A Monitoring Plan to Assess the Ecological Benefits of Kinnickinnic River Dam Removal and River Restoration in River Falls, Wisconsin

First Edition

SUBMITTED TO:

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1. Introduction

On February 27, 2018, the City of River Falls (WI) passed Council Resolution No. 6234, which states in part:

> "Now, Therefore Be It Resolved that the City Council hereby finds that the future of the Kinnickinnic River Corridor should be based on a long-term vision of a free flowing Kinnickinnic River, including associated ecological restoration to maintain the current classifications as a Class I trout stream, an Outstanding Resource Water above STH 35, and an Exceptional Resource Water below STH 35 as defined by the WDNR."

This resolution affirmed the public's desire and the City's support to remove the Junction Falls and Powell Falls Dams, currently impounding the Kinnickinnic River in River Falls, Wisconsin. The resolution further specifies that "The City shall document the Powell hydroelectric facility removal process to evaluate ecological restoration successes and failures and use those findings to enhance strategies for the ultimate removal of the Junction Falls hydroelectric facilities and associated river restoration". This monitoring plan will provide the City with the data and information necessary to make this evaluation.

The monitoring plan:

1. Provides an overview of monitoring benefits, goals, and objectives.
2. Reviews background information for the Powell Falls and Junction Falls Dams.
3. Defines the Kinnickinnic River Monitoring Project Area.
4. Provides an inventory of past monitoring datasets.
5. Describes key monitoring plan components, including monitoring types, partners, stations, frequency, duration, and protocols.
6. Outlines the next steps and overall budget for plan implementation.

1.1 WHY A MONITORING PLAN?

Stream restoration projects involve an array of partners, including natural resource professionals, funding agencies, engineers, scientists, land managers, and public users. All parties have a vested interest in ensuring project success, but success may be hard to quantify. Monitoring is therefore an essential component of any stream restoration project, providing quantifiable data on project successes, failures, and unintended consequences (Reeve, et al. 2006; Johnson 2010; Johnson 2019a).

Specifically, stream restoration monitoring is the systematic collection and analysis of data that provides information useful for measuring project performance, determining when modification of efforts is necessary, and building long-term public support for habitat protection and restoration (Thayer et al. 2005).

This Kinnickinnic River Monitoring Plan is intended to provide guidance to public and private partners interested in successful dam removal and ecological restoration of the Kinnickinnic River through River Falls, WI. Implementation of this plan (Section 1.3) will involve non-profit groups, governmental organizations, scientists, and public individuals working together for data collection, analysis, and reporting.

1.2 MONITORING PLAN GOALS AND OBJECTIVES

Monitoring plan goals provide a framework on which necessary ideas and resources can be gathered and generated to accomplish project purposes. Goals state the criteria on which the success or failure of a plan will ultimately be based.

After discussion with partners and stakeholder groups, the following goals were developed for this monitoring plan:

1. Provide the pre- and post-restoration qualitative and quantitative data necessary to "Evaluate ecological restoration successes and failures and use those findings to enhance strategies for the ultimate removal of the Junction Falls hydroelectric facilities and associated river restoration" (City of River Falls Council Resolution No. 6234, February 2018).

2. Evaluate the impact of the Lake Louise drawdown, dam removal, and river restoration on downstream ecological communities.

3. Evaluate river and riparian conditions within, downstream, and upstream of the former Lake Louise impoundment before, during, and after restoration of the river channel.

4. Meet monitoring requirements set by permitting and regulatory agencies.

5. Engage with stakeholder groups and individuals to gather public support for restoration.

Monitoring plan objectives should be specific, measurable, achievable, relevant, and time-based (USDA 2006). The individual monitoring plan components (Sections 3-8) have their own objectives, which are explained further in each section. These specific objectives ensure that the overall monitoring plan goals are met.

1.3 IMPLEMENTING THIS PLAN

This monitoring plan contains a number of components which local stakeholder groups can implement, including, aquatic biology, riparian biology, photo documentation, water quality, fluvial geomorphology, and community science and public engagement. Each monitoring component has a number of monitoring types, with each type including a specific monitoring objective, references for recommended monitoring protocols, where and when monitoring should occur, and suggestions for who is best suited to implement the monitoring work. Sample field forms for select monitoring types are included in Appendix A. This first edition of the monitoring plan recommends that the groups collecting the monitoring data be responsible for data management, including quality assurance and quality control, data storage and backup, and summary reporting.

With traditional stream restoration projects, a monitoring plan is developed in conjunction with project design, and prior to any changes to the project site, so the monitoring plan incorporates the design goals and objectives (Kondolf and Micheli 1995). Project goals and objectives should clearly state desired outcomes that are measurable through monitoring (Lewis, et al. 2009).

Additionally, monitoring often utilizes a Before-After-Control-Impact (BACI) approach to characterize conditions temporally and spatially at a control site and at an impact site (Green 1979). This approach is intended to account for watershed scale impacts and statistically determine if improvements occurred at the project site.

Due to the June 28-29, 2020 flood, the drawdown of the former Lake Louise impoundment is expected to remain and the new river channel allowed to naturally carve through the former lakebed. The drawdown fundamentally changed Lake Louise from a lake to a river system and caused sedimentation and pool-filling in downstream Kinnickinnic River reaches. These circumstances preclude a full BACI monitoring plan, although past monitoring work may be sufficient to describe pre-drawdown site conditions. Instead, this monitoring plan will allow for the scientific description of the river as the channel naturally evolves within and downstream of the former Lake Louise, and responds to eventual Powell Falls Dam removal and river restoration. It is recommended that, at a minimum, monitoring occurs until 5 years after river restoration has been completed.

In conjunction with eventual river restoration design, this plan should be updated and reissued (in the form of a new edition), to reflect specific restoration project goals and objectives, add monitoring locations as needed, incorporate new monitoring techniques as funding allows, and include any permitting requirements for monitoring.

2. Project Background

2.1 JUNCTION FALLS AND POWELL FALLS DAMS

Various dams have occupied the Kinnickinnic River through River Falls, WI since the 1800s, and the two remaining dams (which both replaced older dams) were built on top of the natural waterfalls that provide the City's name. The upper, concrete Junction Falls Dam was originally constructed in 1920, and the lower, concrete Powell Falls Dam was constructed in 1966. The dams created impoundments called Lake George (Junction Falls Dam) and Lake Louise (Powell Falls Dam) and have provided power and recreation for River Falls since their construction. Many citizens associate these dams with the City's past and a perceived setting of picturesque "lakes". However, the dams and their impoundments have also limited river connectivity, increased river temperatures, degraded riverine habitats, and created a safety concern for City staff and recreational users.

Both dams are currently licensed under Federal Energy Regulatory Commission (FERC) Permit (Project P-10489). With the current FERC license expiring in 2023, the City of River Falls Municipal Utilities (RFMU) was proposing to relicense the Junction Falls Development and decommission the Powell Falls Development with dam removal.

As a result of a large rain event (6.75 inches in River Falls from June 28-29, 2020) major flooding occurred within the Kinnickinnic River Watershed and the surrounding areas. At USGS gage 05342000, located at the County Road F crossing in Pierce County, Kinnickinnic River discharge peaked at 6,450 cfs at 2:45 PM on June 29th (Figure 1). This is approximately the 5% annual exceedance probability event (6,550 cfs) (USACE 2021).

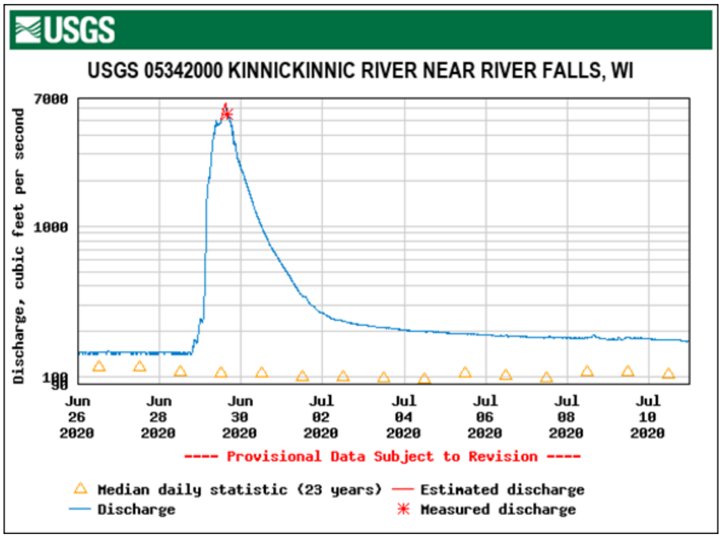

Figure 1: USGS gage data from the flood occurring on June 28-29, 2020.

The June 28-29 flood event damaged the Powell Falls Dam and prompted the River Falls Municipal Utilities (RFMU) to draw down Lake Louise for dam inspection in October 2020. Damage to the dam structure was documented by Ayres (2020).

