely get wet and perhaps muddy—old tennis shoes work great, or water shoes/sandals that stay secure on your feet—**NO FLIPFLOP SANDALS**! Clothing that can get wet (fast drying fabric a plus, i.e. preferably not cotton) hat, sunscreen, bug repellent, water/beverage, snacks (all refuse is packed out). Also consider: dry set of clothes/towel in dry bag or left in transport vehicle. Leave personal valuables such as wallets, cell phones, keys, and other electronics at home/school/car or put in a dry bag at start of river trip.

Things to Bring—Leaders/group (not all of following will be included on all trips): Trip planner and personal health information forms for each participant with all emergency contact information; maps; cell phone(s); extra water bottles; extra food; dry bags; garbage bags; electronic gear for trip documenting; mussel collection kit (bags, sharpie marker, ruler, Write-In-Rain logbook, pencil or waterproof pen); macroinvertebrate “tools”; identification field guides (birds, plants, fish, macros, mussels, insects, trees…); secchi tube; YSI sonde…

A basic medical kit will be brought on each trip, but if individuals have anaphylactic reactions, they should bring their own bee sting kit~EpiPen. Also, participants that have asthma or may require use of an inhaler should make sure they bring their inhaler along as well.

Drivers of school or personal vehicles may want to consider bringing extra towels, blankets, plastic, or some type of seat covering in case paddlers are wet and/or muddy at end of river trip.

Route Notes/Planning Considerations: Beginning access at Norman CoRd 29 approx. 1 mile NE of Twin Valley (will scout to see which side of bridge is best to put-in). Take-out at north edge of Twin Valley just downstream of MN Hwy 32 on south side of river above Heiberg Dam. Total route is 3.6 river miles. Estimated time on river at 2.5 hours depending on time available, conditions encountered, and stops taken for documentation, discussion, or other purposes.

Documentation:

Will use waterproof digital cameras with geo-tagging features to document river conditions, plants, wildlife, mussels, etc. to share with natural resource managers and others.

Post paddle: develop news release to raise awareness of local rivers, River Explorers program, and RW teams exploring local waterways, documenting conditions, and in general raising watershed awareness. Evaluate mix of paddle time, exploration, documentation as well as trip planning/preparation. Get feedback from trip participants on trip experience, expectations, results, attitudes, interest in further trips, next steps to investigate more information about rivers explored, etc.

Other…
Review if there are any assessments of this reach of river (DNR/MPCA/RW/Wild Rice WD), projects underway, cultural, historic sites/uses, etc.

Logistics DRAFT: Wild Rice River from Norman CoRd 29 to MN Hwy 32, approx 3.6 river miles

Approx. 30 minutes from Wayne Goeken place to put-in location at Norman CoRd 29. Approx. 2.7 road miles between put-in and take-out locations via Norman CoRd 29, 190th Ave, and MN Hwy 32.

10:45 IWI staff arrive at Norman CoRd 29 put-in site to unload boats/gear and set-up. Shuttle vehicle/trailer to take-out at Heiberg Park.

11:30 Norman Co. East RW team arrive at Norman CoRd 29 put-in site. Introductions and overview of river trip. Fit lifejackets and adjust footpegs in kayaks; camera distribution/set-up; basic kayak tips and instructions for trip documentation.

11:50 Begin paddling on river trip. Total of 3.6 river miles. (Estimating 2.5 hrs on-river)

~Photo documentation, observations, exploration for macroinvertebrates, mussels, etc.

2:20+/- Reach endpoint-Heiberg Dam. Shuttle back to get NCE vehicle at put-in while others clean/load kayaks/gear. Trip review, evaluation, thoughts on trip.

2:40 Done loading and leaving for respective home bases. NCE RW team may leave before all loading done as per time constraints.

Post trip notes:

Norman County East River Explorers Kayak Trip on Wild Rice River: September 19, 2016

Slope: elevation change of 20 ft (start-1919' to end-999') over 3.6 miles for average slope of 5.6 ft/mile. (4.5'/mile from start at Norman CoRd 29 to Agassiz Rec. Trail-1010' (ART); 6.9'/mile from ART to end at Heiberg)

Sinuosity = 2.0. [River mile distance of 3.6 miles/straight line distance from start to end of 1.8 miles.]

Wild Rice River at Twin Valley: USGS Daily Mean Values based on 90 years of records (1908-2016)

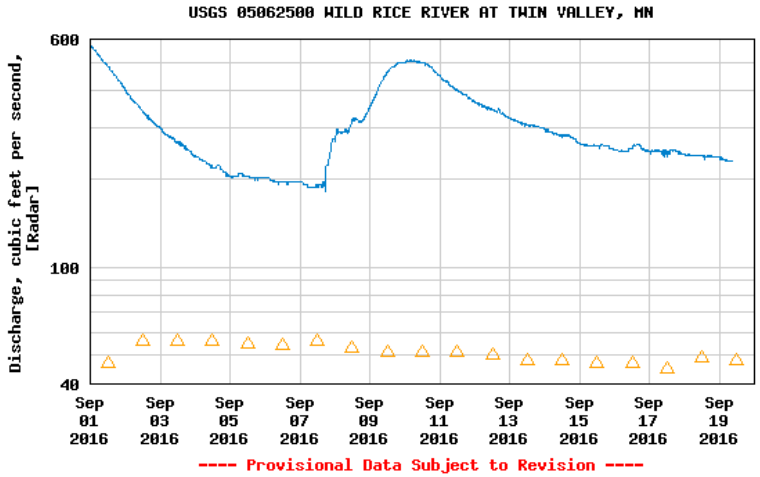
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	61	53	75	523	576	393	385	164	96	85	169	97
2	60	52	74	538	560	377	363	154	104	84	167	96
3	60	52	72	542	544	386	346	145	111	84	161	95
4	60	52	72	556	531	387	333	139	119	85	153	92
5	59	52	75	570	517	373	332	136	125	86	148	89
6	59	52	81	638	509	366	316	128	122	87	145	86
7	59	52	84	667	501	360	307	128	125	93	151	85
8	58	52	85	687	498	364	315	128	120	93	151	84
9	58	52	86	683	497	423	311	135	111	92	146	82
10	58	52	89	704	507	460	312	141	110	93	141	81
11	57	52	91	722	510	418	322	144	120	101	136	79
12	57	53	121	751	508	394	291	142	123	108	133	79
13	57	53	144	769	506	371	269	137	116	119	130	76
14	56	53	171	765	491	366	260	133	109	121	126	75
15	56	53	172	740	476	383	253	127	107	120	124	74
16	56	53	170	726	477	387	243	119	103	118	122	73
17	55	53	173	734	470	373	230	115	98	120	118	72
18	55	53	205	746	468	379	217	112	96	127	116	71
19	55	53	221	709	457	370	214	105	92	130	115	70
20	55	53	235	676	445	399	284	99	90	127	114	69
21	54	54	249	658	439	426	283	95	88	124	112	68
22	54	55	262	645	425	425	295	92	87	121	108	67
23	54	57	274	629	413	516	266	89	86	121	108	67
24	54	59	295	619	402	364	232	91	95	122	106	66
25	54	61	317	610	397	354	223	95	100	127	105	65
26	54	65	318	597	394	468	229	94	99	127	105	65
27	54	71	306	595	392	437	229	91	94	143	103	65
28	54	72	330	630	386	419	222	87	90	148	101	64
29	53	63	367	617	379	408	210	85	89	142	100	63
30	53		415	597	386	398	189	86	88	157	98	63
31	53		487		387		175	90		169		62

Wild Rice River at Twin Valley: USGS Daily Mean Values based on 90 years of records (1908-2016)

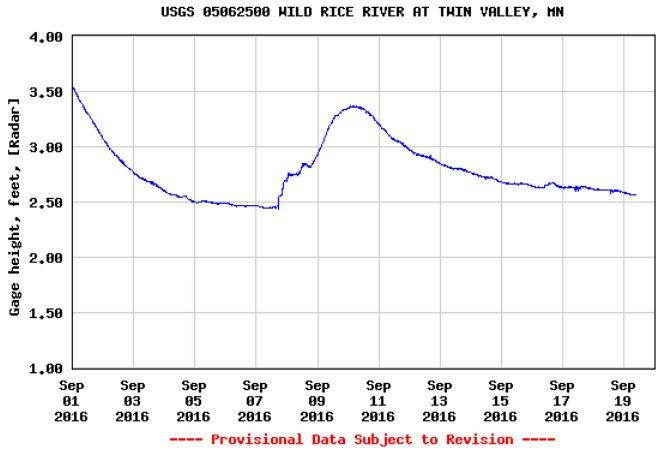
Daily discharge, cubic feet per second – statistics for Sep 19 based on 90 years of record

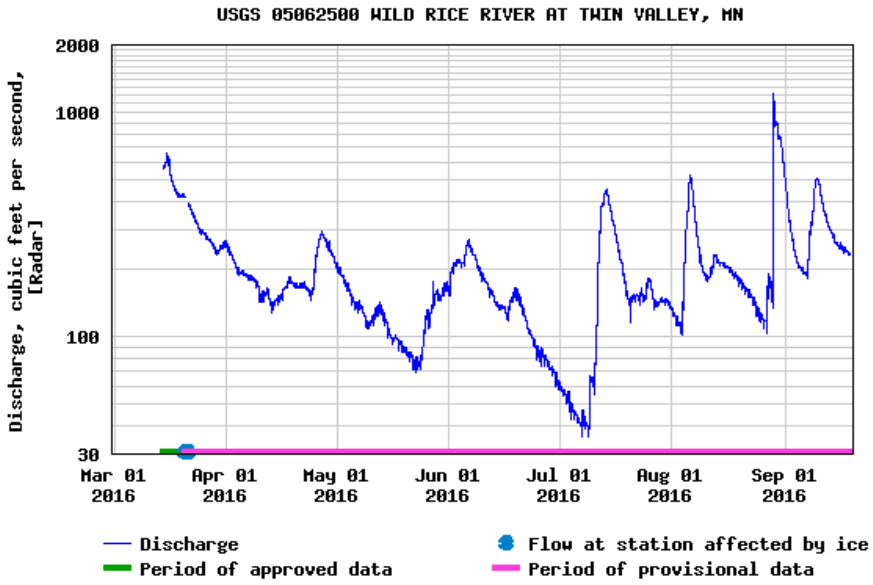
Min (1989)	25th percen-tile	Median	Mean	75th percen-tile	Most Recent Instantaneous Value Sep 19	Max (1999)
1.8	20	48	92	104	230	657

Discharge: cubic feet per second (cfs)



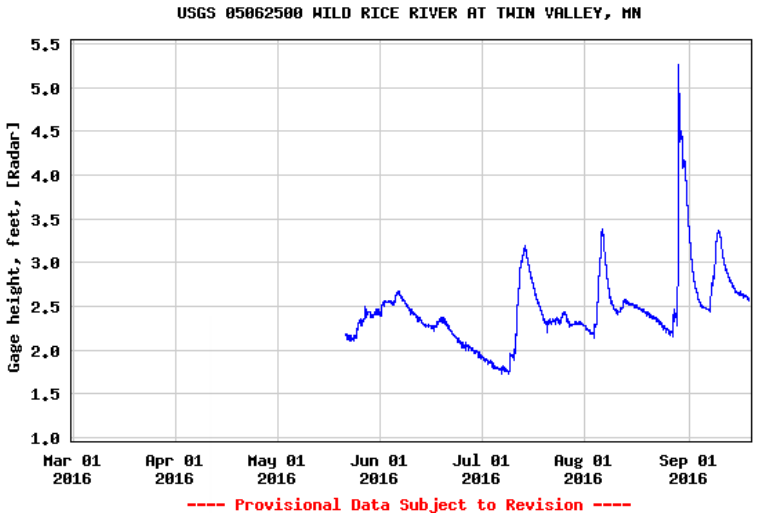
Gage Height: feet



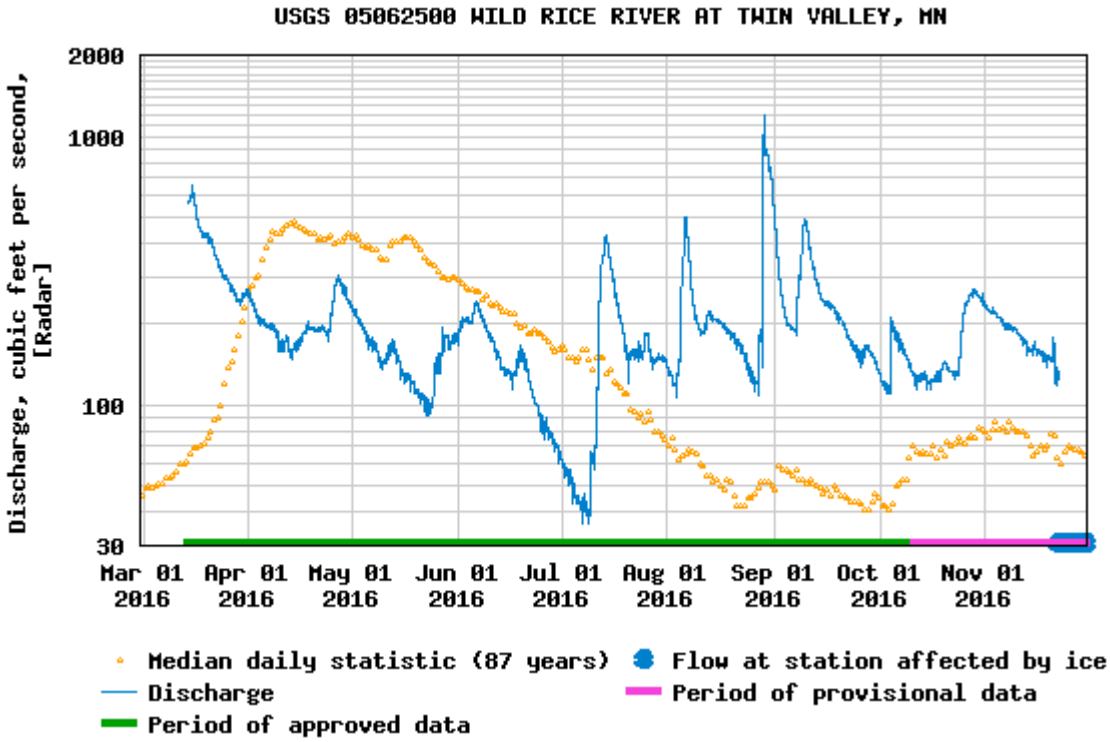


Gage height, feet, [Radar]

Most recent instantaneous value: 2.57 09-19-2016 07:45 CDT



Hydrograph for 2016 illustrates that the flow on 9/19/2016 date of NCE kayak outing of approx. 210 cfs was considerably above median discharge for this date based on 90 years of record.



InternationalWaterInstitute
Flood research and watershed education for the Red River Basin

For Immediate Release: September 23, 2016

Norman County East River Watch Team Explores Wild Rice River

Beautiful river and weather conditions were enjoyed by the Norman County East River Watch (RW) team on a recent September 19th kayak outing on the Wild Rice River. The team paddled a scenic 3.6 mile reach from Norman Co Rd 29 just northeast of Twin Valley to Heiberg Park just west of MN Highway 32. Abundant wildlife was seen along the river corridor including songbirds, deer, red-tailed hawks, a fox, mussels, and two river otters.

Six students from the Norman County East High School RW team and their advisor and NCE Science Teacher Kara Eken explored the reach using kayaks provided through the International Water Institute's (IWI) River Explorers program. The students were accompanied by staff from the IWI, who helped point out river features along the way such as cutbanks and depositional areas on inside river bends.

The team found easy access both on and off the river and the river level perfect for a fun paddle among a few rock boulders and minor rapids. Paddlers can readily find real-time water level and flow information at an online U.S. Geological Survey gaging station based on river flow at Norman Co Rd 29. NCE Science Instructor Kara Eken commented on what an excellent recreation asset the Wild Rice River is for the Twin Valley community.

The local team regularly monitors water quality of the Wild Rice River and its tributaries Mashaug, Coon, and Moccasin Creeks through participation in the River Watch program with water quality generally being found to be meeting state standards. For more information on monitoring results, the River Explorers Program, and access to the online flow and stage levels contact Andy Ulven, IWI Monitoring and Education Specialist at 701-429-4518.

River Explorers is a program of the International Water Institute that promotes discovery by high school River Watch students of conditions and recreation opportunities of local rivers in the Red River Basin. Program supporters include the Minnesota Clean Water Legacy Fund, the Red River Watershed Management Board, and the Wild Rice Watershed District.

