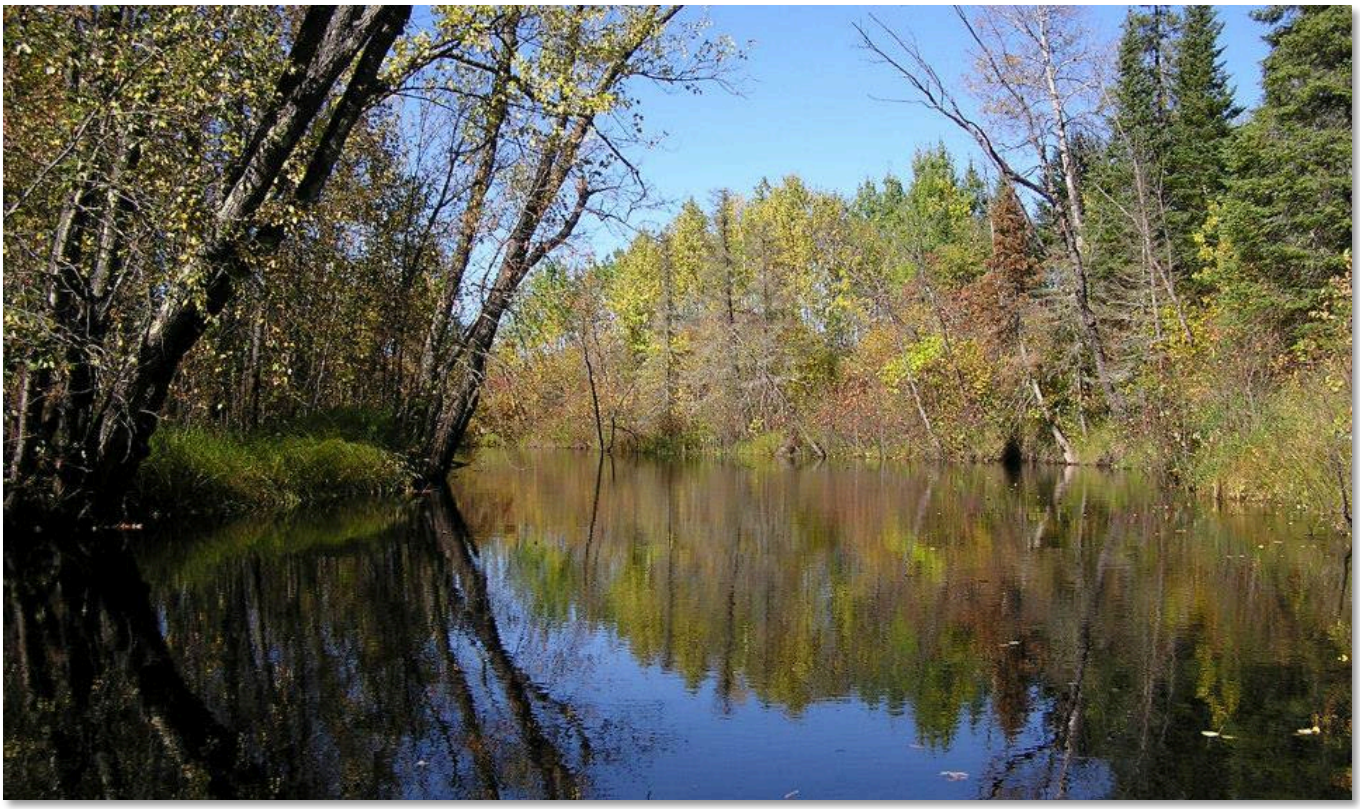
Grant

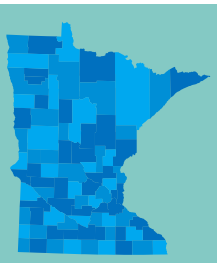
March 2024

Nine Key Element supplement for Rat Root River Subwatershed in the Rainy Lake-Rainy River WRAPS Report

This supplement will meet all nine key elements of watershed planning for the U.S. Environmental Protection Agency federal Clean Water Act Section 319



MINNESOTA POLLUTION CONTROL AGENCY



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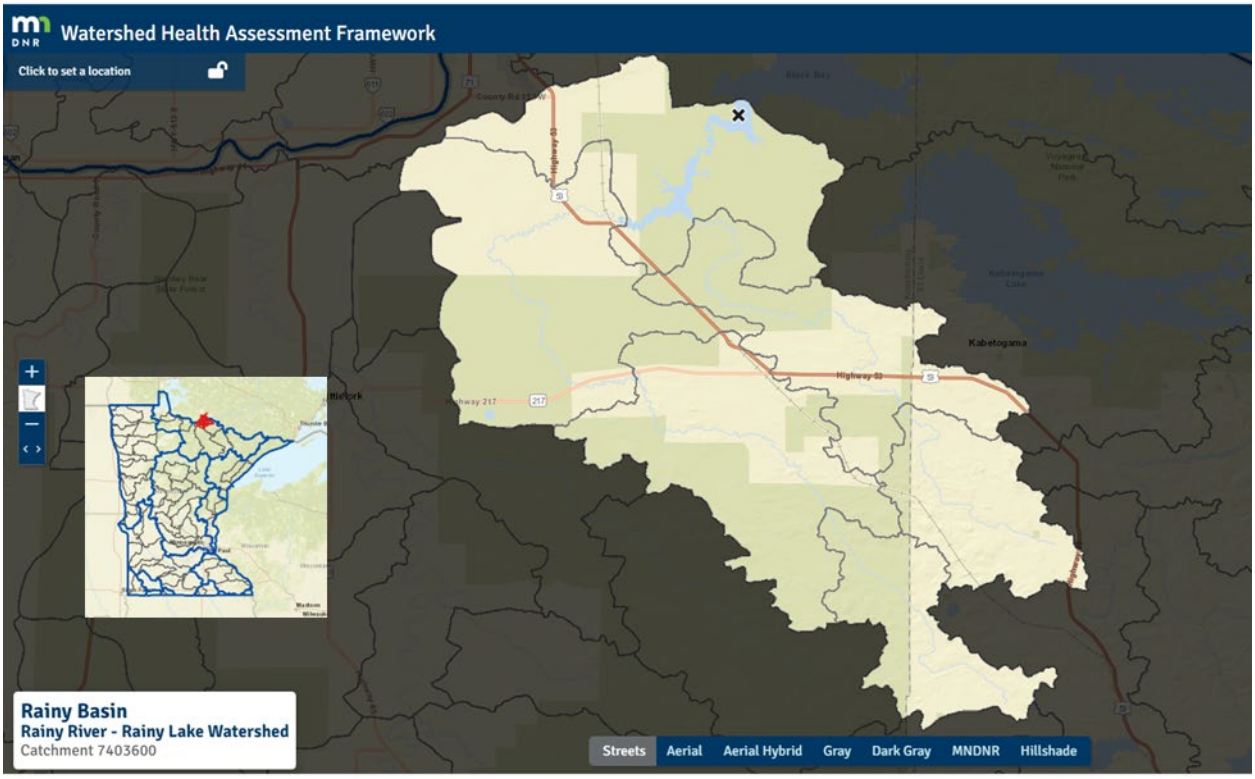
Executive summary

The *Rainy River-Rainy Lake Watershed Restoration and Protection Strategy (WRAPS) Report* was approved in 2022. This nine key element (NKE) plan will rely on the WRAPS to inform most of the requirements for the Rat Root River (RRR) Watershed. This information will be summarized in this document for ease of use.

The RRR Watershed is in Koochiching County, Minnesota (Figure 1) and is part of the Rainy River- Rainy Lake Watershed.

Figure 1. Map of RRR (Watershed Health Assessment and Framework (WHAF), Minnesota Department of Natural Resources (DNR), 2023)



The targeted goal for this watershed is to improve the health of the RRR and decrease loading to Rainy Lake. Rainy Lake is an international border lake, with nutrient reduction goals in place. The Minnesota Nutrient Reduction Strategy calls for a reduction of nutrients in Rainy Lake. The Watershed Nutrient Loads to Accomplish Minnesota's NRS Goals estimates a needed TP load reduction of .3 MT/yr (approximately 1%) for the Rainy Lake HUC-8 Watershed (09030004). The nutrient reduction goal for the RRR will help achieve these goals (MPCA, 2022).

There is strong collaboration between local partners to protect and restore the river. Koochiching SWCD has collaborated with many different local partners and groups to plant trees, stabilize shorelines, and provide critical spawning habitat for walleye. In addition to local partnerships, the SWCD has worked with federal agencies, state agencies and other nongovernmental organizations. Outreach and workshops with local partners are conducted to increase buy-in to adopt BMPs.

The NKE plan (in collaboration with the RRR's other reports and documentation) is addressing pollutants, sources, and solutions in the watershed. For the purposes of the Section 319 grant program, only practices and activities eligible for funding under the EPA 2014 Section 319 program guidance and Minnesota's Nonpoint Source Pollution Program Management Plan (NPSPPMP) are eligible for Section 319 funding. All match activities must be eligible for Section 319 funding, except where noted in the NPSPPMP.

Water quality conditions

In 2017, the Minnesota Pollution Control Agency (MPCA) initiated monitoring efforts of the RRR Watershed and in 2019, four stream reaches and one lake were assessed for aquatic life, aquatic recreation, and/or aquatic consumption use support. Results from the study found that most of the stream miles in the watershed are meeting water quality standards. However, in parts of this watershed, total suspended solids (TSS) and dissolved oxygen (DO) occasionally exceed water quality standards. The region's geologic past left behind flat topography and fine sediment, a legacy which likely plays a significant role in the metrics. Increases in anthropogenic stressors, such as historical and recent forest cover changes, backwater effects from a downstream dam, and the draining of wetlands, may locally affect aquatic life health. Where standards are being met, protection strategies to maintain good water quality are important (WRAPS, 2022).

The RRR is part the Rainy River-Rainy Lake Major Watershed hydrologic unit code (HUC)-8 09030003. It is further divided into six HUC-12s as described in Table 1. There are two different HUC numbers associated with these HUC-12s. For the purposed of this plan, the current HUC-12s will be used. The Pollutant Load Estimation Tool (PLET) uses the previous HUC-12 numbers and are included in the table for cross-reference purposes.

Table 1. HUC-12s in the RRR Watershed

HUC-12 number	PLET HUC-12	HUC name
090300031101	090300030401	Headwaters RRR
090300031102	090300030402	Town of Ray-RRR
090300031103	090300030403	Town of Ericsburg – RRR
090300031104	090300030404	Upper East Branch RRR
090300031105	090300030405	Lower East Branch RRR
090300031106	090300030406	Rat Root Lake

Impairments

The only impairments in the RRR Watershed are aquatic consumption by mercury in fish tissue for Moose Lake (AUID 36-0008-00) and there is no TMDL. Mercury impairments are out of the scope of control for local governmental units and the state recommendations in the Mercury TMDL Implementation Plan will be used to address this impairment.

Current conditions

Assessable streams, those with sufficient information available to make assessments, in the RRRLW are limited to the Rat Root River and the Rat Root River, East Branch (Figure 2). Three of the four assessed stream reaches in the RRRLW fully supported aquatic life and/or recreation. The fourth stream reach, the Rat Root River (from Unnamed Creek to Rat Root River, East Branch) had inconclusive information to determine if aquatic life use standards were being met but was determined to be supporting aquatic recreation (MPCA, 2022). These results are summarized in Table 2.