Based on the findings of the Ayres dam inspection and discussion at a joint workshop with the River Falls City Council and Utility Advisory Board on January 19, 2021, the City decided to keep Lake Louise drawn down, but fix and adjust certain structures within the dam to allow more flow passage through the dam. The City will also begin impoundment sediment removal in 2021, and hopes to surrender the current FERC license for the Powell Falls Development in 2022. The City will then apply under state jurisdiction to remove the Powell Falls Dam, after amending the current FERC license to include only the Junction Falls Development. If the City is successful in the application and permitting process, Powell Falls Dam removal and river restoration through the former Lake Louise are expected to be complete by 2026. Currently, the City is planning to continue operating the Junction Falls Development under the current FERC license until 2035, at which time it will also be removed between 2035 and 2040 (City of River Falls 2018).

2.2 KINNICKINNIC RIVER MONITORING PROJECT AREA

The Kinnickinnic River and its headwater tributaries in St. Croix County flow within sandy glacial tills until reaching River Falls. There, the river encounters near-surface limestone that formed a series of natural cascades, providing the foundation geology necessary to construct the Powell and Junction Falls Dams. Downstream of the dams and impoundments, the river passes through a deep, narrow, bedrock (limestone) gorge before emptying into the St. Croix River.

Monitoring of the Kinnickinnic River River has occurred with some regularity since the early 1990s (see Section 2.3 below). For the purpose of this monitoring plan, the Kinnickinnic River

Monitoring Project Area extends from the northeast corner of the City of River Falls (upstream end) to the confluence with the St. Croix River (downstream end). Within the project area, nine monitoring stations were selected (Table 1 and Figure 2) to document conditions relevant to dam removal and river restoration. Monitoring stations are identified based on the river centerline available in the National Hydrologic Dataset (NHD) (USGS 2021). Monitoring stations are numbered based on their distance upstream from the St. Croix River confluence, rounded to the nearest 100 ft. For instance, monitoring station 120 is approximately 12,000 feet upstream from the Kinnickinnic River confluence with the St. Croix River. This nomenclature provides a standardized identification system for the nine monitoring stations, allows legacy data to be more easily compared to data collected for this monitoring plan, and allows monitoring stations to be added as the project evolves. Table 1 summarizes the nine monitoring stations and denotes each site as a control or impact site, based on the BACI monitoring format (Green 1979).

Table 1: Kinnickinnic River monitoring station designation, location, and BACI classification (control or impact).

Monitoring Station	Description	Control/ Impact
120	County Road F/USGS Gage	Control
264	KRLT Drewiske Family Preserve	Impact
478	Glen Park, Lime Kiln	Impact
504	Below Powell Falls Dam	Impact
515	Lake Louise	Impact
529	Below Junction Falls Dam	Impact
544	Lake George	Impact
574	Division Street	Impact
652	WI STH35	Control

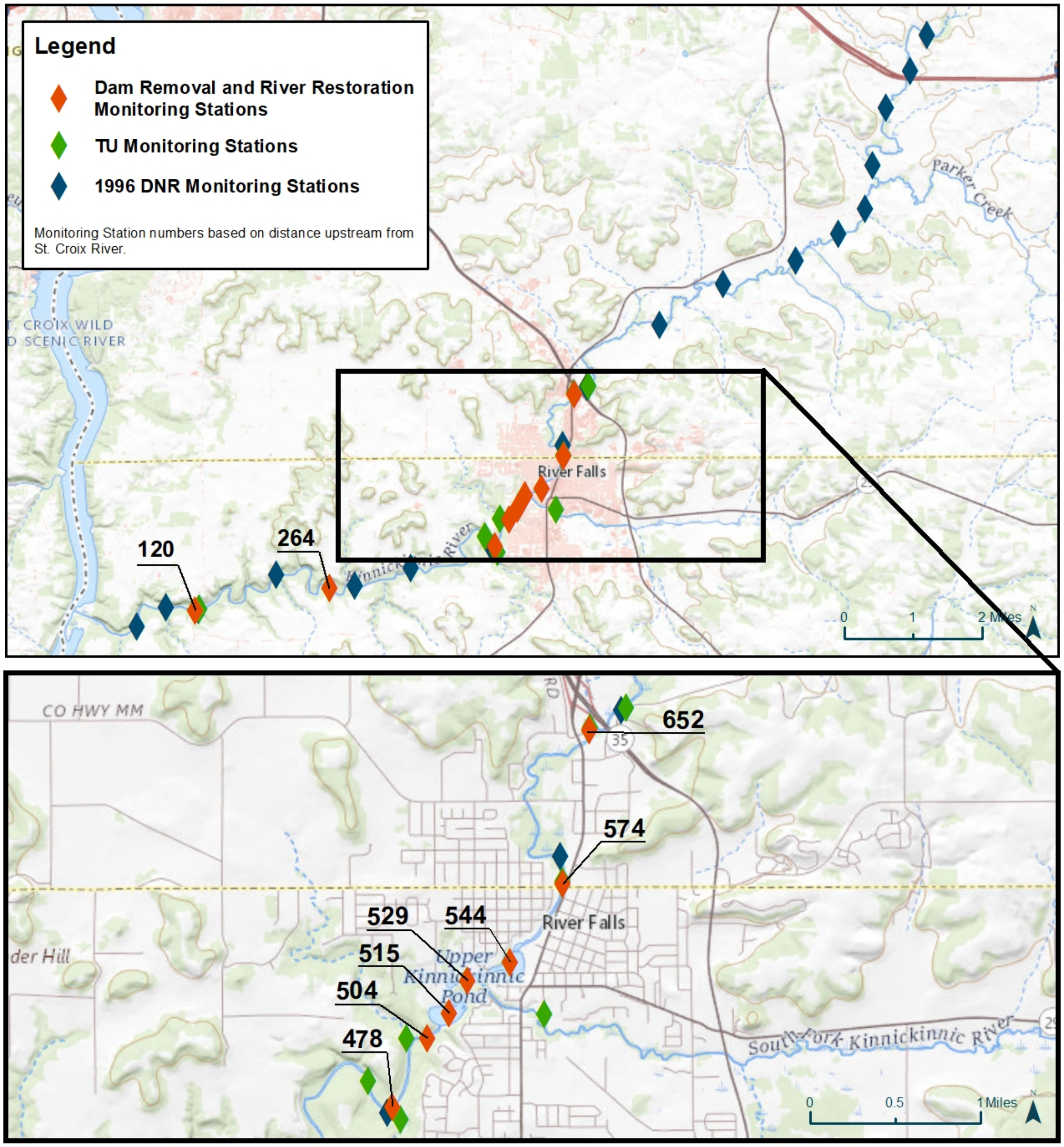

Figure 2: Past and currently active Kinnickinnic River monitoring stations. Dam removal and river restoration monitoring stations are shown by monitoring station number.

2.3 INVENTORY OF PAST MONITORING DATASETS

An inventory of past and current monitoring within the Kinnickinnic River Monitoring Project Area (Figure 2) is presented in Appendix B. This inventory describes the monitoring work conducted by numerous governmental agencies (City of River Falls, Wisconsin Department of Natural Resources, U.S. Geological Survey, U.S. Army Corps of Engineers), non-profit organizations (Kiap-TU-Wish Chapter of Trout Unlimited, Kinni Corridor Collaborative, Friends of the Kinni), educational institutions (University of Wisconsin-River Falls), consulting firms (Ayres Associates, Great Lakes Environmental Center, Gulf South Research Corporation, Inter-Fluve, TRC), and the public (River Sky Drones). The inventory includes recent (2019-2020) studies required by the Federal Energy Regulatory Commission (FERC) for re-licensing of the River Falls Hydroelectric Project (FERC Project P-10489) by the City of River Falls. Inventory components provide information on the monitoring entity, monitoring objective, details on monitoring type, location(s), frequency, duration, and protocol, a reference for monitoring data and information, and available reports and publications.

This inventory represents a rich history of data and information that helps to describe the condition of the Kinnickinnic River Monitoring Project Area prior to dam removal and river restoration, including any impacts of Lake Louise before the unexpected and permanent drawdown in October 2020 (Section 2.1). The inventory also informed this monitoring plan by suggesting monitoring types, locations, details, and potential partners for future monitoring work to "evaluate ecological restoration successes and failures" related to Powell Falls Dam removal and associated river restoration. As this monitoring plan is implemented (Section 1.3), the inventory will be updated to include new monitoring work.

3. Aquatic Biology

The aquatic organisms that inhabit the Kinnickinnic River are standard indicators of river health. As such, biological assessments are an effective way to evaluate the condition of a waterbody using biological surveys and other direct measurements of the resident biota in surface waters (Barbour et al. 1999).

For the purpose of this monitoring plan, Aquatic Biology is subdivided into three monitoring types: fish, benthic macroinvertebrates (aquatic insects and crustaceans), and aquatic vegetation. A summary of suggested monitoring needs for Aquatic Biology is presented in Table 2.

The overall goal of this monitoring component is to evaluate the aquatic community that inhabits the Kinnickinnic River and determine whether that community changes in response to dam removal and river restoration.

Table 2: Summary of Aquatic Biology monitoring. For additional details, see narrative descriptions in subsequent sections.