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For more information about this article/activity contact Wayne Goeken, International Water Institute Special Projects Coordinator at 218-280-0516 or wayne@iwinst.org or Andy Ulven at the contact info below.

The following photos and captions provided as suggested options. Larger original format photos available upon request from Andy Ulven at andy@iwinst.org or 701-429-4518.

NCE Science Teacher Kara Eken leading River Watch team on exploration of Wild Rice River near Twin Valley.

Photo credit: Andy Ulven, IWI

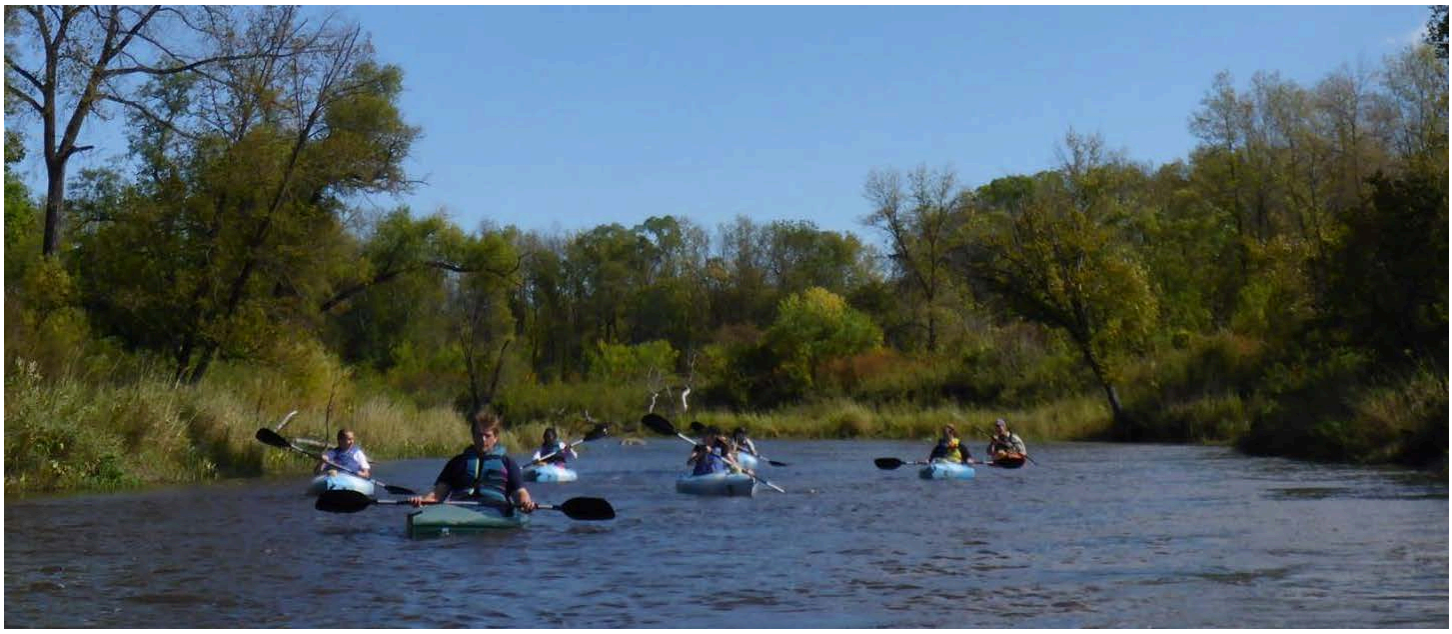
Norman County East River Watch Team below bluff on the Wild Rice River north of Twin Valley.

(L to R: Milo Winter, Shana Bennefeld, Savanna Hoekstra, Kara Eken, Mariah Stueness, Brooke Miller, and Vince Wasfaret)

Photo credit: Andy Ulven, IWI

Norman County East River Watch team kayaking Wild Rice River near Twin Valley.

Photo credit: Andy Ulven, IWI



Additional photos to choose from are at IWI Facebook page post associated with this trip:

https://www.facebook.com/InternationalWaterInstitute/photos/pcb.1023890597709168/1023886037709624/?type=3&theater

Red Lake Falls RW River Explorers Trip Planner ~ Red Lake River

Date: July 19, 2016

Time: 9:30 a.m. to 1:30 p.m. (Total RW team time: on-river time plus pre/post trip travel and logistics)

Location: Red Lake River from MN Hwy 32 east of Red Lake Falls to Sportsmen's Park. 4.8 river miles.

Participants/Phone Contact: Wayne Goeken (IWI)-218-280-0516; Andy Ulven (IWI)-701-429-4518; Ashley Hitt (RLWD)-573-321-0109; Jason Kenfield, RLF Science Teacher/River Watch Advisor-218-280-2286; RLF RW Team members Emily Valley, Stephanie Doyle, and Taylor Kenfield. (Total on river trip: 7)

Emergency Contacts: Red Lake Co. Sherriff Office: 218-253-2996; Riverview Clinic-RLF: 253-4606: Altru Clinic-RLF: 253-4343.

River Conditions: 747 cfs/11.17 ft. as of 10:00 a.m. on 7/19/16 as per USGS gaging station on Red Lake R at Red Lake Falls (CoRd13). Dropping throughout day—went from 850 to 500 cfs in 7/29/16 24 hr period. http://www.dnr.state.mn.us/waters/csg/site_report.html?mode=get_site_report&site=63025001.

Boats/Gear: Use 7 kayaks, paddles, and life jackets provided by the IWI River Explorers Program. Safety kit(medical kit, tow line, floating rescue throw line) will be in staff boat. 2-3 hand bilge pumps and sponges.

Weather Conditions:) A 20 percent chance of showers and thunderstorms after 4pm. Mostly sunny, with a high near 85. South southeast wind 6 to 15 mph, with gusts as high as 22 mph. (forecast as of Tuesday morning, 7/19/16)

Things to Bring—Individuals): Footwear that will likely get wet and perhaps muddy—old tennis shoes work well, or sandals that stay secure on your feet—**NO FLIPFLOP SANDALS**! Clothing that can get wet (fast drying fabric a plus, i.e. preferably not cotton) hat, sunscreen, bug repellent, water/beverage, snacks (all refuse is packed out). Also consider: dry set of clothes/towel in dry bag or left in transport vehicle. IWI will have several waterproof digital cameras with geo-tagging features for the River Explorers team to use in documenting the trip. If participants want to bring their own camera, IWI staff will have some extra drybags that can be used for protection in between use, but if personal electronic gear is used, it is at the risk and responsibility of the individual owner/user. Leave personal valuables such as wallets, cell phones, keys, and other electronics at home/school/car or put in dry bag at start of river trip.

Things to Bring—Leaders/group (not all of following will be included on all trips): Trip planner with all emergency contact information, maps, etc.; cell phone(s); extra water bottles; extra food; dry bags; garbage bags; electronic gear for trip documenting; mussel collection kit (bags, sharpie marker, ruler, Write-In-Rain logbook, pencil or waterproof pen); macroinvertebrate "tools"; identification field guides (birds, plants, fish, macros, mussels, insects, trees…); secchi tube; YSI sonde…

A basic medical kit will be brought on each trip, but if individuals have anaphylactic reactions, they should bring their own bee sting kit~EpiPen. Also, participants that have asthma or may require use of an inhaler should make sure they bring their inhaler along as well.

Drivers of school or personal vehicles may want to consider bringing extra towels, blankets, plastic, or some type of seat covering in case paddlers are wet and/or muddy at end of river trip.

Route Notes/Planning Considerations: Beginning access at MN Hwy 32 NE of Red Lake Falls. Access on SE corner of Hwy 32 bridge (upstream side of bridge). Total route to Sportsmen's Park take-out is 4.8 river miles. Estimated time on river at 2 hours (could be less, depending on any stops taken and documentation, discussion—or more if more floating than paddling). Takeout at Sportsmen's Park boat access at confluence of Red Lake and Clearwater River.

Documentation:

Will use waterproof digital cameras with geo-tagging features to document river conditions, plants, wildlife, mussels, etc. to share with natural resource managers and others.

Post paddle: develop news release to raise awareness of River Explorers program and RW teams exploring local waterways, documenting conditions, and in general raising watershed awareness. Evaluate mix of paddle time, exploration, documentation as well as trip planning/preparation. Get feedback from trip participants on trip experience, expectations, results, attitudes, interest in further trips, next steps to investigate more information about rivers explored, etc.

Other…
Review if there are any DNR/MPCA assessments of this reach of river. Also RLWD and RW water quality information.

Logistics DRAFT: Red Lake River from MN Hwy 32 to Sportsmen's Park, approx 4.8 river miles

Approx. 30 minutes (27 road miles) from Wayne Goeken place to put-in location at MN Hwy 32 just NE of Red Lake Falls. Approx. 3.3 road miles between put-in and take-out locations via MN Hwy 32 and local roads.

8:40 IWI staff leave Wayne's place

9:10 Arrive at MN Hwy 32 put-in site. IWI staff unload boats/lifejackets/gear.

9:30 RLWD staff and Red Lake Falls RW team arrive at MN Hwy 32 put-in site. Shuttle IWI vehicle with trailer and RLF RW team vehicle(s) to ending take-out site (Sportsmen's Park). RLWD staff/vehicle used for shuttling.

10:00 Re-assemble at put-in. Final fit of lifejackets and adjust footpegs in kayaks; camera distribution/set-up; basic kayak tips and instructions for trip documentation.

10:15 Begin paddling on river trip. Total of 4.8 river miles (actual time of start of paddle=10:05)

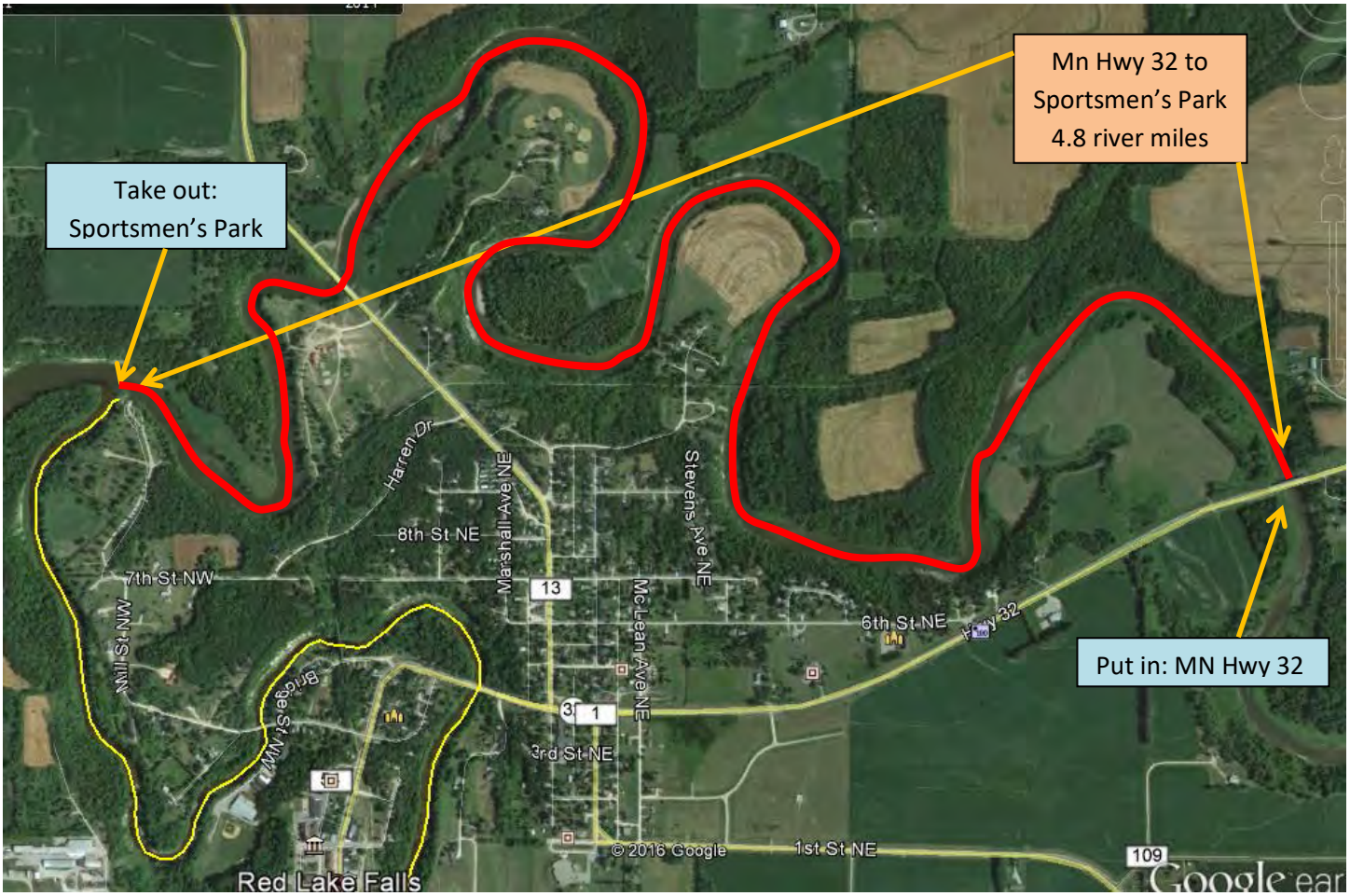
~Photo documentation, observations, exploration for macroinvertebrates, mussels, etc.

12:15+/- Reach endpoint-Sportsmen's Park. Shuttle back to get RLWD vehicle at put-in while others clean/load kayaks/gear. Trip review, evaluation, thoughts on trip. (actual time off river=13:05)

12:45 Done loading and leaving for respective home bases. (actual time approx. 13:30)

1:15 IWI staff back at Wayne's (unless other river scouting in the afternoon-TBD)

Post trip notes: Excellent weather conditions and flow/stage at level that was perfect for paddling, though did need to negotiate rocks in several areas of rapids. Fairly easy to do so, but also easy to capsize, as happened on 3 occasions. Fortunately both air and water temps were warm and not a problem. Also shallow in the areas of capsizes so relatively easy to empty kayak of water and get back in. On water at 10:05 and off at about 1:05—3 hours total for trip with VERY low paddling exertion—lots of floating by team plus the 3 capsize recoveries. Good access points both getting on and off the river. Very scenic reach of river. One back water area off the main river channel explored a bit revealed active beaver lodge and white water lilies. Cliff swallows in nests on bluffs along river and also under bridges; one bald eagle seen along the route. Songbirds present. A few mussel shells found and a live mussel. Macroinverts present on rocks in riffle areas. Many plants along river banks identified as part of trip outing. Several tubers floating down the river. This is route promoted by RLF RW Team in their 2016 Forum poster—definitely worthy of further promotion. Teacher shared some of history of City hydropower plant (building still there), former saw and flour mills, and fur trading post.