No reaches in the RRRLW are designated as impaired for aquatic life use. Fish index of biological integrity (F-IBI) and macroinvertebrate index of biological integrity (M-IBI) scores are poorer than expected thresholds in the middle section of the Rat Root River due stress caused by sedimentation and low DO.

This is likely a function of easily mobilized fine, glacially derived sediments that are found in this area, and low gradients caused by backwater effects from the dam. Additionally, localized areas of erosion and incision have been observed in both the Rat Root River and East Rat Root River contributing additional sediment to the system. The likely causes of observed moderate erosion may include disturbances near the stream from limited agricultural lands near surface waters, timber harvesting, and changes in the stream channel in response to legacy impacts, including that of historic large-scale timber harvesting. (MPCA, 2022). Low DO is likely due to natural wetland environments, low gradient nonaerating reaches, and the "backwater" effect from downstream damming. TSS is frequently elevated in the downstream to mid-river reaches of the East Rat Root River. Despite elevated TSS in the East Rat Root River, biological index scores are good, with F-IBI and M-IBI scores meeting their expected thresholds at the sampled locations (MPCA, 2022).

Table 2. Assessment status of river reaches in the RRR Watershed

			Aquatic life indicators:						
AUID (Last 3 digits)	**River**	**Reach description**	Fish Index of biotic integrity	Macroinvertebrate index of biotic integrity	Dissolved oxygen	Turbidity/TSS	Eutrophication	Aquatic life	Aquatic recreation (bacteria)
634	Rat Root River	Headwaters to Unnamed Creek	MTS	MTS	IF	IF		SUP	- -
635	Rat Root River	Unnamed Creek to Rat Root River, East Branch	MTS	- -	NA*	EXS	IC	IC	SUP
632	Rat Root River, East Branch	Headwaters to Unnamed Creek	MTS	- -	IF	IF		SUP	- -
633	Rat Root River, East Branch	Unnamed Creek to Rat Root River	MTS	MTS	IF	EXS		SUP	SUP

Sup = found to meet the water quality standard, Imp = does not meet the water quality standard and, therefore, is impaired, EXS = fails standard, MTS = meets standard, IF = the data collected was insufficient to make a finding, NA = not assessed, IC = Inconclusive information

Assessment Unit Identifier (AUID); Hydrologic Unit Code (HUC)

Protection streams are 1) currently healthy but near the impairment threshold, or 2) currently healthy and are indicating good water quality. Table 3 summarizes the protection reaches in RRR.

Figure 2. Assessed rivers in the RRR Watershed (adapted from MPCA, 2022)

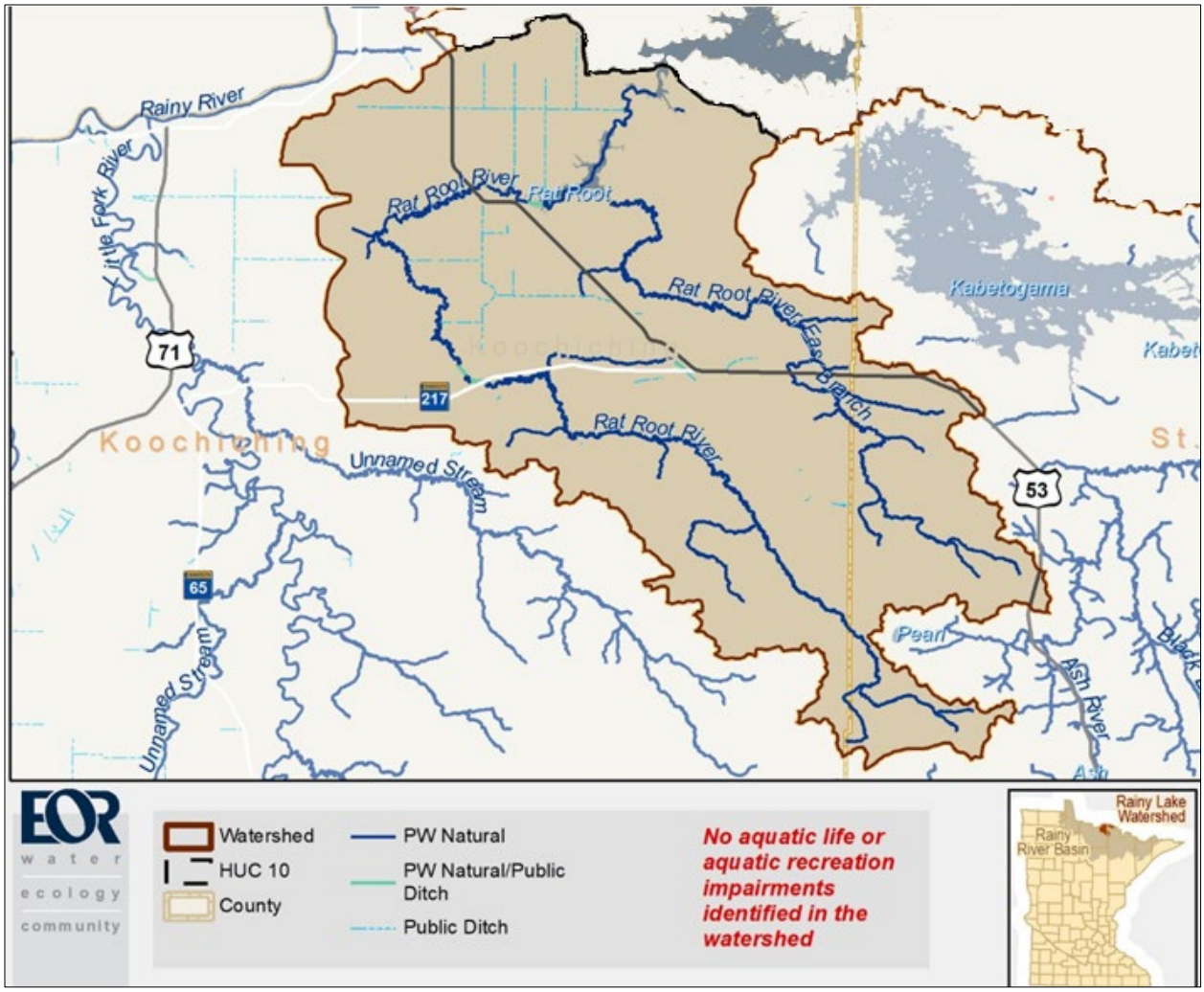


Table 3. Stream protection and prioritization results for the RRR Watershed (MPCA, 2022)

AUID	Stream name	Reach length (miles)	Drainage area (mi^2)	TALU	Cold/warm	Fish or Macroinvertebrate Community Nearly Impaired	Riparian risk	Watershed risk	Current protection level	Protection prioritization class
-633	Rat Root River, East Branch	22.39	76.0	General	Warm	one	low	low	medium	B
-634	Rat Root River	30.44	73.3	General	Warm	one	low	low	high	B
-632	Rat Root River, East Branch	20.37	51.2	General	Warm	neither	low	low	med/high	C

Assessment Unit Identifier (AUID); Tiered Aquatic Life Uses (TALU)

Goals

This plan intends to reduce both TSS and TP by 5%. The WRAPS report determined loading using the HSPF model. For the purposes of this plan, loads and reductions are calculated using the US EPA Pollutant Load Estimation Tool (PLET). The loads between HSPF and PLET are similar; therefore, it is assumed that the reductions and loads calculated using PLET will properly estimate the reductions needed to protect and restore the RRR. All loading estimates are rounded to the nearest whole number. The PLET model calculates loads slightly differently, with less granularity, than the HSPF model. The loads are calculated by the subwatershed and major land use categories. The loads by subwatershed are summarized in Table 4.

Table 4. Estimated pollutant loading and desired goal reduction by subwatershed in the RRR Watershed (PLET, 2023)

		Nitrogen (lbs/yr)		Phosphorus (lbs/yr)		TSS (t/yr)	
HUC-12	**HUC name**	**Load**	**Reduction**	**Load**	**Reduction**	**Load**	**Reduction**
90300031101	Headwaters RR	2390	120	744	37	43	2
90300031102	Town of Ray-RRR	15681	784	3697	185	1322	66
90300031103	Town of Ericsburg – RRR	7946	397	1970	98	89	4
90300031104	Upper East Branch RRR	2492	125	783	39	39	2
90300031105	Lower East Branch RRR	10610	531	3143	157	2975	149
90300031106	Rat Root Lake	3611	181	1309	65	36	2
Totals		**42730**	**2137**	**11646**	**582**	**4505**	**225**

The PLET model estimates and the desired reductions by source are summarized in Table 5.

Table 5. Pollutant load and desired goal reduction estimates by source in the RRR Watershed (PLET, 2023)

	Nitrogen (lbs/yr)		Phosphorus (lbs/yr)		TSS (t/yr)	
Sources	**Load**	**Reduction**	**Load**	**Reduction**	**Load**	**Reduction**
Urban	7851	393	1209	60	181	9
Cropland	75	4	13	1	2	0
Pastureland	14465	723	1144	57	60	3
Forest	12967	649	6435	322	131	7
Septic	762	38	298	15	0	0
Streambank	6610	331	2545	127	4131	206
TOTAL	**42730**	**2137**	**11646**	**582**	**4505**	**225**

The implementation activities described in this plan are estimated to exceed the 5% reduction goals for phosphorus and TSS in 10 years, if the plan is fully implemented. This also will help achieve the TP reductions in the Nutrient Reduction Strategy.

Implementation strategies

The implementation strategies, schedule, milestones, assessments, costs, and the estimated pollutant reductions by practice are described in Table 6. The plan is estimated to yield the reductions needed to improve water quality standards within 10 years. Estimated pollutant reductions by practice were calculated per practice using the EPA's PLET for decision-making purposes. The complete reductions for this plan were calculated using the PLET combined efficiencies. Complete plan reductions are summarized in Table 8.

Eligibility for funding refers to current practice eligibility in 2023, as described in the EPA's 2014 Guidance and Minnesota's 2021 NSPMP. Practices are subject to final verification at the time of any financial award and must meet all current and necessary rules and guidelines for eligibility. Any stormwater activities that take place in an MS4 permitted conveyance system are not eligible for Section 319 grant funding, nor can they be used for match funding. General diagnostic and exploratory monitoring activities are not eligible for funding or match purposes.