Type	Entity	Stations	Frequency	Duration	Protocol
Fish	WDNR	120[1], 478[1], 515[1], 544, 652[1]	Yearly	Ongoing	Standard WDNR Protocol
Benthic Macro -invertebrates	Professional and Volunteer	120[1], 478[1], 504[1], 515[1], 529, 544, 574, 652[1]	Yearly	Ongoing	Garry (2006) WDNR (2017)
Aquatic Vegetation	Volunteer	120[1], 478[1], 504[1], 515[1], 529, 544, 574, 652[1]	Yearly	Ongoing	FOTK (2019) WDNR (2018)

[1] Priority site for Powell Falls Dam removal and river restoration

The use of environmental DNA (eDNA) is a potentially effective technique that could complement the biological monitoring methods described below. eDNA uses DNA released by an organism and into the environment, to discern what species live within the aquatic ecosystem (Pilliod et al. 2012). In particular, eDNA is useful to determine the presence of small, rare, secretive, and other species living in the aquatic ecosystem that are otherwise difficult to detect through traditional biotic surveying methods. As such, eDNA data can pair well with field data collected using standard techniques.

3.1 FISH

Objective - Quantify the abundance and diversity of fish communities in the project area, before, during, and after dam removal and river restoration.

Fish species, and particularly trout, are key indicators of Kinnickinnic River health. Since 1955, the WDNR has collected fish survey data in the project area (Stations 120, 478, and 652), using the methodology in Simonson (2015). The WDNR intends to continue these data collection efforts. This monitoring plan incorporates past and future fish survey data collected by the WDNR, to assess the response of fish communities upstream, downstream, and within the former impoundments following dam removal and river restoration. In addition to continuation of current WDNR fish survey stations, a new survey station is proposed in the former Lake Louise (Station 515) in 2021 or 2022, before restoration work begins. A fish survey of Lake George (Station 544) should be conducted in the year prior to drawdown and removal of the Junction Falls Dam, and a post-restoration survey should be conducted in the former Lake George.

3.2 BENTHIC MACROINVERTEBRATES

Objective - Assess the relative abundance of environmentally sensitive and tolerant aquatic macroinvertebrates species, before, during, and after dam removal and river restoration.

Benthic macroinvertebrates are proven indicators of river water quality (Garry 2006; SEH 2014). Standardized surveys of these organisms can be conducted by citizens or professional scientists. However, training in sampling methodology and macroinvertebrate identification is required to obtain accurate and reproducible results. Methodology for samples collected as part of this project will follow the procedures outlined in Garry (2006) and WDNR (2017), and the data will be analyzed to calculate the Hilsenhoff Biotic Index (HBI) (Hilsenhoff 1987). The HBI has been utilized extensively across the state of Wisconsin by the WDNR and in previous Kinnickinnic River biomonitoring supported by the City of River Falls.

Analysis of acquired samples will occur at the Aquatic Biomonitoring Lab (ABL) at the University of Wisconsin-Stevens Point. After sample analysis, ABL generates an array of useful metrics in addition to HBI (WDNR 2003), including the particularly informative macroinvertebrate Index of Biotic Integrity (mIBI) (WDNR 2017). Having HBI values as primary data points for quantifying this objective provides consistency with past and future WDNR monitoring efforts in the Kinnickinnic River. Inclusion of the mIBI metric provides a strong foundation not only over the course of this project, but for future projects as well.

Recommended stations for macroinvertebrate monitoring are shown in Table 2. Annual samples should be collected at all stations using the WDNR (2017) protocol, with priority given to stations 120, 478, 504, 515, and 652 while Powell Falls Dam removal and river restoration occurs. A macroinvertebrate survey of Lake George (Station 544) should be conducted in the year prior to drawdown and removal of the Junction Falls Dam, using the methodology recommended by EPA (2016). A post-restoration survey should be conducted in the former Lake George, using WDNR methodology (2017). Samples should be collected at four stations (120, 478, 574, and 652) using the Garry (2006) protocol, on three occasions: prior to dam removal and river restoration, post-Powell Falls Dam removal and river restoration, and post-Junction Falls Dam removal and river restoration.

3.3 AQUATIC VEGETATION

Objective - Measure trends in periphyton (attached algae) and macrophyte (rooted aquatic plants) abundance and diversity, to provide a qualitative indication of changes in water quality and habitat as a result of dam removal and river restoration.

Periphyton and macrophytes are also excellent indicators of river water quality. Aquatic vegetation monitoring is ideal for citizen scientists and volunteers, due to its low cost and established sampling procedures. For in-stream periphyton monitoring by volunteers, sampling should follow the methodology outlined in Friends of the Kinni (2019) and WDNR (2018). For in-stream macrophyte monitoring, sampling should follow the methodology outlined by the WDNR (2002). A detailed explanation of sampling procedures and example dataforms for algae and aquatic plants are also available in Collier et al. (2007). For algal and aquatic plant monitoring in Lake George, sampling should follow the methodology outlined in Hauxwell (2010). Of special concern is the prevalence of invasive species, which have been documented in both Lake George and Lake Louise (Inter-Fluve and GSRC 2020a). Periphyton and macrophyte sampling should be conducted in the late summer, when growth of aquatic vegetation (biomass) is expected to be at its peak. Recommended stations for aquatic vegetation monitoring are shown in Table 2.

4. Riparian Biology

Kinnickinnic River health is influenced by features that occur outside of the river channel. These include the riparian area, floodplain, and upland areas that influence run-off and bank stability, and provide habitat and a travel corridor for a diverse array of organisms. For the purpose of this monitoring plan, Riparian Biology is subdivided into two monitoring types: riparian vegetation and nongame wildlife. A summary of suggested monitoring needs is presented in Table 3.

The overall goal of this monitoring component is to quantify the riparian community that inhabits and traverses the Kinnickinnic River corridor and assess how that community changes in response to dam removal and river restoration.

Table 3: Summary of Riparian Biology monitoring. For additional details, see narrative descriptions in subsequent sections.

Type	Entity	Stations	Frequency	Duration	Protocol
Riparian Vegetation	**Volunteer**	**478, 504, 515, 544[1]**	**Yearly**	**Ongoing**	**Lewis et al. (2009)**
Nongame Wildlife	**Volunteer**	**Varies**	**Varies**	**Ongoing**	**Hastings et al. (2009)**

[1] Monitoring to occur after drawdown of Lake George

4.1 RIPARIAN VEGETATION

Objective - Assess changes in riparian vegetation within the former impoundments (Lakes George and Louise) post-drawdown, to determine the effectiveness of establishing native vegetation and the need for invasive species control.

Riparian vegetation provides habitat and aquatic cover, filters surface and groundwater, and can stabilize river banks. However, establishment of native riparian species is often hindered by the expansion of invasive species, such as reed canary grass (*Phalaris arudinacea*), even when seeding with native species occurs (Orr and Koenig 2006). Post-drawdown vegetation monitoring in the former impoundments is critical to provide the data necessary for vegetation management decisions. Riparian vegetation monitoring is ideal for experienced volunteer groups such as The

Prairie Enthusiasts. Lewis et al. (2009) provide guidance on developing a vegetation monitoring plan for river restoration projects. Vegetation monitoring should occur annually, ideally in late summer when vegetation biomass peaks. Monitoring is recommended for both impoundments, beginning immediately post- drawdown.

4.2 NONGAME WILDLIFE

Objective - Determine the response of nongame wildlife in the Kinnickinnic River riparian area, following dam removal and river restoration.

River riparian areas within the Driftless Area provide many unique habitats for a rich biological community of nongame wildlife, including some of the area's rare and endangered species. Hastings (2009) provides a detailed guide to monitoring nongame wildlife in the Driftless Area, and monitoring for this project should follow those procedures. Nongame species of interest could include amphibians, reptiles, birds, invertebrates, and mammals. A variety of cellular phone applications and websites (such as iNaturalist and EDDMapS) are available to facilitate data collection by volunteers and citizen scientists. These sources provide easy data entry and a data repository for volunteer observations. Data collection is suggested to be ongoing and species specific. A portion of data relevant to this monitoring plan is already being collected by the St. Croix Valley Bird Club, as part of the River Falls designation as a Bird City. Recommended nongame wildlife monitoring locations, frequency, and duration vary, depending on the species of interest.

5. Photo Documentation

Photo documentation is a critical part of any monitoring work and can provide the imagery to help the public better understand the science. For the purpose of this monitoring plan, Photo Documentation is subdivided into two monitoring types: drone imagery and ground-based photography. A summary of suggested monitoring needs is presented in Table 4.

The overall goal of this monitoring component is to photographically document changes to the Kinnickinnic River corridor in response to dam removal and river restoration.

Table 4: Summary of Photo Documentation monitoring. For additional details, see narrative descriptions in subsequent sections.

Type	Entity	Stations	Frequency	Duration	Protocol
Drone Imagery	River Sky Drones	478, 504, 515, 529, 544	Monthly	Ongoing	Video and Orthomosaic
Ground-Based Photography	Volunteer	504, 515, 529, 544, 574	Quarterly	Ongoing	Dressing & Meals (2016) Bates (2015)

5.1 DRONE IMAGERY

Objective - Collect drone-based aerial imagery within the project area, to document changes related to dam removal and river restoration.