Stage: 11.24 ft at Jul 19, 2016 05:30 CST

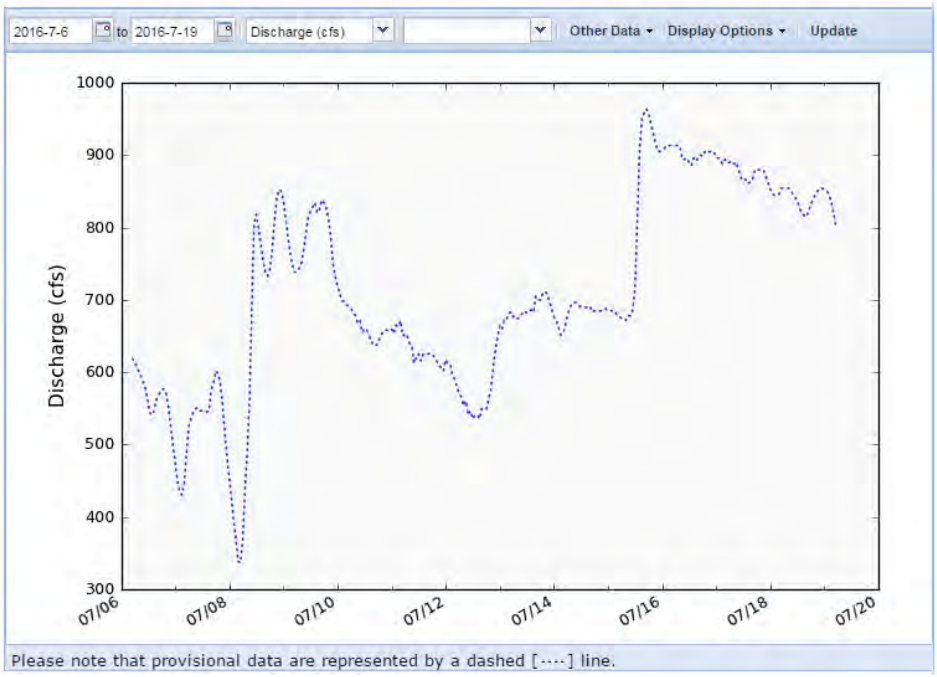
Flow: 798.835 ft^3/sec at Jul 19, 2016 05:30 CST

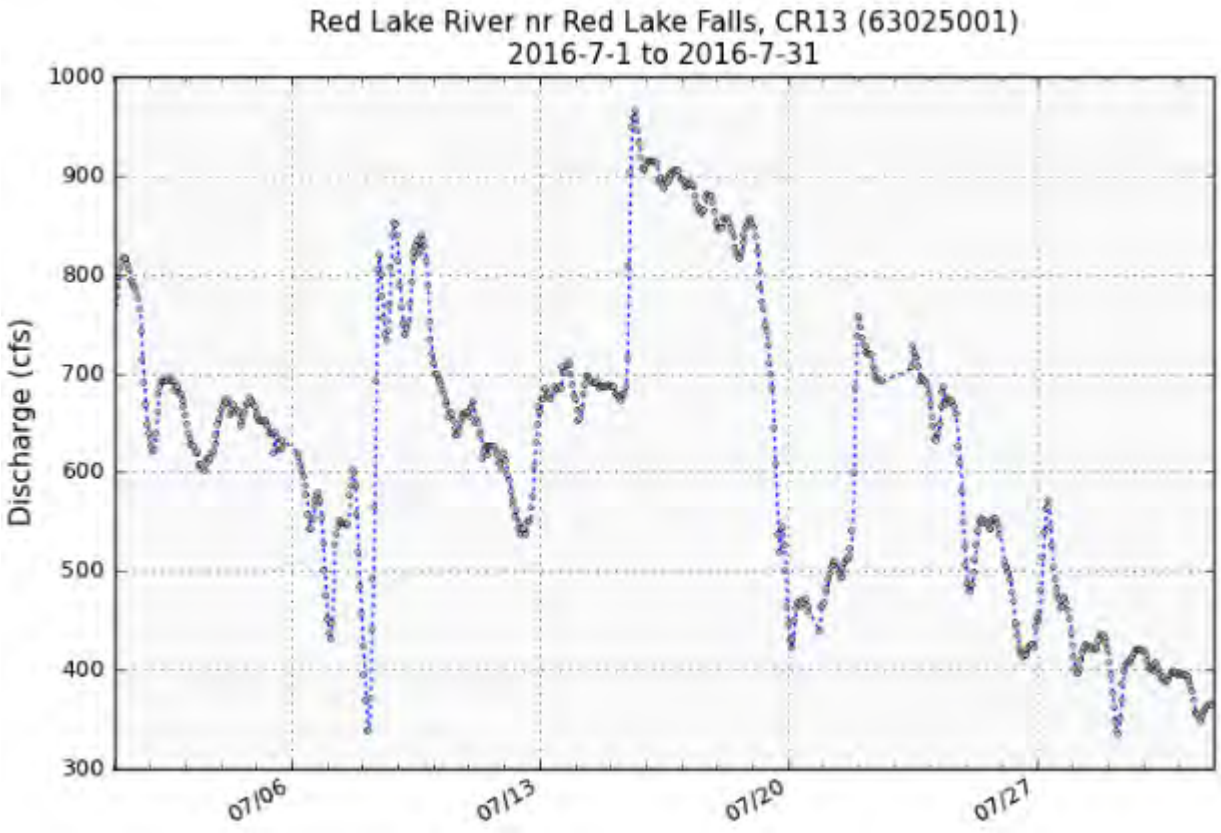
Telemetry data: 2015-01-01 to 2016-07-19

Available data: all telemetry variables

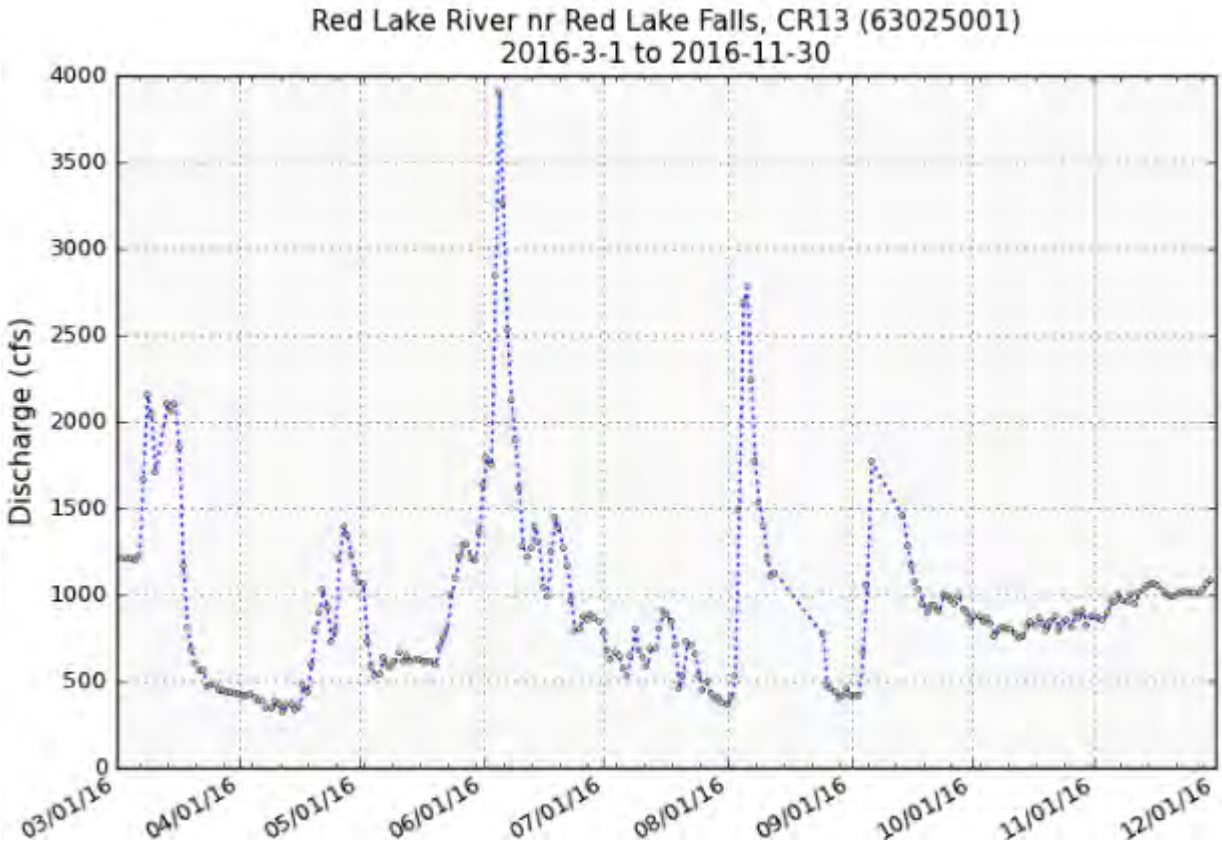
Archive data: 2007-01-01 to 2014-12-31

Available data: daily discharge, daily rainfall





As shown on above hydrograph, on date of 7/19/2016 paddle, the Red Lake R dropped from approx. 850 cfs to 500 cfs. As shown on annual hydrograph below, for much of the year, flow was above 500 cfs.



For Immediate Release: July 25, 2016

Red Lake Falls River Watch Team Explores Red Lake River

Beautiful river and weather conditions were enjoyed by the Red Lake Falls River Watch (RW) team on a July 19th kayak outing on the Red Lake River. The team paddled the scenic 4.8 mile reach from MN Highway 32 to the confluence with the Clearwater River at Sportsmen's Park, spotting songbirds, hundreds of cliff swallows swirling about their river bluff nests, and one mature bald eagle gliding overhead with a watchful eye on the paddling entourage.

Three students from the Red Lake Falls High School RW team and their advisor and science teacher, Jason Kenfield, explored the reach using kayaks provided through the International Water Institute's (IWI) River Explorers program. The students were accompanied by staff from the IWI and the Red Lake Watershed District, who helped point out river features along the way and plants commonly found along river corridors in northwest Minnesota. The rich history of river use in this area was also noted, including saw mills, flour mills, a hydroelectric plant, and a fur trading post.

As part of a poster that the team presented at the 2016 River Watch Forum, the team identified better parking and access at the MN Highway 32 bridge as a way to improve the river as a recreation asset to the community. The team found access to be quite convenient on the date of the trip, and agreed the community is fortunate to have this excellent river resource in their "backyard." To help with trip planning, real-time water level and flow information is readily available online for both the Red Lake and Clearwater Rivers in the Red Lake Falls area.

The local team regularly monitors water quality of the Red Lake River, Black River, and Clearwater River through participation in the River Watch program. The water quality of these rivers is generally found to meet state standards most of the year. IWI staff also monitors the Red Lake and Clearwater Rivers on a more frequent basis, especially during spring runoff and after rain events. For more information on monitoring results, the River Explorers Program, and access to the online flow and stage levels contact Andy Ulven, IWI Monitoring and Education Specialist, at 701-429-4518.

Exploration of local rivers in the Red River Basin is made possible through the International Water Institute's River Explorers Program whereby local high school River Watch teams get out in kayaks to discover what their local rivers offer for recreational enjoyment. Program supporters include the Minnesota Clean Water Legacy Fund, the Red River Watershed Management Board, and the Red Lake Watershed District.

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For more information about this article/activity contact Wayne Goeken, International Water Institute Special Projects Coordinator at 218-280-0516 or wayne@iwinst.org

Photos and captions below provided as suggested options.
Photos are compressed—larger original format versions will be included as separate attachments.

Red Lake Falls River Watch Team kayaking on the Red Lake River

Photo credit: Wayne Goeken, IWI

(L to R: Ashley Hitt, Jason Kenfield, Stephanie Doyle, Taylor Kenfield, and Emily Valley)

p.s. Ashley Hitt is staff with the Red Lake Watershed District and Jason Kenfield is the RLF Science Teacher and River Watch Advisor

Red Lake Falls River Watch team kayaking Red Lake River rapids in Red Lake Falls

Photo credit: Wayne Goeken, IWI

Additional photos to choose from are at IWI Facebook page post associated with this trip:

https://www.facebook.com/InternationalWaterInstitute/photos/pcb.974492495982312/974490702649158/?type=3&theater

River Explorers Report ~ Snake River

Snake River Diversion to Island Park April 29, 2016

Date/Time: April 29, 2016 Approx. 4hr 15min-on-water paddle time (10:15-2:30) (confirm/edit as needed)

Participants: Warren-Alvarado-Oslo River Watch team members-8 (Ceaira Chandler, Tyler Estabrook, Alexis Jevning, Koby Johnson, Ashton Pettyjohn, Alex Porter, Angela Spidahl, and Hallee Spidahl) ; Kevin Johnson-WarrenAO Science Teacher/RW Advisor; Andy Ulven-International Water Institute; and Wayne Goeken-IWI. TOTAL: 11

Contacts: Andy Ulven-701-429-4518; Wayne Goeken-218-280-0516; Kevin Johnson-218-745-4646(school)

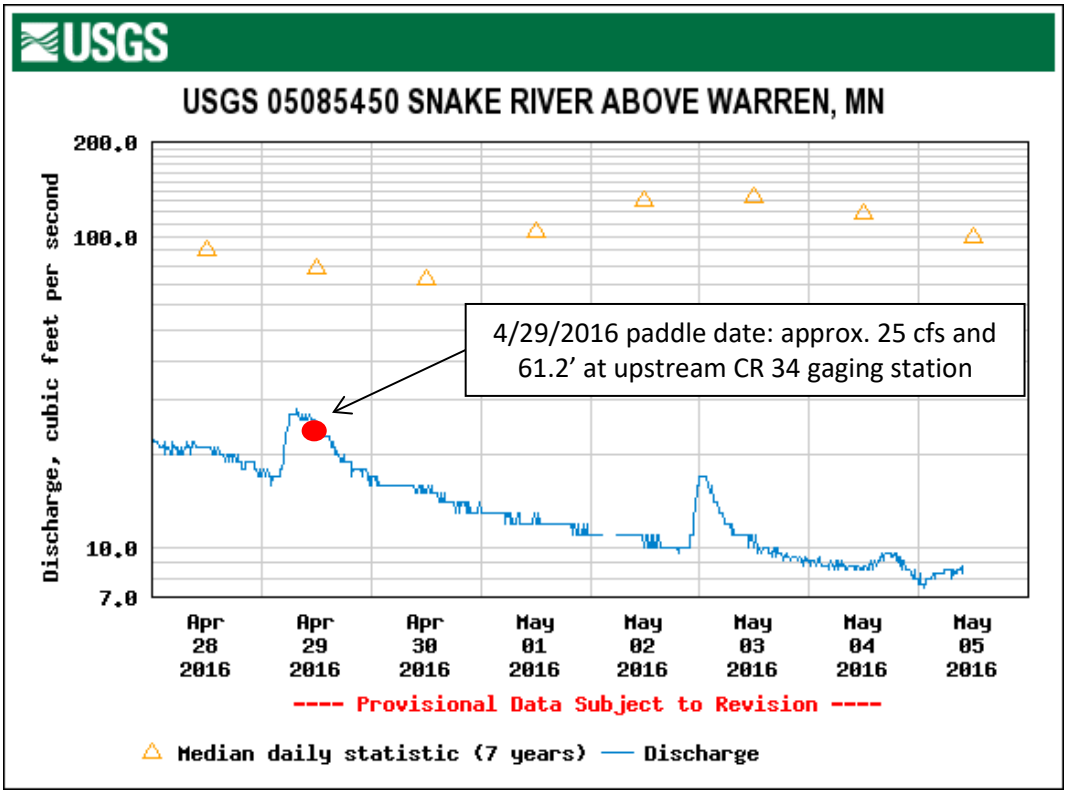
Emergency Contacts: Marshall Co Sherriff: 218-745-5411; North Valley Health Center (Warren Hospital/clinic: 218-745-4211.

Boats/Equipment: Used 11 solo kayaks and gear combination of IWI River Explorers Program, Stephen City kayaks and WarrenAO student kayaks.

Weather Conditions-4/29/16: Sunny with temps into mid 60's.

Location/Route Notes: Start location just downstream of Snake River Diversion—gated access by permission of Middle Snake Tamarac Rivers Watershed District, Danny Omdahl administrator contact (218-745-4741). Paddled 4.4 miles on Snake River to take-out at Island Park.

Gaging Station (CR 34-USGS 0508545- SNAKE RIVER ABOVE WARREN, MN) data for day of paddle (4/29/2016) approx 20-25 cfs/61.2' gage height (provisional data). The gaging station is just upstream of Warren at the Marshall CoRd 34 road crossing of the Snake R. As shown, on the April 29th date of the paddle trip, the water level had come up at this upstream station. It was likely approx. 25 cfs through Warren at the time of the paddle outing. As shown, less than a week later, flow was down below 10 cfs which likely would be difficult to paddle the route that the group paddled through Warren. The median daily flow for this time of year however is generally around 100 cfs, but keep in mind that is based on a limited seven years of data at this station.



Post-trip Notes:

Good day for paddling—sunny and calm in the river corridor. Moderate flow with good depth for most part except at rock rapids areas hit rocks and scraped bottom—often needing some assistance to get through. One student got caught on rocks sideways and kayak filled with water—did not actually capsize though. Student stepped out and IWI staff drained the kayak and trip resumed without incident. Two spots with tree snags that required extra time to get through, but managed to work through with only minor time delay.

Water was low for this time of year based on hydrograph above, but keep in mind hydrograph is based on only seven years of record. Also, in looking at other statistical flow data for this site, water levels by mid summer and into fall are generally quite low.

Put in just below Snake River diversion structure—off of rock rip-rap area. This worked fine. Good mowed open staging area, but normal public access not available to this site due to locked gate and access road to site controlled by MSTWD for maintenance and flow control management of diversion. Came off 4.4 river miles downstream at Island Park. Paddled up narrow channel off Snake R and managed to get out. This is not an official access—quite muddy.