Table 6. Implementation types, eligibility, activities, schedule, milestones, assessment criteria, costs, and estimated per practice pollutant reductions (PLET, 2022)

Type	319 Eligible	BMP/ Practice/ Activity	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)			P #/yr	N lbs/yr	TSS t/yr
Administration	Y	Coordination and implementation of 319 activities by working with Landowners, stakeholders, agencies, or participating parties for Koochiching SWCD.	Coordinate and/or implement NKE Plan activities.	Coordinate and/or implement NKE Plan activities.	Coordinate and/or implement NKE Plan activities.	Coordinate and/or implement NKE Plan activities.	Coordinate and/or implement NKE Plan activities.		$1,150,000			
Cropland	Y	Implement (340) cover crops on 122.2 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	# acres cover crops # years in cover	$70,248	1429.42	101.28	6.05
	Y	Riparian buffers on agricultural land 122.2 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	# acres buffer # feet buffer # acres treated	$70,247	37.64	30.92	48.88
	Y	Implement (393) filter strips on 122.2 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	# acres filter strips # feet filter strip # acres treated	$71,949	37.64	30.92	48.88
	Y	Implement (386) field borders on 122.2 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	# acres	$100,337	6358.31	451.87	27.6
	Y	Implement (329) No till on 122.2 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	# acres	$2,744	50.69	12.15	1.88
	Y	Implement 345 Tillage Management on 122.2 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	24.45 acres	# acres	$3,391	29.79	3.15	0.33
	Y	590 Nutrient management, treating 122.2 acres	1 Plan, 24.45 acres implemented	1 Plan, 24.45 acres implemented	1 Plan, 24.45 acres implemented	1 Plan, 24.45 acres implemented	1 Plan, 24.45 acres implemented	# acres treated # plans	$16,094	37.64	30.18	0

Type	319 Eligible	BMP/ Practice/ Activity	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)			P #/yr	N lbs/yr	TSS t/yr
Forestry	Y	Sub-Contract with consultant foresters and develop in-house Forest Stewardship Plans (min 20 acres each): Ensure 14,706 acres of priority private forest land along the river is covered by forest management plans with approx. 283 landowners and 283 BMPs identified	Forest Stewardship Plans written covering 2,941 acres of privately owned forestland or 57 landowners	Forest Stewardship Plans written covering 2,941 acres of privately owned forestland or 57 landowners	Forest Stewardship Plans written covering 2,941 acres of privately owned forestland or 57 landowners	Forest Stewardship Plans written covering 2,941 acres of privately owned forestland or 57 landowners	Forest Stewardship Plans written covering 2,941 acres of privately owned forestland or 57 landowners	# acres planned # landowner agreements # BMPs identified for implementation	$202,548			
	Y*	Forest Protection Program Enrollment - Sustainable Forest Incentive Act (SFIA): Assist landowners with new forest protection program enrollment and to maintain eligibility in existing covenants covering 14,706 acres or approximately 283 landowners	Assist landowners with new forest protection program enrollment and to maintain eligibility in existing covenants covering 2,941 acres or approximately 57 landowners	Assist landowners with new forest protection program enrollment and to maintain eligibility in existing covenants covering 2,941 acres or approximately 57 landowners	Assist landowners with new forest protection program enrollment and to maintain eligibility in existing covenants covering 2,941 acres or approximately 57 landowners	Assist landowners with new forest protection program enrollment and to maintain eligibility in existing covenants covering 2,941 acres or approximately 57 landowners	Assist landowners with new forest protection program enrollment and to maintain eligibility in existing covenants covering 2,941 acres or approximately 57 landowners	# acres SIFA # Landowners	$283,000			
	Y	Implementation of forest management plan BMPs on 14,706 acres, with approximately 283 landowners	Provide BMP cost-share and assist landowners with implementation of completed forest management plans covering 2,941 acres	Provide BMP cost-share and assist landowners with implementation of completed forest management plans covering 2,941 acres	Provide BMP cost-share and assist landowners with implementation of completed forest management plans covering 2,941 acres	Provide BMP cost-share and assist landowners with implementation of completed forest management plans covering 2,941 acres	Provide BMP cost-share and assist landowners with implementation of completed forest management plans covering 2,941 acres	# BMPs implemented # acres treated # participants	$566,000	26.76	468.34	8.36
	Y	Reforestation on nonforested land and after cutting - Diversify tree species, emphasizing longer-lived conifers and climate change resiliency in species	Plant 279,427 trees on 922.2 acres of open and/or harvested area	Plant 279,427 trees on 922.2 acres of open and/or harvested area	Plant 279,427 trees on 922.2 acres of open and/or harvested area	Plant 279,427 trees on 922.2 acres of open and/or harvested area	Plant 279,427 trees on 922.2 acres of open and/or harvested area	# trees planted # acres planted # species planted	$405,169	654.75	46.52	3.00

Type	319 Eligible	BMP/ Practice/ Activity	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)			P #/yr	N lbs/yr	TSS t/yr
		selection, planting 279,427 resilient species on 4,611 acres of land.										
	Y	Riparian tree planting to improve shading - Establish and maintain permanent vegetation along the stream corridor that includes a variety of grass, trees, and shrubs preferably greater than 100 ft and downstream of roads, agricultural areas, and recently harvested timber.	Plant 1,000,000 trees in riparian area on the Main stem and East branch of the Rat Root	Plant 1,000,000 trees in riparian area on the Main stem and East branch of the Rat Root	Plant 1,000,000 trees in riparian area on the Main stem and East branch of the Rat Root	Plant 1,000,000 trees in riparian area on the Main stem and East branch of the Rat Root	Plant 1,000,000 trees in riparian area on the Main stem and East branch of the Rat Root	# trees planted # acres treated # species	$4,200,000	2911.44	2097.39	47.95
Monitoring	Y*	Plan for and monitor the effectiveness of past and future stream restoration and riparian area enhancement projects as well as the effects of BMPs implemented on the landscape.	Planning projects, working with landowners, monitoring past restoration projects/BMP's.	Planning projects, working with landowners, monitoring past restoration projects/BMP's.	Planning projects, working with landowners, monitoring past restoration projects/BMP's.	Planning projects, working with landowners, monitoring past restoration projects/BMP's.	Planning projects, working with landowners, monitoring past restoration projects/BMP's.	# BMPs monitored # successes # adaptive management opportunities	$30,000			
	Y	Water Quality Sampling (WPLMN Equivalent) to evaluate the effectiveness of BMPs implemented. Water Quality samples and field measurements collected at least 3 sites throughout the Rat Root Watershed.	3 sampling sites sampled up to 20 times per sampling season	3 sampling sites sampled up to 20 times per sampling season	3 sampling sites sampled up to 20 times per sampling season	3 sampling sites sampled up to 20 times per sampling season	3 sampling sites sampled up to 20 times per sampling season	# sites # samples # data trends established	$400,000			
	N	Monitor the water quality and geomorphology impacts of future large wood formations to document benefits and to guide future decisions surrounding potential removal if a large	Monitor old and new wood formations to determine whether or not	Monitor old and new wood formations to determine whether or not	Monitor old and new wood formations to determine whether or not	Monitor old and new wood formations to determine whether or not	Monitor old and new wood formations to determine whether or not	# sites # samples # inventories	$100,000			

Type	319 Eligible	BMP/ Practice/ Activity	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)			P #/yr	N lbs/yr	TSS t/yr
		wood formation is found to be detrimental Work with DNR to continue past CPL work to determine log jam removal vs. keeping woody debris. Monitor the entire Rat Root Main branch and East Branch for wood formations and document location and severity.	removal is necessary.	removal is necessary.	removal is necessary.	removal is necessary.	removal is necessary.					
	Y*	Examine the role of sediment-oxygen-demand in low DO reaches, with a particular focus on the middle reach of the Rat Root River. Determine the effectiveness of BMPs and the impact on DO and fish/bugs.	Monitor locations in the middle reach of the Rat Root River for low DO.	Monitor locations in the middle reach of the Rat Root River for low DO.	Monitor locations in the middle reach of the Rat Root River for low DO.	Monitor locations in the middle reach of the Rat Root River for low DO.	Monitor locations in the middle reach of the Rat Root River for low DO.	# locations # samples # analysis	$50,000			
Outreach	Y	Continue to work with agricultural landowners to encourage BMPs such as, nutrient management plans, residue and tillage management, and edge of field BMPs	Planning projects, working with landowners, monitoring past restoration projects/BMPs.	Planning projects, working with landowners, monitoring past restoration projects/BMPs.	Planning projects, working with landowners, monitoring past restoration projects/BMPs.	Planning projects, working with landowners, monitoring past restoration projects/BMPs.	Planning projects, working with landowners, monitoring past restoration projects/BMPs.	# BMPs implemented # landowners contacted	$300,000			
	Y	Provide opportunities for discussing how to coordinate timber harvests while using site level guidelines/ BMP with private landowners and logger events. 4 workshops will have been held, materials have been dispersed, information on Koochiching SWCD website	Planning year for workshops - Work with Forest Resource Specialist, develop website information and written materials	Hold 1 workshop	Hold 1 workshop	Hold 1 workshop	Hold 1 workshop	# workshops # attendees # materials produced # harvests coordinated	$11,389			

Type	319 Eligible	BMP/ Practice/ Activity	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)			P #/yr	N lbs/yr	TSS t/yr
	Y	Provide opportunities for logger education on MFRC site level guidelines and riparian/water quality harvest BMPs through workshop and events. 4 workshops will have been held, materials have been dispersed, information on Koochiching SWCD website	Planning year for workshops - Work with Forest Resource Specialist, develop website information and written materials	Hold 1 workshop	Hold 1 workshop	Hold 1 workshop	Hold 1 workshop	# workshops # attendees # materials produced # harvest BMPs	$11,389			
	Y	Provide education to private landowners of streambanks and shorelines on the importance of maintaining natural buffers near waterbodies. 4 workshops will be held, materials have been dispersed, information on Koochiching SWCD website.	Planning year for workshops - Work with Forest Resource Specialist, develop website information and written materials	Hold 1 workshop	Hold 1 workshop	Hold 1 workshop	Hold 1 workshop	# workshops # attendees # materials produced # feet buffers	$11,389			
	Y	Educate and/or assist private landowners in forest, pasture, cropland, and overall healthy riparian area and watershed management. 4 workshops will have been held, materials have been dispersed, information on Koochiching SWCD website.	Planning year for workshops - Work with Forest Resource Specialist, develop website information and written materials	Hold 1 workshop	Hold 1 workshop	Hold 1 workshop	Hold 1 workshop	# workshops # attendees # materials produced # acres riparian managed	$11,389			
	Y	Section 319 NKE plan kickoff and engagement. Kick off meeting, followed by at least 4 workshops and 4 public events to educate and engage the community about the state of the river and their roles in the protection of water quality.	Add information to website, newspaper article to kick off 319 project, Social media updates	1 workshop and 1 public event held. At least 1 workshop/public event posted on YouTube. Social media updates, articles, website updates completed	1 workshop and 1 public event held. At least 1 workshop/public event posted on YouTube. Social media updates, articles, website updates completed	1 workshop and 1 public event held. At least 1 workshop/public event posted on YouTube. Social media updates, articles, website updates completed	1 workshop and 1 public event held. At least 1 workshop/public event posted on YouTube. Social media updates, articles, website updates completed	# workshops # attendees # materials produced # inquiries to action	$11,237			