River Sky Drones (River Falls, WI) and the Kinni Corridor Collaborative have been collecting drone aerial imagery of Lakes George and Louise since June 2020, and the lower Kinnickinnic River (Glen Park area) since September 2020, typically on a monthly basis (weather dependent). More frequent monitoring was conducted during and after the Lake Louise drawdown in October 2020, providing critical information for interpreting post-drawdown fluvial processes and river response (Inter-Fluve 2020). Continuing collection of drone aerial imagery will help to document changes that occur within and downstream of the project area during dam removal and river restoration. Other benefits of drone imagery include determination of algal abundance (Flynn and Chapra 2014), and topography in non-vegetated areas (Carriavick and Smith 2018). Additional sensors may also be mounted on commercially available drones, to allow for the collection of water temperature data with FLIR sensors, and the collection of bare earth topographic data with LiDAR sensors.

This plan recommends that River Sky Drones and the Kinni Corridor Collaborative continue their photo documentation monitoring work of Lake George, the former Lake Louise impoundment, and downstream Kinnickinnic River areas on a monthly basis (as weather allows), with more frequent data collection after large flood events. Given available funding, additional repeat FLIR and LiDAR sensor data could supplement this monitoring effort. Recommended monitoring stations for drone imagery are shown in Table 4.

5.2 GROUND-BASED PHOTOGRAPHY

Objective - Using on-the-ground photography, document site-specific changes within the project area, related to dam removal and river restoration.

Photographs at repeatable photo points within the project area are a good volunteer task to enhance public engagement. Clearly, consideration should be given to photo documentation protocol, so that the photo data are well-documented and accessible. Guidance for setting up a photo point monitoring program is available in Dressing and Meals (2016), and Bates (2015). At a minimum, photos should include metadata on time, date, coordinates, azimuth (compass direction), and photographer name. For this monitoring plan, multiple photo points should be established within the project area, to document changes over time. Interested individuals may be assigned a unique photo point and be responsible for ongoing documentation of changes. At a minimum, photos should be taken four times a year, with two leaf-off and two leaf-on photos (March, May, August, and November) and after large flood events. Photos should be taken from the center of the river channel, in both the upstream and downstream directions, with additional photos taken as needed to document various site conditions (bank erosion, vegetation, etc). Recommended monitoring stations for ground-based photography are shown in Table 4, and more photo points may be added based on interest.

6. Water Quality

For this monitoring plan, water quality constitutes the physical and chemical conditions of the Kinnickinnic River at the monitoring stations selected. The Water Quality component is subdivided into five monitoring types: temperature, water clarity, eutrophication and dissolved oxygen (DO), WiseH2O mobile application (App), and other pollutants. A summary of suggested monitoring needs is presented in Table 5.

The overall goal of this monitoring component is to characterize the water quality of the Kinnickinnic River and determine how water quality changes in response to dam removal and river restoration.

Table 5: Summary of Water Quality monitoring. For additional details, see narrative description in subsequent sections.

Type	Entity	Stations	Frequency	Duration	Protocol
Temperature	Trout Unlimited	See Figure 1	Annual (April-Oct)	Ongoing	Hastings et al. (2011) Dauwalter et al. (2018)
Water Clarity	Volunteer	120[1], 478[1], 504[1], 515[1], 529[1], 574, 652	Annual (Biweekly) (April-Oct)	Ongoing	Ohrel and Register (2006) MPCA (2020)
Eutrophication and DO	Volunteer	529, 544, 574	Annual (April-Oct)	Twice (Before Lake George Drawdown)	Betz et al. (2020) MPCA (2014) MPCA (2015)
WiseH20 App	Volunteer	120[1], 478[1], 504[1], 515[1], 529[1], 574, 652	Annual (April-Oct)	Ongoing	Johnson (2019b)
Other Pollutants	Volunteer	Varies	As desired	As desired	Varies

[1] Priority site for Powell Falls Dam removal and river restoration

6.1 TEMPERATURE

Objective - Document the thermal benefits of dam removal and river restoration, and evaluate the impacts of urbanization and climate change on the Kinnickinnic River.

The Kiap-TU-Wish Chapter of Trout Unlimited (TU) has conducted in-stream temperature monitoring at 8 locations on the Kinnickinnic River and adjacent tributaries (Figure 2) since 1992

(Johnson 1995; Johnson and Lamberson 2003; Johnson 2018). A ninth monitoring location will be added below the Junction Falls Dam in 2021, to better document the effects of Powell Falls Dam removal and river restoration through the former Lake Louise. Monitoring is typically conducted from mid-April to mid-October each year, using electronic instrumentation that continuously measures river temperatures at 10-minute intervals (Hastings et al. 2011; Dauwalter et al. 2018). Recurring costs for the program are approximately $500 per year and 75 volunteer hours. TU will continue its temperature monitoring program as a part of this monitoring plan.

6.2 WATER CLARITY

Objective - Document impacts on water clarity (turbidity and total suspended solids) due to dam drawdown, removal, and river restoration.

Turbidity (a measure of water clarity) may be monitored with hand-held or continuous sensors (nephelometer), or with a Secchi Disk or Secchi (transparency) Tube. Measurements of total suspended solids (TSS) are typically made by collecting water samples, with laboratory analysis. The diverse array of monitoring instruments for turbidity analysis means costs can range widely, from low-cost Secchi Tube measurements made by volunteers to high-cost automatic or continuous turbidity sensors. For this project, volunteer Secchi Disk (lake) or Secchi Tube measurements (river) are recommended. The turbidity data may be augmented by lab-analyzed TSS samples, to supplement the Secchi Disk/Tube measurements and better quantify suspended sediment levels. Guides to volunteer sampling procedures for turbidity monitoring can be found in Ohrel and Register (2006) and MPCA (2020). At a minimum, Secchi Tube measurements and any supplementary TSS samples (MPCA 2014, 2015) should be obtained on a bi-weekly basis during the spring, summer, and fall (generally April-October). Additional measurements and/or samples should be obtained following larger runoff events. Recommended stations for water clarity monitoring are shown in Table 5.

6.3 EUTROPHICATION AND DISSOLVED OXYGEN

Objective - Document changes in eutrophication and dissolved oxygen, as a result of Junction Falls Dam removal and river restoration through Lake George.

Eutrophication, an excessive richness of nutrients in a lake or river, can cause an overgrowth of plants and algae that degrades habitat for other aquatic and wildlife species. Algal blooms can create unsightly (green) conditions, odors, and reduced water clarity and oxygen concentrations. All of these conditions can adversely impact human and domestic animal health, when contact with the water occurs. This is of particular concern in shallow, nutrient-rich lakes such as Lake George.

Since Lake George is likely to persist until Junction Falls Dam removal between 2035 and 2040, monitoring of the lake will help characterize any pre-removal water quality impacts. The WDNR

Citizen Lake Monitoring Network includes protocols and materials that can be used to monitor Lake George (Betz et al. 2020). The WDNR Network also includes an online database which may be used to input the data collected. Phosphorus (total and dissolved), nitrogen (nitrite-nitrate and total Kjeldahl), chlorophyll-a, temperature, and dissolved oxygen should be monitored in Lake George, using procedures outlined in Betz et al. (2020) and/or MPCA (2014, 2015). The monitoring should be conducted for a two-year period (April-October each year) prior to Junction Falls Dam removal. To fully characterize in-lake and downstream impacts, water quality monitoring should be conducted during both baseflow and storm runoff conditions, including at monitoring stations upstream and downstream from Lake George. Recommended monitoring stations are shown in Table 5. Drone imagery (Section 5.1) should be used to complement eutrophication monitoring of Lake George, as it is an excellent tool for evaluating the extent of algal presence in the lake.

6.4 WISEH20 MOBILE APPLICATION

Objective - Use the WiseH2O Mobile Application (App) to document changes in water quality and river habitat conditions, related to dam removal and river restoration.

National Trout Unlimited (TU) is placing a high priority on Community Science (See Section 8 below) and the benefits it provides for angler education and coldwater resource management. TU's national science team partnered with MobileH2O, LLC (https://www.mobileh2o.com/) to develop a customized mobile application (WiseH2O App) that can be used by anglers and other volunteers to monitor water quality and habitat conditions in Driftless Area trout streams. The WiseH20 App measures alkalinity (mg/L), hardness (mg/L), nitrate-nitrogen (mg/L), nitrite-nitrogen (mg/L), pH, orthophosphate (mg/L), stream disturbances, weather conditions, and river temperature (ºF).

The Kiap-TU-Wish Chapter of Trout Unlimited has an existing water quality monitoring program using the WiseH2O App (Johnson 2019b; Borden et al. 2019). It is recommended that Kiap-TU-Wish anglers and other community volunteers monitor conditions in the Kinnickinnic River using the WiseH20 App, and that the data be incorporated into this monitoring plan. Recommended stations for WiseH2O App monitoring are shown in Table 5.

6.5 OTHER POLLUTANTS

Objective - Document the presence/absence of other pollutants within the former Lake Louise and existing Lake George.