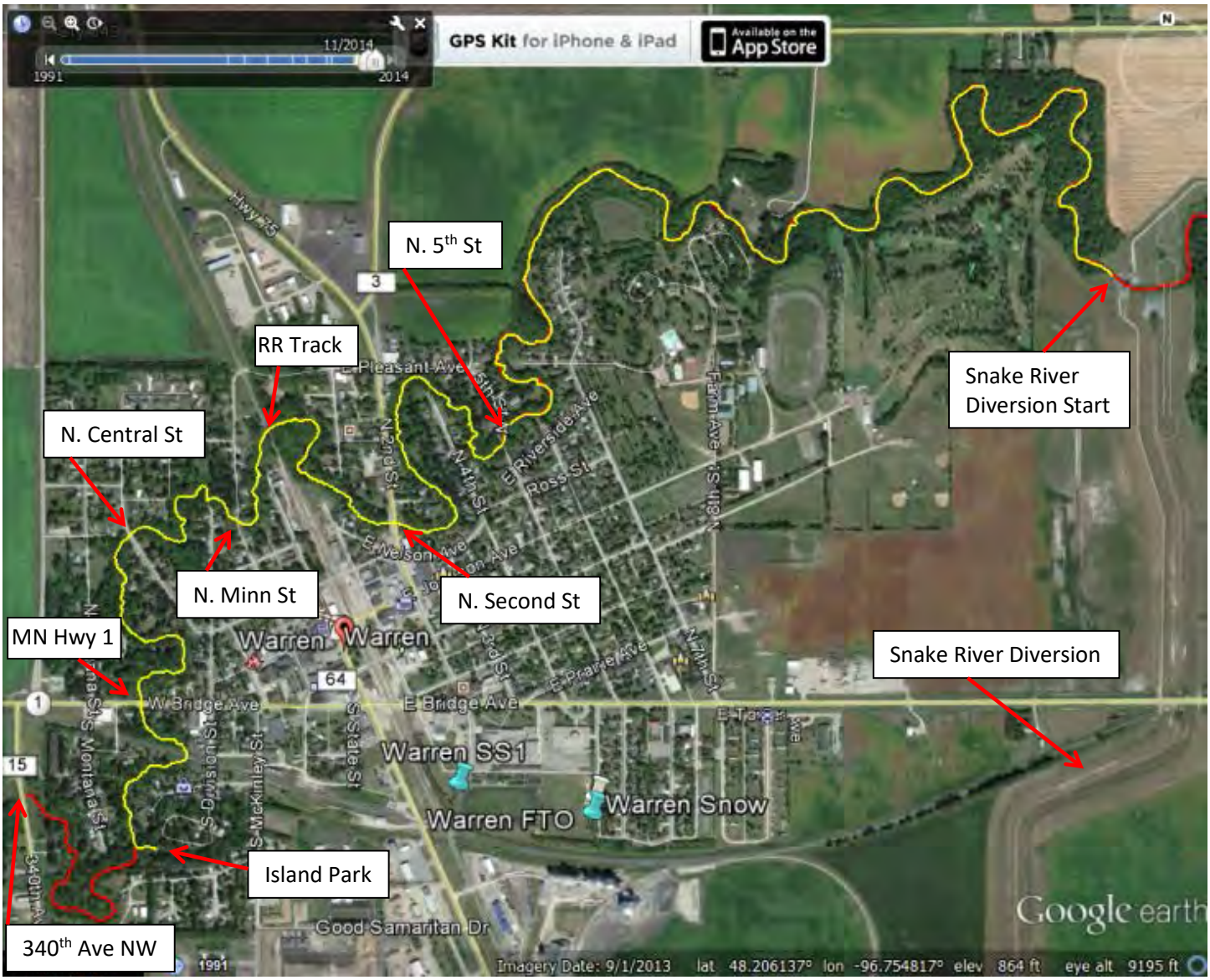
Many road crossings throughout Warren as river winds through town. Some algae present in water—likely very abundate later in summer. Trees just starting to leaf out—will provide good shade canopy when fully leafed out. Turtles and ducks observed. A couple of northern fish also spotted. One resident along river noted two otters commonly seen here. Also signs of beaver activity. A few mussel shells observed but overall, didn't see many. Turning over rocks in riffle areas did not yield much in way of macroinvertebrates either.

Bank sloughing and erosion at several sites along the way, but not too bad. Once into Warren residential area where river winds through people's backyards there was a considerable amount of trash with the river often being used as a dumpsite. Many sites in residential area where yard waste and grass clippings were dumped over the bank and into the river.

Limited spots to easily get out of kayaks to explore shoreline—easiest at rock riffle areas. Did find spot to pull off and have lunch. The WarrenAO team had identified a location just before getting into residential backyards that is owned by the City of Warren where an access point could be developed. It was a tiered and gradual slope to the river that bears looking into further.

In general, this was a nice reach to paddle at the current or higher water levels. Lower water would necessitate getting out of kayaks and dragging through rocky rapids/riffle areas. Since tree snags were limited, these could be partially removed to provide clear passage. The main issue for enjoyment of this reach of river was the significant amount of trash in the residnetial area of Warren and dumping of yard wastes in the river that contributes to nutrient loading and algae growth. Recommend an Adopt-A-River cleanup effort and public education about yard waste management along with access development and education/awareness of recreation opportunities.

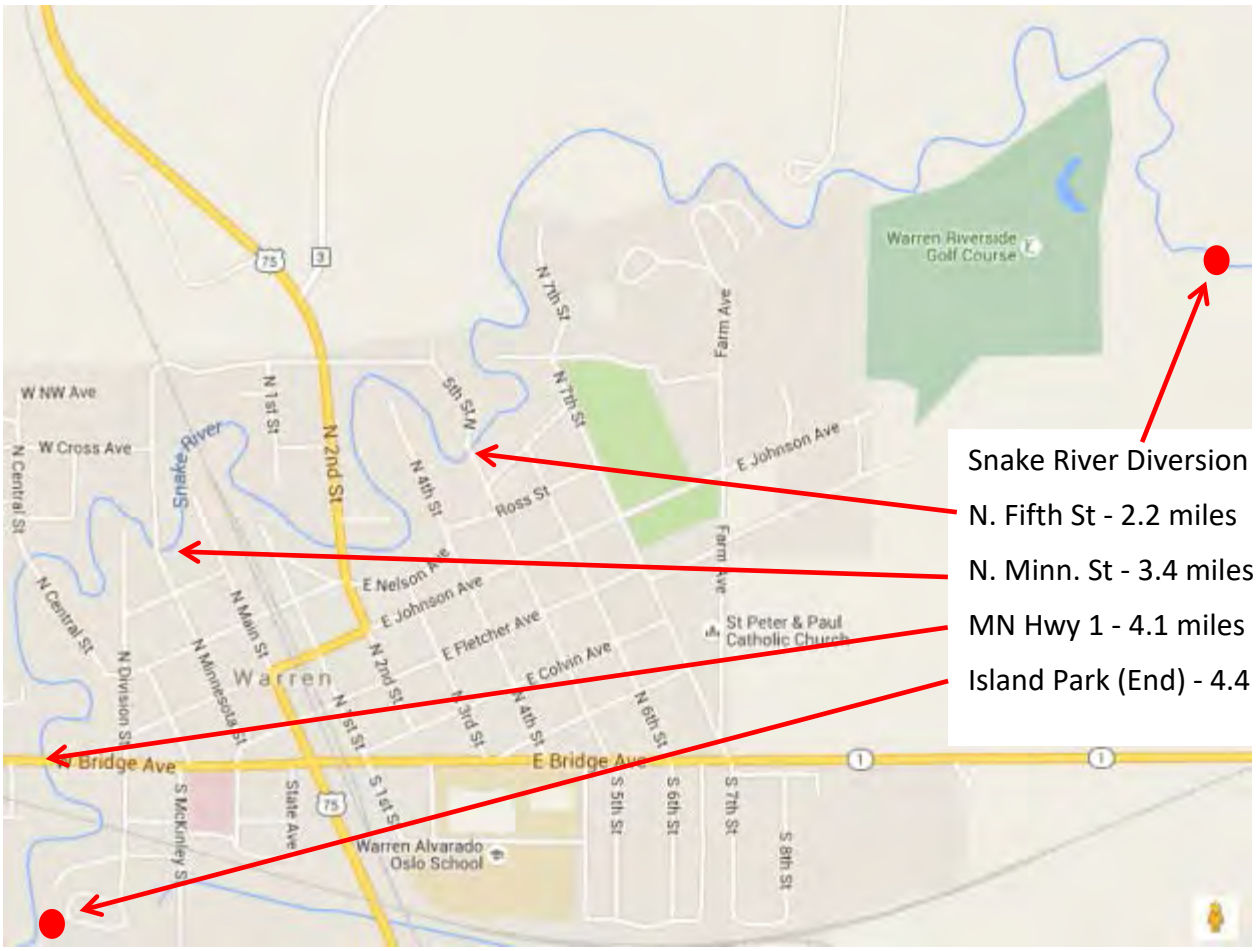
Snake River through Warren community



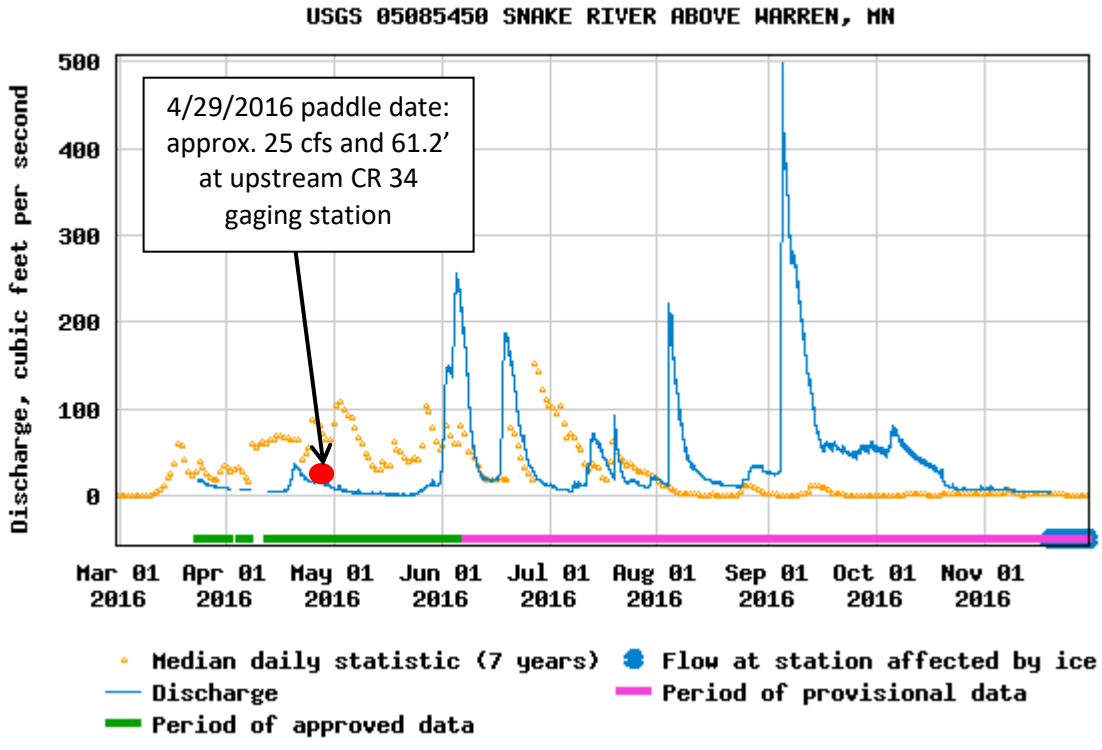
	Elevation (GoogleE)	Elevation (IWI LiDar)	Marshall CoRd 34 start (miles)	Snake R. Diversion start (miles)	Incremental from last crossing (miles)	Slope (ft/mile)
Marshall CoRd 34	864		0	-3.3	NA	
Snake R. Diversion	851		3.3	0	3.3	3.94
N. 5th St	847		5.54	2.24	2.24	1.79
N 2nd St	850		6.16	2.86	0.62	-4.84
RR tracks	850		6.49	3.19	0.33	0.00
N. Minn St	848		6.67	3.37	0.18	11.11
N. Central St	846		6.97	3.67	0.3	6.67
MN Hwy 1	843		7.38	4.08	0.41	7.32
Island Park	840		7.73	4.43	0.35	8.57
340th Ave NW	841		8.23	4.93	0.5	-2.00

Note: The Google Earth elevations shown in table are taken from elevation profile tool in Google Earth. Apparently a rough approximation as for a couple of segments the downstream elevation measures higher than the upstream point. Check with IWI LiDAR viewer to see if more accurate elevation data are available.

Total paddled on 4/29/16 from Diversion to Island Park=4.43 river miles/1.67 straight line miles = 2.65 sinuosity



Below is hydrograph for Snake River for calendar year 2016 which illustrates that the approx. 20-25 cfs flow on 4/29/16 paddle date was low with several much higher flows later in the year. Appears to be a very flashy flow regime. Caution advised for paddling at the higher flow levels.



For Immediate Release: May 6, 2016

Kayak Exploration of Snake River by Local Students

Students from the Warren-Alvarado-Oslo (WAO) River Watch team were pleasantly surprised to find relatively easy passage along the Snake River through the Warren community on a recent April 29th kayak trip. The team has proposed that access be improved to enhance the river's recreation value to the community. This trip was to scout access options and check on river conditions.

Eight WAO students, Science Teacher and River Watch advisor Kevin Johnson, and two staff from the International Water Institute started at the Snake River diversion structure just upstream of Warren and paddled to Island Park—a total of 4.4 river miles. Turtles, ducks, songbirds, and a few fish were spotted along the way. Signs of beaver, otter, and deer were also evident.

Adequate flow and good water clarity provided a positive impression of the Snake River. Two tree snags were negotiated without much difficulty while several mini-rapids provided some thrills in this otherwise flat stretch of river. Overall, students were impressed with how easy it was to paddle along the river and what a pleasant experience it was.

However, the students also observed problems along the river corridor with some erosion and streambank sloughing. The two major issues observed through the Warren residential area were the significant amount of trash along the river banks and grass clippings and leaves also being dumped in the river. The grass clippings and leaves contribute to nutrient loading of the river which results in algae growth and recreation impairment.

By the end of the trip, students were talking about helping organize a community Adopt-A-River cleanup and further look into access options. Also consideration of making kayaks available for public use similar to what the Stephen community does for residents to use on the Tamarac River. All the students whole-heartedly agreed that they loved the experience and would go again if given the opportunity.

Exploration of local rivers in the Red River Basin is made possible through the International Water Institute's River Explorers Program whereby local high school River Watch teams get out in kayaks to discover what their local rivers have in store for recreational enjoyment. Photo documentation is also done and shared with local resource managers to help identify and address potential issues. Partial funding for the program is made available through the Minnesota Clean Water Legacy Fund and the Red River Watershed Management Board. For more information on the program, contact Danni Halvorson, IWI Education Program Director at 218-280-0515.

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For more information about this article/activity contact Wayne Goeken, International Water Institute Special Projects Coordinator at 218-280-0516 or wayne@iwinst.org

Photos and captions below provided as suggested options. Photos are compressed—larger format available for all.