Type	319 Eligible	BMP/ Practice/ Activity	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)			P #/yr	N lbs/yr	TSS t/yr
Pasture	Y	Implement (327) conservation cover on 5,734.25 acres of open lands/pastures	1,146.85 acres	1,146.85 acres	1,146.85 acres	1,146.85 acres	1,146.85 acres	# acres conservation cover	$5,467,454	2931.33	174.87	10.8
	Y	Implement (512) forage and biomass planting on 5,612.05 acres	1,122.41 acres	1,122.41 acres	1,122.41 acres	1,122.41 acres	1,122.41 acres	# acres	$2,023,305	221.7	15.93	0.39
	Y	Implement 516 Livestock Pipeline, treating 2,000 acres	4 installations	4 installations	4 installations	4 installations	4 installations	# acres # feet	$120,518	38.19	4.79	0.54
	Y	Implement 642 Water well-Livestock, treating 2,000 acres	4 installations	4 installations	4 installations	4 installations	4 installations	# wells # acres treated	$155,750	38.19	4.79	0.54
	Y	Implement 614 Livestock Water Facility, treating 2,000 acres	4 installations	4 installations	4 installations	4 installations	4 installations	# acres treated # implemented	$16,781	38.19	4.79	0.54
	Y	Implement 472 Access Control, treating 2,000 acres	80 acres Installed	80 acres Installed	80 acres Installed	80 acres Installed	80 acres Installed	# acres fenced # acres treated # each	$20,752	38.19	4.79	0.54
Riparian	Y	Establish a forested riparian buffer along stream segment for 2,904 ft.	Plant 341 trees to cover approximately .5 acres of riparian area					# acres treated # trees planted	$494	1.40	0.68	0.01
	Y	Maintain a forested riparian buffer along stream segment for 21,780 feet to prevent additional loading, working with 7 private landowners along this stream and BMPs implemented between Rat Root Lake and County Road 97- WID 635	Work with 1 landowner to install site appropriate BMPs and protection on this segment of the river	Work with 1 landowner to install site appropriate BMPs and protection on this segment of the river	Work with 1 landowner to install site appropriate BMPs and protection on this segment of the river	Work with 2 landowner to install site appropriate BMPs and protection on this segment of the river	Work with 2 landowner to install site appropriate BMPs and protection on this segment of the river	# Landowners # feet improved # BMPs implemented	$14,000			

Type	319 Eligible	BMP/ Practice/ Activity	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)			P #/yr	N lbs/yr	TSS t/yr
Streambank	N	396 Aquatic Passage, Modify/replace dams culverts & fish passage barriers – Continue to work with County Engineering department to identify culverts contributing to erosion or reducing stream connectivity for aquatic life.	Work with county and highway staff to identify culverts for replacement and modification. Install/modify culverts that are identified as needing replacement or modification.	Work with county and highway staff to identify culverts for replacement and modification. Install/modify culverts that are identified as needing replacement or modification.	Work with county and highway staff to identify culverts for replacement and modification. Install/modify culverts that are identified as needing replacement or modification.	Work with county and highway staff to identify culverts for replacement and modification. Install/modify culverts that are identified as needing replacement or modification.	Work with county and highway staff to identify culverts for replacement and modification. Install/modify culverts that are identified as needing replacement or modification.	# culverts identified	$100,000			
	N	Ravine Stabilization - Perform field review of very high priority potential grade stabilization structures predicted from the ACPF tool to identify and fix gully erosion in the watershed and pinpoint high priority ravines for project implementation.	Review ravines predicted from the ACPF to identify and implement projects to fix gully erosion.	Review ravines predicted from the ACPF to identify and implement projects to fix gully erosion.	Review ravines predicted from the ACPF to identify and implement projects to fix gully erosion.	Review ravines predicted from the ACPF to identify and implement projects to fix gully erosion.	Review ravines predicted from the ACPF to identify and implement projects to fix gully erosion.	# priorities identified # projects identified	$100,000			
	Y	Bank Stabilization project: A one-mile reach (1 stream mile length downstream of latitude: 48.402038°/longitude: -93.301813°) in the Old Highway 217 (Town Rd 174), Banks with high erosion rates that could potentially contribute to sediment issues in stream.	Project planning and development	Project implementation				# feet stabilized	$792,000			
	Y	Bank Stabilization project: Between monitoring sites RR4 and RR3 on Rat Root River WID-634, Banks with high erosion rates that could potentially contribute to sediment issues in stream.	Project planning and development	Project implementation				# feet stabilized	$792,000	0.82	0.5	0.01

Type	319 Eligible	BMP/ Practice/ Activity	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)			P #/yr	N lbs/yr	TSS t/yr
	Y	Bank Stabilization project: A 3,500-feet reach immediately upstream of East Rat Root River site ERR3 (Koochiching County Highway 3 crossing. Banks with high erosion rates could potentially contribute to sediment issues in stream.			Project planning and development	Project implementation		# feet stabilized	$525,000	0.82	0.5	0.01
	Y	Remove bridges and pilings at former trail crossing with consideration of removal methods that will not negatively impact stream stability. Pilings and bridge is removed from the Rat Root River.	Planning and coordination	Planning and coordination	Bridge and piling removal project completed.	Project inspection and monitoring	Project inspection and monitoring	# plans # bridge and pilings removed	$50,000	0.79	0.48	0.01
	Y	(East Rat River (Bank 547) 98.12 ft stream restoration. Stream restoration project development and instalment on Bank 547.		Project planning and development	Project implementation			# feet restored	$25,000	18.21	7.01	11.4
	Y	Rat Root (Bank 223) 60.48 ft stream restoration. Stream restoration project development and instalment on Bank 223.		Project planning and development	Project implementation			# feet restored	$15,000	10.91	4.74	0.7
	Y	E. Rat Root (Bank 563) 371.93 ft stream restoration. Stream restoration project development and instalment on Bank 563.			Project planning and development	Project implementation		# feet restored	$90,000	65.13	25.07	40.7
	Y	Rat Root (Bank 224) 74.22 ft stream restoration. Stream restoration project development and instalment on Bank 224.				Project planning and development	Project implementation	# feet restored	$20,000	12.37	4.76	7.7

Type	319 Eligible	BMP/ Practice/ Activity	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)			P #/yr	N lbs/yr	TSS t/yr
	Y	E. Rat Root (bank 202) 280.75 ft stream restoration. Stream restoration project development and instalment on Bank 202.		Project planning and development	Project implementation			# feet restored	$70,000	46.24	17.8	28.9
	Y	Rat Root (bank39) 182.1 ft stream restoration. Stream restoration project development and instalment on Bank 39.			Project planning and development	Project implementation		# feet restored	$45,000	34.65	10.23	16.6
	Y	Rat Root (bank 298) 92.34 ft stream restoration. Stream restoration project development and instalment on Bank 298.				Project planning and development	Project implementation	# feet restored	$25,000	12.39	4.77	7.7
	Y	Rat Root (bank 41) 370.37 ft stream restoration. Stream restoration project development and instalment on Bank 41.		Project planning and development	Project implementation			# feet restored	$90,000	47.29	18.2	29.6
	Y	Rat Root (bank 42) 440.04 ft stream restoration. Stream restoration project development and installment on Bank 42.			Project planning and development	Project implementation		# feet restored	$110,000	57.14	22	35.7
	Y	East Rat Root River (bank 565) 226.97 ft stream restoration. Stream restoration project development and instalment on Bank 565				Project planning and development	Project implementation	# feet restored	$60,000	26.46	11.34	18.4
	Y	East Rat Root River (bank 569) 174.68 ft stream restoration. Stream restoration project development and instalment on Bank 569.		Project planning and development	Project implementation			# feet restored	$45,000	22.67	8.73	14.2

Type	319 Eligible	BMP/ Practice/ Activity	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10-year (2033)			P #/yr	N lbs/yr	TSS t/yr
Study	N	Explore and incorporate actions and conservation planning specific to climate change being developed by various agencies at the Federal, State and Local levels. Gather region specific climate data applicable to current planting effort and incorporate the information into new and updated plans in coordination with plan writers and planning teams.	Gather applicable data and incorporate into 1 plan	Gather applicable data and incorporate into 1 plan	Gather applicable data and incorporate into 1 plan	Gather applicable data and incorporate into 1 plan	Gather applicable data and incorporate into 1 plan	# plans enhanced # climate change actions planned # climate change actions taken	$12,500			
	N	Building on current BANCS survey data in areas with potentially high bank erosion inputs, such as the Rat Root River, East Branch between County State Aid Highway (CSAH) 3 and Rainy Lake, and gullies and tributaries that appear unstable or at-risk. BANCS survey on a minimum of 5 reaches in the Rat Root Watershed to determine bank erosion locations and unstable stream segments.	BANCS survey on 1 stretch of the Rat Root and East Branch.	BANCS survey on 1 stretch of the Rat Root and East Branch.	BANCS survey on 1 stretch of the Rat Root and East Branch.	BANCS survey on 1 stretch of the Rat Root and East Branch.	BANCS survey on 1 stretch of the Rat Root and East Branch.	# banks surveyed # restorations indicated # plans initiated	$100,000			
Total costs									**$18,917,800**			

* Final determination of Section 319 funding eligibility will be made based on the most current Section 319 guidelines and the NSPMP.

Element a. Sources identified

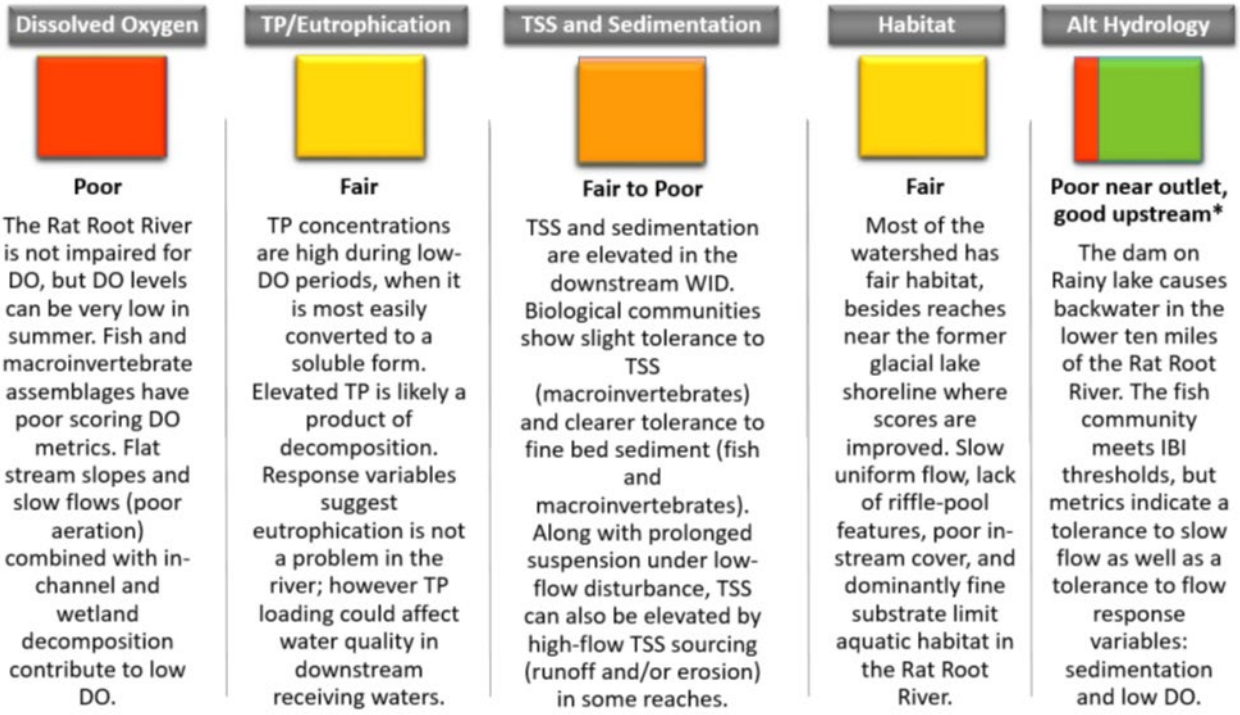
> *An identification of the causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions estimated in this watershed-based plan (and to achieve any other watershed goals identified in the watershed-based plan), as discussed in item (b) immediately below. Sources that need to be controlled should be identified at the significant subcategory level with estimates of the extent to which they are present in the watershed (e.g., X numbers of dairy cattle feedlots needing upgrading, including a rough estimate of the number of cattle per facility; Y acres of row crops needing improved nutrient management or sediment control; or Z linear miles of eroded streambank needing remediation).*
>
> *EPA Handbook for Restoring and Protecting Our Waters*

The primary issues in the RRR Watershed are low gradient streams and the lack of flow. The outlet dam at Rainy Lake can also affect flow in the RRR. Good forestry practices in the area help to protect and reduce nutrient loading to the stream. Stream connectivity, restoration, and reforestation following harvest are expected to address the sediment and nutrient loading. Land use contributions are summarized in Table 5.