Additional pollutants, including microplastics (Simmerman and Wasik 2019), PAHs (polycyclic aromatic hydrocarbons), PCBs (polychlorinated biphenyls), and heavy metals (arsenic, cadmium, chromium, lead, mercury) have been detected at low levels within the Lake George and Lake Louise impoundments (Inter-Fluve 2016) and within the project area. Other potential pollutants may include herbicides and pesticides (e.g., atrazine, glyphosate, neonicotinoids) that are commonly used in agricultural and urban areas. Many of these pollutants can be ingested by the various biological organisms living within the Kinnickinnic River, impacting their life cycles. Monitoring these nonpoint source pollutants and their presence in water, sediment, and biota is not required as a part of this monitoring plan. However, if interest and resources are available, monitoring of these and other potential pollutants within and downstream of the impoundments can provide an indication of any in-situ and/or post-dam removal impacts.

7. Fluvial Geomorphology

Fluvial geomorphology is the study of the interactions between the physical shapes of rivers and their floodplains, the river processes which transport water and sediment, and the formation and reshaping of the resultant landforms. For the purpose of this monitoring plan, Fluvial Geomorphology is subdivided into three monitoring types: geomorphic and habitat assessment, sediment transport, and hydrology. A summary of suggested monitoring needs is presented in Table 6.

The overall goal of this monitoring component is to describe the changing geomorphic conditions of the Kinnickinnic River, related to dam removal and river restoration.

Table 6: Summary of Fluvial Geomorphology monitoring. For additional details, see narrative descriptions in subsequent sections.

Type	Entity	Stations	Frequency	Duration	Protocol
Geomorphic and Habitat Assessment	Volunteer and Professional	264, 478, 504, 515, 544[1], 652	Yearly	Ongoing	WDNR (2002)
Sediment Transport	Volunteer and Professional	264, 478. 504, 515, 544[1], 652	Yearly	Ongoing	Wolman (1954) Harrelson et al. (1994)
Hydrology	USGS and City of River Falls	120	Continuous	Ongoing	USGS Gage and City of River Falls Weather Station

[1] Lake George monitoring station to be added post drawdown

7.1 GEOMORPHIC AND HABITAT ASSESSMENT

Objective - Document changes in geomorphology and habitat conditions within and downstream of the former Lake George and Lake Louise impoundments, related to dam removal and river restoration.

An evaluation of aquatic and riparian habitat conditions is useful in determining the type, prevalence, and quality of habitat along a river. Habitat conditions are expected to change drastically within the Lake George and Lake Louise impoundments following dam drawdowns and river restoration, and may also change downstream of the dams due to sediment releases related to dam drawdown and removal. Control sites are useful for documenting changes related to changing watershed conditions, compared to changes caused by dam removal and river restoration. WDNR has established procedures for sampling reach-scale habitat in wadeable streams (WDNR 2002) and along lakeshores (WDNR 2020). These methodologies are best suited to be conducted by professionals or experienced citizen scientists. Habitat surveys should be conducted in the fall (after leaf fall) or spring (before bud break). Recommended monitoring stations are shown in Table 6.

Additional desktop-based GIS analysis may be used to supplement geomorphic and habitat monitoring. A GIS study could utilize historical aerial photography to conduct a meander analysis of the Kinnickinnic River below Powell Falls, thereby determining the historical rate of channel movement and comparing that to the modern rate of channel movement. This analysis could also examine vegetation growth patterns over time.

Another potential study is to use the available LiDAR data for the lower Kinnickinnic River to map geomorphic features, such as fluvial terraces. This study would benefit from the development of a relative elevation model of individual river reaches, to determine the elevation of the surrounding land surface above the river channel.

7.2 SEDIMENT TRANSPORT

Objective - Track sediment movement in the Kinnickinnic River project area, before, during, and after dam removal and river restoration.

Pebble counts and repeat river cross-sections can provide insights into the fate of sediment eroded from the impoundments and/or transported from other sources. A commonly used and easily implemented pebble count technique is described in Wolman (1954). Repeat cross-sections document change at a specific location over time, using a relatively simple methodology (Harrelson et al. 1994). These techniques are appropriate for implementation by professionals and/or students and citizen scientists, given adequate training. It is recommended that pebble counts and repeat cross-sections be conducted on an annual basis. At monitoring station 478, cross-section end points were established as a part of the Inter-Fluve and GSRC (2020b) habitat assessment and should be used as a part of this monitoring effort. Recommended stations for sediment transport monitoring are shown in Table 6.

Sediment transport modeling is an option, either in addition to or in lieu of field data collection. Sediment transport modeling can accurately predict the fate of sediment eroded during and after dam removal projects (Cui et al. 2019). Such modeling would help inform future decisions on how best to manage sediment within the existing Lake George and Lake Louise impoundments.

7.3 HYDROLOGY

Objective - Monitor flow in the Kinnickinnic River and weather conditions within the watershed.

Understanding the frequency of flood events and the duration of seasonal low-flow conditions is critical for understanding geomorphic and habitat responses. Since 2002, the U.S. Geological Survey (USGS) has continuously operated gage 05342000 on the Kinnickinnic River at County Road F. Most recently, flow data from this gage were analyzed by the U.S. Army Corps of Engineers (USACE), to determine flood flows in the project area and estimate the magnitude of historic floods (USACE 2021).

Since 2010, the City of River Falls has continuously operated a weather station, located at River Falls City Hall. The station logs weather data (air temperature, relative humidity, dew point, and precipitation) at fifteen-minute intervals, year-round (SEH 2014). The precipitation data provide very helpful information regarding the timing and intensity of rain events that influence Kinnickinnic River hydrology. The precipitation and temperature data also provide valuable context for evaluating changes in water quality and biological communities over time.

The USGS and City of River Falls monitoring stations are noted in Table 6. These stations and the data they generate are a critical part of the monitoring plan, and the partners providing these monitoring services are encouraged to continue this work, with community support as needed.

8. Community Science and Public Engagement

The involvement of community members and volunteers in this monitoring plan has three primary objectives:

1. Allow for an expansion of data collection efforts (crowdsourcing) at multiple sites throughout the project area.
2. Foster a sense of ownership and connection with the Kinnickinnic River, including support and resources for the process of removing the dams and restoring a free-flowing river.
3. Provide an educational opportunity for residents and local students on the science of river systems and water quality.

Volunteer data collection is typically conducted by individuals with minimal formal training in data collection for river monitoring. However, several simple procedures may be implemented to maximize the reliability and validity of data collected by volunteers. A detailed discussion of setting up a program for community-based volunteer monitoring programs for dam removal projects can be found in Meyer et al. (2020). The Kiap-TU-Wish Chapter of Trout Unlimited has also pioneered the use of a mobile application (WiseH2O App), which allows volunteers to easily and quickly monitor water quality and habitat conditions (Johnson 2019a) (see Section 6.4).

This monitoring plan includes a wide array of monitoring locations and techniques. Most monitoring techniques will require some form of training. Training sessions can occur either online or in person, and should review instructions for proper data collection, introduce project leaders, and engage participants in the scientific, conservation, and educational goals of the program. Classrooms currently participating in Trout Unlimited's "Trout in the Classroom" (TIC) program could adopt one or more stations for a particular monitoring protocol, as their interest or skill governed. Assigning individuals specific monitoring sites helps instill a sense of ownership and generally improves the reliability and consistency of the data collected.

A quality assurance/quality control program plan should be developed for volunteer-based monitoring programs and the data collected. The plan should be designed to minimize data collection errors, identify and remove data that fail to meet the program's standards, and input data into a computerized database. Personnel (volunteers, nonprofit group members, public partner employees) who are responsible for the QA/QC program plan should be clearly identified and known to all data collectors. After input into the computerized database, data should also be reviewed for any discrepancies and/or abnormalities, keeping in mind that "it is a phenomenon of human nature that data suddenly seem more believable once computerized" (USEPA 1997).

Initially, the monitoring data collected as a result of this plan will be maintained by those entities that conduct or coordinate the monitoring work. However, as this plan is implemented and the volume of data grows, it is anticipated that a single entity will be needed to provide organized and secure storage for the monitoring data.

Data analysis and reporting are the final and potentially most critical aspects of monitoring work. Although often seen as highly technical and complex, facilitating participant involvement in data analysis allows for improved interpretation, fosters community engagement, and increases volunteer retention (Meyer et al. 2020). An increasingly common practice is to hold "data parties" to help volunteers see the big picture, visualize the data they collected, gain participants' impressions and interpretation of their data, and provide a social experience to build community identity. The River Falls Public Library has a large area for community events that could be utilized by citizen scientists at a "Kinni Science Fair", where they present their findings associated with the monitoring work and the datasets created. A web-based story map can also be a compelling way to present project monitoring information (Holland 2021). Alternatively, project leaders could present data, photos, and other items of interest on social media, a website, and/or a Facebook Group created, maintained, and administered by a group such as the KCC. Other social media efforts could be employed to raise awareness of the monitoring plan, monitoring activities and findings.

9. Summary and Next Steps

Most rivers, once dammed, will never again have the opportunity to become free-flowing. Most will remain bound by concrete walls dividing the river's once unbroken course. At one time, the course of the Kinnickinnic River was interrupted by five dams; today only two remain. However, the community of River Falls has made a decision to remove the remaining two dams, allowing the Kinnickinnic River to again flow freely (City of River Falls 2018).