Photo credit: Andy Ulven, IWI

Warren-Alvarado-Oslo River Watch Team kayaking on the Snake River through Warren

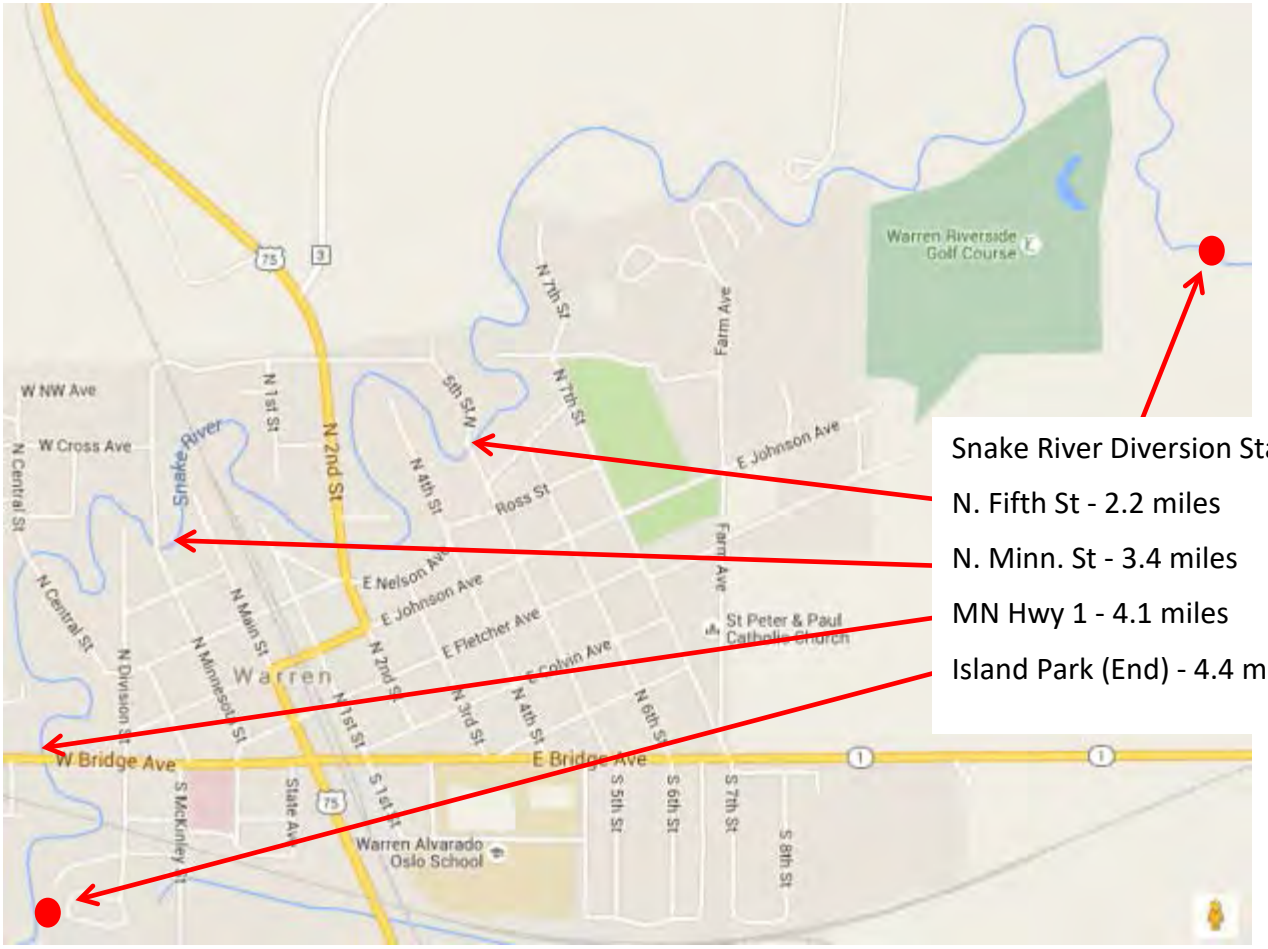

Photo credit: Andy Ulven, IWI
Ashton Pettyjohn showing turtle from Snake River


Photo credit: Wayne Goeken, IWI
Angela Spidahl running “rapids” on Snake River in Warren


Photo Credit: Wayne Goeken, IWI
WarrenAO River Watch Team exploring Snake River in Warren


Photo Credit: Wayne Goeken, IWI
Trash caught up in tree snag on Snake River in Warren

Below is map of the reach of the Snake River paddled by WarrenAO River Watch Team



Text for June 2016 IWI River Rendezvous e-newsletter to accompany photo:

The Warren-Alvarado-Oslo (WAO) River Watch team kayaked a 4.4 mile reach of the Snake River through Warren to identify access options and river conditions as part of their proposal to evaluate how the river could be a recreation asset to the community. Good water clarity and flow on their late spring paddle provided a positive impression.

Turtles, ducks, songbirds, and fish were spotted along the way 4.4 mile reach explored. Signs of beaver, otter, and deer were also evident. But a good deal of trash and yard waste were also observed that presents a challenge for raising awareness of river stewardship needs. The team followed up with a river clean-up day as part of their community service activities.

2016 River Explorers Scouting Tally						
Date	Watershed	Water Body	Location	Miles	cfs	Notes
4/19/2016	MSTR	Middle R	Pembina Trail NW to 250th Ave NW	6.5	93	Paddled through this reach following River of Dreams canoe release in Old Mill State Park. River drops through boulder fields and rock ledges through this reach. Flow is fast but not high volume so even if paddler gets hung up on rocks should be relatively easy to get out of kayak and drag through. I did not have to get out on this reach from rocks nor from any tree snags that covered entire stream channel. Very scenic--recommend this route, but perhaps not for novices--though at warm time of year even beginners could just get out and wade as needed.
6/2/2016	MSTR	Middle R	250th Ave NW to Marshall CR 4	3.0	431	Total time from start to end: About 45 minutes covering 3 river miles for average speed of 4.0 mph. No tree snags that covered entire river. Fairly easy to get on and off river at road crossings. Very good flow and high enough water that rocks were not a problem. Very scenic reach of river and enjoyable paddle.
6/2/2016	MSTR	Tamarac R	Marshall CR 6 to Florian County Park	6.0	845	High, fast water from recent rains. Several tree snags to drag around and debris piled up against one bridge crossing. Potentially dangerous conditions due to high/fast flow. Scenic, but wouldn't recommend for novice paddlers. More relaxed conditions as approached reservoir at Florian Park.
6/5/2016	Red Lake	Clearwater R	Confluence w/ Lost R to Red Lake CR 12 E. of Terrebonne	2.7	450	See Lost R notes for this date also. Final reach of Clearwater after confluence was fast and uneventful as high water levels kept paddler above most all of boulders in this reach at this high water level.
6/5/2016	Red Lake	Clearwater R	Red Lake CR 1 near Plummer to Red Lake CR 12 east of Terrebonne	11.4	450	Paddle at high water. On-water paddling from 14:54 to 16:50. (Hit confluence of Lost River at 16:25) Raining during last part including one roll of thunder--did not see any lightning. High water kept paddler above most rocks, though section just before confluene with Lost R had rocks--steep, fast descent. Was paddling hard, especially at end with thunderstorm threat. Averaged 6.22 mph. With high water, no sand bars to stop. Also could not see bottom due to depth and turbidity from fast, high flow.
8/17/2016	Red Lake	Clearwater R	Terrebonne to Red Lake Falls	18.0	723	Dropped boat/gear upstream of Terrebonne and car at Huot Park. Tanya Billberg at Red Lake SWCD provided shuttle from Huot Park to Terrebonne. Recent rains providing high water for this time of year--median flow for this date is 110 cfs. Paddle time 9:05 to 12:25--3 hr 20 min for 5.3 mph avg. Stretch stops and photo taking of erosion and river conditions. Very good flow and high enough to be over many rocks but still plenty of rapids to negotiate. No tree snags covering entire river channel. Not for novice paddlers, but fun for intermediate paddlers. Eagles along the way, great blue herons, ducks. One very degraded pasture area where cattle access river, otherwise generally good riparian corridor and scenic. See photo set for sampler of conditions.
6/5/2016	Red Lake	Lost R	Red Lake CR 119 W of US 59 to Clearwater R confluence	8.4	232	High water from recent rains. Couple of tree snags had to get off river and drag around--not a problem though. Fast flow. Pair of eagles at confluence with Clearwater R. Was on water from 10:43 to 13:06--this inclusive of final 2.7 miles on Clearwater after confluence to CR12. Total of 11.1 miles in 2 hrs 23 min for average of 4.66 mph.

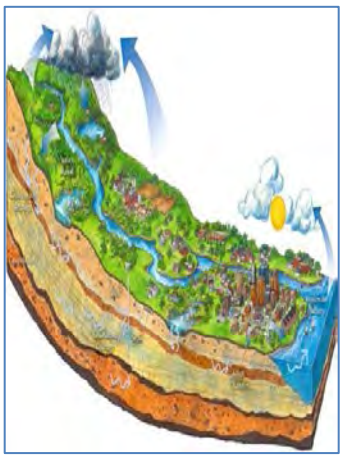
Date	Watershed	Water Body	Location	Miles	cfs	Notes
6/11/2016	Red Lake	Red Lake R	St. Hilaire City Park to Red Lake Falls MN Hwy 32	18.3	1322	On river from 9:20-12:18 with 1 stop of 15 min--so did at >6mph pace--was good current but also pushing paddling at strong pace. High water that covered most of channel--50-100 ft wide--no exposed sandbar islands or rock ledges--could get off on some inside bends with some gravel/rock areas. High enough water to go over most rocks but also many that needed to be maneuvered around--hit a few as sea kayak not too nimble. Made it fine at fast clip with 16 ft Old Town Millenium 160-16 ft kayak. Light N. breeze, mostly overcast--nice and cool. Two eagles, Canada geese and goslings, songbirds. Al Page (RLWD Bd member from Red Lake Falls) provided shuttling service for me back to my car at end. 75.1 road miles total round trip from WG home to St. Hilaire and back.
8/17/2016	Red Lake	Red Lake R	Red Lake Falls to Huot	13.5	1068	Dropped boat/gear at Terrebonne and car at Huot Park. Tanya Billberg at Red Lake SWCD provided shuttle from Huot Park to Terrebonne. Recent rains providing high water for this time of year. 1068 cfs is from 8/13--appears to be problem with gaging station so not sure of actual flow on 8/17/date of this paddle. Paddle time after break following paddle of Clearwater from Terrebonne to Sportsmen's Park from 12:50 to 3:20--2 hrs 30 min for 5.4 mph avg. Stretch stop and photo taking of erosion and river conditions. Very good flow and high enough to be over many rocks but still plenty of rapids to negotiate. No tree snags. Not for novice paddlers, but fun for intermediate paddlers. Eagles along the way, great blue herons, ducks. Generally good riparian corridor and scenic. See photo set for sampler of conditions.
8/20/2016	Red Lake	Red Lake R	Central Park upstream and back	4.5	1060	Oxcart Days Canoe and Kayak race. Good flow and depth for paddling. Wind seemed to be more of a factor than current, i.e. seemed to be easier to paddle upstream into current than downstream against the wind.
9/8/2016	Red Lake	Red Lake R	Huot to Crookston	28.5	2500	Dropped boat/gear at Huot Park. Drove to take-out at US Hwy 75 by-pass boat access downstream of Crookston. Theresa Helgeson (UMC) provided ride back to Huot Park. Good water flow with river rising--paddled fairly hard most of the way. Paddle from 10 a.m to 3 p.m.-5 hrs @ 5.7 mph. Took some photos. Long trip, not terribly scenic. No issues with snags or any obstacles. Getting out at rock dam by hospital not the easiest--swirling turbulent waters below dam but high water worked well to get through.
4/13/2016	Sand Hill	Sand Hill R	MN Hwy 32 to Nature Ctr Rd	1.4	28	low water. Able to work around tree snags. Golf course sawing some trees along banks.
5/11/2016	Sand Hill	Sand Hill R	Nature Ctr Rd to West Mill Rd	2.0	26	searching for ROD canoes and checking water level. Found six ROD canoes that I re-released downstream below first drop structure. Water level low but passable except at rock ledge near end. One tree blocking channel that required dragging around--others able to work through on-water.

Date	Watershed	Water Body	Location	Miles	cfs	Notes
6/4/2016	Sand Hill	Sand Hill R	Mahnomen CR7 to Rindal	8.4	55	high water from recent rains. Good flow. No obstructions in entire reach. Had to get out to drag around Bear Park structure. Lots of waterfowl including 100s of wood ducks above Bear Park along with nesting pair of trumpeter swans. Waterfowl throughout. Saw one otter. Beaver dam remnants including just upstream of Rindal. Duckweed abundant. Filamentous algae will likely soon become too thick for paddling at lower water. Great passage on this day though. Very safe and enjoyable paddle.
8/9/2016	Sand Hill	Sand Hill R	MN Hwy 32 to West Mill Rd	3.3	140	gage info from 1:45 p.m. and rising. Paddle time from 3:30-4:10 or 40 minutes -approx 5 mph. Fast current at higher than normal water level--over top of many of rocks. Several new trees and limbs down. Had to get out for one large downed tree near end-easy to drag around on left side--rock ledge just below this able to "bounce" over on right side. Final rocks just before West Mill culverts churning--made it on left side without incident. Would not recommend this reach, especially below Nature Ctr Rd for novice paddlers or those not very strong (young kids), especially if it would be at time of year with colder water.
7/22/2016	Sand Hill	Sand Hill R	Below 1st drop structure to Polk CR 14 W. of Beltrami	10.5	37	Paddling through drop structures before modifications done and riffles added. Good water level--moderate fast current in narrow channel. Sometimes channel less than paddle width due to willows growing in from sides. Portaged around the drop structures, the old bridge abuttment just downstream of railroad/bridge crossing at Beltrami, and at Texas crossing west of Beltrami. Great blue herons below drop structures. Eagle near end.
8/14/2016	Sand Hill	Sand Hill R	Mahnomen CR107 to Bear Park	7.6	199	Good flow from recent rains--bankfull and water into vegetation & floodplain in areas--clear/bog stain color. Appeared from vegetation that river was up 4-8 inches higher at recent peak flow within past 1-2 weeks. Two spots with trees leaning over most of river channel--able to get around edge without getting out of kayak. Two spots where channel narrowed and algae/weeds choked channel--able to pull through muck with paddle--very rotten smell when stirred up. Had to get out to drag around bridge at WEM30 site due to high water and lack of clearance under bridge. Narrow channel at places--4-6 feet with cattails/grasses lining river--generally 10-30 ft width. Many areas with crops (corn, soybeans, small grains) up to waters edge, i.e. limited or no buffer with water draws up into fields in several spots. Deer, eagle, great blue herons, green herons, white egret, ducks, northern harrier, red wing blackbirds. Beaver lodge off-channel in reach upstream of Bear Park. Duckweed abundant. Very safe and enjoyable paddle. (Had first gone to FOS20 site by Riersons with intent to paddle to Polk Co 1 east of Winger but too low and channel too narrow due to vegetation overgrowth. Also upstream of PC 1, group of cattle in river channel might have posed risk.)

Date	Watershed	Water Body	Location	Miles	cfs	Notes
8/29/2016	Sand Hill	Sand Hill R	Ericksons to Polk CR 1	2.8	185	5"+ rain in Fertile area previous night. River at bankfull or beyond. Cattle in river at Erickson's right at start. Electric fence across also near start--managed to go over it near right bank. One more electric fence and two barbed wire fences in this reach. Up to 10 tree snags (see photos) across channel. Was able to get around or through all but one at this high water. Current wasn't too strong so able to control getting through. One spot near start where appears house will be built--bank denuded. Channel generally 20 ft wide up to 30-40' in spots. Some tall bluffs in spots w/ springs seeping out of bank. After last barbed wire fence channel was clear and very nice paddle. Likely the houses just downstream along this reach have kept the lower end of this reach clear of tree snags. If not for cattle, fences, and tree snags a very nice reach to paddle. 50 minutes paddle time.
8/29/2016	Sand Hill	Sand Hill R	Polk CR 1 to MN Hwy 32	1.9	185	5"+ rain in Fertile area previous night. River at bankfull. Three logs just at or below water surface--able to slide over them. Easily able to get around right side of old bridge abuttment. Water high enough to allow passage over rocks normally found in this reach--some good standing waves--some lapped over kayak. Able to stay out of overhanging trees in rapids areas. Fast, nice run at this river level. 30 minutes paddle time.
8/29/2016	Sand Hill	Sand Hill R	MN Hwy 32 to Nature Ctr Rd	1.4	185	5"+ rain in Fertile area previous night. River near bankfull. Water high enough to allow passage over rocks normally found in this reach. Able to stay out of overhanging trees in rapids areas. A couple of trees downed might have been new--some careful maneuvring needed to get through--would be good to do some clearing when water goes down. Fast, nice run at this river level. 30 minutes paddle time.
8/29/2016	Sand Hill	Sand Hill R	Nature Ctr Rd to West Mill Rd	2.0	185	5"+ rain in Fertile area previous night. River near bankfull--high enough to allow passage over rocks normally hit in this reach. Able to stay out of overhanging trees in rapids areas. One large tree across channel by tall bluff near end--was able to scooch through to the left of tree without getting out (it would have been easy to get out and drag around.) Able to bounce over rock ledge immediately downstream of this tree--normally have to drag around. Some standing waves below this that lapped over side of kayak. Rocks just before culverts at end churning waves up--got through on left side OK. Fast run at this river level. 30 minutes paddle time.
9/7/2016	Sand Hill	Sand Hill R	MN Hwy 32 to Nature Ctr Rd	1.4	173	high water for this time of year. Gaging data missing for this date. Used chest waders and hand saw to clear some tree limbs/debris for safer passage.