Stressors

The SID focused primarily on the Rat Root River based on monitoring and assessment findings and local watershed priorities, and emphasized hydrology, TSS, DO and physical habitat. According to the SID results, low DO, sedimentation, slow flow velocities, mediocre habitat, and to a lesser degree TSS, negatively influence biological communities in the Rat Root River. Natural conditions such as low gradient stream channels and glacially-derived clay soils are significant factors in water quality and habitat conditions. Although development is low in the watershed, human impacts over the past century or more have altered watershed and stream health. Conclusions from the SID report are summarized in Figure 3 (MPCA, 2022).

Figure 3. Stressors summary for the RRR Watershed



Point sources

Point sources are defined as facilities that discharge stormwater or wastewater to a lake or stream and have a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Permit (Permit). There are four NPDES/SDS permits with two surface water discharges located in the RRR watershed (Table 7). There are no active NPDES/SDS permitted feedlots located within the RRRLW. Due to low population density, there are no Municipal Separate Storm Sewer System (MS4) permits within the watershed (MPCA, 2022). Point sources are not expected to be a source of pollutant loads due to their permit requirements.

Table 7. Point sources in RRR Watershed (adapted MPCA, 2022)

Aggregated HUC-12 Subwatershed	Name	MPCA site ID	Station type	Station	Station description
Rat Root River, East Branch (0903000318-02)	Mark Sand & Gravel Acquisition Co	MNG490125	Surface Discharge	SD 043	MNG49 Stormwater, Nonspecific
Rat Root River (0903000318-01)	MnDOT SP 3608-48 International Falls	MNG790265	Surface Discharge	SD 002	Effluent To Surface Water
Rat Root River (0903000318-01)	NKASD WWTP	MN0020257	Land Application	LA 347	Application Site, Biosolids
Rat Root River (0903000318-01)	Pucks Point Sanitary Sewer District	MN0070530	Waste Stream	WS005	Intermediate: WW to Land
Rat Root River (0903000318-01)	Pucks Point Sanitary Sewer District	MN0070530	Waste Stream	WS006	Intermediate: WW to Land

Aggregated HUC-12 Subwatershed	Name	MPCA site ID	Station type	Station	Station description
Rat Root River (0903000318-01)	Pucks Point Sanitary Sewer District	MN0070530	Waste Stream	WS007	Intermediate: WW to Land

Nonpoint sources

Nonpoint pollution, unlike pollution directly discharged from industrial and municipal wastewater treatment facilities (WWTFs), refers to pollutants collected from many diffuse sources, often transported by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-caused pollutants and deposits them into lakes and streams. Significant nonpoint and natural pollutant sources were identified in the RRRL WRAPS (MPCA, 2022) and include:

- Watershed runoff: Land cover and soil type influence how pollutants such as sediment and phosphorus are carried from the landscape to the RRR. Much of the landscape is undeveloped and protective from pollutant loading through run-off. Local areas of development can have higher impacts to pollutant loading.
- Wetland export: Wetlands make up a significant portion of the RRRW and phosphorus export from wetlands is a well-known phenomenon in northern Minnesota wetlands.
- Altered Hydrology: Human-induced changes to the natural flow regime, including downstream Rainy Lake water level management, can further reduce stream velocities in naturally low gradient streams. Low stream velocities often contribute to increased sedimentation and low DO conditions.
- Streambank Erosion: Areas of streambank erosion were observed in the Rat Root River contributing sediment and phosphorus to the system. The likely causes of observed moderate erosion may include disturbances near the stream from limited agricultural lands near surface waters, timber harvesting, and changes in the stream channel in response to legacy impacts, including that of historic large-scale timber harvesting.
- Geology and soils: The fine silty clay soils in the RRRLW were formed in the former glacial Lake Agassiz. Watersheds containing glacial clays are more vulnerable to elevated TSS concentrations because glacial clays are easily suspended and are slow to settle out of the water column.
- Timber harvesting: Forest harvest has been and currently is a major activity within the RRRLW. Historical large-scale forest removal occurred in the watershed, which may have created legacy effects still being experienced by streams today. These impacts may include stream instability and adjustment.
- Limited agriculture and pastureland: Although agricultural use is minimal in this watershed, there are locations where agriculture BMPs, such as riparian buffers and conversion of open lands to forest, can reduce nutrient loading and provide water quality benefits.

Altered hydrology

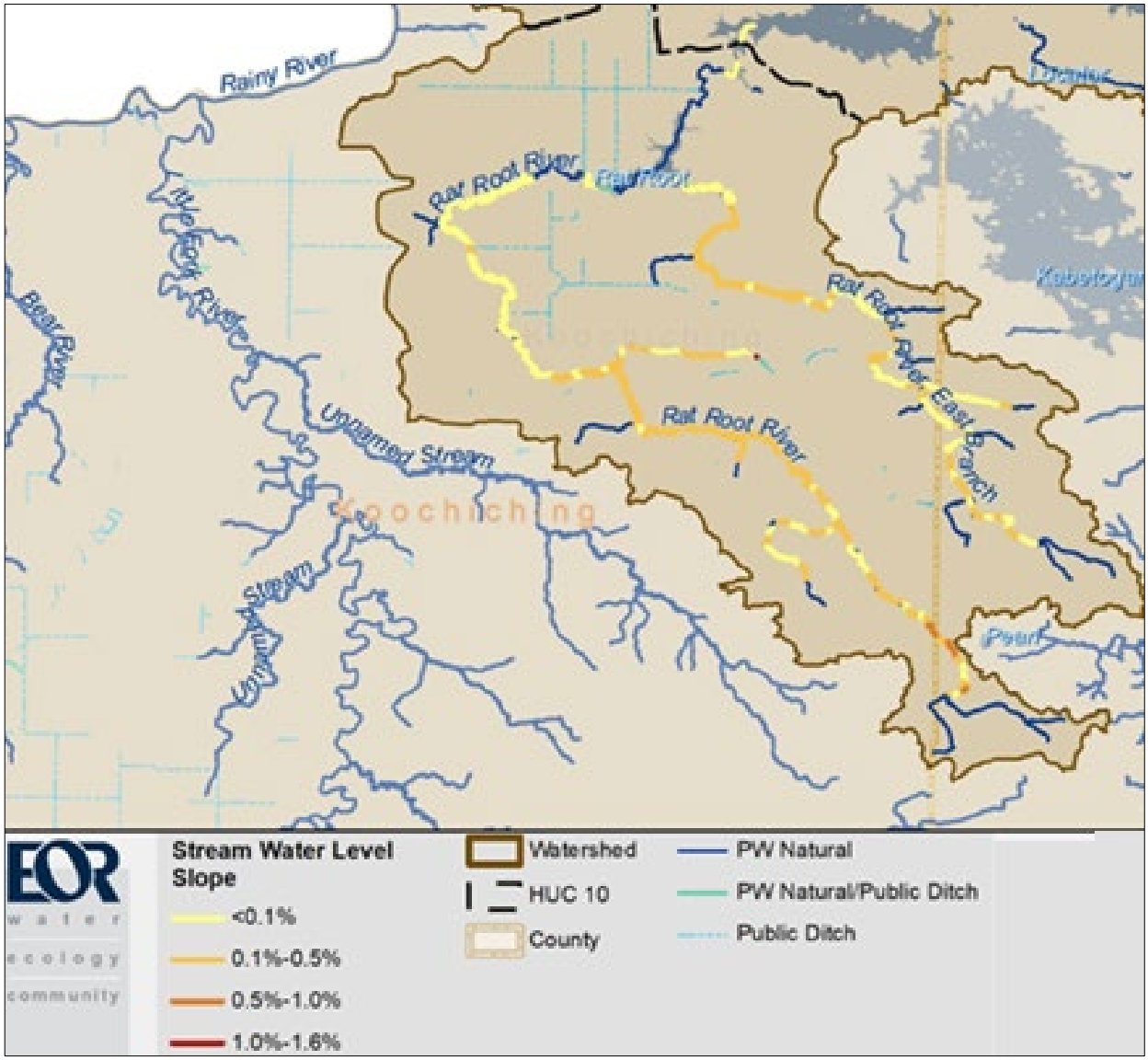
Human activities that modify drainage patterns within a watershed can also play a significant role in determining the health and quality of its water resources. Hydrologic alterations within the RRRLW can cause disruptions to aquatic life, changes in stream flow, and modifications to groundwater surface water interactions. In the Rat Root River Subwatershed most of these alterations, such as ditched wetlands or backwater effects from the downstream dam, are in the lower reaches near Rat Root Lake. Modifications to drainage systems within wetlands can influence the nutrient balance within these areas and can lead

to flushes of nutrients to downstream resources. Backwater effects from the downstream dam slow stream velocities, resulting in an accumulation of sediment in the stream. (MPCA, 2022).

Low gradient streams

The low gradient topography exacerbates the effects of the dam on stream velocity in the RRR (Figure 4). The RRR and East RRR include segments that were identified by the DNR as stable low gradient reaches (DNR 2020a). These stream reaches are considered healthy, with access to the floodplain and well-vegetated banks with low erosion rates. The DNR survey did not reveal any significant sediment loading from upland sources. There are localized and scattered areas of the streams that are contributing to erosion and TSS loading. The sediment from erosion is contributing to the TSS load in the RRR. The fine silty clay soils in the downstream of the RRR and East RRR are drivers of TSS. These can also contribute sediment-bound phosphorus to the system (MPCA, 2022).

Figure 4. Stream water level slope in the Rainy River-Rainy Lake Watershed (adapted from MPCA, 2022).



Streambank erosion

Elevated concentrations of TSS are present in the RRR and East RRR but are below impairment in the upper watershed and rose above the threshold in the middle of the watershed and remained high until the inlet of Rat Root Lake. Despite higher TSS levels, the IBI shows that both fish and macroinvertebrates are not impaired. The Minnesota Department of Natural Resources (DNR) assessed 30 miles of river using the Bank Assessment for Non-point Source Consequences of Sediment (BANCS) model developed by Rosgen. The 10 stream sections with the highest erosion for the RRR and East RRR are illustrated in Figure 5 and Figure 6.