Implementing this monitoring plan (Section 1.3) will require coordination amongst a diverse group of local organizations and individuals, including volunteers and professionals, citizens, and scientists. But more than anything else, it will take the passionate community of River Falls working together to improve and restore the Kinnickinnic River. Successful implementation of this plan can demonstrate that resources and efforts spent to remove the dams and restore the river have created a revitalized and valued community resource in the heart of River Falls.

Climate change will continue to disrupt the world's natural rhythms. In western Wisconsin, climate change is expected to cause hotter summers, milder winters, larger, more frequent storms and flooding, and increased river temperatures, resulting in the general degradation of coldwater streams and fisheries (WICCI 2011; Mitro et al. 2010; Mitro et al. 2019; Dauwalter 2019). Discerning the effects of climate change versus the effects of dam removal and river restoration is an important factor when analyzing the results of data collected via this monitoring plan.

As the City of River Falls continues the FERC relicensing process for the River Falls Hydroelectric Project, consideration must be given to future river restoration within the former Lake Louise impoundment. A restoration plan for the new Kinnickinnic River should be designed and prepared by those experienced in dam removal and river restoration. The plan should identify the desired ecological goals and objectives for the river in the project reach, the habitat features needed to achieve them, and infrastructure constraints which may limit or influence river restoration. Further, the river restoration plan should be integrated with the Kinnickinnic River Corridor Plan, to ensure that goals for public use and recreation are met and integrate seamlessly with natural processes and engineering designs.

10. Monitoring Plan Budget

A proposed budget for the Kinnickinnic River monitoring plan is presented in Table 7. Since this monitoring plan may not fully account for any future monitoring requirements associated with agency permitting of the dam removal and river restoration process, the Monitoring Plan Budget may need to be modified to support any additional monitoring work. In this event, the budget could be increased, or other components of the monitoring plan could be reduced to maintain a similar total cost, as proposed below.

Volunteer hours are not included in the Monitoring Plan Budget, since the extent of volunteer involvement still needs to be determined and will vary based on public interest. However, volunteer hours should be tracked and included as in-kind, matching sources for grant opportunities to fund this plan. In-kind contributions from monitoring agencies (WDNR, USGS, City of River Falls) should also be tracked and used as matching sources for grant funding.

Successful implementation of this monitoring plan will create needs for data management (data/information organization, storage, and quality assurance), data assessment and reporting, and communication of monitoring results to the River Falls community. These needs typically require professional expertise and attention, so that all aspects of monitoring can be integrated, interpreted, and shared. The Monitoring Plan Budget does not fully account for these professional services, so additional resources (in-kind contributions from the monitoring partners and/or consultant support) may be necessary.

Table 7: Estimated budget for the Kinnickinnic River Monitoring Plan

Monitoring Type	Assumptions	Implementation Costs Estimate
Fish	Assumes continued fish survey work by the Wisconsin DNR	$0
Benthic Macro - invertebrates	Assumes field supplies for volunteers ($500[1]) + $250 per unpicked sample at five sites ($1,250/year) + 1-year Lake George ($500[1]) + multihabitat surveys ($2,000/year x 3 years = $6,000[1])	$1,750
Aquatic Vegetation	Assumes field supplies for volunteer survey	$250[1]
Riparian Vegetation	Assumes field supplies for volunteer survey	$250[1]
Nongame Wildlife	Assumes volunteer survey only	$0
Drone Imagery	Assumes in-kind work from River Sky Drones	$0
Site Photos	Assumes volunteer survey only	$0
Temperature	Assumes continued temperature monitoring work by Kiap-TU-Wish	$0
Water Clarity	Assumes field supplies for volunteer survey with Secchi Tube ($500[1]) + lab analysis of TSS samples ($500/year)	$1,000
Eutrophication/DO	Lab analysis of water samples ($2000/year), for two years only	$2,000[1]
WiseH20 Mobile Application	Assume 10 test kits at a cost of $20 dollar each per year. Additional cost for miscellaneous field items.	$250
Other Pollutants	No other pollutant monitoring at this time	$0
Geomorphic and Habitat Assessment	Assumes field assessment by professional in conjunction with sediment transport monitoring	$1,000
Sediment Transport	Assumes field assessment by professional in conjunction with habitat monitoring	$1,000
Hydrology	Assumes continued support from other sources for USGS gage at Cty F and City of River Falls weather station	$0
Community Science/ Public Engagement	Volunteer training and year-end meeting, for monitoring feedback and input on report preparation	$1,000
Data Assessment and Coordination	Support for data management, project support, and reporting	$2,000

[1] Non-yearly cost

Estimated Year 1 Cost:	$8,500
Estimated Annual Cost:	$7,000
Estimated 10-Year Cost:	$82,000

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Appendix A:

Select Field Forms

BENTHIC MACROINVERTEBRATE FIELD DATA SHEET

STREAM NAME	LOCATION
STATION #_________ RIVERMILE_________	STREAM CLASS
LAT ______________ LONG ______________	RIVER BASIN
STORE(T) #	AGENCY
INVESTIGATORS	LOT NUMBER
FORM COMPLETED BY	DATE _______ TIME _______ AM PM REASON FOR SURVEY

HABITAT TYPES	**Indicate the percentage of each habitat type present** ❑ Cobble_____% ❑ Snags_____% ❑ Vegetated Banks_____% ❑ Sand_____% ❑ Submerged Macrophytes_____% ❑ Other ( )_____%
SAMPLE COLLECTION	**Gear used** ❑ D-frame ❑ kick-net ❑ Other _________________________ **How were the samples collected?** ❑ wading ❑ from bank ❑ from boat **Indicate the number of jabs/kicks taken in each habitat type.** ❑ Cobble_____ ❑ Snags_____ ❑ Vegetated Banks_____ ❑ Sand_____ ❑ Submerged Macrophytes_____ ❑ Other ( )_____
GENERAL COMMENTS	

QUALITATIVE LISTING OF AQUATIC BIOTA
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare, 2 = Common, 3= Abundant, 4 = Dominant

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

FIELD OBSERVATIONS OF MACROBENTHOS
Indicate estimated abundance: 0 = Absent/Not Observed, 1 = Rare (1-3 organisms), 2 = Common (3-9 organisms), 3= Abundant (>10 organisms), 4 = Dominant (>50 organisms)

Porifera	0	1	2	3	4	Anisoptera	0	1	2	3	4	Chironomidae	0	1	2	3	4
Hydrozoa	0	1	2	3	4	Zygoptera	0	1	2	3	4	Ephemeroptera	0	1	2	3	4
Platyhelminthes	0	1	2	3	4	Hemiptera	0	1	2	3	4	Trichoptera	0	1	2	3	4
Turbellaria	0	1	2	3	4	Coleoptera	0	1	2	3	4	Other	0	1	2	3	4
Hirudinea	0	1	2	3	4	Lepidoptera	0	1	2	3	4						
Oligochaeta	0	1	2	3	4	Sialidae	0	1	2	3	4						
Isopoda	0	1	2	3	4	Corydalidae	0	1	2	3	4						
Amphipoda	0	1	2	3	4	Tipulidae	0	1	2	3	4						
Decapoda	0	1	2	3	4	Empididae	0	1	2	3	4						
Gastropoda	0	1	2	3	4	Simuliidae	0	1	2	3	4						
Bivalvia	0	1	2	3	4	Tabinidae	0	1	2	3	4						
						Culcidae	0	1	2	3	4						

BENTHIC MACROINVERTEBRATE SAMPLE LOG-IN SHEET

Date Collected	Collected By	Number of Containers	Preservation	Station #	Stream Name and Location	Date Received by Lab	Lot Number	Date of Completion		
								sorting	mounting	identification

Serial Code Example: B0754001(1)
B = Benthos (F = Fish; P = Periphyton)**#** 0754 = project number **#** 001 = sample number **#** (1) = lot number (e.g., winter 1996 =1; summer 1996 = 2)

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (FRONT)

page _____ of _____

STREAM NAME	LOCATION
STATION #_________ RIVERMILE_________	STREAM CLASS
LAT ______________ LONG ______________	RIVER BASIN
STORET #	AGENCY
COLLECTED BY DATE_________	LOT #
TAXONOMIST DATE_________	SUBSAMPLE TARGET ❑ 100 ❑ 200 ❑ 300 ❑ Other ____

Enter Family and/or Genus and Species name on blank line.