Date	Watershed	Water Body	Location	Miles	cfs	Notes
8/31/2016	Wild Rice	Wild Rice R	Norman CR40/Faith to Norman CR173/36	7.3	700	High water/fast flow allowed easy passage over rocks and rapids. No tree snags covering channel--might be 2 tree snags that will block channel when water goes down but will be able to easily get out of boat and drag around them when that occurs. Several gravel bars along inside bends that paddlers could get out on as desired. Wildlife seen: great blue heron, owls, hawks, mature bald eagle and an immature bald eagle perched by eagle nest in this reach, pileated woodpecker, wood ducks, and deer. In first half mile, soybean field right up to river's edge. Later in reach (or next reach?--see photos), a corn field up to river's edge. Overall, very good riparian vegetation--forested. Spring Creek was good flow, clear water coming into more turbid Wild Rice R mainstem--noticeable difference. Marsh Creek had larger volume of water entering Wild Rice R with about same turbidity appearance. Paddle time: 1 hr 24 min (5.2 mph). Steady and strong paddling but also taking pictures of conditions. Was easy to get in at Norman CR40/Faith on upstream south side under bridge--water was at bankfull--slipped in off grass on shore--very nice. At downstream Norman CR 173 on downstream right (north) side of bridge was nice spot to get in/out on rocks under bridge. Area along road had been mowed making for great access area.
8/31/2016	Wild Rice	Wild Rice R	Norman CR173/36 to Norman CR29/USGS	9.1	700	High water/fast flow allowed easy passage over rocks and rapids. One tree snag that nearly blocked channel but able to get through on left side. Two trees reaching from opposite banks could be blockage at higher water level. Many gravel bars along inside bends that paddlers could get out on as desired. One spot the mainstem branched off to new channel being cut---joined mainstem again downstream. Wildlife seen: great blue herons, hawks, mature bald eagle, many wood ducks, and deer. Snapping turtle plopped in river off resting spot on bank. One spot where corn up to river's edge (or was this in upstream reach--review photos). Overall very good riparian vegetation--forested. "Normal" bank eroision including tall bluffs with spring seeps. Paddle time: 1.5 hrs (6.07 mph). Steady and strong paddling but also taking pictures of conditions. Took rest stop at NC29 bridge--downstream N. side nice "slip" for kayak--easy to get in/out.
8/31/2016	Wild Rice	Wild Rice R	Norman CR29/USGS to MN Hwy32/Heiberg	3.6	700	High water/fast flow allowed easy passage over rocks and rapids. Less rocks/rapids in this reach than upstream. Gravel bars along inside bends that paddlers could get out on as desired. Wildlife seen: great blue heron, red-tailed hawks, owl, mature bald eagle, wood ducks, and deer. Overall very good riparian vegetation--forested. Paddle time: 37 min (.617 hrs) (5.84 mph). Steady and strong paddling but also taking pictures of conditions. Easy to get out on left (south) side just above Heiberg Dam

Date	Watershed	Water Body	Location	Miles	cfs	Notes
9/1/2016	Wild Rice	Wild Rice R	MN Hwy32/Heiberg to Norman CR2/167	9.3	490	High water/fast flow allowed easy passage over rocks and rapids. Less rocks/rapids in this reach than upstream but still plenty to have fun with. Gravel bars along inside bends that paddlers could get out on as desired. One large cottonwood was new downed tree that spanned channel, but easy to get out and drag around left side. Wildlife seen: great blue heron(LOTS), red-tailed hawks, owl, wood ducks, bank beaver and deer. Mature bald eagle spotted up Mashuag Creek trib. Both Mashuag Crk and Coon Crk had good flow coming in--both were clearer water coming in with brownish bog stain appearance. Overall very good riparian vegetation--forested. But some crops up to river's edge. Also many eroding bluffs--some 50 ft+. Paddle time: 1 hr 55 min (4.87 mph). Steady and strong paddling but also taking pictures of conditions and 10 min. stop at downed tree. Easy to get on river below Heiberg Dam at boat landing. Very nice city park.
9/1/2016	Wild Rice	Wild Rice R	Norman CR2/167 to Norman CR24	3.7	490	High water/fast flow allowed easy passage over rocks and rapids.Less rapids as river flattens out. Gravel bars along inside bends that paddlers could get out on as desired. Wildlife seen: great blue heron(LOTS), red-tailed hawks, owl, wood ducks, bank beaver and deer. Overall very good riparian vegetation--forested but some crops up to river's edge and eroding bluffs still along this reach. Paddle time: 35 min (6.4 mph). Steady and strong paddling but also taking pictures of conditions
9/1/2016	Wild Rice	Wild Rice R	Norman CR24 to Norman CR167	6.6	490	High water/fast flow allowed easy passage. River flattens out, few rocks/rapids. Gravel bars along inside bends that paddlers could get out on as desired. Only a few great-blue herons in this reach, red-tailed hawks, deer. Overall good riparian vegetation--forested. Dike along part of this reach. CoRd167 bridge at end had large debris pile stacked up at bridge covering channel--would be difficult for most to get out. Wild Rice Watershed District notified and debris will be removed. Paddle time: 22 min (5.9 mph). Steady and strong paddling but also taking pictures of conditions
			Total Miles Scouted in 2016	**203.0**		



2016 River Watch Fall Kickoffs

October 4th 5th 6th, Thief River Falls, East Grand Forks, Moorhead

Time	Group 1	Group 2
9:00	Arrive (use bathroom park water is off)	Arrive
9:15	Depart for River Trip	RW Introductions, Info about program
9:30	At landing for safety talk, boat captain introduction, life jacket sizing, etc	Blue Rivers Activity
9:45	River Talk	
10:00	Launch Boats (Paddle)	Presentation on watersheds
11:00	Return to Landing at Park	Lunch
11:15	Travel from Park to classroom	Use bathroom at classroom park water is off
11:30	Lunch	Depart for River Trip
11:45		At landing for safety talk, boat captain introduction, life jacket sizing, etc
12:00	RW Introductions, Info about program	River Talk
12:15	Blue Rivers Activity	Launch Boats (Paddle)
12:30		
12:45	Presentation on watersheds	
1:00		
1:15		Return to Landing
1:30	Depart	Depart

2017 River Watch Forum Assignment
Our Place in the Basin: Understanding our Subwatersheds

This year's River Watch Forum assignment will take you on a deep dive into your subwatershed. The Tamarac, the Buffalo, the Forest, the Red Lake- all River Watch teams represent a subwatershed which contributes to the Red River of the North. In turn, the Red River of the North flows to its outlet at Lake Winnipeg, which ultimately drains to Hudson Bay in the subarctic region of northeast Manitoba.

So what makes your subwatershed unique to the ~30 in the Red River Basin? Your first task will be to complete the attached worksheet which will reveal quantitative and qualitative (look these up) information about your subwatershed. Information revealed through this research will guide your team toward devising a 30-60 minute lesson intended for 4th or 5th grade students in your school, which will be implemented with the help of a 4th-5th grade teacher this fall or winter. After delivering the activity/lesson, you will discuss strengths and weaknesses with the elementary teacher so that the lesson might be used again in the future. What would they add or subtract from the lesson? What visuals or examples might have made the lesson better? Evaluation can include pre/post quizzes given to the elementary students to track what they learned or anecdotal quotes or testimony from the teacher and students. **Your poster will be populated with background on your subwatershed, the activity/lesson you developed, and any evaluation measures produced throughout.**

In order to deliver the lesson, you will need to master the basics of your subwatershed and be able to put things in context for elementary level learners. All lessons will begin with watershed vocabulary (headwaters, outlet, tributary, confluence, etc.) and must discuss the subwatershed's fit into the larger Red River Basin. Beyond that, you have the freedom to utilize whatever tools you would like (Google Earth flyovers, mapping activities, water quality 101, geography basics, and relevant books, videos, or other web resources).

The lesson must be implemented this winter. Rough draft posters must be submitted by February 3 so we can review before beginning the printing process. Final posters are due February 17. **Your team will not be presenting at the Forum. Instead, all teams will record their presentation in a 4-6 minute video to be submitted for judging by March 8.**

School Name_____

Subwatershed_____

Vocabulary: Define the following watershed terms

Headwaters:_____

_____

Outlet:_____

_____

Confluence:_____

_____

Tributary:_____

_____

Meander:_____

_____

Watershed:_____

_____

Mouth:_____

_____

Hydrograph:_____

_____

Thalweg:_____

_____

Streamflow gaging:

_____

_____

Identify the Following for Your Subwatershed

Headwaters:_____

Mouth/Outlet:_____

Tributaries and confluence locations:_____

Size (in square miles):_____

Human population:_____

Land use makeup:_____

Names of cities and towns:_____

Counties included:_____

Stream gaging locations: _____

Mainstem stream length:_____

Number of dams:_____

Total watershed stream miles (including all tributaries):

_____

Decision makers/agencies in your

watershed:_____

List and describe water quality or public health concerns in your watershed:

Possibilities include pollutant loads, impaired stream segments, erosion, AIS, etc.

Other Watershed Considerations to Incorporate into your Classroom Activity/Lesson

Social/cultural history
Flooding
Wildlife
River Access

Recreation
Art
Creative writing

AND MANY MORE!

RIVER WATCH TEAM POSTER CRITERIA

For the ***2017 River Watch Forum to be held MARCH 15TH*** each team will be creating a poster to display and for use in their video presentation. Posters will be **30 in. high and 40 in. wide.** IWI will arrange for posters to be printed. In order for you to complete your video presentation in time for the Forum**,** we will need to receive your first draft by **Friday, Feb. 3rd**. This deadline is firm. We need time to review and send them back with comments and suggestions, and still give you time to revise and return to us no later than **February 17th** for printing and redistribution,

Our goal is that when you have completed your poster, it will be representative of the work you do, polished and accurate. The poster may then be presented to your local watershed office, posted in your school or placed in a community location such as a library. The posters will also provide a consistent look across River Watch teams and be able to be archived and shared electronically.

River Watch Poster Criteria

- Posters can be created in Microsoft Powerpoint (template on website) or Publisher (no template provided) and will be converted into a pdf when finalized. A tutorial for creating a poster with Powerpoint can be found here if needed. http://www.youtube.com/watch?v=MqgjgwIXadA
- Posters are to be 30 in. tall by 40 in wide. Posters must include the following sections and use an appropriate font and size.
- **Suggested font and size**:
  - Headings (except title): Trebuchet MS, 36 type, bold
  - Subheadings: Trebuchet MS, 28 type, bold
  - Text: Trebuchet MS, 18 type, normal

- **Title**: Font: Verdena, type size: 66- Try to incorporate the theme into your title.
- **School name, watershed or river name and date**: Verdena 32 type, bold

Bottom corner of poster (*right or left*):
Team: Heading: Arial, 32 type; List of members: Arial, 24 type
Sponsor: Heading: Arial, 32 type; listing in Arial, 24 type

Questions? danni@iwinst.org

Understanding our Subwatersheds Web resources

MPCA Watersheds: https://www.pca.state.mn.us/water/watersheds

- Characteristics
- Monitoring and assessment reports and data
- Maps

USGS Flow Stations:

ND http://waterdata.usgs.gov/nd/nwis/current/?type=flow

MN http://waterdata.usgs.gov/mn/nwis/current/?type=flow

- Daily stage and stream flow
- WaterWatch
- Historical Flow summaries

USGS StreamStats: http://water.usgs.gov/osw/streamstats/ssonline.html

- Delineate your watershed
- Download watershed boundary
- Basin characteristics

DNR/MPCA Stream Flow: http://www.dnr.state.mn.us/waters/csg/index.html

- Stream Flow and stage
- Historical Data
- Precipitation

EPA Surf Your Watershed: https://cfpub.epa.gov/surf/locate/index.cfm

- Watershed Health Assessments
- Water use data
- Science in your watershed
- Places involving the watershed

USDA Rapid Watershed Assessment:

MN http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mn/technical/dma/rwa/?cid=nrcs142p2_023658

ND http://www.nrcs.usda.gov/wps/portal/nrcs/main/nd/technical/dma/rwa/

- Watershed Overview
- Resource Profile
- Land Use Land Cover
- Census and Social Data

Watershed Pollutant Load Monitoring Network:

https://www.pca.state.mn.us/water/watershed-pollutant-load-monitoring-network#grants

- Pollutant Load Maps
- Runoff/Precipitation Maps

Additional Resources:

USGS

- http://water.usgs.gov/wsc/
- http://nd.water.usgs.gov/floodinfo/red.html

Minnesota

- https://www.pca.state.mn.us/water/watersheds
- http://www.rrwmb.org/#
- http://www.mnwatershed.org/
- http://www.extension.umn.edu/environment/water/education-for-professionals/watershed/index.html

North Dakota

- http://www.swc.nd.gov/pdfs/water_reference_guide.pdf
- http://www.swc.nd.gov/info_edu/map_data_resources/publishedmaps/
- http://www.swc.nd.gov/info_edu/water_education/
- http://www.redriverjointwrd.org/member-water-resource-districts.html

International

- http://www.rrbdin.org/
- http://www.ijc.org/en_/Red_River_Basin

Curriculum Examples

- http://www.riverswest.ca/media/documents/education/Red_River_Basin_Curr.pdf

Google Example Maps

- Kick-Off Red River Basin
- Kick-Off Ottertail River

2016 River Watch Kick-Off

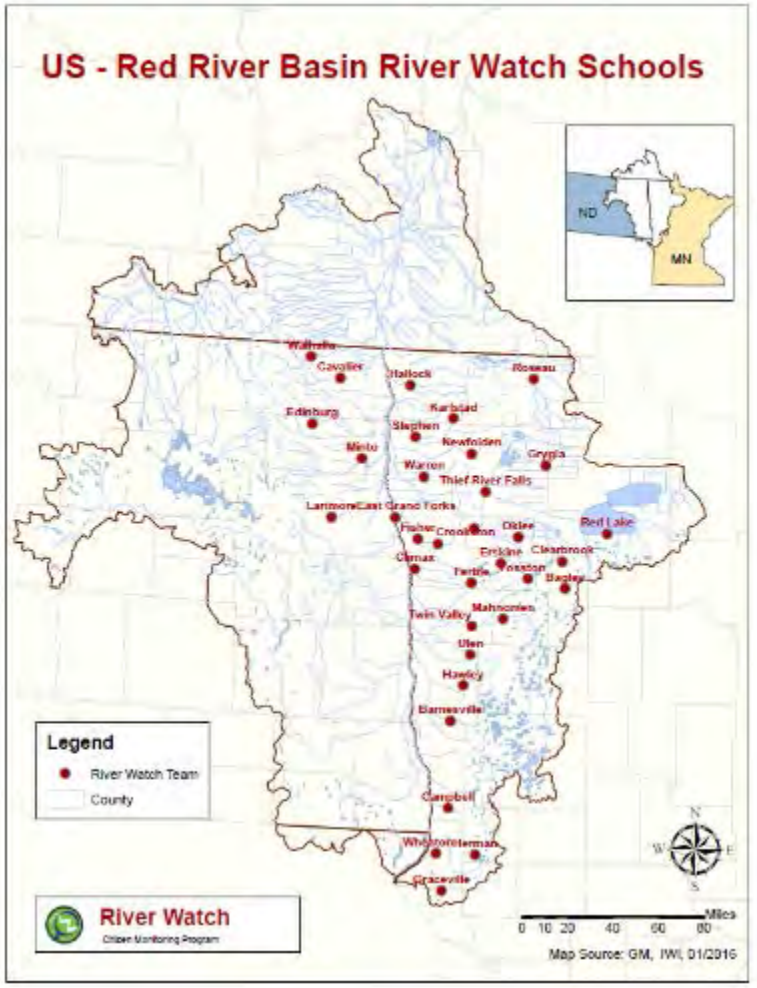
International Water Institute

Introductions

- IWI staff:
  - Danni Halvorson
  - Asher Kingery
  - Andy Ulven
  - Wayne Goeken (emeritus)
- Partners:
  - Laura Bell (UMC)
  - Ashley Hitt (RLWD)