Figure 5. Map of erosions rates and location of banks with highest ten erosion rates within the RRR

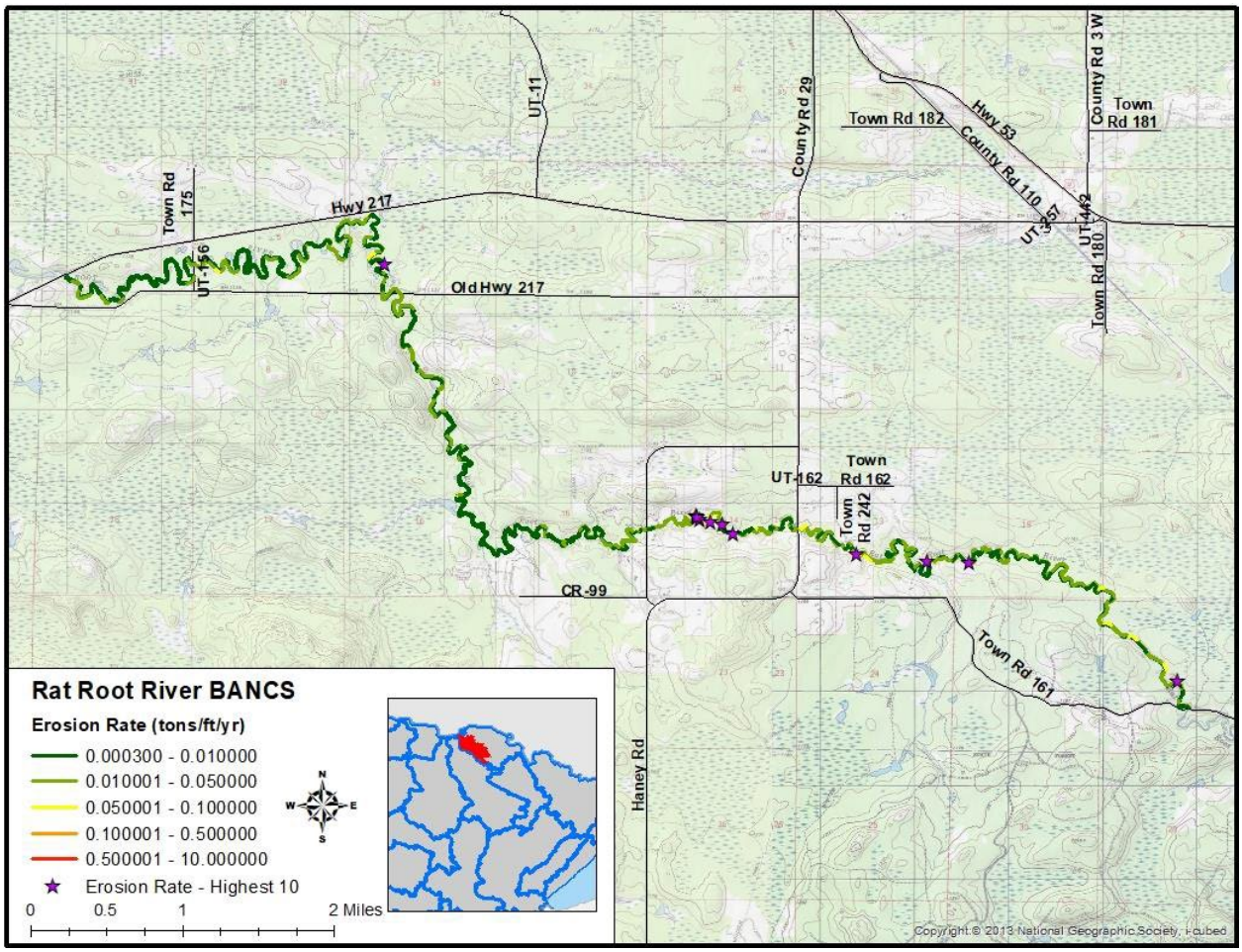
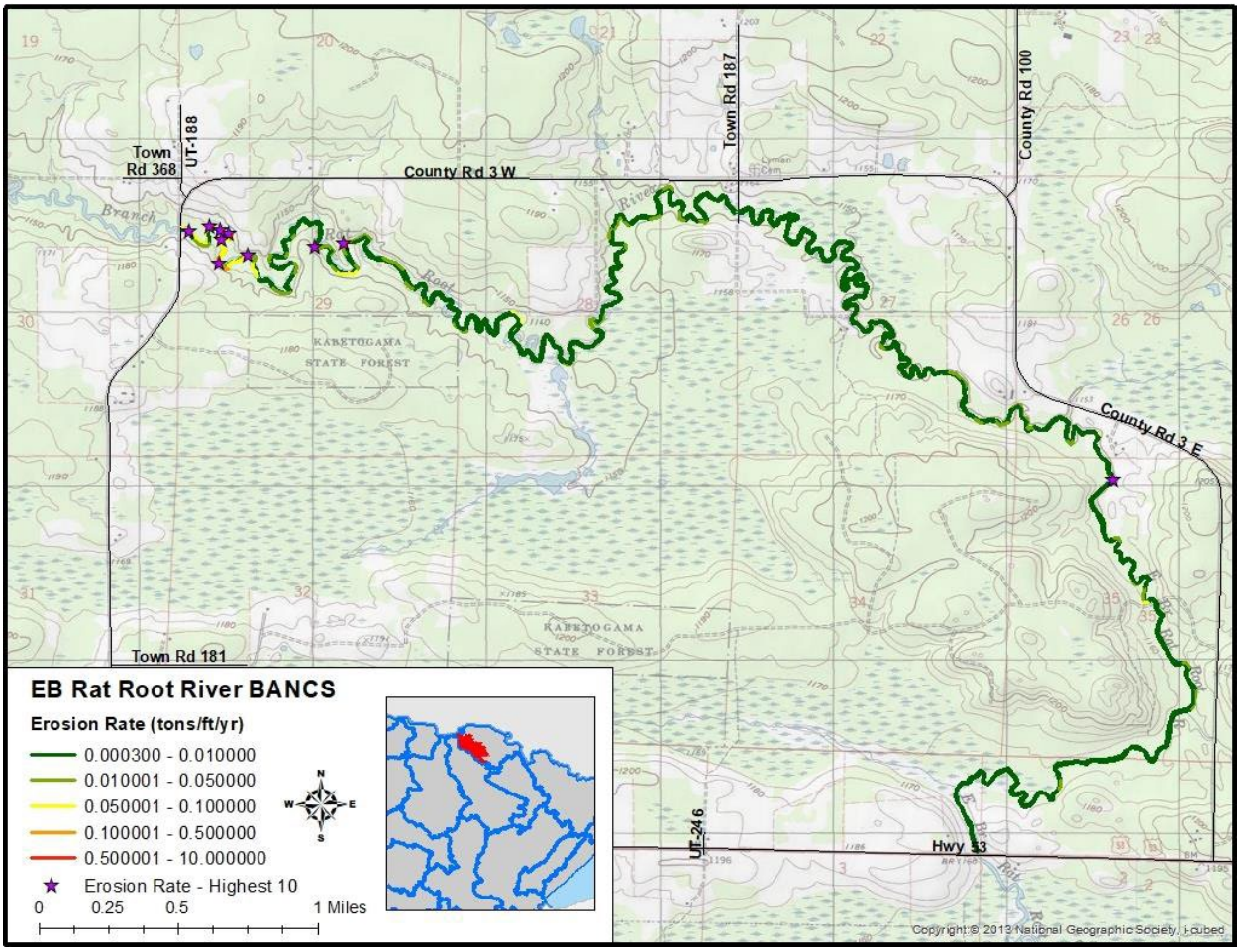


Figure 6. Map of erosion rates and location of banks with highest ten erosion rates within the East RRR



Element b. Estimated reductions

> *An estimate of the load reductions expected for the management measures described under paragraph (c) below (recognizing the natural variability and the difficulty in precisely predicting the performance of management measures over time). Estimates should be provided at the same level as in item (a) above (e.g., the total load reduction expected for dairy cattle feedlots; row crops; or eroded stream banks).*
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The implementation activities described in Table 6 will exceed the protection goal of the 582 lbs/yr TP and 225 t/yr TSS reduction. The loads and reductions were calculated using the EPA's PLET model. Table 6 summarizes the total number of practices and the individual estimated reductions by practice. The reductions in this section are calculated using the combined efficiencies calculator to calculate the impact of this plan as a system.

Total plan reductions

The activities described in Table 6 are estimated to reduce loading as summarized in Table 9.

Table 8. Summary of estimated reduction for the implementation of all activities in the RRR Watershed (PLET 2023)

Watershed	N reduction (lbs/yr)	P reduction (lbs/yr)	TSS reductions (t/yr)
090300030403	397	98	4
090300030406	181	65	2
090300030401	120	37	2
090300030402	784	185	66
090300030405	531	157	149
090300030404	125	39	2
Totals	**2,137**	**582**	**225**

Forestry activities

The estimated reduction from activities on forest land was 2840 lbs/yr TP and 53 t/yr of TSS. The activities planned for forestry land are summarized in Table 9.

Table 9. Summary of estimated reductions for forestry activities in the RRR Watershed (PLET 2023)

Watershed	N reduction (lbs/yr)	P reduction (lbs/yr)	TSS reductions (t/yr)
090300030403	904	543	12
090300030406	748	450	10
090300030401	377	226	5
090300030402	1847	1026	13
090300030405	578	347	8
090300030404	415	249	6
Total	**4868**	**2840**	**53**

Pasture activities

The estimated reduction from activities on pastureland was 969 lbs/yr TP and 42 t/yr of TSS. The activities planned for pastureland are summarized in Table 10.

Table 10. Summary of estimated reductions for pasture activities in the RRR Watershed (PLET 2023)

Watershed	N reduction (lbs/yr)	P reduction (lbs/yr)	TSS reductions (t/yr)
090300030403	2932	210	11
090300030406	674	48	2
090300030401	202	14	1
090300030402	6801	477	16
090300030405	2559	183	10
090300030404	506	36	2
Total	**13675**	**969**	**42**

Cropland activities

The estimated reduction from activities on cropland was 5 lbs/yr TP and 1 t/yr of TSS. The activities planned for crop land are summarized in Table 11. Cropland does not constitute a significant source of loading for this watershed. However, soil health practices are advantageous for water quality and agricultural production.

Table 11. Summary of estimated reductions for cropland activities in the RRR Watershed (PLET 2023)

Watershed	N reduction (lbs/yr)	P reduction (lbs/yr)	TSS reductions (t/yr)
090300030403	6	2	0.28
090300030406	-	-	-
090300030401	-	-	-
090300030402	11	3	0.35
090300030405	3	1	0.14
090300030404	-	-	-
Total	**20**	**5**	**0.77**

Streambank activities

The estimated reduction from activities on streambank was 2418 lbs/yr TP and 3925 t/yr of TSS. The activities planned for streambanks are summarized in Table 12.