Organisms		No.	LS	TI	TCR	Organisms		No.	LS	TI	TCR
Oligochaeta						Megaloptera					
Hirudinea						Coleoptera					
Isopoda											
Amphipoda						Diptera					
Decapoda											
Ephemeroptera											
						Gastropoda					
						Pelecypoda					
Plecoptera											
						Other					
Trichoptera											
Hemiptera											

Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials

Total No. Organisms _______________ **Total No. Taxa** _______________

BENTHIC MACROINVERTEBRATE LABORATORY BENCH SHEET (BACK)

SUBSAMPLING/SORTING INFORMATION

Sorter ___________________

Date ___________________

Number of grids picked: __________

Time expenditure __________ No. of organisms __________

Indicate the presence of large or obviously abundant organisms:

QC: ❑ YES ❑ NO **QC Checker** ________________________

organisms originally sorted [ ] ÷ (# organisms recovered by checker [ ] + # organisms originally sorted [ ]) = % sorting efficiency [ ]

≥90%, sample passes __________

<90%, sample fails, action taken ____________________________________

____

TAXONOMY

ID ___________________

Date ___________________

Explain TCR ratings of 3-5:

Other Comments (e.g. condition of specimens):

QC: ❑ YES ❑ NO **QC Checker** ________________________

Organism recognition ❑ pass ❑ fail

Verification complete ❑ YES ❑ NO

PRELIMINARY ASSESSMENT SCORE SHEET
(PASS)

page _____ of _____

STREAM NAME	LOCATION
STATION #_________ RIVERMILE_________	STREAM CLASS
LAT ______________ LONG ______________	RIVER BASIN
STORET #	AGENCY
COLLECTED BY DATE_________	LOT # _______ NUMBER OF SWEEPS __________
HABITATS: ❏ COBBLE ❏ SHOREZONE ❏ SNAGS ❏ VEGETATION	

Enter Family and/or Genus and Species name on blank line.

Organisms		**No.**	**LS**	**TI**	**TCR**	**Organisms**		**No.**	**LS**	**TI**	**TCR**
Oligochaeta						Megaloptera					
Hirudinea						Coleoptera					
Isopoda											
Amphipoda						Diptera					
Decapoda											
Ephemeroptera											
						Gastropoda					
						Pelecypoda					
Plecoptera											
						Other					
Trichoptera											
						Taxonomic certainty rating (TCR) 1-5:1=most certain, 5=least certain. If rating is 3-5, give reason (e.g., missing gills). LS= life stage: I = immature; P = pupa; A = adult TI = Taxonomists initials					
Hemiptera											

	Site Value	**Target Threshold**	If 2 or more metrics are ≥ target threshold, site is **HEALTHY**
Total No. Taxa			
EPT Taxa			If less than 2 metrics are within target range, site is **SUSPECTED IMPAIRED**
Tolerance Index			

REPRESENTATIVE REACH PEBBLE COUNT

STREAM: | **DATE:**

REACH: | **CREW:**

PARTICLE TALLY COUNTS BY TRANSECT

ft	PARTICLE	mm		1	2	3	4	5	6	7	8	9	10	Tot Pool	Tot Riff	Comb Tot	%CUM
	Silt/Clay	< .062	S/C														
	Very Fine	.062 - .125	S														
	Fine	.125 - .25	A														
	Medium	.25 - .50	N														
	Coarse	.50 - 1.0	D														
	Vry Coarse	1.0 - 2	S														
	Very Fine	2 - 4															
	Fine	4 - 6	G														
	Fine	6 - 8	R														
	Medium	8 - 12	A														
	Medium	12 - 16	V														
	Coarse	16 - 24	E														
	Coarse	24 - 32	L														
	Vry Coarse	32 - 48	S														
	Vry Coarse	48 - 64															
0.21-0.31	Small	64 - 96	C														
0.31-0.42	Small	96 - 128	O														
0.42-0.63	Large	128 - 192	B														
0.63-0.84	Large	192 - 256	L														
0.84-1.26	Small	256 - 384	B														
1.26-1.68	Small	384 - 512	L														
1.68-3.36	Medium	512 - 1024	D														
3.36-6.72	Lrg	1024 - 2048	R														
6.72-13.43	Vry Lrg	2048-4096															
	Bedrock	>4096	BDRK														
		FEATURE SAMPLED															

	Length	Proportion	No. Units	Sampled
REACH				
POOL				
RIFFLE				
RUN				

Transect	Feature	Length	Width
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Site Name: ______________________________ Date: ______________

SWIMS ID: ______________________ Staff: __________________

	Location	NA	0	1	2	3
Transect 1						
Transect 2						
Transect 3						
Transect 4						
Transect 5						
Transect 6						
Transect 7						
Transect 8						
Transect 9						
Transect 10						
Transect 11						
Transect 12						

DPI Sample: Y N

Note: DPI stands for Diatom Phosphorus Index. A DPI sample can be collected working in cooperation with Local WDNR staff. Consult with local WDNR field biologist for methods.

From - Procedure for Citizen Assessment of Benthic Algal Abundance in Wadeable Streams

Table 1. Photo Point Data Form – School

<table>
<tr><th colspan="6">Photo Point Data Form</th></tr>
<tr><td colspan="4">Observer:</td><td colspan="2">Email:</td></tr>
<tr><td colspan="4">Phone:</td><td colspan="2"></td></tr>
<tr><td colspan="6">Additional observers: (first and last names in first form)</td></tr>
<tr><td>Day:</td><td>Month:</td><td colspan="2">Year:</td><td colspan="2">Time: (military)</td></tr>
<tr><td colspan="3">Wildlife Area:</td><td colspan="2">Point#:</td><td>Accuracy feet/meters if point is unmarked.</td></tr>
<tr><td colspan="3">Did you find exact point? (yes / no)</td><td colspan="3">How is point marked?</td></tr>
<tr><td>Zone:</td><td colspan="3">UTM-E/Latitude</td><td colspan="2">UTM-N/Latitude</td></tr>
<tr><td colspan="3">Photo 1 direction
(use compass):</td><td colspan="3">Photo 2 direction
(use compass):</td></tr>
<tr><td colspan="3">Photo 3 direction
(use compass):</td><td colspan="3">Photo 4 direction
(use compass):</td></tr>
<tr><td colspan="3">Other photo:</td><td colspan="3">Other photo:</td></tr>
<tr><td colspan="6">Additional notes or details (note if baseline photo):</td></tr>
<tr><td colspan="6">Remember these steps:
1. Use the widest camera angle possible.
2. Camera set to HDR for each photo (some require resetting for each photo).
3. Take photo of form before EIM photo (remember 1 form for each direction).
4. Check compass direction and compare view to baseline; be sure to observe correct declination for location.
5. Take photo.
6. You and a team member compare photo to baseline photo are they identical?
7. If not delete photo and try again until successful.</td></tr>
</table>

From - Photo Point Monitoring Using Technology in Field Investigations

Cover Board Method
Density Board

Study Number	Date	Examiner

Allotment Name & Number	Pasture

Density Board Location -

Percent Cover

	Plot 1		Plot 2		Plot 3		Plot 4		Avg. Cover
5									
4									
3									
2									
1									

Total Average Cover- ________________

From - Sampling Vegetation Attributes
Interagency Technical Reference

Density

Study Number	Date	Examiner	Allotment Name & Number	Pasture	Plot Size

Study Location

Plot	1		2		3		4		5		6		7		8		9		10		Total	
Coordinates																						
Plant Species	Mature	Seedling	Mature	Seedling	Mature	Seedling	Mature	Seedling	Mature	Seedling	Mature	Seedling	Mature	Seedling	Mature	Seedling	Mature	Seedling	Mature	Seedling	Mature	Seedling

Appendix B:

An Inventory of Past and Current Monitoring Within the Kinnickinnic River Monitoring Project Area

Current spreadsheet is on following page, digital inventory is stored on a Google Sheet and available upon request

https://docs.google.com/spreadsheets/d/1XuMktzrS7W1DN5W7SGsnu3pb4eQnjeAytlXM_dUbbSg/edit?usp=sharing

Monitoring to Assess the Ecological Benefits of Kinnickinnic River Dam Removal and River Restoration in River Falls, Wisconsin

Appendix A. Inventory of Past and Current Monitoring Within the Kinnickinnic River Project Area

Spreadsheet developed by Sean Morrison, Inter-fluve and Kent Johnson Kiap-TU-Wish Chapter

Note - DNR database located here https://dnr.wi.gov/Water/waterDetail.aspx?key=16375