History of River Watch

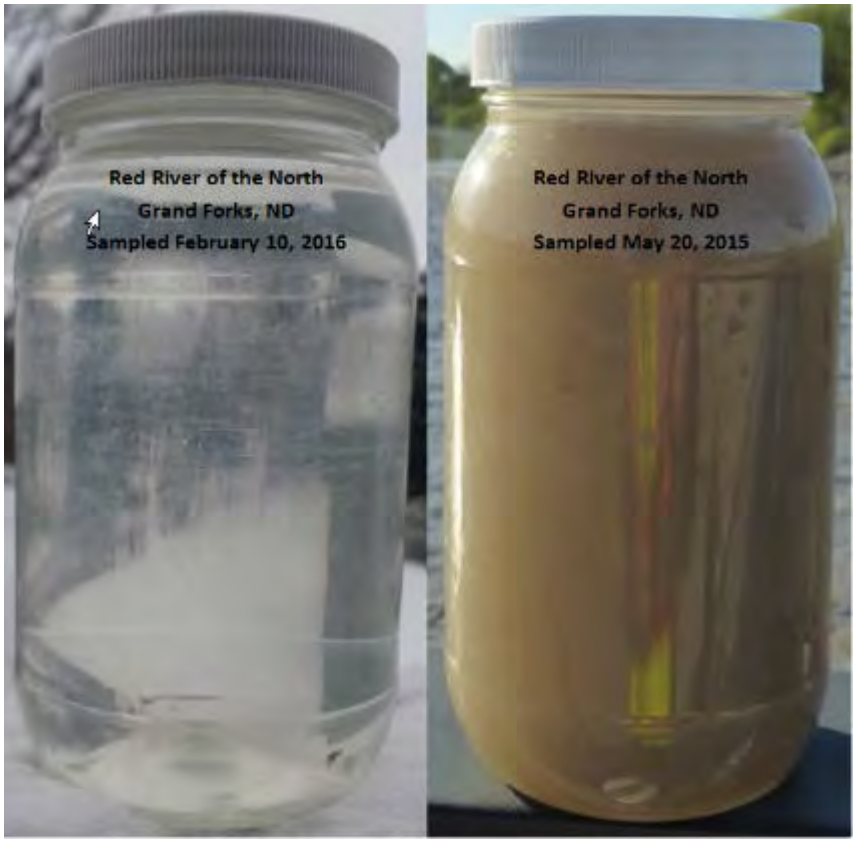
- Began in 1995 with 4 schools
- Currently 23 schools in MN and ND
  - (plus 22 in Manitoba)
- Over 10,000 river visits
- Expanded to include River Explorers in 2012
- Red River Basin focus



Watershed Ed Programs

- River Watch
  - Water quality monitoring
  - River Explorers
  - Macroinvertebrates
  - Snow and frost study
- River of Dreams
- Community Paddle Events

Snapchat/Insta-Worthy (No filter)



Snapchat/Insta-Worthy (No filter)

Snapchat/Insta-Worthy (No filter)

Snapchat/Insta-Worthy (No filter)

Vocabulary and Terminology

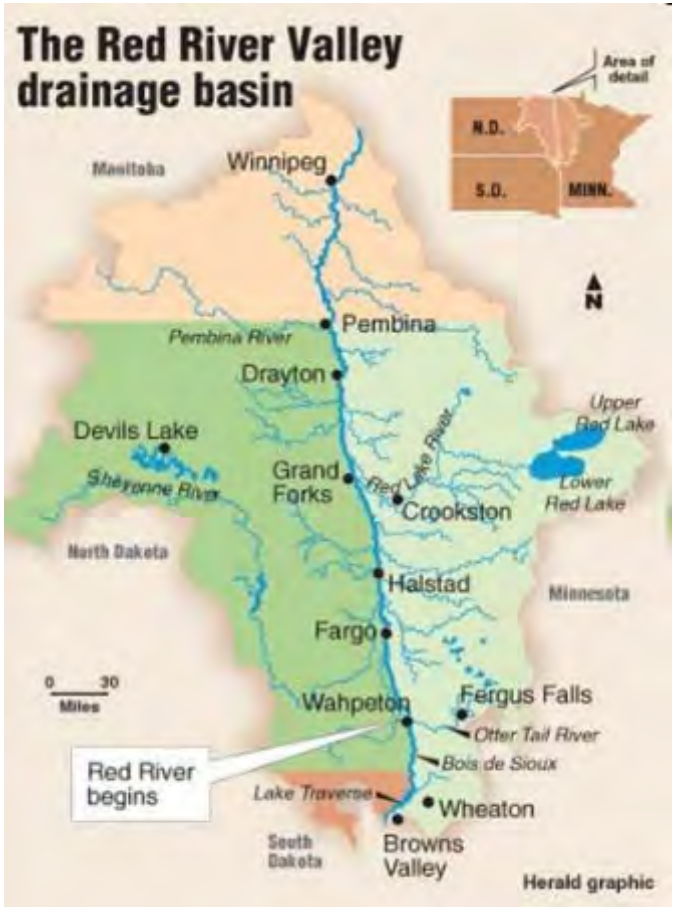
- Watershed
- Headwaters
- Tributary
- Confluence
- Mouth
- Outlet
- Meander
- Thalweg
- Hydrograph
- Streamflow gaging

Subwatersheds

- You monitor a Red River Basin subwatershed
- Each subwatershed is a piece of the larger Red River Basin puzzle
- Let's tour a subwatershed in Google Earth

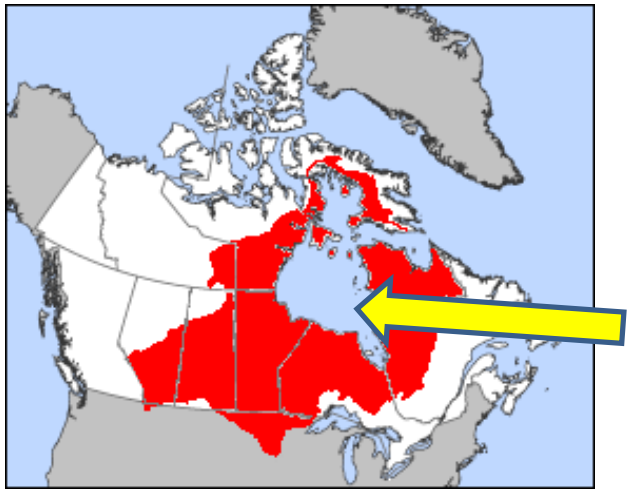
The Red River Basin

- Your local river is a **tributary** to the Red River.
- Its watershed is part of a bigger watershed, known as the Red River Basin.
- The Red River flows *north* to Canada and its **mouth** is at Lake Winnipeg's southern end.
- The Red River Basin in Google Earth



…And beyond

- Water from Lake Winnipeg eventually reaches the sea at Hudson Bay after joining the Nelson River on the northern end of the lake.
- Hudson Bay is part of the Atlantic Ocean, which connects to the Arctic Ocean.
- All water is connected in the **water cycle**.
- Beyond the Red River Basin in Google Earth



A Real-World “Paddle” to the Sea

- Natalie Warren, a Minnesota resident, paddled all the way from St. Paul to Hudson Bay one summer with Ann Raiho.
- The trip took around 90 days to complete.
- Natalie spoke at our River Watch Forum in 2015.

Worksheet Overview

- View vocab definitions and Otter Tail watershed worksheet
- Any questions about river stats or definitions?
- Go ahead and start on the worksheet for your own subwatershed.

International Water Institute presents 21st Anniversary

River Watch Citizen Monitoring Program

Red River Basin River Watch Forum ~ 2016

Tuesday, March 15, 2016

University of Minnesota-Crookston Campus

8:30 Registration. Set-up Displays. Continental Breakfast. (Bede Conference Center)

Posters from each River Watch team in Bede Conference Center for viewing throughout the day

9:30 Welcome-Bede Conference Center
River Watch Overview: Danni Halvorson, Director, IWI Center for Watershed Education

9:40 What's Your Watershed IQ? – Andy Ulven, IWI Education Specialist

10:00 Water Works: Human Impact and Urban Wilderness – Mark Hennager~Wilderness Inquiry

10:40 Announcements and First Door Prize Drawings

11:00 First Concurrent Session

11:30 Second Concurrent Session

12:00 Lunch (Brown Dining Hall) and Display Viewing and Voting

12:55 Team photos with posters in Bede Ballroom

1:10 Third Concurrent Session

1:40 Best of Red River Basin River Recreation & New Adventures

2:00 Final Door Prize Drawings

2:05 Awards ~ Recognition of Excellence for Schools and Partners

2:30 Adjournment

~Public Welcome ~

CLEAN WATER LAND & LEGACY AMENDMENT

InternationalWaterInstitute
Flood research and watershed education for the Red River Basin

Parking: It will be spring break on the UMC campus thus all parking lots are available to use. Parking Lot A is recommended for convenient access to Forum activities. Campus map at http://www1.crk.umn.edu/prod/groups/crk/@pub/@crk/documents/content/crk_content_369822.pdf

2016 River Watch Forum Concurrent Session Descriptions

Concurrent session online registration at: www.SignUpGenius.com/go/10C0B4CAEAD2DA5FD0-river

River Watch→About Us~ (TEACHER/ADMIN SESSION) Learn of new RW opportunities including: establishing macroinvertebrate reference sites, River Explorers, River of Dreams, Summer Teacher Training, and MORE. Meet and learn from fellow teachers. **Danni Halvorson**- IWI (Dowell 121, 11:00 session only)

River Recreation Posters: View and Vote~ River Watch teams share their assessment of a local river reach for recreation potential, identifying highlights to feature and issues to address to make rivers a community asset. Vote on best displays. **Evelyn Ashiamah**-International Water Institute (Bede Ballroom, limit 40/session)

Stream Table~ Explore impacts of stream flow, erosion, sediment deposition and land use. Try your hand at creating river meanders and trying to make water "behave." Emphasis on river recreation needs. **Karen Terry**-Univ. of MN Extension Water Educator-Morris (Northern Lights Lounge, limit 20/session)

River Access & Use FAQs ~ Where can I get on a river? When am I trespassing? Can I camp anywhere along a river? What about fences across rivers? Do I have to license my kayak? Learn how to legally navigate public waters and more. **Tim Williamson** - Trails and Waterways, MN DNR-Bemidji (Dowell 100, limit 38/session)

Wilderness Inquiry: The River Recreation Authority ~ WI staff share what makes their extraordinary paddling and adventure trips thrive! Get a behind the scenes look at their headquarters while learning about essential skills and considerations to ensure successful paddling trips of your own. Prepare to be amazed by their trip offerings in Minnesota - and beyond! **Wilderness Inquiry Trail Staff** (Dowell 106, limit 40/session)

Let Your RiverWatch Project Paddle in more Opportunities—Exploring *Science Fair* and *Science of Agriculture* ~You've done the work, now learn about two great opportunities to share your work for chances to win scholarships, awards, trips, and more!! Reap River Watch Rewards! **Katy Smith**-Biology Professor-UofMN-Crookston and **Margo Bowerman**-Youth Leadership-UofMN Extension/4-H (Dowell 125, limit 30/session)

Drones Watching our Watersheds~Learn about exciting, emerging applications using drones for aerial streambed mapping, weed monitoring, precision ag practices, and more as part of Northland Community Technical College's innovative UAS program. **Jon Beck**-UAS Program Manager-Northland CTC-Thief River Falls. (Dowell 200, limit 40/session)

A Few of My Favorite BUGS! ~ Find out about the cool critters that are essential to river life and how they are indicators of water quality. Amazing life cycles and adaptations to match different river conditions. See real specimens! **Moriya Rufer**-RMB Environmental Labs-Detroit Lakes (Dowell 206, limit 40/session)

Watersheds & Wildlife ~ Eagles, otters, and turtles are just some of the "watchable wildlife" that provide highlights of paddle trips on local rivers. Find out the role of river corridors as critical wildlife habitat and tips on wildlife observation. **Christine Herwig**-Nongame Wildlife, MN DNR-Bemidji (Dowell 207, limit 40/session)

Red River Fisheries ~What fish species are found in the Red River Basin? Where are they found? Learn how scientists survey fish along the Red River and how distribution of fish species and numbers varies along the Red River. **Nathan Mielke**-Stream Fish Biologist, MPCA-Brainerd (Dowell 225, limit 40/session)

River Watch Forum ~ March 15, 2016 Univ.of MN Crookston

	Bede Ballroom	Northern Lights Lounge	Dowell 100 (38)	Dowell 106 (47)	Dowell 121 (30)	Dowell 125 (30)	Dowell 200 (56)	Dowell 206 (40)	Dowell 207 (65)	Dowell 225 (60)
Session 1 11:00	RW Posters View & Vote Evelyn Ashiamah 40	Stream Table Karen Terry 20	River Access & Use FAQ Tim Williamson 38	Wilderness Inquiry River Recreation WI Trail Staff 40	River Watch, About Us Danni Halvorson 30	Science Fair & Science of Ag Katy Smith & Margo Bowerman 30	Drones Watching our Watersheds Jon Beck 40	A Few of My Favorite Bugs! Moriya Rufer 40	Watersheds & Wildlife Christine Herwig 40	Red River Fisheries Nathan Mielke 40
Session 2 11:30	RW Posters View & Vote Evelyn Ashiamah 40	Stream Table Karen Terry 20	River Access & Use FAQ Tim Williamson 38	Wilderness Inquiry River Recreation WI Trail Staff 40		Science Fair & Science of Ag Katy Smith & Margo Bowerman 30	Drones Watching our Watersheds Jon Beck 40	A Few of My Favorite Bugs! Moriya Rufer 40	Watersheds & Wildlife Christine Herwig 40	Red River Fisheries Nathan Mielke 40
12:00 Noon	Lunch-Brown Dining Hall Posters—View and Vote, Bede Ballroom									
12:50	River Watch Team Photos with Posters in Bede Ballroom									
Session 3 1:05	RW Posters View & Vote Evelyn Ashiamah 40	Stream Table Karen Terry 20	River Access & Use FAQ Tim Williamson 38	Wilderness Inquiry River Recreation WI Trail Staff 40		Science Fair & Science of Ag Katy Smith & Margo Bowerman 30	Drones Watching our Watersheds Jon Beck 40	A Few of My Favorite Bugs! Moriya Rufer 40	Watersheds & Wildlife Christine Herwig 40	Red River Fisheries Nathan Mielke 40

River Rendezvous
Promoting watershed education and awareness in the Red River Basin
March 2016 Issue #24 www.iwinst.org

River Recreation Theme of 21st Annual River Watch Forum

In 2015, ten River Watch teams kayaked their local watersheds to see first-hand the field conditions affecting water quality of the rivers that they monitor. Students from these and other River Watch schools presented posters that featured local river recreation at the 21st Annual River Watch Forum held March 15th at the University of MN Crookston campus.

Mark Hennager, Wilderness Inquiry, sharing insights on river recreation connections.

Even River Watch teams that haven't made it out on a kayak outing yet, shared posters of river recreation possibilities in their local area that they plan to explore through the International Water Institute's River Explorers program. Beginning in late 2012, the program has involved nearly 1,000 participants paddling over 3,000 miles on rivers in the Red River Basin.

Participants are finding lesser known rivers such as the Tamarac, Clearwater, Sand Hill, Wild Rice, and Buffalo provide excellent local recreation opportunities. Students shared posters with ideas for how to further enhance these river recreation options with improved access, tree snagging, litter cleanups, equipment rentals, and raised awareness through information sharing. As students explore river routes, they are also documenting watershed conditions with waterproof gps enabled cameras to share with resource managers. (See river condition reports and river story maps here.)

Inside this issue:

Photo Credit for all 2016 RW Forum photos to Rose Clarke

River connections was the theme of the keynote address. Mark Hennager, an experienced trail guide with Wilderness Inquiry, emphasized how Wilderness Inquiry paddling programs also engage students in observing and understanding watershed connections as a key part of creating a stewardship ethic to preserve and protect our valuable water resources.

Concurrent session speakers also tied in river recreation to a varied range of topics including fishing, macroinvertebrates, wildlife, drone use in watershed management, and river access issues.


Red Lake River Watch team members presenting poster to judging panel

2016 River Watch Forum Poster Awards

River Watch Citizen Monitoring Program

River Watch Teams shared posters featuring river recreation opportunities on their local waterways.

*****Judges' Awards*****

- Gold - Larimore, ND
- Silver - Clearbrook-Gonvick
- Bronze - Barnesville

Larimore, ND RW—Judges' Gold Award & 10 Years River Watch Monitoring

*****People's Choice Awards*****

- Gold - Fisher
- Silver - Campbell-Tintah
- Bronze - Climax

Fisher RW–People's Gold Award

Climax-Shelly RW—Manager's Choice Award presented by John Finney, Chairman of Red River Watershed Management Board

View 2016 posters from all the following schools here

Barnesville
Campbell-Tintah
Cavalier
Clearbrook-Gonvick
Climax-Shelly
Crookston
Valley Edinburg
EGForks Sacred Heart
Fisher
Hawley
Larimore
Marshall Co. Central
Minto
Red Lake
Red Lake Co. Central
Red Lake Falls
Stephen-Argyle
North Border-Walhalla
Warren-Alvarado-Oslo
Win-E-Mac

Special Appreciation to 2016 Poster Judges

(back l to r): Erika Kolbow, Josh Hunter, Grit May, Meg Krueger, Andy Butzer, Dan Olson, Paul Swenson, Tina Harding, Bruce Paakh, Dave Bergman.
(front): Skylar Niesche, Evelyn Ashiamah, Jessica Cruezer, and Lisa Newton.