Table 12. Summary of estimated reductions for streambank activities in the RRR Watershed (PLET 2023)

Watershed	N reduction (lbs/yr)	P reduction (lbs/yr)	TSS reductions (t/yr)
090300030403	-	-	-
090300030406	-	-	-
090300030401	-	-	-
090300030402	1853	713	1158
090300030405	4427	1705	2767
090300030404	-	-	-
Total	**6280**	**2418**	**3925**

Element c. Best management practices

> *A description of the BMPs (NPS management measures) that are expected to be implemented to achieve the load reductions estimated under paragraph (b) above (as well as to achieve other watershed goals identified in this watershed-based plan), and an identification (using a map or a description) of the critical areas (by pollutant or sector) in which those measures will be needed to implement this plan.*
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A variety of best management practices (BMPs) and nonpoint source management activities will be used to protect and improve the RRR Watershed from pollutant, stream channel, and aquatic habitat degradation and achieve the water quality goals for the resources. The BMPs and management activities are described in the implementation strategies section (Table 6). Many of the BMPs and management activities are derived from the Rainy Lake - Rainy River WRAPS report.

Forestry

The natural forested state of the watershed, it's adjacency to Minnesota's only and the U.S.'s largest water-based national park, and proximity to the international border with Canada make private forest management and further forest protection good conservation strategies for both public and private landowners. Minnesota forest protection models such as the Board of Water and Soil Resources' Clean Water-Working Forests strategies have found success in identifying the most vulnerable and highest resource value areas within such watersheds, engaging landowners to further best management practices, and encouraging forest restoration and protection opportunities. In fact, voluntary forest protection programs like the Sustainable Forest Incentive Act and 2C Managed Forest property tax designation have become popular in neighboring watersheds where targeted private forest management (PFM) campaigns have occurred, resulting in the enrollment of thousands of acres of intact native forestland. The corresponding map illustrates the basic concept of targeted private forest management outreach strategies and protection opportunities within the RRR. Non-industrial private forestland (NIPF) parcels are indicated where there is adjacency with a waterbody within the watershed.

In general, riparian parcels are the most critical for their terrestrial ecology and clean water benefits. BMP's such as forested riparian buffer plantings, species diversification, or shoreline stabilization are important in these situations. In a few cases, livestock feedlot improvements, cover crops, no-till seeding, and other agricultural water management projects may be applicable. Minnesota's PFM programs and services encourage—and in some cases require—the development of 10-year land management plans in order to receive the benefits of forest protection incentives and project cost-share. These plans address all aspects of the private landowner's land cover, land use, and opportunities to improve natural resources through BMP enactment and conservation project implementation.

Stream restoration

When utilizing Natural Channel Design principles for stream restoration (USDA, 2007), engagement from the DNR will provide assurance that actions are appropriately targeting pollutants while simultaneously

protecting stream habitat. Determine stream bank stability and potential degree of aggregation or sedimentation at locations of interest. Assess and allow for a healthy amount of wood to establish naturally in the stream channel.

The BANCS study identified the 10 highest erosion rates from the RRR and East RRR (Table 13).

Table 13. Ten banks with the highest erosion rates from the RRR and East RRR (DNR, 2020).

Stream	Bank ID	BEHI	NBS	BER (ft/yr)	Length (ft)	Height (ft)	Erosion rate (t/yr/ft)	Total erosion (t/yr) [% of total]	HUC 12 location
E. Rat Root	547	3	3	0.25	98.12	10	0.12	11.98 [.03]	-1105
Rat Root	223	4	3	0.38	60.48	6.5	0.12	7.18 [0.2]	-1102
E. Rat Root	563	3	3	0.25	371.93	9	0.11	40.85 [1.0]	-1105
Rat Root	224	4	3	0.38	74.22	6	0.11	8.14 [0.2]	-1102
E. Rat Root	202	4	2	0.25	280.75	9	0.11	30.47 [0.2]	-1105
Rat Root	39	3	3	0.25	182.1	8	0.1	17.48 [0.4]	-1102
Rat Root	298	3	2	0.15	92.34	12	0.09	8.16 [0.2]	-1102
Rat Root	41	3	3	0.25	370.37	7	0.09	31.64 [0.8]	-1102
Rat Root	42	3	3	0.25	440.04	7	0.09	37.59 [1.0]	-1102
E. Rat Root	565	3	3	0.25	226.97	7	0.09	19.39 [0.5]	-1105
E. Rat Root	569	3	3	0.25	174.68	7	0.09	14.92 [0.4]	-1105

Shoreline and riparian protection and improvement

The shoreline around Rat Root Lake is not heavily developed; however, there are areas of development and there is the possibility of additional future development. Statewide, the DNR projects that 1-2% of natural buffers on shoreline will be lost per decade in Minnesota from 2003 baseline measurements. Encouraging lakeshore front properties to manage and improve vegetation, reduce mowing and inputs into residential yards, and stabilize the shore will reduce both TSS and TP loads. Areas that do not have degradation should be protected.

Riparian areas also need protection and restoration. Areas along the stream can be improved through increased vegetation, replating trees, protection of existing old growth forests, protection of wetlands, and improved buffers.

Healthy shorelines and riparian areas also protect and improve habitat.

Agricultural practices

Agriculture is not a significant land use in the RRR Watershed. Areas that do include rotational row crops can be improved by increasing soil health practices such as cover crops, no and reduced tilling, and nutrient management.

Pastured animals can have a significant impact on water quality. Protecting streams by limiting animal access, adding vegetative borders, providing alternative drinking water sources, and plating trees and shrubs can reduce pollutant loading. Areas of shrub/scrub that are not being used for animal grazing can also be replanted with trees to help reestablish forests following harvests.

Critical areas

The protection of forested land is critical to maintaining the integrity of this system and to reduce nutrient and sediment loading to the RRR. Harvested lands are more successfully replanted when the planting takes place within two years of harvesting. There is ongoing harvesting in these watersheds; therefore, this number of acres may fluctuate. The assumption is that harvested parcels greater than 75 acres, with less than 75% forest coverage according to the National Land Cover Dataset are most critical for replanting. The number of acres estimated is based on the assumption that acres harvested in 2019 and 2020 will be average numbers of acres. As new data are available, these milestones will be updated accordingly. Parcels that are located within 1,000 feet of the waterbodies will be given further prioritization.

Streambank prioritization will be in the order of identified erosion rates in the BANCS study. These results are summarized in Table 13.

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Element d. Expected costs and technical assistance

> *An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources and authorities that will be relied upon, to implement the entire plan (include administrative, Information and Education, and monitoring costs). Expected sources of funding, States to be used Section 319, State Revolving Funds, USDA's Environmental Quality Incentives Program and Conservation Reserve Program, and other relevant Federal, State, local and private funds to assist in implementing this plan.*
>
> EPA *Handbook for Restoring and Protecting Our Waters*

The estimated costs of the activities in this plan are shown in Table 6. The costs to implement this NKE plan are estimated at $18,917,800 when fully implemented.

Funding for this plan will be sought through Section 319 funding, when completed, BWSR 1W1P funding, implementation grants, NRCS/EQIP funding, Conservation Stewardship Program, DNR forestry grant and cost-share programs, BWSR soil health cost-share, and other opportunities.

Table 14. Partners' Potential Roles and Responsibilities

	Partner	General roles	Potential responsibilities
Citizen Groups	Landowners and Residents	Provide input, information & feedback Share information Provide leadership Collaborate on projects development	Provide local perspectives Share information Volunteer for citizen science projects Monitor or allow monitoring of projects Implement resource improvement projects
	Little Fork/ Rat Root Rivers Management Board	Produced locally adopted river management plan in 1995 Provide a forum for broad implementation and management discussions Help coordinate implementation efforts	Maintain record of discussions Organize meetings Discuss implementation priorities
	MN Forest Resources Council (MFRC) Northern Landscape Committee	Gather regional/local forestry perspective and goals from area stakeholders for state decision-making consideration and inclusion in other area resource planning-includes the Rainy River-Rainy Lake watershed	Captures local perspectives, goals, and strategies for forest-water quality in this watershed. Suggest areas of focus for forest protection.

	Partner	General roles	Potential responsibilities
		Outreach & civic engagement	Provide citizen engagement
		Generate project ideas	Act as ambassadors
		Volunteer Coordination	Volunteer Coordination
		Educate their members	Organize watershed meetings/events
			Support habitat management and water quality goals through grant funds
	Rainy Lake Sportfishing Club		Tree Planting
Non-Profit Organizations	Conservation Corps of Minnesota	Provide conservation project implementation services	Support implementation projects
Local Government	Rainy River-Rainy Lake 1W1P Watershed Planning Group (Koochiching SWCD, Koochiching County, City of Ranier, City of International Falls)	Develop Comprehensive Water Management Plan for the Rainy River-Rainy Lake Watershed (which encompasses the Rat Root River):	Attend meetings
		Maintain record of meetings and discussions	Share information
		Organize public meetings	Support implementation projects
		Engage Stakeholders; solicit input on priority resource concerns	Organize watershed meetings/events
		Discuss implementation priorities	
	Koochiching County Soil & Water Conservation District (Assisted by Technical Service Area VIII)	Koochiching County SWCD serves as project lead in partnership with MPCA	Koochiching County SWCD implements Rat Root River Nine-Key Element Plan
		Serve on many state and local conservation-based committees	Maintain list of potential and finished projects
		Design and implement technical conservation projects, forest management plans, invasive species control, shoreline stabilization, tree planting, water sampling, soil sampling, etc.	Provide technical assistance to landowners/projects
		Manage grant projects	Provide cost-share opportunities
		Pursue and develop funding proposals	Write funding requests
		Conduct landowner outreach and community engagement	Contractor facilitation and project management

	Partner	General roles	Potential responsibilities
		Initiate and maintain landowner contacts and relationships	Conservation project development
	Koochiching County (Highway, Environmental Services, and Land and Forestry Departments)	Serve on the 1W1P Policy and Advisory Committees Manage lands and forests Oversee county roads Enforce planning & zoning Enforce wetland rules, construction setbacks and lot width, and SSTS. Land and Forestry Dept is the County weed inspector	Design and create outreach materials GIS mapping and data collection Manage land for sustainable forestry Forest management education for landowners Provide upland forest inventory Maintain and construct transportation infrastructure Consult implementation plan in zoning decisions Keep partners aware of opportunities Provide project management Establish water quality issues and goals for forestry conducted in this watershed. Use in establishing priority areas and establishing goals and measurable forestry outcomes.
State Government	Minnesota Board of Water and Soil Resources	Serve on the 1W1P Advisory Committee Administer MN Clean Water Fund Projects Provide technical assistance Lead HUC 8 based Landscape Stewardship Planning efforts Serves on County Technical Evaluation Panels for wetland permits	Keep partners aware of opportunities Provide project management
	Minnesota Department of Natural Resources (Divisions of Fisheries, Forestry and Ecological and Water Resources)	Serve on the 1W1P Advisory Committee Administer DNR programs, issue Public Waters Permits, conduct wetland rule enforcement Provide technical assistance for hydrology, fisheries, geomorphology and forestry Assist in development and evaluation of project proposals	Review/approve projects under Minnesota DNR programs Provide cost-share assistance for conservation projects Provide technical comments on project design Assist landowners with design and implementation of conservation projects