Data input by	Monitoring Entity (Who?)	Monitoring Type (What?)	Monitoring Plan Components	Monitoring Location(s) (Where?)	Monitoring Frequency (When?)	Monitoring Duration (When?)	Monitoring Protocol (How?)	Monitoring Objective (Why?)	Monitoring Cost	Contact for Monitoring Data and Information	Available Reports/Publications	Comments
Kent Johnson d.kent. johnson@gmail.com	Kiap-TU-Wish Chapter Trout Unlimited	Stream Temperature	Aquatic Biology	8 Locations (see attached map)	Annual (April-October)	1992-2021 (Duration varies by site)	Onset Tidbit continuous temperature loggers (10-minute interval)	Evaluate impacts of River Falls stormwater discharges, River Falls hydropower dams, and long-term climate change on the Kinni	~ $500/Year ~ 75 Volunteer Hours/Year	Kent Johnson d.kent. johnson@gmail.com	https://www.kiaptuwish.org/coldwater-science-library/	
Kent Johnson d.kent. johnson@gmail.com	City of River Falls	Macroinvertebrate	Aquatic Biology	3 Locations: North Main at WI Hwy 35 Swinging Gate at WI Hwy 65 Hebert-Hagen at WI Hwy 65	Annual (May-June)	2004-2012	Hilsenhoff Biotic Index (HBI) (Hilsenhoff 1987)	Evaluate effectiveness of the River Falls Stormwater Management Ordinance for preventing degradation of the Kinni due to new City development	~ $1500/Year (Sample Analysis) ~ 16 Volunteer Hours/Year	Crystal Raleigh (City Engineer) craleigh@rfcity.org	https://www.rfcity.org/254/Kinni-River-Monitoring	
Sean Morrison smorrison@interfluve.com	Inter-fluve (For River Falls Municipal Utilities)	Habitat	Fluvial Geomorphology	Kinni River downstream of Powell Falls	Once	2020	Modified version of US Forest Service Level I & II Stream Inventory Handbook and Guidelines For Evaluating Habitat in Wisconsin Wadable Streams	Assess habitat conditions downstream of Powell Falls prior to dam removal	~$30,000	Sean Morrison smorrison@interfluve.com	https://www.rfcity.org/DocumentCenter/View/4326/Riverine-Habitat-Assessment?bidId=	
Clarke Garry clarke. garry@uwrf.edu	UWRF and Kiap-TU-Wish Chapter Trout Unlimited	Macroinvertebrate	Aquatic Biology	17 locations (1996 Wisconsin DNR Kinnickinnic River Habitat Evaluation Stations)	Bimonthly (January - December)	1999-2002	Multihabitat, 10 D-net subsamples per visit corresponding to proportion of habitats at each station	Document macroinvertebrate diversity of the Kinnickinnic River using a multiseason, multihabitat approach	~ $1200/year, 204 in-stream hours (volunteer), unquantified specimen i. d. hours (volunteer)	Clarke Garry clarke. garry@uwrf.edu	*A Preliminary Inventory of Benthic Macroinvertebrates of the Kinnickinnic River, Pierce and St. Croix Counties, Wisconsin*, 2002, 34 pp (unpublished report); *A Survey of Benthic Macroinvertebrates of the Kinnickinnic River of Western Wisconsin*, 2006, 42 pp (unpublished report); *In the Kinnickinnic, Stories of a River and Its Insect Life*, 2017, 283 pp (book)	
Kasey Yallaly kasey. yallaly@wisconsin.gov	Wisconsin DNR	Fish	Aquatic Biology	4 sites: County Rd F, Glen Park below Powell Falls Dam, WI Hwy 35/65 and County Rd JJ	Annual (June-August)	1955-2019	Wisconsin DNR standard stream sampling protocol, Station length: 35xMSW. All trout collected and measured.	Annual trend site sampling to monitor trout populations throughout river. Monitor fish population changes resulting from dam removal and restoration.		Kasey Yallaly kasey. yallaly@wisconsin.gov	Email Kasey Yallaly for pdf and data	
Kent Johnson d.kent. johnson@gmail.com	UWRF and Kiap-TU-Wish Chapter Trout Unlimited	Macroinvertebrate	Aquatic Biology	8 Locations: 4 Upper River 4 Lower River	Once (June)	2011	Hilsenhoff Biotic Index (HBI) (Hilsenhoff 1987)	Determine the ecological condition of the Kinni at select Upper River and Lower River sites.		Joseph Gathman joseph.gathman@uwrf.edu	https://www.kiaptuwish.org/coldwater-science-library/	
Kent Johnson d.kent. johnson@gmail.com	Ayres Associates (For River Falls Municipal Utilities)	Stream Temperature Dissolved Oxygen	Water Quality	8 Locations: Division Street, Lake George, Below Junction Falls Dam, Below Powell Falls Dam	Annual	2019 (July-Sept) 2020 (May-Sept)	Onset HOBO U26-001 continuous dissolved oxygen/temperature loggers (15-minute interval)	Evaluate the impacts of Junction Falls and Powell Falls Dams on dissolved oxygen concentrations and stream temperature in the Kinnickinnic River.	$77,900 (2019-2020)	Ellen Faulkner, Ayres Associates faulknere@ayresassociates.com	https://www.rfmu.org/DocumentCenter/View/4313/Dissolved-Oxygen-and-Temperature-Monitoring-Updated-Study-Report---2019-and-2020-Monitoring-Seasons_Ayres-202101	
Kent Johnson d.kent. johnson@gmail.com	Inter-fluve (For River Falls Municipal Utilities)	Aquatic Invasive Species	Aquatic Biology	2 Locations: Lake George (149 sites) Lake Louise (162 sites)	Once (July)	2020	Hauxwell et al. (2010)	Evaluate the types of aquatic invasive species in Lakes George and Louise, as well as the extent of their coverage.	$19,948	Sean Morrison smorrison@interfluve.com	https://www.rfmu.org/DocumentCenter/View/4314/Aquatic-Invasive-Species-Report---July-2020-USACE_PAS-program_Inter-fluve-202009	
Kent Johnson d.kent. johnson@gmail.com	Gulf South Research Corporation (For River Falls Municipal Utilities)	Shoreline Habitat Assessment	Fluvial Geomorphology	Lake George	Once (July)	2020	WDNR (2020)	Evaluate shoreline habitat conditions in Lake George and the upstream Kinnickinnic River (to Division Street).	$25,822	Josh McEnany	https://www.rfmu.org/DocumentCenter/View/4319/Lake-George-Shoreline-Habitat-Assessment-Report_USACE_GSRC202012	
Kent Johnson d.kent. johnson@gmail.com	TRC and Ayres Associates (For River Falls Municipal Utilities)	Sediment Transport Assessment	Fluvial Geomorphology	Lake Louise and downstream Kinnickinnic River	Once	2021	Randle and Bounty (2017) USSD (2015)	Evaluate the impact of Powell Falls Dam removal, including downstream sediment transport and potential impacts on geomorphology and aquatic resources (ecological risk).	$40,000	Lesley Brotkowski lbrotkowski@trccompanies.com Peter Haug haugp@ayresassociates.com	https://www.rfmu.org/DocumentCenter/View/4327/Sediment-Report	
Kent Johnson d.kent. johnson@gmail.com	City of River Falls	Meteorological	Fluvial Geomorphology	River Falls City Hall	Continuous	2010-2021	Onset HOBO U30 Weather Station	Provide meteorological data (air temperature, dew point, relative humidity, rainfall) for the City of River Falls	00 (Weather Station Cost)	Crystal Raleigh (City Engineer) craleigh@rfcity.org	https://www.hobolink.com/p/400b93f740499a64aad73a592e680217	
Kent Johnson d.kent. johnson@gmail.com	U.S. Geological Survey	Stream Flow	Fluvial Geomorphology	County Road F, at Kinnickinnic State Park	Continuous	2002-2021	Sauer and Turnipseed (2010)	Provide hydrological data for the Kinnickinnic River Watershed		Ben Torrison btorrison@usgs.gov	https://waterdata.usgs.gov/nwis/uv?05342000	
Kent Johnson d.kent. johnson@gmail.com	Friends of the Kinni Great Lakes Environmental Center UW-River Falls	Benthic Algae	Aquatic Biology	3 Locations: Kinni at Cty. Road MM (River Falls) Kinni Above Rocky Branch (Glen Park) Kinni at Cty. Road F	Once	2018 6 Sampling Dates July-September	Friends of the Kinni (2019) WDNR (2018)	Provide baseline biological data specific to benthic algal abundance as a biological response indicator of nutrient enrichment status in the Kinni.		Tyler Linton tlinton@glec.com	Email Tyler Linton for 2018 monitoring data	
Sean Morrison smorrison@interfluve.com	Kinni Corridor Collaborative Inter-fluve	Drone-Based Drawdown Analysis	Photo Documentation	Lake Louise	Once	2020	Inter-Fluve (2020)	Assess channel movement following Lake Louise Drawdown	~$2,000	Sean Morrison smorrison@interfluve.com	Email Sean Morrison	
Kent Johnson d.kent. johnson@gmail.com	UW-River Falls	Microplastics in Water, Macroinvertebrates, and Trout	Water Quality	3 Locations: Upstream of River Falls Within City of River Falls Downstream of River Falls	Once	2019	Simmerman and Coleman Wasik (2019)	Provide baseline data on the presence of microplastics in the Kinnickinnic River (water, macroinvertebrates, and trout) in the vicinity of River Falls.		Jill Coleman Wasik jill.colemanwasik@uwrf.edu	https://www.researchgate.net/publication/338243428_The_effect_of_urban_point_source_contamination_on_microplastic_levels_in_water_and_organisms_in_a_cold-water_stream	
Kent Johnson d.kent. johnson@gmail.com	WDNR	Drawdown Monitoring (Water Quality, Habitat, Macroinvertebrates)	Water Quality	4 Locations: Kinni below Junction Falls Dam Kinni below Powell Falls Dam Kinni Above Rocky Branch (Glen Park) Kinni at Cty. Road F	Once	2020 (October)	WDNR (2005) WDNR (2002) WDNR (2017)	Evaluate the potential impact of the Lake Louise drawdown on downstream aquatic resources in the Kinnickinnic River.		Mike Rogney michael.rogney@wisconsin.gov	Email Mike Rogney for 2020 drawdown monitoring plan and data	