2016 River Watch Forum

Partnership Awards

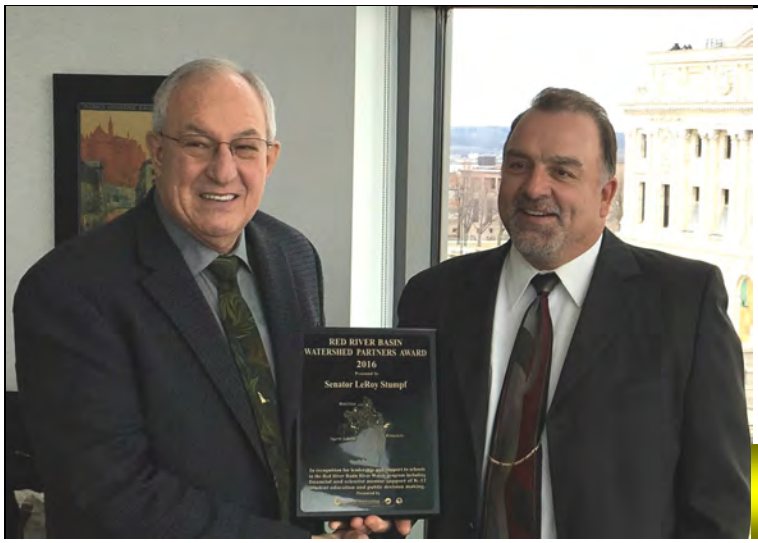
The River Watch **PARTNERSHIP AWARD** recognizes individuals or organizations that have helped support and advance the River Watch program in the Red River Basin through leadership, technical assistance, financial resources, coordination, or other support. There were three Partnership Award recipients in 2016.

Stuart Blotter (r) Assistant State Conservationist for Field Operations, accepting Partnership Award on behalf of North Dakota Natural Resources Conservation Service from Danni Halvorson, IWI Center for Watershed Education Director

The **North Dakota Natural Resources Conservation Service** oversees the delivery of conservation practices for landowners; ranging from technical assistance to financial assistance and covering everything from honeybees to water and wetlands. The River Watch Partnership Award to ND NRCS is in recognition of their financial assistance to help establish a network of schools in the Red River basin in the northeast corner of North Dakota to engage in River Watch watershed education and monitoring activities.

Gary Thompson (r) Board Chair of Red River Joint Water Resource District accepting Partnership Award on behalf of RRJWRD from Danni Halvorson, IWI Center for Watershed Education Director

The **Red River Joint Water Resource District** provides a coordinated and cooperative approach to water management and provides critical funding to member districts to develop and finance water retention projects. This joint district is made up of 14 individual county districts in the Red River Basin who realize that teamwork is crucial to deal with water issues. The Joint District is helping fund the ND River Watch program in recognition of the opportunities it provides to engage today's students in addressing water resource needs.



Senator LeRoy Stumpf was presented a Partnership Award for championing the cause of River Watch at the Minnesota State Legislature. Senator Stumpf has been the lead author of Senate funding bills to support continued growth and development of the River Watch program. As a leader in education and environmental issues, Senator Stumpf has been an advocate for the River Watch program as a way to engage youth in meaningful hands-on outdoor education that provides valuable STEM skills for the students, data for resource managers, and instills a stewardship ethic in youth to protect our valuable water resources.

Senator LeRoy Stumpf accepting Partnership Award from Chuck Fritz, IWI Executive Director

Voyageur Awards

Just as French voyageurs in the Red River Basin were known for extraordinary hard work and exceptional skill at their craft, the **VOYAGEUR AWARD** recognizes efforts that go above and beyond the normal activities of the River Watch program, demonstrating the greater potential and contribution that River Watch can provide to a school, a community, and a watershed. This year we have two recipients of our Voyageur Award for their efforts over the past years.

Danni Halvorson presented Voyageur Award to Minto River Watch Team for integrating all aspects of the River Watch program for education.

Danni Halvorson presenting Voyageur Award to Skylar Niesche in recognition of her ongoing contributions to the River Watch program

The recipient of the first 2016 Voyageur Award was the Minto River Watch Team. In their first year of involvement Minto completed all activities offered by the River Watch Program: from water quality monitoring and paddling to snow study research and macroinvertebrate monitoring. The Forest River in northeast North Dakota now has a group of young students actively expanding the watershed knowledge and contributing to a better understanding of their river. Going above and beyond our River Watch program, Minto won the ND state contest for the National Samsung Solve for Tomorrow Challenge and helped to submit one of 50 nationwide videos explaining how STEM can help improve a community. With the leadership of Cindy Stave, science teacher and River Watch Advisor, and other students, Minto studied the relationship between tile drainage and flooding in the Red River Basin. The next project for Minto is writing and submitting their own grant to secure a YSI sonde and other equipment. To round out their first year, Minto presented their first River Watch Poster at the 2016 River Watch Forum.

The second Voyageur Award was presented to Skylar Niesche, Campbell-Tintah River Watch alumni, for exemplary service to River Watch. Starting in the 8th grade and through her senior year, Skylar engaged in all aspects of RW including monitoring, macroinvertebrates, snow study, kayak trips, and a special tile drainage study. She taught watershed science to elementary students. She led poster presentations to her school board and the Bois de Sioux Watershed District. Skylar has also had a tremendous impact on RW support through her sharing of RW impact with Minnesota state legislators, first testifying as an eighth grader at a 2010 MN Legislative hearing in Moorhead and then before a Legislative Committee in St. Paul in 2015, both times sharing her passion for RW and demonstrating the power of youth to make a difference. Legislative funding for the RW program is in no small part due to her poised and passionate sharing of the value of the RW program to her, her school, her community, and her watershed. Skylar continued her RW legacy by helping judge posters at the 2016 RW Forum.

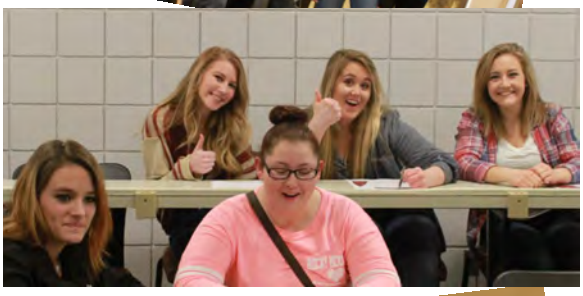
2016 Annual River Watch Forum

Thank You

River Watch Citizen Monitoring Program

A VERY Special THANK YOU to all Forum Presenters for sharing your expertise and enthusiasm for watershed science and recreation

- Mark Hennager, Wilderness Inquiry, Minneapolis
- Karen Terry, Univ. of MN Extension, Watershed Educator
- Tim Williamson, MnDNR Trails & Waterways, Bemidji
- Adreon Morgan & Allie Dart, Wilderness Inquiry, Mpls
- Katy Smith, UofM-Crookston Math, Science & Tech Dept.
- Margo Bowerman, UofM Extension Youth Leadership
- Moriya Rufer, RMB Environmental Labs, Inc.
- Christine Herwig, MN DNR Nongame Wildlife
- Jon Beck, Northland Community Technical College, TRF
- Nathan Mielke, MPCA Stream Fish Biologist, Brainerd



And Special Appreciation to the 2016 Poster Judges

- Dan Olson, MN Pollution Control Agency, Detroit Lakes
- Jessica Cruezer, River Keepers of Fargo/Moorhead
- Josh Hunter, Ground Up Adventures-Grand Forks
- Meg Krueger, Wilderness Inquiry, Minneapolis
- Grit May, International Water Institute, Fargo
- Erika Kolbow, Turtle River State Park, Arvilla
- Dave Bergman, MN Office of Tourism, Thief River Falls
- Tina Harding, ND State Water Commission
- Skylar Niesche, Campbell-Tintah River Watch Alumni
- Paul Swenson, International Water Institute, Bemidji
- Bruce Paakh, Detroit Lakes
- Andy Butzer, Minnesota Pollution Control Agency
- Lisa Newton, East Polk Soil & Water Conservation District

And a final BIG THANKS to

- Anna Peterson, UofMN-Crookston Extension staff for coordinating the online registration process
- Linda Kingery, Northwest Regional Sustainable Development Partnerships for coordinating laptop computer use
- Laura Bell, UofMN-Crookston Agriculture and Natural Resources Department for Forum support and door prize coordination
- Rose Clarke, Conservation Corps MN & Iowa-Community Outreach Corpsmember for photography services

River Watch—By the Numbers

Over the 21 years of River Watch in the Red River Basin, 48 teams have been involved at one time or another, contributing 205,000 student hours to watershed science through monitoring, River Watch Forums, macroinvertebrate sampling, snow study, River Explorers, and other watershed activities.

RW teams have recorded nearly 10,000 samples, covering 285 sample sites on over 100 water bodies in the Red River basin. As shown in Figure 1 to the right, the Red Lake watershed has by far the most samples collected, accounting for 1/3rd of all River Watch samples. It also has had the most River Watch teams (13) that have sampled at 83 sites.

In terms of the water body that has been sampled the most; the Sand Hill River clearly rises to the top with 1,285 samples taken. This is largely due to the fact that the Red River Basin River Watch program began on the Sand Hill River back in 1995 with ongoing data collection since then. As shown in Figure 2, the Clearwater River and Red Lake River follow—as those areas were next to begin River Watch monitoring.

Fig. 1. % of River Watch Samples by Watershed, 1995-2015

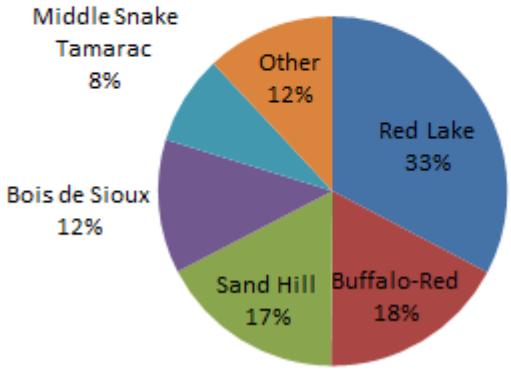
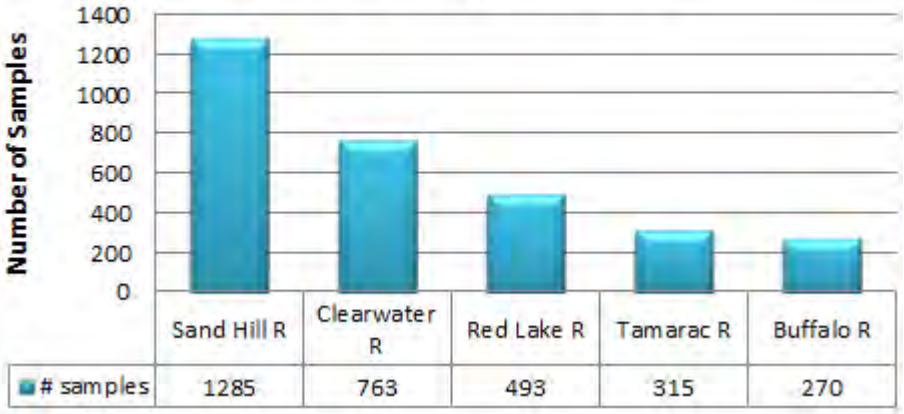


Fig. 2. Top 5 Rivers Sampled by River Watch Teams, 1995-2015



It should be noted that the above numbers do not yet reflect monitoring that has begun in the North Dakota portion of the Red River Basin. That data will soon be incorporated into the IWI online data base to help provide a more complete picture of surface water quality across the Red River Basin.

Congratulations River Watch Teams for helping make a difference in understanding our river resources!

~~~ Thank You to our 2016 River Watch Forum Sponsors ~~~

- Red River Watershed Management Board
- Otter Tail Power Company
- Sand Hill River Watershed District
- Buffalo-Red River Watershed District
- MN Pollution Control Agency ~ Det. Lakes
- Houston Engineering, Inc.
- Ducks Unlimited
- Enbridge
- Pembina County Soil Conservation District
- North Dakota Department of Health
- Moore Engineering
- HDR Engineering
- Paul Swenson

Goeken River Watch "Retirement"

Tribute was paid to Wayne Goeken at the 2016 River Watch Forum to mark his River Watch "retirement." Goeken has often been called the "father" of River Watch in the Red River Basin as he started the program back in 1995 and has been involved with its growth ever since.

Dan Wilkens, Sand Hill Watershed District Administrator commented on Goeken's role in the RW program's origins, "the Sand Hill Watershed District needed water quality data for a project and Wayne stepped in and proved that high school students could provide scientifically sound data to meet everyone's needs. Other watershed districts saw the benefits of working with local youth to raise awareness of water quality needs and helped expand the program."

Wilkens shared his vision that students throughout the Red River Basin including North Dakota and Manitoba will be part of River Watch, collecting comparable, sound data across the Basin and becoming the future watershed managers and informed citizens to help manage the Basin's land and water resources.

It was noted that Goeken has "tried" to retire before, but found too much yet needed to be done. This time, Goeken has cut back from most River Watch duties, but did stay involved in planning the 2016 River Watch Forum and will continue to produce the IWI e-newsletter. He also looks forward to staying involved with his favorite part of River Watch, the River Explorers program of engaging students and the public in paddling explorations of their local watersheds.

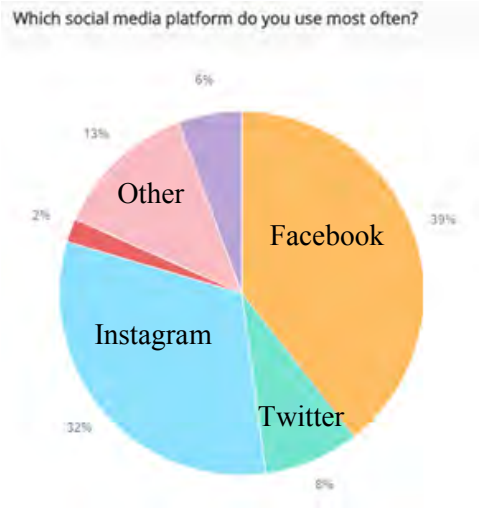
Wayne Goeken (left) receiving retirement plaque for over 20 years service to the Red River Basin River Watch Program from John Finney, Red River Watershed Management Board Chairman

Goeken thanked everyone for their support, commenting "It's been an honor to be involved in such a great program and everyone who has made it possible. I'm especially grateful to the Red River Watershed Management Board for their support of youth watershed education. Also special credit to the teachers for putting in extra effort to make it possible for students to have this experience. And a special thanks to the many River Watch students—current and alumni, who made it all worthwhile—who took an interest in their local rivers and helped raise awareness of the need to protect, improve, and enjoy our valuable river resources. Thank you all."

Wayne Goeken receiving "Continue Your Voyage" original artwork from IWI staff and Board commemorating his retirement and encouraging ongoing voyages in life.

Fun at the Forum…online polling

To get an idea of how mobile technologies can be used to gather and share information, an online poll allowed Forum participants to use their cell and smart phones, tablets, or iPads to respond and see the results in real time. Following are some responses compared to previous years.



⇒ Regarding use of mobile devices, while Apple still was most used at 55%, this was down from 64% in 2014, with Android devices gaining user share.

⇒ Facebook gained significantly as the main social media platform used, up from last year's 23% to 39%. Instagram stayed the same at 32%, whereas Twitter dropped dramatically from 28% to 8%.

⇒ The most popular information source remained the internet—constant at 66%.

⇒ Of all students attending the 2016 Forum, 60% were juniors or seniors.

⇒ Aside from River Watch, 64% of students indicated they are in three or more extracurricular activities, with 30% involved in five or more.

⇒ Those that have never canoed before rose from 23 to 29%, whereas those that have never kayaked stayed nearly constant at 20%.

⇒ Awareness of geocaching increased with only 25% not having a clue about geocaching (was 50% in 2014 and 2015) and the remaining 75% indicating they have heard of geocaching or are engaged in it.

Red River Resources: Send your events, links, and information for inclusion in the newsletter to Wayne Goeken.

River Watch Schools: Send us your photos, news releases and interesting facts. Have a question? Send it our way and we'll report back!

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River Watch
Citizen Monitoring Program

River Rendezvous is produced by **River Watch**, a citizen water monitoring and education program of the *International Water Institute*

Available on-line here or at ***www.iwinst.org/education/educate-me/newsletter***

Interested in River Watch activities?

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CLEAN WATER LAND & LEGACY AMENDMENT