	Partner	General roles	Potential responsibilities
	Minnesota Pollution Control Agency	Serve on the 1W1P Advisory Committee Administer MPCA and Section 319 funding programs	Oversee implementation plan Keep partners aware of opportunities
		Provide technical assistance for hydrology, geomorphology and water quality Assist in development and evaluation of project proposals	Provide data administration
	Minnesota Department of Transportation	Oversee state highway	Maintain Highway 53 corridor
Federal Government	Environmental Protection Agency (Region 5, ORD-Duluth laboratory)	Provide Section 319 grants and guidance Watershed monitoring	Provide temperature loggers
	Natural Resources Conservation Service	Serve on the 1W1P Advisory Committee Provide technical review Administer U.S. Department of Agriculture (USDA) funding programs	Make Committee aware of funding opportunities Landowner engagement and education Provide cost-share assistance for conservation projects Assist landowners with design and implementation of conservation projects
	US Army Corps of Engineers	Provide watershed modeling	Update models with new data Explain & educate local stakeholders
	Federal Emergency Management Agency	Provide floodplain mapping Provide hazard mitigation funding and assistance	Updated floodplain maps Hazard mitigation planning and grants
	Voyageurs National Park (VNP)	Conduct studies and resource management within the park boundary.	Conduct education and outreach and provide a venue for engagement Provide input on resource concerns

Element e. Education and outreach

> *An information/education component that will be implemented to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, implementing, and maintaining the NPS management measures that will be implemented.*
>
> EPA *Handbook for Restoring and Protecting Our Waters*

The *Koochiching County Comprehensive Local Water Management Plan (2018-2028)* stated Koochiching County and SWCD have identified public education and outreach as an essential activity to sustain high water quality and good land management. A priority is sharing information with the citizens, businesses, and organizations about their watershed and their impacts on water quality. Education opportunities for both youth and adults are hosted by the County and SWCD (Koochiching 2018).

The SWCD is planning a series of educational and interactive events for landowners and stakeholders to first kick off the implementation of the RRR NKE plan, and then to share different aspects of it in relevant ways to different stakeholders. The community will be told about the current state of the watershed, what stressors have been found in the system, what possible future stream health stressors may be present (e.g., climate), and the importance of watershed protection.

Strategies will include public meetings, hands-on and on the ground workshops to share BMPs on shoreline and forestland practices, youth activities, and shared information through the Koochiching SWCD website and social media platforms, and local paper(s). There are also opportunities to collaborate with local schools and the Citizen Monitoring Program. We will make efforts to work with these groups to further expand/support monitoring efforts.

Specific activities, milestones, costs, and assessment criteria are identified in Table 6.

Element f. Reasonably expeditious schedule

> *A schedule for implementing the activities and NPS management measures identified in this plan that is reasonably expeditious.*
>
> EPA *Handbook for Restoring and Protecting Our Waters*

Timelines for proposed implementation are shown in Table 6.

Implementation activities described in Table 6 will yield estimated reductions greater than estimated reductions desired to reach water quality goals within 10 years. This schedule will be updated using the adaptive management as funding, partnerships, effectiveness of implementation, and new information becomes available.

Element g. Milestones

> *A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.*
>
> EPA *Handbook for Restoring and Protecting Our Waters*

The milestones column in Table 6 provide interim, measurable milestones for determining successful implementation of practices. The milestones in this plan serve the purpose of measuring continuous progress toward the protection of the Rat Root River Watershed.

Element h. Assessment criteria

> *A set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made toward attaining water quality standards.*
>
> EPA *Handbook for Restoring and Protecting Our Waters*

The milestones columns in Table 6 provide interim, measurable milestones for determining successful implementation of practices and progress toward executing this plan. The assessment criteria focuses on measuring the forward progress of the implementation of practices and BMPs.

It is difficult to anticipate the response of the stream to BMPs within a 10-year period. While water chemistry and other water quality monitoring is considered the gold standard, to encourage the continued adoption and support of these efforts, alternative and additional measures must be employed. The connection of BMPs on the landscape to the response in chemistry changes can be difficult to communicate to the public. The milestones described in Table 6 offer an alternative means of measuring, and importantly, communicating the successes to support the forward momentum of implementation adoption. There are estimated reductions associated with these practices which will allow watershed professionals to have an approximate idea of the loading changes to be expected. These milestones are to ensure that the expected reductions are taking place. Traditional water quality monitoring (chemical, sediment, and biological) and the visual inspections of the watershed demonstrate success. Visual inventories of streambank erosion, gullies, and runoff can be the leading indicator of the success of implementation.

Element i. Monitoring

> *The monitoring & evaluation component to track progress and evaluate the effectiveness of the implementation efforts over time, measured against the criteria established under item (h) immediately above.*
>
> EPA *Handbook for Restoring and Protecting Our Waters*

Water quality and water quantity monitoring serves the dual purposes of identifying problems in the watershed (investigative or diagnostic monitoring) and to determine the progressions and effectiveness of planning and implementation efforts.

The *Rainy Lake – Rainy River WRAPS Report* (2022) identified the following opportunities to expand monitoring in the RRR and East RRR:

- Evaluating the effectiveness of past and future stream restoration, riparian enhancement, and other BMP implementation projects.
- Continuing the geomorphic assessments of the middle reaches of both branches of the Rat Root River (previously identified in Section 3.1).
- Building on current BANCS survey data in areas with potentially high bank erosion inputs, such as the Rat Root River, East Branch between County State Aid Highway (CSAH) 3 and Rainy Lake, and gullies and tributaries that appear unstable or at-risk.
- Anticipating future issues, such as monitoring DO and water temperature to improve the understanding of climate change in the watershed.
- Examining the role of sediment-oxygen-demand in low DO reaches, with a particular focus on the middle reach of the Rat Root River.
- Monitor the water quality and geomorphology impacts of future large wood formations to document benefits and to guide future decisions surrounding potential removal if a large wood formation is found to be detrimental. (p. 63)

Watershed Pollutant Load Monitoring Network

The Watershed Pollutant Load Monitoring Network (WPLMN) leverages partnerships with state and federal agencies, Metropolitan Council Environmental Services, state universities, and local entities to collect water quality data and flow on streams. Those data are used to calculate pollutant loading and to track the differences that emerge from seasonal flow changes, storm events, etc. The WPLMN site for the RRR is located on the RRR near International Falls CR145(H74033011) and is identified in the Environmental Quality Information System (EQuIS) as S007-612 (MPCA 2022).

Stream monitoring

There are five streams sites that were monitored for fish and macroinvertebrates and two sites that were monitored for water chemistry in 2017 through 2018 as part of the Intensive Water Monitoring (IWM) strategy of the MPCA. The IWM monitors various watersheds on a 10-year cycle. The biological sites are summarized in Table 15 and the chemistry sites in Table 16.

Table 15. Intensive watershed monitoring biological monitoring stations in the RRR Watershed (EQuIS)

WID	Biological station ID	Waterbody name	Biological station location
09030003-635	17RN001	Rat Root River	Upstream of Hwy 53, 1.5 mi. NW of Ericsburg
09030003-634	17RN003	Rat Root River	End of FR 174 (Old Hwy 217), 4.5 mi. W of Ray
09030003-634	17RN004	Rat Root River	Upstream of FR 161, 3.5 mi. S of Ray
09030003-633	17RN006	Rat Root River, East Branch	Upstream of CSAH 3, 2 mi. N of Ray
09030003-632	17RN007	Rat Root River, East Branch	Upstream of unnamed FR, 4.5 mi. NW of Arbutus

Table 16. Intensive watershed monitoring water chemistry stations in the RRR and East RRR Watershed (EQuIS)

EQuIS ID	Biological station ID	WID	Waterbody name	Location
S009-293	17RN001	09030003-635	Rat Root River	Upstream of Hwy 53, 1.5 mi. NW of Ericsburg
S009-450	17RN006	09030003-633	Rat Root River, East Branch	Upstream of CSAH 3, 2 mi. N of Ray

The MPCA and Koochiching SWCD will continue to monitor their long-term sites at the same frequencies, with follow up monitoring or additional sites added as identified through new information (MPCA 2022).

BMP monitoring

On-site monitoring of implementation practices will take place to better assess BMP effectiveness. All practices are to be inspected by the landowner on a regular basis. Technical staff confirm that the project is functioning as designed through completion of site inspections during the effective life of the project. For BMPs installed through other sources, a variety of criteria such as land use, soil type, and other watershed characteristics, as well as monitoring feasibility, will be used to determine which BMPs to monitor. Monitoring of a specific type of implementation practice can be accomplished at one site and can be applied to similar practices under similar criteria and scenarios. Effectiveness of other BMPs can be extrapolated based on monitoring results (MPCA 2022).

Local and citizen monitoring

The MPCA's Citizen Monitoring Program will be promoted and employed in the RRR Watershed. Like the permanent load monitoring network, having citizen volunteers monitor a stream site monthly and from year-to-year can provide the long-term picture needed to help evaluate status and trends. Citizen monitoring is especially effective at helping to track water quality changes that occur in the years between intensive monitoring years. There are two high priority stream sites in the watershed in need of volunteer monitoring, one on the Rat Root River at the County Road 97 crossing, and the other on the Rat Root River, East Branch, at the County State Aid Highway 3 crossing near the community of Ray. The Koochiching SWCD, with the MPCA, will develop an outreach campaign to promote the Citizen Monitoring programs in the RRR and East RRR Watershed. Further ideas include potentially crowd-source funding monitoring stations.

There is an opportunity to engage with students through the Citizen's monitoring program.

Woody debris

Monitoring the water quality and geomorphology impacts of future large wood formations to document benefits and to guide future decisions surrounding potential removal if a large wood formation is found to be detrimental. This can be done in conjunction with the DNR to identify whether there is a need for log jam removal or to keep the woody debris for habitat.

Adaptive management

Adaptive management is an approach to water quality restoration efforts where BMP implementation efforts are combined with an on-going evaluation of the water quality issues. Effects of implemented BMPs are reflected by adjustments to the resource goals, implementation plan and/or implementation efforts when needed. Adjustments are made to incorporate the knowledge gained through the combined efforts. Adaptive management—sometimes referred to as adaptive implementation—is critical when various uncertainties are significant in a watershed (Shabman et al., 2007). This approach is essentially a "learning while doing" approach. It means that uncertainty is not forgotten once implementation begins. Rather, a focus is placed on reducing the uncertainty present through implementation, monitoring and evaluation, research, and experimentation. The knowledge gained through these efforts is then focused on reducing the uncertainties in reduction goal-setting, the implementation approaches and/or water uses and criteria. The approach goes beyond just asking "when" in implementation to include "where, what, how and why" (Shabman et al., 2007).

Uncertainties related to the water quality criteria, reduction goal numbers, sediment sources and aquatic life stressors are present in the RRR and East RRR studies, even though much was learned. Through an adaptive management approach, this initial implementation plan has been developed to begin implementation activities, continue survey and inventory efforts, and evaluate the progress toward meeting the aquatic life goals for the river. As this work is completed, the implementation goals, priorities and BMPs will be examined and revised, as needed.

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